Conceptual Closure Plan for 2/5 Dam Tailings Storage Facility at MMG Rosebery

Prepared for: MMG Australia Limited
Client representative: Mark Elford
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Rev 00
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1. Introduction

1.1 Background

This Conceptual Closure Plan (CCP) has been prepared as an Appendix to the Development Proposal and Environmental Management Plan (DPEMP) for the 2/5 Dam Tailings Storage Facility (TSF) for submission to the Environment Protection Authority (EPA).

The DPEMP has been prepared for the construction of a new TSF at the MMG Rosebery Mine in an area which has previously been used as a TSF. Since their decommissioning the area has been used as storage ponds for treated sewerage under the Rosebery town sewerage scheme. Existing MMG facilities are expected to provide tailings storage capacity until March 2017, however with a current mine life until 2023, a new facility will be required beyond the current existing capacity.

This CCP has been prepared to guide MMG in planning for eventual close of the proposed 2/5 Dam TSF. It will be implemented in the event of a permanent closure of the 2/5 Dam TSF.

The CCP is necessarily a dynamic plan which may change over time if the requirements and expectations of the regulators, key stakeholders and interested parties change or if the project changes overtime.

1.2 Objectives

The key objective of this CCP is to provide an overview of the closure concept of the 2/5 Dam TSF. The CCP is a high level plan which identifies the closure concept as well as any issues and probable costs associated with closure of the 2/5 Dam TSF.

A Decommissioning and Rehabilitation Plan (DRP) will be prepared when closure of the 2/5 Dam TSF is imminent. The DRP will outline the full costs, the works schedule, approval requirements and post closure maintenance and monitoring, as well as outlining any stakeholder consultation commitments.
2. **Key policies, permits and legislation**

2.1 **Key statutes and regulations**

The key legislation applicable to the current and future activity on the site includes the following:

- **Mineral Resources Development Act 1995 (MRDA)**
- **Environmental Management and Pollution Control Act 1994 (EMPCA)**
- **Water Management Act 1999**
- **Work Health and Safety Act 2012 (WHSA)**
- **Threatened Species Protection Act 1995 (TSPA)**
- **Environment Protection and Biodiversity Conservation Act 1999 (EPBCA)**
- **Weed Management Act 1999**
- **Land Use Planning and Approvals Act 1993 (LUPAA)**
- **Aboriginal Relics Act 1975**
- **Historic Cultural Heritage Act 1995.**

The regulatory instruments applicable to the site include:

- **The State Policy on Water Quality Management 1997**
- **The Work Health and Safety Regulations 2012**
- **The Weed Management Regulations 2000.**

2.2 **Closure approvals**

2.2.1 **Environment Protection Authority**

The mine is an existing operation which operates in accordance with the Environment Protection Notice No. 7153/3 issued by the Tasmanian EPA under the *Environmental Management and Pollution Control Act 1994*.

The CCP will be approved by the EPA, prior to its implementation. However, a more detailed and definitive Decommissioning and Rehabilitation will be prepared and submitted to the EPA in the future, prior to the 2/5 Dam TSF closure.

2.2.2 **West Coast Council**

The West Coast Council is unlikely to require a planning permit for the closure of the 2/5 Dam TSF as demolition works will not be required as part of the closure of the 2/5 Dam TSF.

2.2.3 **Mineral Resources Tasmania**

Approval for closure is not required from Mineral Resources Tasmania.
3. Project description

3.1 Background

MMG Rosebery currently manages an operating TSF at Bobadil. The system has been designed and constructed to support operations through to its ultimate design height of Relative Level (RL) 199 m.

At current production rates, the Bobadil TSF is expected to provide tailings storage capacity until Quarter 2 of 2017. With a current LOM until 2023, a new TSF will be required beyond existing capacity.

Following an extensive options analysis of alternative locations for a new TSF location, the redevelopment of a redundant TSF known as the 2/5 Dam was decided to be most effective option with the least potential environmental impacts and most potential environmental benefits.

3.2 Tailings storage facility design

The proposed new 2/5 Dam TSF is located over the footprint of the existing 1, 2 and 5 Dams as well as an additional area to the north of the current 2 Dam embankment with a total footprint area of 75.3 ha (which includes the existing dam area). The general layout of the TSF is indicated in Figure 1.

