Attachment 3B: Proposed Activities

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MUNGARI GOLD PROJECT

FEASIBILITY STUDY
TAILINGS STORAGE FACILITY
CELL 3 AND CELL 4 DESIGN REPORT

PREPARED FOR:

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Knight Piésold CONSULTING

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MUNGARI GOLD PROJECT

FEASIBILITY STUDY

TAILINGS STORAGE FACILITY

CELL 3 AND CELL 4 DESIGN REPORT

KP Job No. PE801-00137/29

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EXECUTIVE SUMMARY

Introduction

This report contains the design details of an additional tailings storage facility at the Mungari Gold Project to meet a processing throughput of 2.5 Mtpa over a 10 year mine life. The TSF design includes a proposed Cell 3 and Cell 4, located immediately west of the existing facility, with a total capacity of 25 Mt and 133 Ha in outer footprint size.

Site Characteristics

The climate at the site can be described as semi-arid with hot summers and mild winters. The average annual rainfall is 269 mm while the average annual pan evaporation is 2,608 mm. The location of the TSF is close to the boundary of two drainage areas, namely, Kopai Lake and Kurrawang Lake which are both salt lakes. The topography is relatively flat but elevated from the lakes, with drainage generally sloping away from the TSF footprint.

TSF Consequence Assessment

An updated dam break and category assessment was completed for the final stage of the TSF based on two guidelines. The TSF is assessed to be HIGH Category 1 and SIGNIFICANT for the DMIRS Code of Practice and ANCOLD guidelines respectively.

Geotechnical Site Investigations

A geotechnical site investigation in the proposed TSF footprint was undertaken in 2018. The in situ basin materials are generally suitable for use as Zone A and Zone C material during construction. Material is typically clayey sand to a depth of 3 metres overlain by approximately 500 mm of topsoil/subsoil.

Tailings Characteristics

The dry densities of tailings to be deposited into the facility can be predicted from laboratory testing. Assuming the TSF is efficiently operated it is estimated that the average field density is in the order of 1.40 – 1.50 t/m^3, similar to the existing cells. Further Cone Penetration Testing (CPT) and tailings laboratory testing will be required during operation to verify tailings parameters used in design.

Facility Design

The proposed TSF will be located on undisturbed land west of the existing TSF. It consists of two rectangular cells operated simultaneously, in conjunction with the existing facility intermittently, until the storage capacity is met.

The facility consists of a multi-zoned perimeter embankment with an initial starter embankment (Stage 1), one downstream lift (Stage 2), one centreline lift (Stage 3) and 7 upstream stages

(Stages 4 to 10). A low permeability soil liner will be constructed over the entire TSF basin during borrow works as part of Stage 1 construction.

Deposition of tailings will be designed such that the ponds will be maintained in the centre of each cell around a centralised decant tower. Access to the decant towers shall be from causeways extending to the centre of each cell. Supernatant water shall be removed from the TSF via submersible pumps located within the decant towers. Solution recovered will be pumped back to the plant for re-use in the process circuits.

The design incorporates a central basin underdrainage system (network of finger drains, collector drains and toe drains) over the entire TSF basin to reduce seepage, increase tailings densities, and improve the geotechnical stability of the facility. Each system will gravity feed to sumps located at the base of extraction infrastructure, for water removal to reduce the pressure head on the facility.

Water Balance

There is sufficient stormwater storage capacity on the TSF to accommodate all design storm events (including PMP) and rainfall sequences, with sufficient freeboard to comply with regulations.

Due to low recycle rates during the drier months of each year, it is recommended that any external water supply design be based on an average 25 - 35% recycle from the TSF. It is also recommended that the decant pump capacity is designed for maximum recycle from the TSF, i.e. 95% of water in slurry.

Seepage and Stability Modelling

Continual operation of the TSF underdrainage system is required to reduce the phreatic surface within the TSF. Modelling has indicated downstream buttressing will be required as part of the Stage 5 embankment raise which will also double as the closure slope. This will be confirmed by CPT works, tailings laboratory testing and stability analysis using measured phreatic surfaces during Stage 3.

Monitoring

A monitoring programme for the TSF has been developed which meets operational, compliance and performance aspects. Compliance monitoring includes (but is not limited to):

- Survey pins to check embankment movement.
- Piezometers to monitor the phreatic surface.
- Monitoring bores downstream of the TSF.

A Trigger Action Response Plan (TARP) will be developed for most parameters to provide an early indication of deviations from predicted design assumptions.

Surface Water Management

Surface drains will be constructed around the perimeter of the facility, feeding into sedimentation basins at the north-west and south-west extents of the facility.

1. INTRODUCTION

1.1 GENERAL

Evolution Mining Ltd (Evolution) operates the Mungari Gold Mine. The project mines ore from one open pit (White Foil) and an underground mine (Frogs Leg). The site is located approximately 20 km to the west of the town of Kalgoorlie in Western Australia.

Evolution currently stores tailings generated by the operation in a Tailings Storage Facility (TSF) located approximately 1.8 km to the north west of the plant site. The facility contains two cells, namely Cell 1 and Cell 2, with the storage capacity to be met in early-2021 with the proposed Stage 5 works.

Evolution engaged Knight Piésold Pty Ltd (KP) to undertake the design of an additional facility to meet a processing throughput of 2.5 Mtpa over a 10 year mine life. The TSF design includes Cell 3 and Cell 4, located immediately west of the existing facility, and has a total capacity of 25 Mt and 133 Ha in outer footprint size.

The site general arrangement is shown on Drg. No. 801-137-C3000-050.

1.2 DESIGN OBJECTIVES

The design objectives for the TSF are summarised as follows:

- Permanent and secure containment of all solid tailings materials generated over the life of the project.
- Increase of residue densities using sub-aerial deposition.
- Continual removal and reuse of free water from the facility to recycle to the process plant.
- Control of seepage to reduce risk of groundwater contamination and increase stability.
- Provide excess storage capacity to retain design storm events.
- Incorporate safety into the design, construction and operation of the facility.
- Extensive stability and seepage monitoring networks comprising of piezometers, survey settlement monitoring pins and groundwater bores.
- Reduced environmental impact with rapid and effective rehabilitation.
- Provide ease of operation.
- Allow for reclaiming of tailings as part of the paste backfill operation.

A summary of the key policies and guidance documents used for the design of the tailings storage are summarised as follows:

- Guidelines on the Consequence Categories for Dams, ANCOLD, October 2012 (Ref. 1).
- Guidelines on Tailings Dams – Planning, Design, Construction, Operation and Closure, ANCOLD, July 2019 (Ref. 2).
- Guidelines for Design of Dams and Appurtenant Structures for Earthquake, ANCOLD, May 2019 (Ref. 3).
- Department of Mines Industry Regulation and Safety (DMIRS) “Code of Practice – Tailings Storage Facilities in Western Australia” 2013 (Ref. 4).
- Guide to Preparation of a Design Report for Tailings Storage Facilities (TSFs) - DMIRS, August 2015 (Ref. 5).
- Guide to Departmental Requirements for the Management and Closure of Tailings Storage Facilities (TSFs) - DMP, August 2015 (Ref. 6).

1.3 AVAILABLE DATA

The following site information is available and has been used in the TSF design:

- Site topographical data (supplied by Evolution May 2018).
- Heritage Layers (provided by Evolution from publicly available registers).
- Lease boundaries (provided by Evolution).
- Proposed clearance extents, stockpile areas and infrastructure (supplied and recommended by Evolution).
- Soil characterisation (supplied by Soilwater Group Ref. 7).
- Flora and vegetation survey map (undertaken by Native Vegetation Solutions Ref. 8).

The design parameters shown in Table 1.1 were developed during the conceptual design phase (attached as Appendix A) and updated for this report.

Table 1.1: TSF Design Parameters

Parameter	Value	Source
Total Tonnage	25 Mt	Evolution
Average Throughput	2.5 Mtpa	Evolution
Tailings Percent Solids	42% w/w	Evolution
Paste Reclaim	0 – 720ktpa	Evolution (considered 0 for life of mine purposes)
Number of Cells	2	KP nominated
Tailings Beach Slope	1V:120H	Survey
Tailings Dry Density	1.4 - 1.45 t/m^3	KP back calculation
Raise Technique	Downstream for 2 years Centreline for 1 year Upstream for 7 years	KP nominated
Maximum Embankment	Target final approved elevation as existing TSF	KP nominated

1.4 DIFFERENCES IN DESIGN FROM CELLS 1 AND 2

The existing TSF at Mungari gold mine comprises two cells, namely Cells 1 and 2, designed by KP in 2013. Stage 1 Construction of the facility was completed November 2013, with annual raises and tailings deposition ongoing since this date.

The design of Cells 3 and 4 has been based on the experience and performance of the existing facility, whereby certain features have been incorporated into the new design and others have been improved through lessons learnt during operation. The following items outline key design changes to Cells 3 and 4 based on the performance of Cells 1 and 2:

- The site has been selected in a location remote to current and proposed mine and public infrastructure, adjacent to the existing Cell 2 embankment. This will limit the additional risk from hypothetical dam breaks and enable the existing TSF infrastructure to be utilised.
- The cut-off trench will be excavated to a minimum depth of 4 metres into the foundation. The geotechnical investigation found that the sub surface profile is generally clayey sand, transitioning to a sandy clay at around a depth of 3 metres. By constructing a cut off trench keyed into the sandy clay layer, it is anticipated this will reduce preferential seepage flows through the foundation material and beneath the embankment.

- An ‘upper’ toe drain will be constructed along the Stage 1 upstream embankment toe, which will gravity drain toward toe drain sumps located at each internal corner of the respective cell. The grade shall be a minimum 1V:100H to allow water removal, increase tailings densities near the embankment, and reduce the phreatic surface.
- A ‘lower’ toe drain will be constructed near the base of the embankment cut-off trench, feeding into the toe drain sumps located at each internal corner of the respective cell.
- A ‘Geonet’ filter drain will be placed along the upstream batter of the cut-off trench, between the lower and upper toe drains. It is anticipated that any horizontal flows will be intercepted by the geonet filter drain and directed toward the lower toe drain, ultimately flowing into the toe drain sumps for extraction.
- The toe drain sumps shall be constructed to a minimum depth of 5 metres below the foundation, ensuring the pumping head is suitable for the toe drains to operate efficiently. The sumps will comprise suitable filter material encased in geotextile to promote drainage.
- Toe drain riser pipes will be installed within each sump and extended along the upstream embankment face with each raise. Submersible pumps shall be installed within each riser pipe to remove water from the toe drain system, with discharge into the active supernatant pond.
- Vibrating wire piezometers shall be installed beneath the embankment foundation prior to Stage 1 construction. This will allow for early detection of seepage and adequate monitoring of the phreatic water level within the facility during operation in areas not achievable with conventional installation from the crest.
- A number of standpipe piezometers shall be installed on the embankment crest to further monitor the phreatic surface through the facility.
- Additional monitoring bores will be located downstream of the facility, installed in advance of Stage 1 construction to obtain groundwater levels prior to the TSF operation.
- An extensive underdrainage system shall be constructed within the basin of each cell. The area shall be excavated to form a profile that has a positive grade toward a central sump comprising an underdrainage tower installed to a depth of 5 metres. The basin underdrainage grade shall be a minimum 1V:50H to allow water removal from the tailings mass.

- The underdrainage tower shall be located within the decant causeway, approximately 50 metres from the decant tower. This will ensure the decant tower and underdrainage tower operate independently of one another and prevent short circuiting of the supernatant pond downwards.
- The facility has been sized for a throughput of 2.5 Mtpa, with an allowance for downstream construction by mining to be implemented, in the event that testing of the tailings mass deems upstream construction unsuitable post stage 3. The topsoil/subsoil stockpile locations are such that downstream embankment construction can be undertaken within the footprint without the need to rehandle stockpiles in the future.
- Embankment buttressing has been allowed for as part of the design, to ensure the factor of safety is maintained throughout the life of the facility.
- Surface water management will include collection channels located downstream of the facility and the subsoil/topsoil stockpiles designed to limit the catchment reporting to the downstream embankment toe.

2. SITE CHARACTERISTICS

2.1 CLIMATE

The climate at the site can be described as semi-arid with hot summers and mild winters. The average annual rainfall is 269 mm while the average annual pan evaporation is 2,608 mm.

A detailed baseline climatology assessment for the project is provided in Appendix B with design storms for the 1% Annual Exceedance Probability (AEP) 72 hour event of 203 mm and the Probable Maximum Precipitation (PMP) of 900 mm.

2.2 FLORA AND FAUNA

2.2.1 Flora

A Flora and Vegetation Survey was undertaken by Native Vegetation Solutions in 2017 (Ref. 8) within the mining lease M15/829 that encapsulates the Cell 3 and Cell 4 TSF footprint. A vegetation map was developed for the lease area and four vegetation zones identified as follows:

i. Mixed Eucalyptus Woodlands over sclerophyll shrublands.

ii. Eucalyptus Salubris woodlands.

iii. Casuarina pauper over sclerophyll shrublands.

iv. Eucalyptus oleosa thicket over sclerophyll shrublands.

The study also indicated the following:

"No threatened or Priority Flora were recorded in the survey area. No Threatened Ecological Communities (TECs) or Priority Ecological Communities (PECs) were recorded within the survey area."

"The proposed clearing of vegetation will result in the loss of some individuals from the local area; however, the impact will not be great enough to remove whole communities or populations. Most of the species and communities recorded during this survey are widespread throughout the Eastern Goldfields subregion and adjoining regions, and therefore the loss of a small proportion from this area will not be significant."

2.2.2 Fauna

A fauna survey was undertaken by Terrestrial Ecosystems in March 2010 (Ref. 9) during the design phase of Cell 1 and Cell 2 TSF. The conclusion from the study was that it was unlikely that significant fauna will be impacted by the extent of the clearing proposed.

The study also recommended minimising impacts on the salt lake and to avoid creating any residual isolated patches of vegetation. As the TSF is a single area and is situated north of the salt lake these conditions will be met by the TSF design. During construction, measures will be taken to control soil erosion and sediment runoff which may impact surrounding areas.

A vertebrate fauna assessment has also been completed within the mining lease M15/829 that encapsulates the Cell 3 and Cell 4 TSF footprint. No conservation significant vertebrate fauna were detected.

2.3 TOPOGRAPHY AND DRAINAGE

The proposed TSF area is located above a drainage area feeding into the Kurrawang Lake which is a salt lake located to the south.

Catchment areas reporting to the TSF site total some 110 Ha and lie to the north of the TSF. The facility itself will be a paddock design and run-on of surface water is not considered an issue in terms of water management of the TSF. However, flows reporting to the toe of the embankments will need to be controlled and diverted around the TSF. Surface water diversion shall incorporate the existing surface drain north of Cell 1 and Cell 2.

2.4 GEOLOGY

2.4.1 Soils

A study of soils across the site was undertaken by Soilwater Group in January 2019 (Ref. 7). The assessment established that *“there is little physical or chemical differentiation between the topsoil and subsoil material”.* Viable topsoil/subsoil is present across the TSF area to a maximum depth of approximately 1,500 mm and this will need to be recovered for future rehabilitation. The average topsoil/subsoil depth across the Cell 3 and Cell 4 TSF footprint is 500 mm.

2.4.2 Solid Geology

The following geological description is taken from the RPS Group memorandum (Ref. 10):

The Kalgoorlie area is underlain by Archaean bedrock locally incised by a series of Tertiary aged palaeochannel deposits and overlain by widespread alluvium, colluvium and lake deposits.

Based on regional geology and detailed foundation investigations at Cells 1 and 2, TSF Cell 3 is underlain by volcanoclastic sediments.

Five geotechnical investigation boreholes (BH-TSF-01 to BH-TSF-05) were drilled to 30 mbgl as part of the foundation investigation at Cells 1 and 2.

The drilling intersected a thin veneer of cover material (clayey sand), to a maximum depth of 3m (below ground), overlying saprolites (extremely weathered basement rocks - predominantly clay). The saprolite clay extends some 16m to 30m below ground and overlies transition zone weathered metadolerite and dolerite.

The geotechnical site investigation at the Cell 3 and Cell 4 location undertaken by KP in 2018 included four (4) boreholes to depth of 25 metres. The results are shown in Appendix C, with each borehole comprising a soil profile comparable to that identified in the Cell 1 and Cell 2 geotechnical site investigation.

2.5 HYDROGEOLOGY

2.5.1 General

Hydrogeological studies for the mine site were undertaken by RPS Group in 2017 (Ref. 10). The following sections describing the hydrogeological context are extracted from that memorandum.

2.5.2 Regional Hydrogeology

The regional basement rocks form part of the Yilgarn Goldfields fractured-rock groundwater province. The fractured bedrock is characterized by secondary permeability resulting from tectonic and decompression fracturing enhanced by chemical dissolution along fracture lines. Fractured-bedrock aquifers occur more commonly in mafic, ultramafic, and granitic rocks than in the sedimentary or felsic volcanic and volcaniclastic rocks.

The Tertiary paleochannels form major aquifers in the region, and have supported significant groundwater abstractions from a number of borefields. There are two tributary paleochannels in close proximity to the Project, one to the north and one to the south. The southern tributary was also used in the past for aquifer injection of excess dewatering production from the Mungari pit and for water disposal during extended test pumping of trial dewatering bores at Frog's Leg.

The weathered profile (regolith) is largely composed of clays (saprolite) and generally forms a low permeability aquifer/aquitard in the region although the transition zone between the saprolite and fresh rock can be highly permeable and form local aquifers (e.g. at Frog's Leg, the transition zone required dewatering by a number of pit perimeter bores).

Temporary, intermittent perched aquifers can develop in shallow cover horizons immediately following major rainfall events. Groundwater recharge is by the infiltration of rainfall runoff. Only a very small proportion of rainfall contributes to groundwater recharge with most of the rainfall being directly evaporated or used by the vegetation. Direct recharge to the basement rock aquifers principally occurs where the bedrock outcrops beneath surface drainages. Recharge to the paleochannel aquifers occurs upstream and to the west of the Project where the paleochannel sands subcrop beneath cover material.

A regional watertable occurs and the depth to the watertable ranges from less than 1m in playa-lake environments to more than 40 m in elevated areas. Groundwater flow is towards the major palaeodrainages and modern playa lakes where the watertable is close to the surface. Groundwater discharge occurs mainly by evaporation from playa lakes, with a relatively small amount of discharge via flow through the palaeochannels. There will also be discharge as baseflow to local drainages (from shallow aquifers) when the water table is elevated immediately following significant rainfall events.

Groundwater is mainly saline to hypersaline. The salinity ranges from around 1,000 mg/L TDS in some shallow aquifers in cover or saprolite adjacent to basement outcrops and in intermittent perched aquifers following rainfall, to as much as 200,000 mg/L TDS in the palaeochannels, adjacent playa-lake sediments, and in fractured and weathered bedrock.

2.5.3 Local Hydrogeology

Mineral exploration drilling, prior to the development of the Mungari [White Foil] Pit, intersected variable water returns in all lithologies, although the wetter holes tended to be towards the north, and associated with the contact between the Quartz Gabbro and the Black Flag Beds.

During initial mining of the Mungari [White Foil] Pit, there were major seepage zones associated with the Quartz Gabbro – Black Flag Beds contact zone and with the main NE-SW fault zone in the NE wall of the pit. There were also numerous seepage zones on the Hanging Wall (i.e. W wall in Black Flag Beds) associated with minor shear zones, and minor seepage zones in the footwall (i.e. Gabbro).

In-pit grade control drill holes that intersected the Quartz Gabbro – Black Flag Beds contact were observed to 'flow' and deeper in-pit investigation holes that intersected the contact experienced high water inflow problems.

The first significant inflows from the pit walls appeared when the pit intersected the transition zone between weathered and fresh basement rocks (gravelly clays / clayey gravels made up of a mix of saprolite and fresh rock fragments). During more recent

mining, most pit inflows appear to be from the zone where the NE-SW fault zone intersects the SE pit wall.

2.6 SEISMICITY

A seismic hazard assessment using probabilistic and deterministic methods was undertaken for the site. Details are provided in Appendix D.

Based on the design criteria listed in Section 3.3 (ANCOLD SIGNIFICANT) below and the seismic assessment, the parameters for use in the TSF design are presented in Table 2.1. This was updated for the recent ANCOLD 2019 seismic guidelines.

Table 2.1: Seismic Design Parameters

Scenario	Design Case	Return Period (yr)	Peak Ground Acceleration (PGA)
NSHA18	OBE	475	0.10g
	SEE	1,000	0.12g
MCE		>10,000	0.49g

3. FACILITY LOCATION AND CLASSIFICATION

3.1 LOCATION OPTION STUDY

A location option study was undertaken in February 2019, assessing areas adjacent to the existing facility due to existing tailings infrastructure, lease boundaries and mine waste availability. The assessment is included as Appendix A.

The option for a facility to the west of the existing TSF was selected from a project timeframe perspective (given a geotechnical site investigation had already been completed) coupled with a relatively flat, elevated topography that will promote surface water management.

Multiple other options were investigated however were not considered feasible due to lease boundary restrictions, limited geotechnical data availability, existing infrastructure within the footprints, poor surface water management and shallow groundwater depths.

The new facility will comprise two cells and expand off the western embankment of Cell 2. Sub-aerial deposition will occur from all embankments to maintain a supernatant pond adjacent to the decant tower, located at the centre of each cell.

An underdrainage system has been incorporated to reduce seepage through the basin and the embankment, drain the tailings mass, collect supernatant water and increase the strength of tailings mass adjacent to the embankment.

Ongoing tailings reclamation within Cell 1 and Cell 2 (to generate a paste product for underground backfill) has not been factored into the design of Cell 3 and Cell 4, to provide a conservative life of mine footprint. It is proposed that tailings reclamation will continue within Cell 1 and Cell 2 once the new facility is commissioned and is operational.

3.2 TSF CONSEQUENCE / HAZARD ASSESSMENT

As part of the design a hazard rating for the TSF was completed in accordance with the requirements of the ANCOLD document “Guidelines on Tailings Dam Planning, Design, Construction, Operation and Closure” (Ref. 2) and the DMIRS Code of Practice (Ref. 4). The hazard rating is derived by considering the potential impacts in terms of safety, environmental and economic factors as well as with respect to the embankment maximum height.

Under a dam break scenario, the following implications may apply to the Mungari TSF:

- The current explosives storage facility is at risk of being inundated from Cell 3. This is similar to the existing Cell 2 outcome hence does not change the risk rating for this structure.

- Kopai Lake and Kurrawang Lake are at risk of receiving residual tailings which could be carried with runoff water.
- The water may have some residual cyanide in solution and is hypersaline which may impact vegetation growth.
- The access road to the TSF and the haul road from the pit is at risk of being cut off, including the (currently conceptual) cutters ridge access road south.
- The tailings reclamation area is at risk of being inundated.

The dam break assessment is contained in Appendix E.

The result of the dam break and subsequent category determination define the design criteria to be used for design. The TSF is assessed as '**HIGH Category 1'** and '**SIGNIFICANT'** in accordance with the DMIRS and ANCOLD guidelines respectively.

3.3 DESIGN CRITERIA

The overall minimum design criteria for this study are summarised in Table 3.1. These design criteria are in accordance with the DMIRS Code of Practice (Ref. 4) and ANCOLD guidelines (Ref. 2) where criteria are given. Other parameters were adopted on the basis of industry best practice and client requirements.

Table 3.1: Tailings Storage Facility design criteria and specifications

HYDRAULICS	
Design Storm Storage Allowance (Appendix 5, DMIRS)	1% AEP, 72 hour duration storm with no release, evaporation or decant.
Freeboard (Appendix 5, DMIRS)	Total Freeboard of at least 0.5 m or wave plus 0.3 m; Operational Freeboard to be the greater of 0.3 m or the predicted crest deformation due to the maximum seismic event.
Operating Spillway	None.
Closure Spillway	None.
Diversion structures during operation	2% AEP storm
STABILITY	
Earthquake loading (Table 7 ANCOLD 2019)	OBE 475 Year SEE 1,000 Year Post Closure MCE
Minimum Factor of Safety (Table 8 ANCOLD 2019)	Long term drained 1.5 Short term undrained 1.3 Post Seismic 1.1
DAM SAFETY / INSPECTION FREQUENCY	
Inspection Frequency	• Comprehensive inspection by Dam Designer or equivalent qualified Engineer after first year and then every 2 years. • Annual intermediate inspections by Dam Engineer. • Routine daily by operations personnel.

4. GEOTECHNICAL SITE INVESTIGATIONS

4.1 SCOPE OF WORK

A geotechnical site investigation was undertaken at the Cell 3 and Cell 4 TSF site in June 2018. The work and findings are presented in KP Report PE801-00137/23 (attached as Appendix C).

The purpose of the investigation was to:

- Assess ground conditions for the proposed TSF site.
- Assess the suitability of site materials for TSF construction.

The geotechnical investigation comprised the following scope:

- Drilling of 4 No. boreholes using diamond coring techniques including in situ SPT and permeability testing.
- Excavation of 35 No. test pits at the TSF site.
- Laboratory testing of samples obtained from the boreholes and test pits. Tests included:
  - Particle Size Distribution.
  - Atterberg Limits.
  - Linear Shrinkage.
  - Remoulded Permeability.
  - Emerson Dispersion.
  - Consolidated Undrained Triaxial Testing (effective strength parameters, consolidation and permeability).

4.2 SUB-SURFACE CONDITIONS

Sub-surface conditions as determined from the exploratory holes are summarised in Table 4.1.

Table 4.1: Summary of sub-surface conditions – boreholes BH-TSF-01 to 04

Depth		Material Description	Consistency / Weathering
From	To		
0	2.5-4.5	Clayey SAND	Medium Dense
2.5-4.5	20	Silty CLAY	Stiff to Very Stiff
20	EOH	Metadolerite	Extremely to Distinctly Weathered

Groundwater was recorded at depths of between 9.3 m and 13.9 m below natural ground surface.

4.3 GEOTECHNICAL DESIGN PARAMETERS

From the findings of the investigation, the following geotechnical design parameters for in situ materials were determined:

Table 4.2: Geotechnical design parameters for in situ materials

Material	ɣ (kN/m^3)	c' (kPa)	Φ' (deg)	Permeability (m/s)
Clayey Sand	18	15	25	5x10^{-8}
Silty Clay/Clayey Silt	19	20	25	1x10^{-8}
XW-DW rock	21	50	33	5x10^{-8}

XW = extremely weathered; DW = distinctly weathered;

More detailed undrained and post seismic parameters are discussed in Appendix H.

4.4 INVESTIGATION FINDINGS

The following conclusions were drawn from the investigation in relation to material suitable for use during construction:

- The near surface profile can be excavated with conventional earthmoving equipment, as no rock was encountered and material typically comprised firm to stiff clayey sands and silty clays. A cut-off trench should extend through this layer to reduce horizontal seepage through the foundation.
- The in-situ materials in the proposed TSF basin are generally suitable for use as Zone A and Zone C material during construction. However, clay in the silty clay layer, possibly due to the presence of calcrete or gypsum, is potentially dispersive. This should be accounted for during construction and should be encapsulated with a compacted clay layer to prevent direct contact with water/ tailings.
- Based on the site investigation, a significant borrow area will be developed within each basin to construct Stage 1.

5. TAILINGS CHARACTERISTICS

5.1 GENERAL

Tailings physical testing and geochemical analysis was conducted on tailings samples in 2011 (contained in Appendix F) during the Cell 1 and Cell 2 detailed design phase. To verify the design capacity of the TSF and parameters used in the design, an operating sample was obtained and tested in 2015 (contained in Appendix F).

The following physical tests were carried out on the samples:

i. Classification tests to determine:
   - Particle size distribution of the tailings.
   - Supernatant liquor density.
   - Liquid and plastic limits of the tailings solids.
   - Tailings solids particle density.

ii. Undrained and drained sedimentation tests.

iii. Air drying tests.

iv. Permeability tests.

v. Consolidation tests.

vi. Geochemistry tests.

vii. Acid generation potential.

viii. Multi element analysis.

ix. Supernatant water quality.

Full details of the tests undertaken, the results and interpretation are provided in Appendix F. A summary of the design parameters and associated implications for design are provided in the following sections.

An additional tailings sample was provided in 2019, with testing undertaken to determine material properties for closure purposes. The results are also included in Appendix F.

5.2 DESIGN PARAMETERS

The deposition methodology and design uses expected tailings material types and properties based on laboratory testing of bench scale samples in design and a subsequent operating sample in 2015. In addition, a CPT program was conducted in 2018 to measure in situ tailings parameters within the existing facility. It is envisaged that the material properties will differ daily and over the life of the project. Material properties

which may affect deposition methodology include particle size distribution, percent solids of discharge, slurry flow rate and specific gravity of solids and liquids.

The tailings design parameters are summarised in Table 5.1.

Table 5.1: Tailings Material Properties

Parameter	Value
Maximum Air Dried Density	1.50 t/m^3
P_{80}	106 µm
Beach Slope	1V : 120H
Solids Content	42 – 47%
Supernatant Release	30 – 35%
Underdrainage Release	5-10%
Vertical Permeability	5x10^{-7} m/s
Horizontal Permeability	5x10^{-6} m/s
Coeff. Of Consolidation (Cv)	55 – 110 m^2/yr
Coeff. Of Volume Decrease (Mv)	0.02 – 0.03 m^2/kN
Compression Index (Cc)	0.4 – 0.6

5.3 IMPLICATIONS FOR DESIGN

Results of the physical and geochemical testing on samples of tailings from the Mungari project indicate the following:

- The tailings are Non Acid Forming (NAF).
- The multi-element analyses of the solids indicate several metals to be present at elevated concentrations (namely arsenic, barium, manganese and sulfur in both samples, and cadmium, copper, nickel, vanadium and zinc in the Frogs Legs sample). As such, a cover system will be required on closure to isolate the tailings from the environment.
- Testing of the supernatant water quality shows a number of exceedances of reference values for release from mining operations and livestock and wildlife drinking water. As such, measures are incorporated into the design to reduce seepage from the basin and release of supernatant to the environment.
- The supernatant and seepage is hypersaline due to the use of hypersaline groundwater in the processing of ore. The groundwater in the vicinity of the TSF is hypersaline. As such it is not expected that seepage from the facility will result in an increase in groundwater salinity.

- The facility may need to be fenced to prevent access by stock or terrestrial wildlife which may be adversely affected by drinking the supernatant/seepage water. This should be undertaken if there is evidence of fauna fatalities attributable to the TSF.
- A cover system will be constructed on closure to reduce any water ingress and resulting seepage.

6. TAILINGS STORAGE FACILITY DESIGN

6.1 GENERAL

The Mungari site already has extensive existing infrastructure from the previous development including process plant, pits, waste dumps and stockpiles.

The proposed TSF will be located on undisturbed land west of the existing TSF, which is north of Kurrawang Lake and north west of the current explosives storage facility.

The TSF will consist of two rectangular cells operated simultaneously, in conjunction with the existing facility, until the storage capacity is met. The site layout is shown on Drawing No. PE801-137-C3000-050.

6.2 DESIGN PARAMETERS

Design criteria are listed in Section 3.3. Geotechnical design parameters are summarised in Section 4.3 and design parameters for tailings are presented in Section 5.2.

Typically, construction shall be sequenced to allow for 12 months of storage capacity across both cells. The exception to this shall be in the initial year of operation, where it is envisaged that Cell 3 will be constructed to Stage 2 crest elevation, allowing 12 months capacity whilst Cell 4 is constructed adjacent. Once each cell has been constructed, raises of the facility can be on an annual basis.

6.3 TSF BORROW DEVELOPMENT

The site investigation indicated that the TSF area was underlain by a significant depth of materials which would be suitable for use in the construction of embankments. It is envisaged that following topsoil stripping, 1 metre underlying shall be suitable for use as Zone C material, with the following 3 metres suitable for use as Zone A material. The current design assumes all borrow material won from the TSF basin during Stage 1 works shall be utilised for embankment fill of Stage 1 and parts of Stage 2.

The bases of the borrow areas will be sloped so that the drainage falls towards the relevant underdrainage and toe drain sumps.

Additional Zone A borrow material for subsequent raises shall be sourced from areas previously identified north and east of the existing facility. Mine waste will also be utilised by direct hauling of primary rock from the mine.

The layout and sections through the borrow areas are shown on Drawing Nos. PE801 00137-C3000-200 and PE801-00137-C3000-201 respectively.

6.4 TSF DEPOSITION MODELLING

A tailings deposition and density model was generated for the facility to determine the tailings beach level and hence TSF cell embankment levels over the life of the operation. The results of the modelling are summarised in Table 6.1 below.

Table 6.1: Embankment crest elevations

Stage	Deposition Period	Tonnage (Mt)	Cumulative Tonnage (Mt)	Tails Beach Level (mRL)	Achieved Average Densities (t/m^3)	Crest Elevation (mRL)	Crest Raise Height (m)
1	Year 1	2.5	2.5	347.1	1.30	347.4	Max 4.4
2	Year 2	2.5	5.0	348.8	1.34	349.1	1.70
3	Year 3	2.5	7.5	350.4	1.36	350.7	1.60
4	Year 4	2.5	10.0	352.0	1.38	352.4	1.65
5	Year 5	2.5	12.5	353.8	1.39	354.1	1.70
6	Year 6	2.5	15.0	355.5	1.39	355.8	1.70
7	Year 7	2.5	17.5	357.3	1.39	357.6	1.80
8	Year 8	2.5	20.0	359.0	1.39	359.4	1.80
9	Year 9	2.5	22.5	361.0	1.39	361.3	1.90
10	Year 10	2.5	25.0	362.9	1.39	363.2	1.90

Note:

- This assumes deposition will be switched continuously between each cell. The design allows for Cell 3 to be utilised solely for Year 1 which will require Cell 3 to be built to Stage 2 crest elevation prior to Cell 4 Stage 2 being completed.
- Rate of rise within Cell 3 and Cell 4 shall be reduced if Cell 1 and Cell 2 are used for tailings reclamation and deposition going forward.

The shape and level of the basin of the TSF cells prior to deposition will be different due to variance in initial ground levels and the borrow plan. The western cell (Cell 4) will be approximately 1 m lower than the eastern cell (Cell 3). Deposition will be undertaken within Cell 3 in the first year, which will allow for construction of Cell 4 to be completed during this period. Once the Stage 2 capacity of Cell 3 is met, deposition will switch to Cell 4. Deposition will then be balanced equally between the cells for the remainder of the operational life.

No spillway is allowed for in the TSF operational design. A freeboard allowance of 0.3 m was used to determine embankment crest levels and this will allow storage of a 24 hour PMP storm event on the facility.

Review of crest levels will be undertaken each year ahead of construction so that any adjustments for achieved densities, throughputs and beach slopes can be accommodated.

Access to Cell 3 and Cell 4 will be via access ramps located within the proposed cleared TSF footprint extents, upstream of the subsoil/topsoil stockpiles. Ramps will be raised as required during the life of mine.

6.5 EMBANKMENT PROFILE

The perimeter and divider embankments and the decant causeways will be constructed in annual stages. Staged embankment crest elevations were determined based on the deposition/density results as outlined in Table 5.1.

The perimeter embankment will consist of an initial starter embankment (Stage 1), one downstream lift (Stage 2), one centreline lift (Stage 3) and 7 upstream stages (Stages 4 to 10) as shown on Drawing PE801-137-C3000-302. The divider embankment and decant causeways will be raised at each stage as shown on Drawing No. PE801-137-C3000-302 and PE801-137-C3000-506 respectively. The perimeter embankment will have an upstream slope of 1V:2H. The downstream raises will have downstream batters of 1V:3H whilst the upstream raises will have downstream batters of 1V:4H. A 6 m bench on the downstream face will be provided at the Stage 3 crest level. During Stage 5 additional fill will be placed to widen the bench to 10 m and flatten the Stage 5 embankment slope to 1V:4H as shown on Drawing No. PE801-137-C3000-302. A crest width of 8 m will be provided for each stage.

The divider embankment will have an upstream slope of 1V:2H. The downstream raises will have downstream batters of 1V:3H whilst the upstream raises will have downstream batters of 1V:2H. A crest width of 8 m will be provided for Stages 1 – 3, reducing to 7 metres for the remaining raises.

The decant causeways will have slopes of 1V:2H with crest widths of 8 m.

The Stage 1 perimeter starter embankment will be zoned with an upstream low permeability zone (Zone A) constructed from suitable material from the basin borrow. The downstream structural zone (Zone C) will be also be constructed of material won from the basin borrow. For the remaining stages, Zone A material will be sourced from a borrow area adjacent to the facility. During Stages 2, 3 and 5 mine waste material will be sourced from the open pit, hauled and placed by the mining fleet.

Stage 1 and 2 of the divider embankment shall be constructed in advance of Cell 4, thus will have the same profile as the perimeter embankment to allow the cell to operate independently of Cell 3. For the remaining raises, the embankment will be constructed from borrow material as available at the time of construction.

The decant causeways will be constructed from borrow material, overburden or run of mine waste (Zone C) as available at the time of construction.

6.6 DECANT AND RETURN WATER SYSTEM

Abstraction of water from the supernatant ponds will be required to supply water to the process plant and to control pond levels in the facility. Deposition of tailings will be designed such that the ponds will be maintained in the centre of each cell around a centralised decant tower.

A tower decant in each cell will comprise a rockfill surround and a vertical tower type arrangement to reduce the fines entering the tower and provide a simple mechanism to locate the inlet of the pump above the tailings level (refer to Drawing No. PE801-137-C3000-502 to PE801-137-C3000-504 inclusive). Submersible pumps will be installed in the towers to recover the supernatant and return it to the Process Plant. As tailings levels increase the tower and access causeway will be raised. The pump and pipework design, including power provision, is addressed by the Client's mechanical and electrical design team.

Under normal operating conditions it is expected that the decant system will run continuously and only under an extended dry period would the pumping rate from the facility be reduced. It is envisaged only one pump system will cycle between the two cells however a duty and standby pump would be required to ensure continuity in return water.

6.7 SEEPAGE CONTROL

6.7.1 General

The main functions of the seepage control system are to:

- Reduce seepage through the basin and under/through the embankment. This is beneficial both in terms of environmental performance and embankment stability.
- Drain the tailings mass, thus increasing the density of the tailings and providing a more efficient facility in terms of storage.
- Collect supernatant and return the water to the processing plant.
- Increase the strength of the tailings mass immediately adjacent to the embankment.

The major components of the seepage control system proposed are:

- Basin foundation.
- Cut-off (key) trench at the embankments.
- Basin underdrainage collection system.
- Embankment toe drains.
- Recovery infrastructure.

6.7.2 Basin Foundation

The basin of the TSF comprises alluvial and residual soils to depth. These materials are generally of low permeability (10^{-7} to 10^{-9} m/s) but contain pockets of more granular materials.

Once topsoil and subsoil has been stripped from the basin footprint, the upper 300 mm of the resulting surface will be scarified, moisture conditioned and recompacted. Where more granular materials are exposed in the basin they will be removed for embankment fill or covered with 300 mm of borrowed Zone A material to provide a consistent low permeability liner across the whole basin.

6.7.3 Cut-off Trench

A cut-off trench will be excavated along the upstream toe of the proposed main embankments to reduce seepage along the interface between original ground and the new embankment. The trench shall be excavated 1 m into the sandy clay layer, which exists at approximately 3 m depth below natural ground.

The trench will be backfilled with Zone A material and will tie into the Zone A upstream slope of the starter embankment and the basin foundation liner.

6.7.4 Basin Underdrainage Collection System

The basin underdrainage system will comprise a circular piped drainage system underneath each supernatant pond, typically 150 m to 250 m from the Stage 1 upstream embankment toe.

The extents of the underdrainage system will be shaped during the borrow operations in order to generate a positive grade on the pipework, on average 1V:50H. Material obtained from the excavation will be loaded, hauled and placed as Zone A/Zone C material in the Stage 1 embankment.

Each drain will comprise Draincoil pipe, surrounded by a sandy gravel drainage medium. Rip-rap and geofabric will cover the drainage material for erosion protection. The piped drainage system will report to an underdrainage sump centrally located as shown on Drawing No. PE801-137-C3000-500 and PE801-137-C3000-501.

6.7.5 Embankment Toe Drain

Three toe drains will be constructed along the upstream toe of the perimeter embankments. The intent of the toe drains is to reduce the phreatic surface in the tailings mass adjacent to the embankments thereby improving stability and reducing seepage from the facility whilst also promoting drying and consolidation of the tailings.

An upper toe drain will consist of 2 No. 160 mm Draincoil pipe running parallel to the upstream embankment toe surrounded by suitable drainage material (typically gravelly sand). The drainage medium will be encapsulated with geotextile. The drains will gravity drain toward toe drain sumps located at each internal corner of the respective cell.

A lower toe drain will consist of a 160 mm Draincoil pipe constructed at the upstream toe of the embankment cut-off trench, surrounded by suitable drainage material (typically gravelly sand). The drainage medium will be encapsulated with geotextile. A Geonet filter drain will be placed along the upstream batter of the cut-off trench and connect to the lower toe drain. The drain will gravity flow toward toe drain sumps located at each internal corner of the respective cell.

The toe drains will gravity drain to several 5 metre deep toe drain collection sumps. Material obtained from the excavation will be loaded, hauled and placed as Zone A/Zone C material in the embankment.

The layout of the toe drain system is shown on Drawing No. PE801-137-C3000-500.

6.7.6 Underdrainage Towers

The vertical tower systems will be constructed of reinforced concrete pipe. Submersible pumps will operate within the sumps at the base of the towers drawing seepage water build up out of the facility. The towers will be raised during each construction phase.

One underdrainage tower will be constructed at the centre of each cell, accessible by the decant access causeway, shown on Drg No. PE801-137-C3000-500.

The control of the pumps will be configured so that the entire underdrainage system will operate at atmospheric pressure as much as practicable to reduce the pressure head on the basin and embankment and therefore reduce seepage. The pump design is addressed by the Client’s mechanical design team.

A total of 2 pump systems will be required i.e. no cycling between infrastructure. This will ensure full time operation of all towers even during periods of no tailings deposition.

Discharge from the underdrainage systems will be pumped directly to the decant tower in the active cell for recovery to the Plant.

6.7.7 Toe Drain Collection Sumps

Four (4) toe drain collection sumps will be excavated at the lowest points of excavation for the toe drains, as shown on Drg No. PE801-137-C3000-500. The locations are the internal corners of each cell, adjacent to the embankment upstream toe. The sumps will collect solution from the toe drains and collected solution will be abstracted by a submersible pump situated at the base of a riser pipe running up the embankment upstream face. The underdrainage sump will consist of the following components.

An excavation nominally 5 m deep (minimum), 3 m by 3 m at the base. The sump is backfilled with clean gravel material (Zone F2), overlain with drainage sand/gravel material (Zone F1) and wrapped in geotextile.

One 450 mm diameter HDPE riser pipe, running from the base of the sump, on the embankment upstream face to the crest elevation. The bottom 3 m of riser pipe will be slotted with an end plate. The riser pipes will be situated on the embankment face and ballasted with concrete, with pipes extended up the embankment each raise.

A submersible pump (bore pump style) will be situated at the base of the riser pipe (slotted section), within the collection sump. The pump will operate with a level control adjusted to ensure the water level is maintained below original ground level. The control of the pumps will be configured so that the entire system will operate at atmospheric pressure as much as possible to reduce the pressure head on the basin and embankment and therefore reduce seepage. The pump design is addressed by the Client's mechanical design team.

A total of 8 pump systems will be required i.e. no cycling between infrastructure. This will ensure full time operation of all systems even during periods of no tailings deposition. Discharge from the toe drain systems will be pumped directly to the decant tower in the active cell for recovery to the Plant.

6.8 SEEPAGE ASSESSMENT

6.8.1 General

The seepage analysis was used to assess order of magnitude seepage losses and drainage volumes from the TSF and the location of the phreatic surface through the tailings, embankment and foundation.

The summary is included in Appendix G with key outputs summarised as follows:

- Seepage flows through the embankment and in the underdrainage systems increase over the stages as driving head increases. Seepage flows also increase substantially when a larger pond is present on the facility, putting more pressure on the toe drain performance.
- Predicted flows through the embankment and in the underdrainage (including toe drain and basin underdrain), for a range of drainage capacities were determined. It is recommended a 5 L/s pump is installed in each toe drain riser and 20 L/s pump installed in each underdrainage tower to account for final stage predicted values.
- The water pressure head through the tailings and embankment (highlighting the predicted location of the phreatic surface), for varied drainage capacities is sensitive to the performance of the drains. These need to be monitored with both in tailings Vibrating Wire Piezometers (VWP) and embankment VWPs to verify the actual phreatic surface during operation.

6.8.1 Conclusions

Based on the assessment, the following conclusions are made for the proposed design configuration:

- The seepage loss is considered moderate (~0.8 kL/Ha/day) with both basin underdrains and toe drains operating with the average pond.
- The seepage loss will be high (~4.4 kL/Ha/day) if the toe drain is not operated to the design intent and a large pond is maintained.

The phreatic surface and flows should be monitored to calibrate the performance of the overall system.

6.9 STABILITY ASSESSMENT

6.9.1 General

The modelling assessed stability of the embankment under long-term drained, short-term undrained and post-seismic loading conditions. For the case where the assessed Factor of Safety (FoS) does not meet ANCOLD stability requirements (Refs. 2 and 3), a buttress design at Stage 5 crest elevation has been included. A summary of the stability assessment is included in Appendix H.

6.9.2 Conclusions

The assessment includes a varied level of efficiency from the toe drain system and the basin underdrainage system and its effect on the phreatic surface. The analysis indicted that up to Stage 3 satisfies stability requirements with the toe drain non-operational. Inclusion and allowance of a downstream buttress (to Stage 5 crest RL at 10 m crest width and 4H:1V downstream slope) is recommended during Stage 5 to account for potential deviations in phreatic surface assumptions or material properties.

Recommendations based on the analysis are provided in Appendix H. This includes a requirement to conduct CPT within tailings and specialised tailings laboratory testing as part of Stage 3 pre-works to determine the drained and undrained shear strength parameters. During these works, a network of VWPs will be installed within the tailings mass to complement the embankment VWPs which are installed as part of Stage 1. Ongoing assessment using insitu testing is recommended every second stage to continue to monitor the development of the tailings insitu state, assess the susceptibility of tailings to liquefaction and verify the phreatic surface.

6.10 FREEBOARD

6.10.1 General

The TSF is designed to operate without the need for a spillway. A minimum Total Freeboard (water) of 500 mm shall be maintained on the facility after a storm event together with a minimum Operational Freeboard (solids) of 300 mm, as outlined in the DMIRS Code of Practice (Ref. 4).

Freeboard allowances are set such that a PMP event can be retained on the facility without breach of the perimeter embankments. Following high rainfall events, increased decant return to the Plant will be used to lower the pond level and increase available storm storage capacity.

Definitions for freeboard are provided below:

Operational Freeboard (for solids) is the vertical height between the lowest elevation of the perimeter embankment and the tailings beach immediately inside the embankment. The operational freeboard varies over the course of a deposition cycle as the storage is raised and fills with tailings. The operational freeboard becomes critically important at the end of a deposition cycle, particularly to reduce the potential for back flow and overtopping as a result of mounding of tailings at discharge points. The Operational Freeboard is 300 mm.

Total Freeboard (for water) is the vertical height between the lowest elevation of the perimeter embankment and the pond level **AFTER** a 1% AEP 72 hour storm event assuming no decant or evaporation. As a result, it is difficult to visualise operationally if the storm event hasn't taken place. Hence the maximum pond level before the design event is determined mathematically to account for the potential inflow. The Total Freeboard is after the event is then 500 mm.

Beach Freeboard is the vertical height between the normal operating pond level and the point on the beach where the operational freeboard is measured i.e. the exposed beach extent. The Beach Freeboard can vary significantly during the life of the storage and depends upon beach length, slurry/tailings characteristics and deposition methodology.

When a 1% AEP 72 hour storm event is superimposed on either cell during the deposition sequence, the pond level will remain greater than 200 mm in vertical height below the maximum tailings elevation. Due to this, the operational freeboard of 300 mm will dictate the maximum tailings elevation for each raise, as shown in Table 6.2.

6.11 TAILINGS DISTRIBUTION AND DECANT RETURN CORRIDOR

The TSF will be serviced by a tailings distribution and decant return corridor which will include a pipe trench for distribution and decant pipework, the main 12 m wide access haul road and electrical power distribution powerlines. The layout and details for the corridor are shown on Drawing No. PE801-137-C3000-700 and PE801-137-C3000-710.

The bunded pipe trench will be constructed by localised cut-to-fill with longitudinal grades adjusted such that any rainwater or accidental release of fluids from the pipelines will report to the emergency containment basin located along the existing corridor leading to Cell 1 and Cell 2. The base of the trench and bunds will be compacted to reduce permeability and limit seepage from the trench in the event of leaks.

The access haul road allows inspection and maintenance of the pipelines and powerlines. As rock products for erosion protection and decant tower surround are to be sourced from existing waste stockpiles, the road will also serve as the haul route for construction traffic moving engineering fill materials.

The road is sized for use by 40 T dump trucks and will be constructed above grade. The pavement construction comprises scarification, moisture conditioning and compaction of the in situ materials followed by placement of a minimum of 300 mm of coarse rock mine waste. The road will be sheeted with 100 mm of wearing course materials.

A traffic management plan will be developed by Evolution prior to construction of TSF Cells 3 and Cell 4. This will cover the development of the new facility, coupled with operational changes to traffic management between the four cells and the surrounding infrastructure.

6.12 EXISTING BOREHOLE SEALING

Exploration, sterilisation or geotechnical boreholes, if left unsealed or improperly sealed, are a potential conduit for solute migration into the groundwater and sub-surface regimes. In order to limit the possibility of vertical movement of groundwater and/or sub-surface solute through this conduit, it is important to return the sub-surface environment to the original pre-drilling conditions. The aim of backfilling boreholes is to fill the hole with a material that is low permeability to water, seals the hole completely (including fissures in the wall rocks) and does not shrink and crack.

Backfilling of MB-01 located within the Cell 3 basin footprint shall be completed using a drill rig to pump a grout mix through drill rods or a tremie tube, filling from the base of the hole upwards to the surface. As a minimum requirement the hole shall be backfilled by grouting the entire hole depth.

It is important that the borehole is backfilled using the appropriate grouting equipment, method and mix. Where groundwater is encountered, the hole is to be backfilled from a minimum of 5 m below the water table upwards, ensuring displacement of standing water as the hole is progressively backfilled. To assist in the water displacement, “air-lifting” the downhole water may be completed to reduce the head of water acting against the pumping equipment. It may be necessary to re-drill the hole if it collapsed in the time between drilling and backfilling.

Further specification regarding backfilling requirements, equipment, consumables and methodology will be provided in a separate technical memorandum.

7. WATER BALANCE MODELLING

7.1 GENERAL

The management of water within the Mungari Project area is a critical aspect of the design. In order to understand (and enable control) the flow of water around the site, a TSF water balance model was developed.

The primary objectives of the water balance modelling are summarised below:

- Estimate settled tailings densities.
- Establish the filling rate for tailings solids within the TSF.
- Determine net flows and average supernatant pond volumes within the TSF throughout operation.
- Determine supernatant pond volumes following design rainfall events and sequences.
- Determine staged embankment crest elevations, to ensure containment of tailings and prevent discharge of supernatant water for design rainfall events and sequences.
- Determine the magnitude of recycle water shortfalls during design dry rainfall sequences.

For the water management model the following inputs into the TSF were included:

- Water in the tailings slurry from the plant.
- Rainfall runoff from the tailings and pond surface (refer to Appendix B for the site climatology assessment).

The production data for modelling are summarised in Table 7.1.

Table 7.1: Tailings production data

Parameter	Value (Single Cell / Total)
Total Throughput	12.5Mt / 25Mt
Life of Mine	10.0 years
Annual Throughput Rate	2.5 Mtpa

The following rainfall sequences were modelled:

- Average climatic conditions.
- 1% AEP, 1 year dry rainfall sequence.
- 1% AEP, 1 year wet rainfall sequence.

- 1% AEP, 72 hour duration storm event superimposed over average rainfall sequence.

Outputs from the TSF included:

- Evaporation losses.
- Seepage losses.
- Water returned to the plant as process make-up water (pumped system).

The model allows for the build-up of tailings area, calculation of tailings densities, supernatant release, and rainfall and evaporation losses from various surfaces.

The TSF water balance modelling was based on a monthly time step and undertaken using a density model. Full details of the modelling process and results are presented in Appendix I. A summary of the key results and conclusions is provided below.

7.2 RESULTS AND CONCLUSIONS

The operating strategy for the facility assumes a constant throughput is deposited into one cell until that stage capacity is met at which point deposition is transferred into the alternate cell. Therefore, one cell was modelled to assess the water return rates expected. This also provides a conservative estimate of the expected tailings density noting improvements will be made by cycling between both active cells when available. Water balance modelling results are summarised in Table 7.2.

Table 7.2: Water balance modelling summary

	Design Conditions			
	Average Rainfall Conditions	1% AEP Dry Year Rainfall Conditions	1% AEP Wet Year Rainfall Conditions	Average Conditions + 72-hour 1% AEP Storm
Peak Monthly Supernatant Pond Volume (m^3)	8,000	8,000	8,300	130,000
Average Monthly TSF Recycle Rate (m^3)	87,000	82,000	96,000	-
Maximum Monthly TSF Recycle Rate (m^3)	101,000	94,000	122,000	-
Minimum Monthly TSF Recycle Rate (m^3)	70,000	70,000	69,000	-

A typical year of TSF recycle is shown in Table 7.3. Year 6 of operation has been nominally selected.

Table 7.3: Example of monthly recycle rates – Year 6 (Single Cell)

Month	Recycle Rate (m^3/month)		
	Average Rainfall Conditions	1% AEP Dry Year Rainfall Conditions	1% AEP Wet Year Rainfall Conditions
January	70,000	72,000	69,000
February	79,000	70,000	79,000
March	82,000	84,000	119,000
April	97,000	77,000	111,000
May	96,000	81,000	116,000
June	85,000	93,000	122,000
July	91,000	84,000	85,000
August	101,000	89,000	118,000
September	89,000	86,000	99,000
October	83,000	82,000	86,000
November	87,000	79,000	78,000
December	84,000	78,000	78,000

Based on the modelling undertaken, a number of conclusions can be drawn:

- There is sufficient stormwater storage capacity on the TSF to accommodate design storm events (including PMP) and rainfall sequences, with sufficient freeboard to comply with regulations. This requires the supernatant pond to be maintained within acceptable limits.
- Under average conditions, a recycle water shortfall occurs during each month of operation throughout the life of the facility. The maximum annual shortfall is approximately 2,057,000 m^3 in Year 1.
- The maximum annual recycle water shortfall for 1% AEP dry conditions is 2,129,000 m^3 per cell.
- Due to the low but relatively consistent recycle rates throughout each year of operation, it is recommended that planning for process water supply be based on approximately 25 - 35% of the annual demand being recycled from the TSF.

It is recommended that the pump capacity be designed for maximum recycle from the TSF, i.e. 95% of water in slurry. It should be noted that during operations there will be periods where only one cell is operated e.g. during embankment raises. For these periods, sufficient pumping and pipework capacity should be made available to discharge the total plant tailings throughput to one cell and return the total decant volume from one decant tower.

8. MONITORING AND MAINTENANCE

8.1 MONITORING PROGRAMME

As part of the TSF operation, extensive monitoring of all aspects of the operation will be undertaken to ensure the TSF design intent is met. This monitoring will comprise three basic types. These are:

- Operation monitoring

  This will include items such as spigot offtake location, whether pipe joints are leaking, etc. This level of monitoring is directed at ensuring that the facility is operating smoothly.

- Compliance monitoring

  This includes items such as checking survey pins for movement, monitoring bores for contamination, etc. This monitoring is required to ensure that the project is meeting all its commitments in regard to a safe and secure operation.

- Performance monitoring

  This will include items such as tailings level surveys and water flow measurements, etc. This monitoring is necessary to assess the performance of the facility and refine future embankment lift levels and final extents.

The monitoring programme for the facility is summarised in Table 8.1 and further details on compliance and performance monitoring are provided in Sections 8.2 and 8.3.

Table 8.1: Monitoring programme

Area	Monitoring Requirement	Frequency*
Operation Monitoring		
TSF	Outer perimeter area and embankments	Daily
	Condition of roads and ramps	Daily
	Tailings pipeline integrity	Daily
	Tailing behaviour at deposition point	Daily
	Visual check on tailings and water levels versus embankment crest	Daily
	Offtake location	Daily
	Blockage or damage of discharge	Daily
	Monitoring Instrumentation	Daily
TSF Decant System	Size of supernatant pond	Daily
	Location of supernatant pond	Daily
	Return Water Pipeline integrity	Daily
	Blockage of decant tower	Daily
	Visual check on decant tower operation	Daily
TSF Underdrainage, Toe Drains, Seepage Trench and groundwater recovery bores	Blockage of towers/pipes	Daily
	Visual checks of water level in towers/pipes	Daily
	Visual check of pipeline integrity	Daily
Compliance Monitoring		
TSF Embankment	Survey pins	Monthly
	Drone survey	Quarterly
TSF Basin	Water volume and level	Weekly
	Tailings beach-head level	Weekly
Monitoring Bores	Water level	Monthly
	Water quality – Basic	Monthly
	Water quality – Intermediate	Quarterly
	Water quality – Comprehensive	Annually
Standpipe and VWPs	Water level/Pore water pressure	Monthly
Performance Monitoring		
Climatic (Kalgoorlie Bureau of Meteorology station 12038)	Precipitation, Evaporation, Maximum - minimum temperatures, Wind direction and speed	Daily
Tailings	Tailings solids (tonnes)	Weekly
	Water in tailings (tonnes or m^3)	Weekly
	Average tailings flow (m^3/s)	Weekly
	Tailings surface survey (drone)	Quarterly
	Tailings geochemistry testing	Annually (Or as per any change to tailings characteristics)
Water	Outflow from decant pumps	Daily
	Outflow from toe drain, underdrainage and recovery bores	Daily
	SG of Decant Water	Daily
TSF	Processing Manager Inspection	Monthly
Technical Audit	Independent Geotechnical Engineer	Annually

*Or as specified in permit conditions

8.2 COMPLIANCE MONITORING

8.2.1 Survey Pins

Survey pins will be installed at regular intervals along the upstream side of the TSF embankment crest (total 14 No. for Stage 1 – refer to Drawing No. PE801-137-C3000-900) in order to monitor embankment movements to assess effects of any such movement on the embankment. The details of each pin (date of installation, survey pin ID, Northing, Easting and RL) will be recorded on installation.

Each pin will be monitored for movement at regular intervals as outlined in the monitoring programme. Any displacement of the embankment which is considered excessive or ongoing may indicate embankment stability problems and will require investigation by a qualified geotechnical engineer. Remedial action will be undertaken if required based on the conclusions drawn from such an investigation.

8.2.2 Monitoring Bores

The TSF design incorporates a number of measures to reduce the amount of seepage which will occur from the TSF in order to mitigate the extent of any effects on the downstream environment. Eight (8) groundwater monitoring stations will be installed downstream of the TSF perimeter embankment to facilitate early detection of changes in groundwater level and/or quality, both during the operating life and following decommissioning. These are labelled as MB-07 to MB-14 and are shown on Drawing No. PE801-137-C3000-900.

Three levels of testing will be undertaken at the frequencies listed in Table 8.1. The test parameters are detailed in Table 8.2.

Table 8.2: Monitoring bore testing parameters

Level	Parameters to be Tested
Basic	pH, Electrical Conductivity (EC)/Total Dissolved Solids (TDS)
Intermediate	EC/TDS, pH, WAD cyanide
Comprehensive	pH, EC, TDS, WAD CN, Ca, Mg, Na, K, CO_3, Cl, SO_4, Al, As, Cd, Cr, Cu, Fe, Mn, Ni, Zn, Pb and Co.

Each monitoring bore station consists of one shallow bore, extending to a depth of approximately 8 to 15 m in the deep surface horizon, and one deep bore to intercept groundwater terminating at approximately 30 m in bedrock. The shallow bore is intended to detect any seepage from the facility flowing within the surface sediment and changes in groundwater levels, whilst the deep bore will monitor the chemical composition of the groundwater. Each borehole will be cased and screened over an interval set in the field during installation, and sealed back to surface with low permeability grout. The casing

for the monitoring bores will be 100 mm diameter so that each monitoring bore can be converted to a de-watering bore if required. A typical detail of a monitoring bore is shown in Drawing No. PE801-137-C3000-921. It is recommended that the boreholes are constructed before commissioning of each cell in order to accumulate baseline data specific to the facility location.

8.2.3 Vibrating Wire Piezometers

Pore water pressures will be monitored at several locations within the perimeter embankment to assess the performance of the underdrainage system and construction activities and ensure that stability is not compromised.

Vibrating wire piezometers (VWP) will be installed at fifteen (15) locations (pairs) beneath the Stage 1 embankment footprint as shown on Drawing No. PE801-137-C3000-900. The VWPs will be connected to a telemetry network which can be read online.

Each piezometer location will consist of a 50 mm diameter PVC tube which will contain two nested instruments. The instruments will be placed at different depths and the hole will be sealed with a bentonite/cement grout, surrounding the cable that leads out to a monitoring station on the downstream side of the facility. A typical detail of a vibrating wire piezometer is shown in Drawing No. PE801-137-C3000-921.

The piezometers will be monitored at regular intervals as outlined in the monitoring programme and any rises in water level noted. Increases of greater than 10% of the embankment height should be referred to a qualified geotechnical engineer for further investigation. The piezometer levels should be monitored to ensure that the phreatic surface does not reduce the overall stability of the embankments below acceptable levels. Remedial action will be undertaken if increases in pore water pressure are unacceptably high.

Additional vibrating wire piezometers will also be installed as the crest moves upstream into the facility.

8.2.4 Standpipe Piezometers

Standpipe piezometers will be installed at ten locations on the Stage 3 TSF embankment.

Each piezometer will consist of a 50 mm diameter PVC tube slotted at the base or supplied with a filter tip. The slotted section will be surrounded by sand, and bentonite pellets will be placed above the sand to provide a seal.

The remainder of the hole will be sealed with a bentonite/cement grout. The top of the piezometer will be provided with a lockable cap to prevent tampering or vandalism. The base of each piezometer will be located within the embankment fill to ensure that the

phreatic surface within the embankment, as opposed to natural groundwater level, is being measured.

The piezometers will be monitored at regular intervals as outlined in the monitoring programme and any rises in water level noted. Increases of greater than 10% of the embankment height should be referred to a qualified geotechnical engineer for further investigation. The piezometer levels should be monitored to ensure that the phreatic surface does not reduce the overall stability of the embankments below acceptable levels. Remedial action will be undertaken if increases in pore water pressure are unacceptably high.

8.3 PERFORMANCE MONITORING

Performance monitoring of the TSF will include monitoring of the following variables on a daily basis:

- Solids tonnage to the TSF.
- Percent solids of tailings slurry.
- Any additional water inputs to the TSF.
- Rainfall and evaporation at the TSF - sourced from BOM Kalgoorlie.
- Water return from the TSF to Plant Site.
- Collection efficiency of the underdrainage system based on underdrainage sump pump monitoring.

Monitoring of tailings moisture contents and densities, and survey of the tailings beach and supernatant pond locations will be conducted quarterly. The daily monitoring of the above information in conjunction with the beach survey and resulting density and level measurements will be used to calibrate the water balance model. This will allow ongoing projections of tailings and supernatant pond levels against time relative to the original design assumptions and proposed embankment raise schedule.

8.4 TECHNICAL AUDIT

It is important that suitably qualified geotechnical advice is available during the operating life of the facility. The Client should keep the Geotechnical Engineer informed of the operating performance of the facility and raise any performance or operational questions immediately.

During the early operation of the TSF, frequent communication should be maintained and it is proposed that site visits should be made during this period. After the first year of operation the frequency of visits will most likely reduce to annually for audit purposes,

provided that the operation and performance of the facility continues to be satisfactory. The proposed schedule of visits is summarised in Table 8.3.

Table 8.3: Geotechnical audit visits

Visit Number	Approximate Date*	Purpose
1	January 2021	Prior to operation
2	April 2021	3 month review for initial startup
3	July 2021	6 month review for standard operation
4	January 2022 - 2030	Annual audits

*assumes commissioning of facility in February 2021.

