

APPENDIX E1

AZM MPL RISK ASSESSMENT

ANGAS PROCESSING FACILITY

MISCELLANEOUS PURPOSES LICENSE APPLICATION

2019/0826



ABN | 67 062 576 238

Unit 7 / 202-208 Glen Osmond Road | Fullarton SA 5063

Impact Assessment

Impact ID	Relevant Chapter	Environmental Aspect	Description of Potential Impact Event	Mine Life Phase	Source	Pathway	Receptor	Understanding of source, pathway, receptor (given limitations in information used in assessment)	Uncertainties and assumptions (relating to SPR)	Sensitivity to change of any assumptions	Confidence of S-P-R	Outcome required?	Justification/evidence as to why no S-P-R	Factors that limit / mitigate impact (control measures)
PIE_3_1	Waste	Waste	Increased waste stream volumes affecting the ongoing operation of existing waste management facilities (e.g. Alexandria Council)	Upgrade, Operation, Closure	Waste generated from mining activities	Increased waste volume to landfill	Existing landfill	High: Waste streams to utilise AZM landfill or contracted licensed removal (i.e. Veolia). AZM site currently has a licensed landfill that may be utilised as an alternative to using local waste disposal services. Site Waste Management Plan currently in operation. There were no waste volume issues from AZM operations.	Waste streams volumes will be lower than was during operation of ML E239. All waste appropriately documented and disposed of within EPA regulations and licensing as per the waste management plan. The expected types of waste will be similar to those generated during the processing operations at AZM.	Low: Expected waste volumes not likely to significantly change	No	No	Existing capacity of the licensed Waste disposal facility on site is still sufficient to take the low volume of waste from the proposed mining activities. EPA landfill licence 34942.	EPA licensed waste management facility available on site; site waste management plan.
PIE_8_1	Public Safety	Site security	Fatality/injury of unauthorised persons due to inadequate site security	Operation, Closure	Access of unauthorised persons	Operations of site including heavy vehicles, processing plants and storage	Unauthorised persons	Medium: Without controls in place, such as closure of the electric access gate, an unauthorised could enter the site and harm themselves. The likelihood of this occurring is unknown.	Likelihood of unauthorised entry and level of injuries sustained unknown through operations. (none reported). Very limited occurrence through care and maintenance (c/s between Oct 2013 and June 2018)	Low: Conclusions reached in the impact assessment are highly unlikely to change if assumptions are found to be incorrect.	Yes	Yes	N/A	2.8km security fencing in place, encompasses the Central and Southern domains, complies with Australian Standards AS1752-2003, Chain-link fabric security fencing and gates. Front entrance gate is remotely controlled from the mine office. Security rounds outside of operational hours. Security cameras and alarms in high value areas.
PIE_8_2	Public Safety	Fire	Fire caused by processing activities causes third party property damage / injury/fatality impacting local community	Operation, Closure	Fire caused by processing activities	Unauthorised travelling site	Local community	Medium: Good understanding of the fire risk, however potential spread of fire difficult to predict.	Potential spread and exacerbation of fire unknown.	High: Potential for much greater impact than expected	Yes	Yes	N/A	Implement adequate fire prevention strategies to ensure no unplanned fires onsite and to ensure control measures are in place to manage potential off-site impacts - Hot works permits - onsite ERT personnel - Fire suppressant systems in HV room - Proximity to local services, CFS, etc. Active land management to reduce potential onsite fuel load (Weed and Pest Management Plan)
PIE_9_1	Traffic	Traffic and Transport	Increased traffic from APF operations has the potential to delay school buses and impact on the school community	Upgrade, Operation, Closure	Mine traffic	Traffic movement on public roads	Local community	Medium: Baseline traffic information available. Transport impact assessment is on order for FY 2017-2018. One haulage vehicles will not operate between 8:00am and 4:30pm on school days. There is no viable pathway to cause delay to school bus routes.	Traffic Impact Assessment assumes the following trips per day: 24 x haulage vehicles (12 return), 4 x supply truck, 6 x light vehicle, 40 x employee vehicle and 4 x visitor trips per day. Per week: 2 concentrate trucks	Low: Expected mine traffic volumes unlikely to significantly change	No	No	One haulage trucks will not be operating during local school bus pick-up and drop-off times. Chapter 9: Traffic section 9.6.	N/A
PIE_9_2	Traffic	Traffic and Transport	Increased traffic from APF operations has the potential to increase the rate of road deterioration and road maintenance requirements	Operation	Mine traffic on road segments	Traffic movement on public roads	Public road traffic/users	High: Information available on current road conditions and expected traffic increase. Traffic assessment shows that generated traffic from the proposed operation is within the capacity of the surrounding road system and is not expected to adversely impact on operation of the wider road network. The percentage increase of commercial vehicles on Naime Road, Bald Hills Road and South Eastern Freeway between 1% and 100% is not expected to have a significant adverse impact on the road condition over the lifetime of the mine.	Traffic Impact Assessment assumes the following trips Per day: 24 x one haulage vehicle 19m truck and dog combination movements (i.e. 12 return trips), 4 supply truck, 4 company/contractor light vehicle, 40 employee and 4 visitors vehicle. Per week: 2 concentrate trucks	Low: Expected traffic volumes unlikely to significantly change	No	No	Increased traffic is within the capacity of the road system and cannot reasonably be expected to impact on a receptor. Chapter 9: Traffic section 9.3. Traffic Impact Assessment Appendix F.1.	Upgrade of property access for the AZM operation was constructed to Transport SA (PPT) requirements. Upgrade of Callington/Naime Road being analysed but not finalised (Volume of traffic could be reduced by using larger vehicles to transport product from mine). Callington Road speed limit was reduced from 100km/hr to 80km/hr during the operation of AZM.
PIE_9_3	Traffic	Traffic and Transport	Mine traffic entering and exiting access road on Callington Road has the potential to cause injury/fatality to pedestrians	Upgrade, Operation, Closure	Mine traffic on Callington Road	Vehicle collision	Pedestrians	Medium: Based on known pedestrian use of Callington Road (pedestrians very rare occurrence) and already present risks. Road rules require traffic entering and exiting Callington Road to give way to Callington Road foot and vehicle traffic.	Drivers will be licensed and follow road rules. Vehicles will be registered and fit for purpose.	Low: Conclusions reached in the impact assessment are highly unlikely to change if assumptions are found to be incorrect.	No	No	Assuming road rules are followed, the hazard is of such low intensity that it could not reasonably be expected to cause harm to a receptor.	N/A
PIE_9_4	Traffic	Traffic and Transport	Mine traffic exiting the site has the potential to cause dust/sediment dragout and result in a safety hazard for public road traffic/users on Callington Road	Operation, Closure	Mine traffic exiting site	Vehicle displacement/dragout	Public road traffic/users	High: Dragout has occurred previously at AZM and without mitigation measures in place it is likely to occur during operation of the APF.	Vehicles leaving site could possibly have come into contact with dust/sediment in order to result in dragout occurring	Low: Conclusions reached in the impact assessment are highly unlikely to change if assumptions are found to be incorrect.	Yes	Yes	N/A	Sealed access road, vehicle wash before exit, road sweeper will be used as required, employee and visitor vehicles are located in a dedicated car park and do not have general access to enter the site. Road speed limit on site of 25km/hr.
PIE_9_5	Traffic	Traffic and Transport	Mine traffic has the potential to interact with members of the public accessing the Visitors Viewing Area	Operation, Closure	Mine traffic on Callington Road	Vehicle collision	Members of the public accessing the Visitors Viewing Area	High: The Visitors Viewing Area is outside of the northern security fence, overlooking the box cut, and not in close proximity to the APF. It was also in operation during the operation of AZM. The pathway for this potential impact event is not valid.	N/A	Low: Conclusions reached in the impact assessment are highly unlikely to change if assumptions are found to be incorrect.	No	No	The Visitors Viewing Area is outside of the northern security fence, overlooking the box cut, and not in close proximity to the APF or the main entry. The pathway for this potential impact event is not valid. Chapter 1: Figure 1-4 for main entry location.	N/A
PIE_9_6	Traffic	Traffic and Transport	Transport of explosives has the potential to cause injury/fatality from traffic accident and impact on the local community	Operation	Explosives transport	Vehicle collision	Public road traffic/users	High: Australian Standards for transport and handling of explosives. Transport route known, risk of vehicle collision always present however likelihood and level of impact (consequence) unknown.	Based on current proposed Project site designs, control and management strategies and experience from other mines.	Medium: Reliance on driver, vehicle selection and maintenance and other road user behaviour	Yes	Yes	N/A	Legislative requirements for the licensing of the transport and handling of explosives, including the suitability and serviceability of the vehicles used to transport explosives. Limited quantities of explosive will be transported due to the mining method to be employed at BH (i.e. no large blasts). Construction and commissioning of a licensed magazine at the BH site to reduce the frequency of explosive transport between sites. Driver training and awareness as part of induction. Contractual agreement with contractors and suppliers. Delivery schedule to avoid school drop off/pick up hours and public events Truck warning signage along Pfeiffer Road Video cameras in trucks Driver alcohol limits to be controlled and enforced in accordance with South Australian legislation (on-site alcohol testing).

Impact ID	Justification of assumptions - EVIDENCE	Description of Grouped Environmental Impact	Significance of expected impact 1 = Negligible 2 = Low, 3 = Med 4 = High	Validation of modelling	Effectiveness of design measures	Effectiveness of management measures	Actions to reduce uncertainty	Excluded worst case impact	Limitation of Credible worst case impact	Risk Ranking (Low = yellow, High = red, Very High = orange)	Impact covered by other Act or Limit (Yes/No)	Act / Limit Reference	Proposed Outcome	Outcome measurement criteria	Leading Indicator criteria (where required)
PIE_3_1	Waste streams (source) will be of such low volume that it cannot be reasonably expected to impact on receptors.	N/A	1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
PIE_8_1	Possible result of unauthorised entry	N/A	1	N/A	High: Appropriate barriers are already in place and have proven to restrict access.	Medium: Security measures will minimise, but cannot completely prevent unauthorised access.	Increased security and safety measures if necessary.	Catastrophic	Rare	High	N/A	N/A	No public injuries and/or deaths to members of the public caused by mining operations	All unauthorised entries to the mine site are investigated and investigations demonstrate all reasonable and practical measures were in place to prevent entry (and injury, if applicable)	Record of monthly visual inspections of the perimeter fence and vent effluent demonstrate they are maintained as designed.
PIE_8_2	Vehicles and equipment can cause fires.	N/A	2	N/A	High: Significant fire prevention and management design measures in place - known to be effective in preventing fire spread if ignited.	Medium: Reliance on standard management measures and appropriate resourcing of land management.	N/A	Catastrophic	Rare	High	Yes	Fire and Emergency Services Act 2005 (SA) - Duties to prevent fire	No public injuries and/or deaths to members of the public caused by mining operations	Independent investigation of all incidents that result in injury or death are completed in 14 days, or as agreed with the Director of Mines, and demonstrate that the mine operator could not have reasonably prevented the incident from occurring.	Annual safety audit does not identify additional actions that could reasonably be taken to reduce risks to the public.
PIE_9_1	N/A	Impact on social values of school community	1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
PIE_9_2	N/A	Impacts on road infrastructure	1	Medium: Baseline data available. Standard model used but expected traffic volumes are indicative.	Medium: Access designed and will be approved to DPI standards. Upgrades as required in consultation with DPI and AHC.	High: Reliance on standard measures to manage traffic impacts.	Road upgrades if required through consultation with DPI, AHC and appropriate consultants. Upgrade of property access completed in upgrade to reduce Callington Road damage.	Minor	Possible	Low	No	N/A	No impacts to third party infrastructure caused by mining operations	Investigation of all public infrastructure related complaints demonstrates that the Mine Operator did not cause or could not reasonably have prevented the incident from occurring, and all public infrastructure related complaints were acknowledged within 48 hours and closed out within 14 days to the satisfaction of the complainant or as agreed with the Chief Inspector of Mines.	complaints hotline re: minor spillage on roads that drivers haven't identified. Investigate to see if damage originated from BIH vehicles.
PIE_9_3	N/A	Impacts on pedestrians	1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
PIE_9_4	Dragout is a known impact from unmitigated operations. Chapter 9: Traffic section 9.6.	Impacts on road users, air quality, surface water quality.	2	N/A	High	High: Reliance on standard measures to manage traffic impacts.	N/A	Minor	Realistic	Low	No	N/A	No adverse impacts offsite are caused by accidents, noise, dust and dragout by traffic from or to the mine operations that could have been reasonably prevented.	Accumulation of dragout (aggregate, sand, dirt and other detritus) will be monitored through daily visual inspection of the mine entrance (Callington road intersection) and reported by exception, to ensure DPI standard intervention levels are not exceeded; + 1m2 at intersection segments, curves, bicycle lanes, pedestrian crossings or walkways + 10m2 in other location	None proposed
PIE_9_5	A physical barrier (security fence and distance) eliminates the presence of a pathway. See site design in chapter 3.		1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
PIE_9_6	Access between sites is only via public roads, hence vehicle collisions are a possibility as factors are outside of Terramin's control.	Impacts on road users, general public and infrastructure	1	N/A	High - Vehicles used to carry explosives will be designed and maintained in accordance with AS 2387.1 for licensing with SafeWork SA, which includes limiting quantities and types of explosives carried and how they must be arranged on the vehicle during transport (i.e. physical separation etc)	Moderate - plan to limit speed and timing of truck deliveries. Explosive transport vehicles and operators will be licensed with SafeWorkSA.	Monitoring of traffic accidents and near misses involving mine traffic. Reportable. Scheduled maintenance and safety inspections of all company/contractor vehicles.	Major	Rare	Medium	Yes	Explosives Act 1936	No adverse impacts offsite are caused by accidents, noise, dust and dragout by traffic from or to the mine operations that could have been reasonably prevented.	Independent investigation of all traffic accidents involving the public are completed in 14 days, or as agreed with the Director of Mines, and demonstrate that the mine operator could not have reasonably prevented the accident from occurring.	complaints hotline re: minor spillage on roads that drivers haven't identified. Investigate to see if damage originated from BIH/APF vehicles.

Impact Assessment

Impact ID	Relevant Chapter	Environmental Aspect	Description of Potential Impact Event	Mine Life Phase	Source	Pathway	Receptor	Understanding of source, pathway, receptor (given limitations in information used in assessment)	Uncertainties and assumptions (relating to SPR)	Sensitivity to change of any assumptions	Confirmation of S-P-R	Outcome required?	Justification/evidence as to why no S-P-R	Factors that limit / mitigate impact (control measures)
PIE_9_7	Traffic	Traffic and Transport	Transport of mine infrastructure has the potential to cause traffic delays for road users in the region	Upgrade	Mine site infrastructure (transport of mine infrastructure)	Traffic movements on public roads	Public road traffic/users	High: Well understood. No source exists as no large infrastructure modules required for process plant upgrade (on current information)	No large infrastructure module transportation required for AZM upgrade.	Low: Conclusions are highly unlikely to change.	No	No	No large infrastructure modules are identified as requiring transport to/from site for the APF upgrade and it could not reasonably be expected to impact on local traffic. Chapter 3: Proposed operations.	Limited/If any large modules required at AZM for plant upgrade which would cause substantial traffic delay.
PIE_10_1	Visual Amenity	Air Quality	Dust generation from processing operations (crushing and processing) results in poor visual amenity for local residents and local community	Operations, Closure	Dust (TSF) generated from operations (crushing and processing)	Air and prevailing winds	Local community	High: Pathways well understood. Impact of crusher well understood. Dust modelling for gold ore processing undertaken (AECOM 2017). Modelling shows no expected exceedances of TSP at receptors, however there are no monitoring targets for visual amenity. Dust emissions from APF are expected to be much lower than those experienced during operation of AZM, as no mining activities will be undertaken and processing load will be approx 1/3.	Extreme climatic events may result in short term periods of higher dust generation.	Medium: Extreme climatic conditions may result in very short term (hours) of greater dust mobilisation.	Yes	Yes	N/A	Dust suppression via appropriate design, asphalt roads, water carts, sprinklers, water sprays on ROM stockpile, vegetation windbreaks, progressive rehabilitation. Implementation of Dust Management and Monitoring Plan.
PIE_10_2	Visual Amenity	Air Quality	Dust generation from mine site post-closure results in poor visual amenity for local residents and local community	Post Closure	Dust (TSF) generated from post-closure activities	Air and prevailing winds	Local community	Medium: Air quality modelling does not address post-closure as final landform is not expected to provide sources of impact. Approved PEPR for ML 6239 Closure Plan outlines all monitoring requirements for both air quality and erosion through the closure monitoring phase. AZM Closure Concepts include progressive rehabilitation of the site, to a geotechnical and erosion stable final landform, demonstrated by USA and erosion monitoring.	Air quality modelling does not address post-closure stage, assuming progressive rehabilitation (as monitored by USA) is successful in stabilising soils. The Central Domain closure strategy includes the following tasks relevant to the MPC: - Undertake a site contamination assessment at closure, and manage or remove contaminated soil and hazardous material; and - Revegetate the boundary of the central zone light industrial area.	Low: Revegetation trials during operation to adapt and modify revegetation and dust suppression techniques (e.g. rock mulch, hydromulch, hydrosediment) and progressive rehabilitation will guide successful closure practices.	No	No	Revegetation trials suggest that post-closure landforms will be successfully stabilised, and therefore wind-generated dust (source) will be of such low intensity or concentration that it could not reasonably be expected to impact on visual amenity. Chapter 16: section 16.8.	N/A
PIE_10_3	Visual Amenity	Lighting	Lighting of the Angas Processing Facility at night impacts local residents	Operations	Lighting at APF	Sightlines	Local community	High: Lighting at Angas Processing Facility well understood - lighting audit conducted on current processing plant. No changes to infrastructure locations are proposed.	Lighting audit has been conducted as part of ML6239 and confirms no impact to potential sensitive receptors.	Low: Processing plant already constructed.	Yes	Yes	N/A	Lighting for site activities are compliant with AS4292:1997. Bunding was constructed to shield the APF from various vantage points during AZM. Visual amenity plantings and direct seeding have been undertaken in accordance with AZM's rehabilitation plan.
PIE_10_4	Visual Amenity	Visual Impact	Inappropriate waste storage procedures for non-putrescible waste has the potential to impact visual amenity of local community	Upgrade, Operations, Closure	On-site waste (non-putrescible)	Sightlines	Local community	High: Sightlines of AZM well understood and documented baseline conditions prior to ML6239. Site design takes sightlines into account, especially regarding the impact from Wilyiwooi. Wastestreams well understood. Presence of S-P-R depends on procedural controls (correct implementation of WMP).	Waste Management Plan is followed effectively.	Low: Conclusions reached in the impact assessment are highly unlikely to change if assumptions are found to be incorrect.	Yes	Yes	N/A	Implementation of Waste Management Plan. Site audits.
PIE_10_5	Visual Amenity	Visual Impact	Stockpiling of gold ore has the potential to impact visual amenity of local community	Operation	Gold ore stockpiles	Sightlines	Local community	High: ROM pad is not visible from any viewpoints the local community can access offsite. Pathway is not viable.	Site design finalised. Bunding was constructed to shield the APF from various vantage points during AZM.	Low: Conclusions reached in the impact assessment are highly unlikely to change if assumptions are found to be incorrect.	No	No	Areas assigned for the stockpiling of ore (i.e. ROM) are not visible from publically accessed locations offsite. Chapter 10: section 9.4 and 9.7.1.	N/A
PIE_10_6	Visual Amenity	Revegetation	Revegetation failure of TSF embankments results in unsightly barren post-closure impacting local community (Wilyiwooi)	Post Closure	TSF embankment	Sightlines	Local community	High: RTSF visibility well understood from 10 years of photo monitoring from Location 1 (Ch9, Figure 9-3). Revegetation in 20 areas demonstrates success of revegetation programs from direct seeding over 2.5 years.	Site design finalised. Photo montage provides understanding of expected vegetation on TSF embankment after 5 years. Assumes vegetation success.	Low: Conclusions reached in the impact assessment are highly unlikely to change if assumptions are found to be incorrect.	Yes	Yes	N/A	Mine Closure Plan developed for ML6239 including Revegetation Plan with revegetation procedure. Visual amenity plantings and direct seeding have been undertaken in accordance with AZM's rehabilitation plan.

Impact ID	Justification of assumptions - EVIDENCE	Description of Grouped Environmental Impact	Significance of expected impact 1 = Negligible 2 = Low, 3 = Mid 4 = High	Validation of modelling	Effectiveness of design measures	Effectiveness of management measures	Actions to reduce uncertainty	Excitable worst case impact	Unlikelihood of credible worst case impact	Risk Ranking (Low/Mid/High)	Impact covered by alternative Act or Limit (Yes/No)	Act / Limit Reference	Proposed Outcome	Outcome measurement criteria	Leading Indicator criteria (where required)
PIE_9_7	N/A	Impacts on road users and infrastructure	1	Medium: Baseline data available. Standard model used but expected traffic volumes are indicative.	N/A	N/A	N/A	Insignificant	Almost certain	Low	No	N/A	N/A	N/A	N/A
PIE_10_1	Air quality modelling shows that dust will be generated by processing operations. Chapter 9: Visual Amenity section 9.7. Air Quality Impact Assessment - Appendix N3.	Visual amenity impacts from dust generation during operation	1	Medium: Baseline data available. Model shows a reasonable approximation of real conditions but relies on a number of assumptions. Conservative modelling applied.	High: Industry standard and best practice designs. Well understood and demonstrated across industry. Effectiveness at AZM?	Medium: Management measures are considered routine and used effectively throughout industry. Impact mitigation relies on real time monitoring and appropriate management response.	Monitoring during operation to verify results of modelling.	Insignificant	Likely	Low	No	N/A	No public nuisance impacts to local residents from dust, air emissions and/or odour caused by mining operations	Dust generated from the mining lease during operation activities, measured twelve static Dust Deposition Gauges located on and off the mining lease shown in Figure 14.1 demonstrates average dust deposition at sensitive receivers is in accordance with the Air Quality Impact Assessment using standardised monitoring techniques and demonstrates that annual average does not exceed 4g/m ² to ensure no nuisance impacts to local residents from dust generated by processing or closure activities. If these levels are obtained for 12 months post closure, monitoring will no longer be required.	Twelve static Dust Deposition Gauges located on and off the mining lease shown in Figure 14.1, will be monitored monthly for total in-soluble solids (TMS) as per AS 3380.30.1-1991 standards. This will demonstrate that total in-soluble solids are less than Australian best practice deposition levels of 4g/m ² /month. Any exceedance of 4g/m ² /month to be investigated with reference to meteorological data and on-site activities to ascertain whether the source is likely to be Terminus's activities.
PIE_10_2	Revegetation trials suggest that post closure landforms will be successfully stabilised, and therefore wind-generated dust (source) will be of such low intensity or concentration that it could not reasonably be expected to impact on visual amenity.	Dust generation from IM, post closure	1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
PIE_10_3	Lighting audit Appendix G2	Visual amenity impacts	1	Medium: Auditing of lighting to date has been undertaken on existing infrastructure. Some minor changes could be expected, however not considered significant at this stage.	High: lighting audits undertaken to date confirm that there are no impacts to sensitive receptors. No major changes to the location of infrastructure and it's lighting are planned for the APF.	Medium: Reliance on standard management and design measures	Continue regular site audits	Unlikely	Minor	Low	N/A	N/A	No public nuisance or amenity impacts caused by lighting from the mining operations	Out-door lighting of the processing facility audited by a suitably qualified independent person to demonstrate compliance with AS 4282-1997 'Control of the obtrusive effects of outdoor lighting'.	None proposed
PIE_10_4	Incorrect placement of non-pyrexible waste may temporarily impact on visual amenity.	Visual amenity impacts	1	N/A	Low: Limited scope to use design measures to reduce risk	Medium: Reliance on standard management measures	Regular site audits	Insignificant	Possible	Low	No	N/A	No impact to visual amenity caused by rubbish from mining operations	Investigation of all visual amenity related complaints demonstrates that the Mine Operator did not cause or could not reasonably have prevented the incident from occurring, and all visual amenity related complaints were acknowledged within 48 hours and closed out within 7 days to the satisfaction of the complainant or as agreed with the Director of Mines. If complaints were not resolved the Mine Operator conducted further investigations to demonstrate that visual amenity complied with the outcome achievement values as agreed by the Director of Mines.	None proposed
PIE_10_5	Local community cannot see ROM pad, therefore no visible pathway.	Visual amenity impacts	1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
PIE_10_6	TSF embankments viewable from Location 1 (Willyaroo). Chapter 10: Visual Amenity section 9.7 - Figure 9.7.	Visual amenity impacts	1	Medium: Vegetation relies on some assumptions of future revegetation success	High: Revegetation design measures known to be effective throughout many industries and onsite at ML 6229 already.	Medium: Revegetation relies on some human maintenance in first developing years (0-3 years)	None identified	Unlikely	Minor	Low	N/A	N/A	Maintain visual amenity in line with broader existing environment	Upon completion of rehabilitation activities independent verification and a photo point assessment at ten locations (MCP Appendix H) will demonstrate that a visual amenity plan (developed in consultation with stakeholders and submitted to government) has been fully implemented.	None proposed

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PIE_11_1	Groundwater	Surface Water	Infiltration of contaminated water within the APF operational zone has the potential to contaminate groundwater and impact on groundwater recharged watercourses (Angas River)	Operation	Contaminated water within the "operational zone" infiltrates to groundwater	Groundwater flow and discharge to surface waters	Surface water quality (Angas River)	Medium: Source and receptor understood. Groundwater modelling indicates flow of groundwater towards the cone of depression, not moving offsite. Groundwater monitoring for AZM to date (2007-2018) indicates no evidence of contaminated soils within the "dirty zone" impacting the groundwater quality.	BH gold ore has a lower risk of acid generation compared to AZM ore and waste rock due to volume of sulfides, therefore risk of contamination is lower.	Low: Conclusions reached in the impact assessment are highly unlikely to change if assumptions are found to be incorrect.	No	No	Groundwater monitoring indicates that groundwater flows towards the cone of depression for the life of the MPL, not offsite, therefore there is no credible pathway.	N/A
PIE_11_2	Groundwater		Infiltration of contaminated water within the APF operational zone (from hydrocarbons) has the potential to contaminate groundwater and impact on local groundwater users	Operation	Contaminated water within the "operational zone" infiltrates to groundwater	Groundwater flow and discharge to surface waters	Surface water quality (Angas River)	Medium: Source and receptor understood. Groundwater modelling indicates flow of groundwater towards the cone of depression, not moving offsite. Groundwater monitoring for AZM to date (2007-2018) indicates no evidence of contaminated soils within the "dirty zone" impacting the groundwater quality.	BH gold ore has a lower risk of acid generation compared to AZM ore and waste rock due to volume of sulfides, therefore risk of contamination is lower.	Low: Conclusions reached in the impact assessment are highly unlikely to change if assumptions are found to be incorrect.	No	No	No, see section 10.3.2 for discussion. Not credible pathway. Terramin will continue groundwater monitoring program to confirm regardless.	N/A
PIE_11_3	Groundwater		Surface water – flooding of operational area results in contaminated water infiltrating into the groundwater impacting local groundwater users.	Operation	Contaminated water within the "operational zone" infiltrates to groundwater	Groundwater flow and discharge to surface waters	Surface water quality (Angas River)	Medium: Source and receptor understood. Groundwater modelling indicates flow of groundwater towards the cone of depression, not moving offsite. Groundwater monitoring for AZM to date (2007-2018) indicates no evidence of contaminated soils within the "dirty zone" impacting the groundwater quality.	BH gold ore has a lower risk of acid generation compared to AZM ore and waste rock due to volume of sulfides, therefore risk of contamination is lower.	Low: Conclusions reached in the impact assessment are highly unlikely to change if assumptions are found to be incorrect.	No	No	No, even if surface water infrastructure fails, still drains to basins. Groundwater modelling completed for mine void recharge included in MLEB25. Source not adding a credible concentration or volume to impact existing AMD mine void. Modelling completed and included in Appendix H6 (includes updated mine void source term). No credible pathway.	N/A
PIE_11_4	Groundwater	Groundwater	Re-injection of water back into the aquifer (MAR) infiltrates to groundwater impacting local groundwater users.	Operation	Contaminated water within the operational area	Groundwater or surface water flows	Local groundwater users	Medium: Source, pathway and receptor understood. Groundwater modelling of reinjection completed and groundwater monitoring for AZM to date (2007-2018) indicates no evidence of MAR contaminating groundwater.	No receptors within potential MAR "impact" zone identified. Water quality assumed to be of same or better quality as receiving aquifer.	likely to change, source may vary insignificantly, however	Yes	Yes	N/A	Included in Chapter 11: Section 11.6 Significant features includes collection of water that has been in contact with potentially contaminated surfaces (referred to as operational zone) and diversion to mine process water circuit or onsite water treatment facilities (clarifiers, filters, Reverse Osmosis) and live water quality monitoring at discharge points.

