Environmental Impact Statement Assessment Report under the *Environmental Protection Act 1994*

for the Sarsfield Expansion Project proposed by Carpentaria Gold Pty Ltd

Prepared by: Statewide Environmental Assessments, Department of Environment and Heritage Protection

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1 Introduction

Carpentaria Gold Pty Ltd (Carpentaria Gold), a wholly owned subsidiary of Resolute Mining Limited (RML), is seeking approval to expand its open pit gold mining operation at the Ravenswood Gold Mine in North Queensland through the Sarsfield Expansion Project (project).

The existing Ravenswood gold mine lies adjacent to the historic mining town of Ravenswood, located 150km south-west of Townsville and 65km east of Charters Towers. The mine has been in operation since 1987.

The environmental impact statement (EIS) process was initiated by an application made by the proponent on 28 July 2011 for approval to voluntarily prepare an EIS under the *Environmental Protection Act 1994 (*EP Act) for the proposed expansion of the existing Ravenswood gold mine. On 2 August 2011 the application to prepare a voluntary EIS was granted by the former Department of Environment and Resource Management (former DERM); now the Department of Environment and Heritage Protection (EHP) and the draft terms of reference (TOR) were advertised in October 2011. Following a period of public consultation, public comments were incorporated and the final TOR were published on 11 February 2012.

On 2 September 2011, the project was declared a controlled action (EPBC 2011-6062) under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). The Commonwealth decided that the project was to be assessed through the EP Act's EIS process under "An Agreement Between the Commonwealth and the State of Queensland Under Section 45 of the *Environment Protection And Biodiversity Conservation Act 1999* Relating to Environmental Assessment" (the bilateral agreement). The controlling provisions were:

- World heritage properties (sections 12 and 15A)
- National heritage places (sections 15B and 15C)
- Listed threatened species and communities (sections 18 and 18A)
- Great Barrier Reef Marine Park (sections 24B and 24C).

As the administering authority, EHP has coordinated the EIS process for the project under the EP Act. This assessment report has been prepared pursuant to sections 58 and 59 of the EP Act. Section 58 of the EP Act lists the criteria that EHP must consider when preparing an EIS assessment report and section 59 states that the content of the report must:

- address the adequacy of the EIS in addressing the TOR
- address the adequacy of the environmental management plan
- make recommendations about the suitability of the project
- recommend any conditions on which any approval required for the project may be given
- contain another matter prescribed under a regulation.

This report provides an evaluation of the EIS process for the project pursuant to chapter 3 of the EP Act and contains an assessment of the significance of impacts of the project on the controlling provisions (refer to section 4.25 of this report) for the purpose of assessment for the EPBC Act. A copy of this report will be given to the Commonwealth Environment Minister, who will separately decide whether to approve or refuse the controlled action under part 9 of the EPBC Act.

This report summarises the key issues associated with the potentially adverse and beneficial environmental, economic and social impacts of the project. It discusses the management, monitoring, planning and other measures proposed to minimise any adverse environmental impacts of the project. It notes those issues of particular concern that were either unresolved or require specific conditions in order for the project to proceed.

The giving of this report to the proponent will complete the EIS process under the EP Act.

2 Project description

Under the existing mining operations both the Sarsfield and Nolans pits are decommissioned for mining and are instead being used as disposal sites for tailings from ore processing. The site is essentially crushing, processing and disposing of the ore recovered from the Mount Wright mine located immediately to the North. The Mount Wright operation is expected to cease at end 2015.

The project aim is to recommence mining on the immediate site, requiring dredging of the tailings from the Sarsfield pit and placing them into a new tailings storage facility (TSF), recommence mining in the Sarsfield and Nolans pits; both of which would be deepened and expanded. The project is expected to continue production at the same rate as currently approved, [processing approximately five million tonnes per annum (Mtpa) of ore and to include an extension of existing operations by 20 years; being one year construction, 17 years mining and two years decommissioning.

The mine would produce up to 1.6 million ounces of gold from processing 84 million tonnes of ore and generate approximately 141 million tonnes of waste rock. The project disturbance area would be approximately 511ha with principal footprint created by the tailings storage facility (232ha) and waste rock dumps (223ha). The actual pit expansions account for 30ha at the Nolans pit and 13ha at the Sarsfield pit.

Gold production was estimated as approximately 1.6million ounces of gold (A$2.4 billion in today's terms) at, on average, approximately 96,500 ounces of gold each year (A$139 million pa in today's terms).

Total capital expenditure on mine development was estimated as approximately A$150 million, with construction phase activities over 12 to 18 months estimated at $150 million and decommissioning estimated to cost $50 million over two years.

The project has changed significantly since the September 2012 EIS was released. For example, an increase in the amount of mining, processing and consequently increased tailings storage and waste rock disposal.

The footprint of the project has increased to include adjacent tenure for the purpose of larger TSF and waste rock dump and for the management of existing contaminated groundwater. This report refers simply to the amended/final project rather than maintaining an ongoing discourse about the original and expanded project.

2.1 Location

The existing Ravenswood gold mine is located immediately adjacent to the historic mining town of Ravenswood, some 150km south-west of Townsville and 65km east of Charters Towers. The mine has been in operation since 1987. Aspects of the mine are within close proximity to adjacent sensitive receptors for example Ravenswood residential housing, school and church.

2.2 Mine infrastructure

Infrastructure to support the mining operations would include a new fuel farm, wash bays, welding workshop, office complex (including administration and ablutions building), workshop complex (including maintenance bays, service bays, warehouse and workshop office) and ablutions, hardstand areas, fenced secure laydown area and a sandblasting shed.

Smaller bunded sheds would be used for flammable material storage.

A new fuel and lubricant store would replace the existing one. The new store would include:

- seven 80,000L diesel fuel tanks
- three 10,000L lubricant storage tanks
- two 10,000L waste oil tanks
- one 2000L hydraulic fluid tank.

Refuelling areas would be hard-surfaced and would drain to sumps for ease of recovery of spilt material.

A 38KL liquid petroleum gas (LPG) storage facility would be installed at the processing plant.

A 2500m^2 explosives magazine area would be established within a specifically bunded area at distances to minimise risks in the case of an emergency. The area would house all equipment for the management and storage of the Class 1 explosives and ammonium nitrate emulsion products proposed for the project.

The existing Sarsfield crushing plant would be refurbished and used for 12-15 months until a new crushing plant had been constructed.

Upgrading of the ore processing circuits would include construction of a new 30KL hydrochloric acid storage facility, relocation of the lead nitrate tanks and upgrading of the cyanide mixing and storage facility. Solid reagents would be stored to the appropriate standards either in areas with specific stormwater runoff management including on hardstands or in a dry store. Liquid reagents would be delivered either in 1KL bulk containers and stored on site or in dedicated road tankers that would pump into the site's storage tanks.

2.3 Tenures and tenements

The project area extends over a mix of State land, land leased from Charters Towers Regional Council and Carpentaria Gold-owned land. The project site and surrounds is located within the existing mining leases (ML) 1639, 1379, 1337, 1395, 1412, 1532, 1574, 1380, 1416, 1417, 1640, 1682, 1692, 1418, 1394, 1753, 1722, 1736, 10170, 10039, 10040, 10041 and 10237. The Mount Wright Underground Mine is located on ML 1338 and 1435. The proponent plans to submit three ML applications for three areas adjacent to the existing MLs, including:

- one ‘wedge’ shape in the south-western corner of EPM 14778 - to accommodate the proposed footprint of the Sarsfield TSF (refer to Figure 1, Area A)
- an area in the south-eastern corner of the project area to potentially accommodate the topsoil stockpile (refer to Figure 1, Area B)
- an area to the south of the existing ML 10170 for use as a potential environmental buffer zone and groundwater monitoring area (refer to Figure 1, Area C).

2.4 Resource base

The Sarsfield-Nolans gold deposit extends over an area approximately 800m by 1500m. The EIS indicates proven and probable reserves of 747,000 and 423,000 ounces respectively. At least 90% of the gold is associated with sulphide vein networks in a diorite host rock. Veins are very rarely developed over less than 5m and vary in width from hairline fractures up to 1-2m wide locally. The ore body would be mined to 400m in the Sarsfield pit and 165m in the Nolans pit.

2.5 Mining methods and equipment

Clearing of topsoil and subsoil, up to 300mm, would be undertaken before civil works. Topsoil and subsoil would be pushed outside work areas and stored in separate stockpiles of suitable heights. Stockpiles would be shaped to reduce erosion. As soon as practicable, stockpiles would be reused for rehabilitation purposes. A stockpile area for top soil and sub soil would be established on an approximately 9ha site.

Prior to the commencement of mining, approximately 12Mt of tailings currently stored in the Sarsfield pit must be removed. They would be dredged and pumped as slurry to the new Sarsfield TSF. The dry, semi-consolidated sand tailings currently in the Nolans pit would be removed by an excavator and truck fleet and also disposed into the new TSF.

Mine operations would be continuous (365 days per year, 24 hours per day) employing an estimated 220 people. All mining would be open-cut, with stripping of waste to provide ore feed to the processing plant. The mine would utilise drilling and blasting, with a fleet of excavators and trucks to transfer waste rock to dumps and ore to the run of mine (ROM) pads for processing. Equipment would be conventional diesel-powered earthmoving equipment including drill rigs, excavators, haul trucks, front end loaders, tracked and rubber tracked dozers, graders, water trucks, service trucks, a tyre handler and other smaller units like skid steer loaders, four wheel drives, busses and compactors.

Benches within the Sarsfield pit cutback would be at 10 metre (m) intervals, and overall the pit walls would have an approximately 55° batter angle.

Blasting would be conducted to comply with relevant Queensland guidelines and the blasting procedures would be progressively refined as mining in the pits advances. Refinements would reduce the blasting exclusion zone from 400m (after approximately 4-6 months) to 300m and to 200m (after approximately 6-12 months of operations). Blasting times would initially be after school hours (e.g. 4-6pm) three days per week while the exclusion zone affects the community. The school and residents would be evacuated during blasting times, while they are still within the blasting exclusion zone.

Selection of ore would be based on a grade control sample program.

Ore processing is currently 1.5Mtpa. It is proposed that this rate would increase to 5Mtpa, the currently approved limit. Ore would be mined using conventional diesel-powered earthmoving equipment and would be hauled to the ROM pads via haul roads from the Sarsfield and Nolans pits. Waste material would be placed in a waste rock dump located to the east of the pits. Ore would be crushed then ground before processing. The existing crushing plant would be used for the first approximately 12 months until a new crushing plant is completed on the Nolans ROM pad at which time the Sarsfield crushing plant would be decommissioned. Up to 100,000t of crushed ore would be stored in a stockpile. Grinding would consist of primary and secondary ball mills generating a slurry of ore that would then be processed through hydrocyclones and a leach adsorption circuit. The leach adsorption circuit would use cyanide to dissolve gold and then recover the gold through adsorption onto carbon. The gold loaded carbon would then be stripped in an elution circuit, the gold electrically precipitated and smelted into bullion.

The tailings circuit would separate the solid and liquid portions of the tailings from the leach-adsorption circuit to reclaim the liquid portion for reuse of the water and reagents in the processing plant. The solid portion of the tailings (which would still contain some liquid) would settle to the bottom of the tailings thickener, after which tailings would be deposited into the Sarsfield TSF. The tailings would contain on average 130parts per million (ppm) of cyanide in the liquor. The liquid portion above the solids would be pumped to the process water pond, the thickened portion pumped to the TSF.

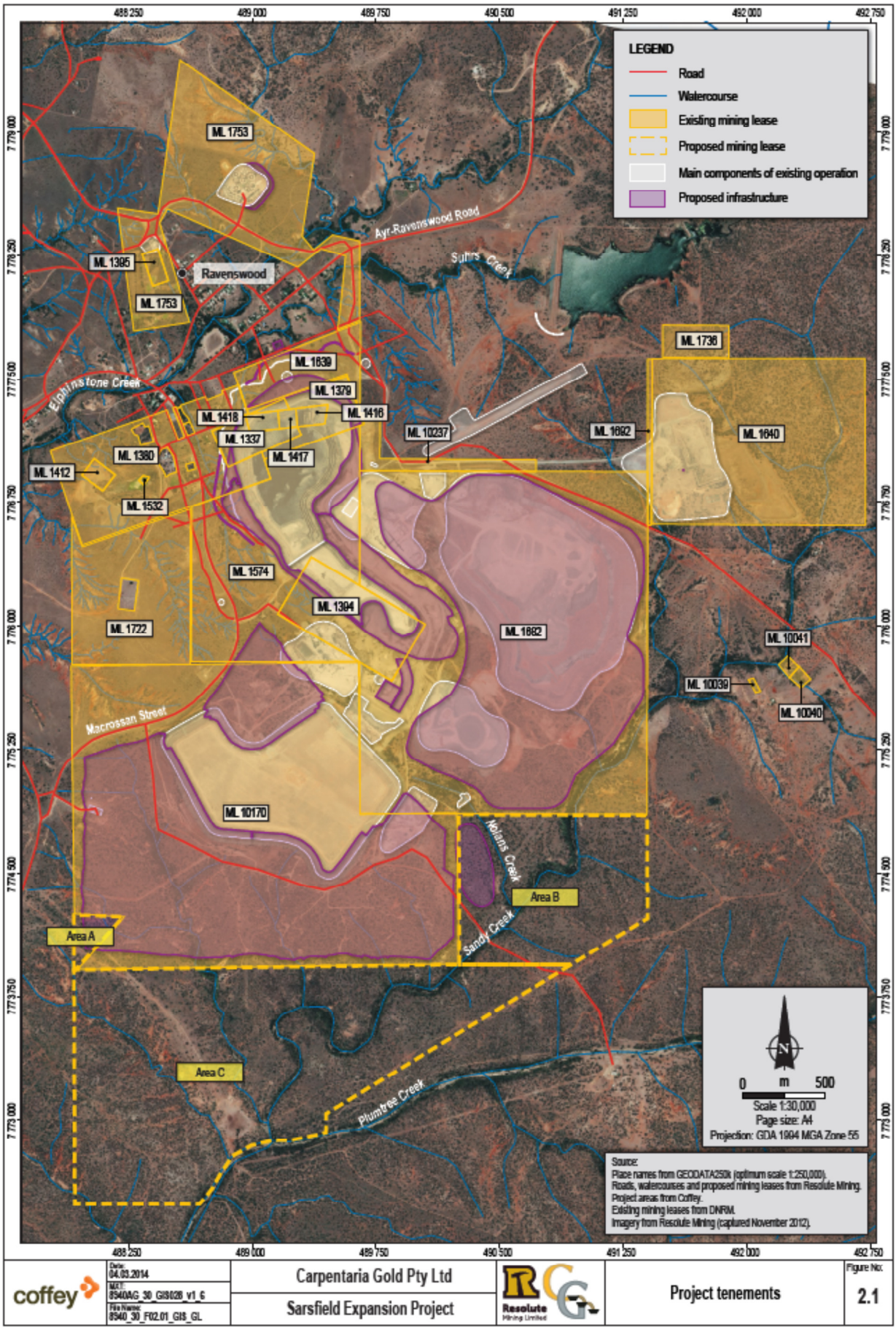


Figure 1 (extract of fig 2.1 from SEIS)

2.6 Acoustic bund

An approximately 3km long acoustic bund currently surrounds the northern portions of the Sarsfield pit adjacent to the township of Ravenswood. A 1km section of that bund would be relocated closer to the town to allow the pit to expand and to continue the noise attenuation required for the management of mine noise impacts at the township.

2.7 Mine sequencing

The existing operation of processing Mount Wright ore would continue until the end of 2015. The Nolans pit would be mined for approximately 11 years with a planned final pit depth of 165m.

Sarsfield pit operations would commence some time in year two after the approximately 12-18 month dewatering and tailings dredging has been completed. The Sarsfield pit mining would continue for 17 years, with a planned final pit depth of 400m.

The EIS states that based on economic assumptions, no economic resources will be left unmined or sterilised.

2.8 Waste management

2.8.1 Waste rock

Proposed is a 223ha waste rock dump of approximately 45-55m high (approximately 20m higher than the current dump). It would be shaped with 10m high benches with capacity to store 143Mt of waste rock, tyres, abandoned plant, various hard wastes and scats or rejects from the ore grinding process. The waste rock would include 45Mt of potentially acid forming (PAF) and 96Mt of non-acid forming (NAF) material. The PAF is associated with sulphide material and would predominantly come from the Sarsfield pit.

The EIS states that geochemical-related impacts are expected to be dominated by leachate and seepage with elevated sulphate concentrations, but near-neutral pH and relatively low concentrations of metals and metalloids in the medium term. The waste rock dump is stated to have been designed in accordance with the Technical Guidelines for the Environmental Management of Exploration and Mining in Queensland and to have sufficient capacity to store all of the waste rock produced by the project. PAF material would be encapsulated in NAF – e.g. at least a 30m buffer from PAF to the outer wall toe, at least 10m from any outer wall and a NAF base at least 2m thick. On closure the design aim is for internally draining runoff directed back toward the pit. The dump would have a store and release cover to manage rainfall and be designed to manage erosion, including rock armouring.

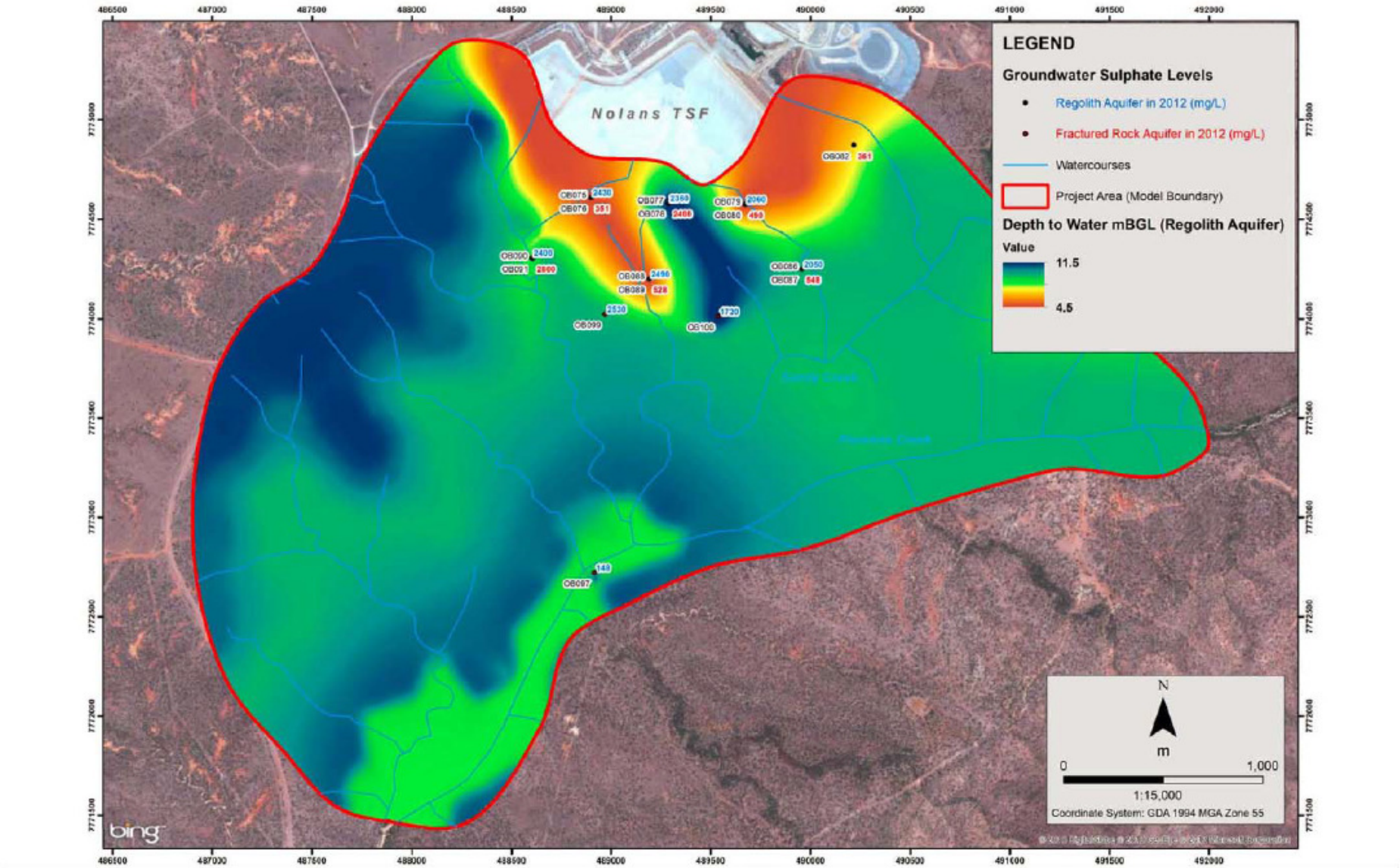
2.8.2 Tailings storage facility (TSF)

The existing Nolans TSF has been closed, capped and the surface rehabilitated. The Sarsfield pit currently contains about 12Mt of tailings from Mount Wright and Sarsfield processing tailings. The tailings in the Sarsfield pit are known to have an elevated risk of acid generation compared to the expected tailings generated by ore processing under the expansion plan. The acid generation is linked to the Mount Wright tailings that have different characteristics, including elevated sulphate, compared to the Sarsfield and Nolans tailings. Of the new proposed processing approximately 30% is considered to be PAF.

The project would require a new 232ha TSF that would have three cells constructed around and connected to the existing Nolans TSF. Construction of the TSF is expected to take approximately 12-18 months, it would have capacity for 89Mt of tailings, sufficient for those to be dredged from the Sarsfield pit and for all processing from the expanded project. It would be designed and constructed according to the Tailings Management Guideline of the Technical Guidelines for the Environmental Management of Exploration and Mining in Queensland, Australian National Committee on Large Dams (ANCOLD) guidelines and the Department of Environment and Heritage Protection manual for assessing hazard categories and hydraulic performance of dams.

The TSF was assessed in the EIS as a “significant consequence” dam and it would be constructed by cut and fill with starter embankments and base lined with a 1.5mm high density polyethylene (HDPE) liner. An underdrainage collection system would lie over the liner to capture leachate from under the tailings. Leachate would be pumped to the decant pond. A toe drain around the Nolans TSF would intercept the shallow component of current seepage from that TSF before it interacts with the new TSF. A leakage detection system is proposed under the liner of the new TSF, allowing only approximately 10% of any leakage to be detected.

There is an ongoing significant leakage of contaminated leachate from the existing unlined Nolans TSF, which has resulted in a significantly contaminated groundwater table/mound developing under and downstream of the Nolans TSF (refer to figure 2 extracted from attachment 5 of the SEIS). Surface flows of this contaminated groundwater are also recorded as flowing into the adjacent Sandy Creek.



Date	24/01/2013	Drawn	PK	Client:	Carpentaria Gold Pty Ltd
Scale	As Above	Approved	VK	Map Title:	Recent groundwater sulphate levels in the Project Area
Original size	A3	Project:	ENAUBRIS09052	Figure no:	FIGURE 16

Figure 2 Contaminated groundwater mound under existing TSF

As a consequence, the monitoring and management of seepage and leakage of contaminants to surface or groundwater from the proposed TSF and project works must be able to separately identify between existing contamination and contamination from the new facilities and operations. In addition, the overall performance management of both the proposed TSF and the existing TSF must be coordinated and delivered in such a way that all relevant environmental values are protected. The EIS states that dewatering bores are proposed around the toe of the Sarsfield TSF to continue remediation of the contaminated groundwater. The EIS also states that these bores would also assist in recovery of leakage from the new TSF if the liner becomes compromised. The number and location of the bores is not defined in the EIS and is stated as being subject to further detailed geotechnical investigation. Resolving the number of bores, their configuration and their operation is critical prior to considering approval of the project

2.8.3 Hard waste dump

An existing mine landfill used as part of the existing operation is located within the site of the proposed Sarsfield TSF. This would be replaced by a new dump to be sited within the proposed waste rock dump, becoming an integrated waste rock dump (IWRD) and remain in operation until burial at the time of decommissioning.

2.8.4 Mine affected water

Mine affected water storages on site would include a process water pond (30ML), the Sarsfield TSF (49GL) and a decant pond (350ML). The EIS indicates that an estimated 850kL/day surplus of water would be generated on the site, and that this would variously be used to minimise raw water pumping, be lost to passive evaporation or disposed of through operation of evaporation fans. The proposal also includes an unspecified number of 1ML storage ponds noted as being used for dust suppression and fire-fighting; there is no mention in the EIS of the typical water quality or of management of their contents. The EIS includes that sediment basins would also be used to temporality store water – this appears to include mine-affected water, however there are no specific statements in the EIS around the management of water inputs or output or water quality within those basins.

The EIS states that the decant pond would be double lined, with a HDPE and a geosynthetic clay liner – and its role would be to store the excess mine-affected water from the operations, including, process water, leachate from the new TSF and contaminated groundwater recovered from bores adjacent the existing Nolans TSF.

Mine affected water, tailings leachate and supernatant, and water produced by Sarsfield pit dewatering would contain elevated levels of total dissolved solids, metals and cyanide. The EIS indicates that this water would be used to supplement the process water requirements, or be disposed of as excess water through an evaporation fan system. Water evaporation fans are proposed initially over the Sarsfield pit in order to remove 11GL of excess water in the pit before dredging starts. The fans would then be relocated to the southern walls of the existing Nolans TSF for continued disposal of mine affected water and tailings water through evaporation. The EIS states that the fans would operate with a management system depending on weather conditions. However there is little information about potential impacts and water quality and where contaminants would ultimately end up.

Water entering the pits from surface runoff or from subsurface flow would be drained to sumps and pumped from the pits on a continuous basis to the water cart standpipe (consisting of a dam and/or tank and water-filling equipment) for dust suppression or, if needed, to the process water pond. The EIS states that, when found to be of suitable water quality, the first preference would be to use pit runoff and sump water for dust suppression on the haul road. Stormwater would be separated into clean and impacted streams, then depending on its quality, it would be retained for use as process water, used for dust suppression or placed in the decant pond for disposal through evaporation fans.

2.8.5 Sewage treatment

Two new sewage treatment plants (STPs) would be developed, one on-site for the mine operation and one off-site for the accommodation village. Effluent at the mine site would be disposed to a septic tank and leach drain system. The 300 person STP at the accommodation village would be a Class A tertiary treatment standard and the effluent would be disposed through an automatic irrigation system onto the golf course.

2.9 Rehabilitation and decommissioning

Rehabilitation of disturbed areas would be carried out progressively throughout the life of the project. The objective of the rehabilitation strategy is stated to be to return areas affected by mining to a stable, non-eroding, and safe condition, having biologically sustainable ecosystems requiring minimum long-term management. The proposed post mining land suitability is Class VIII, native ecosystem which is the pre-mine land use and the final void (pits) acting as water storage, noting that this is in conflict with the expected scale and quality of the water within. A mine closure plan would be developed during the operational phase to identify the specifics of rehabilitation and decommissioning.

2.9.1 Final voids

Two linked final voids of approximately 110ha would remain on mine closure, the Nolans and Sarsfield pits. The voids would progressively accumulate surface and groundwater; the level of water is modelled to become stable after approximately 100 years at around 135m lower than the pit crest, 265m deep and 75m below the existing water table. The water would progressively become hypersaline through evaporation to around 3500mg/L salts after 100 years and to over 19,000mg/L after 1000 years. The void would be a permanent groundwater sink in that groundwater would continue to flow into it over time.

2.10 Transport

During construction and operation significant heavy road transport would be required, in particular between the mine and Townsville and Gladstone. During operations, road transport of materials to and from the site would occur seven days per week including fuel, explosives, lime, reagents, grinding media, spares and general consumables.

For minor shift rotations employees would travel in shuttle buses provided by the proponent between the accommodation village and the mine along the Mount Wright haul road. For major shift rotations employees would travel in the proponent's coach service between Townsville (and Charters Towers) and the accommodation village.

The project proposes to upgrade five public road intersections, these are:

- Intersection 1: Macrossan Street (south), Nolans Mine Access Road and existing dirt road
- Intersection 2: Ayr-Ravenswood Road, Mount Wright Haul Road and Sarsfield heavy vehicle bypass
- Intersection 3: Burdekin Falls Dam Road and Macrossan Street (north)
- Intersection 4: Burdekin Falls Dam Road and Macrossan Street (south)
- Intersection 5: Macrossan Street (north) and Sarsfield heavy vehicle bypass.

Road signage is proposed at two of the public road intersection upgrades (Intersections 2 and 5) to discourage public users from inadvertently entering the heavy vehicle bypass routes.

All upgrades would be completed in conjunction with Charters Towers Regional Council (CTRC) and the Department of Transport and Main Roads (DTMR).

Rail transport is unlikely to be used closer to the mine than Townsville.

Air transport is limited for the project. The Charters Towers Regional Council own and operate an unsealed airstrip east of the Sarsfield pit for monthly Royal Flying Doctor Service visits and the proponent has a helipad near the Nolans mine access road for use by Emergency Management Queensland (EMQ) helicopters for emergency patient evacuation.

2.11 Energy

The mine would require approximately 17MW per year of electrical power at full operating capacity (5Mtpa). The existing system that provides for the mine, township and surrounding area would not require an upgrade. However, some of the on-site distribution lines and transformers would be relocated and optimised to suit the new footprint and the Sarsfield pit dewatering and dredge program. Two new capacitor banks would be installed to improve the site power system.

Diesel powered generators would be used in some locations for dewatering bores and pumps where capital cost savings dictate.

2.12 Water supply and storage

Raw water for the operation would come per existing licenced arrangements from the Burdekin River via Suhrs Creek dam. That water would also be used to provide potable water for the mine and the township.

Raw water use on site would be inclusive of processing plant (2ML/day), Mount Wright mine (0.6ML/day), dust suppression (1.5ML/day) and for treatment to potable standards (0.3ML/day). The potable water would be used in the mine operations (0.1ML/day) and distributed to the Ravenswood township (0.2ML/day). The existing potable water treatment plant would be replaced with a new one as part of this project.

Proposed water storages on site include Suhrs Creek dam (1.4GL), a turkeys nest dam (1.3GL), process water pond (30ML) Sarsfield TSF (49GL) and decant pond (350ML). The proposal includes an unspecified number of 1ML storage ponds noted as being used for dust suppression and fire-fighting. There is no mention in the EIS of the typical water quality or management of their contents. Sediment basins would also be used to temporality store water, again with no specific statements around the management of water inputs or output or water quality within those basins.

Stormwater would be separated into clean and impacted streams, then depending on its quality, it would be either retained for use as process water, applied for dust suppression or placed in the decant pond for disposal through evaporation fans.

2.13 Off lease infrastructure

2.13.1 Potable water treatment

A new potable water treatment plant (0.5ML/d) treating water from Suhrs Creek dam would be constructed off-site in Chapel St, Ravenswood. It would replace the existing on-site plant and continue to be operated by the proponent including for the purposes of town water supply.

2.13.2 Suhrs Creek dam

The Suhrs Creek dam would be upgraded in two stages by the proponent on behalf of the Charters Towers Regional Council (CTRC) so that it would meet current flood capacity guidelines. The upgrade is not directly related to the project and would not affect the supply of water to the project. The approvals and regulation of that upgrade would be separate to this project.

2.13.3 Ravenswood community land fill

The Ravenswood community landfill, operated by CTRC, is located within the proposed footprint of the TSF and would require excavation and relocation. That action, conducted by CTRC, would not form part of the EIS assessment.

2.13.4 Accommodation

Construction activities would take approximately 12-18 months and up to 229 people would be either employed or contracted during that period.

Carpentaria Gold currently operates an accommodation village on the north side of Ravenswood for permanent and contractor personnel required for both the Mount Wright Underground Mine and the Ravenswood site. The expansion project workforce would increase by up to 240 additional personnel. If required, the capacity of the existing village may be increased by up to 120 en-suite rooms and the dining area and kitchen facilities would be expanded to suit. The expansion of the village would be influenced by overlap with the existing operations at Mount Wright.

It is anticipated that a small percentage of the additional workforce would either be employed from Ravenswood or chose to reside in Ravenswood. The proponent has purchased additional land in Ravenswood adjacent to existing company housing and, if required, would construct additional company houses on this land to accommodate workers.

3 The EIS process

3.1 Timeline

The EIS process was initiated by the proponent applying to EHP for approval to prepare a voluntary EIS under section 70 of the EP Act. The application was received on 28 July 2011 and approved on 2 August 2011. The proponent submitted draft TOR and project description on 28 July 2011, however withdrew those on 2 August 2011 while it contacted the Commonwealth about EPBC matters. A referral was made to the Commonwealth under EPBC on 4 August 2011 and a decision (EPBC 2011-6062) was made that the project was a controlled action to be assessed under the bilateral agreement with Queensland. The proponent resubmitted the TOR and project description on 14 September 2011.

On 5 October 2011 EHP notified the proponent of its decision to publish the draft TOR in: The Brisbane Courier-Mail and Townsville Bulletin on Saturday 8 October 2011 and the Northern Miner on Tuesday 11 October 2011. Copies of the draft TOR were circulated to all members of the advisory body. The comment period for the draft TOR was from Monday 10 October 2011 until close of business on Friday 18 November 2011.

EHP received comments on the draft TOR from seven advisory body members/stakeholders during the comment period. All comments, together with those provided by EHP itself, were forwarded to the proponent on 1 December 2011. The proponent responded to the comments on 17 January 2012 and EHP published the finalised TOR on 11 February 2012, taking into account all comments and the proponent's response to those comments.

On 4 July 2012 the proponent submitted a draft EIS and on 1 August 2012 EHP decided that the EIS could proceed to public notification and that the submission period would be from 28 September to 12 November 2012. Public notices appeared in the Australian, Courier Mail and the Townsville Bulletin on Thursday 13 September 2012 and in the Northern Miner on Friday 14 September 2012. On Friday 28 September the EHP website noted the start of the submission period for the EIS. The proponent also provided copies of the public notice of the EIS to affected and interested persons.

EHP received 16 submissions on the EIS within the submission period. These included 12 submissions from state government, one from the Charters Towers Regional Council, one from the former Commonwealth Department of Sustainability, Environment, Water, Population and Communities, one from Skills Queensland and one from the Queensland Heritage Council. All 16 submissions were accepted in accordance with section 55 of the EP Act. The submissions, together with a submission from EHP were forwarded to the proponent on 26 November 2012 for consideration and response. At that time the proponent was required to provide a response to submissions and relevant amendments to the EIS on or before 8 January 2013. The proponent then sought an extension of time within which to make the response and on 17 December 2012 was granted an extension until 31 March 2013 within which to submit the response to submissions and amended EIS referred to here as the supplementary EIS (SEIS).

The SEIS was not submitted within that time and consequently, under section 67 of the EP Act, the EIS process for the project was suspended. At that time the EIS process could resume if the response under section 56(2) was provided on or before 1 April 2014.

On 25 March 2014 the proponent submitted an amended project description to account for proposed changes to the project other than in response to submissions on the EIS. Those changes related to an increase in the expansion of the project following further pit optimisation studies and increases in the gold price. As the changes were not in response to the submissions on the EIS, the appropriate fee and amendment notice were also provided under section 66 of the EP Act.

On 31 March 2014 the proponent submitted the SEIS and a response to the submissions on the EIS. EHP considered the responses and the amended EIS and on 30 April 2014 decided that the EIS could proceed to the assessment report and EIS completion phase. A notice of that decision was given to the proponent on 14 May 2014. This assessment report is the final action and giving it to the proponent completes the EIS process.

