COBAR MANAGEMENT PTY LTD
CSA Mine

Statement of Environmental Effects

For the Upgrade of the Tailings Storage Facility
CSA Mine, Cobar, NSW
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1. INTRODUCTION

This Statement of Environmental Effects (SoEE) has been prepared by Cobar Management Pty Ltd (CMPL) to accompany a Development Application to the Cobar Shire Council (CSC) for the Stage 9 Wall Raise South Tailings Storage Facility expansion project.

The lodgement of a Development Application is a requirement under the Cobar Local Environmental Plan 2012 (Western Division Regional Environmental Plan No 1 – Extractive Industries). The proposed upgrade of the TSF is considered an Integrated Development under Section 91 of the Environmental Planning and Assessment Act (EP&A) 1979 and will require approval from the NSW Resources Regulator and the NSW Environmental Protection Authority.

2. BACKGROUND

2.1. CSA MINE

Operated by Cobar Management Pty Ltd (CMPL), the CSA Mine is located approximately 11km north of the Cobar Township in western NSW. The current underground copper mine and ore processing operation commenced in 1999. The mining lease on which CSA Mine is situated (CML5), covers a total area of 2,474 ha and comprises of an approved area of surface disturbance of approximately 248 ha which includes mine headframes, a treatment plant, tailings storage facility (TSF), water storage dams, workshops, warehouses and offices.

Three Department of Primary Industries (Derelict Mines) excised areas have been removed from the lease and are no longer the responsibility of CMPL. These areas include the Subsidence Zone, the old Big Mt Brown area and the Northern TSF (NTSF). The excised areas account for 117 ha, leaving approximately 130 ha of land requiring rehabilitation by CSA Mine prior to mine closure. The currently operating Southern TSF (STSF) accounts for approximately 87 ha of this disturbance.

Figures 1 and 2 depict the Mining Lease (CML5) area and the major site features respectively.

CMPL also holds several smaller exploration leases in the surrounding area (EL 5693, EL 5983, EL 6140, EL 6260, EL 6383 and EL 6501). The Western Lands Lease covering the proposed development is WLL 9565.
Figure 1 - Site Location Plan (GHD, 2012)
Figure 2 - Site Features (GHD 2012).

Legend:
- **Mining Lease Boundary**

Site Features Map

Cobar Management Pty Ltd
CSA Mine Site Water Management Plan

Site Features Map

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2.2. EXISTING OPERATIONS

The STSF is located approximately 1 km east of the ore processing mill at the CSA Mine. It was originally situated within a west–east draining valley and has since been extended to the west to cover the upper reach of a valley draining to the south-west. It is sited over hard sedimentary rock with thin soil cover. The STSF comprises a tailings storage area and a decant dam. The tailings storage area includes an east tailings mound and a west tailings mound, both contained by a single perimeter embankment. The perimeter embankment has been raised a number of times and the STSF is currently in Stage 8 of operation.

Ore from the mining operation is crushed and milled before passing through flotation separation cells to produce copper concentrate. Tailings are dewatered and thickened to a solids concentration of approximately 50 to 65% by weight. The full tailings stream is distributed either to the paste fill plant or the STSF according to underground backfill requirements and plant availability. Centrifugal pumps deliver the tailings slurry to the STSF via a 200mm diameter HDPE pipeline. The pipeline extends from the Mill along a bunded corridor before rising up causeway ramps to the crest of the east and west tailings mounds. Tailings slurry is discharged via 60 mm layflat hoses and 100 mm diameter HDPE pipe spigots and forms a beach away from the end of the respective causeway ramps. The spigots are configured in a horseshoe shape at the end of each causeway ramp to allow for cycling of tailings deposition around the respective mounds.

The length of the Stage 8 tailings beach ranges between approximately 550 m (between the end of the east causeway and the spillway) and 170 m (adjacent to the west causeway). At the typical solids concentration of 50% - 65% by weight, there is minimal release of supernatant water from the tailings that reaches the perimeter of the tailings beach. Rainfall runoff from the tailings beach drains around the perimeter to the southern side, from where it is discharged via a gravity flow decant structure (and ultimately a spillway) to the Decant Dam.