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PIE_11_1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Yes	Environment Protection (Water Quality) Policy (54) Natural Resources Management Act 2004 (5A)	N/A	N/A	N/A
PIE_11_2	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Yes	Environment Protection (Water Quality) Policy (54) Natural Resources Management Act 2004 (5A)	N/A	N/A	N/A
PIE_11_3	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Yes	Environment Protection (Water Quality) Policy (54) Natural Resources Management Act 2004 (5A)	N/A	N/A	N/A
PIE_11_4	Control measures - included in Chapter 11: Section 11.6 Groundwater Rejection modelling: Appendix H7 and H8	Rejection of poorer quality water can impact receptors	1	High: Groundwater modelling undertaken for ML629 has been continually recalibrated between 2007 and 2017 and demonstrated to be reflective of groundwater conditions. Medium: System still relies on maintenance and monitoring of system to ensure water quality of eight parameters prior to rejection.	High: Water treatment through reverse osmosis known to be effective at water treatment prior to MMR scheme - ML629. Medium: System still relies on maintenance and monitoring of system to ensure water quality of eight parameters prior to rejection.	N/A	N/A	Minor	Possible	Low	Yes	Environment Protection (Water Quality) Policy (54) Natural Resources Management Act 2004 (5A)	No adverse impact to the supply or quality of water caused by the mining operations to existing users and water dependent ecosystems	Groundwater will be sampled quarterly, as per AS/NZS 5667.1:1998 standards, at five boreholes (B61, B62, B63, B64 and B65) located on and adjacent to the ML 629 (Figure 38) and demonstrate that potential contaminants (Pb, Zn, As, Cd, Fe, Se, pH, EC and TDS) do not exceed maximum baseline values (Table 28). Are these contaminants relevant to gold processing?	Groundwater will be sampled quarterly, as per AS/NZS 5667.1:1998 standards, at five boreholes (B61, B62, B63, B64 and B65) located on and adjacent to the ML 629 (Figure 38) and demonstrate that potential contaminants (Pb, Zn, As, Cd, Fe, Se, pH, EC and TDS) are less than two standard deviations of the mean baseline values (Table 28)

Impact ID	Relevant Chapter	Environmental Aspect	Description of Potential Impact Event	Mine Life Phase	Source	Pathway	Receptor	Understanding of source, pathway, receptor (given limitations in information used in assessment)	Uncertainties and assumptions (relating to SPR)	Sensitivity to change of any assumptions	Confirmation of S-P-R	Outcome required?	Justification/evidence as to why no S-P-R	Factors that limit / mitigate impact (control measures)
PIE_11_5	Groundwater		Re-injection of water back into the aquifer (MAR) results in artesian conditions, leading to impacts on vegetation (water logging).	Operation	water re-injected during MAR operation which does not meet water quality parameters	MAR re-injection system	Nature vegetation	Medium: Source, pathway and receptor understood. Groundwater modelling of reinjection completed and groundwater monitoring for AZM in date (2007-2018) indicates no evidence of artesian conditions and vegetation monitoring has shown no evidence of water logging.	Assumption is volume as per water balance.	Low: unlikely to be higher volume as no dewatering of mine. Volume increase not likely to change any assumptions of potential impact.	No	No	Not credible: No artesian conditions occurred through operation of mine water MAR scheme under M&S29 (which was much higher volumes). Much less water proposed for MPL.	N/A
PIE_12_1	Surface Water	Surface Water	Onsite storage and handling of waste and hazardous materials has the potential to spill and impact on surface water quality.	Upgrade, Operation, Closure	Onsite storage and handling of waste and hazardous materials	Mobilisation of surface water flows of spilled contaminants	Surface water (Angas River)	Medium: Sources of contamination in waste materials well understood. Use and storage of hazardous substances known and accounted for in Waste Management Plan and Stormwater Management Plan.	Location and volume of spill unknown. Handling activities with the potential to cause a spill will be undertaken in the designated areas of the "operational zone".	Low: Standard measures employed and use of hazardous substances unlikely to change significantly	No	No	No, even if surface water infrastructure fails, still drains to boecut. No credible pathway.	Implementation of Waste Management Plan. Bunding and storage to standards, appropriate wastewater treatment plants. Spill response plans, clean up kits etc. available. Spills localised. EPA waste management plan to be completed with. Training of staff and contractors on waste management procedures and handling and storage of potentially hazardous materials. QA and Procedures in place to control the handling of potentially hazardous material. MSDS for all potentially hazardous materials stored on site.
PIE_12_2	Surface Water	Water quality	ANFO spill in magazine impacts surface water quality (Angas River)	Operation	ANFO in magazine	Surface water flows	Surface water (Angas River)	Medium: The magazine is bunded and therefore surface water in the surrounding area has been redirected from the area.	Site design consistent with the AZM original facility	Medium: if the bunding is damaged or has excess erosion	Yes	Yes	N/A	The procedures for the use of the magazine requires the inspection of the area to ensure that any spills would be contained
PIE_12_3	Surface Water	Water quality	Earthworks during the refurbishment phase results in increase sediment load entering the surface water system impacting surface water quality (Angas River)	Refurbishment	Earthworks and disturbed soils	Surface water flows	Surface water (Angas River)	High: Site design finalised and stormwater flows well understood. The runoff water from the areas being refurbished will be managed by the use of standard construction earthworks sediment control, noting the majority of the areas being worked would also drain to the boecut in the event of significant event.	As per proposed design.	Low: Assumptions are highly unlikely to change.	Yes	Yes	N/A	Implementation of Standard Earthwork management procedures for the control of sediments
PIE_12_4	Surface Water	Water quality	Flood event results in contaminated water from the operational zone impacting surface water quality (Angas River)	Operation	Operational zone	Surface water flows	Surface water (Angas River)	High: Site design finalised and stormwater flows well understood. All water from operational zones will flow towards boecut and/or not leave site due to site design and stormwater flows. Pathway is not viable.	Site design is not altered.	Low: Assumptions are highly unlikely to change.	No	No	No, even if surface water infrastructure fails, still drains to boecut. No credible pathway.	N/A

Impact ID	Justification of assumptions - EVIDENCE	Description of Grouped Environmental Impact	Significance of expected impact 1 = Negligible 2 = Low, 3 = Med 4 = High	Validation of modelling	Effectiveness of design measures	Effectiveness of management measures	Actions to reduce uncertainty	Confidence worst case impact	Unlikelihood of credible worst case impact	Best Baseline (No Baseline, High, or Low)	Impact covered by alternative Act or Limit (Yes/No)	Act / Limit Reference	Proposed Outcome	Outcome measurement criteria	Leading Indicator criteria (where required)
PIE_12_5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Yes	Environment Protection (Water Quality) Policy (SA) Natural Resources Management Act 2004 (SA)	N/A	N/A	N/A
PIE_12_1	Chapter 12, section 12.6 Appendix K1	N/A	1	NA	High: Bunding and waste water treatment plants known to be effective	Medium: Reliance on standard management measures	It is planned to expand the BIH Land Management Plan to include a separate hydrocarbon and hazardous substance waste management strategy as the Project progresses. Records will be kept of all waste and all hazardous substances on site and demonstrate all waste disposal (at both ADM and BIH) is stable and will prevent long term effects on the air, groundwater, soil or surface water in or adjacent to the site.	Minor	Possible	Low	Yes	National Environment Protection (Assessment of Site Contamination) Measure 1999 (CR), EPA licenced activity	N/A	N/A	N/A
PIE_12_2	Chapter 12, section 12.6 Appendix K1	N/A	1	High: topographic model is reflective of site conditions	High: Bunding and flow paths contain runoff within the ANFO site	High: routine maintenance. Known to be effective on sites		Medium/HS	Possible	Low	Yes	Environment Protection (Water Quality) Policy (SA) Natural Resources Management Act 2004 (SA)	No adverse impacts on soil quality or quantity caused by mining operations	If a spill of fuel, oil or hazardous chemical occurs outside bunded areas, it will be reported and remediated within 48 hours. Any remediated spills out of the operational zone will be soil tested as per AS 4482.1, 1997 standards, and tested for As, Cd, Cu, Pb, Zn, Hg, Ni and Zn to ensure no levels higher than the topsoil stockpile baseline maximum.	Monthly review of weekly waste management site inspections records, focusing on storage of waste and hazardous materials, will indicate less than 5 occurrences a month of incorrectly disposed or stored waste.
PIE_12_3	Chapter 12, section 12.6 Appendix K1		1	Medium: Silt ponds located at the discharge points of the site.	High: Bunding and flow paths runoff within the site from the operational areas	High: routine maintenance. Known to be effective on sites	Continuing the rehab of the site to reduce the potential for sediment runoff	Minor	Rare	Low	Yes	Environment Protection (Water Quality) Policy (SA) Natural Resources Management Act 2004 (SA)	No contamination of natural water drainage systems, streams and rivers, groundwater, land and soils occur either on or off site resulting from permanent disposal or temporary storage of mine ore or waste material	Triplicate samples to be taken when water is running from the Front Entrance (pre-wetland), visitors viewing area, Pre-Swale, overflow point of the sediment dam, and exit point at the Evaporation Pan (Figure 12-11). Samples to be measured as per AS/NZS 5667.1:1998 standards. A paired t-test will demonstrate that turbidity at these sites is not significantly different from the mean of the triplicate samples taken at Hohenberg or greater than the mean of the triplicate samples taken at Hohenberg. If the samples obtained at the pre-wetland location, visitors viewing area or silt dam overflow are significantly different from and greater than the mean of the triplicate samples taken at Hohenberg, verification will be undertaken to determine whether water is in fact leaving the Mineral Lease/MP, in order to ascertain the source of the potential contamination.	After high rainfall events which generate runoff, records from visual inspections of silt traps, the silt retention dam and surface drainage systems on ML 6229 and MP (Figure 12-12) demonstrate that silt volume is no more than 50% of trap capacity volume and there is no breach in walls. After high rainfall events which generate runoff, visual inspections of all sloped areas, one and topsoil stockpiles will occur to ensure no evidence of sediment loss through erosion (formation of rills and gullies)
PIE_12_4	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Impact ID	Relevant Chapter	Environmental Aspect	Description of Potential Impact Event	Mine Life Phase	Source	Pathway	Receptor	Understanding of source, pathway, receptor (given limitations in information used in assessment)	Uncertainties and assumptions (relating to SPR)	Sensitivity to change of any assumptions	Confirmation of S-P-R	Outcome required?	Justification/evidence as to why no S-P-R	Factors that limit / mitigate impact (control measures)
PIE_12_5	Surface Water	Surface Water	Contamination of surface water flows due failure of monitoring system impacts surface water quality (water treatment monitoring has failed at all points)	Operation	Stormwater from the "operational zone"	Surface water flows	Surface water (Angas River)	Medium: Sources of contamination in Surface Water well understood. Use and storage of hazardous substances known and accounted for in Waste Management Plan and Stormwater Management Plan.	That the pump system and control system is operational	Medium: if the pump control system fails	Yes	Yes	N/A	If the the control system fails and pumps containment water there is a number of controls in place - silt removal tanks, silt ponds Wetlands, infiltration trenches and the silt pond and sampling points located at the boundary.
PIE_12_6	Surface Water	Surface Water	Erosion of landforms onsite results in increased sedimentation and impacts surface water (Angas River)	Operation	Surface water erosion of onsite landforms	Surface water flows	Surface water (Angas River)	High: Landforms located outside the "operational" zone, which has potential to add sedimentation to drainage lines which enter the Burroside Creek and ultimately Angas River are vegetation appropriately which highly reduces sedimentation risk. Surface water from access roads around the TSF are captured in the silt retention dam prior to leaving site (at this point, turbidity sample is taken). Onway and Visitors Viewing area surface water points enter the STEDS wetland before entering Burroside Creek.	Site design is not altered.	Low: based on the observation of the system during the AZM operational period	Yes	Yes	N/A	Implementation of Standard Earthwork management procedures for the control of sediments
PIE_12_7	Surface Water	Soil quality	Stockpiled topsoil becomes contaminated, impacting rehabilitation success and surface water run off, impacting the Angas River	Closure, Post Closure	Surface water erosion of contaminated topsoil	Surface water flows	Surface water (Angas River)	High: Topsoil stockpile has been sampled annually from 2007 to 2016. Evidence to date indicates topsoil within NPM H6 C guidelines / baseline assessments. Run off from topsoil stockpiles reports to silt retention dam, water is sampled upon leaving site.	Topsoil will be used in closure rehabilitation. Upon completion of rehabilitation earthworks, site will undergo site contamination audit, as per the EPA legislative process. EPA monitoring will identify trends in revegetation deficiency and allow for active land management. See approved RPR for M6229 Closure Plan (Appendix C).	Low: Conclusions are highly unlikely to change.	Yes	Yes	N/A	Spills procedure and annual topsoil monitoring manage and prevent this.
PIE_12_8	Surface Water	Surface Water	Stormwater from M61 operational area ("operational zone") has the potential to impact surface water quality (Angas River)	Operation	Stormwater from the "operational zone"	Surface water flows	Surface water (Angas River)	High: Surface water drainage within M6229 well understood. Baseline surface water samples obtained prior to AZM construction. All surface water within AZM operational area ("operational zone") drains to central boquet. What happens next? What is sampled? Any evidence of contaminated SW leaving site?	Site design is not altered.	Low: Site design has been constructed and will not be altered. Assumptions are highly unlikely to change.	No	No	No, even if surface water infrastructure fails, still drains to boquet. No credible pathway.	N/A
PIE_12_9	Surface Water	Surface Water	Gold ore on ROM pad impacts surface water quality (sulfide hosted ore)	Operations	Gold ore stockpiles	Stormwater on off	Surface water (Angas River)	Medium: Area within the operational area, sulfides hosted in Acid Consuming Material. Pathway present but presents lower risk than existing AZM ore. Consumption of ore within 2-3 days on surface.	Geochemical composition of gold ore well understood, as is surface water drainage through operations and closure. Assumption that closure earthworks and audit as per EPA requirements will remove any potential for adverse impacts to soil quality post-closure. Quality of soil to be used during closure known.	Low: Conclusions are highly unlikely to change.	No	No	No, groundwater modelling has demonstrates no credible impact based on hydrogeology.	N/A
PIE_12_10	Surface Water	Surface Water	Rupture of process tanks/pond at the APF has the potential to impact surface water quality (Angas River)	Operation	Rupture of APF process tank	Surface water flow	Surface water (Angas River)	High: Site design finalised and stormwater flows well understood. All water from rupture of process water tank would flow towards boquet and/or and not leave site due to site design and stormwater flows. Pathway is not viable.	Site design is not altered.	Low: Assumptions are highly unlikely to change.	No	No	No, even if surface water infrastructure fails, still drains to boquet. No credible pathway.	N/A
PIE_12_11	Surface Water	Water quality	Wastewater (ablation) generated on site has the potential to be accidently released and impact local water sources	Operation	Unplanned release of wastewater (ablation)	Groundwater or surface water flows	Surface water (Angas River)	High: Waste pathway of ablation facilities well understood. Ablation facilities, septic system and wastewater treatment system from M6229 operations already constructed and in use. There has been no unplanned release of wastewater recorded during the operation of AZM. In the unlikely event of a wastewater release, surface wastewater will be captured in the stormwater treatment system and groundwater will flow towards the cone of depression, not moving offsite.	System will continue to function effectively. Annual audits.	Low: Conclusions reached in the impact assessment are highly unlikely to change if assumptions are found to be incorrect.	No	No	No, even if surface water infrastructure fails, still drains to boquet. No credible pathway.	N/A
PIE_12_12	Surface Water	Water quality	Spill of processing chemicals (copper sulfate, cbex, etc) results in impacts to surface water (Angas River)	Operation	Chemicals stored in operational area	Surface water flows	Surface water (Angas River)	High: Site design finalised and stormwater flows well understood. All water from rupture of process water tank would flow towards boquet and/or and not leave site due to site design and stormwater flows. Pathway is not viable.	Site design is not altered.	Low: Assumptions are highly unlikely to change.	No	No	No, EPA constructed and approved facility.	N/A

Impact ID	Justification of assumptions - EVIDENCE	Description of Grouped Environmental Impact	Significance of expected impact 1 = Negligible 2 = Low, 3 = Med 4 = High	Validation of modelling	Effectiveness of design measures	Effectiveness of management measures	Actions to reduce uncertainty	Excluded worst case impact	Unlikelihood of credible worst case impact	Residual Risk Rating (Low/High/Med)	Impact covered by alternative Act or Limit (Yes/No)	Act / Limit Reference	Proposed Outcome	Outcome measurement criteria	Leading Indicator criteria (where required)
PIE_12_5	Chapter 12, section 12.6 Appendix K1	N/A	1	Medium: Industry standard effective at management of the possible contamination from the site activities	High: Bunding and flow paths contain runoff within the site from the operational areas.	High: routine maintenance. Known to be effective on sites.	N/A	Minor	None	Low	Yes	Environment Protection (Water Quality) Policy (SA) Natural Resources Management Act 2004 (SA)	No contamination of natural water drainage systems, streams and rivers; groundwater; land and soils occurs either on or off site resulting from permanent disposal or temporary storage of mine ore or waste material	Triplicate samples to be taken when water is running from the Front Entrance (pre-wetland), visitors viewing area, Pre-Wetland overflow point of the sediment dam, and exit point at the Evaporation Pan (Figure 12-11). Samples to be measured as per AS/NZS 5667.1:1998 standards. A paired t-test will demonstrate that turbidity at these sites is not significantly different from the mean of the triplicate samples taken at Hogben or greater than the mean of the triplicate samples taken at Hogben. If the samples obtained at the pre-wetland location, visitors viewing area or off-dam overflow are significantly different from and greater than the mean of the triplicate samples taken at Hogben, verification will be undertaken to determine whether water is in fact leaving the Mineral Lease/MP, in order to ascertain the source of the potential contamination.	After high rainfall events which generate runoff, records from visual inspections of silt traps, the silt retention dam and surface drainage systems on MS 5239 and MPA (Figure 12-11) demonstrate that silt volume is no more than 50% of trap capacity volume and there is no breach in walls. After high rainfall events which generate runoff, visual inspections of all sloped areas, ore and topsoil stockpiles will occur to ensure no evidence of sediment loss through erosion (formation of rills and gullies)
PIE_12_6	Chapter 12, section 12.6 Appendix K1	N/A	1	High: Industry standard effective at management of the possible contamination from the site activities	High: Bunding and flow paths direct all flow to monitored discharge points	High: routine maintenance. Known to be effective on sites	Continuing the rehab of the site to reduce the potential for sediment runoff	Minor	Possible	Low	Yes	Environment Protection (Water Quality) Policy (SA) Natural Resources Management Act 2004 (SA)	NA	NA	NA
PIE_12_7	Chapter 12, section 12.6 Appendix K1	N/A	1	N/A	High: Bunding and flow paths direct all flow to monitored discharge points	High: monitoring plans able to identify issues early.	N/A	Minor	Unclear	Low	Yes	Environment Protection (Water Quality) Policy (SA) Natural Resources Management Act 2004 (SA)	No adverse impacts on soil quality or quantity caused by mining operations	During high rainfall events which generate runoff, turbidity will be measured at the Front Entrance (pre-wetland), visitors viewing area, overflow point of the sediment dam, and exit point at the Evaporation Pan (Figure 12-11) as per sampling method AS/NZS 5667.1:1998 standards to ensure the NTU does not exceed ANZECC/ARMCANZ (2000) guidelines of 50NTU.	After high rainfall events which generate runoff, records from visual inspections of silt traps, the silt retention dam and surface drainage systems on the proposed MPA demonstrate that silt volume is no more than 50% of trap capacity volume and there is no breach in walls
PIE_12_8	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
PIE_12_9	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
PIE_12_10	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
PIE_12_11	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
PIE_12_12	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Impact Assessment

Impact ID	Relevant Chapter	Environmental Aspect	Description of Potential Impact Event	Mine Life Phase	Source	Pathway	Receptor	Understanding of source, pathway, receptor (given limitations in information used in assessment)	Uncertainties and assumptions (relating to SPR)	Sensitivity to change of any assumptions	Confidence in S-P-R	Outcome required?	Justification/evidence as to why no S-P-R	Factors that limit / mitigate impact (control measures)
PIE_12_13	Surface Water	Water quality	Spill of RO chemicals results in impacts to surface water (Angas River)	Operation	Demining borehole RO area	Surface water flow	Surface water (Angas River)	High: Site design finalised and stormwater flows well understood. All water from rupture of process water tank would flow towards bores and/or not leave site due to site design and stormwater flows. Pathway is not viable.	Site design is not altered.	Low: Assumptions are highly unlikely to change.	No	No	No, even if surface water infrastructure fails, still drains to bores. No credible pathway.	N/A
PIE_12_14	Surface Water	Water quality	Spill of agricultural chemicals results in impacts to surface water (Angas River)	Operation	Agricultural chemicals stored in ore sheds	Surface water flow	Surface water (Angas River)	High: Site design finalised and stormwater flows well understood. All water from rupture of process water tank would flow towards bores and/or not leave site due to site design and stormwater flows. Pathway is not viable.	Site design is not altered.	Low: Assumptions are highly unlikely to change.	No	No	No, not of significant enough volume or concentration to impact surface water (Angas River)	N/A
PIE_12_15	Surface Water	Water quality	Hydrocarbon spills from diesel tank results in impacts to surface water quality (Angas River)	Operation	Diesel tank	Surface water flow	Surface water (Angas River)	High: Site design finalised and stormwater flows well understood. All water from rupture of Diesel tank would flow towards bores and/or not leave site due to site design and stormwater flows. Pathway is not viable.	Site design is not altered.	Low: Assumptions are highly unlikely to change.	No	No	No, even if surface water infrastructure fails, still drains to bores. No credible pathway.	N/A
PIE_13_1	Soil and land quality	Groundwater	Onsite storage and handling of waste and hazardous materials has the potential to spill and impact on soil quality.	Upgrade, Operation, Closure	Onsite storage and handling of waste and hazardous materials	Mobilisation (leachate/runoff) of spilled contaminants	Soil quality (with indirect impacts on groundwater quality)	Medium: Sources of contamination in waste materials well understood. Use and storage of hazardous substances known and accounted for in Waste Management Plan and Stormwater Management Plan.	Location and volume of spill unknown. Handling activities with the potential to cause a spill will be undertaken in the designated areas of the "dry cover"	Low: Standard measures employed and use of hazardous substances unlikely to change significantly	Yes	Yes	N/A	Implementation of Waste Management Plan. Bunding and storage to standards, appropriate wastewater treatment plants. Spill response plans, clean up kits etc. available. Spills localised: EPA waste management plan to be completed with. Training of staff and contractors on waste management procedures and handling and storage of potentially hazardous materials. QA and Procedures in place to control the handling of potentially hazardous material. MSDS for all potentially hazardous materials stored on site.
PIE_13_2	Soil and land quality	Surface Water	Gold ore on ROM pad impacts soil quality, resulting in failure of post closure land use (sulphide hosted ore)	Post closure	Gold ore stockpiles	Stormwater run off	Soil quality (with impacts to future land use)	Medium: sulphides hosted in Acid Consuming Material. Pathway present but presents lower risk than existing AIM ore. Consumption of ore within 2-3 weeks on surface.	Geochemical composition of gold ore well understood, as is surface water drainage. Assumption that closure earthworks and suit as per EPA requirements will remove any potential for adverse impacts to soil quality post-closure. Quality of soil to be used during closure known.	Low: ore composition understood and closure requirements ascertained in accordance with EPA legislation	Yes	Yes	N/A	Material assessment of Bih gold ore included in Chapter 13 Soil and Land Quality. Implementation of closure process for site contamination (including removal of all contaminated soils and audit) ascertained in consultation with EPA and mining regulator to be in accord with state legislation, policies and guidelines for site contamination. ROM area clearly delineated. Drainage of ROM pad directed to process ponds to remove potential for containment issues.
PIE_13_3	Soil and land quality	Surface Water	Inadequate removal of contaminated soils leads to soil impacting soil quality, and hinders successful rehabilitation	Post Closure	MPI activities	Contaminated collingies	Soil quality (with impacts to the health and establishment of vegetation)	High: Hazardous chemicals to be used onsite known, site design well understood for higher risk areas, and closure strategy approved by EPA.	Assumption that EPA and DEMUTE contamination audit prior to surrender of lease adequate	Low: Closure process ascertained in consultation with EPA and mining regulator to be in accord with state legislation, policies and guidelines for site contamination	Yes	Yes	N/A	Implementation of Waste Management Plan. Bunding and storage to standards, appropriate wastewater treatment plants. Spill response plans, clean up kits etc. available. Spills localised: EPA waste management plan to be completed with. Training of staff and contractors on waste management procedures and handling and storage of potentially hazardous materials. QA and Procedures in place to control the handling of potentially hazardous material. MSDS for all potentially hazardous materials stored on site. Closure process for site contamination ascertained in consultation with EPA and mining regulator to be in accord with state legislation, policies and guidelines for site contamination
PIE_13_4	Soil and land quality	Surface Water	MPI activities contaminate topsoil used during rehabilitation leads to soil impacting soil quality, and hinders successful rehabilitation	Post Closure	MPI activities	Contaminated collingies	Soil quality (with impacts to the health and establishment of vegetation)	High: Hazardous chemicals to be used onsite known, site design well understood for higher risk areas, and closure strategy approved by EPA.	Assumption that topsoil already stockpiled and has data from 2008-2017 indicating no contamination issues. Assumption that continuation of monitoring occurs.	Low: Closure process ascertained in consultation with EPA and mining regulator to be in accord with state legislation, policies and guidelines for site contamination. Limited potential contamination events possible due to location. Sampled annually.	Yes	Yes	N/A	Implementation of Waste Management Plan. Bunding and storage to standards, appropriate wastewater treatment plants. Spill response plans, clean up kits etc. available. Spills localised: EPA waste management plan to be completed with. Training of staff and contractors on waste management procedures and handling and storage of potentially hazardous materials. QA and Procedures in place to control the handling of potentially hazardous material. MSDS for all potentially hazardous materials stored on site. Closure process for site contamination ascertained in consultation with EPA and mining regulator to be in accord with state legislation, policies and guidelines for site contamination

Impact ID	Justification of assumptions - EVIDENCE	Description of Grouped Environmental Impact	Significance of expected impact 1 = Negligible 2 = Low, 3 = Med 4 = High	Validation of modelling	Effectiveness of design measures	Effectiveness of management measures	Actions to reduce uncertainty	Credible worst case impact	Unlikelihood of credible worst case impact	Best Baseline (Low/High/Very High)	Impact covered by alternative Act or Limit (Yes/No)	Act / Limit Reference	Proposed Outcome	Outcome measurement criteria	Leading Indicator Criteria (where required)
PIE_12_13	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
PIE_12_14	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
PIE_12_15	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
PIE_13_1	Spills outside of sealed areas have the potential to contaminate soils if not managed appropriately. Waste Management Plan and Spills procedure in Appendix B1. Also see Chapter 3.6: Wastes. Closure process for contaminated soils included in Chapter 13: section 13.7.	Reduced soil/land quality on lease compromising future land productivity	1	N/A	High: Bunding and waste water treatment plants known to be effective	Medium: Reliance on standard management measures	Review of draft Waste Management Plan prior to refurbishment of processing plant	Minor	Possible	Low	Yes	Environment Protection Act 1994 (SA) National Environment Protection Council Act 1994 (Cth) / National Environment Protection Measures (NEMPS)	No adverse impacts on soil quality or quantity caused by mining operations	If a spill of fuel, oil or hazardous chemical occurs outside bunded areas, it will be reported and remediated within 48 hours. Any spills out of the dirty operational zone will be soil tested as per AS 4482.1:1997 standards, and tested for As, Cd, Cu, Pb, Mn, Hg, Ni and Zn to ensure no levels higher than the topsoil stockpile baseline maximum. Records will be kept of volumes of putrescible waste taken off site to demonstrate disposal of all potentially polluting waste taken to an approved EPA site and in accordance with the site's Waste Management Plan (Appendix B3)	Monthly review of weekly waste management site inspections records, focusing on storage of waste and hazardous materials, will indicate less than 5 occurrences a month of incorrectly disposed or stored waste.
PIE_13_2	Sulphide ore can present a risk to soil quality if not contained through operations and removed post-closure. See Chapter 13: Soil and Land Quality section 13.7.	Reduced soil/land quality on lease compromising future land productivity	2	Geological model for BH orebody has been completed on data available to date	High: Drainage and containment known to be effective, removal of all ROM material and site contamination audit through closure significantly reduces/removes potential for residual impacts and impacts to post-closure land use. Standard measures for industrial site clean-up.	Medium (operations): Relies on standard management measures of ore containment and parcel to remove contaminated materials from area during closure. High (closure) effectiveness in EPA site contamination audit process.	Geological modelling will be updated as new information is available	Moderate	Possible	Medium	Yes	Environment Protection Act 1994 (SA) National Environment Protection Council Act 1994 (Cth) / National Environment Protection Measures (NEMPS)	No adverse impacts on soil quality or quantity caused by mining operations	Records will be kept of volumes of putrescible waste taken off site to demonstrate disposal of all potentially polluting waste taken to an approved EPA site and in accordance with the site's Waste Management Plan (Appendix B3)	None proposed.
PIE_13_3	Spills outside of sealed areas have the potential to contaminate soils if not managed appropriately. Waste Management Plan and Spills procedure in Appendix B1. Also see Chapter 3.6: Wastes. Closure process for contaminated soils included in Chapter 13: section 13.7.	Reduced soil/land quality on lease compromising future land productivity	1	N/A	High: Closure strategies known to be effective at a number of industrial sites	High: Reliance on standard measures to manage potential site contamination impacts	Review of draft Waste Management Plan prior to refurbishment of processing plant	Uncertain	Moderate	Medium	Yes	Environment Protection Act 1994 (SA) National Environment Protection Council Act 1994 (Cth) / National Environment Protection Measures (NEMPS)	No adverse impacts on soil quality or quantity caused by mining operations	Provision of a report once prior to entering closure monitoring phase by a suitably qualified site contamination consultant verifies that a site contamination assessment and if required remediation in accordance with the NEM and relevant EPA guidelines (including the T3) has occurred, ensuring there is no unacceptable risk to human health or the environment as a result of the contamination when compared with relevant baseline concentrations and relevant NEM investigation levels.	None proposed
PIE_13_4	Topsoil stockpile data 2008-2017. See topsoil control measure in Chapter 13: Soil and Land Quality section 13.6.1.4.	Reduced soil/land quality on lease compromising future land productivity	1	N/A	High: Closure strategies known to be effective at a number of industrial sites	High: Reliance on standard measures to manage topsoil stockpile	Review of topsoil samples annually for early detection of any issues.	Uncertain	Moderate	Medium	Yes	Environment Protection Act 1994 (SA) National Environment Protection Council Act 1994 (Cth) / National Environment Protection Measures (NEMPS)	No adverse impacts on soil quality or quantity caused by mining operations	Annual photo monitoring of all topsoil stockpiles located on the proposed MFL will show vegetation establishment and no signs of erosion (formation of rills, gullies or other evidence of topsoil loss). Annual survey of topsoil available / stockpiled for closure demonstrates that there is no loss of existing (pre-mining) topsoil.	All topsoil stockpiles located on M6 6229 will be annually sampled, to AS 4482.1:2005 standards, and tested for As, Cd, Cu, Pb, Mn, Hg, Ni, Zn, pH, EC, and exchangeable cations Na, Hg, and Ca. Any results higher than the topsoil baseline maximum (Appendix L1) for any analyte will be investigated and appropriate actions taken. A materials balance of topsoil available / stockpiled for closure demonstrates requirements are met or identifies a deficiency.

Impact ID	Relevant Chapter	Environmental Aspect	Description of Potential Impact Event	Mine Life Phase	Source	Pathway	Receptor	Understanding of source, pathway, receptor (given limitations in information used in assessment)	Uncertainties and assumptions (relating to SPR)	Sensitivity to change of any assumptions	Confirmation of S-P-R	Outcome required?	Justification/evidence as to why no S-P-R	Factors that limit / mitigate impact (control measures)
PIE_13_5	Soil and land quality	Surface Water	Flood event results in contaminated surface water impacting soil quality through operations	Operations	MPL activities	Contaminated soil fillings	Soil quality	High: Hazardous chemicals to be used onsite known, site design well understood for higher risk areas, and closure strategy approved by EPA.	Assumption that EPA and DEM site contamination audit prior to surrender of lease adequate	Low: Closure process ascertained in consultation with EPA and mining regulator to be in accord with state legislation, policies and guidelines for site contamination	Yes	Yes	N/A	processing/mill area drains report to the process water ponds and thus the treatment plant located onsite, implementation of Waste Management Plan, Bunding and storage to standards, appropriate wastewater treatment plants. Spill response plans, clean up kits etc. available. Spills localised. EPA waste management plan to be complied with. Training of staff and contractors on waste management procedures and handling and storage of potentially hazardous materials. QA and Procedures in place to control the handling of potentially hazardous material. MSDS for all potentially hazardous materials stored on site. Closure process for site contamination ascertained in consultation with EPA and mining regulator to be in accord with state legislation, policies and guidelines for site contamination
PIE_13_6	Soil and land quality	Surface Water	Flood event results in contaminated surface water impacting soil quality post closure	Post Closure	MPL activities	Contaminated soil fillings	Soil quality (with respect to fauna and flora)	High: Hazardous chemicals to be used onsite known, site design well understood for higher risk areas, and closure strategy approved by EPA.	Assumption that EPA and DEM site contamination audit prior to surrender of lease adequate	Low: Closure process ascertained in consultation with EPA and mining regulator to be in accord with state legislation, policies and guidelines for site contamination	Yes	Yes	N/A	Implementation of Waste Management Plan, Bunding and storage to standards, appropriate wastewater treatment plants. Spill response plans, clean up kits etc. available. Spills localised. EPA waste management plan to be complied with. Training of staff and contractors on waste management procedures and handling and storage of potentially hazardous materials. QA and Procedures in place to control the handling of potentially hazardous material. MSDS for all potentially hazardous materials stored on site. Closure process for site contamination ascertained in consultation with EPA and mining regulator to be in accord with state legislation, policies and guidelines for site contamination
PIE_13_7	Soil and land quality		Bioaccumulation of heavy metals by plants in the operational zone impacts native fauna	Operations, post closure	Contaminated soils	Bioaccumulation	Native fauna populations	High: no plants have been located in operational zone which would have the potential to bioaccumulate and impact fauna. See Vegetation maps in Chapter 19: Vegetation and Weeds.	Assumptions are based on the site flora and fauna surveys undertaken to date, ongoing site inspections	Low: Area will remain operation during the MPL activities and vegetation is unlikely to be present. Closure process ascertained in consultation with EPA and mining regulator to be in accord with state legislation, policies and guidelines for site contamination	No	No	no plants located in operational zone which have the potential to bioaccumulate and impact fauna. See Vegetation maps in Chapter 19: Vegetation and Weeds.	N/A
PIE_14_1	Geochemistry	TSF	Basal liner failure (major) resulting in major leak over short time period impacting groundwater	Operations, post closure	TSF water	Groundwater seepage	Groundwater and/or local groundwater users	High: Annual compliance reports to date indicate no immediate risk to receptors (based upon 9 years of operation).	Assumption that TSF pipelines built to specifications as per Design in appendix V3.	Low: Groundwater modelling complete with updated geochemistry modelling in 2016 based on conservative decant pond water quality.	Yes	Yes	N/A	TSF design as per Appendix V3, AGT GW modelling for basal liner failure (appendix VI), Operation and Maintenance manual (routine monitoring) in Appendix 13.
PIE_14_10	Geochemistry	TSF	Discharge through spillway (buffer storage capacity / water level not managed / storm event overtops through spillway) impacts soil quality outside TSF	Operations, closure	Ground disturbance	Physical impact of machinery	Soil quality	High: Understanding of the Geotechnical condition of the Spillway and the construction of the spillway the drainage paths	Assumption that TSF operated and audited annually as per Operations and Maintenance Manual (Appendix 13)	Low: the design was completed to the ANCCOLD standards	Yes	Yes		Goes into spillway / artificial wetland / silt retention dam. Operation and Maintenance manual has buffer levels, leading indicator and compliance criteria which indicates acceptable levels of tailings and free water in TSF. Currently designed to 1:100 / 72 hours storm event.
PIE_14_11	Geochemistry	TSF	Discharge through spillway (buffer storage capacity / water level not managed / storm event overtops through spillway) impacts surface water quality outside TSF (gauge river)	Operations, closure	TSF stormwater	Spillway	Surface water (gauge/river)	High: Understanding of the Geotechnical condition of the Spillway and the construction of the spillway the drainage paths	Assumption that TSF operated and audited annually as per Operations and Maintenance Manual (Appendix 13)	Low: the design was completed to the ANCCOLD standards	Yes	Yes	N/A	Goes into spillway / artificial wetland / silt retention dam. Operation and Maintenance manual has buffer levels, leading indicator and compliance criteria which indicates acceptable levels of tailings and free water in TSF. Currently designed to 1:100 / 72 hours storm event.