In accordance with the requirements of the ANCOLD "*Guidelines on Tailings Dam Planning, Design, Construction, Operation and Closure*" (Ref. 2) and DMIRS (Ref. 4), the TSF will require annual audits by a suitably qualified geotechnical engineer to ensure that the facility is operating in a safe and efficient manner. The audit should include, but not be limited to, the following items:

- Tailings beach survey showing spot elevations along embankments and across tailings beaches.
- Reconciliation of stored tailings volume and calculated densities with the expected design values, and assessment of available capacity remaining in terms of volume and time.
- Assessment of in situ tailings properties, including particle size distribution, in situ strength, density and moisture properties.
- Water balance studies with approximate reconciliations of slurry volumes, solids content, decant recovery, site rainfall and evaporation. In conjunction with contained moisture information, this will provide an indication of possible seepage losses.
- Validation of storage design, using input parameters derived from site measurements and testing, implications for future storage if present trends are continued, and recommendations for any necessary operational or design modifications.
- Presentation and interpretation of monitoring results, proposals for additional monitoring of identified areas, changes to operational procedures resulting from monitoring results and proposals for any necessary seepage recovery systems.

- General description of TSF, complete review of tailings and water management practices and operating manual procedures, their problems, failures and successes, and any alteration to the facility or operating procedures that are proposed.
- A complete description of the previous embankment raise with as-built drawings and design proposals for the next embankment raise (as appropriate) based on the recorded data.

A comprehensive Geotechnical Audit Report will be prepared and submitted to the Client and DMIRS following each annual audit site visit.

8.5 MAINTENANCE PROGRAMME

Inspection and maintenance of the TSF is largely aimed at mitigating potential problems by dealing with them before they can develop into major problems.

Some aspects of the maintenance programme, such as inspections, can be integrated into the monitoring programme. If problems are detected, then the problem is either to be corrected immediately or to be noted on the inspection checklist and the relevant maintenance request form filled in. The maintenance request form will generally allow for varying levels of urgency depending on the gravity of the situation. The assessment of urgency should be based on the potential for the problem to affect the operation or integrity of the facility. The maintenance will then be integrated with the overall site maintenance programme.

Table 8.4 outlines the maintenance requirements for each area of the TSF. Modifications to the maintenance programmes should be made as a result of emergency situations or annual audits (if required).

Table 8.4: Maintenance programme

Area	Maintenance Requirement	Frequency
Pipeline	Inspect pipeline for pipe bursts and leaking joints.	Daily
	Inspect off-take(s) for potential blockages, failure etc. before occurring. Repair and/or replace as necessary. Re-locate off-take(s) to new location and check that flow at new location is acceptable.	Each shift
	Inspect the pipeline containment ramp for signs of potential leakage or rainfall erosion.	Daily
	Break pipeline at selected locations and observe wear on valves, fittings and pipes. Remove any accumulated material from valves etc. Rotate pipeline if excessive wear is occurring along invert of pipe (flanges date stamped).	Annually during programmed plant shut down
	Carry out maintenance on valves and fittings as recommended by suppliers. Test leak detection system on tailings and reclaim water line.	Biannually
Embankment	Check general structural integrity and visual signs of seepage through perimeter embankment.	Daily
	Detailed inspection for slips, erosion problems including around survey pins, tension cracks etc. Problems to be referred to qualified geotechnical engineer for assessment.	Weekly
	Inspect discharge location or downstream face for erosion or damage. Repair as appropriate.	Daily
Decant	Inspect supernatant pond and location. Adjust discharge location to maintain pond around decant tower.	Daily
	Detailed inspection of decant system for damage or debris.	Weekly or after significant rain events
Underdrainage System	Detailed inspection of collector, finger and toe drains for damage, collapse or ingress of material until covered by tailings.	Monthly or after significant rain events
	Detailed inspection for erosion damage to protection layer and soil liner.	Monthly or after significant rain events
Instrumentation	Inspect all instrumentation and repair / replace as required.	Monitoring frequency specified
General	General inspection of TSF and all structures.	Daily
	General assessment of dust emissions.	Daily

8.6 INCIDENT REPORTING

During TSF operation, there are many potential incidents that should be recorded; however, the reporting of such incidents are split into two categories:

- Reportable internally – these are incidents that may impact day to day TSF operations and are generally relatively minor. These consist of ongoing company specific safety and environment reports. The Responsible Engineer should be notified of these incidents summarised as part of annual audits.
- Reportable externally – these are serious incidents that impact or could have impacted the environment and the health and safety of employees and/or the public. The DWER and/or DMIRS is to be informed of all reportable incidents associated with the TSF within 24 hours of occurrence. The Responsible Engineer should also be notified and specialist advice sought if the incidents relate to the operation and integrity of the TSF.

Reporting of incidents is required in accordance with the Mine Safety and Inspection Act (Ref. 11).

In the event that an incident occurs, the Evolution Incident Reporting system should be followed and a report completed and submitted to the relevant parties within 24 hours of the occurrence of the incident. Additionally, should the license conditions be breached then an incident will be externally reportable.

Regardless of the reportable status, any incident will fall under one of the following three general categories:

- Environmental.
- Structural.
- Health and Safety (Personnel or Public).

Reporting of incidents is an extremely important task as part of the safe TSF operation. It is recommended that the reporting procedure include, but not necessarily be limited to, the following:

i. Which reporting category is appropriate to the incident?

ii. If external reporting is appropriate, review specific procedure and implement as appropriate.

iii. For internal reporting, the following should be considered:

- Which general category is appropriate to the incident?
- Description of the incident including: location, date, time, weather conditions, result (damage) and potential cause of the incident.

iv. Description of remedial actions to be taken to rectify the incident.

v. Description of precautionary measures to be taken to prevent re-occurrence of the incident.

vi. Review of remedial and precautionary measures once initiated, to assess whether they are achieving the desired result.

It is recommended that an incident and reporting register is established prior to the TSF being commissioned and a basic reporting pro-forma developed. This will assist in the reporting of minor incidents, which are more likely to occur during the initial stages of operation and will assist in preventing the minor incidents from re-occurring.

9. DEPOSITION MANAGEMENT

9.1 DEPOSITION OBJECTIVES

The tailings deposition strategy was designed and will be managed throughout the life of the facility to meet the following objectives:

- Deposition of a basin lining within the inundation area.
- Maintenance of freeboard against the upstream embankment face.
- Discharge to improve sub-aerial deposition and consolidation of tailings.
- Deposition to effectively utilise the net available storage capacity.
- Effective management of the size and location of the supernatant pond.
- Reduce the volume of water stored on the facility at any time.
- Reduce the operating costs of the tailings distribution system.
- Reduce down time by providing operational flexibility.
- Facilitate the implementation of the storage closure strategy.
- Reduce potential for dust generation.

9.2 DEPOSITION INFRASTRUCTURE

Tailings will be delivered to the storage facility by HDPE delivery pipe and distributed to offtake spigots by HDPE distribution pipe.

The tailings delivery line will run along the main access road to the TSF in a containment channel. At the toe of the TSF access ramp, the tailings pipeline will be lined to provide containment up the ramp. Flow meters will be installed at the plant and the TSF to provide real time monitoring of the tailings discharge pipeline, connected via telemetry directly to the alarm system at the Plant.

Emergency dump ponds will be installed at low points of the tailings pipeline to contain a minor pipe burst and limit the spillage of tailings to the environment. The dump ponds have been designed to store the volume of tailings within the section of the pipeline between each high and low point, as well as the volume of slurry likely to be pumped between the period of leak detection and pump shutdown.

The tailings delivery pipeline will connect to a distribution pipeline on the crest of the facility. The distribution pipelines will extend around the full perimeter of the TSF and across the divider embankment. The pipework is located on the upstream side of the embankment crest behind the road safety bund so that any leakage will flow into the TSF basin and not be released to the external environment.

The distribution pipeline will be fitted with spigot offtakes, located at 25 m intervals along the main embankment crest. Nominally 6 to 8 spigots will be in operation during each cycle.

Each offtake will consist of a flanged spool connected into the main tailing distribution line with a HDPE offtake branch. A valve will be connected to each offtake allowing the deposition location to be controlled. A 1.5 m length of water delivery pipe will be connected to the spigot offtake and will discharge into a uPVC storm water drainpipe, slotted along the pipe soffit. This will direct the tailings down the upstream face of the embankment, reducing erosion.

Note that design of the delivery and distribution pipelines are not included in this report.

When embankments are to be raised the distribution pipeline and associated offtakes will be removed from the crest to allow earthworks to progress. Once the new crest level has been reached the pipework will be reinstalled on the crest and recommissioned.

9.3 DEPOSITION TECHNIQUE

The deposition of tailings into the facility will be sub-aerially from the embankments. Sub-aerial deposition allows for the maximum amount of water removal from the facility by the formation of a large beach for drying and draining. Together with keeping the pond size small, sub-aerial deposition will increase the settled density of the tailings, and hence improve the storage potential and efficiency of the facility.

Deposition will occur from multiple spigots inserted along the tailings line. The deposition locations will be moved progressively along the delivery line as required to control the location of the supernatant pond. After initial establishment of the tailings beaches, a suitable cycle time will be determined in order to evenly deposit the tailings around the facility perimeter, thereby maintaining the supernatant pond at a central location within each cell.

A degree of segregation of the tailings will occur against the embankment, promoting de-watering of the tailings through the toe drain and thus enhancing stability, consolidation and reducing basin drainage. Tailings deposition will then be moved either side of this initial point to line the basin area whilst controlling the location of the supernatant pond.

The tailings will be deposited in the facility from the embankment in such a way as to encourage the formation of beaches over which the slurry will flow in a laminar non-turbulent manner.

The solids will settle as deposition continues and water will be released to form a thin film on the surface of the tailings. This water will evaporate or flow to the supernatant pond from where it will be removed from the storage area.

Deposition of the tailings will be carried out on a cyclic basis with the tailings being deposited over one area of the storage until the required layer thickness has been built up. Deposition will then be moved to an adjacent part of the storage to allow the deposited layer to dry and consolidate. This will be repeated around the perimeter of the facility until the first deposition point is reached after which the process will be repeated. This will facilitate maximum storage to be achieved over the whole facility by allowing the greatest possible drying times for the tailings.

After deposition on a particular area of beach ceases and settling of the tailings has been completed, further de-watering will take place due partly to drainage into the underdrainage system but mainly due to evaporation. As water evaporates and the moisture content drops the volume of tailings will reduce to maintain a condition of full saturation within the tailings. This process will continue until interaction between the tailings particles hinders volume reduction.

Whilst deposition is ongoing, the underdrainage and toe drain sumps will need to be pumped to prevent build-up of supernatant within the underdrainage and promoting tailings settlement.

Rates of rise of tailings are expected to be reasonably low and of the order 2 m per year. Combined with high evaporation rates, a small supernatant pond volume, high tailings permeability and the presence of underdrainage within the facility, it is not expected that there will be any issues with excessive saturation of tailings or poor consolidation.

9.4 DEPOSITION CONTROL

Initial deposition will occur from all sides of each cell to fill the low points generated by natural topography and borrow activities. As these areas are filled, a tailings beach that slopes from the perimeter of each cell into the centre where the decant tower is located will be formed.

Once the initial beach profile is established and the pond is centrally located the deposition points will be varied to maintain a consistent beach and ensure that the ponds remain in the centre of each cell.

At Stage 4 it is proposed that construction will shift from downstream/centreline to upstream methodology.

As the Stage 4 construction window approaches, deposition will cease in one of the cells to allow the tailings beach a month or so to dry prior to construction. Once the first cell is raised, all deposition will be directed to the enlarged cell thereby allowing the second cell time to dry before its embankments are raised. The procedure for this switching operation will be developed as part of the Stage 4 design.

9.5 OPERATIONAL FLEXIBILITY

The facility design and proposed deposition process is based on laboratory test data and a number of assumptions that can only be verified once the TSF is in operation. In addition the properties of the tailings will vary as different source rocks are used and the processing operation is refined. As such the design includes for flexibility to enable changes to be made to the TSF to suit the characteristics of the tailings.

Continual monitoring of the location of the decant pond will be undertaken during operation of the TSF. Whilst the deposition sequence will be planned in a cyclic manner around the facility, if the pond starts to move away from the decant location then deposition will need to be adjusted to push the pond back to its correct location. There will be multiple discharge points around the facility to allow control of beach development and pond location.

Since the embankments will be constructed in stages, the performance of the tailings will be monitored to allow the height and timing of future embankment stages to be modified to suit the measured performance of the tailings in the storage facility.

10. SURFACE WATER MANAGEMENT DESIGN

10.1 GENERAL

The TSF is a paddock arrangement and rainfall onto the facility is managed through the water management plan (water balance) and appropriate freeboard allowances. There are no inflows from external catchments that will report to the TSF basin.

For this site, surface water management comprises management of run-off reporting to the toe of the facility in order to prevent ponding and/or erosion of the embankments.

10.2 UPSTREAM CATCHMENTS

The total catchment area contributing runoff to the proposed diversions is approximately 110 Ha. General topography in the TSF area falls from northeast to southwest towards Kurrawang Salt Lake.

10.3 TSF EMBANKMENT TOE PROTECTION

Prevention of erosion of the TSF embankment toe by surface flows during rainfall events will be achieved through the use of protective engineered fill material. Where coarse run-of-mine waste is used as Zone C construction material it is anticipated that this material will provide adequate erosion protection. Should finer material be used for Zone C then an additional layer of Zone E (or similar) will be placed at the embankment toe.

The erosion protection material will not be placed at Stage 1 because shortly after, construction of the Stage 2 downstream raise will commence which comprises run-of-mine waste on the downstream side. The period where there may be a risk of erosion during adverse rainfall events is short and confined to the summer months. In addition, there will be regular monitoring of the TSF embankments and maintenance undertaken as necessary to ensure safe operation of the facility.

10.4 EXTERNAL SURFACE DRAINAGE

Surface water catchment areas that currently report to Cell 1 and Cell 2 are directed into a shallow surface drain located downstream of the north embankments and Cell 2 west embankment. The drain flows into a sedimentation basin south west of Cell 2, capable of storing short duration storm events.

As part of the Cell 3 and Cell 4 design, the northern portion of the surface drain will be extended along the downstream toe of Cell 3 and Cell 4 north embankment and continuing along the downstream toe of the Cell 4 western embankment. This will flow into a sedimentation basin west of Cell 4.

An additional surface drain will be constructed along the downstream toe of the Cell 4 west and south embankments, flowing into a sedimentation basin south of Cell 3.

The surface drain and sedimentation basin location and profiles are shown on Drawing No. PE801-137-C3000-800 and. PE801-137-C3000-821.

10.5 TAILINGS DISTRIBUTION AND DECANT RETURN CORRIDOR

The access corridor includes the construction of bunds and road pavement above natural ground level. This will result in infilling of natural drainage channels. In high rainfall events some localised ponding of water against the corridor will occur but it is expected that the water will naturally dissipate in a short period of time. Ponding water should not affect the integrity or operation of the corridor.

The corridor will tie into the existing corridor that leads to Cell 1 and Cell 2, using the same dimensions for road and trench widths.

Should excessive ponding occur post-commissioning, then culverts will be installed at critical locations along the corridor to reduce the occurrence of ponding water.

10.6 SEDIMENT CONTROL

During construction, large areas will be disturbed by construction activities including vegetation clearing and placement of earthfill. This has the potential to lead to increased soil erosion and sediment loading in downstream waterways if not properly managed. It is proposed that soil erosion and sediment control during the TSF cell construction will be mitigated by source control and astute placement of temporary structures within and downstream of the area of disturbance. Types of temporary measures that may be employed include:

- Diversion Channels.
- Brushwood Barriers.
- Geotextile Silt Fences.
- Rock-lined Channels.
- Rock Check Dams.
- Level Spreaders.
- Sedimentation Basins and Traps.
- Environmental Buffer Zones.

Prior to construction, an Erosion and Sediment Control Plan should be prepared by the Contractor. This should outline detailed sediment control measures for the project.

11. EMERGENCY ACTION PLANS

11.1 GENERAL

Emergency situations and unforeseen natural disasters can have serious effects on the operation of the TSF. A detailed emergency action plan will be provided in the operating manual for the TSF to manage emergency situations and unforeseen natural disasters. Procedures will be developed for the following emergency situations and stored in the site document control system:

- Massive embankment failure.
- Partial embankment failure.
- Excessive seepage/piping.
- Excessive surface erosion.
- Tailings delivery pipeline failure.
- Tailings distribution pipeline failure.
- Return water pipeline failure.
- Power loss/pump failure to decant system.
- Decant tower failure.
- Imminent embankment overtopping.
- Embankment overtopping.
- Excessive sub-surface seepage.

The following non-critical items are discussed in this section:

- Evacuation procedure.
- Earthquake events (major and minor).
- Extreme rainfall events.
- Tailings pipeline leakage/blockage.
- Water return pipeline leakage/blockage.
- Power failure.
- Excessive dust.

11.2 EVACUATION PROCEDURE

In the event of a failure or an impending failure occurring, the following steps should be taken:

- Notify all personnel to immediately leave the TSF area by the nearest and safest exit route and to assemble at the designated assembly point shown in Appendix E. All nominated personnel shall gather at the assembly point in the event of an emergency; and
- Account for all personnel associated with TSF operation. If there are any persons unaccounted for, inform emergency services.

11.3 EARTHQUAKE EVENTS

The site is located in an area of low seismicity however earthquake events have occurred in the area. The TSF has been designed to stringent stability criteria and the stability of the TSF perimeter embankment should be checked annually as part of the annual audit of the TSF.

Contingency procedures to be adopted in the event of an earthquake are dependent on the intensity of the earthquake event at the site and are outlined below:

11.3.1 Major Earthquake Event (Modified Mercalli Intensity VI or Greater)

Recognition: Difficulty standing, hanging objects quiver, masonry cracks, waves on ponds, some minor injuries.

Response
i) Immediately terminate deposition of tailings into the TSF and pumping from the decant.
ii) Immediate inspection of TSF embankments and decants for obvious deformation or movement.
iii) Immediate inspection of all pipes including tailings pipeline(s) for rupture or leakage.
iv) If any damage is noted refer to Evolution Crisis Management Plans.
v) Deposition can be recommenced if no major damage to facility and pipelines has occurred and that power has been restored.
vi) Survey pins and monitoring bores are to be read immediately after the event and all instrumentation to be read daily until readings have stabilised.

11.3.2 Minor Earthquake Event (Modified Mercalli Intensity V or Less)

Recognition: Felt outdoors as well as indoors, liquid disturbed, small objects displaced, doors swing open or closed, pictures move.

Response:
i) Inspect pipelines for rupture or leakage.
ii) Inspect embankments and decants for obvious deformation or movement.
iii) If any damage is noted refer to the Tailings Emergency procedures.
iv) Monitor all instrumentation immediately after the event and weekly thereafter until readings return to normal.

11.4 EXTREME RAINFALL EVENTS

The TSF is designed to operate without the need for a spillway. Regulatory freeboard is set to maintain a 500 mm depth following a 100 year ARI 72 hour storm event. Water storage allowances are set such that a PMP event can be retained on the facility without breach of the perimeter embankments. Following high rainfall events, increased decant return to the Plant will be used to lower the pond level and increase available storm storage capacity.

Major storm events can cause serious erosion problems as well as other damage. A system of inspections should be conducted to mitigate any potential adverse consequences of extreme rainfall.

It is recommended that access roads are designed for all weather capability to ensure inspections can be undertaken under all circumstances.

11.5 TAILINGS PIPELINE LEAKAGE/BLOCKAGE

11.5.1 General

For the tailings discharge system, the following two situations are covered below:

- Leakage in the delivery and/or distribution pipeline (including joint failure).
- Blockage of the distribution line and/or off-takes.

The tailings pipeline will be contained in a bunded trench when remote from the TSF embankment crest. A flow meter is installed at the process plant and will also be installed at the toe of the TSF embankment for both the Tailings and Reclaim Water lines. These flow meters form the leak detection system and will result in automatic shutdown of either the tailings or reclaim water pumps. Consequently, these situations should not result in the release of tailings from the TSF or contamination of any surface water systems.

However, the capacity of such systems to store tailings is limited and regular inspections and maintenance should be conducted.

The potential emergencies and the appropriate responses are outlined in the following sections.

11.5.2 Leakage in the Tailings Delivery/Distribution Pipeline

The most likely location for rupture is at valves, joints and fittings along the pipeline(s). Regular inspection of the pipeline(s) should be conducted. All minor leakages should be noted and the joint(s) disassembled, checked and repaired as required during the next programmed maintenance period or plant shutdown. This procedure will prevent major problems from developing.

Should a major rupture occur, local erosion of the embankment or overtopping of the pipeline containment trench may occur. Any tailings spillages should be cleaned up and the tailings placed into the TSF. Any damage to the embankment, bund, etc., should be repaired.

11.5.3 Distribution Pipeline/Off-take Blockage

The distribution pipeline will run along the TSF perimeter embankment crest and along the causeway embankment. The procedures to be undertaken if a blockage occurs in the distribution line will comprise either moving the deposition location back along the line closer to the process plant, switching deposition to an alternate deposition line or, if this is not possible, temporarily ceasing deposition.

The failure of a spigot off-take will be treated in a similar manner to the procedures for a blockage in the distribution line. The off-take containing the blockage should be removed and the new off-take assembled and installed in its place. On replacement, deposition should be returned to its original position. Components may be salvaged from the ruptured off-take for future use.

11.6 RETURN WATER PIPELINE FAILURE

11.6.1 General

For the return water system, two potential emergency situations are possible:

- Rupture in the pipeline (including joint failure).
- Blockage of the return line.

The TSF return water pipeline should be contained in a suitable erosion protected trench in areas when remote from the TSF embankment crest. Consequently, leakage should not result in the release of supernatant water from the TSF or contamination of local

surface water systems. However, the capacity of such systems to store water is limited and regular inspections and maintenance should be conducted.

The potential emergencies and the appropriate responses are outlined in the following sections.

11.6.2 Leakage in the Return Water System

The most likely location for rupture is at valves, joints and fittings along the pipeline. Regular inspection of the pipeline should be conducted. All minor leakages should be noted and the joint disassembled, checked and repaired as required during the next programmed maintenance period or plant shutdown. This procedure will prevent major problems from developing.

Should a major rupture of the TSF return water pipeline occur, local erosion of containment trench surface, or overtopping of the pipeline containment trench may occur. Any residue resulting from spillages should be cleaned up and placed into the TSF. Any damage to the pipeline containment trench, bunds, etc. should be repaired.

11.6.3 Water Return Pipeline Blockage

In the unlikely event that a blockage occurs in the return water line, the TSF decant pumps should be switched off. The section of pipeline containing the blockage should then be removed and unblocked and the pipeline re-assembled. Pumping may then re-commence.

11.7 POWER FAILURE

11.7.1 General

The tailings pumps will be connected to the process plant power distribution system. In the event of a total loss of power, all systems including all pumps and automatic valves not connected to standby generators will cease operations. Systems affected could include:

- Water control and removal in the supernatant pond.
- Underdrainage pumping system.
- Tailings pumping system.

A summary of the actions required for each of these systems is summarised in the following sections.

11.7.2 Water Control and Removal in the Supernatant Pond

Shutdown of the decant pump will mean that the level of the water in the supernatant pond will slowly begin to rise if tailings continue to be discharged. Daily visual inspection of the supernatant pond level will be required. While, the available storage volume is very large, it is recommended that temporary power facilities be installed if power cannot be reinstated within seven days.

11.7.3 Underdrainage Pumping System

Shutdown of the underdrainage pump will mean that the head of water overlying the underdrainage system will increase, and consequently the potential for seepage will also increase. If the power outage is likely to be for more than seven days then an emergency plan should be initiated to supply power to the underdrainage pump.

On resumption of power all pumps and controls should be checked to ensure they are operating correctly.

11.7.4 Tailings Pumping System

Upon loss of power, the tailings pumping system will shut down. It is expected that, during normal operations / brief shutdowns, the tailings will be re-mobilised readily on re-commencing pumping. For extended shutdowns (>12 hrs) it is recommended that the pipe be flushed. In the event that the tailings cannot be re-mobilised, the pipeline(s) will need to be flushed and drained by manual valves into the Plant Site event pond or TSF.

Discontinuing tailings discharge will have no significant effect on the TSF operation. Rainfall Runoff will continue to report to the supernatant pond.

11.8 EXCESSIVE DUST

Dust is a potential hazard both to site personnel and the surrounding environment and therefore should be controlled throughout TSF operation.

There are a number of distinct operations and effects associated with TSFs that have the potential to create dust emissions. The potential sources of dust are:

- Wind.
- Movement of vehicles around the site.
- Material excavation, handling and tipping operations.
- Rehabilitation works.

The following dust measures are considered to be adequate for the control of dust emissions from the TSF. These are:

- Cyclic deposition of tailings around the entire perimeter of the facility to ensure that the tailings beach remains moist. Relocation of the discharge location on a more regular basis may be required during hot windy conditions.
- Regular and adequate employment of water spraying on unsurfaced areas to reduce dust emissions. The need for this control will be assessed continually, based upon on-site observations, weather conditions and the potential for dust emission across the site. In particular, dry conditions with high wind speeds would be a ‘high risk’ situation.
- Cessation of a particular operation or an amendment to an operational procedure, when dust cannot be controlled.
- Implementation of a speed limit around the TSF (suggested 20 km/h). This should be enforced to reduce the potential for the disturbance of “bulldust”.
- Progressive rehabilitation and establishment of vegetative cover on the perimeter embankment downstream face as soon as practicable during operation. In addition, temporary revegetation may be considered in higher dust risk areas.

If it is considered essential that operations susceptible to dust are undertaken, and personnel are to be exposed to elevated dust levels, appropriate precautions must be undertaken which can include, but are not limited to, the following:

- Small localised dust suppression, including mist spray.
- Supply and wearing of appropriate dust masks.
- Change and washdown facilities separate from other personnel.
- Personnel dust monitors.
- Restriction of working periods in elevated dust environments.

The TSF operators, or any contractors working at the TSF shall conduct regular audits of dust emissions and stop work if dust emissions are considered excessive or have the potential to cause a safety or environmental problem.

12. SAFETY IN DESIGN

12.1 GENERAL

As part of the requirements for the design of the TSF facility it is the responsibility of everyone involved to reduce risks associated with the facility as much as practicable.

The TSF will go through a number of phases in its life cycle as outlined below:

Phase 1:	Initial concept development and design.
Phase 2:	Initial construction including installation of equipment, pipework etc.
Phase 3:	Discharge of tailings into Cell 3 (Stage 1 and 2) and operation of water recovery and control systems.
Phase 4:	Review of operating data and design of Cell 4 (Stage 1 and 2).
Phase 5:	Construction of Cell 4 (Stage 1 and 2).
Phase 6:	Discharge of tailings.
Phases 7 to 32:	Repeat of Phases 4 to 6 for stages 3 to 9.
Phase 33:	Review of operating data and final design of facility closure.
Phase 34:	Construction of closure components.
Phase 35:	Monitoring and reporting on compliance with closure criteria requirements.

12.2 DELINEATION OF RESPONSIBILITY

Each phase has separate requirements and may be under the control of different stakeholders. Table 12.1 provides a list of responsible parties for each of the current phases and an outline of the technical requirements for the responsible parties for future phases.

It should be noted that as the facility designer, KP will provide a design for all stages of the facility based on projected throughput and other data. This does not remove the need for design review and detailed documentation development for each future stage.

Table 12.1: Designated responsible parties

Stage	Design	Construction	Operation
1	Designer: Knight Piésold Pty Ltd Client: Evolution Mining	Geotechnical Engineer: Knight Piésold Pty Ltd Contractor: TBA Client: Evolution Mining Civil Superintendent: Evolution Mining	Operator: Evolution Mining
2 – 10	To be designated (refer to Note 1)	To be designated (refer to Note 2)	Operator (refer to Note 3)
Closure	To be designated (refer to Note 2 and 4)	To be designated (refer to Note 2)	Operator (refer to Note 3)

Note 1: Review of operating parameters and design of facility stages and closure requires selection of an appropriate engineering firm with experience in tailings management and civil engineering fields to act as the Engineer of Record (EoR) for the facility.

Note 2: Client Supervisor responsibility requires selection of an appropriate engineering firm with experience in supervision of civil engineering/earthworks construction.

Contractor responsibility requires selection of an appropriate construction company with experience in construction of civil engineering facilities particularly construction of dams and interaction with mining fleet operations.

Note 3: The current operator of the mine is Evolution Mining, and it is assumed that their responsibility will be extended to include the operation of the TSF.

Note 4: The designer of the closure phase will also need to include experience in the design of TSF shutdown and closure / rehabilitation requirements.

12.3 INCORPORATION OF SAFETY COMPONENTS IN DESIGN STAGE

12.3.1 General

There is a hierarchy of control measures to eliminate or reduce risks as follows:

1. Elimination.
2. Substitution.
3. Isolation.
4. Engineering controls.
5. Administrative controls.
6. Personal protective equipment.

For the storage of tailings there are a number of minimum requirements of the facility including embankments, methods for delivery of the tailings and removal of surplus water that cannot be eliminated. As a result, many of the hazards associated with the facility cannot be eliminated / substituted and engineering and administrative control systems are required.

12.3.2 Engineering Controls

The design has incorporated a number of design aspects to reduce risks associated with the facility as follows:

- The site selection resulting in a location remote to current and proposed mine and public infrastructure.
- Downstream embankment profiles have been used for Stages 1 and 2 to increase the embankment factor of safety.
- The embankment has been designed with low permeability zones to reduce seepage flow.
- A 4 metre deep cut-off trench has been included under the embankment to reduce seepage flows through the foundation material.
- Drains have been incorporated into the facility upstream toe to increase tailings densities near the embankment, reduce the phreatic surface and reduce seepage losses.
- An extensive, well graded central underdrainage system has been incorporated into the facility basin to maximise water removal from the tailings mass.
- Conservative parameters and safety factors have been used in the design.
- Design includes safety berms for all embankment crest areas and access roads.
- Testing of the tailings mass is specified in advance of upstream construction to demonstrate adequate strength for this form of construction.
- Additional embankment buttressing has been allowed for as part of the Stage 5 embankment raise.
- A comprehensive monitoring instrumentation programme has been allowed for which includes monitoring bores, vibrating wire piezometers, standpipe piezometers and survey pins.
- Surface water management has been incorporated into the design to limit the catchment reporting to the downstream embankment toe.

12.3.3 Knowledge Transfer To Downstream Responsible Parties

As the designer it is necessary to provide a clear understanding to the responsible parties for the construction and operational phases regarding the assumptions made in the design. Primarily knowledge transfer is achieved by providing various documents outlining construction requirements and management procedures.

These include:

Construction

- Provision of construction drawings for Stage 1 construction.
- A technical specification covering all aspects of construction of the facility including QA/QC requirements.
- Specification for QA testing separate from the Contractor.

Operation

- An operating manual outlining deposition concepts and targets, minimum monitoring and maintenance requirements and required inspection levels and frequency.

12.3.4 Ongoing Review and Design Reassessment

In order to ensure that the original design intent is met or alternatively that changes to the intent are backed up with detailed design work, the life cycle incorporates a series of regular checks on the operation and design. These include the following:

- Annual audits of the facility by a competent geotechnical engineer to comply with the requirements of the ANCOLD and DMIRS guidelines (Refs. 2 and 4 respectively).
- A design phase for each subsequent stage to involve a review of operating parameters to date and any required modifications to the design based on forward projections for the next stage.
- Testing of rehabilitation and closure requirements during the operating phase with ongoing monitoring after closure (as outlined in the closure documentation).

The ongoing review of the operation and design will ensure that the facility can be modified as required for any changes to the conditions and operation of the mine site.

13. CLOSURE AND REHABILITATION

13.1 CLOSURE CONCEPTS

During operation of the facility a detailed closure plan will be developed. A closure criteria checklist will be produced consisting of general targets and specific items for each government authority, if required, developed through interaction with the relevant authorities.

The general concepts for the closure of the TSF include:

i. No pipework, valves or tailings facility infrastructure to remain in the rehabilitated area.
ii. Closure materials selected and designed to reduce long term erosion.
iii. All batters reshaped to a suitable slope for rehabilitation and long-term stability.
iv. Tailings surface to be water harvesting with provision of a spillway to manage extreme rainfall events.
v. Placement of a low-permeability layer over the tailings surface to reduce infiltration and therefore seepage from the base of the facility.
vi. Placement of a closure cover that prevents release of tailings to the environment whilst also providing a suitable growth medium for establishment of vegetation.
vii. Surface and slopes planted with suitable local provenance vegetation.
viii. Ongoing monitoring of movement pins, piezometers and monitoring bores until consistent conditions are achieved.

13.2 EMBANKMENT PROFILE

At the end of the operation of the TSF, the downstream faces of the TSF perimeter embankment will have a slope of 1V:4H up to Stage 5, followed by a 10 m wide bench and 1V:4H above that to the final crest level. The adopted downstream profile will be inherently stable under both normal and seismic loading conditions, will provide a stable drainage system, and will allow for rehabilitation and re-vegetation.

The final crest and associated bunding will be adjusted as required to ensure sufficient freeboard above the closure surface to store a PMP event on the facility.

Within the facility, slots will be excavated through the crests of the divider embankment and decant causeways to allow uninterrupted flow of water around the facility surface and reduce the amount of ponding which could occur against internal embankments.

13.3 TAILINGS PROFILE

The facility is to be water harvesting on closure with captured water consumed either by established vegetation or through evaporation.

On completion of deposition, the final tailings surface will slope towards the centre of each cell thereby providing a water harvesting profile. As such no reprofiling of the tailings surface is required.

Rehabilitation of the tailings surface will commence upon termination of deposition into the facility and will be completed to comply with the rehabilitation methodology outlined by Evolution in the Site Closure Plan (TSF Extract provided in Appendix K).

13.4 SPILLWAY

Whilst the facility will be water harvesting and sufficient storage will be available on the facility surface to store a PMP event, once operations have ceased there will be no on-site presence or equipment to dewater the facility and increase storm storage capacity following an extreme event. In order to maintain integrity of the structure in the unlikely scenario of successive extreme events, a spillway will be provided from the TSF with discharge directed into the White Foil Pit as a soak-away.

The spillway will be sized for flows generated by a 1 in 1,000 AEP event assuming that the TSF has no available storage and all rainfall reports directly to the spillway.

The spillway will be rock lined to reduce scour of the channel. Longitudinal grades on the channel will be adjusted at detailed design stage, through positioning of the spillway inlet and routing to the pit, such that flows are reduced to a velocity where rock armouring provides adequate erosion resistance.

13.5 REHABILITATION

13.5.1 Rehabilitation Design Criteria

Geochemical testing of tailings samples has shown the material to be non-acid forming. However, there are some elemental enrichments which, if released, could affect the local environment. As such a cover system is required that prevents release of the tailings solids to the environment.

The tailings will have high salinity due to the hypersaline process water used. A capillary break is necessary to prevent upward migration of salt which may impact the re-established vegetation over time. A sufficient thickness of growing medium will also need to be provide to prevent plant roots extending down into the saline materials.

13.5.2 Nominal Cover Design

The proposed capping cover system has been developed by La Mancha (the former owner of Mungari Gold Mine) for the Cell 1 and Cell 2 design. A copy of the design is provided in Appendix K and will form the basis of design prior to further investigation during closure of Cell 1 and Cell 2.

The capping layer will consist of the following components (starting from the base of the cover):

i. Low Permeability Layer

1.5 to 2.0 m of low permeability oxide waste will be placed to reduce infiltration into the tailings mass.

ii. Waste Rock Layer

0.6 m of non-acid forming waste rock to be placed as the capillary break.

iii. Topsoil

Over the entire surface the topsoil that has been stripped from the area will be placed back over the top of the waste rock layer. The thickness of the layer will be nominally 0.3m.

iv. Wood Mulch

Mulch generated from the vegetation clearance pre-construction will be spread over the topsoil at an average thickness of 0.1 m. The mulch will be mixed with the topsoil when the surface is ripped and cultivated prior to seeding.

v. Vegetation

The surface will be seeded and/or planted with suitable local provenance vegetation.

13.5.3 Embankment Face Rehabilitation

The downstream face of the TSF perimeter embankments will be constructed of natural materials from borrow and/or non-acid forming mine waste. As such rehabilitation of the batters will require placement of topsoil and mulch only.

13.6 CLOSURE SEQUENCE

The closure of the facility will proceed through the following steps:

- The final supernatant pond will be removed via evaporation on the beach.
- The tailings surface will be allowed to dry until it has sufficient strength to provide access.

- The decant tower sections will be removed to below tailings level and sealed.
- Embankment external faces rehabilitated.
- The cover design placed over the tailings surface.
- The underdrainage and toe drain system will continue to be operated.
- Revegetation for the tailings cover will be undertaken.

The underdrainage system will need to continue to operate for some time after completion of capping and re vegetation to drain excess water from the tailings deposit. The quantity of water recovered from the underdrainage system will reduce with time and experience with similar facilities suggests that water recovery may continue for a period of several years following closure. During this time, water from the underdrainage will be pumped back onto the facility for evaporation. After the flow ceases, the underdrainage pump will be removed and the underdrainage riser pipe backfilled and sealed as part of the rehabilitation process.

All monitoring pins, piezometers and standpipes will need to be retained for ongoing monitoring of the TSF post closure. The instrumentation will need to be raised to match the final rehabilitated surface and permanent covers installed to protect the instruments from damage and/or ingress of debris.

14. RISKS AND OPPORTUNITIES

14.1 GENERAL

An evaluation of risks and opportunities for the project was conducted for the design presented in this report. The risks generally cover technical aspects of the work although some cost aspects are also addressed.

14.2 RISKS

14.2.1 Tailings Beach Slope

It was assumed that the tailings beach slope will average 0.83% (1V:120H) over the TSF. If the beach slope is steeper than predicted or concave in shape, then for a given embankment level, the storage capacity for tailings will decrease, and the stormwater storage capacity will increase. Conversely, if the beach slope is flatter than predicted, then the storage capacity for tailings will increase, and the stormwater storage capacity will decrease.

The current TSF design can accommodate a beach slope flatter than 0.83%. However subsequent raise construction will need to be expedited if a steeper beach slope occurs. Regular beach topographical surveys will be needed to monitor beach slopes and inform planning of future embankment raises.

14.2.2 Upstream Construction

The design allows for upstream construction from Stage 4 to Stage 10 using natural borrow material for construction. Whilst testing and analysis undertaken to date shows that upstream construction on the tailings beach is possible, validation testing (such as CPT and tailings laboratory testing) will be required of the tailings beach prior to constructing an upstream raise. There is a risk that, if there is inadequate strength gain in the tailings beach or the phreatic surfaces are too high, downstream or centreline construction may have to be adopted beyond Stage 3. In the event this is the case, an allowance for downstream construction has been made on the facility footprint.

14.2.3 Tailings Geochemistry

Geochemical testing of the tailings should be continued at points throughout the life of the facility, particularly when different ore bodies or process plant blending is occurring, to ensure that initial testing remains valid. Measurement will need to continue as part of ongoing operations to ensure information is available on the geochemical behaviour of the tailings.

14.2.4 Life of Mine Planning

Any changes to the life of mine plan may impact upon the tailings storage requirements for the site. Issues to be considered are specific proportions of tailings types and blends, facility capacity, and construction timing. Any significant increases in total tonnages may require an expansion of the current TSF which would require additional approvals. Any reductions in total tonnage will result in a lower embankment height and can be accommodated.

14.3 OPPORTUNITIES

14.3.1 Recovery of Tailings for Paste Backfill

The Cell 3 and Cell 4 design assumes no tailings will be removed from the facility during the life of mine, as a conservative approach to ensure the design meets the required capacity. Cell 1 and Cell 2 shall operate to include tailings recovery once Cell 3 and Cell 4 are operational, providing additional storage capacity through tailings deposition when required (likely during construction raises of Cell 3 and Cell 4).

14.3.2 Alternate Decant System

To limit the cost in raising the decant structure on an annual basis, an alternative method of supernatant water extraction in the form of decant turrets could be considered. The turrets are manufactured by RBH Engineering and act as a floating water intake device that can theoretically operate at shallow pond depths. In conjunction with this, a pump(s) would be located on the embankment adjacent to the pond and draw the water from the turret.

Limitations to the turret includes, but are not limited to:

- More frequent monitoring and control of the infrastructure to ensure the turret remains central to the supernatant pond.
- It will be difficult to extract water from a small supernatant pond and may result in bogging of the turret in the tailings.
- Operational depth of water is unknown.

14.3.3 Reduction in Embankment Final Elevation

As outlined in the previous section, additional storage capacity may become available during operations due to paste reclaim. This in turn could result in a reduction in the final crest elevation required for Cell 3 and Cell 4 and thus reduce overall construction cost.

14.3.4 Use of Tailings in Embankment

It is common practice in Western Australian gold projects to utilise tailings (won from the TSF basin) for TSF raise construction. This would result in cost savings due to the

significantly shorter haul distance for Zone A raise construction, as opposed to a civil contractor winning mined natural material from borrow.

The suitability of tailings for use in embankment construction will be assessed during operation particularly with regard to geochemical behaviour and stability, using data gathered from TSF monitoring and maintenance programmes. An initial assessment was conducted in 2018 (Ref. 12) and found that the permeability was generally an order of magnitude higher than the current Zone A hence could not fully replace this zone.

14.3.5 Alternative Borrow Sources

For Stages 2 to 10 the design assumes that all embankment general fill materials (Zones A and C) will be sourced from the borrow area north and east of Cell 1. In the event that the area is not available, alternative borrow sources could be considered west of the new facility to reduce the haul distance necessary for the fill materials.

14.3.6 Cell 3 Construction ahead of Cell 4

Cell 3 has been designed such that it can be constructed and operated independent of Cell 4 being constructed. In the event that the required storage capacity is reduced for the life of mine, there is opportunity for Cell 4 not to be constructed and Cell 3 utilised in conjunction with Cell 1 and Cell 2 only.

14.3.7 Surface Monitoring

Further settlement monitoring instrumentation could be implemented as part of the Cell 3 and Cell 4 design to measure settlement/movement within the embankment.

These include, but are not limited to:

- Automated Total Station Monitoring. This includes precise optical monitoring that requires total station and prisms located at various points on the embankment, linked via telemetry to processing software that will provide a live measurement.
- Satellite Mapping. This includes imagery obtained by satellite over a given timeframe, to generate maps of surface deformation or digital elevation. Whilst it may be effective in developing monthly trends, it cannot provide a live measurement.
- Embankment inclinometers and extensometers can be used to measure vertical deformation and horizontal deflection in boreholes within the embankment. These can be manual readings or permanent installations.

14.3.8 Sampling for closure design

Ongoing sampling of tailings and embankment material during TSF operation will allow for more accurate characterisation of material at the Mungari site. This will ensure accurate closure cover modelling parameters and trials can be developed based on the proposed closure and rehabilitation design.

15. REFERENCES

1. Guidelines on the Consequence Categories for Dams, ANCOLD, October 2012.
2. Guidelines on Tailings Dams – Planning, Design, Construction, Operation and Closure, ANCOLD, Revision 1, July 2019.
3. Guidelines for Design of Dams and Appurtenant Structures for Earthquake, ANCOLD, May 2019.
4. Department of Mines, Industry Regulation and Safety (DMIRS) "Code of Practice – Tailings storage facilities in Western Australia" 2013.
5. Department of Mines, Industry Regulation and Safety (DMIRS) *"Guide to the preparation of a design report for tailings storage facilities (TSFs)"*, August 2015.
6. Department of Mines, Industry Regulation and Safety (DMIRS) *"Guide to Departmental Requirements for the Management and Closure of Tailings Storage Facilities (TSFs)"*, August 2015.
7. Soilwater Consultants, Ref. EVN-004-1-1, *Mungari TSF Cell 3 Soil Characterisation*, January 2019.
8. Native Vegetation Solutions, *Mungari TSF 2 Level 2 Flora and Vegetation Survey*, May 2017.
9. Terrestrial Ecosystems, *Level 1 Fauna Risk Assessment for La Mancha Resources White Foil Gold Deposit Project Area.* March 2010.
10. RPS Group, Ref. EWP1725H004/008b, *Mungari TSF Expansion – Groundwater Impact Assessment*, 2017.
11. Government of Western Australia, *Mine Safety and Inspection Act*, 1994.
12. Knight Piésold, *Mungari Gold Project – Tailings Suitability Testing*, Memorandum Ref. PE18-00431, 14th May 2018.

DRAWINGS

MUNGARI GOLD PROJECT

TAILINGS STORAGE FACILITY
CELLS 3 & 4 EXPANSION

FEASIBILITY STUDY
DECEMBER, 2019

Prepared for:

EVOLUTION MINING LTD.

Evolution MINING

Prepared by:

Knight Piésold CONSULTING

A.B.N. 67 001 040 419
A.C.N. 001 040 419

Knight Piésold Pty. Ltd.
Level 1, 184 Adelaide Terrace
EAST PERTH, WA 6004
AUSTRALIA

REVISIONS								
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B	11/11/2019	ISSUED FOR FEASIBILITY STUDY UPDATE	UT	BJC	BJC	DJTM		
C	09/01/2020	ISSUED FOR FEASIBILITY STUDY UPDATE - DECEMBER	PRK	BJC	DSS	BAS		

SHEET SIZE A3
REFERENCES

DRAWING No.	DRAWING TITLE

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MUNGARI GOLD PROJECT
TAILINGS STORAGE FACILITY - CELLS 3 & 4 EXPANSION
TITLE PAGE

SCALE N.T.S.
STATUS: FS
DRAWING NUMBER 801-137-C3000-001
REV C

Uncontrolled if Printed

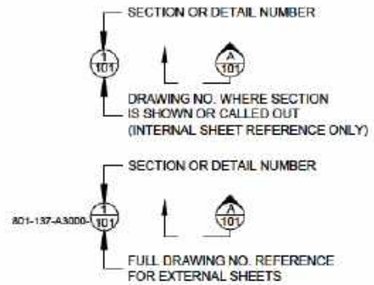
COMMON LEGEND

EXISTING GROUND SURFACE OR BOTTOM OF EXCAVATION

260 EXISTING GROUND CONTOUR AND ELEVATION (IN METRES)

SLOPE INDICATOR

SLOPE INDICATOR (HORIZONTAL TO VERTICAL)



ABBREVIATIONS

APPROX. ≈	APPROXIMATELY	N.T.S.	NOT TO SCALE
BOP	BOTTOM OF PIPE	OD	OUTSIDE DIAMETER
℄	CENTRELINE	OMC	OPTIMUM MOISTURE CONTENT
CPT	CORRUGATED POLYETHYLENE TUBING	PC	POINT OF CURVATURE
		PI	POINT OF INTERSECTION
DIA. Ø	DIAMETER	PT	POINT OF TANGENT
ELEV	ELEVATION	PVC	POLYVINYL CHLORIDE
HLF	HEAP LEACH FACILITY	RC	REINFORCED CONCRETE
HDPE	HIGH DENSITY POLYETHYLENE	RCP	REINFORCED CONCRETE PIPE
ID	INSIDE DIAMETER	REQ'D	REQUIRED
IL	INVERT LEVEL	R.L.	REDUCED LEVEL
IWL	INTEGRATED WASTE LANDFORM	SDR	STANDARD DIMENSIONAL RATIO
LCRS	LEAKAGE COLLECTION & RECOVERY SYSTEM	SCH	SCHEDULE
		SCS	SEDIMENT CONTROL STRUCTURE
LLDPE	LINEAR LOW DENSITY POLYETHYLENE	SMDD	STANDARD MAXIMUM DRY DENSITY
MH	MANHOLE	SOL	SETTING OUT LINE
MAX.	MAXIMUM	SOP	SETTING OUT POINT
MIN.	MINIMUM	TSF	TAILINGS STORAGE FACILITY
MMDD	MAXIMUM MODIFIED DRY DENSITY	TYP.	TYPICAL
NOM	NOMINAL	WSD	WATER STORAGE DAM

GENERAL NOTES

1. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.
2. ALL COORDINATES STATED IN GRID PROJECTION: MGA94 ZONE 51.
3. ALL ELEVATIONS IN METRES, RELATIVE TO MEAN SEA LEVEL.
4. DRAWINGS ARE NOT TO BE SCALED.
5. DRAWINGS TO BE READ IN CONJUNCTION WITH THE TECHNICAL SPECIFICATIONS.

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EMBANKMENT LAYOUT - STAGE 1 (STARTER)	C	801-137-C3000-101
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EMBANKMENT SECTIONS AND DETAILS - SHEET 2	C	801-137-C3000-302
EMBANKMENT SECTIONS AND DETAILS - SHEET 3	A	801-137-C3000-303
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WATER RECLAMATION SECTIONS AND DETAILS - SHEET 1	B	801-137-C3000-501
WATER RECLAMATION SECTIONS AND DETAILS - SHEET 2	B	801-137-C3000-502
WATER RECLAMATION SECTIONS AND DETAILS - SHEET 3	B	801-137-C3000-503
WATER RECLAMATION SECTIONS AND DETAILS - SHEET 4	B	801-137-C3000-504
WATER RECLAMATION SECTIONS AND DETAILS - SHEET 5	B	801-137-C3000-505
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TYPICAL SPIGOT PIPEWORK DETAILS	B	801-137-C3000-720
TYPICAL SPIGOT CLAMP DETAILS	A	801-137-C3000-725
CULVERT LAYOUT	C	801-137-C3000-800
CULVERT SECTIONS AND DETAILS	B	801-137-C3000-821
MONITORING INSTRUMENTATION LAYOUT	C	801-137-C3000-900
MONITORING INSTRUMENTATION DETAILS	B	801-137-C3000-921

SHEET SIZE A3

REFERENCES

DRAWING No.	DRAWING TITLE

REVISIONS

REV	DATE	DESCRIPTION	DRN	DESIGN	CKD	APP	CLIENT APP
A	04/09/2019	ISSUED FOR FEASIBILITY STUDY	PAN	BJC	BJC	DJTM	
B	11/11/2019	ISSUED FOR FEASIBILITY STUDY UPDATE	UT	BJC	BJC	DJTM	
C	09/01/2020	REVISED INDEX OF DRAWINGS	PRK	BJC	DSS	BAS	

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	DATE	DESIGNED	CHECKED	APPROVED	CLIENT APP'D

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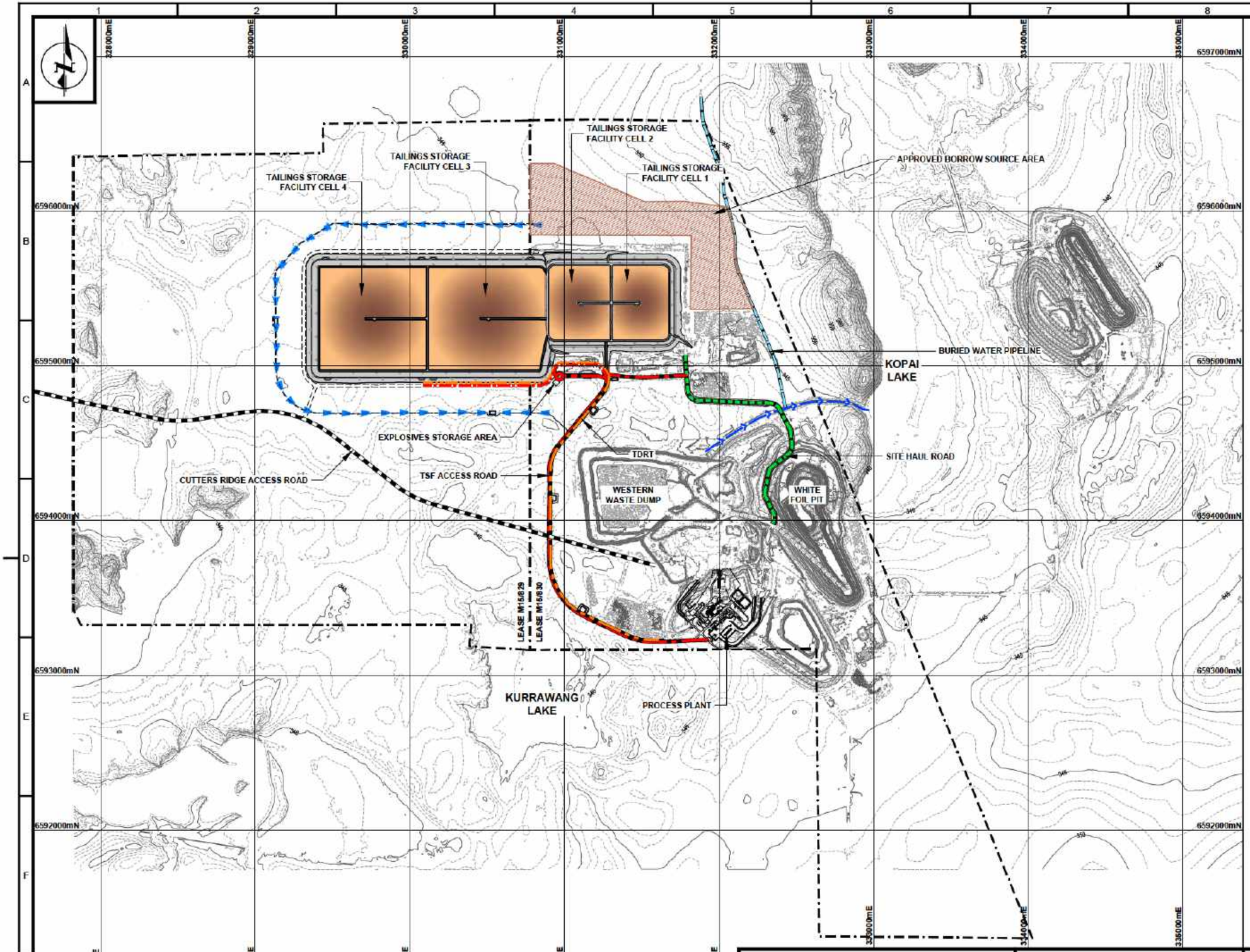
MUNGARI GOLD PROJECT
TAILINGS STORAGE FACILITY - CELLS 3 & 4 EXPANSION
CONTENTS, COMMON LEGEND AND ABBREVIATIONS

SCALE N.T.S.
STATUS: FS
DRAWING NUMBER 801-137-C3000-002
REV C

287 410



LEGEND:

- LEASE BOUNDARY
- BURIED WATER PIPELINE
- EXISTING SITE ACCESS ROAD
- EXISTING SITE HAUL ROAD
- EXISTING TAILINGS AND DECANT RETURN PIPELINE CONTAINMENT CORRIDOR (TDRT)
- DIVERSION CHANNEL
- PROPOSED CUTTERS RIDGE ACCESS ROAD
- PROPOSED TAILINGS AND DECANT RETURN PIPELINE CONTAINMENT CORRIDOR AND ACCESS ROAD

NOTES:

1. 1m CONTOUR INTERVALS SHOWN. EXTERNAL TOPOGRAPHICAL DATA PROVIDED BY EVOLUTION MINING, MAY 2018.
2. WESTERN WASTE DUMP DATA PROVIDED BY EVOLUTION MINING, FEBRUARY 2018.
3. EXISTING TAILINGS STORAGE FACILITY CELLS 1 AND 2 FINAL (STAGE 6) EMBANKMENT SHOWN.
4. TAILINGS STORAGE FACILITY CELLS 3 AND 4 FINAL STAGE SHOWN.

SCALE (METRES) 600 300 100 0 250 500 750 1000 — 1:25,000 (A3)

ORIGINAL STAMPED IN RED

REV	DATE	DESCRIPTION	DRN	DESIGN	CKD	APP	CLIENT APP
A	04/09/2019	ISSUED FOR FEASIBILITY STUDY	PAN	BJC	BJC	DJTM	
B	11/11/2019	ISSUED FOR FEASIBILITY STUDY UPDATE	UT	BJC	BJC	DJTM	
C	09/01/2020	ADDED CUTTERS ROAD, REVISED PROPOSED TDRT	PRK	BJC	DSS	BAS	

SHEET SIZE A3

REFERENCES

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	DATE	DESIGNED	CHECKED	APPROVED	CLIENT APP'D

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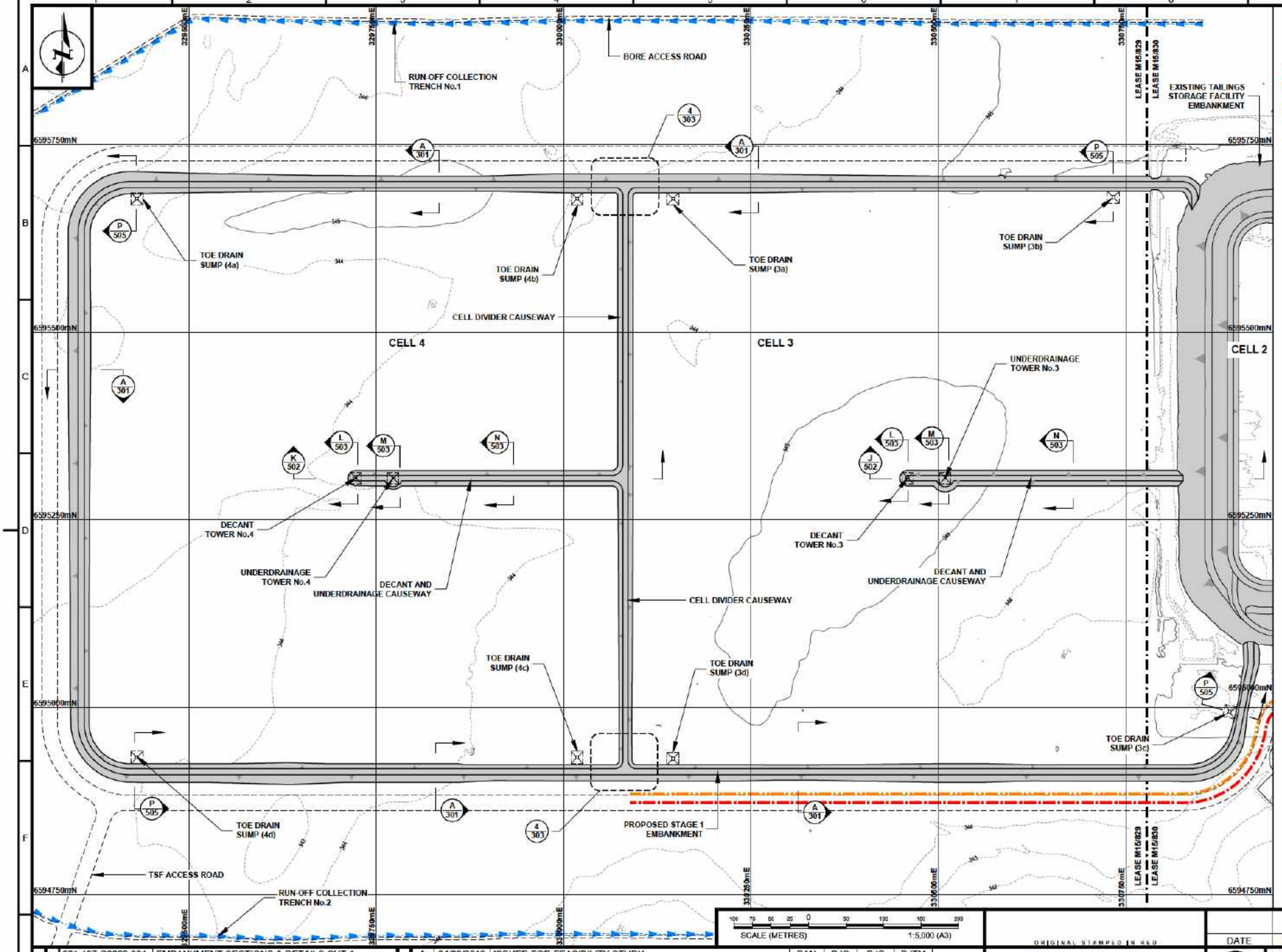
EVOLUTION MINING LTD.
MUNGARI GOLD PROJECT
TAILINGS STORAGE FACILITY - CELLS 3 & 4 EXPANSION
SITE GENERAL ARRANGEMENT PLAN

SCALE 1:25,000
STATUS: FS
DRAWING NUMBER **801-137-C3000-050**
REV **C**

287 410



LEGEND:

- LEASE BOUNDARY
- EXISTING SITE ACCESS ROAD
- PROPOSED TAILINGS AND DECANT RETURN PIPELINE CONTAINMENT CORRIDOR AND ACCESS ROAD
- SURFACE WATER RUN-OFF CONTAINMENT DITCH

NOTES:

1. 1m CONTOUR INTERVALS SHOWN. EXTERNAL TOPOGRAPHICAL DATA PROVIDED BY EVOLUTION MINING, MAY 2018.
2. EXISTING TAILINGS STORAGE FACILITY CELLS 1 AND 2 FINAL (STAGE 6) EMBANKMENT SHOWN.

SHEET SIZE A3

REFERENCES

DRAWING No.	DRAWING TITLE
801-137-C3000-301	EMBANKMENT SECTIONS & DETAILS-SHT 1
801-137-C3000-303	EMBANKMENT SECTIONS & DETAILS-SHT 3
801-137-C3000-502	WATER RECLAMATION SECTIONS & DETAILS-SHT 2
801-137-C3000-503	WATER RECLAMATION SECTIONS & DETAILS-SHT 3
801-137-C3000-505	WATER RECLAMATION SECTIONS & DETAILS-SHT 5

REVISIONS

REV	DATE	DESCRIPTION	DRN	DESIGN	CKD	APP	CLIENT APP
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B	11/11/2019	ISSUED FOR FEASIBILITY STUDY UPDATE	UT	BJC	BJC	DJTM	
C	09/01/2020	ADDED ACCESS ROADS	PRK	BJC	DSS	BAS	

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MUNGARI GOLD PROJECT
TAILINGS STORAGE FACILITY - CELLS 3 & 4 EXPANSION
EMBANKMENT LAYOUT - STAGE 1 (STARTER)

SCALE 1:5,000
STATUS: FS
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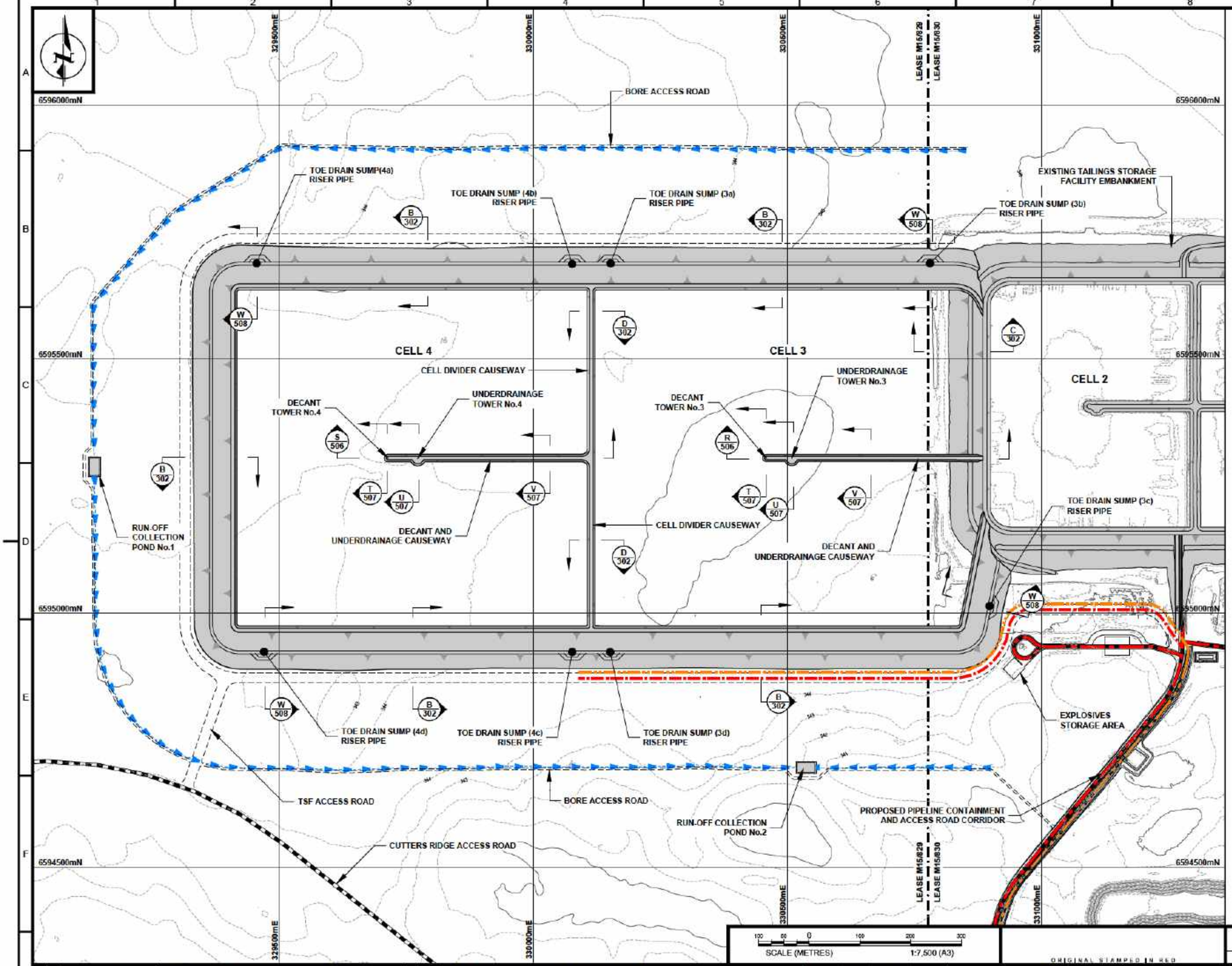

LEGEND:

- LEASE BOUNDARY
- EXISTING SITE ACCESS ROAD
- PROPOSED CUTTERS RIDGE ACCESS ROAD
- PROPOSED TAILINGS AND DECANT RETURN PIPELINE CONTAINMENT CORRIDOR AND ACCESS ROAD
- SURFACE WATER RUN-OFF CONTAINMENT DITCH

NOTES:

1. ALL COORDINATES SHOWN IN GRID PROJECTION MGA84 ZONE 51.
2. 1m CONTOUR INTERVALS SHOWN. EXTERNAL TOPOGRAPHICAL DATA PROVIDED BY EVOLUTION MINING, MAY 2018.
3. EXISTING TAILINGS STORAGE FACILITY CELLS 1 AND 2 FINAL (STAGE 6) EMBANKMENT SHOWN.