Construction includes two staged embankment raises with stage 1 resulting in a crest elevation of RL 170 m and Stage 2 resulting in a crest elevation of RL 173 m. An emergency spillway will be located at the northern point of the 2/5 Dam TSF. A vegetated screening bund and catchment drain will be constructed adjacent to the western 2/5 Dam TSF embankment to provide flood mitigation in the event of embankment failure. Two borrow areas for embankment material are located within the footprint of the 2/5 Dam TSF.

A runoff collection bypass drain will be located along the south western side of the 2/5 Dam TSF to divert clean overland flow from the adjacent hill away from the 2/5 Dam TSF. The bypass drain will comprise an unlined earthen ditch with a nominal slope of 1% and will enter the Stitt River upstream of the 2/5 Dam TSF footprint.

A seepage collection drain will be constructed along the toe of the eastern and northern 2/5 Dam TSF embankments. Any seepage will be directed to a seepage collection pond for return to the TSF via a pump and pipe.

Tailings and water return will follow the existing pipeline routes between the 2/5 Dam and the Effluent Treatment Plant (ETP) at the mine site. The discharge of tailings into the 2/5 Dam TSF will be from the northern, western and eastern sides of the TSF via a ring main feeding floating spigots. Decant will be via an outlet at the northern end of the 2/5 Dam TSF enabling gravity feedback to the ETP. Pipeline routes are indicated Figure 1.

Tailings from the Mill currently report to the Bobadil TSF via the ETP. Following construction of the 2/5 dam TSF, tailings will instead be pumped from the Mill to the 2/5 Dam TSF. Decant return water and any collected seepage will be gravity fed back to the ETP, then discharged to Lake Pieman via the Bobadil Outfall.

In order to reduce the potential for oxidisation, subaqueous deposition of tailings is proposed with a minimum of 2 m water to be maintained at the facility.
Figure 1 – 2/5 Dam Tailings Storage Facility General Layout
4. Background studies

Numerous background studies were undertaken as part of the design of the redeveloped 2/5 Dam TSF as well as preparation of the DPEMP. The majority of engineering design was undertaken by ATC Williams and is included in various documents, as referenced below.

- ATC Williams Memorandum, 30 April 2015, Geotechnical Conditions.
- ATC Williams Memorandum, 18 March 2015, Embankment Layout and Deposition Options.
- ATC Williams Memorandum, 30 January 2015, Sub-aerial versus sub-aqueous tailings deposition.
- ATC Williams Memorandum, 13 January 2015, Seepage Management – DPEMP Input document.

Other reports include:

- Coffey Environments Australia Pty Ltd, 2014, 1/2/5 Dam Tailings Storage Facility, MMG Rosebery Mine Final Hydrogeological Investigation Report, January 2014.

Additional to the engineering studies undertaken for the 2/5 Dam project area, there were also numerous studies undertaken to identify environmental values of the site, including:

- North Barker Ecosystem Services, 2014, MMG Rosebery Proposed Tailings Dam Flora and Fauna Habitat Assessment, April 2014.
- Cultural Heritage Management Australia, 2014, Proposed Tailings Dam on the MMG Mining Lease at Rosebery, West Coast Region, Tasmania, Aboriginal Cultural Heritage Assessment, February 2014.
- Cultural Heritage Management Australia, 2014, Proposed Tailings Dam on the MMG Mining Lease at Rosebery, West Coast Region, Tasmania, Historic Heritage Assessment, March 2014.
- Wood & Grieve Engineers, 2015, Air Quality Assessment, Air Quality Report 2/5 Dam, March 2015.
5. **Environmental Management Strategies**

Strategies for the environmental management of the closure of the 2/5 Dam TSF will focus on the following key areas: future land use, the final land form of the structure, water management, and seepage management.

These strategies will be further developed following detailed engineering design of the 2/5 Dam TSF and consequently further engineering design for the dam closure, as well as input from stakeholders.