Impact Assessment

Impact ID	Justification of assumptions - EVIDENCE	Description of Grouped Environmental Impact	Significance of expected impact 1 = Negligible 2 = Low, 3 = Med 4 = High	Validation of modelling	Effectiveness of design measures	Effectiveness of management measures	Actions to reduce uncertainty	Excluded worst case impact	Unlikelihood of credible worst case impact	Residual Risk Rating (Low/Medium/High)	Impact covered by alternative flow Act or Limit (Yes/No)	Act / Limit Reference	Proposed Outcome	Outcome measurement criteria	Leading Indicator criteria (where required)
PIE_13_5	Hazardous chemicals can leave residual risk if not cleaned up appropriately. See control measure in Chapter 13: Soil and Land Quality section 13.6.	Reduced soil/land quality on-lease compromising future land productivity	1	N/A	High: Closure strategies known to be effective at a number of industrial sites	High: Reliance on standard measures to manage potential site contamination impacts	Review of draft Waste Management Plan prior to refurbishment of processing plant	Unlikely	Moderate	Medium	Yes	Environment Protection Act 1994 (SA) National Environment Protection Council Act 1994 (EPHC) / National Environment Protection Measures (NEMPMs)	No adverse impact to the supply or quality of water caused by the mining operations to existing users and water dependent ecosystems	Triplicate surface water samples will be taken during rain events where there is a potential for discharge into the Angas River from M6, 6229. Samples will be taken, as per AS/NZS 5667.1:1998, where the Angas River flows at one potential discharge location (Croser) and one upstream control sample point (Hogben). A paired t-test will demonstrate that potential contaminants (Pb, Zn, Cd, pH, TDS, SO4, EC and turbidity) at Croser are not significantly different (p-value ≤ 1-test value) from the mean of the samples taken at Hogben at that point in time over a consecutive period no less than 5 years.	Triplicate surface water samples will be taken quarterly, as per AS/NZS 5667.1:1998, where the Angas River flows at one potential discharge location (Croser) and one upstream control sample point (Hogben). A paired t-test will demonstrate that potential contaminants (Pb, Zn, Cd, pH, TDS, SO4, EC and turbidity) at Croser are not significantly different (p-value ≤ 1-test value) from the mean of the samples taken at Hogben at that point in time.
PIE_13_6	Hazardous chemicals can leave residual risk if not cleaned up appropriately. Closure process for contaminated soils included in Chapter 13: section 13.7.	Reduced soil/land quality on-lease compromising future land productivity	1	N/A	High: Closure strategies known to be effective at a number of industrial sites	High: Reliance on standard measures to manage potential site contamination impacts	Review of draft Waste Management Plan prior to refurbishment of processing plant	Unlikely	Moderate	Medium	Yes	Environment Protection Act 1994 (SA) National Environment Protection Council Act 1994 (EPHC) / National Environment Protection Measures (NEMPMs)	No adverse impact to the supply or quality of water caused by the mining operations to existing users and water dependent ecosystems	During high rainfall events which generate runoff, turbidity will be measured at the pre wetland location, visitors viewing area and the overflow point of the silt retention dam as per sampling method AS/NZS 5667.1:1998 standards to ensure the NTU does not exceed ANZCC/ANMACANZ (2000) guidelines of 50NTU.	After high rainfall events which generate runoff, records from visual inspections of silt traps, the silt retention dam and surface drainage systems on the proposed MPM, demonstrate that an volume is no more than 50% of trap capacity volume and there is no breach in walls.
PIE_13_7	N/A	Reduced soil/land quality on-lease compromising fauna populations	1	N/A	N/A	N/A	N/A	Unlikely	Negligible	Low	No	N/A	N/A	N/A	N/A
PIE_14_1	Appendix V3, Appendix H6 and Appendix I3	Ground Water	2	High: Groundwater modelling complete with updated geochemistry modelling in 2016 based on conservative decant pond water quality.	High: design of monitoring system includes early warning systems, ANCCOLD design and build.	High: Daily and Weekly inspection sheets, monitoring as per Operation and Maintenance manual and annual audit against Operation and Maintenance Manual.	N/A. Annual review provides recommendations which are implemented.	Moderate	Unlikely	Medium	Yes	Environment Protection Act 1994 (SA) Environment Protection (Water Quality) Policy (SA) Natural Resources Management Act 2004 (SA)	No contamination of natural water drainage systems, streams and rivers, groundwater, land and soils occurs either on or off site resulting from permanent disposal or temporary storage of mine ore or waste material	Standing Water Levels (SWL) will be monitored monthly as per AS/NZS 5667.1:1998 standards at groundwater monitoring boxes TSF A, B, C and D (Figure 11.5) An independent expert will verify through annual analysis of the monthly data that no leakage from the TSF into the surrounding aquifer has been detected. Groundwater monitoring boxes TSF A, B, C and D (Figure 11.5) will be sampled and analysed monthly as per AS/NZS 5667.1:1998 standards for pH, EC, TDS, Al, Cd, Pb, Zn, Mn and Fe. An independent expert will verify, through annual analysis of the monthly data that no leakage from the TSF into the surrounding aquifer has been detected.	Groundwater monitoring boxes TSF A, B, C and D will be sampled and analysed monthly as per AS/NZS 5667.1:1998 standards for pH, EC, TDS, Al, Cd, Pb, Zn, Mn and Fe. A standard deviation no change in quality beyond 2 standard deviation of the mean (Figure 11.5). If a change from the 2 standard deviation occurs, results are to be submitted to an independent expert for analysis.
PIE_14_10	N/A	Soil	1	High: Annual inspection of the wall and confirmation still in accordance with the design standards	High: Dam designed, build, maintained and managed as per ANCCOLD guidelines	High: Daily and Weekly inspection sheets, monitoring as per Operation and Maintenance manual and annual audit against Operation and Maintenance Manual.	Review and recommission TSF and update operations and maintenance manual prior to restarting TSF.	Minor	Unlikely	Low	Yes	Environment Protection Act 1994 (SA) National Environment Protection Council Act 1994 (EPHC) / National Environment Protection Measures (NEMPMs)	No contamination of natural water drainage systems, streams and rivers, groundwater, land and soils occurs either on or off site resulting from permanent disposal or temporary storage of mine ore or waste material	Provision of a report once prior to entering closure monitoring phase by a suitably qualified site contamination consultant verifies that a site contamination assessment and if required remediation in accordance with the NEMPA and relevant EPA guidelines for the central and southern domains (including the TSF) Figure 2 has occurred, ensuring there is no unacceptable risk to human health or the environment as a result of the contamination when compared with relevant baseline concentrations and relevant NEMPA investigation levels.	None proposed
PIE_14_11	N/A	Surface Water	1	High: Annual inspection of the wall and confirmation still in accordance with the design standards	High: Dam designed, build, maintained and managed as per ANCCOLD guidelines	High: Daily and Weekly inspection sheets, monitoring as per Operation and Maintenance manual and annual audit against Operation and Maintenance Manual.	Review and recommission TSF and update operations and maintenance manual prior to restarting TSF.	Moderate	Unlikely	Medium	Yes	Environment Protection Act 1994 (SA) Environment Protection (Water Quality) Policy (SA) Natural Resources Management Act 2004 (SA)	No adverse impact to the supply or quality of water caused by the mining operations to existing users and water dependent ecosystems	Triplicate surface water samples will be taken during rain events where there is a potential for discharge into the Angas River from MPM. Samples will be taken, as per AS/NZS 5667.1:1998, where the Angas River flows at one potential discharge location (Croser) and one upstream control sample point (Hogben). A paired t-test will demonstrate that potential contaminants (Pb, Zn, Cd, pH, TDS, SO4, EC and turbidity) at Croser are not significantly different (p-value ≤ 1-test value) from the mean of the samples taken at Hogben at that point in time over a consecutive period no less than 5 years.	Triplicate surface water samples will be taken quarterly, as per AS/NZS 5667.1:1998, where the Angas River flows at one potential discharge location (Croser) and one upstream control sample point (Hogben). A paired t-test will demonstrate that potential contaminants (Pb, Zn, Cd, pH, TDS, SO4, EC and turbidity) at Croser are not significantly different (p-value ≤ 1-test value) from the mean of the samples taken at Hogben at that point in time.

Impact Assessment

Impact ID	Relevant Chapter	Environmental Aspect	Description of Potential Impact Event	Mine Life Phase	Source	Pathway	Receptor	Understanding of source, pathway, receptor (given limitations in information used in assessment)	Uncertainties and assumptions (relating to SPR)	Sensitivity to change of any assumptions	Confirmation of S-P-R	Outcome required?	Justification/evidence as to why no S-P-R	Factors that limit / mitigate impact (control measures)
PIE_14_12	Geochemistry	TSF	Dust deposition from TSF impacts negatively upon neighbouring productive land	Operations	Tailings - both insoluble matter	deposition system (wind)	Surrounding agricultural land	TSF is moist during operations. This prevents dust. To be capped after operations. No evidence of impact from construction (2006) to present (2018). Air quality modelling indicates no impact. Large database of dust deposition data from 2006-2018.	Assumption that TSF will continue to be operated as per the operations and maintenance manual (Appendix 13). Air quality modelling indicates no impact. Large database of dust deposition data from 2006-2018.	Low - Monitoring data from 2008 to 2018 indicates no evidence of source impacting receptor, however if operations and maintenance manual no adhered to, still potential.	Yes	Yes	N/A	Moisture content of tailings reduces aero-entrainment (rotation of spigots). Dust suppression sprays utilised. Background levels of metal in soils to north of ML higher than NEPM HILs (Chapter 13).
PIE_14_13	Geochemistry	TSF	Dust deposition from TSF results in nuisance impacts on local community	Operations	Tailings - TSF	deposition system (wind)	Local community	TSF is moist during operations. This prevents dust. To be capped after operations.	Assumption that TSF will continue to be operated as per the operations and maintenance manual (Appendix 13). Air quality modelling indicates no impact. Large database of dust deposition data from 2006-2018.	Low - Monitoring data from 2008 to 2018 indicates no evidence of source impacting receptor, however if operations and maintenance manual no adhered to, still potential.	Yes	Yes	N/A	Moisture content of tailings reduces aero-entrainment (rotation of spigots). Dust suppression sprays utilised. Background levels of metal in soils to north of ML higher than NEPM HILs (Chapter 13).
PIE_14_14	Geochemistry	TSF	Dust deposition from TSF results in health impacts on local community	Operations	Dust (PM10) generated from TSF operation	Air and prevailing winds	Local community	TSF is moist during operations. This prevents dust. To be capped after operations.	Assumption that TSF will continue to be operated as per the operations and maintenance manual (Appendix 13). Air quality modelling indicates no impact. Large database of dust deposition data from 2006-2018.	Low - Monitoring data from 2008 to 2018 indicates no evidence of source impacting receptor, however if operations and maintenance manual no adhered to, still potential.	Yes	Yes	N/A	Moisture content of tailings (30% slurry). Dust suppression sprays utilised. Grind size (based on 80micron), reduced pm10 potential.
PIE_14_15	Geochemistry	TSF	Flood - Erosion of tailings material in dam from flooding in River results in impact to surface water (Kings River)	Operations, closure, post closure	Tailings	Flood	Surface water (Kings River)	High - the site is higher than the local town and the Council Flood mapping doesn't include the site in any flood event. Built >100m from 1:100 ARI flood plain.	Located significantly higher than 1:100 ARI flood plain.	Low - Groundwater modelling complete with updated geochemistry modelling in 2016 based on conservative decant pond water quality.	No	No	TSF built >100m from 1:100m ARI flood plain. Figure 14 S. Not credible.	N/A
PIE_14_16	Geochemistry	TSF	Geochemical reaction between BH and AZM tailings causes air quality impacts on local community	Operations, closure, post closure	TSF	chemical reaction	Local community	High: Geochemistry analysis and modelling undertaken to understand source (JACOBS 2017), pathway potential and receptors	modelling indicates no gas or air quality impacts possible	Low sensitivity	No	No	Appendix M7	N/A
PIE_14_17	Geochemistry	TSF	Overtopping of TSF due to underestimation of sg/ore volumes/beach disposition due to poor management practices/etc. results in impact on soil quality outside TSF	Operations	Tailings	Soliment disposition	Soil quality	Medium: Uncertainty exists regarding the final volume of tailings materials balance. Volume modelling will be updated annually as part of the Operation and Maintenance manual annual report.	Assumption that TSF operated and audited annually as per Operations and Maintenance Manual (Appendix 15). BH tailings densities and volumes determined in Appendix 12.	Medium - Based on known current resource volume. Volumes to be recalculated if any resource update.	Yes	Yes	N/A	Operation and Maintenance manual - deposition early warning indicators, monitor progressive volume during filling, embankment raise possible if was required. Annually inspection report and review of the remaining volume in the TSF.
PIE_14_18	Geochemistry	TSF	Overtopping of TSF due to underestimation of sg/ore volumes/beach disposition due to poor management practices/etc. results in impact on soil quality outside TSF	Operations	Tailings	Site water direct flow	Surface water (Kings River)	Medium: Uncertainty exists regarding the final volume of tailings materials balance. Volume modelling will be updated annually as part of the Operation and Maintenance manual annual report.	Final Volume of tailing to be placed into the TSF	Medium - based on the final volumes and the SG of the material when plotted	Yes	Yes	N/A	Operation and Maintenance manual - deposition early warning indicators, monitor progressive volume during filling, embankment raise possible if was required. Annually inspection report and review of the remaining volume in the TSF.

Impact Assessment

Impact ID	Justification of assumptions - EVIDENCE	Description of Grouped Environmental Impact	Significance of expected impact 1 = Negligible 2 = Low, 3 = Mid 4 = High	Validation of modelling	Effectiveness of design measures	Effectiveness of management measures	Actions to reduce uncertainty	Confidence worst/Best case impact	Uncertainty of Credible worst case impact	Best Ranking (Low/Mid/High)	Impact covered by alternative Act or Limit (Yes/No)	Act / Limit Reference	Proposed Outcome	Outcome measurement criteria	Leading Indicator criteria (where required)
PIE_14_12	TSF Operations and Maintenance Manual, air quality data from 2006 to 2018, air quality impact assessment.	Agricultural impacts	1	High: air quality modelling used for operational phase of M&E229 and was reflective of conditions	High: standard techniques used on TSF through the industry	High: standard techniques used on TSF through the industry	N/A	Minor	Possible	Low	Yes	Environment Protection Act 1994 (SA) South Australian Environmental Protection (Air Quality) Policy 2016	No public nuisance impacts to local residents from dust, air emissions and/or odour caused by mining operations	Dust generated from the mining lease during operation activities, measured Twelve static Dust Deposition Gauges located on and off the mining lease shown in Figure 14-1, will be monitored monthly for total insoluble solids (TIS) as per AS 3580.10.1-1991 standards. This will demonstrate that total insoluble solids are less than Australian best practice deposition levels of 4g/m ² /month. Any exceedance of 4g/m ² /month to be investigated with reference to meteorological data and onsite activities to ascertain whether the source is likely to be Teramin's activities.	Twelve static Dust Deposition Gauges located on and off the mining lease shown in Figure 14-1, will be monitored monthly for total insoluble solids (TIS) as per AS 3580.10.1-1991 standards. This will demonstrate that total insoluble solids are less than Australian best practice deposition levels of 4g/m ² /month. Any exceedance of 4g/m ² /month to be investigated with reference to meteorological data and onsite activities to ascertain whether the source is likely to be Teramin's activities.
PIE_14_13	TSF Operations and Maintenance Manual, air quality data from 2006 to 2018, air quality impact assessment.	Air quality	1	High: air quality modelling used for operational phase of M&E229 and was reflective of conditions	High: standard techniques used on TSF through the industry	High: standard techniques used on TSF through the industry	N/A	Minor	Unclear	Low	Yes	Environment Protection Act 1994 (SA) South Australian Environmental Protection (Air Quality) Policy 2016	No public nuisance impacts to local residents from dust, air emissions and/or odour caused by mining operations	If these levels are obtained for 12 months post closure, monitoring will no longer be required.	Twelve static Dust Deposition Gauges located on and off the mining lease shown in Figure 14-1, will be monitored monthly for total insoluble solids (TIS) as per AS 3580.10.1-1991 standards. This will demonstrate that total insoluble solids are less than Australian best practice deposition levels of 4g/m ² /month. Any exceedance of 4g/m ² /month to be investigated with reference to meteorological data and onsite activities to ascertain whether the source is likely to be Teramin's activities.
PIE_14_14	TSF Operations and Maintenance Manual, air quality data from 2006 to 2018, and continuation of PM10 air quality monitoring program.		1	High: air quality modelling used for operational phase of M&E229 and was reflective of conditions	High: standard techniques used on TSF through the industry	High: standard techniques used on TSF through the industry	Grind size to be ascertained. Further metallurgy work to ascertain further metal composition of tailings.	Minor	None	Low	N/A	N/A	No public injuries and/or deaths to members of the public caused by mining operations	PM10 dust levels collected from the HVAS "Northern/Side Gate" shown in Figure 14-1, will be sampled over a 24-hour period every 14 days as per AS 3580.9.3-2003 standards. Data will demonstrate compliance with BPF Air criteria of 50 µg/m ³ per 24-hour period with <5 days exceedances per year.	None proposed
PIE_14_15	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Yes	Environment Protection Act 1994 (SA) Environment Protection (Water Quality) Policy (SA) Natural Resources Management Act 2004 (SA)	N/A	If these levels are obtained for 12 months post closure, monitoring will no longer be required.	N/A
PIE_14_16	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Yes	Environment Protection Act 1994 (SA) Environment Protection (Water Quality) Policy (SA) Natural Resources Management Act 2004 (SA)	N/A	N/A	N/A
PIE_14_17	Operation and Maintenance Manual (3, Design of TSF Appendix V3, Tailings and Water Management Study Appendix I2).	Soil	2	High - Modelling input include the annual survey of the TSF and the estimates of the process rates for the next year	High - Dam designed, build, maintained and managed as per ANCOOLD guidelines	High: Daily and Weekly inspection sheets, monitoring as per Operation and Maintenance manual and annual audit against Operation and Maintenance Manual.	Tailings materials balance. Active adaptive management. Annual reviews of volumes, etc.	Moderate	Unclear	Medium	Yes	Environment Protection Act 1994 (SA) National Environment Protection Council Act 1994 (Cth) / National Environment Protection Measures (NEMPMs)	No contamination of natural water drainage systems, streams and rivers, groundwater, land and soils occurs either on or off site resulting from permanent disposal or temporary storage of mine ore or waste material	Provision of a report once prior to entering closure monitoring phase by a suitably qualified site contamination consultant verifies that a site contamination assessment and if required remediation in accordance with the NEMPM and relevant EPA guidelines for the central and southern domains (including the TSF Figure 1-2) has occurred, ensuring there is no unacceptable risk to human health or the environment as a result of the contamination when compared with relevant baseline concentrations and relevant NEMPM investigation levels.	None proposed
PIE_14_18	Operation and Maintenance Manual (3, Design of TSF Appendix V3, Tailings and Water Management Study Appendix I2).	Surface Water	1	High - Modelling input include the annual survey of the TSF and the estimates of the process rates for the next year	High - Dam designed, build, maintained and managed as per ANCOOLD guidelines	High: Daily and Weekly inspection sheets, monitoring as per Operation and Maintenance manual and annual audit against Operation and Maintenance Manual.	Tailings materials balance. Active adaptive management. Annual reviews of volumes, etc.	Moderate	Possible	Medium	Yes	Environment Protection Act 1994 (SA) Environment Protection (Water Quality) Policy (SA) Natural Resources Management Act 2004 (SA)	No adverse impact to the supply or quality of water caused by the mining operations to existing users and water dependant ecosystems	Triplicate surface water samples will be taken during rain events where there is a potential for discharge into the Angas River from MFL. Samples will be taken, as per AS/NZS 5667.1:1998, where the Angas River flows at one potential discharge location (Croser) and one upstream control sample point (Hogben). A paired test will demonstrate that potential contaminants (Pb, Zn, Cd, pH, TDS, SO4, EC and turbidity) at Croser are not significantly different (p-value <1 test value) from the mean of the samples taken at Hogben at that point in time over a consecutive period no less than 5 years.	Triplicate surface water samples will be taken quarterly, as per AS/NZS 5667.1:1998, where the Angas River flows at one potential discharge location (Croser) and one upstream control sample point (Hogben). A paired test will demonstrate that potential contaminants (Pb, Zn, Cd, pH, TDS, SO4, EC and turbidity) at Croser are not significantly different (p-value <1 test value) from the mean of the samples taken at Hogben at that point in time.

Impact ID	Relevant Chapter	Environmental Aspect	Description of Potential Impact Event	Mine Life Phase	Source	Pathway	Receptor	Understanding of source, pathway, receptor (given limitations in information used in assessment)	Uncertainties and assumptions (relating to SPR)	Sensitivity to change of any assumptions	Confirmation of S-P-R	Outcome required?	Justification/evidence as to why no S-P-R	Factors that limit / mitigate impact (control measures)
PIE_14_19	Geochemistry	TSF	Overtopping of TSF due to underestimation of g/ore volumes/beach disposition due to poor management practices/etc. results in impact on soil quality outside TSF	Operations	Tailings	Overland flow	Groundwater and/or local groundwater users	Medium: Uncertainty exists regarding the final volume of tailings materials balance. Volume modelling will be updated annually as part of the Operation and Maintenance manual annual report.	Final Volume of tailing to be placed into the TSF	Medium - based on the final volumes and the SG of the material when placed	Yes	Yes	N/A	Operation and Maintenance manual - deposition early warning indicators, monitor progressive volume during filling, embankment raise possible if was required. Annually inspection report and review of the remaining volume in the TSF.
PIE_14_20	Geochemistry	TSF	Basal liner failure (minor) resulting in slow leak over long time period impacting groundwater	Operations, closure, post closure	TSF water	Groundwater seepage	Groundwater and/or local groundwater users	High: Annual compliance reports to date indicate no immediate risk to receptors (based upon 9 years of operation).	Assumption that TSF pipelinet built to specifications as per Design in appendix V3.	Low: Groundwater modelling complete with updated geochemistry modelling in 2016 based on conservative decant pond water quality.	Yes	Yes	N/A	TSF design as per Appendix V3, AGT GW modelling for basal liner failure (Appendix H6), Operation and Maintenance manual (routine monitoring in Appendix I3).
PIE_14_20	Geochemistry	TSF	Overflow of seepage pit from either pump failure or increased pressure above double liner results in overflow of seepage pit impacting groundwater quality	Operations, closure	Seepage pit water	Site water directional flows	Groundwater and/or local groundwater users	High: Annual compliance reports to date indicate no immediate risk to receptors (based upon 9 years of operation).	N/A	Low: Groundwater modelling complete with updated geochemistry modelling in 2016 based on conservative decant pond water quality.	No	No	TSF design as per Appendix V3, AGT GW modelling for basal liner failure (Appendix H6), Operation and Maintenance manual (routine monitoring in Appendix I3). Water quantity or quality not significant enough to credibly impact receptor.	N/A
PIE_14_21	Geochemistry	TSF	Overflow of seepage pit from either pump failure or increased pressure above double liner results in overflow of seepage pit impacting soil quality outside of the MLP.	Operations, closure	Seepage pit water	Sediment disposition	Soil quality	High: Annual compliance reports to date indicate no immediate risk to receptors (based upon 9 years of operation).	N/A	Low: Groundwater modelling complete with updated geochemistry modelling in 2016 based on conservative decant pond water quality.	No	No	TSF design as per Appendix V3, AGT GW modelling for basal liner failure (Appendix H6), Operation and Maintenance manual (routine monitoring in Appendix I3). Water quantity or quality not significant enough to credibly impact receptor.	N/A
PIE_14_22	Geochemistry	TSF	Overflow of seepage pit from either pump failure or increased pressure above double liner results in overflow of seepage pit impacting surface water quality (Angas River)	Operations, closure	Seepage pit water	Site water of occasional flows	Surface water (Angas River)	High: Annual compliance reports to date indicate no immediate risk to receptors (based upon 9 years of operation).	N/A	Low: Groundwater modelling complete with updated geochemistry modelling in 2016 based on conservative decant pond water quality.	No	No	TSF design as per Appendix V3, AGT GW modelling for basal liner failure (Appendix H6), Operation and Maintenance manual (routine monitoring in Appendix I3). Water quantity or quality not significant enough to credibly impact receptor.	N/A

Impact ID	Justification of assumptions - EVIDENCE	Description of Grouped Environmental Impact	Significance of expected impact 1 = Negligible 2 = Low, 3 = Med 4 = High	Validation of modelling	Effectiveness of design measures	Effectiveness of management measures	Actions to reduce uncertainty	Excluded worst case impact	Realistic worst case impact	Method of Credible worst case impact	Best Ranking (Low = Best, High = Worst)	Impact covered by alternative Act or Limit (Yes/No)	Act / Limit Reference	Proposed Outcome	Outcome measurement criteria	Leading Indicator criteria (where required)
PIE_14_19	Operation and Maintenance Manual (3, Design of TSP Appendix V3, Tailings and Water Management Study Appendix 12).	Ground Water	1	Medium: Based on current known resource. Modelling input to include the annual survey of the TSP and the estimates of the process rates for the next year	High - Dam designed, built, maintained and managed as per ANCCOLD guidelines	High: Daily and Weekly inspection sheets, monitoring as per Operation and Maintenance Manual and annual audit against Operation and Maintenance Manual.	Tailings materials balance iteratively reviewed through lifecycle. Active adaptive management. Annual reviews of volumes included in annual TSP audit.	Moderate	Possible	Medium	Yes	Environment Protection Act 1994 (SA) Environment Protection (Water Quality) Policy (SA) Natural Resources Management Act 2004 (SA)	No contamination of natural water drainage systems, streams and rivers, groundwater, land and soils occurs either on or off site resulting from permanent disposal or temporary storage of mine ore or waste material	Standing Water Levels (SWL) will be monitored monthly as per AS/NZS 5667.1:1998 standards at groundwater monitoring bores TSP A, B, C and D (Figure 11.5). An independent expert will verify through annual analysis of the monthly data that no leakage from the TSP into the surrounding aquifer has been detected.	Groundwater monitoring bores TSP A, B, C and D will be sampled and analysed monthly as per AS/NZS 5667.1:1998 standards for pH, EC, TDS, Al, Cd, Pb, Zn, Mn and Fe, to demonstrate no change in quality beyond 2 standard deviation of the mean (Figure 11.5). If a change from the 2 standard deviation occurs, results are to be submitted to an independent expert for analysis.	Six embankment monitoring bores (MB1 to MB6) located on the TSP main embankment will be monitored monthly to ensure no water is detected. If water is detected, it will be sampled for pH, EC, TDS, Al, Cd, Pb, Zn, Mn and Fe, as per AS/NZS 5667.1:1998 standards, and results submitted to an independent expert for analysis.
PIE_14_2		Ground Water	2	High: Groundwater modelling complete with updated geochemistry modelling in 2018 based on conservative decant pond water quality.	High: design of monitoring system includes early warning systems, ANCCOLD design and build.	High: Daily and Weekly inspection sheets, monitoring as per Operation and Maintenance Manual and annual audit against Operation and Maintenance Manual.	N/A. Annual review provides recommendations which are implemented.	Minor	Possible	Low	Yes	Environment Protection Act 1994 (SA) Environment Protection (Water Quality) Policy (SA) Natural Resources Management Act 2004 (SA)	No contamination of natural water drainage systems, streams and rivers, groundwater, land and soils occurs either on or off site resulting from permanent disposal or temporary storage of mine ore or waste material	Standing Water Levels (SWL) will be monitored monthly as per AS/NZS 5667.1:1998 standards at groundwater monitoring bores TSP A, B, C and D (Figure 11.5). An independent expert will verify through annual analysis of the monthly data that no leakage from the TSP into the surrounding aquifer has been detected.	Groundwater monitoring bores TSP A, B, C and D will be sampled and analysed monthly as per AS/NZS 5667.1:1998 standards for pH, EC, TDS, Al, Cd, Pb, Zn, Mn and Fe, to demonstrate no change in quality beyond 2 standard deviation of the mean (Figure 11.5). If a change from the 2 standard deviation occurs, results are to be submitted to an independent expert for analysis.	Six embankment monitoring bores (MB1 to MB6) located on the TSP main embankment will be monitored monthly to ensure no water is detected. If water is detected, it will be sampled for pH, EC, TDS, Al, Cd, Pb, Zn, Mn and Fe, as per AS/NZS 5667.1:1998 standards, and results submitted to an independent expert for analysis.
PIE_14_20	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Yes	Environment Protection Act 1994 (SA) Environment Protection (Water Quality) Policy (SA) Natural Resources Management Act 2004 (SA)	N/A	N/A	N/A	N/A
PIE_14_21	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Yes	Environment Protection Act 1994 (SA) Environment Protection (Water Quality) Policy (SA) Natural Resources Management Act 2004 (SA)	N/A	N/A	N/A	N/A
PIE_14_22	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Yes	Environment Protection Act 1994 (SA) Environment Protection (Water Quality) Policy (SA) Natural Resources Management Act 2004 (SA)	N/A	N/A	N/A	N/A

Impact ID	Relevant Chapter	Environmental Aspect	Description of Potential Impact Event	Mine Life Phase	Source	Pathway	Receptor	Understanding of source, pathway, receptor (given limitations in information used in assessment)	Uncertainties and assumptions (relating to SPR)	Sensitivity to change of any assumptions	Confirmation of S-P-R	Outcome required?	Justification/evidence as to why no S-P-R	Factors that limit / mitigate impact (control measures)
PIE_14_23	Geochemistry	TSF	The mixing of 2 types of tailings causes a chemical reaction that causes leaks through the liner or impact/stops the designed seepage system from operating and that cascades into forcing a leak impacting the groundwater table.	Operations, closure, post closure	TSF	chemical reaction	Groundwater and/or local groundwater users	High: Geochemistry analysis and modelling undertaken to understand source (MCCOM 2017), pathway potential and receptors	Modelling indicates no negative possible impacts from chemical reactions	Low sensitivity	Yes	Yes	N/A	Carbonate tailings may cause improvements in the tail pore water quality, no chemical reactions foreseeable to damage hdpe liner or seepage drain system, significant unsaturated zone beneath the tsf, extensive closure modelling of failure modes indicates limited or no impact over a 1000 year timespan for leakage.
PIE_14_24	Geochemistry	TSF	The mixing of 2 types of tailings causes a chemical reaction that causes leaks through liner or impact/stops the designed seepage system from operating and that cascades into forcing a leak through the TSF walls/embankments impacting the surface water (Angas River).	Operations, closure, post closure	TSF	chemical reaction	Surface water (Angas River)	High: Geochemistry analysis and modelling completed to understand source, pathway potential and receptors	Modelling indicates no negative possible impacts from chemical reactions	Low sensitivity	No	No	Known tailings properties of both BH and AZM tailings. No foreseeable effect on basal liner. Appendix M7.	N/A
PIE_14_25	Geochemistry	TSF	Increased decant pond size (>15000m ² for more than 180 days) results in increased pressure head over double liner, resulting in seepage into aquifer beneath TSF impacting the groundwater quality	Operations	TSF Water	Groundwater flow	Groundwater and/or local groundwater users	High: Understanding of engineered TSF design and groundwater modelling provides increased understanding of receptors and impacts.	Understanding of engineered TSF design and groundwater modelling provides increased understanding of receptors and impacts. Updated water balance and water processing circuit completed by ATC Williams. Modelling indicates no exceedances of 15 000m ² for more than 74 days (includes modelled rainfall scenarios included in Appendix D).	Low: Groundwater modelling complete with updated geochemistry modelling in 2016 based on conservative decant pond water quality.	Yes	Yes	N/A	Terramin operated the TSF decant pond out of compliance between 2010 and 2012. This resulted in no environmental impact or water being evident in the embankment piezometers or TSF monitoring bores (see all TSF annual audits to date). The system was successfully pressure tested. Assumption is that Terramin will operate the TSF within compliance to the Operations and Maintenance Manual, which controls decant pond size.
PIE_14_26	Geochemistry	TSF	Unsuitable material for the ET cap redesign results in cap failure, water ingress into tailings and seepage into groundwater impacting groundwater quality	closure, post closure	TSF Tailings	cap failure: leachpilling, etc	Groundwater and/or local groundwater users	Medium: Understanding of engineered TSF cover design provides confidence that updated design with BH tailings makes no negative change from previous TSF cover design	Medium: The original ET Cap design was completed using material from the existing site, a source of additional material has been located but still need testing	Low: the additional material is likely to be similar to the site material proposal in the original Design	Yes	Yes	N/A	geotechnical material properties for TSF capping undertaken and suitable. Stockpiled onsite. Appendix M1.