3.2 Approvals

3.2.1 Mineral Resources Act 1989

An exploration permit issued under chapter 4 of the *Mineral Resources Act 1989*, allows the holder to undertake exploration activities on the permit land. Exploration permits act also as a prerequisite for acquiring higher forms of tenure. The proponent holds exploration permits for minerals (EPM) around the existing mine area, namely EPMs 14778 and 15099. The proponent plans to apply to the Department of Natural Resources and Mines (DNRM) for a mining lease over the area of EPM 14778. The proponent currently holds 23 mining leases within the project area and surrounds. To implement the project, three additional mining lease applications would be required to be submitted to DNRM. The EIS referred to these planned mining lease applications as areas A, B and C (refer to Figure 1), they are located adjacent to existing Ravenswood mining leases in this report and are required for TSF, waste rock dump and groundwater management respectively.

3.2.2 Environmental Protection Act 1994

The conduct of proposed project activities within the mining lease application (MLA) area would require an environmental authority (EA) under chapter 5 of the EP Act. This approval would cover mining and the activities listed as environmentally relevant activities (ERA) under schedules 2 and 2A of the Environmental Protection Regulation 2008 (EP Reg) that are directly associated with, or facilitate or support, the mining activities. Relevant ERAs for the project include: mining of gold ore, Chemical storage (ERA 8), Metal smelting and refining (ERA 30), Mineral processing (ERA 31), Crushing, milling, grinding or screening (ERA 33), Bulk material handling (ERA 50), Regulated waste storage (ERA 56), Regulated waste treatment (ERA 58), Waste disposal (ERA 60), Sewage treatment (ERA 63).

The current Ravenswood Gold Mine operation has an EA EPML00979013 (formerly MIN 102515111), the implementation of this project would therefore require an amendment to that existing EA. An amendment has not yet been sought and consequently the consideration of that request for amendment would occur under the EP Act currently in force, rather than the pre-green tape EP Act in force at the time the voluntary EIS application was made. The following notifiable activities being undertaken for the project would also be authorised under the EA:

- Notifiable activity 1—Abrasive blasting: Carrying out abrasive blast cleaning (other than cleaning carried out in fully enclosed booths) or disposing of abrasive blasting material.

- Notifiable activity 7—Chemical storage: Storing more than 10t of chemicals (other than compressed or liquefied gases) that are dangerous goods under the dangerous goods code.
- Notifiable activity 14—Engine reconditioning works: Carrying out engine reconditioning work at a place where more than 500L of any of the following are stored:
  - Halogenated and non-halogenated hydrocarbon solvents
  - Dangerous goods in Class 6.1 under the dangerous goods code
  - Industrial degreasing solutions.
- Notifiable activity 29—Petroleum product or oil storage: storing petroleum products or oil:
  - In underground tanks with more than 200L capacity
  - In above ground tanks with petroleum products:
    - or oil in class 3 in packaging groups 1 and 2 of the dangerous goods code—more than 2500L capacity
    - or oil in class 3 in packaging groups 3 of the dangerous goods code—more than 5000L capacity
    - that are combustible liquids in class C1 or C2 in AS 1940–2004—more than 25,000L capacity.

The proponent would be required to notify the Contaminated Lands Register of all notifiable activities and the identified notifiable activities should be clearly identified and listed for site management purposes. For potential contaminated land on-site (e.g. landfill), the proponent is required to address the following:

- Any disturbance or work associated with contaminated land (including hazardous contaminants and notifiable activities) should be undertaken in consultation with a suitably qualified person in accordance with section 564 of the EP Act and management should be in accordance with provisions under part 8 Contaminated Land of the EP Act.
- Should the proponent become aware of any contaminant present on-site, they have an obligation under section 371 of the EP Act to notify EHP as the administering authority.
- The administering authority should be advised of any notifiable activity occurring on the MLA.
- If it is confirmed that land has been contaminated regardless of whether or not a notifiable activity is occurring, the EHP should be advised in accordance with section 371 of the EP Act.

3.2.3 Water Act 2000

The *Water Act 2000* provides for the sustainable management of water and other resources and the establishment and operation of water authorities. The act enables the granting of various water licences and permits.

The existing operation extracts water from the Burdekin River under two water extraction licences. One licence (No. 4003888) is held by CTRC and the other by the proponent (No. 57293A). Both are operated by the proponent for the purpose of supplying water to the Ravenswood township and the existing mine. The existing licences are sufficient for the proposed expansion.

3.2.4 Aboriginal Cultural Heritage Act 2003

A cultural heritage management plan (CHMP) would be required under the *Aboriginal Cultural Heritage Act 2003* (ACH Act) prior to approvals being issued for the project. The EIS stated that a CHMP had been negotiated with the Birri-Gubba People and signed by representatives of that group on 25 June 2012, however the elements of the expanded project may not be included in that CHMP and it would need to be finalised before approvals for the project were considered.

3.2.5 Environment Protection and Biodiversity Conservation Act 1999

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) provides a framework to protect and manage matters of national environmental significance. The project is a controlled action under the EPBC Act and is being assessed in this EIS process under the bilateral agreement. A separate decision about approval of the potential impacts on matters of national environmental significance (MNES) would be required by the Commonwealth Minister for the environment after this EIS process. The EIS includes a separate chapter (Attachment 2 of the EIS) that addressed the matters relevant to the controlling provisions. The EPBC Act aspects of this project are described further in section 4.25 of this report.

3.2.6 Nature Conservation Act 1992

The proponent would need to comply with the *Nature Conservation Act 1992* (NC Act), particularly in regard to obtaining the following approvals for the project:

- Where there is a requirement for the clearing of plants protected under the NC Act, clearing of protected plants must only occur in accordance with an exemption under the NC Act. Further detail is provided in the Nature Conservation (Protected Plants) Conservation Plan 2000.
- Where the activities of the proponent may cause disturbance to animal breeding places, the proponent must prepare a species management program under section 332 of the Nature Conservation (Wildlife Management) Regulation 2006 and obtain approval from EHP.
- Any spotter catcher employed by the project must be in possession of a rehabilitation permit (spotter catcher endorsement) for managing fauna during clearing activities (section 207 of Nature Conservation (Wildlife Management) Regulation 2006).
- If it is necessary to remove animals posing a threat to human health or property, a damage mitigation permit under section 181 of the Nature Conservation (Wildlife Management) Regulation 2006 would be required.

3.2.7 Queensland Heritage Act 1992

In accordance with the *Queensland Heritage Act 1992*, the proponent would need to notify EHP if an archaeological artefact is discovered and provide information on the location and description of the discovery. Currently, 13 sites or places that lie within or are adjacent to the project area are identified on the Queensland Heritage Register.

3.2.8 Transport Infrastructure Act 1994

To ensure compliance with the *Transport Infrastructure Act 1994* and *Transport Operations (Road Use Management) Act 1995* the proponent would need to consult with and resolve matters raised by the Department of Transport and Main Roads on all matters concerning:

- road impacts assessments
- road-use management plans
- investigation of potential road safety hot spots.

The proponent would need to apply for permits for over-dimension loads and road corridor permits. Section 4.16 of this assessment report provides further information on transport related approvals.

3.3 Consultation program

3.3.1 Public consultation

In addition to the statutory requirements for advertising the TOR, EIS and notices to interested and affected parties, the proponent consulted members of the public, other stakeholders and the community at community consultation sessions held in Ravenswood. During the public submission period of the EIS, a number of presentations aimed at briefing stakeholders on the project were conducted in Brisbane, Townsville, Charters Towers and Ravenswood. Aspects of community engagement undertaken by the proponent included:

- distribution of a survey questionnaire
- interviews with landholders
- newsletter mail outs
- provision of information sheets
- provision of fact sheets
- provision of posters
- provision of a community relations advisor
- provision of an email enquiry service (response given within 48 hours).

The EIS listed the stakeholders, engagements completed including the number of persons consulted or resources applied. The EIS stated that the issues raised were then responded to in follow up sessions and in regular newsletters that were circulated locally and to interested persons. A summary of stakeholders key issues raised during the pre EIS consultation program was provided in the EIS. The issues included, dust, traffic, noise, water, light, blasting, cultural heritage, employment, training and economic impacts. Those issues were also subsequently discussed in the relevant sections of the EIS.

3.3.2 Advisory body

EHP invited a range of organisations to assist in its assessment of the TOR and EIS by participating as members of the EIS advisory body. During the EIS public submission period, advisory body briefings were held in Brisbane on 9 October 2012, Townsville on 10 October 2012 and Charters Towers on 11 October 2012. A site inspection was also conducted following the briefing in Charters Towers.

Over the duration of the EIS process, a significant number of agencies that were members of the advisory body were restructured and or changed names. The advisory body included the former:

- Department of Communities
- Department of Infrastructure and Planning
- Department of Employment , Economic Development and Innovation
- Department of Education and Training
- Treasury Department
- Queensland Health
- Queensland Police Service
- Department of Community Safety
- Department of Transport and Main Roads
- Queensland Treasury and Trade
- Department of Education, Training and Employment
- Department of State Development, Infrastructure & Planning
- Department of Housing and Public Works
- Department of Agriculture, Fisheries and Forestry
- Department of Natural Resources and Mines
- Department of Science, Information Technology, Innovation and the Arts
- Charters Towers Regional Council
- North Queensland Conservation Council
- Queensland Conservation Council
- North Queensland Land Council
- Wildlife Preservation Society Queensland
- North Queensland Dry Tropics
- Ergon Energy
- Construction, Forestry, Mining & Energy Union
- Birri People
- Commonwealth Department of Sustainability, Environment, Water, Population and Communities (SEWPaC).

Queensland Government changes

In accordance with the Public Service Departmental Arrangements Notice (No.1) 2012, the following changes became effective on 3 April 2012 to the Queensland Government departments referred to in this report.

Table 1 Queensland Government changes

New department (as of 3 April 2012)	Previous department(s)/amalgamations
Department of State Development, Infrastructure and Planning	Department of Employment, Economic Development and Innovation
Queensland Treasury and Trade	Treasury Department/ Department of Employment, Economic Development and Innovation
Department of Science, Information Technology, Innovation and the Arts;	Department of Employment, Economic Development and Innovation/Department of Public Works
Department of Natural Resources and Mines	Department of Employment, Economic Development and Innovation/ Department of Environment and Resource Management
Department of Agriculture, Fisheries and Forestry	Department of Employment, Economic Development and Innovation/ Department of Environment and Resource Management
Department of Environment and Heritage Protection	Department of Environment and Resource Management
Department of National Parks, Recreation, Sport and Racing	Department of Environment and Resource Management

Department of Education, Training and Employment	Department of Education and Training
Department of Housing and Public Works	Department of Communities
Department of Communities, Child Safety and Disability Services	Department of Communities

3.3.3 Public notification

In accordance with the statutory requirements, public notices of the draft TOR and EIS and public comment periods were published in the Courier Mail, Townsville Bulletin the Northern Miner and on EHP's website.

The draft TOR and EIS were placed on public display at the following locations during their respective public comment and submission periods:

- EHP website (draft TOR only)
- EHP, Customer Service Centre, 400 George Street, Brisbane
- EHP, Cape Pallarenda Road, Townsville
- Charters Towers Regional Library, 130 Gill Street, Charters Towers
- Townsville Flinders Street Library, Level 1, Northtown on the Mall, 280 Flinders Mall, Townsville
- Ravenswood Post Office, Lot 1 Macrossan Street, Ravenswood.

3.4 Matters considered in the EIS assessment report

Section 58 of the EP Act requires that an EIS assessment report consider the following matters:

- the final TOR for the EIS
- the submitted EIS (including the proponent's responses, addendum and amended EM plan)
- all properly made submissions and any other submissions accepted by the chief executive
- the standard criteria
- another matter prescribed under a regulation.

These matters are addressed in the following subsections.

3.4.1 The final TOR

The final TOR, published on 11 February 2012, were considered when preparing this EIS assessment report. Although compiled to include all the likely significant issues, the TOR state that if other significant matters arose during the preparation of the EIS then such issues should be fully included. All such matters have been considered in the EIS assessment report.

In deciding to allow the EIS to proceed to the preparation of an assessment report, EHP consider the submitted EIS documents and determined that the information provided adequately met the requirements of the TOR.

3.4.2 The submitted EIS

The project changed significantly since the September 2012 EIS was released. For example an increase in the amount of mining, processing and consequently increased tailings storage and waste rock disposal. Under those changes the footprint of the project has also increased to include adjacent tenure for the purpose of larger TSF and waste rock dump and for the management of existing contaminated groundwater. This report refers simply to the "project" as represented by the amended/final project rather than maintaining an ongoing discourse about the original and expanded project.

The submitted EIS was considered when preparing this report. The submitted EIS comprised:

- the EIS that was made available for public submissions on 28 September 2012
- properly made submissions
- the response to submissions and the amendments to the EIS (in the form of a supplementary EIS) received by the department on 31 March 2014.

3.4.3 Properly made submissions

EHP accepted 16 submissions on the EIS from the following:

- Department of Education, Training and Employment
- Department of Aboriginal and Torres Strait Islander and Multicultural Affairs

- Department of Science, Information Technology, Innovation and the Arts
- Department of Natural Resources and Mines
- Department of Transport and Main Roads
- Department of State Development, Infrastructure and Planning
- Department of Education, Training and Employment
- Department of Agriculture, Fisheries and Forestry
- Department of Energy and Water Supply
- Queensland Health
- Queensland Police Service
- Charters Towers Regional Council
- Commonwealth Department of Sustainability, Environment, Water, Population and Communities
- Department of Community Safety
- Skills Queensland
- Queensland Heritage Council.

EHP also made its own submission on the EIS.

Once the SEIS was received it was provided to all who had made submissions on the EIS, and responses were sought from them about the suitability of the SEIS in addressing their submissions. As the SEIS also included an amended project, their views were also sought on the revised project. All submissions and other comments by submitters were considered when preparing this EIS assessment report.

3.4.4 The standard criteria

Section 58 of the EP Act requires that, among other matters, the standard criteria listed in schedule 3 of the EP Act must be considered when preparing the EIS assessment report. The standard criteria are:

a. the principles of ecologically sustainable development as set out in the National Strategy for Ecologically Sustainable Development;
b. any applicable environmental protection policy;
c. any applicable Commonwealth, State or local government plans, standards, agreements or requirements;
d. any applicable environmental impact study, assessment or report;
e. the character, resilience and values of the receiving environment;
f. all submissions made by the applicant and submitters;
g. the best practice environmental management for activities under any relevant instrument, or proposed instrument, as follows:
    I. an environmental authority
    II. a transitional environmental program
    III. an environmental protection order
    IV. a disposal permit
    V. a development approval;
h. the financial implications of the requirements under an instrument, or proposed instrument; mentioned in paragraph (g) as they would relate to the type of activity or industry carried out, or proposed to be carried out, under the instrument;
i. the public interest;
j. any applicable site management plan;
k. any relevant integrated environmental management system or proposed integrated environmental management system; and
l. any other matter prescribed under a regulation.

EHP considered the standard criteria when assessing the project.

3.4.5 Prescribed matters

In addition, section 58 of the EP Act requires that the following prescribed matters, under the Environmental Protection Regulation 2008, are considered when making an environmental management decision for this project:

- Section 51, matters to be considered for environmental management decisions
- Section 52, conditions to be considered for environmental management decisions
- Section 53, matters to be considered for decisions imposing monitoring conditions.

3.4.6 Environment Protection and Biodiversity Conservation Act 1999

On 4 August 2011, Carpentaria Gold referred the project to the former SEWPaC in accordance with the Commonwealth EPBC Act. On 2 September 2011, the former SEWPaC determined the project to be a controlled

action pursuant to Section 75 of the EPBC Act. The relevant controlling provisions related to:

- World Heritage properties (sections 12 and 15A)
- National Heritage places (sections 15B and15C)
- Listed threatened species and communities (sections 18 and 18A)
- Great Barrier Reef Marine Park (sections 24B and 18A).

Matters of national environmental significance are further discussed in Section 4.25 of this EIS assessment report. This EIS process under the EP Act is accredited for the assessment under Part 8 of the EPBC Act in accordance with the Bilateral Agreement between the Commonwealth of Australia and the State of Queensland. The Commonwealth was included as an advisory body for the assessment of the project and provided comments on the draft TOR and EIS documents. A copy of this EIS assessment report will be given to the Commonwealth Environment Minister to assist in making a decision on the project under the EPBC Act.

4 Adequacy of the EIS

This section of the assessment report discusses in more detail the adequacy of the EIS documents, taking into account key matters of concern identified in the EIS documents and particularly those of significant interest raised in submissions. The level of detail of the assessment is proportional to the significance of the potential impacts of the project, particularly on environmental values. Where possible, outstanding matters that need further assessment are identified, particularly those required by the proponent to meet State policy and legislative requirements.

Specifically, the following matters are addressed for each values section:

- a brief outline of the assessment methodology
- a brief outline of the environmental values identified
- statement of impacts as identified in the EIS documents
- adequacy of the avoidance, minimisation and management measures proposed
- summary of the adequacy of the EIS section, including any outstanding issues identified during the EIS assessment process and any recommendations to address these issues.

4.1 Introduction

The EIS provided an adequate introduction to the project, its objectives and scope. The various sections are clearly set out and guidance about reading of the EIS is provided.

4.2 Project need and alternatives

This section of the EIS adequately described the project need and alternatives. The positive and negative impacts, appropriate mitigation and management measures and environmental protection commitments of the project were addressed in later sections of the EIS.

Alternatives were discussed and included alternative mining methods and the advantages of the preferred (open cut) method, while noting that underground mining was unsuitable due to low-grade mineralisation (average 1.1gram gold/tonne (g/t). Other technical reasons were given with respect to the geology and geometry of the ore deposits, which the EIS stated are better suited to bulk mining in association with the open pit method and would ensure a constant high ore feed rate thus would maximise the use of the existing processing plant.

4.3 Impact assessment approach

The impact assessment chapters of the EIS were set out in a systematic way. A uniform set of subheadings were typically presented within each of these chapters as follows:

- legislative and policy context
- assessment method
- environmental protection objectives
- existing environment and environmental values
- issues and potential impacts
- avoidance, mitigation and management measures
- residual impacts
- inspection and monitoring requirements.

The above subheadings provided the framework for a consistent discussion and evaluation of the environmental issues addressed in the EIS.

A structured assessment approach was also adopted. Within each chapter, the potential impacts of the proposed expansion on environmental and social values were assessed by using one of three assessment methods:

- Significance Assessment - this method was adopted where an understanding of the vulnerability, or sensitivity of the environmental asset, or resource was important
- Risk Management Assessment - this method was adopted for impacts that could arise through the management of materials and substances (e.g. dangerous goods and waste)
- Compliance Assessment - was adopted for environmental aspects, such as air quality and noise, which are regulated by statutory guidelines where there is a clear limit that must be met to achieve compliance.

4.4 Regulatory approvals

The methodology and objectives of the EIS process, key approvals required for the project and relevant policies, guidelines, planning policies and planning schemes to be considered in assessing the project were adequately described in the EIS. These are summarised in section 3.2 of this assessment report.

4.5 Consultation

The consultation carried out as part of the EIS process, including its objectives, activities undertaken, stakeholders consulted, stakeholder issues and the way in which these issues were addressed in the EIS was adequately described in the EIS. A summary of the key issues raised during the consultation program and 259 consolidated specific responses to those issues were provided in the EIS. A summary of the consultation process undertaken by the proponent as part of the EIS process is summarised in section 3.3 of this assessment report. Matters that are not resolved have been identified in the relevant sections of this report and collated at section 6.

4.6 Description of the project

The EIS adequately described the location, scope and schedule for the project. An adequate discussion on all aspects of the project was provided, including: the resource base, construction, proposed mining activities and handling, processing and disposal of mine wastes, operations, workforce accommodation and rehabilitation/decommissioning. Principal issues relating to specific omissions or lack of detail, in particular about waste disposal or impact mitigation are noted in the relevant following sections.

A summary of the project is provided in section 2 of this assessment report.

4.7 Climate

4.7.1 Existing values

The local and regional climatic conditions in the vicinity of the project area and climatic extremes in relation to natural and other hazards were described and identified in the EIS. The EIS combined local and regional weather station data and regional weather parameters considered analogous to the local Ravenswood climate to prepare long-term averages of weather parameters.

Climate information was used in subsequent sections of the EIS (particularly air and noise) to assist in making predictions about impacts of the project. The impacts of natural hazards (bushfire and flooding) on surrounding land uses during operations and employee welfare were considered in the hazard assessment chapter of the EIS, hazard and risk are discussed further in section 4.21.1 of this assessment report.

The EIS suitably described the climate of the site as experiencing hot and humid summers, receiving annual rainfall between 170mm and 1440mm, mainly in summer and comprising dry winter adapted subtropical vegetation. Wind is dominated by north easterlies and strongest in the late afternoons.

Evaporation ranged from 1900mm to 2613mm per year; approximately three to four times the annual average rainfall of 680mm. The site is subject to tropical cyclones with 16 recorded within 100km of the site in the 100 years to 2006.

The principal climatic aspects noted by the EIS were the effect of extremely variable seasonal rainfall on water management on site and need for management measures to prevent the release of unauthorised contaminants from the site, flood protection design and the effect of wind on dust and noise. Climatic aspects that could affect the potential for environmental impacts and risks and the management of operations at the site were addressed in other chapters of the EIS.

4.7.2 Impacts

Principal climate driven impacts to the project identified related to the effect of evaporation and risk of flooding.

Evaporation was noted to lower water content in surface sediments, increasing dust generation and also decreasing the availability of water for dust suppression.

Increased intensity of peak rain events was considered a moderate risk to the potential for overflow from and erosive damage to the TSF. The EIS noted that flooding presented a regular risk of sedimentation in Sandy Creek from erosion where the southeast edge of both the TSF and waste rock dump extend into the 1 in 2 year average recurrence interval (ARI) flood envelope.

4.7.3 Avoidance, mitigation and management measures

A management system to track performance against objectives such as dust suppression and process water availability were the primary management measures proposed in the EIS and potentially developing increased on-site water storage if required.

Spillway and TSF wall design and ongoing maintenance and monitoring of structures were stated by the EIS as suitable to manage TSF failure risks related to climate induced flood.

4.7.4 Conclusions and recommendations

The EIS suitably addressed the potential for climate related impacts on the project and stated that residual risk for the climate related impacts to the proposal remained as moderate, for example relating to the TSF failure and bushfires while more manageable risks such as increasing dust were mitigated to a low residual risk.

4.8 Air

4.8.1 Existing values

The baseline assessment of air quality for the EIS involved a study area of a 13km by 13km area encompassing the Ravenswood township, the Ravenswood Gold Mine and Mount Wright Underground Mine – as well as 31 identified sensitive receptors.

In the absence of suitable background air quality data from either the mine site or the greater Ravenswood region, proxy data for particulate matter was obtained by combining air quality data from EHP monitoring stations located in Townsville and Gladstone. In terms of existing air quality, the EIS acknowledges both that:

- the lack of site-specific data for particulate matter in the existing Ravenswood airshed has prevented an assessment of any current concerns relating to dust
- current ground level concentrations (GLCs) of particulate matter at sensitive receptors in Ravenswood typically exceed relevant air quality objectives under the Environment Protection (Air) Policy 2008 (EPP Air).

Monitoring data for nitrogen dioxide (NO_2), sulphur dioxide (SO_2), ozone and lead in total suspended particles (TSP) were sourced from Townsville.

The EIS stated that dispersion of emissions was directly influenced by prevailing meteorological conditions. To support air dispersion modelling, meteorological data for 2006 from the Ravenswood Gold Mine weather station was used as a suitable, representative dataset.

4.8.2 Impacts

The EIS adopted industry-standard methods for the assessment of air quality impacts, with conservative assumptions or inputs being used to address data deficiencies, providing a generally reliable basis for assessing impacts on air quality.

In assessing impacts on air quality the EIS focused on the operational phase, on the grounds that construction activities would be largely conducted during daylight hours, when air dispersion conditions are most favourable and effective dust suppression measures could be applied.

As an input to modelling, an emissions inventory was prepared for three emission scenarios:

- existing sources of emissions from operation of the Mount Wright Underground Mine
- the peak future operations
- average future operations.

The EIS stated that for identification of sources and modelling of emissions it represented a likely worst-case for emissions from project activities, the peak operations scenario was presumed to be representative of worst case conditions.

The EIS identified several potential types of air quality impacts for the 'peak' and 'average' scenarios:

- impacts affecting the health and wellbeing of humans (both on site and at sensitive receptors) through increases:
    - of fugitive dust particles that are small enough to be inhaled
    - in metal/metalloids as part of fugitive dust
    - in gaseous emissions (carbon monoxide, NO_2, SO_2, and volatile organic compounds (VOCs)) from various mechanical activities
- increases in heavy dust particles that settle at sensitive receptors, causing an amenity nuisance.

The EIS presented ambient air quality objectives to guide its assessment of the acceptability of predicted outcomes, those objectives were mainly sourced from the EPP Air. Compliance with requirements for dust deposition under the current environmental authority for the Ravenswood Mine was also discussed.

The EIS noted that the primary fugitive emissions from tanks in the processing circuit and active TSF areas would be associated with the use of cyanide. Cyanide losses to the air would occur due to volatilisation of sodium cyanide to hydrogen cyanide (HCN). The EIS stated that emissions of HCN from the project would exceed existing levels but be within suitable hourly average objectives.

Particulate emissions from construction activities associated with relocation of the acoustic bund and the development of the new TSF cells were incorporated into the modelled scenarios. Key sources of particulate emissions during the operational stage included: wheel-generated emissions from vehicle movements on unpaved haul routes, crushing of ore at the upgraded Sarsfield crushing plant, overland conveying of crushed ore to the processing plant and blasting or wind erosion off TSF areas.

Dispersion modelling of emissions in the EIS assumed the implementation of existing and proposed particulate emission controls and mitigation measures, because it was acknowledged both that particulate levels are an issue for the current mine site and that any additional emissions would not meet suitable air quality objectives.

The EIS concluded that cumulative concentrations of particulate matter (PM) - $PM_{2.5}$ and PM_{10}, being particulate matter of 2.5 or 10 micrometres or less in size respectively. As well as the level of dust deposition, would exceed expected conditions of approval in each of the modelled scenarios.

In particular, GLCs for the PM_{10} objective were predicted to not comply with the EPP Air objective at 29 of the 31 identified sensitive receptors for the 'peak' scenario. The EIS also stated that:

- the most significantly impacted sensitive receptor locations were located in the areas immediately north and northwest of the Sarsfield Pit (vicinity of township)
- there would be a reduction in particulate emissions at the majority of sensitive receptor locations during the 'peak' and 'average' scenarios, relative to the existing operations
- the magnitude and frequency of exceedances would generally decline after the peak of production stage in the third year (i.e. the year with most ore and waste processing).

Emissions reductions modelled under the 'peak' and 'average' scenarios' relative to the 'current' scenario were driven by the:

- completion of construction as well as of operations at the Mount Wright Underground Mine at the end of 2015, including the completion of haulage along the Mount Wright haul road
- proposed implementation of new or increased mitigation and management measures (e.g. increased use of dust control measures).

The EIS concluded that based on modelling the project could comply with conditions for PM_{10} under the existing environmental authority at all but one sensitive receptor (Cecil St). However, it predicted that levels would exceed contemporary limits (for example model mining conditions based on EPP Air) at the majority of sensitive receptor sites with dust impacting on human health and wellbeing of Ravenswood residents.

The EIS concluded that particulate matter emissions (TSP, $PM_{2.5}$ and PM_{10}) and dust deposition are the most critical air quality pollutants associated with the project. It also found that GLCs for other air pollutants (i.e. gaseous pollutants, hydrogen cyanide (HCN), various metals/metalloids and odours) would fall below the applicable statutory criteria and would therefore be acceptable.

4.8.3 Avoidance, mitigation and management measures

The EIS stated that the project's objectives for air quality mitigation and management were based on the requirements of EPP Air, with the aim of protecting the existing air environment and its environmental values by

adopting the hierarchy of methods:

- avoid – adopt measures to prevent high impact – i.e., ceasing high air emission activities at times of high wind
- mitigate – adopting measures to reduce impact
- manage – locating the source of emissions and adopting measures to control the impact.

However, a detailed plan to apply the above hierarchy in order to achieve relevant air quality objectives was not provided in the EIS.

While acknowledging that the modelling predictions for particulate matter in the EIS point to a substantial potential for exceedances of air quality objectives under likely conditions of approval and the EPP Air, the EIS states that that acceptable outcomes will be achievable on the basis that:

- The modelling predictions provide conservative or "worst case" estimates and the actual outcomes are likely to involve fewer exceedances of EPP Air objectives
- An improvement in air quality relative to the current performance of the Ravenswood Mine will be achieved, noting the high degree of compliance of the mine with current environmental authority requirements
- Adoption of real-time monitoring of PM_{10} as well as of wind speed and direction at the mine site will inform a trigger-based ("reactive") approach to apply further air quality management measures
- An on-going reliance on a community relations approach will ensure that appropriate personnel are aware of operational issues which are then to be addressed through effective on-site management measures and operator education.

The EIS included a key commitment to:

- Modify mine activities for the Sarsfield Expansion Project, to the extent practicable, under adverse meteorological conditions (dry, windy conditions), particularly when sensitive receptors are located downwind of the construction or operations activities.

4.8.4 Outstanding issues

The EIS has not adequately described how the air quality objectives would be achieved, monitored and audited, and how corrective action would be taken when needed.

The relevant objectives for assessment of the project are those under the EPP Air. These objectives correspond to the quantitative limits for $PM_{2.5}$, PM_{10} and TSP under the Model Mining Conditions (MCC), which are likely to be the conditions imposed should the project proceed.

The EIS shows that, based on modelling there is a high potential for non-compliance with the MCC and EPP Air objectives for dust and has not demonstrated that the project could achieve these objectives. Nor have effective auditing and governance arrangements been put forward in the EIS. In particular, the focus of the EIS commitments with respect to air quality is on the potential for the project to comply with the requirements of the existing environmental authority, rather than on compliance with the MMC and/or EPP Air.

Other aspects specified by the TOR that have not adequately been addressed by the EIS include:

- frequency contour plots for typical and maximum emissions under the expected range of meteorological conditions including the worst case
- assessment of the human health risk associated with emissions from the project
- backup measures to be incorporated that will act in the event of failure of primary measures to minimise the likelihood of plant upsets and adverse air impacts
- how proposed emission control processes accord with the management hierarchy for air emissions in the EPP Air
- the potential for sensitive receptors to be exposed to high levels of particulate matter during the two month construction period for the proposed new acoustic bund has not been assessed.

A potential health risk associated with air quality that has not been assessed in the EIS is the possible impact on sensitive receptors of aerosols created by the proposed use of evaporative fans to dewater the Sarsfield mine pit and ongoing water disposal at the TSF.

4.8.5 Conclusions and recommendations

The EIS has provided a credible basis for concluding that (at least following the closure of the Mount Wright Underground Mine) the air quality outcomes from the project could be an improvement upon the air quality conditions currently affecting sensitive receptors in Ravenswood. However it has not demonstrated that the project would comply with relevant objectives under the EPP Air or MCC and has failed to consider other critical aspects such as potential impacts to air from the evaporative fan system. Importantly these aspects include human health and amenity issues within the township of Ravenswood. Resolving those matters is critical prior to considering

approval of the project.

4.9 Greenhouse gas emissions

4.9.1 Existing values

The Australian and Queensland governments have accepted the need to contribute to global efforts to stabilise and reduce anthropogenic contributions to the atmospheric concentration of greenhouse gases that are driving global warming. Australia is a signatory to both the United Nations Framework Convention on Climate Change and the Kyoto Protocol, committing under the latter to limit its aggregate greenhouse gas emissions for 2012 to 108% of the country's 1990 emissions levels.

4.9.2 Impacts

The EIS applied the methodology of the National Greenhouse Accounts Factors (NAFG) workbook for three broad categories or sources of the project's greenhouse gas emissions:

- direct emissions from sources owned or controlled by the proponent, including on-site fuel combustion, blasting, onsite disposal of non-mining waste, wastewater treatment plant, and fugitive emissions from sulphur hexafluoride (SF6) (as a result of gas insulation for switch gear and circuit breakers)
- indirect emissions from consumption of purchased electricity
- indirect upstream emissions from off-site activities involved in the supply of raw materials, as well as downstream emissions from offsite transportation of recovered product (final product) and offsite transport of work personnel and offsite disposal of non-mining waste.

Three project scenarios were evaluated: existing operations (with ore coming only from the Mount Wright Underground Mine); peak future operations; and average future operations.

Sources were assessed in terms of their carbon dioxide equivalent "greenhouse" value. The EIS identified that consumption of purchased electricity was the dominant source of emissions across all three scenarios (77%, 52% and 55% respectively). Diesel consumption and upstream emissions were also significant contributions, with diesel emissions contributing approximately 92% of direct emissions across all scenarios. All other sources would contribute less than 2.6% of total emissions across all scenarios.

The total annual emissions for the existing operations, peak future operations and average future operations scenarios were assessed in the EIS as being: 89,128; 217,808; and 161,061 tonnes of carbon dioxide equivalent (t CO2-e/y). These emissions were stated as 0.002%, 0.015% and 0.01% of Australian emissions reported for 2009 respectively.

4.9.3 Avoidance, mitigation and management measures

Reduction of electricity consumption and the reduction of diesel consumption through design and efficiency measures were identified as important mitigation strategies. Potential mitigation measures posed in the EIS included:

- use of haul trucks with state-of-the-art electric drive systems and fuel-efficient diesel engines
- progressively optimise the mine design to minimise haulage distances between the pits and the waste rock dumps
- a requirement for loaded trucks hauling uphill to use second gear rather than first gear.

The EIS committed to preparation of an energy and greenhouse gas management plan that will detail strategies for optimising energy efficiency and complying with external obligations (e.g. under the Commonwealth's *National Greenhouse and Energy Reporting Act 2007*) associated with energy use and greenhouse emissions.

4.9.4 Outstanding issues

The EIS has addressed most aspects specified by the TOR. However, the EIS's assessment of the project's contribution to greenhouse gas emissions has not been updated in light of the revised project description. The EIS did not identify preferred measures to achieve energy efficiency and to minimise emissions or to develop its proposed energy and greenhouse gas management plan for the project.

The EIS did not propose any offsets for the project's greenhouse gas emissions, as required by the TOR. This is not considered a significant issue because of the changing Commonwealth policy framework.

4.9.5 Conclusions and recommendations

The outstanding actions for Greenhouse matters such as development of an energy and greenhouse gas management plan for the project and any relevant offsets can be conducted within the suitable timeframe outside the EIS process.

4.10 Land

4.10.1 Land use

4.10.1.1 Existing values

The EIS adequately described the existing land use and values of the project site and local area and acknowledged the primarily agricultural land use, the proximity to the township of Ravenswood, including the immediately adjacent school and the historically intensive gold mining in the local area. The agricultural land of the site and surrounds was described in the EIS as Class C and D, and as otherwise marginally suitable and unsuitable agricultural land.

4.10.1.2 Impacts

The EIS states that extending the life of the existing mine would be a useful continuation of the existing land-use and the expansion of the accommodation village is generally compatible with the township. Expansion of the Sarsfield pit would encroach on low density residential land that will be acquired to prevent residential use and minimise risk of harm from blasting activities. The EIS considered the project to be a moderate impact to existing land use values and predicted a high impact on human activities during the construction phase.

Impacts to agricultural land were assessed as negligible, given the low value of the existing site. The EIS stated that the final voids would serve as water storages. However, the other detail provided in the EIS clearly indicates that the hypersaline water at significant distances below ground level would be unlikely to serve any benefit.

Upgrading of the Suhrs Creek spillway and the potable water treatment plant were both stated in the EIS to be a high beneficial impact to the township of Ravenswood.

4.10.1.3 Avoidance, mitigation and management measures

Limited action was stated in the EIS, primarily about consultation with affected landowners. It seemed appropriate that short term disruptions around development of infrastructure of benefit to the community would be accommodated to achieve the longer term benefit.

