REPORT

Medcalf Project

Tailings Storage Facility Design Concept

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1.0 INTRODUCTION

1.1 General Background

Audalia Resources Limited (Audalia) has commissioned Golder Associates Pty Ltd (Golder) to assist with the conceptual design for a tailings storage facility (TSF) for its Medcalf Project (Medcalf). Medcalf is located about 470 km south-east of Perth, near Lake Johnston in Western Australia. Access to the site is planned to be via the Coolgardie-Esperance Highway, with an intersection located about 54 km south of Norseman. Medcalf is expected to be a vanadium, titanium, and iron producer and has a resource of at least 32 Mt (at 0.47% vanadium oxide, 3.98% titanium oxide, and 49.2% iron oxide), contained within Egmont, Vesuvius, Fuji, and Pinatobu deposits.

In 2015, on behalf of Audalia, Golder undertook a pre-feasibility study (PFS) of a TSF location for the Medcalf Project. In 2017, an alternative TSF site, located to the north-east of mining operations was considered with Golder engaged by Audalia to prepare an updated waste management concept. Changes to the mine schedule have occurred since, requiring the design to be updated. This report presents the updated design concept, construction quantities and a summary of the waste management design, to support an Environmental Protection Authority (EPA) assessment.

1.2 Scope of Study

This report presents a summary of the tailings management storage concepts and includes:

- Basis of design, including preliminary tailings characterisation testwork and commentary on tailings solids concentration
- Design concepts and associated preliminary design studies
- Qualitative risk assessment
- Monitoring requirements
- Figures presenting the design concept (contained in Appendix A).

1.3 Study Limitations

There was insufficient information available at the time of undertaking this study to enable the TSF and/or evaporation pond design to be progressed to a level of confidence that would preclude re-visiting the assumptions, design approach, facility configuration and their progressive development at the next stage of design. Golder has applied its professional and experience-based judgement to the basis of design and to the establishment of preliminary design parameters in order to develop design concepts that can be considered to be appropriate for the project, as it is currently interpreted. The designs as presented should therefore be considered as preliminary, or “conceptual”.

The battery limits for the scope of work covered by Golder and documented in this report are the discharge points for tailings slurry, and exclude all pumping and piping requirements for the tailings and water between the process plant and TSF, as well as between the TSF and the process plant. The facilities have been designed for the currently anticipated life of the project and have incorporated closure considerations.

2.0 PROVIDED INFORMATION

Audalia provided Golder with copies of the following reports and files relating to the Medcalf project:

- Graeme Campbell and Associates Pty Ltd (GCA) report[1] *Medcalf Project: Geochemical Characterisation of Slurry Samples of Deslimed-Tailings and Gravity-Reject Tailings and Implications for Tailings Management*
- Groundwater Resource Management Pty Ltd (GRM) report[2] *Lake Medcalf Hydrogeological and Hydrological Study Surface Water Assessment*
- Groundwater Resource Management Pty Ltd (GRM) draft report[3] *Groundwater Supply Investigation Audalia Resources Ltd Medcalf Vanadium Project*
- Preston Consulting (Preston) report[4] *Audalia Resources Ltd Medcalf Project Environmental Scoping Document*
- Live versions of .dxf drawing files showing minesite layout, minesite road layout and pit footprints, dated 16 January 2020
- Live version of a .xls spreadsheet file *Schedule_audalia_vesuvius_fuji_egmount_Sep2019 v2 Outputs GH.*

3.0 BASIS OF DESIGN

3.1 Design Codes and Guidelines

The TSF has been designed to be consistent with the requirements of the Department of Mines and Petroleum (DMP) *Code of Practice for Tailings Storage Facilities*[5], which is now administered by the Department of Mines, Industry Regulation and Safety (DMIRS). We have also taken cognisance of the Australian National Committee on Large Dams (ANCOLD) – *Guidelines on Tailings Dams; Planning Design, Construction, Operation and Closure*[6].

3.2 Environmental Compliance Criteria

The environmental compliance criteria (ECC) for the TSF are influenced by the selected TSF location and the local receptors. Audalia has advised that the TSF is not located in a groundwater licence area and there are no beneficial users. It is anticipated that there will not be a need to limit seepage from the TSF, owing to setting and the benign nature of the tailings (see Section 5.3), but that there will be groundwater quality targets and a maximum groundwater elevation that must be adhered to, at a monitoring point (or points) to be confirmed (possibly the lease boundary). Surface water quality (including sediment loading) will likely also require control measures in order to meet identified compliance criteria. For the purpose of the concept design of the TSF, we have assumed that the following ECC, or similar, will need to be satisfied.

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[1] Graeme Campbell and Associates Pty Ltd (2019). Medcalf Project: Geochemical Characterisation of Slurry Samples of Deslimed-Tailings and Gravity-Reject Tailings and Implications for Tailings Management, 17 December 2019.

[2] Groundwater Resource Management (2019), Lake Medcalf Hydrogeological and Hydrological Study Surface Water Assessment, October 2019

[3] Groundwater Resource Management (2019) Groundwater Supply Investigation Audalia Resources Ltd Medcalf Vanadium Project, November 2019

[4] Preston Consulting (2019) Audalia Resources Ltd Medcalf Project Environmental Scoping Document, March 2019

[5] Department of Mines and Petroleum (2013). Tailings storage facilities in Western Australia – Code of Practice.

[6] Australian National Committee on Large Dams (ANCOLD) (2019). Guidelines on Tailings Dams – Planning, Design, Construction, Operation and Closure. ANCOLD, Addendum released in 2019.

1) There will be no detrimental effect on groundwater quality beyond the lease boundary such that current and/or future users would be compromised.
2) There will be no adverse effects on native vegetation surrounding the TSF at a distance greater than 50 m from the perimeter of the facilities (i.e. the downstream crest of the surrounding toe drain).
3) There will be no release of tailings solids or contact water to the surrounding ground surface.
4) Solid particles that erode through wind and/or rainfall from the confining embankments and/or soil covers will report to the surrounding ground surface at a rate that can be accommodated by the receiving environment such that vegetation quality will not be compromised.
5) The final land use will not be significantly different from that prevailing prior to mining.

3.3 Tailings Production Schedule

Processing of vanadium, titanium, and iron is expected to occur through a beneficiation plant that will produce a concentrate that will be transported off site. The beneficiation plant will generate a tailings stream designated beneficiation tailings (BT).

Based on information provided by Audalia, there will be a requirement to store approximately 562,500 tonnes of BT annually, resulting in a total of approximately 7.2 Mt, over the life of mine of 13 years.

3.4 TSF Consequence Category

The DMP (now DMIRS) and ANCOLD design codes and guidelines have been referenced to establish the consequence categories for the TSF, assuming the dimensions established from the above. The consequence categories assigned to the TSF and the justifications for selection are presented in Table 1.

Table 1: Consequence Categories

Guideline	Consequence Category	Justification
DMP (2013)	Category 1, Medium	■ Height greater than 15 m ■ No loss of life expected but the possibility recognised ■ No potential for human exposure ■ No potential for loss of livestock ■ Economic repairs can be made ■ Loss of capacity possible, repairs possible ■ Temporary environmental damage possible ■ Limited adverse effects on flora and fauna ■ No potential for damage to items of heritage value
ANCOLD (2012)	Significant (Major Severity Level and <1 PAR*)	■ Minor damage to property & road infrastructure (<$10M) ■ Severe impacts to business ■ Limited public health risks ■ Limited social dislocation ■ Small impact area (<5 km^2) and short impact duration (<5 years) ■ Limited effects on rural land and local flora and fauna

Note: *PAR – population at risk

The consequence category, under both the DMP code of practice and the ANCOLD guidelines is similar, mainly due to the economic impacts associated with failure of the TSF, including reputational damage to Audalia. The outcomes of this consequence category assessment have been used to indicate freeboard and stability requirements.

3.5 Water Management

The removal of the supernatant water and the management of incident rainfall of the TSF will be consistent with the following:

- Water return facilities. The recovered water from the TSF will be pumped during normal operations to the process plant for reuse within the processing circuit.
- Incident rainfall management. The embankment crest will be constructed with an inwardly-directed crossfall towards the tailings beach. Rainfall runoff from the crest and incident rainfall on the tailings beach will be collected and managed with the supernatant water. Rainfall runoff from the external TSF slopes will be encouraged to flow towards toe drains. Additional surface water management measures to control sediment are to be incorporated into the design, as required to meet the ECC in Section 3.2.
- Freeboard requirements. The freeboard requirements for the TSF are set down in the codes and guidelines identified in Section 3.1. The TSF is classified as a Category 1, Medium Hazard facility according with the DMP Code of Practice and as 'Significant' under the ANCOLD guidelines. Based on the hazard ratings, the minimum freeboard and storm events to be considered in the assessment of TSF storage capacity are summarised below in Table 2.

Table 2: Freeboard Requirements

Criteria		Design Event/Freeboard
ANCOLD Guidelines		
Extreme storm storage allowance		1 in 100 AEP, 72-hour event
Contingency freeboards	Wave Freeboard	1 in 10 AEP wind event
	Additional Freeboard	0.3 m
DMP Code of Practice		
Extreme Storm storage allowance		1 in 100 AEP, 72-hour event
Total freeboard		Minimum 0.5 m with a sub-minimum 0.3 m operational freeboard

The definitions of the freeboard criteria are as follows.

- *Annual Exceedance Probability (AEP)* – The probability that an event will occur in a one year period.
- *Extreme storm storage allowance* – The volume allowed for storage of an extreme storm event to prevent a spill from the dam, above the maximum operating level.
- *Contingency Freeboards* – The additional freeboard allowed on top of the maximum operating level and extreme storm allowance to cater for wave run-up and uncertainty in the adopted freeboard values.
- *Wave Freeboard* – An allowance for wave run up over and above the maximum estimated flood level.
- *Operational Freeboard* – The vertical distance between the top of the tailings and the adjacent embankment crest. A minimum operational freeboard is typically specified to limit the potential for backflow and overtopping due to tailings mounding at discharge points.

These requirements have been incorporated into the design and are discussed further in Section 6.0.

4.0 SITE SETTING

4.1 Overview

The GRM reports referenced in Section 2.0, present information on the climate, topography and land use, geology, and hydrogeology of the mine site area where the TSF is proposed. The following sections provide brief summaries of these aspects of the site setting.

4.2 Climate

4.2.1 Overview

Average monthly climate data has been sourced from the Bureau of Meteorology (BoM) Norseman (BoM Number: 012065), Norseman Airport (BoM Number: 012009), and Salmon Gums (BoM Number: 012071) weather stations. The weather stations have been selected due to their relative proximity to the project location.

Rainfall and temperature data have been extracted from the Norseman and Norseman Airport data. The Salmon Gums data have been adopted as evaporation data are not available in the Norseman weather data. Salmon Gums is located approximately 100 km south-east from Medcalf and its data are considered reasonable for input into this study.

The region has a semi-arid climate with temperature ranging from mean daily maxima of around 35°C in mid-summer and mean daily minima around 5°C in mid-winter. Mean annual rainfall is 289 mm, 305 mm and 357 mm for the Norseman, Norseman Airport, and Salmon Gums weather stations respectively and is fairly evenly distributed throughout the year. Mean annual evaporation for Salmon Gums is 1534 mm, with evaporation exceeding rainfall in all months of the year. A summary of the average monthly climate data for the area is provided in Table 3, with maximum and minimum data highlighted in red and blue, respectively.

Table 3: Average Monthly Climate Data

Item	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Monthly Rainfall (mm)	26.0	24.4	26.4	26.5	33.8	38.1	36.3	34.3	31.6	27.6	26.3	19.7	354.8
Highest Daily Rainfall (mm)	100.1	86.4	91.0	51.0	43.7	42.7	32.4	31.2	65.0	43.2	57.6	56.8	100.1
Mean Daily Pan Evaporation (mm/d)	7.9	6.7	5.1	3.3	1.8	1.4	1.5	2.0	3.1	4.5	6.1	7.2	4.2
Mean Max Temp (°C)	30.7	29.6	27.3	23.8	19.9	16.9	16.1	17.4	20.4	23.6	26.4	29.1	23.4
Mean Min Temp (°C)	13.9	14.1	12.6	9.9	7.1	5.6	4.6	4.7	5.7	7.7	10.1	12.2	9.0

4.2.2 Design Storm Data

Rainfall intensity-frequency-duration (IFD) data were obtained from the BoM website, to a maximum AEP of 1 in 100 (1%), for the Project site from the Bureau of Meteorology website[7] for Norseman (32.5125 S, 120.8125 E). The estimated rainfall IFD for various return intervals is shown below in Figure 1.

[7] Australian Government – Bureau of Meteorology, <http://www.bom.gov.au

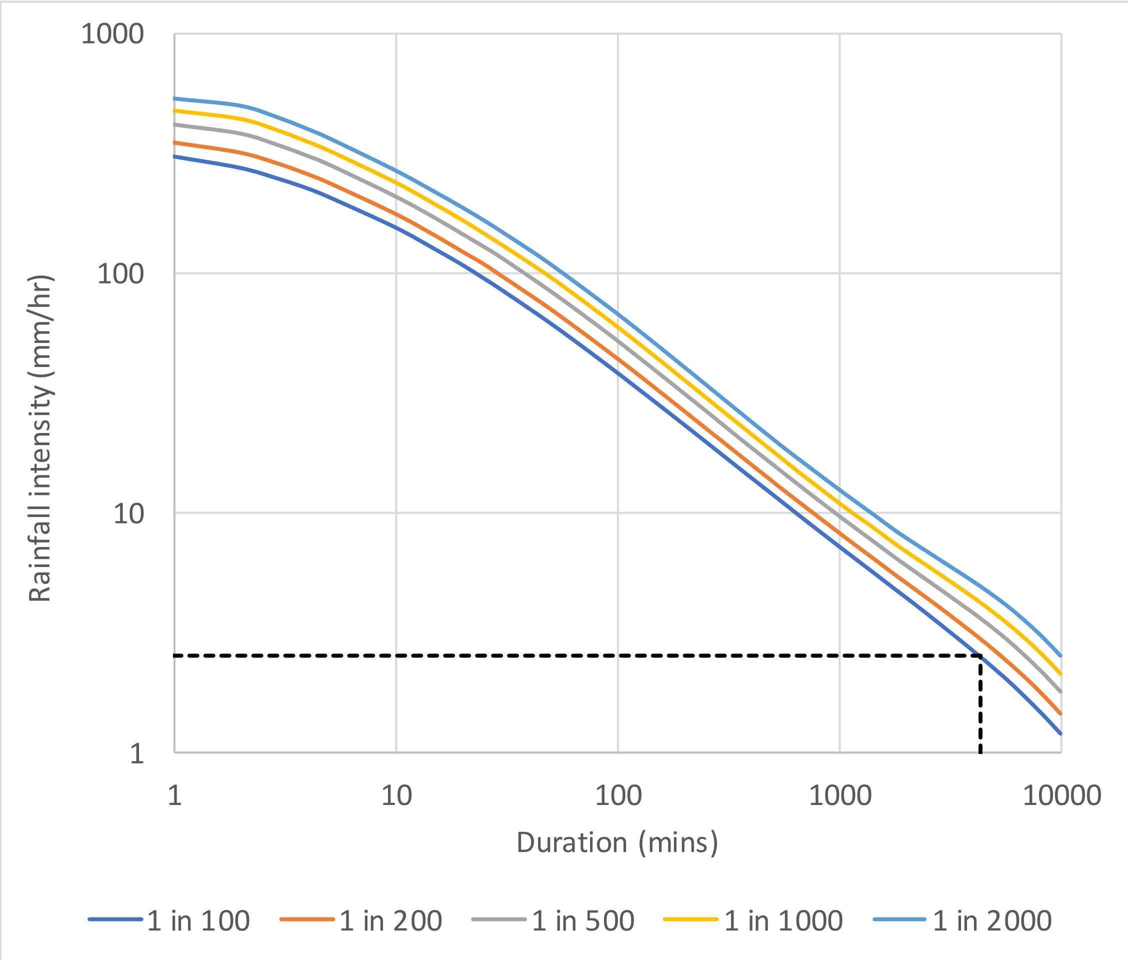


Figure 1: Estimated Rainfall IFD

The rainfall intensity for a 1 in 100 AEP, 72-hour event, is 2.54 mm/hour. This intensity over 72 hours results in a rainfall depth of approximately 183 mm. This event, with consideration for rainfall infiltration and associated runoff, has been adopted for sizing of the TSF.

4.3 Site Description and Land Use

There is aerial photography imagery for the site area, hosted by Google Earth, dating back to December 1984. The available aerial imagery shows that the area is undeveloped and comprises bushland and scrub, with occasional bedrock outcrops, which are principally located at higher points in the topography.

The project will comprise four open pits (Egmont, Vesuvius, Fuji, and Pinatubo), a processing plant, tailings storage facility, waste dump, workshops, and an accommodation village. The topography of proposed mine site is defined by a line of low hills trending in an east-west direction through the Fuji and Vesuvius pits. The surface elevation of the pits ranges from around 385 m AHD at Pinatubo, 416 m AHD at Egmont and Fuji to around 434 m AHD at Vesuvius. The elevation across the proposed site of the TSF varies between approximately 341 m AHD[8] and 372 m AHD. Topographical contours suggest ground surface gradients between approximately 1V:50H and 1V:15H.

[8] Australian Height Datum, which is based on the mean sea level around Australia for 1966-1968 being at elevation 0.000 m.

4.4 Geology and Groundwater

4.4.1 Geology

The GRM draft groundwater supply investigation report presents a description of the geological conditions associated with the project derived from the 1:250000 Lake Johnston geological sheet, the regional interpretation by Gower and Bunting (1976), as well as local geological interpretation provided by Audalia.

"The project lies within the southern extension of the Archean Lake Johnston greenstone belt. The belt lies along the southern margin of the Yilgarn Craton, and forms a narrow, north-west trending zone of approximately 110 km in extent.