SHEET SIZE A3

REFERENCES

DRAWING No.	DRAWING TITLE
801-137-C3000-302	EMBANKMENT SECTIONS & DETAILS-SHT 2
801-137-C3000-506	WATER RECLAMATION SECTIONS & DETAILS-SHT 6
801-137-C3000-507	WATER RECLAMATION SECTIONS & DETAILS-SHT 7

REVISIONS

REV	DATE	DESCRIPTION	DRN	DESIGN	CKD	APP	CLIENT APP
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C	09/01/2020	ADDED ACCESS ROADS	PRK	BJC	DSS	BAS	

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MUNGARI GOLD PROJECT
TAILINGS STORAGE FACILITY - CELLS 3 & 4 EXPANSION
EMBANKMENT LAYOUT - STAGE 10 (FINAL)

SCALE 1:7,500
STATUS: FS
DRAWING NUMBER 801-137-C3000-110
REV C

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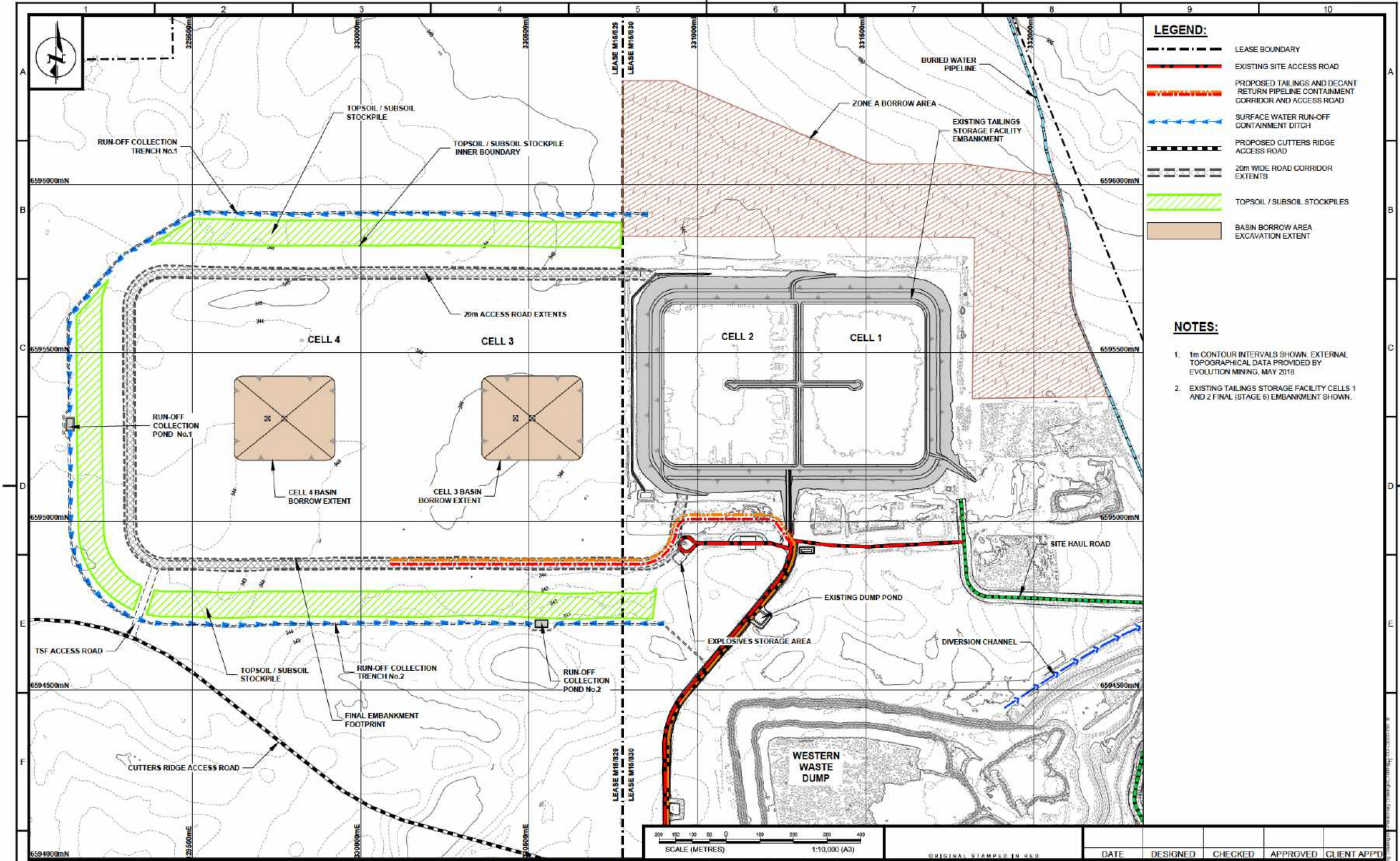

REV	DATE	DESCRIPTION	DRN	DESIGN	CKD	APP	CLIENT APP
A	11/11/2019	ISSUED FOR FEASIBILITY STUDY UPDATE	UT	BJC	BJC	DJTM	
B	09/01/2020	ADDED ACCESS ROAD, REVISED PROPOSED TDRT	PRK	BJC	DSS	BAS	

SHEET SIZE A3

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MUNGARI GOLD PROJECT
TAILINGS STORAGE FACILITY - CELLS 3 & 4 EXPANSION
SITE BORROW AND STOCKPILE AREAS LAYOUT

SCALE 1:10,000
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DRAWING NUMBER 801-137-C3000-150
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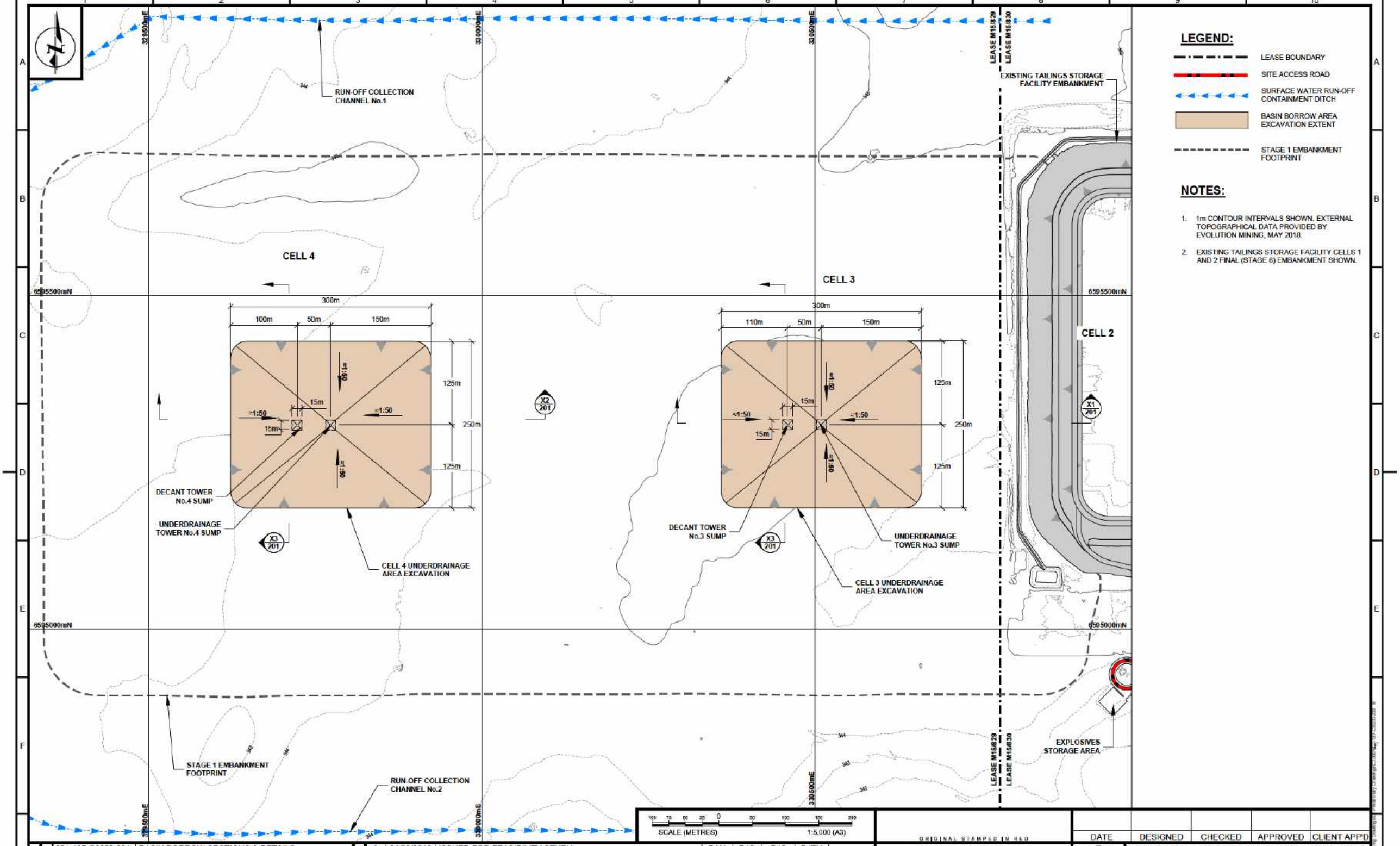

LEGEND:

- LEASE BOUNDARY
- SITE ACCESS ROAD
- SURFACE WATER RUN-OFF CONTAINMENT DITCH
- BASIN BORROW AREA EXCAVATION EXTENT
- STAGE 1 EMBANKMENT FOOTPRINT

NOTES:

1. 1m CONTOUR INTERVALS SHOWN. EXTERNAL TOPOGRAPHICAL DATA PROVIDED BY EVOLUTION MINING, MAY 2018.
2. EXISTING TAILINGS STORAGE FACILITY CELLS 1 AND 2 FINAL (STAGE 6) EMBANKMENT SHOWN.

ORIGINAL STAMPED IN RED

DATE	DESIGNED	CHECKED	APPROVED	CLIENT APP'D

SHEET SIZE A3

REFERENCES

DRAWING No.	DRAWING TITLE
801-137-C3000-201	BASIN BORROW SECTIONS & DETAILS

REVISIONS

REV	DATE	DESCRIPTION	DRN	DESIGN	CKD	APP	CLIENT APP
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B	11/11/2019	ISSUED FOR FEASIBILITY STUDY UPDATE	UT	BJC	BJC	DJTM	

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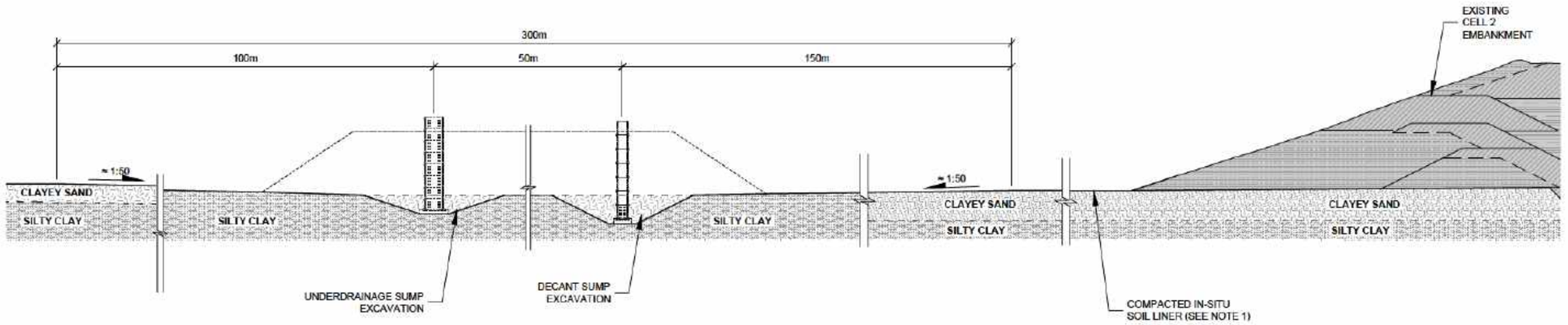
MUNGARI GOLD PROJECT
TAILINGS STORAGE FACILITY - CELLS 3 & 4 EXPANSION
BASIN BORROW AREA PLAN

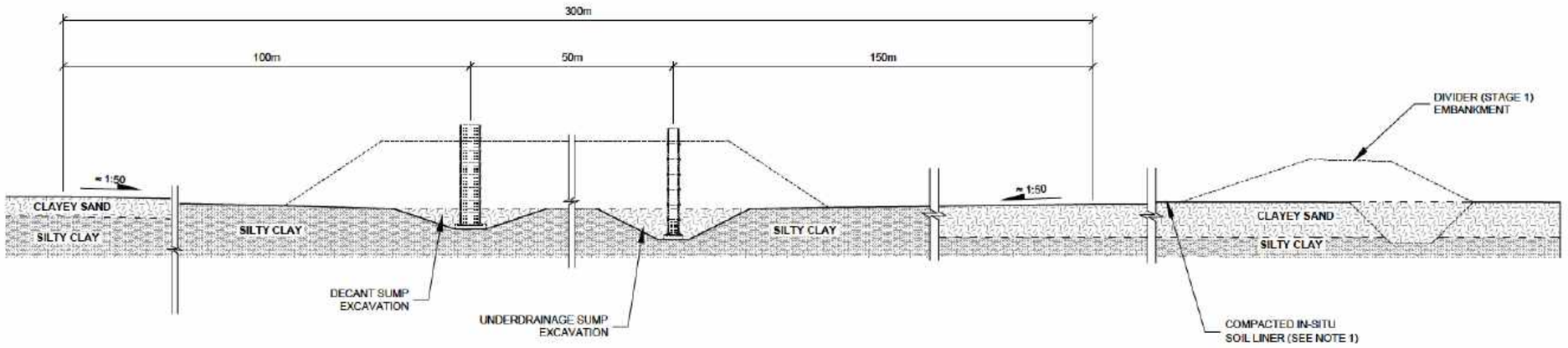
SCALE 1:5,000
STATUS: FS
DRAWING NUMBER 801-137-C3000-200
REV B



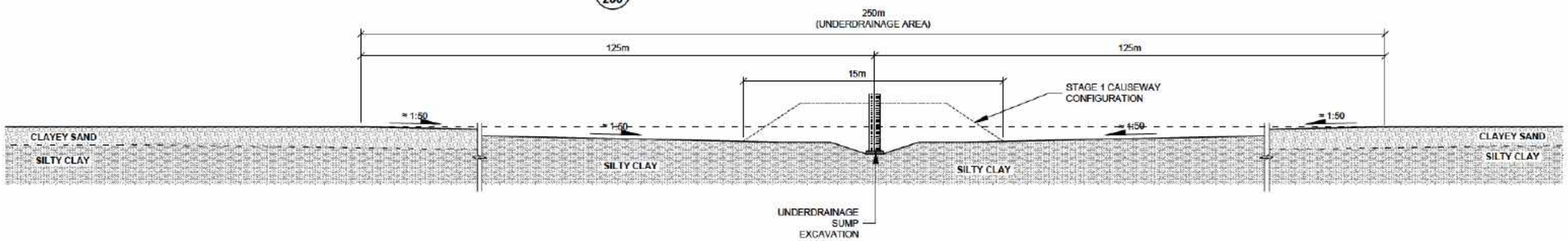
X1 / 200 (1:500) **TYPICAL CELL 3 BASIN BORROW EXCAVATION SECTION**

NOTES:

1. COMPACTED IN-SITU SOIL LINER THROUGHOUT TSF BASIN AREA (300mm).



X2 / 200 (1:500) **TYPICAL CELL 4 BASIN BORROW EXCAVATION SECTION**



X3 / 200 (1:750) **TYPICAL BASIN BORROW EXCAVATION SECTION**

REFERENCES	DRAWING No.	DRAWING TITLE
	801-137-C3000-200	BASIN BORROW AREA PLAN

REVISIONS	REV	DATE	DESCRIPTION	DRN	DESIGN	CKD	APP	CLIENT APP
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	B	11/11/2019	ISSUED FOR FEASIBILITY STUDY UPDATE	AZ	BJC	BJC	DJTM	

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	DATE	DESIGNED	CHECKED	APPROVED	CLIENT APP'D

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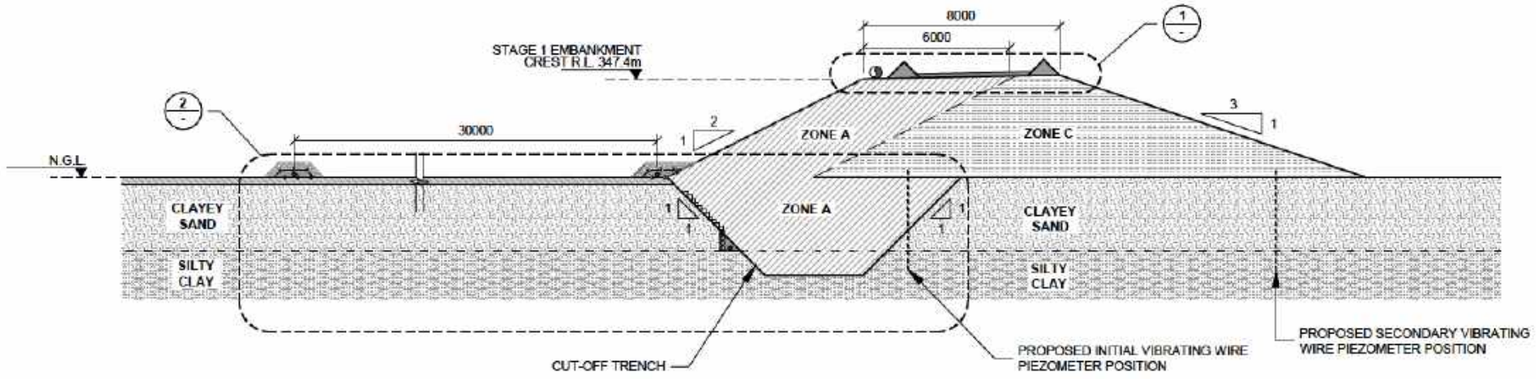
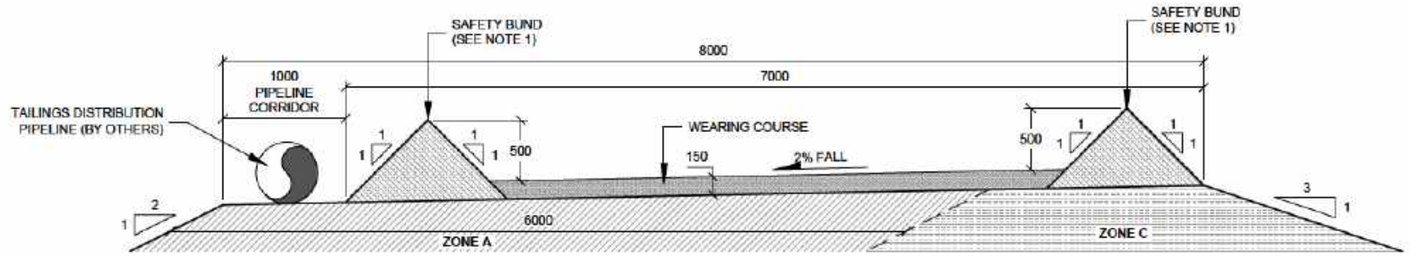
MUNGARI GOLD PROJECT
TAILINGS STORAGE FACILITY - CELLS 3 & 4 EXPANSION
BASIN BORROW SECTIONS AND DETAILS

SCALE AS SHOWN
STATUS: FS
DRAWING NUMBER: 801-137-C3000-201
REV: B

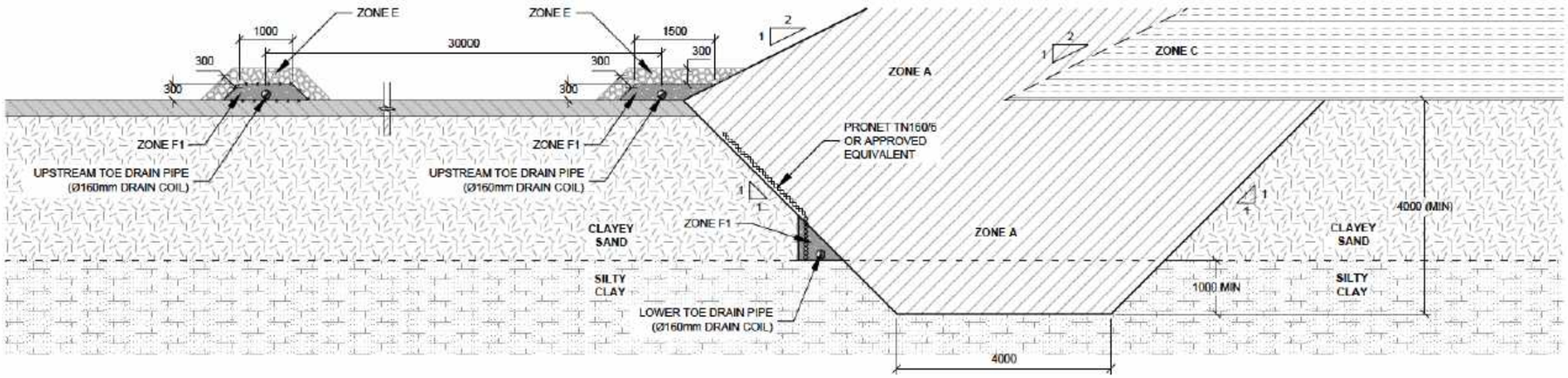
SHEET SIZE A3
287
410



A/101 **TYPICAL STAGE 1 EMBANKMENT SECTION**



1/- 1/302 **TYPICAL EMBANKMENT CREST DETAIL**



2/- 2/302 **TYPICAL CUT-OFF TRENCH AND UPSTREAM TOE DRAIN DETAIL**

NOTES:

1. SAFETY BUND TO BE CONSTRUCTED OF ZONE D (GENERAL FILL MATERIAL). BREAKS IN UPSTREAM SAFETY BUND AT 25m CENTRES TO ALLOW FOR DRAINAGE OF RAINFALL RUNOFF.
2. COMPACTED IN-SITU SOIL LINER THROUGHOUT TSF BASIN AREA (300mm).
3. CUT-OFF TRENCH TO BE EXCAVATED 4m (MIN.) INTO COMPETENT MATERIALS AS DETERMINED BY ENGINEER ON SITE.

TABLE 1:
ZONE SPECIFICATIONS SUMMARY

ZONE KEY	ZONE TYPE	DESCRIPTION	MAXIMUM LAYER THICKNESS	COMPACTION SPECIFICATION
	ZONE A	LOW PERMEABILITY FILL	300mm	98% OF STANDARD MAXIMUM DRY DENSITY -1%<OMC<+2%
	ZONE C	OXIDE WASTE	500mm	95% OF STANDARD MAXIMUM DRY DENSITY
	ZONE D	APPROVED GENERAL FILL	500mm	92% OF STANDARD MAXIMUM DRY DENSITY
	ZONE E	CLEAN ROCKFILL EROSION PROTECTION	300mm	TAMPED WITH EXCAVATOR BUCKET
	ZONE F1	DRAINAGE MEDIUM (SAND OR FINE GRAVEL)	N/A	UNIFORM DENSITY FREE OF VOIDS
	ZONE F2	DRAINAGE MEDIUM (CLEAN GRAVEL)	N/A	UNIFORM DENSITY FREE OF VOIDS
	ZONE G	CLEAN COARSE ROCKFILL	N/A	UNIFORM DENSITY FREE OF VOIDS
	MINE WASTE	MINE WASTE ROCK	N/A	UNIFORM DENSITY FREE OF VOIDS
	COMPACTED SOIL LINER	LOW PERMEABILITY MATERIAL	300mm	98% OF STANDARD MAXIMUM DRY DENSITY -1%<OMC<+2%
	WEARING COURSE	SELECTED GRAVEL	N/A	D_{MAX} = 50mm % FINES < 5

SHEET SIZE A3

REFERENCES

DRAWING No.	DRAWING TITLE
801-137-C3000-101	GENERAL ARRANGEMENT PLAN-STAGE 1
801-137-C3000-302	EMBANKMENT SECTIONS & DETAILS-SHT 2

REVISIONS

REV	DATE	DESCRIPTION	DRN	DESIGN	CKD	APP	CLIENT APP
A	04/09/2019	ISSUED FOR FEASIBILITY STUDY	PRK	BJC	BJC	DJTM	
B	11/11/2019	ISSUED FOR FEASIBILITY STUDY UPDATE	AZ	BJC	BJC	DJTM	

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DATE	DESIGNED	CHECKED	APPROVED	CLIENT APP'D

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MUNGARI GOLD PROJECT
TAILINGS STORAGE FACILITY - CELLS 3 & 4 EXPANSION
EMBANKMENT SECTIONS AND DETAILS - SHEET 1

SCALE AS SHOWN
STATUS: FS
DRAWING NUMBER 801-137-C3000-301
REV B

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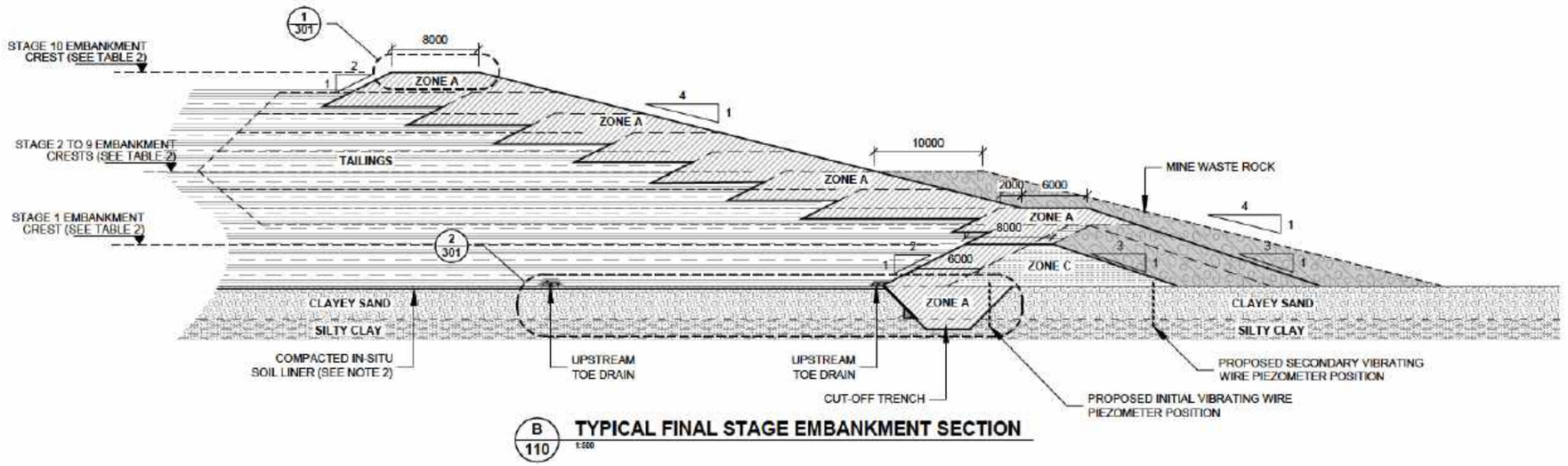
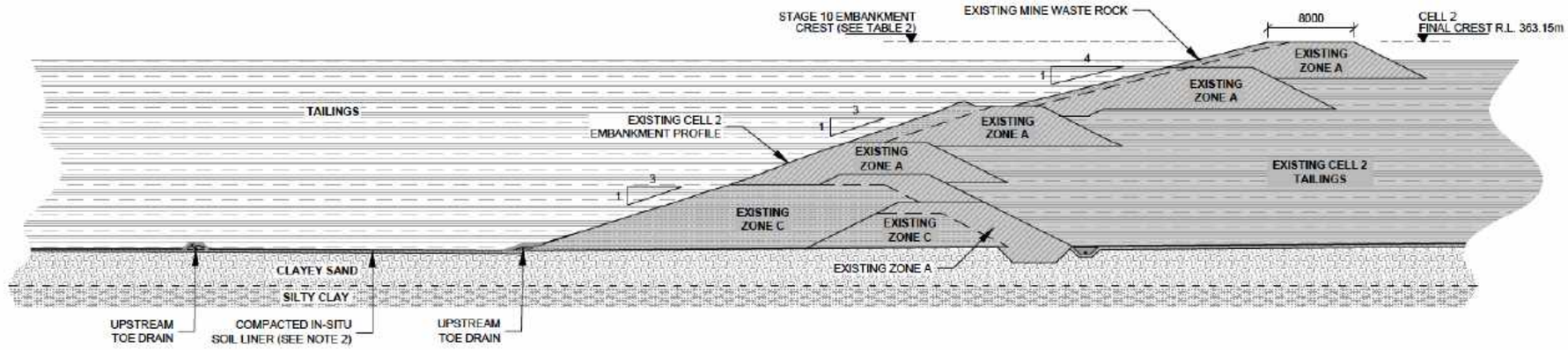
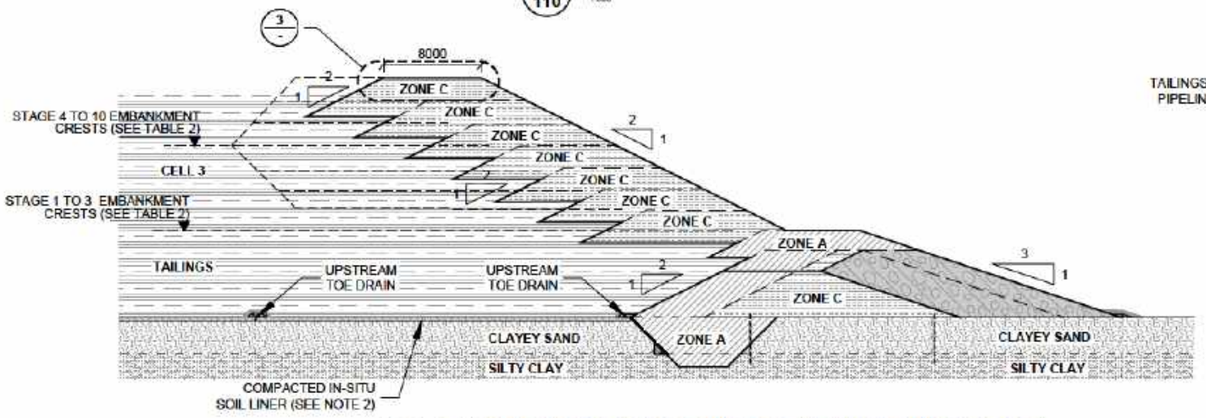


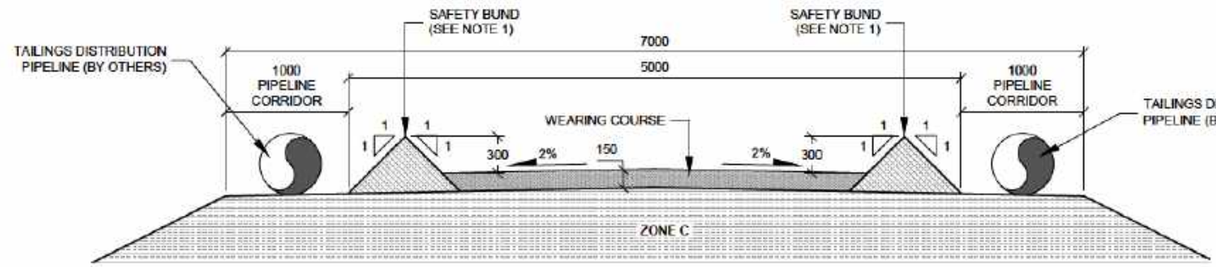
B/110 **TYPICAL FINAL STAGE EMBANKMENT SECTION**



C/110 **TYPICAL FINAL STAGE EMBANKMENT SECTION ALONG EXISTING CELL 2 EMBANKMENT**



D/110 **TYPICAL FINAL STAGE DIVIDER EMBANKMENT SECTION**



3/- **TYPICAL DIVIDER EMBANKMENT CREST DETAIL**

NOTES:

1. SAFETY BUND TO BE CONSTRUCTED OF ZONE D (GENERAL FILL MATERIAL). BREAKS IN UPSTREAM SAFETY BUND AT 25m CENTRES TO ALLOW FOR DRAINAGE OF RAINFALL RUNOFF.
2. COMPACTED IN-SITU SOIL LINER THROUGHOUT TSF BASIN AREA (300mm).
3. CUT-OFF TRENCH TO BE EXCAVATED 4m (MIN.) INTO COMPETENT MATERIALS AS DETERMINED BY ENGINEER ON SITE.
4. FOR ZONE SPECIFICATIONS REFER TABLE 1 ON DRAWING 801-137-C3000-301

TABLE 2:

STAGED EMBANKMENT DETAILS

STAGE	CREST ELEVATION (mR.L.)	RAISE HEIGHT (m)	RAISE TYPE
1	347.40	VARIES	DOWNSTREAM
2	349.10	1.7	
3	350.70	1.6	CENTRELINE
4	352.35	1.7	
5	354.05	1.7	
6	355.75	1.7	
7	357.55	1.8	UPSTREAM
8	359.35	1.8	
9	361.25	1.90	
10	363.15	1.90	

REFERENCES	DRAWING No.	DRAWING TITLE
	801-137-C3000-110	GENERAL ARRANGEMENT PLAN-STAGE 10
	801-137-C3000-301	EMBANKMENT SECTIONS & DETAILS-SHT 1

REVISIONS	REV	DATE	DESCRIPTION	DRN	DESIGN	CKD	APP	CLIENT APP
	A	04/09/2019	ISSUED FOR FEASIBILITY STUDY	PAN	BJC	BJC	DJTM	
	B	11/11/2019	ISSUED FOR FEASIBILITY STUDY UPDATE	AZ	BJC	BJC	DJTM	
	C	09/01/2020	ADDED PIEZOMETER NOTES TO SECTION B	PRK	BJC	DSS	BAS	

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	DATE	DESIGNED	CHECKED	APPROVED	CLIENT APP'D

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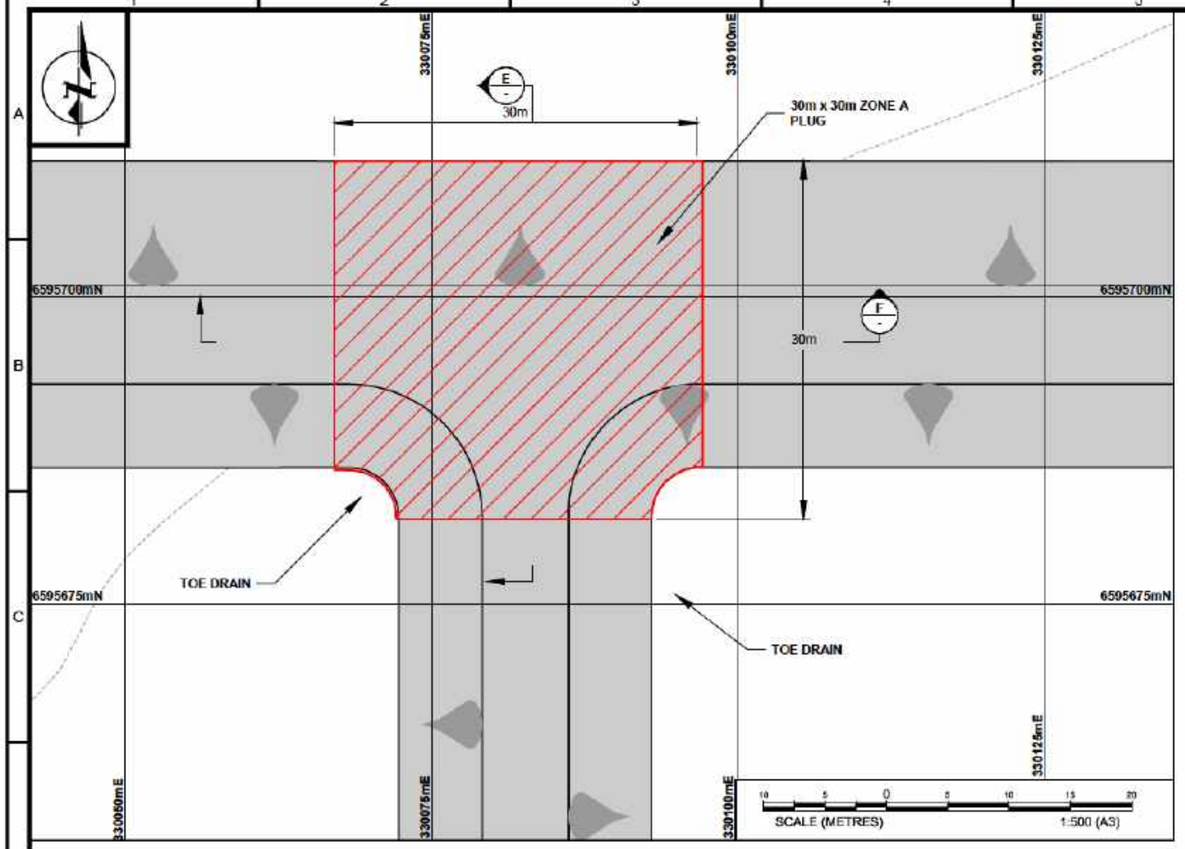
MUNGARI GOLD PROJECT
TAILINGS STORAGE FACILITY - CELLS 3 & 4 EXPANSION
EMBANKMENT SECTIONS AND DETAILS - SHEET 2

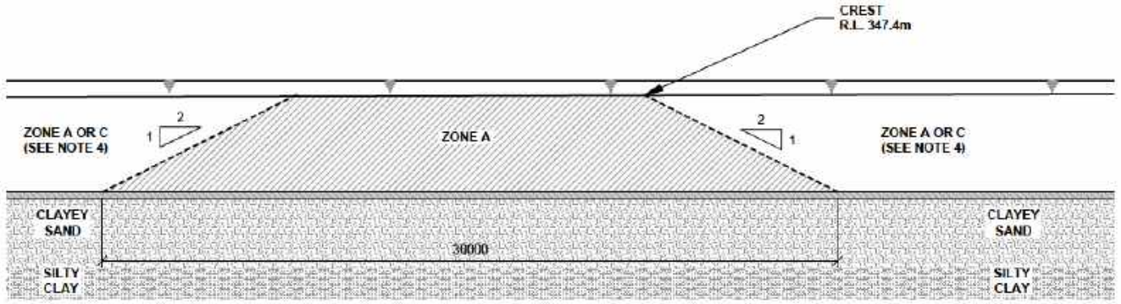
SCALE AS SHOWN
STATUS: FS
DRAWING NUMBER: 801-137-C3000-302
REV: C

SHEET SIZE A3
287



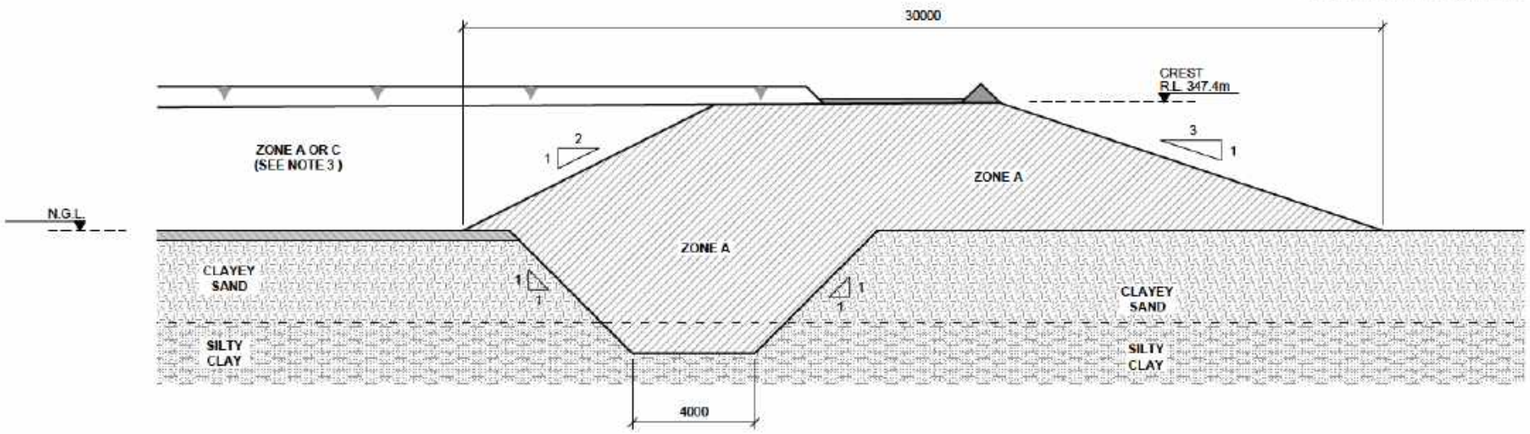
NOTES:

1. 1m CONTOUR INTERVALS SHOWN. EXTERNAL TOPOGRAPHICAL DATA PROVIDED BY EVOLUTION MINING, MAY 2018.
2. FOR ZONE SPECIFICATION REFER TABLE 1 ON DRAWING 801-137-C3000-301.
3. FOR CONVENTIONAL DIVIDER EMBANKMENT ZONING, REFER SECTION D ON DRAWING 801-137-C3000-302.
4. FOR CONVENTIONAL STAGE 1 EMBANKMENT ZONING, REFER SECTION A ON DRAWING 801-137-C3000-301.



F — TYPICAL STAGE 1 EMBANKMENT CORNER SECTION
1:250

4/101 — STAGE 1 ZONE A PLUG AT DIVIDER CAUSEWAY LAYOUT DETAIL
1:500



E — TYPICAL SECTION OF STAGE 1 EMBANKMENT AND DIVIDER CAUSEWAY INTERSECTION ZONE A PLUG
1:200

REFERENCES	DRAWING No.	DRAWING TITLE
	801-137-C3000-301	EMBANKMENT SECTIONS & DETAILS-SHT 1
	801-137-C3000-302	EMBANKMENT SECTIONS & DETAILS-SHT 2

REVISIONS	REV	DATE	DESCRIPTION	DRN	DESIGN	CKD	APP	CLIENT APP
	A	11/11/2019	ISSUED FOR FEASIBILITY STUDY UPDATE	UT	BJC	BJC	DJTM	

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DATE	DESIGNED	CHECKED	APPROVED	CLIENT APP'D

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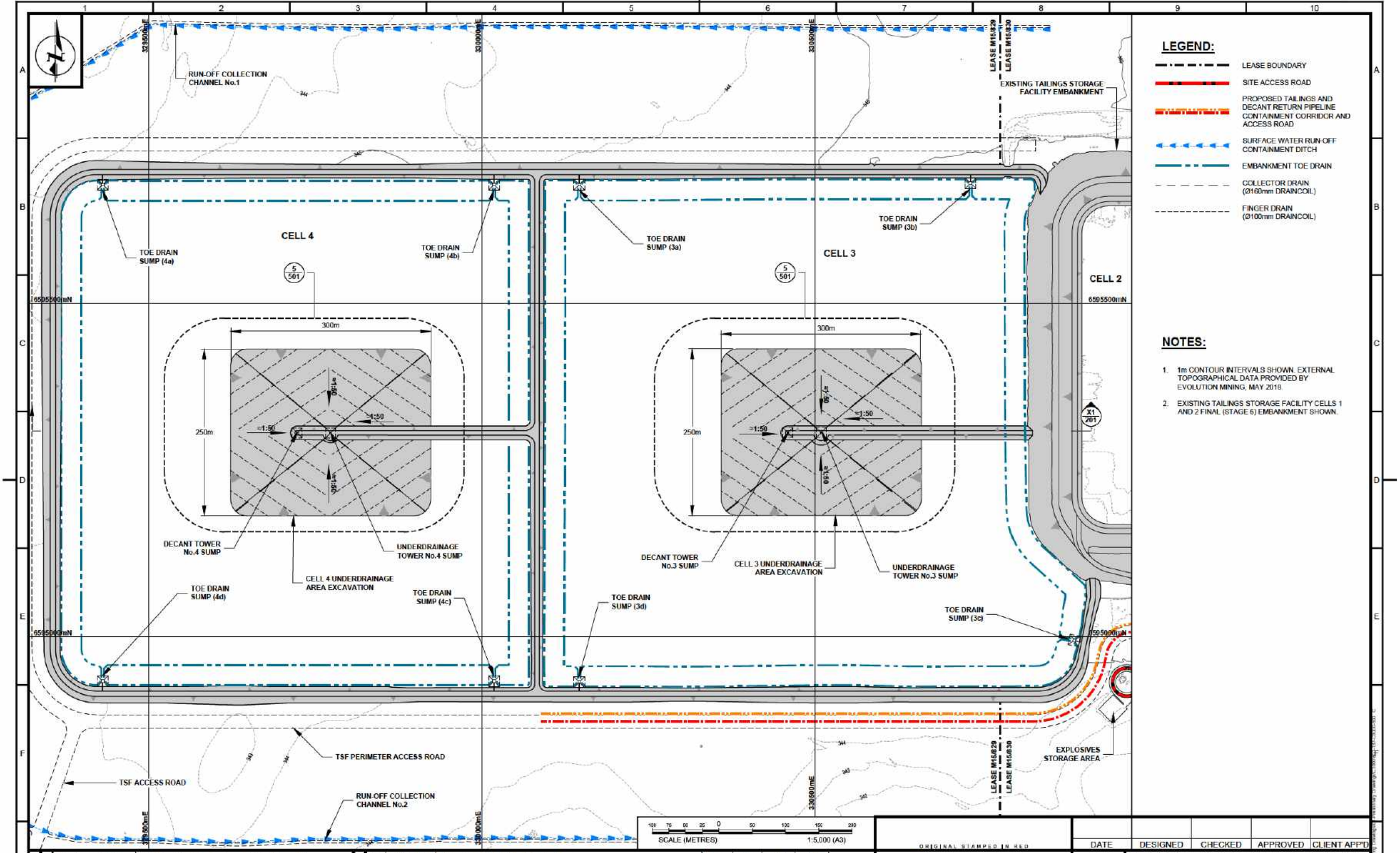
EVOLUTION MINING LTD.
MUNGARI GOLD PROJECT
TAILINGS STORAGE FACILITY - CELLS 3 & 4 EXPANSION
EMBANKMENT SECTIONS AND DETAILS - SHEET 3

SCALE AS SHOWN
STATUS: FS
DRAWING NUMBER 801-137-C3000-303
REV A

SHEET SIZE A3
287
410



LEGEND:

- LEASE BOUNDARY
- SITE ACCESS ROAD
- PROPOSED TAILINGS AND DECANT RETURN PIPELINE CONTAINMENT CORRIDOR AND ACCESS ROAD
- SURFACE WATER RUN-OFF CONTAINMENT DITCH
- EMBANKMENT TOE DRAIN
- COLLECTOR DRAIN (Ø160mm DRAINCOIL)
- FINGER DRAIN (Ø100mm DRAINCOIL)

NOTES:

1. 1m CONTOUR INTERVALS SHOWN. EXTERNAL TOPOGRAPHICAL DATA PROVIDED BY EVOLUTION MINING, MAY 2018.
2. EXISTING TAILINGS STORAGE FACILITY CELLS 1 AND 2 FINAL (STAGE 6) EMBANKMENT SHOWN.

REFERENCES	DRAWING No.	DRAWING TITLE
SHEET SIZE A3	801-137-C3000-201	BASIN BORROW SECTIONS AND DETAILS
	801-137-C3000-501	WATER RECLAMATION SECTIONS & DETAILS-SHT 1

REVISIONS	REV	DATE	DESCRIPTION	DRN	DESIGN	CKD	APP	CLIENT APP
	A	04/09/2019	ISSUED FOR FEASIBILITY STUDY	PAN	BJC	BJC	DJTM	
	B	11/11/2019	ISSUED FOR FEASIBILITY STUDY UPDATE	UT	BJC	BJC	DJTM	
	C	09/01/2020	ADDED ACCESS ROADS	PRK	BJC	DSS	BAS	

ORIGINAL STAMPED IN RED

DATE	DESIGNED	CHECKED	APPROVED	CLIENT APP'D

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EVOLUTION MINING LTD.
MUNGARI GOLD PROJECT
TAILINGS STORAGE FACILITY - CELLS 3 & 4 EXPANSION
WATER RECLAMATION LAYOUT

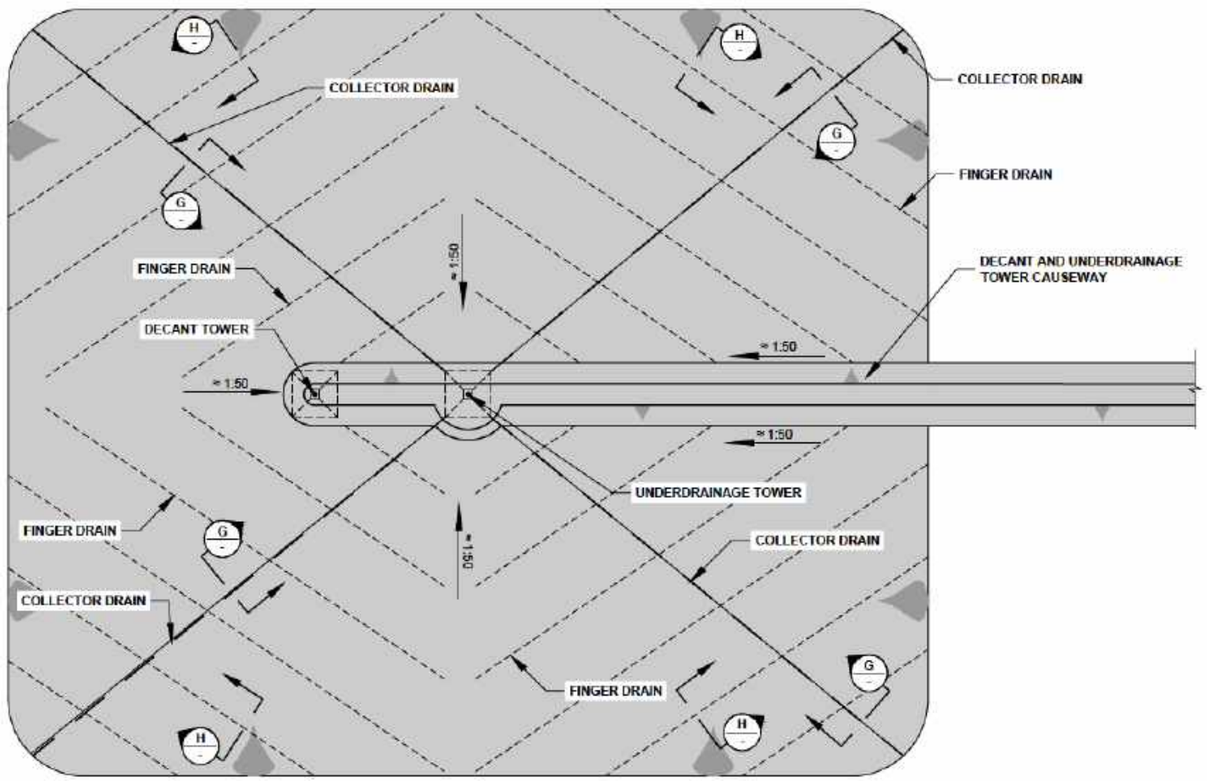
SCALE 1:5,000
STATUS: FS
DRAWING NUMBER 801-137-C3000-500
REV C

LEGEND:

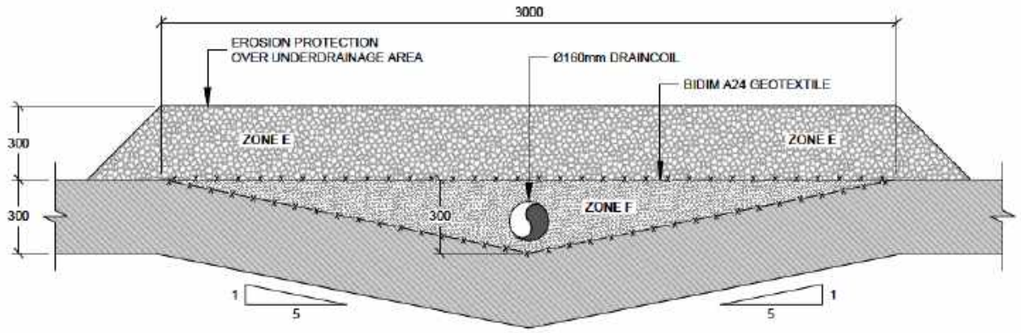
- COLLECTOR DRAIN (Ø160mm DRAINCOIL)
- FINGER DRAIN (Ø100mm DRAINCOIL)

NOTES:

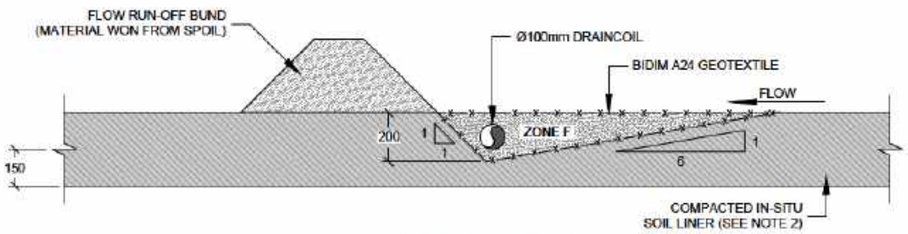
1. FOR DETAILS ON ZONE SPECIFICATIONS REFER TABLE 1 ON DRAWING 801-137-C3000-301.
2. COMPACTED IN-SITU SOIL LINER THROUGHOUT TSF BASIN AREA (300mm).
3. MINIMUM FALL GRADE FOR UNDERDRAINAGE PIPEWORK TO BE 1V TO 50H.
4. FINGER DRAIN SPACING 25m.



5/500 **TYPICAL UNDERDRAINAGE PIPE NETWORK PLAN DETAIL**
1:2000



G/- **TYPICAL COLLECTOR DRAIN SECTION**
1:25



H/- **TYPICAL FINGER DRAIN SECTION**
1:25

SHEET SIZE A3												
REFERENCES	801-137-C3000-301	EMBANKMENT SECTIONS & DETAILS-SHT1	REVISIONS	A	04/09/2019	ISSUED FOR FEASIBILITY STUDY	PRK	BJC	BJC	DJTM		
	801-137-C3000-500	WATER RECLAMATION LAYOUT		B	11/11/2019	ISSUED FOR FEASIBILITY STUDY UPDATE	UT	BJC	BJC	DJTM		
	DRAWING No.	DRAWING TITLE		REV	DATE	DESCRIPTION	DRN	DESIGN	CKD	APP	CLIENT APP	

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DATE	DESIGNED	CHECKED	APPROVED	CLIENT APP'D

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MUNGARI GOLD PROJECT
TAILINGS STORAGE FACILITY - CELLS 3 & 4 EXPANSION
WATER RECLAMATION SECTIONS & DETAILS - SHEET 1

SCALE AS SHOWN
STATUS: FS
DRAWING NUMBER: 801-137-C3000-501
REV: B

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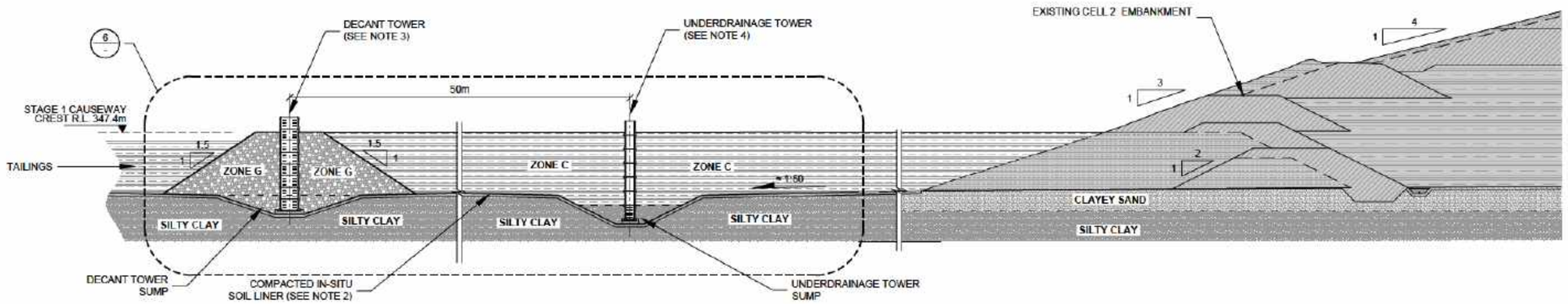
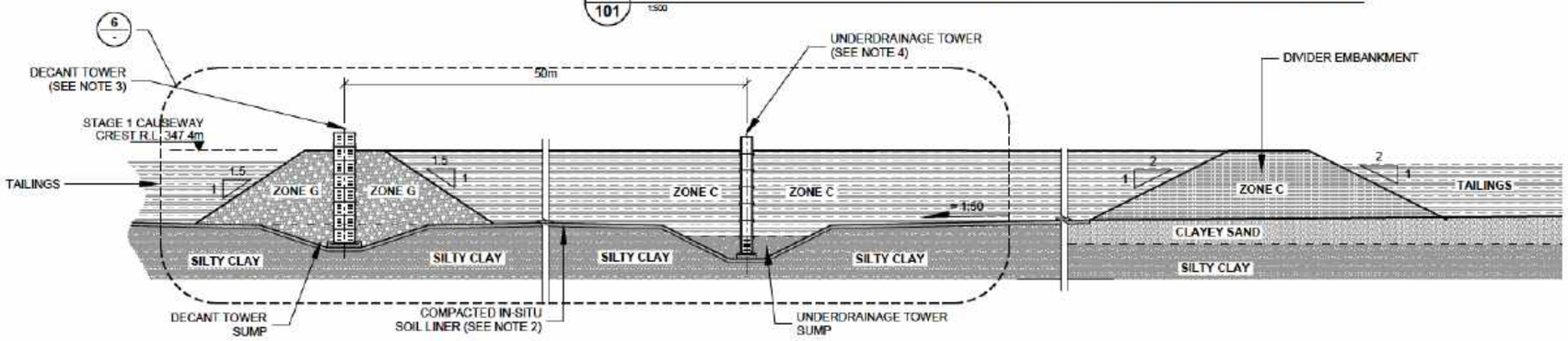


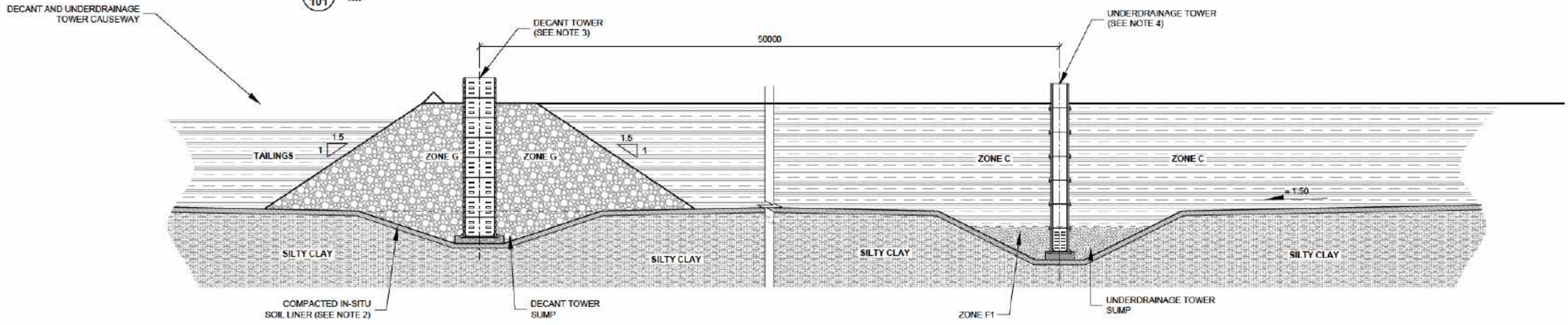
J/101 TYPICAL CELL 3 STAGE 1 DECANT AND UNDERDRAINAGE CAUSEWAY SECTION

1:500



K/101 TYPICAL CELL 4 STAGE 1 DECANT AND UNDERDRAINAGE CAUSEWAY SECTION

1:500



6/- TYPICAL STAGE 1 DECANT AND UNDERDRAINAGE TOWER CAUSEWAY DETAIL (FACING UNDERDRAINAGE TOWER)

1:250

NOTES:

1. FOR DETAILS ON ZONE SPECIFICATIONS REFER TABLE 1 ON DRAWING 801-137-C3000-301.
2. COMPACTED IN-SITU SOIL LINER THROUGHOUT TSF BASIN AREA (300mm).
3. DECANT TOWER TO COMPRISE OF SLOTTED Ø1800mm REINFORCED CONCRETE PIPE SECTIONS.
4. UNDERDRAINAGE TOWER TO COMPRISE OF SOLID Ø900mm REINFORCED CONCRETE PIPE SECTIONS. STARTER PIPE SECTION AT BASE OF TOWER TO BE SLOTTED.