5.1 **Land use**

The 2/5 Dam TSF is located to the south of Rosebery, within the PID 6021427, property address: 6 Hospital Road, Tasmania. There is no Certificate of Title that corresponds to this land. The land is Crown Land, owned by the Tasmanian State Government, Department of Primary Industries, Parks Water and the Environment. The 2/5 Dam site is located west of the Murchison Highway. The Stitt River runs around the northern and eastern perimeter of the site.

Following closure of the 2/5 Dam TSF and rehabilitation, the site is likely to remain Crown Land.

5.2 **Final land form**

The final land form will remain as water storage. Refer to section 5.2.1 below for the water cover closure concept.

5.2.1 **Water cover closure concept**

The closure concept for the 2/5 Dam TSF is a wet closure. The concept is to produce a closure landform that meets the following objectives:

i. Control and minimise the transport mechanism either upwards or downwards for oxidation products within the tailings and

ii. That can safely discharge excess clean water from the closure landform to the environment.

The closure concept will consist of:

- The flooding of the dam post closure so that a minimum permanent water cover depth of 2 m can be achieved;
- Decommissioning of the decant structure;
- Breaching the clean water diversion drain;
- Converting the area downstream of the northern embankment into a wetland to provide passive treatment of possibly impacted runoff; and
- Removal of all pipelines.

It is considered that a minimum permanent water cover of 2 m will achieve the objectives above.

For the water cover closure concept it is assumed that at closure the maximum tailings elevation will be RL 169 m (the design maximum tailings elevation), which is 3 m below the Stage 2 spillway invert level of RL 172 m and 4 m below the Stage 2 crest elevation (RL 173 m). This would result in a 3 m deep water pond before discharge of water to the environment.
The Stage 2 spillway has been designed to safely pass the closure design storm of Probable Maximum Precipitation (PMP) as required by ANCOLD\(^1\). A study conducted by BOM\(^2\) indicated that the 1:100,000 Annual Exceedance Period (AEP) storm is equivalent to the PMP. The spillway will therefore meet objective (ii) above.

After closure, the wetland area will provide a stilling area for rainfall runoff and any minor seepage from the northern and eastern embankment. It is anticipated, although not modelled, that the wetland will reach its field capacity soon after closure and thereafter will be a flow through system. The wetland would be designed to cater for the runoff resulting from a design storm of between 1:10 AEP to 1:100 AEP but would be dependent on the volume of seepage emanating from the facility. A design storm runoff to seepage factor of at least 10 is considered appropriate for sizing of the wetland but less than the volume resulting from a 1:10 AEP design storm.

Clean water in excess of the storage capacity of the closed TSF will be discharged via the Stage 2 spillway into the diversion drain located between the western and northern embankment and from there directly into the Stitt River.

A typical section of the concept closure spillway and dam layout is presented in Figure 2.

**Progressive rehabilitation**

The tailings will be deposited sub-aqueously, as a result, progressive rehabilitation of the 2/5 Dam TSF, other than possible removal of pipework no longer required will not be possible until discharge of tailings is complete.

Construction of the wetland area would be deferred for a period of time after cessation of tailings discharge to assess the seepage base flow so that correct sizing of the wetland could be determined.

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Figure 2 - Concept Closure Plan
5.3 Closure water balance

The aim of the closure water balance is to:

- Evaluate the water contained with 2/5 Dam TSF to identify whether the tailings retain a 2 m cover of water; and
- Identify likely spillway flow.

The closure water balance has been developed by ATC Williams using the computer program GoldSim Software and uses the mass balance approach. The methodology uses the mass balance approach. Refer to the 2/5 Dam TSF Feasibility Design Report for details\(^3\).

The model is divided into three components, inflows, losses and outflows.

5.3.1 Model inputs and losses

**Rainfall**

Rainfall has been modelled for the following model components:

- Direct rainfall onto the TSF water surface; and
- Rainfall onto the southern catchment area.

Rainfall is not factored on the TSF water surface but is routed through the AWB model for runoff from the surrounding catchment as described below.

**Evaporation**

Evaporation is applied to the TSF water surface only. A conservative pan factor of 1.0 has been applied to evaporation.