4.10.1.4 Conclusions and recommendations

The project appears to have a limited impact on existing landuse and to deliver some long term benefits to the local township through infrastructure upgrades. The management of short term disruption through appropriate steps such as consultation is appropriate.

4.10.2 Resource utilisation

The EIS suitably described the extent of the ore body, defined the resource base and production schedule and mining sequence. It stated that the mine pit expansions were designed using a break even cut-off of 0.45g/t of gold to ensure all economic resources were mined. Mine design was stated as ensuring that no resource was sterilised by the project.

Extending mining operations within the existing pits to obtain previously uneconomic resources was stated by the EIS as being consistent with state mineral development policy, with the benefit of undertaking mining in already disturbed land. The EIS stated that the project resource use was assessed as a low-significance beneficial impact to Queensland during construction and decommissioning phases and a moderate-significance beneficial impact through economic returns to the state during operations.

4.10.3 Land contamination

Mining activities can cause land contamination by either concentrating naturally occurring minerals or the use of hazardous materials. If contamination exists, it may affect environmental values if pathways also exist to expose sensitive receptors to the containments.

The EP Act defines ‘notifiable activities’ that are likely to cause land contamination. Properties that are either currently or known to previously to have been subject to notifiable activities must be referred to, and recorded on, the Environmental Management Register (EMR). The EP Act prohibits removal of contaminated soil from land that is listed on the EMR without a permit from the administering authority (EHP). EHP also administers the

Contaminated Land Register (CLR), a record of those contaminated sites that are causing, or may cause, serious environmental harm.

4.10.3.1 Existing values

The project area has been subject to both open pit and underground mining operations since 1868 and currently supports a processing plant, workshops, fuel farms, waste rock dumps, tailings storage facilities and historical mining sites, all of which have potential for contaminated residues. The EIS described existing land contamination at the mine site, as well as the potential for the project to create additional land contamination. Preliminary investigations of historic and other records informed the design of detailed site investigations to characterise mine site contamination and to establish a baseline dataset for the EIS.

Key sensitive receptors for land contamination aspects identified in the EIS were:

- On-site workers
- Ravenswood township, including the primary school located less than 1km to the west of Sarsfield pit and the residential dwellings situated near the Sarsfield pit acoustic bund
- local watercourses, including Sandy Creek and tributaries, Elphinstone Creek and tributaries, Suhrs Creek and dam, and the Burdekin River, tributaries and dam.

To establish background conditions for the EIS, soil sampling was undertaken at target, likely to be contaminated areas, at both off-site and project site locations. The EIS reported:

- elevated background levels of copper in local soils
- elevated levels of arsenic, copper and zinc in the area surrounding the processing plant, the Nolans TSF and landfill area and the Sarsfield crushing plant
- high levels of arsenic, above the “health based investigation” criteria, in two of the twelve locations analysed from the processing area and one location from the crushing plant
- elevated levels of hydrocarbons surrounding the workshop.

The EIS noted that there were no elevated contaminants in soil samples from four down-gradient locations that had the potential for the accumulation of contaminants.

4.10.3.2 Impacts

Based on existing contamination, the EIS noted potential exposure pathways as:

- direct exposure of receptors to contaminated soils, particularly in the investigated areas of the processing plant, the workshop, office area and the Nolans TSF
- vapour intrusion into excavations and buildings through migration of hydrocarbons or other volatile contaminants
- movement of contaminants from the soil into groundwater, then impacting receptors through use of groundwater bores, groundwater discharge into creeks, and use of surface waters
- potential migration of chemicals through surface water and sediment runoff to surrounding receptors.

According to the EIS, additional land contamination from the project could include:

- disturbance of existing contamination, particularly landfill materials and soil from heavy and small vehicle workshops
- unidentified contaminated soils and groundwater encountered during earthworks, which could lead to contamination being spread across the mine site, impacting sensitive receptors
- increased volumes of hazardous materials being transported, stored and used on-site, increasing the risks associated with spills and leaks
- increased volumes of wastes being produced, increasing the risk of leaks and spills of hazardous waste into the environment.

The EIS rated the significance of impacts from both known and possible sources of contamination as high for the processing plant, workshop and office areas. Lower levels of significance were predicted for impacts of contamination for the balance of the project area.

The greatest risks to sensitive receptors from both existing and potential land contamination was stated as being the risk to workers from possible exposure to contaminated material at the mine site and risks to environmental values through connectivity with groundwater contamination.

4.10.3.3 Avoidance, mitigation and management measures

The EIS proposed to address land contamination risks through:

- implementing appropriate design, construction and maintenance of the TSF retaining walls, with ongoing structural monitoring and assessment
- monitoring groundwater that could be affected by contamination
- if required, managing and remediating impacted soil and groundwater in accordance with Queensland guidelines
- notifying of any property not listed on the EMR that is subject to a 'notifiable activity' or is found to be contaminated
- implementing a site management plan for properties with residual contamination that require on-going management or may restrict the intended future use
- undertaking monitoring to characterise areas of potential contamination and monitor for any releases of contaminants. The monitoring would include soil, sediment, surface water and groundwater in areas of concern and within down-gradient locations.
- developing of safety procedures to reduce the potential for complete exposure pathways to known and possible contaminated material
- considering remediation or engineered management controls for areas of known contamination to prevent potential migration of contaminants and to remove exposure pathways.

4.10.3.4 Outstanding issues

The EIS generally provided an adequate response to the TOR with respect to land contamination. However, critical outstanding issues remain including:

- the EIS acknowledged that detailed site investigation was constrained by the presence of an unconsolidated rock layer that prevented installation of groundwater monitoring bores using equipment available at the time of investigation. Therefore the investigation of groundwater conditions affected by existing land contamination was deficient
- risks around the potential for contamination of groundwater and associated ecosystems from the TSF, decant pond and the IWRD are not suitably addressed, section 6.7 of this report provides more details of the outstanding matters
- risks of site and off-site contamination from the operation of the evaporative fan system are not suitably addressed; section 4.12 of this report provides more details of the outstanding matters.

4.10.3.5 Conclusions and recommendations

The risk of contamination of groundwater as a result of leakage from the TSF, decant pond, IWRD, evaporative fans and existing contaminated sites has not been adequately assessed in the EIS. Nor have robust project design and management measures been specified to effectively address noted elevated levels of risk.

The project should proceed only when practical and effective measures are demonstrated that will address the potential impact of contamination to land from those sources.

4.11 Waste management

4.11.1 Waste characterisation and quantification

4.11.1.1 Existing values

The EIS states the preferred hierarchy of waste management for the project to include avoid, minimise, reuse, recycle, energy recovery and disposal.

4.11.1.2 Impacts

The EIS indicates that wastes generated by the project have the potential to create environmental or social impacts upon the community, road transport, air quality, water (surface and groundwater) quality, soil quality, hazard and risk associated with the project, and visual amenity of the site and the surrounding environment if they are not suitably managed. It indicated that potential impacts primarily include a risk of generating acidic, saline or metalliferous runoff and seepage from the new waste rock dump, the new TSF and the wall rock within the Nolans and Sarsfield pits.

The EIS estimated that the quantities of project waste are generally continuations of the existing waste stream from the site and not expected to impact existing off site waste disposal services.

The EIS noted that the project would require: landfill for hard waste including scats (steel grinding balls and unbroken rock from the processing plant) and rubber; two STP for sewage, an approximately 223ha waste rock dump (WRD); hydrocarbon bioremediation pad; and a new tailings storage facility (TSF).

The project will also require the decommissioning of the Ravenswood community landfill as it will be covered by the proposed TSF. The EIS states that the CTRC will be required to locate and construct a new community landfill off-site, consequently that action was not assessed in the EIS.

Project waste to be taken off-site would include metal for recycling, waste oil and oily water, batteries, sewage sludge and regulated wastes such as acids, bases, solvents detergents etc.

The EIS provided a waste inventory of predicted wastes and details of waste types, estimated quantities and project design features and processes relevant to waste management.

The EIS noted that significant quantities of diverse hard wastes will be placed in the WRD including general waste, clinical waste, chemical containers, rubber hose and conveyor, steel crushing circuit screens, decommissioned crushing plant, concrete, timber and heavy tyres. This facility will therefore be referred to in this report as an integrated waste rock dump (IWRD) to clarify the additional risk of impacts through inclusion of the hard waste stream.

Waste tailings and processing chemicals would be disposed to the new 232ha Sarsfield TSF which would have three cells constructed around and connected to the existing Nolans TSF, it would have capacity for 89Mt of tailings. Supernatant and leachate from the TSF would be pumped to a new decant pond. Tailings were characterised in the EIS; the tailings in the Sarsfield pit are known to have an elevated risk of acid generation compared to the expected tailings generated by ore processing under the expansion plan. The EIS stated that acid generation is linked to the elevated sulphate of the Mount Wright tailings. Of the new proposed processing, approximately 30% of its tailings are considered potentially acid forming (PAF).

Excess mine affected water and tailings supernatant would be disposed to air through evaporation using a system of fans drawing water from the pit or TSF at various stages of the project. Initially 11GL of pit water would need disposal and thereafter approximately 850ML per day of excess water.

Sewage effluent at the accommodation village would be disposed to the golf course after treatment and at the mine site to a septic tank and leach drain on-site.

4.11.1.3 Avoidance, mitigation and management measures

The EIS stated that avoidance, mitigation and management measures from the current operation would be applied along with additional measures to account for the increased waste from the project and to achieve the identified environmental protection objectives. Those along with details of training programs, monitoring and measurement programs were described.

Principal measures were: minimising scale (ie of footprints); reuse of site and process water where possible; separation of clean and dirty surface water and runoff; substituting materials with less hazardous ones if possible; implementing waste management plans and procedures; and managing tailings to minimise standing water, maximise water recovery, recover reagents and reduce raw water pumping. The accommodation STP would be improved to Class A treatment and all effluent is proposed to be irrigated to the golf course.

The EIS stated the need to design, re-establish and progressively encapsulate the project hard waste area in accordance with relevant legislation, guidelines and policies and in line with best industry practice and that the hard waste area will be managed in accordance with an as yet undeveloped Waste Management Procedure. The extent to which the guidelines and procedures will address the site sensitivities and risk about seepage entering the groundwater under the dump is not explained in the EIS.

The EIS stated that TSF would be designed and constructed according to the Tailings Management Guideline of the Technical Guidelines for the Environmental Management of Exploration and Mining in Queensland, ANCOLD guidelines and the EHP manual for assessing hazard categories and hydraulic performance of dams. The TSF was assessed in the EIS as a “significant consequence” dam to be constructed by cut and fill with starter embankments and base lined with a 1.5mm HDPE liner. An underdrainage collection system would lie over the liner to capture leachate from under the tailings. Leachate would be pumped to the decant pond. A toe drain around the Nolans TSF would intercept the shallow component of current seepage from that TSF before it interacted with the new TSF. A leakage detection system is proposed under the liner of the new TSF, however only detecting approximately 10% of any leakage.

4.11.1.4 Outstanding issues

A mine closure plan is not fully developed and will have to specifically address waste minimisation and disposal for the decommissioning phase.

Potential impacts of the IWRD, decant pond and TSF were not detailed in the waste section of the EIS, they were inadequately covered in other directly relevant sections of the EIS such as groundwater and surface water. The potential risks are discussed in more detail in this report at sections 4.13 and 0.

Potential impacts of the evaporative fan system disposal of mine affected water and tailings supernatant was not suitably explained in the EIS, it does not clearly describe how this risk will be managed.

A waste management procedure has not been developed for the IWRD including hard waste disposal area, the potential impacts to groundwater and surface water from that facility is not addressed.

4.11.1.5 Conclusions and recommendations

The waste management approach appeared to follow typical industry approaches and was addressed in sufficient detail by the EIS apart from potential impacts from the incorporated waste rock and hard waste dump, tailings storage facility, management of dust suppression water quality and the evaporative disposal of mine affected water. Those elements must be suitably resolved prior to considering approval of the project.

4.11.2 Mine waste/waste rock and overburden

4.11.2.1 Existing values

The EIS provided an evaluation of the waste rock and tailings based on a range of suitable assessments and founded on an assumption that there was little geological distinction between the Sarsfield and Nolans pits. The EIS also included geochemical characterisation of waste rock from both pits and determined that the principal considerations in the EIS were about potential for acid rock drainage and stated that the assessment was based on considering the baseline conditions to be the exiting situation including the problematic Nolans TSF and Sarsfield waste rock dump.

4.11.2.2 Impacts

A 223ha waste rock dump, over 42m high, is proposed in the EIS. It would store 143Mt of waste rock, tyres, abandoned plant, and scats or rejects from the ore grinding process. The EIS states that the waste rock would include 45Mt of potentially acid forming (PAF) and 96Mt of non-acid forming (NAF) material. The PAF is associated with sulphide material and is predominantly to come from the Sarsfield pit. The EIS stated that geochemical-related impacts are expected to be dominated by leachate and seepage that would impact groundwater and surface waters unless managed. Seepage and leachate are stated in the EIS to likely include elevated sulphate concentrations (up to 2700mg/L), concentrations of metals and metalloids and near-neutral pH.

Currently the existing WRD is contributing contaminants to the surface and groundwater at the site; these existing impacts are specifically discussed in sections 4.13 and 0 of this report respectively. The existing conditions on site reflect strongly the significant impacts of the existing operation, in particular from the unlined TSF and WRD. These are described as existing conditions in reviewing the EIS, but are also interpreted by advisory bodies as actual examples of potential impacts of the proposal if suitable mitigation and management regimes are not applied. The EIS did not specifically address the likely potential impact of the integrated waste dump on groundwater it based the assessment on a premise that the new IWRD would continue to pose the same potential impacts as the current WRD.

4.11.2.3 Avoidance, mitigation and management measures

The waste rock dump is stated by the EIS to have been designed in accordance with the Technical Guidelines for the Environmental Management of Exploration and Mining in Queensland and to have sufficient capacity to store all the waste rock produced by the project. PAF material would be encapsulated in NAF for example, at least a 30m buffer from PAF to the outer wall toe, at least 10m from any outer wall, and a NAF base of minimum 2m thick. On closure, the design aim is for internally draining runoff directed back toward the pit. The dump would have a store and release cover to manage rainfall and be designed to manage erosion including rock armouring.

The EIS stated that environmental management of waste rock will be addressed in a waste rock management procedure, which will be developed for the project and that further and continued characterisation of waste rock prior to and during operations would be implemented. The waste rock management procedure would include assigning either NAF or PAF classification to waste rock blocks, placement and use of NAF waste rock and encapsulation of PAF waste rock.

4.11.2.4 Outstanding issues

The EIS acknowledges that the operation of the new IWRD will continue to create proportionately greater and longer residual environmental impacts to ground and surface water that are known from the existing WRD.

The entire process of avoidance, mitigation and management presented in the EIS relies upon diligent on-ground implementation of a waste rock management plan that has not yet been developed to ensure that PAF material is being managed to appropriately mitigate impacts. That management plan is critical to the minimisation of environmental impacts and must be completed prior to the activities commencing.

The management of seepage to groundwater is limited to extraction of that adjacent to the toe of the IWRD through shallow trenches and there is no direct measure or mitigation of seepage under the IWRD. Given the known high vertical transmission of seepage at the site, the predominant flow of seepage is likely to be vertical until it intercepts a groundwater mound or basement material. Shallow toe drains will likely be of very limited use in managing impacts of seepage or monitoring performance of the IWRD.

4.11.2.5 Conclusions and recommendations

There remains a significant potential environmental risk from the project of seepage of contaminated water and runoff from the WRD related to the confirmed characteristics of the porous natural foundation of the WRD, the measured quality of waste rock including components that are PAF and the unspecified potential impact of leachate from the large volumes of varied hard waste that are proposed to be disposed within the WRD.

The impact would be likely direct to groundwater and then to surface waters and there is inadequate assessment of the ability of the detection, management or recovery of seepage under the WRD.

Before the project proceeds the effectiveness of the mitigation measures should be fully assessed and residual potential impacts to ground and surface water specified against the relevant environmental values so that an acceptability assessment can be made.

Before the activity proceeds the specifics of the proposal to manage the waste rock to achieve environmental objectives should be provided in a waste rock management plan.

4.12 Mine water management

4.12.1 Mine affected water

The EIS described a proposed mine water management system, including supply and use. Details of the water supply and use are provided in section 2.12 of this report.

Sources of mine affected water described in the EIS included: process water; pit water from surface runoff or from subsurface flow; contaminated groundwater from existing operations; tailings leachate and supernatant; and seepage from the TSF and IWRD.

Water balance modelling conducted for the EIS concluded that on average there will be an estimated 850kL/day of surplus mine affected water generated on-site. The EIS stated this excess will variously be used to minimise raw water pumping, otherwise be lost to passive evaporation, or disposed to air through operation of evaporation fans.

Mine affected water storages proposed would include process water pond (30ML) Sarsfield TSF (49GL) and decant pond (350ML). The proposal also includes an unspecified number of 1ML storage ponds noted as being used for dust suppression and fire-fighting. However, for these storages there is no mention of the typical water quality or management of their contents. The EIS includes that sediment basins will also be used to temporality store water. It also appears to include mine affected water in those though there are no specific statements around the management of water inputs or output or water quality within those basins.

Water that enters the pits from surface runoff or from subsurface flow will be drained to sumps and pumped from the pits on a continuous basis to the water cart standpipe (which consists of a dam and/or tank and water-filling equipment) for dust suppression or, if needed, to the process water pond. The EIS stated that when deemed of suitable water quality, the pit runoff and sump water will be used as a first preference for dust suppression on the haul road. There is no detail of the appropriate quality standards or systems for managing risks of contamination from the mine affected water.

Water evaporation fans are proposed initially over the Sarsfield pit to dispose of 11GL of excess water in the pit before dredging starts. The EIS stated that the fans will then be relocated to the southern walls of the Nolans (existing) TSF for continued disposal of mine affected water and tailings water through evaporation. The EIS stated that fans will operate with a management system depending on weather conditions. However there is little information about potential impacts and water quality and where contaminants will ultimately go.

4.12.2 Potential impacts

The EIS stated that mine affected water, tailings leachate and supernatant and water produced by Sarsfield pit dewatering will have elevated levels of total dissolved solids, sulphate, metals and cyanide. The EIS stated that excess water would be disposed into air through an evaporation fan system. There is some ambiguity in the EIS about proposed application of mine affected water as a dust suppressant.

There are significant potential impacts associated with mine affected water including to groundwater and surface water and for contamination of otherwise "clean" site areas. There are questions about the potential human health implications of the evaporation fan mist if inhaled or in contact with skin.

Those risks are detailed in sections 4.13 and 4.23 of this report respectively.

4.12.3 Avoidance, mitigation and management measures

The EIS stated that the decant pond will be double lined, with a HDPE and a geosynthetic clay liner, and the new TSF will be lined with a HDPE liner. The liners are proposed to reduce the leakage of mine affected water that would contaminate ground and surface water.

The evaporative fan system is stated as being automated to operate only in suitable weather conditions.

Management measures are not well developed around the operation of the numerous water storages including the need for lining, measurement of quality and triggers for the use of their contents on-site for dust suppression.

4.12.4 Outstanding issues

The potential for significant environmental impact to surface and groundwater from contaminated mine affected water is acknowledged in the EIS. The level of detail around how the various water storages would be operated including the knowledge of their contents, suitability of the containment of seepage, and use of or disposal of the contents is generally deficient in the EIS to allow certainty that they will be operated to effectively achieve a suitable environmental outcome.

The evaporative fan system in particular carries unknown risk to human health, site contamination and surface water impacts. There is very little detail about how the system would operate, if it can operate within a safe and environmentally acceptable fashion and still perform effectively as a water disposal method. There is no alternative disposal method proposed for the expected 850KL/day excess contaminated water.

4.12.5 Conclusions and recommendations

That before consideration about approval of the project:

- an assessment of the numerous water storages that could contain contaminated water be made to ascertain their need for seepage prevention and detection, management and monitoring of their contents and control over the disposal or use of the water
- the evaporation fan system or an alternative disposal system be suitably explained to address it's effective operation while managing risks including to human health, surface water quality and land contamination.

4.13 Surface water

4.13.1 Existing values

The EIS identified surface water environmental values in the area to include agricultural stock watering, recreational, ecological values, and cultural and spiritual values. The EIS noted that surface water is generally not suitable for potable use without treatment and therefore potable use was not considered an environmental value.

The existing surface water quality was poor, existing conditions on-site reflect strongly the significant impacts of the existing operation, in particular the unlined TSF and WRD. So whilst described as existing conditions in reviewing the EIS these are also interpreted by advisory bodies as examples of potential impact of the project if suitable mitigation and management regimes are not applied.

Based on the climatic conditions at the site, water quality fluctuated over the monitoring periods as flows halted and ponds dried up. Surface water quality was noted to exceed the stock watering guidelines primarily driven by sulphate concentrations.

The EIS noted that there were elevated concentrations of copper, cyanide and nitrate recorded in surface water. For example, copper concentrations were up to 0.45mg/L and cyanide concentrations up to approximately 4.5mg/L.

Consistent with groundwater quality, there was an increasing trend in sulphate concentrations in surface waters at

the site which has continued since 1995, when deposition of tailings into the Nolans TSF commenced. Sulphate concentrations are currently between 2000 and 3000mg/L. TDS concentrations followed similar trends to sulphate.

The EIS stated that recorded contaminant levels in surface waters suggest that the surface water at some locations is largely groundwater derived, that is, recorded surface water is actually contaminated seepage from the Nolans TSF. The field studies confirmed that groundwater from the TSF and WRD seepage was expressed as surface water in the gullies which flow directly to Sandy Creek.

4.13.2 Impacts

The characterisation of seepage and the current surface water quality data are demonstration of current impacts from the Nolans TSF and WRD. This highlights that failure to contain the tailings and IWRD leachates of the project will continue to have long term ecological impact including on values of groundwater and surface water. The impacts are also likely to extend off-site if not mitigated.

The EIS noted that any lined TSF will result in some seepage to groundwater during operations due to unavoidable deterioration and potential tearing of the HDPE liner. The EIS was not able to confirm the actual seepage rate however modelled a range of values to take into account of a range of defects and deterioration in the liner. It stated that once in operation the seepage would be of similar composition to that from the existing Nolans seepage and it would flow through the Deco aquifer and reach Sandy Creek. The EIS noted that dilution from rainfall recharge of groundwater and surface flow would influence the contaminant concentrations that reach Sandy Creek. The climate section of the EIS demonstrated that rainfall is limited on-site and is predominantly in summer months with little or no rain for the majority of the year. The EIS did not include definitive statements about the likely specifics of water quality in the surface waters or in Sandy Creek.

The EIS noted the potential for erosion and sediment mobilisation were also risks from the project to surface water quality. The main project activities identified that would have the potential to increase sedimentation in surface water included the construction of the acoustic bund, waste rock dump and the Sarsfield TSF. The highest risk period was stated as during vegetation clearance and before the TSF and the waste rock dump bunds were high enough to contain all rainfall and runoff internally. Specific impacts were not defined however mitigation measures were proposed including construction of sediment detention basins.

The EIS proposed to use evaporative fans to remove excess mine affected water however failed to provide consideration or detail about the potential for impacts of that, including on surface water quality. Advisory body responses noted that if not suitably managed, the drift of spray from that evaporative fan operation would deliver contaminants from the tailings and other mine and process affected water onto areas affecting surface water quality.

The EIS proposes the use of mine water for dust suppression. However, the EIS does not provide details of a management and testing process to ensure that water that did not meet the appropriate standards would not be used for dust suppression. There is a risk that use of contaminated water could impact on surface waters.

The EIS impact assessments identified residual significance of impacts, following the implementation of avoidance, mitigation and management measures. All residual impacts were assessed as having low or negligible residual significance, with the exception of the operation of the TSF which the EIS states could lead to contamination of surface water and stream bed sediment quality through contaminated seepage and leachate from the TSF cells and decant pond and risk of TSF wall failure and subsequent discharge of tailings and other contaminants downstream. Despite that the risks were clarified as a residual that is already mitigated or managed, the EIS states that those activities would have to be further controlled by design constraints. No further detail was provided. The EIS includes a commitment to further define a suitable outcome in conjunction with the appropriate authorities.

4.13.3 Avoidance, mitigation and management measures

The EIS confirmed that discharge of excess water to Sandy Creek, as originally proposed, would no longer be considered for the project.

Mitigation measures and commitments for surface water were presented in the EIS to reduce the impacts on environmental values. Because the most significant threats to surface water quality from the project relate to contamination of groundwater, many of those mitigation and management measures are identical to those proposed for waste management (see section 4.11 of this report) and groundwater protection (see section 4.14 of this report) and are discussed in those sections of this report, not repeated here.

Water management within the project area was described in the EIS and included capturing runoff and some seepage and transporting that to water storages on-site for appropriate management such as reuse in the mining process. Surface water storages are described. Design and construction of the TSF would follow appropriate guidelines and practice.

A limited leakage monitoring system is proposed for inclusion under the HDPE liner and comprises of leak detection drains, piezometers, and monitoring/recovery groundwater bores.

The EIS committed to install stream monitoring stations at two sites on Sandy Creek – a reference site and a site downstream of the project area, to monitor surface water flows. Monitoring would occur in conjunction with a wider surface water monitoring program and inspection regime for the project. The EIS committed to provide results to the government consistent with the conditions of approval. Water quality data would be used to prepare local water quality objectives in accordance with the Queensland Water Quality Guidelines and to protect the approved environmental values.

The EIS states that sediment generation and mobilisation to watercourses would be minimised through design features and sequencing of construction activities, in particular for the TSF and waste rock dump. For example, infrastructure would be constructed such that it becomes internally draining as soon as possible.

Sediment detention basins would be constructed to limit the mobilisation of sediment to receiving waters, with runoff collected in these basins reporting to the decant pond. Basins would be designed to ensure that the entire basin could be discharged within a suitable timeframe. Short term sediment detention basins would be constructed to control runoff during the initial clearance of vegetation and ground disturbance. These sediment detention basins would be constructed around the Sarsfield TSF, waste rock dump and acoustic bund. Longer term detention basins would be smaller and would assist in managing runoff from the externally draining outer batters of the Sarsfield TSF and IWRD.

The EIS stated that erosion risk would be minimal throughout the full spectrum of probable events. However flooding presents a regular risk of sedimentation in Sandy Creek from erosion where the southeast edge of both the TSF and waste rock dump extend into the 1 in 2 ARI flood envelope. The EIS stated that the risk would be mitigated through standard design measures and rock armouring for the relevant areas of the TSF.

4.13.4 Outstanding issues

The characterisation of seepage and the current surface water quality data demonstrate the ongoing contamination of surface water from the operation. This highlights that failure to contain the tailings and IWRD leachates of the project would continue to have long term impact on ecological and values of groundwater and surface water with likelihood to extend off-site if not mitigated. There remains a residual risk of significant impact to surface water quality from the proposal.

The management of seepage quality and volume from the IWRD is not fully resolved. The proposals for leak detection beneath the TSF are not acceptable on the basis of:

- difficulty in resolving between the existing contaminated groundwater mound and new contributions from the project
- low coverage (10% cover) of proposed seepage collection and reporting under the TSF
- slow (multiyear) response on the basis of bore hole monitoring for migration of a contaminated plume
- coarse resolution on the basis of water mass balance.

There is inadequate consideration in the EIS of the detection of leakage under the decant pond.

The proposal for evaporation of mine affected water and tailings supernatant using fans has the potential to impact surface water quality and the EIS does not clearly described how this risk will be managed.

The EIS did not specify a suitable standard for water to be acceptable in use as a dust suppressant. Nor did it detail a management and testing process to ensure that water that does not meet the appropriate standard is not used for dust suppression. There is a risk that contaminated water utilised could impact surface waters.

4.13.5 Conclusions and recommendations

Despite claims in the EIS that the residual impacts of mobilisation of sediment and contaminants to the receiving environment would be substantially reduced when the proposed management measures were in place, several advisory bodies submitted that the assessment of impacts on surface waters and proposed management measures in the EIS were inadequate. The information presented in the EIS clearly shows that there are significant issues to be resolved in relation to the proposed project associated with impacts on surface waters, including IWRB, TSF, evaporative fan use and quality management of water used for dust suppression.

4.14 Groundwater

4.14.1 Existing values

The EIS identified groundwater uses in the region to include stock watering bores and support of ground and surface water ecology, it noted that groundwater is not used as a source of drinking water.

Two broad aquifer systems were identified within the groundwater study area: a shallow upper regolith aquifer and a lower fractured and unfractured basement aquifer. The upper aquifer was described as made up of decomposed and weathered porous material with a series of linear permeable zones associated with fault zones, which are surrounded by lower permeability material. The shallow aquifer typically starts 5-7m below ground level and varies vertically from 0-30m thickness. The shallow system is recharged by river recharge, direct infiltration of rainfall runoff, and seepage from the Nolans TSF and waste rock dumps; it discharges naturally to local surface water systems such as Sandy Creek. There is vertical connectivity to the underlying basement aquifer.

The basement aquifer consists of lower permeability rock with fracturing including along river drainage and fault zones. The basement was largely intercepted at depths of 13-19m below ground level and its vertical thickness is unknown. The aquifer is recharged by vertical leakage from the overlying aquifer, particularly where fracture zones interface.

The EIS noted contaminated seepage into groundwater from the Nolans TSF was approximately 1,500 m^3/day and that had created a contaminated water table mound beneath (and within) the Nolans TSF, from which contaminated groundwater now flows both north into the Sarsfield pit and south into Sandy Creek. The EIS noted that within the general groundwater flow there are preferred flow pathways associated with the high permeability fault zones within the shallow aquifer.

Modelling for the EIS indicated that the rate of seepage is expected to gradually decrease over the next approximately 25 years to a seepage rate of less than 20m^3/day until it ultimately ceases. An existing seepage recovery system using groundwater pumping from three boreholes is in place to reduce the volume of contaminated groundwater from Nolans TSF discharging to Sandy Creek.

The groundwater is described in the EIS as having low metals concentration and neutral to alkaline pH and elevated sulphate. It noted that sulphate has been increasing in concentration in observation bores at the Nolans TSF to levels of over 2500mg/L. The EIS stated that the rate of increase has apparently slowed since about 2010. Total dissolved solids (TDS) concentrations in groundwater are strongly influenced by sulphate concentrations, and have consequently followed similar trends.

The EIS states that groundwater concentrations of arsenic, cadmium, copper, iron, manganese, nickel, lead and zinc have not increased substantially over time as a result of tailings deposition in the Nolans TSF.

4.14.2 Impacts

4.14.2.1 Seepage

The EIS states that the HDPE liner beneath the Sarsfield TSF would contain much of the leachate during operations and seepage to groundwater was estimated to be 55m^3/day. The tailings to be deposited in the Sarsfield TSF are expected to have characteristics very similar to the tailings deposited into the Nolans TSF, and the EIS assumed that the seepage would be of similar composition – i.e. close to neutral pH, including arsenic, cadmium, copper, iron, manganese, nickel, lead and zinc and significantly elevated sulphate (2300mg/L) and TDS.

The EIS indicates that the geochemical characteristics of the deco aquifer would initially partially remove arsenic, copper, lead and manganese from seepage through precipitation. It predicted that the combined maximum seepage to groundwater from the rehabilitated Nolans TSF and the proposed Sarsfield TSF during operations would be 153.5m^3/day and it would flow through the Deco aquifer and reach Sandy Creek. Modelling in the EIS predicted that seepage from the proposed Sarsfield TSF would continue for at least approximately 20 years post-closure.

The EIS states that the groundwater recovery bores have the volumetric capacity to recover all the seepage generated during operations, however noted that seepage would bypass the recovery system and flow to Sandy Creek. It stated that dissolved arsenic, copper and zinc loads are predicted to be low under all scenarios. Predicted maximum annual load values are: Arsenic 0.111kg, copper 0.113, zinc 0.394kg, nitrogen 187.59kg. The EIS concluded that contaminant loads are unlikely to result in downstream toxicity.

The EIS concludes that with the groundwater and surface water management measures in place, downstream watercourses (Plumtree Creek, Kirk River and Burdekin River) are not expected to show elevated concentrations of sulphate above existing levels and there are no adverse impacts expected upon beneficial uses or sensitive environments as a result of project activities.

The EIS contended that the environment in which the proposed Sarsfield TSF is located to be of low environmental value and therefore any anticipated reasonable seepage, leaks, spills and losses from the proposed facility would be unlikely to cause unacceptable environmental harm.

4.14.2.2 Pit void

The EIS states that the pit void would remain as a groundwater sink post-closure. Post mining groundwater inflows and surface water runoff would cause a lake to develop within the pit void. Over time an equilibrium water level would develop as a balance between evaporation and inflows. That level is modelled to be approximately 75m below the pre-mining water table and 135m below the pit crest, approximately 265m deep. The actual water level is expected to fluctuate on a seasonal and annual basis, depending on natural variability in rainfall, groundwater flow and evaporation. The EIS concludes that the pit would remain a groundwater sink in the long-term, with groundwater flowing towards the pit and that evaporative concentration would cause the pit lake to become progressively more saline; it is predicted to reach 3500mg/L 100 years post-closure and 19,000mg/L after 1000 years. The EIS contends that because groundwater would flow towards the pit, the high salinity concentrations within the pit void would have no impact on the surrounding groundwater.

4.14.3 Avoidance, mitigation and management measures

The EIS included a range of mitigation and management measures including to:

- increase the waste rock dump height rather than its lateral extent to minimise the expansion of its horizontal seepage area
- any potentially contaminated shallow seepage adjacent to the waste rock dumps would be managed by collection of the seepage in trenches in targeted locations and pumped back to the decant pond for reuse or disposal
- progressively rehabilitate non-operational areas of the waste rock dump with a suitable capping (e.g., clay or other low permeability material) to limit water infiltration.
- install a HDPE geomembrane underlain by a Geosythetic Clay Liner (GCL) (a double liner) within the decant pond
- thicken tailings to minimise standing water and therefore seepage from the TSF
- line the base of the Sarsfield TSF with a HDPE liner
- install an underdrainage system on top of the liner and pump leachate to a lined decant pond
- continue groundwater pump out and install additional bores around the new TSF
- a leak detection system is proposed to cover 10% of the liner and provide indicative measures of seepage quantity and quality
- post-closure the TSF will be capped to manage the ingress of rainfall into the TSF

4.14.4 Outstanding issues

There are clear indications that the current mine operations, including a waste rock dump, a decant pond and TSF is not complying with the existing approval requirements, and is having unacceptable impacts on the environment through the groundwater. The challenges in resolving the current situation revolve around complex local pathways for groundwater, low aquifer permeability and apparent direct connections between shallow groundwater surface water such as Sandy Creek. These challenges would apply equally to the new works proposed in the EIS.

The statement of potential impacts in the EIS does not adequately consider impacts on aquatic values. Consequently, actual impacts on ecological values would be likely to be significantly higher than stated in the EIS.

Although the expanded TSF and IWRD would be constructed on areas of significant shearing and jointing in the underlying rock, it was unclear from the EIS how this would be addressed in assessing and managing the risk of contaminated groundwater seepage, particularly from the unlined IWRD.

More clearly defined operational controls and operational procedures are required than was provided in the EIS, to detail the environmental risk from operation of the IWRD. There is a need for development of a waste rock management procedure that details measures to avoid acid rock drainage problems including for example:

- characterisation of waste rock
- assignment of either NAF or PAF classification to waste rock blocks,
- placement and use of NAF waste rock, and appropriate encapsulated disposal of PAF waste rock
- measures to minimise potentially contaminated seepage to groundwater under the WRD
- monitoring of performance against the above.

The current proposal involving no leak detection beneath the decant pond and only 10% coverage of leak detection under the TSF are clearly inadequate given the environmental risks identified in the EIS. A suitable means to confirm the performance of both lining systems should be developed prior to considering approval of the project.