Tailings is deposited for extended periods of time, i.e. between 8 and 10 months, from either the east mound causeway or the west mound causeway. This allows for periods of drying and desiccation of the tailings, and is required for the upstream raise strategy of the perimeter embankment. Tailings are deposited in the STSF at an average rate of approximately 45 000 dry tonnes per month, i.e. 540 000 dry tonnes per annum. Assuming an average dry density of 1.35 t/m$^3$ and that tailings deposition is evenly spread over the two mounds, the average rate of rise for Stage 8 is about 0.7 m per year. Due to the deposition strategy between the two mounds, and the differing area size of the mounds, the rate of rise for the west mound, for Stage 8, is about 1.7 m per year and the rate of rise for the east mound is about 1.1 m per year. The rate of rise will progressively increase with subsequent upstream raises and the storage footprint area diminishes in size.
The relatively low rate of rise for the Stage 8 layout (and the rate of rise for scheduled future raises), together with the shedding nature of the STSF layout and the semi-arid climate of the region, results in the tailings being largely unsaturated. The recent raises to the STSF have been completed using the upstream construction method with compacted tailings. This raise method is suited to tailings storage facilities (TSFs) sited in areas of relatively low seismicity and high net evaporation. The recent raises were designed in accordance to and have been reviewed against guidelines published by the DSC and the Australian National Committee on Large Dams (ANCOLD).

Tailings deposition on the western mound of Stage 9 layout is expected to commence in Q3 2019 and capacity of Stage 9 of the STSF is expected to be reached sometime in the first half of 2022, subject to the rate of deposition and the dry density of the deposited tailings.

The current life of mine plan for the STSF is based on two additional upstream raises after Stage 9, i.e. through to Stage 11, providing storage through to the end of 2031. Based on rate of rise considerations the Stage 11 raise will be the final operational stage of development for the STSF.

3. PROPOSED WORKS

Golder Associates (Golder) have been the consulting Geotechnical Engineers for the TSF since 1999 and have been commissioned for the STSF Stage 9 design. The proposed works as per Golder’s design are characterised by the following features:

- An upstream raise to the perimeter embankment, using locally sourced materials; non-acid generating mine waste rock.
- A widened upstream raise along the southern portion of the embankment to allow for construction of an inclined chute for the gravity decant system that will be subsequently raised for Stages 10 and 11.

A gravity decant system, comprising:

- A decant outfall pipe through the widened zone of the embankment, adjacent to the existing spillway. The outfall pipe will be installed through the Stage 8 embankment and descend down the slope of the Stage 7 and Stage 6 embankment. It will include an air valve at the point where there is a marked change in the outfall gradient. The pipe will outlet to the lined compartment of the Decant Dam.
- A junction box at the upstream toe of the embankment raise.
- An inclined chute on the upstream slope.

Centreline raises to the east and west causeways for tailings deposition.

A raise to the existing spillway.

Decommissioning of the existing gravity decant structure.

Retention of the existing Decant Dam and Stormwater Collection Pond.
The alignment of the perimeter embankment and tailings deposition causeways are designed for continued drainage of surface water (rainfall and supernatant) runoff around the edge of the tailings beach to the gravity decant and spillway structures.

The new gravity decant system will discharge runoff into the geomembrane lined compartment of the Decant Dam, via the existing outlet. Progressive placement of lids over the decant chute, in advance of the rising tailings beach will allow for control of the water pond level over the tailings beach.

The raised spillway will provide for emergency release of pond water into the Decant Dam in the event that high rainfall (and runoff) exceeds the capacity of the gravity decant system. Due to the proposed ‘top-hat’ raises for Stages 10 and 11, temporary erosion protection lining will be provided over the Stage 9 spillway invert.

3.1. ALTERNATIVE OPTIONS

Previous studies on Life of Mine (LOM) tailings storage requirements conducted by Golder assessed a number of potential alternative arrangements for the disposal and storage of tailings on CML5. As part of the study, designs and costs were drafted to determine the viability of; recommissioning the NTSF, and constructing a new TSF on Big Mt Brown, and construction of a new western facility on previously undisturbed land. Construction, operation, environmental and community risks and impacts were considered and the following conclusion reached;

- Recommissioning the NTSF; problematic issues arose associated with existing embankment height and stability, and potential Acid Mine Drainage (AMD). There is minimal information or historical records available on the dam construction and wall lifts, or the dam operation. Geochemical assessments conducted on historic tailings detected ongoing acid generation and a capacity to leach various metals including Cadmium, Copper, Lead and Zinc. Golder concluded that the deposition of contemporary tailings on historic tailings may result in accelerated underground seepage and adverse environmental effects. Extensive excavation and remediation would therefore be required of the upper and border zones of the NTSF to contain and neutralise acid generation prior to any further deposition.