The greenstone belt comprises three formations, listed from deepest to shallowest:

- Maggie Hays Formation – consisting predominantly of extrusive pillow-form mafic sequences, some mafic and ultramafic intrusive rocks, and minor sedimentary horizons (banded iron formation and stratified metasediments of tuffaceous origin).
- Honman Formation – consisting of banded iron formation, clastic sedimentary rocks and minor felsic volcanics. Commonly these sequences are completely altered and contain predominantly quartz and kaolinite.
- Glasse Formation – consisting of fine-grained mafic units, with mafic intrusives and ultramafic sequences in the lower part of the formation.

The project's vanadium, titanium and iron mineralisation is associated with a magnetite rich pyroxenite, which forms a distinct band within a layered gabbro of the lower Maggie Hays Formation. The pyroxenite lies near-surface in the vicinity of the project area due to the north plunging Gordon Anticline, of which the project area is located on the southern margin. North-south trending faults have also been observed in the project area, resulting in lateral displacement of the ore."

The bedrock geology is overlain by Quaternary and Tertiary deposits comprising alluvium, colluvium, and laterite. The 1:100 000 Geological Series map for Tay (Sheet 3032) is reproduced as Figure 2 and shows the surface geology at the site comprises the following main geological materials:

- *Granitic and Amphibolitic Bedrock* – Typically metamorphosed rocks of the Yilgarn Craton both underlie and outcrop at the site. Outcrop is largely restricted to higher ground.
- *Duricrust* – Ferruginous duricrust, massive to rubbly, includes iron-cemented reworked products
- *Colluvium*
  - colluvium derived from different rock types: includes gravel, sand, and silt.
  - Ferruginous gravel and reworked ferruginous duricrust
- *Alluvium* – Clay, silt, sand, and gravel accumulated in drainage channels and floodplains.

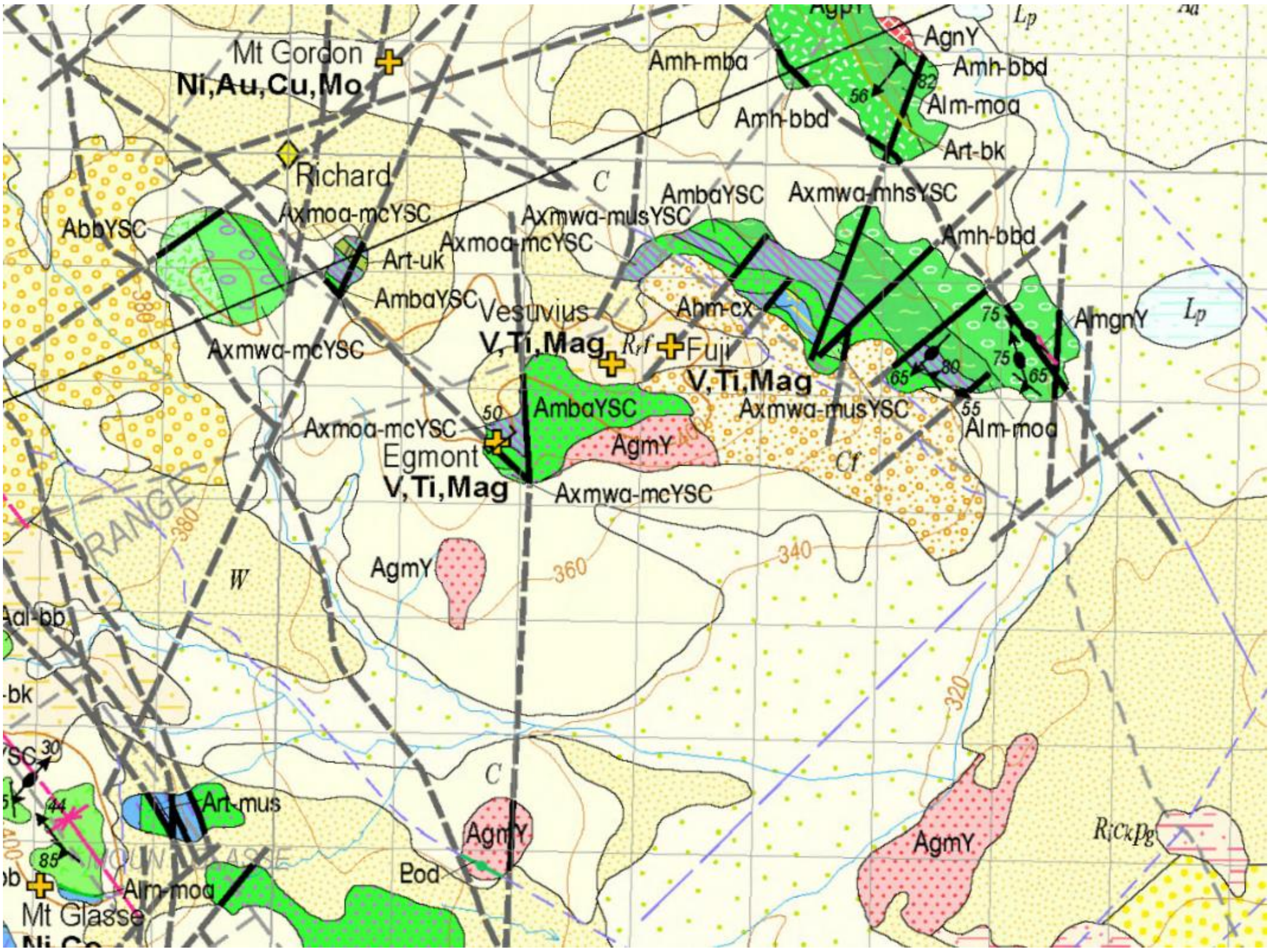


Figure 2: Site Geology 1:100,000 Tay Geological Sheet

4.4.2 Groundwater and Surface Water

The GRM groundwater supply investigation report presents a description of the regional hydrogeological conditions associated with the project derived from regional hydrogeological assessments completed by Kern (1995) for the nearby Boorabbin 1:250,000 sheet, Commander's report on the hydrogeology of Tertiary palaeochannels (1991), and GRM's previous experience in the Lake Johnston greenstone belt.

The GRM report suggests that the hydrogeology of the project area is characterised by low relief and north easterly draining palaeodrainage systems, underlain by Archean sequences. The groundwater level is expected to be in the order of 305 to 310 m AHD. There are no perennial streams and the TSF is remote from any ephemeral flow channels.

4.4.3 Subsurface Conditions

To the north of the proposed location of the TSF, surface geological mapping described in the GRM report indicates areas of rock corresponding to the east-west trending low hills and mine resource area. The mapping suggests the presence of surface colluvium on the north and south faces of the hills. On this basis, a portion of the TSF is likely to be underlain by sheetwash material (silt, sand, and gravel) as well as ferruginous duricrust with iron-cemented reworked products. Higher up the hill faces, where the surface gradients are steeper, the soils are likely to be relatively thin (less than 5 m). Soil thickness may be greater than 5 m in gullies and wide valleys present between topographic highs, where sheetwash and alluvial process will have led to an increase in soil thickness.

Geophysical surveys across the site have been completed by Applied Scientific Services and Technology, one survey location (Location 8) was completed in the vicinity of the TSF. The results of the of the survey indicate limited thickness of alluvial/colluvial material is present (interpreted from the report as the dry sandy topsoil layer). In addition to the geophysical survey a number of boreholes were drilled as part of the ground water supply investigation. None of the boreholes were drilled within the immediate vicinity of the proposed TSF location, and thus provide limited context to the subsurface conditions at the TSF location. Nine monitoring bores were installed during the GRM field investigations, with measured standing water levels ranging from 6.35 m and 45 m below top of casing. Elevations for the monitoring bores were not provided on the borehole logs. The groundwater level is in the order of 305 to 310 m AHD (GRM, 2019), and a minimum surface elevation at the proposed TSF site of about 340 m AHD, a depth to groundwater of 30 m to 40 m may be expected. Site investigations will be required to identify the elevation and quality of the groundwater in the vicinity of the TSF.

5.0 TAILINGS CHARACTERISATION

5.1 General

In 2015 Golder received samples of gravity tailings and natural slimes, which form the majority components of the BT. These materials were combined at a ratio consistent with the mass balance proposed by Simulus Engineers to form a ‘representative’ sample of the BT. This has been subjected to preliminary geotechnical and geochemical testwork in order to help establish parameters for use in the TSF concept design. Laboratory test certificates are included as Appendix B.

5.2 Geotechnical Characterisation

5.2.1 Tailings Index Properties

Particle size distribution (PSD) measurements of the sample were undertaken by Microanalysis Pty Ltd using laser sizing. A particle density test was also carried out to establish a solids specific gravity for use in density and other geotechnical calculations. A summary of the results is provided in Table 4. Based on the PSD results, the BT are classified as a low plasticity Clayey SILT (CL) in accordance with the Unified Soil Classification System (USCS).

Table 4: Summary of PSD Test Results

Test	Parameter	Value
Particle Size Distribution	Diameter at which 80% of the material is passing (P_{80})	32 µm
	Diameter at which 50% of the material is passing (D_{50})	10 µm
	% passing 60 µm (silt + clay fraction)	90%
	% passing 2 µm (clay-sized fraction)	13%
Particle Density	Specific Gravity	3.42

5.2.2 Tailings Settling Behaviour

Settling tests were carried out on the tailings sample, with the aim of estimating the rate of initial water release and the associated increase in dry density over time. A suite of settling tests was undertaken on the BT sample to estimate the water release of tailings across the TSF beach. These comprised:

- Top and bottom undrained (to simulate tailings behaviour in the supernatant pond if the TSF is lined)
- Top undrained, bottom drained (to simulate tailings behaviour in the supernatant pond if the TSF is unlined)
- Top drained, bottom undrained (to simulate tailings behaviour across the beach of a lined facility)
- Top and bottom drained (to simulate tailings behaviour across the beach of an unlined facility).

The results of the testing are presented in Appendix B and a presentation of settled dry density versus time is provided in Table 5 and Figure 3.

Table 5: Settling Tests – Final Dry Density Achieved (t/m^3)

Case	Dry Density (t/m^3)	Approximate Time to 90% of Final Density (days)
Undrained	0.90	4
Top drained	0.88	6
Bottom drained	1.12	10
Top and bottom drained	1.10	10

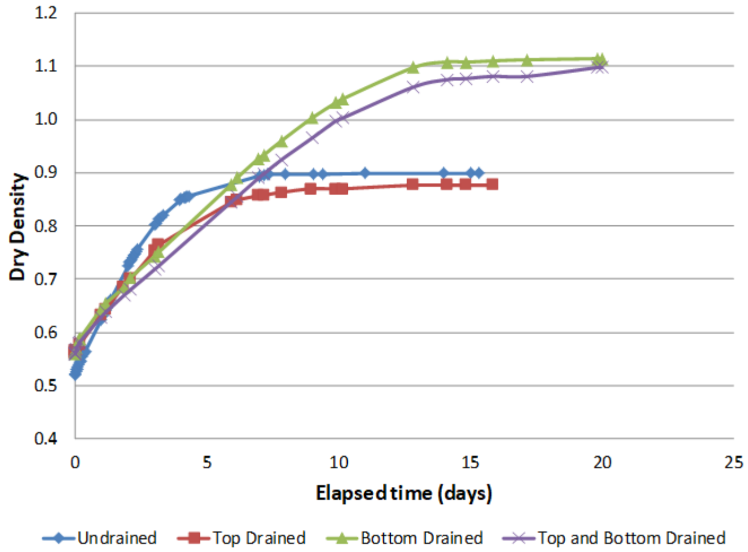


Figure 3: Settling Test Results – Dry Density vs Time

Based on the test results, the time taken to achieve 90% of settled density is approximately ten days for the bottom drained cases (i.e. on an unlined TSF or a lined TSF with overliner drainage). The tailings on the beaches, as well as in the supernatant pond can be expected to settle to approximately 1.1 t/m^3 in an unlined TSF. However, if no drainage is provided at the base of the TSF, the undrained and top drained results indicate that the density of the tailings is unlikely to increase significantly after achieving a dry density of about 0.9 t/m^3 over four to six days.

5.2.3 Air Drying

Air drying testing was carried out to assess the propensity of surficial tailings to desiccate and increase in dry density. When deposition is cycled appropriately in a TSF, this process can result in significant increases in dry density, frequently achieving dry densities similar to those achieved through self-weight consolidation loading at significant depth.

The air drying process involved two independent tests, outlined as follows:

- Shrinkage tests, wherein material is poured into a ring of known dimensions and allowed to dry. Measurement of mass and volume of the sample are taken at regular intervals. This test enables a relationship between moisture content and dry density to be established for a given material. It also provides an indication of Shrinkage Limit, which is the maximum dry density achievable through air drying. The tests are performed in a 40-50°C oven. Time-dependent behaviour is not provided directly by this test.

- Time-dependent drying tests, wherein the material is poured into a bowl, and is first permitted to undergo the majority of undrained settling within the drying bowl. Following settling, the surficial clear water (if present) is decanted from the sample. The required time for settling to be completed is assessed by the undrained settling tests undertaken in parallel, and by visual observations of the bowl. Following settling, the drying bowl is then weighed over time to track moisture loss. The bowl is kept in locations with temperature set to the approximate daytime and evening temperatures of the relevant site. The locations consist of ovens, fridges, or climate-controlled laboratory areas, depending on the target temperatures. Typically, two tests are undertaken, to allow simulation of winter and summer conditions at the site under consideration.

The relevant climatic conditions for the Medcalf site have been estimated on the basis of typical temperatures for Norseman.

The summary of the air drying test results are summarised in Figure 4 and Figure 5.

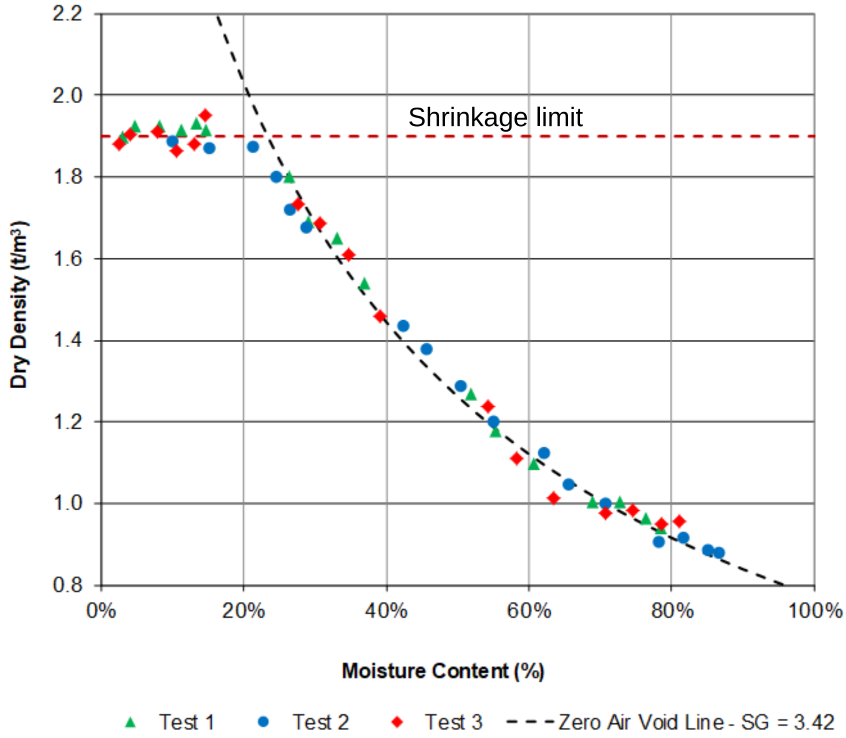


Figure 4: Shrinkage Test Results

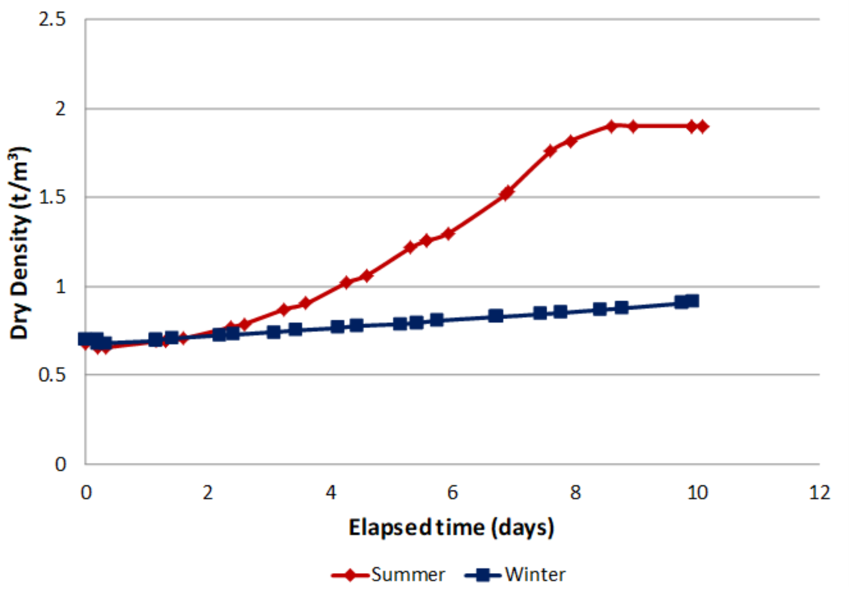


Figure 5: Air Drying – Dry Density vs Time

The following can be interpreted from the air drying test results:

- The shrinkage limit and maximum dry density (1.9 t/m^3) may be achieved after approximately seven days under summer conditions.
- In winter conditions only a small increase in the dry density was observed, indicating that the density of the tailings will not significantly increase through evaporative drying during the winter months.