**Runoff from the southern catchment area**

Runoff from the southern catchment area has been modelled for two cases as follows

- Case 1 - The clean water diversion is retained, thus the external catchment area runoff reporting to the TSF is between the TSF and the clean water diversion drain; and
- Case 2 - The clean water diversion drain is breached at closure, thus the external catchment area runoff reporting to the TSF consists of the entire Southern catchment area.

These cases give external catchment areas of 13 ha and 71 ha respectively. Runoff from this catchment has been modelled using the AWB model.

\(^3\) ATC Williams, 2015, MMG Roseberry Mine, Future Tailings Storage Feasibility Study, 2/5 Dam TSF Feasibility Design Report, August 2015
**Seepage Loss through the Tailings**

Seepage losses through the tailings have been based on the tailings coefficient of permeability derived from:

- CPT testing performed on the tailings at the existing 5 Dam in February 2015, further details of which can be found in ATCW geotechnical report⁴; and
- Rowe Cell testing of tailings samples from the South Marionoak study in 2008⁵.

The sensitivity of the tailings coefficient of permeability has been based on the above test results has been assessed with the water balance. The range of coefficient of permeability from the above testing is summarised in Table 1.

<table>
<thead>
<tr>
<th>Testing Type</th>
<th>Coefficient of Permeability (m/s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CPT (2015)</td>
<td>$6.1 \times 10^{-7} - 7.7 \times 10^{-8}$</td>
</tr>
<tr>
<td>Rowe Cell (2008)</td>
<td>$1.1 \times 10^{-7} - 6 \times 10^{-8}$</td>
</tr>
</tbody>
</table>

Based on these results, tailings coefficient of permeability ($k$) values between the range of $1.1 \times 10^{-7}$ m/s and $2.0 \times 10^{-8}$ m/s have been modelled within the water balance, where $k = 1.1 \times 10^{-7}$ m/s is considered the lower bound and hence most conservative case.

However, the field coefficient of permeability achieved for the adopted sub-aqueous tailings deposition method will need to be confirmed through permeability testing closer to the end of the operational life via insitu testing techniques.

The coefficient of permeability value of $1.1 \times 10^{-7}$ m/s results in an average seepage loss of 2,500 m³/day for Case 1 (with diversion drain) and 4,000 m³/day for Case 2 (diversion drain breached). The lower seepage loss of Case 1 is a result of the pond being empty for a significant portion of the mine life for this permeability value.

**5.3.2 Results**

The key outputs from the water balance model are

- TSF water cover depth; and
- An estimate of the likely spillway flow.

**TSF Pond water depth**

As discussed, various tailings coefficient of permeability values have been investigated to observe the effect on water depth. Greater tailings coefficient of permeability ($1.1 \times 10^{-7}$ m/s) will result in higher seepage losses, and therefore a reduced pond volume. Conversely, lower tailings coefficient of permeability ($2.0 \times 10^{-8}$ m/s) will result in lower seepage losses and an increase in pond volume.

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These values have been trialed over the two cases of the diversion drain being retained in closure and the diversion drain being breached at closure. Figure 3 presents the results of the case where the clean water diversion drain is in place. Figure 4 presents the results of the case where the diversion drain has been breached. The results of these figures are summarised below.

Case 1 (with diversion drain retained in closure)
- $2.0 \times 10^{-8}$ - Tailings maintain a minimum permanent water cover greater than 2 m depth, and hence meet the closure concept objectives.
- $6.0 \times 10^{-8}$ - Tailings maintain a permanent water cover, however this only averages 1.5 m depth, and hence does not meet the closure concept objectives.
- $1.1 \times 10^{-7}$ - Tailings periodically dry out.
- $2.0 \times 10^{-7}$ - Tailings periodically dry out.

Case 2 (diversion drain breached at closure)
- $6.0 \times 10^{-8}$ - Tailings maintain a minimum permanent water cover greater than 2 m depth.
- $1.1 \times 10^{-7}$ - Tailings maintain a minimum permanent water cover greater than 2 m depth 96% of the time over the 100 year model. After initial raising of the water level at closure, the permanent water depth remains greater than 2 m in all instances except for two years. On these two occasions the minimum permanent water depth is approximately 1.9 m, suggesting that this case generally meets the closure objectives.
- $2.0 \times 10^{-7}$ - Tailings periodically dry out.