- Construction of a new TSF on Big Mt Brown; was assessed at the request of regulatory bodies on account of historic disturbance and contamination, lack of existing vegetation and proximity to the operation. Investigations concluded that these benefits were far outweighed by the minimal storage capacity it would provide and the uneconomical implications of scattering tailings deposition outside of a single facility.

- Construction of a new TSF on previously undisturbed land was investigated and dismissed as the construction on a new facility would require the clearing of new land and create additional disturbance, which would increase costs for rehabilitation and closure. Furthermore the construction of a new facility would create a materials deficit for already stockpiled closure materials such as topsoil.
4. EXISTING ENVIRONMENT

4.1. TOPOGRAPHY
The STSF is formed by perimeter embankments. The original topography underlying the main, east area of the STSF was a broad valley sloping to the east, as indicated by the relative height of the embankment on the eastern side. The topography underlying the western extension area is a gentle slope towards the south west.

4.2. GEOLOGY AND HYDROGEOLOGY
The local geology in the area of the STSF is characterised by CSA Siltstone of Devonian age. The CSA Siltstone comprises thinly bedded siltstone and mudstone with some sandstone beds. Geotechnical investigations undertaken by Golder in 2006 for the western extension of the STSF indicated the presence of weathered shales/mudstones and siltstones at a shallow depth below surface. Independent hydrogeological investigations conducted by GHD and Golder reported the occurrence of fractured rock aquifers adjacent geological features in the proximity of the TSF from 12m to 75m below the surface. Groundwater resources were described as being generally acidic to neutral, brackish to saline and characterised by high iron and sulphate concentrations unsuitable for use (without intensive processing) outside of industrial and agricultural purposes.

Potential impacts of the project on groundwater and applicable controls are discussed further in Section 6.1.

4.3. CLIMATE
Climatic data for Cobar are collected at a Bureau of Meteorology (BoM) weather station (MO 48027) located adjacent to Louth Road, south of the mine. Rainfall and temperature records have been recorded from May 1962 and evaporation from November 1967.

The climate of Cobar is semi-arid with evaporation typically exceeding rainfall by a ratio of 6:1. Mean annual rainfall for Cobar is approximately 400 mm. During summer months, maximum temperatures typically range between 28ºC to 39ºC and during the winter months, maximum temperatures typically range between 13ºC and 20ºC. Climatic data is summarised below in Table 1.
Rainfall intensity-frequency-duration (IFD) data are used for the design of water and tailings storage facilities to reduce the risk of damage resulting from large storm events. The ECF and spillway capacity require assessments to evaluate the required storage capacity of the Decant Dam, and the discharge capacity of the TSF and Decant Dam spillways.

IFD data for the probable maximum precipitation (PMP) event and annual exceedance probabilities (1 in x AEP) is presented in Table 2. Data estimates are based on the “Generalised Short-Duration Method” and were obtained from the BoM website.

The key values relative to this SoEE are:

- The rainfall intensity for a 1 in 10 AEP, 72-hour event, i.e. 1.52 mm/hour. This intensity results in a rainfall depth of approximately 109 mm.
The rainfall intensity for the 1 in 10,000 AEP, 1-hour event, i.e. 172 mm/hour. For the STSF storage area, this intensity results in an estimated peak flow at the spillway of 20.3 m^3/sec.

### 4.4. FLORA AND FAUNA

A flora and fauna survey conducted on CML5 in 2012 identified a total of 160 Fauna species, comprising: 110 bird species; 20 reptile species; 3 frog species, 15 mammal species and 12 bat species.