Impact ID	Justification of assumptions - EVIDENCE	Description of Grouped Environmental Impact	Significance of expected impact 1 = Negligible 2 = Low, 3 = Med. 4 = High	Validation of modelling	Effectiveness of design measures	Effectiveness of management measures	Actions to reduce uncertainty	Exclude worst case impact	Limit of Credible worst case impact	Best Ranking (Low = Best, High = Worst)	Impact covered by alternative Act or Limit (Yes/No)	Act / Limit Reference	Proposed Outcome	Outcome measurement criteria	Leading Indicator criteria (where required)
PIE_14_23	Appendix M7 and Appendix H6	Groundwater	1	High - ground water modelling calibrated to recharge of mine void 2013-2016 and updated geochemistry modelling in 2016 based on conservative decant pond water quality.	High - TSF built to ANZSGL guidelines, annual compliance audits since 2007, no issues with leakage	High - Daily and Weekly inspection sheets, monitoring as per Operation and Maintenance manual and annual audit against Operation and Maintenance Manual.	N/A	Medium	Low	Low	Yes	Environment Protection Act 1994 (SA) Environment Protection (Water Quality) Policy (SA) Natural Resources Management Act 2004 (SA)	No contamination of natural water drainage systems, streams and rivers, groundwater, land and soils occurs either on or off site resulting from permanent disposal or temporary storage of mine ore or waste material	Standing Water Levels (SWL) will be monitored monthly as per AS/NZS 5667:1:1998 standards at groundwater monitoring bores TSF A, B, C and D (Figure 11.5). An independent expert will verify through annual analysis of the monthly data that no leakage from the TSF into the surrounding aquifer has been detected. Groundwater monitoring bores TSF A, B, C and D (Figure 11.5) will be sampled and analysed monthly as per AS/NZS 5667:1:1998 standards for pH, EC, TDS, As, Cd, Pb, Zn, Mn and Fe, to demonstrate no change in quality beyond 2 standard deviation of the mean (Figure 11.5). If a change from the 2 standard deviation occurs, results are to be submitted to an independent expert for analysis.	Groundwater monitoring bores TSF A, B, C and D will be sampled and analysed monthly as per AS/NZS 5667:1:1998 standards for pH, EC, TDS, As, Cd, Pb, Zn, Mn and Fe, to demonstrate no change in quality beyond 2 standard deviation of the mean (Figure 11.5). If a change from the 2 standard deviation occurs, results are to be submitted to an independent expert for analysis.
PIE_14_24	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Yes	Environment Protection Act 1994 (SA) Environment Protection (Water Quality) Policy (SA) Natural Resources Management Act 2004 (SA)	N/A	N/A	N/A
PIE_14_25	Appendix I3, Appendix I2 and Appendix M4	Groundwater	1	High - Groundwater modelling complete with updated geochemistry modelling in 2016 based on conservative decant pond water quality.	High - Dam designed, built, maintained and managed as per ANZSGL guidelines and site specific Operations and Maintenance Manual	High - Daily and Weekly inspection sheets, monitoring as per Operation and Maintenance manual and annual audit against Operation and Maintenance Manual.	Review and recommission TSF and update operations and maintenance manual prior to restarting TSF.	Minor	Possible	Low	Yes	Environment Protection Act 1994 (SA) Environment Protection (Water Quality) Policy (SA) Natural Resources Management Act 2004 (SA)	No contamination of natural water drainage systems, streams and rivers, groundwater, land and soils occurs either on or off site resulting from permanent disposal or temporary storage of mine ore or waste material	Survey markers (pegs) installed on the upstream slope of the TSF main embankment for estimation of pond area and Reduced Level (RL) indicator on the external well (opposite side) of the decant chute will be read monthly to ensure no head of water on the area of single lining, i.e. RL not to exceed 88m AHD or surface area not to exceed 15,000m ² for a period of more than 180 days (or as per updated and approved TSF Operations and Maintenance Manual). RL will be measured until the 15,000m ² area is reached and from then, all monitoring will be based on surface water area.	Monthly inspections of the survey markers (pegs) installed on the upstream slope of the TSF main embankment for estimation of pond area will demonstrate surface area is $+12,000m^2$ (80% of the 15,000m ² limit) (or as per updated and approved TSF Operations and Maintenance Manual).
PIE_14_26	Appendix M1 - geotechnical properties results Appendix I6 - Export/transportation/proclog cover design	Soil	1	High - IT Capping model based on the site material results and consistent with the results of the AACAP trials (30km away)	High - Industry standard and the AACAP program results	High standard Management plan including a detailed inspection schedule - Appendix 530	N/A	Minor	Unlikely	Low	Yes	Environment Protection Act 1994 (SA) Environment Protection (Water Quality) Policy (SA) Natural Resources Management Act 2004 (SA)	No contamination of natural water drainage systems, streams and rivers, groundwater, land and soils occurs either on or off site resulting from permanent disposal or temporary storage of mine ore or waste material	Standing Water Levels (SWL) will be monitored monthly as per AS/NZS 5667:1:1998 standards at groundwater monitoring bores TSF A, B, C and D (Figure 11.5). An independent expert will verify through annual analysis of the monthly data that no leakage from the TSF into the surrounding aquifer has been detected. Groundwater monitoring bores TSF A, B, C and D (Figure 11.5) will be sampled and analysed monthly as per AS/NZS 5667:1:1998 standards for pH, EC, TDS, As, Cd, Pb, Zn, Mn and Fe, to demonstrate no change in quality beyond 2 standard deviation of the mean (Figure 11.5). If a change from the 2 standard deviation occurs, results are to be submitted to an independent expert for analysis.	Groundwater monitoring bores TSF A, B, C and D will be sampled and analysed monthly as per AS/NZS 5667:1:1998 standards for pH, EC, TDS, As, Cd, Pb, Zn, Mn and Fe, to demonstrate no change in quality beyond 2 standard deviation of the mean (Figure 11.5). If a change from the 2 standard deviation occurs, results are to be submitted to an independent expert for analysis.

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PIE_14_27	Geochemistry	TSF	Water balance - RO reject more than expected results in too much water in TSF, increasing pressure upon liner and results in seepage into groundwater	Operations	TSF - increased pressure head on liners	Seepage	Groundwater and/or local groundwater users	High: Annual compliance reports to date indicate no immediate risk to receptors (based upon 9 years of operation).	N/A	Low: Groundwater modelling complete with updated geochemistry modelling in 2016 based on conservative decant pond water quality.	Yes	Yes	N/A	Terramin operated the TSF decant pond out of compliance between 2010 and 2012. This resulted in no environmental impact or water being evident in the ambient groundwater or TSF monitoring bores (see all TSF annual audits to date). The system was successfully pressure tested. Assumption is that Terramin will operate the TSF within compliance to the Operations and Maintenance Manual, which controls decant pond size.
PIE_14_3	Geochemistry	TSF	Discharge of contaminated water from return water pipeline failure impacting groundwater quality	Operations	Return water pipeline	Site water directional flow	Groundwater and/or local groundwater users	High understanding of the return pipeline alignment and the bunding management and the inspection each staff during the operation phase	Assumption that TSF pipelines build to specifications as per Design in appendix V3.	Low - the pipe quantity and the bunding	Yes	Yes	N/A	Pipes located in "dirty zone". Refer to the SEMP. Bunded zone, which runs into process pond or TSF.
PIE_14_4	Geochemistry	TSF	Discharge of contaminated water from return water pipeline failure impacting soil quality outside MPL	Operations	Return water pipeline	Site water directional flows	Soil quality	High understanding of the return pipeline alignment and the bunding management and the inspection each staff during the operation phase	Assumption that TSF pipelines build to specifications as per Design in appendix V3.	Low - the pipe quantity and the bunding	Yes	Yes	N/A	Pipes located in "Operational zone" which drains to boxcut or to silt retention dam. Operational zone is bunded zone, which runs into process pond or TSF. Silt retention dam located in south-western corner capture run off decant return pipelines. Pipelines on TSF walls drain to TSF. Surface Water Monitoring includes monitoring of all water emanating offsite from defined drainage points - no discharge from silt retention dam since construction (constructed to appropriate size to contain run off).

Impact Assessment

Impact ID	Justification of assumptions - EVIDENCE	Description of Grouped Environmental Impact	Significance of expected impact 1 = Negligible 2 = Low, 3 = Med 4 = High	Validation of modelling	Effectiveness of design measures	Effectiveness of management measures	Actions to reduce uncertainty	Exclude worst/least impact	Unlikely of credible worst case impact	Best Ranking (Low = Best, High = Worst)	Impact covered by other Act or Limit (Yes/No)	Act / Limit Reference	Proposed Outcome	Outcome measurement criteria	Leading Indicator criteria (where required)
PIE_14_27	Appendix 13, Appendix 12 and Appendix M14		1	High: Groundwater modelling complete with updated geochemistry modelling in 2016 based on conservative decant pond water quality.	High: design of monitoring system includes early warning systems, ANCCLD design and build.	Daily and Weekly inspection sheets, monitoring as per Operation and Maintenance manual.	N/A. Annual review provides recommendations which are implemented.	Moderate	Possible	Medium	Yes	Environment Protection Act 1994 (SA) Environment Protection (Water Quality) Policy (SA) Natural Resources Management Act 2004 (SA)	No contamination of natural water drainage systems, streams and rivers, groundwater, land and soils occurs either on or off site resulting from permanent disposal or temporary storage of mine ore or waste material	Standing Water Levels (SWL) will be monitored monthly as per AS/NZS 5667.1:1998 standards as groundwater monitoring bores TSF A, B, C and D (Figure 11.5). An independent expert will verify through annual analysis of the monthly data that no leakage from the TSF into the surrounding aquifer has been detected. Groundwater monitoring bores TSF A, B, C and D (Figure 11.5) will be sampled and analysed monthly as per AS/NZS 5667.1:1998 standards for pH, EC, TDS, As, Cd, Pb, Zn, Mn and Fe. An independent expert will verify, through annual analysis of the monthly data that no leakage from the TSF into the surrounding aquifer has been detected.	Groundwater monitoring bores TSF A, B, C and D will be sampled and analysed monthly as per AS/NZS 5667.1:1998 standards for pH, EC, TDS, As, Cd, Pb, Zn, Mn and Fe, to demonstrate no change in quality beyond 2 standard deviation of the mean (Figure 11.5). If a change from the 2 standard deviation occurs, results are to be submitted to an independent expert for analysis. Six embankment monitoring bores (MB1 to MB6) located on the TSF main embankment will be monitored monthly to ensure no water is detected. If water is detected, it will be sampled for pH, EC, TDS, As, Cd, Pb, Zn, Mn and Fe, as per AS/NZS 5667.1:1998 standards, and results submitted to an independent expert for analysis.
PIE_14_3		Ground Water	1	High: Groundwater modelling complete with updated geochemistry modelling in 2016 based on conservative decant pond water quality.	High: Industry standard	High: operational requirement for a inspection each staff	N/A. Annual review provides recommendations which are implemented.	Minor	Possible	Low	Yes	Environment Protection Act 1994 (SA) Environment Protection (Water Quality) Policy (SA) Natural Resources Management Act 2004 (SA)	No contamination of natural water drainage systems, streams and rivers, groundwater, land and soils occurs either on or off site resulting from permanent disposal or temporary storage of mine ore or waste material	Standing Water Levels (SWL) will be monitored monthly as per AS/NZS 5667.1:1998 standards as groundwater monitoring bores TSF A, B, C and D (Figure 11.5). An independent expert will verify through annual analysis of the monthly data that no leakage from the TSF into the surrounding aquifer has been detected. Groundwater monitoring bores TSF A, B, C and D (Figure 11.5) will be sampled and analysed monthly as per AS/NZS 5667.1:1998 standards for pH, EC, TDS, As, Cd, Pb, Zn, Mn and Fe. An independent expert will verify, through annual analysis of the monthly data that no leakage from the TSF into the surrounding aquifer has been detected.	Groundwater monitoring bores TSF A, B, C and D will be sampled and analysed monthly as per AS/NZS 5667.1:1998 standards for pH, EC, TDS, As, Cd, Pb, Zn, Mn and Fe, to demonstrate no change in quality beyond 2 standard deviation of the mean (Figure 11.5). If a change from the 2 standard deviation occurs, results are to be submitted to an independent expert for analysis. Six embankment monitoring bores (MB1 to MB6) located on the TSF main embankment will be monitored monthly to ensure no water is detected. If water is detected, it will be sampled for pH, EC, TDS, As, Cd, Pb, Zn, Mn and Fe, as per AS/NZS 5667.1:1998 standards, and results submitted to an independent expert for analysis.
PIE_14_4		Soil	1	N/A	High: Industry standard	High: Daily and Weekly inspection sheets, monitoring as per Operation and Maintenance manual and annual audit against Operation and Maintenance Manual.	N/A	Minor	Possible	Low	Yes	Environment Protection Act 1994 (SA) National Environment Protection Council Act 1994 (EPA) / National Environment Protection Measures (NEPMS)	No contamination of natural water drainage systems, streams and rivers, groundwater, land and soils occurs either on or off site resulting from permanent disposal or temporary storage of mine ore or waste material	Provision of a report once prior to entering closure monitoring phase by a suitably qualified site contamination consultant verifies that a site contamination assessment and if required remediation in accordance with the NEPM and relevant EPA guidelines for the central and southern domains (excluding the TSF) Figure 2 has occurred, ensuring there is no unacceptable risk to human health or the environment as a result of the contamination when compared with relevant baseline concentrations and relevant NEPM investigation levels.	None proposed

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PIE_14_5	Geochemistry	TSF	Discharge of contaminated water from return water pipeline failure impacting surface water quality (Angas River)	Operations	Return water pipeline	Site water / seasonal flows	Surface water (Angas River)	High understanding of the return pipeline alignment and the bunding management and the inspection each staff during the operation phase	Assumption that TSF pipelines build to specifications as per Design in appendix V3.	Low - the pipe quantity and the bunding	Yes	Yes	N/A	Pipes located in Operational zone* which drains to boxcut or to silt retention dam. Operational zone is bunded zone, which runs into process pond or TSF. Silt retention dam located in south-western corner capture run off decant return pipelines. Pipelines on TSF walls drain to TSF. Surface Water Monitoring includes monitoring of all water emanating offsite from defined drainage points - no discharge from silt retention dam since construction (constructed to appropriate size to contain run off).
PIE_14_6	Geochemistry	TSF	Discharge of solids - tailings pipeline failure results in impact to groundwater quality	Operations	Tailings	Pipeline failure	Groundwater and/or local groundwater users	High understanding of the tailing pipeline alignment and the bunding management and the inspection each shift during the operation phase	Assumption that TSF pipelines build to specifications as per Design in appendix V3.	Low - the pipe quantity and the bunding	Yes	Yes	N/A	Pipes located in Operational zone* which drains to boxcut or to silt retention dam. Operational zone is bunded zone, which runs into process pond or TSF. Silt retention dam located in south-western corner capture run off decant return pipelines. Pipelines on TSF walls drain to TSF. Surface Water Monitoring includes monitoring of all water emanating offsite from defined drainage points - no discharge from silt retention dam since construction (constructed to appropriate size to contain run off).
PIE_14_7	Geochemistry	TSF	Discharge of solids - tailings pipeline failure results in impact to soil quality post closure	Post closure	Tailings	Pipeline failure	Soil quality	High understanding of the tailing pipeline alignment and the bunding management and the inspection each shift during the operation phase	Assumption that TSF pipelines build to specifications as per Design in appendix V3.	Low - the pipe quantity and the bunding	Yes	Yes	N/A	Pipes located in Operational zone* which drains to boxcut or to silt retention dam. Operational zone is bunded zone, which runs into process pond or TSF. Silt retention dam located in south-western corner capture run off decant return pipelines. Pipelines on TSF walls drain to TSF. Surface Water Monitoring includes monitoring of all water emanating offsite from defined drainage points - no discharge from silt retention dam since construction (constructed to appropriate size to contain run off).

Impact Assessment

Impact ID	Justification of assumptions - EVIDENCE	Description of Grouped Environmental Impact	Significance of expected impact 1 = Negligible 2 = Low, 3 = Med 4 = High	Validation of modelling	Effectiveness of design measures	Effectiveness of management measures	Actions to reduce uncertainty	Excluded worst case impact	Unlikelihood of credible worst case impact	Best Ranking (Low = Best, High = Worst)	Impact covered by alternative Act or Limit (Yes/No)	Act / Limit Reference	Proposed Outcome	Outcome measurement criteria	Leading Indicator criteria (where required)
PIE_14_5		Surface water	1	N/A	High - Industry standard	High: Daily and Weekly inspection sheets, monitoring as per Operation and Maintenance manual and annual audit against Operation and Maintenance Manual.	N/A	Minor	Unlikely	Low	Yes	Environment Protection Act 1994 (SA) Environment Protection (Water Quality) Policy (SA) Natural Resources Management Act 2004 (SA)	No adverse impact to the supply or quality of water caused by the mining operations to existing users and water dependent ecosystems.	Triplicate surface water samples will be taken during rain events where there is a potential for discharge into the Angas River from MRL. Samples will be taken, as per AS/NZS 5667:1:1998, where the Angas River flows at one potential discharge location (Crosser) and one upstream control sample point (Hogben). A paired t-test will demonstrate that potential contaminants (Pb, Zn, Cd, pH, TDS, SO4, EC and turbidity) at Crosser are not significantly different (p-value ≤ 1-t test value) from the mean of the samples taken at Hogben at that point in time over a consecutive period no less than 5 years.	Triplicate surface water samples will be taken quarterly, as per AS/NZS 5667:1:1998, where the Angas River flows at one potential discharge location (Crosser) and one upstream control sample point (Hogben). A paired t-test will demonstrate that potential contaminants (Pb, Zn, Cd, pH, TDS, SO4, EC and turbidity) at Crosser are not significantly different (p-value ≤ 1-t test value) from the mean of the samples taken at Hogben at that point in time.
PIE_14_6		Groundwater	1	High: Groundwater modelling complete with updated geochemistry modelling in 2016 based on conservative desicant pond water quality.	High - Industry standard	High: Daily and Weekly inspection sheets, monitoring as per Operation and Maintenance manual and annual audit against Operation and Maintenance Manual.	N/A. Annual review provides recommendations which are implemented.	Minor	Possible	Low	Yes	Environment Protection Act 1994 (SA) Environment Protection (Water Quality) Policy (SA) Natural Resources Management Act 2004 (SA)	No contamination of natural water drainage systems, streams and rivers, groundwater, land and soils occur either on or off site resulting from permanent disposal or temporary storage of mine ore or waste material.	Standing Water Levels (SWL) will be monitored monthly as per AS/NZS 5667:1:1998 standards at groundwater monitoring bores TSF A, B, C and D (Figure 11.5). An independent expert will verify through annual analysis of the monthly data that no leakage from the TSF into the surrounding aquifer has been detected. Groundwater monitoring bores TSF A, B, C and D (Figure 11.5) will be sampled and analysed monthly as per AS/NZS 5667:1:1998 standards for pH, EC, TDS, Al, Ca, Pb, Zn, Mn and Fe. An independent expert will verify, through annual analysis of the monthly data that no leakage from the TSF into the surrounding aquifer has been detected.	Groundwater monitoring bores TSF A, B, C and D will be sampled and analysed monthly as per AS/NZS 5667:1:1998 standards for pH, EC, TDS, Al, Ca, Pb, Zn, Mn and Fe. To demonstrate no change in quality beyond 2 standard deviation of the mean (Figure 11.5), if a change from the 2 standard deviation occurs, results are to be submitted to an independent expert for analysis. Six embankment monitoring bores (MBS1 to MBS6) located on the TSF main embankment will be monitored monthly to ensure no water is detected. If water is detected, it will be sampled for pH, EC, TDS, Al, Ca, Pb, Zn, Mn and Fe, as per AS/NZS 5667:1:1998 standards, and results submitted to an independent expert for analysis.
PIE_14_7		Soil	1	N/A	High - Industry standard	High: Daily and Weekly inspection sheets, monitoring as per Operation and Maintenance manual and annual audit against Operation and Maintenance Manual.	N/A	Minor	Risk	Low	Yes	Environment Protection Act 1994 (SA) National Environment Protection Council Act 1994 (Cth) / National Environment Protection Measures (NEMPS)	No contamination of natural water drainage systems, streams and rivers, groundwater, land and soils occur either on or off site resulting from permanent disposal or temporary storage of mine ore or waste material.	Provision of a report once prior to entering closure monitoring phase by a suitably qualified site contamination consultant verifies that a site contamination assessment and if required remediation in accordance with the NEMM and relevant EPA guidelines for the central and southern domains (excluding the TSF) Figure 3-2 has occurred, ensuring there is no unacceptable risk to human health or the environment as a result of the contamination when compared with relevant baseline concentrations and relevant NEMM investigation levels.	None proposed

Impact ID	Relevant Chapter	Environmental Aspect	Description of Potential Impact Event	Mine Life Phase	Source	Pathway	Receptor	Understanding of source, pathway, receptor (given limitations in information used in assessment)	Uncertainties and assumptions (relating to SPR)	Sensitivity to change of any assumptions	Confirmation of S-P-R	Outcome required?	Justification/evidence as to why no S-P-R	Factors that limit / mitigate impact (control measures)
PIE_14_8	Geochemistry	TSF	Discharge of solids - tailings pipeline failure results in impact to surface water (Angas River)	Operations	Tailings	Pipeline failure	Surface water (Angas River)	High understanding of the tailings pipeline alignment and the bunding management and the inspection each shift during the operation phase	Assumption that TSF pipelines build to specifications as per Design in appendix V2.	Low - the pipe locations and bunding to remain as per existing design	Yes	Yes	N/A	Pipes located in operational zone" which drains to local or to silt retention dam. Operational zone is bunded zone, which runs into process pond or TSF. Silt retention dam located in south-western corner capture run off decant return pipelines. Pipelines on TSF walls drain to TSF. Surface Water Monitoring includes monitoring of all water emanating offsite from defined drainage points - no discharge from silt retention dam since construction (constructed to appropriate size to contain run off).
PIE_15_9	Geochemistry	TSF	Discharge through spillway (buffer storage capacity / water level not managed / storm event overtopps through spillway) impacts groundwater quality outside TSF	Operations, closure	TSF decant water	Spillway	Groundwater and/or local groundwater users	High - Understanding of the Geotechnical condition of the Spillway and the construction of the spillway the drainage paths	Assumption that TSF operated and audited annually as per Operations and Maintenance Manual (Appendix 15)	Low - the design was completed to the ANCCOLD standards	Yes	Yes	N/A	Goes into spillway / artificial wetland / silt retention dam. Operation and Maintenance manual has buffer levels, leading indicator and compliance criteria which indicates acceptable levels of tailings and free water in TSF. Currently designed for 1:100 / 72 hours storm event.
PIE_15_1	Geohazards	groundwater	Earthquake compromises the integrity of the Processing plant, (Rupture tanks, pipes etc.) causing a release of contaminants (processing slurries etc.) outside bunded areas	Refurbishment, Operations, Closure	Processing components, slurries, additives, tailings etc	Surface drainage systems, resulting in seepage into groundwater	Groundwater and/or local groundwater users	High - the design of the plan will not be changed significantly, understanding from operating AZM	Based on performance of the plant during AZM operations, also from seismic hazard predictions from Geoscience Australia	Low	No	No	No, would be of such low intensity or volume as to pose no credible impact pathway	N/A
PIE_15_2	Geohazards	soil	Earthquake compromises the integrity of the Processing plant, (Rupture tanks, pipes etc.) causing a release of contaminants (processing slurries etc.) outside bunded areas	Refurbishment, Operations, Closure	Processing components, slurries, additives, tailings etc	Surface drainage systems, resulting in seepage into soil	Soil quality	High - the design of the plan will not be changed significantly, understanding from operating AZM	Based on performance of the plant during AZM operations, also from seismic hazard predictions from Geoscience Australia	Low - infrastructure built to Australian Standards	No	No	No, would be of such low intensity or volume as to pose no credible impact pathway	N/A

Impact ID	Justification of assumptions - EVIDENCE	Description of Grouped Environmental Impact	Significance of expected impact 1 = Negligible 2 = Low, 3 = Med 4 = High	Validation of modelling	Effectiveness of design measures	Effectiveness of management measures	Actions to reduce uncertainty	Credible worst case impact	Likelihood of Credible worst case impact	Risk Ranking (Low/Med/High)	Impact covered by alternative Act or Limit (Yes/No)	Act / Limit Reference	Proposed Outcome	Outcome measurement criteria	Leading Indicator criteria (where required)
PIE_14_8	TSF design - Appendix V3	Surface water	1	N/A	High - Industry standard effective at a range of mining sites and waste dams.	High - Operations and maintenance manual complied with and annually audited against independently. No evidence of procedural failures resulting in environmental impact since construction.	None identified.	Minor	Possible	Low	Yes	Environment Protection Act 1994 (SA) Environment Protection (Water Quality) Policy (SA) Natural Resources Management Act 2004 (SA)	No adverse impact to the supply or quality of water caused by the mining operations to existing users and water dependant ecosystems.	Triplicate surface water samples will be taken during rain events where there is a potential for discharge into the Angas River from MPL. Samples will be taken, as per AS/NZS 5667.1:1998, where the Angas River flows at one potential discharge location (Crosser) and one upstream control sample point (Hogben). A paired t-test will demonstrate that potential contaminants (Pb, Zn, Cd, pH, TDS, SO4, EC and turbidity) at Crosser are not significantly different (p-value < 1-test value) from the mean of the samples taken at Hogben at that point in time over a consecutive period no less than 5 years.	Triplicate surface water samples will be taken quarterly, as per AS/NZS 5667.1:1998, where the Angas River flows at one potential discharge location (Crosser) and one upstream control sample point (Hogben). A paired t-test will demonstrate that potential contaminants (Pb, Zn, Cd, pH, TDS, SO4, EC and turbidity) at Crosser are not significantly different (p-value < 1-test value) from the mean of the samples taken at Hogben at that point in time.
PIE_14_9		Groundwater	1	High: Groundwater modelling complete with updated geochemistry modelling in 2016 based on conservative decant pond water quality.	High - Dam designed, built, maintained and managed as per ANCOLD guidelines	High: Daily and Weekly inspection sheets, monitoring as per Operation and Maintenance manual and annual audit against Operation and Maintenance Manual.	N/A. Annual review provides recommendations which are implemented.	Minor	Unclear	Low	Yes	Environment Protection Act 1994 (SA) Environment Protection (Water Quality) Policy (SA) Natural Resources Management Act 2004 (SA)	No contamination of natural water drainage systems, streams and rivers, groundwater, land and soils occurs either on or off site resulting from permanent disposal or temporary storage of mine ore or waste material	Standing Water Levels (SWL) will be monitored monthly as per AS/NZS 5667.1:1998 standards at groundwater monitoring bores TSF A, B, C and D (Figure 11.5). An independent expert will verify through annual analysis of the monthly data that no leakage from the TSF into the surrounding aquifer has been detected. Groundwater monitoring bores TSF A, B, C and D (Figure 11.5) will be sampled and analysed monthly as per AS/NZS 5667.1:1998 standards for pH, EC, TDS, Al, Ca, Pb, Zn, Mn and Fe. An independent expert will verify, through annual analysis of the monthly data that no leakage from the TSF into the surrounding aquifer has been detected.	Groundwater monitoring bores TSF A, B, C and D will be sampled and analysed monthly as per AS/NZS 5667.1:1998 standards for pH, EC, TDS, Al, Ca, Pb, Zn, Mn and Fe, to demonstrate no change in quality beyond 2 standard deviation of the mean (Figure 11.5). If a change from the 2 standard deviation occurs, results are to be submitted to an independent expert for analysis. Six embankment monitoring bores (MB1 to MB6) located on the TSF main embankment will be monitored monthly to ensure no water is detected. If water is detected, it will be sampled for pH, EC, TDS, Al, Ca, Pb, Zn, Mn and Fe, as per AS/NZS 5667.1:1998 standards, and results submitted to an independent expert for analysis.
PIE_15_1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
PIE_15_2	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Impact ID	Relevant Chapter	Environmental Aspect	Description of Potential Impact Event	Mine Life Phase	Source	Pathway	Receptor	Understanding of source, pathway, receptor (given limitations in information used in assessment)	Uncertainties and assumptions (relating to SPR)	Sensitivity to change of any assumptions	Confirmation of S-P-R	Outcome required?	Justification/evidence as to why no S-P-R	Factors that limit / mitigate impact (control measures)
PIE_15_3	Geohazards	surface water	Earthquake compromises the integrity of the Processing plant, (Rupture tanks, pipes etc.) causing a release of contaminants (processing slurries etc.) outside bunded areas	Refurbishment, Operations, Closure	Processing components (tanks, add'lives, tallings etc)	Surface drainage systems, resulting in seepage into groundwater	Surface water (Angas River)	High - the design of the plan will not be changed significantly, understanding from operating AZM	Based on performance of the plant during AZM operations, also from seismic hazard predictions from Geoscience Australia	Low	No	No	No, would be of such low intensity or volume as to pose no credible impact pathway	N/A
PIE_15_4	Geohazards	groundwater	Earthquake compromises the integrity of the Processing plant, (Rupture tanks, pipes etc.) causing a release of contaminants (processing slurries etc.) outside bunded areas	Refurbishment, Operations, Closure	Processing components (tanks, add'lives, tallings etc)	Wind transporting exposed contaminants	Groundwater and/or local groundwater users	High - the design of the plan will not be changed significantly, understanding from operating AZM	Based on performance of the plant during AZM operations, also from seismic hazard predictions from Geoscience Australia	Low	No	No	No, would be of such low intensity or volume as to pose no credible impact pathway	N/A
PIE_15_5	Geohazards	soil	Earthquake compromises the integrity of the Processing plant, (Rupture tanks, pipes etc.) causing a release of contaminants (processing slurries etc.) outside bunded areas	Refurbishment, Operations, Closure	Processing components (tanks, add'lives, tallings etc)	Wind transporting exposed contaminants	Soil quality	High - the design of the plan will not be changed significantly, understanding from operating AZM	Based on performance of the plant during AZM operations, also from seismic hazard predictions from Geoscience Australia	Low - infrastructure built to Australian Standards	No	No	No, would be of such low intensity or volume as to pose no credible impact pathway	N/A
PIE_15_6	Geohazards	surface water	Earthquake compromises the integrity of the Processing plant, (Rupture tanks, pipes etc.) causing a release of contaminants (processing slurries etc.) outside bunded areas	Refurbishment, Operations, Closure	Processing components (tanks, add'lives, tallings etc)	Wind transporting exposed contaminants	Surface water (Angas River)	High - the design of the plan will not be changed significantly, understanding from operating AZM	Based on performance of the plant during AZM operations, also from seismic hazard predictions from Geoscience Australia	Low	No	No	No, would be of such low intensity or volume as to pose no credible impact pathway	N/A
PIE_15_28	Geohazards	groundwater	Erosion and/or collapse of ore or other material stockpiled on ROM introducing sediment and dust into the environment	Refurbishment, Operations, Closure	Ore and/or water material stockpiled on ROM	Wind transporting exposed material from ROM	Groundwater and/or local groundwater users	High - understanding of operation from AZM/MLE20 and other sites	Assumptions based on meteorological data for the Strathbryn area and experience at AZM from MLE20.	Low - Meteorology and/or ore characteristics unlikely to significantly change.	Yes	Yes	N/A	ROM Stockpiles constructed at heights of 3m and better slope angles of 1V:3H. Due to the campaigning of processing activities, ore stockpiles will be continually fluctuating in size and shape. Specifically designed water sprays to limit wind erosion of stockpiled material

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PIE_15_3	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
PIE_15_4	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
PIE_15_5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
PIE_15_6	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
PIE_15_28	See Chapter 15: section 15.5.1.3			N/A	High: AZM ROM pad operation indicated no botanical failure events over life of operation based on same design parameters. Longest material on ROM pad is one month. Medium: Relies upon personnel adhering to LV3H		N/A	Minor	None	Low	N/A	N/A	No adverse impact to the supply or quality of water caused by the mining operations to existing users and water dependent ecosystems	Groundwater will be sampled and analysed quarterly, as per AS/NZS 3667.1:2018 standards, at five bores (R1, R2, R3, R4 and R5, note R3 & R4 are dry) located on and adjacent to the ML 623 and proposed MPL boundary (Figure 11-5) to demonstrate that the concentration of potential contaminants (Pb, Zn, As, Cd, Fe, Se, pH, EC and TDS) do not exceed maximum baseline values.	Groundwater will be sampled and analysed quarterly, as per AS/NZS 3667.1:2018 standards, at five bores (R1, R2, R3, R4 and R5) located on and adjacent to the proposed MPL boundary (Figure 11-5) to demonstrate that analyses (Pb, Zn, As, Cd, Fe, Se, pH, EC and TDS) are less than two standard deviations of the mean baseline values.