SHEET SIZE A3

REFERENCES

DRAWING No.	DRAWING TITLE
801-137-C3000-101	EMBANKMENT LAYOUT-STAGE 1 (STARTER)
801-137-C3000-301	EMBANKMENT SECTIONS & DETAILS-SHT1

REVISIONS

REV	DATE	DESCRIPTION	DRN	DESIGN	CKD	APP	CLIENT APP
A	04/09/2019	ISSUED FOR FEASIBILITY STUDY	PRK	BJC	BJC	DJTM	
B	11/11/2019	ISSUED FOR FEASIBILITY STUDY UPDATE	UT	BJC	BJC	DJTM	

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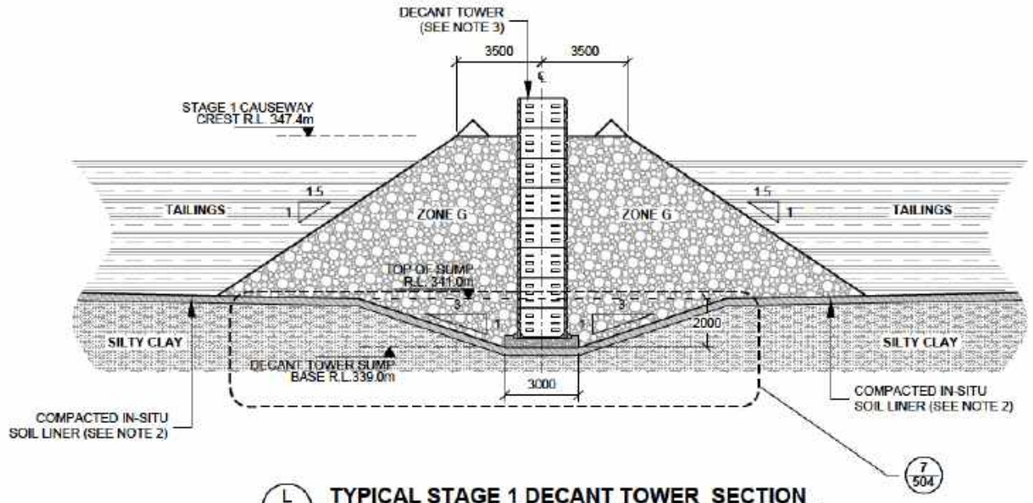
MUNGARI GOLD PROJECT
TAILINGS STORAGE FACILITY - CELLS 3 & 4 EXPANSION
WATER RECLAMATION SECTIONS & DETAILS - SHEET 2

SCALE AS SHOWN
STATUS: FS
DRAWING NUMBER 801-137-C3000-502
REV B

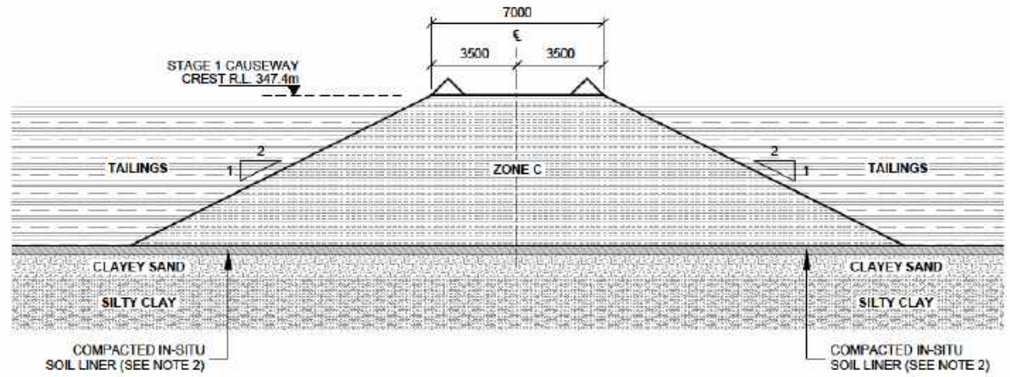
Microsoft Assigned Access Only

NOTES:

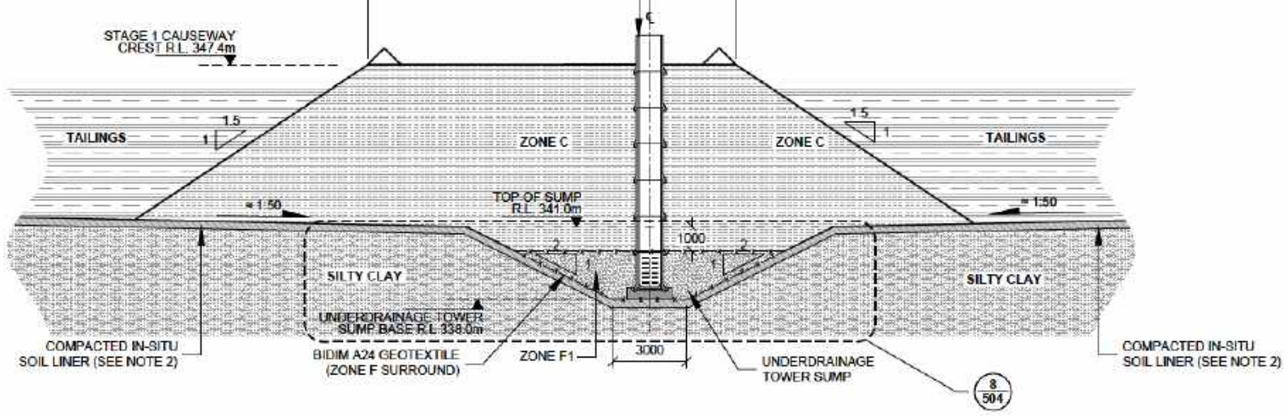
1. FOR DETAILS ON ZONE SPECIFICATIONS REFER TABLE 1 ON DRAWING 801-137-C3000-301.
2. COMPACTED IN-SITU SOIL LINER THROUGHOUT TSF BASIN AREA (300mm).
3. DECANT TOWER TO COMPRISE OF SLOTTED Ø1800mm REINFORCED CONCRETE PIPE SECTIONS.
4. UNDERDRAINAGE TOWER TO COMPRISE OF SOLID Ø900mm REINFORCED CONCRETE PIPE SECTIONS. STARTER PIPE SECTION AT BASE OF TOWER TO BE SLOTTED.



L 101 **TYPICAL STAGE 1 DECANT TOWER SECTION**
1:250



N 101 **TYPICAL STAGE 1 DECANT AND UNDERDRAINAGE TOWER CAUSEWAY SECTION**
1:250



M 101 **TYPICAL STAGE 1 UNDERDRAINAGE TOWER SECTION**
1:250

REFERENCES	DRAWING No.	DRAWING TITLE
	801-137-C3000-101	EMBANKMENT LAYOUT - STAGE 1 (STARTER)
	801-137-C3000-301	EMBANMENT SECTIONS & DETAILS-SHT 1
	801-137-C3000-504	WATER RECLAMATION SECTIONS & DETAILS-SHT 4

REVISIONS	REV	DATE	DESCRIPTION	DRN	DESIGN	CKD	APP	CLIENT APP
	A	04/09/2019	ISSUED FOR FEASIBILITY STUDY	PRK	BJC	BJC	DJTM	
	B	11/11/2019	ISSUED FOR FEASIBILITY STUDY UPDATE	UT	BJC	BJC	DJTM	

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DATE	DESIGNED	CHECKED	APPROVED	CLIENT APP'D

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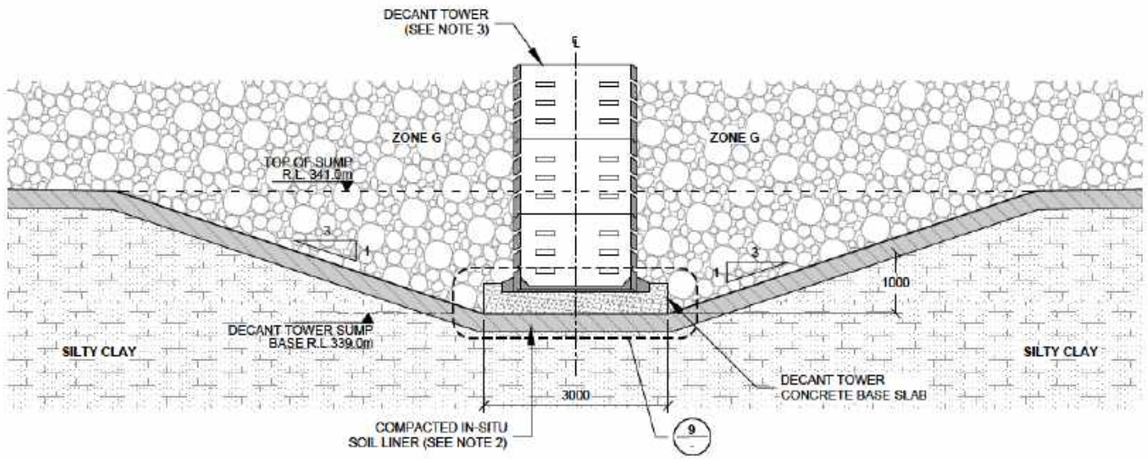
EVOLUTION MINING LTD.
MUNGARI GOLD PROJECT
TAILINGS STORAGE FACILITY - CELLS 3 & 4 EXPANSION
WATER RECLAMATION SECTIONS & DETAILS - SHEET 3

SCALE AS SHOWN
STATUS: FS
DRAWING NUMBER 801-137-C3000-503
REV B

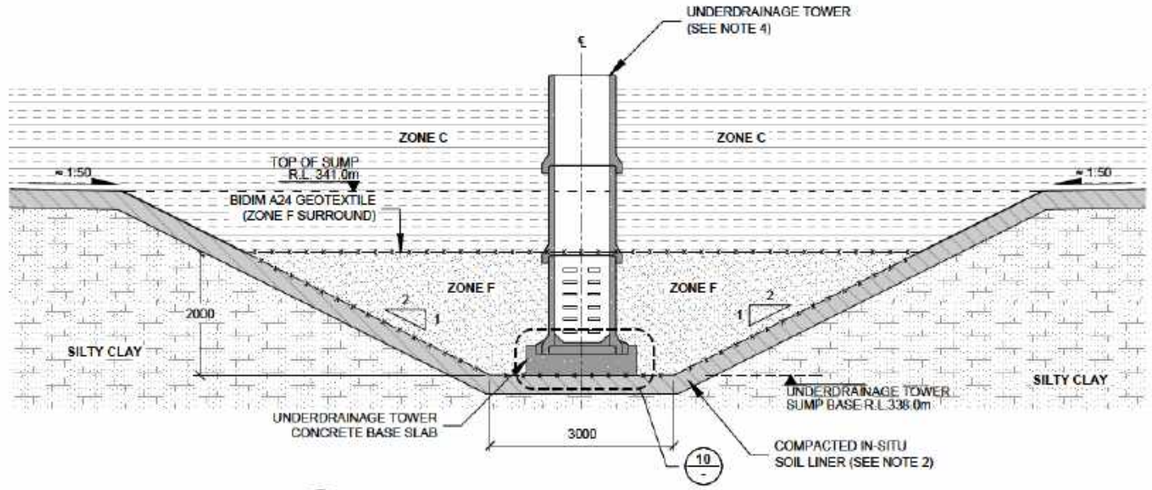
SHEET SIZE A3
287
410

NOTES:

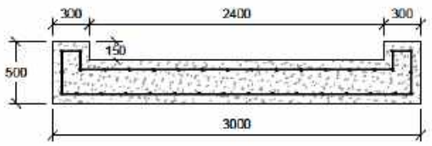
1. FOR DETAILS ON ZONE SPECIFICATIONS REFER TABLE 1 ON DRAWING 801-137-C3000-301.
2. COMPACTED IN-SITU SOIL LINER THROUGHOUT TSF BASIN AREA (300mm).
3. DECANT TOWER TO COMPRISE OF SLOTTED Ø1800mm REINFORCED CONCRETE PIPE SECTIONS.
4. UNDERDRAINAGE TOWER TO COMPRISE OF SOLID Ø900mm REINFORCED CONCRETE PIPE SECTIONS. STARTER PIPE SECTION AT BASE OF TOWER TO BE SLOTTED.



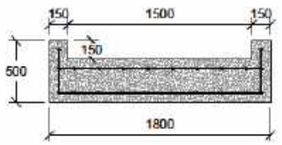
7 / 503 TYPICAL DECANT TOWER SUMP DETAIL
1:100



8 / 503 TYPICAL UNDERDRAINAGE TOWER SUMP DETAIL
1:100



9 / - TYPICAL DECANT TOWER CONCRETE BASE SLAB DETAIL
1:50



10 / - 10 / 505 TYPICAL UNDERDRAINAGE AND TOE DRAIN TOWER CONCRETE BASE SLAB DETAIL
1:50

SHEET SIZE A3

REFERENCES

DRAWING No.	DRAWING TITLE
801-137-C3000-301	EMBANKMENT SECTIONS & DETAILS-SHT 1
801-137-C3000-503	WATER RECLAMATION SECTIONS & DETAILS-SHT 3
801-137-C3000-505	WATER RECLAMATION SECTIONS & DETAILS-SHT 5

REVISIONS

REV	DATE	DESCRIPTION	DRN	DESIGN	CKD	APP	CLIENT APP
A	04/09/2019	ISSUED FOR FEASIBILITY STUDY	PRK	BJC	BJC	DJTM	
B	11/11/2019	ISSUED FOR FEASIBILITY STUDY UPDATE	UT	BJC	BJC	DJTM	

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	DATE	DESIGNED	CHECKED	APPROVED	CLIENT APP'D

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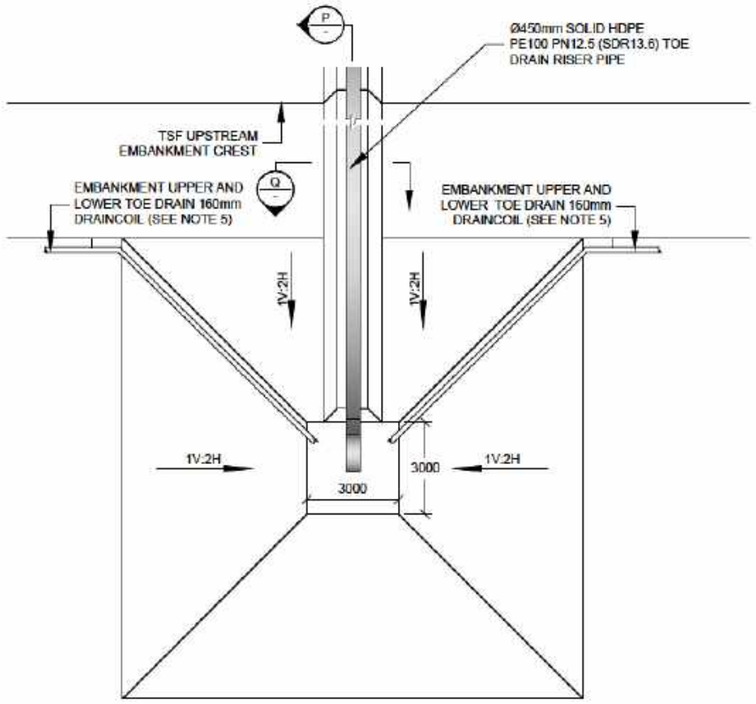
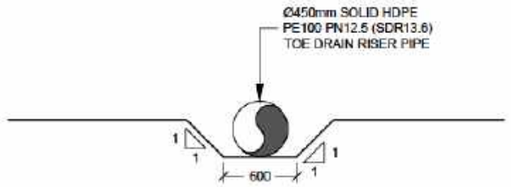
EVOLUTION MINING LTD.
MUNGARI GOLD PROJECT
TAILINGS STORAGE FACILITY - CELLS 3 & 4 EXPANSION
WATER RECLAMATION SECTIONS & DETAILS - SHEET 4

SCALE N.T.S.
STATUS: FS
DRAWING NUMBER 801-137-C3000-504
REV B

Document Set ID: 4810287 Version: 1, Version Date: 11/11/2019



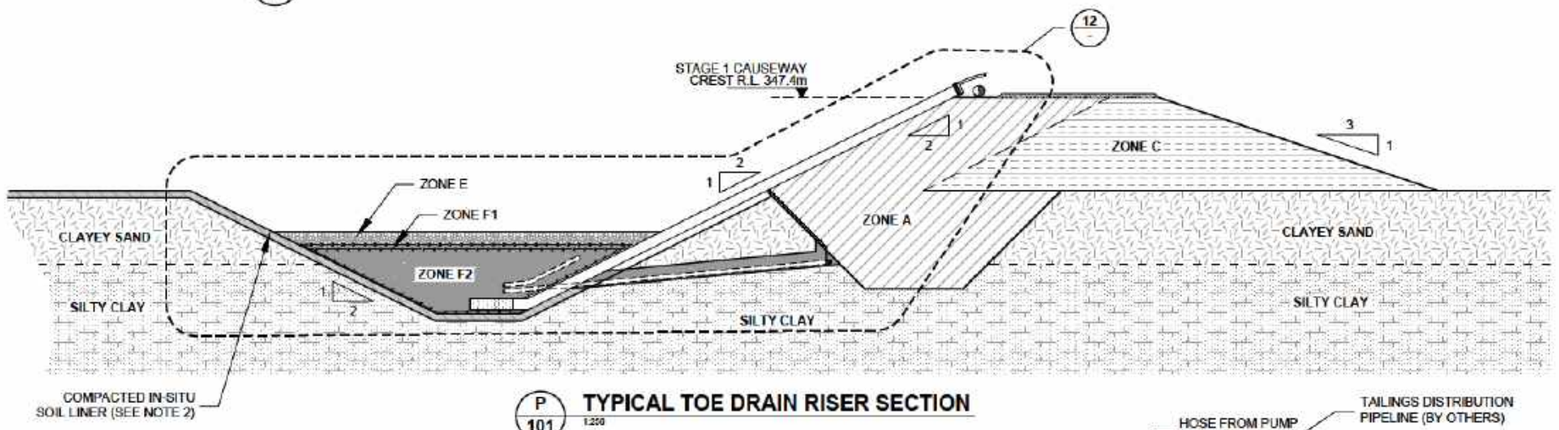
11 / 101 **UNDERDRAINAGE SYSTEM SUMP**
1:200



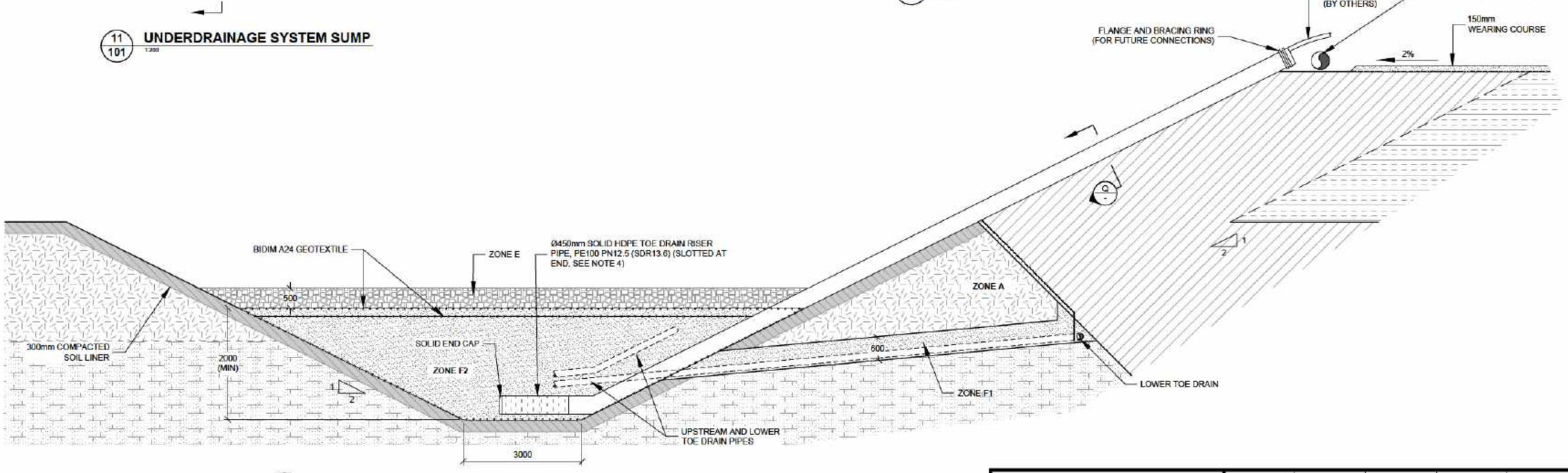
Q / - **TOE DRAIN SUMP RISER PIPE SECTION**
1:50

NOTES:

1. FOR DETAILS ON ZONE SPECIFICATIONS REFER TABLE 1 ON DRAWING 801-137-C3000-301.
2. COMPACTED IN-SITU SOIL LINER THROUGHOUT TSF BASIN AREA (300mm).
3. CUT-OFF TRENCH TO BE EXCAVATED 4m (MIN.) INTO COMPETENT MATERIALS AS DETERMINED BY ENGINEER ON SITE.
4. ROWS OF THREE SLOTS EQUALLY SPACED AROUND THE BOTTOM OF THE PIPE. SLOTS SIZED AT 75mm X 6mm AT 150mm CENTRES.
5. DRAINCOIL ENCASED WITH BIDIM A14 GEOTEXTILE FILTER SOCK. DRAINCOIL SLOT SIZE 2.8mm BY 30mm.



P / 101 **TYPICAL TOE DRAIN RISER SECTION**
1:200



12 / - **UNDERDRAINAGE SYSTEM SUMP AND RISER PIPE**
1:100

REFERENCES	DRAWING No.	DRAWING TITLE
SHEET SIZE A3	801-137-C3000-101	EMBANKMENT LAYOUT - STAGE 1 (STARTER)
	801-137-C3000-301	EMBANKMENT SECTIONS & DETAILS-SHT 1
	801-137-C3000-504	WATER RECLAMATION SECTIONS & DETAILS-SHT 4
	801-137-C3000-507	WATER RECLAMATION SECTIONS & DETAILS-SHT 7

REVISIONS	REV	DATE	DESCRIPTION	DRN	DESIGN	CKD	APP	CLIENT APP
	A	04/09/2019	ISSUED FOR FEASIBILITY STUDY	PRK	BJC	BJC	DJTM	
	B	11/11/2019	ISSUED FOR FEASIBILITY STUDY UPDATE	AZ	BJC	BJC	DJTM	

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	DATE	DESIGNED	CHECKED	APPROVED	CLIENT APP'D

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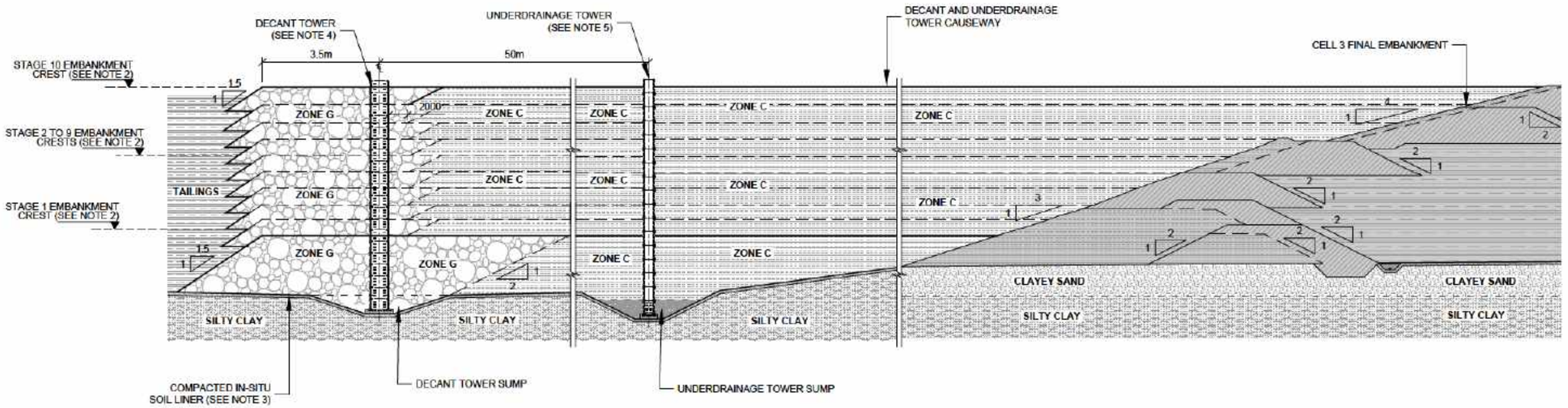
MUNGARI GOLD PROJECT
TAILINGS STORAGE FACILITY - CELLS 3 & 4 EXPANSION
WATER RECLAMATION SECTIONS & DETAILS - SHEET 5

SCALE N.T.S.
STATUS: FS
DRAWING NUMBER **801-137-C3000-505**
REV **B**

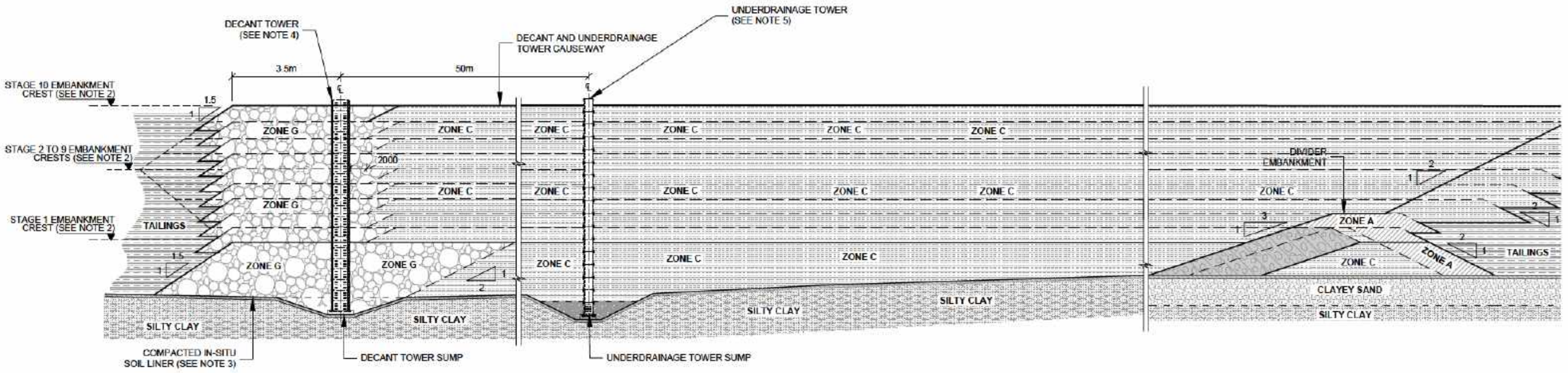
287
410

NOTES:

1. FOR DETAILS ON ZONE SPECIFICATIONS REFER TABLE 1 ON DRAWING 801-137-C3000-301.
2. FOR CAUSEWAY CREST ELEVATIONS REFER TABLE 2 ON DRAWING 801-137-C3000-302.
3. COMPACTED IN-SITU SOIL LINER THROUGHOUT TSF BASIN AREA (300mm).
4. DECANT TOWER TO COMPRISE OF SLOTTED Ø1800mm REINFORCED CONCRETE PIPE SECTIONS.
5. UNDERDRAINAGE TOWER TO COMPRISE OF SOLID Ø900mm REINFORCED CONCRETE PIPE SECTIONS. STARTER PIPE SECTION AT BASE OF TOWER TO BE SLOTTED.



R 110 **TYPICAL CELL 3 FINAL STAGE DECANT AND UNDERDRAINAGE CAUSEWAY SECTION**
1:500



S 110 **TYPICAL CELL 3 FINAL STAGE DECANT AND UNDERDRAINAGE CAUSEWAY SECTION**
1:500

SHEET SIZE A3

REFERENCES

DRAWING No.	DRAWING TITLE
801-137-C3000-110	GENERAL ARRANGEMENT PLAN-STAGE 10
801-137-C3000-301	EMBANKMENT SECTIONS & DETAILS-SHT 1
801-137-C3000-302	EMBANKMENT SECTIONS & DETAILS-SHT 2

REVISIONS

REV	DATE	DESCRIPTION	DRN	DESIGN	CKD	APP	CLIENT APP
A	04/09/2019	ISSUED FOR FEASIBILITY STUDY	PAN	BJC	BJC	DJTM	
B	11/11/2019	ISSUED FOR FEASIBILITY STUDY UPDATE	UT	BJC	BJC	DJTM	

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	DATE	DESIGNED	CHECKED	APPROVED	CLIENT APP'D

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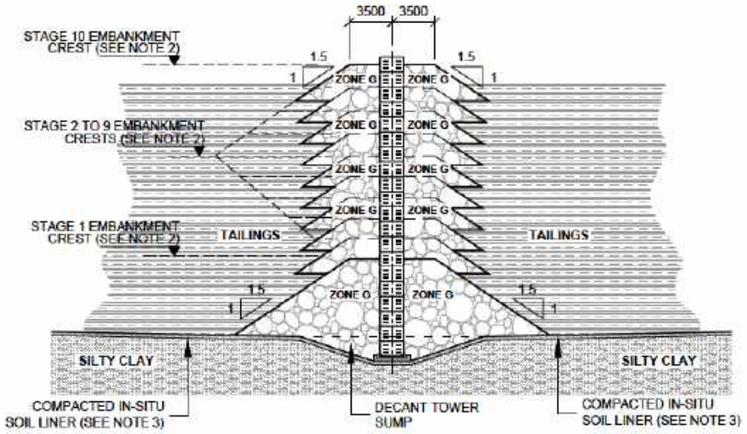
MUNGARI GOLD PROJECT
TAILINGS STORAGE FACILITY - CELLS 3 & 4 EXPANSION
WATER RECLAMATION SECTIONS & DETAILS - SHEET 6

SCALE N.T.S.
STATUS: FS
DRAWING NUMBER **801-137-C3000-506**
REV **B**

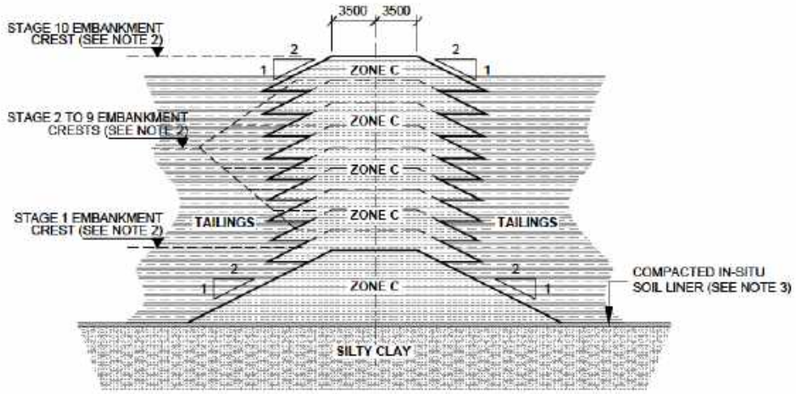
Document Set ID: 4287410 Version: 1, Version Date: 11/11/2019

NOTES:

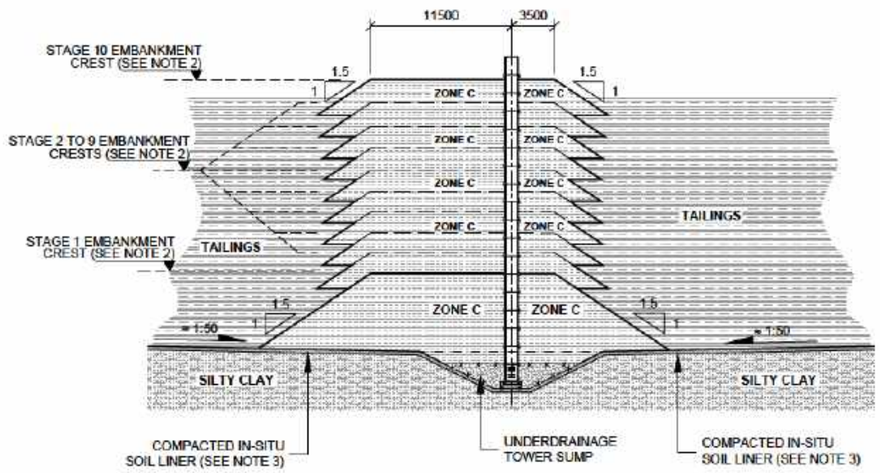
1. FOR DETAILS ON ZONE SPECIFICATIONS REFER TABLE 1 ON DRAWING 801-137-C3000-301.
2. FOR CAUSEWAY CREST ELEVATIONS REFER TABLE 2 ON DRAWING 801-137-C3000-302.
3. COMPACTED IN-SITU SOIL LINER THROUGHOUT TSF BASIN AREA (300mm).
4. DECANT TOWER TO COMPRISE OF SLOTTED Ø1800mm REINFORCED CONCRETE PIPE SECTIONS.
5. UNDERDRAINAGE TOWER TO COMPRISE OF SOLID Ø900mm REINFORCED CONCRETE PIPE SECTIONS. STARTER PIPE SECTION AT BASE OF TOWER TO BE SLOTTED.



T/110 **TYPICAL FINAL STAGE DECANT TOWER SECTION**
1:500



V/110 **TYPICAL FINAL STAGE DECANT AND UNDERDRAINAGE TOWER CAUSEWAY SECTION**
1:500



U/110 **TYPICAL FINAL STAGE UNDERDRAINAGE TOWER SECTION**
1:500

SHEET SIZE A3	REFERENCES	
	801-137-C3000-110	GENERAL ARRANGEMENT PLAN-STAGE 10
	801-137-C3000-301	EMBANKMENT SECTIONS & DETAILS-SHT 1
	801-137-C3000-302	EMBANKMENT SECTIONS & DETAILS-SHT 2
	DRAWING No.	DRAWING TITLE

REVISIONS								
REV	DATE	DESCRIPTION	DRN	DESIGN	CKD	APP	CLIENT APP
A	04/09/2019	ISSUED FOR FEASIBILITY STUDY	PAN	BJC	BJC	DJTM	
B	11/11/2019	ISSUED FOR FEASIBILITY STUDY UPDATE	UT	BJC	BJC	DJTM	
C	09/01/2020	AMENDED DRAWING TITLE	PRK	BJC	DSS	BAS	

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	DATE	DESIGNED	CHECKED	APPROVED	CLIENT APP'D

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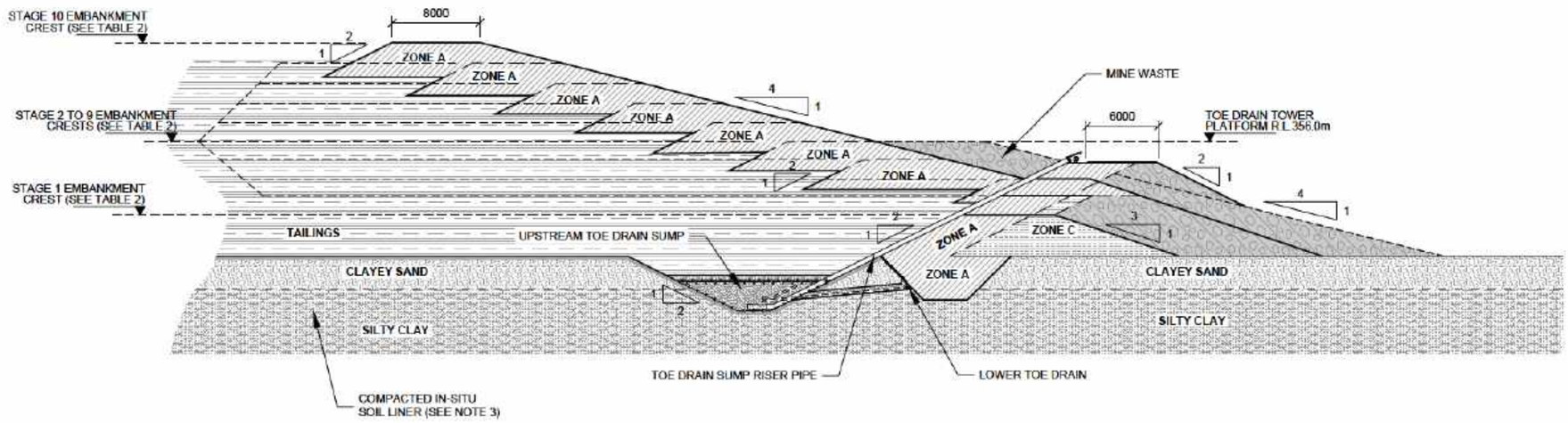
MUNGARI GOLD PROJECT
TAILINGS STORAGE FACILITY - CELLS 3 & 4 EXPANSION
WATER RECLAMATION SECTIONS & DETAILS - SHEET 7

SCALE N.T.S.
STATUS: FS
DRAWING NUMBER **801-137-C3000-507**
REV **C**

287 410

NOTES:

1. FOR DETAILS ON ZONE SPECIFICATIONS REFER TABLE 1 ON DRAWING 801-137-C3000-301.
2. FOR CAUSEWAY CREST ELEVATIONS REFER TABLE 2 ON DRAWING 801-137-C3000-302.
3. COMPACTED IN-SITU SOIL LINER THROUGHOUT TSF BASIN AREA (300mm).
4. CUT-OFF TRENCH TO BE EXCAVATED 1m (MIN.) INTO COMPETENT MATERIALS AS DETERMINED BY ENGINEER ON SITE.



W 110 TYPICAL FINAL STAGE TOE DRAIN SUMP AND RISER PIPE SECTION
1:500

REFERENCES	DRAWING No.	DRAWING TITLE
SHEET SIZE A3	801-137-C3000-110	GENERAL ARRANGEMENT PLAN-STAGE 10
	801-137-C3000-301	EMBANKMENT SECTIONS & DETAILS-SHT 1
	801-137-C3000-302	EMBANKMENT SECTIONS & DETAILS-SHT 2
	801-137-C3000-505	WATER RECLAMATION SECTIONS & DETAILS-SHT 5

REVISIONS	REV	DATE	DESCRIPTION	DRN	DESIGN	CKD	APP	CLIENT APP
	A	04/09/2019	ISSUED FOR FEASIBILITY STUDY	PAN	BJC	BJC	DJTM	
	B	11/11/2019	ISSUED FOR FEASIBILITY STUDY UPDATE	UT	BJC	BJC	DJTM	
	C	09/01/2020	AMENDED DRAWING TITLE	PRK	BJC	DSS	BAS	

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	DATE	DESIGNED	CHECKED	APPROVED	CLIENT APP'D

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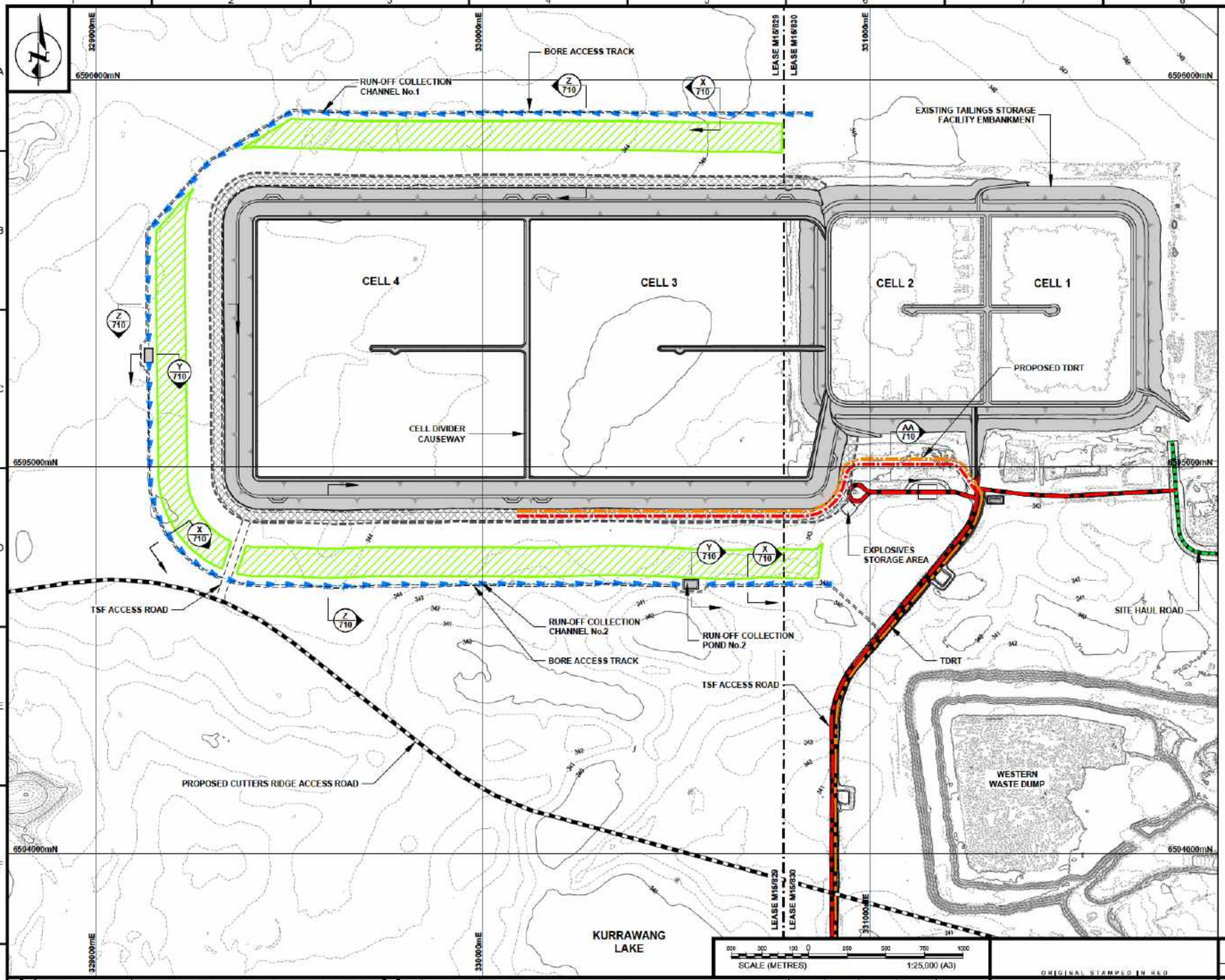
MUNGARI GOLD PROJECT
TAILINGS STORAGE FACILITY - CELLS 3 & 4 EXPANSION
WATER RECLAMATION SECTIONS & DETAILS - SHEET 8

SCALE N.T.S.
STATUS: FS
DRAWING NUMBER **801-137-C3000-508**
REV **C**

287
410



LEGEND:

- LEASE BOUNDARY
- EXISTING SITE ACCESS ROAD
- EXISTING SITE HAUL ROAD
- TAILINGS AND DECANT RETURN PIPELINE CONTAINMENT CORRIDOR (TDRT)
- RUN-OFF COLLECTION CHANNEL
- PROPOSED CUTTERS RIDGE ACCESS ROAD
- PROPOSED TAILINGS DECANT RETURN PIPELINE CONTAINMENT CORRIDOR AND ACCESS ROAD
- ACCESS ROAD
- TOPSOIL / SUBSOIL STOCKPILES

NOTES:

1. ALL COORDINATES SHOWN IN GRID PROJECTION MGA94 ZONE 51.
2. 1m CONTOUR INTERVALS SHOWN. EXTERNAL TOPOGRAPHICAL DATA PROVIDED BY EVOLUTION MINING, MAY 2018.
3. WESTERN WASTE DUMP DATA PROVIDED BY EVOLUTION MINING, FEBRUARY 2018.
4. EXISTING TAILINGS STORAGE FACILITY CELLS 1 AND 2 FINAL (STAGE 6) EMBANKMENT SHOWN.
5. FINAL CELL 3 AND 4 EMBANKMENT DESIGN SHOWN.

SHEET SIZE A3

REFERENCES

DRAWING No.	DRAWING TITLE
801-137-C3000-710	SURFACE WATER MANGAMENT SECTIONS & DETAILS

REVISIONS

REV	DATE	DESCRIPTION	DRN	DESIGN	CKD	APP	CLIENT APP
A	04/09/2019	ISSUED FOR FEASIBILITY STUDY	PAN	BJC	BJC	DJTM	
B	11/11/2019	ISSUED FOR FEASIBILITY STUDY UPDATE	UT	BJC	BJC	DJTM	
C	09/01/2020	ADDED CUTTERS RIDGE ROAD, REVISED PROPOSED TDRT	PRK	BJC	DSS	BAS	

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DATE	DESIGNED	CHECKED	APPROVED	CLIENT APP'D

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MUNGARI GOLD PROJECT
TAILINGS STORAGE FACILITY - CELLS 3 & 4 EXPANSION
SURFACE WATER MANAGEMENT PLAN

SCALE 1:10,000
STATUS: FS
DRAWING NUMBER 801-137-C3000-700
REV C

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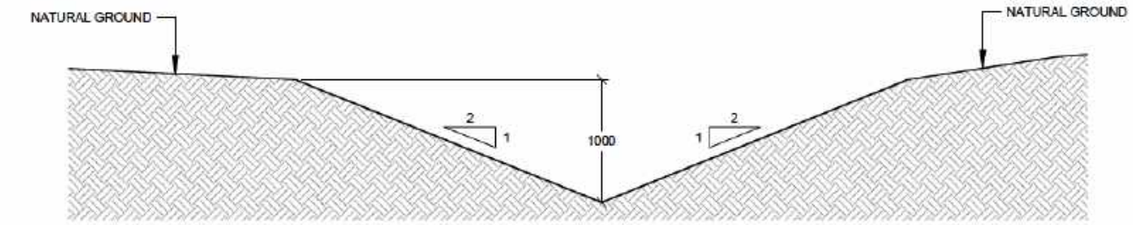
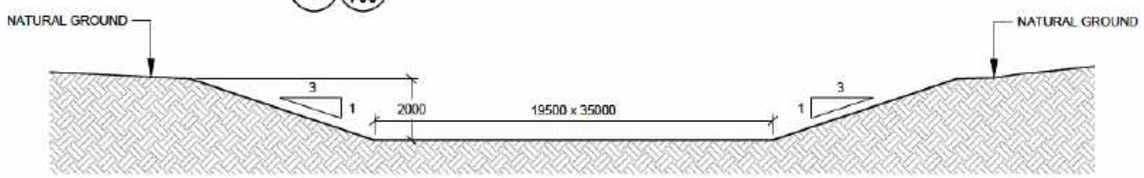
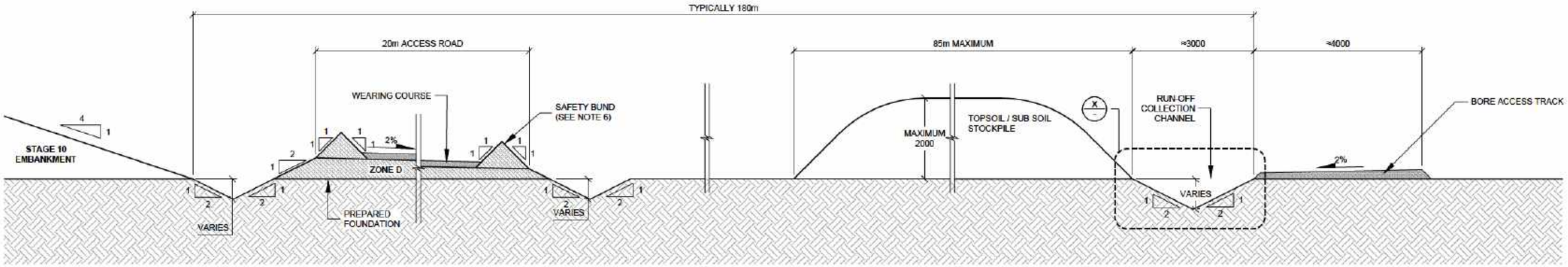


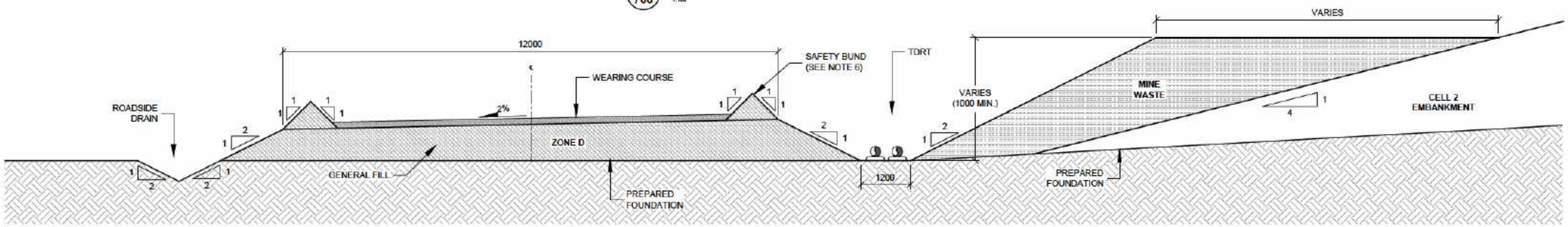
X / - X / 700 **TYPICAL PERIMETER RUN-OFF COLLECTION CHANNEL**
1:50



Y / 700 **TYPICAL SETTLING POND SECTION**
1:200



Z / 700 **TYPICAL ACCESS ROAD AROUND FACILITY WITH STOCKPILE**
1:100



AA / 700 **TYPICAL SINGLE LANE ACCESS ROAD WITH TAILINGS AND DECANT RETURN PIPELINE CONTAINMENT TRENCH SECTION**
1:100

NOTES:

1. FOR ZONE SPECIFICATION DETAILS REFER TABLE 1 ON DRAWING 801-137-A3000-301.
2. ROAD DITCHES TO CONNECT TO EXISTING WATER COURSES, AS DIRECTED BY THE ENGINEER.
3. ROAD CUT SLOPE < 2m TO BE FORMED AT 1V:2H UNLESS OTHERWISE STATED.
4. CUT SLOPES GREATER THAN 2m HIGH TO BE REFERRED TO THE ENGINEER.
5. FILL GREATER THAN 2m TO BE REFERRED TO THE ENGINEER.
6. BREAKS IN SAFETY BUND TO BE PROVIDED EVERY 25m TO ALLOW FOR RAINFALL RUN-OFF.

SHEET SIZE A3

REFERENCES

DRAWING No.	DRAWING TITLE
801-137-C3000-301	EMBANKMENT SECTIONS & DETAILS-SHT 1
801-137-C3000-700	TDRT PIPELINE CORRIDOR LAYOUT

REVISIONS

REV	DATE	DESCRIPTION	DRN	DESIGN	CKD	APP	CLIENT APP
A	04/09/2019	ISSUED FOR FEASIBILITY STUDY	PAN	BJC	BJC	DJTM	
B	11/11/2019	ISSUED FOR FEASIBILITY STUDY UPDATE	AZ	BJC	BJC	DJTM	
C	09/01/2020	ADDED BORE ACCESS TRACK TO SECTION Z	PRK	BJC	DSS	BAS	

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	DATE	DESIGNED	CHECKED	APPROVED	CLIENT APP'D

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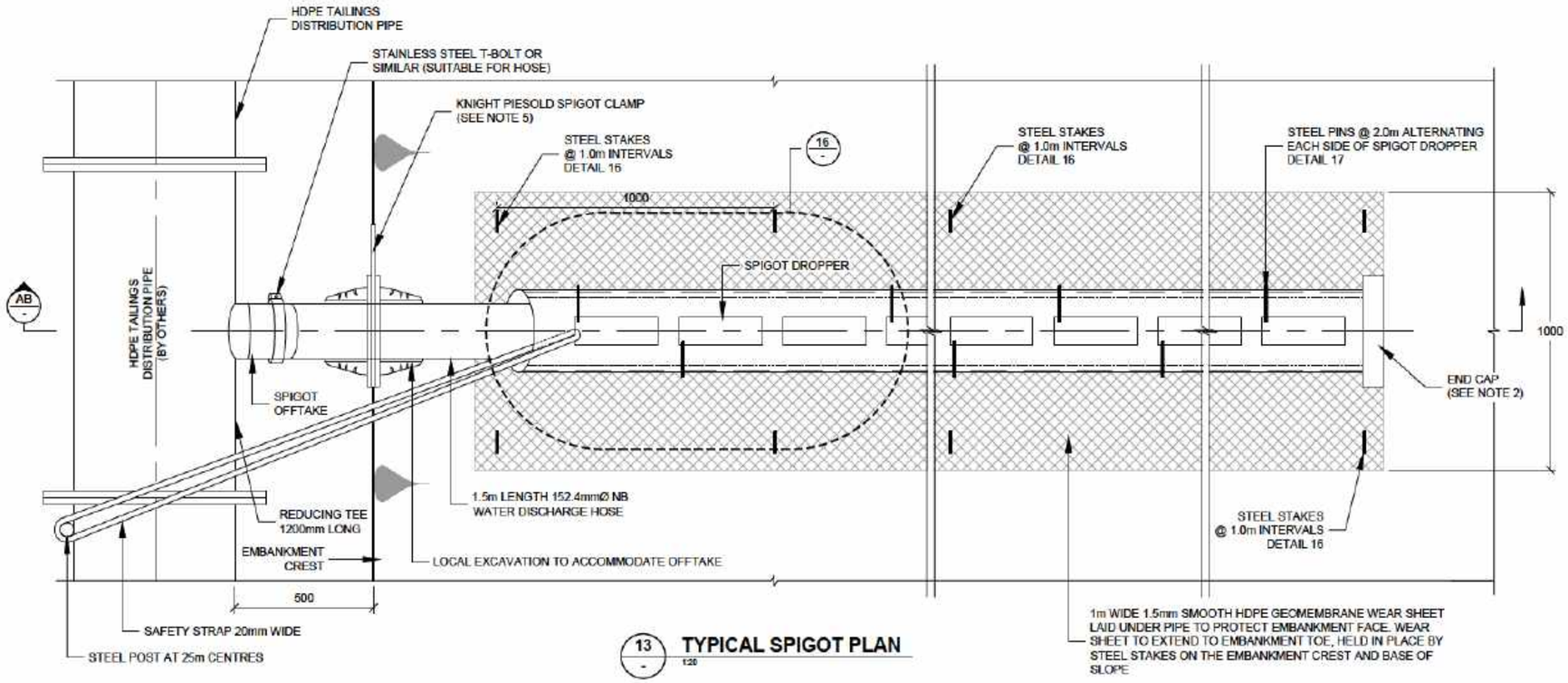
MUNGARI GOLD PROJECT
TAILINGS STORAGE FACILITY - CELLS 3 & 4 EXPANSION
TYPICAL TDRT CORRIDOR SECTIONS AND DETAILS

SCALE N.T.S.
STATUS: FS
DRAWING NUMBER **801-137-C3000-710**
REV **C**

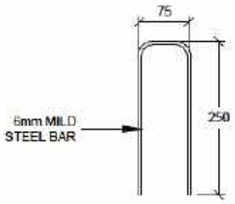
287 410



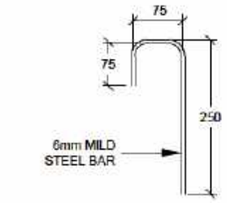
13 - TYPICAL SPIGOT PLAN
1:20

NOTES:

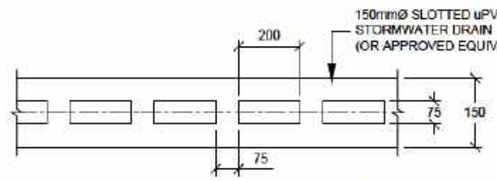
1. FOR SPIGOT CLAMP DETAILS REFER DRAWING 801-137-C3000-725.
2. SPIGOT DROPPER EXTEND BEYOND EMBANKMENT TOE BY 2m OR AS DIRECTED BY ENGINEER.
3. BOTTOM OF SPIGOT DROPPER TO BE PERMANENTLY CAPPED/PLUGGED.
4. OFFTAKE SPACING NOMINAL 25 METRES.



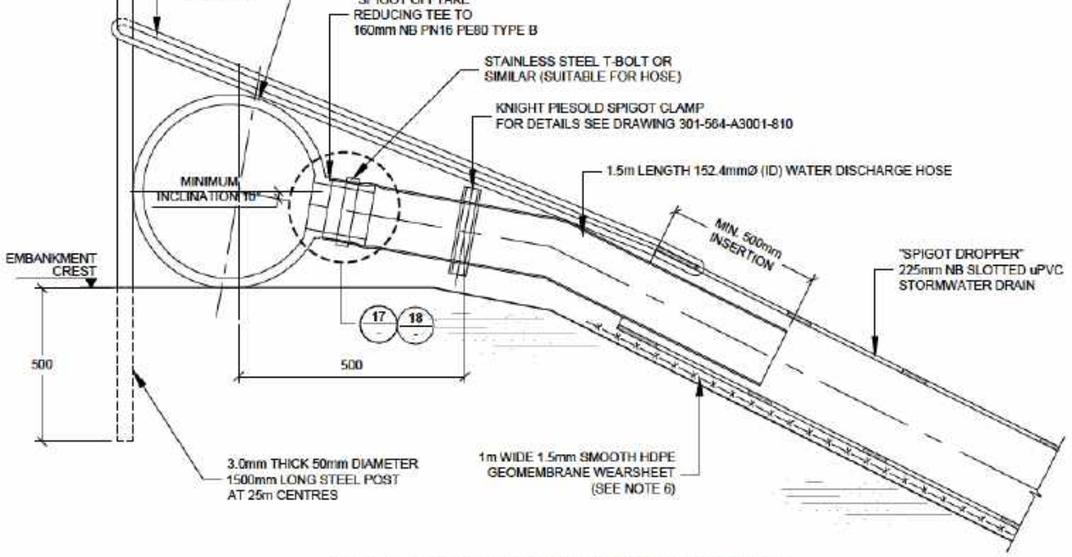
14 - STEEL STAKE DETAIL
1:10



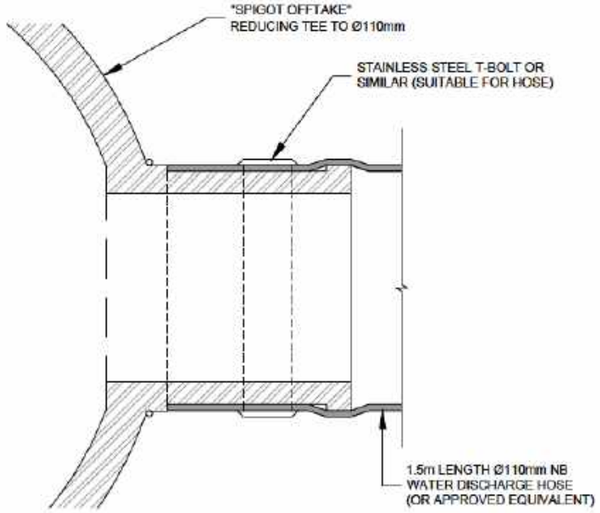
15 - STEEL PINS DETAIL
1:10



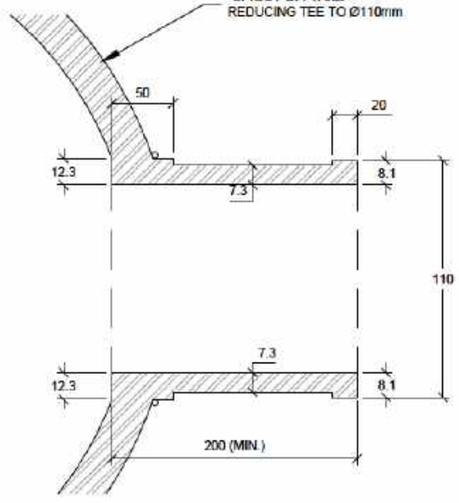
16 - SPIGOT DROPPER DETAIL
1:20



AB - TYPICAL SPIGOT PIPEWORK SECTION
1:20



17 - SPIGOT OFFTAKE AND DISCHARGE HOSE DETAIL
1:5



18 - SPIGOT OFFTAKE DETAIL
1:5

SHEET SIZE A3	REFERENCES	DRAWING No.	DRAWING TITLE
		801-137-C3000-725	SPIGOT CLAMP DETAILS

REVISIONS	REV	DATE	DESCRIPTION	DRN	DESIGN	CKD	APP	CLIENT APP
	A	04/09/2019	ISSUED FOR FEASIBILITY STUDY	PAN	BJC	BJC	DJTM	
	B	11/11/2019	ISSUED FOR FEASIBILITY STUDY UPDATE	UT	BJC	BJC	DJTM	

ORIGINAL STAMPED IN RED

	DATE	DESIGNED	CHECKED	APPROVED	CLIENT APP'D

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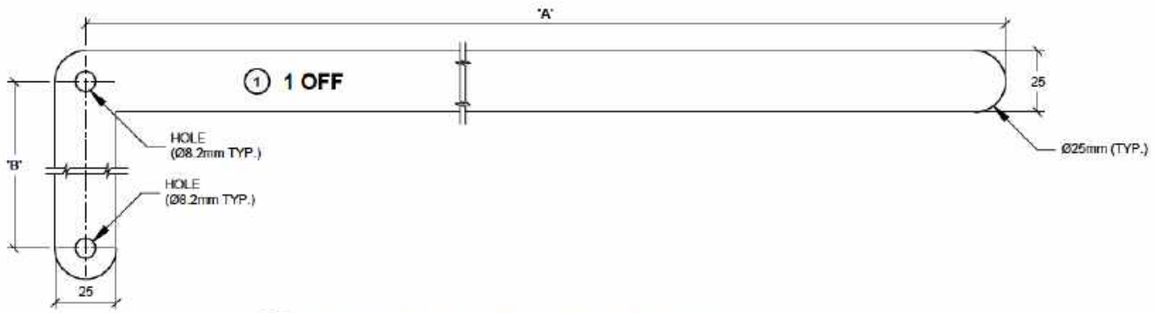
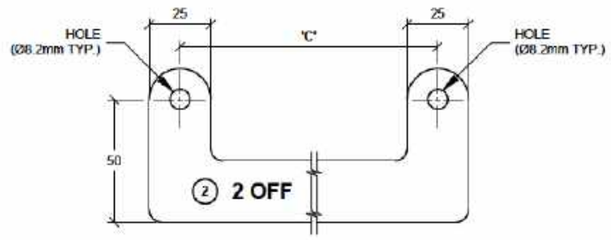
EVOLUTION MINING LTD.
MUNGARI GOLD PROJECT
TAILINGS STORAGE FACILITY - CELLS 3 & 4 EXPANSION
SPIGOT PIPEWORK DETAILS

SCALE AS SHOWN
STATUS: FS
DRAWING NUMBER 801-137-C3000-720
REV B

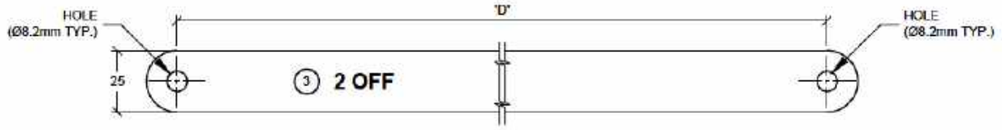
287
410



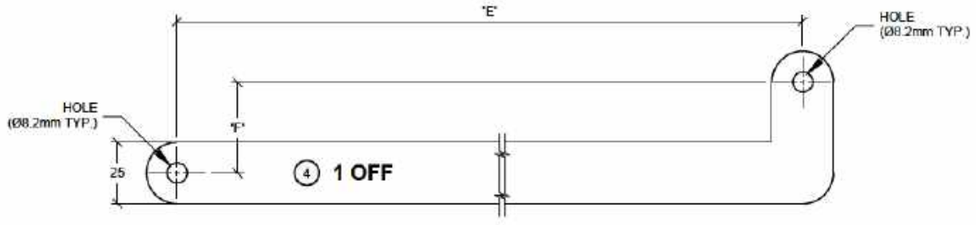
1 - COMPONENT 1 FABRICATION DETAILS
N.T.S.



2 - COMPONENT 2 FABRICATION DETAILS
N.T.S.



3 - COMPONENT 3 FABRICATION DETAILS
N.T.S.



4 - COMPONENT 4 FABRICATION DETAILS
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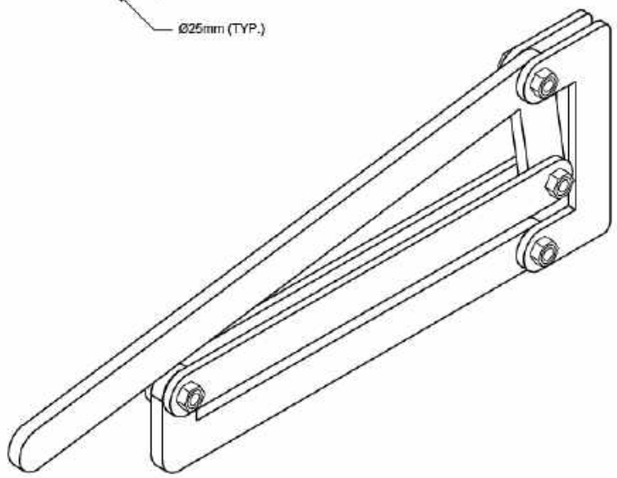
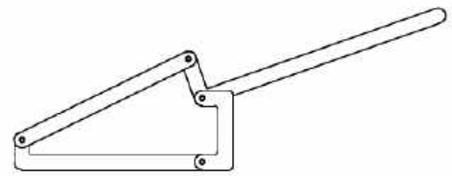


SPIGOT CLAMP - ASSEMBLED VIEW
N.T.S.



SPIGOT CLAMP - OPEN POSITION
N.T.S.

SPIGOT CLAMP - CLOSED POSITION
N.T.S.

LEGEND:

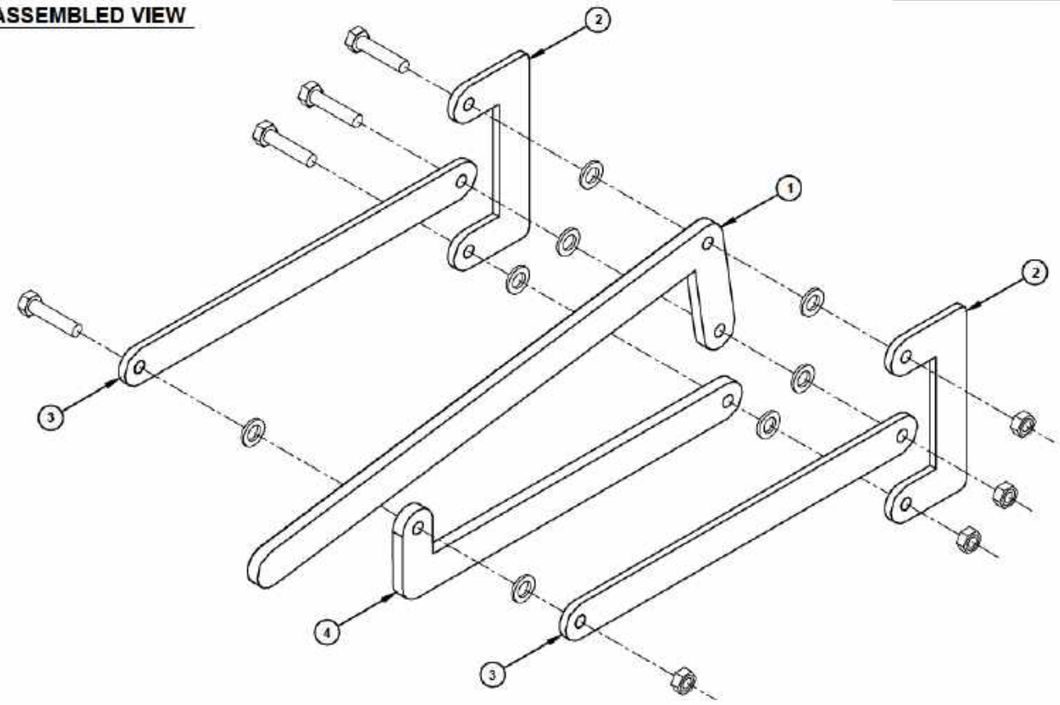
1 4	25mm x 8mm STEEL PLATE
2 3	25mm x 5mm STEEL PLATE

NOTES:

1. ASSEMBLE WITH 4 No. Ø8mm x 90mm LONG BOLTS EACH WITH 2 No. NYLON WASHERS AND ONE "LOCK ON" NUT.
2. SURFACE FINISH GALVANISED.