Nine threatened fauna species and one migratory fauna species listed under Threatened Species Conservation (TSC) Act and Environmental Protection and Biodiversity Conservation (EPBC) Act were detected within CML5 during the 2012 Biodiversity Assessment, including:

- Chestnut Quail Thrush (Cinclosoma castanotum) listed as Vulnerable under TSC Act;
- Grey-crowned Babbler (Pomatostomus temporalis temporalis) listed as Vulnerable under TSC Act;
- Hooded Robin (Melanodryas cucullata cucullata) listed as Vulnerable under TSC Act;
- Little Eagle (Hieraetus morphnoides) listed as Vulnerable under TSC Act;
- Pink Cockatoo (Lophochroa leadbeateri) listed as Vulnerable under TSC Act;
- Varied Sittella (Daphoenositta chrysoptera) listed as Vulnerable under TSC Act;
- Little Pied Bat (Chalinolobus picatus) listed as Vulnerable under TSC Act;
- Yellow-bellied Sheathtail Bat (Saccolaimus flaviventris) listed as Vulnerable under TSC Act;
- Inland Forest Bat (Vespadelus baverstocki) listed as Vulnerable under TSC Act; and
- Rainbow Bee-eater (Merops ornatus) listed as Migratory under EPBC Act.

The assessment also identified 197 flora species presently or previously recorded within CML5 and six Biometric vegetation communities were identified as occurring at the site, including:

- Gum Coolabah woodland on sedimentary substrates mainly in the Cobar Peneplain Bioregion;
- Gum Coolabah - Mulga open woodland on gravel ridges of the Cobar Peneplain Bioregion;
- Poplar Box - Gum Coolabah and White Cypress Pine Shrubby Woodland mainly in the Cobar Peneplain Bioregion;
- Mallee - Gum Coolabah woodland on red earth flats of the eastern Cobar Peneplain Bioregion;
- Derived mixed shrubland on loamy-clay soils in the Cobar Peneplain Bioregion; and
- Cleared/developed land (Non-native vegetation).

Figures 3 and 4 depict extracts from the 2012 biodiversity report and show the location of the TSF in relation to areas of biodiversity value and threatened flora and fauna. As the proposed works will not affect the disturbance footprint of the TSF, flora and fauna is not considered any further within this SoEE.
4.5. ABORIGINAL HERITAGE

CSA Mine conducts Aboriginal Heritage surveys whenever areas of land outside the current mine footprint are to be disturbed. The last assessment was conducted in 2015. Investigation have identified that most artefacts occur along or near drainage lines. No significant aboriginal heritage issues have been previously identified in relation to the CSA mine operation. Figure 5 shows an extract from the assessment conducted in 2015.

No Native Title has been deemed to exist in relation to the proposed development or on the CSA Mine site. An investigation of available records reveals that the grant of Western Lands Lease 731 in perpetuity is a previous exclusive possession act under the provisions of the Native Title Act 1993 (Cth) and native title in the land was extinguished by that past dealing (DIPNR 2006).

As the area is already disturbed and within the active site zone, Aboriginal Heritage is not considered any further within this SoEE.
Figure 3 - Floristic Biodiversity Value on CML5 (EnviroKey, 2012)

Legend

Biodiversity value
- Green: Good
- Blue: Moderate
- Orange: Poor

Study Area

Map Projection: Transverse Mercator
Horizontal Datum: AGD 1998
Grid: Map Grid of Australia, Zone 55

Data sources:
Ecology data: EnviroKey
Spatial data: CMPL

Mapping date: October 2012
Scale: 1:37,500 (A4)
Figure 4 - Threatened Species Identified on CML5 (EnviroKey, 2012).
Figure 5 - Archaeological Sites/Artefacts Identified on CML5 (EMM, 2015).
4.6. EUROPEAN HERITAGE
The closest archaeological or cultural heritage site to the CSA mine is ‘Elouera’, located approximately 1 km from the operational area. This is a former European settlement. Due to the distance from the proposed development there will be no impact on European archaeological and/or cultural heritage as a result of the Stage 9 Wall Raise and therefore it is not considered any further within this SoEE.

4.7. NOISE AND VIBRATION
Noise from the mine has not been identified as an environmental issue during existing operations. The CSA Mine is sufficiently distant from any occupied residences for consideration of noise as a constraint to be warranted. The nearest residence is 2.14 km away from the CSA Mine site. There are no site buildings or offices in the proximity of the TSF.