5.2.4 Consolidation

Consolidation refers to the increase in effective stress and density that occurs following dissipation of pore water pressures as the tailings are exposed to loading. This loading can be expected from the placement of additional material over the previously placed and settled tailings. Consolidation behaviour is important in assessing the expected dry densities likely to be achieved within a TSF, and the time required for such densities to be achieved. This is especially important where the drying of the tailings does not result in significant density increase, as is expected during winter (see Section 5.2.3).

The consolidation of the sample was measured in a slurry consolidometer, which either directly provides, or allows inferences of, the following design parameters:

- Density across a range of vertical effective stresses, typically referenced as the void ratio (e) – the ratio of the volume of voids to the volume of solids
- Permeability (k) across a range of densities

Figure 6 presents a summary of the slurry consolidometer testing results.

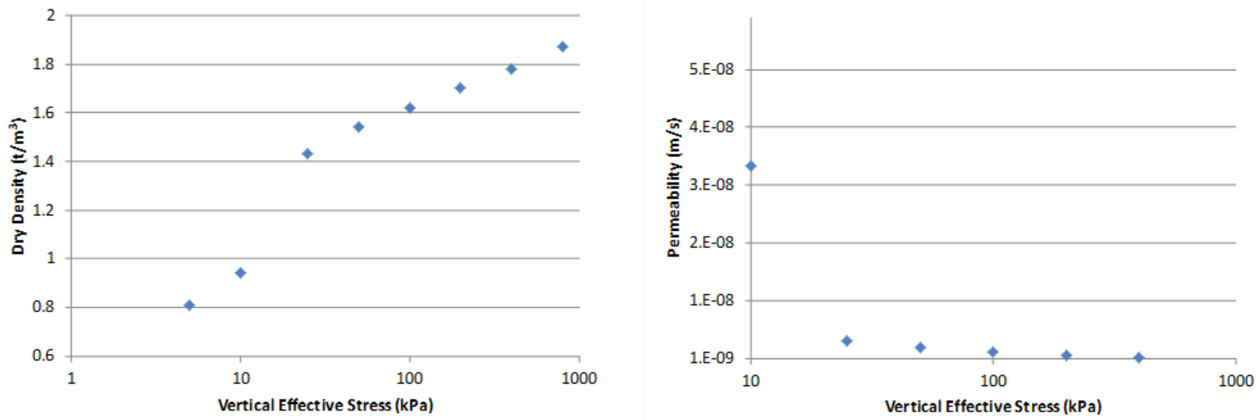


Figure 6: Summary of Consolidation Test Results

The following can be interpreted from the results:

- A maximum consolidated dry density of approximately 1.7 t/m^3 can be expected at the bottom of the tailings stack under self-weight consolidation, assuming a height of facility of about 20 m.
- The tailings permeability can be expected to lie between 3 × 10^{-8} and 1 × 10^{-9} m/s from top to bottom within the TSF.

5.2.5 Summary

The laboratory testing undertaken indicates that the BT can be expected to achieve an initial settled density between about 0.9 and 1.1 t/m^3 on the surface of the TSF. In summer, and with appropriate water management, an air-dried dry density of 1.9 t/m^3 is conceivable, but this is not expected to be achieved in winter, or where the tailings remain submerged. Loading of the tailings could raise the dry density at the base of the TSF to around 1.7 t/m^3 under self-weight consolidation.

These considerations suggest that a dry density of 1.5 t/m^3 is a reasonable overall average value for use in design at PFS level. The parameters (measured or assumed) for the BT that inform the basis of design and have been adopted for this study are summarised in Table 6.

Table 6: Tailings Parameters Adopted for Concept Design

Parameter	Value	Source
Average porosity	0.58	Calculated
Solids specific gravity	3.42	Measured by Golder
Average dry density	1.5 t/m^3	Based on testwork described above
Average porosity	0.58	Calculated

The above parameters have been used to establish approximate dimensions of the TSF. Based on information provided by Audalia, there will be a requirement to store approximately 562,500 tonnes of BT annually – total of approximately 7.2 Mt, or 4.8 Mm^3 over the life of mine of 13 years.

5.3 Geochemical Characterisation

Samples of tailings, prepared in a manner intended to replicate the beneficiation process, were sent by Audalia for geochemical characterisation by Graeme Campbell and Associates (GCA). Two types of tailings were characterised: Deslimed Tailings and Gravity Reject Tailings.

Acid base accounting was carried out on the samples provided. The total sulphur content in the tailings samples ranged from 0.04 to 0.07%, with chromium reducible sulphur values below the limit of detection (i.e. <0.005%). Based on this, GCA classified both the Deslimed Tailings and Gravity Reject Tailings samples as non-acid forming (NAF). In addition to the above, the concentrations of a wide range of minor-elements were typically below, or close to the respective detection-limits.

6.0 DESIGN CONSIDERATIONS

6.1 Siting

Candidate locations for the TSF were considered taking cognisance of the location of the mine pits, the waste dumps, and the extent of the existing mining lease. Siting of the also TSF considered:

- Using the natural topography to minimise earthworks.
- Minimising the management of catchment-derived surface water.
- Limiting the potential to impact upon nearby sensitive environments.

In conjunction with Audalia, a side-hill TSF was selected, located to the south of mining operations within the Audalia leases, as shown on Figure 1.

6.2 Dewatering Considerations

Dewatering of the tailings was considered a high level, as part of the site wide water balance. The following broad options were considered:

- Slurry tailings, with dewatering occurring through a thickener at the plant.
- Paste tailings, achieved through additional dewatering via a deep cone thickener or similar.
- Filtered tailings, achieved through a filter press (or similar) arrangement.

Audalia has opted to progress with a slurry tailings option, which will form the basis of the design concept. However, Audalia has indicated it is investigating filtered tailings options to increase reuse of available water and reduce the water demands across the site.

6.3 Facility Description

The downstream batter slopes of confining embankment have been assumed to be constructed at a slope of 1V:3H, about 18°. This relatively flat batter will allow the slopes to be trafficked during closure. The upstream batter slopes have been assumed to be constructed at a slope of 1V:2H, about 27°. The assumed batter slopes are likely to provide a satisfactory factor of safety against instability, depending on the available construction materials and the strength of the foundation. However, this will need to be confirmed as part of future studies, after completion of a geotechnical investigation.

A crest width of 10 m has been allowed for, providing sufficient room for a tailings delivery pipe (upstream safety barrier) on the upstream crest margin, a safety windrow on the downstream crest margin and vehicle traffic along the crest. A cross-section of the TSF is presented in Figure 7 and on Figure A2 (Appendix A). The volume of fill required to construct the TSF is estimated to be approximately 1.6 Mm^3. It is expected that refinements to the geometry of the confining embankment, and hence the volume of fill required, will be made during future stages of design.

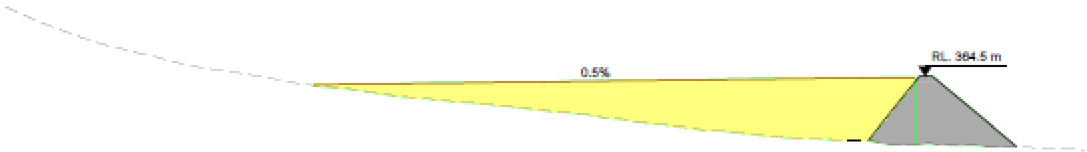


Figure 7: Typical Section

6.4 Operating Philosophy

At this stage it has been assumed that the tailings would be deposited as a slurry, at an assumed beach slope of 0.5% or 1V:200H, allowing a 300 mm operational freeboard, with deposition occurring from the confining embankment as indicated in Figure A1 (Appendix A). Deposition from the embankment would result in the supernatant pond being located to the north of the facility, providing sufficient freeboard to contain the 1 in 100 year, 72-hour rainfall event in line with the freeboard design critera. The concept assumes that the embankment would be constructed using the downstream raise approach, or constructed as a single embankment prior to commencement of operations, depending on availability of materials locally and waste scheduling from the pit(s).

Deposition from the embankment results in the supernatant pond being remote from the embankment, reducing the risks associated with embankment instability, overtopping and seepage (through the embankment), and also providing the opportunity to raise the TSF upstream, should this be viable at a later date. Water would be collected from the TSF by either a pump located on a floating barge or turret decant system which are able to be easily relocated with the movement of the decant to the north over the life of the facility. Supernatant water will be returned to the processing plant for reuse.

6.5 Site Preparation Requirements

The following preliminary site preparation measures are suggested for the TSF site:

- Remove all organic material, roots and other unsuitable or deleterious material from the footprint of TSF, plant site and haul road locations. These materials should be stockpiled separately and are unlikely to be suitable for re-use as structural fill but should be retained for site rehabilitation.
- If soft or loose zones, or concentrations of silt and clay are encountered during site preparation they should be excavated and stockpiled for potential use in TSF embankment construction.
- Proof compaction of exposed surfaces should be completed with appropriate compaction plant to be specified following confirmation of TSF size and height. Areas not passing compaction requirements should be dug out, filled with structural fill and re-compacted. Given the potential presence of duricrust, compaction plant suited to breaking down rock may need to be considered (e.g. grid roller).
- Where fill is required to achieve required foundation levels, a borrow source for structural fill will need to be identified. This material should be moisture conditioned, placed and compacted in layers of no greater than 0.3 m loose thickness.

6.6 Local Borrow

Based on the available information on surface and subsurface conditions, we expect that the materials in the expected excavation zone will be variable, ranging from soil to rock strength materials. The soils and possibly zones of weaker duricrust, are generally expected to be diggable with conventional excavating machinery (excavators, backhoes) with provision for use of rock breaking attachments. However, the presence of cobbles and boulders will need to be taken into consideration when selecting plant such as scrapers. We could not rule out the requirement for ripping in duricrust zones. Although bedrock is likely to have a weathered crust in places, it is expected that very hard ripping would be required to penetrate more than 0.5 m.

Where cut/fill operations are required to obtain desired finish levels it is likely that the colluvial deposits and duricrusts overlying bedrock will present a readily accessible borrow source for re-use as structural fill or as bulk fill for TSF embankments, although some processing (e.g. crushing, screening) is likely to be necessary to produce suitable fill materials.

The geological maps for the area and GRM borehole logs suggest that materials for re-use as low permeability zones may be present within the TSF basin or in close proximity in the TSF embankment. A borrow area with sufficient volume of material has been identified to the north west of the TSF.

Limited geotechnical information has been collected at the site to date for the distinct purpose of excavatability assessment and material re-use. However, it is recognised that further geotechnical site investigation work is expected prior to construction. Scoping of further investigations should consider the following:

- Trial excavations to assess the ripability of near surface materials
- Test pits within colluvium/duricrust to assess possible additional borrow sources
- Laboratory testing for potential material reuse (e.g. particle size distribution, Atterberg Limits, dispersion testing for clay soils, aggregate testing, etc).

6.7 Geotechnical Stability

6.7.1 Approach and Target Factors of Safety

The geotechnical stability of the TSF has been assessed using the limit equilibrium software package Slide 2018, distributed by Rocscience Inc. Model sections were analysed for circular and non-circular (block failure) failure surfaces using the Morgenstern-Price method under static and post liquefaction loading. Superficial slips of depths less than 1 m were ignored in this study.

The following minimum factors of safety (FoS), which are based on the requirements set down by ANCOLD (ANCOLD, 2019), have been used to establish that the facilities will be appropriately stable:

- Peak, FoS = 1.5
- Post peak, FoS = 1.1

These minimum values are consistent with other published values for earth dams.

6.7.2 Representative Section

One section was selected for stability modelling for the TSF (see Figure A2 in Appendix A). The section geometry was based on the design presented in the report and survey provided by Audalia. The section location corresponds to the expected maximum embankment height and has been assessed under both static (peak) and post-peak (e.g. post seismic event) conditions. As the resistance of the tailings against liquefaction is unknown, it has been assumed that the earthquake energy will be sufficient to results in the tailings being liquefied, which is conservative by consistent with ANCOLD (2019).

6.7.3 Material Parameters

The material parameters adopted for the analyses are based on the tailings characterisation and supported by experience with similar tailings and literature values. Foundation materials have been assumed and a geotechnical investigation and laboratory testing will need to be carried out in the future to provide better estimates of the geotechnical parameters. A summary of the material parameters adopted in the analyses are shown in Table 7.

Table 7: Summary of Material Parameters Adopted in Stability Analyses

Material Description	Unit Weight γ_m (kN/m^3)	Friction Angle Φ' (degrees)	Cohesion c' (kPa)	Vertical Stress Ratio (Undrained)	Vertical Stress Ratio (Post Liquefaction)
Foundation Material	20.0	32	15	-	-
Starter Embankment	21.0	33	5	-	-
Contractive saturated BT Tailings	20.0	-	-	0.25	0.05
Dilative/unsaturated BT Tailings	20	33	0	-	-

6.7.4 Results

Two-dimensional circular and non-circular (block) failures under static and post-liquefaction loading conditions have been considered. The results indicate that in all cases, the FoS against embankment failure remain at, or above, the industry recognised minimum values. It is therefore considered to be unlikely that major slope instability would occur within the TSF outer embankments, even following an earthquake with sufficient energy to induce tailings liquefaction. The stability of embankment is not reliant on the strength of the tailings and therefore the post-peak stability is not expected to vary significantly for the static peak results. Nevertheless, some superficial instability (ravelling) may occur during earthquake events. A typical critical failure surface is presented in Figure 8.

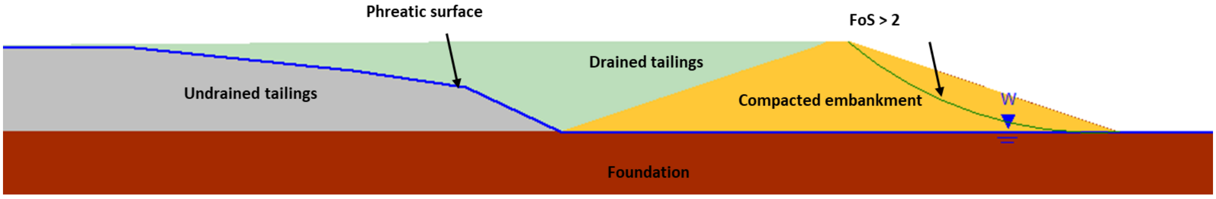


Figure 8: Static Result

6.7.5 Liquefaction Risk

6.7.5.1 General

Liquefaction is the process where saturated or near-saturated soil or tailings temporarily loses its strength due to a loading mechanism. Loading results in settlement of particles, a reduction in pore space and an increase in pore water pressure between particles. When pore water pressure exceeds the overlying soil/tailings weight above, the soil/tailings loses its strength and liquefies. Loading trigger mechanisms could be in the form of rapid loading through a high rate of upstream-raise construction (static liquefaction) or seismic loading, e.g. by an earthquake event (dynamic liquefaction).

The susceptibility of soil and tailings to liquefaction is typically governed by the size and cohesion of the particles; granular particles (coarse silts and fine sands) are more susceptible than fine silts and cohesive clay particles. The potential for liquefaction is also dependant on the *in situ* state of the soil/tailings, with respect to density and degree of saturation. In general, soil/tailings with a lower *in situ* density (i.e. looser state) and higher degree of saturation are more prone to liquefaction.

6.7.5.2 Foundation and Embankments

The thickness of soil material at the TSF is expected to be limited based on the results of the geophysical survey. Any soil material present in the footprint of the TSF will be removed to provide addition fill material for construction of the TSF embankments. As the loose colluvial/alluvial material is removed only fractured rock or extremely dense material will remain the liquefaction/cyclic softening risk to the foundation is low.

The embankments will be constructed using coarse material borrowed from a nearby borrow zone and materials borrow from within the footprint of the TSF. These materials will be placed and machine compacted resulting in dilative conditions within the embankments. In addition to this an internal toe drain will be provided at the upstream toe of the embankment which will protect the embankments against becoming saturated. As the embankments will not be saturated and in a dilative state there is no risk of liquefaction or strength loss in the embankments.

6.7.5.3 Tailings

The post-liquefied strength ratio of soil/tailings is estimated through *in situ* testwork of a soil/tailings deposit or laboratory strength testwork on samples. For the purpose of this assessment a post-liquefaction vertical stress ratio of 0.05 and is considered a reasonable lower bound estimate based on literature values and our experience with similar tailings deposited in Western Australia. The actual post peak strength of the tailings is highly dependent on the *in situ* density and state and this can only be established following the commencement of deposition. Further work is required to establish and calibrated the post-peak strength values of the tailings will need to be established in future stages of work and calibrated throughout the operation of the TSF.

6.8 Consolidation

The rate of rise of the hydraulically-deposited tailings will be approximately 2 m per year. This rate of rise is aimed at achieving air dying of the tailings away from the supernatant pond and the targeted overall average tailings dry density of 1.5 t/m^3 for the tailings. In the areas of the TSF where tailings are submerged by water, the tailings will only consolidate through self-weight and thus likely reach a lower density than on the beaches.

Based on the consolidation test results (Section 5.2.4 on page 12) the facility is expected to undergo a total of between 3 and 4 m of consolidation settlement. Due to the low rate of rise, the majority of this consolidation settlement is expected to occur during operation of the facility and therefore only a small amount of post operational settlement is expected. This is not expected to impact on closure of the facility. Larger (based on proportion) settlements are expected near the decant of the facility where finer particles will be transported due to segregation and lower rates of air drying will be expected. However, due to the topography of the site the decant will progressively move during TSF development allowing early deposition pond locations to consolidate. In addition to this the thickness of tailings at the decant location is expected to be low. Based on this the post deposition settlements are not expected to significantly influence the closure of the facility.

6.9 Seepage

It is anticipated that the starter embankment of the TSF will be formed from materials that will protect the embankment from instability due to seepage and piping erosion. A near surface seepage interception system may be required to collect near surface seepage. A geotechnical and hydrogeological investigation will need to be carried out as part of future studies to characterise the subsurface conditions and hydrogeology of the site. The hydraulic conductivity of the unsaturated and saturated zones should be estimated during the field investigation. This information should be included in a seepage model to estimate the likely quantities of seepage expected from the TSF. This investigation will also assist in identifying the borrow materials for construction of the starter embankments.