A number of proposals associated with leak detection were inadequate in the EIS, including:

- the modelled mass balance for water was relatively course and unable to resolve water losses other than major losses,
- current groundwater monitoring bores are already contaminated due to an existing groundwater plume and, as a result, are unsuitable for using in detecting and managing contaminant leakages from the new TSF,
- leaks of contaminants to groundwater are likely to take over two years to reach the boundary of the new TSF – such a delay is considered to be too long to allow effective responses and remediation.

The potential for preferential groundwater pathways through locally complex, low-permeability strike-slip faults and shear zones (not currently identified or targeted by the limited bore holes) suggests that additional monitoring bores (including reference bores) are required to enable proper detection and management of contaminant leakages to groundwater.

4.14.5 Conclusions and recommendations

Despite the studies included in the EIS, significant uncertainties remain around the ability of the proposed system of trenches and bores to intercept and recover any contaminated seepage leaking through TSF liners. Much of this uncertainty relates to the complexity of local faults and low permeability zones found on the project site. A detailed, peer reviewed assessment of suitable leakage management and mitigation measures is required to ensure that seepage is managed appropriately during the construction and operation of the TSF to prevent unacceptable impacts on environmental values. In particular a leakage detection system providing 100% coverage appears necessary for each lined storage facility.

4.15 Ecology

4.15.1 Broad site values

The project is located on the western slopes of the Leichhardt Range, within the Broken River subregion of the Einasleigh Uplands bioregion. The project is located southeast of the bioregion, in an area where land use is dominated by cattle grazing and a long history of gold mining. The EIS stated that, as a result of industry and grazing, much of the native vegetation around Ravenswood was removed for fuel during the late 1800s and that the landscape around the study area is now highly disturbed, and the natural ecosystems have been severely impacted by extensive clearing, weed invasion and soil erosion.

The EIS noted that, whilst the bioregion as a whole is considered to be a national biodiversity hotspot (comprising high habitat diversity and a number of specialised and restricted habitat types, as well as endemic species populations and threatened species), the habitats present in the desktop study area are widespread and common to the wider region. The EIS stated that whilst the study area was used by 'endangered', 'vulnerable' or 'near-threatened' (EVNT) species, it lacked important habitat for them.

The Leichardt Range is mapped as a 'state significant corridor' under the Biodiversity Planning Assessment (BPA) Einasleigh Uplands Bioregion that includes, for this project, the upper reaches of Sandy Creek and the eastern areas of the site.

The EIS noted that a 'bioregional wildlife corridor' covered a northern portion of the site. That corridor forms part of the western margins of the Wet Tropics – Einasleigh Uplands Ecotone, following the narrow band of wet and dry sclerophyll forest and woodland along the western margin of the Wet Tropics bioregion and the eastern margin of the Einasleigh Uplands. Consequently the EIS assigned state significant biodiversity value of the 'bioregional wildlife corridor' to the relevant woodland vegetation (regional ecosystem 9.3.1) in the southern parts of the site.

The EIS stated that high-value ecosystems were limited across the site, restricted to the riparian habitats (such as regional ecosystem 9.3.1), significant because they provide drought refuge and wildlife corridors and are used by arboreal mammals.

The site was described as being 25% remnant vegetation (478ha), mainly in the southern and eastern portions, and 75% non-remnant vegetation (1423ha) associated with regrowth vegetation, cleared areas and an artificial water body. The existing Ravenswood Gold Mine has a disturbance area of approximately 392ha.

4.15.2 General impacting processes

The EIS described three main categories of activity with the potential to impact on terrestrial ecology values:

- loss or modification of habitat and fauna mortality. For example the EIS stated that vegetation clearing, including of approximately 92.4ha of remnant vegetation, would result in habitat loss including for threatened species
- edge effects, such as displacement of native ground cover and canopy dieback, which can lead to long term changes in habitat composition, displace fauna and encourage weed species to colonise
- habitat fragmentation, where vegetation clearing may increase barriers to movement, isolate populations, reduce movement and increase pest flora and fauna access.

4.15.3 Flora

4.15.3.1 Existing values

325 flora species were identified for the site from both desktop studies and field surveys. Field surveys confirmed 264 of the flora species identified from the desktop studies, including the "near threatened" large-podded trefoil, 13 regionally significant flora species and 72 non-native flora species.

The EIS stated that four flora species, listed as either 'endangered', 'vulnerable' or 'near-threatened' under the *Nature Conservation Act 1992* (NCA) potentially occurred within the study area:

- Large-podded trefoil (*Desmodium macrocarpum*) - 'near threatened' was confirmed on-site
- *Tephrosia leveillei* - 'vulnerable' has the potential to occur within or in proximity to the site
- *Peripleura scabra* - 'near threatened' has the potential to occur within or in proximity to the site
- *Acacia jackesiana* - 'near threatened' has the potential to occur within or in proximity to the site.

Four large-podded trefoil individuals were recorded within regional ecosystem 9.12.1b, distributed over two locations within the field study area. The remaining three species were not recorded in field surveys.

Four regional ecosystems (REs) were mapped on the site: REs 9.3.1, 9.3.3c, 9.3.10 and 9.12.1b.

No areas of mature regrowth were mapped as present within the study area.

No ecological communities of national significance were identified or are known to occur within the field study area.

Seventy two introduced flora species were recorded in the study area, including eight species of declared weeds

The EIS concluded that, despite the degraded nature of the site, it had a good diversity and abundance of native species and, in particular, in woodland areas where woody weeds have been controlled and grazing has been removed that the species diversity in the shrub and ground cover layer was high.

4.15.3.2 Impacts

The EIS stated that the project would result in vegetation clearing, habitat fragmentation and edge effects that would all impact on the site's flora values.

The EIS assessed that the project footprint would cover approximately 511ha and require clearing of 113ha of remnant vegetation (regional ecosystems) and 398ha of non-remnant vegetation and previously cleared areas.

The EIS concluded that whilst three regional ecosystems were mapped in the study area only two would be impacted in the footprint, they are:

- 108.6ha of RE. 9.12.1b Open-woodland to low open woodland of *Eucalyptus xanthoclada* (yellow-branched ironbark) +/- *Corymbia erythrophloia* (red bloodwood) +/- *Corymbia* spp. +/- *Eucalyptus* spp.
- 4.4ha of RE 9.3.1 *Eucalyptus camaldulensis* or *E. tereticornis* +/- *Casuarina cunninghamiana* +/- *Melaleuca spp*. fringing woodland on channels and levees.

It appears that other impacts to the RE's would occur, for example through the noted edge effects and activities adjacent to the constructed footprint, however it is not certain to what extent the EIS has included those likely impacts in the estimated impact noted above.

4.15.3.3 Avoidance, mitigation and management measures

The EIS presented a range of mitigation and management measures for flora, including training of field staff, early rehabilitation, preconstruction surveys with qualified ecologists to identify flora matters and updating of weed plans.

Specifically for EVNT, plans include pre-clear surveys, plant identification and considering relocation of individuals from the clearing footprint. Offsets proposed in the EIS to replace lost flora values are described in section 4.15.6 of this report.

4.15.3.4 Outstanding issues

Several commitments were provided in the EIS about management and mitigation of impacts to flora values. To be effective, those commitments should be formally reviewed and incorporated into the appropriate elements of the management information associated with any approvals for this project, if it should proceed.

Offsets required under Queensland Biodiversity Offsets Policy (QBOP) relating to flora values are described further in section 4.15.6 of this report.

4.15.3.5 Conclusions and recommendations

The EIS suitably notes the site values, potential impacts and provides a commitment to a range of mitigation and management measures to control impacts to flora values. Those actions should be formally attached to any approval subsequently granted for the project, and where required, offsets be confirmed and implemented according to the QBOP.

4.15.4 Fauna

4.15.4.1 Existing values

The terrestrial ecology field surveys identified 167 fauna species comprising 102 birds, 30 mammals, 27 reptiles and eight frogs on-site. The EIS noted that three EPBC Act listed terrestrial fauna species have the potential to occur within the project area:

- Southern subspecies of squatter pigeon (*Geophaps scripta scripta*)
- Southern subspecies of black-throated finch (*Poephila cincta cincta*)
- Koala (*Phascolarctos cinereus*).

The EIS noted that the squatter pigeon was recorded in field surveys and despite the site being in the "hybrid zone" of the northern and southern sub-species of squatter pigeon, it conservatively considered them as being the 'vulnerable' southern sub-species.

The EIS noted that the black-throated finch is recorded in the area, was not identified in field surveys, but considered likely to be present.

The EIS identified koala habitat within riparian vegetation of Sandy Creek and noted that previous studies had found signs of koala activity immediately upstream of the project site, however stated that the predicted impacts would not include koala habitat.

The EIS noted that the EPBC Act listed migratory species, rainbow bee-eater (*Merops ornatus*) was recorded on site and was widespread and common within the local region.

Consideration of the EIS's assessment of EPBC fauna matters is described in more detail in section 4.25 of this report.

Three fauna species listed under the NCA were considered by the EIS to be potentially present within the study area. Of those, the Little pied bat (*Chalinolobus picatus*) (near threatened) was recorded on-site and is expected to be widespread throughout the woodland and riparian habitats surrounding the project area. Whilst not identified on site, habitat for the Short-beaked echidna (*Tachyglossus aculeatus*) was identified and is included in the offset proposal discussed in section 4.15.6 below.

The EIS stated that diversity and abundance of pest fauna species was high, in particular pigs, goats and cats.

4.15.4.2 Impacts

The EIS stated that the project would result in vegetation clearing, habitat fragmentation and edge effects that would all impact on the sites fauna values. The EIS assessed that the project footprint would cover approximately 511ha and require clearing of 113ha of remnant vegetation and 398ha of non-remnant vegetation and previously cleared areas. The EIS states that two RE's would be impacted in the footprint, they are:

- 108.6ha of RE. 9.12.1b Open-woodland to low open woodland of *Eucalyptus xanthoclada* (yellow-branched ironbark) +/- *Corymbia erythrophloia* (red bloodwood) +/- *Corymbia spp*. +/- *Eucalyptus spp*.
- 4.4ha of RE 9.3.1 *Eucalyptus camaldulensis* or *E. tereticornis* +/- *Casuarina cunninghamiana* +/- *Melaleuca spp*. fringing woodland on channels and levees.

It appears that other impacts to fauna would occur, for example the EIS notes edge effects, activities adjacent to the constructed footprint, light spill, noise and vibration, and fauna displacement as ecological condition is reduced. However the EIS did not indicate the scale of potential impact to fauna from those impacts other than from direct habitat loss through clearing.

The EIS predicted that there would be no significant negative impacts on fauna species listed under state or federal legislation, and that the mitigation measures expressed in the EIS would be effective in protecting faunal values.

4.15.4.3 Avoidance, mitigation and management measures

Various mitigation and management measures are presented in the EIS – including training of field staff, use of wildlife handlers (when required), early rehabilitation, preconstruction surveys by qualified ecologists to identify fauna matters, relocation of disturbed fauna, timing of clearing to avoid breeding seasons, management of light spill, updating pest plans and management of wastes that were potential food sources for fauna.

Offsets proposed in the EIS to replace lost fauna values are described in section 4.15.6 of this report.

4.15.4.4 Outstanding issues

A significant number of commitments were made in the EIS about management and mitigation of impacts to fauna values. To be effective, those commitments should be formally reviewed and incorporated into the appropriate elements of the management information associated with any approvals for this project if it should proceed.

Offsets required under the QBOP relating to fauna values are described further in section 4.15.6 of this report.

4.15.4.5 Conclusions and recommendations

The EIS suitably noted the site values, potential impacts and provided a commitment to a range of mitigation and management measures to control impacts to fauna values. Those actions should be formally attached to any approval subsequently granted for the project should it proceed, and where required, offsets be confirmed and implemented according to the QBOP.

4.15.5 Aquatic ecosystems

4.15.5.1 Existing values

The site is within the Burdekin River basin, characterised by an overall surface water drainage pattern from the Leichhardt Range in the northeast towards the southwest, where watercourses ultimately discharge into the Burdekin River. Suhrs Creek, Elphinstone Creek and Sandy Creek are the main watercourses that intersect the project area, with Plumtree Creek located further to the south, away from the project area. The EIS described the watercourses as ephemeral (i.e., cease to flow for periods of time), however noted that flow is maintained throughout the year in Sandy Creek from contaminated seepage from the existing TSF and in Elphinstone Creek from water seeping from Suhrs Creek dam.

The EIS stated that riparian vegetation growing along the watercourses within the site is typical for the region, that in-stream woody habitats observed within the watercourses were comprised of leaves, small branches, logs and mosses. The majority of watercourse banks were shaded by overhanging vegetation and that surrounding land use is dominated by cattle grazing.

The EIS stated that the water quality in the watercourses strongly influenced the ecosystems present and that water quality varied depending on the flow at the time of sampling – e.g. typically poorest water quality was during periods of no-flow or stagnant periods. Many sites sampled displayed elevated nutrients, turbidity, sulphate, some metals and electrical conductivity. Sediment contaminants included elevated nitrogen, sulphate and a range of metals including copper, zinc, aluminium and iron. The EIS noted that contamination gradients showed that the existing mining operations were impacting on watercourses.

Field surveys identified:

- 12 species of freshwater plants, including two introduced species and widespread communities of filamentous algae
- 13 species of fish, 11 native, 1 introduced and 1 translocated from downstream of the Burdekin Falls dam.

The EIS stated that the fish species recorded in the study area were generally resilient species, tolerant of a wide range of conditions and noted that Tilapia (an introduced species) was widely distributed at most sites and among the most abundant of all species recorded.

The EIS noted lower numbers of individual fish and species richness in Sandy Creek and attributed that to its higher sand content and resulting diminished habitat.

The EIS stated that most macroinvertebrate families recorded during the field surveys represented assemblages similar to, or significantly reduced, compared to those expected (based on reference data). The EIS found that in general, pool habitats contained higher levels of biodiversity and were less disturbed and healthier than edge habitats. The EIS suggested that this could be due to water level variability preventing edge populations from stabilising.

The EIS concluded that the freshwater environments of the site ranged from slightly to highly disturbed and suggested that that the macroinvertebrate data for the site reflect the seasonal pattern of rainfall and the existing impacts of mining, water extraction and agricultural land use.

The EIS noted that none of the watercourses relevant to the project had any state or national conservation significance.

The EIS failed to discuss potential linkages between confirmation of perennial contaminated groundwater flows associated with leaking from the existing TSF, observed contamination in sediments and the observed reduced species diversity and abundance of fish in Sandy Creek.

4.15.5.2 Impacts

The EIS noted that impacts to the aquatic ecosystem values would be varied between the construction and operation phases of the project.

Construction phase impacts would be predominantly associated with altered surface water flows, sediment generation and mobilisation and consequently leading to infilling and smothering of freshwater habitats and diminished surface water or sediment quality within Sandy Creek. The potential impact of uncontrolled runoff from construction of the TSF, the IWRD, hard waste area and associated infrastructure was stated as a high magnitude of impact prior to the implementation of mitigation measures.

The development of the TSF would directly remove about 42ha of Sandy Creek catchment, reducing surface water flows once the internally draining structure was effective. The EIS stated this would be likely to have a low impact as it accounts for approximately only 7% of the catchment. The EIS noted that construction of the acoustic bund would permanently reduce the Suhrs and Elphinstone Creek catchments by approximately 10ha, by directing surface flows to the Sarsfield pit. The EIS concluded that this would be likely to have a moderate impact on aquatic ecosystem values.

The EIS also noted that any impact to riparian vegetation including removal or disturbance, would also impact on aquatic ecosystem values, however this impact was not quantified.

Operational phase impacts were primarily associated with risks of contamination of surface waters and groundwater and creation of unseasonal groundwater flows to watercourses.

The EIS noted that contaminated surface water flows would migrate into Sandy Creek, resulting in diminished surface water and sediment quality with impacts on freshwater flora and fauna unable to adapt to these altered conditions. The EIS also noted that potential sources of contaminated surface water included the IWRD rock dump and associated hard waste area.

The EIS established that any groundwater flows from the TSF and IWRD directly connected to Sandy Creek through the “regolith” aquifer would reduce water quality and impact on aquatic values through the introduction of contaminants known to be currently discharging from the site.

The EIS noted that the TSF and decant pond were potential sources for the seepage of contaminants and waste materials into Sandy Creek and they would also have the potential to generate unseasonal surface water flows due to artificial groundwater flow created.

The EIS also noted that as part of the development, the existing Kakadu seepage trench would have to be decommissioned and that this would result in additional contaminated groundwater flows to Nolans Creek and subsequently to Sandy Creek. The EIS noted that these contaminated groundwater flows may impact on freshwater flora and fauna species present within Sandy Creek, and that the magnitude of impact in the event of contaminated seepage reaching Sandy Creek would be high. The EIS suggested that current freshwater communities within Sandy Creek may be tolerant and have a relatively low sensitivity to change which could reduce the impact of any increase in contaminant levels

4.15.5.3 Avoidance, mitigation and management measures

The EIS stated that the primary mechanisms for the protection of freshwater ecological values would include the minimisation of vegetation removal, maintenance of natural drainage patterns, sediment and erosion control, and prevention of surface and subsurface leaks and spills of contaminants.

The EIS identified the residual significance of impacts, following the implementation of the proposed avoidance, mitigation and management measures. Most residual impacts were assessed as having low or negligible residual significance. The EIS accepted that the TSF and decant pond operations were not suitably mitigated and the EIS stated that residual risks would therefore need further control by design constraints, specifically for:

- contaminated seepage and leachate from the TSF cells and decant pond
- TSF wall failure and subsequent discharge of tailings and other contaminants downstream.

The EIS provided a number of commitments about those matters rather than significant detail. The EIS did not suitably address the contaminated seepage from the IWRD.

4.15.5.4 Stygofauna

The EIS provided only a limited assessment of impacts about stygofauna. Sampling was conducted for stygofauna within groundwater from bores in the study area, including impacted and potentially not impacted sites. Individuals were identified only from likely impacted sites from the current mine. Specimens belonging to the Oligochaeta, Syncarida, Isopoda and Amphipoda major taxonomic groups were verified as genuine stygofauna.

The EIS stated that there was considerable uncertainty about the meaning of the data collected other than that the groundwater beneath the study area supports stygofauna, and concluded that stygofauna were poorly known both taxonomically and ecologically, and it was difficult in the EIS to forecast what impacts the project may have on stygofauna communities.

The EIS committed to monitor and assess the potential impacts of the project on stygofauna populations however didn't describe how this would be done.

4.15.5.5 Outstanding issues

EIS did not suitably address the potential impacts of contaminated seepage on the aquatic ecosystem values, it noted the level of potential impact and committed to address it. However, there is no clear proposal, in proportion to the risk, to confirm the performance of the liner under the TSF or decant pond and there is no detail about the management of seepage from the IWRD. Decommissioning of the Kakadu Seepage trench is noted and the associated increased flow of contaminants to Nolans and Sandy Creeks, however there is no clear action or commitment to mitigate this.

Details around proposed stygofauna monitoring are incomplete and a monitoring proposal should be developed to address the current uncertainty around potential impacts to stygofauna communities through both contamination and groundwater level changes during mine dewatering.

4.15.5.6 Conclusions and recommendations

The EIS identifies most of the significant risks to aquatic ecosystem values and proposes suitable measures to reduce the residual risks, however fails to adequately address three critical elements being: the Kakadu seepage trench, the seepage under the IWRD and the performance management of the TSF and decant pond.

Noting the significance of the potential impacts and the EIS's statement that further design constraints will be required, the project should only proceed when suitable practical and effective measures have been developed to manage those risks to an acceptable level.

Acknowledging the significant uncertainty regarding stygofaunal populations and their responses to impacts, monitoring proposal should be developed to improve knowledge of those communities and, in particular, to address the current uncertainty around potential impacts on them from both contamination releases and groundwater level changes during mine dewatering. This program should be developed prior to seeking project approval.

4.15.6 Biodiversity offsets

The Queensland Biodiversity Offsets Policy (QBOP) which sets out the specific requirements of offsets of State Significant Biodiversity Values (SSBV) applies to the project. The EIS stated that as no significant impacts were likely to occur for MNES, the only offsets proposed for the project were therefore those related to the state matters.

The EIS noted that project impacts could extend over 511ha, including 113ha of remnant vegetation adjacent to the existing Nolans TSF. It is the remnant vegetation that forms potential habitat for SSBV and would trigger offsets under QBOP.

The EIS stated that the potentially impacted SSBV included watercourses, connectivity and habitat for both protected animals and plants.

Watercourse SSBV identified in the project footprint included 3.9ha of RE 9.3.1, 91.9ha of RE 9.12.1b and 201.9ha of Non-remnant/cleared areas.

The EIS acknowledged that the project would impact on the SSBV of connectivity, it noted that there were no recognised wildlife corridors in the vicinity of the site and that watercourses were the site's dominant movement corridors. The EIS concluded therefore that offsetting proposed for watercourse values would jointly deliver the necessary offsets for connectivity values.

The EIS notes that habitats for protected animals and plants requiring offsetting include:

- 108.6ha of Squatter pigeon (southern sub-species) (Vulnerable under NCA) habitat (RE 9.12.1b)
- 113.0ha of Little pied bat (Near threatened under NCA) habitat (RE 9.3.1 and 9.12.1b)
- 108.6ha of Black-throated finch (southern sub-species) (Endangered under NCA) habitat (RE 9.12.1b)
- 108.6ha of Short-beaked echidna (Special least concern under NCA) habitat (RE 9.12.1b)
- 108.6ha of Large podded trefoil (Near threatened under NCA) habitat (RE 9.12.1b).

The EIS concludes that 113ha of offset would be required for protected animal and plant habitat and 95.8ha for watercourse vegetation. It is proposed to deliver a direct offset, within an area close to the impact site, however a specific offset plan was not developed in the EIS. The EIS includes a commitment to finalise a suitable offset in conjunction with EHP, prior to the impacts occurring. EHP is satisfied that the proposal is suitable for this stage of the project assessment.

4.16 Transport

4.16.1 Existing values

In the EIS the increased transport demands associated with the project are proposed to be accommodated through limited augmentation of existing infrastructure.

Ravenswood is accessed from Townsville via the Bruce Highway, Flinders Highway and Burdekin Falls Dam Road, or alternately from Ayr via the Ayr–Dalbeg Road and Ayr–Ravenswood Road. Hence these are the potential routes for road haulage to the project.

4.16.2 Impacts

Attention here focuses on project impacts on transport infrastructure arising from the Sarsfield Expansion Project. In terms of transport impacts on the environment and associated hazards, the key issues associated with the project relate to noise, dust, safety and transport of hazardous materials. While safety is directly relevant to the adequacy of road infrastructure for the project, the other issues are dealt with in the relevant sections of this Assessment Report.

The EIS states that the current limited use of air freight for the mine will not change as a result of the project and that rail, shipping and overland conveyor systems do not form elements or requirements of the project. While some consumables and materials are expected to arrive at Townsville via rail and shipping, the volumes will be similar to those during the mine's previous operations and use of those modes will not proceed past major centres such as Townsville.

The EIS concludes that transport for the project will primarily be by road. The primary statutory obligations that relate to potential impacts on road infrastructure assets and use arise under the *Transport Infrastructure Act 1994* and *Transport Operations (Road Use Management) Act 1995*.

The infrastructure to be used mostly comprises State-owned roads managed by DTMR and some roads managed by CTRC. The usual route to the Ravenswood will be via the Flinders Highway and the Burdekin Falls Dam Road. This route will be used for vehicles carrying materials as well as drive-in, drive-out (DIDO) workers.

The EIS states that, during construction, equipment and materials will be brought by road from Gladstone or Brisbane via heavy vehicles including semi-trailers, low loaders, tankers and escorted oversize loads. The majority of heavy vehicles will be at least B-doubles with an average net carrying capacity of 45t. During peak mining operations, 87% of incoming materials transported by road is expected to comprise fuel and explosives. Since mining wastes will be stored or stockpiled on-site, only the relatively small volumes of product (i.e. gold) will be taken from the site.

The EIS estimates that 10 trips of heavy vehicles per week will occur during construction, with 95% of deliveries occurring via the Sarsfield Mine entrance. Heavy vehicle movements during operations are expected to peak at 20 trips per week, and eight trips per week during decommissioning.

Employee transport for the project will primarily involve DIDO of major shift rotations of the workforce sourced from Townsville and Charters Towers to the mine village via a coach service, in order to minimise the use of private vehicles. This service will also be made available to existing operational staff. Transport of employees from the mine village to the mine for minor shift rotations will be via shuttle bus, with senior staff using light vehicles for ad hoc trips. The EIS predicts about 229 employees during construction, 220 during operations and 30 during decommissioning, of those about 17% are expected to reside in Ravenswood, with the rest travelling on a DIDO basis.

The EIS concluded that because of the existing low level of traffic in the vicinity of Ravenswood and the limited number of vehicle movements required, the project will not significantly affect the efficient movement of other road users and will have limited effects on road condition or level of service, provided that limited upgrades to infrastructure and appropriate maintenance are implemented. The EIS forecast no significant increases in traffic volumes on local roads and no changes to travel time, manoeuvrability, speed or safety.

However, several intersections will be affected by the interaction of light and heavy vehicle traffic movements associated with the mine with through and local traffic.

The EIS predicted that the project would increase traffic volumes for the section of the access route along Burdekin Falls Dam Road from Flinders Highway to 3.48km south of Ayr–Ravenswood Road (identified as Macrossan Street (north)). While no haul route would increase daily volumes more than 5% higher than background volumes, the increased number of heavy vehicles is expected to affect the pavement along the Burdekin Falls Dam Road.

4.16.3 Proposed mitigation and management measures

The primary mitigation of infrastructure impacts proposed in the EIS is upgrading of five intersections along the haul routes, in order to meet serviceability requirements. The EIS committed to also make a once-off, up-front maintenance contribution to DTMR for expected pavement impacts of the project, in accordance with an agreed calculation methodology and to assess and monitor specific culverts and in due course to repair project-related damage.

4.16.4 Outstanding issues

The DTMR proposes that the proponent:

- engage with DTMR to finalise a road impact assessment (RIA), road-use management plan (RMP) and traffic management plan (TMP) for approval by DTMR before works start and to be implemented by the proponent
- submit a revised pavement impact assessment spreadsheet to DTMR, as the basis for confirming required payments for necessary rehabilitation, bring-forward and maintenance works
- upgrade delineation and signage at bridges and culverts on the Burdekin Falls Dam Road to conform with Traffic and Road Use Manual (TRUM) standards
- widen the pavement of the Ayr-Ravenswood Road between Devils Elbow Creek and Four Mile Creek in order to comply with the standards in the TRUM for Triple Roads Trains
- submit detailed designs for the intersection upgrades on State-controlled roads to DTMR for its review and approval, on the basis of correct design speed parameters
- monitor the condition of bridges and other relevant structures on State-controlled road and to rectify any damages to these structures that are attributable to project transport
- prior to the commencement of works enter into a Deed of Agreement with DTMR in relation to:
    - contributions to upgrade roads and intersections
    - necessary access to the State-controlled road network
    - rehabilitation and maintenance contributions associated with project traffic.

DTMR stated that the EIS was incorrect in its description of both the Burdekin Falls Dam Road and the Ayr–Ravenswood Road, the implications of these errors will need to be addressed as part of the required RIA and RMP.

4.16.5 Conclusions

The EIS generally provided an adequate assessment of the impacts of the transport components of the project and provided appropriate mitigation responses in response to the TOR. The project will have limited implications for the road network and will not have material implications for other elements of transport infrastructure.

A more detailed assessment of impacts on existing road infrastructure, as well as agreement on required upgrade works, rehabilitation and maintenance contributions, will be needed before project works commence.

4.17 Noise and vibration

The EIS acknowledged that under the Environmental Protection (Noise) Policy 2008 (EPP Noise) the environmental values that could be affected by noise are human health, wellbeing, amenity of the community and the health and biodiversity of ecosystems. Those values reflect the proximity of the project to the Ravenswood township and the habitat values affected by the expansion beyond the current brownfield site. Sensitive receptors in the township noted by the EIS included a church, a school, a hotel and numerous residences. This section focuses primarily on impacts to human values, potential impacts to ecological values are discussed in section 4.15 of this report.

The EIS contends that the EPP Noise objectives, whist the most current acceptable noise levels, were too stringent for what is an existing mine with a mining community that has developed alongside it and that, as a result, has developed a reduced sensitivity to mining activities that generate noise. Consequently the EIS discussed a range of other noise criteria including:

- Conditions in the existing Environmental Authority for operation of the existing Ravenswood Gold Mine that address noise, airblast overpressure and ground vibration impacts. These conditions include requirements that mining activities must not cause an environmental nuisance, and if monitoring indicates exceedance of defined limits then abatement measures must be immediately implemented to avoid further environmental nuisance
- The Model Mining Conditions guideline which both provides standard criteria for noise from mining activities and enables specific conditions to be developed for individual projects
- World Health Organization (WHO) guidelines for community noise that include night time and day time levels to protect people from annoyance.

In developing the EIS, EHP and the proponent considered a set of site specific noise criteria (table 2 below) that could be applied to suit the circumstances of the site. They are louder (less conservative) than the expected conditions that would otherwise be applied to the project for example through the MMC. The principal basis for considering such an approach in the EIS was stated as being based on the:

- mining community that has developed alongside the existing operation has developed a reduced sensitivity to the noise of mining activities
- project being unable to economically meet the contemporary standards such as EPP Noise and MMC
- outcome of the site specific conditions would be an improvement (quieter) on the existing conditions applying to the current operation.

Table 2. Interim noise limits

Noise at sensitive receiver	Day time Monday to Saturday (7am-6pm)	Day time Sunday and public holiday (7am-6pm)	Evening - all days (6pm-10pm)	Night - all days (10pm-7am)
LA_{eq}	52	47	47	42
LA_{max}	57	54	52	49

4.17.1 Impacts

The EIS assessed noise emissions from construction and operational activities. The construction worst-case scenario (the first 12-18 months) included construction of the acoustic bund between 630am and 630pm, Monday to Saturday and construction of the TSF 24 hours a day, seven days a week. The operations worst-case scenario assumed activities would occur concurrently for approximately 17 years, 24 hours a day, seven days a week. Noise from decommissioning activities was not addressed in the EIS on the grounds that it would involve lower noise levels than discussed for construction and operation.

The EIS stated that the operational phase of the project would involve a complex array of noise sources, including:

- use of drills and blasting to extract material from the Sarsfield and Nolans pits
- mills, vibrating screens, water pumps and scat conveyors at the processing plant
- crushers and some mobile plant noise from the crushing plant
- vehicles on the road network including those hauling extracted material.

As operations are proposed to occur 24 hours a day, seven days a week, noise levels will not vary significantly through the week. Noise at the mine site during project operations will be strongly influenced by noise from the Sarsfield crushing plant, which is expected to be less than that from the old Sarsfield crushing plant as a result of new equipment and better noise attenuation. The degree of compliance with noise limits at sensitive receptors was dominated by night time conditions during a temperature inversion with no wind.

4.17.1.1 Operational impacts

The results from the LA_{max} modelling have indicated that four sensitive receptors (two residential, Imperial Hotel and school) are likely to exceed the 49 dBA LA_{max} night time limit during peak operations scenario. The EIS noted that the school would not be occupied at night time and the exceedence was only modelled during periods of temperature inversion with no wind. The EIS stated that during 'average operations', for example year seven that all sites would comply with the interim limits.

4.17.1.2 Construction impacts

The EIS predicted that during construction, seven receptors would experience maximum noise levels above the limits, in the range of 55-60dBA from road train and truck traffic along the Mount Wright haul road. This traffic, associated with the transport of mine material from the Mount Wright Underground Mine to the processing plant at Ravenswood, was predicted to reduce within the first year of project operations, and would cease when mining at Mount Wright is complete.

The EIS also predicted that a small number of residential properties in the vicinity of private roads would be subjected to maximum noise levels (55dBA), over the limits during night time.

Predicted noise levels during the months of relocation of the acoustic bund were stated to be strongly influenced by the location of mobile plant equipment, especially where there is line-of-sight to nearby residential properties. However the EIS stated that the action would be managed to achieve the relevant limits.

The above outcomes for construction noise are subject to some uncertainty including the possibility that the sound power level of some of the equipment was underestimated in modelling. The EIS did note that the modelling of noise levels had assumed the adoption of mitigation measures such as mechanical powered mobile plant being fitted with appropriate mufflers to mitigate noise impacts.

4.17.1.3 Traffic noise impacts.

The EIS adopted a criterion of a change of noise levels of 2 dBA from background noise levels on public roadways to assess compliance. The relevant public roadways for the project are Burdekin Falls Dam Road, Macrossan Street and Sarsfield heavy vehicle bypass. During operations, daily project traffic on public roads is expected to increase noise levels by less than 2 dBA, which the EIS states is effectively unnoticeable to the human ear. Predicted increases in traffic noise levels from the Sarsfield heavy vehicle bypass reflect site deliveries for the project, the EIS stated that the number of deliveries is expected to be small with the peak during construction. Higher peak-hour volumes on the Burdekin Falls Dam Road (between Macrossan Street south and north) as well as daily volumes for the Sarsfield heavy vehicle bypass (between Burdekin Falls Dam Road and the Sarsfield entrance) required the shuttling of workers by bus to and from the mine village, and by large coaches to and from regional centres to reduce vehicle movements and noise.

The EIS stated that night-time traffic noise from private roads would not exceed the limits at nearby residences and the mine camp.

4.17.1.4 Noise and vibration impacts from blasting

The main source of vibration impacts from the project will be from blasting to extract rock within the pits. The EIS assessment indicated that, based on historical data, ground vibration is not predicted to impact sensitive receptors. Site guideline equations developed for the project from historical data were used in the EIS to calculate the maximum instantaneous charge (MIC) levels to comply with objectives for vibration under both the mine's current environmental authority and the EP Act limits. Under the current environmental authority, open-air blasting must only be conducted during daylight hours.

Noting that the EIS used an air blast overpressure limit of 125dB, EHP clarified that the applicable regulatory limit for overpressure would be 120dB at the sensitive receptors and raised concerns regarding the ability of the project to comply with a 120dB limit. The limit is 125dB lin for 1in 10 consecutive blasts per 24 hours and 120dB lin for 9 out of 10 consecutive blasts. The EIS stated that modelled airblast results demonstrated that the 120dB limit could be achieved at the church and at all but one residence, including that the modelling had not factored in the shielding effect of the acoustic bund and the pit wall as blasting occurs at deeper levels. The proponent acknowledged the need for additional measures in order comply with the 120dB limit if monitoring confirms an issue at the affected residence. Limits apply also to the vibration levels not to be exceeded at sensitive locations. The EIS noted that blasting can be accurately tuned to manage vibration by creating smaller blasts offset by small time delays.

4.17.2 Proposed mitigation and management measures

The EIS notes that there are predicted exceedances of the interim noise limits, however states that it is unlikely that the project will cause sleep disturbance in light of the marginal exceedance involved, the high existing ambient noise levels, the modelling based on worst-case conditions and the presumed community tolerance of mining-related noise in Ravenswood.

The EIS states that acceptable noise outcomes would be achieved by:

- relying on the proponent's community and stakeholder communications procedure to maintain a positive relationship with the Ravenswood community
- ensuring that any complaints in relation to noise or vibration are addressed in a timely manner by necessary actions to minimise impacts
- the relatively short duration of construction activities
- management of operational noise to meet limits
- on-going operator education
- on-going noise monitoring (at the Ravenswood State School and designated dwellings) to support timely responses
- formal grievances would be logged in a corrective actions register for a response within stipulated timeframes.

The EIS proposed relying to a substantial extent on the ability to alter project activity schedules for construction and operations in order to achieve compliance with nominated noise criteria. While the TOR called for the EIS to discuss timing schedules with respect to minimising environmental nuisance and harm from noise and vibration, this issue was only addressed in limited depth.