While some additional noise may be associated with the construction of the Stage 9 Wall Raise, it is unlikely to be of determinable difference and therefore is not considered any further within this SoEE.

4.8. AIR QUALITY
The principal air contaminant on site is dust. Regular air quality monitoring on site, measured as depositional dust, indicates low levels of heavy metals in airborne dust. Deposited dust levels tend to be greater in summer months due lack of moisture in the soil. CSA Mine has adopted the EPA’s amenity criteria limit of (4 g/m3/month) for depositional dust. CSA Mine has 12 depositional dust sampling points around the site, located near key sensitive receptors of areas identified as having an increased dust generating potential. Dust movement off site has not been identified as an issue during existing operations.

4.9. VISIBILITY AND AESTHETICS
Mining operations have been semi-continuous at the CSA mine site since 1871 and as a result, the localised area is highly disturbed due to the construction of infrastructure such as buildings, tracks and tailings dams.

The activities of the CSA Mine are not visible from any public road, vantage point or residence. The footprint, height and visual bulk of the STSF will be virtually unchanged by the Stage 9 Wall Raise and will therefore have no impact on the general aesthetic value of the site and is not considered any further within this SoEE.

4.10. REHABILITATION AND CLOSURE
The total security deposit for Mine Closure and Rehabilitation of the CSA Mine currently lodged with the NSW Department of Planning and Environment is $36,803,000.00. Of this, a total of $5,848,839.00 is dedicated to the closure and final rehabilitation of the TSF. This estimate is based on the costs associated with the following activities:

- Application of surface tailings treatment if required (e.g. capping/remediation agent;
- Reshape walls/buttress around the embankments;
- Final trim, rock rake and deep rip;
- Source, cart and spread topsoil;
- Spoil amelioration, supply and spread seed and fertiliser; and
- Maintenance of rehabilitated area (up to 5 years).

The final materials and depths for capping of the tailings facility will be determined based on long term rehabilitation trials. The data collated from a series of trials in the years prior to mine closure will ensure the capping and revegetation methods chosen have proven successful.

The tailings dam facility will need to be permanently fenced at time of mine closure and rehabilitation to keep stock and native fauna off the tailings rehabilitation development, and to prevent animals from damaging the revegetation. The closure security deposit includes these fencing costs.

5. PLANNING CONTEXT

CSA Mine has discussed the approval path way with Cobar Shire Council and has been informed that the approval is deemed an integrated development and will require referral to the NSW Resources Regulator and the NSW Environmental Protection Authority as well as public notification through Cobar Shire Council.

5.1. ZONING, LAND OWNERSHIP AND USE

The land surrounding the TSF is zoned RU1(a) – Primary Production, in the Cobar Local Environmental Plan 2012. CMPL holds a consolidated mining lease for the CSA Mine operations (CML5) which covers a total area of 2,474.1 hectares.

The land use immediately surrounding CML 5 is dominated by sheep and cattle grazing and some mining. Non-company residences in the vicinity of the CSA Mine include:

- “Gattaca” – 3 km south
- “Mopone” – 7 km east
- “Jersey” – 9 km
- “Maryantha” – 9.5 km south-east
- Township of Cobar – 11 km south

CML5 occupies portions of five Western Land Leases (under the Western Lands Commission) (Table 3) and Crown Land including parts of the Cobar Regeneration Belt.
Table 3 - CMPL Land Ownership Details

<table>
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<th>Property Name</th>
<th>Locality</th>
<th>WLL</th>
<th>County</th>
<th>Parish</th>
<th>Plan Number</th>
<th>Lot Number</th>
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<td>CSA Mine</td>
<td>9565</td>
<td>Robinson</td>
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<td>Robinson</td>
<td>Kaloolgleguy</td>
<td>766741</td>
<td>4174</td>
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6. POTENTIAL ENVIRONMENTAL IMPACTS AND CONTROLS

This section outlines the potential environment impacts and their respective controls relative to the development. The design and operational safeguards, together with operational and management procedures are set out where appropriate.

The general principle of environmental management is to, in order of preference:

- Avoid environmental impacts;
- Minimise the impacts;
- Mitigate the impacts; and
- As a last resort, once the above options have been investigated, compensate for the residual impacts.