It is not anticipated that the facility will be required to be lined due to the limited concentrations of leachates, as indicated by GCA, and the hypersaline nature of the underlying aquifers. There are no beneficial users of the aquifer (GRM, 2020)[9] and significant depth to groundwater means that it is unlikely that the seepage will results in a rise of the hypersaline groundwater to the root zone of nearby vegetation.

6.10 Water Balance

6.10.1 Approach

The TSF constitutes a single component of the much broader plant water management system, an assessment of which is outside the scope of this document. A simple annualised water balance has been estimated, based on published meteorological data for the area, predicted tailings throughput, and estimated tailings interstitial moisture and seepage.

The water flow estimates through the tailings system are based on the following parameters:

- A tailings *in situ* dry density of 1.5 t/m^3, slurry density of 50% solids by mass, and deposition rate of 562,500 tpa
- Average annual rainfall and evaporation rate data of 305.2 mm and 4.2 mm/day, respectively
- Seepage rates of 5, 10, and 15% of the total inflow water
- Interstitial water content of the tailings based on a settled dry density of 1.1 t/m^3

The estimated slurry water inflow is based on a slurry density of 50% solids by mass, to provide information regarding the range in decant return volumes that may be achieved. Estimation of the evaporation losses are outlined in Table 8 and the parameters used in the water balance are contained in Table 9.

Table 8: Estimation of Evaporation Losses

Component of TSF	% of Total TSF Area	Evaporation Coefficient
Pond	10	0.7
Wet Beach	30	0.5
Drying Beach	30	0.3
Dry Beach	30	0.1

Table 9: Parameters Used in Water Balance

Parameter	Value
Specific Gravity	3.42
Slurry Water SG	1
Deposition Rate (tpd)	1541
Dry density (t/m^3)	1.5
Area (ha)	50

6.10.2 Results

The annualised water balance results are summarised in Table 10.

[9] Groundwater Resource Management, 2020. Groundwater Supply Investigation Audalia Resources Limited Medcalf Vanadium Project. Report Reference J1843R03

Table 10: Water Balance Estimate

TSF Inflows (%)		Water removals from TSF (%)			
Slurry water	80	Seepage (assumed)	5	10	15
Rainfall	20	Evaporation	36	36	36
		Retained interstitial water	28	28	28
		Water return	31	26	21
Total	**100**	**Total**	**100**	**100**	**100**

Based on the preliminary water balance estimates, decant return water will be between 21 and 31% of total inflow, equivalent to 26 to 39% of process water inflow.

6.11 Water Management and Freeboard

6.11.1 Decant System

A floating turret is proposed to be installed to recover water from the TSF. A floating turret decant will allow the location of the supernatant pond to move during development of the TSF. Floating turret decants allow the supernatant pond to be maintained at a low level (i.e. do not require a significant depth of water before pumping). If the water being decanted is too turbid consideration should be given to whether the pumping be stopped.

Water would be pumped to a purpose-built, lined, water return pond, located in the process plant area, to temporarily store water recovered from the TSF during normal operations prior to re-use in the processing circuit or transfer to the evaporation ponds.

6.11.2 Management of Incident Rainfall

Appropriate surface drainage control measures will be installed on the TSF to limit surficial erosion and overtopping of the outer embankment slopes. The incident rainfall on the crest of the perimeter embankment will be managed through grading and armouring of the crest, which will allow surface runoff to shed towards conveyance structures (slope drains and ramps) located around the perimeter of the TSF. Surface water in the catchment upstream of the TSF will be redirected via a surface water drain. Flows will be directed to a sediment pond located near the south of the TSF prior to flowing off lease.

Incident rainfall on the top of the TSF will naturally flow to the near-central decant pond, from where it will be pumped to the process plant or to an evaporation pond.

Surface water runoff from the slopes of the perimeter embankment will be captured in a toe drain and collected in a sump at topographical low points, prior to being returned to the process plant.

6.11.3 Freeboard

Storage-area-elevation relationships for the TSF basins have been developed based on the design outlined in this report. A pre storm operating pond of 10% of the tailings depositional area has been assumed. In addition, as required by the DMP guidelines, it has been assumed that the decant facility is not operating during the rainfall events.

For completeness, three design rainfall events, the 1 in 100 AEP 72-hour event, the 1 in 1000 AEP 72-hour event and the 12-hour probable maximum precipitation (PMP) event, have been adopted for the freeboard assessment. The runoff resulting from the rainfall events was estimated using the Rational Method, with the runoff coefficient set to 1.0, which conservatively assumes that all of the rainfall reports as runoff and no losses occur due to infiltration or evaporation.

The results of the freeboard assessment are summarised in Table 11 and indicate that compliance to the DMP and ANCOLD requirements can be maintained, and the 12-hour PMP can also be contained (albeit with limited freeboard).

Table 11: Summary of Freeboards Assessment Results

Rainfall Event	Estimated Freeboard (m)
1 in 100 AEP 72-hour	1.1
1 in 1000 AEP 72-hour	1.0
12-hour PMP	0.1

Beach slopes were assumed, and additional freeboard may be available if the beach slopes are steeper. Further studies should be carried to estimate the beach slopes of the tailings.

6.12 Evaporation Ponds

Evaporation ponds are required to store the reject water from the reverse osmosis plant (RO plant). The process plant requires 805 kL/day of fresh water, which will be obtained from the RO plant through treatment of groundwater. Given the high salinity of the groundwater in Medcalf, a 40% conversion rate has been assumed by Audalia to estimate the volume of reject water that will need to be stored in an evaporation pond. Considering the 40% conversion rate, a total of 1207.5 kL/day will be discharged into the evaporation pond.

A conceptual water balance assessment has been developed based the expected inflow volume, rainfall, and evaporation for the site consistent with the numbers presented for the water balance in Section 6.10. Two evaporation ponds have been designed to provide storage for the LoM (approximately 500,000 m^3 per annum). Audalia has advised Golder that there is no requirement to provide a liner for evaporation ponds. Alternatives for water disposal will be investigated during operations. As noted in Section 6.2, Audalia is also considering dewatering options for the tailings, to reduce the discharge to the evaporation pond.

6.13 Dam Break Assessment

6.13.1 Method

A Fault Mode & Effects Analysis (FMEA) has been carried out to assess the potential for failure and the likely consequences of the TSF. This approach is consistent with AS/NZS 3931:1998. The FMEA technique is normally adopted as a first stage “screening” process to assess whether there is a need to carry out more rigorous analyses. It relies upon the subjective identification and assessment of potential failure mechanisms that could result in a flow failure of the TSF.

6.13.2 Possible Failure Mechanisms

The following were identified as being potential failure mechanisms (however unlikely they may be) of the existing TSF and the proposed expansions:

1) Overtopping of a perimeter wall
2) Slope failure of an external embankment (under static conditions)
3) Slope failure of an external embankment (under seismic conditions)
4) Embankment erosion due to tailings delivery or return water pipeline breakage
5) Progressive sloughing due to seepage
6) Piping erosion failure through an external embankment
7) Foundation failure.

Table 12 summarises the failure mechanisms and potential events that could trigger the failure.

Table 12: Potential Events to Trigger Failure Mechanisms

Case	Failure Mechanisms	Required Events to Trigger Failure Mechanisms			Consequence
		Primary	Secondary	Tertiary	
1	Uncontrolled overtopping of a perimeter wall	Extreme rainfall event	Poor surface water management	Minimum freeboard at time of rainfall event	Overtopping and/or release of liquefied tailings
2	Slope failure of an external embankment (under static conditions)	Slope failure	Tension cracking and/or loss of freeboard and/or piping erosion	No corrective action taken and subsequent extreme rainfall	Overtopping and/or release of liquefied tailings
3	Slope failure of an external embankment (under seismic conditions)	Seismic event	Slope failure	No corrective action taken	Release of liquefied tailings
4	Erosion of an embankment due to pipeline breakage	Pipeline burst	Erosion of perimeter embankment	No corrective action taken and subsequent extreme rainfall	Overtopping/ Release of liquefied tailings
5	Progressive sloughing of embankment due to seepage	Saturation of the perimeter embankment	Seepage observed and no corrective action taken	Slope failure	Release of liquefied tailings
6	Piping erosion failure through an external embankment	Seepage through embankment	Seepage observed and no corrective action taken	Slope failure	Release of liquefied tailings
7	Foundation failure	Slope failure	Tension cracking and/or loss of freeboard	No corrective action taken and subsequent extreme rainfall	Release of liquefied tailings

6.13.3 Results

The likelihood of occurrence of each event and the potential for the event to result in a flow failure have been estimated on a scale of 1 to 5 (low = 1, high = 5). The risks of failure for each case have been computed as the product of these two assigned values as shown in Table 13.

Table 13: Assigned Risk to Dam Break Study

Case	Failure Mechanism	Likelihood of Occurrence		Potential to Results in a Flow Failure		Product
		Rating	Justification	Rating	Justification	
1	Uncontrolled overtopping of the external embankment	2	Freeboard estimates indicate overtopping would be very unlikely	3	If overtopping occurs the likelihood of a flow failure is high	6
2	Slope failure of the external embankment (under static conditions)	1	Stability analyses indicate a satisfactory level of assurance	1	Low rates of rise and internal drainage measures likely to result in unsaturated tailings	1
3	Slope failure of the external embankment (under seismic conditions)	2	Stability analyses indicate a satisfactory level of assurance, but higher likelihood than under static loading	2	Liquefaction of tailings and release after major earthquake is possible	4
4	Erosion of the embankment due to pipeline breakage	2	Pipeline failure possible but lines will be inspected on a frequent basis	1	Likelihood of extent of erosion resulting in major flow failure is negligible	2
5	Progressive sloughing of embankment	2	Progressive sloughing unlikely to result in large scale failure due to 3(H):1(V) slopes.	1	Low rates of rise and internal drainage measures likely to result in unsaturated tailings	2

Case	Failure Mechanism	Likelihood of Occurrence		Potential to Results in a Flow Failure		Product
		Rating	Justification	Rating	Justification	
6	Piping erosion failure through the external embankment	2	Internal drainage to be installed.	2	Localised erosion is unlikely to result in large scale failure.	4
7	Foundation failure	1	Stability analyses indicate a satisfactory level of assurance	1	Low rates of rise and internal drainage measures likely to result in unsaturated tailings	1

These values have been entered into the risk-rating matrix presented in Table 14.

Table 14: Summary of Risk Ratings

Likelihood of Occurrence	Potential to Result in Flow Failure				
	Low (1)	Low to Moderate (2)	Moderate (3)	Moderate to High (4)	High (5)
Almost Certain (5)					
Likely (4)					
Moderate (3)					
Unlikely (2)	4,5	3,6	1		
Rare (1)	2,7				

Risk Level
High
Moderate
Low

From Table 13 and Table 14 it is evident that:

- There is no entry in the 'high' risk zone of the matrix.
- Only one entry is in the 'moderate' risk zone (overtopping due to extreme rainfall event).
- Most identified risks are 'low'.
- The average risk rating is 3.

The identified potential failure mechanisms have been addressed as part of the design as follows.

- Overtopping would only arise in the extremely unlikely circumstance of a rainfall event equivalent to the 12-hour PMP occurring near the end of operations. In addition to this adequate freeboard exists to contain the 12-PMP event so surface water measures surrounding the TSF would need to fail allowing additional surface water onto the facility. This risk is considered to be extremely low but could be mitigated through provision of additional freeboard.
- Stability analyses (refer Section 6.7on page 16) demonstrate a high level of assurance that stability of the outer perimeter embankments of the TSF will be maintained under static and post-liquefaction conditions up to the maximum height of the TSF envisaged under the current proposal.
- The use of a turret decant system eliminates the potential for failure of gravity decant systems. Tailings distribution pipework will be located at the internal crest margins and embankment crests will have safety bunds at the outer crest margin with a cross-fall towards the centre of the TSF to capture pipe spillages or failures.

Based on this assessment, the risk of a dam break occurring with release of tailings from the TSF is "low" and a more rigorous dam break analysis is not considered to be required.

6.14 Closure Considerations

6.14.1 Selection of Cover System

Various cover systems can be adopted to close and complete TSFs. ANCOLD (2012) states that *"closure options need to be reviewed on a case by case basis as there are likely to be specific issues to be addressed in each case"*. There are a range of cover types and the climates in which they are generally implemented, as shown Figure 9, published by The International Network on Acid Prevention (INAP 2009).

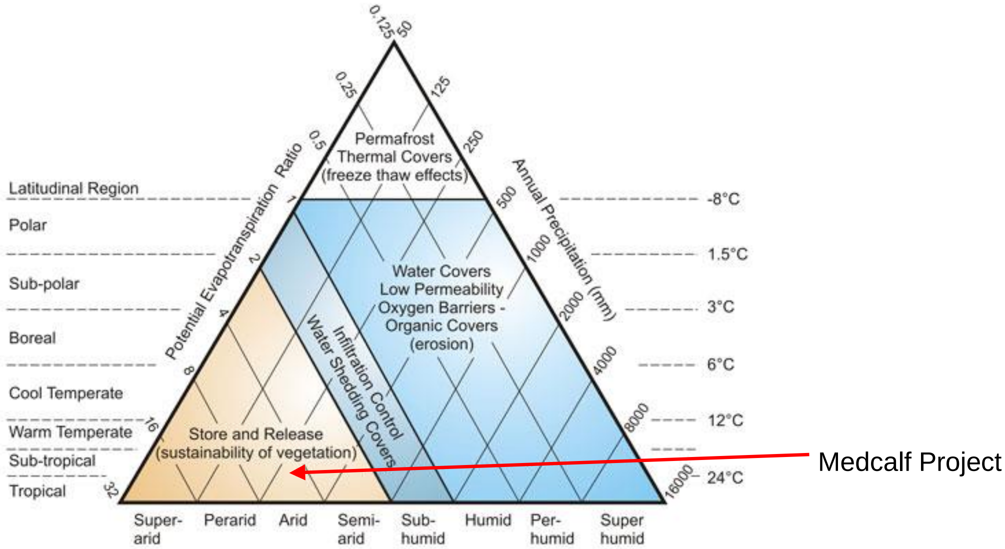


Figure 9: Covers and Climate Types, modified from Holdridge et al., 1971 by Wickland and Wilson (INAP, 2009)

At the site of the TSFs, the annual precipitation is reported to be 350 mm, with a potential evapotranspiration ratio of about five. The site is therefore located in a semi-arid to arid environment, and a store and release cover is indicated to be the most suitable.

The cover options outlined in ANCOLD (2012) are consistent with the tri-linear plot published by INAP (2009), with examples provided as listed below. It should be noted that ANCOLD (2012) takes consideration of Australia's climatic setting and permafrost covers are not possible. Only wet and dry covers are therefore considered.

- *A water or saturated soil cover might be appropriate in a wet climate to maintain the tailings saturation when required to prevent oxidation and the production of contaminants in seepage.*
- *A rainfall shedding cover may be appropriate in a wet climate to minimise infiltration and ongoing seepage with an appropriately sized spillway.*
- *A store/release cover might be appropriate in a moderate or dry climate, possibly including a sealing layer.*
- *Allowing the development of an evaporative crust may be appropriate in a dry climate, in which any infiltration into the desiccated tailings will re-evaporate, without reliance on vegetation.*

A store and release cover has therefore been selected for the Medcalf TSFs, taking cognisance of the climatic setting. We anticipate the cover design for the upper surface of the landform will incorporate the following features:

- A capillary break/drainage layer will be provided on the surface of the tailings to inhibit upward migration of salts and to direct infiltrated rainwater to pre-determined locations.

- The surface of the TSF reshaped to form a water shedding surface and will then be covered with borrowed materials, likely clayey in nature, to form the final landform.
- The stockpiled topsoil will be spread over the surface, to allow growth of native vegetation common in the area.
- The cover material will inhibit water infiltration, capturing and storing some water, which will encourage plant growth and remove water through evapo-transpiration in the drier months.

6.14.2 Closure Landform

The TSFs have been designed with slope batters of 3H:1V (~20°). Placing the material at this angle allows for trafficking of the slopes at closure, facilitating placement of cover materials. Erosion control will be required on the slopes, which may be achieved through placement of durable, erosion-resistant materials from a borrow area located to the north of the TSF.

Tailings storage infrastructure such as pipelines, water storage ponds and the temporary slurry storage area will be decommissioned and rehabilitated. The embankments will be regraded to tie into the surrounding natural ground.

6.14.3 Early Closure

An early termination of mining operations (e.g. if the mine were unable to be developed to its full extent) would lead to the need to close the TSFs prematurely. This may occur with little warning. In the event that it is necessary to decommission the active TSF prior to achieving the design capacity, the following steps would be implemented.

- An immediate care and maintenance plan would be developed
- A pre-decommissioning review of the TSFs would be carried out and a specific closure plan developed in consideration of the stage of development of the TSF.
- The exposed tailings surfaces would be covered with borrowed material.
- Topsoil will be borrowed from the stockpile and spread over the cover surface.

Identification of suitable materials for placement on the surface and slopes of the TSFs should be carried out as part of the next stage of study.

7.0 MONITORING AND AUDITING EXPECTATIONS

Regular inspections and monitoring of the TSF landforms and associated infrastructure will be used to assess the performance of the TSFs. A monitoring program will be designed to monitor key environmental and design performance indicators and will include the following:

- Periodic inspections and/or testing of:
  - The water levels and freeboard on the TSFs and the evaporation ponds.
  - A check for fauna in the TSFs, evaporation and other ponds.
  - Inspection of all sides of the TSFs, including the slope and toe for evidence of seepage. The toe drain allowed for on the crest of the starter embankment should also be inspected for evidence of seepage.
  - Inspection of the surface of the TSFs to identify areas of water ponding that may lead to infiltration.