4.17.3 Outstanding issues

The noise criteria put forward in the EIS for night-time periods in particular are high relative to the provisions of the EPP Noise, the standard criteria for noise in the Model Mining Conditions guideline, and the WHO 'Night Noise Guidelines for Europe'. The EIS did not provide an assessment of impacts relative to the EPP Noise or the Model Mining Conditions' standard criteria.

In this context, the planned 24 hours a day, seven days a week construction of the TSF over the initial two years and the extended 24 hours a day, seven days a week operational regime, including heavy vehicle movements during evening and night periods, have the potential to significantly affect the amenity, health and well-being of some Ravenswood residents. Other aspects contributing to this risk are:

- the expected elevated noise levels from relocation of the acoustic bund during daylight
- the relatively high levels of airblast affecting some properties during at least the early stage of pit deepening
- uncertainties about the sound power levels used for modelling of noise emissions from mobile equipment
- uncertainties about the ability to further reduce noise emissions from mobile equipment.

4.17.4 Conclusions

The EIS provided an adequate response to the TOR for noise and vibration, noting the modelled exceedences of interim noise limits. The interim noise criteria discussed are high relative to the provisions of the EPP Noise, the Model Mining Conditions and the WHO 'Night Noise Guidelines for Europe'. Consideration about the actual conditions imposed should the project succeed should include questioning the presumption of community tolerance of mining-related noise in Ravenswood.

4.18 Economics

The EIS adequately addressed the economic impact matters raised in the TOR.

The study area for the economic impact assessment encompasses the council areas of:

- Charters Towers Regional Council
- Townsville Regional Council
- Burdekin Shire Council.

The EIS's risk assessment framework identified and ranked risks based on sensitivity (i.e., how susceptible or vulnerable the regional economic value is to change, or how valuable the economic value is to the regional economy) and magnitude (i.e., how severe the impact is anticipated to be) to inform key issues and impacts for avoidance, mitigation and management measures.

4.18.1 Existing values

Baseline characterisation of the existing economic environment of the study area and of the broader economic context was developed through:

- review of data sourced from the Australian Bureau of Statistics, Queensland Government, regional councils and other public-sector agencies
- review of available government policies and economic development strategies
- consultation with local businesses, government and peak industry bodies
- review of private-sector data sources and company websites
- review of AEC group's propriety economic models.

An average gold price of around A$1,450 per ounce was assumed in the EIS for the purposes of modelling and the assessment of economic impacts, noting that the current gold price is similar to that the figures in the EIS should be relatively precise.

4.18.2 Impacts

The EIS stated the basis of the estimates of expenditure and estimated sources for goods and services of each phase of the project across region, state and national.

Capital and expenditure costs and direct and indirect employment were discussed for each phase.

4.18.2.1 Construction phase

During the construction phase estimated employment included 100 positions supported in the region, 68 positions in other parts of Queensland and 35 positions generated elsewhere in Australia.
The EIS estimated that for construction:

- approximately 65% of goods and services used would be sourced from within the region with an additional approximately 10% sourced from the rest of Queensland and 7% nationally with the remaining 18% imported from overseas.
- household incomes (including both direct and flow-on activity) generated would be approximately $50.2million in the region and an additional $26.9million generated elsewhere in Queensland

4.18.2.2 Operational phase

During the operation phase estimated employment included approximately 220 full time direct employees. The EIS noted this was the same as existing mine however extended for the additional 17 years. Employment flow-on impacts were estimated to support 20 positions in the retail, accommodation and food services industries.
The EIS estimated that for operations:

- 50% of goods and services would be sourced from within the region, an additional approximately 20% sourced from the rest of Queensland and 10% nationally with the remaining 20% imported from overseas.
- household incomes (including both direct and flow-on activity) generated would be approximately $33.3 million per annum in the region and an additional $9.0 million per annum elsewhere in Queensland.

4.18.2.3 Decommissioning phase

Decommissioning was estimated to cost $50 million over two years with the construction industry in the study area estimated to provide the majority of direct employment. Goods and services used during would be sourced
The EIS estimated that for mine closure and rehabilitation:

- 70% of goods and services would be sourced from within the region, an additional approximately 10% sourced from the rest of Queensland and 5% nationally, with the remaining 15% imported from overseas.

- household incomes (including both direct and flow-on activity) generated would be approximately $7.3 million per annum on average in the region and an additional $1.7 million per annum on average elsewhere in Queensland.

4.18.2.4 General

The EIS committed to source local labour to the extent possible and practical, but noted that some construction and mining employees will be from outside the study area and their incomes would be distributed to other towns and cities not retained locally.
The mined gold was stated as being exported overseas and estimated to contribute $140 million per annum in exports over the project's life.
Taxes and revenue, mainly through royalties, income tax and payroll tax were estimated at $147 million and $479 million to the Queensland and Australian government's respectively over the life of the project.

There was a stated small increase in population that could place pressure on existing services.
Competition for labour and draw-down on businesses were stated as being minor because the workforce is small relative to the broader labour market.

Some of the key economic indicators expected to be impacted by the project included:

- size and structure of the economy
- labour and property markets
- key industries
- local government objectives and strategies
- recent large scale developments.

The EIS noted that the whilst the project represented a stimulus to the economy that would otherwise not occur, it was important to recognise that it would be of a relatively short-term nature in the context of other mines and that on closure there would be a ceasing of that impact, creating a potential negative effect on businesses and incomes supported by the project or by its flow-on activity.

4.18.3 Avoidance, mitigation and management measures

The EIS stated a number of mitigation measures to counter most of the above negative impacts and concluded that when mitigation measures are implemented the residual impacts are predicted to be low. The EIS stated that there were no mitigation measures that would counter the impact of exchange rates, however the EIS stated that, irrespective of mitigation measures, a low impact is predicted.

4.18.4 Conclusion

The EIS concluded that the economic benefits of the project were estimated to outweigh any adverse impacts to the local and Queensland economies, and provide additional economic activity over and above any potential draw-down experienced in some sectors. The residual potential adverse economic impacts were assessed as of low significance, following implementation of the identified mitigation measures.

4.19 Social

The Queensland Government released new *Social Impact Assessment Guidelines* in July 2013. These focus on the need for measures to effectively address identified social impacts. While requirements for assessment of social impacts in the EIS have changed with respect to the TOR, the response to the TOR is considered to be satisfactory.

4.19.1 Existing values

The EIS approached the potential for social impacts by first considering the "social baseline" or existing conditions and noted that the character, infrastructure, regional context and attitudes of the Ravenswood community will all influence the potential for social impacts.

The EIS noted that Ravenswood is a small historic mining town whose population has fluctuated since its establishment in the early 1870s. At the 2006 census the population was 191, having declined 44% over the preceding five years. There are a relatively a low proportion of young people aged 19 years or under and a high proportion of persons aged 55 and over. Ravenswood has a strongly "blue collar", mining-based workforce with no persons at the 2006 census having a post-secondary school qualification. A small proportion of people are employed in tourism and other services occupations. Unemployment is very low and the median weekly income is much higher than the Queensland average.

The Ravenswood population is now spread across a low-density urban area, in 71 detached dwellings. Rates of home ownership are high and there are relatively low rates of renting. There are also temporary accommodation options, including two hotels, a caravan park and a camp ground.

Ravenswood has limited municipal and community infrastructure:

- The town is dependent on water supplies sourced from the Burdekin River via facilities operated by the proponent.
- A majority of households in Ravenswood are not connected to sewerage, and sewage disposal is via septic tanks.
- Only a primary school exists in the town and commuting access to secondary level education is limited to the city of Charters Towers.
- The mine employs two nurses on a 24-hour rotation who focus primarily on the needs of mine workers, and then offers the services of the nurses to the Ravenswood community.
- Ravenswood is well serviced in terms of recreational facilities, which include a swimming pool, tennis courts, gym and a nine-hole golf course, which have been funded by the proponent.

The regional context will also influence the potential for social impacts arising from the project. In particular:

- most workers for the Ravenswood Gold Mine are expected to come from or at least reside in Charters Towers or Townsville
- Ravenswood residents largely rely on Charters Towers as the regional service centre
- comparatively high levels of socioeconomic disadvantage exist in the wider Charters Towers area
- the Northern Region in which Ravenswood is located, i.e. centred around Townsville, has had very high rates of assault, including domestic violence, high rates of sexual behavioural offences, and very high rates of other offences against the person and good order offences.

The EIS identified what are presented to be widely held values amongst residents of the Ravenswood community including residents that:

- identify themselves as a “unique ‘heritage’ community
- value and are protective of Ravenswood’s rich heritage and important place in Queensland’s history. They appreciate living in such a unique town and value their role as guardians of this historically important town.
- recognised the different factors influencing the economic and social sustainability of their community. They “value the relative affordability that the town provides”, supported by comparatively low housing prices and reflected in a high degree of home ownership.
- value the sense of rural friendliness and a rural lifestyle and desire that it be retained
- understand that the sustainability of the town is reliant upon continued economic prosperity
- highly value that their community is a healthy and safe place to live
- wish to protect against any threat to the inherent safety of the community.

4.19.2 Impacts

The EIS stated that the project is likely to have relatively predictable positive and negative impacts on the Ravenswood community, as well as giving rise to various concerns within the community.

The EIS highlighted the following key issues as having been raised during community consultation and stakeholder engagement activities:

- Inadequate communication and liaison by the proponent with the community in relation to matters of concern.
- Potential for an increase in dust from mining activities affecting the community’s quality of life, health in an ageing community, the local tourism industry as well as the marketability of severely affected properties.
- Potential for increased heavy vehicle traffic, use of heavy machinery and night-time mining operations to increase noise and light pollution and hence impact on residents’ amenity.
- Potential for the project to both consume a higher proportion of available water and to cause contamination, impacting the supply available to the local community and downstream users.
- Frequent blasting and the requirement for evacuation from the exclusion zone, causing regular disturbance to the lives of Ravenswood residents, with associated concerns regarding community safety, potential for destabilisation of buildings as well as damage to homes.
- Possibility that the effects of mining activities might damage heritage-listed buildings, deter tourists from visiting the local area and thereby affect the local tourism industry.
- Anxiety regarding the potential for fires or major disasters such as an explosion or hazardous chemical fire resulting from project activities.

The EIS states that:

- The construction and operations workforce of mostly males with a relatively young median age will temporarily alter the existing demographic balance of Ravenswood's population.
- Ten percent of operational positions created by the project are expected to be filled by existing Ravenswood residents.
- Indigenous residents of Ravenswood as well as Charters Towers will have an opportunity to gain employment on the project.
- Around 43 permanent residents are expected to come to Ravenswood directly as a result of the project, including 18 single employees and five families of five, increasing the existing population by 22% until decommissioning commences.
- Limited growth of local services and the associated population is expected, as most project workers will reside in the mine village and most local businesses will not require new staff.

As the Mount Wright Underground Mine operations are expected to finish before mining re-commences at the Sarsfield and Nolan pits, the existing 230 room mine village will be sufficient to meet accommodation requirements of a peak workforce of 229 personnel. Consequently, the project is not expected to directly generate additional demand for housing or short-term accommodation in the area. However, if the project gives rise to some new services jobs in Ravenswood, there is a moderate potential for inflationary pressure on the local housing market. On the other hand, if houses owned by the proponent's employees were to be released for sale in over short timeframe once decommissioning commences, there could be a deflationary effect on local housing prices.

The EIS suggested that the project is likely to have a predominantly positive impact on Ravenswood's social and community infrastructure, although limited detail is provided. One aspect identified is that the small influx of additional residents to the town is likely to result in additional pupils attending the Ravenswood State School, helping to maintain its viability.

The EIS also considered the potential impacts on the wellbeing of the Ravenswood community from the influx of a non-resident workforce. A relatively large, transient population increase is forecast for both the construction (119%) and operations (103%) phases of the project. As a consequence, there is a potential for social change affecting perceptions of safety, security and community cohesion. In the context of elevated regional levels of violent crime, the EIS noted the potential for an increase in anti-social behaviour and crime by project employees, who are expected to be mainly young males. The EIS also suggested that an income disparity between residents and project workforce could contribute to social tensions and diminished social cohesion within the community. The EIS stated that lack of engagement with stakeholders and communication with the broader community has the potential to generate community resentment in Ravenswood for the life of the project.

The eventual decommissioning of the project, including the withdrawal of key services, was seen by stakeholders to involve particular challenges in terms of socio-economic dislocation within the Ravenswood community.

The EIS concludes that the potential for the negative social changes outlined above to occur is uncertain and actual outcomes will depend on whether effective and collaborative action is taken to mitigate related risks.

In terms of amenity and health-related impacts on the Ravenswood community, the EIS stated the following:

- The project will potentially result in the residents being exposed to elevated levels of noise, artificial lighting, odour (from cordite) and vibration generated by blasting events, crushing and processing of ore, lighting of night operations and increased vehicle movements
- Project activities are particularly likely to affect properties within 400m of the Sarsfield Pit, including 15 detached dwellings, a teacher's residence, Saint Patrick's church and Ravenswood State School. The school, in particular, could be exposed to elevated noise levels including from the proposed use of evaporative fans to dewater the Sarsfield pit.
- A number of attributes of the project have the potential to have an effect on the prevailing level of environmental health in the surrounding local area, including the generation of increased dust and noise, flyrock from blasting and contamination of groundwater.

4.19.3 Proposed mitigation and management measures

The EIS stated that the project, including an extended mine life, and improvements to road and public infrastructure would provide some positive social impacts. The EIS included specific commitments to:

- develop a Mine Closure plan that presents strategies to address related economic effects
- refine the Blast Management Procedure, including by limiting the hours within which blasting occurs and adjusting the exclusion zone
- relocate the existing community waste landfill from the project area to a new site, in consultation with the Charters Towers Regional Council.

The EIS proposed addressing social impact requirements through a suite of Social Impact Action Plans, two elements of which that are relevant to the community concerns identified above are:

- maintaining a Community and Stakeholder Communications Procedure
- enforcing a Behaviour Management Procedure.

The EIS concludes that the potential social impacts of the project are manageable through the implementation of the proposed mitigation and management measures committed to in the EIS.

Submissions from CTRC sought for the proponent to:

- cooperate in the development of a “township master plan” for Ravenswood to address matters including infrastructure and housing needs both during and after mining
- develop annual reporting and “master plans” for matters of community concern, including; blasting, cyanide management, light nuisance, demand for and access to health services, the health impacts on the local community of an increased workforce, and loss of social cohesion on decommissioning
- establish of a Community Consultative Committee.

The EIS concludes that “town planning remains a government responsibility”.

The DETE submitted that the proponent should fund the development of a new school as well as provide new accommodation for school staff, outside the blast zone. There are ongoing negotiations and commitments between the proponent and DETE around the directly affected school.

4.19.4 Outstanding issues

Since social impacts on the Ravenswood community will result from various project activities and physical effects, some of the potential social impacts will depend on the effectiveness of mitigation measures for particular physical effects, such as air emissions and blasting overpressure. The viability of the Ravenswood State School in its current location, even with the proposed adjustments to the proposed blasting regime, is not clear.

The Social Impact Action Plans put forward in EIS have provided a partial response to the concerns raised by stakeholder inputs to the social impact study as well as in the CTRC’s submission in relation to scope of potential changes to the Ravenswood community’s character, amenity and well-being as a result of the project. Greater clarity in relation to a commitment by the proponent to engage effectively with the Ravenswood community and to cooperate with the CTRC is desirable if constructive, on-going relationships are to be established.

4.19.5 Conclusions

It is possible that the combination of social dislocation from the expansion of the mining workforce, together with perceptions around high air emissions, elevated noise, blasting impacts, risks to groundwater, and impacts on amenity for tourism, may pose stress to the local community. Further measures than those provided in the EIS will be needed to mitigate some of these risks. It appears also that clarity of responsibility and closer engagement between the proponent, Ravenswood community stakeholders and the CTRC is needed.

4.20 Cultural heritage

4.20.1 Indigenous cultural heritage

Land disturbance associated with the project, especially the expanded TSF, has the potential to affect Indigenous cultural heritage of the Birri-Gubba People (or ‘Birriah People’), who hold native title over the land leased by the proponent for the project.

Indigenous cultural heritage is primarily protected under the *Aboriginal Cultural Heritage Act 2003*, which places a 'duty of care' on any person or company whose activities may harm or threaten Indigenous cultural heritage. As a response to this duty of care, the Act may require an approved cultural heritage management plan (CHMP) for a project. A CHMP is a mandatory requirement where an EIS is triggered.

4.20.1.1 Existing values

Cultural heritage investigations for the EIS identified areas in proximity to watercourses as being of particular significance within the project area, as they tend to retain a moderate to high level of potential for Indigenous cultural heritage. They are more likely to contain cultural heritage sites such as artefact scatters, campsites and scarred trees. Areas beyond watercourses in the wider Ravenswood region typically have a lower density of artefact scatters and isolated artefacts.

4.20.1.2 Impacts

Field surveys for the EIS identified 32 Indigenous cultural heritage sites within the project area, concentrated near Sandy Creek and its tributaries. The surveys were undertaken in consultation with representatives of the Birriah People. As no major constraints affected the field investigations, the EIS stated that the identified sites accurately reflect the Indigenous cultural heritage record of the area.

The types and low density of identified stone artefacts, as well as their raw materials, were considered to be consistent with assemblages recorded across the wider area of Birriah People homelands. EIS concluded that it is unlikely that any major cultural heritage sites of significance were undetected and that the preservation of the majority of Indigenous cultural heritage sites is poor as they are located on highly eroded and unstable terrain.

The key conclusions of the EIS about Indigenous cultural heritage values and associated project impacts were that the:

- sites represent the remains of relatively small and ephemeral Aboriginal occupation sites (such as 'dinnertime camps') not major occupation camps
- Birriah representatives assessed the sites and associated materials recorded as having high levels of Aboriginal cultural significance, as they represent a tangible link to their heritage, ancestors and homelands, and firm 'connection to country'
- impact of the proposed mining activities on the Indigenous cultural heritage values can be effectively managed within the project area.

The EIS did not address the possibility of chance finds of Indigenous human remains during excavations for the construction, operational, rehabilitation and decommissioning phases of the project. This is a significant possibility in light of the area's history of periodic human occupation and exploitation.

4.20.1.3 Proposed mitigation and management measures

A CHMP was endorsed by the Birriah People and proponent in June 2012. However, a new CHMP needs to be developed to encompass all of the mining lease areas that were surveyed for the project. The endorsement of the initial CHMP by the Birriah People established a number of requirements that have been translated into EIS commitments. The EIS stated that consultation with the Birriah People confirmed that there are no major objections to the project if the CHMP requirements are implemented to protect on-site Indigenous cultural heritage values.

Key commitments from the EIS include:

- indigenous cultural heritage places and objects, as well as disturbance to the banks of watercourses, are to be avoided where practicable
- a systematic cultural heritage salvage of cultural materials from each recorded site is to be conducted by the Birriah People prior to relevant mining or development works
- cultural heritage surveys are to be conducted, in any areas not previously assessed, if changes to the project footprint or location of project infrastructure are to occur.

4.20.1.4 Outstanding issues

The primary outstanding issue is the need for updating of the CHMP. It is appropriate for the CHMP to address the chance discovery of Indigenous human remains.

While the project commitments in the EIS include avoiding disturbance to the banks of watercourses where practicable, this issue warrants further specification in the final CHMP in terms of site management to avoid the exacerbation of erosion of cultural heritage sites.

4.20.1.5 Conclusions

The EIS has provided a generally adequate assessment of the impacts of the project on Indigenous cultural heritage in response to the TOR. In the context of the endorsement of an initial CHMP by the Birriah People, and the proponent's commitment to develop an updated CHMP, the intended approach to manage impacts on Indigenous cultural heritage is considered appropriate.

4.20.2 Non-Indigenous cultural heritage

4.20.2.1 Existing values

European occupation of the Burdekin River catchment for sheep and cattle grazing began in 1861. After gold was discovered at Ravenswood in 1868, initial alluvial workings were quickly followed by mining of numerous gold reefs. This was the first significant reef mining field in the northern Australia. The town was gazetted in May 1871, by which time the population was around 900 people. In the first phase of building, all buildings had sawn timber frames with corrugated iron roofs. Many of the public buildings were replaced during the 1880s, including the court

house, the post and telegraph office and St Patricks Church.

Ravenswood's early prosperity was short-lived. By 1909 gold production began to fall and the population progressively dwindled. The town's decline was only arrested in the 1960s when tourism became significant. This renewed interest in the town and gold fields led to efforts in the 1970s to conserve some of the historic buildings. Indeed, the entire town was listed on the National Trust of Queensland Heritage Register. It was also listed on the former Register of the National Estate, because of the area's significance as an early centre of early gold mining in northern Queensland. Through the renewed mining of gold since 1987 by the proponent, this historic association has continued.

The EIS identified 13 sites or places that lie within or are adjacent to the project area that are listed on the Queensland Heritage Register under the *Queensland Heritage Act 1992*. These sites and places are mainly individual buildings. The EIS also identified ten sites and places in or adjacent to the project area that are listed in the heritage sites register of the former Dalrymple Shire Council planning scheme, which remains in effect. The latter sites and places include individual buildings, the cemetery and the remains of various structures.

The EIS also identified 13 unregistered non-Indigenous cultural heritage sites within the project area, including domestic artefact scatters, mine sites, house remains and mature exotic trees. None of the unregistered non-Indigenous cultural heritage sites discovered during investigations for the EIS was considered significant enough to warrant their subsequent nomination for inclusion on statutory heritage registers.

4.20.2.2 Impacts

The main sources of potential project impacts on non-Indigenous cultural heritage are as a result of direct effects of project works on heritage assets:

- within the project area due to ground disturbance
- outside the project area, e.g. due to vibration or flyrock from blasting or visual intrusion.

The registered non-Indigenous cultural heritage sites are located outside the project area, and hence will not be affected by ground disturbance during construction. However, three of the 13 unregistered non-Indigenous cultural heritage sites identified by the EIS investigations within the project area could be destroyed by ground disturbance works. Two of these three sites are remnants of mine workings and the third is a mature fig tree. Impacts on the two mining sites were rated as of moderate significance, while the impact on a mature fig tree was rated as high largely because of its contribution to the historic landscape and its potential removal. However, removal of the tree may be avoided if the siting of the acoustic bund can be adjusted.

The EIS identified 25 registered structures and buildings of non-Indigenous cultural heritage significance sited either within or adjoining proposed blasting exclusion zones that could be impacted by blasting at the northern face of the Sarsfield Pit, as a result of either vibration or fly rock. These structures and buildings were rated as being of either low or moderate sensitivity, on the basis of their recognition at either a State or local level. The EIS rated the significance of potential impacts on these structures and buildings as low or negligible.

The EIS stated that past investigations of blasting at the Ravenswood mine indicate that damage to existing buildings is not sustained at vibration levels below five millimetres per second (mm/s). Further, it is stated that the structural integrity of non-Indigenous cultural heritage structures in Ravenswood, including buildings and chimneys, has not been affected, where all blast parameters had been within the criteria of 2 mm/s for sensitive buildings.

The EIS used predictive modelling of fly rock throw to derive appropriate minimum distances for exclusion zones to be applied during blasting. It is expected that fly rock will be thrown no closer than half the distance from the blast to the Ravenswood Community Church, which is the closest non-Indigenous structure to the Ravenswood mine.

The proposed acoustic bund for the mine expansion will be the main element of the project causing some visual intrusion within the historic heritage landscape, particularly in relation to the Ravenswood Community Church.

The EIS did not address the possibility of chance finds of human remains, of either Indigenous or non-Indigenous origin, during future excavations for the project.

4.20.2.3 Proposed mitigation and management measures

When proposed mitigation and management measures were taken into account, residual impacts on registered and unregistered sites identified as part of the EIS were mostly considered to be minor or negligible. Some commitments of note in the EIS were:

- To adopt the management strategies and chance finds process in the historical heritage management plan
- Keep the height of the acoustic bund to a minimum, where practicable, to "minimise impacts on the views and vistas of the historic cultural heritage of Ravenswood"
- To undertake baseline dilapidation surveys of all Ravenswood heritage-listed structures … and all occupied buildings within 400m of blasting activities.

4.20.2.4 Outstanding issues

The primary outstanding issue is the need for finalisation of the historical heritage management plan. It will be appropriate for the chance finds (i.e. "yet undiscovered") aspect of this plan to address discovery of non-Indigenous human remains.

4.20.2.5 Conclusions

The EIS has provided a generally adequate assessment of the impacts of the project on non-Indigenous cultural in response to the TOR, as well as an adequate basis for finalising the historical heritage management plan.

4.21 Landscapes and visual amenity

4.21.1 Existing values

The EIS described the project as being located in the Burdekin Rangelands subregion of the Burdekin Dry Tropics region of North Queensland, an area noted for its escarpments, elevated plateaus and undulating landforms and noted that the landscape has been extensively modified by mining activities at Ravenswood, including both the small-scale workings that commenced in the late 1860's and the large-scale modern mining in recent decades. The EIS states that Ravenswood is the oldest surviving inland town in North Queensland and that while the population of the town peaked with 4700 residents in 1903, the diminished current township retains a heritage character (see section 4.20.2 in this report). Grazing and farming activities as well as mining have modified the natural landscape of the surrounding area to form open grasslands with small tracts of native forests.

The environmental values associated with the landscape and visual amenity within the study area relate to the existing built form and township precinct in the context of the surrounding natural landscape. The EIS stated, reasonably, that the sensitivity of the landscape to change is dependent on how it is valued in relation to the existing condition of the land, its cultural significance to people, and the perceived value to stakeholders of scenic views and the land's characteristics.

4.21.2 Impacts

The landscape impact of the project was evaluated in the EIS in terms of how successfully it would be 'visually absorbed' into the existing landscape. The EIS also considered impacts on visual amenity, which were assessed in relation to the sensitivity of viewers to altered perspectives, which in turn reflect factors including: the importance of the viewpoint (e.g. a conservation reserve or roadside); the number and expectations of viewers (e.g. tourists, local residents, motorists driving through); and the magnitude of the visual impact (which relate to changes to both the viewpoint and the landscape features due to the project, as well as to the distance, duration and any screening involved). The EIS selected ten viewpoints from private and public vantage points within the study area, on the basis of the estimated zone of visibility, to represent 'visual receptors' in terms of their exposure to worst-case scenarios of views most affected by the project.

The EIS identified that several components of the project have the potential to impact on landscape and visual values as a result of construction, because of their visual profile (built form), the removal of native vegetation, exposure of soil or rock, and the visual impact of associated infrastructure, dust, heavy machinery, truck traffic and night lighting. In particular:

- expansion of the Sarsfield pit will extend the pit walls to the north and west by up to 140m, bringing it closer to the Ravenswood township, with the depth increasing to 400m
- relocation of a section of the acoustic bund will bring it closer to the township
- expansion of the TSF with up to 52m high walls would involve clearance of a greater than 200ha foot print including native vegetation as well as affecting the landscape character of the 'Open Undulating Tableland and Tributaries' area and the viewpoints of Ravenswood residents
- The new waste rock dump is expected to be about 20m higher than the current dump, and to be 45-55m high, also requiring the removal of 65 ha of native vegetation.

The EIS also notes that visual impacts would result from the development of other facilities, including extension of the mine village and the topsoil stockpiles. Impacts during operations and decommissioning would result from dust, heavy machinery, truck traffic and night lighting.

The Open Undulating Tableland and Tributaries landscape character type will experience the greatest impact as this type underlies most of the project area. According to the EIS:

- Although this landscape character type is already strongly influenced by mining activity within the region, the expansion of the Ravenswood Gold Mine, combined with the loss of landscape features, will result in a notable change to the existing landscape through the increased scale and dominance of mining activities. This change will be most felt by nearby residences and community facilities (receptors), particularly in relation to landform and views associated with the relocation of the acoustic bund and potential visual effects related to dust.

The EIS states that the construction of the new TSF would have the greatest impact on views from Burdekin Falls Dam Road to the southwest of the project. However would also increase the existing visual intrusion together with the impact of dust on visual amenity from other key viewpoints. The EIS rated the impact on Ravenswood State School as being 'moderate' on the basis of its sensitivity, given its listing on the former Register of the National Estate. Impacts on most of the 10 representative viewpoints were rated as 'minor', including based on the fact that some viewpoints already have screening of views to mine infrastructure from intervening vegetation.

4.21.3 Proposed mitigation and management measures

The EIS noted that the acoustic bund would provide a visual buffer of the town from other mine infrastructure. At the same time, the bund is a significant visual element in its own right. The EIS proposed to mitigate project impacts to visual amenity through a range of site management measures, namely:

- site clearance management
- erosion and sediment control
- batter stabilisation
- appropriate rehabilitation
- management of access roads
- waste management
- infrastructure treatment
- weed control.

The EIS notes that those measures would have limited effect on impacts to landscape features.

4.21.4 Conclusions

The EIS has adequately addressed the TOR in its description of existing environmental values as well as in its assessment of the projects potential impacts on landscape values or visual amenity.

The project entails changes to and some expansion of existing infrastructure at the Ravenswood Gold Mine, which already has had a major impact on the landscape of the area. In this context, the general contention of the EIS that the project will not have a further major impact on landscape values or visual amenity is accepted.

The increased visual prominence of the relocated acoustic bund and the enlarged TSF and IWRD will have the greatest permanent impacts, while dust generated during construction, operations and decommissioning will be a key contributor to the project's ongoing impact on visual amenity. Control of dust is therefore important for visual amenity, as well as for air quality. The Mine Closure Plan and its effective implementation will be the critical factors in mitigating longer-term landscape impacts. Consequently, while the general form of the TSF and IWRD have little scope for modification, their successful rehabilitation with a sustainable soil and vegetation cover will be crucial.

4.22 Hazard and risk

The TOR called for the EIS to address the hazards and risk to people and property that may be associated with the project; hazards and risk to the natural environment were to be addressed under other headings. The EIS focussed on hazards and risks for people (including the workforce and general public) associated with storage and handling of dangerous goods and combustible materials, general health and safety issues, and security issues, with a focus on hazards and risks to people and property from potentially significant incidents. The EIS has responded appropriately to the TOR.

The Ravenswood Gold Mine is classified as a potential major hazard facility, in accordance with the *National Standard for the Control of Major Hazard Facilities* (2002), based largely on the remote location of the site and the quantities of sodium cyanide, ammonium nitrate and explosive devices stored and used at the site, which form part of the existing project and the proposed expansion.

4.22.1 Existing values

The EIS identified the environmental values relevant to “hazard and risk” as being the health and safety of the community and workforce. Various sensitive receptors, including the township precinct, the Ravenswood State School, residences and non-Indigenous cultural heritage structures and buildings lie adjacent to the mine site or within the proposed blasting exclusion zones.

4.22.2 Impacts

The EIS stated that as part of compliance with engineering standards the project will incorporate extensive safety controls and consequently the assessment focused on residual risks. Following a systematic process of identifying risks, risk assessment, and then consideration of risk mitigation measures, a number of project hazards were rated in the EIS as having high residual risks including:

- uncontrolled blasting generating flyrock leading to severe injury or extensive property damage
- failure to manage worker health and safety leading to long-term health impacts, injury or fatality
- failure of the TSF or Suhrs Creek dam leading to loss of production, equipment damage, injury or fatality
- failure to properly manage explosives and blasting devices leading to injury, fatality or property damage
- security breach and subsequent theft, loss or unauthorised use of explosives, ammonium nitrate or other hazardous materials from site, leading to injury or fatality
- pit wall failure leading to fatality, lost productivity and equipment damage.

4.22.3 Proposed mitigation and management measures

The EIS developed an integrated risk management approach for the project based on the existing Health, Safety and Environmental Management System framework with plans and procedures either already established or to be developed to focus on the management of site and project-specific hazards and their associated risks.

The EIS set an objective for residual risks to be “as low as reasonably achievable”. To achieve that the EIS identified possible causes of potential incidents and their likely consequences and considered the operational and organisational controls needed to minimise the consequences or mitigate the likelihood of the hazardous event occurring. The EIS included a commitment to monitor existing controls and to implement changes as part of an integrated risk management system to ensure the effectiveness of the controls during the life of the project.

The EIS included a commitment by to inspect all regulated dams annually via third-party experts to mitigate the risk of failure of the Suhrs Creek dam, the TSF and other structures.

The explosive storage area is proposed to be located adjacent to the old Sandy Creek heap leach facility in order to create a minimum 1,300m buffer zone between the explosives magazine area and the office buildings and workshops. The EIS states that this measure reduces the potential severity and health ramifications of any explosion and fire, and responds to community safety concerns.

4.22.4 Outstanding issues

The existing Health, Safety and Environmental Management System framework needs to be updated to suitably incorporate the additional elements and risks of the project.

4.22.5 Conclusions

The EIS has provided a satisfactory assessment of and response to hazards and risks to people and property.

4.23 Health and Safety

The TOR called for the EIS to assess the project's potential health impact on the community of Ravenswood and broader region including Charters Towers and Townsville. While the EIS provided an overview of risks to public health, the content of the health impact assessment (HIA) overlaps with other components of the EIS. Risks related to occupational health and safety for mine workers have been addressed more fully under the heading of Hazard and Risk (section 4.22 of this report).

4.23.1 Existing values

The TOR required the EIS to describe the existing community values for public health and safety that may be affected by the project and to pay particular attention to those sections of the population who are especially sensitive to environmental health factors.

The EIS did that at a broad level and identified vulnerable groups in the regional community as including:

- socio-economically disadvantaged people, of whom there is a substantial proportion in both Charters Towers and Ravenswood
- indigenous people, of whom there is an above-average representation in both Charters Towers and Ravenswood, statistically they have poorer levels of health and well-being than non-Indigenous people
- children, who while they form a low proportion of the Ravenswood population, are particularly vulnerable to the effects of environmental contaminants
- older adults, who are both more prone to life-threatening diseases and more affected by the influence of housing, social isolation and access to transport and health services.

The EIS noted that protective factors, particularly for mental health, include good social relationships and networks. The maintenance of such "social capital" in Ravenswood would therefore influence the degree of emotional distress in the community that mine-related activities may create.

The EIS noted that infrastructure also influences health outcomes; that there is no hospital in Ravenswood and no resident doctor, but the Royal Flying Doctors Service can access the town and makes monthly visits. Two nurses are currently provided on a 24 hour rotation by the proponent to provide services principally to the workforce but also to residents of Ravenswood.

4.23.2 Impacts

The HIA in the EIS did assess potential health impacts during the construction, operations and decommissioning phases. The HIA concluded that even after all mitigation measures are applied there would still be significant residual health risks for Ravenswood because of its close proximity to the mine site. Some of these impacts are judged as being of very high significance, because of their severe consequences even though their likelihood is deemed to be "rare", namely:

- major disaster such as pit wall failure or hazardous chemical fire
- structural failure of TSF or Suhrs Creek dam
- blasting fly rock and hazards to aircraft
- diminished access to health services.

Health risks from some operational activities appeared to be understated through selection of consequence and likelihood criteria that may not have been objective. For example, risks from air quality from dust and disease vectors from increased breeding of mosquito or midges were both rated as being of "medium" significance on the basis that the duration is typically "short-term acute", while the consequences are "moderate" and the likelihood "possible". In particular for air quality that does not appear to match the potential risk profile described in the EIS or the certainty about achieving performance objectives (refer to section 4.8 of this report). Any risk to public health associated with persistent reduced air quality conditions should not be downplayed relative to either rare catastrophic events (e.g. failure of the TSF) or longer-term, major impacts (reduced access to health services after mine closure).

The EIS noted potential mental health risks as including:

- members of the ageing population in Ravenswood to experience mental stress from driving among increased heavy vehicles on local roads
- night works including noise, vibration and light pollution to heightening levels of annoyance and sleep disturbance
- shift work at the mine, uncertainty about the township's future and concern about changing property values.

EIS commented that physical health risks to the community included potential increases in sexually transmitted disease in the community associated with the project workforce.