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PIE_15_29	Geohazards	soil	Erosion and/or collapse of ore or other material stockpiled on ROM introducing sediment and dust into the environment	Refurbishment, Operations, Closure	Ore and/or waste material stockpiled on ROM	Wind transporting exposed materials from ROM	Soil quality	High - understanding of operation from AZM/ML6229 and other sites	Assumptions based on meteorological data for the Strathalbyn area and experience at AZM from ML6229.	Low: Meteorology and/or ore characteristics unlikely to significantly change.	Yes	Yes	N/A	ROM Stockpiles constructed at heights of 3m and batter slope angles of 1V:3H. Due to the campaigning of processing activities, ore stockpiles will be continually fluctuating in size and shape. Specifically designed water sprays to limit wind erosion of stockpiled material
PIE_15_30	Geohazards	surface water	Erosion and/or collapse of ore or other material stockpiled on ROM introducing sediment and dust into the environment	Refurbishment, Operations, Closure	Ore and/or waste material stockpiled on ROM	Wind transporting exposed materials from ROM	Surface water (leakage flow)	High - understanding of operation from AZM/ML6229 and other sites	Assumptions based on meteorological data for the Strathalbyn area and experience at AZM from ML6229.	Low: Meteorology and/or ore characteristics unlikely to significantly change.	Yes	Yes	N/A	ROM Stockpiles constructed at heights of 3m and batter slope angles of 1V:3H. Due to the campaigning of processing activities, ore stockpiles will be continually fluctuating in size and shape. Specifically designed water sprays to limit wind erosion of stockpiled material
PIE_15_31	Geohazards	groundwater	Erosion and/or collapse of ore or other material stockpiled on ROM introducing sediment and dust into the environment	Refurbishment, Operations, Closure	Ore and/or waste material stockpiled on ROM	Surface water transporting exposed material from ROM	Groundwater and/or local groundwater users	High - understanding of operation from AZM/ML6229 and other sites	Assumptions based on understanding and experience at AZM from ML6229 regarding surface water flows.	Low: Meteorology and/or ore characteristics unlikely to significantly change.	Yes	Yes	N/A	ROM Stockpiles constructed at heights of 3m and batter slope angles of 1V:3H. Due to the campaigning of processing activities, ore stockpiles will be continually fluctuating in size and shape. Stormwater management Plan, Geotechnical Management Plan (includes regular inspection of onsite stockpiles)
PIE_15_32	Geohazards	soil	Erosion and/or collapse of ore or other material stockpiled on ROM introducing sediment and dust into the environment	Refurbishment, Operations, Closure	Ore and/or waste material stockpiled on ROM	Surface water transporting exposed material from ROM	Soil quality	High - understanding of operation from AZM/ML6229 and other sites	Assumptions based on understanding and experience at AZM from ML6229 regarding surface water flows.	Low: Meteorology and/or ore characteristics unlikely to significantly change.	Yes	Yes	N/A	ROM Stockpiles constructed at heights of 3m and batter slope angles of 1V:3H. Due to the campaigning of processing activities, ore stockpiles will be continually fluctuating in size and shape. Stormwater management Plan, Geotechnical Management Plan (includes regular inspection of onsite stockpiles)

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PIE_15_29	See Chapter 15: section 15.5.1.3	Potential for soil impacts through release of tailings into the environment	1	N/A	High: AZM ROM pad operation indicated no geotechnical failure events over life of operation based on same design parameters. Longest material on ROM pad is one month.	Medium: Relies upon personnel adhering to IV:3H	N/A	Minor	Unlikely	Low	Yes	Environment Protection Act 1994 (SA) National Environment Protection Council Act 1994 (EPA) / National Environment Measures (NEMs)	No contamination of natural water drainage systems, streams and rivers, groundwater, land and soils occurs either on or off site resulting from permanent disposal or temporary storage of mine ore or waste material	Provision of a report once prior to entering closure monitoring phase by a suitably qualified site contamination consultant verifies that a site contamination assessment and if required remediation in accordance with the NEM and relevant EPA guidelines for the central and southern domains (including the TSF) Figure 2 has occurred, ensuring there is no unacceptable risk to human health or the environment as a result of the contamination when compared with relevant baseline concentrations and relevant NEM investigation levels.	None proposed
PIE_15_30	See Chapter 15: section 15.5.1.3			N/A	High: AZM ROM pad operation indicated no geotechnical failure events over life of operation based on same design parameters. Longest material on ROM pad is one month.	Medium: Relies upon personnel adhering to IV:3H	N/A	Minor	Unlikely	Low	Yes	Environment Protection Act 1994 (SA) Environment Protection (Water Quality) Policy (SA) Natural Resources Management Act 2004 (SA)	No contamination of natural water drainage systems, streams and rivers, groundwater, land and soils occurs either on or off site resulting from permanent disposal or temporary storage of mine ore or waste material	Triplicate samples to be taken when water is running from the Front Entrance (pre-wetland), visitors viewing area, Pre-Swale, overflow point of the settlement dam, and exit point at the Evaporation Pan (Figure 12-11). Samples to be measured as per AS/NZS 1667:1 1998 standards. A saved test will demonstrate that turbidity at these sites is not significantly different from the mean of the triplicate samples taken at Hogben or greater than the mean of the triplicate samples taken at Hogben. If the samples obtained at the pre-wetland location, visitors viewing area or settlement overflow are significantly different from and greater than the mean of the triplicate samples taken at Hogben, verification will be undertaken to determine whether water is in fact leaving the Mineral Lease/MPL, in order to ascertain the source of the potential contamination.	After high rainfall events which generate runoff, records from visual inspections of silt traps, the silt retention dam and surface drainage systems on ML6229 and MPL (Figure 13-1) demonstrate that silt volume is no more than 50% of trap capacity volume and there is no breach in walls.
PIE_15_31	See Chapter 15: section 15.5.1.3			N/A	High: AZM ROM pad operation indicated no geotechnical failure events over life of operation based on same design parameters. Longest material on ROM pad is one month.	Medium: Relies upon personnel adhering to IV:3H	N/A	Minor	Unlikely	Low	N/A	N/A	No adverse impact to the supply or quality of water caused by the mining operations to existing users and water dependent ecosystem	Groundwater will be sampled and analysed quarterly, as per AS/NZS 5667:1 1998 standards, at five borers (R61, R62, R63, R64 and R65, note R63 & R65 are dry) located on and adjacent to the ML 6229 and proposed MPL boundary (Figure 11-5) to demonstrate that the concentration of potential contaminants (Pb, Zn, As, Cd, Fe, Se, pH, EC and TDS) do not exceed maximum baseline values.	Groundwater will be sampled and analysed quarterly, as per AS/NZS 5667:1 1998 standards, at five borers (R61, R62, R63, R64 and R65) located on and adjacent to the proposed MPL boundary (Figure 11-5) to demonstrate that analyses (Pb, Zn, As, Cd, Fe, Se, pH, EC and TDS) are less than two standard deviations of the mean baseline values.
PIE_15_32	See Chapter 15: section 15.5.1.3	Potential for soil impacts through release of tailings into the environment	1	N/A	High: AZM ROM pad operation indicated no geotechnical failure events over life of operation based on same design parameters. Longest material on ROM pad is one month.	Medium: Relies upon personnel adhering to IV:3H	N/A	Minor	Unlikely	Low	Yes	Environment Protection Act 1994 (SA) National Environment Protection Council Act 1994 (EPA) / National Environment Measures (NEMs)	No contamination of natural water drainage systems, streams and rivers, groundwater, land and soils occurs either on or off site resulting from permanent disposal or temporary storage of mine ore or waste material	Provision of a report once prior to entering closure monitoring phase by a suitably qualified site contamination consultant verifies that a site contamination assessment and if required remediation in accordance with the NEM and relevant EPA guidelines for the central and southern domains (including the TSF) Figure 2 has occurred, ensuring there is no unacceptable risk to human health or the environment as a result of the contamination when compared with relevant baseline concentrations and relevant NEM investigation levels.	None proposed

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PIE_15_33	Geohazards	surface water	Erosion and/or collapse of one or other material stockpiled on ROM introducing sediment and dust into the environment	Refurbishment, Operations, Closure	One and/or waste material stockpiled on ROM	Surface water transporting exposed material from ROM	Surface water (legislation)	High - understanding of operation from AZM/ML6229 and other sites	Assumptions based on understanding and experience at AZM from ML6229 regarding surface water flows.	Low: Meteorology and/or one characteristics unlikely to significantly change.	Yes	Yes	N/A	ROM Stockpiles constructed at heights of 3m and batter slope angles of 1:3.5. Due to the campaigning of processing activities, one stockpiles will be continually fluctuating in size and shape. Stormwater management Plan. Geotechnical Management Plan (includes regular inspection of onsite stockpiles)
PIE_15_34	Geohazards	Groundwater	Erosion of conveyor cutting embankment results in collapse of conveyor and split ore impacting groundwater through infiltration	Operations, closure, post closure	Embankment surface (soil) of conveyor cutting	Surface water transporting material from exposed embankment.	Groundwater and/or local groundwater users	High - understanding of operation from AZM/ML6229 and other sites	Assumptions based on understanding and experience at AZM from ML6229 regarding surface water flows.	Low: Meteorology and/or one characteristics unlikely to significantly change.	Yes	Yes	N/A	Infrastructure constructed as per detailed geotechnical investigations by Golder associates. Localised erosion may occur, however, of limited impact.
PIE_15_37	Geohazards	Groundwater	Erosion of conveyor cutting embankment results in collapse of conveyor and split ore impacting groundwater through infiltration	Operations, closure, post closure	Embankment surface (soil) of conveyor cutting	When transporting exposed materials from exposed embankment.	Groundwater and/or local groundwater users	High - understanding of operation from AZM/ML6229 and other sites	Assumptions based on understanding and experience at AZM from ML6229 regarding surface water flows.	Low: Meteorology and/or one characteristics unlikely to significantly change.	No	No	No, would be of such low intensity or volume as to pose no credible impact pathway	N/A
PIE_15_35	Geohazards	soil	Erosion of conveyor cutting embankment results in collapse of conveyor and split ore impacting soil quality	Operations, closure, post closure	Embankment surface (soil) of conveyor cutting	Surface water transporting material from exposed embankment	Soil quality	High - understanding of operation from AZM/ML6229 and other sites	Assumptions based on understanding and experience at AZM from ML6229 regarding surface water flows.	Low: Meteorology and/or one characteristics unlikely to significantly change.	Yes	Yes	N/A	Infrastructure constructed as per detailed geotechnical investigations by Golder associates. Localised erosion may occur, however, of limited impact.

Impact ID	Justification of assumptions - EVIDENCE	Description of proposed Environmental Impact	Significance of expected impact 1 = Negligible 2 = Low, 3 = Med 4 = High	Validation of modelling	Effectiveness of design measures	Effectiveness of management measures	Actions to reduce uncertainty	Excluded worst case impact	Likelihood of credible worst case impact	Risk Ranking (low, medium, high)	Impact covered by alternative Act or Limit (Yes/No)	Act / Limit Reference	Proposed Outcome	Outcome measurement criteria	Leading indicator criteria (where required)
PIE_15_13	See Chapter 15: section 15.5.1.3			N/A	High: AZM ROM pad operation indicated no geotechnical failure events over life of operation based on same design parameters. Longest material on ROM pad is one month.	Medium: Relies upon personnel adhering to 1V:3H	N/A	Minor	Unlikely	Low	Yes	Environment Protection Act 1994 (SA) Environment Protection (Water Quality) Policy (SA) Natural Resources Management Act 2004 (SA)	No contamination of natural water drainage systems, streams and rivers, groundwater, land and soils occurs either on or off site resulting from permanent disposal or temporary storage of mine ore or waste material	Triplicate samples to be taken when water is running from the Front Entrance (pre-wetland), visitors viewing area, Pre-Swale, overflow point of the sediment dam, and exit point at the Evaporation Pan (Figure 12-11). Samples to be measured as per AS/NZS 5667.1:1998 standards. A paired test will demonstrate that turbidity at these sites is not significantly different from the mean of the triplicate samples taken at Hogben or greater than the mean of the triplicate samples taken at Hogben. If the samples obtained at the pre-wetland location, visitors viewing area or silt dam overflow are significantly different from and greater than the mean of the triplicate samples taken at Hogben, verification will be undertaken to determine whether water is in fact leaving the Mineral Lease/MPL, in order to ascertain the source of the potential contamination.	After high rainfall events which generate runoff, records from visual inspections of silt traps, the silt retention dam and surface drainage systems on ML6229 and MPL (Figure 12-11) demonstrate that silt volume is no more than 50% of trap capacity volume and there is no breach in walls.
PIE_15_34	Processing plant geotechnical testing and modelling undertaken by Golder Associates and included in Appendix M1.5.			High: Original geotechnical testing and modelling for process plant reflective of current conditions 10 years post-modelling	High: Original design and geotechnical testing as per current conditions indicates design success	Medium: Relies upon management systems to processing plant after seismic event	Put conveyor embankment into erosion monitoring plan	Minor	Rare	Low		N/A	No adverse impact to the supply or quality of water caused by the mining operations to existing users and water dependent ecosystems	Groundwater will be sampled and analysed quarterly, as per AS/NZS 5667.1:1998 standards, at five bores (RG1, RG2, RG3, RG4 and RG8, note RG5 & RG6 are dry) located on and adjacent to the ML 6229 and proposed MPL boundary (Figure 11-5) to demonstrate that the concentration of potential contaminants (Pb, Zn, As, Cd, Fe, Se, pH, EC and TDS) do not exceed maximum baseline values.	Groundwater will be sampled and analysed quarterly, as per AS/NZS 5667.1:1998 standards, at five bores (RG1, RG2, RG3, RG4 and RG8) located on and adjacent to the proposed MPL boundary (Figure 11-5) to demonstrate that analytes (Pb, Zn, As, Cd, Fe, Se, pH, EC and TDS) are less than two standard deviations of the mean baseline values.
PIE_15_37	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
PIE_15_35	Processing plant geotechnical testing and modelling undertaken by Golder Associates and included in Appendix M1.5.	Potential for soil impacts through release of tailings into the environment		High: Original geotechnical testing and modelling for process plant reflective of current conditions 10 years post-modelling	High: Original design and geotechnical testing as per current conditions indicates design success	Medium: Relies upon management systems to processing plant after seismic event	Put conveyor embankment into erosion monitoring plan	Minor	Rare	Low	Yes	Environment Protection Act 1994 (SA) National Environment Protection Council Act 1994 (Cth) / National Environment Protection Measures (NEMs)	No contamination of natural water drainage systems, streams and rivers, groundwater, land and soils occurs either on or off site resulting from permanent disposal or temporary storage of mine ore or waste material	Provision of a report once prior to entering closure monitoring phase by a suitably qualified site contamination consultant verifies that a site contamination assessment and if required remediation in accordance with the NEM and relevant EPA guidelines. For the central and southern domains (excluding the TSF Figure 1-2) has occurred, ensuring there is no unacceptable risk to human health or the environment as a result of the contamination when compared with relevant baseline concentrations and relevant NEM investigation levels.	None proposed

Impact ID	Relevant Chapter	Environmental Aspect	Description of Potential Impact Event	Mine Life Phase	Source	Pathway	Receptor	Understanding of source, pathway, receptor (given limitations in information used in assessment)	Uncertainties and assumptions (relating to SPR)	Sensitivity to change of any assumptions	Confirmation of S-P-R	Outcome required?	Justification/evidence as to why no S-P-R	Factors that limit / mitigate impact (control measures)
PIE_13_38	Geohazards	soil	Erosion of conveyor cutting embankment results in collapse of conveyor and spill ore impacting soil quality	Operations, closure, post closure	Embankment surface (soil) of conveyor cutting	Wind transporting exposed materials from exposed embankment	Soil quality	High - understanding of operation from AZM/ML6229 and other sites	Assumptions based on understanding and experience at AZM from ML6229 regarding surface water flows.	Low: Meteorology and/or one characteristics unlikely to significantly change.	Yes	Yes	N/A	Infrastructure constructed as per detailed geotechnical investigations by Golder associates. Localised erosion may occur, however, of limited impact.
PIE_13_39	Geohazards	surface water	Erosion of conveyor cutting embankment results in collapse of conveyor and spill ore impacting surface water (Angas River) quality	Operations, closure, post closure	Embankment surface (soil) of conveyor cutting	Surface water transporting material from exposed embankment	Surface water (Angas River)	High - understanding of operation from AZM/ML6229 and other sites	Assumptions based on understanding and experience at AZM from ML6229 regarding surface water flows.	Low: Meteorology and/or one characteristics unlikely to significantly change.	Yes	Yes	N/A	Infrastructure constructed as per detailed geotechnical investigations by Golder associates. Localised erosion may occur, however, of limited impact.
PIE_13_39	Geohazards	surface water	Erosion of conveyor cutting embankment results in collapse of conveyor and spill ore impacting surface water (Angas River) quality	Operations, closure, post closure	Embankment surface (soil) of conveyor cutting	Wind transporting exposed materials from exposed embankment	Surface water (Angas River)	High - understanding of operation from AZM/ML6229 and other sites	Assumptions based on understanding and experience at AZM from ML6229 regarding surface water flows.	Low: Meteorology and/or one characteristics unlikely to significantly change.	Yes	Yes	N/A	Infrastructure constructed as per detailed geotechnical investigations by Golder associates. Localised erosion may occur, however, of limited impact.

Impact ID	Justification of assumptions - EVIDENCE	Description of Grouped Environmental Impact	Significance of expected impact 1 = Negligible 2 = Low, 3 = Med 4 = High	Validation of modelling	Effectiveness of design measures	Effectiveness of management measures	Actions to reduce uncertainty	Excluded worst case impact	Likelihood of credible worst case impact	Best Ranking (Low Ranking = High)	Impact covered by alternative Act or Limit (Yes/No)	Act / Limit Reference	Proposed Outcome	Outcome measurement criteria	Leading Indicator criteria (where required)
PIE_15_30	Processing plant geotechnical testing and modelling undertaken by Golder Associates and included in Appendix M13.	Potential for soil impacts through release of tailings into the environment		High: Original geotechnical testing and modelling for process plant reflective of current conditions 10 years post-modelling	High: Original design and geotechnical testing as per current conditions indicates design success	Medium: Relies upon management systems to processing plant after seismic event	Put conveyor embankment into erosion monitoring plan	Minor	Low	Low	Yes	Environment Protection Act 1994 (SA) National Environment Protection Council Act 1994 (Cth) / National Environment Protection Measures (NEMPMs)	No contamination of natural water drainage systems, streams and rivers, groundwater, land and soils occurs either on or off site resulting from permanent disposal or temporary storage of mine ore or waste material	Provision of a report once prior to entering closure monitoring phase by a suitably qualified site contamination consultant verifies that a site contamination assessment and if required remediation in accordance with the NEMPM and relevant EPA guidelines for the central and southern domains (excluding the TSI Figure 5-2 has occurred) ensuring there is no unacceptable risk to human health or the environment as a result of the contamination when compared with relevant baseline concentrations and relevant NEMPM investigation levels.	None proposed
PIE_15_30	Processing plant geotechnical testing and modelling undertaken by Golder Associates and included in Appendix M13.			High: Original geotechnical testing and modelling for process plant reflective of current conditions 10 years post-modelling	High: Original design and geotechnical testing as per current conditions indicates design success	Medium: Relies upon management systems to processing plant after seismic event	Put conveyor embankment into erosion monitoring plan	Minor	Low	Low	Yes	Environment Protection Act 1994 (SA) Environment Protection (Water Quality) Policy (SA) Natural Resources Management Act 2004 (SA)	No contamination of natural water drainage systems, streams and rivers, groundwater, land and soils occurs either on or off site resulting from permanent disposal or temporary storage of mine ore or waste material	Triplicate samples to be taken when water is running from the Front Entrance (pre-wetland), visitors viewing area, Pre-Swale, overflow point of the sediment dam, and exit point at the Evaporation Pan (Figure 12-11). Samples to be measured as per AS/NZS 5667.1:1998 standards. A paired t-test will demonstrate that turbidity at these sites is not significantly different from the mean of the triplicate samples taken at Hogben or greater than the mean of the triplicate samples taken at Hogben. If the samples obtained at the pre-wetland location, visitors viewing area or sediment dam overflow are significantly different from and greater than the mean of the triplicate samples taken at Hogben, verification will be undertaken to determine whether water is in fact leaving the Mineral Lease/MPL, in order to ascertain the source of the potential contamination.	After high rainfall events which generate runoff, records from visual inspections of silt traps, the silt retention dam and surface drainage systems on ML6229 and MPL (Figure 12-11) demonstrate that silt volume is no more than 50% of trap capacity volume and there is no breach in walls.
PIE_15_30	Processing plant geotechnical testing and modelling undertaken by Golder Associates and included in Appendix M13.			High: Original geotechnical testing and modelling for process plant reflective of current conditions 10 years post-modelling	High: Original design and geotechnical testing as per current conditions indicates design success	Medium: Relies upon management systems to processing plant after seismic event	Put conveyor embankment into erosion monitoring plan	Minor	Low	Low	Yes	Environment Protection Act 1994 (SA) Environment Protection (Water Quality) Policy (SA) Natural Resources Management Act 2004 (SA)	No contamination of natural water drainage systems, streams and rivers, groundwater, land and soils occurs either on or off site resulting from permanent disposal or temporary storage of mine ore or waste material	Triplicate samples to be taken when water is running from the Front Entrance (pre-wetland), visitors viewing area, Pre-Swale, overflow point of the sediment dam, and exit point at the Evaporation Pan (Figure 12-11). Samples to be measured as per AS/NZS 5667.1:1998 standards. A paired t-test will demonstrate that turbidity at these sites is not significantly different from the mean of the triplicate samples taken at Hogben or greater than the mean of the triplicate samples taken at Hogben. If the samples obtained at the pre-wetland location, visitors viewing area or sediment dam overflow are significantly different from and greater than the mean of the triplicate samples taken at Hogben, verification will be undertaken to determine whether water is in fact leaving the Mineral Lease/MPL, in order to ascertain the source of the potential contamination.	After high rainfall events which generate runoff, records from visual inspections of silt traps, the silt retention dam and surface drainage systems on ML6229 and MPL (Figure 12-11) demonstrate that silt volume is no more than 50% of trap capacity volume and there is no breach in walls.

Impact ID	Relevant Chapter	Environmental Aspect	Description of Potential Impact Event	Mine Life Phase	Source	Pathway	Receptor	Understanding of source, pathway, receptor (given limitations in information used in assessment)	Uncertainties and assumptions (relating to SPR)	Sensitivity to change of any assumptions	Confirmation of S-P-R	Outcome required?	Justification/evidence as to why no S-P-R	Factors that limit / mitigate impact (control measures)
PIE_15_13	Geohazards	Groundwater	Erosion of the TSF capping material, exposing tailings material and impacting on groundwater quality	closure, post closure	Tailings	Surface water flow - erosion	Groundwater and/or local groundwater users	High - Understanding of standard design of the ET Capping profile	TSF cap modelling based on assumptions outlined in Appendix 56. Approved during 2017 ML6220 approval as fit for purpose.	Low - the design was completed to the ANCOLD standards. Annual compliance reports verify no leakage to date	Yes	Yes	N/A	The TSF will be rehabilitated with an evapotranspiration cover (phytocap) at closure as outlined in Appendix 56 and monitored as per Appendix 130 (post ET cover construction monitoring plan)
PIE_15_12	Geohazards	soil	Erosion of the TSF capping material, exposing tailings material and impacting on soil quality outside the TSF	closure, post closure	Tailings	Surface water flow - erosion	Soil quality	High - Understanding of the overland flow paths and standard design of the ET Capping profile and flow control structures	TSF cap modelling based on assumptions outlined in Appendix 56. Approved during 2017 ML6220 approval as fit for purpose.	Low - the design was completed to the ANCOLD standards. Annual compliance reports verify no leakage to date	Yes	Yes	N/A	The TSF will be rehabilitated with an evapotranspiration cover (phytocap) at closure as outlined in Appendix 56 and monitored as per Appendix 130 (post ET cover construction monitoring plan)
PIE_15_15	Geohazards	soil	Erosion of the TSF capping material, exposing tailings material and impacting on soil quality outside the TSF	closure, post closure	Tailings	Wind transporting exposed contaminants	Soil quality	High - Understanding of standard design of the ET Capping profile	TSF cap modelling based on assumptions including met. data outlined in Appendix 56. Approved during 2017 ML6220 approval as fit for purpose.	Low - the design was completed to the ANCOLD standards. Annual compliance reports verify no leakage to date	Yes	Yes	N/A	The TSF will be rehabilitated with an evapotranspiration cover (phytocap) at closure as outlined in Appendix 56 and monitored as per Appendix 130 (post ET cover construction monitoring plan)

Impact ID	Justification of assumptions - EVIDENCE	Description of Grouped Environmental Impact	Significance of expected impact 1 = Negligible 2 = Low, 3 = Med 4 = High	Validation of modelling	Effectiveness of design measures	Effectiveness of management measures	Actions to reduce uncertainty	Credible worst case impact	Unlikelihood of Credible worst case impact	Risk Ranking (Low, Medium, High or Extreme)	Impact covered by alternative Act or Limit (Yes/No)	Act / Limit Reference	Proposed Outcome	Outcome measurement criteria	Leading Indicator criteria (where required)
PIE_15_13	PEPR Angas Zinc Mine 2017			Medium: ET cap design peer reviewed and determined as fit for purpose in 2017. Limitations until built and recalibrated.	High: Site specific design based on location meteorology and materials. Similar successful cover system 80km from AZM (AACAP trial)	Medium: Post-construction monitoring plan for TSF cover system finalised however relies on effective management system and checking of instrumentation	Landscape function analysis post-construction as per OMC	Minor	Unlikely	Low		N/A	No contamination of natural water drainage systems, streams and rivers, groundwater, land and soils occur either on or off site resulting from permanent disposal or temporary storage of mine ore or waste material	Standing Water Levels (SWL) will be monitored monthly as per AS/NZS 5667.1:1998 standards as groundwater monitoring boxes TSF A, B, C and D (Figure 11.5). An independent expert will verify through annual analysis of the monthly data that no leakage from the TSF into the surrounding aquifer has been detected. Groundwater monitoring boxes TSF A, B, C and D (Figure 11.5) will be sampled and analysed monthly as per AS/NZS 5667.1:1998 standards for pH, EC, TDS, As, Cd, Pb, Zn, Mn and Fe. An independent expert will verify, through annual analysis of the monthly data that no leakage from the TSF into the surrounding aquifer has been detected.	Groundwater monitoring boxes TSF A, B, C and D will be sampled and analysed monthly as per AS/NZS 5667.1:1998 standards for pH, EC, TDS, As, Cd, Pb, Zn, Mn and Fe, to demonstrate no change in quality beyond 2 standard deviation of the mean (Figure 11.5). If a change from the 2 standard deviation occurs, results are to be submitted to an independent expert for analysis. Six embankment monitoring boxes (M81 to M86) located on the TSF main embankment will be monitored monthly to ensure no water is detected. If water is detected, it will be sampled for pH, EC, TDS, As, Cd, Pb, Zn, Mn and Fe, as per AS/NZS 5667.1:1998 standards, and results submitted to an independent expert for analysis.
PIE_15_12	PEPR Angas Zinc Mine 2017	Potential for soil impacts through release of tailings into the environment		Medium: ET cap design peer reviewed and determined as fit for purpose in 2017. Limitations until built and recalibrated.	High: Site specific design based on location meteorology and materials. Similar successful cover system 80km from AZM (AACAP trial)	Medium: Post-construction monitoring plan for TSF cover system finalised however relies on effective management system and checking of instrumentation	Landscape function analysis post-construction as per OMC	Moderate	Unlikely	Medium	Yes	Environment Protection Act 1996 (SA) National Environment Protection Council Act 1994 (Cth) / National Environment Protection Measures (NEPMs)	No contamination of natural water drainage systems, streams and rivers, groundwater, land and soils occur either on or off site resulting from permanent disposal or temporary storage of mine ore or waste material	Provision of a report once prior to entering closure monitoring phase by a suitably qualified site contamination consultant verifies that a site contamination assessment and if required remediation in accordance with the NEPM and relevant EPA guidelines for the central and southern domains (including the TSF) Figure 1.2 has occurred, ensuring there is no unacceptable risk to human health or the environment as a result of the contamination when compared with relevant baseline concentrations and relevant NEPM investigation levels.	None proposed
PIE_15_15	PEPR Angas Zinc Mine 2017	Potential for soil impacts through release of tailings into the environment		Medium: ET cap design peer reviewed and determined as fit for purpose in 2017. Limitations until built and recalibrated.	High: Site specific design based on location meteorology and materials. Similar successful cover system 80km from AZM (AACAP trial)	Medium: Post-construction monitoring plan for TSF cover system finalised however relies on effective management system and checking of instrumentation	Landscape function analysis post-construction as per OMC	Moderate	Unlikely	Medium	Yes	Environment Protection Act 1996 (SA) National Environment Protection Council Act 1994 (Cth) / National Environment Protection Measures (NEPMs)	No contamination of natural water drainage systems, streams and rivers, groundwater, land and soils occur either on or off site resulting from permanent disposal or temporary storage of mine ore or waste material	Provision of a report once prior to entering closure monitoring phase by a suitably qualified site contamination consultant verifies that a site contamination assessment and if required remediation in accordance with the NEPM and relevant EPA guidelines for the central and southern domains (including the TSF) Figure 1.2 has occurred, ensuring there is no unacceptable risk to human health or the environment as a result of the contamination when compared with relevant baseline concentrations and relevant NEPM investigation levels.	None proposed

Impact ID	Relevant Chapter	Environmental Aspect	Description of Potential Impact Event	Mine Life Phase	Source	Pathway	Receptor	Understanding of source, pathway, receptor (given limitations in information used in assessment)	Uncertainties and assumptions (relating to SPR)	Sensitivity to change of any assumptions	Confirmation of S-P-R	Outcome required?	Justification/evidence as to why no S-P-R	Factors that limit / mitigate impact (control measures)
PIE_15_11	Geohazards	Surface Water	Erosion of the TSF capping material, exposing tailings material and impacting on surface water quality (Angas River)	closure, post closure	Tailings	Surface water flows - erosion	Surface water (Angas River)	High - Understanding of the overland flow paths and standard design of the ET Capping profile and flow control structures	TSF cap modelling based on assumptions outlined in Appendix 56. Approved during 2017 ML6229 approval as fit for purpose.	Low - Due to the high level of understanding of the ET capping system and the local Flora available	Yes	Yes	N/A	The TSF will be rehabilitated with an evapotranspiration cover (phytocap) at closure as outlined in Appendix 56 and monitored as per Appendix 130 (post ET cover construction monitoring plan)
PIE_15_14	Geohazards	Surface Water	Erosion of the TSF capping material, exposing tailings material and impacting on surface water quality (Angas River)	closure, post closure	Tailings	Wind transporting exposed contaminants	Surface water (Angas River)	High - Understanding of standard design of the ET Capping profile	TSF cap modelling based on assumptions including met. data outlined in Appendix 56. Approved during 2017 ML6229 approval as fit for purpose.	Low - the design was completed to the ANCOLD standards. Annual compliance reports verify no leakage to date	Yes	Yes	N/A	The TSF will be rehabilitated with an evapotranspiration cover (phytocap) at closure as outlined in Appendix 56 and monitored as per Appendix 130 (post ET cover construction monitoring plan)
PIE_15_7	Geohazards	surface water	Floodwaters from the Angas River eroding and compromising the integrity of the TSF embankment resulting in exposure of tailings to surface water systems (Angas River)	Refurbishmen t, Operations, Closure	Tailings	Floodwaters	Surface water (Angas River)	High - based on performance during AZM	Based on current 1:100 year ARI flood plain	Low	No	No	No, TSF built >100m from 1:100m ARI flood plain. Not credible.	N/A
PIE_15_10	Geohazards	TSF	Seismic activity causing TSF embankment failure resulting in overflow of tailings into the environment impacting soil quality, surface water quality and groundwater quality outside TSF	Operations, closure, post closure	Tailings	Seismic activity	Surface water (Angas River)	High - Understanding of the Geotechnical condition of the wall and the constructions standards	Assumptions based on seismic probabilities for the Strathbryn area.	Low - the design was completed to the ANCOLD standards	Yes	Yes	N/A	<ul style="list-style-type: none"> Embankment designed and built as per ANCOLD guidelines operation and maintenance of TSF as per Operation and Maintenance Manual (ATC Williams) Annually inspections of the dam the data collected

Impact ID	Justification of assumptions - EVIDENCE	Description of Grouped Environmental Impact	Significance of expected impact 1 = Negligible 2 = Low, 3 = Med 4 = High	Validation of modelling	Effectiveness of design measures	Effectiveness of management measures	Actions to reduce uncertainty	Excluded worst case impact	Unlikelihood of credible worst case impact	Best Reasoning (for High or Low)	Impact covered by alternative Act or Limit (Yes/No)	Act / Limit Reference	Proposed Outcome	Outcome measurement criteria	Leading Indicator criteria (where required)
PIE_15_11	PEPR Angas Zinc Mine 2017	Surface Water	1	High: Annual inspection of the wall and confirmation still in accordance with the design standards.	High - industry standard and the AACAP program results	High standard Management plan including a detailed inspection schedule	N/A	Major	None	Medium	Yes	Environment Protection Act 1994 (SA) Environment Protection (Water Quality) Policy (SA) Natural Resources Management Act 2004 (SA)	No adverse impacts on soil quality or quantity caused by mining operations	A report by an independent and suitably qualified expert (to DPC's satisfaction) will verify once prior to application for surrender that all available information and data from UC demonstrates that representative test sites on the borrow and TSF areas have been rehabilitated to a safe, stable landform and have achieved, or by trends, may be confidently predicted to reach and pass sustainability thresholds as defined by Landscape Function Analysis (Sustainability thresholds for each parameter are interpreted as the points of maximum curvature on the sigmoidal curve shape as per Tongway and Hindley (2005)).	Fill and gully erosion will be monitored annually until LFA monitoring indicates sustainable land function, at all permanent Landscape Function Analysis (LFA) monitoring transects established post rehabilitation earthworks (MCP, Appendix EIV). LFA erosion monitoring methods will also be used to record width and depth of any rills or gullies to ensure they are not to exceed, 300mm width and 300mm depth (no mine waste material); 200mm in width and 200mm depth (on the TSF cover system and spillway interface); 250mm in width and 250mm depth (TSF embankments). This will be done until: 1) LFA monitoring indicates sustainable function (Sustainability thresholds for each parameter are interpreted as the points of maximum curvature on the sigmoidal curve shape as per Tongway and Hindley (2005)). 2) LFA will be repeated annually for the first 5 years and then at a frequency recommended in the report provided at year 5. 3) LFA will then be repeated to confirm trend 24 months before submission of surrender of Mining Lease document.
PIE_15_14	PEPR Angas Zinc Mine 2017			Medium: ET cap design peer reviewed and determined as fit for purpose in 2017. Limitations until built and recalibrated.	High: Site specific design based on location meteorology and materials. Similar successful cover system 80m from AZM (AACAP trial)	Medium: Post-construction monitoring plan for TSF cover system finalised however relies on effective management system and checking of instrumentation.	Landscape function analysis post-construction as per DMC	Moderate	Unlikely	Medium	Yes	Environment Protection Act 1994 (SA) Environment Protection (Water Quality) Policy (SA) Natural Resources Management Act 2004 (SA)	No adverse impacts on soil quality or quantity caused by mining operations	A report by an independent and suitably qualified expert (to DPC's satisfaction) will verify once prior to application for surrender that all available information and data from UC demonstrates that representative test sites on the borrow and TSF areas have been rehabilitated to a safe, stable landform and have achieved, or by trends, may be confidently predicted to reach and pass sustainability thresholds as defined by Landscape Function Analysis (Sustainability thresholds for each parameter are interpreted as the points of maximum curvature on the sigmoidal curve shape as per Tongway and Hindley (2005)).	Fill and gully erosion will be monitored annually until LFA monitoring indicates sustainable land function, at all permanent Landscape Function Analysis (LFA) monitoring transects established post rehabilitation earthworks (MCP, Appendix EIV). LFA erosion monitoring methods will also be used to record width and depth of any rills or gullies to ensure they are not to exceed, 300mm width and 300mm depth (no mine waste material); 200mm in width and 200mm depth (on the TSF cover system and spillway interface); 250mm in width and 250mm depth (TSF embankments). This will be done until: 1) LFA monitoring indicates sustainable function (Sustainability thresholds for each parameter are interpreted as the points of maximum curvature on the sigmoidal curve shape as per Tongway and Hindley (2005)). 2) LFA will be repeated annually for the first 5 years and then at a frequency recommended in the report provided at year 5. 3) LFA will then be repeated to confirm trend 24 months before submission of surrender of Mining Lease document.
PIE_15_7	N/A		1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
PIE_15_10	Based on performance and monitoring results during the operation of AZM, and annual independent TSF audits.	Potential for surface water impacts through release of tailings into the environment	2	High: Annual inspection of the wall and confirmation still in accordance with the design standards	High - Dam designed, built, maintained and managed as per ANCOLD guidelines	High - operating manual provided by designer and reviewed regularly, annual tail audit undertaken	Review and recommission TSF and update operations and maintenance manual prior to restarting TSF.	Moderate	None	Low	Yes	Environment Protection Act 1994 (SA) Environment Protection (Water Quality) Policy (SA) Natural Resources Management Act 2004 (SA)	No contamination of natural water drainage systems, streams and rivers, groundwater, land and soils occur either on or off site resulting from permanent disposal or temporary storage of mine ore or waste material.	Survey readings of the position and elevation (i.e. x, y, z coordinates) of all installed fifteen settlement/movement monuments on TSF embankments shall be obtained at monthly intervals and be audited annually to determine if TSF embankments are geotechnically stable.	None proposed.