    - Inspection of crests, benches, and slopes for signs of settling or failure (e.g., crack development, minor slumps) or signs of erosion.
    - Inspection of peripheral vegetation for signs of stress.
    - Inspection following heavy rainfall events or flooding of the TSFs for signs of erosion of the slopes, crest or ramps, or the creation of low spots.
- Vibrating wire piezometers (VWPs) should be installed in the TSFs to monitor for pore pressure in the embankments. The location of the VWPs will be selected as part of future studies.
- Groundwater monitoring should be carried out in accordance with the license.
- A technical review and operational audit of the TSF should be carried out by a suitably qualified geotechnical professional after the first six months of operation and every year thereafter. The technical review will assess the performance of the TSF against the design criteria and the conditions outlined in the License to Operate and approved Mining Proposal. The audit will include a review of the tailings management procedures, operating manual, and monitoring data.

8.0 IMPORTANT INFORMATION

Your attention is drawn to the document titled – “Important Information Relating to this Report”, which is included in Appendix C of this report. The statements presented in that document are intended to inform a reader of the report about its proper use. There are important limitations as to who can use the report and how it can be used. It is important that a reader of the report understands and has realistic expectations about those matters. The Important Information document does not alter the obligations Golder has under the contract between it and its client.

Golder Associates Pty Ltd

Brendan Cummins
Senior Tailings Engineer

Peter Chapman
Principal

THH-BPC/PJC/hn

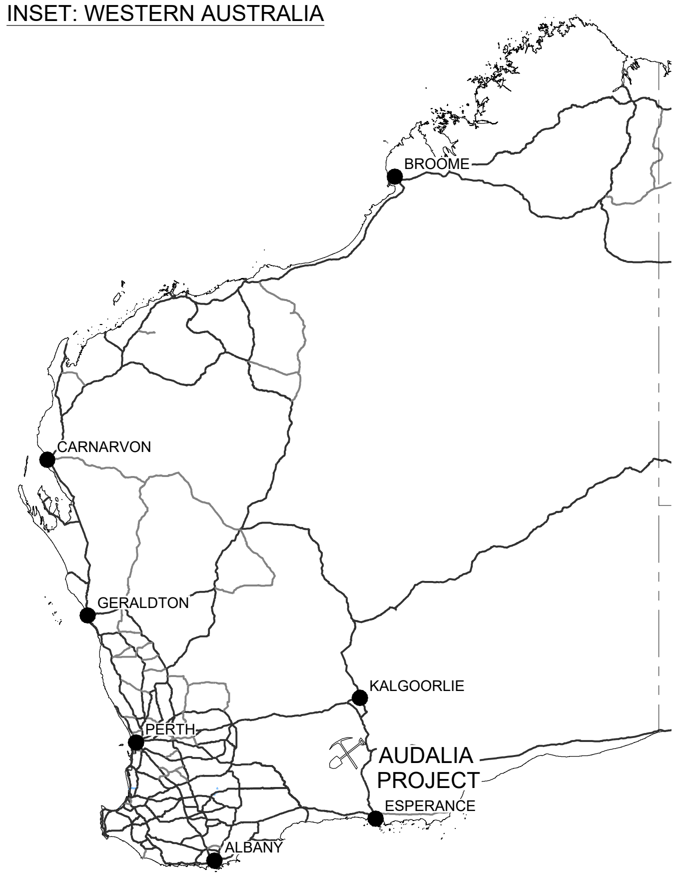
A.B.N. 64 006 107 857

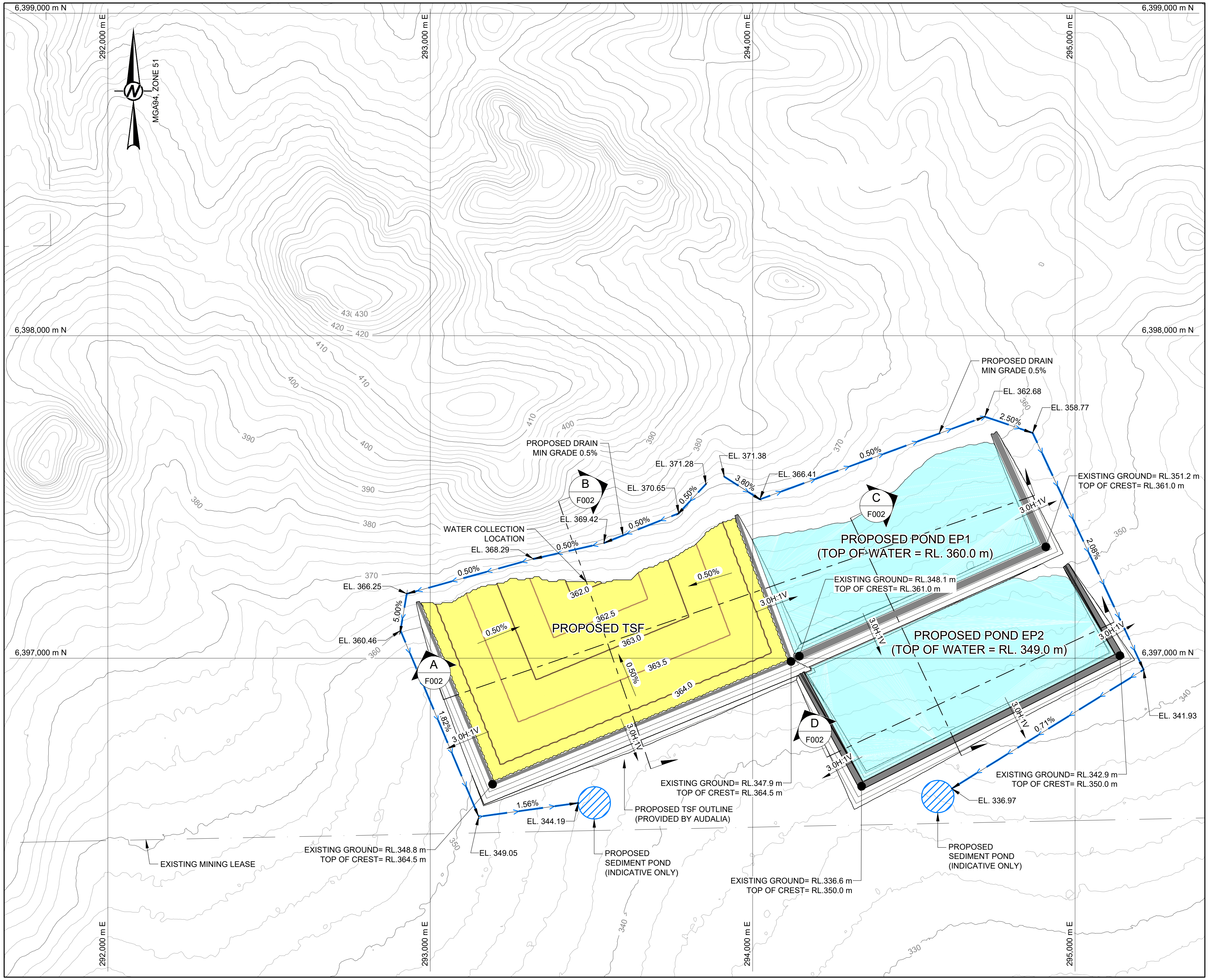
https://golderassociates.sharepoint.com/sites/120972/project files/6 deliverables/002/20136893-002-r-rev2 tsf design report.docx

APPENDIX A

Figures

INSET: WESTERN AUSTRALIA





NOT FOR CONSTRUCTION

DRAFT

0 250 500

1:12,500 METRES

CLIENT
AUDALIA RESOURCES LIMITED

PROJECT
AUDALIA TAILINGS MANAGEMENT

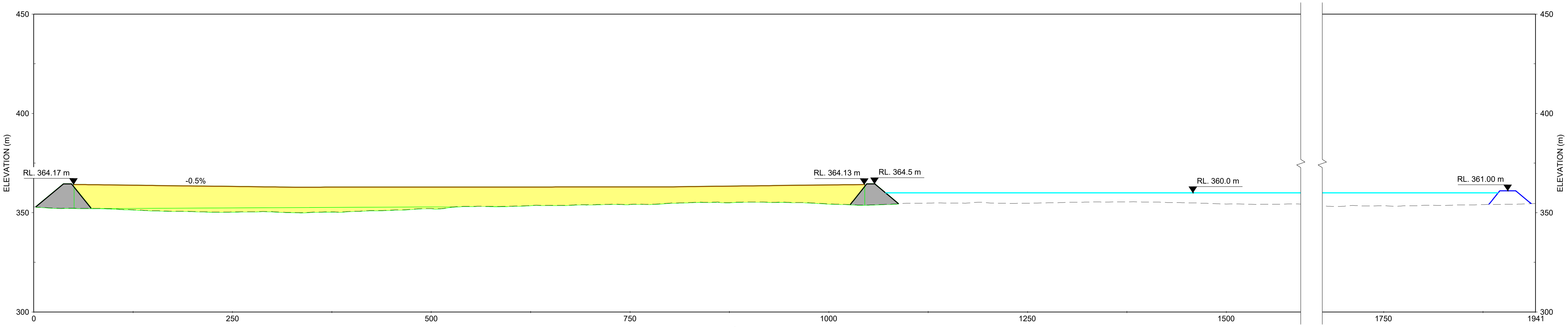
CONSULTANT

GOLDER

YYYY-MM-DD	2020-05-27
DESIGNED	TH
PREPARED	CB
REVIEWED	PC
APPROVED	

TITLE
PROPOSED TAILINGS STORAGE FACILITY

PROJECT NO.	DOC.	REV.	FIGURE
20136893	001-R	2	F001



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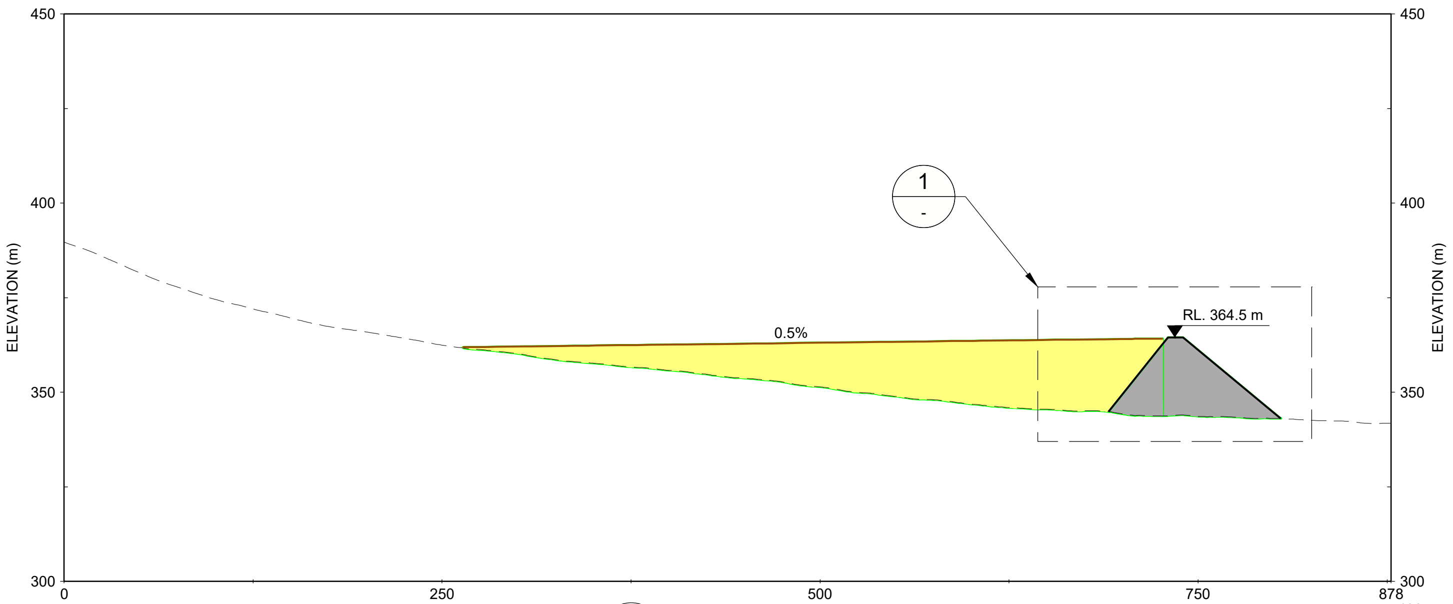
VERT. SCALE 1:2,000 F001



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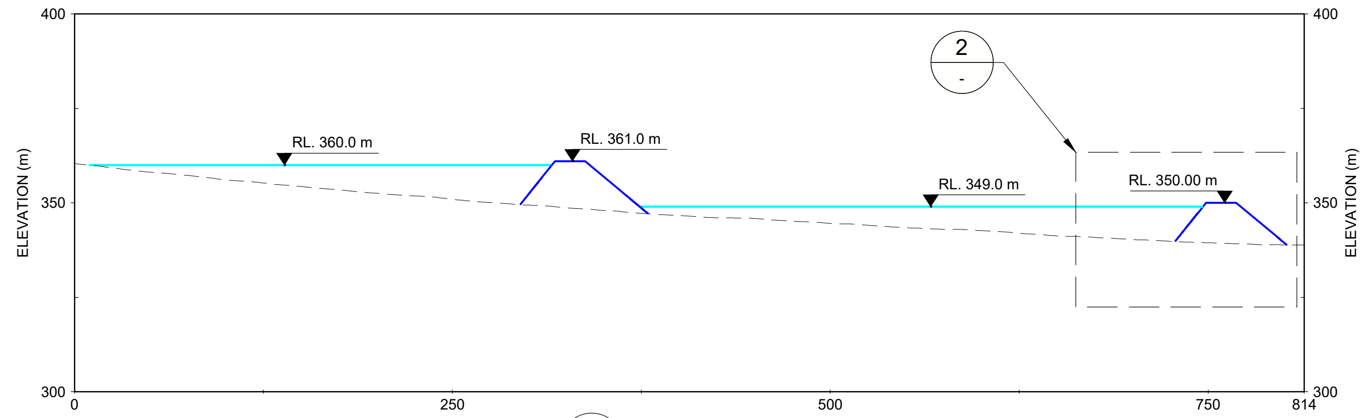
VERT. SCALE 1:2,000 F001



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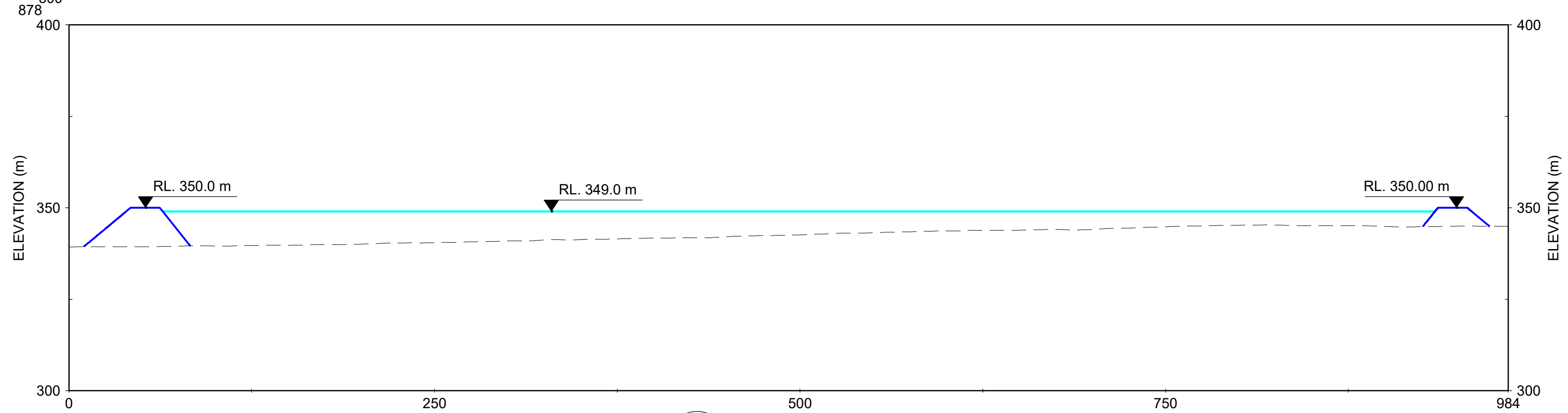
VERT. SCALE 1:2,000 F001



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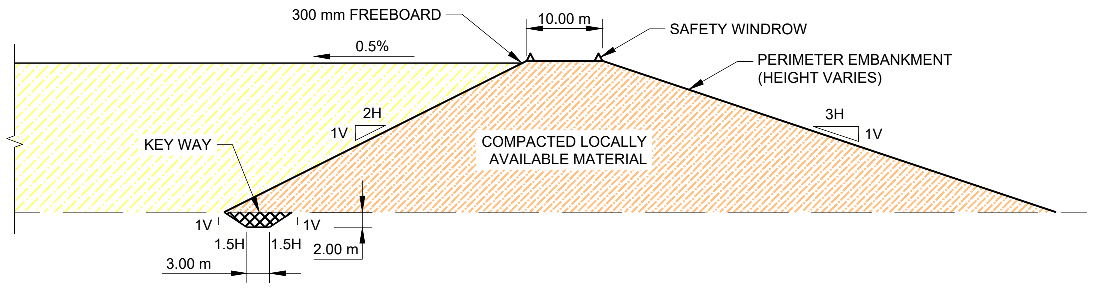
VERT. SCALE 1:2,000 F001