4.23.3 Proposed mitigation and management measures

The EIS noted that an integrated risk management approach had been developed for the project based on the existing mine's Health, Safety and Environmental Management System. The EIS included a commitment to monitor and evaluate mitigation actions for health impacts that are rated as very high, high or medium. That monitoring would be included in a yet to be developed Health Management Plan. Strategies to mitigate and manage a range of aspects of health and safety risk were identified in the HIA but described more fully in other parts of the EIS.

4.23.4 Outstanding issues

The EIS failed to address some relevant health and safety aspects including:

- Potential impacts on human health from use of recycled or mine affected water; for example Queensland Health raised concerns that water from the mine pit might be used for dust suppression on roads and the EIS had not detailed how management of the various water storages would mitigate potential human health risks of that including to support statements that use would only occur if deemed of suitable water quality. There was no specific information about the management of human or environmental health impacts from the operation of evaporative fans that would spray contaminated water and tailings leachate into the air for disposal of the water through evaporation.
- Cumulative impacts: The TOR required potential impacts on the community's health, safety, and quality of life, as well as any cumulative impacts on public health be addressed. However, the EIS did not clearly identify how the various, combined effects of the project might impact on different parts of the Ravenswood community and thereby affect the overall quality of life
- Monitoring, auditing and corrective action: The EIS stated that the Health, Safety and Environmental Management System would underpin internal management of health issues, however the EIS did not establish how public transparency would be provided with respect to the management of risks to community health and safety.

4.23.5 Conclusions

With the above important exceptions the EIS otherwise provided a reasonable response to the TOR health and safety matters. Those unresolved matters should be resolved from the human health and safety perspective before decisions about approval of the project are made.

4.24 Rehabilitation and decommissioning

4.24.1 Rehabilitation objectives, indicators and goals

The land-related environmental values of the project area have been assessed in the EIS for surface geology, landform, soils, degree of existing disturbance and current land use, as well as the combination of factors influencing susceptibility to future disturbance.

Non-mining land uses include areas within the project area with a cover of native vegetation supporting ecological and habitat values and some potential for grazing. About 60% of the study area is classified as Class C agricultural land, while the remaining 40% of land has been classified as Class D agricultural land, not suitable for agriculture.

Currently disturbed areas reflect recent mining activities, the EIS notes the susceptibility of disturbed areas to water and wind erosion, and hence sedimentation, as well as slope instability, waterlogging, salinity and anthropogenic influences. Different components of the project will have distinct impacts on land-related environmental values, and will present corresponding challenges for rehabilitation. In particular:

- expansion of the mine pit will modify the dimensions of the residual void
- extension of waste rock dump will disturb erodible soils during its construction, as well as permanently altering the landscape within its footprint
- extension of TSF will permanently alter the landscape with the footprint, much of which is relatively undisturbed, as well as presenting a risk of extended impacts if erosion or failure of the TSF wall were to occur.

The EIS noted rehabilitation objectives focusing on conserving existing environmental values, reducing project impacts on the existing landscape and rehabilitating the capacity of the landscape to support its intended future use. It noted that some disturbed parts of the study area have been previously rehabilitated by, first, placing a mixture of topsoil, subsoil and sometimes residual soil or weathered rock over the site, then deep ripping, adding organic material and fertiliser, and finally establishing vegetation cover.

EIS stated that the rehabilitation plan would be based on the EHP Rehabilitation Requirements for Mining Projects guideline. The EIS proposed general strategies to assist in the rehabilitated outcome and to maintain and restore the land-related environmental values of the project area such as to:

- reduce the clearance footprint as far as is practicable
- apply measures to reduce and control erosion, as well as sedimentation
- carefully manage the limited soil resources in order to reduce degradation of soil structure and enable rehabilitation
- re-shape the final form of the constructed landforms to optimise their stability.

The EIS committed to (but did not include a rehabilitation management procedure and mine closure plan) inform actions by the mine operator to establish suitable end-state conditions. The EIS includes general statements of intent such as:

- the “TSF is to be rehabilitated to stable, safe, non-polluting landform with self-sustaining soil fertility for the designated land use”
- to remove mining landforms associated with project, where feasible, and otherwise, to reprofile batters such that slopes do not exceed 12°, unless the material is capable of safely sustaining higher slopes
- to manage, in accordance with the rehabilitation management procedure and the mine closure plan, the structure and stability of the erosive, dispersive soils of the mine site (e.g. by deep ripping, mulching, and adding organic content and potassium nitrite fertiliser)
- reinstate soil profiles with comparable physical and chemical properties to the pre-disturbance characteristics, to sustain future land-use.

4.24.2 Outstanding issues

The TOR required that EIS provide details about a preferred rehabilitation strategy including details of rehabilitation success criteria to be used in monitoring rehabilitation and post mine closure plan detailing maintenance and monitoring. That detail was not provided the EIS committed to the development of those elements at a later date.

4.24.3 Conclusions

The rehabilitation management procedure and mine closure plan should be completed to the appropriate degree prior to considering approval of the project.

4.25 Matters of National Environmental Significance

The project is a controlled action under the EPBC Act (EPBC 2011-6062) and the controlling provisions are:

- World Heritage properties (S12 and12A)
- National Heritage places (S15B and15C)
- Listed threatened species and communities (S18 and 18A)
- Great Barrier Reef Marine Park (GBRMP) (S24B and 24C)

The assessment approach was decided as being under the assessment bilateral agreement with Queensland.

The EIS included a stand-alone report on the matters of national environmental significance and subsequent updates concluded that that amendment of the project made no material change to the impacts outlined in the original EIS, and that the mitigation measures expressed in the EIS will be effective in protecting biodiversity values.

The Commonwealth Department of the Environment (DOE) submission on the EIS was summarised in Chapter 5 of the SEIS and recorded and responded to in the issue register table in SEIS Chapter 6, Issue and Response Register.

In deciding whether or not to approve the proposal under the EPBC Act, and what conditions to attach to such an approval, the Commonwealth Environment Minister must not act inconsistently with:

- Australia’s obligations under:
    - The Biodiversity Convention
    - The Apia Convention
    - Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), or
- a recovery plan or threat abatement plan.

In deciding whether or not to approve the proposal under the EPBC Act, the Commonwealth Environment Minister must have regard to any approved conservation advice for the species or community.

4.25.1 Existing values

The EIS described the existing environment and environmental values in a stand alone report (Attachment 2 to EIS), that report included a general description of the local area , bioregion, geology, land use, and summarised the landscape around the study area as being highly disturbed and the natural ecosystems severely impacted by extensive clearing, weed invasion and soil erosion. It noted that the bioregion as a whole is considered to be a national, biodiversity hotspot comprising high habitat diversity, including containing a number of specialised and restricted habitat types and endemic species, populations and threatened species.

However, the EIS concluded that the habitats present in the study area are widespread and common to the wider region, and that while some parts of the study area may periodically be used by EVNT species, in general the study area lacked important habitat for EVNT species.

An EPBC Act protected matters search was undertaken for the project. The search identified 11 threatened (8 fauna and 3 flora) species and 15 migratory species potentially on site. That search confirmed that no World Heritage properties or National Heritage properties occur in, or relate to the project area.

The EIS stated that flora and fauna assessments included dry and wet season field surveys. The terrestrial ecology field surveys identified 167 fauna species on site, comprising 102 birds, 30 mammals, 27 reptiles and 8 frogs. Desktop assessment and the field surveys identified 325 flora species on site.

4.25.1.1 Recovery plans and Threat abatement plans

There is one recovery plan for species that may occur, likely to occur or are known to occur in the project area. There are three threat abatement plans that list species of interest or possibly impacted by the threat that occur in the project area. The relevant plans are:

- National Recovery Plan for the Black-throated finch southern subspecies
- Threat abatement plan for predation by feral cats
- Threat abatement plan for predation, habitat degradation, competition and disease transmission by feral pigs
- Threat Abatement Plan for Predation by the European Red Fox
- Threat Abatement Plan for competition and land degradation by rabbits
- Threat Abatement Plan to reduce the impacts of tramp ants on biodiversity in Australia and its territories

4.25.1.2 Listed threatened fauna species

The EIS confirmed that two EPBC Act listed 'threatened' terrestrial fauna species have the potential to occur within the project area:

- Southern subspecies of squatter pigeon (*Geophaps scripta scripta*) ('vulnerable').
- Southern subspecies of black-throated finch (*Poephila cincta cincta*) ('endangered').

4.25.1.2.1 Squatter Pigeon (southern) (*Geophaps scripta scripta*) ('vulnerable').

The squatter pigeon was recorded on site in field surveys but the EIS noted that as the study area is located within the hybrid zone of the northern and southern sub-species of squatter pigeon, it was not possible to confirm that the specific southern sub-species was present and that it is probable that the observed birds were in fact hybrids. However, for the purposes of the EIS assessment, birds recorded were conservatively considered as the 'vulnerable' southern sub-species.

The Squatter pigeon is listed as Vulnerable under the EPBC Act and Queensland's NC Act. General information about this species includes that it is patchily distributed through Queensland and is commonly observed in more open areas of dry eucalypt woodland on sandy soil dissected by low gravelly ridges, and close to permanent water to open forest on the inland slopes of the Great Dividing Range, stretching from the Burdekin-Lynd divide to scattered sites in South East Queensland and west to Longreach. Historically, populations of the Squatter pigeon declined during the late nineteenth and early twentieth century. However, the decline in numbers has now slowed. The current population of the subspecies is estimated to be stable at around 40 000 breeding birds, with some locally abundant populations found in the northern part of its current distribution.

DOE notes that there is an abundance of suitable available habitat in central and northern Queensland. Considered sedentary or locally nomadic, it is a ground-dwelling pigeon that forages on insects, ticks, fallen grass seeds, herbs and shrubs. The breeding season generally occurs from late winter through summer, though may extend throughout the year if conditions are suitable. The squatter pigeon breeds in a scrape in the ground lined with dry grass. It is often seen in pairs or in small family groups. Movement is restricted as this species is ground dwelling and flies to nearby trees only when flushed or for courtship.

Conservation advice, recovery plans and threat abatement plans

The approved Conservation Advice for the Squatter Pigeon identifies main threats to the Squatter pigeon (southern) to include habitat degradation and ongoing clearance of habitat for development purposes or farming, grazing of habitat and predation by feral cats (*Felis catus*) and foxes (*Vulpes vulpes*).

The Conservation Advice for the Squatter Pigeon lists priority recovery and threat abatement actions including: control and eradication of feral herbivores; stock management; securing sites for conservation; raising awareness of the species among land managers; monitoring management effectiveness; and implementing the appropriate recommendations outlined in the relevant Threat Abatement Plans.

There is no Recovery Plan for the Squatter Pigeon.

The following Threat Abatement Plans are relevant for the Squatter Pigeon:

- Threat Abatement Plan for predation by feral cats;
- Threat Abatement Plan for predation by the European Red Fox; and
- Threat Abatement Plan for competition and land degradation by rabbits; and
- Threat Abatement Plan to reduce the impacts of tramp ants on biodiversity in Australia and its territories

The EIS provided an assessment of the potential impacts associated with the project on the Squatter pigeon against the EPBC Act significant impact criteria for vulnerable species.

4.25.1.2.2 Southern subspecies of black-throated finch (*Poephila cincta cincta*) ('endangered')

The black-throated finch (BTF) was not recorded onsite in field surveys but is known from the local area. The EIS stated that the study area is dominated by exotic grasses that reduces BTF habitat values and therefore reduces the likelihood of the BTF occurring on site.

The southern subspecies of the BTF is listed as 'Endangered' under the EPBC Act and 'Vulnerable' under the Queensland NC Act.

Its habitat requirements are riparian areas within open eucalypt, acacia or melaleuca forest and woodlands and occasionally tussock grasslands. The BTF occurs in the Townsville region and at scattered sites in central-eastern Queensland. The species requires a mosaic of different habitats in which it can feeds on fallen grass seed and obtain daily water.

The Significant Impact Guidelines for the BTF note that the BTF requires access to three key habitat resources, being water sources, grass seeds and trees providing suitable nesting habitat. The presence and configuration between and within these three key resources governs the distribution of the BTF. Any disruption to the connectivity between these resources will have a serious impact on an area's ability to sustain BTF populations. While suitable nesting sites are likely to be relatively common in the landscape, the distribution and availability of water and foraging habitat is much more limited and will, in turn, limit the number of nesting sites available to the BTF.

BTF can breed all year, however breeding activity peaks in February and May. They nest in loose colonies in trees and shrubs. The movement patterns on this species are poorly understood, however the finch may undertake some movements in response to rainfall or drought prompted by food availability.

Conservation advice, recovery plans and threat abatement plans

National Recovery Plan for the Black-throated Finch (southern subspecies)

The National Recovery Plan for the BTF lists possible threats to the species as clearing and fragmentation of woodland, riverside habitats and wattle shrub land; degradation of habitat by domestic stock and rabbits, including alterations to fuel load, vegetation structure and wet season food availability; and alteration of habitat by changes in fire regime; invasion of habitat by exotic weed species, including exotic grasses; illegal trapping of birds; predation by introduced predators; and hybridisation with escapees of the northern subspecies.

The national recovery plan identifies that proper management of habitat for the BTF is critical to the survival of the species, including managing overgrazing, clearing and fragmentation appropriately and implementing suitable fire and weed management strategies.

Guidelines for habitat management for the BTF southern subspecies, as outlined in the recovery plan includes:

- management practices aimed at minimising impacts on habitat by domestic stock and rabbits
- fire management
- weed management strategies to minimise invasion of habitat by exotic weed species, including exotic grasses.

The EIS has committed to a number of these measures, to be implemented through the proposed Pest and Weed Management Plan. The EIS has also committed to ensuring compliance with these management practices by implementing weed and pest management procedures and fire management protocols.

The key State legislation for the conservation and recovery of the Black-throated finch in Queensland is the *Nature Conservation Act 1992* (NC Act), including the Nature Conservation Regulation 1994.

The NC Act facilitates threatened species conservation through:

- listing Vulnerable and Endangered species
- requiring permits for the taking of Vulnerable and Endangered species
- preparation of conservation plans for species or groups of species
- management of wildlife in accordance with the declared management intent for Vulnerable and Endangered fauna.

There are two relevant Threat Abatement Plans for the Black-throated Finch:

- Threat Abatement Plan to reduce the impacts on northern Australia's biodiversity by the five listed grasses
- Threat Abatement Plan for competition and degradation by rabbits.

4.25.1.1 Listed migratory species

In deciding whether or not to approve the proposal for the purpose of section 20 or 20A of the EPBC Act, and what conditions to attach to such an approval, the Commonwealth Minister for the Environment must not act inconsistently with Australia's obligations under the following conventions and agreements:

- The Bonn Convention
- CAMBA
- JAMBA
- An international agreement approved under subsection 209(4) of the EPBC Act.

Many animals migrate to Australia and its external territories, or pass through or over Australian waters during their annual migrations. Many migratory species listed under international conventions and agreements that Australia is party to, are protected under the EPBC Act. These species include migratory birds.

4.25.1.1.1 Rainbow bee-eater (Merops ornatus)

The rainbow bee-eater (*Merops ornatus*) was recorded on site. The EIS stated that it is widespread and common within the local region and not associated with a particular location or habitat. Field surveys identified two EPBC Act migratory listed species; the eastern great egret (*Alba modesta*) and the white-bellied sea-eagle (*Haliaeetus leucogaster*) at the freshwater dam at Suhrs Creek, adjacent to but outside the project area.

The rainbow bee-eater is a common and widespread species across Australia inhabiting a range of habitat types throughout the project area including remnant and non-remnant vegetation. Foraging habitat is varied and includes disturbed and undisturbed areas while breeding habitat involves the excavation of a burrow in soil such as along a river bank, dam wall, gravel pit or soil piles.

The potential impacts to migratory species in the project area are predicted to be minor as many of the species are highly mobile and capable of relocating with changes in the availability of suitable habitat. There are no recovery plans in place for those migratory species known or likely to occur in the project area. The project is not expected to substantially interfere with the recovery of migratory species. There are no migratory species where an ecologically important proportion of the population will be impacted.

4.25.1.2 Listed flora species

Five listed flora species were identified as potentially occurring on site based on a 100km search of records around the study area. One species, *Tephrosia leveillei*, listed as 'vulnerable', was assessed as having a moderate likelihood of occurrence within the study area. The EIS stated that given the history of land disturbance in the area and the low precision record from 1931, it is unlikely that the plant even exists on site. The remaining four species were classified as having a low or very low likelihood of occurrence. None of the EPBC act listed flora species were verified during the field surveys.

4.25.1.3 Threatened ecological communities

On the basis of surveys of the project site and a search of records undertaken for the EIS it concluded that no threatened ecological communities of national environmental significance were present or potentially present in or within 10km of the project area.

4.25.2 Impacts

The EIS assessed all species classified as having a moderate likelihood of occurrence and above (therefore considered possible to occur within the project area) against the relevant significant impact criteria. All other species considered of low or very low likelihood of occurrence within the project area, for example as a result of a lack of suitable habitat, or being outside of the species normal range, were not assessed further.

The EIS stated that potential impacts on terrestrial flora and fauna resulting from project activities were likely to be primarily associated with vegetation clearance and habitat loss, degradation and fragmentation of remaining habitat, direct disturbance of fauna through noise and construction activities, and the introduction or spread of invasive weeds or pests.

4.25.2.1 Listed fauna species

The EIS stated that potential impacts to squatter pigeons and black-throated finch from the proposed development would be similar and could include:

- The loss of 88.25ha of woodland habitat due to vegetation clearing. The EIS stated that similar habitats were widespread in the local area and consequently potential impacts such as habitat loss, degradation and fragmentation, would be minor in extent. The EIS claimed this would be a minor impact due to the woodland habitat to be cleared being only 0.09% of the woodland within the Einasleigh Uplands Bioregion and 0.33% within the local area and in particular that a large (26,114ha) tract of similar woodland habitat was located to the northeast of the project area. The EIS concluded that it was unlikely that the loss of the woodland habitats would significantly affect the local squatter pigeon or black-throated finch populations.
- Loss of water resources due to changes in groundwater and/or surface water flows, pooling and flooding (including modification/loss of artificial bodies such as dams). The EIS noted that squatter pigeons and black throated finches are known to regularly frequent watercourses and it is probable that permanent or semi-permanent water is an important habitat. The EIS noted that because grazing has introduced abundant water resources throughout the region, any loss of surface water from the project is likely to be of little consequence.
- Edge effects. The EIS noted that areas adjacent to the project site were not well managed and included weeds and, because of the location of the project, that the nature of the expansion would not impact on connectivity or access to refugia.

4.25.2.2 Listed flora species

The EIS stated that despite no occurrences on site, potential impacts to all listed flora species such as *Tephrosia leveillei* will be similar and could include:

- loss of potential habitat through vegetation clearing
- decreased habitat quality through edge effects
- decreased condition of supporting vegetation communities through increased grazing pressure, increased level of weed invasion, excessive dust, changed fire regimes, altered surface hydrology.

4.25.2.3 Great Barrier Reef Marine Park

The EIS stated that during the operation of the TSF and associated decant pond, seepage of waste materials has the potential to impact groundwater dependent ecosystems and cause contamination and diminished surface water quality in Sandy Creek.

The EIS noted that whilst the project is directly 75km west of the coastal zone where physical coastal processes are active, it is a significantly longer path to the GBRMP via waterways. Downstream from the project the watercourses of Sandy Creek and Elphinstone Creek drain to Connolly Creek and Barabbas Creek, respectively, which then drain to the Burdekin River upstream from the Burdekin Falls dam, then flow about 38km through the Burdekin Falls dam impoundment, finally the Burdekin River discharges to the Great Barrier Reef lagoon, approximately 240km from the project area.

The EIS states that no significant impacts from the project are expected to occur outside the Sandy Creek and Plumtree Creek catchment. Consequently it concludes that the project would not cause loss, degradation or damage to the World Heritage values or National Heritage values associated with the GBRMP and would not alter, modify, obscure or diminish any World Heritage value or National Heritage value associated with the GBRMP.

4.25.2.4 Great Barrier Reef World Heritage Area

The Great Barrier Reef World Heritage Area (GBRWHA) stretches more than 2300 km along the northeast coast of Queensland, from the tip of Cape York to just north of Bundaberg. Its width varies from around 90km to around 300km.

The GBRWHA was inscribed on the World Heritage List in 1981 for all four of the natural heritage criteria specified in the United Nations Educational, Scientific and Cultural Organisation's 2012 *Operational Guidelines for the Implementation of the World Heritage Convention*; criteria (vii), (viii), (ix) and (x).

The current natural heritage criteria for World Heritage properties are that they:

vii. contain superlative natural phenomena or areas of exceptional natural beauty and aesthetic importance;
viii. be outstanding examples representing major stages of earth's history, including the record of life, significant on-going geological processes in the development of landforms, or significant geomorphic or physiographic features;
ix. be outstanding examples representing significant on-going ecological and biological processes in the evolution and development of terrestrial, fresh water, coastal and marine ecosystems and communities of plants and animals; and
x. contain the most important and significant natural habitats for in-situ conservation of biological diversity, including those containing threatened species of outstanding universal value from the point of view of science or conservation.

The EIS states that no significant impacts from the project are expected to occur outside the Sandy Creek and Plumtree Creek catchment. Consequently it concludes that the project would not cause loss, degradation or damage to the World Heritage values or National Heritage values associated with the GBRMP and would not alter, modify, obscure or diminish any World Heritage value or National Heritage value associated with the GBRMP.

4.25.2.5 Great Barrier Reef National Heritage Place

In May 2007, the Great Barrier Reef was placed on the National Heritage List. This list comprises natural and cultural places that contribute to our national identity, providing a tangible link to past events, processes and people.

The Great Barrier Reef (GBR) was one of 15 World Heritage properties included in the National Heritage List in 2007. The GBR National Heritage place has national heritage values in respect of the following national heritage criteria:

- the place has outstanding heritage value to the nation because of the place's importance in the course, or pattern, of Australia's natural or cultural history
- the place has outstanding heritage value to the nation because of the place's possession of uncommon, rare or endangered aspects of Australia's natural or cultural history
- the place has outstanding heritage value to the nation because of the place's potential to yield information that will contribute to an understanding of Australia's natural or cultural history
- the place has outstanding heritage value to the nation because of the place's importance in demonstrating the principal characteristics of:
    - a class of Australia's natural or cultural places; or
    - a class of Australia's natural or cultural environments;
- the place has outstanding heritage value to the nation because of the place's importance in exhibiting particular aesthetic characteristics valued by a community or cultural group.

The EIS stated that no significant impacts from the project are expected to occur outside the Sandy Creek and Plumtree Creek catchment. Consequently it concludes that the project would not cause loss, degradation or damage to the World Heritage values or National Heritage values associated with the GBRMP and would not alter, modify, obscure or diminish any World Heritage value or National Heritage value associated with the GBRMP.

4.25.3 Avoidance, mitigation and management measures

4.25.3.1 Fauna

Listed threatened terrestrial fauna species with a likelihood of occurrence within the project area (squatter pigeon and black-throated finch) could be impacted by the project through vegetation clearance and loss of habitat. The EIS claimed that occurrence of additional suitable habitat within the local area is likely to reduce the impacts on these species, as the proportion of relevant vegetation cleared compared to that available within the region is low. The EIS also included commitments to implement mitigation measures, serve to reduce the impact of the project on

either of the species.

The EIS noted that the mitigation measures would be difficult to effectively implement, but would include:

- restricting vegetation clearing to required disturbance areas only; clearance zones would be clearly demarked to ensure clearing activities do not extend beyond planned clearing zones
- reduction of grazing pressures within lease areas. This would involve consideration of a grazing management plan with a focus on fencing in conjunction with adjoining landowners
- updating the existing Pest (Biosecurity) Management Plan and undertaking predatory pest (pig, fox, dog and cat) control in conjunction with adjacent landowners
- increasing the level of awareness of weed and pest fauna species and associated issues within the project area so that the relevant employees and contractors would be able to identify key pest species and have knowledge of issues, impacts and management
- revegetation of disturbed areas and waste-rock dumps using native grass and shrub species
- keeping machinery operators vigilant to watch for any injured birds resulting from clearing activities
- providing access to veterinary treatment for injured wildlife.

4.25.3.2 Flora

The EIS noted the unlikely presence of *Tephrosia leveillei* on-site however proposed mitigation and management measures including:

- pre-construction clearance surveys in suitable habitat (regional ecosystem 9.12.1) within 200m of proposed disturbance as a precautionary measure to identify and map any potential individuals/populations
- where disturbance to populations is unavoidable, policy and permit requirements relevant to the removal of EVNT flora species will be adhered to
- plant translocation should be explored where possible
- utilise existing recovery plans and threatened species advice statements where available.

4.25.3.3 Great Barrier Reef Marine Park

Sediment generation and mobilisation to watercourses will be minimised through design features and sequencing of construction activities, in particular for the TSF and waste rock dump. Infrastructure will be constructed such that it becomes internally draining as soon as possible.

The EIS stated that erosion risk is minimal throughout the full spectrum of possible events. Flooding presents a minor risk in Sandy Creek where the southeast edge of the TSF and waste rock dump extend into the 1 in 100 ARI flood envelope. The EIS stated that the risk would be mitigated through standard design measures and rock armouring for the relevant areas of the TSF.

4.25.3.4 Great Barrier Reef World Heritage Area

The EIS stated that no significant impacts from the project are expected to occur outside the Sandy Creek and Plumtree Creek catchment, it concluded that the project would not cause loss, degradation or damage to the World Heritage values associated with the GBRMP and would not alter, modify, obscure or diminish any World Heritage value associated with the GBRMP. Therefore the EIS did not include specific mitigation measures for this element.

4.25.3.5 Great Barrier Reef National Heritage Place

The EIS stated that no significant impacts from the project are expected to occur outside the Sandy Creek and Plumtree Creek catchment, it concluded that the project would not cause loss, degradation or damage to the National Heritage values associated with the GBRMP and would not alter, modify, obscure or diminish any National Heritage value associated with the GBRMP. Therefore the EIS did not include specific mitigation measures for this element.

4.25.3.6 Cumulative impacts

Cumulative impacts were assessed in the EIS and it concluded that due to the remote location of the project, the absence of other major projects or proposals directly affecting the Ravenswood township, and the often-localised impacts, no potential cumulative impacts were identified for MNES.

4.25.3.7 Offsets

The EIS stated that since the assessment concludes the project has no residual significant impacts on MNES, there are no plans for offsets and there are no regulatory requirements for offsets at this stage. The EIS included a commitment that if the need for offsets is identified during project implementation then a plan will be developed in consultation with EHP and DOE.

4.25.4 Outstanding issues

In response to statements in the EIS that no offsets are proposed due to identified low risk of significant impacts to EPBC species, the DOE indicated in its response to the SEIS that further information should be provided by the proponent to indicate mitigation and avoidance measures taken to protect MNES and to justify that residual impacts are not considered to be significant.

If residual significant impacts to MNES are subsequently determined likely to occur, DOE will discuss this matter with the proponent prior to making the final decision.

4.25.5 Conclusions and recommendations

The supplementary terrestrial ecological assessment concluded that changes to the project description from the amendment made no material changes to the impacts originally outlined in the EIS, and that the mitigation measures expressed in the EIS would likely be effective in protecting biodiversity values. The EIS did include the appropriate assessments and concluded that no significant negative impacts to MNES are likely to occur within the project area or as a consequence of the project, specifically including for local squatter pigeon and black-throated finch populations and the GBRMP. No offsets were proposed.

5 Adequacy of the Environmental Management Plan

The EIS included an environmental management plan (EMP) that the EIS described as a strategic EMP, which was prepared to detail the projects: environmental values; issues and impacts; and management and mitigation measures (generally referred to as commitments).

The EIS stated that the strategic EMP would serve as the application information for the proposed environmental authority amendment application process under Greentape amendments since the EIS process commenced. In that context, the requirement of the EP Act is that the EMP should provide all the detail to allow EHP to condition the project should approval of an EA be granted.

On the whole, the strategic EMP did set out sections for each of the key issues posed in the EIS, the format was generally in keeping with that of a generic EMP. The EMP included a reflection of the values, issues and impacts as expressed in the EIS and consequently repeated rather than resolved the issues about compliance with appropriate standards as identified in the EIS and raised by the advisory body in reviews.

The following consideration of the EMP's suitability is limited to some of the specific critical matters identified in the EIS review, noting that some of the unresolved matters of the EIS are intrinsically linked to action taken under another matter. For example, linkages between air quality, land contamination, surface water quality and human health from waste disposal such as evaporative fan operation.

5.1 Air quality

The section on air quality management noted that the project would result in an improvement of existing air emissions and therefore was deemed suitable despite that PM_{10} was predicted to exceed limits on the existing EA and MMC.

The objectives proposed in the EMP were stated at high level, specifically:

- To adopt measures to minimise the release of pollutants from mine activities into the local airshed.
- To mitigate and manage impacts due to increases of pollutants into the local airshed.

The EMP did not include air quality objectives in the specific performance criteria. It stated compliance with the EA objectives however did not specify "existing" or MMC. Given the material presented in the EIS there is no demonstration that either of those limits could be fully achieved by the project as presented. Therefore the air section of the EMP is not suitable as the application information for an EA.

5.2 Noise and vibration

The section on noise and vibration did include specific limits for compliance, they were the "interim" limits discussed earlier in section 4.17 of this report. Despite that the EIS stated that compliance with the noise limits would be problematic, the level of information for noise appears suitable as the application information for an EA. A separate specific consideration would be required during the EA assessment about whether the proposed interim conditions were suitable or not.

5.3 Waste management

The EMP sets out the nature of the predicted waste, the proposed facilities and actions for its management and potential impacts to the environment.
The environmental objectives are broadly stated as to:

- minimise waste-related impacts to the integrity, ecological function and environmental values of the air, land and water environments
- design the layout and operations to minimise the generation of waste during all stages of the Project
- minimise the generation of waste by means of avoidance, followed by reduction, reuse, recycling, treatment and disposal
- ensure safe management and disposal of waste that can't be reused or recycled.

Performance criteria were limited to compliance with legislative codes and standards. Specific statements about the design and operation of the TSF and IWRD reflect the material presented in the EIS and do not provide an appropriate range of specific measures to confirm the performance of those facilities to meet the stated objectives. Therefore the waste section of the EMP is not suitable as the application information for an EA.

5.4 Groundwater management

Groundwater performance criteria for operation and construction were limited to:

- having no observable impact to baseline water quality.

Under the risk profile established in the EIS for potential groundwater impacts, the EMP should include specific measureable performance criteria including in reference to the appropriate environmental values to be protected. The environmental value of the groundwater, for example to stygofauna, was not included in the groundwater plan, consequently the objectives did not reflect that value.

The existing operation is failing to meet the limits of its current EA because of ongoing groundwater contamination, and the EIS stated that the existing (contaminated) conditions are taken to be the "baseline" conditions. The EMP set the performance criteria for construction and operational activities as:

- do not have an observable impact to baseline groundwater quality.

The proposed performance criteria are unacceptable as they seek to continue the release of contaminated groundwater for the new operation. Therefore the groundwater section of the EMP is not suitable as the application information for an EA.

5.5 Surface water

The EMP identified the potential surface water values for the project and therefore values to be protected as:

- Consumptive or productive values (agricultural and industrial uses)
- Aesthetic and human interaction values (primary contact and secondary contact)
- Ecological values (protection of slightly to moderately disturbed surface waters).

The performance criteria stated were:

- Avoid permanent impact to the physical form or hydrology of watercourses as a result of project activities
- Prevent unauthorised release of contaminants directly or indirectly into watercourses
- Compliance with water quality objectives.

No specific surface water conditions were proposed in the EMP. On that basis the relevant conditions that could apply to the project would follow the MMC and therefore include a trigger value based on values for protection of aquatic ecosystems. However, the EIS has not demonstrated that the project could comply with those limits. Therefore the surface water section of the EMP is not suitable as the application information for an EA.

5.6 Freshwater ecology

The EMP identified the potential freshwater ecological values as including flora fauna and stygofauna. The EMP noted that the freshwater ecosystems are dependent on groundwater in areas where discharge is to the surface. The potential impacts of the project were identified and the environmental objectives stated as:

- To avoid or minimise impacts to freshwater ecology within watercourses and wetlands within and downstream of the project area
- To avoid or minimise impacts to groundwater dependent ecosystems (stygofauna)
- To control the introduction or spread of new or existing pest freshwater species.

The performance criteria stated were:

- No unauthorised release of contaminants directly or indirectly into watercourses
- No reported instances of infestations of new or existing exotic aquatic flora or fauna species resulting from project activities
- Compliance with water quality objectives.

No specific performance criteria about water quality were included, on that basis the relevant conditions that could apply to the project would follow the MMC and include a trigger value based on values for protection of aquatic ecosystems and limits based on downstream stock watering. However, the EIS has not demonstrated that the project could comply with those limits. Therefore the freshwater ecology section of the EMP is not suitable as the application information for an EA.

5.7 Social

The EMP sets out the existing environment values and potential impacts of the project. It states that the predominant impact on the township of Ravenswood is likely positive, on the basis of population and economic growth and notes potential impacts to physical or psychological health of the community as a result of dust emissions causing reduction in air quality, contamination of groundwater and private water sources. It does not include other potential impacts noted in the EIS, such as impacts to the community through loss of visual amenity, noise, vibration and light.

The EMP sets out an implementation strategy to mitigate effects noting social impact linked to environmental performance. EHP does not regulate social matters and the suitability of those environmental matters that link to social impacts are addressed in other sections of this report.

5.8 Health

The EMP sets out the existing environment, values and potential impacts of the project on the health of the Ravenswood community. Whilst noting potential for catastrophic impact i.e. from blasting accidents or TSF failure, it states that the predominant impact on the township of Ravenswood is likely through:

- waste management
- water management
- air quality and dust
- traffic
- noise
- community access to health services and infrastructure
- mental health driven by stress from project elements and future.

The EMP does not address the matters around aerosols from the proposed evaporative fan system.

The EMP sets out an implementation strategy to mitigate effects noting health impact linked to environmental performance. EHP does not regulate health matters directly and the suitability of those environmental matters that link to health impacts are addressed in other sections of this report.

5.9 Conclusion

The EMP is not suitable as the application information for the proposed amendment of the environmental authority that would be required to seek approval to implement the project.

6 Outstanding matters

6.1 Air

The EIS shows that based on modelling there is a high potential for non-compliance with the MCC and EPP Air objectives for dust and has not demonstrated that the project could achieve these objectives, importantly these aspects include human health and amenity issues.

The EIS has not adequately described how the air quality objectives would be achieved, monitored and audited, and how corrective action would be taken when needed.

Other air aspects not adequately addressed by the EIS include:

- frequency contour plots for typical and maximum emissions under the expected range of meteorological conditions including the worst case
- assessment of the human health risk associated with emissions from the project
- backup measures to be incorporated that will act in the event of failure of primary measures to minimise the likelihood of plant upsets and adverse air impacts
- how proposed emission control processes accord with the management hierarchy for air emissions in the EPP Air
- the potential for sensitive receptors to be exposed to high levels of particulate matter for a period of two months during construction of the new acoustic bund has not been assessed
- specific health risk assessment associated with air quality from aerosols created by the proposed use of evaporative fans to dewater the Sarsfield mine pit and ongoing contaminated water disposal.

Resolving those matters is critical prior to considering approval of the project.

6.2 Greenhouse gas emissions

The outstanding actions for Greenhouse matters include that:

- the assessment of the project's contribution to greenhouse gas emissions has not been updated for the revised project description
- the preferred measures to achieve energy efficiency and to minimise emissions were not identified
- an energy and greenhouse gas management plan was not developed for the project.

These actions could be completed within the suitable timeframe outside the EIS process.