From these results it can be concluded that the model is extremely sensitive to small variations in the tailings coefficient of permeability.

Depending upon the findings of insitu testing, additives to the tailings stream (modified tailings) may be required in the latter stages of the mine life to reduce the tailings coefficient of permeability. Depending on the measured coefficient of permeability, the additives to the tailings stream would possibly be clay type particles at an addition rate of 3% to 5% in order to reduce the coefficient of permeability to around $1.1 \times 10^{-7}$ m/s. The clay type particles could be slurried natural clay soils added to the tailings tank (upstream of the tailings pumps) or possibly powdered bentonite. The requirements for additives and, if required, addition rates would need to be determined at least 2 years prior to mine closure to allow sufficient time to modify tailings infrastructure (tailings tank, assess pump power, PLC, etc.) so that a minimum depth of modified tailings of 500 mm can be placed across the tailings surface.

The addition of fine grained material to improve the engineering parameters of tailings, specifically the coefficient of permeability of tailings has been proven in laboratory tests\(^6\). The addition of clay particles occupies the void space between the tailings particles and hence reduced the overall coefficient of permeability.

Figure 3 - Permanent Pond Depth - diversion drain retained at closure

Figure 4 - Permanent pond depth – diversion drain breached at closure
**Spillway Discharge**

Spillway discharge has been assessed for the case where the clean water diversion drain has been breached as it is considered that the case where the drain is retained at closure will not achieve the concept objectives. A summary of the average daily spillway flow for all of the modelled cases is presented in Table 2.

Table 2 – Average spillway flow

<table>
<thead>
<tr>
<th>Diversion case</th>
<th>Tailings coefficient of permeability (m/s)</th>
<th>Average spillway flow (m³/day)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clean water diversion drain retained at closure</td>
<td>2.0 x 10⁻⁷</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>1.1 x 10⁻⁷</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>6.0 x 10⁻⁸</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>2.0 x 10⁻⁸</td>
<td>1,087</td>
</tr>
<tr>
<td>Clean water diversion drain breached at closure</td>
<td>2.0 x 10⁻⁷</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>1.1 x 10⁻⁷</td>
<td>398</td>
</tr>
<tr>
<td></td>
<td>6.0 x 10⁻⁸</td>
<td>2,184</td>
</tr>
</tbody>
</table>

The lower bound case of 1.1 x 10⁻⁷ m/s and the clean water diversion drain breached is illustrated in Figure 5 below.

The spillway has been designed to meet ANCOLD criteria, this being to be able to pass the Probable Maximum Precipitation (PMP) rainfall event for a High Consequence Category dam during operations. This design criteria is also applicable to the closure case. The spillway inlet dimensions are 20 m wide by 1 m deep. For this cross section, the maximum flow depth for the above discharge is less than 0.1 m.
5.4 Seepage management

The existing 2/5 Dam structure discharges impacted seepage water, as outlined in section 2.3.4 of the DPEMP. The engineering design of the proposed redeveloped 2/5 Dam TSF will greatly reduce seepage rates, with mitigation measures implemented through the western wall, northern wall and eastern wall embankments to minimise seepage, refer to section 2.4.5 and 2.4.6 of the DPEMP.

Additionally the construction of a seepage collection drain around the eastern and northern portion of the site will occur. This drain will intercept any near surface and surface flows from the eastern and northern embankments. The drain will be constructed to the north the 2 Dam which is downstream of the existing seepage. The drain will be terminated at a small wetland and lined pond. A pump will be installed to transfer any run-off and collected seepage to the TSF.

This drain will remain post closure for ongoing monitoring.

For further details on existing seepage and water storage and discharge of the 2/5 Dam refer to sections 2.3.4 and 2.3.5 of the DPEMP.

For further details on the proposed design and management measures to reduce seepage rates, refer to sections 2.4.5 TSF Wall Design and Seepage Management, 2.4.6 Spillway Requirements and 2.4.7 Run-off Collection Bypass and Seepage Collection Drains of the DPEMP.
6. Management Plans

Management plans will be developed in accordance with the management strategies, decommissioning and rehabilitation objectives and information from monitoring and background studies, as part of the DRP.