6.1. WATER MANAGEMENT

6.1.1. SURFACE WATER

Overland flow on the TSF has the potential to contaminate surrounding natural areas if discharged. In order to prevent this, the raise layout is configured to direct surface runoff from the tailings surface to the decant structure and spillway. Water on the surface resulting from either tailings bleed (supernatant water) or incident rainfall will mostly be shed to the edge of the tailings beach before flowing towards the decant structure and spillway, as per the current operational layout. Water may be temporarily trapped in small areas before overflowing to the perimeter and to the water release structures.

Ponding of water against the perimeter embankment, except around the decant structure and spillway, is not expected to be sustained due to prevailing evaporation and the design shape of the tailings mounds. Excavation of temporary drains in the tailings beach may be required at various stages of operation to facilitate effective drainage towards the decant structure. The requirement for and details of drain excavations will be assessed throughout the operation based on a review of the tailings beach profile. Ground survey of the tailings beach will continue to be undertaken on a quarterly basis, i.e. every three months.
Water storage around the decant structure is also expected to be limited by management of the inlet level. Lids will be progressively placed ahead of the rising tailings beach to control the potential depth of water below the inlet. The vertical height between the tailings beach and the decant inlet will typically be maintained between 300mm and 500mm. During periods of operation without rainfall runoff, the rate of water released by the decant structure through the decant outfall pipe is not expected to exceed 0.01 m$^3$/sec. This estimate represents the expected bleed water from tailings deposited at a rate of approximately 45,000 dry tonnes per month at a solids content by weight of 50%.

The Decant Dam will continue to provide flood storage capacity. The Dam comprises a geomembrane lined compartment and two unlined compartments. The capacity of the Decant Dam allows for storage of the Environmental Containment Freeboard (ECF) plus additional operational water storage. The total catchment area of the TSF and Decant Dam is approximately 70 ha.

The ECF represents storage of rainfall runoff from the 1 in 10 AEP, 72-hour storm event. This event is a relatively low intensity rainfall, i.e. 1.42 mm/hour. Estimation of the runoff volume is based on infiltration losses of 0.5 mm/hour on both tailings beach and embankment surfaces. The estimated ECF volume is approximately 55,000 m$^3$. The total storage capacity provided by the three compartments is approximately 80,000 m$^3$. Approximately 10,000 m$^3$ of this volume is provided in the lined compartment.

The TSF spillway invert will be raised by approximately 2.2m. The spillway will facilitate the release of water once the tailings beach reaches the spillway invert or earlier if the decant structure capacity is exceeded. The new spillway will have a width of 20m and a depth of 1m and will tie into the existing 25m wide Stage 8 spillway. The reduction in spillway width is as a result of the reduction in catchment area due to the upstream raising of the facility.

The Decant Dam spillway will be retained without modification. It comprises two invert levels; the lower invert is at RL 257.6m and the upper invert is at 258.1m. The base width of the lower central portion of the spillway is approximately 4 m. The base width of the upper invert either side of the central portion is approximately 8 m. The total width of the Decant Dam spillway is approximately 30 m and the maximum depth is approximately 1.2 m.

The spillways are sized for capacity to discharge the outflow resulting from a 1 in 10 000 AEP critical duration design storm event, in accordance with ANCOLD guidelines. Sizing assessments are based on the assumption that water and/or tailings are at the spillway invert prior to the design storm event. For the TSF spillway it is assumed that flow in the decant structure is relatively minor and therefore is not included.

### 6.1.2. GROUNDWATER

Deposition of partially saturated tailings poses the risk of underground seepage and contamination of groundwater resources. As the TSF has been active since the 1960’s and construction of the Stage 9 embankment will occur on the existing tailings beach, the risk of supernatant tailings water seepage into groundwater is considered to be minimal. The major risk factor in tailings seepage is the mismanagement of deposition causing increases in the pore pressure of the TSF which over time can result in wall failure. To control this risk there are a number of standpipe piezometers, Vibrating Wire Piezometers (VWPs) and groundwater monitoring bores installed within and surrounding the TSFs. The Standpipe Piezometers and VWPs have been installed to various depths within and at the
embankment toe of the TSF facility in order to monitor the phreatic surface, and also to detect potential seepage migrating through and under the embankments. A high phreatic surface in the embankment indicates a build-up of water and pressure behind the structure, and has the potential to compromise the stability of the embankment. High water levels in piezometers outside of the embankment footprint may potentially indicate seepage emanating through the embankment foundation.