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PIE_15_11	Geohazards	TSF	Seismic activity causing TSF embankment failure resulting in overflow of tailings into the environment impacting soil quality, surface water quality and groundwater quality outside TSF	Operations, closure, post closure	Tailings	Seismic activity	Groundwater and/or local groundwater users	High - Understanding of the Geotechnical condition of the wall and the constructions standards	Assumptions based on seismic probabilities for the Strathalbyn area.	Low - the design was completed to the ANCOLD standards	Yes	Yes	N/A	Embankment designed and built as per ANCOLD guidelines operation and maintenance of TSF as per Operation and Maintenance Manual (ATC Williams) Annually inspections of the dam the data collected
PIE_15_9	Geohazards	TSF	Seismic activity causing TSF embankment failure resulting in overflow of tailings into the environment impacting soil quality, surface water quality and groundwater quality outside TSF	Operations, closure, post closure	Tailings	Seismic activity	Soil quality	High - Understanding of the Geotechnical condition of the wall and the constructions standards. Annual compliance reports to date indicate no immediate risk to receptors (based upon 9 years of operation).	Assumptions based on seismic probabilities for the Strathalbyn area.	Low - the design was completed to the ANCOLD standards	Yes	Yes	N/A	Embankment designed and built as per ANCOLD guidelines operation and maintenance of TSF as per Operation and Maintenance Manual (ATC Williams) Annually inspections of the dam the data collected
PIE_15_21	Geohazards	surface water	TSF embankment failure from lack of structural integrity resulting in release of tailings into the environment impacting surface water quality outside TSF	Operations, closure	Tailings	Wind transporting exposed contaminants	Surface water (high flow)	High: Very high understanding of how TSF operates. Annual compliance reports to date (2008-2018) indicate no immediate risk to receptors (based upon 9 years of operation).	Modelling completed in 2016 for a more highly concentrated water quality and larger volume demonstrates limited risk to groundwater aquifer outside of ML6229 boundary	Low: Groundwater modelling complete with updated geochemistry modelling in 2016 based on conservative decant pond water quality.	Yes	Yes	N/A	TSF wall geotechnical characteristics suitable for construction. Annual independent audit (visual and analysis of documentation (O+M manual), weekly inspections. Seepage monitoring and decant system functional and indicates leakage potential. Embankment piezometers to indicate presence of water. Embankment designed and built as per ANCOLD guidelines. Operation and maintenance of TSF as per Operation and Maintenance Manual (ATC Williams) Survey monitoring of TSF walls/embankment to detect movement TSF solids not highly mobile.
PIE_15_18	Geohazards	groundwater	TSF embankment failure from lack of structural integrity resulting in release of tailings into the environment impacting groundwater quality outside TSF	Operations, closure	Tailings	Wind transporting exposed contaminants	Groundwater and/or local groundwater users	High: Very high understanding of how TSF operates. Annual compliance reports to date (2008-2018) indicate no immediate risk to receptors (based upon 9 years of operation).	Modelling completed in 2016 for a more highly concentrated water quality and larger volume demonstrates limited risk to groundwater aquifer outside of ML6229 boundary	Low: Groundwater modelling complete with updated geochemistry modelling in 2016 based on conservative decant pond water quality.	Yes	Yes	N/A	TSF wall geotechnical characteristics suitable for construction. Annual independent audit (visual and analysis of documentation (O+M manual), weekly inspections. Seepage monitoring and decant system functional and indicates leakage potential. Embankment piezometers to indicate presence of water. Embankment designed and built as per ANCOLD guidelines. Operation and maintenance of TSF as per Operation and Maintenance Manual (ATC Williams) Survey monitoring of TSF walls/embankment to detect movement TSF solids not highly mobile.
PIE_15_22	Geohazards	Groundwater	TSF embankment failure from lack of structural integrity resulting in release of tailings into the environment impacting groundwater quality outside TSF	Operations, closure, post closure	Tailings	Surface water transporting exposed material	Groundwater and/or local groundwater users	High: Very high understanding of how TSF operates. Annual compliance reports to date (2008-2018) indicate no immediate risk to receptors (based upon 9 years of operation).	Modelling completed in 2016 for a more highly concentrated water quality and larger volume demonstrates limited risk to groundwater aquifer outside of ML6229 boundary	Low: Groundwater modelling complete with updated geochemistry modelling in 2016 based on conservative decant pond water quality.	Yes	Yes	N/A	TSF wall geotechnical characteristics suitable for construction. Annual independent audit (visual and analysis of documentation (O+M manual), weekly inspections. Seepage monitoring and decant system functional and indicates leakage potential. Embankment piezometers to indicate presence of water. Embankment designed and built as per ANCOLD guidelines. Operation and maintenance of TSF as per Operation and Maintenance Manual (ATC Williams) Survey monitoring of TSF walls/embankment to detect movement TSF solids not highly mobile.

Impact ID	Relevant Chapter	Environmental Aspect	Description of Potential Impact Event	Mine Life Phase	Source	Pathway	Receptor	Understanding of source, pathway, receptor (given limitations in information used in assessment)	Uncertainties and assumptions (relating to SPR)	Sensitivity to change of any assumptions	Confidence of S-P-R	Outcome required?	Justification/evidence as to why no S-P-R	Factors that limit / mitigate impact (control measures)
PIE_15_25	Geohazards	Groundwater	TSF embankment failure from lack of structural integrity resulting in release of tailings into the environment impacting groundwater quality outside TSF	Operations, closure, post closure	Tailings	Soil infiltration	Groundwater and/or local groundwater users	High: Very high understanding of how TSF operates. Annual compliance reports to date (2008-2018) indicate no immediate risk to receptors (based upon 9 years of operation).	Modelling completed in 2016 for a more highly concentrated water quality and larger volume demonstrates limited risk to groundwater aquifer outside of ML6229 boundary	Low: Groundwater modelling complete with updated geochemistry modelling in 2016 based on conservative decant pond water quality.	Yes	Yes	N/A	TSF wall geotechnical characteristics suitable for construction. Annual independent audit (visual and analysis of documentation (O+M manual), weekly inspections. Seepage monitoring and decant system functional and indicates leakage potential. Embankment piezometers to indicate presence of water. Embankment designed and built as per ANCOLD guidelines. Operation and maintenance of TSF as per Operation and Maintenance Manual (ATC Williams) Survey monitoring of TSF walls/embankment to detect movement TSF solids not highly mobile.
PIE_15_26	Geohazards	soil	TSF embankment failure from lack of structural integrity resulting in release of tailings into the environment impacting soil quality outside TSF	Operations, closure	Tailings	Wind transporting exposed contaminants	Soil quality	High: Very high understanding of how TSF operates. Annual compliance reports to date (2008-2018) indicate no immediate risk to receptors (based upon 9 years of operation).	Modelling completed in 2016 for a more highly concentrated water quality and larger volume demonstrates limited risk to groundwater aquifer outside of ML6229 boundary	Low: Groundwater modelling complete with updated geochemistry modelling in 2016 based on conservative decant pond water quality.	Yes	Yes	N/A	TSF wall geotechnical characteristics suitable for construction. Annual independent audit (visual and analysis of documentation (O+M manual), weekly inspections. Seepage monitoring and decant system functional and indicates leakage potential. Embankment piezometers to indicate presence of water. Embankment designed and built as per ANCOLD guidelines. Operation and maintenance of TSF as per Operation and Maintenance Manual (ATC Williams) Survey monitoring of TSF walls/embankment to detect movement TSF solids not highly mobile.
PIE_15_27	Geohazards	soil	TSF embankment failure from lack of structural integrity resulting in release of tailings into the environment impacting soil quality outside TSF	Operations, closure, post closure	Tailings	Surface water transporting exposed material	Soil quality	High: Very high understanding of how TSF operates. Annual compliance reports to date (2008-2018) indicate no immediate risk to receptors (based upon 9 years of operation).	Modelling completed in 2016 for a more highly concentrated water quality and larger volume demonstrates limited risk to groundwater aquifer outside of ML6229 boundary	Low: Groundwater modelling complete with updated geochemistry modelling in 2016 based on conservative decant pond water quality.	Yes	Yes	N/A	TSF wall geotechnical characteristics suitable for construction. Annual independent audit (visual and analysis of documentation (O+M manual), weekly inspections. Seepage monitoring and decant system functional and indicates leakage potential. Embankment piezometers to indicate presence of water. Embankment designed and built as per ANCOLD guidelines. Operation and maintenance of TSF as per Operation and Maintenance Manual (ATC Williams) Survey monitoring of TSF walls/embankment to detect movement TSF solids not highly mobile.
PIE_15_28	Geohazards	soil	TSF embankment failure from lack of structural integrity resulting in release of tailings into the environment impacting soil quality outside TSF	Operations, closure, post closure	Tailings	Soil infiltration	Soil quality	High: Very high understanding of how TSF operates. Annual compliance reports to date (2008-2018) indicate no immediate risk to receptors (based upon 9 years of operation).	Modelling completed in 2016 for a more highly concentrated water quality and larger volume demonstrates limited risk to groundwater aquifer outside of ML6229 boundary	Low: Groundwater modelling complete with updated geochemistry modelling in 2016 based on conservative decant pond water quality.	Yes	Yes	N/A	TSF wall geotechnical characteristics suitable for construction. Annual independent audit (visual and analysis of documentation (O+M manual), weekly inspections. Seepage monitoring and decant system functional and indicates leakage potential. Embankment piezometers to indicate presence of water. Embankment designed and built as per ANCOLD guidelines. Operation and maintenance of TSF as per Operation and Maintenance Manual (ATC Williams) Survey monitoring of TSF walls/embankment to detect movement TSF solids not highly mobile.
PIE_15_29	Geohazards	Surface Water	TSF embankment failure from lack of structural integrity resulting in release of tailings into the environment impacting surface water outside TSF	Operations, closure, post closure	Tailings	Surface water transporting exposed material	Surface water (Magle River)	High: Very high understanding of how TSF operates. Annual compliance reports to date (2008-2018) indicate no immediate risk to receptors (based upon 9 years of operation).	Modelling completed in 2016 for a more highly concentrated water quality and larger volume demonstrates limited risk to groundwater aquifer outside of ML6229 boundary	Low: Groundwater modelling complete with updated geochemistry modelling in 2016 based on conservative decant pond water quality.	Yes	Yes	N/A	TSF wall geotechnical characteristics suitable for construction. Annual independent audit (visual and analysis of documentation (O+M manual), weekly inspections. Seepage monitoring and decant system functional and indicates leakage potential. Embankment piezometers to indicate presence of water. Embankment designed and built as per ANCOLD guidelines. Operation and maintenance of TSF as per Operation and Maintenance Manual (ATC Williams) Survey monitoring of TSF walls/embankment to detect movement TSF solids not highly mobile.

Impact Assessment

Impact ID	Justification of assumptions - EVIDENCE	Description of Grouped Environmental Impact	Significance of expected impact 1 = Negligible 2 = Low, 3 = Med 4 = High	Validation of modelling	Effectiveness of design measures	Effectiveness of management measures	Actions to reduce uncertainty	Exclude worst case impact	Limitation of credible worst case impact	Best Practice (for Baseline High or Low)	Impact covered by alternative Act or Limit (Yes/No)	Act / Limit Reference	Proposed Outcome	Outcome measurement criteria	Leading Indicator criteria (where required)
PIE_15_25	TSF designed as per Appendix V3. TSF wall geotechnical characteristics for closure as per Appendix 5B. ET cap as per Appendix M6. Operations and Maintenance Manual per per Appendix I3. Post ET cap construction monitoring plan as per Appendix S10.	Potential for soil/water impacts through release of tailings into the environment	1	High: Annual inspection of the wall and confirmation still in accordance with the design standards	High- Dam designed, build, maintained and managed as per ANCOLD guidelines	High - operating manual provided by designer and reviewed regularly, annual tsf audit undertaken	Review and recommission TSF and update operations and maintenance manual prior to restarting TSF.					N/A	No contamination of natural water drainage systems, streams and rivers, groundwater, land and soils occurs either on or off site resulting from permanent disposal or temporary storage of mine ore or waste material	Standing Water Levels (SWL) will be monitored monthly as per AS/NZS 5667.1:1998 standards at groundwater monitoring boxes TSF A, B, C and D (Figure 11.5) An independent expert will verify through annual analysis of the monthly data that no leakage from the TSF into the surrounding aquifer has been detected. Groundwater monitoring boxes TSF A, B, C and D (Figure 11.5) will be sampled and analysed monthly as per AS/NZS 5667.1:1998 standards for pH, EC, TDS, As, Cd, Pb, Zn, Mn and Fe. An independent expert will verify, through annual analysis of the monthly data that no leakage from the TSF into the surrounding aquifer has been detected.	Groundwater monitoring boxes TSF A, B, C and D will be sampled and analysed monthly as per AS/NZS 5667.1:1998 standards for pH, EC, TDS, As, Cd, Pb, Zn, Mn and Fe, to demonstrate no change in quality beyond 2 standard deviation of the mean (Figure 11.5). If a change from the 2 standard deviation occurs, results are to be submitted to an independent expert for analysis.
PIE_15_26	TSF designed as per Appendix V3. TSF wall geotechnical characteristics for closure as per Appendix 5B. ET cap as per Appendix M6. Operations and Maintenance Manual per per Appendix I3. Post ET cap construction monitoring plan as per Appendix S10.	Potential for soil/water impacts through release of tailings into the environment	1	High: Annual inspection of the wall and confirmation still in accordance with the design standards	High- Dam designed, build, maintained and managed as per ANCOLD guidelines	High - operating manual provided by designer and reviewed regularly, annual tsf audit undertaken	Review and recommission TSF and update operations and maintenance manual prior to restarting TSF.	Mothers	Rice	Low	Yes	Environment Protection Act 1994 (SA) National Environment Protection Council Act 1994 (Cth) / National Environment Protection Measures (NEMs)	No contamination of natural water drainage systems, streams and rivers, groundwater, land and soils occurs either on or off site resulting from permanent disposal or temporary storage of mine ore or waste material	Provision of a report once prior to entering closure monitoring phase by a suitably qualified site contamination consultant verifies that a site contamination assessment and if required remediation in accordance with the NEM and relevant EPA guidelines for the central and southern domains (including the TSF) Figure 2 has occurred, ensuring there is no unacceptable risk to human health or the environment as a result of the contamination when compared with relevant baseline concentrations and relevant NEM investigation levels.	None proposed
PIE_15_27	TSF designed as per Appendix V3. TSF wall geotechnical characteristics for closure as per Appendix 5B. ET cap as per Appendix M6. Operation and Maintenance Manual per per Appendix I3. Post ET cap construction monitoring plan as per Appendix S10.	Potential for soil/water impacts through release of tailings into the environment	1	High: Annual inspection of the wall and confirmation still in accordance with the design standards	High- Dam designed, build, maintained and managed as per ANCOLD guidelines	High - operating manual provided by designer and reviewed regularly, annual tsf audit undertaken	Review and recommission TSF and update operations and maintenance manual prior to restarting TSF.				Yes	Environment Protection Act 1994 (SA) National Environment Protection Council Act 1994 (Cth) / National Environment Protection Measures (NEMs)	No contamination of natural water drainage systems, streams and rivers, groundwater, land and soils occurs either on or off site resulting from permanent disposal or temporary storage of mine ore or waste material	Provision of a report once prior to entering closure monitoring phase by a suitably qualified site contamination consultant verifies that a site contamination assessment and if required remediation in accordance with the NEM and relevant EPA guidelines for the central and southern domains (including the TSF) Figure 2 has occurred, ensuring there is no unacceptable risk to human health or the environment as a result of the contamination when compared with relevant baseline concentrations and relevant NEM investigation levels.	None proposed
PIE_15_28	TSF designed as per Appendix V3. TSF wall geotechnical characteristics for closure as per Appendix 5B. ET cap as per Appendix M6. Post ET cap construction monitoring plan as per Appendix S10.	Potential for soil/water impacts through release of tailings into the environment	1	High: Annual inspection of the wall and confirmation still in accordance with the design standards	High- Dam designed, build, maintained and managed as per ANCOLD guidelines	High - operating manual provided by designer and reviewed regularly, annual tsf audit undertaken	Review and recommission TSF and update operations and maintenance manual prior to restarting TSF.				Yes	Environment Protection Act 1994 (SA) National Environment Protection Council Act 1994 (Cth) / National Environment Protection Measures (NEMs)	No contamination of natural water drainage systems, streams and rivers, groundwater, land and soils occurs either on or off site resulting from permanent disposal or temporary storage of mine ore or waste material	Provision of a report once prior to entering closure monitoring phase by a suitably qualified site contamination consultant verifies that a site contamination assessment and if required remediation in accordance with the NEM and relevant EPA guidelines for the central and southern domains (including the TSF) Figure 2 has occurred, ensuring there is no unacceptable risk to human health or the environment as a result of the contamination when compared with relevant baseline concentrations and relevant NEM investigation levels.	None proposed
PIE_15_30	TSF designed as per Appendix V3. TSF wall geotechnical characteristics for closure as per Appendix 5B. ET cap as per Appendix M6. Operation and Maintenance Manual per per Appendix I3. Post ET cap construction monitoring plan as per Appendix S10.	Potential for soil/water impacts through release of tailings into the environment	1	High: Annual inspection of the wall and confirmation still in accordance with the design standards	High- Dam designed, build, maintained and managed as per ANCOLD guidelines	High - operating manual provided by designer and reviewed regularly, annual tsf audit undertaken	Review and recommission TSF and update operations and maintenance manual prior to restarting TSF.				Yes	Environment Protection Act 1994 (SA) Environment Protection (Water Quality) Policy (SA) Natural Resources Management Act 2004 (SA)	No contamination of natural water drainage systems, streams and rivers, groundwater, land and soils occurs either on or off site resulting from permanent disposal or temporary storage of mine ore or waste material	Survey readings of the position and elevation (at x, y, z coordinates) of all installed filter and settlement/movement monuments on TSF embankments shall be obtained at monthly intervals and be audited annually to demonstrate TSF embankments are geotechnically stable.	None proposed

Impact ID	Relevant Chapter	Environmental Aspect	Description of Potential Impact Event	Mine Life Phase	Source	Pathway	Receptor	Understanding of source, pathway, receptor (given limitations in information used in assessment)	Uncertainties and assumptions (relating to SPR)	Sensitivity to change of any assumptions	Confirmation of S-P-R	Outcome required?	Justification/evidence as to why no S-P-R	Factors that limit / mitigate impact (control measures)
PIE_15_27	Geohazards	Surface Water	TSF embankment failure from lack of structural integrity resulting in release of tailings into the environment impacting surface water outside TSF	Operations, closure, post closure	Tailings	Soil infiltration	Surface water (Pipes River)	High: Very high understanding of how TSF operates. Annual compliance reports to date (2008-2018) indicate no immediate risk to receptors (based upon 9 years of operation).	Modelling completed in 2016 for a more highly concentrated water quality and larger volume demonstrates limited risk to groundwater aquifer outside of MLE229 boundary	Low: Groundwater modelling complete with updated geochemistry modelling in 2016 based on conservative decant pond water quality.	Yes	Yes	N/A	TSF wall geotechnical characteristics suitable for construction Annual independent audit (visual and analysis of documentation (O+M manual), weekly inspections. Seepage monitoring and decant system functional and indicates leakage potential. Embankment piezometers to indicate presence of water. Embankment designed and built as per ANCOLD guidelines Operation and maintenance of TSF as per Operation and Maintenance Manual (ATC Williams) Survey monitoring of TSF walls/embankment to detect movement TSF solids not highly mobile.
PIE_15_16	Geohazards	groundwater	TSF embankment failure, from major dam liner defect and leakage impacts groundwater quality outside TSF	Operations, closure, post closure	Tailings	Soil infiltration	Groundwater and/or local groundwater users	High: Very high understanding of how TSF operates. Annual compliance reports to date (2008-2018) indicate no immediate risk to receptors (based upon 9 years of operation).	Modelling completed in 2016 for a more highly concentrated water quality and larger volume demonstrates limited risk to groundwater aquifer outside of MLE229 boundary	Low: Groundwater modelling complete with updated geochemistry modelling in 2016 based on conservative decant pond water quality.	Yes	Yes	N/A	Embankment designed and built as per ANCOLD guidelines operation and maintenance of TSF as per Operation and Maintenance Manual (ATC Williams) survey monitoring of TSF walls/embankment to detect movement tsf solids not highly mobile.
PIE_15_17	Geohazards	soil	TSF embankment failure, from major dam liner defect and leakage impacts soil quality outside TSF	Operations, closure, post closure	Tailings	Soil infiltration	Soil quality	High: Very high understanding of how TSF operates. Annual compliance reports to date (2008-2018) indicate no immediate risk to receptors (based upon 9 years of operation).	Modelling completed in 2016 for a more highly concentrated water quality and larger volume demonstrates limited risk to groundwater aquifer outside of MLE229 boundary	Low: Groundwater modelling complete with updated geochemistry modelling in 2016 based on conservative decant pond water quality.	Yes	Yes	N/A	Survey prisms in embankment, annual independent audit (visual and analysis of documentation (O+M manual), weekly inspections. Seepage monitoring and decant system functional and indicates leakage potential. Embankment piezometers to indicate presence of water.
PIE_15_18	Geohazards	soil	TSF embankment failure, from major dam liner defect and leakage impacts surface water quality outside TSF	Operations, closure, post closure	Tailings	Overland surface water flow	Surface water (Pipes River)	High: Very high understanding of how TSF operates. Annual compliance reports to date (2008-2018) indicate no immediate risk to receptors (based upon 9 years of operation).	Modelling completed in 2016 for a more highly concentrated water quality and larger volume demonstrates limited risk to groundwater aquifer outside of MLE229 boundary	Low: the design was completed to the ANCOLD standards. Annual compliance reports verify no leakage to date	Yes	Yes	N/A	Survey prisms in embankment, annual independent audit (visual and analysis of documentation (O+M manual), weekly inspections. Seepage monitoring and decant system functional and indicates leakage potential. Embankment piezometers to indicate presence of water.
PIE_16_1	Air quality	Health	Disturbance of contaminated soil during closure results in public health impacts to local community	Closure	Disturbance of contaminated soil	Air and prevailing winds	Local community	Medium: Baseline soil assessment undertaken prior to MLE229 construction. Naturally elevated soils containing elevated concentrations of lead in soils well understood. See chapter 16, section 16.4.5.	See approved MLE229 PEPR - Closure Plan (appendix C)	Low: Conclusions reached in the impact assessment are highly unlikely to change if assumptions are found to be incorrect (conservative modelling applied).	Yes	Yes	N/A	Water truck onsite through closure phase to control dust. Dust Management and Monitoring Plan to include a Trigger Action Response Plan which will be utilised and reported against. See chapter 16, section 16.7 and AQIA (Appendix N) section 7.0 for further control measures.

Impact Assessment

Impact ID	Justification of assumptions - EVIDENCE	Description of Grouped Environmental Impact	Significance of expected impact 1 = Negligible 2 = Low, 3 = Mid 4 = High	Validation of modelling	Effectiveness of design measures	Effectiveness of management measures	Actions to reduce uncertainty	Confidence in the assessment High Medium Low	Residual risk (after mitigation) High Medium Low	Residual risk (after mitigation) High Medium Low	Residual risk (after mitigation) High Medium Low	Residual risk (after mitigation) High Medium Low	Residual risk (after mitigation) High Medium Low	Residual risk (after mitigation) High Medium Low	Residual risk (after mitigation) High Medium Low	Act / Limit Reference	Proposed Outcome	Outcome measurement criteria	Leading indicator criteria (where required)
PIE_15_27	TSF designed as per Appendix V3. TSF wall geotechnical characteristics for closure as per Appendix S8. ET cap as per Appendix M6. Operations and Maintenance Manual per per Appendix C3. Post ET cap construction monitoring plan as per Appendix S10.	Potential for soil/water impacts through release of tailings into the environment	1	High: Annual inspection of the wall and confirmation still in accordance with the design standards	High - Dam designed, build, maintained and managed as per ANCOLD guidelines	High - operating manual provided by designer and reviewed regularly, annual tsf audit undertaken	Review and recommission TSF and update operations and maintenance manual prior to restarting TSF.	Medium	Low	Yes	Environment Protection Act 1994 (SA) Environment Protection (Water Quality) Policy (SA) Natural Resources Management Act 2004 (SA)	No contamination of natural water drainage systems, streams and rivers, groundwater, land and soils occurs either on or off site resulting from permanent disposal or temporary storage of mine ore or waste material	Survey readings of the position and elevation (i.e. x, y, z coordinates) of all installed Effluent settlement/movement monuments on TSF embankments shall be obtained at monthly intervals and be audited annually to demonstrate TSF embankments are geotechnically stable.	None proposed					
PIE_15_18	TSF design as per Appendix V3. Most recent TSF annual audit included in Appendix M12. Groundwater modelling as per Appendix H6. ET cover system design as per Appendix M6.	Ground Water	2	High: Annual inspection of the wall and confirmation still in accordance with the design standards	High - Dam designed, build, maintained and managed as per ANCOLD guidelines	High - operating manual provided by designer and reviewed regularly, annual tsf audit undertaken	Review and recommission TSF and update operations and maintenance manual prior to restarting TSF.	Medium	Medium	Yes	Environment Protection Act 1994 (SA) Environment Protection (Water Quality) Policy (SA) Natural Resources Management Act 2004 (SA)	No contamination of natural water drainage systems, streams and rivers, groundwater, land and soils occurs either on or off site resulting from permanent disposal or temporary storage of mine ore or waste material	Standing Water Levels (SWL) will be monitored monthly as per AS/NZS 5667.1:1998 standards as groundwater monitoring bores TSF A, B, C and D (Figure 11.5). An independent expert will verify through annual analysis of the monthly data that no leakage from the TSF into the surrounding aquifer has been detected. Groundwater monitoring bores TSF A, B, C and D (Figure 11.5) will be sampled and analysed monthly as per AS/NZS 5667.1:1998 standards for pH, EC, TDS, Al, Cu, Pb, Zn, Mn and Fe. An independent expert will verify, through annual analysis of the monthly data that no leakage from the TSF into the surrounding aquifer has been detected.	Six embankment monitoring bores (MB1 to MB6) located on the TSF main embankment will be monitored monthly to ensure no water is detected. If water is detected, it will be sampled for pH, EC, TDS, Al, Cu, Pb, Zn, Mn and Fe, as per AS/NZS 5667.1:1998 standards, and results submitted to an independent expert for analysis.					
PIE_15_17	TSF design as per Appendix V3. Most recent TSF annual audit included in Appendix M12. Groundwater modelling as per Appendix H6. ET cover system design as per Appendix M6.	Potential for soil impacts through release of tailings into the environment	1	High: Annual inspection of the wall and confirmation still in accordance with the design standards	High - Dam designed, build, maintained and managed as per ANCOLD guidelines	High - operating manual provided by designer and reviewed regularly, annual tsf audit undertaken	Review and recommission TSF and update operations and maintenance manual prior to restarting TSF.	Medium	Low	Yes	Environment Protection Act 1994 (SA) National Environment Protection Council Act 1994 (Cth) / National Environment Protection Measures (NEMs)	No contamination of natural water drainage systems, streams and rivers, groundwater, land and soils occurs either on or off site resulting from permanent disposal or temporary storage of mine ore or waste material	Provision of a report once prior to entering closure monitoring phase by a suitably qualified site contamination consultant verifies that a site contamination assessment and if required remediation in accordance with the NEMs and relevant EPA guidelines for the central and southern domains (excluding the TSF Figure 1.2 has occurred, ensuring there is no unacceptable risk to human health or the environment as a result of the contamination when compared with relevant baseline concentrations and relevant NEMs investigation levels.	None proposed					
PIE_15_18	TSF design as per Appendix V3. Most recent TSF annual audit included in Appendix M12. ET cover system design as per Appendix M6.	Potential for soil impacts through release of tailings into the environment	1	High: Annual inspection of the wall and confirmation still in accordance with the design standards	High - design of monitoring system includes early warning systems, ANCOLD design and build.	Daily and Weekly inspection sheets, monitoring as per O+H manual.	Annual review provides recommendations which are implemented.	Medium	Low	Yes	Environment Protection Act 1994 (SA) Environment Protection (Water Quality) Policy (SA) Natural Resources Management Act 2004 (SA)	No contamination of natural water drainage systems, streams and rivers, groundwater, land and soils occurs either on or off site resulting from permanent disposal or temporary storage of mine ore or waste material	Survey readings of the position and elevation (i.e. x, y, z coordinates) of all installed Effluent settlement/movement monuments on TSF embankments shall be obtained at monthly intervals and be audited annually to demonstrate TSF embankments are geotechnically stable.	None proposed					
PIE_16_1	Baseline Soil/Site Contamination Assessment. Tonkin Consulting - Appendix L1.	Contaminated soils can cause health impacts	1	Low: Soil sampling to be undertaken through operational phase to update closure preparations	High: Industry standard during closure earthworks to use water trucks, highly effective	Medium: Management measures are considered routine and used effectively throughout industry, impact mitigation relies on appropriate management response.	Soil testwork through operational phase to update closure preparations.	Minor	Low	Yes	South Australian Environmental Protection Act 1993 South Australian Environmental Protection (Air Quality) Policy 2016 (PM10) NSW Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales (TSP and dust deposition)	No public injuries and/or deaths to members of the public caused by mining operations	Dust levels collected from two HVAS dust samplers, labelled as Western/Lot 8 and Northern/Site, shown in Figure 14.4, located on the proposed MFL will be sampled over a 24 hour period every six days as per AS 3580.9:2003 standards. Data will demonstrate World Health Organisation guidelines for Total Solid Particulates are less than 120 micrograms/m3 and least content is less than 0.5 micrograms/m3. If these levels are obtained for 12 months post closure, monitoring will no longer be required.	Twelve static Dust Deposition Gauges located on and off the mining lease will be monitored monthly for total insoluble solids as per AS 3580.10:1-1991 standards. This will demonstrate that total insoluble solids are less than Australian best practice deposition levels of 4g/m2/month.					