The stakeholder consultation process will inform the preparation of management plans and enable stakeholders to have their interests considered during the 2/5 Dam TSF closure process. Consultation with stakeholders is an on-going process.

The following issues have been identified for closure of the 2/5 Dam TSF:

- Long term structural integrity of the dam;
- Water management, including seepage;
- Revegetation; and
- Infrastructure decommissioning.

**Long term structural integrity**

The civil design criteria for the 2/5 Dam TSF has included:

- Design to ANCOLD\(^7\) requirements for a 1 in 10,000 year seismic event;
- The spillway has been designed to meet ANCOLD criteria, being able to pass the Probable Maximum Precipitation (PMP) rainfall event for a High Consequence Category dam; and
- Design life for the embankments to allow for a stable structure, both geotechnically and environmentally for > 10,000 years.

The detailed design of the 2/5 Dam will be also independently peer reviewed, prior to submission of an application for a dam permit to the Assessment Committee for Dam Construction (ACDC).

**Water management, including seepage**

The engineering design of the proposed 2/5 Dam will greatly reduce seepage rates, with mitigation measures implemented through the western wall, northern wall and eastern wall embankments to minimise seepage.

An extensive monitoring program of surface water and groundwater monitoring already exists at the 2/5 Dam and will continue throughout the construction, operation and eventual closure of the 2/5 Dam. Refer to section 7 for monitoring requirements post closure.

**Revegetation**

Where any vegetation establishment is required in the vicinity of the 2/5 Dam TSF upon closure, the revegetation methods will be outlined in the DRP.

Vegetation establishment will be monitored. Refer to section 7.

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\(^7\) ANCOLD, 2012 Guidelines on Tailings Dams
Infrastructure decommissioning

Following the redevelopment and operation of the 2/5 Dam, there will not be any major associated infrastructure that will require decommissioning or rehabilitation in the vicinity of the 2/5 Dam area, with the exception of the 2/5 Dam itself and the road access to the 2/5 Dam, both of which will remain following close out of the 2/5 Dam.

The only other infrastructure required to be decommissioned will be the pipeline and pumping infrastructure, which will be decommissioned and removed following cessation of tailings deposition activities. The pipeline route footprint will be rehabilitated in accordance with the natural existing land contours and vegetation type.

6.1 Existing MMG management plans

MMG have a suite of Management Plans that have previously been prepared for the MMG Roseberry site, these management plans are also relevant to the 2/5 Dam redevelopment and any decommissioning and rehabilitation of the 2/5 Dam will need to be undertaken in accordance with these plans. The plans include the following:

- Air Quality, Noise and Vibration Management Plan, January 2015;
- Life of Asset Standard, January 2015;
- Dust Management Plan, October 2012;
- Emergency Management Plan, September 2014;
- Fire Management Plan, January 2012;
- Land and Biodiversity Management Plan, January 2015;
- Mineral Waste Management Plan, April 2015;
- Weed Management Manual, April 2015; and
- 2/5 Dam Safety Emergency Plan, December 2013 (this plan will be amended following project approvals).
7. Monitoring and reporting

Monitoring of the 2/5 Dam TSF will continue post-closure.

**Surface water and groundwater monitoring**

A program of surface water and groundwater monitoring will be continued during operation and closure of the 2/5 Dam TSF.

The new dam footprint will inundate 31 of the existing surface and groundwater monitoring locations. However, it is currently proposed that 14 surface water points and 8 groundwater locations will be monitored across the 2/5 Dam project area. With all existing monitoring locations kept where possible. Final locations will be determined following detailed design of the 2/5 Dam and a site inspection to determine the most appropriate locations.

Monitoring will be undertaken quarterly, with field parameters and laboratory analysis of water samples undertaken in accordance with section 7.1 of the DPEMP.

The monitoring program will be reviewed following the TSF closure.