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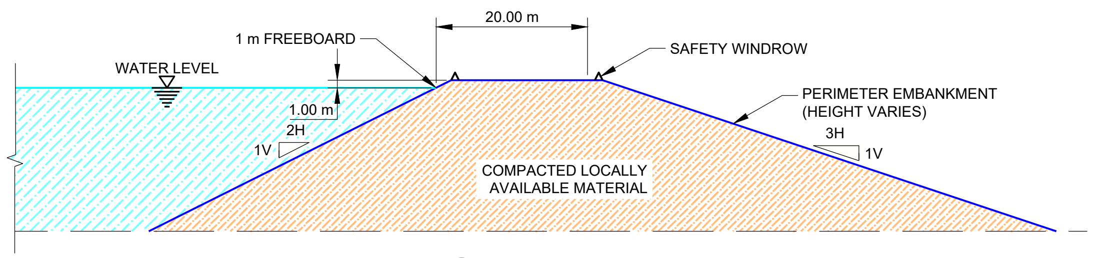


SCALE 1:1,000 2 - TYPICAL POND EMBANKMENT DETAIL

NOT FOR CONSTRUCTION

DRAFT

1:200	0, 5, 10	METRES
1:1,000	0, 25, 50	METRES
1:2,000	0, 50, 100	METRES
1:5,000	0, 100, 200	METRES

CLIENT	AUDALIA RESOURCES LIMITED	PROJECT	AUDALIA TAILINGS MANAGEMENT
CONSULTANT	GOLDER	TITLE	SECTIONS AND DETAILS
YYYY-MM-DD	2020-05-27		
DESIGNED	TH		
PREPARED	CB		
REVIEWED	PC		
APPROVED			

PROJECT NO.	DOC.	REV.	FIGURE
20136893	001-R	2	F002

APPENDIX B

Laboratory Test Certificates

microanalysis australia

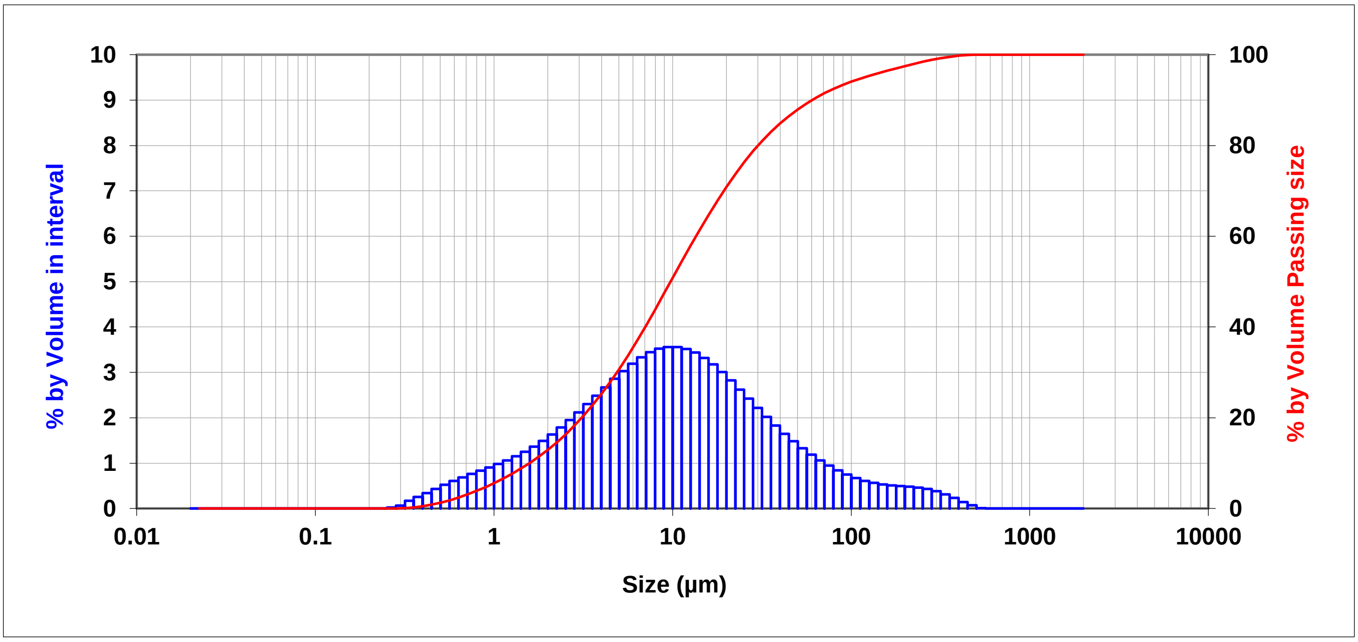
Suite 6
642 Albany Hwy
Victoria Park
WA 6100

Client: Golder and Associates
Client ID: 1538943/151344
Job No : 15_1239
Lab ID No : 15_1239_01

Analysis: Laser diffraction size distribution following ISO13320-1:1999

Dispersant:	Water	**RI/ABS:**	2.74 / 0.1
Additives:	10 millilitres sodium hexametaphosphate	**Analysis Model:**	General purpose
Sonication:	5 min sonication	**Result units:**	Volume

Concentration:	0.0094 % vol	**Vol. Weighted Mean D[4,3]:**	26.82 µm	**d(0.1):**	1.577	µm
Obscuration:	18.64 %	**Surface Weighted Mean D[3,2]:**	4.012 µm	**d(0.5):**	9.756	µm
Weighted Residual:	0.559 %	**Specific Surface Area:**	1.5 m^2/cc	**P80:**	30.126	µm
				d(0.9):	60.397	µm



Size (µm)	Vol Under %	Size (µm)	Vol Under %	Size (µm)	Vol Under %	Size (µm)	Vol Under %	Size (µm)	Vol Under %	Size (µm)	Vol Under %
0.020	0.00	0.142	0.00	1.002	5.63	7.096	40.31	50.238	87.94	355.656	99.54
0.022	0.00	0.159	0.00	1.125	6.62	7.962	43.75	56.368	89.27	399.052	99.78
0.025	0.00	0.178	0.00	1.262	7.68	8.934	47.28	63.246	90.46	447.744	99.92
0.028	0.00	0.200	0.00	1.416	8.83	10.024	50.84	70.963	91.53	502.377	99.99
0.032	0.00	0.224	0.00	1.589	10.08	11.247	54.40	79.621	92.47	563.677	100.00
0.036	0.00	0.252	0.00	1.783	11.45	12.619	57.92	89.337	93.32	632.456	100.00
0.040	0.00	0.283	0.02	2.000	12.94	14.159	61.36	100.237	94.07	709.627	100.00
0.045	0.00	0.317	0.09	2.244	14.57	15.887	64.68	112.468	94.74	796.214	100.00
0.050	0.00	0.356	0.26	2.518	16.36	17.825	67.86	126.191	95.35	893.367	100.00
0.056	0.00	0.399	0.52	2.825	18.31	20.000	70.87	141.589	95.92	1002.374	100.00
0.063	0.00	0.448	0.86	3.170	20.43	22.440	73.69	158.866	96.45	1124.683	100.00
0.071	0.00	0.502	1.30	3.557	22.73	25.179	76.31	178.250	96.96	1261.915	100.00
0.080	0.00	0.564	1.82	3.991	25.22	28.251	78.74	200.000	97.46	1415.892	100.00
0.089	0.00	0.632	2.43	4.477	27.89	31.698	80.96	224.404	97.95	1588.656	100.00
0.100	0.00	0.710	3.12	5.024	30.75	35.566	82.98	251.785	98.42	1782.502	100.00
0.112	0.00	0.796	3.88	5.637	33.78	39.905	84.81	282.508	98.85	2000.000	100.00
0.126	0.00	0.893	4.72	6.325	36.97	44.774	86.45	316.979	99.23		

Analyst: Emily Barker, B.Sc.(Nanotechnology)
Reported: Emily Barker, B.Sc.(Nanotechnology)
Approved: Michael Simeoni, B.Sc.(Chemistry), M.Sc. (Science Administration), Ph.D.

Particle Size Distribution & Plasticity Index Test Report

Perth Laboratory
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Perth WA 6017
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www.golder.com
perthlab@golder.com.au

Client:	Audalia Resources Limited 111 Hay Street West Perth		
Project:	Medcalf Project	**Date:**	3/12/15
Location:	Lake Johnson Western Australia	**Project No.:**	1538943
Lab Reference Number:	151344	**Sample Identification:**	Gravity Tailings

Laboratory Specimen Description: Silty SAND

AS 1726 - Soil Classification:

Particle Size Distribution AS 1289.3.6.1

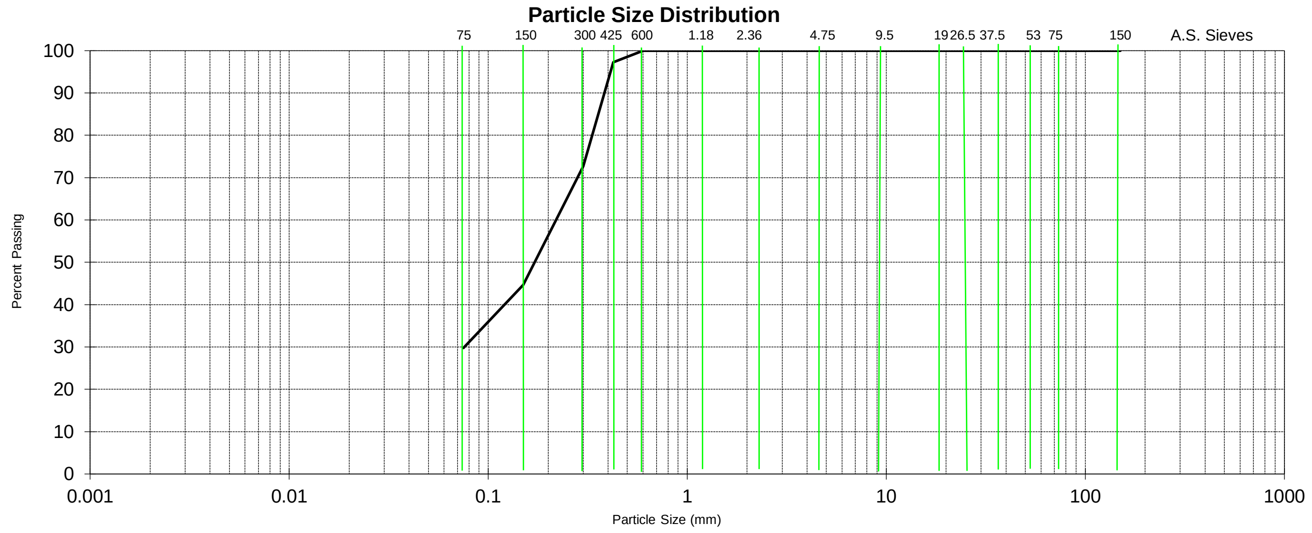
Sieve Size		% Passing	Specification
150.0	mm	100	
75.0	mm	100	
53.0	mm	100	
37.5	mm	100	
26.5	mm	100	
19.0	mm	100	
9.5	mm	100	
4.75	mm	100	
2.36	mm	100	
1.18	mm	100	
0.600	mm	100	
0.425	mm	97	
0.300	mm	73	
0.150	mm	45	
0.075	mm	30	

Plasticity Index and Moisture Content

Test		Method	Result	Specification
Liquid Limit	%	AS 1289.3.1.2	ND	
Plastic Limit	%	AS 1289.3.2.1	ND	
Plasticity Index	%	AS 1289.3.3.1	ND	
Linear Shrinkage	%	AS 1289.3.4.1	ND	
Moisture Content	%	AS 1289.2.1.1	ND	

Sample History: Air Dried
Preparation Method: Dry Sieved
Cracking/Crumbling/Curling of linear shrinkage:
Linear shrinkage mould length (mm):
ND = not determined NO = not obtainable NP = non plastic

Notes:



Tested as received **PLF1-003 RL0 27/11/12**

Certificate Reference: 1538943_151344_TR-150112_Class_Rev0

NATA Accreditation No: 1961 Perth

Accredited for compliance with ISO/IEC 17025

THIS DOCUMENT SHALL ONLY BE REPRODUCED IN FULL

Hamish Campbell – Senior Laboratory Technician

Particle Size Distribution & Plasticity Index Test Report

Golder Associates

Perth Laboratory
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Perth WA 6017
P: +61 8 9441 0700 F: +61 8 9441 0701
www.golder.com
perthlab@golder.com.au

Client:	Audalia Resources Limited 111 Hay Street West Perth		
Project:	Medcalf Project	**Date:**	3/12/15
Location:	Lake Johnson Western Australia	**Project No.:**	1538943
Lab Reference Number:	151344	**Sample Identification:**	Natural Slimes

Laboratory Specimen Description: SILT

AS 1726 - Soil Classification:

Particle Size Distribution AS 1289.3.6.1

Sieve Size		% Passing	Specification
150.0	mm	100	
75.0	mm	100	
53.0	mm	100	
37.5	mm	100	
26.5	mm	100	
19.0	mm	100	
9.5	mm	100	
4.75	mm	100	
2.36	mm	100	
1.18	mm	100	
0.600	mm	100	
0.425	mm	100	
0.300	mm	100	
0.150	mm	100	
0.075	mm	99	

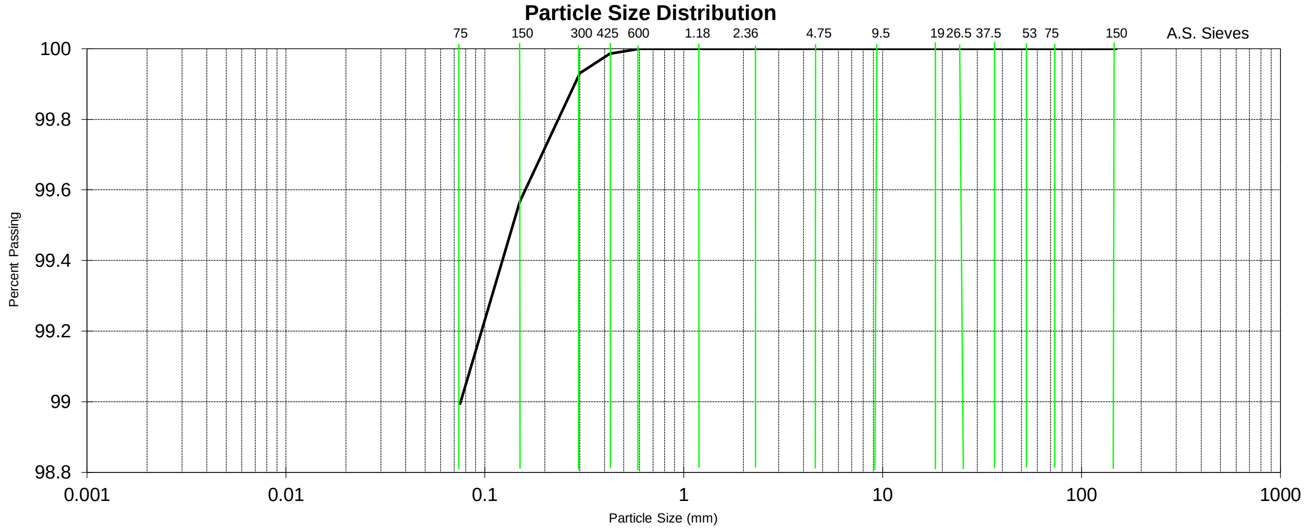
Plasticity Index and Moisture Content

Test		Method	Result	Specification
Liquid Limit	%	AS 1289.3.1.2	ND	
Plastic Limit	%	AS 1289.3.2.1	ND	
Plasticity Index	%	AS 1289.3.3.1	ND	
Linear Shrinkage	%	AS 1289.3.4.1	ND	
Moisture Content	%	AS 1289.2.1.1	ND	

Sample History: Air Dried
Preparation Method: Dry Sieved
Cracking/Crumbling/Curling of linear shrinkage:
Linear shrinkage mould length (mm):

ND = not determined NO = not obtainable NP = non plastic

Notes:



Tested as received **PLF1-003 RL0 27/11/12**

Certificate Reference: **1538943_151344_TR-150112_Class_Rev0**

NATA

NATA Accreditation No: 1961 Perth

Accredited for compliance with ISO/IEC 17025

THIS DOCUMENT SHALL ONLY BE REPRODUCED IN FULL

Hamish Campbell – Senior Laboratory Technician

Particle Size Distribution & Plasticity Index Test Report

Golder Associates
Perth Laboratory
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www.golder.com
perthlab@golder.com.au

Client:	Audalia Resources Limited		
	111 Hay Street West Perth		
Project:	Medcalf Project	**Date:**	3/12/15
Location:	Lake Johnson Western Australia	**Project No.:**	1538943

Lab Reference Number:	151344	**Sample Identification:**	Combined Tailings Natural Slimes / Gravity Tailings

Laboratory Specimen Description: Sandy SILT
AS 1726 - Soil Classification:

Particle Size Distribution AS 1289.3.6.1

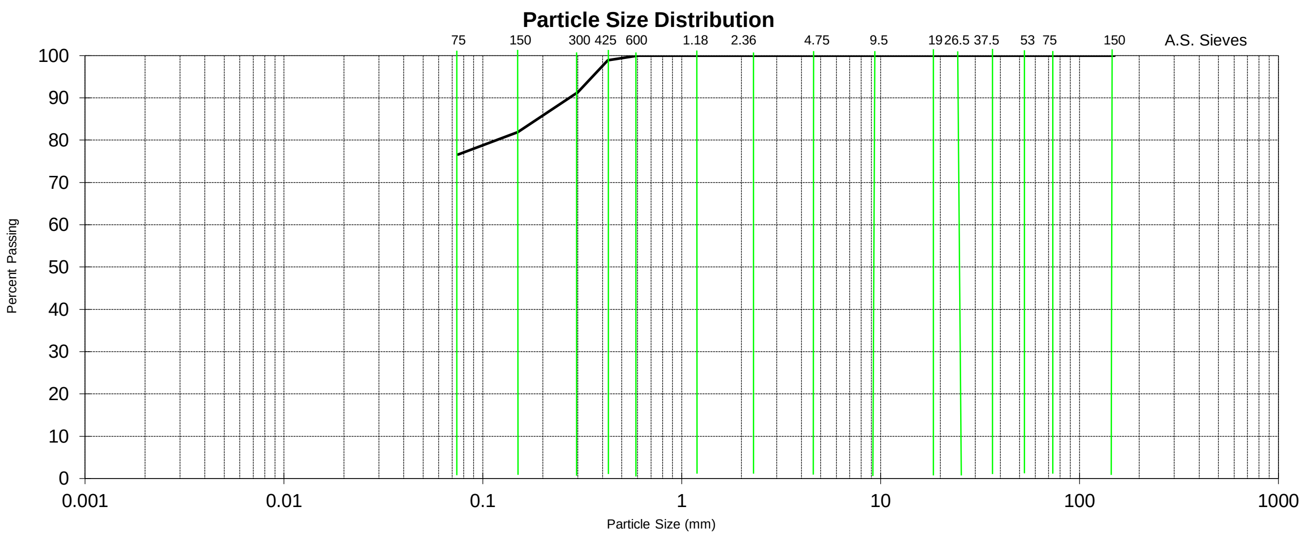
Sieve Size		% Passing	Specification
150.0	mm	100	
75.0	mm	100	
53.0	mm	100	
37.5	mm	100	
26.5	mm	100	
19.0	mm	100	
9.5	mm	100	
4.75	mm	100	
2.36	mm	100	
1.18	mm	100	
0.600	mm	100	
0.425	mm	99	
0.300	mm	91	
0.150	mm	82	
0.075	mm	77	

Plasticity Index and Moisture Content

Test		Method	Result	Specification
Liquid Limit	%	AS 1289.3.1.2	ND	
Plastic Limit	%	AS 1289.3.2.1	ND	
Plasticity Index	%	AS 1289.3.3.1	ND	
Linear Shrinkage	%	AS 1289.3.4.1	ND	
Moisture Content	%	AS 1289.2.1.1	ND	

Sample History: Air Dried
Preparation Method: Dry Sieved
Cracking/Crumbling/Curling of linear shrinkage:
Linear shrinkage mould length (mm):
ND = not determined NO = not obtainable NP = non plastic

Notes:



Tested as received **PLF1-003 RL0 27/11/12**

Certificate Reference: **1538943_151344_TR-150112_Class_Rev0**

NATA
NATA Accreditation No: 1961 Perth
Accredited for compliance with ISO/IEC 17025
THIS DOCUMENT SHALL ONLY BE REPRODUCED IN FULL

Hamish Campbell – Senior Laboratory Technician

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www.golder.com perthlab@golder.com.au

Slurry Consolidometer Test Report

Client: Audalia Resources Limited
111 Hay Street West Perth

Date: 3/12/2015

Project: Medcalf Project

Project No.: 1538943

Sample Identification: Combined Sample - Natural Slimes / Gravity Tailings (2:1 ratio)

Test procedure: In-house
Specimen Type: Slurry
Test Conditions: Top drainage of specimen while undergoing compression
Sample Diameter (mm): 71

Specimen Properties:

Solids
Type: Tailings
Particle Density (t/m^3): 3.42 (measured)

Fluid
Type: DI Water
Preparation solids concentration: 51%
Suspended solids concentration (g/l): Not determined

Preparation description: Sample combined in a 2:1 ratio of natural slimes to gravity tailings. Reslurried using demineralised water to a non-segregating solids concentration consistency.

Test conditions:

Vertical Effective Pressure σv' (kPa)	Void Ratio e (-)	Dry Density ρd (t/m^3)	Permeability k (m/s)	Confining Modulus M (kPa)	Coefficient of Volume Compressibility m_v (m^2/MN)	Coefficient of Consolidation Cv (m^2/yr)
-	-	-	-	-	-	-
10	2.65	0.94	3.4E-08	38	28.5	-
25	1.39	1.43	4.0E-09	43	27.9	0.8
50	1.23	1.54	2.9E-09	372	2.8	3.8
100	1.11	1.62	2.1E-09	963	1.1	6.9
200	1.01	1.70	1.6E-09	2101	0.5	13.0
400	0.92	1.78	1.0E-09	4271	0.2	18.0
800	0.83	1.87	7.2E-10	8580	0.1	21.8
200	0.83	1.87	-	-	-	-
50	0.84	1.86	-	-	-	-
10	0.86	1.84	-	-	-	-
-	-	-	-	-	-	-
-	-	-	-	-	-	-
-	-	-	-	-	-	-
-	-	-	-	-	-	-
-	-	-	-	-	-	-

Notes: Permeability measured by constant head testing. Coefficient of consolidation calculated from base pore pressure dissipation.

Riccardo Fanni - Tailings Engineer

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84 Guthrie Street Osborne Park, Perth WA 6017
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www.golder.com perthlab@golder.com.au

Slurry Consolidometer Test Report

Client:	Audalia Resources Limited 111 Hay Street West Perth	**Date:**	3/12/2015
Project:	Medcalf Project	**Project No.:**	1538943

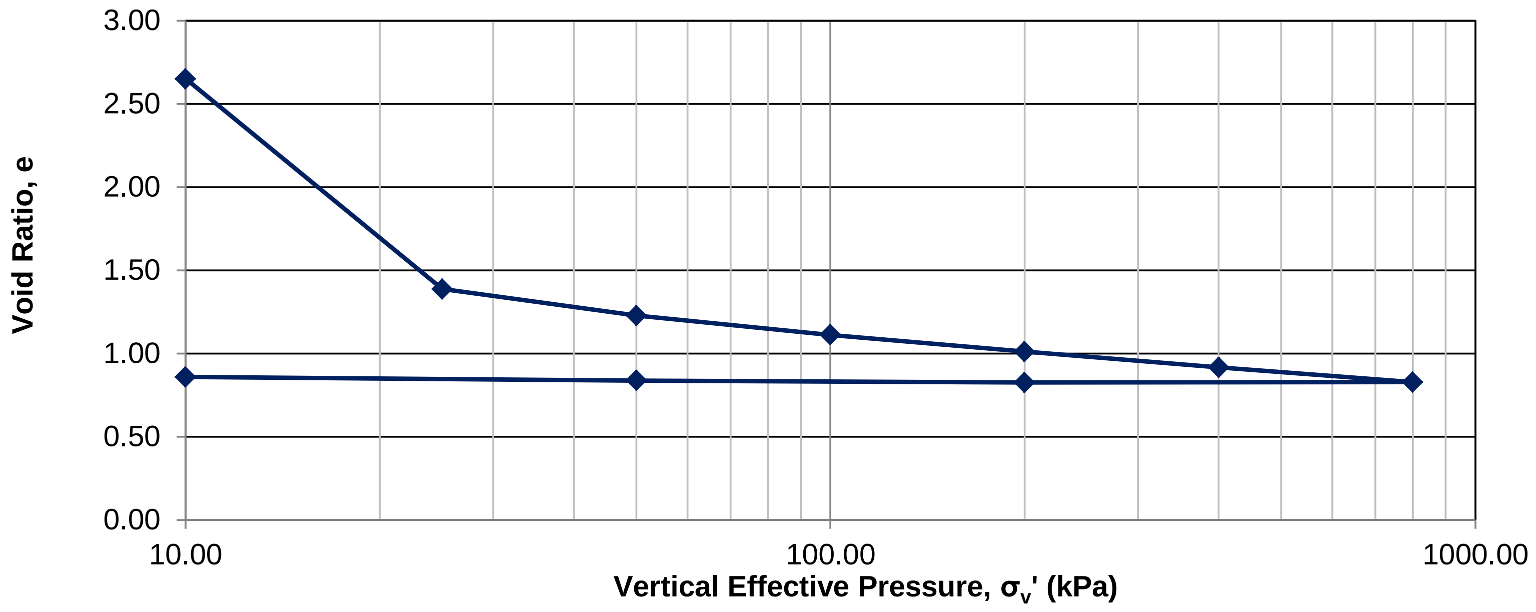
Sample Identification: Combined Sample - Natural Slimes / Gravity Tailings (2:1 ratio)

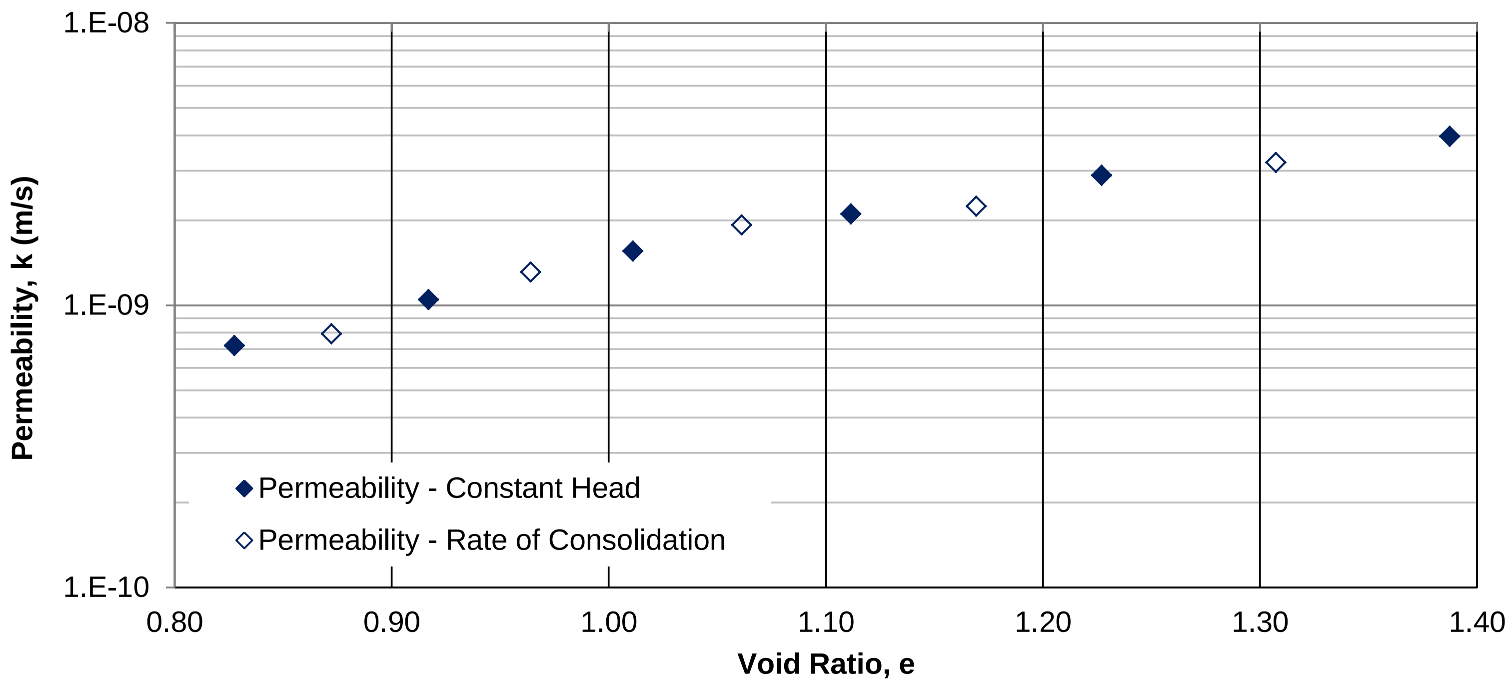
Test procedure: In-house
Specimen Type: Sandy SILT
Test Conditions: Top drainage of specimen while undergoing compression
Sample Diameter (mm): 71

Specimen Properties:

Solids
Type: Tailings
Particle Density (t/m^3): 3.42 (measured)

Fluid
Type: DI Water
Preparation solids concentration: 51%
Suspended solids concentration (g/l): Not determined





Notes: Permeability measured by constant head testing. Coefficient of consolidation calculated from base pore pressure dissipation.

Riccardo Fanni - Tailings Engineer

Settling Tests Summary Report

Perth Laboratory
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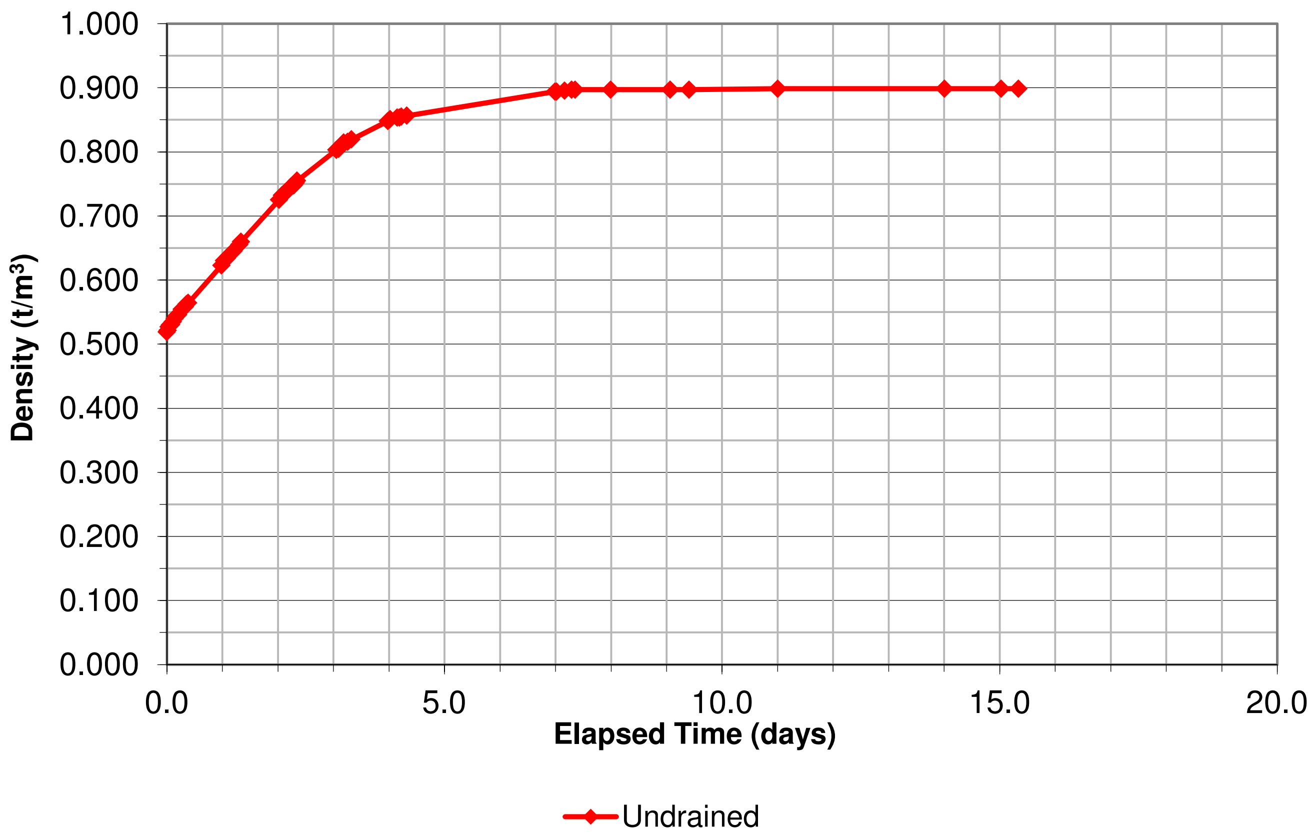
www.golder.com
PTH-LABORATORY@golder.com.au

Client:	Audalia Resources Limited		
	111 Hay street West Perth		
Project:	Medcalf Project	**Date:**	4/11/15
Location:	Lake Johnson Western Australia	**Project No.:**	1538943

Lab Reference No.:	151344	**Sample Identification:**	Combined Sample Natural Slimes / Gravity Tailings

Laboratory Specimen Description:	Sandy Silt
Test Procedure	In-house Method
Tested Percent Solids (%)	38
Date Test Started	19/10/15



Notes: Sample Combined in a 2:1 ratio of natural slimes to gravity tailings

Tested as received **PLF7-007 RL0 28/02/13**

Certificate Reference:	**1538943_151344_TR-150112_Settling_Rev1**

Hamish Campbell - Senior Laboratory Technician

Shrinkage Test

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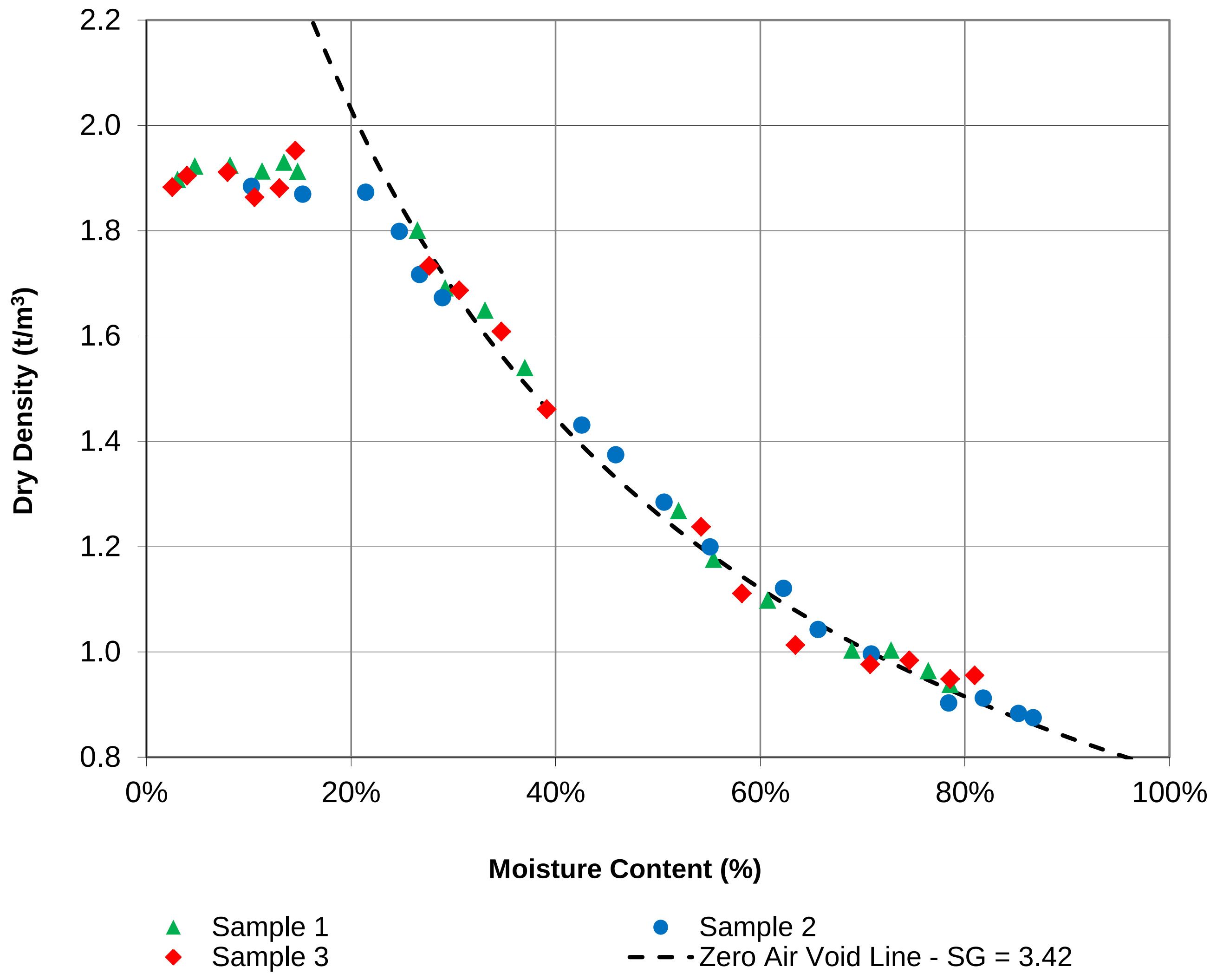
Client:	Audalia Resources Limited 111 Hay Street West Perth		
Project:	Medcalf Project	**Date:**	2/12/15
Location:	Lake Johnson Western Australia	**Project No.:**	1538943

Test procedure: In House Method

Sample Identification: Combined sample - Natural Slimes / Gravity Tailings

Preparation description: Sample combined in a 2:1 ratio of natural slimes to gravity tailings. Reslurried to 50% solids concentration using demineralised water to a non-segregating consistency.