Impact Assessment

Impact ID	Relevant Chapter	Environmental Aspect	Description of Potential Impact Event	Mine Life Phase	Source	Pathway	Receptor	Understanding of source, pathway, receptor (given limitations in information used in assessment)	Uncertainties and assumptions (relating to SPR)	Sensitivity to change of any assumptions	Confirmation of S-P-R	Outcome required?	Justification/evidence as to why no S-P-R	Factors that limit / mitigate impact (control measures)
PIE_16_10	Air quality	Nuisance	Dust deposition from the mine site post-closure results in nuisance impacts to local community	Post Closure	Dust generated from post-closure landforms	Deposition of airborne dust	Local community	<p>Medium: Air quality modelling does not address post-closure as final landform is not expected to provide sources of impact.</p> <p>Approved PEPR for ML 6239 Closure Plan outlines all monitoring requirements for both air quality and erosion through the closure monitoring phase. AZM Closure Concepts include progressive rehabilitation of the site, to a geotechnical and erosion stable final landform, demonstrated by LFA and erosion monitoring.</p>	<p>Air quality modelling does not address post-closure stage, assuming progressive rehabilitation (as monitored by LFA) is successful in stabilising soils.</p> <p>The Central Domain closure strategy includes the following tasks relevant to the MPL:</p> <ul style="list-style-type: none"> - Undertake a site contamination assessment at closure, and manage or remove contaminated soil and hazardous material; and - Revegetate the boundary of the central zone light industrial area. 	<p>Low: Revegetation trials during operation to adapt and modify revegetation and dust suppression techniques (e.g. rock mulch, hydromulch, hydrosedding) and progressive rehabilitation will guide successful closure practices.</p>	No	No	Revegetation trials suggest that post-closure landforms will be successfully stabilised, and therefore wind-generated dust (source) will be of such low intensity or concentration that it could not reasonably be expected to impact on public amenity.	N/A
PIE_16_11	Air quality	Ag	Dust deposition from processing activities negatively impacts health of native vegetation	Upgrade, Operation, Closure	Dust generated from operation (hauling and processing)	Deposition of airborne dust	Native vegetation	<p>High: Native vegetation has been monitored in accordance with the approved PEPR for ML6229 during annual surveys (2014-2017) using LFA and photopoint monitoring. No impact to health of native vegetation has been found. Air quality impact assessments show that the operation of APF under the proposed MPL will generate significantly less dust than operations under ML6229, therefore no impact to native vegetation is expected.</p>	<p>Air quality modelling does not address post-closure stage, assuming progressive rehabilitation (as monitored by LFA) is successful in stabilising soils.</p> <p>The Central Domain closure strategy includes the following tasks relevant to the MPL:</p> <ul style="list-style-type: none"> - Undertake a site contamination assessment at closure, and manage or remove contaminated soil and hazardous material; and - Revegetate the boundary of the central zone light industrial area. - assumptions based on 10 years of AZM revegetation experience. 	<p>Low: Conclusions reached in the impact assessment are highly unlikely to change if assumptions are found to be incorrect (conservative modelling applied). Previous 10 years of vegetation data confident in low sensitivity.</p>	No	No	Annual ML6229 LFA is reported in ML6229 Annual Compliance Reports demonstrates revegetation success.	N/A
PIE_16_12	Air quality	Agriculture	Dust deposition from processing activities results in reduced productivity of surrounding agricultural land	Operation, Closure	Dust generated from operation (hauling and processing)	Deposition of airborne dust	Surrounding agricultural land	<p>High: Pathway well understood. Impact of crusher well understood. Dust modelling for gold ore processing undertaken (AECOM 2017 - Appendix K1). Modelling shows potential exceedance of nuisance deposition guidelines on agricultural land to the north of APF. Routine dust monitoring was conducted at the AZM site from 2006 prior to construction and operation of AZM. Dust levels were measured through 12 Dust Deposition Gauges and 2 High Volume Samplers located on and off site during processing of AZM ore under ML6229.</p> <p>Background dust deposition levels were regularly in excess of 4g/m²/month due to surrounding dust sources. Dust emissions from APF are expected to be much lower than those experienced during operation of AZM, as no mining activities will be undertaken and processing load will be approx 30% of ML6229. Exceedance of 4g/m²/month are still expected due to the high background levels.</p>	<p>Air quality assessment report (AECOM 2017 - appendix N3) states "Air emissions from a number of other sources were not considered as part of this assessment due to small or negligible emission rates. Potential sources of air emissions that were not considered as part of this assessment include:</p> <ul style="list-style-type: none"> - Wet grinding of ore. This process involves water and therefore no dust emissions are expected. - Loading trucks with processed ore for transport off-site - this will be undertaken within an enclosed building - Hauling processed ore off-site - haul trucks will only be using sealed road - Dust emissions from light vehicle movement - Dust emissions from minor areas of bare earth - typically < 100 m² - Evaporator spray from the Tailings Storage Facility (TSF) - water spray from the evaporator used in the TSF result in coarse and they are not operated during strong winds. No spray leaves the TSF compound and as such these were not included in the model. - Vehicle exhaust emissions - plant and vehicle exhaust emissions are not expected to be significant enough to impact on neighbouring sensitive receptors. Combustion gases were therefore not included in this assessment." 	<p>Low: Conclusions reached in the impact assessment are highly unlikely to change if assumptions are found to be incorrect (conservative modelling applied).</p>	Yes	Yes	N/A	See chapter 16: section 16.7 and AQIA (Appendix N3) section 7.0
PIE_16_13	Air quality	Ag	Dust deposition from the mine site post-closure results in reduced productivity of surrounding agricultural land	Post Closure	Wind generated dust from post-closure landforms	Deposition of airborne dust	Surrounding agricultural land	<p>Medium: Air quality modelling does not address post-closure as final landform is not expected to provide sources of impact.</p> <p>Approved PEPR for ML 6239 Closure Plan outlines all monitoring requirements for both air quality and erosion through the closure monitoring phase. AZM Closure Concepts include progressive rehabilitation of the site, to a geotechnical and erosion stable final landform, demonstrated by LFA and erosion monitoring.</p>	<p>Air quality modelling does not address post-closure stage, assuming progressive rehabilitation (as monitored by LFA) is successful in stabilising soils.</p> <p>The Central Domain closure strategy includes the following tasks relevant to the MPL:</p> <ul style="list-style-type: none"> - Undertake a site contamination assessment at closure, and manage or remove contaminated soil and hazardous material; and - Revegetate the boundary of the central zone light industrial area. - Risk profile no higher than agricultural activities - harrowing, seeding, harvesting, reaping, unsealed dirt roads with HV access, etc. 	<p>Low: Revegetation trials during operation to adapt and modify revegetation and dust suppression techniques (e.g. rock mulch, hydromulch, hydrosedding) and progressive rehabilitation will guide successful closure practices.</p>	No	No	Revegetation trials suggest that post-closure landforms will be successfully stabilised, and therefore wind-generated dust (source) will be of such low intensity or concentration that it could not reasonably be expected to impact on public amenity.	N/A

Impact ID	Justification of assumptions - EVIDENCE	Description of Grouped Environmental Impact	Significance of expected impact 1 = Negligible 2 = Low, 3 = Med 4 = High	Validation of modelling	Effectiveness of design measures	Effectiveness of management measures	Actions to reduce uncertainty	Credible worst case impact	Unlikelihood of Credible worst case impact	Best Ranking (Low = Best, High = Worst)	Impact covered by Alternative Act or Limit (Yes/No)	Act / Limit Reference	Proposed Outcome	Outcome measurement criteria	Leading Indicator criteria (where required)
PIE_16_10	N/A	Nuisance impacts from dust on public amenity	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
PIE_16_11	N/A	Dust deposition from mining operations	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
PIE_16_12	Air Quality Impact Assessment (Appendix N3) includes Summary of emission rates by activity which includes processing table 13). Air quality modelling shows that dust deposition has the potential to occur offsite. Appendix N3	Dust deposition from mining operations	1	Medium: Baseline data available. Model shows a reasonable approximation of real conditions but relies on a number of assumptions (i.e. background dust sources generally under-estimated). Conservative modelling applied.	High: Industry standard and best practice design. Well understood and demonstrated across industry. Data from operation of M6229 shows no non-compliance against outcome measurable criteria (2007-2018). Evidence in M6229 Annual Compliance Report.	Medium: Management measures are considered routine and used effectively throughout industry. Impact mitigation relies on appropriate management response.	Monitoring during operation to verify results of modelling	Minor	Unlikely	Low	Yes	South Australian Environmental Protection Act 1993 - South Australian Environmental Protection (Air Quality) Policy 2016 (PM2.5) NSW Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales (TSP and dust deposition)	No adverse impacts offsite are caused by accidents, noise, dust and dragout by traffic from on to the mine operations that could have been reasonably prevented.	Dust generated from the mining lease during operation activities, measured Twelve static Dust Deposition Gauges located on and off the mining lease shown in Figure 14-1 demonstrates average dust deposition at sensitive receivers is in accordance with the Air Quality Impact Assessment using standardised monitoring techniques and demonstrates that annual average does not exceed 4 g/m ² to ensure no nuisance impacts to local residents from dust generated by processing or closure activities. Investigation of all dust related complaints demonstrates that the Mine Operator did no cause or could not reasonably have prevented the incident from occurring, and all dust related complaints were acknowledged within 24 hours and closed out within 14 days to the satisfaction of the complainant or as agreed with the Chief Inspector of Mines. If complaints were not resolved the Mine Operator conducted dust monitoring to demonstrate that dust emissions complied with the outcome achievement values as agreed by the Chief Inspector of Mines.	Twelve static Dust Deposition Gauges located on and off the mining lease shown in Figure 14-1, will be monitored monthly for total in-soluble solids (TIS) at per AS 3580.10:1-1991 standards. This will demonstrate that total in-soluble solids are less than Australian best practice deposition levels of 4g/m ² /month.
PIE_16_13	N/A	Dust deposition from mining operations	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	If these levels are obtained for 12 months post closure, monitoring will no longer be required.	Any exceedance of 4g/m ² /month to be investigated with reference to meteorological data and onsite activities to ascertain whether the source is likely to be Terramin's activities.

Impact ID	Relevant Chapter	Environmental Aspect	Description of Potential Impact Event	Mine Life Phase	Source	Pathway	Receptor	Understanding of source, pathway, receptor (given limitations in information used in assessment)	Uncertainties and assumptions (relating to SPR)	Sensitivity to change of any assumptions	Confirmation of S-P-R	Outcome required?	Justification/evidence as to why no S-P-R	Factors that limit / mitigate impact (control measures)
PIE_16_2	Air quality	Health	Excavation of existing contaminated land has the potential to cause wind generated contaminated dust and impact on the health of the local community	Closure	Dust generated from excavation of existing contaminated land (historic usage of site)	Air and prevailing winds	Local community	Medium: Site Contamination Report and Soil Contamination Baseline Study undertaken - Appendix 11. Proposed activities are within the existing disturbance footprint for AZM and excavation of contaminated land will not occur. No exceedance of GMC criteria (lead) offsite recorded through dust monitoring from 2007-2016. Current and historical use suggest risk to human health is unlikely to increase significantly.	APF will be operated as proposed.	Low: Conclusions reached in the impact assessment are highly unlikely to change if assumptions are found to be incorrect (conservative modelling applied).	Yes	Yes	N/A	See chapter 16: section 16.7 and AQIA (Appendix N3) section 7.0
PIE_16_3	Air quality	Health	Exhaust emissions from vehicles, or other equipment (surfaced) result in nuisance impacts on public amenity or human health impacts	Upgrade, Operation, Closure	Vehicle equipment exhaust emissions	Air and prevailing winds	Local community	High: Air quality assessment report (AECOM 2017) states "Vehicle exhaust emissions - plant and vehicle exhaust emissions are not expected to be significant enough to impact on neighbouring sensitive receptors. Combustion gases were therefore not included in this assessment."	Air quality modelling assumes small or negligible emission rates for combustion gases.	Low: Conclusions reached in the impact assessment are highly unlikely to change if assumptions are found to be incorrect (conservative modelling applied).	No	No	"plant and vehicle exhaust emissions are not expected to be significant enough to impact on neighbouring sensitive receptors." Air Quality Impact Assessment - Appendix N3	N/A
PIE_16_4	Air quality	Health	Fine particulate matter from processing operations (crushing and processing) adversely affects human health	Operation, Closure	Dust (PM10) generated from regeneration (levelling and rip/roaming)	Air and prevailing winds	Local community	High: Impact of crusher well understood. Dust modelling for gold ore processing undertaken (AECOM 2017 - Appendix N3). Modelling shows no expected impact on human health. Baseline dust monitoring was conducted at the AZM site from 2006 prior to construction and operation of AZM. Dust levels were measured through 12 Dust Deposition Gauges and 2 High Volume Samplers located on and off site during processing of AZM ore under M16229. No exceedance of PM10 legislative limit was recorded during operation. Dust emissions from APF are expected to be much lower than those experienced during operation of AZM, as no mining activities will be undertaken and processing load will be approx 30% of M16229. Evaporator spray from the Tailings Storage Facility (TSF) - water spray from the evaporators used in the TSF result in coarse and they are not operated during strong winds. No spray leaves the TSF compound and as such these were not included in the model. Vehicle exhaust emissions - plant and vehicle exhaust emissions are not expected to be significant enough to impact on neighbouring sensitive receptors. Combustion gases were therefore not included in this assessment."	Air quality assessment report (AECOM 2017) states "No emissions from a number of other sources were not considered as part of this assessment due to small or negligible emission rates. Potential sources of air emissions that were not considered as part of this assessment include: - Wet grinding of ore. This process involves water and therefore no dust emissions are expected. - Loading trucks with processed ore for transport offsite - this will be undertaken within an enclosed building. - Hauling processed ore offsite - haul trucks will only be using sealed road - Dust emissions from light vehicle movement - Dust emissions from minor areas of bare earth - typically < 100 m2	Low: Conclusions reached in the impact assessment are highly unlikely to change if assumptions are found to be incorrect (conservative modelling applied).	Yes	Yes	N/A	See chapter 16: section 16.7 and AQIA (Appendix N3) section 7.0
PIE_16_5	Air quality	Health	Operation activities have the potential to disturb contaminated soil and impact on public health	Operation	Disturbance of contaminated soil	Air and prevailing winds	Local community	Medium: Baseline soil assessment undertaken prior to M16229 construction. Naturally elevated soils containing elevated concentrations of metals in soils well understood. High lead levels recorded at AZM were outside of the MPL and operation of the APF will not result in disturbance of these areas. Therefore, source is not viable.	N/A	Low: Conclusions reached in the impact assessment are highly unlikely to change if assumptions are found to be incorrect (conservative modelling applied).	No	No	No new disturbance of processing plant area. New wetland to be constructed, however baseline soil data indicates no elevated lead levels. See Chapter 13: Soil and Land Quality, section 13.1.3.3 Figure 13-4.	N/A
PIE_16_6	Air quality	Health	Particulate matter from magazine or processing plant fire adversely affects human health	Operation, Closure	Particulate matter from magazine fire	Air and prevailing winds	Local community	Medium: Good understanding of fire risk, however potential spread of fire difficult to predict.	Built to Australian Standards, Fire Extinguishers, Terrain Emergency Response personnel onsite. Proximity to local services - CFS (trained and equipped to respond to AZM emergencies).	High: Potential for much greater impact than expected (nature of bushfire)	Yes	Yes	N/A	Implement adequate fire prevention strategies to ensure no unplanned fires onsite and to ensure control measures are in place to manage potential off site impacts: - Hot works permits - onsite ERT personnel - Fire suppression systems in HX room - Proximity to local services, CFS, etc. Active land management to reduce potential onsite fuel load (Wood and Fuel Management Plan)

Impact ID	Justification of assumptions - EVIDENCE	Description of Proposed Environmental Impact	Significance of expected impact 1 = Negligible 2 = Low, 3 = Mid 4 = High	Validation of modelling	Effectiveness of design measures	Effectiveness of management measures	Actions to reduce uncertainty	Exceeds worst case impact	Unlikely to occur	Low	High	Impact covered by alternative Act or Limit (Yes/No)	Act / Limit Reference	Proposed Outcome	Outcome measurement criteria	Leading Indicator criteria (where required)
PIE_16_2	Disturbance of contaminated land (source) will not occur and therefore cannot reasonably be expected to cause harm to a receptor. See chapter 13: Soil and Land Quality, section 13.3.3.	Health impacts from contamination	1	Low: Soil sampling to be undertaken through operational phase to update closure preparations (reassess at end of MPL operations and update accordingly)	High: Industry standard during closure earthworks to use water trucks. Highly effective	Medium: Management measures are considered routine and used effectively throughout industry. Impact mitigation relies on appropriate management response.	Soil testwork through operational phase to update closure preparations.	Unlikely	Low	Yes	South Australian Environmental Protection Act 1993 South Australian Environmental Protection Act 2016 (PE10) Policy 2016 NSW Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales	No public health, loss of amenity and nuisance impacts to local residents from air emissions, dust and odour generated on site as a result of processing operations.	No public injuries and/or deaths to members of the public caused by mining operations.	Dust levels collected from two HVAS dust samplers, labelled as Western/Gate 8 and Northern/Sec Gate, shown in Figure 14.1, located on the proposed MPL, will be sampled over a 24 hour period every 16 days as per AS 3580.9.3:2003 standards. Data will demonstrate World Health Organisation guidelines for Total Solid Particulates are less than 120 micrograms/m3 and Lead content is less than 0.3 micrograms/m3. If these levels are obtained for 12 months post closure, monitoring will no longer be required.	None proposed	
PIE_16_3	N/A	Nuisance impacts from dust on public amenity	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
PIE_16_4	Air Quality Impact Assessment (Appendix N3) includes Summary of emission rates by activity which includes processing (table 13). Air quality modelling shows that dust deposition has the potential to occur offsite. Appendix N3	Human health impacts from dust from refurbishment phase and mining operations	1	Medium: Baseline data available. Model shows a reasonable approximation of real conditions but relies on a number of assumptions. Conservative modelling applied.	High: Industry standard and best practice design. Well understood and demonstrated across industry. Data from operation of M16229 shows no non-compliance against outcome measurable criteria (2007-2018). Evidence in M16229 Annual Compliance Reports.	Medium: Management measures are considered routine and used effectively throughout industry. Impact mitigation relies on appropriate management response.	Monitoring during operation to verify results of modelling	Minor	Possible	Low	Yes	South Australian Environmental Protection (Air Quality) Policy 2016	No public injuries and/or deaths to members of the public caused by mining operations.	Investigation of all dust related complaints demonstrates that the Mine Operator did not cause or could not reasonably have prevented the incident from occurring, and all dust related complaints were acknowledged within 24 hours and closed out within 14 days to the satisfaction of the complainant or as agreed with the Chief Inspector of Mines. If complainants were not resolved the Mine Operator conducted dust monitoring to demonstrate that dust emissions complied with the outcome achievement values as agreed by the Chief Inspector of Mines.	Twelve static Dust Deposition Gauges located on and off the mining lease will be monitored monthly for total insoluble solids as per AS 3580.10.1:1991 standards. This will demonstrate that total insoluble solids are less than Australian best practice deposition levels of 4g/m2/month.	
PIE_16_5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
PIE_16_6	Chapter 8: section 8.6 outlines fire prevention and mitigation controls to reduce/remove potential for inaginate fire.	Fire emissions can cause health impacts	2	N/A	High: Significant fire prevention and management design measures in place - known to be effective in preventing fire spread if ignited.	Medium: Reliance on standard management measures and appropriate encircling of land management.	N/A	Minor	Rare	Low	Yes	Fire and Emergency Services Act 2005 (SA) - Duties to prevent fires	No public injuries and/or deaths to members of the public caused by mining operations	Independent investigation of all incidents that result in injury or death are completed in 14 days, or as agreed with the Director of Mines, and demonstrate that the mine operator could not have reasonably prevented the incident from occurring.	Annual safety audit does not identify additional actions that could reasonably be taken to reduce risks to the public.	

Impact Assessment

Impact ID	Relevant Chapter	Environmental Aspect	Description of Potential Impact Event	Mine Life Phase	Source	Pathway	Receptor	Understanding of source, pathway, receptor (given limitations in information used in assessment)	Uncertainties and assumptions (relating to SPR)	Sensitivity to change of any assumptions	Confirmation of S-P-R	Outcome required?	Justification/evidence as to why no S-P-R	Factors that limit / mitigate impact (control measures)
PIE_16_7	Air quality	Health	Wind generated fine particulate matter from mine site post closure landforms adversely affects human health	Post Closure	Mine generated dust (MMD) from new closure landforms	Air and prevailing winds	Local community	<p>Medium: Air quality modelling does not address post-closure as final landforms is not expected to provide sources of impact.</p> <p>Approved EPR for ML E229 Closure Plan outlines all monitoring requirements for both air quality and erosion through the closure monitoring phase. AZM Closure Concepts include progressive rehabilitation of the site, to a geotechnical and erosion stable final landform, demonstrated by LFA and erosion monitoring.</p>	<p>Air quality modelling does not address post-closure stage, assuming progressive rehabilitation (as monitored by LFA) is successful in stabilising site.</p> <p>The Central Domain closure strategy includes the following tasks relevant to the MPR:</p> <ul style="list-style-type: none"> - Undertake a site contamination assessment at and around, and manage or remove contaminated soil and hazardous material; and - Revegetate the boundary of the central zone light industrial area. 	<p>Low: Revegetation trials and SEB during operation of ML629 demonstrates success to adapt and modify revegetation and dust suppression techniques (e.g. rock mulch, hydromulch, hydroseeding) and progressive rehabilitation will guide successful closure practices.</p>	No	No	<p>Revegetation trials suggest that post-closure landforms will be successfully stabilised, and therefore wind-generated dust (source) will be of such low intensity or concentration that it could not reasonably be expected to impact on public amenity.</p>	N/A
PIE_16_8	Air quality	Health	Wind generated fine particulate matter from new APF landforms adversely affects human health	Post Closure	Wind generated dust (MMD) from new APF landforms	Air and prevailing winds	Local community	<p>High: Pathways and potential receptors well understood. Dust modelling for gold ore processing undertaken (AECOM 2017 - Appendix N3). Modelling shows potential Baseline dust monitoring was conducted at the AZM site from 2006 prior to construction and operation of AZM. Dust levels were measured through 12 Dust Deposition Gauges and 2 High Volume Samplers located on and off site during processing of AZM ore under ML629. No instances of PM10 non-compliance of OMC through ML629.</p>	<p>New wetland to be constructed which will have bare soil until vegetation establishes. Assumption that vegetation growth will be successful over short term based on understanding of revegetation success through ML629.</p>	<p>Low: Revegetation trials and SEB during operation of ML629 demonstrates success to adapt and modify revegetation and dust suppression techniques (e.g. rock mulch, hydromulch, hydroseeding) and progressive rehabilitation will guide successful closure practices.</p>	Yes	Yes	<p>Revegetation trials suggest that wetland will be successfully stabilised over time, and wind generated dust (source) will be of low intensity or concentration that it could not reasonably be expected to impact on public health. Dust monitoring program to continue to monitor situation.</p>	See chapter 16: section 16.7 and AQ4 (Appendix N3) section 7.0
PIE_16_9	Air quality	Nuisance	Dust deposition from processing activities results in nuisance impacts to local community	Operation, Closure	Dust generated from operations (washing and processing)	Deposition of airborne dust	Local community	<p>High: Pathways understood. Impact of crusher well understood. Dust modelling for gold ore processing undertaken (AECOM 2017 - Appendix N3). Modelling shows potential Baseline dust monitoring was conducted at the AZM site from 2006 prior to construction and operation of AZM. Dust levels were measured through 12 Dust Deposition Gauges and 2 High Volume Samplers located on and off site during processing of AZM ore under ML629. Background dust deposition levels were regularly in excess of 4g/m2/month due to surrounding dust sources.</p> <p>Dust emissions from APF are expected to be much lower than those experienced during operation of AZM, as no mining activities will be undertaken and processing load will be approx 30% of ML629. Incidence of 4g/m2/month are still expected due to the high background levels (experienced throughout Care and Maintenance)</p>	<p>Air quality assessment report (AECOM 2017) states "Air emissions from a number of other sources were not considered as part of this assessment due to small or negligible emission rates. Potential sources of air emissions that were not considered as part of this assessment include:</p> <ul style="list-style-type: none"> - Wet grinding of ore. This process involves water and therefore no dust emissions are expected. - Loading trucks with processed ore for transport off-site - this will be undertaken within an enclosed building. - Hauling processed ore off-site - haul trucks will only be using sealed road - Dust emissions from light vehicle movement - Dust emissions from minor areas of bare earth - typically < 100 m2 <p>Evaporator spray from the Tailings Storage Facility (TSF) - water spray from the evaporators used in the TSF result in coarse and fine mist not expected during strong winds. No spray leaves the TSF compound and as such these were not included in the model.</p> <p>- Vehicle exhaust emissions - plant and vehicle exhaust emissions are not expected to be significant enough to impact on neighbouring sensitive receptors. Combustion gases were therefore not included in this assessment."</p>	<p>Low: Conclusions reached in the impact assessment are highly unlikely to change if assumptions are found to be incorrect (conservative modelling applied).</p>	Yes	Yes	N/A	See chapter 16: section 16.7 and AQ4 (Appendix N3) section 7.0
PIE_17_1	Noise	Noise	Upgrade/refurbishment of the processing plant has the potential to generate noise at a level that causes nuisance impacts to the local community	Upgrade	Noise generated from processing plant upgrade	Soundwave transmission	Local community	<p>Medium: Plant upgrade maintenance required, however, noise propagation pathways understood, sensitive receptors identified. Level of noise generated by specific upgrade activities are unknown.</p>	<p>Upgrade activities will be undertaken during the day. Source of noise is temporary only.</p>	<p>Medium: Some upgrade activities are yet unknown regarding plant upgrades. Compliance with Noise EPP.</p>	Yes	Yes	N/A	<p>- Profiled metal duct or UTR - panel barrier has been constructed around the east, north and northern 1/3 of west side of the mill. Mill rubber blanketing erected in identified problem areas. Cladding of the southern and western openings of the flotation building.</p> <p>- Potential installation of a noise barrier directly adjacent to the primary crusher (north western side), if required. Earth noise mounding has been constructed around the site</p>
PIE_17_2	Noise	Noise	Tippling of ore on ROM pad has the potential to generate noise at a level that causes nuisance impacts to the local community	Operation	Noise generated from ore on the ROM pad	Soundwave transmission	Local community	<p>High: Understanding of noise propagation at AZM High due to preceding ML629 activities, noise monitoring, and validation of modelling. Sensitive receptors identified. Noise modelling undertaken for APF (Appendix O1 - WSP 2017). Modelling shows that predicted noise levels based on existing plant are below noise criteria at receptors.</p>	<p>Dumping of ore is only one component of the noise modelling undertaken for APF. In addition to modelling, noise emissions are expected to be less than that experienced during operation of AZM as production loads and therefore associated transportation and processing volumes will be significantly reduced (approx. 1/3).</p>	<p>Low: Model is sufficiently conservative. Noise character will need to be validated during commencement of operations.</p>	Yes	Yes	N/A	Earth noise mounding has been constructed around the site

Impact Assessment

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PIE_16_7	N/A	Human health impacts from dust post closure	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
PIE_16_8	Air Quality Impact Assessment (Appendix N3)	Human health impacts from dust	1	Medium: Baseline data available. Model shows a reasonable approximation of real conditions but relies on a number of assumptions. Conservative modelling applied.	High: Industry standard and best practice design. Well understood and demonstrated across industry. Data from operation of M16229 shows no non-compliances against outcome measurable criteria (2007-2018). Evidence in M16229 Annual Compliance Reports.	Medium: Management measures are considered routine and used effectively throughout industry. Impact mitigation relies on appropriate management response.	Monitoring during operation to verify results of modelling	Minor	Possible	Low	Yes	South Australian Environmental Protection (Air Quality) Policy 2016	No public injuries and/or deaths to members of the public caused by mining operations.	PM10 dust levels collected from the WMS located at the visitors viewing area will be sampled over a 24-hour period every six days as per AS 3580.3:2008 standards. Data will demonstrate compliance with EPA Air criteria of 50 µg/m³ per 24-hour period with <5 days-exceedances per year. Investigation of all dust related complaints demonstrates that the Mine Operator did not cause or could not reasonably have prevented the incident from occurring, and all dust related complaints were acknowledged within 24 hours and closed out within 14 days to the satisfaction of the complainant or as agreed with the Chief Inspector of Mines. If complaints were not resolved the Mine Operator conducted dust monitoring to demonstrate that dust emissions complied with the outcome achievement values as agreed by the Chief Inspector of Mines.	Twelve static Dust Deposition Gauges located on and off the mining lease will be monitored monthly for total insoluble solids as per AS 3580.10:1991 standards. This will demonstrate that total insoluble solids are less than Australian best practice deposition levels of 4g/m²/month.
PIE_16_9	Air Quality Impact Assessment (Appendix N3) includes Summary of emission rates by activity which includes processing (Table 13). Air quality modelling shows that dust deposition has the potential to occur offsite. Appendix N3	Nuisance impacts from dust on public amenity	1	Medium: Baseline data available. Model shows a reasonable approximation of real conditions but relies on a number of assumptions (i.e. background dust sources generally under-estimated). Conservative modelling applied.	High: Industry standard and best practice design. Well understood and demonstrated across industry. Data from operation of M16229 shows no non-compliances against outcome measurable criteria (2007-2018). Evidence in M16229 Annual Compliance Reports.	Medium: Management measures are considered routine and used effectively throughout industry. Impact mitigation relies on appropriate management response.	Monitoring during operation to verify results of modelling	Minor	Possible	Low	Yes	South Australian Environmental Protection Act 1993 - South Australian Environmental Protection (Air Quality) Policy 2016 (PM10) NSW Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales (TSP and dust deposition)	No public nuisance impacts to local residents from dust, air emissions and/or odor caused by mining operations	Dust generated from the mining lease during operation activities, measured Twelve static Dust Deposition Gauges located on and off the mining lease shown in Figure 14-1 demonstrates average dust deposition at sensitive receptors is in accordance with the Air Quality Impact Assessment using standardised monitoring techniques and demonstrates that annual average does not exceed 4 g/m² to ensure no nuisance impacts to local residents from dust generated by processing or closure activities. Investigation of all dust related complaints demonstrates that the Mine Operator did not cause or could not reasonably have prevented the incident from occurring, and all dust related complaints were acknowledged within 24 hours and closed out within 14 days to the satisfaction of the complainant or as agreed with the Chief Inspector of Mines. If complaints were not resolved the Mine Operator conducted dust monitoring to demonstrate that dust emissions complied with the outcome achievement values as agreed by the Chief Inspector of Mines.	Twelve static Dust Deposition Gauges located on and off the mining lease shown in Figure 14-1, will be monitored monthly for total insoluble solids (TIS) as per AS 3580.10:1991 standards. This will demonstrate that total insoluble solids are less than Australian best practice deposition levels of 4g/m²/month.
PIE_17_1	Upgrade activities will generate some level of noise. Discussion in Chapter 17: Noise section 17.6	Noise from mining operations	2	N/A	High: Widely used and demonstrated to be effective	Medium: Some reliance on proper maintenance of equipment	In field monitoring to generate real data.	Major/Significant	Possible	Low	Yes	Environment Protection Act 1992 (SA) Environment Protection (Noise) Policy 2007 (SA)	No public nuisance impacts from noise, vibration and air over pressure caused by mining operations	Noise levels dB(A) will be measured quarterly for seven consecutive days (24 hours a day), at two on-site noise loggers, located east (m1) side) and west (bocux) of the operation and demonstrate compliance with EPA noise limits as defined in Environment Protection (noise) Policy 2007 and successors. Currently at the nearest residence, Day time Leq, 15 min of 57 dB (A) from 7am to 10pm Night time Leq, 15 min of 50dB (A) from 10pm to 7am. This model will be confirmed on an annual basis by an independent expert.	Noise levels at the nearest residence will be less than 47 dBA Leq, 15 min during the day (7am - 10pm) and less than 40 dBA Leq, 15 min at night (10pm - 7am).
PIE_17_2	Noise generated by operation of the APP will be heard at sensitive receptors. Discussion in Chapter 17: Noise section 17.6 and Appendix O1.	Noise from mining operations	2	High: Model well used and accepted as industry best practice by EPA - validated during operations of M16229	High: Widely used and demonstrated to be effective	Medium: Some reliance on human control of stacker height	In field monitoring to generate real data.	Major/Significant	Possible	Low	Yes	Environment Protection Act 1992 (SA) Environment Protection (Noise) Policy 2007 (SA)	No public nuisance impacts from noise, vibration and air over pressure caused by mining operations	Noise levels dB(A) will be measured quarterly for seven consecutive days (24 hours a day), at two on-site noise loggers, located east (m1) side) and west (bocux) of the operation and demonstrate compliance with EPA noise limits as defined in Environment Protection (noise) Policy 2007 and successors. Currently at the nearest residence, Day time Leq, 15 min of 57 dB (A) from 7am to 10pm Night time Leq, 15 min of 50dB (A) from 10pm to 7am. This model will be confirmed on an annual basis by an independent expert.	Noise levels at the nearest residence will be less than 47 dBA Leq, 15 min during the day (7am - 10pm) and less than 40 dBA Leq, 15 min at night (10pm - 7am).