**Biological monitoring**

Biological monitoring of the Stitt River will continue, as per the current EPN No. 7153/3 Condition E3, which requires an annual biological survey and ambient water quality monitoring program of the Stitt River and Lake Pieman.

**Revegetation monitoring**

Where any vegetation establishment is required in the vicinity of the 2/5 Dam TSF upon closure, regrowth and erosion problems will be monitored across the rehabilitated area, with a monitoring program to include:

- Annual inspection in late Spring to identify any further remedial measures to be implemented; and
- A photographic folio with GPS locations will be established.

An estimate of coverage combined with the photographic folio is expected to be sufficient to determine revegetation success.
8. Closure timing

The proposed 2/5 Dam TSF will accommodate all tailings produced from quarter two 2017 through to the currently planned closure of the mine in 2023.

The closure plan will therefore not be implemented prior to 2023.

If the 2/5 Dam TSF development is given approval to proceed, then it is anticipated that the EPA will require a detailed decommissioning and rehabilitation plan to be prepared a minimum of 2 years prior to closure, in 2021.

The post closure monitoring will extend for a period that will be defined at a later stage, upon further discussion with the EPA.
9. **Preliminary closure costs**

Estimated preliminary costs for the closure of the 2/5 Dam TSF are outlined in the table below.

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Cost (AU$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Preliminaries</td>
<td>$200,000</td>
</tr>
<tr>
<td></td>
<td>Site establishment and disestablishment, inclusive of:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• the floating of all plant to and from the site</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• clean-up on completion of the Contractor’s laydown area</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• preparation of construction programme</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• preparation of Quality Assurance Management System</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• site administration</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• compliance with MMG guidelines and regulations, inclusive of induction of the Contractor’s personnel.</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Decommissioning</td>
<td>$200,000</td>
</tr>
<tr>
<td></td>
<td>• demolition of tailings and return pipework (TSF to ETP)</td>
<td>$40,000</td>
</tr>
<tr>
<td></td>
<td>• demolition of tailings pipelines around TSF</td>
<td>$60,000</td>
</tr>
<tr>
<td></td>
<td>• decommission decant structure</td>
<td>$40,000</td>
</tr>
<tr>
<td></td>
<td>• remediation of pipeline route (TSF to ETP), inclusive of culverts and topsoil once pipelines removed.</td>
<td>$60,000</td>
</tr>
<tr>
<td></td>
<td>Demolition of seepage collection sump and construction of wetlands</td>
<td>$500,000</td>
</tr>
<tr>
<td></td>
<td>• demolition of seepage collection sump, disposal of geomembrane at MMG waste disposal site</td>
<td>$50,000</td>
</tr>
<tr>
<td></td>
<td>• construction of 3 ha of wetland, inclusive of realignment of seepage collection drains.</td>
<td>$450,000</td>
</tr>
<tr>
<td>4</td>
<td>Demolition of clean water diversion drain</td>
<td>$100,000</td>
</tr>
<tr>
<td></td>
<td>Breaching the clean water diversion drain at strategic locations to allow water to flow from the southern catchment into the TSF.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>TOTAL - $1,000,000</td>
</tr>
</tbody>
</table>
10. References

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Contact
David Lenel
03 6210 1485
dlenel@pittsh.com.au

Brisbane
Level 2
276 Edward Street
Brisbane QLD 4000
T: (07) 3221 0080
F: (07) 3221 0083

Canberra
LGF, Ethos House
28-36 Ainslie Place
Canberra City ACT 2601
PO Box 122
Civic Square ACT 2608
T: (02) 6274 0100

Devonport
Level 1
35 Oldaker Street
PO Box 836
Devonport TAS 7310
T: (03) 6424 1641
F: (03) 6424 9215

Hobart
199 Macquarie Street
GPO Box 94
Hobart TAS 7001
T: (03) 6210 1400
F: (03) 6223 1299

Launceston
Level 4
113 Cimitiere Street
PO Box 1409
Launceston TAS 7250
T: (03) 6323 1900
F: (03) 6334 4651

Melbourne
Level 1, HWT Tower
40 City Road
Southbank VIC 3006
PO Box 259
South Melbourne VIC 3205
T: (03) 9682 5290
F: (03) 9682 5292

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