Tabulated - Air Drying (Summer Cycle) Test Report

Golder Associates

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PTH-LABORATORY@golder.com.au

Client:	Audalia Resources Limited		
	111 Hay Street West Perth		
Project:	Medcalf Project	**Date:**	3/12/15
Location:	Lake Johnson Western Australia	**Project No.:**	1538943
Lab Reference Number:	151344	**Sample Identification:**	Combined Sample Natural Slimes / Gravity Tailings

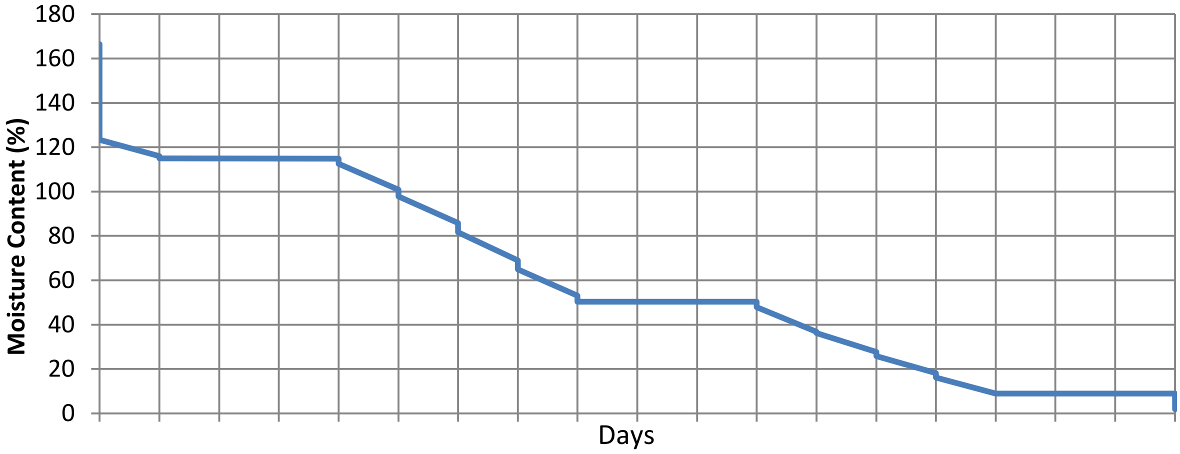
Laboratory Specimen Description: Sandy SILT

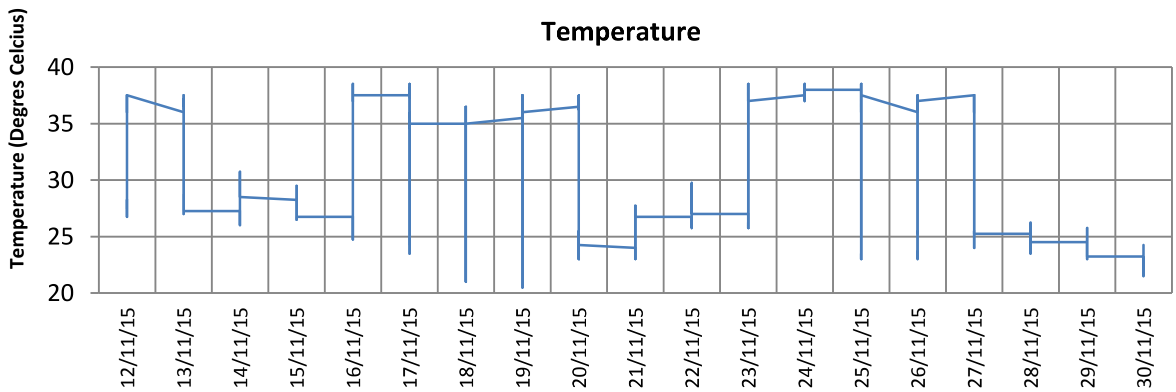
Test procedure: Internal

Required Summer Cycle: **37 During the night in a oven and on bench in laboratory during the day.**

Test Performed with material at 40% Percent Solids

Date Tested: 12/11/2015





Notes:

Tested as received **PLF7-005 RL0 21/01/13**

Certificate Reference: **1538943_151344_TR-0_Summer Cycle_Rev0**

Hamish Campbell - Senior Laboratory Technician

Tabulated - Air Drying (Summer Cycle) Test Report

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www.golder.com
PTH-LABORATORY@golder.com.au

Client:	Audalia Resources Limited 111 Hay Street West Perth		
Project:	Medcalf Project	**Date:**	3/12/15
Location:	Lake Johnson Western Australia	**Project No.:**	1538943
Lab Reference Number: 151344		**Sample Identification:**	Combined Sample Natural Slimes / Gravity Tailings

Laboratory Specimen Description: Sandy SILT

Test procedure: Internal

Initial Container & Wet Sample	**g**	2012.8
Initial Container & Wet Sample After Decant	**g**	1814.2
Final Container & Dry Sample	**g**	1245.3
Container	**g**	731.7
Final Dry Sample Mass	**g**	480.8

Required Summer Cycle: **37 During the night in a oven and on bench in laboratory during the day.**

Date Tested: 12/11/2015

Date:	Time hr:min	Elapsed Time (days)	Sample & Container (g)	Wet Mass (g)	Moisture content (%)
12/11/15	8:34	0.000	1781.4	1049.7	118.3
12/11/15	13:15	0.195	1777.1	1045.4	117.4
12/11/15	13:17	0.197	1809.9	1078.2	124.3
12/11/15	16:26	0.328	1805.3	1073.6	123.3
13/11/15	12:22	1.158	1770.4	1038.7	116.0
13/11/15	16:11	1.317	1765.1	1033.4	114.9
16/11/15	9:18	4.031	1764.4	1032.7	114.8
16/11/15	15:51	4.303	1753.8	1022.1	112.6
17/11/15	10:40	5.088	1697.2	965.5	100.8
17/11/15	16:00	5.310	1682.7	951.0	97.8
18/11/15	7:47	5.967	1625.0	893.3	85.8
18/11/15	16:17	6.322	1604.8	873.1	81.6
19/11/15	8:10	6.983	1543.7	812.0	68.9
19/11/15	16:10	7.317	1524.8	793.1	65.0
20/11/15	9:21	8.033	1467.4	735.7	53.0
20/11/15	15:48	8.301	1454.7	723.0	50.4

Notes:

Tested as received **PLF7-005 RL0 21/01/13**

Certificate Reference: **1538943_151344_TR-0_Summer Cycle_Rev0**

THIS DOCUMENT SHALL ONLY BE REPRODUCED IN FULL

Hamish Campbell - Senior Laboratory Technician

Tabulated - Air Drying (Summer Cycle) Test Report

Golder Associates

Perth Laboratory
84 Guthrie Street Osborne Park
Perth WA 6017
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www.golder.com
PTH-LABORATORY@golder.com.au

Client:	Audalia Resources Limited 111 Hay Street West Perth		
Project:	Medcalf Project	**Date:**	3/12/15
Location:	Lake Johnson Western Australia	**Project No.:**	1538943

Lab Reference Number:	151344	**Sample Identification:**	Combined Sample Natural Slimes / Gravity Tailings

Laboratory Specimen Description: Sandy SILT

Test procedure: Internal

Required Summer Cycle: **37 During the night in a oven and on bench in laboratory during the day.**

Date Tested: 12/11/2015

Date:	Time hr:min	Elapsed Time (days)	Sample & Container (g)	Wet Mass (g)	Moisture content (%)
23/11/15	7:56	10.974	1454.2	722.5	50.3
23/11/15	16:10	11.317	1442.6	710.9	47.9
24/11/15	14:48	12.260	1389.4	657.7	36.8
24/11/15	15:30	12.289	1386.6	654.9	36.2
25/11/15	8:20	12.990	1345.6	613.9	27.7
25/11/15	16:19	13.323	1336.5	604.8	25.8
26/11/15	8:03	13.978	1299.7	568.0	18.1
26/11/15	16:39	14.337	1290.3	558.6	16.2
27/11/15	15:49	15.302	1255.6	523.9	9.0
30/11/15	7:41	17.963	1255.5	523.8	8.9
30/11/15	12:12	18.151	1254.5	522.8	8.7
30/11/15	12:13	18.152	1221.6	489.9	1.9

Notes:

Tested as received **PLF7-005 RL0 21/01/13**

Certificate Reference: **1538943_151344_TR-0_Summer Cycle_Rev0**

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	111 Hay Street West Perth		
Project:	Medcalf Project	**Date:**	3/12/15
Location:	Lake Johnson Western Australia	**Project No.:**	1538943

Lab Reference Number:	151344	**Sample Identification:**	Combined Sample Natural Slimes / Gravity Tailings

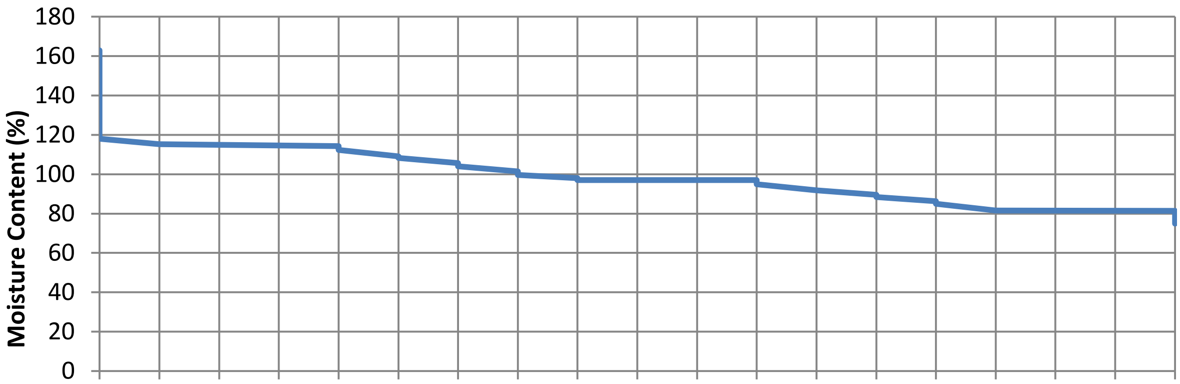
Laboratory Specimen Description: Sandy SILT

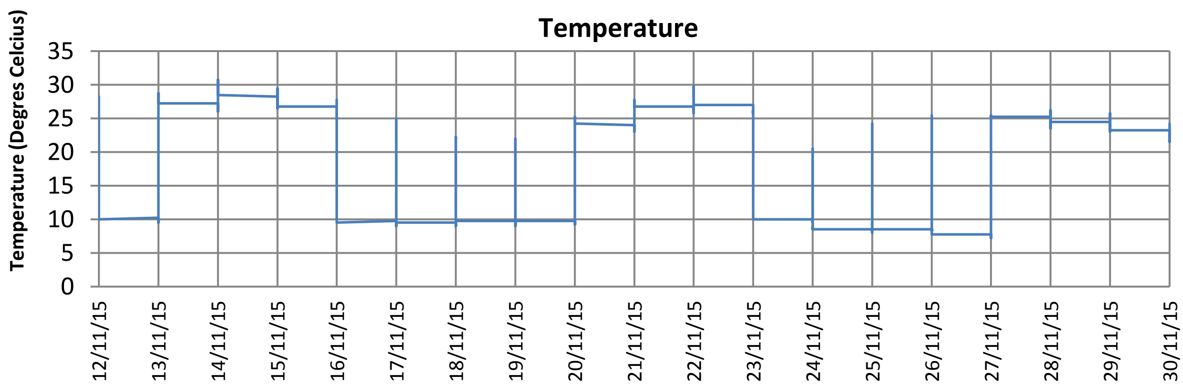
Test procedure: Internal

Required Winter Cycle: **10 During the night in a fridge and on bench in laboratory during the day.**

Test Performed with material at 40% Percent Solids

Date Tested: 12/11/2015





Notes:

Tested as received **PLF7-006 RL0 21/01/13**

Certificate Reference: **1538943_151344_TR-150112_Winter Cycle_Rev0**

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Project:	Medcalf Project	**Date:**	3/12/15
Location:	Lake Johnson Western Australia	**Project No.:**	1538943

Lab Reference Number:	151344	**Sample Identification:**	Combined Sample Natural Slimes / Gravity Tailings

Laboratory Specimen Description: Sandy SILT

Test procedure: Internal

Initial Container & Wet Sample	**g**	2255.3
Initial Container & Wet Sample After Decant	**g**	2000.2
Final Container & Dry Sample	**g**	1334.0
Container	**g**	714.7
Final Dry Sample Mass	**g**	586.0

Required Summer Cycle: **10 During the night in a fridge and on bench in laboratory during the day.**

Date Tested: 12/11/2015

Date:	Time hr:min	Elapsed Time (days)	Sample & Container (g)	Wet Mass (g)	Moisture content (%)
12/11/15	8:40	0.000	1966.9	1252.2	113.7
12/11/15	13:21	0.195	1963.1	1248.4	113.0
12/11/15	13:23	0.197	1996.4	1281.7	118.7
12/11/15	16:24	0.322	1992.1	1277.4	118.0
13/11/15	12:20	1.153	1976.3	1261.6	115.3
16/11/15	9:19	4.027	1970.9	1256.2	114.4
16/11/15	15:52	4.300	1959.4	1244.7	112.4
17/11/15	10:41	5.084	1939.5	1224.8	109.0
17/11/15	15:57	5.303	1935.1	1220.4	108.3
18/11/15	7:43	5.960	1919.4	1204.7	105.6
18/11/15	16:18	6.318	1909.9	1195.2	104.0
19/11/15	8:55	7.010	1895.2	1180.5	101.5
19/11/15	16:09	7.312	1884.9	1170.2	99.7
20/11/15	9:19	8.027	1874.6	1159.9	97.9
20/11/15	15:47	8.297	1869.5	1154.8	97.1
23/11/15	7:57	10.970	1869.1	1154.4	97.0

Notes:

Tested as received **PLF7-006 RL0 21/01/13**

Certificate Reference: **1538943_151344_TR-150112_Winter Cycle_Rev0**

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Location:	Lake Johnson Western Australia	**Project No.:**	1538943

Lab Reference Number:	151344	**Sample Identification:**	Combined Sample Natural Slimes / Gravity Tailings

Laboratory Specimen Description: Sandy SILT

Test procedure: Internal

Required Summer Cycle: **10 During the night in a fridge and on bench in laboratory during the day.**

Date Tested: 12/11/2015

Date:	Time hr:min	Elapsed Time (days)	Sample & Container (g)	Wet Mass (g)	Moisture content (%)
23/11/15	16:11	11.313	1857.1	1142.4	94.9
24/11/15	14:49	12.256	1838.7	1124.0	91.8
24/11/15	15:28	12.283	1838.8	1124.1	91.8
25/11/15	8:22	12.988	1825.7	1111.0	89.6
25/11/15	16:19	13.319	1819.1	1104.4	88.5
26/11/15	8:04	13.975	1806.0	1091.3	86.2
26/11/15	16:38	14.332	1798.9	1084.2	85.0
27/11/15	15:50	15.299	1778.7	1064.0	81.6
30/11/15	7:39	17.958	1778.0	1063.3	81.5
30/11/15	11:58	18.138	1773.0	1058.3	80.6
30/11/15	12:01	18.140	1739.7	1025.0	74.9

Notes:

Tested as received

PLF7-006 RL0 21/01/13

Certificate Reference: **1538943_151344_TR-150112_Winter Cycle_Rev0**

Hamish Campbell - Senior Laboratory Technician

APPENDIX C

Important Information

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