The installation and monitoring of the groundwater bores surrounding the TSFs helps to quantify the relative magnitudes of the effects on groundwater levels from potential variations in rainfall inputs, land use change, groundwater extraction or seepage from the TSFs.

**Standpipe Piezometers**

There are 38 standpipe piezometers in total at the CSA Mine, 26 standpipes around the STSF and 12 around the NTSF. Figure 6 depicts a cross-sectional drawing of the typical set up of standpipe piezometers at the CSA Mine. The locations of the piezometers are determined by dam engineers (Golder Associates) to provide complete coverage of the facility. Table 4 indicates the location of wet piezometers on the embankment wall or on ground level of the TSF.

Figure 6 - Cross Section of STSF Piezometer Orientation.
Table 4 - STSF Piezometer Locations on Embankment Walls or Ground Level.

<table>
<thead>
<tr>
<th>Stage</th>
<th>Piezometers</th>
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<tbody>
<tr>
<td>Ground Level</td>
<td>P8, P17, P33, P35</td>
</tr>
<tr>
<td>Original Wall</td>
<td>P41, P43, P44, P45</td>
</tr>
<tr>
<td>Wall Raise 1</td>
<td>P7, P15, P26, P27, P38</td>
</tr>
<tr>
<td>Wall Raise 2</td>
<td>P14, P37</td>
</tr>
<tr>
<td>Wall Raise 3</td>
<td>P56, P57</td>
</tr>
<tr>
<td>Wall Raise 4</td>
<td>VWPs</td>
</tr>
</tbody>
</table>

There are no requirements from a dam safety perspective to sample water from standpipe piezometers, only the water level of piezometers needs to be measured for dam integrity purposes. Measurement of water depth in standpipe piezometers was undertaken every 2 months in 2018.

Key piezometers have trigger points set by the CSA Mine consultant TSF Dam Engineers (Golder Associates) to comply with DSC requirements; if water levels within the standpipe piezometers reach this trigger point, it could indicate that the TSF embankments are not operating as designed and will need to be investigated to ensure the structure and integrity of the TSF is still intact. The trigger levels are based on a stability analysis undertaken for each successive STSF wall raise design.

All data from the TSF piezometer phreatic surface monitoring is sent to the CSA Mine’s Dam Engineers for assessment of embankment stability, and a yearly surveillance report is completed by qualified external engineers providing comment on performance and maintenance issues as well as any recommended actions. This information is also passed on to the NSW Dam Safety Committee.

**Vibrating Wire Piezometers**

Installation of the VWP systems in early 2014 and 2015 has provided far superior environmental monitoring than the standard standpipe piezometers due to the continuous acquisition of data. The VWPs are linked into a system that provides continuous data logging regarding the movement of the TSF embankment and phreatic head, and are also programmed to alert when the set trigger levels are reached. There are currently 30 VWPs installed from Stage 6 upwards, which includes 12 on Stage 6, 8 on Stage 7 and 10 on Stage 8. There are plans following the next wall raise (Stage 9) will include 24 new VWP’s and
replace the existing standpipe piezometers for better data capture and increased monitoring frequency.

**Groundwater Bores**

The CSA Mine established a monitoring program in 2011 to measure the depth of groundwater from pilot holes drilled in 2010 surrounding the STSF and NTSF. Consultants were commissioned to investigate the potential for groundwater harvesting in local groundwater systems. The report by consultants Aquaterra completed in 2010 concluded that there was no likely connection between the TSF and local groundwater systems. The following is an excerpt from the report.