TABLE No.1
COMPONENT SIZING

LENGTH I.D.	LENGTH (mm)
'A'	375
'B'	73
'C'	109
'D'	265
'E'	255
'F'	36
SUITABLE HOSE SIZE	
INTERNAL HOSE Ø (mm)	110
HOSE WALL THICKNESS (mm)	T.B.A.



SPIGOT CLAMP ASSEMBLY - EXPLODED VIEW
N.T.S.

REV	DATE	DESCRIPTION	DRN	DESIGN	CKD	APP	CLIENT APP
A	04/09/2019	ISSUED FOR FEASIBILITY STUDY	PRK	BJC	BJC	DJTM	

ORIGINAL STAMPED IN RED

DATE	DESIGNED	CHECKED	APPROVED	CLIENT APP'D

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EVOLUTION MINING LTD.
MUNGARI GOLD PROJECT
TAILINGS STORAGE FACILITY - CELLS 3 & 4 EXPANSION
SPIGOT CLAMP DETAILS

SCALE N.T.S.
STATUS: FS
DRAWING NUMBER 801-137-C3000-725
REV A

SHEET SIZE A3
REFERENCES
DRAWING No. | DRAWING TITLE

287
410

RUN-OFF COLLECTION CHANNEL No.1
BORE ACCESS TRACK
6596000mN
331000mE
LEASE M15/829
LEASE M15/830
332000mE
EXISTING TAILINGS STORAGE FACILITY EMBANKMENT
BURIED WATER PIPELINE
CELL 4
CELL 3
CELL 2
CELL 1
CELL DIVIDER CAUSEWAY
AB 821
6595000mN
RUN-OFF COLLECTION POND No.1
TSF ACCESS ROAD
TSF PERIMETER ACCESS ROAD
EXPLOSIVES STORAGE AREA
SITE HAUL ROAD
RUN-OFF COLLECTION CHANNEL No.2
RUN-OFF COLLECTION POND No.2
TDRT
TSF ACCESS ROAD
TDRT PIPELINE CULVERT (2 No.)
CUTTERS RIDGE ACCESS ROAD
WESTERN WASTE DUMP
WHITE FOIL PIT
6594000mN
KURRAWANG LAKE
SCALE (METRES)
1:10,000 (A3)

LEGEND:

- LEASE BOUNDARY
- EXISTING SITE ACCESS ROAD
- EXISTING SITE HAUL ROAD
- EXISTING DIVERSION CHANNEL
- TAILINGS AND DECANT RETURN PIPELINE CONTAINMENT CORRIDOR (TDRT)
- RUN-OFF COLLECTION CHANNEL
- PROPOSED CUTTERS RIDGE ACCESS ROAD
- PROPOSED TAILINGS DECANT RETURN PIPELINE CONTAINMENT CORRIDOR AND ACCESS ROAD

NOTES:

1. ALL COORDINATES SHOWN IN GRID PROJECTION MGA94 ZONE 51.
2. 1m CONTOUR INTERVALS SHOWN. EXTERNAL TOPOGRAPHICAL DATA PROVIDED BY EVOLUTION MINING, MAY 2018.
3. WESTERN WASTE DUMP DATA PROVIDED BY EVOLUTION MINING, FEBRUARY 2018.
4. EXISTING TAILINGS STORAGE FACILITY CELLS 1 AND 2 FINAL (STAGE 6) EMBANKMENT SHOWN.

SHEET SIZE A3

REFERENCES

DRAWING No.	DRAWING TITLE
801-137-C3000-821	CULVERT SECTIONS AND DETAILS

REVISIONS

REV	DATE	DESCRIPTION	DRN	DESIGN	CKD	APP	CLIENT APP
A	04/09/2019	ISSUED FOR FEASIBILITY STUDY	PAN	BJC	BJC	DJTM	
B	11/11/2019	ISUED FOR FEASIBILITY STUDY UPDATE	UT	BJC	BJC	DJTM	
C	09/01/2020	ADDED ACCESS ROADS, REVISED PROPOSED TDRT	PRK	BJC	DSS	BAS	

ORIGINAL STAMPED IN RED

DATE	DESIGNED	CHECKED	APPROVED	CLIENT APP'D

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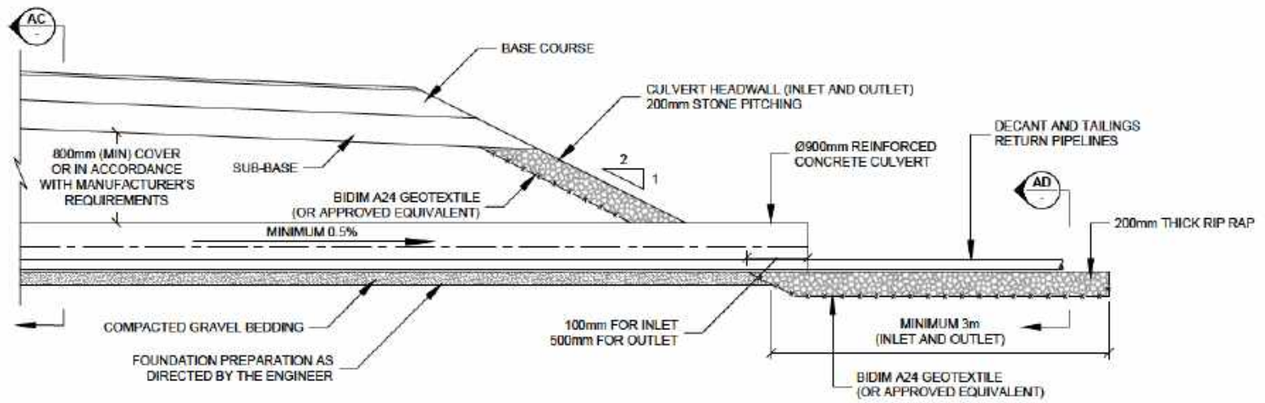
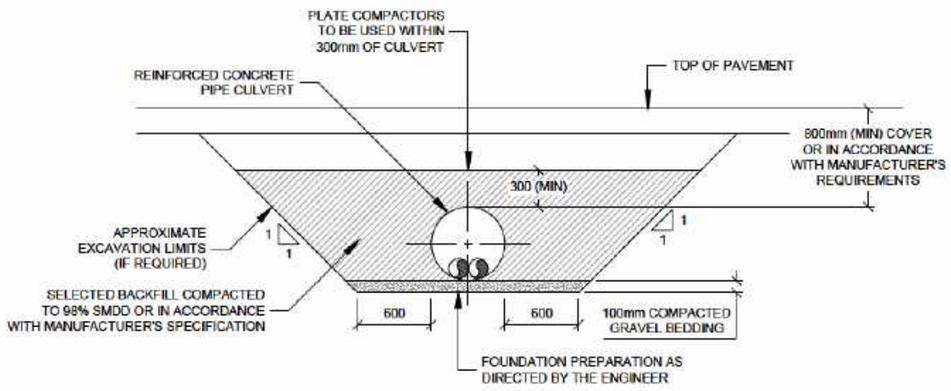
EVOLUTION MINING LTD.
MUNGARI GOLD PROJECT
TAILINGS STORAGE FACILITY - CELLS 3 & 4 EXPANSION
CULVERT LAYOUT

SCALE 1:10,000
STATUS: FS
DRAWING NUMBER 801-137-C3000-800
REV C

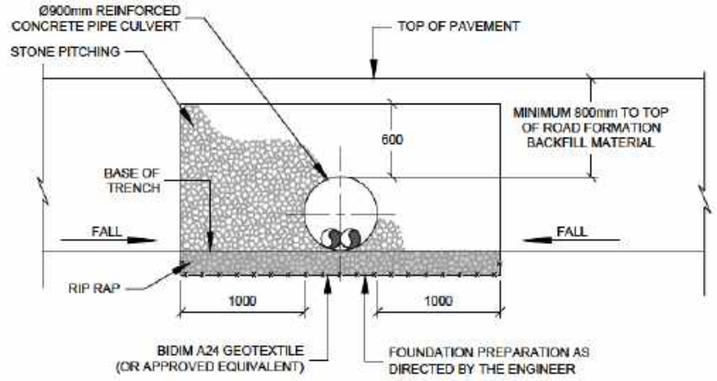
287



AB 800 TYPICAL CULVERT HEADWALL SECTION
N.T.S.



AC - TYPICAL CULVERT TRENCH EXCAVATION AND BACKFILL SECTION
N.T.S.



AD - TYPICAL CULVERT HEADWALL SECTION
N.T.S.

SHEET SIZE A3	DRAWING No.	DRAWING TITLE
REFERENCES	801-137-C3000-800	CULVERT LAYOUT

REVISIONS	REV	DATE	DESCRIPTION	DRN	DESIGN	CKD	APP	CLIENT APP
	A	04/09/2019	ISSUED FOR FEASIBILITY STUDY	PAN	BJC	BJC	DJTM	
	B	11/11/2019	ISSUED FOR FEASIBILITY STUDY UPDATE	UT	BJC	BJC	DJTM	

ORIGINAL STAMPED IN RED

	DATE	DESIGNED	CHECKED	APPROVED	CLIENT APP'D

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EVOLUTION MINING LTD.
MUNGARI GOLD PROJECT
TAILINGS STORAGE FACILITY - CELLS 3 & 4 EXPANSION
CULVERT SECTIONS & DETAILS

SCALE AS SHOWN
STATUS: FS
DRAWING NUMBER **801-137-C3000-821**
REV **B**

Document Set ID: 4838287 Version: 1 Version Date: 27/11/2019

RUN-OFF COLLECTION CHANNEL No.1
BORE ACCESS TRACK
LEASE M15/829
LEASE M15/830
330000mE
329000mE
6596000mN
MB-09
MB-08
MB-07
EXISTING TAILINGS STORAGE FACILITY EMBANKMENT
MB06
MB05
MB-10
CELL 4
CELL 3
CELL 2
CELL 1
MB01
SEE NOTE 6.
MB04
RUN-OFF COLLECTION POND No.1
MB-11
CELL DIVIDER CAUSEWAY
6595000mN
MB03
MB-12
MB-13
MB-14
EXPLOSIVES STORAGE AREA
SITE HAUL ROAD
TSF ACCESS ROAD
RUN-OFF COLLECTION CHANNEL No.2
RUN-OFF COLLECTION POND No.2
TDRT
BORE ACCESS TRACK
TSF ACCESS ROAD
TDRT PIPELINE CULVERT (2 No.)
PROPOSED CUTTERS RIDGE ACCESS ROAD
WESTERN WASTE DUMP
6594000mN
KURRAWANG LAKE
SCALE (METRES) 1:10,000 (A3)

LEGEND:

- LEASE BOUNDARY
- EXISTING SITE ACCESS ROAD
- EXISTING SITE HAUL ROAD
- TAILINGS AND DECANT RETURN PIPELINE CONTAINMENT CORRIDOR (TDRT)
- RUN-OFF COLLECTION CHANNEL
- PROPOSED CUTTERS RIDGE ACCESS ROAD
- PROPOSED TAILINGS DECANT RETURN PIPELINE CONTAINMENT CORRIDOR AND ACCESS ROAD
- EXISTING MONITORING BORE STATION
- PROPOSED MONITORING BORE
- PROPOSED VIBRATING WIRE PIEZOMETER
- PROPOSED SURVEY STATION PIN
- STANDPIPE PIEZOMETERS

NOTES:

1. 1m CONTOUR INTERVALS SHOWN. EXTERNAL TOPOGRAPHICAL DATA PROVIDED BY EVOLUTION MINING, MAY 2018.
2. WESTERN WASTE DUMP DATA PROVIDED BY EVOLUTION MINING, FEBRUARY 2018.
3. EXISTING TAILINGS STORAGE FACILITY CELLS 1 AND 2 FINAL (STAGE 6) EMBANKMENT SHOWN.
4. FOR MONITORING INSTRUMENTATION INSTALLATION DETAILS REFER DRAWING 801-137-C3000-921.
5. MB01 TO BE DECOMMISSIONED.
6. STAGE 3 EMBANKMENT SHOWN.

ORIGINAL STAMPED IN RED

DATE	DESIGNED	CHECKED	APPROVED	CLIENT APP'D

SHEET SIZE A3

REFERENCES

DRAWING No.	DRAWING TITLE
801-137-C3000-921	MONITORING INSTRUMENTATION DETAILS

REVISIONS

REV	DATE	DESCRIPTION	DRN	DESIGN	CKD	APP	CLIENT APP
A	04/09/2019	ISSUED FOR FEASIBILITY STUDY	PAN	BJC	BJC	DJTM	
B	11/11/2019	ISSUED FOR FEASIBILITY STUDY UPDATE	UT	BJC	BJC	DJTM	
C	09/01/2020	ADDED ACCESS ROADS, REVISED VWP LOCATIONS	PRK	BJC	DSS	BAS	

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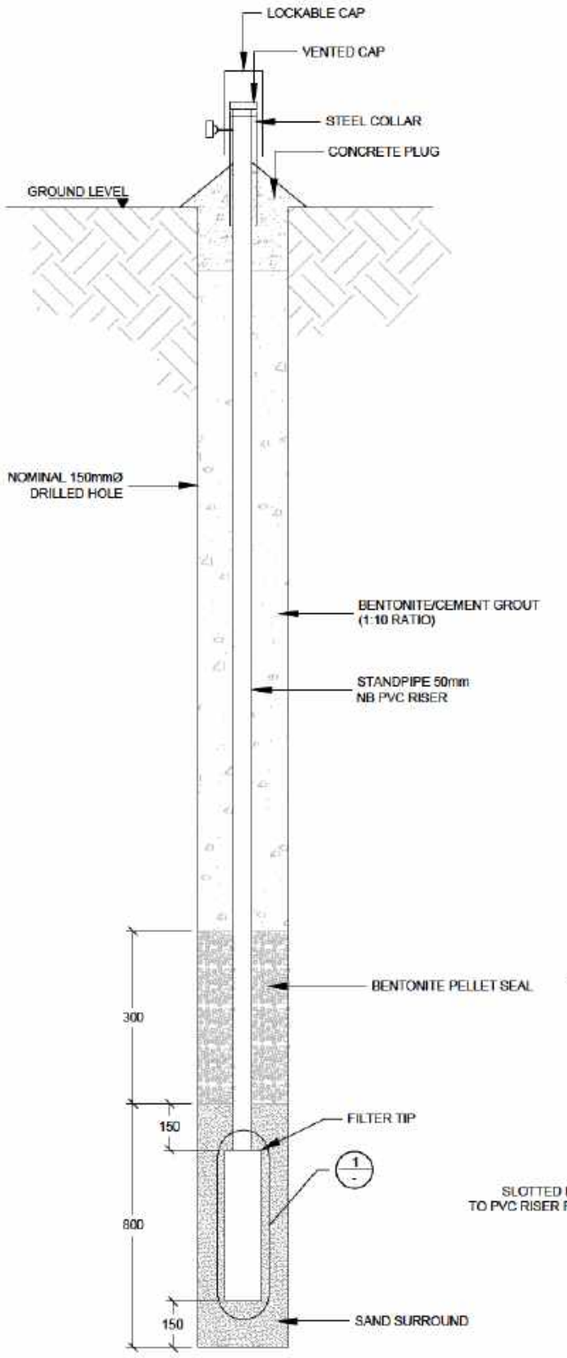
EVOLUTION MINING LTD.
MUNGARI GOLD PROJECT
TAILINGS STORAGE FACILITY - CELLS 3 & 4 EXPANSION
MONITORING INSTRUMENTATION LAYOUT

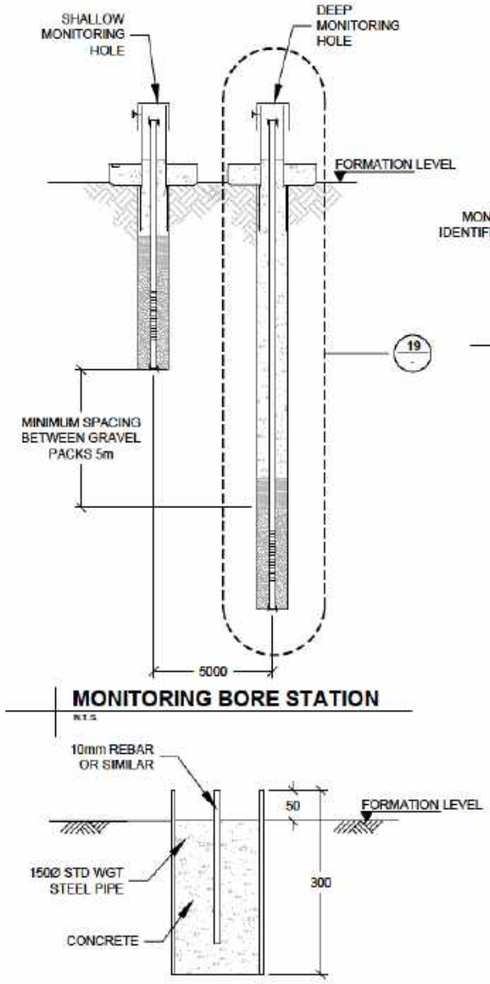
SCALE 1:10,000
STATUS: FS
DRAWING NUMBER 801-137-C3000-900
REV C

287
410



STANDPIPE PIEZOMETER

N.T.S.

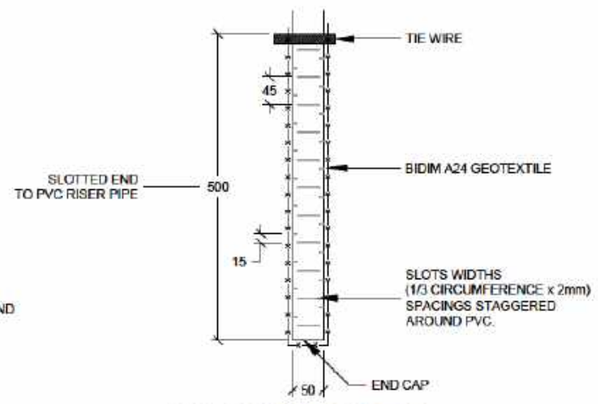


MONITORING BORE STATION

N.T.S.

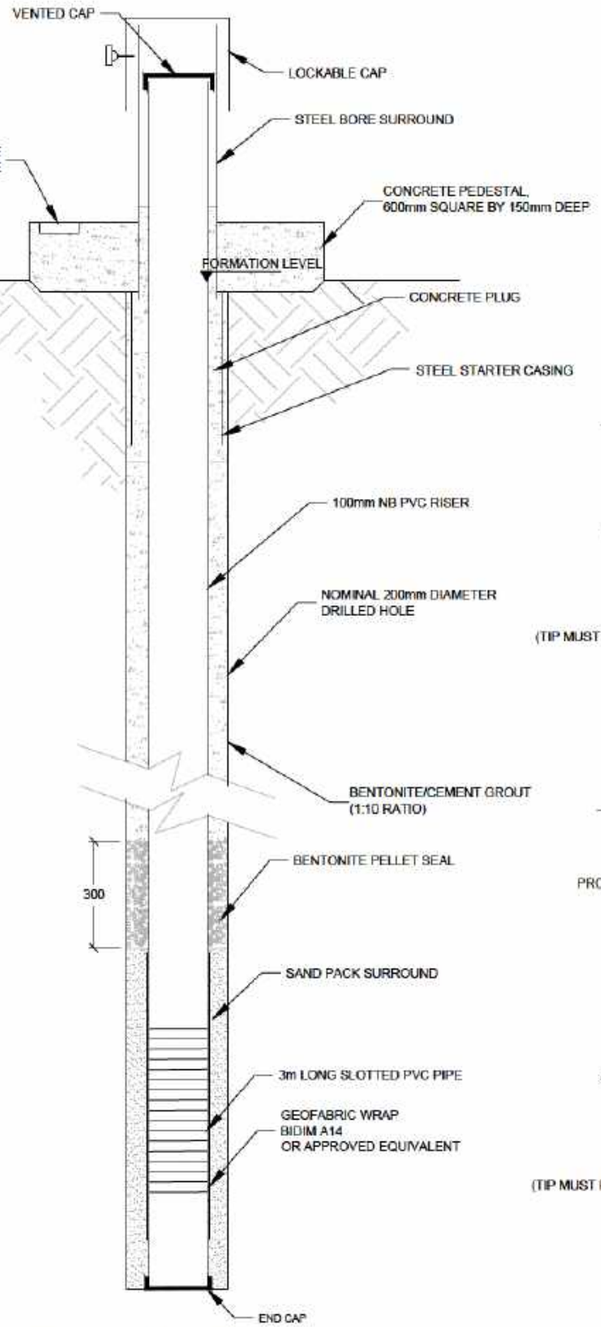
TYPICAL SURVEY STATION PIN

1:10



1 — FILTER TIP DETAIL

1:10

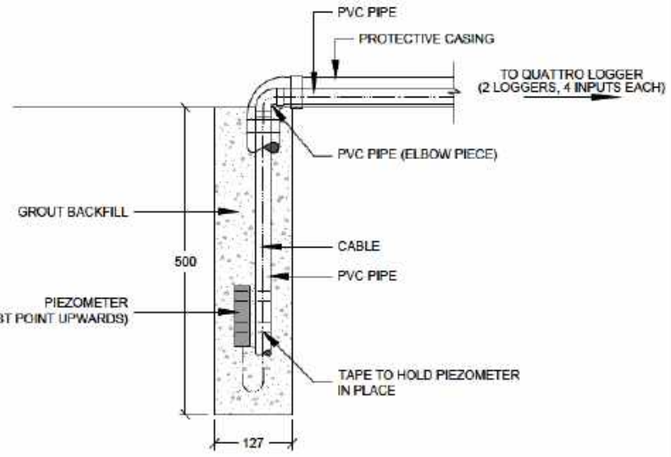


19 — MONITORING BORE INSTALLATION DETAIL

N.T.S.

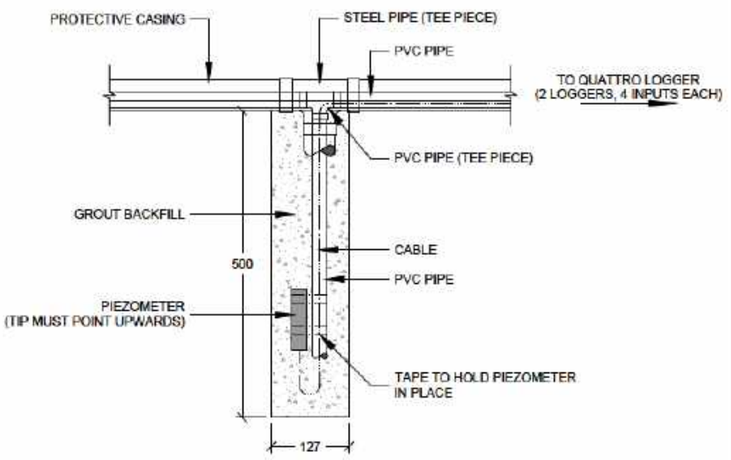
NOTES:

1. DEPTH OF MONITORING BORES TO BE DETERMINED ON SITE. (APPROX 10m AND 20m)
2. BOREHOLE DRILLING TO BE SUPERVISED BY ENGINEER FOR GEOLOGICAL LOGGING.
3. LOCATION OF INSTRUMENTS TO BE DETERMINED BY THE ENGINEER ON SITE.



INITIAL VIBRATING WIRE PIEZOMETER

1:10



SECONDARY VIBRATING WIRE PIEZOMETER

1:10

ORIGINAL STAMPED IN RED

	DATE	DESIGNED	CHECKED	APPROVED	CLIENT APP'D

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SHEET SIZE A3

REFERENCES

DRAWING No.	DRAWING TITLE

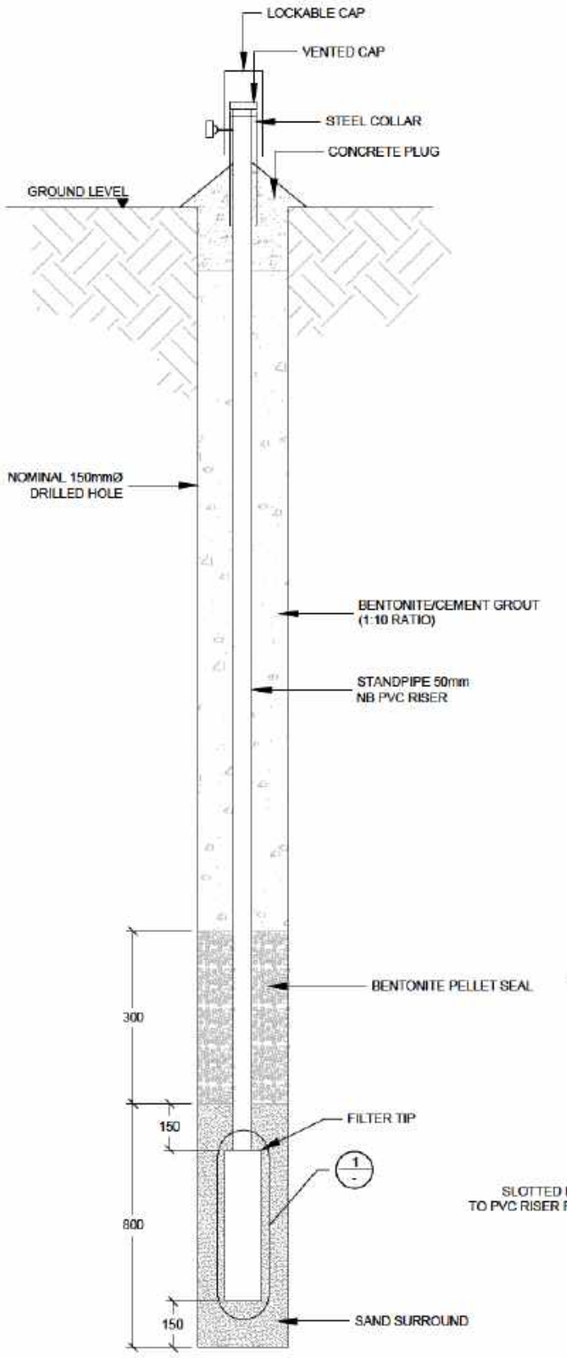
REVISIONS

REV	DATE	DESCRIPTION	DRN	DESIGN	CKD	APP	CLIENT APP
A	04/09/2019	ISSUED FOR FEASIBILITY STUDY	PRK	BJC	BJC	DJTM	
B	11/11/2019	ISSUED FOR FEASIBILITY STUDY UPDATE	UT	BJC	BJC	DJTM	

EVOLUTION MINING LTD.
MUNGARI GOLD PROJECT
TAILINGS STORAGE FACILITY - CELLS 3 & 4 EXPANSION
MONITORING INSTRUMENTATION DETAILS

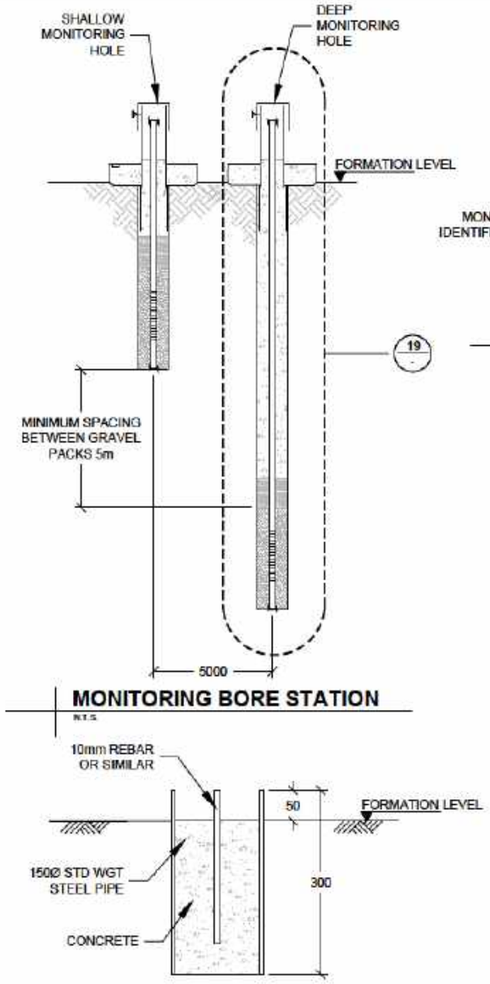
SCALE: AS SHOWN
STATUS: FS
DRAWING NUMBER: 801-137-C3000-921
REV: B

287 410



STANDPIPE PIEZOMETER

N.T.S.

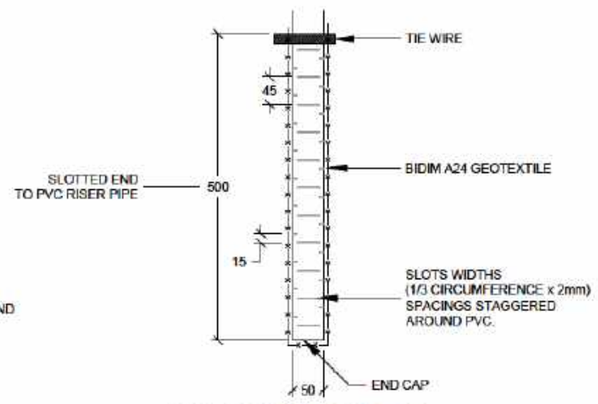


MONITORING BORE STATION

N.T.S.

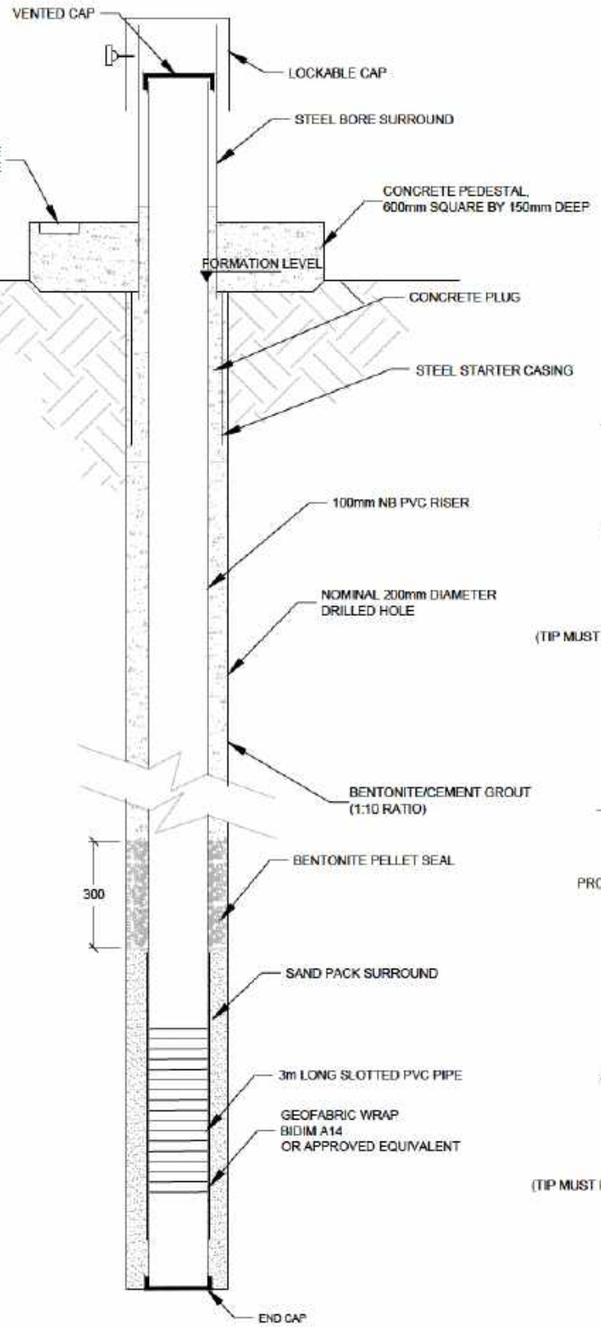
TYPICAL SURVEY STATION PIN

1:10



1 — FILTER TIP DETAIL

1:10

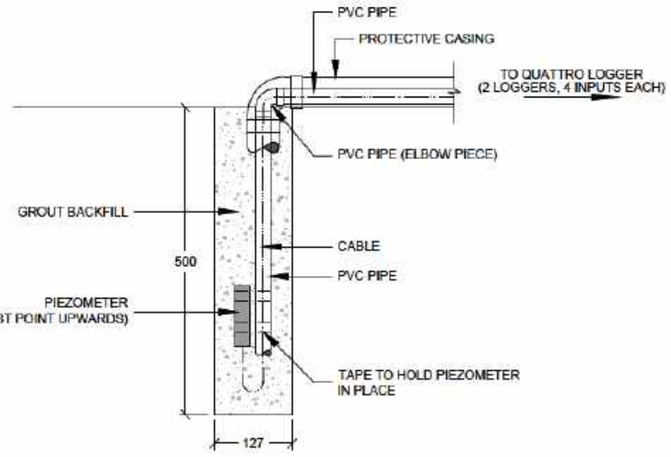


19 — MONITORING BORE INSTALLATION DETAIL

N.T.S.

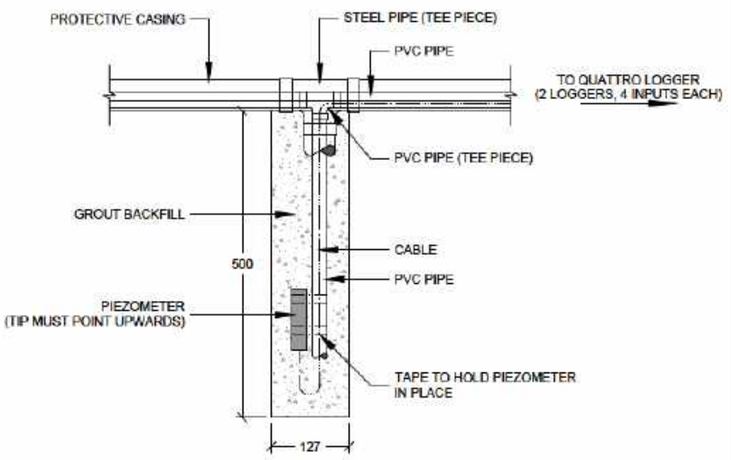
NOTES:

1. DEPTH OF MONITORING BORES TO BE DETERMINED ON SITE. (APPROX 10m AND 20m)
2. BOREHOLE DRILLING TO BE SUPERVISED BY ENGINEER FOR GEOLOGICAL LOGGING.
3. LOCATION OF INSTRUMENTS TO BE DETERMINED BY THE ENGINEER ON SITE.



INITIAL VIBRATING WIRE PIEZOMETER

1:10



SECONDARY VIBRATING WIRE PIEZOMETER

1:10

ORIGINAL STAMPED IN RED

	DATE	DESIGNED	CHECKED	APPROVED	CLIENT APP'D

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SHEET SIZE A3

REFERENCES

DRAWING No.	DRAWING TITLE

REVISIONS

REV	DATE	DESCRIPTION	DRN	DESIGN	CKD	APP	CLIENT APP
A	04/09/2019	ISSUED FOR FEASIBILITY STUDY	PRK	BJC	BJC	DJTM	
B	11/11/2019	ISSUED FOR FEASIBILITY STUDY UPDATE	UT	BJC	BJC	DJTM	

EVOLUTION MINING LTD.
MUNGARI GOLD PROJECT
TAILINGS STORAGE FACILITY - CELLS 3 & 4 EXPANSION
MONITORING INSTRUMENTATION DETAILS

SCALE: AS SHOWN
STATUS: FS
DRAWING NUMBER: 801-137-C3000-921
REV: B

287 410

APPENDIX A

Cell 3 and Cell 4 Option Study and Conceptual Design

Knight Piésold CONSULTING

Knight Piésold CONSULTING

MEMORANDUM

To: Evolution Mining [redacted]	**Date:** 25 February 2019
	Our Ref: PE19-00175
	KP File Ref.: PE801-00137/29-A M19003
	From: [redacted]

RE: MUNGARI – CELL 3 AND CELL 4 OPTION STUDY AND CONCEPTUAL DESIGN

Knight Piésold (KP) has been engaged by Evolution Mining (EM) to undertake the detailed design of a new Tailings Storage Facility (TSF) at the Mungari Gold Project. The facility will comprise two additional cells, namely Cell 3 and Cell 4, expanding off from the existing operating TSF. The facility will provide the ability to cycle tailings deposition between each cell for the remainder of the Life of Mine.

This memorandum provides:

i. An option study used to determine a preferred location for a new TSF. This advances on the concept presented previously to EM in 2016 (Ref 1) and is based on new design data.
ii. A conceptual design highlighting the key features proposed to advance to final design.

1. DESIGN CRITERIA

The key TSF design input parameters to be used for a Cell 3 and Cell 4 facility are provided in Table 1.1.

Table 1.1: TSF Design Parameters

Parameter	Value	Source
Total Tonnage	18 Mt	Evolution (to be confirmed)
Average Throughput	2 Mtpa	Evolution
Tailings Percent Solids	42% w/w	Evolution
Paste Reclaim	0 – 720ktpa	Evolution (considered 0 for life of mine purposes)
Number of Cells	2	KP nominated
Tailings Beach Slope	1V:120H	Survey
Tailings Dry Density	1.4 - 1.45 t/m^3	KP back calculation
Raise Technique	Downstream for 2 years Centreline for 1 year Upstream for 6 years	To be validated by KP/testwork
Maximum Embankment	Target final approved elevation as existing TSF	KP nominated

2. LOCATION OPTIONS

The following locations have been identified by EM and KP for consideration to construct a new TSF. The options are centred around the existing TSF due to existing tailings infrastructure, lease boundaries and mine waste availability. The options examined are shown on Figure 2.1 and discussed below.

The following have been considered in the options assessment study:

- Only the lease where the existing TSF (M15/830) operates and the lease to the west (M15/829) have been considered;
- Topography of both lease areas was provided by EM in May 2018;
- Heritage layers were provided by EM from publically available registers;
- Salt lakes were identified (below RL341 m) as avoidance zones by KP due to potential surface and ground water issues and weaker foundation conditions;
- Existing infrastructure consists of the explosives storage area to the south of Cell 2; and
- Planned Infrastructure consists of a haul road to Cutters Ridge deposit heading west from the plant.

EM have not confirmed whether sterilisation drilling has been completed in each of the areas. EM should confirm the preferred option suitable with a sterilisation report for record. A known deposit (White Tail Pit) is located immediately east of Cell 2 but is not in the current life of mine plan.

A flora and vegetation survey was completed in March 2017 for M15/829 within the extents shown in Appendix A. EM indicated "*No threatened or Priority Flora were recorded in the survey area. No Threatened Ecological Communities (TECs) or Priority Ecological Communities (PECs) were recorded within the survey area.*" It was also assumed the existing M15/830 was also clear of flora issues.

2.1 OPTION 1.1: WEST OF EXISTING TSF

A TSF located adjacent to the existing TSF heading west, sharing the western embankment of Cell 2.

Pros:

- Natural topography is relatively flat which optimises TSF storage capacity;
- The facility will be elevated (by ~5m) from the Kurrawang Lake to the south, aiding surface water drainage;
- It will utilise a common wall with Cell 2 and also aid with current seepage from the west of Cell 2;
- The existing tailings pipeline corridor and power infrastructure can be utilised to the south of the existing facility;
- An extensive geotechnical site investigation (Ref 4) has been completed in the area;
- Borrow material in the foundation area has been identified as suitable for use in embankment construction;
- Groundwater level is typically at 12 metres below surface; and
- No heritage issues in the facility footprint.

Cons:

- The existing explosives storage area will have an increased risk from a TSF failure with the new cell (south-east corner).

2.2 OPTION 1.2: NORTH OF EXISTING TSF

A TSF located adjacent to the existing TSF, sharing the northern embankment of cells 1 and 2.

Pros:

- It will utilise a common wall with Cell 1 and Cell 2 and also aid with seepage from the north of the existing facility;
- The existing tailings pipeline corridor and power infrastructure can be utilised to the south of the existing facility;
- A borrow material site investigation has been completed in the area and the foundation area has been identified as suitable for use in embankment construction; and
- No heritage issues in the facility footprint.

Cons:

- The mining lease boundary north of Cell 1 and Cell 2 could restrict the expandability of the footprint of a new facility;
- A seepage trench tower north of Cell 2 will be covered and would need to be incorporated into the new TSF design;
- Topography rises approximately 7 metres toward the north east which will reduce storage capacity;
- A buttress is currently required as part of the Stage 5 raise for Cell 1 and Cell 2 on the northern side of the TSF. This would need to be incorporated into the design of a new TSF constructed adjacent to this embankment;
- A limited geotechnical site investigation has been completed. Additional boreholes would be required to confirm foundation conditions; and
- Surface water management will be challenging as the footprint intercepts surface flow from east to west.

2.3 OPTION 1.3: EAST OF EXISTING TSF

A TSF located adjacent to the existing TSF, sharing the eastern embankment of Cell 1, shown as Option 1.3A and Option 1.3B.

Option 1.3A illustrates a footprint bound by the constraints of the lease boundary, whereas Option 1.3B illustrates a footprint bound by the constraints of the existing water pipeline.

Pros:

- It will utilise a common wall with Cell 1;
- The existing tailings pipeline corridor and power infrastructure can be utilised to the south of the existing facility;
- Ground disturbance has already been undertaken in this area through borrow excavation. Material in the facility basin suitable for use has been utilised thereby increasing storage capacity; and
- No heritage issues in the facility footprint.

Cons:

- Kopai Lake, a natural ridge and the lease boundary limit the full expansion potential to the east;
- An existing water pipeline runs north – south within the footprint (could be realigned);
- The footprint would be limited for the planned throughput due to the constraints toward the east; and

- A limited geotechnical site investigation has been completed. Additional boreholes would be required to confirm foundation conditions.

2.4 OPTION 1.4: SOUTH OF EXISTING TSF

A TSF located adjacent to the existing TSF, sharing the southern embankment of cells 1 and 2.

Pros:

- It will utilise a common wall with Cell 1 and Cell 2;
- It may utilise a common wall with the existing waste dump; and
- The existing tailings pipeline corridor and power infrastructure can be utilised to the south of the existing facility, reducing pump distance from the plant.

Cons:

- Facility footprint covers key infrastructure including explosives storage area and transformer;
- Facility footprint covers the existing dry tails reclamation area;
- Facility located in salt lake areas with potentially high groundwater associated with seasonal ponding. A facility in this location would be likely to exceed the environmental conditions of maintaining groundwater at 4 metres below surface;
- No geotechnical site investigation has been completed. Foundations would expected to be soft and wet; and
- Heritage areas identified in the facility footprint.

2.5 OPTION 1.5 WEST OF WASTE DUMP

A standalone TSF located west of the waste dump, access road and tailings pipeline corridor.

Pros:

- The existing tailings pipeline corridor and power infrastructure can be utilised to the south of the existing facility. A reduction in pumping costs due to shorter distance from the plant.

Cons:

- Facility located in Kurrawang Lake areas with potentially high groundwater associated with seasonal ponding. A facility in this location would struggle to maintain the environmental conditions of groundwater at 4 metres below surface;
- A dam breach to the south east could reach the plant site and administration building;
- No geotechnical site investigation has been completed. Foundations would expected to be soft and wet;
- The proposed Cutters Ridge access road lies within the footprint and may need to be realigned;
- Heritage areas identified in the facility footprint; and
- Not sharing common embankments with the existing facility which would increase construction costs.

2.6 OPTION 1.6: WEST OF FACILITY ORIENTATED NORTH/SOUTH

A TSF located adjacent to the existing TSF, sharing the western embankment of Cell 2. This differs from Option 1.1 with cells positioned north south to limit westward advancement but of similar total footprint.

Pros:

- Natural topography is relatively flat which optimises TSF storage capacity;
- It will utilise a common wall with Cell 2, which will reduce embankment fill required and also aid with current seepage from the west of Cell 2;
- The existing tailings pipeline corridor and power infrastructure can be utilised to the south of the existing facility;
- An extensive geotechnical site investigation has been completed in the area;
- Borrow material in the foundation has been identified as suitable for use in embankment construction; and
- No heritage issues in the facility footprint.

Cons:

- The facility may encroach on the Kurrawang Lake to the south;
- Location is not ideal for surface water management as water could potentially pond in the corner between the two facilities (i.e. where the seepage trench tower exists); and
- The existing explosives storage area will have an increased risk from a TSF dam failure with the new cells.

2.7 IN PIT DISPOSAL

The option study does not explore in pit disposal in detail (specifically White Foil Pit) however recognises the option was considered and discounted by EM due to unconfirmed resource extents. There may be the potential for additional ore reserve within White Foil pit to expand north-south or go underground. The majority of other decommissioned pits in the area also lie off the mining lease boundary, are significantly further from the plant and would be expected to take some time to gain approval and undertake sterilisation.

3. OPTIONS ASSESSMENT CONCLUSION

The assessment of potential options above indicates the selection of advancing additional cells to the west of the existing TSF is preferred. This is from a project timeframe perspective (site investigation completed) and topography of the layout which influences storage capacity and surface water management.

The increased risk to the existing explosives storage area from a TSF dam failure will have to be considered. Although only visited daily and already considered as part of the Cell 1 and 2 consequence assessment, the additional cell will increase the risks association with TSF failure.

EM prefer to not relocate the facility if this risk is recognised and is considered manageable. To reduce risks, there is an opportunity to construct a section of the new facility utilising downstream construction methods with the cost impact compared to relocating the infrastructure elsewhere.

4. CONCEPTUAL DESIGN

A conceptual two cell TSF design has been developed by KP utilising the area immediately west of the existing facility (Option 1.1).

An area of 90 Ha has been adopted for a 2.0 Mtpa operation with a maximum rate of rise of 3 m/year. A schematic layout and typical cross section is provided in figures 4.1 and 4.2 respectively.

Key details of the design for the new facility include, but are not limited to:

- Downstream construction for stages 1 and 2 of the facility, followed by centreline construction for Stage 3. Upstream construction may be implemented for the remaining stages once site specific insitu testing is conducted and stability assessments confirm suitable factors of safety;
- A nominal 4 metre deep cut off trench that extends through the clayey sand into the silty clay layer, typically 3 metres below surface;
- Dual draincoil encapsulated by filter sand within the toe drain which is located adjacent to the cut off trench at the base of the cutting;
- Additional draincoil to be located at original ground, with chute connector drains every 100 metres to facilitate drainage toward the toe drain;
- Two toe drain towers within each cell located at the embankment corners to reduce the distance solution is required to travel within the toe drains. The base of these will be a further 2m deeper to provide positive fall and underdrainage pump head to operate;
- A nominal 4 metre deep sloped excavation within the central underdrainage area. The underdrainage network will be constructed to flow toward the centre of each cell as natural ground has limited fall. This fill will be used within the starter embankments;
- An underdrainage tower and decant tower located centrally within each cell, accessible by a causeway from the divider embankment;
- Vibrating wire piezometers installed pre construction (in lieu of stand pipe piezometers) into the foundation at two locations along each transect within each cells embankment. The system will be connected to the existing telemetry system; and
- A closure profile within the design to allow early rehabilitation of lower slopes.

The above features will be modelled in seepage and stability programs as part of the final design to demonstrate their effectiveness and expected performance.

No paste reclaim has currently been allowed for in the storage capacity design to provide a conservative life of mine footprint. However, up to 720 ktpa paste reclaim will be included in the overall operating strategy incorporating Cell 1 and 2 and the new TSF.

It is noted that a dam break and consequence assessment is required to confirm design requirements, based on DMIRS (Ref 2) and ANCOLD (Ref 3) guidelines.

5. CONCLUSION

Based on the option assessment undertaken, the new TSF location is recommended west of the existing facility. This site provides a relatively flat, elevated surface with a deeper groundwater level. Borrow material has been identified as suitable for use in construction. The area does not have heritage issues or existing infrastructure and can tie into the existing facility on the east.

The increased risk to the existing explosives storage area from a TSF dam failure will have to be considered.

A conceptual design has been developed based on findings from the ongoing operation of cells 1 and 2, coupled with a geotechnical site investigation west of the existing facility. Key design aspects have been outlined and will be refined in the detailed design phase which will ensure the facility meets the DMIRS guidelines (Ref 2).

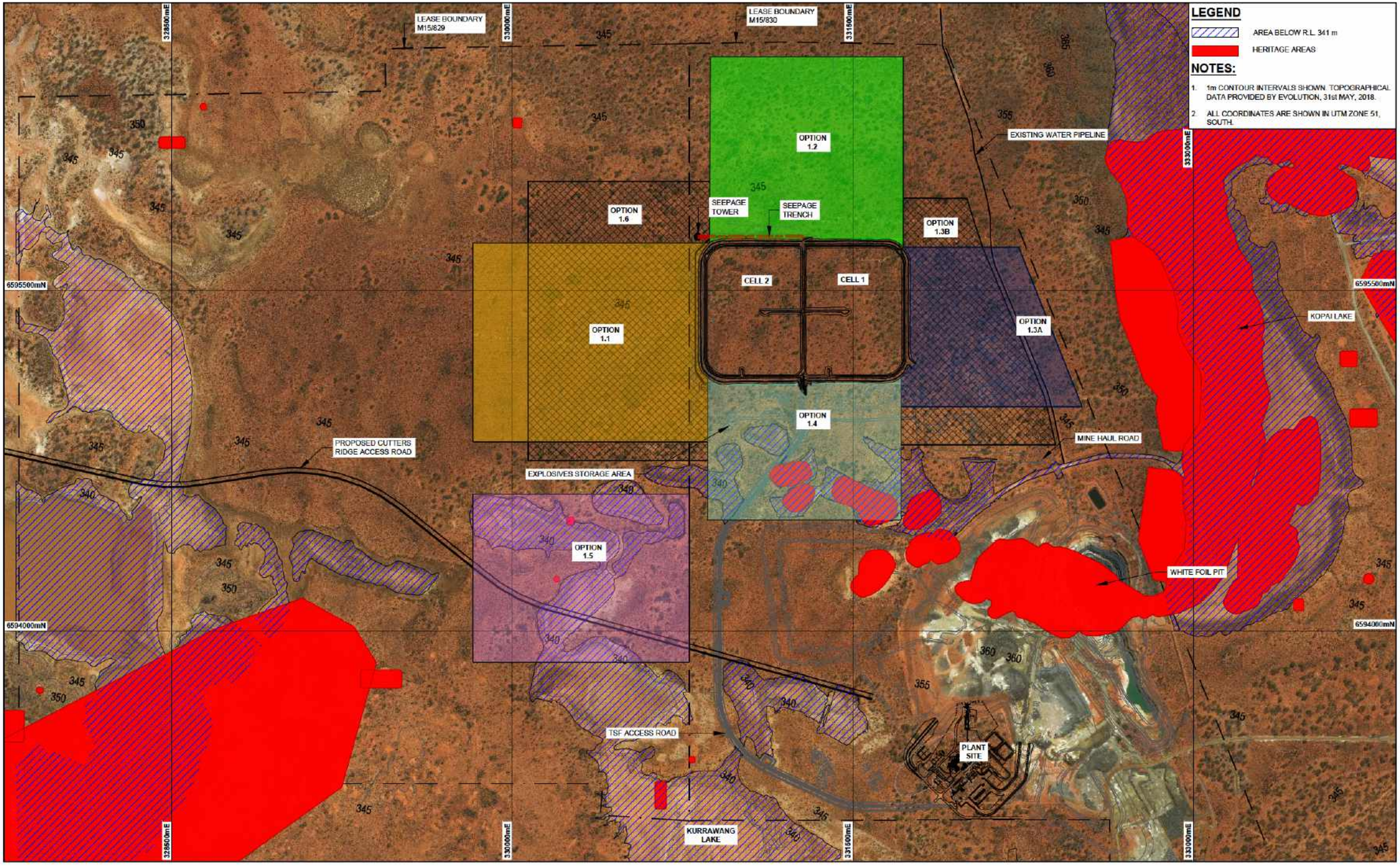
We trust this is sufficient information for your current requirements. If you have any questions, please contact us.

[redacted]

REFERENCES

1. Knight Piésold, *"TSF Cell 3 Conceptual Design"* Ref PE16-00983, November 2016.
2. Department of Mines, Industry Regulation and Safety (DMIRS) *"Guide to the preparation of a design report for tailings storage facilities (TSFs)"*, August 2015.
3. ANCOLD *"Guidelines on Tailings Dams, Planning, Design, Construction, Operation and Closure"* May 2012.
4. Knight Piésold, *"Tailings Storage Facility Cell 3 Geotechnical Investigation Report"* (Ref PE801-00137/23 Rev A), June 2018.

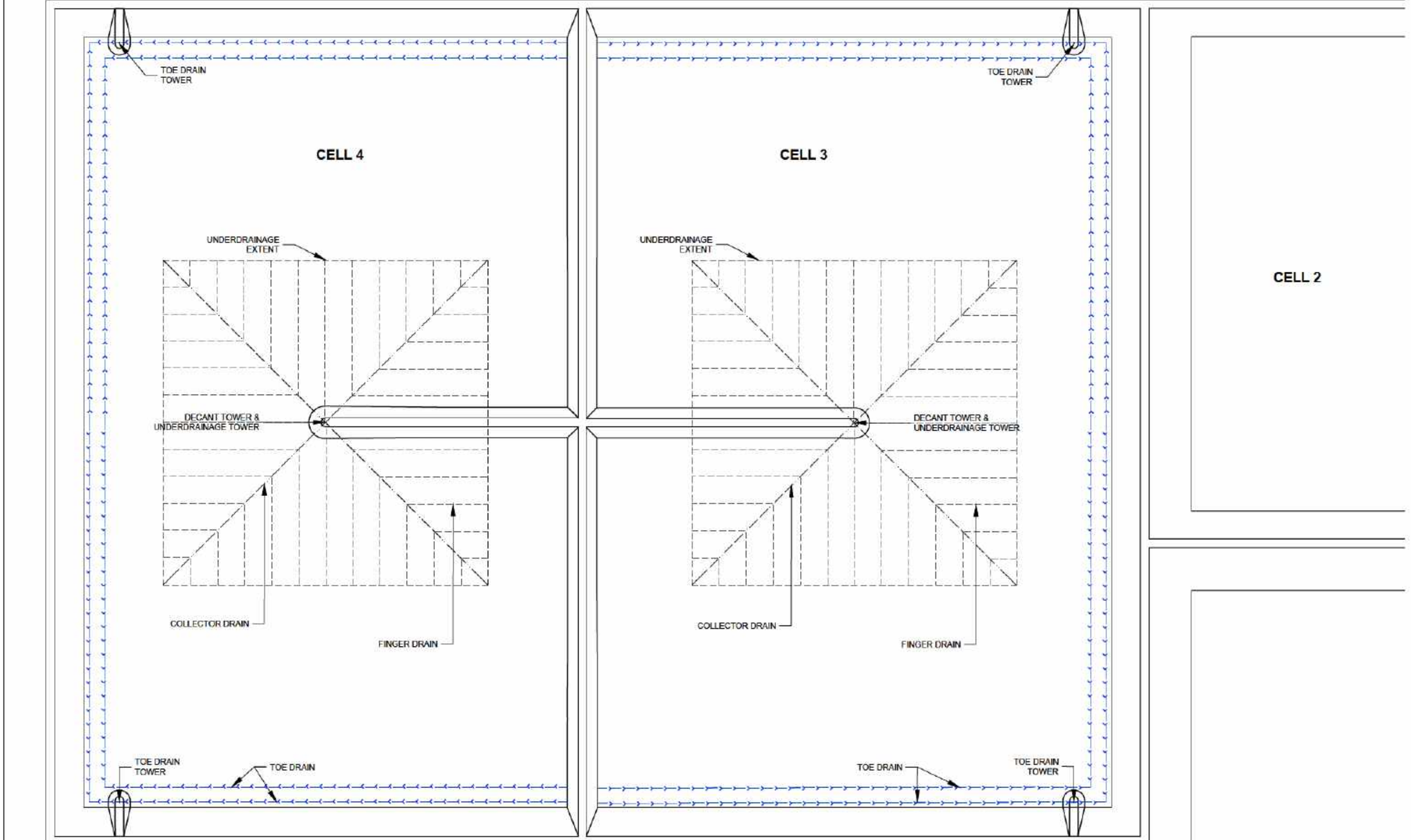
FIGURES



Knight Piésold CONSULTING

MUNGARI GOLD PROJECT
TAILINGS STORAGE FACILITY - CELLS 3 & 4
OPTION ASSESSMENT

PE801-00137 M19003
Figure 2.1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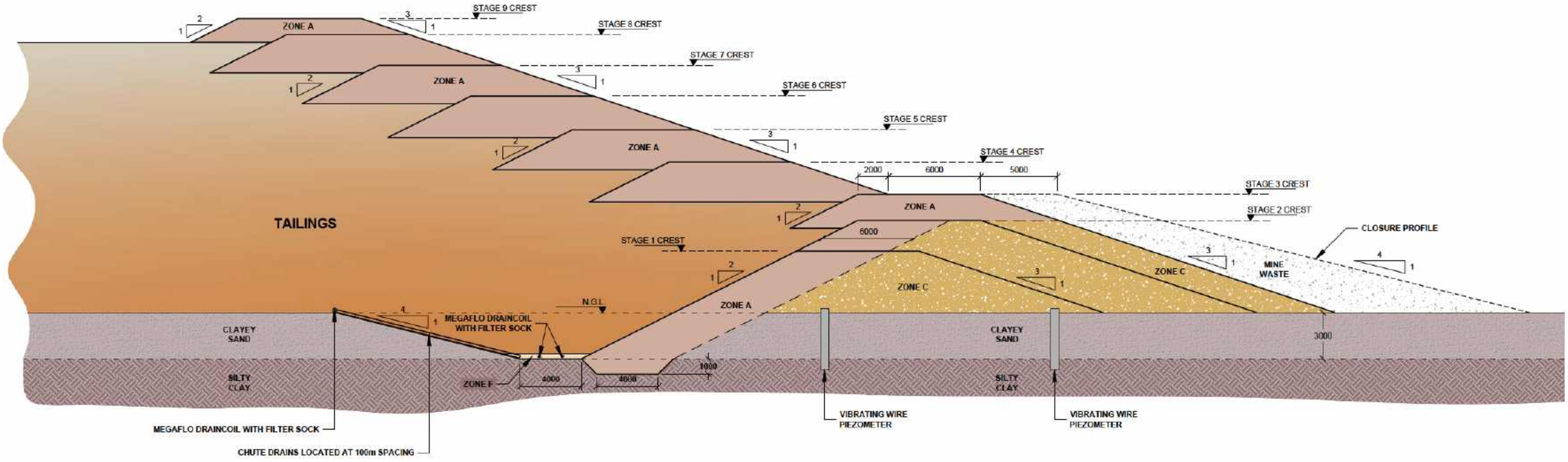
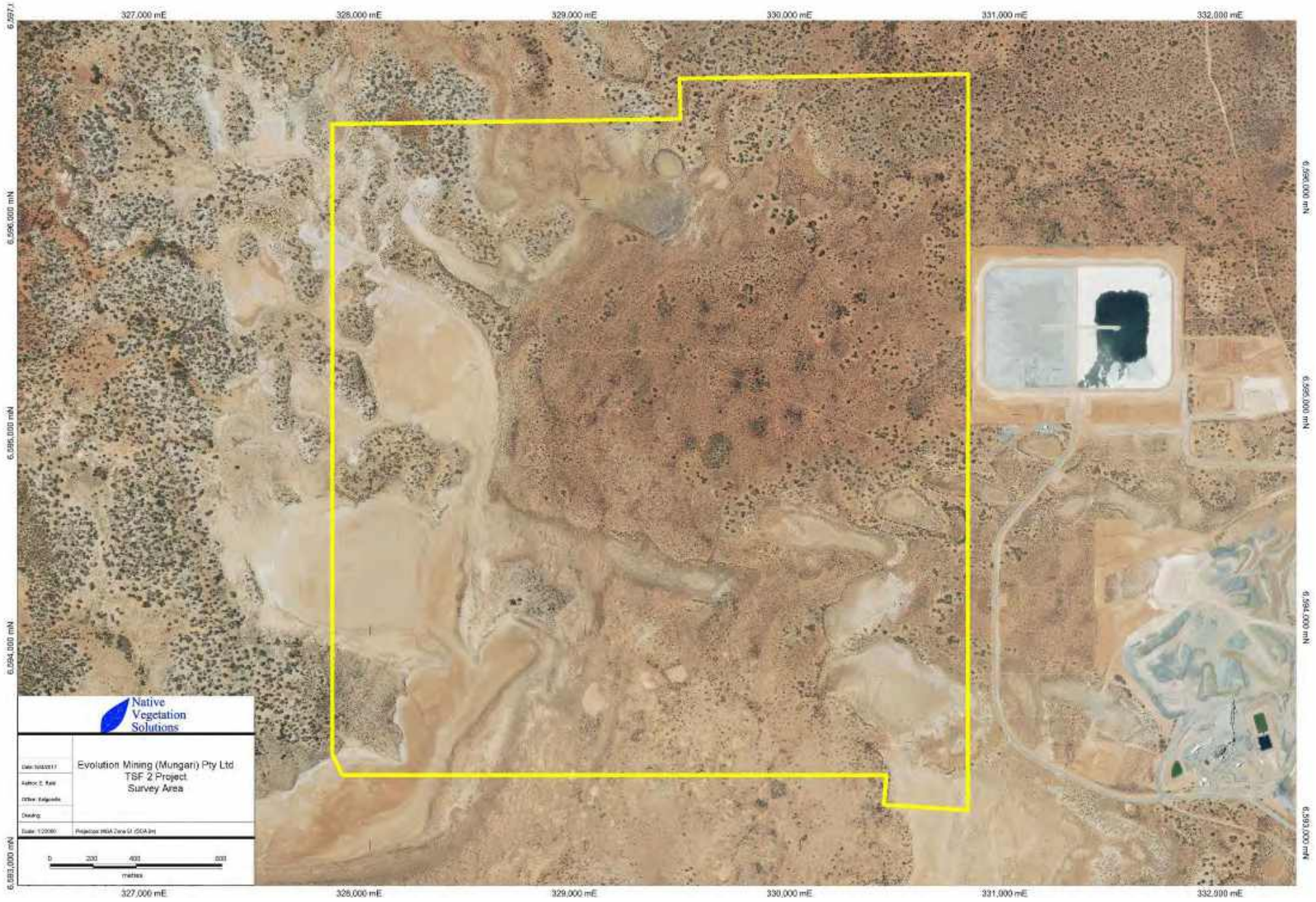


TYPICAL EMBANKMENT CROSS SECTION

1:200

APPENDIX A
Flora and Vegetation Survey


327,000 mE
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Native Vegetation Solutions
Evolution Mining (Mungari) Pty Ltd
TSF 2 Project
Survey Area
0
200
400
800
metres

APPENDIX B

Climatology Assessment

Knight Piésold CONSULTING

Knight Piésold CONSULTING

MEMORANDUM

To: Evolution Mining [redacted]	**Date:** 17 April 2019
	Our Ref: PE19-00401
	KP File Ref.: PE801-00137/29-A M19007
	From: [redacted]

RE: MUNGARI GOLD PROJECT – BASELINE DESIGN CLIMATOLOGY

Knight Piésold (KP) is pleased to provide the following memorandum regarding baseline design climatology that has been developed for the Mungari Gold Project site near Kalgoorlie in Western Australia. The investigation and calculations discussed herein provide the hydrologic basis for the Cell 3 & 4 Feasibility Design.

This memorandum supersedes the memorandum issued during Cell 1 and 2 Definitive Feasibility Design phase in 2013 – PE13-00494. This is due to ongoing updates in methodology and longer data sets being available.