6.3 Land

6.3.1 Land contamination

The potential risk of contamination to land from a range of sources was not adequately assessed in the EIS, including:

- the investigation of groundwater conditions affected by existing land contamination was deficient and should be completed
- as a result of leakage from water storages including the TSF, decant pond and others
- as a result of seepage from under the IWRD
- emissions from the evaporative fans.

The project should not proceed until practical and effective measures are demonstrated that will address the potential impact of contamination to land from those sources.

6.4 Waste management

There remains a significant potential environmental risk from the project of seepage of contaminated water and runoff from the IWRD related to the confirmed characteristics of the porous natural foundation of the WRD, the measured quality of waste rock including components that are PAF and the unspecified potential impact of leachate from the large volumes of varied hard waste that are proposed to be disposed within the WRD.

Before the project could proceed outstanding matters should be resolved including:

- the specifics of the proposal to manage the waste rock to achieve environmental objectives should be provided in a waste rock management plan
- assessment of the potential impact to groundwater and then to surface waters of the likely seepage from the IWRD
- assessment of the ability of detection, management or recovery of seepage from the IWRD and residual potential impacts to ground and surface water specified against the relevant environmental values so that an acceptability assessment can be made.

6.5 Mine water management

The following mine water matters need to be resolved before considering approval of the project:

- an assessment of the numerous water storages that could contain contaminated water be made to ascertain their need for seepage prevention and detection, management and monitoring of their contents and control over the disposal or use of their water
- the evaporation fan system or an alternative excess water disposal system be suitably developed to demonstrate effective operation while managing risks including to human health, surface water quality and land contamination.

6.6 Surface water

There remain significant matters that must be resolved prior to considering approval of the project including:

- the management of seepage quality and volume from the IWRD
- the proposals for leak detection beneath the TSF, decant pond and any storage for similarly contaminated water
- management of risk of impact to surface water quality through use of fans for the evaporation of mine affected water and tailings supernatant
- management of risk that contaminated water utilised for dust suppression could impact surface waters.

6.7 Groundwater

The expanded TSF and IWRD are proposed over areas of significant shearing and jointing, however, it was unclear in the EIS how this was to be considered in assessing the risk of contaminated groundwater seepage, in particular from the unlined IWRD.

A waste rock management procedure is required that details measures to avoid acid rock drainage problems including for example:

- characterisation of waste rock
- assignment of either NAF or PAF classification to waste rock blocks
- placement and use of NAF waste rock, and appropriate encapsulated disposal of PAF waste rock
- measures to minimise potentially contaminated seepage to groundwater under the WRD
- monitoring of performance against the above.

The current proposal for no leak detection beneath the decant pond and only 10% coverage of leak detection under the TSF both are inadequate given the environmental risks identified in the EIS. A suitable means to confirm the performance of both lining systems should be developed prior to considering approval of the project.

The potential for preferential groundwater pathways to include locally complex low permeability strike-slip faults and shear zones not currently identified or targeted by the limited boreholes proposed for the project indicates that additional monitoring bores (including reference bores) should be considered for confirmation of the quality and degree of migration of groundwater from the site.

Significant uncertainties remain around the ability to intercept and recover contaminated seepage through trenches and bores once it is through a liner. Much of this relates to the complexity of local faults and low permeability zones that are evidenced on site. A full assessment of mitigation measures to be implemented is required to ensure that any seepage is managed to not cause environmental harm during the construction, operation and post closure of the TSF and any other storage that includes similarly contaminated water. In particular 100% coverage of any leak detection system for contaminated water storage faculties is warranted.

6.8 Ecology

6.8.1 Flora

A significant number of commitments were made in the EIS about management and mitigation of impacts to flora values. Those commitments should be formally reviewed and incorporated into the appropriate elements of the management information associated with any application for approval for this project. The agreed actions should be formally attached to any approval should it be granted.

6.8.2 Fauna

A significant number of commitments were made in the EIS about management and mitigation of impacts to fauna values. Those commitments should be formally reviewed and incorporated into the appropriate elements of the management information associated with any application for approval for this project. The agreed actions should be formally attached to any approval should it be granted.

6.8.3 Aquatic ecosystems

EIS did not suitably address the potential impacts of contaminated seepage on the aquatic ecosystem values, it noted the level of potential impact and committed to address it. However, there is no clear proposal, in proportion to the risk, to suitably assess impacts through:

- confirm the performance of the liner under the TSF or decant pond
- management of seepage from the IWRD
- mitigation of the increased flow of contaminants to Nolans and Sandy Creeks following the decommissioning of the Kakadu Seepage trench.

Details around proposed stygofauna monitoring are incomplete and a monitoring proposal should be developed to address the current uncertainty around potential impacts to stygofauna communities through both contamination and groundwater level changes during mine dewatering.

Noting the significance of the potential impacts and the EIS's statement that further design constraints will consequently be required, the project should only proceed if suitable practical and effective measures can be developed to manage those risks to an acceptable level.

6.8.4 Biodiversity offsets

The Queensland Biodiversity Offsets Policy (QBOP) which sets out the specific requirements of offsets of State Significant Biodiversity Values (SSBV) applies to the project. The EIS concluded that 113ha of offset would be required for protected animal and plant habitat and 95.8ha for watercourse vegetation. It proposed to deliver a direct offset, within an area close to the impact site, however a specific offset plan was not developed in the EIS. A suitable offset should be developed in conjunction with EHP, prior to the impacts occurring.

6.9 Transport

The DTMR proposes that the proponent:

- engage with DTMR to finalise a road impact assessment (RIA), road-use management plan (RMP) and traffic management plan (TMP) for approval by DTMR before works start and to be implemented by the proponent
- submit a revised pavement impact assessment spreadsheet to DTMR, as the basis for confirming required payments for necessary rehabilitation, bring-forward and maintenance works
- upgrade delineation and signage at bridges and culverts on the Burdekin Falls Dam Road to conform with Traffic and Road Use Manual (TRUM) standards
- widen the pavement of the Ayr-Ravenswood Road between Devils Elbow Creek and Four Mile Creek in order to comply with relevant standards in the Traffic and Road Use Manual (TRUM) for Triple Roads Trains
- submit detailed designs for the intersection upgrades on State-controlled roads to DTMR for its review and approval, on the basis of correct design speed parameters
- monitor the condition of bridges and other relevant structures on State-controlled road and to rectify any damages to these structures that are attributable to project transport
- prior to the commencement of works enter into a Deed of Agreement with DTMR in relation to:
    - contributions to upgrade roads and intersections
    - necessary access to the State-controlled road network
    - rehabilitation and maintenance contributions associated with project traffic.

DTMR stated that the EIS was incorrect in its description of both the Burdekin Falls Dam Road and the Ayr–Ravenswood Road, the implications of these errors will need to be addressed as part of the required RIA and RMP.

6.10 Noise and vibration

The interim noise criteria discussed are high, relative to the provisions of the EPP Noise, the Model Mining Conditions and the WHO 'Night Noise Guidelines for Europe'. Noting that the EIS stated modelled exceedences of interim noise limits would occur, further consideration about the recommended conditions to be imposed should the project succeed should include:

- questioning the presumption of community tolerance of mining-related noise in Ravenswood, especially noting the concerns of the community noted in section 4.19 of this report
- determination of the appropriate inputs tot eh sound modelling for mobile plant and consideration of the range of available additional mitigation measures that could apply for the project to achieve an appropriate standard.

6.11 Social

The EIS notes that it is possible that the combination of social dislocation from the expansion of the mining workforce, together with perceptions around high air emissions, elevated noise, blasting impacts, risks to groundwater, and impacts on amenity for tourism, may pose stress to the local community.

Further measures than those provided in the EIS will be needed to mitigate some of these risks in their own right however in addressing those risks responses should be also included to the concerns raised by stakeholders about potential changes to the Ravenswood community's character, amenity and well-being as a result of the project.

Greater clarity about the commitment in the EIS to engage effectively with the Ravenswood community and to cooperate with the CTRC is desirable if constructive, on-going relationships are to be established. Clarity of the relevant responsibilities between the proponent and the CTRC is needed.

6.12 Cultural heritage

6.12.1 Indigenous cultural heritage

A Cultural Heritage Management Plan has been developed in conjunction with the Birriah People for an earlier version of the project. That CHMP must be updated to incorporate the amended project including to:

- include a new section to address the chance discovery of Indigenous human remains
- address site management to avoid the exacerbation of erosion of cultural heritage sites.

6.12.2 Non Indigenous cultural heritage

The historical heritage management plan has not been finalised and also requires the inclusion of a "chance finds" (i.e. "yet undiscovered") section to address discovery of non-Indigenous human remains. The EIS has provided an adequate basis for finalising the historical heritage management plan.

6.13 Hazard and risk

The Health, Safety and Environmental Management System framework for the existing mine operation should be updated to suitably incorporate the additional elements and risks of the project.

6.14 Health and Safety

The EIS failed to address:

- potential impacts on human health from use of recycled or mine affected water, for example from use of mine pit used for dust suppression on roads
- the management of human health impacts from the operation of evaporative fans that would spray contaminated water and tailings leachate into the air for disposal of the water through evaporation
- cumulative impacts of the project on the overall quality of life different parts of the Ravenswood community and thereby impacts on public health
- a targeted Health, Safety and Environmental Management System to underpin internal management of health issues, including management of risks to community health and safety.

These matters should be resolved before decisions about approval of the project are made.

6.15 Rehabilitation and decommissioning

The EIS did not provide details about:

- a preferred rehabilitation strategy including details of rehabilitation success criteria to be used in monitoring rehabilitation
- post mine closure plan detailing maintenance and monitoring.

The rehabilitation management procedure and mine closure plan should be completed to the appropriate degree prior to considering approval of the project.

6.16 MNES

In response to statements in the EIS that no offsets are proposed due to identified low risk of significant impacts to EPBC species, the DOE indicated that further information should be provided by the proponent to indicate mitigation and avoidance measures taken to protect MNES and to justify that residual impacts are not considered to be significant. If residual significant impacts to MNES are later determined likely to occur, DOE will discuss this matter with the proponent prior to making the final EPBC decision.

6.17 Environmental authority application information

The EIS included a strategic EMP prepared as the application information under Greentape for the proposed environmental authority amendment application process. In that context, the requirement of the EP Act is that the EMP should provide all the detail to allow EHP to condition the project should approval of an EA be granted.

The EMP included a reflection of the values, issues and impacts as expressed in the EIS and consequently repeated rather than resolved the issues about compliance with appropriate standards as identified in the EIS and raised by the advisory body in reviews. Consequently, a number of critical matters in the EMP were not a suitable basis on which to condition the project should it be approved.

Should an application for an EA amendment for the project be made on the basis of the information in the EMP it is likely that the information would be considered inadequate and the application rejected. For example the information does not provide specific conditions for approval for some key matters and the EIS does not demonstrate that the project would comply with the conditions that would likely be applied.

7 Recommended conditions of approval

7.1 Environmental Protection Act 1994

The project is poorly developed in terms of resolving some critical matters under the EP Act and consideration of approval should not occur until those matters are suitably resolved. In many respects, the appropriate conditions that would apply under the EP Act for this project would be the model mining conditions. However, the EIS has demonstrated that the project could not comply with those conditions or achieve the appropriate environmental outcome; consequently specific conditions of approval under the EP Act cannot be provided.

Post Greentape amendments, the EIS provided a strategic EMP as the application information for the proposed environmental authority amendment application process. A review of that application information concluded in section 5.9 of this report that the EMP was not suitable as the sole application information for the proposed amendment of the environmental authority that would be required to seek approval to implement the project.

In many respects, the appropriate conditions that would otherwise apply under the EP Act for this project are the model mining conditions and conditions for regulated structures. Despite that the EIS demonstrated that the project in its current form could not comply with some of those conditions, these are provided here (Appendix A and B respectively), as conditions that must be addressed before the proponent applies for an approval for the project.

A separate consideration would be required during the EA assessment about what specific conditions would apply to an approval if granted. However, to be clear, an application for approval for the project that did not comply with the conditions recommended here is not likely to be accepted.

In addition to those conditions, to treat other high risk aspects of the proposal identified in this assessment, the following matters should also be specifically included and conditioned in any consideration of approval of the project:

- there should be no controlled release of contaminants to surface waters
- standard conditions for regulated structures would apply, however an additional condition around full (100%) coverage of leakage detection and management of *any* storage containing mine water, tailings liquor or process water is warranted
- given the complexity of the existing site contamination and the proposed location of the TSF, a specific groundwater and surface water contamination management and monitoring plan should be developed. That plan must achieve outcomes including demonstrated ability to:
    - monitor performance of the proposed new storages separately from existing contamination
    - manage seepage and leakage, if detected, to ensure that environmental values are not impacted and agreed environmental objectives are achieved.
- the groundwater and surface water contamination management and monitoring plan must be peer reviewed and finalised to the satisfaction of EHP taking into account the results of that peer review
- implementation of the approved groundwater and surface water contamination management and monitoring plan should form part of any conditions if the project is approved
- the outstanding matters included in section 6 of this report must be resolved to the satisfaction of EHP.

7.2 Approvals under other legislation

A range of other approvals would apply for the project (refer to section 3.2 of this report). Generally conditions for those approvals would not be generated until the appropriate information is provided. This report notes in sections above the status of the assessment for the full range of matters and section 6, outstanding matters, identifies specific deficiencies in information. For example, prior to recommended conditions of approval under other legislation being developed, outstanding information would have to be provided for:

- *Aboriginal Cultural Heritage Act 2003*
- *Environmental Protection and Biodiversity Conservation Act 1999*
- *Nature Conservation Act 1992*
- *Transport Infrastructure Act 1994.*

8 Suitability of the project

This project represents a challenging situation because the site is:

- located immediately adjacent (within 100's of metres) to the township of Ravenswood
- currently significantly contaminated through the leakage of contaminated water from tailings through the base of the Nolans TSF, from seepage to ground and surface water from the existing WRD and from other sites such as Kakadu
- subject to ongoing compliance action by EHP in response to the discharge of contaminants.

Based on the matters considered in this report there are three principal elements of the proposal that therefore must be thoroughly addressed before applying for approval of the project:

- impacts to human health and safety and social well-being in the Ravenswood community
- impacts to groundwater and surface water
- the ability of the proposal to comply with appropriate environmental outcomes.

The project would be suitable provided it adequately addressed the recommended conditions set out in section 7 of this report.

8.1 Human health and safety and social well-being

The EIS acknowledged that some Ravenswood residents are currently subject to levels of air-borne particulate matter and noise from the existing operation that may exceed contemporary acceptable limits and suggested that there is a high level of acceptance of this diminished environmental quality within the community. However, the EIS also acknowledged that there is a significant concern amongst Ravenswood residents that the proposed mine expansion may expose them to unacceptable, on-going, high levels of dust, noise and blasting vibration as well as heavy vehicle traffic. The HIA in the EIS identified that some members of the Ravenswood population are particularly vulnerable to the health impacts of diminished environmental quality.

Evidence provided in the EIS indicated that residents in the vicinity of the mine could be exposed to levels of air-borne particulates during some periods of the project's construction and operation that would constitute a

significant health risk. In the absence of local air quality data, modelling for the EIS assessment was based on data including from distant coastal sites. Consequently, there is a significant level of uncertainty regarding both current and potential levels of impact. Also, while a range of mitigation and management strategies were put forward in the EIS to address project risks, their likely effectiveness in achieving required standards was not demonstrated. Protecting human health in the Ravenswood community is a priority, it is therefore not sufficient to rely on a commitment in the EIS to "monitor and manage" required air quality while a high degree of uncertainty exists about the effectiveness of the proposed mitigation and management measures.

The EIS noted that there is the possibility that noise from proposed 24 hour operational activities and heavy vehicles may create on-going sleep disturbance and stress for some Ravenswood residents and that, coupled with high level day-time noise impacts during the relocation of the acoustic bund and noise from blasting, this may result in health and social impacts within the community. The EIS noted that usual limits for noise would not be achievable at some sensitive receptors, based on project's proximity to the township. The EIS sought that higher noise limits be applied to the project, while acknowledging that full compliance with those relaxed limits might be difficult.

The EIS stated that the project would offer important economic benefits and that that the social impacts of the project would be mainly positive, on the basis of stimulating local economic and population growth. However, the economic analysis for the EIS indicated that significant economic benefits would mainly occur at a regional and higher level, it did not specifically state what the proportion of the benefit would be to the local community. Considering the expected noise and air quality impacts as well as the potential impacts of the project workforce on social cohesion, there is a reasonable likelihood that the project may result in a net negative impact on the well-being of the existing Ravenswood community. The SIA reported that potential impacts of the project on amenity and social well-being are also the strong concerns of the community.

An integrated assessment of the project's net impact on the Ravenswood community has yet to be provided and there is no coherent strategy to protect the community's well-being from the potential impacts of the project.

8.2 Impacts on groundwater and surface water

The proposal to expand the operation, including through construction of a large TSF immediately adjacent to the existing TSF and above the contaminated groundwater mound (refer to figure 2) introduces a major compounding issue for this project. Potential impacts to groundwater from the new TSF is made much more difficult because, to be effective, performance monitoring of the new facilities must be able to discriminate new leakage from the existing contamination. To protect the environment, there is little that can be done practically to repair a leak in the liner or dewater the tailings should a leak develop. Further contamination of groundwater and surface water is clearly unacceptable.

It would not be acceptable for the project to continue to impact on groundwater at existing levels occurring under the current operation as is proposed in some sections of the EIS. Potential impacts to groundwater from poor performing large TSF and IWRDs are both wide scale and would extend well beyond the operational lifespan of the mine, for example seepage from the TSF would continue for over 20 years post closure.

While studies for the EIS point to the "acid buffering capacity" of the tailings and waste rock as constraining the generation of acid to date within the existing TSF and WRD, the potential for oxidising conditions to become established in the longer term has not been clearly addressed. Depending on this potential, as well as the effectiveness of final design, capping and rehabilitation of the facilities, and the on-going capacity for management and remediation of discharges, significant impacts could continue into the longer-term.

There is a high probability, on the basis of the current design proposals, that the expanded TSF and the IWRD will discharge contaminated water to shallow aquifers, which would in turn flow into Sandy Creek and downstream waterways. In light of the identified role of the waterways as ecological corridors, the risk that contaminated waters might also affect fauna is significant. The EIS did not demonstrate that the project could comply with the likely environmental outcomes that would apply for the project, including conditions for protection of aquatic ecosystems, an identified environmental value for the site.

The EIS showed that the likely surface water quality in the final pit voids would preclude their use as water storages because contaminant concentrations the contaminants would continue to increase through ongoing inputs and evaporation in perpetuity.

8.3 Summary

While Ravenswood has experienced open-cut gold mining over many years and the proposal is for the expansion of an existing mine, the EIS has not provided an adequate assessment of the likely impacts of the proposed project on either the health and well-being of the community or the ecosystems and other environmental values of the area. The EIS did claim that the project would not result in unacceptable impacts. However, it provided little

evidence to support that and has not demonstrated that the project would result in an acceptable level of environmental risk.

Many of the potential environmental impacts of the project would be felt directly by the Ravenswood community including: decreased water quality; loss of amenity; reduced air quality; increased noise and inhalable dust; increased heavy traffic; and reduced human health, community cohesion and social well-being.

8.4 Conclusion

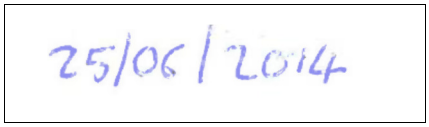
The EIS process for this project has been protracted, with substantial project changes being presented in the SEIS. During the EIS process there has been considerable interaction between the proponent and members of the advisory body, in particular to clarify the regulators' expectations about the project's performance and required environmental outcomes. Despite that ongoing engagement and assessment, the EIS overall has not demonstrated that the project as proposed can meet the required environmental outcomes required under applicable policies.

Considering the EIS, public submissions and the matters required under the EP Act, including the standard criteria, it is apparent that:

- inter-generational equity is an important consideration due to the potential long-term duration of groundwater pollution
- the long-term risk to the conservation of environmental values, biological diversity and ecological integrity of ecosystems in local waterways from both seepage and potential failure of the TSF needs to be more effectively addressed
- the ability of the project to meet likely surface water, groundwater, air quality and noise standards imposed through model mining conditions has not been adequately demonstrated
- the mitigation and management measures proposed in the EIS appear to have assumed a greater degree of resilience of the receiving hydrogeological, ecological and human environments than is warranted by the evidence provided
- proposed design and mitigation solutions for critical aspects are, in part, yet to be developed and the efficacy of most to achieve environmental outcomes complying with Environment Protection Policy, model mining conditions or other relevant standards has not been confirmed
- The EMP is not suitable as the application information for the proposed amendment of the environmental authority that would be required to seek approval to implement the project
- the public interest warrants that a conservative approach be adopted to ensure the protection of the health and well-being of the Ravenswood community
- the precautionary principle points to the need for further action, before any authorisation for the project is granted, to effectively characterise the risks of serious environmental harm associated with the impacts of contaminated water on environmental values and the risk of human health impacts through elevated particulate matter, elevated noise and other stressors.

This assessment concludes that the project should be considered for approval when the outstanding matters are suitably addressed. It is recommended that the proponent not seek approval by applying for an amendment of an environmental authority under the EP Act unless the application adequately addresses the recommended conditions in section 7 of this report.

Approved by



Signature

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Appendix A Model mining conditions

These conditions are indicative only and based on the model mining conditions available from http://www.ehp.qld.gov.au/land/mining/pdf/model-mining-conditions-em944.pdf

Please note that additional matters that should also be conditioned are included in section 7 of this report.

An EA, if issued will only include the conditions considered appropriate by the delegate when the decision is made, there may be additional conditions imposed above those considered in the assessment report

Note: Insertions required by applicants and/or the administering authority are in blue. These should be suitably completed prior to the condition being finalised.

Schedule A - General

A1 This environmental authority authorises environmental harm referred to in the conditions. Where there is no condition or this environmental authority is silent on a matter, the lack of a condition or silence does not authorise environmental harm.

A2 In carrying out the mining activity authorised by this environmental authority, disturbance of land:
- a) may occur in the areas marked 'A'
- b) must not occur in the areas marked 'B'

A3 The holder of this environmental authority must:
- a) install all measures, plant and equipment necessary to ensure compliance with the conditions of this environmental authority
- b) maintain such measures, plant and equipment in a proper and efficient condition
- c) operate such measures, plant and equipment in a proper and efficient manner
- d) ensure all instruments and devices used for the measurement or monitoring of any parameter under any condition of this environmental authority are properly calibrated.

Monitoring

A4 Except where specified otherwise in another condition of this environmental authority, all monitoring records or reports required by this environmental authority must be kept for a period of not less than 5 years.

Financial assurance

A5 The activity must not be carried out until the environmental authority holder has given financial assurance to the administering authority as security for compliance with this environmental authority and any costs or expenses, or likely costs or expenses, mentioned in section 298 of the Act.

A6 The amount of financial assurance must be reviewed by the holder of this environmental authority when a plan of operations is amended or replaced or the authority is amended.

Risk management

A7 The holder of this environmental authority must develop and implement a risk management system for mining activities which mirrors the content requirement of the Standard for Risk Management (ISO31000:2009), or the latest edition of an Australian standard for risk management, to the extent relevant to environmental management, by <<Insert date 3 months from date of issue>>

Notification of emergencies, incidents and exceptions

A8 The holder of this environmental authority must notify the administering authority by written notification within 24 hours, after becoming aware of any emergency or incident which results in the release of contaminants not in accordance, or reasonably expected to be not in accordance with, the conditions of this environmental authority.

A9 Within 10 business days following the initial notification of an emergency or incident, or receipt of monitoring results, whichever is the latter, further written advice must be provided to the administering authority, including the following:

a) results and interpretation of any samples taken and analysed
b) outcomes of actions taken at the time to prevent or minimise unlawful environmental harm
c) proposed actions to prevent a recurrence of the emergency or incident.

Complaints

A10 The holder of this environmental authority must record all environmental complaints received about the mining activities including:

a) name, address and contact number for of the complainant
b) time and date of complaint
c) reasons for the complaint
d) investigations undertaken
e) conclusions formed
f) actions taken to resolve the complaint
g) any abatement measures implemented
h) person responsible for resolving the complaint.

A11 The holder of this environmental authority must, when requested by the administering authority, undertake relevant specified monitoring within a reasonable timeframe nominated or agreed to by the administering authority to investigate any complaint of environmental harm. The results of the investigation (including an analysis and interpretation of the monitoring results) and abatement measures, where implemented, must be provided to the administering authority within 10 business days of completion of the investigation, or no later than 10 business days after the end of the timeframe nominated by the administering authority to undertake the investigation.

Third-party reporting

A12 The holder of this environmental authority must:

a) within 1 year of the commencement of this environmental authority, obtain from an appropriately qualified person a report on compliance with the conditions of this environmental authority
b) obtain further such reports at regular intervals, not exceeding 3 yearly intervals, from the completion of the report referred to above; and
c) provide each report to the administering authority within 90 days of its completion.

A13 Where a condition of this environmental authority requires compliance with a standard, policy or guideline published externally to this environmental authority and the standard is amended or changed subsequent to the issue of this environmental authority, the holder of this environmental authority must:

a) comply with the amended or changed standard, policy or guideline within 2 years of the amendment or change being made, unless a different period is specified in the amended standard or relevant legislation, or where the amendment or change relates specifically to regulated structures referred to in condition XX, the time specified in that condition

b) until compliance with the amended or changed standard, policy or guideline is achieved, continue to remain in compliance with the corresponding provision that was current immediately prior to the relevant amendment or change.

Schedule B - Air

Point source releases to air

B1 Discharges of contaminants to air from the activity, other than dust and particulate matter addressed by condition B4, must be in accordance with **Tables B1—release points (air)** and **B2—contaminant limits (air)**.

B2 Conduct a monitoring program of contaminant releases to the atmosphere at the release points, frequency and for the contaminants specified in **Table B2—contaminant limits (air)** and which complies with the most recent edition of AS4323.1 Stationary source emissions method 1: Selection of sampling positions, and the most recent edition of the administering authority's air quality sampling manual.

Table B1—release points (air)

Release point	Release point description	Source description	Minimum release height (metres above ground)	Minimum exit gas temperature (°C)	Minimum efflux velocity (m/s)
To be completed	To be completed	To be completed	To be completed	To be completed	To be completed

Table B2—contaminant limits (air)

Contaminant	Release point	Limit type	Release limit	Release limit units	Minimum monitoring frequency
To be completed	To be completed	To be completed	To be completed	To be completed	To be completed

B3 The release of point source and fugitive emissions from the mining activities must not cause the concentrations of the contaminants listed in Table B1, when measured at [a sensitive place or at specified monitoring stations], to exceed the levels shown in Table B2.

Dust and particulate matter monitoring

B4 The Proponent shall ensure that all reasonable and feasible avoidance and mitigation measures are employed so that the dust and particulate matter emissions generated by the mining activities do not cause exceedances of the following levels when measured at any sensitive or commercial place:

a) Dust deposition of 120 milligrams per square metre per day, averaged over 1 month, when monitored in accordance with the most recent version of Australian Standard AS3580.10.1

Methods for sampling and analysis of ambient air—Determination of particulate matter—Deposited matter – Gravimetric method.

b) A concentration of particulate matter with an aerodynamic diameter of less than 10 micrometres (PM10) suspended in the atmosphere of 50 micrograms per cubic metre over a 24-hour averaging time, for no more than 5 exceedances recorded each year, when monitored in accordance with the most recent version of either:
   1. Australian Standard AS3580.9.6 Methods for sampling and analysis of ambient air—Determination of suspended particulate matter—PM_{10} high volume sampler with size-selective inlet – Gravimetric method; or
   2. Australian Standard AS3580.9.9 Methods for sampling and analysis of ambient air—Determination of suspended particulate matter—PM_{10} low volume sampler—Gravimetric method.

c) A concentration of particulate matter with an aerodynamic diameter of less than 2.5 micrometres (PM2.5) suspended in the atmosphere of 25 micrograms per cubic metre over a 24-hour averaging time, when monitored in accordance with the most recent version of AS/NZS3580.9.10 Methods for sampling and analysis of ambient air—Determination of suspended particulate matter—PM (sub)2.5(/sub) low volume sampler—Gravimetric method.

d) A concentration of particulate matter suspended in the atmosphere of 90 micrograms per cubic metre over a 1 year averaging time, when monitored in accordance with the most recent version of AS/NZS3580.9.3:2003 Methods for sampling and analysis of ambient air—Determination of suspended particulate matter—Total suspended particulate matter (TSP)—High volume sampler gravimetric method.

Schedule C - Waste management

C1 General waste must only be disposed of into the waste disposal trench facility of <insert tenement number> and identified in Schedule # Figure # – Site Map.

C2 Unless otherwise permitted by the conditions of this environmental authority or with prior approval from the administering authority and in accordance with a relevant standard operating procedure, waste must not be burnt.

C3 The holder of this environmental authority may burn vegetation cleared in the course of carrying out extraction activities provided the activity does not cause environmental harm at any sensitive place or commercial place.

Tailings disposal

C4 Tailings must be managed in accordance with procedures contained within the current plan of operations. These procedures must include provisions for:

a) containment of tailings
b) the management of seepage and leachates both during operation and the foreseeable future
c) the control of fugitive emissions to air
d) a program of progressive sampling and characterisation to identify acid producing potential and metal concentrations of tailings
e) maintaining records of the relative locations of any other waste stored within the tailings
f) rehabilitation strategy
g) monitoring of rehabilitation, research and/or trials to verify the requirements and methods for decommissioning and final rehabilitation of tailings, including the prevention and management of acid mine drainage, erosion minimisation and establishment of vegetation cover.

Acid sulphate soils

C5 Treat and manage acid sulphate soils in accordance with the latest edition of the Queensland Acid Sulfate Soil Technical Manual.

Schedule D - Noise

Noise limits

D1 The holder of this environmental authority must ensure that noise generated by the mining activities does not cause the criteria in **Table D1 – Noise limits** to be exceeded at a sensitive place or commercial place.

Table D1 – Noise limits

Sensitive Place						
Noise level dB(A) measured as:	**Monday to Saturday**			**Sundays and Public Holidays**		
	7am to 6pm	**6pm to 10pm**	**10pm to 7am**	**9am to 6pm**	**6pm to 10pm**	**10pm to 9am**
LAeq, adj, 15 mins	CV = 50 AV = 5	CV = 45 AV = 5	CV = 40 AV = 0	CV = 45 AV = 5	CV = 40 AV = 5	CV = 35 AV = 0
LA1, adj, 15 mins	CV = 55 AV = 10	CV = 50 AV = 10	CV = 45 AV = 5	CV = 50 AV = 10	CV = 45 AV = 10	CV = 40 AV = 5
Commercial Place						
Noise level dB(A) measured as:	**Monday to Saturday**			**Sundays and Public Holidays**		
	7am to 6pm	**6pm to10pm**	**10pm to7am**	**7am to 6pm**	**6pm to 10pm**	**10pm to 7am**
LAeq, adj, 15 mins	CV = 55 AV = 10	CV = 50 AV = 10	CV = 45 AV = 5	CV = 50 AV = 10	CV = 45 AV = 10	CV = 40 AV = 5

Table D1 – Noise limits notes:

1. *CV = Critical Value*
2. *AV = Adjustment Value*
3. *To calculate noise limits in Table D1:*
   If bg ≤ (CV – AV):

   Noise limit = bg + AV

   If (CV – AV) < bg ≤ CV:

   Noise limit = CV

   If bg > CV:

   Noise limit = bg + 0
4. *In the event that measured bg (**LA90, adj, 15 mins**) is less than 30 dB(A), then 30 dB(A) can be substituted for the measured background level*
5. *bg = background noise level (**LA90, adj, 15 mins**) measured over 3-5 days at the nearest sensitive receptor*
6. *If the project is unable to meet the noise limits as calculated above alternative limits may be calculated using the processes outlined in the "Planning for Noise Control" guideline.*

Airblast overpressure nuisance

D2 The holder of this environmental authority must ensure that blasting does not cause the limits for peak particle velocity and air blast overpressure in **Table D2 – Blasting noise limits** to be exceeded at a sensitive place or commercial place.

D3 Where the Ravenswood State School falls within the blasting exclusion zone, blasting will be limited to between the hours of 4 p.m. to 6 p.m

Table D2 – Blasting noise limits

Blasting noise limits	Sensitive or commercial Blasting noise limits place limits	
	7am to 6pm	6pm to 7am
Airblast overpressure	115 dB (Linear) Peak for 9 out of 10 consecutive blasts initiated and not greater than 120 bB (Linear) Peak at any time	115 dB (Linear) Peak for 9 out of 10 consecutive blasts initiated and not greater than 120 bB (Linear) Peak at any time
Ground vibration peak particle velocity	5mm/second peak particle velocity for 9 out of 10 consecutive blasts and not greater than 10 mm/second peak particle velocity at any time	5mm/second peak particle velocity for 9 out of 10 consecutive blasts and not greater than 10 mm/second peak particle velocity at any time

Monitoring and reporting

D4 Noise monitoring and recording must include the following descriptor characteristics and matters:

a) LAN,T (where N equals the statistical levels of 1, 10 and 90 and T = 15 mins)
b) background noise LA90
c) the level and frequency of occurrence of impulsive or tonal noise and any adjustment and penalties to statistical levels
d) atmospheric conditions including temperature, relative humidity and wind speed and directions
e) effects due to any extraneous factors such as traffic noise
f) location, date and time of monitoring
g) if the complaint concerns low frequency noise, Max LpLIN,T and one third octave band measurements in dB(LIN) for centre frequencies in the 10 – 200 Hz range.

D5 The holder of this environmental authority must develop and implement a blast monitoring program to monitor compliance with **Table D2 – Blasting noise limits** for:

a) at least <insert number> % of all blasts undertaken on this site in each <insert period for example, month or year> at the nearest sensitive place or commercial place <at insert a place nominated in this authority>
b) all blasts conducted during any time period specified by the administering authority at the nearest sensitive place or commercial place.

Schedule E - Groundwater

Contaminant release

In relation to version 2 of condition E1 - Section 63 of the Environmental Protection Regulation 2008 addresses the topic of the release of 'waste' to groundwater. The term 'waste' is defined in Section 13 of the EP Act. Section 63 of the EP Regulation requires the administering authority to refuse an application if:

a) the waste is not being, or may not be, released entirely within a confined aquifer (except for petroleum activities); or
b) the release of the waste is affecting adversely, or may affect adversely, a surface ecological system; or
c) the waste is likely to result in a deterioration in the environmental values of the receiving groundwater.

Paragraph b) is not intended to apply to a surface ecological system which is authorised to be cleared for the purpose of the mining activities. Paragraphs b) and c) are not intended to apply to trivial impacts.

Where contaminants are proposed to be released to groundwater the limits set out in the condition must not be exceeded at the release point. All the potential contaminants generated as part of the mining activity that have a release limit will be included in this table. The limit type and value will need to be determined in consultation with the administering authority.

E1 The holder of this environmental authority is authorised to release contaminants at the release points and at the release frequencies specified in **Table E1 - Groundwater release points, frequency** and comply with the release limits specified in **Table E2 - Groundwater release quality.**

Table E1 - Groundwater release points, frequency

Release points	Release Frequency	Location	
		Easting (GDA94 – Zone 54)	Northing (GDA94 – Zone 54)

Table E2 - Groundwater release quality

Parameter	Release limit

Monitoring and reporting

E2 All determinations of groundwater quality and biological monitoring must be performed by an appropriately qualified person.

E3 Groundwater quality and levels must be monitored at the locations and frequencies defined in **Table - E3 Groundwater monitoring locations and frequency** and Schedule # – Figure # (Groundwater Bore Monitoring Locations) for quality characteristics identified in **Table E4 - Groundwater quality triggers and limits**.