*Potential leakage from the TSF was assessed on the basis of drawdown responses observed during pumping tests on groundwater bores; an analytical model, which was developed to predict the zone of drawdown based on different pumping rates; and groundwater chemistry data measured during pumping.*

*Constant Rate Test (CRT) data showed that no leakage responses were evident in the drawdown/recovery curves and suggests that the extent of drawdown may be limited by a boundary effect associated with the nearby fault. If significant leakage from the TSF was induced via pumping, the drawdown in the bore should stabilise as depicted by the type curve in Figure 4.1. Clearly, there was no evidence of this in the drawdown response for the test.*

*The groundwater levels measured in the bores adjacent to the TSF were 14 m to 40 m below ground level. Based on the groundwater levels alone, there was no evidence of groundwater mounding and therefore leakage around the TSF, with a general groundwater flow direction towards the N to NW.*

*Groundwater chemistry data obtained from boreholes at regular intervals over the duration of the 3-day CRT showed that TDS/EC and pH levels remained constant, with pH levels remaining at neutral levels (6.75 to 6.80). This shows that water from the TSF was not drawn into the borehole during the pumping test.*
6.2. AIR QUALITY

Additional airborne dust emission is expected to occur during the construction phase of the Stage 9 STSF arising from earthworks, vehicle movement and exhaust fumes. Water trucks will be used throughout the construction phase for dust suppression. The operation of the Stage 9 TSF will produce no determinable increase in dust generation compared to current operations.

Monitoring of rates of dust deposition from 12 stations across CML5, 5 of which are in the immediate proximity of the TSF, will continue on a monthly basis during the construction and operations phases.

6.3. REHABILITATION AND CLOSURE

The closure strategy for the Stage 9 raise (and potential subsequent raises) is consistent with the established TSF closure strategy.

Tailings delivery pipelines and spigots will be removed at the cessation of the STSF operation. The gravity decant system will be decommissioned to manage the risks of inadvertent water or tailings ingress, instability and the formation of preferential seepage pathways. The chute and pipe that form the system will be filled with a grout.

The tailings surface will be covered to inhibit long term erosion. A 0.3 m thick layer of weathered rockfill will be placed over the tailings surface and hard rock armour will be placed along drainage courses around the perimeter of the tailings mounds. Vegetation plots will be formed at strategic locations across the rockfill layer. Each plot will be approximately 30 m × 30 m × 2 m deep, lined with geomembrane and backfilled with subsoil and topsoil prior to planting of vegetation. Trial vegetation plot(s) will be prepared during operation to demonstrate the effectiveness of this strategy.
The perimeter embankments will be reshaped for long term erosion and stability management. The crest of the embankments will be re-profiled to maintain drainage courses at the outer edge of the tailings mounds, directing runoff towards the spillway. The downstream slope of the embankments will be reshaped to form an unbroken concave slope, i.e. without berms. Hard rock armour will be placed at the toe of the slope to resist erosion and felled vegetation will be placed over the remainder of the slope to limit wind and water energy, and promote growth of vegetation. Note, reshaping works have progressed around the south-east of the STSF. The spillway will be modified to provide capacity to discharge the peak flow resulting from a Probable Maximum Flood (PMF) event, thus limiting the risk of uncontrolled flow over the perimeter embankment. Hard rock armour will be used for erosion protection lining of the modified spillway.

Closure costs for the STSF will be covered by the exiting security liability for CML 5 and rehabilitation will be in line with the currently approved MOP.

7. JUSTIFICATION OF THE PROPOSAL

The current STSF is expected to reach capacity by Q2 2019 Increasing the tailings storage necessary to maintain production at CSA Mine. Without further capacity for tailings storage the Mine will have the cease operations impacting the livelihood of over 400 workers and their families.

7.1. ENVIRONMENTAL CONSIDERATIONS

CMPL will ensure to continue all operations in an environmentally responsible manner, implementing a range of industry recognised safeguards and procedures to ensure the impact of this development proposal upon the local environment is minimised. The environmental safeguards and procedures outlined this document ensure that emphasis is placed on the anticipation and presentation of environmental damage, rather than a reactive, remedial approach.

Progressive rehabilitation and regular review of the Mine Closure and Rehabilitation Plan will ensure that the design of the final landform created by the TSF will provide an area amendable to unimproved pasture production and livestock grazing. The works proposed will not cause any increase in the disturbance footprint of the mine.

7.2. SOCIAL CONSIDERATIONS

Implementation of the proposed development is in the public interest as it ensures there is no interruption to production at the CSA Mine, thus ensuring on-going employment for the present workforce and prolonged income for many local businesses. Construction of the Stage 9 TSF upgrade will be completed by local and external contractors. There will not be any additional personnel employed upon completion of the project.