The site is located in a region with a Köppen climate classification of Desert, hot (persistently dry) with hot dry summers and cold winters.

1. DATA SOURCE / SUMMARY

Daily historic hydrologic data for an Australian Bureau of Meteorology (BOM) climate station in the vicinity of the Mungari Gold Project was obtained for use in deriving baseline design climatology. This station, illustrated on Figure 1.1 is the Kalgoorlie-Boulder Airport (#76047) climate station. It is located 19.5 kilometres (km) east of the project.

Historic daily precipitation data from the Kalgoorlie-Boulder climate station spanning the period March 1938 – November 2018 were analysed to obtain desired design inputs for water balance modelling, namely:

- Typical variability of annual precipitation;
- Typical variability of monthly precipitation; and
- Synthetic monthly precipitation sequences for three climate scenarios:
  - 1% Annual Exceedance Probability (AEP) Wet precipitation, 1 year duration;
  - Average precipitation, 1 year duration;
  - 1% AEP Dry precipitation, 1 year duration;

Average monthly pan evaporation values were sourced from a gridded dataset developed by the BOM. The dataset was developed using daily evaporation values spanning the period January 1975 – December 2005.

Design storms were developed using the BOM 2016 IFD generating tool. Probable Maximum Precipitation (PMP) was estimated using the methods developed by the BOM (Ref. 1, 2 & 3).

2. WATER BALANCE PRECIPITATION ANALYSES

Precipitation data from the Kalgoorlie-Boulder climate station was reduced into a standardised format and then analysed on annual and monthly time scales to develop inputs for water balance modelling. The following sections detail the various analyses conducted and the results achieved.

2.1 ANNUAL ANALYSES

Daily precipitation records from the Kalgoorlie-Boulder climate station were summed to produce annual totals for the 79 years of record available. KP notes that water years of record (October through September) were excluded from the analyses if greater than 15% of the daily data from that year were missing (approximately 2 months); this was done to prevent missing records from introducing bias into computed climate statistics. Sampling statistics were computed from the annual sums to provide a broad overview of the variability of annual climate at the project site, as given in Table 2.1.

Table 2.1: Annual precipitation statistics

Selected Statistic	Precipitation Value (mm)
Average	269
Median	253
Std. Deviation	96
Minimum	115
Maximum	506
25th Percentile	200
75th Percentile	321

2.2 MONTHLY ANALYSES

Daily precipitation from the Kalgoorlie-Boulder climate station was summed in a manner similar to that described in Section 2.1 to produce monthly totals. KP notes that months of record were excluded from the analyses if greater than 25% of the daily data from that month were missing (approximately 1 week); for the same reason as given in Section 2.1. Sampling statistics were computed on the monthly sums to provide a broad overview of the variability of monthly climate at the project site, as given in Table 2.2.

Table 2.2: Monthly precipitation statistics

Month	Average	Median	Std. Dev.	Min.	Max.	25th Pct.	75th Pct.
Oct.	16	11	18	0	84	4	21
Nov.	19	15	20	0	115	3	29
Dec.	17	11	17	0	89	3	23
Jan.	28	11	40	0	186	3	37
Feb.	32	15	47	0	308	6	47
Mar.	26	10	36	0	197	3	28
Apr.	20	13	21	0	99	4	34
May	25	19	24	0	110	8	34
Jun.	27	19	29	1	186	9	37
Jul.	24	20	18	1	83	12	32
Aug.	22	16	17	2	74	11	30
Sep.	14	11	15	0	98	4	18

Note: all computed precipitation statistics are measured in (mm).

The sample statistics for monthly precipitation at the Kalgoorlie-Boulder climate station were also depicted as “box and whisker” plots to illustrate the variability of monthly values at the project site, as shown on Figure 2.1.

It is shown on Figure 2.1 that February is generally the wettest month of the year at the Kalgoorlie-Boulder station, with measureable precipitation occurring throughout the year with no other definite wet season trends observed.

2.3 SYNTHETIC WATER BALANCE SCENARIOS

KP performed frequency analysis on annual duration values (from Kalgoorlie-Boulder dataset) to estimate the statistical likelihood of experiencing extremely “Wet” or “Dry” periods of weather at the project site. Exceedance and non-exceedance probabilities were assigned to various duration totals of daily precipitation values, by sorting the values in descending (for the “Wet” series) and ascending (for the “Dry” series) order.

A number (64) of different probability distributions, e.g.: Log-Pearson 3, Generalised Extreme Value, Wakeby, Inverse Gaussian, etc. were fitted to the various sums of daily precipitation data using EasyFit 5.4 Professional software. Three of the best fits were selected for comparison in each case, as shown in the following figures:

- Wet precipitation series 1 year duration – Figure 2.2; and
- Dry precipitation series, 1 year duration – Figure 2.3.

Ideally, the distributions having the best weighted Kolmogorov-Smirnov and Anderson-Darling goodness-of-fit test ranking results will match across all scenarios, thereby providing consistent results. In this case, the goodness-of-fit test results indicated the Wakeby distribution was statistically the best fit. The resulting estimated extreme wet and dry annual precipitation depths are shown in Table 2.3.

Table 2.3: Design annual precipitation - Wet and Dry scenarios

AEP	1 Year Precipitation Totals (mm)	
	Wet	Dry
1%	526	113
2%	498	118
5%	451	131
10%	406	151
20%	351	183

In order to apportion the statistically-computed climate series precipitation totals to monthly time series for use in water balance modelling, the following observed rainfall patterns were used:

- 1 year duration Wet scenarios: October 1991 – September 1992, the wettest observed water year of record;
- 1 year duration Average scenario: October 1996– September 1997, a year closest to the median observed water year of record with no total months of rainfall that are statistical outliers; and
- 1 year duration Dry scenarios: October 1971 – September 1972, the driest observed water year of record.

Ratios of observed monthly to observed total precipitation were computed for each scenario. These ratios were then multiplied by the computed statistical totals (at the selected design frequency, 1% AEP) to form the desired synthetic climate scenarios for water balance modelling. The resulting climate scenarios are summarised (in monthly format) in Table 2.4.

Table 2.4: Annual synthetic climate scenarios

Month	Annual Climate Scenarios (mm)		
	1% AEP Dry	Average	1% AEP Wet
Oct	2.7	5.7	10.6
Nov	4.3	20.6	1.5
Dec	12.6	27.2	13.3
Jan	6.9	4.2	1.2
Feb	2.7	22.5	21.8
Mar	30.7	26.5	109.3
Apr	2.6	46.9	77.8
May	1.8	36.7	80.9
Jun	26.3	7.9	91.5
Jul	5.3	20.2	6.2
Aug	11.7	37.6	76.7
Sep	4.6	13.2	34.4

It is noted that the 1% AEP Wet year may have months where the precipitation is less than the average or the 1% AEP dry year. Similarly the 1% AEP Dry year may have months where the precipitation is greater than the average or the 1% AEP wet year. This is not an error and is due to the rainfall pattern within the specific year selected to develop the rainfall patterns.

3. DESIGN STORMS

Aside from climate scenarios for water balance modelling, design storms were derived for surface water management design and storm containment.

3.1 PROBABLE MAXIMUM PRECIPITATION (PMP)

PMP was estimated using three different methods published by BOM, depending on the duration of the candidate storm. Generally speaking, for storm durations of up to 6 hours, the Generalised Short Duration Method (GSDM) procedures (Ref. 1) are employed. However, because the Mungari Gold Project site lies in the intermediate duration limit zone, GSDM estimates are only valid up to durations of 3.5 hours.

Because the Mungari Gold Project site lies in the GSAM-GTSMR Western Australia Transition Zone, both the Generalised Southeast Australia Method (GSAM) procedures (Ref. 2) and the Generalised Tropical Storm Method, Revised (GTSMR) procedures (Ref. 3) were evaluated to determine the governing method for deriving PMP for storm durations from 24 hours to 120 hours. Seasonality was also considered as different phenomena drive precipitation behaviour at different times of the year.

Results from estimating PMP with the various methods (and seasons) were plotted to determine which results in the largest (i.e. governing) values:

- Short duration (≤ 6 hour) PMP is governed by the GSDM method and
- Long duration (> 6 hour) PMP is governed by the GTSMR Summer method.

Composite curve results for the Mungari Gold Project site are summarised in Table 3.1.

Table 3.1: Composite depth-duration relationship for PMP

Estimation Procedure	Duration (hr)	Depth (mm)
GSDM	0.25	180
	0.50	270
	0.75	340
	1.0	420
	1.5	470
	2.0	520
	2.5	560
	3.0	600
GTSMR Summer	24	660
	30	720
	36	770
	48	830
	60	850
	72	900
	96	1,020

3.2 INTENSITY / FREQUENCY / DURATION

Intensity / Frequency / Duration (IFD) and corresponding Depth / Frequency / Duration (DFD) relationships for design storms (63.2% ≤ AEP ≤ 0.05%) were sourced from the BOM 2016 IFD tool (Ref. 4) for the grid cell (30.76°S, 121.23°E). The design storm information is summarised as storm depths in Table 3.2.

Table 3.2: Design storm depths

Duration (h)	Precipitation Depth (mm) for a given AEP							
	10%	5%	2%	1%	0.5%	0.2%	0.1%	0.05%
1	28	34	43	51	59	72	84	97
2	35	42	54	63	73	90	105	121
3	40	48	62	73	84	103	120	138
6	50	62	79	94	108	132	153	177
12	64	80	103	123	140	172	199	229
24	79	100	130	156	180	221	257	297
48	94	120	157	188	220	272	317	368
72	100	129	168	**203**	242	302	355	415
96	104	133	174	210	254	319	378	445
120	106	135	177	214	260	329	390	461
144	107	136	179	217	263	333	396	469
168	108	137	180	219	264	334	396	471

A summary of all of the estimate storm depths is provided as a DFD table and an IFD Table in Appendix A. This is also shown graphically on Figures 2.4 to 2.6.

4. EVAPORATION

The average monthly pan evaporation values were sourced from the BOM gridded evaporation dataset and are summarised in Table 4.1 below.

The resulting lake evaporation was determined as per "Evaporation Data for Western Australia" (Ref. 5) estimated the annual pan factor as 0.71, also shown in Table 4.1 below.

Table 4.1: Average monthly evaporation

Month	Average Pan Evaporation (mm)	Average Lake Evaporation (mm)
Oct	253	180
Nov	304	216
Dec	367	261
Jan	387	274
Feb	304	216
Mar	268	190
Apr	172	122
May	107	76
Jun	76	54
Jul	84	60
Aug	113	80
Sept	171	121

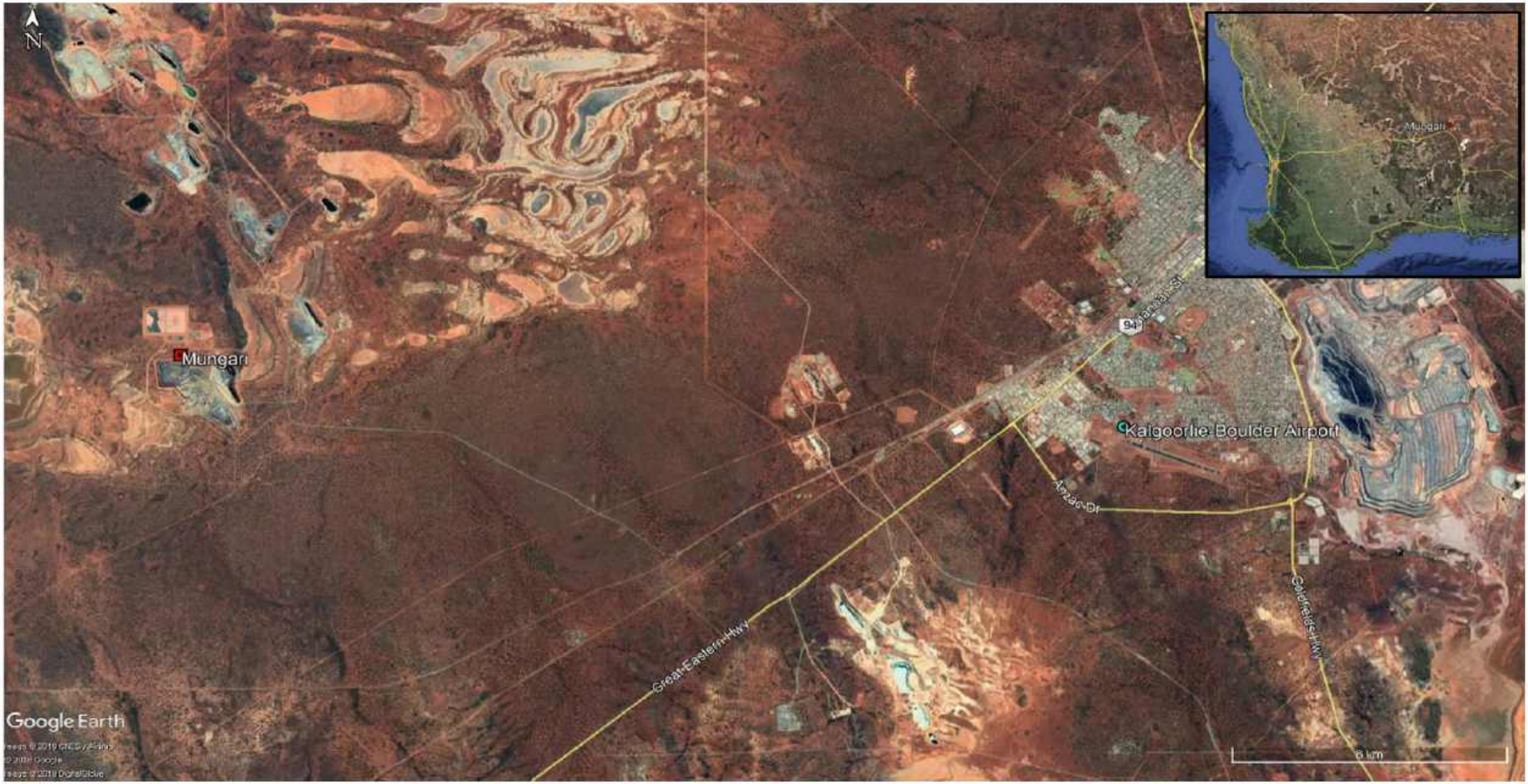
We trust that this memorandum is sufficient for your current needs. Please contact us if you have any queries.

[redacted]

REFERENCES

1. Australian Bureau of Meteorology. *"The Estimation of Probable Maximum Precipitation in Australia: Generalised Short-Duration Method*", 2003. Melbourne, VIC. Australia.
2. Australian Bureau of Meteorology. "Development of the Generalised Southeast Australia Method for Estimating Probable Maximum Precipitation, HRS Report No. 4", 1996. Melbourne, VIC. Australia
3. Australian Bureau of Meteorology. "*Revision of the Generalised Tropical Storm Method for Estimation Probable Maximum Precipitation, HRS Report No. 8*", 2003. Melbourne, VIC. Australia.
4. Bureau of Meteorology, "*Design Rainfall Data System (2016)*", http://www.bom.gov.au/water/designRainfalls/revised-ifd/?
5. Luke G.J., Burke K.L., O'Brien T.M. (1987), "Evaporation Data for Western Australia". Department of Agriculture and Food, Western Australia. Report 65.

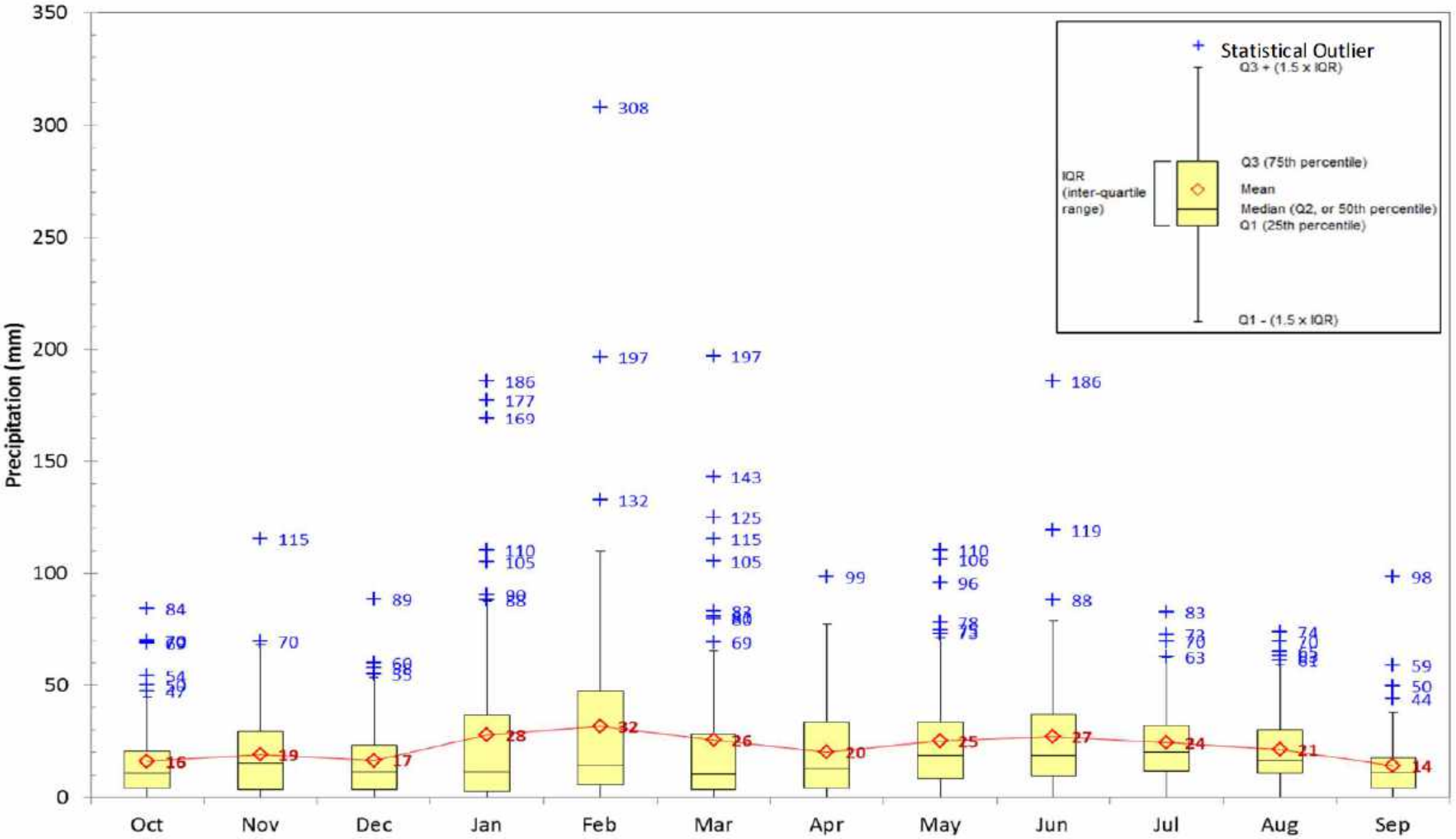
FIGURES



Knight Piésold CONSULTING

MUNGARI GOLD PROJECT
BASELINE DESIGN CLIMATOLOGY
NEARBY STATIONS

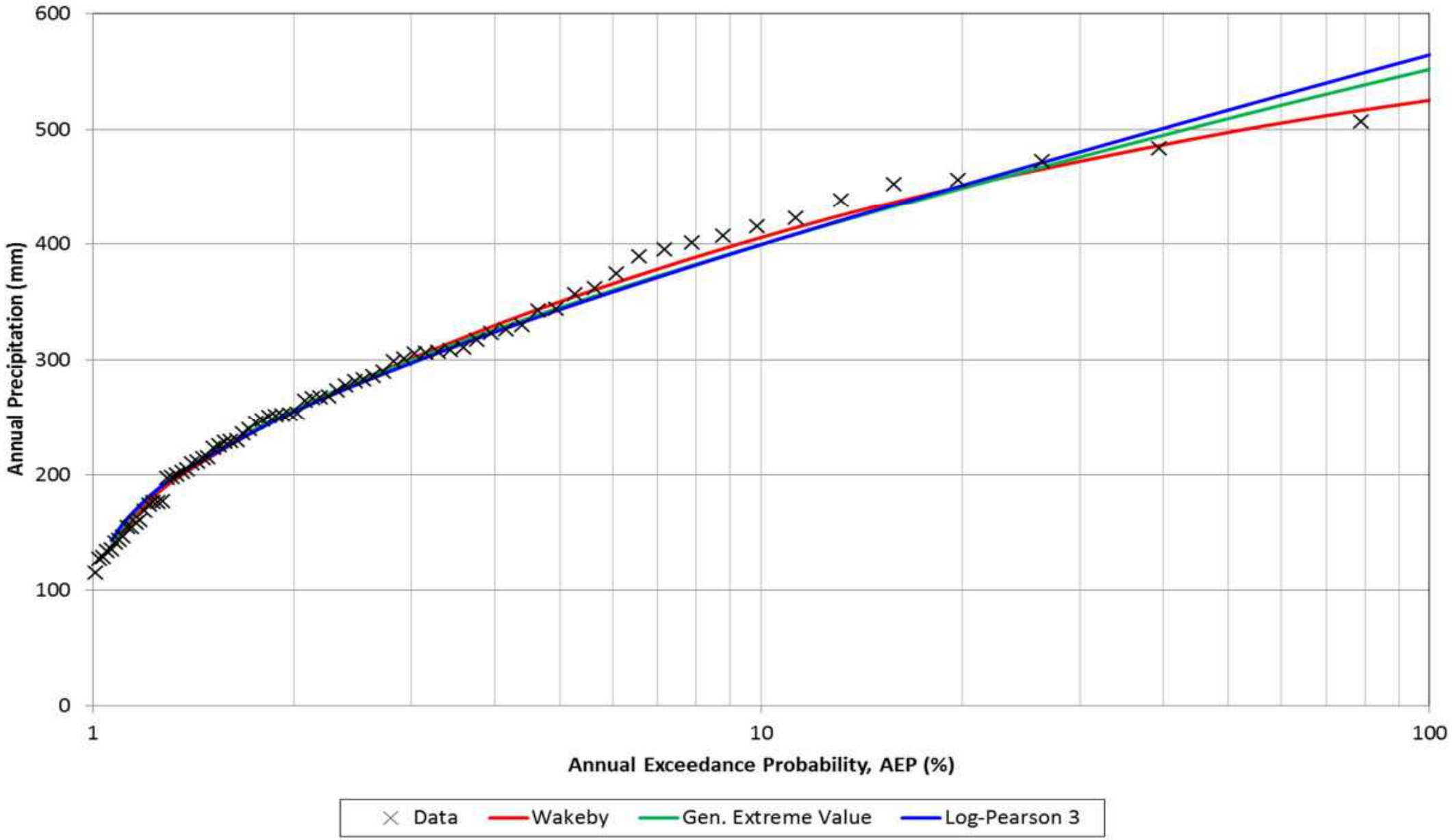
PE801-00137 M19007
Figure 1.1



Knight Piésold CONSULTING

MUNGARI GOLD PROJECT
BASELINE DESIGN CLIMATOLOGY
MONTHLY PRECIPITATION STATISTICS: KALGOORLIE BOM STATION

PE801-00137 M19007
Figure 2.1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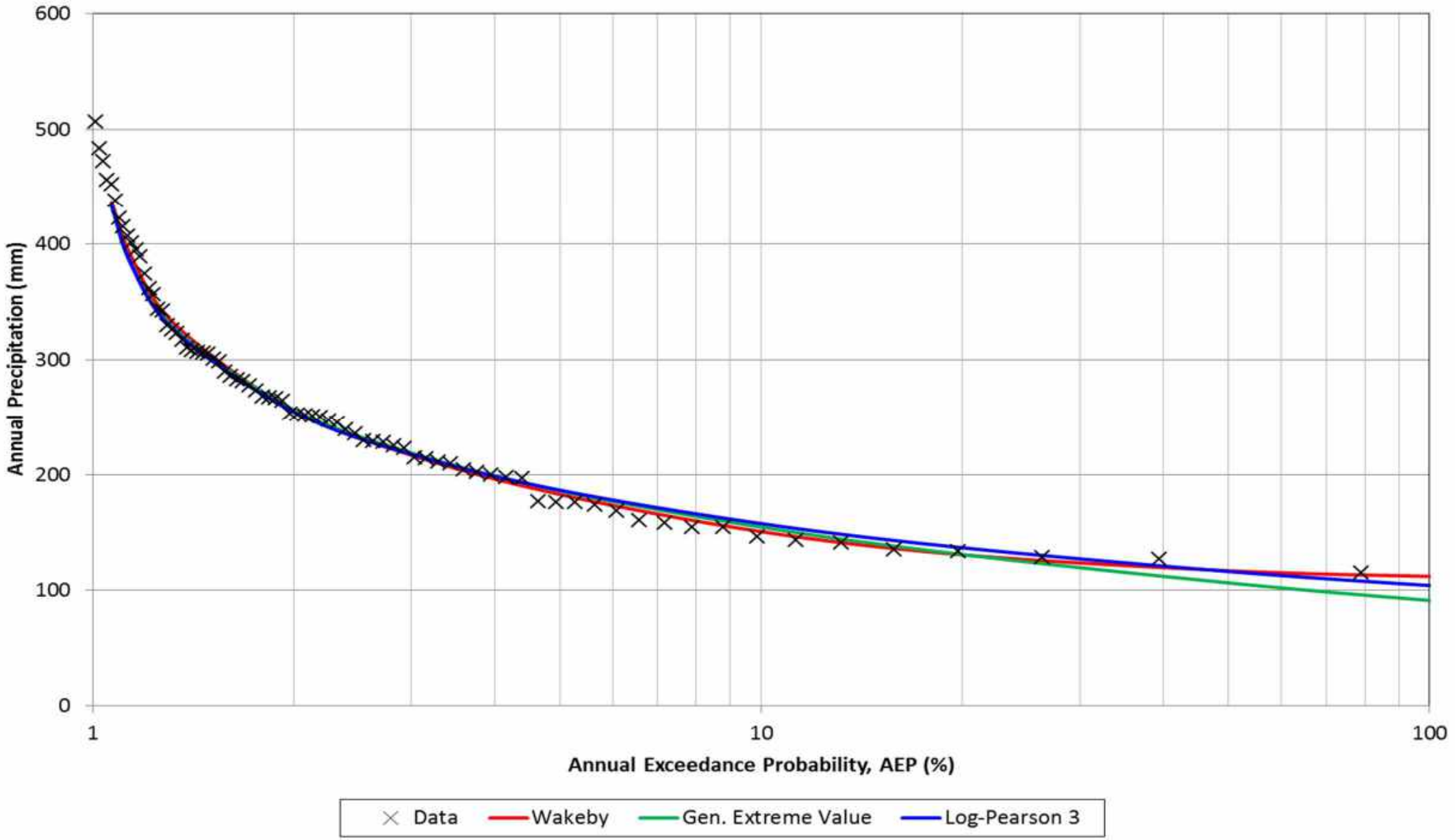
500
400
300
200
100
0
Annual Precipitation (mm)
1
10
100
Annual Exceedance Probability, AEP (%)
Data
Wakeby
Gen. Extreme Value
Log-Pearson 3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Annual Precipitation (mm)
1
10
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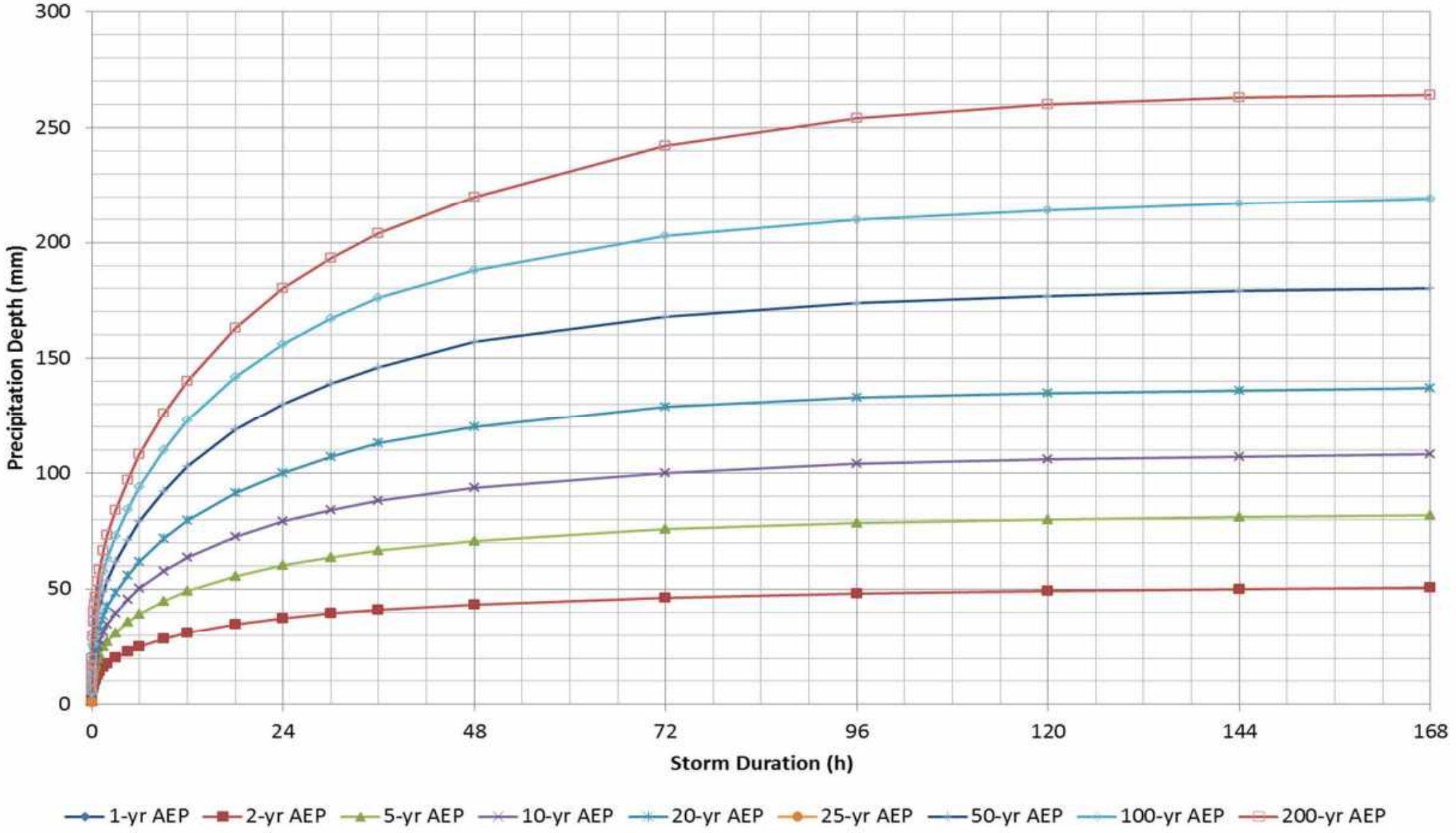
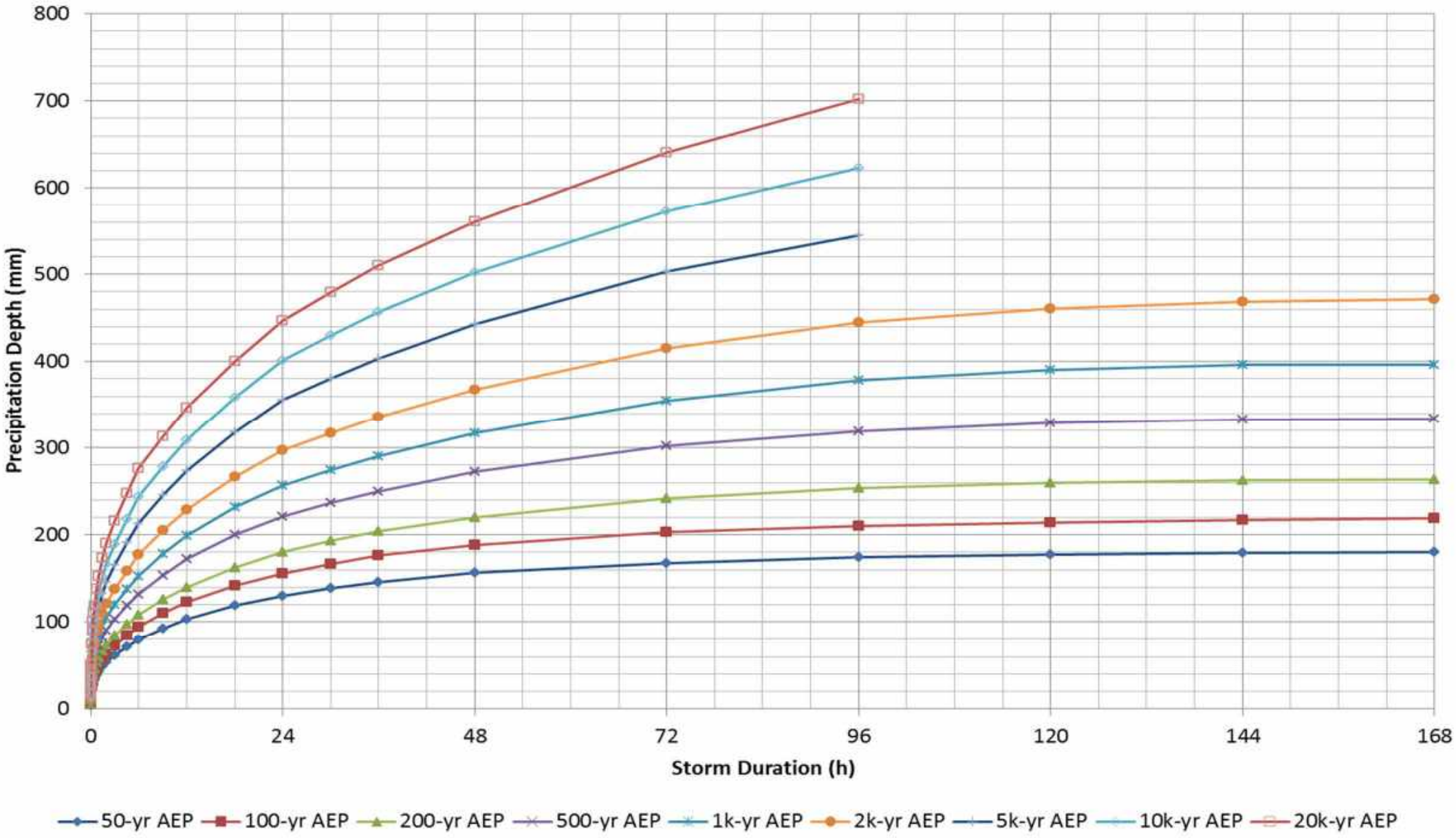
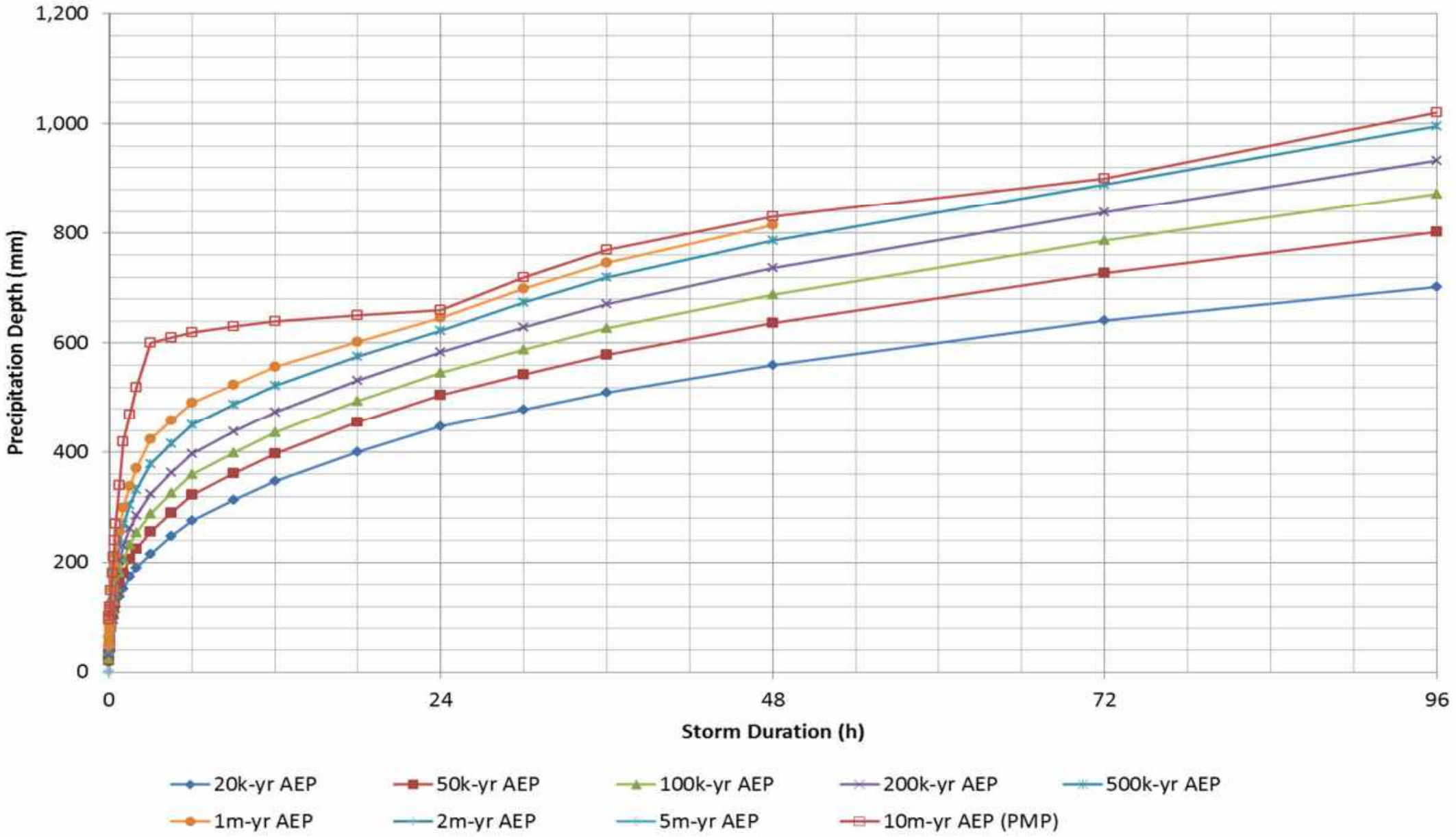
Annual Exceedance Probability, AEP (%)
Data
Wakeby
Gen. Extreme Value
Log-Pearson 3


300
250
200
150
100
50
0
Precipitation Depth (mm)
0
24
48
72
96
120
144
168
Storm Duration (h)
1-yr AEP
2-yr AEP
5-yr AEP
10-yr AEP
20-yr AEP
25-yr AEP
50-yr AEP
100-yr AEP
200-yr AEP


800
700
600
500
400
300
200
100
0
Precipitation Depth (mm)
0
24
48
72
96
120
144
168
Storm Duration (h)
50-yr AEP
100-yr AEP
200-yr AEP
500-yr AEP
1k-yr AEP
2k-yr AEP
5k-yr AEP
10k-yr AEP
20k-yr AEP


1,200
1,000
800
600
400
200
0
Precipitation Depth (mm)
0
24
48
72
96
Storm Duration (h)
20k-yr AEP
50k-yr AEP
100k-yr AEP
200k-yr AEP
500k-yr AEP
1m-yr AEP
2m-yr AEP
5m-yr AEP
10m-yr AEP (PMP)

APPENDIX A
DFD and IFD Summary Tables

Knight Piésold CONSULTING	Subject: Evolution Mining	Made by: ACSB	Job No.: PE801-00137
	Mungari Gold Project	Checked	Date: 29/11/2018
	Design Storms	Approved	

Mungari Gold Project: Depth (mm) / Frequency (AEP) / Duration (h) Table

Storm Duration		Precipitation Depth (mm) for a given AEP (%) or ARI (yr)																				
		63.2%[1]	50%[2]	20%[3]	10%	5%	2%	1%	0.5%	0.2%	0.1%	0.05%	0.02%	0.01%	0.005%	0.002%	0.001%	0.0005%	0.0002%	0.0001%	0.00005%	0.00002%	PMP[4]
(min)	(h)	1.00	1.44	4.48	9.49	20	50	100	200	500	1,000	2,000	5,000	10,000	20,000	50,000	100,000	200,000	500,000	1,000,000	2,000,000	5,000,000	
1	0.017	1.2	1.4	2.2	2.9	3.5	4.5	5.3	6.1	7.5	8.7	10.0	12.2	14.2	16.7	20.9	25.0	30.0	38.7	47.2	58.0	77.0	96.0
2	0.033	2.1	2.5	3.9	4.9	5.9	7.4	8.7	10.2	12.6	14.7	17.0	20.6	23.8	27.6	33.4	38.7	44.7	54.2	62.8	72.6	88.1	102.0
3	0.050	2.8	3.4	5.2	6.6	8.0	10.1	11.9	13.9	17.1	19.9	23.1	28.0	32.3	37.1	44.3	50.4	57.2	67.1	75.4	84.4	97.3	108.0
4	0.067	3.4	4.1	6.3	8.0	9.8	12.5	14.7	17.0	21.0	24.4	28.2	34.0	38.9	44.4	52.3	58.9	66.0	76.1	84.3	92.8	104.7	114.0
5	0.083	3.9	4.7	7.3	9.3	11.4	14.5	17.1	19.8	24.3	28.3	32.6	39.1	44.6	50.5	59.1	66.1	73.5	83.8	91.9	100.3	111.5	120.0
10	0.167	5.8	6.9	10.8	13.8	17.0	21.7	25.6	29.5	36.1	41.9	48.3	57.9	65.7	74.1	85.6	94.7	103.8	115.8	124.6	133.0	143.2	150.0
15	0.25	7.0	8.3	13.1	16.7	20.5	26.2	31.0	35.6	43.7	50.6	58.4	70.1	79.6	89.8	103.8	114.7	125.7	140.1	150.5	160.4	172.2	180.0
20	0.33	7.9	9.4	14.7	18.8	23.1	29.5	34.9	40.1	49.2	57.1	65.9	79.1	90.0	101.5	117.7	130.3	143.2	160.3	172.9	185.0	199.9	210.0
25	0.42	8.6	10.3	16.1	20.5	25.2	32.1	37.9	43.7	53.6	62.1	71.7	86.1	98.1	111.0	129.1	143.5	158.3	178.2	193.3	208.1	226.8	240.0
30	0.50	9.2	11.0	17.2	21.9	26.9	34.2	40.4	46.6	57.2	66.4	76.7	92.3	105.3	119.3	139.2	155.3	172.1	195.0	212.6	230.3	253.3	270.0
45	0.75	10.7	12.7	19.8	25.1	30.8	39.2	46.2	53.4	65.6	76.2	88.0	105.9	121.1	137.7	161.8	181.6	202.7	232.5	256.2	280.8	314.2	340.0
60	1.0	11.8	14.1	21.8	27.6	33.8	42.9	50.6	58.6	72.0	83.7	96.7	116.6	133.7	152.8	181.0	204.8	230.8	268.6	299.9	333.5	381.3	420.0
90	1.5	13.5	16.1	24.9	31.5	38.5	48.9	57.6	66.6	82.0	95.2	110.0	132.7	152.1	173.6	205.5	232.2	261.4	303.6	338.3	375.4	427.8	470.0
120	2.0	14.8	17.6	27.3	34.5	42.3	53.7	63.3	73.2	90.0	105.0	121.0	145.5	166.5	189.8	224.5	253.7	285.7	332.3	370.9	412.4	471.8	520.0
180	3.0	16.9	20.1	31.1	39.5	48.4	61.6	72.8	83.9	103.0	120.0	138.0	165.5	189.2	215.6	254.9	288.2	324.9	378.6	423.5	472.1	542.3	600.0
270	4.5	19.2	22.9	35.6	45.3	55.8	71.2	84.3	97.0	119.0	138.0	159.0	190.9	217.8	247.3	290.1	325.3	362.9	416.1	458.6	502.7	563.2	610.0
360	6.0	21.0	25.1	39.2	50.1	61.9	79.2	94.0	108.0	132.0	153.0	177.0	213.3	243.5	276.2	322.5	359.7	398.3	450.9	491.1	531.2	582.8	620.0
540	9.0	23.8	28.4	44.8	57.6	71.8	92.3	110.0	126.0	154.0	178.0	205.0	245.3	278.4	313.4	361.9	399.7	438.0	488.1	524.8	559.7	601.9	630.0
720	12	25.9	31.0	49.1	63.6	79.6	103.0	123.0	140.0	172.0	199.0	229.0	273.5	309.5	347.0	397.9	436.6	474.7	522.7	556.3	586.5	620.2	640.0
1080	18	28.9	34.7	55.6	72.5	91.6	119.0	142.0	163.0	200.0	232.0	267.0	318.4	359.1	400.6	455.0	494.6	531.7	575.3	602.8	624.6	643.6	650.0
1440	24	31.1	37.4	60.3	79.1	100.0	130.0	156.0	180.0	221.0	257.0	297.0	355.5	401.3	447.1	505.6	546.5	583.2	623.0	645.1	659.4		660.0
1800	30	32.7	39.4	63.8	84.1	107.0	139.0	167.0	193.0	237.0	274.0	317.0	380.1	429.5	479.2	543.0	588.0	628.6	673.2	698.5	715.5		720.0
2160	36	34.0	41.0	66.6	88.0	113.0	146.0	176.0	204.0	250.0	290.0	336.0	403.6	456.7	510.1	578.8	627.2	671.0	719.2	746.6	765.0		770.0
2880	48	35.9	43.3	70.8	93.7	120.0	157.0	188.0	220.0	272.0	317.0	368.0	443.0	501.7	560.7	636.0	688.8	735.9	786.7	814.6			830.0
4320	72	38.3	46.2	75.7	100.0	129.0	168.0	203.0	242.0	302.0	355.0	415.0	503.4	572.5	641.2	727.8	786.9	838.1	889.9				900.0
5760	96	39.7	47.9	78.4	104.0	133.0	174.0	210.0	254.0	319.0	378.0	445.0	544.7	623.3	702.2	802.7	872.2	933.1	996.1				1,020.0
7200	120	40.7	49.1	80.0	106.0	135.0	177.0	214.0	260.0	329.0	390.0	461.0											
8640	144	41.5	49.9	81.1	107.0	136.0	179.0	217.0	263.0	333.0	396.0	469.0											
10080	168	42.1	50.6	81.9	108.0	137.0	180.0	219.0	264.0	334.0	396.0	471.0											

- **Estimated using the BOM IFD TOOL 2016**
- **Estimated by interpolation methodology as described in Section 3.5.2.2 of ARR 2016.**
- **Logarithmically interpolated for mid duration events**
- **Not estimated due to interpolation errors.**
- **Linearly extrapolated for short duration events**
- **Estimated using the procedures taken from "The Estimation of Probable Maximum Precipitation in Australia", June 2003 (GSDM)**
- **Estimated using the procedures taken from "Revision of the Generalised Tropical Storm Method for Estimating Probable Maximum Precipitation, HRS Report No. 8", August 2003 (GTSMR).**
- **Estimated using the procedures taken from "Development of the Generalised Southeast Australia Method for Estimating Probable Maximum Precipitation, HRS Report No. 4", August 1996 (GSAM).**

Notes:

1. 63% AEP is equivalent to 1 Exceedances per year (EY). This event of greater will occur once ever year.
2. The 50% AEP IFD does not correspond to the 2 year Average Recurrence Interval (ARI) IFD. Rather it corresponds to the 1.44 ARI.
3. The 20% AEP IFD does not correspond to the 5 year Average Recurrence Interval (ARI) IFD. Rather it corresponds to the 4.48 ARI.
4. PMP is assumed to be equivalent to a 0.00001% AEP or 10,000,000 year ARI Event.

Knight Piésold CONSULTING	Subject: Evolution Mining	Made by: ACSB	Job No.: PE801-00137
	Mungari Gold Project	Checked	Date: 29/11/2018
	Design Storms	Approved	

Mungari Gold Project: Intensity (mm/h) / Frequency (AEP) / Duration (h) Table

Storm Duration		Precipitation Intensity (mm/h) for a given AEP (%) or ARI (yr)																				
		63.2%[1]	50%[2]	20%[3]	10%	5%	2%	1%	0.5%	0.2%	0.1%	0.05%	0.02%	0.01%	0.005%	0.002%	0.001%	0.0005%	0.0002%	0.0001%	0.00005%	0.00002%	PMP[4]
(min)	(h)	1.00	1.44	4.48	9.49	20	50	100	200	500	1,000	2,000	5,000	10,000	20,000	50,000	100,000	200,000	500,000	1,000,000	2,000,000	5,000,000	
1	0.017	72.0	85.8	134.4	171.0	210.0	267.6	316.2	364.2	447.6	519.0	599.4	729.3	852.3	1,002.7	1,255.4	1,499.4	1,802.5	2,322.5	2,834.8	3,482.7	4,617.9	5,760.0
2	0.033	62.7	74.7	115.5	145.5	176.7	223.2	261.9	306.0	378.0	441.0	510.0	618.1	714.9	826.9	1,002.5	1,159.8	1,341.9	1,627.3	1,883.1	2,179.3	2,643.7	3,060.0
3	0.050	56.4	67.2	104.0	131.4	160.2	202.0	238.0	278.0	342.0	398.0	462.0	560.8	646.4	742.3	885.9	1,008.2	1,143.1	1,341.5	1,507.3	1,687.3	1,947.0	2,160.0
4	0.067	51.3	61.4	95.1	120.6	147.5	187.5	220.5	255.0	315.0	366.0	423.0	509.9	584.0	665.3	784.5	883.4	989.7	1,141.3	1,263.8	1,392.4	1,570.4	1,710.0
5	0.083	47.3	56.5	87.8	111.6	136.8	174.0	205.2	237.6	291.6	339.6	391.2	469.3	534.9	606.3	709.1	793.0	881.7	1,005.5	1,103.1	1,203.3	1,337.9	1,440.0
10	0.167	34.7	41.5	64.8	82.8	102.0	130.2	153.6	177.0	216.6	251.4	289.8	347.2	394.4	444.3	513.7	567.9	622.8	694.8	747.7	798.1	859.2	900.0
15	0.25	27.9	33.4	52.4	66.8	82.0	104.8	124.0	142.4	174.8	202.4	233.6	280.3	318.6	359.0	415.1	458.8	502.8	560.2	602.1	641.6	689.0	720.0
20	0.33	23.7	28.3	44.1	56.4	69.3	88.5	104.7	120.3	147.6	171.3	197.7	237.3	269.9	304.6	353.0	391.0	429.6	480.8	518.6	555.0	599.7	630.0
25	0.42	20.7	24.7	38.6	49.2	60.5	77.0	91.0	104.9	128.6	149.0	172.1	206.8	235.5	266.3	309.8	344.3	379.9	427.7	463.9	499.4	544.3	576.0
30	0.50	18.5	22.0	34.4	43.8	53.8	68.4	80.8	93.2	114.4	132.8	153.4	184.5	210.5	238.5	278.5	310.6	344.1	389.9	425.2	460.6	506.5	540.0
45	0.75	14.3	16.9	26.4	33.5	41.1	52.3	61.6	71.2	87.5	101.6	117.3	141.2	161.5	183.6	215.7	242.1	270.3	310.0	341.6	374.4	419.0	453.3
60	1.0	11.8	14.1	21.8	27.6	33.8	42.9	50.6	58.6	72.0	83.7	96.7	116.6	133.7	152.8	181.0	204.8	230.8	268.6	299.9	333.5	381.3	420.0
90	1.5	9.0	10.7	16.6	21.0	25.7	32.6	38.4	44.4	54.7	63.5	73.3	88.4	101.4	115.7	137.0	154.8	174.3	202.4	225.5	250.2	285.2	313.3
120	2.0	7.4	8.8	13.7	17.3	21.2	26.9	31.7	36.6	45.0	52.5	60.5	72.7	83.2	94.9	112.2	126.9	142.8	166.1	185.4	206.2	235.9	260.0
180	3.0	5.6	6.7	10.4	13.2	16.1	20.5	24.3	28.0	34.3	40.0	46.0	55.2	63.1	71.9	85.0	96.1	108.3	126.2	141.2	157.4	180.8	200.0
270	4.5	4.3	5.1	7.9	10.1	12.4	15.8	18.7	21.6	26.4	30.7	35.3	42.4	48.4	55.0	64.5	72.3	80.7	92.5	101.9	111.7	125.2	135.6
360	6.0	3.5	4.2	6.5	8.4	10.3	13.2	15.7	18.0	22.0	25.5	29.5	35.5	40.6	46.0	53.8	59.9	66.4	75.1	81.9	88.5	97.1	103.3
540	9.0	2.6	3.2	5.0	6.4	8.0	10.3	12.2	14.0	17.1	19.8	22.8	27.3	30.9	34.8	40.2	44.4	48.7	54.2	58.3	62.2	66.9	70.0
720	12	2.2	2.6	4.1	5.3	6.6	8.6	10.3	11.7	14.3	16.6	19.1	22.8	25.8	28.9	33.2	36.4	39.6	43.6	46.4	48.9	51.7	53.3
1080	18	1.6	1.9	3.1	4.0	5.1	6.6	7.9	9.1	11.1	12.9	14.8	17.7	20.0	22.3	25.3	27.5	29.5	32.0	33.5	34.7	35.8	36.1
1440	24	1.3	1.6	2.5	3.3	4.2	5.4	6.5	7.5	9.2	10.7	12.4	14.8	16.7	18.6	21.1	22.8	24.3	26.0	26.9	27.5		27.5
1800	30	1.1	1.3	2.1	2.8	3.6	4.6	5.6	6.4	7.9	9.1	10.6	12.7	14.3	16.0	18.1	19.6	21.0	22.4	23.3	23.9		24.0
2160	36	0.9	1.1	1.9	2.4	3.1	4.1	4.9	5.7	6.9	8.1	9.3	11.2	12.7	14.2	16.1	17.4	18.6	20.0	20.7	21.2		21.4
2880	48	0.7	0.9	1.5	2.0	2.5	3.3	3.9	4.6	5.7	6.6	7.7	9.2	10.5	11.7	13.3	14.3	15.3	16.4	17.0			17.3
4320	72	0.5	0.6	1.1	1.4	1.8	2.3	2.8	3.4	4.2	4.9	5.8	7.0	8.0	8.9	10.1	10.9	11.6	12.4				12.5
5760	96	0.4	0.5	0.8	1.1	1.4	1.8	2.2	2.6	3.3	3.9	4.6	5.7	6.5	7.3	8.4	9.1	9.7	10.4				10.6
7200	120	0.3	0.4	0.7	0.9	1.1	1.5	1.8	2.2	2.7	3.3	3.8											
8640	144	0.3	0.3	0.6	0.7	0.9	1.2	1.5	1.8	2.3	2.8	3.3											
10080	168	0.3	0.3	0.5	0.6	0.8	1.1	1.3	1.6	2.0	2.4	2.8											

- Estimated using the BOM IFD TOOL 2016

- Linearly extrapolated for short duration events

- Estimated by interpolation methodology as described in Section 3.5.2.2 of ARR 2016.

- Estimated using the procedures taken from "The Estimation of Probable Maximum Precipitation in Australia", June 2003 (GSDM)

- Logarithmically interpolated for mid duration events

- Estimated using the procedures taken from "Revision of the Generalised Tropical Storm Method for Estimating Probable Maximum Precipitation, HRS Report No. 8", August 2003 (GTSMR).

- Not estimated due to interpolation errors.

- Estimated using the procedures taken from "Development of the Generalised Southeast Australia Method for Estimating Probable Maximum Precipitation, HRS Report No. 4", August 1996 (GSAM).

Notes:

1. 63% AEP is equivalent to 1 Exceedances per year (EY). This event of greater will occur once ever year.
2. The 50% AEP IFD does not correspond to the 2 year Average Recurrence Interval (ARI) IFD. Rather it corresponds to the 1.44 ARI.
3. The 20% AEP IFD does not correspond to the 5 year Average Recurrence Interval (ARI) IFD. Rather it corresponds to the 4.48 ARI.
4. PMP is assumed to be equivalent to a 0.00001% AEP or 10,000,000 year ARI Event.

APPENDIX C

Geotechnical Investigation Report

Knight Piésold CONSULTING

EVOLUTION MINING LTD
MUNGARI GOLD PROJECT

TAILING STORAGE FACILITY CELL 3
GEOTECHNICAL INVESTIGATION REPORT

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MUNGARI GOLD PROJECT

TAILING STORAGE FACILITY CELL 3

GEOTECHNICAL INVESTIGATION REPORT

KP Job No. PE801-00137/18

KP Report No. PE801-00137/23

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1. INTRODUCTION

Knight Piésold Pty Ltd (KP) was engaged by Evolution Mining Ltd (Evolution) to undertake a geotechnical investigation on the proposed tailing storage facility (TSF) Cell 3 site of the Mungari Gold Project. The site investigation was carried out between 13 and 23 March 2017. The scope and purpose of the investigation was to:

- Assess ground conditions for the proposed TSF site; and
- Assess the suitability of site materials for TSF construction.

This report details the scope of the geotechnical investigation, presents an interpretation of ground conditions and material properties across the TSF Cell 3 Site, and evaluates the suitability of materials for use in TSF construction. Interpretation of site conditions is based on the sub-surface lithology revealed during the investigation programme, visual assessments of the in situ materials, the results of in situ field tests, and the results of laboratory testing carried out on selected representative samples.

All fieldwork, interpretation and terminology used in this report are in accordance with the guidelines presented in AS1726-2017 Geotechnical Site Investigation (Ref. 1).

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2. SITE AREA

2.1 SITE LOCATION

The proposed TSF Cell 3 site is located approximately 20 km to the west of the town of Kalgoorlie in Western Australia. Within the designated area, there are existing access roads thus the site is readily accessible.

2.2 SITE DESCRIPTION

The site is relatively flat, and is covered with shrubs and scattered with trees. Red brown clayey sand is easily identified as top soil on site. Access roads pass through the site. From site observations, the surrounding land is relatively flat with little change of the topography.

The proposed TSF Cell 3 area is adjacent to the existing TSF Cell 2, located close to the boundary of two drainage areas, namely, Kopai Lake and Kurrawang Lake which are both salt lakes.

General site layout is shown in Figure 2.1.

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3. GEOTECHNICAL INVESTIGATION

3.1 GENERAL

The geotechnical investigation comprised the following scope:

- Drilling of 4 boreholes using diamond coring techniques;
- Excavation of 35 test pits; and
- Laboratory testing of samples obtained from the boreholes and test pits.

Fieldwork was supervised by a geotechnical engineer from KP. The test locations were selected following discussions between Evolution and KP prior to mobilising to site, and the locations were set out by Evolution's team. The test locations are shown in Figure 3.1.

3.2 BOREHOLE DRILLING

A total of 4 boreholes were drilled at the proposed TSF Site. The boreholes were drilled using a DE 840 drilling rig with HQ3 (OD ϕ=96mm) coring bits supplied and operated by Top drill. The recovered core was placed into core trays and subsequently logged and photographed by a KP site representative. During the drilling of each borehole, Standard Penetration Tests (SPT) were undertaken typically at intervals of 1.5m in order to assess the consistency and strength characteristics of the in situ material. The entire length of the each borehole was sealed with a bentonite grout mix after bore hole drilling.

Permeability tests were carried out using packer test in each bore hole.

A summary of the drilling works is presented in Table 3.1. The SPT results are presented in Table 3.2 and the SPT N values are plotted in Figure 3.2. Logs and photographs of the boreholes are presented in Appendix A.

Table 3.1: Summary of borehole drilling

Borehole ID	Drill depth (m)	Water table (m)	Easting	Northing
BH -01	25	13.9	330384	6595696
BH -02	25	2.7	329940	6595301
BH -03	25	13.3	330370	6595291
BH -04	25	9.3	330611	6594886

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Table 3.2: Summary of SPT test results

Borehole	Depth (m)	SPT Blows	N Value
BH -01	1.0 to 1.45	3,5,6	11
BH -01	2.5 to 2.95	4,5,5	10
BH -01	4.0 to 4.45	2,4,2	6
BH -01	XXXXXXXX 4.8?	XXXXXX	23
BH -01	7 to 7.25	50, 50/100mm (HB)	Refusal
BH -01	8.5 to 8.7	29, 50/50mm (HB)	Refusal
BH -01	10 to 10.45	6,14,15	29
BH -01	11.5 to 11.95	3,8,15	23
BH -01	16.6 to 17.05	9,17,25	42
BH -01	19.5 to 19.95	8,15,22	37
BH -01	23 to 23.45	13,32,51	83
BH- 02	1.0 to 1.45	5,7,8	15
BH- 02	2.5 to 2.95	3,4,4	8
BH- 02	4.0 to 4.45	4,7,5	12
BH- 02	7.5 to 7.95	7,12,23	35
BH- 02	9 to 9.45	5,11,15	26
BH- 02	11 to 11.45	7,11,13	24
BH- 02	13 to 13.45	4,11,18	29
BH- 02	15 to 15.45	3,7,23	30
BH- 02	17 to 17.45	6,12,13	25
BH- 02	19 to 19.45	5,8,16	24
BH- 02	20.5 to 20.95	11,25,45	70
BH- 02	22.5 to 22.95	21,47,80	Refusal
BH- 03	1.0 to 1.45	4,5,6	11
BH- 03	2.5 to 2.95	4,5,8	13
BH- 03	4.0 to 4.45	5,7,10	17
BH- 03	5.5 to 5.95	4,7,13	20
BH- 03	8 to 8.45	16,37,55	92
BH- 03	9.5 to 9.7	37, 50/50mm (HB)	Refusal
BH- 03	11 to 11.2	30, 50/50mm (HB)	Refusal
BH- 03	14 to 14.1	70/100mm (HB)	Refusal
BH- 03	17 to 17.3	21, 71/150mm (HB)	Refusal
BH- 03	20 to 20.15	62/150mm (HB)	Refusal
BH- 04	1.0 to 1.45	3,3,6	9
BH- 04	2.5 to 2.95	4,7,12	19
BH- 04	4.0 to 4.45	6,11,10	21
BH- 04	7 to 7.45	7,13,17	30
BH- 04	8.5 to 8.95	6,11,18	29

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Borehole	Depth (m)	SPT Blows	N Value
BH- 04	10 to 10.45	6,12,25	37
BH- 04	11.5 to 11.95	4,9,14	23
BH- 04	13 to 13.45	6,11,20	31
BH- 04	14.5 to 14.95	4,9,16	25
BH- 04	16 to 16.45	15,70,81	Refusal
BH- 04	17.5 to 17.95	14,42,57	99
BH- 04	19 to 19.45	27,87,91	Refusal
BH- 04	22 to 22.45	26,63,95	Refusal

The SPT results in Figure 3.2 showed SPT N values increasing from approximately 10 to about 25 to 30 at about 20 m depth. The equivalent undrained shear strength is about 50kPa to 150kPa. This indicates the clay or silt component is generally firm to very stiff.

3.3 IN-SITU PERMEABILITY TEST

During the drilling of boreholes packer tests were undertaken in order to assess the in situ permeability characteristics. Each test was carried out by inserting a wireline gas-inflated packer at the top of the section to be tested, and then measuring the volume of water acceptance into that section of borehole at 5 minute intervals and at varying water pressures.

The results and interpretation of the packer testing are summarised in Table 3.3.

Table 3.3: Summary of packer and falling head test results

BH No.	Test Depth (m)	Permeability k (m/s)	Note	Material
BH- 01	5m to 7m	7×10^{-08}	Single Packer test	Silty Clay
BH- 02	7m to 9m	5×10^{-08}	Single Packer test	Silty Clay
BH- 03	6m to 8m	4×10^{-08}	Single Packer test	XW rock, gravel
BH- 04	4m to 7m	2×10^{-06}	Single Packer test	Clay

3.4 TEST PITS

Thirty-five test pits were excavated at the proposed TSF Cell 3 site to depths of between 2.1 m and 3.0 m using either a 5 ton Kubota excavator, or 45 ton excavator, supplied and operated by Kirkby Bobcat & Excavation and Rapid Dam, respectively. Each test pit was logged and photographed by a KP site representative and bulk samples were collected for laboratory testing. All test pits were backfilled with the excavated spoil on completion of logging and sampling. A summary of the test pitting works is presented in Table 3.4.