Table E3 - Groundwater monitoring locations and frequency

Monitoring Point	Location		Surface RL (m)[1]	Monitoring Frequency
	Easting (GDA94 – Zone 54)	Easting (GDA94 – Zone 54)		
Reference Bores[2]				
Compliance Bores				

1. Monitoring is not required where a bore has been removed as a direct result of the mining activity.
2. RL must be measured to the nearest 5cm from the top of the bore casing.
3. Reference sites must:
   (a) have a similar flow regime;
   (b) be from the same bio-geographic and climatic region;
   (c) have similar geology, soil types and topography; and
   (d) not be so close to the test sites that any disturbance at the test site also results in a change at the reference site.

Table E4 - Groundwater quality triggers and limits

Parameter	Contaminant Triggers	Contaminant Limit

E4 Groundwater levels when measured at the monitoring locations specified in **Table E3 -Groundwater monitoring locations and frequency** must not exceed the groundwater level trigger change thresholds specified in **Table E5 - Groundwater level monitoring** below.

Table E5 - Groundwater level monitoring

Monitoring location	Level trigger threshold

Exceedance Investigation

E5 If quality characteristics of groundwater from compliance bores identified in **Table E3 - Groundwater monitoring locations and frequency** exceed any of the trigger levels stated in **Table E4 - Groundwater quality triggers and limits** or exceed any of the groundwater level trigger threshold stated in **Table E5 - Groundwater level monitoring**, the holder of this environmental authority must compare the compliance monitoring bore results to the reference bore results and complete an investigation in accordance with the ANZECC and ARMCANZ 2000.

E6 Results of monitoring of groundwater from compliance bores identified in **Table E3 - Groundwater monitoring locations and frequency**, must not exceed any of the limits defined in **Table E4 - Groundwater quality triggers and limits**.

Bore construction and maintenance and decommissioning.

E7 The construction, maintenance and management of groundwater bores (including groundwater monitoring bores) must be undertaken in a manner that prevents or minimises impacts to the environment and ensures the integrity of the bores to obtain accurate monitoring

Schedule F - Water

Contaminant release

F1 Contaminants that will, or have the potential to cause environmental harm must not be released directly or indirectly to any waters as a result of the authorised mining activities, except as permitted under the conditions of this environmental authority.

F2 The release of mine affected water to internal water management infrastructure installed and operated in accordance with a water management plan that complies with condition F10 is permitted.

F3 All determinations of water quality and biological monitoring must be performed by an appropriately qualified person.

F4 The release of contaminants from the authorised activity to surface waters must not exceed the water quality objectives stated in Schedule F – Table F1 (Receiving Water and Sediment Quality Objectives) when measured at the compliance point stated in Schedule F – Table F2 (Receiving Waters Monitoring Locations)

Schedule F – Table F1 (Receiving Water and Sediment Quality Objectives)

Parameter[1]	**Water Quality Objective (mg/L unless otherwise specified)**	**Sediment Quality Objective[2] (mg/kg dry wt, unless otherwise specified)**
pH (pH units)	6.0[3] or 20th percentile of reference site concentration, whichever is lower. 7.5[3] or 80th percentile of reference site concentration, whichever is higher.	Not applicable
EC (µS/cm)	250[4] or 80th percentile of reference site concentration whichever is higher	
Dissolved oxygen	For interpretative purposes only	
Sulphate	80th percentile of reference site concentration	2 x 80th percentile of reference site concentration
Fluoride	Default Value[7] or 80th percentile of reference site concentration	2 x 80th percentile of reference site concentration
Major cations	For interpretive purposes only	Not applicable
Major anions		
Aluminium	0.055[3] or 80th percentile of reference site concentration whichever is higher	2 x 80th percentile of reference site concentration
Antimony	80th percentile of reference site concentration	2 x 80th percentile of reference site concentration
Arsenic[5]	0.013[3] or 80th percentile of reference site concentration whichever is higher	70[6] or 2 x 80th percentile of reference site concentration or whichever is higher
Cadmium	0.0002[3] or 80th percentile of reference	106 or 2 x 80th percentile of reference

Parameter[1]	Water Quality Objective (mg/L unless otherwise specified)	Sediment Quality Objective[2] (mg/kg dry wt, unless otherwise specified)
	site concentration whichever is higher	site concentration whichever is higher
Chromium[5]	0.001[3] or 80th percentile of reference site concentration whichever is higher	3706 or 2 x 80th percentile of reference site concentration whichever is higher
Cobalt	80th percentile of reference site concentration	2 x 80th percentile of reference site concentration
Copper	0.0014[3] or 80th percentile of reference site concentration whichever is higher	270[6] or 2 x 80th percentile of reference site concentration whichever is higher
Lead	0.0034[3] or 80th percentile of reference site concentration whichever is higher	220[6] or 2 x 80th percentile of reference site concentration whichever is higher
Manganese	1.9[3] o or 80th percentile of reference site concentration whichever is higher	2 x 80th percentile of reference site concentration
Molybdenum	80th percentile of reference site concentration	2 x 80th percentile of reference site concentration
Nickel	0.011[3] or 80th percentile of reference site concentration whichever is higher	52[6] or 2 x 80th percentile of reference site concentration whichever is higher
Selenium	0.011[3] or 80th percentile of reference site concentration whichever is higher	2 x 80th percentile of reference site concentration
Tungsten	80th percentile of reference site concentration	2 x 80th percentile of reference site concentration
Zinc	0.008[3] or 80th percentile of reference site concentration whichever is higher	410[6] or 2 x 80th percentile of reference site concentration whichever is higher
<Insert any additional parameters specific to project>		
Total Hardness	For interpretive purposes only	Not applicable
Particle size distribution	For interpretive purposes only	
Total petroleum hydrocarbons	No detectable film or odour	Not applicable

1. For water quality objectives parameters, all metals and metalloids must be measured and reported as both total (unfiltered) and dissolved (field filtered) levels.
2. All stream sediment sampling must be undertaken in accordance with AS 5667.12 *Guidance on Sampling of Bottom Sediments of 1998*.
3. ANZECC/ARMCANZ (2000) values for aquatic ecosystems indicative of slightly-to-moderately disturbed tropical Australian upland river ecosystems Tables 3.3.4 and Table 3.4.1 (high reliability trigger values) and moderate or low reliability trigger values (Section 8.3) if no value available in Table 3.4.1.
4. ANZECC/ARMCANZ (2000) values for upland and lowland rivers Table 3.3.5.
5. Routine analysis for this parameter is based on combined/total species of the element, where the exceedance of the WQO is identified, an additional sample must be taken and analysed as soon as practicable to determine and quantify speciated forms of this element. This does not apply to sediment analysis.
6. ANZECC (2000) Interim Sediment Quality Guidelines – ISQG – high values based on total sediments (dry weight).

7. A trigger value for Fluoride (for which no default value is provided in Table 3.4.1) derived using the methods described in ANZECC 2000 Section 8.3.4.4.

Note: Where the 80th percentile of a water quality objective (WQO)/sediment quality objective (SQO) is exceeded at a receiving water site and the reference site also exceeds this concentration during the release/flow event, the value of the reference site applies as the WQO/SQO for the duration of the event.

Schedule F – Table F2 (Receiving Waters Monitoring Locations)

Monitoring Point	Description	Coordinates (GDA94 MGA ZONE 55)	
		Easting	Northing
Compliance Point			
Receiving Water Points			
X Creek			
XX Creek			
Reference Points			
X Creek			
XX Creek			

How do I comply:

This condition ensures that receiving water and sediment quality objectives in the table above are met.

Based on the framework proposed above for the release quality objective, if release requirements have been complied with the water quality objective listed in the table will be met at the listed compliance points.

As explained above the release quality objectives should be assessed on a site by site basis by each mine prior to finalisation of applications. The assessment will take into account such characteristics as the geology and chemical characteristics of the land to be disturbed, the types of contaminants likely to be found in processing the quality characteristics of receiving waters.

Where there are multiple water quality guidelines for a particular indicator to protect different environmental values, the most stringent water quality guideline applies

To ensure the regulation of mine releases to the environment the receiving water monitoring locations must be proposed and must include

1. Reference Sites: A suitable reference site for each potentially impacted water course must be included. Depending on the local environment this could range from one site to many.
2. Compliance Points: Compliance points must be nominated after the mixing zone of the release but within or at the boundary of the Mining Lease
3. Receiving water points: Receiving water points are generally sites within 15km downstream of the relevant compliance points. These points are used as part of the Receiving Environment Monitoring Program (REMP).

Receiving Environment Monitoring Program (REMP)

F5 The environmental authority holder must develop and implement a Receiving Environment Monitoring Program (REMP) to monitor, identify and describe any adverse impacts to surface water environmental values, quality and flows due to the authorised mining activity. This must include monitoring the effects of the mine on the receiving environment periodically (under natural flow conditions) and while mine affected water is being discharged from the site. For the purposes of the REMP, the receiving environment is the waters of the *XX* and connected or surrounding waterways within *XX* (for example, *X*km) downstream of the release. The REMP should encompass any sensitive receiving waters or environmental values downstream of the authorised mining activity that will potentially be directly affected by an authorised release of mine affected water.

F6 A REMP Design Document that addresses the requirements of the REMP must be prepared and made available to the administrating authority upon request.

F7 A report outlining the findings of the REMP, including all monitoring results and interpretations must be prepared annually and made available on request to the administrating authority. This must include an assessment of background reference water quality, the condition of downstream water quality compared against water quality objectives, and the suitability of current discharge limits to protect downstream environmental values.

How do I comply:

To comply with this condition, the environmental authority holder must develop and implement a program that includes but not be limited to the following:

Water Management: Description of receiving waters

The REMP must assess the condition or state of receiving ground and surface waters and their key communities, including upstream conditions, spatially within the REMP area. This must take into consideration background water quality characteristics based on accurate and reliable monitoring data and temporal variation (e.g. seasonality).

Water Management: Environmental values and water quality objective

The REMP must be designed to facilitate assessment against water quality objectives for the relevant environmental values that need to be protected. (i.e. as scheduled pursuant to the *Environmental Protection (Water) Policy 2009*).

Water Management: Locations of monitoring points/ reference sites

The REMP must include the locations of monitoring points (including the locations of reference/ upstream and downstream potentially impacted site for each release point and as a minimum, the location specified in Table?). Reference sites must comply with the following criteria:

I. Be from the same bio-geographic and climatic region
II. Have similar geology, soil types and topography
III. Contain a range of habitats similar to those at the potentially impacted sites
IV. Have a similar flow regime, and
V. Not be so close to the potentially impacted sites and that any disturbance at the potentially impacted sites also results in a change at the reference site.

The REMP must also contain a description of any spatial and temporal controls to exclude potential confounding factors and include monitoring for any potential adverse environmental impacts caused by a release.

Water Management: Sampling and analysis

The REMP must describe sampling and analysis methods as well as quality assurance and control and must provide a description of the statistical basis on which conclusions are drawn. It must also specify the frequency and timing of sampling required in order to reliably assess ambient conditions and to provide sufficient data to derive site specific background reference values within two years (depending on wet season flows) in accordance with the Queensland Water Quality Guidelines 2006. This should include monitoring during periods of natural flow irrespective of mine or other discharges.

Water Management: Environmental values and water quality objective

REMP must include the monitoring of physical and chemical parameters including as a minimum those specified in Table XX (Contaminant Release Trigger Level and Limits) in addition to assessment water and sediment quality

within the receiving environment. Water quality parameters include assessment of dissolved oxygen saturation, temperature and those listed in Table XX and XX. This includes monitoring for any potential adverse environmental impacts caused by direct and indirect release of contaminants from the tailings storage facility to surface waters.

This includes:

I. Monitoring of surface water quality at potentially impacted locations downstream and/or down gradient of the regulated structures;
II. Monitoring of stream sediment quality at least twice a year (once at the end of the wet season and once at the end of the dry season) downstream of the tailings storage facility;
III. Determination of an appropriate monitoring frequency for surface waters downstream of the tailings storage facility that provides representative results and allows for early detection of any contaminant releases;
IV. Development of appropriate water quality and stream sediment reference data set which complies with ANZECC 2000 methodology.

Water Management: Stream Sediments

Include, where appropriate, monitoring of metals/metalloids in sediments (in accordance with ANZECC & ARMCANZ 2000, BATLEY and/or the most recent version of AS5667.1 Guidance on Sampling of Bottom Sediments) for permanent and semi-permanent water holes and water storages.

Water Management: Macro invertebrates

Include, where appropriate, monitoring biological indicators for macro invertebrates in accordance with the AusRivas methodology and the latest edition of the administering authority's Water Quality Sampling Manual.

Water Management: Environmental values and water quality objective

Apply procedures and/or guidelines from ANZECC and ARMCANZ 2000 guidelines for slightly to moderately disturbed ecosystems and other relevant guideline documents.

Water Management: Environmental values and water quality objective

Incorporate stream flow and hydrological information in the interpretations of water quality and biological data.

Conclusion/ Reporting

A REMP Design Document that addresses each criterion presented described above to address condition ## must be prepared and submitted to the administering authority no later than 3 months after the date of issue of this environmental authority include for new sites or expansion projects, remove for existing mine sites which already have REMP Design Documents. Due consideration must be given to any comments made by the administering authority on the REMP Design Document and subsequent implementation of the program.

A report outlining the findings of the REMP, including all monitoring results and interpretations must be prepared annually and made available on request to the administrating authority. This must include an assessment of background reference water quality, the condition of downstream water quality compared against water quality objectives, any assimilative capacity for those contaminants monitored and the suitability of current discharge limits to protect downstream environmental values.

Water Management: Environmental values and water quality objective

Monitoring of the impact of the mass load of nutrients in the receiving environment as a result of release from licensed containment structures;

Relevant Literature/ History

The REMP needs to address any relevant reports prepared by other governmental or professional research organisations and any historical datasets that relate to the receiving environment to which the REMP applies.

Annual Water Monitoring Reporting

F8 The following information must be recorded in relation to all water monitoring required under the conditions of this environmental authority and submitted to the administering authority in the specified format:

a) the date on which the sample was taken

b) the time at which the sample was taken

c) the monitoring point at which the sample was taken

d) the measured or estimated daily quantity of mine affected water released from all release points

e) the release flow rate at the time of sampling for each release point

f) the results of all monitoring and details of any exceedances of the conditions of this environmental authority

g) water quality monitoring data must be provided to the administering authority in the specified electronic format upon request.

Temporary Interference with waterways

F9 Destroying native vegetation, excavating, or placing fill in a watercourse, lake or spring necessary for and associated with mining operations must be undertaken in accordance with Department of Natural Resources and Mines (or its successor) *Guideline – Activities in a Watercourse, Lake or Spring associated with Mining Activities*.

Water Management Plan

F10 A Water Management Plan must be developed by an appropriately qualified person and implemented.

The Water Management Plan should be developed in accordance with Departmental guideline *"Preparation of water management plans for mining activities – EM324*" and include:

a) Study of the sources of contaminants
b) A water balance model of the site
c) A water management system for the site
d) Measures to manage and precent saline drainage
e) Measures to manage and prevent saline drainage
f) Contingency procedures for emergencies
g) A program for monitoring and review of the effectiveness of the water management plan

The Water Management Plan must be reviewed annually to assess the adequacy of the plan, ensure actual and potential environmental impacts are managed, and identify any necessary amendment to the plan to ensure compliance with the environmental authority.

Stormwater and Water sediment controls

F11 An Erosion and Sediment Control Plan must be developed by an appropriately qualified person and implemented for all stages of the mining activities on the site to minimise erosion and the release of sediment to receiving waters and contamination of stormwater.

F12 Stormwater, other than mine affected water, is permitted to be released to waters from:

a) erosion and sediment control structures that are installed and operated in accordance with the Erosion and Sediment Control Plan required by condition F11

b) water management infrastructure that is installed and operated, in accordance with a Water Management Plan that complies with condition F10, for the purpose of ensuring water does not become mine affected water.

Schedule G - Sewage treatment

Explanatory note—G1 may need amendment if other contaminants are permitted to be released to land. Monthly monitoring of E-coli may be revised based on location/remoteness of mine site.

G1 The only contaminant permitted to be released to land is treated sewage effluent in compliance with the release limits stated in **Table G1 - Contaminant release limits to land.**

Table G1 - Contaminant release limits to land

Contaminant	Unit	Release limit	Limit type	Frequency
5 day Biochemical oxygen demand (BOD)1	mg/L	20	Maximum	Monthly
Total suspended solids	mg/L	30	Maximum	Monthly
Nitrogen	mg/L	30	Maximum	Monthly
Phosphorus	mg/L	15	Maximum	Monthly
E-coli	Organisms/100ml	1000	Maximum	Monthly
pH	pH units	6.0 – 9.0.	Range	Monthly

G2 Treated sewage effluent may only be released to land in accordance with the conditions of this approval at the following locations:

(a) within the nominated area(s) identified in Schedule ##—Figure ## (sewage treatment plant and effluent disposal)

(b) other land for the purpose of dust suppression and/or fire fighting.

G3 The application of treated effluent to land must be carried out in a manner such that:

(a) vegetation is not damaged

(b) there is no surface ponding of effluent

(c) there is no run-off of effluent.

G4 If areas irrigated with effluent are accessible to employees or the general public, prominent signage must be provided advising that effluent is present and care should be taken to avoid consuming or otherwise coming into unprotected contact with the effluent.

G5 All sewage effluent released to land must be monitored at the frequency and for the parameters specified in **Table G1 - Contaminant release limits to land**.

G6 The daily volume of effluent release to land must be measured and records kept of the volumes of effluent released.

G7 When circumstances prevent the irrigation or beneficial reuse of treated sewage effluent such as during or following rain events, waters must be directed to a wet weather storage or alternative measures must be taken to store/lawfully dispose of effluent.

G8 A minimum area of <<insert area>> of land, excluding any necessary buffer zones, must be utilised for the irrigation and/or beneficial reuse of treated sewage effluent.

Explanatory note — the supply of treated wastewater for re-use is regulated under the *Water Supply (Safety and Reliability) Act 2008.*

G9 Treated sewage effluent must only be supplied to another person or organisation that has a written plan detailing how the user of the treated sewage effluent will comply with their general environmental duty under section 319 of the Act whilst using the treated sewage effluent.

Schedule H - Land and rehabilitation

The contents of **Table H1 - Rehabilitation Requirements** below are included as examples only.

H1 Land disturbed by mining must be rehabilitated in accordance with **Table H1 - Rehabilitation Requirements**.

Table H1 - Rehabilitation Requirements

Mine Domain	Mine Feature Name	Rehabilitation Goal	Rehabilitation Objectives	Indicators	Completion Criteria
Dams ML XXXX	Tailings dam	1. Safe	(a) Site safe for humans and animals	(a) Structural, geotechnical and hydraulic adequacy of the dam	
		2. Non-polluting	(a) Acid mine drainage will not cause environmental harm	(a) Technical design of capping (b) Surface and groundwater monitoring	e.g. Monitoring meeting release limits
		3. Stable	(a) Minimise erosion	(a) Engineered structure to control water flow (b) Vegetation cover	e.g. Surface armour/ engineered drop structures in place and functioning e.g. X% foliage cover recorded over a period of X years
		4. Self-sustaining	Describe post mine land use of land suitability or land capability	(a) Species diversity (b) Presence of key species	e.g. Certification that X% species diversity achieved and maintained for X years e.g. Certification that key species present over a period of X years
Waste rock dump					
Infrastructure					
Voids					
Roads					

H2 Rehabilitation must commence progressively in accordance with the plan of operations.

Contaminated Land

H3 Before applying for surrender of a mining lease, the holder must (if applicable) provide to the administering authority a site investigation report under the Act, in relation to any part of the mining lease which has been used for notifiable activities or which the holder is aware is likely to be contaminated land, and also carry out any further work that is required as a result of that report to ensure that the land is suitable for its final land use.

H4 Before applying for progressive rehabilitation certification for an area, the holder must (if applicable) provide to the administering authority a site investigation report under the Act, in relation to any part of the area the subject of the application which has been used for notifiable activities or which the holder is aware is likely to be contaminated land, and also carry out any further work that is required as a result of that report to ensure that the land is suitable for its final land use under condition H1.

H5 Minimise the potential for contamination of land by hazardous contaminants.

Biodiversity offsets

H6 The holder of this environmental authority must provide an offset for impacts on applicable state significant biodiversity values, in accordance with Queensland Biodiversity Offset Policy. The biodiversity offset must be consistent with the requirements for an offset as identified in the Biodiversity Offset Strategy (as per condition H7) and must be provided:

a) prior to impacting on state significant biodiversity values; or

b) where a land based offset is to be provided, within 12 months of the later of either of the following
   1. the date of issue of this environmental authority; or
   2. the relevant stage identified in the Biodiversity Offset Strategy submitted under condition H7; or

c) where an offset payment is to be provided, within 4 months of the later of either of the following
   1. the date of issue of this environmental authority; or
   2. the relevant stage identified in the Biodiversity Offset Strategy submitted under conditions H7.

H7 A Biodiversity Offset Strategy must be developed and submitted to the administering authority within either 30 days, or a lesser period agreed to by the administering authority, prior to impacting on the applicable state significant biodiversity values.

Schedule I - Light

I1 In the event of a complaint about light from any mining activity that, after investigation, is in the opinion of an authorised person causing a nuisance at a sensitive place, the holder of this environmental authority must take appropriate action to mitigate the nuisance. The holder of this environmental authority must take the action within the reasonable time set by the administering authority.

Schedule J – Waste Rock

J1 A waste rock and spoil disposal plan should be developed and include, where relevant, at least:

a) effective characterisation of the waste rock and spoil to predict under the proposed placement and disposal strategy the quality of runoff and seepage generated concerning potentially environmentally significant effects including salinity, acidity, alkalinity and dissolved metals, metalloids and non-metallic inorganic substances

b) a program of progressive sampling and characterisation to identify dispersive and non-dispersive spoil and the salinity, acid and alkali producing potential and metal concentrations of waste rock

c) a materials balance and disposal plan demonstrating how potentially acid forming and acid forming waste rock will be selectively placed and/or encapsulated to minimise the potential generation of acid mine drainage
d) where relevant, a sampling program to verify encapsulation and/or placement of potentially acid-forming and acid-forming waste rock
e) how often the performance of the plan will be assessed
f) the indicators or other criteria on which the performance of the plan will be assessed
g) rehabilitation strategy.

Monitoring or rehabilitation, research and/or trials to verify the requirements and methods for decommissioning and final rehabilitation of the placed materials, including the prevention and management of acid mine drainage, erosion minimisation and establishment of vegetation cover.

End of conditions

ADVICE - OTHER AREAS OF CONCERN TO BE CONSIDERED

Monitoring

Upon request from the administering authority, copies of monitoring records and reports should be made available and provided to the administering authority's nominated office within 10 business days or an alternative timeframe agreed between the administering authority and the holder.

Any management or monitoring plans, systems or programs required to be developed and implemented by a condition of this environmental authority should be reviewed for effectiveness in minimising the likelihood of environmental harm on an annual basis, and amended promptly if required, unless a particular review date and amendment program is specified in the plan, system or program.

Chemicals and flammable or combustible liquids

All explosives, hazardous chemicals, corrosive substances, toxic substances, gases and dangerous goods should be stored and handled in accordance with the current Australian standard where such is applicable.

Flammable and combustible liquids, including petroleum products, should be stored and handled in accordance with the latest edition of AS1940—The storage and handling of flammable and combustible liquids.

Where no relevant Australian standard exists store such materials within an effective on-site containment system.

Minimise the potential for contamination of land and waters by diverting stormwater around contaminated areas and facilities used for the storage of chemicals and flammable or combustible liquids.

Meteorological monitoring

Environmental authority holders are encouraged to establish and maintain an automatic weather station to measure and record wind speed, wind direction, temperature and rainfall intensity to aid in the compliance with conditions of approval.

It is possible for environmental authority holders to utilise relevant and available weather monitoring information collected by other parties as reference data.

Transportation

It is recommended that the holder of the environmental authority ensure that vehicles (including trains) used for transporting bulk materials from mining lease(s), leave the mining lease(s) with appropriate load preparation to prevent the spillage and/or loss of particulate matter and/or windblown dust during transport.

Appendix B Draft Conditions for regulated Structures

These conditions are indicative only and based on the model mining conditions available from http://www.ehp.qld.gov.au/land/mining/pdf/guide-structures-dams-levees-mining-em634.pdf

Please note that additional matters that should also be conditioned are included in section 7 of this report.

An EA, if issued will only include the conditions considered appropriate by the delegate when the decision is made, there may be additional conditions imposed above those considered in the assessment report

Assessment of consequence category

(X 1) The **consequence category** of any structure must be **assessed** by a **suitably qualified and experienced person** in accordance with the Manual for Assessing Consequence Categories and Hydraulic Performance of Structures (EM635) at the following times:

a) prior to the design and **construction** of the **structure,** if it is not an **existing structure**; or

b) if it is an existing structure, prior to the adoption of this schedule; or

c) prior to any change in its purpose or the nature of its stored contents.

(X 2) A **consequence assessment** report and **certification** must be prepared for each **structure assessed** and the report may include a consequence assessment for more than one structure.

(X 3) Certification must be provided by the suitably qualified and experienced person who undertook the assessment, in the form set out in the *Manual for Assessing Consequence Categories and Hydraulic Performance of Structures (EM635)*.

Design and construction[1] of a regulated structure

(X 4) Conditions X5 to X9 inclusive do not apply to existing structures.

(X 5) All **regulated structures** must be designed by, and **constructed[2]** under the supervision of, a suitably qualified and experienced person in accordance with the requirements of the *Manual for Assessing Consequence Categories and Hydraulic Performance of Structures (EM635)*.

(X 6) Construction of a regulated structure is prohibited unless the **holder** has submitted a **consequence category assessment** report and certification to the administering authority which has been **certified** by a suitably qualified and experienced person and a **design** and **design plan** and the associated operating procedures in compliance with the relevant conditions of this **authority**.

(X 7) Certification must be provided by the suitably qualified and experienced person who oversees the preparation of the design plan in the form set out in the *Manual for Assessing Consequence Categories and Hydraulic Performance of Structures (EM635)*, and must be recorded in the Register of Regulated Structures.

[1] Construction of a structure includes modification of an existing structure—refer to the definitions.

[2] Certification of design and construction may be undertaken by different persons.

(X 8) **Regulated structures** must:

a) be designed and constructed in accordance with and conform to the requirements of the *Manual for Assessing Consequence Categories and Hydraulic Performance of Structures (EM635);*

b) be designed and constructed with due consideration given to ensuring that the design integrity would not be compromised on account of:

i) floodwaters from entering the **regulated dam** from any **watercourse** or drainage line; and

ii) wall failure due to erosion by floodwaters arising from any watercourse or drainage line.

c) have the floor and sides of the **dam** designed and constructed to prevent or minimise the passage of the wetting front and any entrained contaminants through either the floor or sides of the dam during the operational life of the dam and for any period of decommissioning and rehabilitation of the dam.

(X 9) Certification by the suitably qualified and experienced person who supervises the construction must be submitted to the administering authority on the completion of construction of the regulated structure, and state that:

a) the 'as constructed' drawings and specifications meet the original intent of the design plan for that regulated structure;

b) construction of the regulated structure is in accordance with the design plan.

Operation of a regulated structure

(X 10) Operation of a regulated structure**,** except for an existing structure, is prohibited unless:

c) the holder has submitted to the administering authority:

i) one paper copy and one electronic copy of the design plan and certification of the 'design plan' in accordance with condition (X6), and

ii) a set of 'as constructed' drawings and specifications, and

iii) certification of those 'as constructed drawings and specifications' in accordance with condition (X9), and

iv) where the regulated structure is to be managed as part of an integrated containment system for the purpose of sharing the DSA volume across the system, a copy of the certified system design plan.

v) the requirements of this authority relating to the **construction** of the regulated structure have been met;

vi) the holder has entered the details required under this **authority**, into a Register of Regulated Structures; and

vii) there is a current operational plan for the regulated structures.

Insert X11 if there are existing regulated structures.

(X 11) For existing structures that are regulated structures:

a) where the existing structure that is a regulated structure is to be managed as part of an **integrated containment system** for the purpose of sharing the DSA volume across the system, the holder must submit to the administering authority within within 12 months of the commencement of this condition a copy of the certified **system design plan** including that structure; and

b) There must be a current operational plan for the existing structures.

(X 12) Each regulated structure must be maintained and operated, for the duration of its operational life until decommissioned and rehabilitated, in a manner that is consistent with the current operational plan and, if applicable, the current design plan and associated certified 'as constructed' drawings.

Mandatory reporting level

(X 13) Conditions X14 to X17 inclusive only apply to Regulated Structures which have not been certified as low consequence category for 'failure to contain – overtopping'.

(X 14) The **Mandatory Reporting Level** (the **MRL**) must be marked on a regulated dam in such a way that during routine inspections of that dam, it is clearly observable.

(X 15) The holder must, as soon as practical and within forty-eight (48) hours of becoming aware, notify the administering authority when the level of the contents of a regulated dam reaches the MRL.

(X 16) The holder must, immediately on becoming aware that the MRL has been reached, act to prevent the occurrence of any unauthorised discharge from the regulated dam.

(X 17) The holder must record any changes to the MRL in the Register of Regulated Structures.

Design storage allowance

(X 18) The holder must assess the performance of each regulated dam or linked containment system over the preceding November to May period based on actual observations of the available storage in each regulated dam or linked containment system taken prior to 1 July of each year.

(X 19) By 1 November of each year, storage capacity must be available in each regulated dam (or network of linked containment systems with a shared DSA volume), to meet the **Design Storage Allowance** (**DSA**) volume for the **dam** (or network of linked containment systems).

(X 20) The holder must, as soon as possible and within forty-eight (48) hours of becoming aware that the regulated dam (or network of linked containment systems) will not have the available storage to meet the DSA volume on 1 November of any year, notify the administering authority.

(X 21) The holder must, immediately on becoming aware that a regulated dam (or network of linked containment systems) will not have the available storage to meet the DSA volume on 1 November of any year, act to prevent the occurrence of any unauthorised discharge from the regulated dam or linked containment systems.

Annual inspection report

(X 22) Each regulated structure must be inspected each calendar year by a suitably qualified and experienced person.

(X 23) At each annual inspection, the condition and adequacy of all components of the **regulated structure** must be assessed and a suitably qualified and experienced person must prepare an **annual inspection report** containing details of the assessment and include recommended actions to ensure the integrity of the regulated structure**.**

(X 24) The suitably qualified and experienced person who prepared the annual inspection report must certify the report in accordance with the *Manual for Assessing Consequence Categories and Hydraulic Performance of Structures (EM635)*.

(X 25) The holder must:

a) Within 20 business days of receipt of the annual inspection report, provide to the administering authority:

i) The recommendations section of the annual inspection report; and

ii) If applicable, any actions being taken in response to those recommendations; and

b) If, following receipt of the recommendations and (if applicable) actions, the administering authority requests a full copy of the annual inspection report from the holder, provide this to the administering authority within 10 business days[3] of receipt of the request.

Transfer arrangements

(X 26) The holder must provide a copy of any reports, documentation and certifications prepared under this authority, including but not limited to any Register of Regulated Structures, consequence assessment, design plan and other supporting documentation, to a new holder on transfer of this authority.

Decommissioning and rehabilitation

(X 27) Structures must not be abandoned but be either:

a) decommissioned and rehabilitated to achieve compliance with condition (X28); or

b) be left in-situ for a **beneficial use(s)** provided that:

i) it no longer contains contaminants that will migrate into the environment; and

ii) it contains water of a quality that is demonstrated to be suitable for its intended beneficial use(s); and

iii) the administering authority, the holder of the environmental authority and the landholder agree in writing that the structure will be used by the landholder following the cessation of the environmentally relevant activity(ies).

(X 28) After decommissioning, all significantly disturbed land caused by the carrying out of the environmentally relevant activity(ies) must be rehabilitated to meet the following final acceptance criteria:

a) the landform is safe for humans and fauna;

b) the landform is stable with no subsidence or erosion gullies for at least three (3) years;

c) any contaminated land (e.g. contaminated soils) is remediated and rehabilitated;

d) not allowing for acid mine drainage; or

e) there is no ongoing contamination to waters (including groundwater);

f) rehabilitation is undertaken in a manner such that any actual or potential acid sulfate soils on the area of significant disturbance are treated to prevent or minimise environmental harm in accordance with the Instructions for the treatment and management of acid sulfate soils (2001);

g) all significantly disturbed land is reinstated to the pre-disturbed soil suitability class;

h) for land that is not being cultivated by the landholder:

a. groundcover, that is not a declared pest species is established and self-sustaining
b. vegetation of similar **species richness** and **species diversity** to pre-selected **analogue sites** is established and self-sustaining, and
c. the maintenance requirements for rehabilitated land is no greater than that required for the land prior to its disturbance caused by carrying out the petroleum activity(ies).

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[3] Please note that for some model conditions, such as model conditions for structures associated with a resource activity - non mining activity, the notification requirements may be located in a separate part of the conditions of an environmental authority (e.g. under notification requirement conditions).

i) for land that is to be cultivated by the landholder, cover crop is revegetated, unless the landholder will be preparing the site for cropping within 3 months of petroleum activities being completed.

Register of Regulated Structures

(X 29) A **Register of Regulated Structures** must be established and maintained by the **holder** for each **regulated structure**:

(X 30) The holder must provisionally enter the required information in the Register of Regulated Structures when a design plan for a regulated structure is submitted to the administering authority.

(X 31) The holder must make a final entry of the required information in the Register of Regulated Structures once compliance with condition (X10)and (X11) has been achieved.

(X 32) The holder must ensure that the information contained in the Register of Regulated Structures is current and complete on any given day.

(X 33) All entries in the Register of Regulated Structures must be approved by the chief executive officer for the holder of this authority, or their delegate, as being accurate and correct.

(X 34) The holder must, at the same time as providing the annual return, supply to the administering authority a copy of the records contained in the Register of Regulated Structures, in the electronic format required by the administering authority.

Transitional arrangements

(X 35) All existing structures that have not been assessed in accordance with either the Manual or the former Manual for Assessing Hazard Categories and Hydraulic Performance of Dams must be assessed and certified in accordance with the Manual within 6 months of amendment of the authority adopting this schedule.

(X 36) All existing structures must subsequently comply with the timetable for any further assessments in accordance with the Manual specified in Table 1 (Transitional requirements for existing structures), depending on the consequence category for each existing structure assessed in the most recent previous certification for that structure.

(X 37) Table 1 ceases to apply for a structure once any of the following events has occurred:

a) It has been brought into compliance with the hydraulic performance criteria applicable to the structure under the Manual; or

b) It has been decommissioned; or

c) It has been certified as no longer being assessed as a regulated structure.

(X 38) Certification of the transitional assessment required by X35 and X36 (as applicable) must be provided to the administering authority within 6 months of amendment of the authority adopting this schedule.

Schedule G – Table 1 (Transitional hydraulic performance requirements for existing structures)

Transition period required for existing structures to achieve the requirements of the *Manual for Assessing Consequence Categories and Hydraulic Performance of Structures*			
Compliance with criteria	**High**	**Significant**	**Low**
>90% and a history of good compliance performance in last 5 years	No transition required	No transition required	No transitional conditions apply. Review consequence assessment every 7 years.
>70%-≤90%	Within 7 years, unless otherwise agreed with the administering authority, based on no history of unauthorised releases.	Within 10 years, unless otherwise agreed with the administering authority, based on no history of unauthorised releases.	No transitional conditions apply. Review consequence assessment every 7 years.
>50-≤70%	Within 5 years unless otherwise agreed with the administering authority, based on no history of unauthorised releases.	Within 7 years unless otherwise agreed with the administering authority, based on no history of unauthorised releases.	Review consequence assessment every 7 years.
≤50%	Within 5 years or as per compliance requirements (e.g. TEP timing)	Within 5 years or as per compliance requirements (e.g. TEP timing)	Review consequence assessment every 5 years.