Impact Assessment

Impact ID	Relevant Chapter	Environmental Aspect	Description of Potential Impact Event	Mine Life Phase	Source	Pathway	Receptor	Understanding of source, pathway, receptor (given limitations to information used in assessment)	Uncertainties and assumptions (relating to SPR)	Sensitivity to change of any assumptions	Confirmation of S-P-R	Outcome required?	Justification/evidence as to why no S-P-R	Factors that limit / mitigate impact (control measures)
PIE_17_3	Noise	Noise	Operation of the processing plant has the potential to generate noise at a level that causes nuisance impacts to the local community	Operation	Noise generated by processing plant operation	Soundwave transmission	Local community	High: Understanding of noise propagation at AZM high due to preceding ML6229 activities, noise monitoring, and validation of modelling. Sensitive receptors identified. Noise modelling undertaken for APP (Appendix C1 - WSP 2017). Modelling shows that predicted noise levels based on existing plant are below noise criteria at receptors.	Noise emissions from the primary crusher are based on AZM operation data, where the ore being crushed contained rocks that were up to 1,000mm in diameter. The gold ore that will be transported to site from BIH site will be up to 300mm in diameter, and as such when run through the crusher the emissions are expected to be less. Terramin has advised that given the smaller ore diameter, the primary crusher may not be required (i.e. the ore may be fed directly to the coarse ore bin).	Low: Model is sufficiently conservative. Noise character was validated during operations of ML 6229.	Yes	Yes	N/A	Profiled metal deck or ultra panel barrier has been constructed around the east, north and northern 1/3 of west side of the mill. Mill rubber baulking erected in identified problem areas. Cladding of the southern and western openings of the flotation building. Potential installation of a noise barrier directly adjacent to the primary crusher (north western side), if required. Earth noise mounding has been constructed around the site
PIE_17_4	Noise	Noise	Truck loading of gold product has the potential to generate noise at a level that causes nuisance impacts to the local community	Operation	Noise generated by loading of trucks	Soundwave transmission	Local community	High: Understanding of noise propagation at AZM high due to preceding ML6229 activities, noise monitoring, and validation of modelling. Sensitive receptors identified. Noise modelling undertaken for APP (Appendix C1 - WSP 2017). Modelling shows that predicted noise levels based on existing plant are below noise criteria at receptors.	Truck loading of gold product is only one component of the noise modelling undertaken for APP. In addition to modelling, noise emissions are expected to be less than that experienced during operation of AZM as production loads and therefore associated transportation and processing volumes will be significantly reduced (approx 1/3).	Low: Model is sufficiently conservative. Noise character was validated during operations of ML 6229.	Yes	Yes	N/A	Design of concentrate loading facilities - enclosed. Currently constructed shed from Colorbond around the B-double loading area to control impulsive noise from truck loading. Low tip height Broadband reversing alarms for all mobile plant that are regularly used on site
PIE_17_5	Noise	Noise	Infrastructure removal and decommissioning has the potential to generate noise at a level that causes nuisance impacts to the local community	Closure	Noise from infrastructure removal and decommissioning	Soundwave transmission	Local community	Medium: Infrastructure removal requirements well understood. Sensitive receptors identified. Level of noise generated by specific activities are unknown.	Decommissioning activities will be undertaken during the day. Source of noise is temporary only.	Low: Decommissioning of plant understood	Yes	Yes	N/A	Maintenance of equipment, White noise (broadband) reverse beepers on all on-site vehicles. Selection of equipment. Hours of operation
PIE_17_6	Noise	Noise	Final landform shaping and earthworks activities (i.e. grading, spreading and ripping) has the potential to generate noise at a level that causes nuisance impacts to the local community	Closure	Noise generated by closure earthworks	Soundwave transmission	Local community	Medium: Infrastructure removal requirements well understood. Sensitive receptors identified.	Compliance with EPP - Noise Policy EPA. Noise management plan to be for upgrade to be developed and implemented. Refer to approved ML6229 PEPR - Appendix C Closure Plan	Low: Decommissioning of plant understood	Yes	Yes	N/A	Maintenance of equipment, White noise (broadband) reverse beepers on all on-site vehicles, selection of equipment, hours of operation.

Impact ID	Justification of assumptions - EVIDENCE	Description of Grouped Environmental Impact	Significance of expected impact 1 = Negligible 2 = Low, 3 = Med 4 = High	Validation of modelling	Effectiveness of design measures	Effectiveness of management measures	Actions to reduce uncertainty	Excluded worst case impact	Unlikelihood of credible worst case impact	Best Ranking (Low = Best, High = Worst)	Impact covered by alternative Act or Limit (Yes/No)	Act / Limit Reference	Proposed Outcome	Outcome measurement criteria	Leading Indicator criteria (where required)
PIE_17_3	Noise generated by operation of the APF will be heard at sensitive receptors. Discussion in Chapter 17: Noise section 17.5 and Appendix O1.	Noise from mining operations	2	High: Model well used and accepted as industry best practice by EPA - validated during operations of ML6229	High: Widely used and demonstrated to be effective	Medium: Some reliance on proper maintenance of equipment	In field monitoring to generate real data.	Minor	Possible	Low	Yes	Environment Protection Act 1993 (SA), Environment Protection (Noise) Policy 2007 (SA)	No public nuisance impacts from noise, vibration and air over pressure caused by mining operations	Noise levels dB(A) will be measured quarterly for seven consecutive days (24 hours a day), at two on-site noise loggers, located east (mitl side) and west (boxcut) of the operation and demonstrate compliance with EPA noise limits as defined in Environment Protection (noise) Policy 2007 and successors. Currently at the nearest residence: Day time Leq, 15 min of 57 dB (A) from 7 am to 10pm Night time Leq, 15min of 50dB (A) from 10pm to 7am. This model will be confirmed on an annual basis by an independent expert.	Noise levels at the nearest residence will be less than 47 dBA Leq, 15 min during the day (7am - 10pm) and less than 40 dBA Leq, 15 min at night (10pm - 7am).
PIE_17_4	Noise generated by operation of the APF will be heard at sensitive receptors. Discussion in Chapter 17: Noise section 17.5 and Appendix O1.	Noise from mining operations	2	High: Model well used and accepted as industry best practice by EPA - validated during operations of ML6229	High: Widely used and demonstrated to be effective	Medium: Some reliance on proper maintenance of equipment	In field monitoring to generate real data.	Major/Frequent	Possible	Low	Yes	Environment Protection Act 1993 (SA), Environment Protection (Noise) Policy 2007 (SA)	No public nuisance impacts from noise, vibration and air over pressure caused by mining operations	Noise levels dB(A) will be measured quarterly for seven consecutive days (24 hours a day), at two on-site noise loggers, located east (mitl side) and west (boxcut) of the operation and demonstrate compliance with EPA noise limits as defined in Environment Protection (noise) Policy 2007 and successors. Currently at the nearest residence: Day time Leq, 15 min of 57 dB (A) from 7 am to 10pm Night time Leq, 15min of 50dB (A) from 10pm to 7am. This model will be confirmed on an annual basis by an independent expert. All noise complaints will be investigated and a response provided to the complainant within two working days. All noise complaints and associated actions will be recorded in a data base. Detail will include: complainants contact details, reason for complaint, time and date of noise issue, time and date of complaint, when and how the issue was actioned and the time and date the issue was closed out.	Noise levels at the nearest residence will be less than 47 dBA Leq, 15 min during the day (7am - 10pm) and less than 40 dBA Leq, 15 min at night (10pm - 7am).
PIE_17_5	Decommission activities will generate some level of noise for limited periods. Discussion in Chapter 17: Noise section 17.6.	Noise during closure / decommissioning	2	N/A	High: Widely used and demonstrated to be effective	Medium: Reliance on proper maintenance of equipment	In field monitoring to generate real data.	Major/Frequent	Possible	Low	Yes	Environment Protection Act 1993 (SA), Environment Protection (Noise) Policy 2007 (SA)	No public nuisance impacts from noise, vibration and air over pressure caused by mining operations	Noise levels dB(A) will be measured quarterly for seven consecutive days (24 hours a day), at two on-site noise loggers, located east (mitl side) and west (boxcut) of the operation and demonstrate compliance with EPA noise limits as defined in Environment Protection (noise) Policy 2007 and successors. Currently at the nearest residence: Day time Leq, 15 min of 57 dB (A) from 7 am to 10pm Night time Leq, 15min of 50dB (A) from 10pm to 7am. This model will be confirmed on an annual basis by an independent expert. All noise complaints will be investigated and a response provided to the complainant within two working days. All noise complaints and associated actions will be recorded in a data base. Detail will include: complainants contact details, reason for complaint, time and date of noise issue, time and date of complaint, when and how the issue was actioned and the time and date the issue was closed out.	Noise levels at the nearest residence will be less than 47 dBA Leq, 15 min during the day (7am - 10pm) and less than 40 dBA Leq, 15 min at night (10pm - 7am).
PIE_17_6	Final rehabilitation activities will generate some level of noise for limited periods. Discussion in Chapter 17: Noise section 17.6.	Noise during closure / decommissioning	2	N/A	High: Widely used and demonstrated to be effective	Medium: Reliance on proper maintenance of equipment	In field monitoring to generate real data.	Major/Frequent	Possible	Low	Yes	Environment Protection Act 1993 (SA), Environment Protection (Noise) Policy 2007 (SA)	No public nuisance impacts from noise, vibration and air over pressure caused by mining operations	Noise levels dB(A) will be measured quarterly for seven consecutive days (24 hours a day), at two on-site noise loggers, located east (mitl side) and west (boxcut) of the operation and demonstrate compliance with EPA noise limits as defined in Environment Protection (noise) Policy 2007 and successors. Currently at the nearest residence: Day time Leq, 15 min of 57 dB (A) from 7 am to 10pm Night time Leq, 15min of 50dB (A) from 10pm to 7am. This model will be confirmed on an annual basis by an independent expert. All noise complaints will be investigated and a response provided to the complainant within two working days. All noise complaints and associated actions will be recorded in a data base. Detail will include: complainants contact details, reason for complaint, time and date of noise issue, time and date of complaint, when and how the issue was actioned and the time and date the issue was closed out.	Noise levels at the nearest residence will be less than 47 dBA Leq, 15 min during the day (7am - 10pm) and less than 40 dBA Leq, 15 min at night (10pm - 7am).

Impact ID	Relevant Chapter	Environmental Aspect	Description of Potential Impact Event	Mine Life Phase	Source	Pathway	Receptor	Understanding of source, pathway, receptor (given limitations in information used in assessment)	Uncertainties and assumptions (relating to SPR)	Sensitivity to change of any assumptions	Confidence of S-P-R	Outcome required?	Justification/evidence as to why no S-P-R	Factors that limit / mitigate impact (control measures)
PIE_19_7	Vegetation and Weeds	Vegetation	Poor vegetation establishment on re contour through closure earthworks due to lack of moisture, nutrients in soils impacts on post-closure rehabilitation success	Post-closure	Vegetation	Germination	Local community	Medium: Pathway understood through ML6229 revegetation programmes, however, future climate may be unknown.	Species used successfully during ML6229 revegetation will be used during closure as per the revegetation plan. Previous demonstrated success onsite.	Low: previous demonstrated success onsite.	Yes	Yes	N/A	Revegetation Planning, maintenance and monitoring through Landscape Function Analysis util self-sustaining systems establish.
PIE_18_1	Fauna and Pests	Traffic and Transport	Onsite traffic has the potential to cause fauna mortality and impact on native species populations	Operation, Closure	Mine traffic	Vehicle collision	Native fauna populations	High: Pathway possible, however, not measurably higher than risk profile of local road network. No recorded instances of fauna mortality through operations of ML6229. Isolated fatality of individuals unlikely to impact local populations.	Operation assumed	Low: Conclusions reached in the impact assessment are highly unlikely to change if assumptions are found to be incorrect.	No	No	The occurrence of onsite vehicle strike fatality of fauna is of such low intensity that it could not reasonably be expected to cause harm to local fauna populations.	N/A
PIE_18_2	Fauna and Pests	Pest Impacts	Onsite putrescible waste has the potential to increase pest populations and impact on neighbouring properties	Operation	Pest animals, insects, on-site putrescible waste	Increase in pest species population	Neighbouring properties	High: Pest animals are known to be attracted to putrescible waste. Baseline fauna study undertaken in 2006. Weed and Pest Management Plan is implemented onsite and has identified pests currently present. Onsite waste is managed in accordance with Waste Management Plan. Previous experience with putrescible waste at AZM directly comparable; volume not expected to exceed AZM levels. Main threats are known but unknown pest threats may emerge.	Assumed to be similar or less putrescible waste as compared to ML6229.	Low: Conclusions reached in the impact assessment are highly unlikely to change if assumptions are found to be incorrect.	No	No	The risk of increases to pest populations due to putrescible waste is of such low intensity that it could not reasonably be expected to impact on neighbouring properties.	N/A
PIE_18_3	Fauna and Pests	Pest impacts	Onsite putrescible waste has the potential to increase pest populations and impact on native fauna populations.	Operation	Pest animals, insects, on-site putrescible waste	Competition/colonizer or predation	Native fauna populations	High: Pest animals are known to be attracted to putrescible waste. Baseline fauna study undertaken in 2006. Weed and Pest Management Plan is implemented onsite and has identified pests currently present. Onsite waste is managed in accordance with Waste Management Plan. Previous experience with putrescible waste at AZM directly comparable; volume not expected to exceed AZM levels. Main threats are known but unknown pest threats may emerge.	Assumed to be similar or less putrescible waste as compared to ML6229.	Low: Conclusions reached in the impact assessment are highly unlikely to change if assumptions are found to be incorrect.	No	No	The risk of increases to pest populations due to putrescible waste is of such low intensity that it could not reasonably be expected to impact on local fauna populations.	N/A
PIE_18_4	Fauna and Pests	Native Fauna Impacts	TSF contents have the potential to harm native fauna populations	Operation	TSF cover materials	Poisoning of animals accessing TSF	Native fauna populations	S-P-R Relationship well understood from ML6229 (2007-2018). Even though no viable S-P-R impact events have been confirmed, Terrainin propose an outcome and associated measurable and leading indicator criteria for fauna in Table 18-9 in order to identify any unforeseen issues and allow trends to be tracked if an unforeseen issue does occur.	Assumption from BII tailings geochemical assessment (Appendix M7) that water quality will remain at same or better quality in TSF. There has been no fauna mortalities associated with the TSF throughout AZM operations (2008-2018). Assumed to continue.	Low: Conclusions reached in the impact assessment are highly unlikely to change if assumptions are found to be incorrect.	No	No	There has been no fauna mortalities associated with the TSF throughout AZM operations (2008-2018). The risk of poisoning animals accessing the TSF is of such low intensity that it could not reasonably be expected to impact on local fauna populations, as there is no food for fauna to consume to allow the poison pathway to work.	N/A
PIE_18_5	Fauna and Pests	Native Fauna Impacts	A reduction in the abundance or diversity of faunal species on the MPA due to noise / vibration from the process plant operations	Operation	Process plant	Vibration/noise	Native fauna populations	S-P-R Relationship well understood from ML6229 (2007-2018). Even though no viable S-P-R impact events have been confirmed, Terrainin propose an outcome and associated measurable and leading indicator criteria for fauna in Table 18-9 in order to identify any unforeseen issues and allow trends to be tracked if an unforeseen issue does occur.	Vibration/noise of processing plant not at scale to impact native fauna within proximity of plant. Assumed no native fauna living in processing plant, however to be checked immediately prior to refurbishment.	Low: Conclusions reached in the impact assessment are highly unlikely to change if assumptions are found to be incorrect.	No	No	No, no evidence of native fauna residing within the vicinity of the process plant over the care and maintenance period (2013-2018). Small commensals introduced fauna may be displaced, however, are not expected to be impacted.	N/A
PIE_19_1	Vegetation and Weeds	Traffic and Transport	Equipment and vehicles transported on and offsite have the potential to introduce and spread weeds and impact on neighbouring properties	Operation	Movement of goods, equipment and vehicles	Spread of weeds	Neighbouring properties	Medium: Known risk, numerous sources of weed. Baseline flora study undertaken in 2005. Weed and Pest Management Plan is implemented onsite and has identified weeds currently present. Main threats are known but unknown weed threats may emerge.	No evidence of new weeds being brought in through operation of ML6229. Source uncertain however pre-entry cleaning requirements on Terrainin vehicles.	Low: Conclusions reached in the impact assessment are highly unlikely to change if assumptions are found to be incorrect.	Yes	Yes	N/A	Weed and Pest Management Plan implements a biannual (Winter and Summer) Weed and Pest Survey to enable trends to be identified (can identify increases in weed populations seasonally, and then enables active land management practices for the preceding season in order to minimise the potential for spread of plant pathogens).

Impact ID	Justification of assumptions - EVIDENCE	Description of Grouped Environmental Impact	Significance of expected impact 1 = Negligible 2 = Low, 3 = Med 4 = High	Validation of modelling	Effectiveness of design measures	Effectiveness of management measures	Actions to reduce uncertainty	Excluded worst case impact	Unlikelihood of credible worst case impact	Residual Risk Rating (Low, Medium, High)	Impact covered by alternative Act or Limit (Yes/No)	Act / Limit Reference	Proposed Outcome	Outcome measurement criteria	Leading Indicator(s) (where required)
PIE_19_7	<p>Poor vegetation establishment may be for a variety of causes - weather, plague, soil nutrients, etc. Current SEB revegetation areas demonstrate Terramin's revegetation success, however, areas still to be monitored with Landscape Function Analysis until systems self sustaining.</p> <p>Revegetation Plan outline for Closure included in Chapter 3. Detailed revegetation for closure included in Appendix C of the 2017 approved PEPR for M6229.</p>	Soil quality can impact revegetation success		N/A	Medium: Species selection same as successful SEB revegetation areas	High: Demonstrated success of revegetation through SEB revegetation areas proves management strategies effective onsite.	Continue LFA monitoring	Minor	Unlikely	Low	N/A	N/A	<p>Maintain visual amenity in line with broader existing environment</p>	<p>1. LFA on rehabilitated areas within the southern and central domains will be repeated annually following completion of rehabilitation earthworks and vegetation direct seeding for the first 5 years and then at a frequency recommended in the year 5 report.</p> <p>2. LFA on rehabilitated areas within the southern and central domains will be repeated to confirm trend 24 months before submission of summer application.</p> <p>3. Once prior to application for surrender independent and suitably qualified expert (to OHC's satisfaction) will verify through a report that representative test sites on rehabilitated areas within the southern and central domains (Appendix BIV) have achieved or by trends may be confidently predicted to reach and pass sustainability thresholds as defined by Landscape Function Analysis (Sustainability thresholds for each parameter interpreted as the points of maximum curvature on the sigmoidal curve shape as per Tongue and Hindley (2005) (MCP Appendix AM)).</p>	N/A
PIE_18_1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Yes	National Parks and Wildlife Act 1972 (SA) Environment Protection and Biodiversity Conservation Act 1999 (Cth)	No native fauna injuries or deaths caused by mining operations that could reasonably have been prevented.	All native fauna deaths or injuries on-site will be reported and an investigation will be undertaken to demonstrate it could not have reasonably been prevented.	None proposed.
PIE_18_2	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Yes	Natural Resources Management Act 2004	No introduction of new species of declared weeds or pests (including feral animals), or sustained increase in abundance of existing declared weed or pest species caused by mining operations.	An annual winter weed and pest survey shown in Figure 18-1 using step point monitoring and photo documentation to demonstrate there has not been a significant increase in weeds, pests and disease from the previous survey.	None proposed.
PIE_18_3	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Yes	National Parks and Wildlife Act 1972 (SA) Environment Protection and Biodiversity Conservation Act 1999 (Cth)	No net adverse impacts from the mining operations on the native fauna	All native fauna deaths or injuries on-site will be reported and an investigation will be undertaken to demonstrate it could not have reasonably been prevented.	None proposed.
PIE_18_4	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Yes	National Parks and Wildlife Act 1972 (SA) Environment Protection and Biodiversity Conservation Act 1999 (Cth)	No net adverse impacts from the mining operations on the native fauna	All native fauna deaths or injuries on-site will be reported and an investigation will be undertaken to demonstrate it could not have reasonably been prevented.	None proposed.
PIE_18_5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Yes	National Parks and Wildlife Act 1972 (SA) Environment Protection and Biodiversity Conservation Act 1999 (Cth)	No net adverse impacts from the mining operations on the native fauna	All native fauna deaths or injuries on-site will be reported and an investigation will be undertaken to demonstrate it could not have reasonably been prevented.	None proposed.
PIE_19_1	Introduction and spread of weeds is a known risk from other operations.	Weeds and pathogens can be reported from machinery and cause impacts	1	N/A	Low: Limited scope to use design measures to reduce risk	Medium: Management measures are considered routine and used effectively throughout industry. Impact mitigation relies on real time monitoring and appropriate management response.	Continue pest and weed monitoring	Minor	Unlikely	Low	Yes	Natural Resources Management Act 2004	No introduction of new species of declared weeds or pests (including feral animals), or sustained increase in abundance of existing declared weed or pest species caused by mining operations.	A winter annual weed and pest survey at open permanent transects on M6 6229 using step point monitoring and photo documentation to demonstrate there has not been a significant increase in weeds, pests and disease from the previous survey.	None proposed

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PIE_19_2	Vegetation and Weeds	Traffic and Transport	Imported equipment has the potential to introduce phytophthora from infected areas and impact on surrounding agricultural land	Operation, Closure	Phytophthora in imported equipment	Introduction of equipment to site	Surrounding agricultural land	High: PR2 / PEZ / PIZ well understood. Vine Health Australia protocol which has been developed for BH will also apply as BH Pytophthora may be introduced from areas where the infection has not been identified.	Uncertain where equipment/Heavy Vehicles to be imported from. Precautionary measure.	Low: Conclusions reached in the impact assessment are highly unlikely to change if assumptions are found to be incorrect.	Yes	Yes	N/A	Vehicle and equipment hygiene protocols which comply with VineHealth Australia. Weed and Pest Management Plan implements a biannual (Winter and Summer) Weed and Pest Survey to enable trends to be identified (can identify increases in weed populations seasonally, and then enables active land management practices for the proceeding season in order to minimise the potential for spread of plant pathogens).
PIE_19_3	Vegetation and Weeds	Traffic and Transport	Equipment and vehicles transported on and offsite have the potential to introduce and spread weeds and impact on native vegetation	Operation	Movement of equipment and vehicles	Spread of weeds	Native vegetation	Medium: Known risk, numerous sources of weed. Baseline flora study undertaken in 2005. Weed and Pest Management Plan is implemented onsite and has identified weeds currently present. Main threats are known but unknown weed threats may emerge.	No evidence of new weeds being brought in through operation of ML6229. Source uncertain however pre-wet cleaning requirements on Terramin vehicles.	Low: Conclusions reached in the impact assessment are highly unlikely to change if assumptions are found to be incorrect.	Yes	Yes	N/A	Weed and Pest Management Plan implements a biannual (Winter and Summer) Weed and Pest Survey to enable trends to be identified (can identify increases in weed populations seasonally, and then enables active land management practices for the proceeding season in order to minimise the potential for spread of plant pathogens).
PIE_19_4	Vegetation and Weeds	Traffic and Transport	Unauthorised vehicle movements off designated mine access roads leading to clearance / disturbance outside of approved clearance footprint and loss of native vegetation.	Operation	Unauthorised vehicles	Soil compaction	Native vegetation	High: areas of native vegetation well understood and identified.	Uncertain how credible source is, however monitoring of remnant native vegetation to demonstrate no impact.	Low: Receptor unlikely to change.	Yes	Yes	N/A	Remnant vegetation flagged or fenced off
PIE_19_5	Vegetation and Weeds	Soil	Inadequate removal of contaminated soils results in impacts to post closure land use (revegetation)	Post closure	Contaminated soil	Germination	Local community	High: potential pathway and receptor well understood for contaminated land - source to be updated.	EPA site audit upon cessation of closure earthworks removes uncertainties of vegetation establishment failure due to contaminated soils	Low: Closure process ascertained in consultation with EPA and mining regulator to be in accord with state legislation, policies and guidelines for site contamination	Yes	Yes	N/A	Revegetation Planning, maintenance and monitoring through Landscape Function Analysis until self-sustaining systems establish.
PIE_19_6	Vegetation and Weeds	Revegetation	Seed sterilization in stockpiles impacts on post-closure rehabilitation success	Closure, Post Closure	Topsoil stockpiles	Germination	Local community	Medium: with ripping, ploughing, harrowing and direct seeding of all rehabilitation areas during closure, native seed bank contributions within topsoil are additional positive outcomes, however not relied upon.	Topsoil stockpile does not exceed 2.5 m, as per guidelines. Native seed bank not relied upon.	Low: Native seed bank not relied upon	No	No	Seedbank in topsoil stockpile likely to have introduced pasture grasses/weeds. Seeds not of significance and could be detrimental to revegetation success.	N/A
PIE_20_1	Heritage	Heritage	Ground disturbance during operation and closure has the potential to damage, disturb or interfere with an unidentifiable site, object or remain of Aboriginal heritage significance	Operation, Closure	Ground disturbance	Physical impact of machinery	Indigenous community (Aboriginal heritage)	Medium: A search of the Central Archive revealed no entries for Aboriginal heritage sites in the vicinity of the mine prior to development of ML6229. Similarly, there are no Native Title Claims or applications, nor are there any non-Indigenous heritage sites registered prior to development of ML6229. Risk of undiscovered source always present, however, likelihood of disturbance as a result of MPL operations is low as all activities will occur within the existing footprint.	Undiscovered heritage sites may exist onsite. The proposed MPL activities will occur within the existing AZM footprint and discovery of unknown sites, if they exist, will not occur.	Low: Conclusions reached in the impact assessment are highly unlikely to change if assumptions are found to be incorrect.	No	No	Appendix T2 It may still be a possibility, however low, that artefacts could exist at the site and will implement induction procedures for all employees and contractors which include the recognition of cultural heritage, as well as the implementation of a site discovery procedure, which includes casing work until the relevant approvals are obtained. This commitment will be reflected within the proposed Outcome Measurement Criteria.	N/A
PIE_20_2	Heritage	Heritage	Ground disturbance during operation and closure has the potential to damage or disturb an unidentified site or item of non-Aboriginal heritage significance	Operation, Closure	Ground disturbance	Physical impact of machinery	European heritage (Arts and Cultural heritage)	Medium: A search of the SA and Commonwealth heritage registers reveals no European heritage places or artefacts within or surrounding proposed MPL footprint. New wetland is cleared agricultural paddock reducing likelihood event further.	Undiscovered heritage sites may exist onsite, however unlikely.	Low: Conclusions reached in the impact assessment are highly unlikely to change if assumptions are found to be incorrect.	No	No	NatureMaps 2018 (DEWNR) It may still be a possibility, however low, that artefacts could exist at the site and will implement induction procedures for all employees and contractors which include the recognition of cultural heritage, as well as the implementation of a site discovery procedure, which includes casing work until the relevant approvals are obtained. This commitment will be reflected within the proposed Outcome Measurement Criteria.	N/A

Impact ID	Justification of assumptions - EVIDENCE	Description of Proposed Environmental Impact	Significance of expected impact 1 = Negligible 2 = Low, 3 = Med 4 = High	Validation of modelling	Effectiveness of design measures	Effectiveness of management measures	Actions to reduce uncertainty	Credible worst case impact	Uncertainty	Level of Credible worst case impact (Not Ranking) (Low, Medium, High)	Impact covered by alternative Act or Limit (Yes/No)	Act / Limit Reference	Proposed Outcome	Outcome measurement criteria	Leading Indicator criteria (where required)
PIE_19_2	Vehicle and equipment hygiene procedures which comply with VineHealth Australia	Weeds and pathogens can be reported from machinery and cause impacts	1	N/A	Low: Limited scope to use design measures to reduce risk	High: Known to be effective throughout numerous industries including viticulture.	Continue pest and weed monitoring	High	Uncertainty	Medium	Yes	Natural Resources Management Act 2004	No introduction of new species of declared weeds or pests (including feral animals), or sustained increase in abundance of existing declared weed or pest species caused by mining operations	A Phytothora/Phytovora Management Plan to be provided with submission of PER. A winter annual weed and pest survey at seven permanent transects on M6 S223 using step point monitoring and photo documentation to demonstrate there has not been a significant increase in weeds, pests and disease from the previous survey.	None proposed
PIE_19_3	Weed and Pest Management Plan - Appendix 06	Weeds and pathogens can be reported from machinery and cause impacts	1	N/A	Low: Limited scope to use design measures to reduce risk	Medium: Management measures are considered routine and used effectively throughout industry. Impact mitigation relies on real time monitoring and appropriate management response.	Continue pest and weed monitoring	Minor	Uncertainty	Low	Yes	Natural Resources Management Act 2004	No introduction of new species of declared weeds or pests (including feral animals), or sustained increase in abundance of existing declared weed or pest species caused by mining operations	A winter annual weed and pest survey at seven permanent transects on M6 S223 using step point monitoring and photo documentation to demonstrate there has not been a significant increase in weeds, pests and disease from the previous survey.	None proposed
PIE_19_4	Still exists even though access tracks signed and delineated. Figure 19-6 outlines melaleuca lanceolata tree.		1	N/A	Medium: fencing or flagging used as standard to protect vegetation.	Medium: management procedures must be in place to prevent removal of fencing or flagging	N/A	Minor	Uncertainty	Low	Yes	N/A	No permanent loss of abundance, condition or diversity of native vegetation (as defined by Native Vegetation Act 1991) caused by mining operations	Annual monitoring through visual inspection and photo documentation of the remnant native vegetation located within the proposed MPA, will demonstrate no decrease of remnant native vegetation post-construction.	None proposed
PIE_19_5	Poor vegetation establishment may be for a variety of causes - weather, plague, soil nutrients or contamination, etc. Current SIB revegetation areas demonstrates Terramin's revegetation success, however, areas still to be monitored with Landscape Function Analysis until systems self sustaining. EPA closure site contamination audit to remove uncertainties regarding soil contamination post-closure. Revegetation Plan outline for Closure included in Chapter 3. Detailed revegetation for closure included in Appendix C of the 2017 approved PER for M6S229.	Soil contamination can impact revegetation	1	N/A	Medium: operational and non-operational zones delineate activities through operational phase.	Medium-High: Operational phase relies on soil management and reporting procedures being adhered to. Closure - EPA site contamination audit process reduces likelihood of vegetation failure significantly.	Continue LFA monitoring	Moderate	Uncertainty	Medium	N/A	N/A	Maintain visual amenity in line with broader existing environment	1. LFA on rehabilitated areas within the southern and central domains will be repeated annually following completion of rehabilitation earthworks and vegetation direct seeding for the first 5 years and then at a frequency recommended in the year 5 report. 2. LFA on rehabilitated areas within the southern and central domains will be repeated annually following completion of rehabilitation earthworks and vegetation direct seeding for the first 5 years and then at a frequency recommended in the year 5 report. 3. Once prior to application for surrender an independent and suitably qualified expert (to DPC's satisfaction) will verify through a report that representative test sites on rehabilitated areas within the southern and central domains (Appendix B3) have achieved or by trends may be confidently predicted to reach and pass sustainability thresholds as defined by Landscape Function Analysis (Sustainability thresholds for each parameter interpreted as the points of maximum concavity on the sigmoidal curve shape as per Tongway and Hendley (2005) (MCP Appendix AM)).	N/A
PIE_19_6	N/A	N/A	N/A	N/A	N/A	N/A	Continue pest and weed monitoring	N/A	N/A	N/A	Yes	Natural Resources Management Act 2004	N/A	N/A	N/A
PIE_20_1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Yes	Aboriginal Heritage Act 1988	No impact to heritage sites, places, remains or objects caused by mining operations without prior authorisation under the Aboriginal Heritage Act 1988 and/or the Heritage Places Act 1993.	Records will be kept of all complaints and any artefacts discovered related to Aboriginal heritage and an investigation will be undertaken to demonstrate no inappropriate actions by the mine operator.	None proposed.
PIE_20_2	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Yes	Heritage Places Act 1993	No impact to heritage sites, places, remains or objects caused by mining operations without prior authorisation under the Aboriginal Heritage Act 1988 and/or the Heritage Places Act 1993.	Records will be kept of all complaints and any artefacts discovered related to Aboriginal or European heritage and an investigation will be undertaken to demonstrate no inappropriate actions by the mine operator.	None proposed.