Table 3.4: Summary of test pitting

Test Pit ID	Location	Depth (m)	Easting	Northing
TP-01	TSF	2.8	330009	6595598
TP-02	TSF	2.9	330179	6595639
TP-03	TSF	3.0	330372	6595639
TP-04	TSF	2.8	330582	6595639
TP-05	TSF	3.0	330759	6595598
TP-06	TSF	2.9	330106	6595533
TP-07	TSF	3.0	330365	6595518
TP-08	TSF	3.0	330643	6595518
TP-09	TSF	2.9	330009	6595447
TP-10	TSF	3.0	330183	6595439
TP-11	TSF	3.0	330100	6595339
TP-12	TSF	2.7	330333	6595347
TP-13	TSF	2.8	330509	6595348
TP-14	TSF	2.7	330658	6595347
TP-15	TSF	2.8	330759	6595397
TP-16	TSF	2.7	330009	6595297
TP-17	TSF	3.0	330209	6595297
TP-18	TSF	2.8	330393	6595259
TP-19	TSF	2.7	330591	6595220
TP-20	TSF	2.7	330759	6595197
TP-21	TSF	3.0	330009	6595147
TP-22	TSF	3.05	330159	6595173
TP-23	TSF	3.0	330333	6595147
TP-24	TSF	3.0	330509	6595148
TP-25	TSF	2.5	330638	6595129
TP-26	TSF	3.0	330775	6595111
TP-27	TSF	3.0	330009	6594998
TP-28	TSF	3.0	330159	6595047
TP-29	TSF	3.0	330333	6595047
TP-30	TSF	2.1	330509	6595048
TP-31	TSF	3.0	330659	6595048
TP-32	TSF	3.0	330209	6594947
TP-33	TSF	3.0	330409	6594948
TP-34	TSF	3.0	330609	6594947
TP-35	TSF	3.0	330809	6594947

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Logs and photographs of the test pits are presented in Appendix B.

3.5 LABORATORY TESTING

Representative samples of the in situ soils are taken from the test pits and boreholes and delivered to the SGS and E-Precision Laboratory for testing. The purpose of the testing was to classify and characterise the soils in order to assess their behaviour characteristics under foundation loading and their suitability for use in earthworks.

Tests were carried out in accordance with Australian Standard AS1289: Methods of Testing Soil for Engineering Purposes (Ref. 2). A summary of the laboratory test results is presented in Tables 3.5 and 3.6, and the laboratory test reports are presented in Appendix C.

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Table 3.5: Summary of laboratory test results on TEST PIT bulk samples

Facility	Test Pit Ref. No	Sample Depth (m)	Soil description	Particle size distribution			Atterberg limits				USCS symbol	Emerson Class	Compaction			Fine Particle Specific Density (g/cc)	Permeability k (m/s)
				Gravel (%)	Sand (%)	Silt/Clay (%)	LL (%)	PL (%)	PI (%)	Linear Shrinkage (%)			MMDD t/m^3	OMC (%)	Dry Density Ratio (%)		
TSF	TP05	2.5 - 2.9	CLAY, Sandy	0	51	49	27	16	11	5.5	CL	5	1.70	19.0	95.3	2.50	1×10^{-10}
	TP07	2.0 - 2.3	CLAY, Sandy	4	51	45	73	26	47	17	CH						
	TP11	2.0 - 2.7	CLAY, Sandy	0	51	49	59	21	38	13.5	CH	5	1.77	19.0	94.2	2.49	4×10^{-11}
	TP12	0.5 - 1.0	SAND, Clayey	4	75	21	42	25	17	9	SC		1.72	18.5	95.6		5×10^{-8}
	TP16	0.5 - 1.0	SAND, Clayey	11	68	21	44	23	21	8.5	SC		1.74	16.5	94.6		4×10^{-8}
	TP27	0.5 - 1.0	SAND, Clayey	6	62	32	37	18	19	8	SC		1.78	15.0	94.9		3×10^{-9}
	TP35	0.5 - 1.0	SAND, Clayey	1	71	28	29	15	14	6	SC		1.91	11.0	94.7		2×10^{-7}

Notes:
LL – liquid limit, PL – plastic limit, PI – plasticity index, LS – linear shrinkage
USCS – universal soil classification system
MMDD – Modified Maximum Dry Density, OMC – Optimum Moisture Content

Table 3.6: Summary of laboratory testing results on BOREHOLES

Facility	Sample Ref. Number	Sample Depth (m)	Soil description	Particle size distribution				Atterberg Limits				USCS symbol	Moisture Content (%)	Emerson Class	Calcium Carbonate Content (%)	Triaxial Test Results		
				Gravel (%)	Sand (%)	Silt (%)	Clay (%)	LL (%)	PL (%)	PI (%)	Linear shrinkage (%)					c' (kPa)	Φ (degs)	Cv (m^2/year)
TSF	TSF_BH02_KP01	4.50 - 5.00	CLAY, Sandy	1	53.1	26.9	19	57	29	28	17.16	CH	37.6	5		26.93	24.65	0.016
	TSF_BH02_B_KP01	7.00 – 7.50	CLAY, Sandy	19.6	11.9	56	12.5	61.1	34.3	26.8	11.31	MH	42.3	4	9.4			
	TSF_BH03_KP01	4.45 - 4.95	SAND, Silty	0.1	46.2	39.5	14.2	57.8	32.9	24.9	17.67	MH	30.7	6		22.38	25.06	0.005
	TSF_BH04_KP01	4.45 - 4.95	SAND, clayey	8.3	69.2	16.6	5.9	29.1	19.4	9.7	6.23	CL	11	5		5.61	36.35	0.049
	TSF_BH01_KP01	3.50 - 4.00	SAND, clayey	4.8	52.8	30.3	12.1	53.9	28.4	25.5	13.54	CH	25.2	6				

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4. INVESTIGATION FINDINGS

4.1 REGIONAL GEOLOGY

The regional geological assessment of the site area is based on reference to the Geological Survey of Western Australia, 1:250,000 scale geological plans for Kalgoorlie (sheet SH51-9, Ref. 3). The map records the near surface geology at the TSF Cell 3 site comprises sand, silt and gypsum in stabilised dunes adjacent to playas (Cztd) and evaporate interbedded with clay and sand in playas (Czts).

4.2 SITE CONDITIONS

4.2.1 Surface Conditions

In general, the geotechnical investigation in TSF areas shows the ground has little or no disturbance at the time of investigation. Red-brown clayey sand is easily identified as top soil on site and ground is covered by shrubs and scattered trees of various sizes.

4.2.2 Sub-surface Conditions

Within the TSF Site, boreholes were drilled and test pits were excavated in order to determine the sub-surface conditions.

In general terms the sub-surface conditions of natural ground comprise the following:

- Clayey SAND overlying;
- Silty CLAY with sand; and
- Metadolerite sills.

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Clayey SAND:

The thickness of top Clayey SAND layer varies from 2.5 m to 4.5 m. Clayey SAND recorded an average particle size distribution of 3.7 % gravel, 59.1 % sand and 37.2 % fines. Atterberg limit tests (average PI=23.2% and average LL=46.2%) identified the fines fraction tended to be above A-line and to be generally low to medium plasticity. CLAY component becomes more dominant at depths. Figure 4.1 and 4.2 plots particle size distribution results for the test pit and borehole samples respectively. Figure 4.3 summarizes the Atterberg test results for all samples tested.

SPT values in this layer vary between 9 and 21 with an average value of 12. The Clayey SAND is medium dense.

If the Clayey SAND is compacted to 95% MMDD (Modified Maximum Dry Density), equivalent to a medium dense to dense consistency, testing indicates permeability in the range $2x10^{-7}$ m/s to $4x10^{-11}$ m/s, with an average of $4.3x10^{-8}$ m/s. Figure 4.4

illustrates the compaction test results, while Figure 4.5 presents the permeability with respect to fines fraction results.

The Emerson tests indicate that Clayey SAND has an Emerson Class of 5, suggesting that soil dispersion in this layer should not be a major concern.

Silty CLAY

Silty CLAY underlies the Clayey SAND with a thickness varying between 17m and 23m. Based on the current and previous geotechnical investigations (Ref.4), it appears to have the same, or similar, characteristics and properties to Silty CLAY underlying the existing TSF cell foundation. The fine content is generally very high, becoming more dominant at depth. The CLAY has medium to high plasticity.

SPT values in this layer increase with depth, varying between 20 and refusal, indicating a very stiff to very hard consistency.

Permeability in this layer is generally low; the in-situ packer tests indicated permeability in the range 7 x 10^{-8} m/s to 4 x 10^{-8} m/s.

Soil dispersion tests indicated an Emerson class number of between 4 and 6. However, previous dispersion tests undertaken on samples from this layer indicated an Emerson class number of between 2 and 4. This suggests that some of the materials, possibly due to existence of calcrete or gypsum in this layer, are potentially dispersive. This should be considered during TSF design and maintenance.

Table 4.1 summarises the subsurface profiles.

Table 4.1: Summary of sub-surface conditions – boreholes BH-TSF-01 to 05

Depth		Material Description	Consistency / Weathering
From	To		
0	2.5-4.5	Clayey SAND	Medium Dense
2.5-4.5	20	Silty CLAY	Stiff to Very Stiff
20	EOH	Metadolerite	Extremely to Distinctly Weathered

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5. GEOTECHNICAL ASSESSMENT

5.1 SOIL PARAMETERS

Table 5.1 provides the suggested TSF design soil shear strength and permeability parameters based on current and previous geotechnical investigation works.

Permeability values are based on in-situ packer tests, laboratory test results, and previous geotechnical investigations.

Unit weight values are based on laboratory test results and typical values for these materials.

Friction angles are based on triaxial test results and test results from previous geotechnical investigations. The cohesions reflect the degree of over-consolidation and cementation within the in situ materials.

Table 5.1: Adopted average shear strength parameters

Material	γ (kN/m^3)	c' (kPa)	Φ' (deg)	Permeability (m/s)
Clayey Sand	18	15	25	$5x10^{-8}$
Silty Clay/Clayey Silt	19	20	25	$1x10^{-8}$
XW-DW rock	21	50	33	$5x10^{-8}$

XW = extremely weathered; DW = distinctly weathered

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5.2 CONSTRUCTION CONSIDERATIONS

5.2.1 Workability of Near Surface Materials

Near surface materials are likely to comprise clayey sand or sandy clay with silty clay at depths. Conventional earthmoving equipment, such as dozers, excavators and graders will be capable of excavating the near surface materials. A cutoff trench should extend through this layer to reduce horizontal seepage through the foundation.

5.2.2 Excavated Material as Backfill

It is expected that substantial soil fill quantities will be required for the TSF construction. The top 2.5m to 4.5m clayey sand in the proposed TSF basin could be used for this purpose.

Zone A Fill – Low permeability Zone A material is required for the low permeability section of the TSF embankment. This material should ideally have a fines content of ≥ 35 %, a remoulded permeability of ≤ 1 x 10^{-8} m/s or ≤ 1 x 10^{-9} m/s, a plasticity index of > 8% and be workable to achieve a level of compaction of 98% of SMDD.

With selective excavation, the top layer of clayey sand could meet this specification; Zone A material could be won from the clayey sand and silty clay layers in the proposed TSF basin.

Zone C materials – Zone C material is required for the general construction of the TSF embankment. No specific requirements are placed on this material with the exception that it should be workable to achieve a compaction of 95% SMDD. The top clayey sand layer is suitable for use as Zone C.

However, attention should be paid to the presence of calcrete or gypsum in the silty clay layer in localized zones. Dispersion testing undertaken for in situ materials indicated an Emerson class number between 2 and 4, and this should be considered during TSF design and maintenance; these layers should be encapsulated with a compacted clay layer to prevent direct contact with water/tailings.

5.2.3 Groundwater

Water level was measured in the BHs on 20 to 22 March 2017 in this investigation. Water level was measured as 2.7m in BH2 and 9.3m in BH4 respectively, however, it is understood that these water table may be perched water or retained drilling fluid in the BHs. Based on previous investigations and monitoring data from existing bore, which have indicated groundwater levels of 12.0 m to 19.4 m below natural ground with some seasonal fluctuation, it is unlikely that groundwater will be encountered during construction. However care must be taken when excavating near Cell 2 as seepage has been reported at surface indicating shallow ground water. A new network of monitoring bores would be required as part of the Cell 3 facility to benchmark the groundwater level and quality.

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6. CONCLUSIONS AND RECOMMENDATIONS

KP undertook a site investigation of at the proposed Mungari Gold Project TSF Cell 3 site. The following conclusions have been drawn from the site investigation:

- The areas investigated are predominantly undisturbed and relatively flat;

  The near surface profile can be excavated with conventional earthmoving equipment. A cutoff trench should extend through this layer to reduce horizontal seepage through the foundation;
- The site is suitable for the proposed Cell 3 TSF;
- Suggested design parameters are incorporated into the body of the report. These include shear strength and permeability parameters; and
- The in situ materials in the proposed TSF basin are generally suitable for use a Zone A and Zone C material during construction. However, clay in the silty clay layer, possibly due to the presence of calcrete or gypsum, is potentially dispersive. This should be accounted for during construction should be encapsulated with a compacted clay layer to prevent direct contact with water/ tailings.

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7. LIMITATIONS

This report was prepared by Knight Piésold Pty Ltd (hereafter referred to as KP) for Evolution Mining Ltd (hereafter referred to as Client) for purpose of Mungari Gold Project to provide geotechnical input to the design of TSF Cell 3. This report is confidential, may only be used and relied on by the Client and must not be used for any other purpose. It must not be copied to, used by, or relied on by any person other than the Client. KP and its employees have no responsibility to any person other than the Client arising from or in connection with this report.

This report as a whole presents the findings of the geotechnical investigation works, it should not be altered, amended or abbreviated, issued in part or issued incomplete in any manner whatsoever without prior consent from KP. The logs, figures, table and drawings should not be redrawn and included in any other documents and drawings etc. KP expressly disclaims responsibility for any liability which may arise from circumstances of issuance and quotation of this report in part, or incomplete, or its modification in any way whatsoever.

Subsurface conditions are variable and may change with time. The interpretation presented in this report is based on factual information, obtained at a specific period of time and specific points of the site, and engineering judgement. As such, the interpretations in this report will have a level of uncertainty due to the limited works and services undertaken. The works and services undertaken by KP in connection with preparing this report were limited to those detailed in the scope of works in Section 1 of this report.

KP has prepared this report on the basis of information provided by the Client, which KP has not independently verified or checked (unverified information). KP expressly disclaims responsibility in connection with the unverified information, including (but not limited to) errors in, or omissions from, this report that were caused or contributed to by errors in, or omissions from, the unverified information.

The opinions, conclusions and recommendations contained in this report are based on, but not limited to, assumptions described in this report when undertaking works, services and preparing this report. The assumptions cannot be substantiated until the project implementation has commenced and necessary verification works, including, but not limited to, instrumentation monitoring works, have been carried out according to KP's recommendations. KP expressly disclaims responsibility for any error in, or omission from, this report arising from or in connection with any of the unverified assumptions being incorrect. If another party undertakes the implementation of, or construction according to, the opinion, conclusion and recommendations contained in

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this report, there is a risk that the same may be misinterpreted and KP cannot be held responsible for such misinterpretation.

The opinions, conclusions and any recommendations in this report are based on information obtained from, and investigation undertaken at or in connection with, specific investigation points at site. Site conditions at other parts of the site may be different from the site conditions found at the specific investigation points. Actual site conditions may differ from those inferred to exist due to hidden conditions unrevealed and/or changes after the date of acquisition of information on which this report is based. The Client should retain the service of KP through all development phases to carry out further investigations, if required, to identify any variance during construction/implementation and to search for solutions to problems due to the same.

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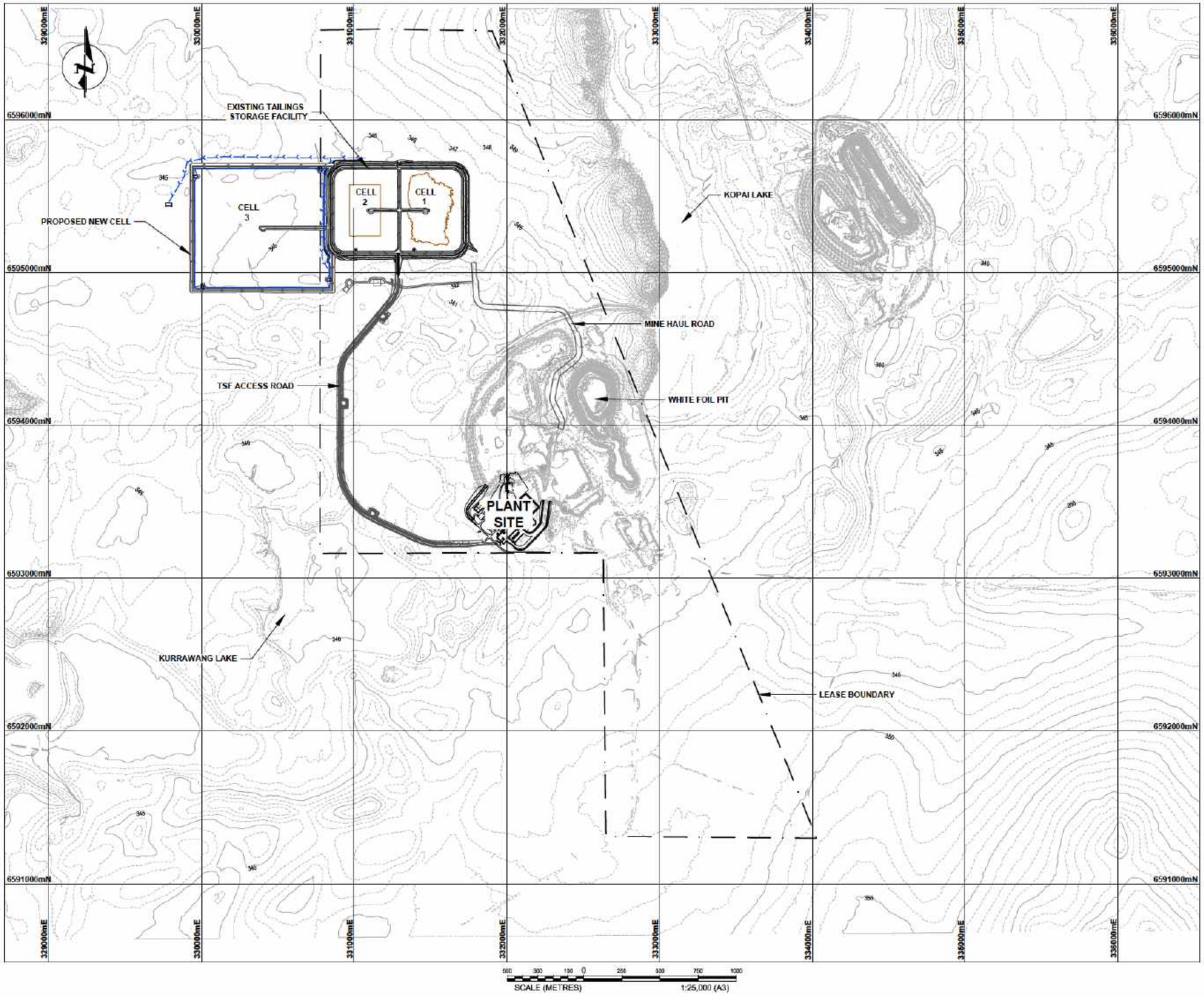
8. REFERENCES

1. Geotechnical Site Investigations – AS 1726 – 2017. Australian Standards.
2. Methods of Testing Soils for Engineering Purposes, AS 1289.0 – 2000. Australian Standards.
3. Geological Survey of Western Australia, 1:250,000 scale geological plans for Kalgoorlie.
4. Knight Pièsold, "Tailing Storage Facility Geotechnical Investigation Report (Ref PE801-00137/05 Rev A), April 2013.

DRAFT

FIGURES



LEGEND:

LEASE BOUNDARY

SURFACE DRAIN

NOTES:

1. 1m CONTOUR INTERVALS SHOWN. TOPOGRAPHICAL DATA PROVIDED BY EVOLUTION, 5th MARCH, 2014.

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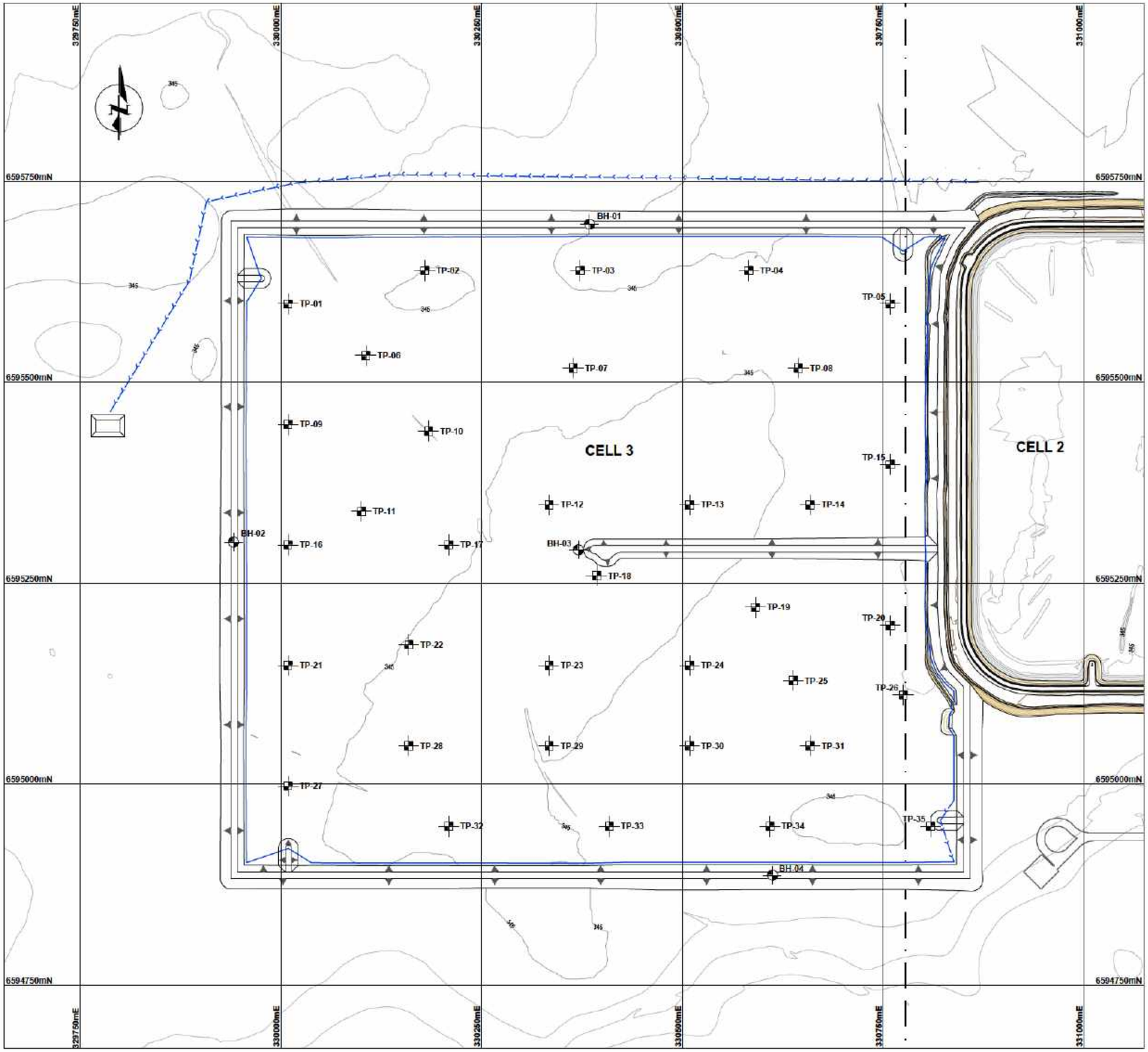
MUNGARI GOLD PROJECT
TAILINGS STORAGE FACILITY - CELL 3
SITE GENERAL ARRANGEMENT

Ref: PE801-00137/23
Figure 2.1



LEGEND:

- LEASE BOUNDARY
- TEST PIT LOCATION
- BOREHOLE LOCATION

NOTES:

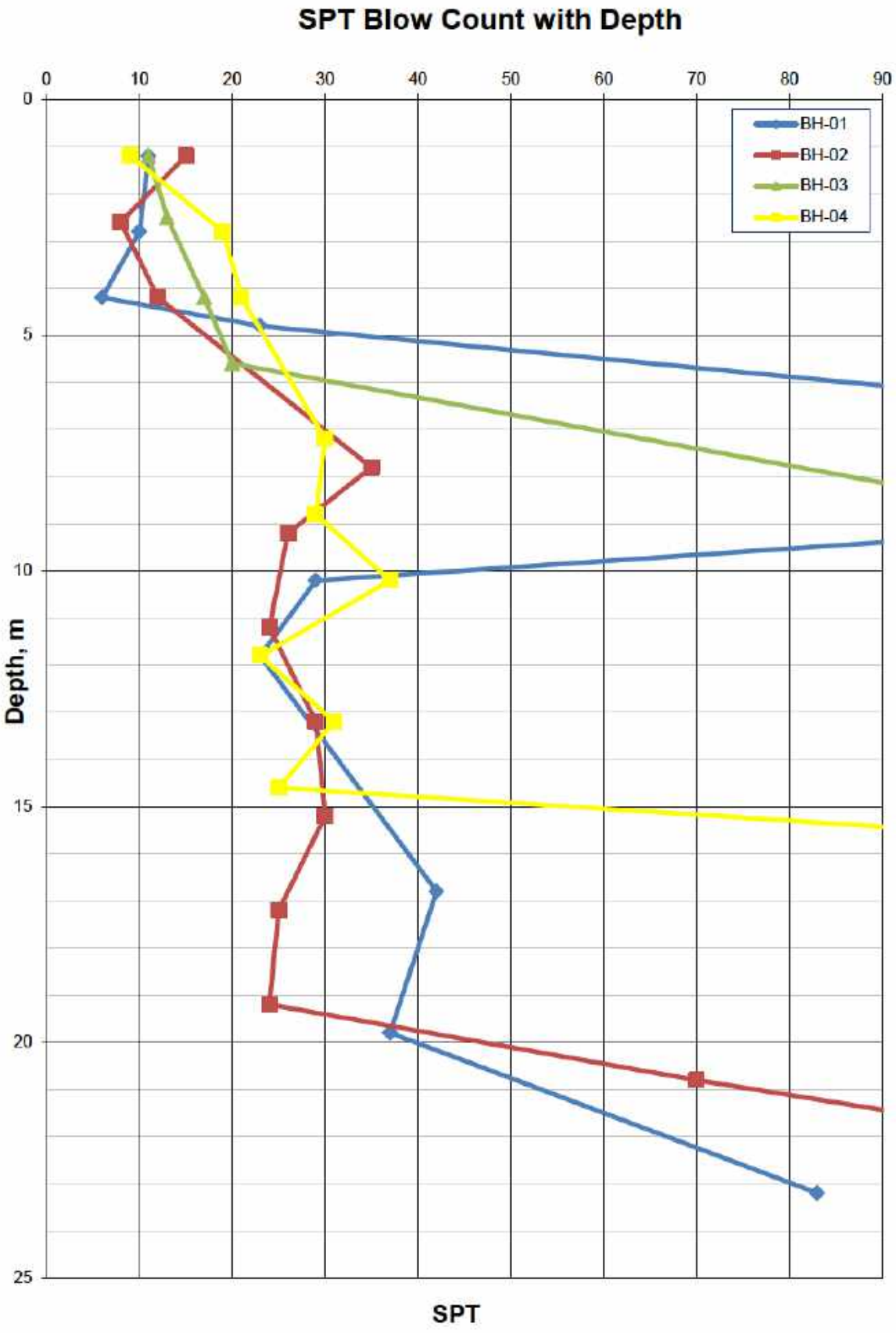
1. 1m CONTOUR INTERVALS SHOWN. EXTERNAL TOPOGRAPHICAL DATA PROVIDED BY LA MANCHA RESOURCES, 20 NOVEMBER, 2012.

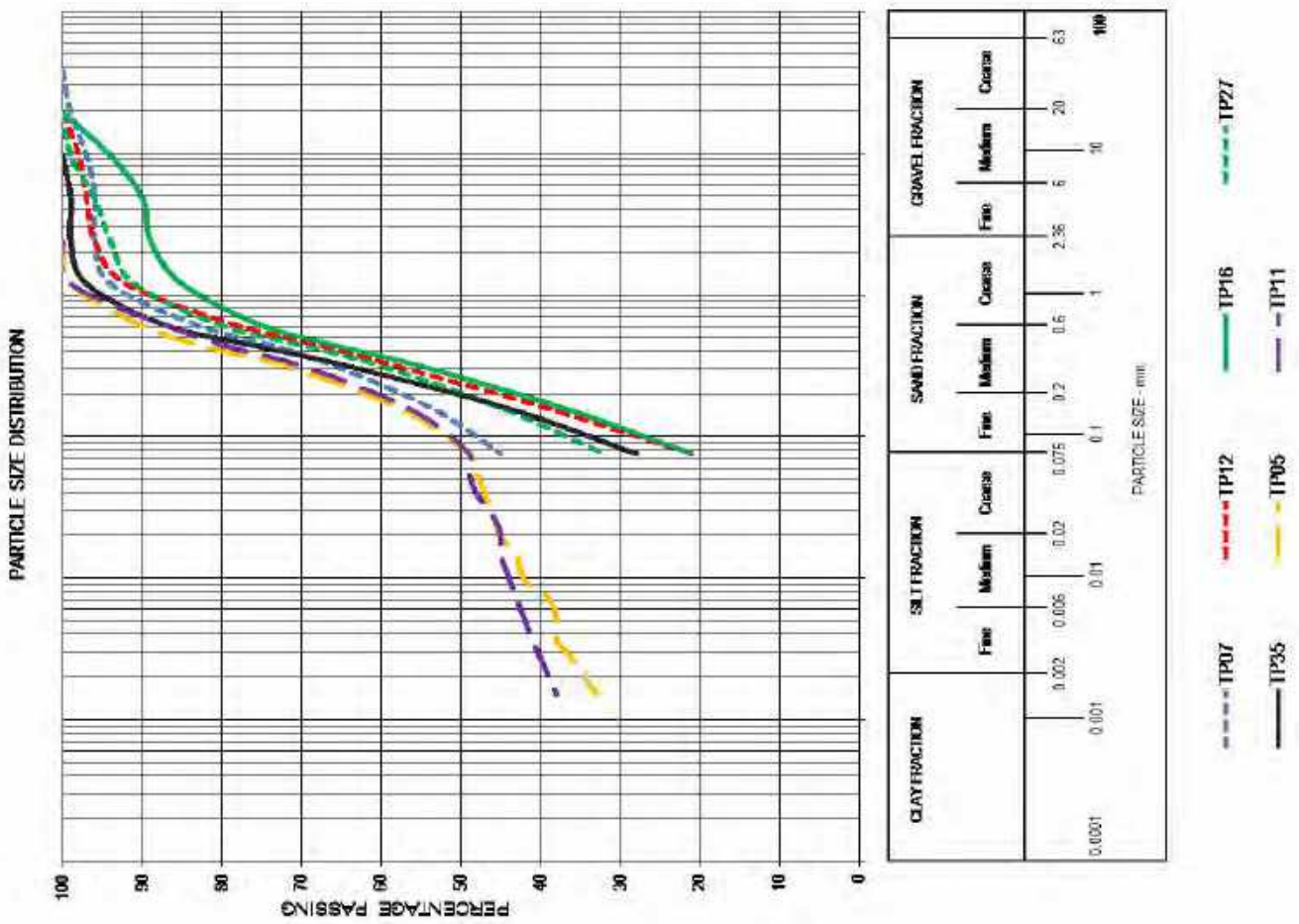
TEST PIT LOCATIONS

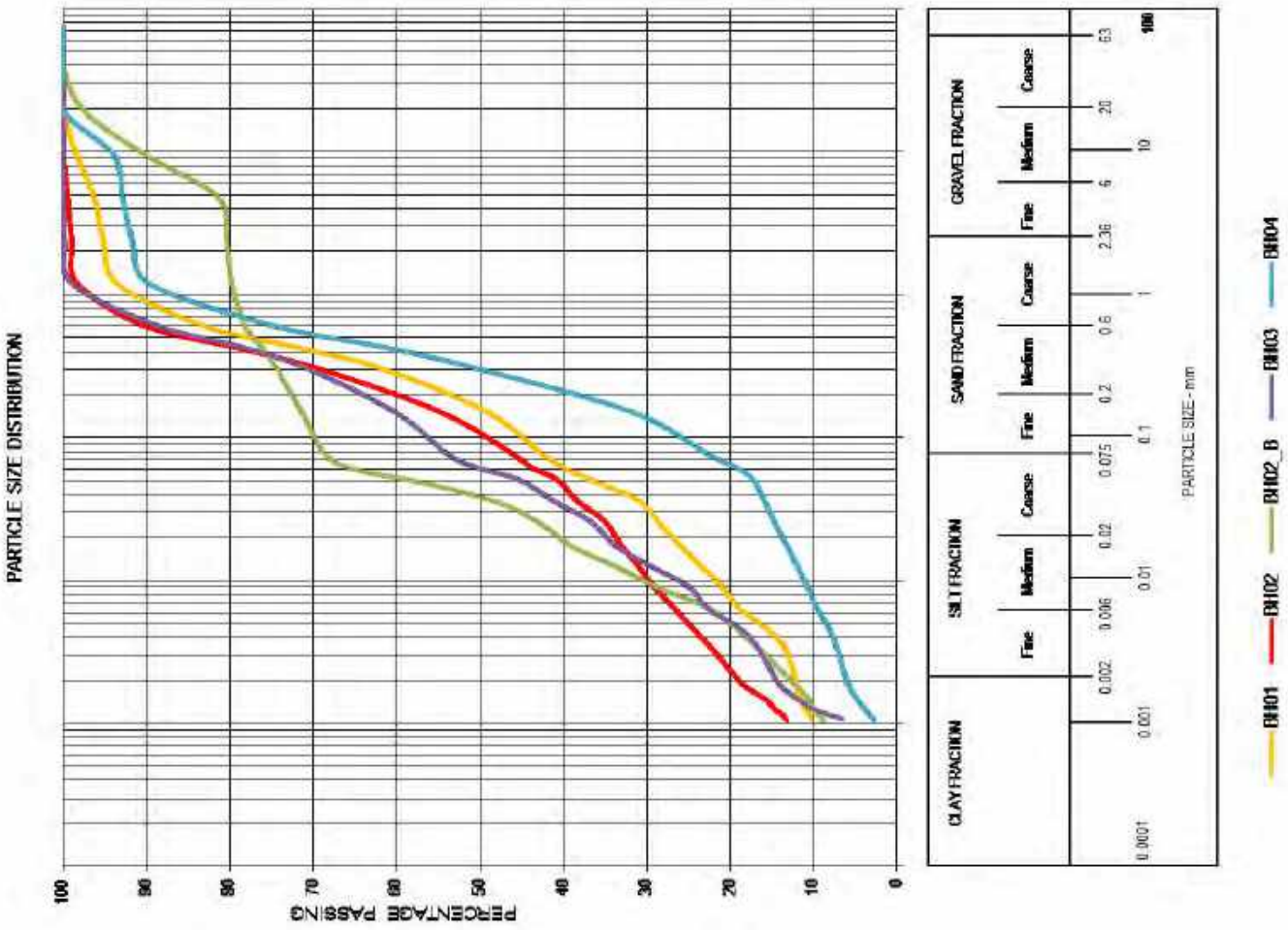
TEST PIT I.D.	EASTING	NORTHING
TP-01	330009	6595598
TP-02	330179	6595639
TP-03	330373	6595639
TP-04	330582	6595639
TP-05	330759	6595598
TP-06	330106	6595534
TP-07	330384	6595518
TP-08	330644	6595518
TP-09	330009	6595448
TP-10	330184	6595439
TP-11	330100	6595340
TP-12	330334	6595348
TP-13	330509	6595348
TP-14	330659	6595348
TP-15	330759	6595398
TP-16	330009	6595298
TP-17	330209	6595298
TP-18	330393	6595260
TP-19	330591	6595220
TP-20	330759	6595198
TP-21	330009	6595148
TP-22	330159	6595174
TP-23	330334	6595148
TP-24	330509	6595148
TP-25	330638	6595129
TP-26	330775	6595111
TP-27	330009	6594998
TP-28	330159	6595048
TP-29	330334	6595048
TP-30	330509	6595048
TP-31	330659	6595048
TP-32	330209	6594948
TP-33	330409	6594948
TP-34	330609	6594948
TP-35	330809	6594948

BOREHOLE LOCATIONS

BOREHOLE I.D.	EASTING	NORTHING
BH-01	330384	6595697
BH-02	329941	6595301
BH-03	330370	6595292
BH-04	330612	6594887


SPT Blow Count with Depth
0
10
20
30
40
50
60
70
80
90
0
5
10
15
20
25
Depth, m
SPT
BH-01
BH-02
BH-03
BH-04


PARTICLE SIZE DISTRIBUTION
PERCENTAGE PASSING
100
90
80
70
60
50
40
30
20
10
0
CLAY FRACTION
SILT FRACTION
SAND FRACTION
GRAVEL FRACTION
Fine
Medium
Coarse
Fine
Medium
Coarse
Fine
Medium
Coarse
0.0001
0.001
0.002
0.006
0.01
0.02
0.075
0.1
0.2
0.6
1
2.36
5
10
20
63
100
PARTICLE SIZE - mm
TP07
TP35
TP12
TP05
TP16
TP11
TP27


PARTICLE SIZE DISTRIBUTION
PERCENTAGE PASSING
100
90
80
70
60
50
40
30
20
10
0
CLAY FRACTION
SILT FRACTION
SAND FRACTION
GRAVEL FRACTION
Fine
Medium
Coarse
Fine
Medium
Coarse
Fine
Medium
Coarse
0.002
0.006
0.02
0.075
0.2
0.6
2.36
6
20
63
0.0001
0.001
0.01
0.1
1
10
100
PARTICLE SIZE - mm
DH01
DH02
DH02_B
DH03
DH04

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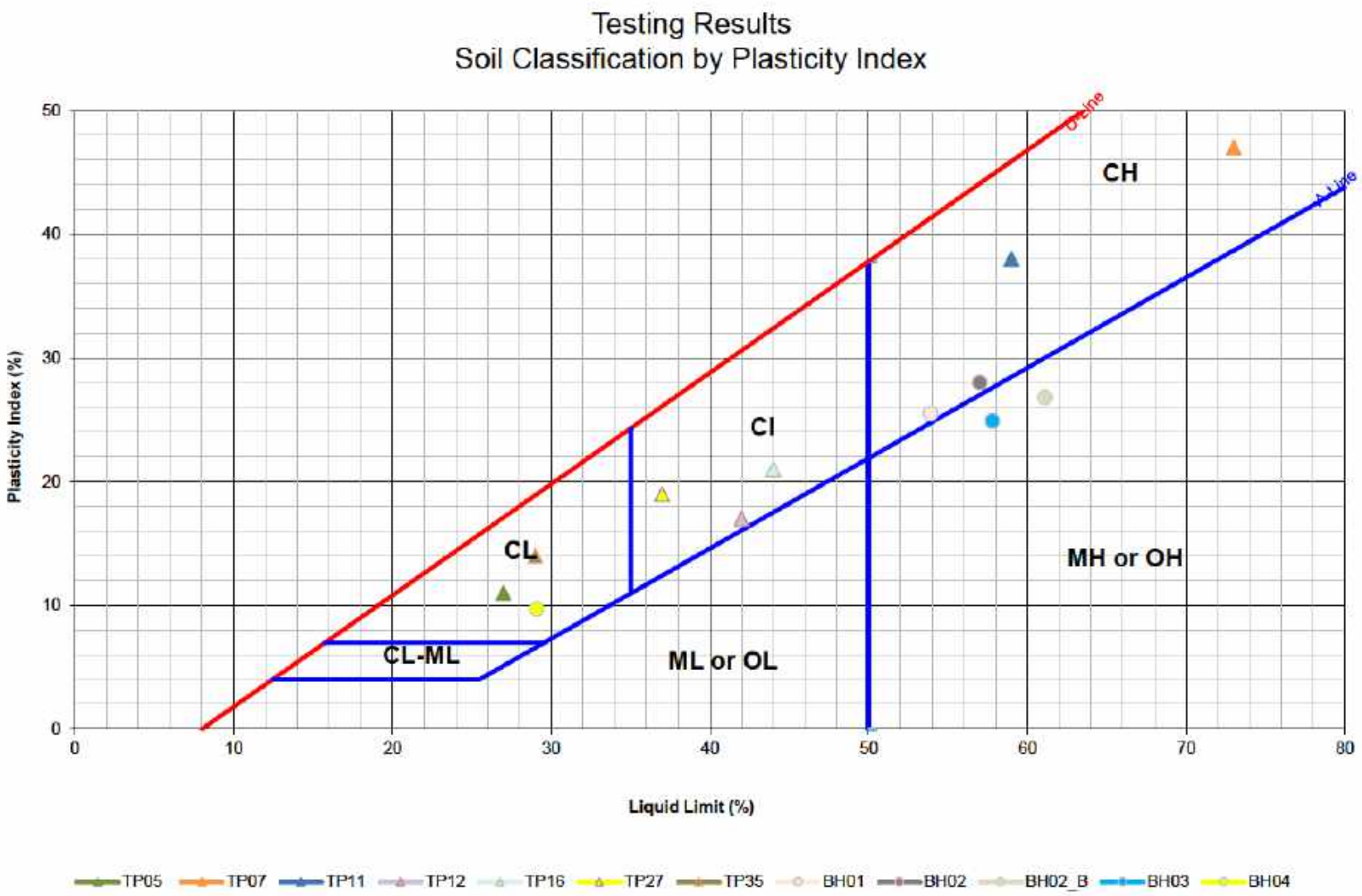
MUNGARI GOLD PROJECT
TSF SITE
PLASTICITY TEST RESULTS

Ref: PE801-00137/23
Figure 4.3



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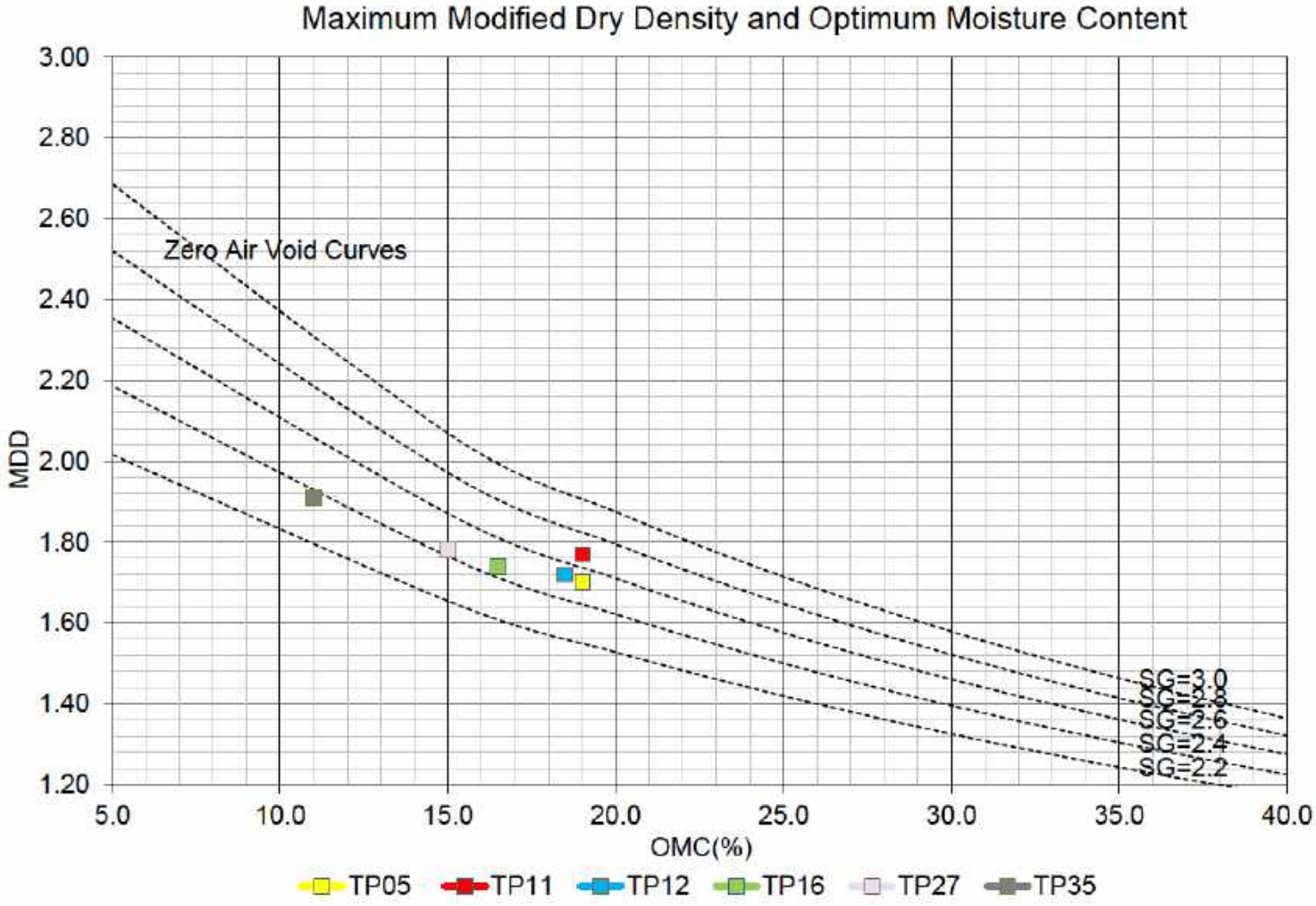
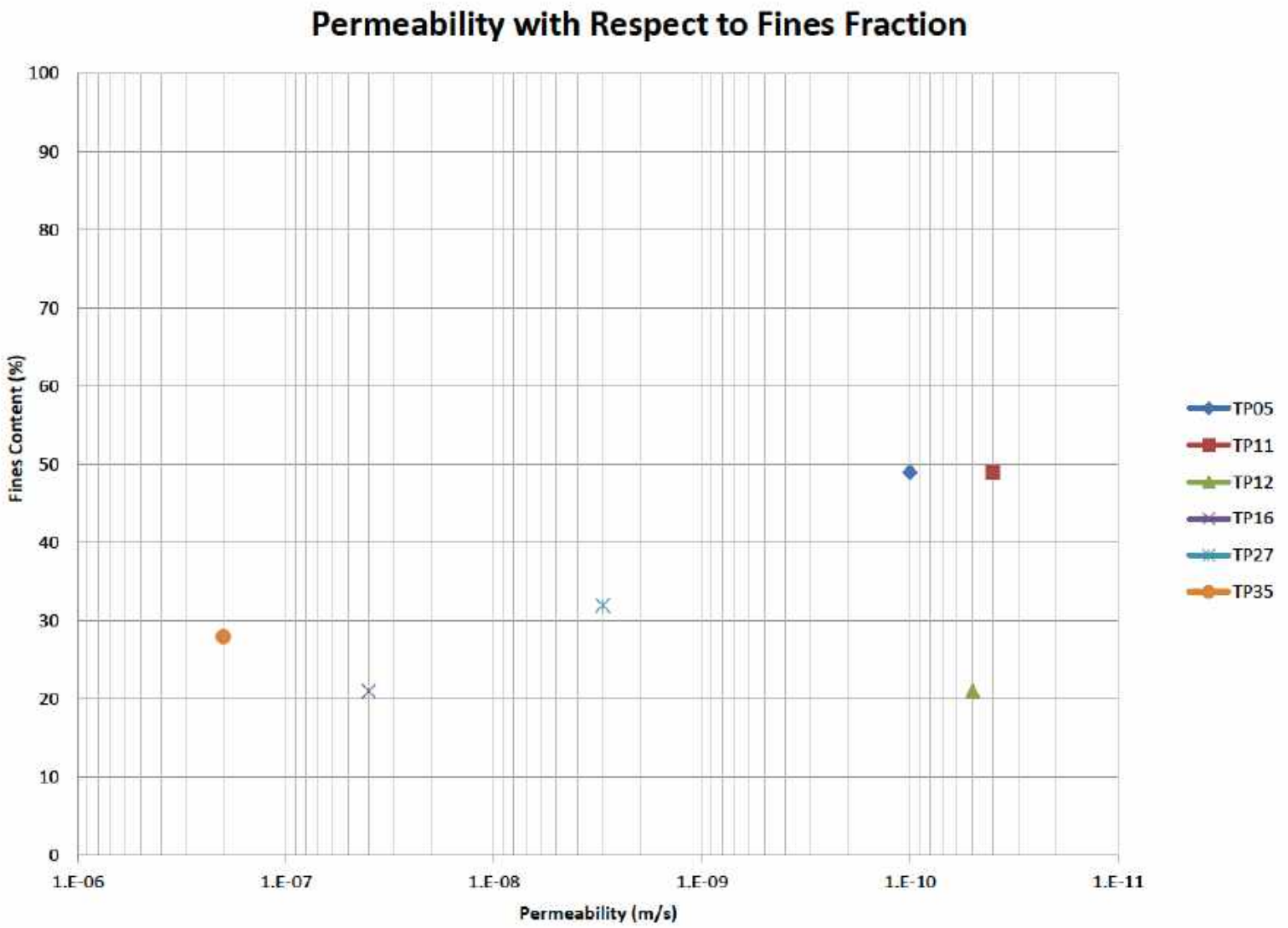
MUNGARI GOLD PROJECT
TSF SITE
COMPACTION TEST RESULTS



Ref: PE801-00137/23
Figure 4.4



MUNGARI GOLD PROJECT
TSF SITE
FALLING HEAD PERMEABILITY TESTS

APPENDIX A

Borehole Logs and Core Photographs

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HOLE: **BH 01**	
Sheet 1 of 3	*Rev*
JOB NUMBER: PE801-00137	

TCR (%)	SCR (%)	RQD (%)	FRACTURE FREQUENCY	GRAPHIC LOG	DEPTH (m)	MATERIAL DESCRIPTION	STRENGTH/ CONSISTENCY	WEATHERING	DEFECTS/ADDITIONAL COMMENTS	IN SITU TESTING	SAMPLING (DEPTH IN m)
0.9	0.9	-	-		0m	**SAND**, clayey, non to low plastic, red brown, moist, medium dense. Sand particles are fine to medium, sub rounded.	MD				
-	-	-	-		1					3, 5, 6 N=11	
0.55	0.55	-	-		2						
-	-	-	-		2.5m	**CLAY**, sandy, trace gravel, low to medium plasticity, red brown, grey, moist, stiff to very stiff. Sand particles are fine to medium, sub rounded.	F - St			4, 5, 5 N=10	
0.45	0.45	-	-		3						3.5
-	-	-	-		4						4
Push Tube	-	-	-							2, 4, 2 N=6	
0.5	0.5	-	-		4.5m	**CLAY**, silty, low to medium plasticity, light brown, grey, cream white moist, very stiff to hard.	VSt - H			3, 8, 15 N=23	
1.3	1.3	-	-		5						
0.5	0.5	-	-		6						
-	-	-	-		7					50, 50/100mm (HB), - N=Refusal	
1.25	1.25	-	-		7.5m	**CLAY**, silty, low plasticity, light brown, grey, cream white moist, very stiff to hard.					
-	-	-	-		8					29, 50/50mm (HB), - N=Refusal	
1.3	1.3	-	-		9						

NOTES:

Undisturbed Sample

Standard Penetration Test

CONTRACTOR : Top Drill
MACHINE : De840 Rig6

LOGGED BY : BZ
CHECKED BY :

DATE STARTED : 15-Mar-17
DATE PROFILED : 17-Mar-17
HOLE SIZE : HQ

NORTHING : 6595696
EASTING : 330384
ELEVATION : -

INCLINATION: -90

KP_BH_2013_REV_0_PE801-00137_BH LOGS 2017 SI GPJ KP_DATATEMPLATE_BH_2013.GDT 7-4-17

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HOLE: **BH 01**	
Sheet 2 of 3	*Rev*
JOB NUMBER: PE801-00137	

TCR (%)	SCR (%)	RQD (%)	FRACTURE FREQUENCY	GRAPHIC LOG	DEPTH (m)	MATERIAL DESCRIPTION	STRENGTH/ CONSISTENCY	WEATHERING	DEFECTS/ADDITIONAL COMMENTS	IN SITU TESTING	SAMPLING (DEPTH IN m)
-	-	-	-		10					6, 14, 15 N=29	
1.05	1.05	-	-		11						
										3, 8, 15 N=23	
2	2	-	-		12						
					13						
1.5	1.5	-	-		14						
					15	15m **CLAY**, silty, low plasticity, light brown, grey, cream white moist, firm to stiff.					
1.6	1.6	-	-		16						
-	-	-	-		17					9, 17, 25 N=42	
0.35	0.35	-	-			17.5m **CLAY**, silty, low plasticity, light brown, grey, cream white moist, stiff to very stiff.					
1.2	1.2	-	-		18						
					19						
0.4	0.4	-	-								
-	-	-	-							8, 15, 22 N=37	
1.1	1.1	-	-		20	20.3m **CLAY**, silty, low plasticity, grey, greenish grey moist, hard.					
					21						
0.2	0.2	-	-								

KP_BH_2013_REV_0_PE801-00137_BH LOGS 2013 SLOG1_KP_DATATEMPLATE_BH_2013.GDT 7/4/17

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HOLE: **BH 01**	
Sheet 3 of 3	*Rev*
JOB NUMBER: PE801-00137	

TCR (%)	SCR (%)	RQD (%)	FRACTURE FREQUENCY	GRAPHIC LOG	DEPTH (m)	MATERIAL DESCRIPTION	STRENGTH/ CONSISTENCY	WEATHERING	DEFECTS/ADDITIONAL COMMENTS	IN SITU TESTING	SAMPLING (DEPTH IN m)
1.2	1.2	-	-		22						
					23					13, 32, 51 N=83	
1	1	-	-		24						
1	1	-	-		25	Borehole BH 01 terminated at 25 m depth.					
					26						
					27						
					28						
					29						
					30						
					31						
					32						
					33						

KP_BH_2013_REV_0_PE801-00137_BH LOGS 2017 SLG21 KP_DATATEMPLATE_BH_2013.GDT 7/4/17

Plate 1: Borehole BH-01 – 0.0 to 4.45 m

Plate 2: Borehole BH-01 – 4.45 to 7.0 m

Plate 3: Borehole BH-01 – 7.0 to 11.5 m

Plate 4: Borehole BH-01 – 11.5 to 15.0 m

Plate 5: Borehole BH-01 – 15.0 to 20 m

Plate 6: Borehole BH-01 – 20 to 23.45 m

Plate 7: Borehole BH-01 – 23.45 to 25.0 m

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HOLE: **BH 02**	
Sheet 1 of 3	*Rev*
JOB NUMBER: PE801-00137	

TCR (%)	SCR (%)	RQD (%)	FRACTURE FREQUENCY	GRAPHIC LOG	DEPTH (m)	MATERIAL DESCRIPTION	STRENGTH/ CONSISTENCY	WEATHERING	DEFECTS/ADDITIONAL COMMENTS	IN SITU TESTING	SAMPLING (DEPTH IN m)
1	1	-	-		0m	**SAND**, clayey, non to low plastic, red brown , moist, medium dense. Sand particles are fine to medium, sub rounded.	MD				
-	-	-	-		1					5, 7, 8 N=15	
1.05	1.05	-	-		2						
-	-	-	-							3, 4, 4 N=8	
0.3	0.3	-	-		3						
-	-	-	-		4					4, 7, 5 N=12	
Push Tube	-	-	-		4.5m	**CLAY**, sandy, trace gravel, low to medium plasticity, red brown, grey, moist, stiff to very stiff. Sand particles are fine to medium, sub rounded.	VSt - H				4.5
0.5	0.5	-	-		5						5
0.2	0.2	-	-		6						
0.6	0.6	-	-		6.5m	**CLAY**, silty, low to medium plasticity, light brown, grey, cream white moist, stiff to very stiff.					7
Push Tube	-	-	-		7						
-	-	-	-		7.5m	**CLAY**, silty, trace gravel, low plasticity, red brown, cream white, moist, stiff to very stiff. Sand particles are fine to medium, sub rounded.				7, 12, 23 N=35	7.5
0.85	0.85	-	-		8						
-	-	-	-		9					5, 11, 15 N=26	
0.55	0.55	-	-								

NOTES:

■ Undisturbed Sample

⊠ Standard Penetration Test

CONTRACTOR : Top Drill
MACHINE : De840 Rig6

LOGGED BY : BZ
CHECKED BY :

DATE STARTED : 17-Mar-17
DATE PROFILED : 19-Mar-17
HOLE SIZE : HQ

NORTHING : 6595301
EASTING : 329940
ELEVATION : -

INCLINATION: -90

KP_BH_2013_REV_0_PE801-00137_BH LOGS 2017 SI GEI KP_DATATEMPLATE_BH_2013.GDT 7/4/17

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HOLE: **BH 02**	
Sheet 2 of 3	*Rev*
JOB NUMBER: PE801-00137	

TCR (%)	SCR (%)	RQD (%)	FRACTURE FREQUENCY	GRAPHIC LOG	DEPTH (m)	MATERIAL DESCRIPTION	STRENGTH/ CONSISTENCY	WEATHERING	DEFECTS/ADDITIONAL COMMENTS	IN SITU TESTING	SAMPLING (DEPTH IN m)
0.95	0.95	-	-		11					7, 11, 13 N=24	
-	-	-	-								
1.3	1.3	-	-		12						
-	-	-	-		13					4, 11, 18 N=29	
0.65	0.65	-	-		14						
-	-	-	-		15					3, 7, 23 N=30	
0	0	-	-		16						
-	-	-	-		17					6, 12, 13 N=25	
0.4	0.4	-	-		18						
0.6	0.6	-	-			18.2m **CLAY**, silty, low plasticity, grey, greenish grey moist, hard.					
-	-	-	-		19					5, 8, 16 N=24	
-	-	-	-								
0.4	0.4	-	-		20						
100	100	-	-								
-	-	-	-							11, 25, 45 N=70	
-	-	-	-		21						
100	100										
1.15	1.15	-	-								

KP_BH_2013_REV_0_PE801-00137_BH LOGS 2017 SLOPE KP_DATATEMPLATE_BH_2013.GDT 7.4.17

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HOLE: **BH 02**	
Sheet 3 of 3	*Rev*
JOB NUMBER: PE801-00137	

TCR (%)	SCR (%)	RQD (%)	FRACTURE FREQUENCY	GRAPHIC LOG	DEPTH (m)	MATERIAL DESCRIPTION	STRENGTH/ CONSISTENCY	WEATHERING	DEFECTS/ADDITIONAL COMMENTS	IN SITU TESTING	SAMPLING (DEPTH IN m)
100	100	-	-		22						
-	-	-	-							21, 47, 80 N=127	
					23						
					24						
1	1	-	-		25	Borehole BH 02 terminated at 25 m depth.					
					26						
					27						
					28						
					29						
					30						
					31						
					32						
					33						

KP_BH_2013_REV_0_PE801-00137_BH LOGS 2017 SLG21 KP_DATATEMPLATE_BH_2013.GDT 7/4/17

Plate 8: Borehole BH-02 – 0.0 to 5.6 m

Plate 9: Borehole BH-02 – 5.6 to 9.0 m

Plate 10: Borehole BH-02 – 9.0 to 13.0 m

Plate 11: Borehole BH-02 – 13.0 to 19.0 m

Plate 12: Borehole BH-02 – 19.0 to 23 m

Plate 13: BH-02 – 23 to 25.0 m

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HOLE: **BH 03**	
Sheet 1 of 3	*Rev*
JOB NUMBER: PE801-00137	

TCR (%)	SCR (%)	RQD (%)	FRACTURE FREQUENCY	GRAPHIC LOG	DEPTH (m)	MATERIAL DESCRIPTION	STRENGTH/ CONSISTENCY	WEATHERING	DEFECTS/ADDITIONAL COMMENTS	IN SITU TESTING	SAMPLING (DEPTH IN m)
1	1	-	-		0m	**SAND**, clayey, non to low plastic, red brown , moist, medium dense. Sand particles are fine to medium, sub rounded.	MD				
-	-	-	-		1					4, 5, 6 N=11	
1.05	1.05	-	-		2						
-	-	-	-		2.5m	**CLAY**, sandy, trace gravel, low to medium plasticity, red brown, grey, moist, stiff to very stiff. Sand particles are fine to medium, sub rounded.	St - VSt			4, 5, 8 N=13	
1.05	1.05	-	-		3						
-	-	-	-		4					5, 7, 10 N=17	4.45
Push Tube	-	-	-		5						4.95
0.55	0.55	-	-		5m	**CLAY**, silty, low to medium plasticity, light brown, grey, cream white moist, stiff to very stiff					
-	-	-	-		6					4, 7, 13 N=20	
0.9	0.9	-	-		6.7m	**CLAY**, silty, trace gravel, low plasticity, red brown, cream white, moist, stiff to very stiff. Sand particles are fine to medium, sub rounded.	VSt - H				
1	1	-	-		7						
-	-	-	-		8m	**CLAY**, silty, low plasticity, grey, greenish grey moist, hard.				16, 37, 55 N=92	
1.05	1.05	-	-		8						
					9					37, , - N=Refusal	

NOTES:

Undisturbed Sample

Standard Penetration Test

CONTRACTOR : Top Drill
MACHINE : De840 Rig6

LOGGED BY : BZ
CHECKED BY :

DATE STARTED : 19-Mar-17
DATE PROFILED : 20-Mar-17
HOLE SIZE : HQ

NORTHING : 6595291
EASTING : 330370
ELEVATION : -

INCLINATION: -90

KP_BH_2013_REV_0_PE801-00137_BH LOGS 2017 SLG01.KP_DATATEMPLATE_BH_2013.GDT 7-4-17

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HOLE: **BH 03**	
Sheet 2 of 3	*Rev*
JOB NUMBER: PE801-00137	

TCR (%)	SCR (%)	RQD (%)	FRACTURE FREQUENCY	GRAPHIC LOG	DEPTH (m)	MATERIAL DESCRIPTION	STRENGTH/ CONSISTENCY	WEATHERING	DEFECTS/ADDITIONAL COMMENTS	IN SITU TESTING	SAMPLING (DEPTH IN m)
1.5	1.5	-	-		11					30, 50/50mm (HB), - N =Refusal	
1.4	1.4	-	-		12						
1.4	1.4	-	-		13						
1.4	1.4	-	-		14					70/100mm (HB), - - N =Refusal	
1.5	1.5	-	-		15						
					16	15.8m **CLAY**, silty, low plasticity, grey, greenish grey moist, indurated, hard.					
1.2	1.2	-	-		17					21, 71/150mm (HB), - N =Refusal	
1.5	1.5	-	-		18						
1.3	1.3	0.8	11		19						
					20	20.2m **METADOLERITE**, clayey, non plastic, yellow brown, grey, moist, extremely low to very low strength, extremely weathered.	ELS - VLS	XW		62/150mm (HB), - - N =Refusal	
					21						

KP_BH_2013_REV_0_PE801-00137_BH LOGS 2017 SLG21 KP_DATATEMPLATE_BH_2013.GDT 7/4/17

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HOLE: **BH 03**	
Sheet 3 of 3	*Rev*
JOB NUMBER: PE801-00137	

TCR (%)	SCR (%)	RQD (%)	FRACTURE FREQUENCY	GRAPHIC LOG	DEPTH (m)	MATERIAL DESCRIPTION	STRENGTH/ CONSISTENCY	WEATHERING	DEFECTS/ADDITIONAL COMMENTS	IN SITU TESTING	SAMPLING (DEPTH IN m)
1.2	1.2	0.95	8		22						
1.5	1.5	1.38	8		23						
0.7	0.7	0.6	3		24						
					25	Borehole BH 03 terminated at 25 m depth.					
					26						
					27						
					28						
					29						
					30						
					31						
					32						
					33						

KP_BH_2013_REV_0_PE801-00137_BH LOGS 2017 SLG21 KP_DATATEMPLATE_BH_2013.GDT 7/4/17

Plate 14: Borehole BH-03 – 0.0 to 4 m.

Plate 15: Borehole BH-03 – 4 to 6.5 m.

Plate 16: Borehole BH-03 – 6.5 to 9.7 m.

Plate 17: Borehole BH-03 – 9.7 to 13 m.

Plate 18: Borehole BH-03 – 13 to 16.5 m.

Plate 19: Borehole BH-03 – 16.5 to 19 m.

Plate 20: Borehole BH-03 – 19 to 22 m.

Plate 21: Borehole BH-03 – 22 to 25 m.

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HOLE: **BH 04**	
Sheet 1 of 3	*Rev*
JOB NUMBER: PE801-00137	

TCR (%)	SCR (%)	RQD (%)	FRACTURE FREQUENCY	GRAPHIC LOG	DEPTH (m)	MATERIAL DESCRIPTION	STRENGTH/ CONSISTENCY	WEATHERING	DEFECTS/ADDITIONAL COMMENTS	IN SITU TESTING	SAMPLING (DEPTH IN m)
0.7	0.7	-	-		0m	**SAND**, clayey, non to low plastic, red brown , moist, medium dense. Sand particles are fine to medium, sub rounded.	MD			3, 3, 6 N=9	
-	-	-	-		1						
1.05	1.05	-	-		2						
-	-	-	-							4, 7, 12 N=19	
1.05	1.05	-	-		3	3m **CLAY**, sandy, trace gravel, low to medium plasticity, red brown, grey, moist, stiff to very stiff. Sand particles are fine to medium, sub rounded.	St - VSt				
-	-	-	-		4	3.8m **CLAY**, silty, low to medium plasticity, orange brown, yellow brown, grey, cream white moist, very stiff to hard.				6, 11, 10 N=21	4.45
Push Tube	-	-	-		5						4.95
0.4	0.4	-	-								
-	-	-	-		6						
0	0	-	-		7		VSt - H			7, 13, 17 N=30	
-	-	-	-			7.5m **CLAY**, silty, low plasticity, light brown, grey, cream white moist, very stiff to hard.					
1	1	-	-		8						
-	-	-	-							6, 11, 18 N=29	
1.05	1.05	-	-		9						

NOTES:

Undisturbed Sample

Standard Penetration Test

CONTRACTOR : Top Drill
MACHINE : De840 Rig6
LOGGED BY : BZ
CHECKED BY :

DATE STARTED : 21-Mar-17
DATE PROFILED : 22-Mar-17
HOLE SIZE : HQ

NORTHING : 6594886
EASTING : 330611
ELEVATION : -

INCLINATION: -90

KP_BH_2013_REV_0_PE801-00137_BH LOGS 2017.GLB1 KP_DATATEMPLATE_BH_2013.GDT 7-4-17

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HOLE: **BH 04**	
Sheet 2 of 3	*Rev*
JOB NUMBER: PE801-00137	

TCR (%)	SCR (%)	RQD (%)	FRACTURE FREQUENCY	GRAPHIC LOG	DEPTH (m)	MATERIAL DESCRIPTION	STRENGTH/ CONSISTENCY	WEATHERING	DEFECTS/ADDITIONAL COMMENTS	IN SITU TESTING	SAMPLING (DEPTH IN m)
-	-	-	-		10					6, 12, 25 N=37	
1.05	1.05	-	-		11						
-	-	-	-			11.5m **CLAY**, silty, low plasticity, yellow brown, grey, cream white moist, firm to stiff				4, 9, 14 N=23	11.95
Push Tube	-	-	-		12						12.45
0.55	0.55	-	-								
-	-	-	-		13					6, 11, 20 N=31	
1.05	1.05	-	-		14						
-	-	-	-							4, 9, 16 N=25	
1.05	1.05	-	-		15						
-	-	-	-		16					15, 70, 81 N=151	
1.05	1.05	-	-			16.5m **CLAY**, silty, low plasticity, grey, greenish grey, yellow brown moist, hard					
-	-	-	-		17					14, 42, 57 N=99	
1.05	1.05	-	-		18						
-	-	-	-		19					27, 87, 91 N=178	
1.05	1.05	-	-		20						
1.5	1.5	-	-		21						

KP_BH_2013_REV_0_PE801-00137_BH LOGS 2017 SLG01.KP_DATATEMPLATE_BH_2013.GDT 7/4/17

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HOLE: **BH 04**	
Sheet 3 of 3	*Rev*
JOB NUMBER: PE801-00137	

TCR (%)	SCR (%)	RQD (%)	FRACTURE FREQUENCY	GRAPHIC LOG	DEPTH (m)	MATERIAL DESCRIPTION	STRENGTH/ CONSISTENCY	WEATHERING	DEFECTS/ADDITIONAL COMMENTS	IN SITU TESTING	SAMPLING (DEPTH IN m)
-	-	-	-		22					26, 63, 95 N =158	
1.05	1.05	-	-		23						
0.5	0.5	-	-		24						
					25	Borehole BH 04 terminated at 25 m depth.					
					26						
					27						
					28						
					29						
					30						
					31						
					32						
					33						

KP_BH_2013_REV_0_PE801-00137 BH LOGS 2017 SLG21 KP_DATATEMPLATE_BH_2013.GDT 7.4.17

Plate 22: Borehole BH-04 – 0.0 to 3 m.

Plate 23: Borehole BH-04 – 3 to 5.95 m.

Plate 24: Borehole BH-04 – 5.95 to 10.45 m.

Plate 25: Borehole BH-04 – 10.45 to 14.5 m.

Plate 26: Borehole BH-04 – 14.5 to 17.5 m.

Plate 27: Borehole BH-04 – 17.5 to 20.5 m.

Plate 28: Borehole BH-04 – 20.5 to 25 m.

APPENDIX B

Test Pit Logs and Photographs

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TEST PIT: **TP01**	
Sheet 1 of 1	*Rev*

JOB NUMBER: PE801-137/18

DEPTH (m)	USC	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE
0	SC		**SAND**, clayey, silty, fine to medium grained, red brown, dry to slightly mosit, loose to medium dense.	
0.2m	SC		TOPSOIL Sand particles are fine to medium, sub rounded.	
0.5			**SAND**, clayey, silty, fine to medium grained, red brown, dry to slightly mosit, medium dense. Clay content increase with depth. ALLUVIUM Sand particles are fine to medium, sub rounded.	
1.0				
1.5				
2.0				
2.5				
2.8m			Test pit TP01 terminated at depth 2.8 m	
3.0				
3.5				
4.0				
4.5				
5.0				

NOTES:
1. **Hole stopped at 2.8 m. Target depth.**
2. **Few small to large sized roots to 0.2m depth.**
3. **No samples.**
4. **No seepage.**
5. **Pit stable.**
6. **Coordinate system: MGA94, zone 51**

CONTRACTOR : **Kirkby Bobcat and Excavations**
MACHINE : **5 T Excavator**

LOGGED BY : **BZ**
CHECKED BY :

DATE EXCAVATED:
DATE PROFILED:
EXCAVATION SIZE: **1.2 m x 3.3 m**

EASTING: **330009 m**
NORTHING: **6595598 m**
ELEVATION: **m**

KP_TP_2013_REV_0_PE801-00137_TP LOGS 2017 SI.GPJ KP_DATATEMPLATE_TP_2013.GDT 7-4-17

Plate 1: Test Pit TP-01

Plate 2: Test Pit TP-01

Plate 3: Test Pit TP-01

Plate 4: Test Pit TP-01

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TEST PIT: **TP02**	
Sheet 1 of 1	*Rev*

JOB NUMBER: PE801-137/18

DEPTH (m)	USC	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE
0	SC		**SAND**, clayey, silty, fine to medium grained, red brown, dry to slightly mosit, loose to medium dense.	
0.2m	SC		TOPSOIL Sand particles are fine to medium, sub rounded.	
0.5			**SAND**, clayey, silty, fine to medium grained, red brown, mosit, medium dense. Clay content increase with depth. ALLUVIUM Sand particles are fine to medium, sub rounded.	
1.0				
1.5				
2.0				
2.5				
2.9m			Test pit TP02 terminated at depth 2.9 m	
3.0				
3.5				
4.0				
4.5				
5.0				

NOTES:
1. **Hole stopped at 2.9 m. Target depth.**
2. **Few small to large sized roots to 0.2m depth.**
3. **No samples.**
4. **No seepage.**
5. **Pit stable.**
6. **Coordinate system: MGA94, zone 51**

CONTRACTOR : **Kirkby Bobcat and Excavations**
MACHINE : **5 T Excavator**

LOGGED BY : **BZ**
CHECKED BY :

DATE EXCAVATED:

DATE PROFILED:

EXCAVATION SIZE: **1.3 m x 3.3 m**

EASTING: **330179 m**

NORTHING: **6595639 m**

ELEVATION: **m**

KP_TP_2013_REV_0_PE801-00137_TP LOGS 2017 SI.GPJ KP_DATATEMPLATE_TP_2013.GDT 7-4-17

Plate 5: Test Pit TP-02

Plate 6: Test Pit TP-02

Plate 7: Test Pit TP-02

Plate 8: Test Pit TP-02

Plate 9: Test Pit TP-02

Plate 10: Test Pit TP-02

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TEST PIT: **TP03**	
Sheet 1 of 1	*Rev*

JOB NUMBER: PE801-137/18

DEPTH (m)	USC	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE
0	SC		**SAND**, clayey, silty, fine to medium grained, red brown, dry to slightly mosit, loose to medium dense.	
0.2m	SC		TOPSOIL Sand particles are fine to medium, sub rounded.	
0.5			**SAND**, clayey, silty, fine to medium grained, red brown, mosit, medium dense. Clay content increase with depth. ALLUVIUM Sand particles are fine to medium, sub rounded.	
1.0				
1.5				
2.0				
2.5				
3.0				
3m			Test pit TP03 terminated at depth 3 m	
3.5				
4.0				
4.5				
5.0				

NOTES:
1. **Hole stopped at 3.0 m. Target depth.**
2. **Few small to large sized roots to 0.2m depth.**
3. **Large bulk sample taken as indicated.**
4. **No seepage.**
5. **Pit stable.**
6. **Coordinate system: MGA94, zone 51**

CONTRACTOR : Kirkby Bobcat and Excavations
MACHINE : 5 T Excavator

LOGGED BY : BZ
CHECKED BY :

DATE EXCAVATED:
DATE PROFILED:
EXCAVATION SIZE: 1.3 m x 3.3 m

EASTING: 330372 m
NORTHING: 6595639 m
ELEVATION: m

KP_TP_2013_REV_0_PE801-00137_TP LOGS 2017 SI.GPJ KP_DATATEMPLATE_TP_2013.GDT 7-4-17

Plate 11: Test Pit TP-03

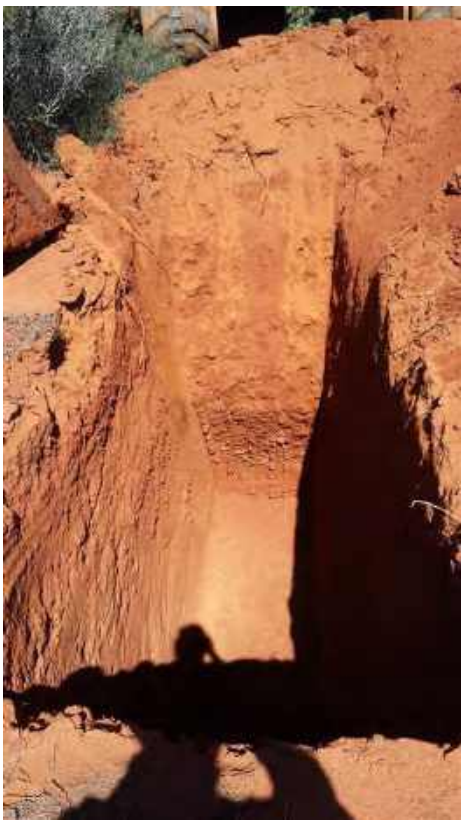

Plate 12: Test Pit TP-03

Plate 13: Test Pit TP-03

Plate 14: Test Pit TP-03

Plate 15: Test Pit TP-03

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TEST PIT: **TP04**	
Sheet 1 of 1	*Rev*

JOB NUMBER: PE801-137/18

DEPTH (m)	USC	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE
0	SC		**SAND**, clayey, silty, fine to medium grained, red brown, dry to slightly mosit, loose to medium dense.	
	sC		0.2m TOPSOIL Sand particles are fine to medium, sub rounded.	
0.5			**SAND**, clayey, silty, fine to medium grained, red brown, mosit, medium dense. Clay content increase with depth. ALLUVIUM Sand particles are fine to medium, sub rounded.	
1.0				
1.5				
2.0				
2.5				BULK
			2.8m Test pit TP04 terminated at depth 2.8 m	
3.0				
3.5				
4.0				
4.5				
5.0				

NOTES:
1. **Hole stopped at 2.8 m. Target depth.**
2. **Few small to large sized roots to 0.2m depth.**
3. **Large bulk sample taken as indicated.**
4. **No seepage.**
5. **Pit stable.**
6. **Coordinate system: MGA94, zone 51**

CONTRACTOR : Kirkby Bobcat and Excavations
MACHINE : 5 T Excavator

LOGGED BY : BZ
CHECKED BY :

DATE EXCAVATED:
DATE PROFILED:
EXCAVATION SIZE: 1.3 m x 3.8 m

EASTING: 330582 m
NORTHING: 6595639 m
ELEVATION: m

KP_TP_2013_REV_0_PE801-00137_TP LOGS 2017 SI.GPJ KP_DATATEMPLATE_TP_2013.GDT 7-4-17

Plate 16: Test Pit TP-04

Plate 17: Test Pit TP-04

Plate 18: Test Pit TP-04

Plate 19: Test Pit TP-04

Plate 20: Test Pit TP-04

Plate 21: Test Pit TP-04

Plate 22: Test Pit TP-04

Plate 23: Test Pit TP-04

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TEST PIT: **TP05**	
Sheet 1 of 1	*Rev*

JOB NUMBER: PE801-137/18

DEPTH (m)	USC	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE
0	SC		**SAND**, clayey, silty, fine to medium grained, red brown, dry to slightly moist, loose to medium dense.	
	SC		0.2m TOPSOIL Sand particles are fine to medium, sub rounded.	
0.5			**SAND**, clayey, silty, fine to medium grained, red brown, moist, medium dense. Clay content increase with depth. ALLUVIUM Sand particles are fine to medium, sub rounded.	
1.0				
1.5				
2.0				
2.5	CL		2.5m **CLAY**, sandy, silty, with some gravel, low plasticity, red brown, moist, firm to stiff. ALLUVIUM Sand particles are fine to medium, sub rounded.	BULK
3.0			3m Test pit TP05 terminated at depth 3 m	
3.5				
4.0				
4.5				
5.0				

NOTES:
1. **Hole stopped at 3.0 m. Target depth.**
2. **Few small to large sized roots to 0.2m depth.**
3. **Large bulk sample taken as indicated.**
4. **No seepage.**
5. **Pit stable.**
6. **Coordinate system: MGA94, zone 51**

CONTRACTOR : **Kirkby Bobcat and Excavations**
MACHINE : **5 T Excavator**
LOGGED BY : **BZ**
CHECKED BY :

DATE EXCAVATED:
DATE PROFILED:
EXCAVATION SIZE: **1.2 m x 3.3 m**

EASTING: **330759 m**
NORTHING: **6595598 m**
ELEVATION: **m**

KP_TP_2013_REV_0_PE801-00137_TP LOGS 2017 SI.GPJ KP_DATATEMPLATE_TP_2013.GDT 7-4-17

Plate 24: Test Pit TP-05

Plate 25: Test Pit TP-05

Plate 26: Test Pit TP-05

Plate 27: Test Pit TP-05

Plate 28: Test Pit TP-05

Plate 29: Test Pit TP-05

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TEST PIT: **TP06**	
Sheet 1 of 1	*Rev*

JOB NUMBER: PE801-137/18

DEPTH (m)	USC	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE
0	SC		**SAND**, clayey, silty, fine to medium grained, red brown, dry to slightly mosit, loose to medium dense.	
0.2m	SC		TOPSOIL Sand particles are fine to medium, sub rounded.	
0.5			**SAND**, clayey, silty, fine to medium grained, red brown, mosit, medium dense. Clay content increase with depth. ALLUVIUM Sand particles are fine to medium, sub rounded.	
1.0				
1.5				
2.0				
2.5				
2.9m			Test pit TP06 terminated at depth 2.9 m	
3.0				
3.5				
4.0				
4.5				
5.0				

NOTES:
1. **Hole stopped at 2.9 m. Target depth.**
2. **Few small to large sized roots to 0.2m depth.**
3. **No samples.**
4. **No seepage.**
5. **Pit stable.**
6. **Coordinate system: MGA94, zone 51**

CONTRACTOR : **Kirkby Bobcat and Excavations**
MACHINE : **5 T Excavator**

LOGGED BY : **BZ**
CHECKED BY :

DATE EXCAVATED:

DATE PROFILED:

EXCAVATION SIZE: **1.4 m x 3.2 m**

EASTING: **330106 m**

NORTHING: **6595533 m**

ELEVATION: **m**

KP_TP_2013_REV_0_PE801-00137 TP LOGS 2017 SI.GPJ KP_DATATEMPLATE_TP_2013.GDT 7-4-17

Plate 30: Test Pit TP-06

Plate 31: Test Pit TP-06

Plate 32: Test Pit TP-06

Plate 33: Test Pit TP-06

Plate 34: Test Pit TP-06

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TEST PIT: **TP07**	
Sheet 1 of 1	*Rev*

JOB NUMBER: PE801-137/18

DEPTH (m)	USC	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE
0	SC		**SAND**, clayey, silty, fine to medium grained, red brown, dry to slightly moist, loose to medium dense.	
	SC		0.2m TOPSOIL Sand particles are fine to medium, sub rounded.	
0.5			**SAND**, clayey, silty, fine to medium grained, red brown, moist, medium dense. Clay content increase with depth. ALLUVIUM Sand particles are fine to medium, sub rounded.	
1.0				
1.5				
2.0				BULK
	CL		2.3m **CLAY**, sandy, silty, low plasticity, red brown, moist, firm to stiff. ALLUVIUM Sand particles are fine to medium, sub rounded.	
2.5				
3.0			3m Test pit TP07 terminated at depth 3 m	
3.5				
4.0				
4.5				
5.0				

NOTES:
1. **Hole stopped at 3.0 m. Target depth.**
2. **Few small to large sized roots to 0.2m depth.**
3. **Large bulk sample taken as indicated.**
4. **No seepage.**
5. **Pit stable.**
6. **Coordinate system: MGA94, zone 51**

CONTRACTOR : Kirkby Bobcat and Excavations
MACHINE : 5 T Excavator

LOGGED BY : BZ
CHECKED BY :

DATE EXCAVATED:
DATE PROFILED:
EXCAVATION SIZE: 1.3 m x 3.3 m

EASTING: 330365 m
NORTHING: 6595518 m
ELEVATION: m

KP_TP_2013_REV_0_PE801-00137_TP LOGS 2017 SI.GPJ KP_DATATEMPLATE_TP_2013.GDT 7-4-17

Plate 35: Test Pit TP-07

Plate 36: Test Pit TP-07

Plate 37: Test Pit TP-07

Plate 38: Test Pit TP-07

Plate 39: Test Pit TP-07

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TEST PIT: **TP08**	
Sheet 1 of 1	*Rev*

JOB NUMBER: PE801-137/18

DEPTH (m)	USC	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE
	SC		**SAND**, clayey, silty, fine to medium grained, red brown, dry to slightly mosit, loose to medium dense.	
0.2m	SC		TOPSOIL Sand particles are fine to medium, sub rounded.	
0.5			**SAND**, clayey, silty, fine to medium grained, red brown, mosit, medium dense. Clay content increase with depth. ALLUVIUM Sand particles are fine to medium, sub rounded.	
1.0				
1.5				
2.0				
2.5				
3.0			Test pit TP08 terminated at depth 3 m	
3m				
3.5				
4.0				
4.5				
5.0				

NOTES:
1. **Hole stopped at 3.0 m. Target depth.**
2. **Few small to large sized roots to 0.2m depth.**
3. **Large bulk sample taken as indicated.**
4. **No seepage.**
5. **Pit stable.**
6. **Coordinate system: MGA94, zone 51**

CONTRACTOR : Kirkby Bobcat and Excavations
MACHINE : 5 T Excavator

LOGGED BY : BZ
CHECKED BY :

DATE EXCAVATED:

DATE PROFILED:

EXCAVATION SIZE: 1.3 m x 3.8 m

EASTING: 330643 m

NORTHING: 6595518 m

ELEVATION: m

KP_TP_2013_REV_0_PE801-00137_TP LOGS 2017 SI.GPJ KP_DATATEMPLATE_TP_2013.GDT 7-4-17

Plate 40: Test Pit TP-08

Plate 41: Test Pit TP-08

Plate 42: Test Pit TP-08

Plate 43: Test Pit TP-08

Plate 44: Test Pit TP-08

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TEST PIT: **TP09**	
Sheet 1 of 1	*Rev*

JOB NUMBER: PE801-137/18

DEPTH (m)	USC	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE
0	SC		**SAND**, clayey, silty, fine to medium grained, red brown, dry to slightly mosit, loose to medium dense.	
0.2m	SC		TOPSOIL Sand particles are fine to medium, sub rounded.	
0.5			**SAND**, clayey, silty, fine to medium grained, red brown, mosit, medium dense. Clay content increase with depth. ALLUVIUM Sand particles are fine to medium, sub rounded.	
1.0				
1.5				
2.0				
2.5				
2.9m			Test pit TP09 terminated at depth 2.9 m	
3.0				
3.5				
4.0				
4.5				
5.0				

NOTES:
1. **Hole stopped at 2.9 m. Target depth.**
2. **Few small to large sized roots to 0.2m depth.**
3. **Large bulk sample taken as indicated.**
4. **No seepage.**
5. **Pit stable.**
6. **Coordinate system: MGA94, zone 51**

CONTRACTOR : Kirkby Bobcat and Excavations
MACHINE : 5 T Excavator

LOGGED BY : BZ
CHECKED BY :

DATE EXCAVATED:
DATE PROFILED:
EXCAVATION SIZE: 1.4 m x 3.1 m

EASTING: 330009 m
NORTHING: 6595447 m
ELEVATION: m

KP_TP_2013_REV_0_PE801-00137_TP LOGS 2017 SI.GPJ KP_DATATEMPLATE_TP_2013.GDT 7-4-17

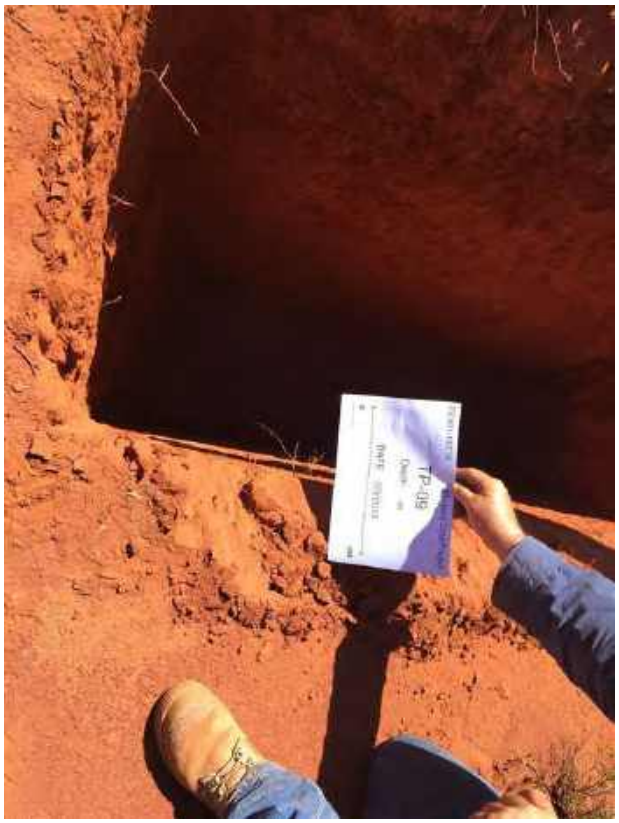

Plate 45: Test Pit TP-09

Plate 46: Test Pit TP-09

Plate 47: Test Pit TP-09

Plate 48: Test Pit TP-09

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TEST PIT: **TP10**	
Sheet 1 of 1	*Rev*

JOB NUMBER: PE801-137/18

DEPTH (m)	USC	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE
0	SC		**SAND**, clayey, silty, fine to medium grained, red brown, dry to slightly mosit, loose to medium dense.	
0.1m	SC		TOPSOIL Sand particles are fine to medium, sub rounded.	
0.5			**SAND**, clayey, silty, fine to medium grained, red brown, mosit, medium dense. Clay content increase with depth. ALLUVIUM Sand particles are fine to medium, sub rounded.	
1.0				
1.5				
2.0				
2.5				
3.0				
3m			Test pit TP10 terminated at depth 3 m	
3.5				
4.0				
4.5				
5.0				

NOTES:
1. **Hole stopped at 3.0 m. Target depth.**
2. **Few small to large sized roots to 0.2m depth.**
3. **Large bulk sample taken as indicated.**
4. **No seepage.**
5. **Pit stable.**
6. **Coordinate system: MGA94, zone 51**

CONTRACTOR : Kirkby Bobcat and Excavations
MACHINE : 5 T Excavator

LOGGED BY : BZ
CHECKED BY :

DATE EXCAVATED:
DATE PROFILED:
EXCAVATION SIZE: 1.2 m x 3.2 m

EASTING: 330183 m
NORTHING: 6595439 m
ELEVATION: m

KP_TP_2013_REV_0_PE801-00137_TP LOGS 2017 SI.GPJ KP_DATATEMPLATE_TP_2013.GDT 7-4-17

Plate 49: Test Pit TP-10

Plate 50: Test Pit TP-10

Plate 51: Test Pit TP-10

Plate 52: Test Pit TP-10

Plate 53: Test Pit TP-10

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TEST PIT: **TP11**	
Sheet 1 of 1	*Rev*

JOB NUMBER: PE801-137/18

DEPTH (m)	USC	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE
0	SC		**SAND**, clayey, silty, fine to medium grained, red brown, dry to slightly mosit, loose to medium dense.	
0.2m	SC		TOPSOIL Sand particles are fine to medium, sub rounded.	
0.5			**SAND**, clayey, silty, fine to medium grained, red brown, mosit, medium dense. Clay content increase with depth. ALLUVIUM Sand particles are fine to medium, sub rounded.	
1.0				
1.5				
2.0				BULK
2.5				
3.0			3m Test pit TP11 terminated at depth 3 m	
3.5				
4.0				
4.5				
5.0				

NOTES:
1. **Hole stopped at 3.0 m. Target depth.**
2. **Few small to large sized roots to 0.2m depth.**
3. **Large bulk sample taken as indicated.**
4. **No seepage.**
5. **Pit stable.**
6. **Coordinate system: MGA94, zone 51**

CONTRACTOR : Kirkby Bobcat and Excavations
MACHINE : 5 T Excavator

LOGGED BY : BZ
CHECKED BY :

DATE EXCAVATED:
DATE PROFILED:
EXCAVATION SIZE: 1.2 m x 2.7 m

EASTING: 330100 m
NORTHING: 6595339 m
ELEVATION: m

KP_TP_2013_REV_0_PE801-00137_TP LOGS 2017 SI.GPJ KP_DATATEMPLATE_TP_2013.GDT 7-4-17

Plate 54: Test Pit TP-11

Plate 55: Test Pit TP-11

Plate 56: Test Pit TP-11

Plate 57: Test Pit TP-11

Plate 58: Test Pit TP-11

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TEST PIT: **TP12**	
Sheet 1 of 1	*Rev*

JOB NUMBER: PE801-137/18

DEPTH (m)	USC	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE
0.0	SC		**SAND**, clayey, silty, fine to medium grained, red brown, dry to slightly mosit, loose to medium dense.	
0.2m	SC		TOPSOIL Sand particles are fine to medium, sub rounded.	
0.5			**SAND**, clayey, silty, fine to medium grained, red brown, mosit, medium dense. Clay content increase with depth. ALLUVIUM Sand particles are fine to medium, sub rounded.	BULK
1.0				
1.5				
2.0				
2.5				
2.7m			Test pit TP12 terminated at depth 2.7 m	
3.0				
3.5				
4.0				
4.5				
5.0				

NOTES:
1. **Hole stopped at 2.7 m. Target depth.**
2. **Few small to large sized roots to 0.2m depth.**
3. **Large bulk sample taken as indicated.**
4. **No seepage.**
5. **Pit stable.**
6. **Coordinate system: MGA94, zone 51**

CONTRACTOR : **Kirkby Bobcat and Excavations**
MACHINE : **5 T Excavator**
LOGGED BY : **BZ**
CHECKED BY :

DATE EXCAVATED:
DATE PROFILED:
EXCAVATION SIZE: **1.2 m x 2.7 m**

EASTING: **330333 m**
NORTHING: **6595347 m**
ELEVATION: **m**

KP_TP_2013_REV_0_PE801-00137 TP LOGS 2017 SI.GPJ KP_DATATEMPLATE_TP_2013.GDT 7-4-17

Plate 59: Test Pit TP-12

Plate 60: Test Pit TP-12

Plate 61: Test Pit TP-12

Plate 62: Test Pit TP-12

Plate 63: Test Pit TP-12

Plate 64: Test Pit TP-12

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TEST PIT: **TP13**	
Sheet 1 of 1	*Rev*

JOB NUMBER: PE801-137/18

DEPTH (m)	USC	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE
0	SC		**SAND**, clayey, silty, fine to medium grained, red brown, dry to slightly mosit, loose to medium dense.	
0.2m	SC		TOPSOIL Sand particles are fine to medium, sub rounded.	
0.5			**SAND**, clayey, silty, fine to medium grained, red brown, mosit, medium dense. Clay content increase with depth. ALLUVIUM Sand particles are fine to medium, sub rounded.	
1.0				
1.5				
2.0				
2.5				
2.8m			Test pit TP13 terminated at depth 2.8 m	
3.0				
3.5				
4.0				
4.5				
5.0				

NOTES:
1. **Hole stopped at 2.8 m. Target depth.**
2. **Few small to large sized roots to 0.2m depth.**
3. **Large bulk sample taken as indicated.**
4. **No seepage.**
5. **Pit stable.**
6. **Coordinate system: MGA94, zone 51**

CONTRACTOR : Kirkby Bobcat and Excavations
MACHINE : 5 T Excavator

LOGGED BY : BZ
CHECKED BY :

DATE EXCAVATED:
DATE PROFILED:
EXCAVATION SIZE: 1.0 m x 3.0 m

EASTING: 330509 m
NORTHING: 6595348 m
ELEVATION: m

KP_TP_2013_REV_0_PE801-00137_TP LOGS 2017 SI.GPJ KP_DATATEMPLATE_TP_2013.GDT 7-4-17

Plate 65: Test Pit TP-13

Plate 66: Test Pit TP-13

Plate 67: Test Pit TP-13

Plate 68: Test Pit TP-13

Plate 69: Test Pit TP-13

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TEST PIT: **TP14**	
Sheet 1 of 1	*Rev*

JOB NUMBER: PE801-137/18

DEPTH (m)	USC	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE
0	SC		**SAND**, clayey, silty, fine to medium grained, red brown, dry to slightly mosit, loose to medium dense.	
0.2m	SC		TOPSOIL Sand particles are fine to medium, sub rounded.	
0.5			**SAND**, clayey, silty, fine to medium grained, red brown, mosit, medium dense. Clay content increase with depth. ALLUVIUM Sand particles are fine to medium, sub rounded.	
1.0				
1.5				
2.0				
2.5				
2.7m			Test pit TP14 terminated at depth 2.7 m	
3.0				
3.5				
4.0				
4.5				
5.0				

NOTES:
1. **Hole stopped at 2.7 m. Target depth.**
2. **Few small to large sized roots to 0.2m depth.**
3. **Large bulk sample taken as indicated.**
4. **No seepage.**
5. **Pit stable.**
6. **Coordinate system: MGA94, zone 51**

CONTRACTOR : **Kirkby Bobcat and Excavations**
MACHINE : **5 T Excavator**
LOGGED BY : **BZ**
CHECKED BY :

DATE EXCAVATED:
DATE PROFILED:
EXCAVATION SIZE: **1.0 m x 3.0 m**

EASTING: **330658 m**
NORTHING: **6595347 m**
ELEVATION: **m**

KP_TP_2013_REV_0_PE801-00137_TP LOGS 2017 SI.GPJ KP_DATATEMPLATE_TP_2013.GDT 7-4-17

Plate 70: Test Pit TP-14

Plate 71: Test Pit TP-14

Plate 72: Test Pit TP-14

Plate 73: Test Pit TP-14

Plate 74: Test Pit TP-14

Plate 75: Test Pit TP-14

Plate 76: Test Pit TP-14

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TEST PIT: **TP15**	
Sheet 1 of 1	*Rev*

JOB NUMBER: PE801-137/18

DEPTH (m)	USC	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE
0	SC		**SAND**, clayey, silty, fine to medium grained, red brown, dry to slightly mosit, loose to medium dense.	
	SC		0.2m TOPSOIL Sand particles are fine to medium, sub rounded.	
0.5			**SAND**, clayey, silty, fine to medium grained, red brown, mosit, medium dense. Clay content increase with depth. ALLUVIUM Sand particles are fine to medium, sub rounded.	
1.0				
1.5				
2.0	CL		2m **CLAY**, sandy, silty, low plasticity, red brown, moist, firm to stiff. ALLUVIUM Sand particles are fine to medium, sub rounded.	
2.5				
			2.8m Test pit TP15 terminated at depth 2.8 m	
3.0				
3.5				
4.0				
4.5				
5.0				

NOTES:
1. **Hole stopped at 2.8 m. Target depth.**
2. **Few small to large sized roots to 0.2m depth.**
3. **Large bulk sample taken as indicated.**
4. **No seepage.**
5. **Pit stable.**
6. **Coordinate system: MGA94, zone 51**

CONTRACTOR : Kirkby Bobcat and Excavations
MACHINE : 5 T Excavator

LOGGED BY : BZ
CHECKED BY :

DATE EXCAVATED:
DATE PROFILED:
EXCAVATION SIZE: 1.0 m x 3.0 m

EASTING: 330759 m
NORTHING: 6595397 m
ELEVATION: m

KP_TP_2013_REV_0_PE801-00137_TP LOGS 2017 SI.GPJ KP_DATATEMPLATE_TP_2013.GDT 7-4-17

Plate 77: Test Pit TP-15

Plate 78: Test Pit TP-15

Plate 79: Test Pit TP-15

Plate 80: Test Pit TP-15

Plate 81: Test Pit TP-15

Plate 82: Test Pit TP-15

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TEST PIT: **TP16**	
Sheet 1 of 1	*Rev*

JOB NUMBER: PE801-137/18

DEPTH (m)	USC	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE
0.0	SC		**SAND**, clayey, silty, fine to medium grained, red brown, dry to slightly mosit, loose to medium dense.	
0.2m	SC		TOPSOIL Sand particles are fine to medium, sub rounded.	
0.5			**SAND**, clayey, silty, fine to medium grained, red brown, mosit, medium dense. Clay content increase with depth. ALLUVIUM Sand particles are fine to medium, sub rounded.	BULK
1.0				
1.5				
2.0				
2.5				
2.7m			Test pit TP16 terminated at depth 2.7 m	
3.0				
3.5				
4.0				
4.5				
5.0				

NOTES:
1. **Hole stopped at 2.7 m. Target depth.**
2. **Few small to large sized roots to 0.2m depth.**
3. **Large bulk sample taken as indicated.**
4. **No seepage.**
5. **Pit stable.**
6. **Coordinate system: MGA94, zone 51**

CONTRACTOR : Kirkby Bobcat and Excavations
MACHINE : 5 T Excavator

LOGGED BY : BZ
CHECKED BY :

DATE EXCAVATED:
DATE PROFILED:
EXCAVATION SIZE: 1.0 m x 3.0 m

EASTING: 330009 m
NORTHING: 6595297 m
ELEVATION: m

KP_TP_2013_REV_0_PE801-00137 TP LOGS 2017 SI.GPJ KP_DATATEMPLATE_TP_2013.GDT 7-4-17

Plate 83: Test Pit TP-16

Plate 84: Test Pit TP-16

Plate 85: Test Pit TP-16

Plate 86: Test Pit TP-16

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TEST PIT: **TP17**	
Sheet 1 of 1	*Rev*

JOB NUMBER: PE801-137/18

DEPTH (m)	USC	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE
0	SC		**SAND**, clayey, silty, fine to medium grained, red brown, dry to slightly mosit, loose to medium dense.	
0.2m	SC		TOPSOIL Sand particles are fine to medium, sub rounded.	
0.5			**SAND**, clayey, silty, fine to medium grained, red brown, mosit, medium dense. Clay content increase with depth. ALLUVIUM Sand particles are fine to medium, sub rounded.	
1.0				
1.5				
2.0				
2.5				
3m			Test pit TP17 terminated at depth 3 m	
3.0				
3.5				
4.0				
4.5				
5.0				

NOTES:
1. **Hole stopped at 3.0 m. Target depth.**
2. **Few small to large sized roots to 0.2m depth.**
3. **No samples.**
4. **No seepage.**
5. **Pit stable.**
6. **Coordinate system: MGA94, zone 51**

CONTRACTOR : **Kirkby Bobcat and Excavations**
MACHINE : **5 T Excavator**

LOGGED BY : **BZ**
CHECKED BY :

DATE EXCAVATED:
DATE PROFILED:
EXCAVATION SIZE: **1.2 m x 3.7 m**

EASTING: **330209 m**
NORTHING: **6595297 m**
ELEVATION: **m**

KP_TP_2013_REV_0_PE801-00137_TP LOGS 2017 SI.GPJ KP_DATATEMPLATE_TP_2013.GDT 7-4-17

Plate 87: Test Pit TP-17

Plate 88: Test Pit TP-17

Plate 89: Test Pit TP-17

Plate 90: Test Pit TP-17

Plate 91: Test Pit TP-17

Plate 92: Test Pit TP-17

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TEST PIT: **TP18**	
Sheet 1 of 1	*Rev*

JOB NUMBER: PE801-137/18

DEPTH (m)	USC	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE
0	SC		**SAND**, clayey, silty, fine to medium grained, red brown, dry to slightly mosit, loose to medium dense.	
0.2m	SC		TOPSOIL Sand particles are fine to medium, sub rounded.	
0.5			**SAND**, clayey, silty, fine to medium grained, red brown, mosit, medium dense. Clay content increase with depth. ALLUVIUM Sand particles are fine to medium, sub rounded.	
1.0				
1.5				
2.0				
2.5				
2.8m			Test pit TP18 terminated at depth 2.8 m	
3.0				
3.5				
4.0				
4.5				
5.0				

NOTES:
1. **Hole stopped at 2.8 m. Target depth.**
2. **Few small to large sized roots to 0.2m depth.**
3. **No samples.**
4. **No seepage.**
5. **Pit stable.**
6. **Coordinate system: MGA94, zone 51**

CONTRACTOR : **Kirkby Bobcat and Excavations**
MACHINE : **5 T Excavator**

LOGGED BY : **BZ**
CHECKED BY :

DATE EXCAVATED:

DATE PROFILED:

EXCAVATION SIZE: **1.0 m x 3.0 m**

EASTING: **330393 m**

NORTHING: **6595259 m**

ELEVATION: **m**

KP_TP_2013_REV_0_PE801-00137_TP LOGS 2017.GPJ KP_DATATEMPLATE_TP_2013.GDT 7-4-17

Plate 93: Test Pit TP-18

Plate 94: Test Pit TP-18

Plate 95: Test Pit TP-18

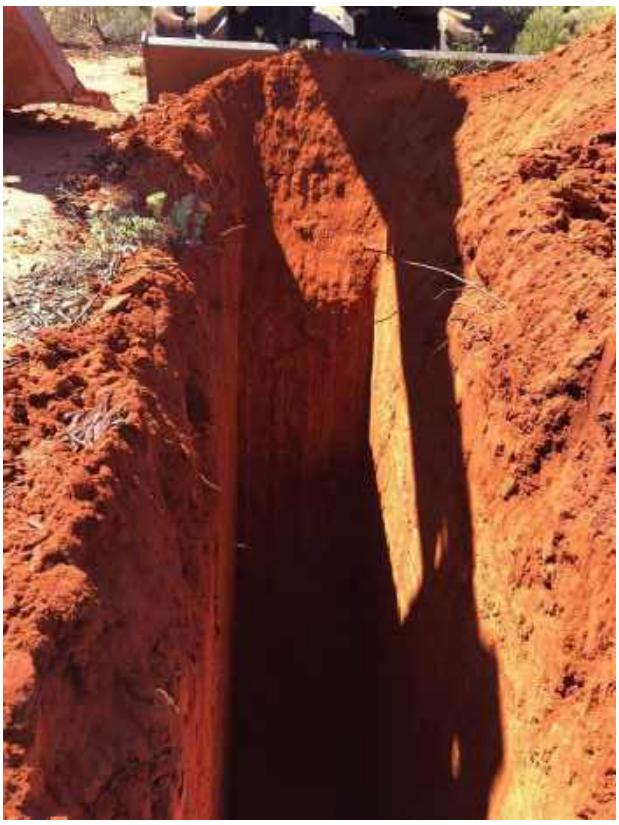

Plate 96: Test Pit TP-18

Plate 97: Test Pit TP-18

Plate 98: Test Pit TP-18

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TEST PIT: **TP19**	
Sheet 1 of 1	*Rev*

JOB NUMBER: PE801-137/18

DEPTH (m)	USC	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE
0	SC		**SAND**, clayey, silty, fine to medium grained, red brown, dry to slightly mosit, loose to medium dense.	
0.2m	SC		TOPSOIL Sand particles are fine to medium, sub rounded.	
0.5			**SAND**, clayey, silty, fine to medium grained, red brown, mosit, medium dense. Clay content increase with depth. ALLUVIUM Sand particles are fine to medium, sub rounded.	BULK
1.0				
1.5				
2.0				
2.5				
2.7m			Test pit TP19 terminated at depth 2.7 m	
3.0				
3.5				
4.0				
4.5				
5.0				

NOTES:
1. **Hole stopped at 2.7 m. Target depth.**
2. **Few small to large sized roots to 0.2m depth.**
3. **Large bulk sample taken as indicated.**
4. **No seepage.**
5. **Pit stable.**
6. **Coordinate system: MGA94, zone 51**

CONTRACTOR : Kirkby Bobcat and Excavations
MACHINE : 5 T Excavator

LOGGED BY : BZ
CHECKED BY :

DATE EXCAVATED:
DATE PROFILED:
EXCAVATION SIZE: 1.0 m x 3.0 m

EASTING: 330591 m
NORTHING: 6595220 m
ELEVATION: m

KP_TP_2013_REV_0_PE801-00137_TP LOGS 2017 SI.GPJ KP_DATATEMPLATE_TP_2013.GDT 7-4-17

Plate 99: Test Pit TP-19

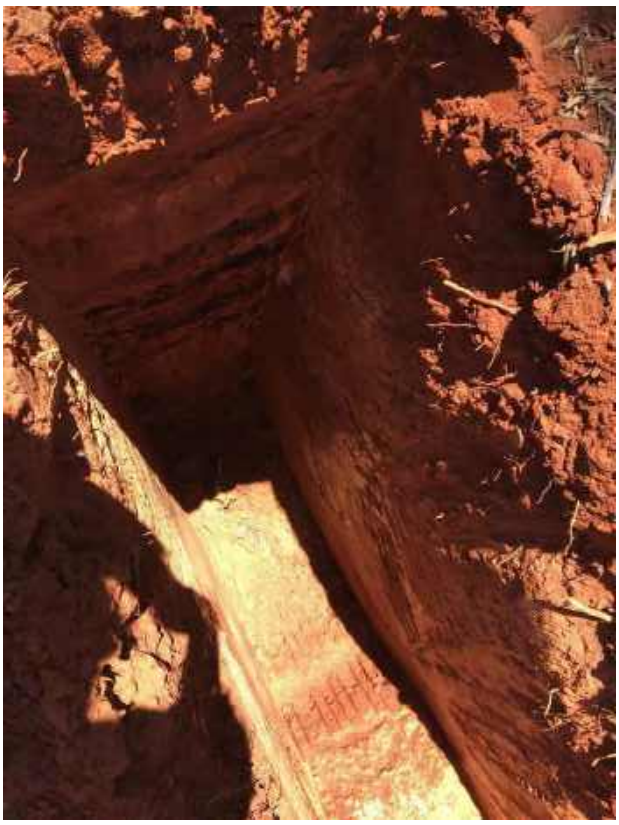

Plate 100: Test Pit TP-19

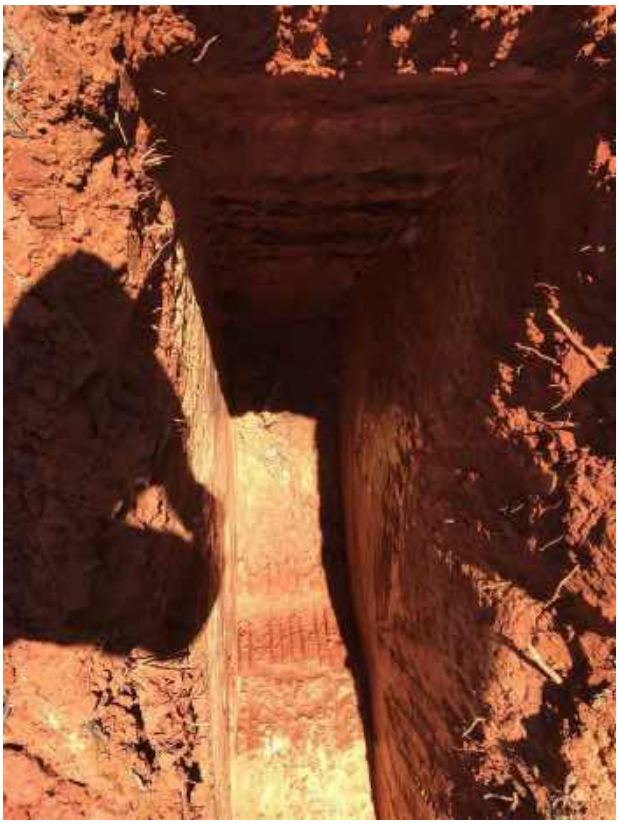

Plate 101: Test Pit TP-19

Plate 102: Test Pit TP-19

Plate 103: Test Pit TP-19

Plate 104: Test Pit TP-19

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TEST PIT: **TP20**	
Sheet 1 of 1	*Rev*

JOB NUMBER: PE801-137/18

DEPTH (m)	USC	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE
0	SC		**SAND**, clayey, silty, fine to medium grained, red brown, dry to slightly mosit, loose to medium dense. TOPSOIL	
	SC		0.3m Sand particles are fine to medium, sub rounded.	
0.5			**SAND**, clayey, silty, fine to medium grained, red brown, mosit, medium dense. Clay content increase with depth. ALLUVIUM	
1.0			Sand particles are fine to medium, sub rounded.	
1.5				
2.0				
2.5				
	CL		2.6m **CLAY**, sandy, silty, low plasticity, red brown, moist, firm to stiff. 2.7m ALLUVIUM	
3.0			Sand particles are fine to medium, sub rounded. Test pit TP20 terminated at depth 2.7 m	
3.5				
4.0				
4.5				
5.0				

NOTES:
1. **Hole stopped at 2.7 m. Target depth.**
2. **Few small to large sized roots to 0.2m depth.**
3. **No samples.**
4. **No seepage.**
5. **Pit stable.**
6. **Coordinate system: MGA94, zone 51**

CONTRACTOR : Kirkby Bobcat and Excavations
MACHINE : 5 T Excavator
LOGGED BY : BZ
CHECKED BY :

DATE EXCAVATED:
DATE PROFILED:
EXCAVATION SIZE: 1.0 m x 3.0 m

EASTING: 330759 m
NORTHING: 6595197 m
ELEVATION: m

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Plate 105: Test Pit TP-20

Plate 106: Test Pit TP-20

Plate 107: Test Pit TP-20

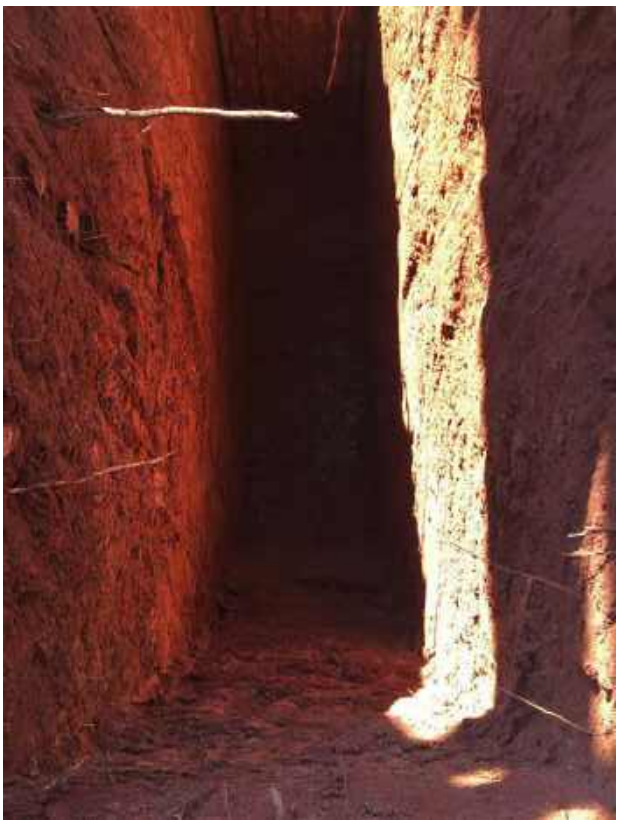

Plate 108: Test Pit TP-20

Plate 109: Test Pit TP-20

Plate 110: Test Pit TP-20

Plate 111: Test Pit TP-20

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TEST PIT: **TP21**	
Sheet 1 of 1	*Rev*

JOB NUMBER: PE801-137/18

DEPTH (m)	USC	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE
0	SC		**SAND**, clayey, silty, fine to medium grained, red brown, dry to slightly mosit, loose to medium dense.	
0.2m	SC		TOPSOIL Sand particles are fine to medium, sub rounded.	
0.5			**SAND**, clayey, silty, fine to medium grained, red brown, mosit, medium dense. Clay content increase with depth. ALLUVIUM Sand particles are fine to medium, sub rounded.	
1.0				
1.5				
2.0				
2.5				
3m			Test pit TP21 terminated at depth 3 m	
3.0				
3.5				
4.0				
4.5				
5.0				

NOTES:
1. **Hole stopped at 3.0 m. Target depth.**
2. **Few small to large sized roots to 0.2m depth.**
3. **No samples.**
4. **No seepage.**
5. **Pit stable.**
6. **Coordinate system: MGA94, zone 51**

CONTRACTOR : **Kirkby Bobcat and Excavations**
MACHINE : **5 T Excavator**

LOGGED BY : **BZ**
CHECKED BY :

DATE EXCAVATED:

DATE PROFILED:

EXCAVATION SIZE: **1.0 m x 2.8 m**

EASTING: **330009 m**

NORTHING: **6595147 m**

ELEVATION: **m**

KP_TP_2013_REV_0_PE801-00137_TP LOGS 2017 SI.GPJ KP_DATATEMPLATE_TP_2013.GDT 7-4-17

Plate 112: Test Pit TP-21

Plate 113: Test Pit TP-21

Plate 114: Test Pit TP-21

Plate 115: Test Pit TP-21

Plate 116: Test Pit TP-21

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TEST PIT: **TP22**	
Sheet 1 of 1	*Rev*

JOB NUMBER: PE801-137/18

DEPTH (m)	USC	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE
0	SC		**SAND**, clayey, silty, fine to medium grained, red brown, dry to slightly mosit, loose to medium dense.	
0.2m	SC		TOPSOIL Sand particles are fine to medium, sub rounded.	
0.5			**SAND**, clayey, silty, fine to medium grained, red brown, mosit, medium dense. Clay content increase with depth. ALLUVIUM Sand particles are fine to medium, sub rounded.	
1.0				
1.5				
2.0				
2.5				
3.0				
3.05m			Test pit TP22 terminated at depth 3.05 m	
3.5				
4.0				
4.5				
5.0				

NOTES:
1. **Hole stopped at 3.05 m. Target depth.**
2. **Few small to large sized roots to 0.2m depth.**
3. **No samples.**
4. **No seepage.**
5. **Pit stable.**
6. **Coordinate system: MGA94, zone 51**

CONTRACTOR : **Kirkby Bobcat and Excavations**
MACHINE : **5 T Excavator**
LOGGED BY : **BZ**
CHECKED BY :

DATE EXCAVATED:
DATE PROFILED:
EXCAVATION SIZE: **1.0 m x 3.8 m**

EASTING: **330159 m**
NORTHING: **6595173 m**
ELEVATION: **m**

KP_TP_2013_REV_0_PE801-00137_TP LOGS 2017 SI.GPJ KP_DATATEMPLATE_TP_2013.GDT 7-4-17

Plate 117: Test Pit TP-22

Plate 118: Test Pit TP-22

Plate 119: Test Pit TP-22

Plate 120: Test Pit TP-22

Plate 121: Test Pit TP-22

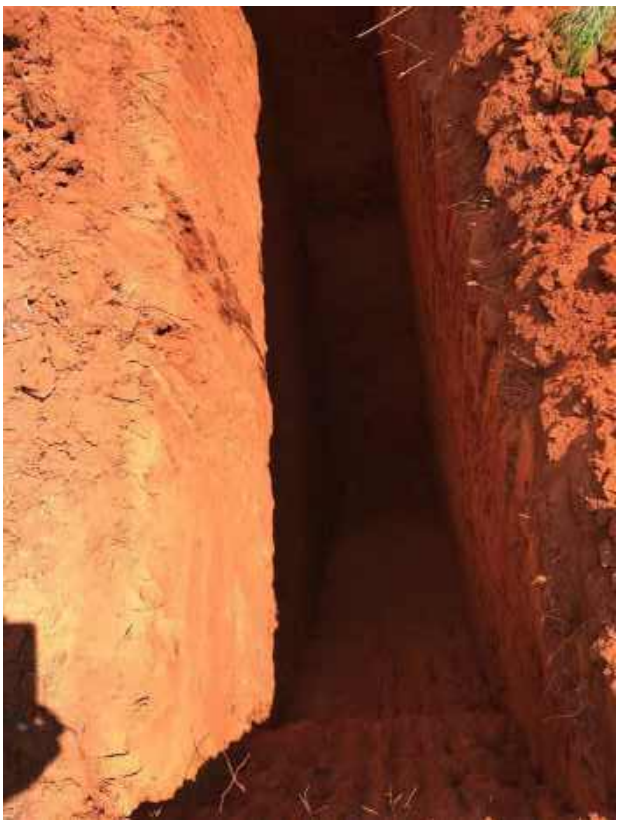

Plate 122: Test Pit TP-22

Plate 123: Test Pit TP-22

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TEST PIT: **TP23**	
Sheet 1 of 1	*Rev*

JOB NUMBER: PE801-137/18

DEPTH (m)	USC	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE
	SC		**SAND**, clayey, silty, fine to medium grained, red brown, dry to slightly mosit, loose to medium dense.	
0.2m	SC		TOPSOIL Sand particles are fine to medium, sub rounded.	
0.5			**SAND**, clayey, silty, fine to medium grained, red brown, mosit, medium dense. Clay content increase with depth. ALLUVIUM Sand particles are fine to medium, sub rounded.	
1.0				
1.5				
2.0				
2.5				
3.0			Test pit TP23 terminated at depth 3 m	
3m				
3.5				
4.0				
4.5				
5.0				

NOTES:
1. **Hole stopped at 3.0 m. Target depth.**
2. **Few small to large sized roots to 0.2m depth.**
3. **No samples.**
4. **No seepage.**
5. **Pit stable.**
6. **Coordinate system: MGA94, zone 51**

CONTRACTOR : Rapid Dam
MACHINE : 45 T Excavator
LOGGED BY : BZ
CHECKED BY :

DATE EXCAVATED:
DATE PROFILED:
EXCAVATION SIZE: 2.5mx7.0m

EASTING: 330333 m
NORTHING: 6595147 m
ELEVATION: m

KP_TP_2013_REV_0_PE801-00137_TP LOGS 2017 SI.GPJ KP_DATATEMPLATE_TP_2013.GDT 7-4-17

Plate 124: Test Pit TP-23

Plate 125: Test Pit TP-23

Plate 126: Test Pit TP-23

Plate 127: Test Pit TP-23

Plate 128: Test Pit TP-23

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TEST PIT: **TP24**	
Sheet 1 of 1	*Rev*

JOB NUMBER: PE801-137/18

DEPTH (m)	USC	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE
0	SC		**SAND**, clayey, silty, fine to medium grained, red brown, dry to slightly mosit, loose to medium dense.	
	SC		0.2m TOPSOIL Sand particles are fine to medium, sub rounded.	
0.5			**SAND**, clayey, silty, fine to medium grained, red brown, mosit, medium dense. Clay content increase with depth. ALLUVIUM Sand particles are fine to medium, sub rounded.	
1.0				
1.5				
	CL		1.7m **CLAY**, sandy, silty, low plasticity, red brown, moist, firm to stiff. ALLUVIUM Sand particles are fine to medium, sub rounded.	
2.0				
2.5				
3.0			3m Test pit TP24 terminated at depth 3 m	
3.5				
4.0				
4.5				
5.0				

NOTES:
1. **Hole stopped at 3.0 m. Target depth.**
2. **Few small to large sized roots to 0.2m depth.**
3. **No samples.**
4. **No seepage.**
5. **Pit stable.**
6. **Coordinate system: MGA94, zone 51**

CONTRACTOR : Rapid Dam
MACHINE : 45 T Excavator
LOGGED BY : BZ
CHECKED BY :

DATE EXCAVATED:
DATE PROFILED:
EXCAVATION SIZE: 3.0mx8.0m

EASTING: 330509 m
NORTHING: 6595148 m
ELEVATION: m

KP_TP_2013_REV_0_PE801-00137 TP LOGS 2017 SI.GPJ KP_DATATEMPLATE_TP_2013.GDT 7-4-17

MUNGARI GOLD MINE
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Plate 129: Test Pit TP-24

Plate 130: Test Pit TP-24

Plate 131: Test Pit TP-24

Plate 132: Test Pit TP-24

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TEST PIT: **TP25**	
Sheet 1 of 1	*Rev*

JOB NUMBER: PE801-137/18

DEPTH (m)	USC	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE
0	SC		**SAND**, clayey, silty, fine to medium grained, red brown, dry to slightly mosit, loose to medium dense.	
	SC		0.2m TOPSOIL Sand particles are fine to medium, sub rounded.	
0.5			**SAND**, clayey, silty, fine to medium grained, red brown, mosit, medium dense. Clay content increase with depth. ALLUVIUM Sand particles are fine to medium, sub rounded.	
1.0				
1.5				
2.0				
	CL		2.3m **CLAY**, sandy, silty, low plasticity, red brown, moist, firm to stiff. ALLUVIUM	
2.5			2.5m Sand particles are fine to medium, sub rounded. Test pit TP25 terminated at depth 2.5 m	
3.0				
3.5				
4.0				
4.5				
5.0				

NOTES:
1. **Hole stopped at 2.5 m. Target depth.**
2. **Few small to large sized roots to 0.2m depth.**
3. **No samples.**
4. **No seepage.**
5. **Pit stable.**
6. **Coordinate system: MGA94, zone 51**

CONTRACTOR : Rapid Dam
MACHINE : 45 T Excavator

LOGGED BY : BZ
CHECKED BY :

DATE EXCAVATED:
DATE PROFILED:
EXCAVATION SIZE: 2.5mx7.0m

EASTING: 330638 m
NORTHING: 6595129 m
ELEVATION: m

KP_TP_2013_REV_0_PE801-00137_TP LOGS 2017 SI.GPJ KP_DATATEMPLATE_TP_2013.GDT 7-4-17

Plate 133: Test Pit TP-25

Plate 134: Test Pit TP-25

Plate 135: Test Pit TP-25

Plate 136: Test Pit TP-25

Plate 137: Test Pit TP-25

Plate 138: Test Pit TP-25

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TEST PIT: **TP26**	
Sheet 1 of 1	*Rev*

JOB NUMBER: PE801-137/18

DEPTH (m)	USC	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE
0	SC		**SAND**, clayey, silty, fine to medium grained, red brown, dry to slightly mosit, loose to medium dense.	
	SC		0.2m TOPSOIL Sand particles are fine to medium, sub rounded.	
0.5			**SAND**, clayey, silty, fine to medium grained, red brown, mosit, medium dense. Clay content increase with depth. ALLUVIUM Sand particles are fine to medium, sub rounded.	
1.0				
1.5				
2.0	CL		2m **CLAY**, sandy, silty, low plasticity, red brown, moist, firm to stiff. ALLUVIUM Sand particles are fine to medium, sub rounded.	
2.5				BULK
3.0			3m Test pit TP26 terminated at depth 3 m	
3.5				
4.0				
4.5				
5.0				

NOTES:
1. **Hole stopped at 3.0 m. Target depth.**
2. **Few small to large sized roots to 0.2m depth.**
3. **Large bulk sample taken as indicated.**
4. **No seepage.**
5. **Pit stable.**
6. **Coordinate system: MGA94, zone 51**

CONTRACTOR : Rapid Dam
MACHINE : 45 T Excavator

LOGGED BY : BZ
CHECKED BY :

DATE EXCAVATED:
DATE PROFILED:
EXCAVATION SIZE: 2.5mx7.0m

EASTING: 330775 m
NORTHING: 6595111 m
ELEVATION: m

KP_TP_2013_REV_0_PE801-00137_TP LOGS 2017 SI.GPJ KP_DATATEMPLATE_TP_2013.GDT 7-4-17

Plate 139: Test Pit TP-26

Plate 140: Test Pit TP-26

Plate 141: Test Pit TP-26

Plate 142: Test Pit TP-26

Plate 143: Test Pit TP-26

Plate 144: Test Pit TP-26

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TEST PIT: **TP27**	
Sheet 1 of 1	*Rev*

JOB NUMBER: PE801-137/18

DEPTH (m)	USC	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE
0	SC		**SAND**, clayey, silty, fine to medium grained, red brown, dry to slightly mosit, loose to medium dense.	
0.2m	SC		TOPSOIL Sand particles are fine to medium, sub rounded.	
0.5			**SAND**, clayey, silty, fine to medium grained, red brown, mosit, medium dense. Clay content increase with depth. ALLUVIUM Sand particles are fine to medium, sub rounded.	BULK
1.0				
1.5				
2.0				
2.5				
3.0			Test pit TP27 terminated at depth 3 m	
3.5				
4.0				
4.5				
5.0				

NOTES:
1. **Hole stopped at 3.0 m. Target depth.**
2. **Few small to large sized roots to 0.2m depth.**
3. **Large bulk sample taken as indicated.**
4. **No seepage.**
5. **Pit stable.**
6. **Coordinate system: MGA94, zone 51**

CONTRACTOR : Rapid Dam	**DATE EXCAVATED:**	**EASTING:**	**330009 m**
MACHINE : 45 T Excavator	**DATE PROFILED:**	**NORTHING:**	**6594998 m**
LOGGED BY : BZ			
CHECKED BY :	**EXCAVATION SIZE:** **2.5mx7.5m**	**ELEVATION:**	**m**

KP_TP_2013_REV_0_PE801-00137_TP LOGS 2017 SI.GPJ KP_DATATEMPLATE_TP_2013.GDT 7-4-17

Plate 145: Test Pit TP-27

Plate 146: Test Pit TP-27

Plate 147: Test Pit TP-27

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TEST PIT: **TP28**	
Sheet 1 of 1	*Rev*

JOB NUMBER: PE801-137/18

DEPTH (m)	USC	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE
0	SC		**SAND**, clayey, silty, fine to medium grained, red brown, dry to slightly mosit, loose to medium dense.	
0.2m	SC		TOPSOIL Sand particles are fine to medium, sub rounded.	
0.5			**SAND**, clayey, silty, fine to medium grained, red brown, mosit, medium dense. Clay content increase with depth. ALLUVIUM Sand particles are fine to medium, sub rounded.	
1.0				
1.5				
2.0				
2.5				
3.0			Test pit TP28 terminated at depth 3 m	
3.5				
4.0				
4.5				
5.0				

NOTES:
1. **Hole stopped at 3.0 m. Target depth.**
2. **Few small to large sized roots to 0.2m depth.**
3. **No samples.**
4. **No seepage.**
5. **Pit stable.**
6. **Coordinate system: MGA94, zone 51**

CONTRACTOR : Rapid Dam
MACHINE : 45 T Excavator

LOGGED BY : BZ
CHECKED BY :

DATE EXCAVATED:
DATE PROFILED:
EXCAVATION SIZE: 2.5mx7.5m

EASTING: 330159 m
NORTHING: 6595047 m
ELEVATION: m

KP_TP_2013_REV_0_PE801-00137_TP LOGS 2017 SI.GPJ KP_DATATEMPLATE_TP_2013.GDT 7-4-17

Plate 148: Test Pit TP-28

Plate 149: Test Pit TP-28

Plate 150: Test Pit TP-28

Plate 151: Test Pit TP-28

Plate 152: Test Pit TP-28

Plate 153: Test Pit TP-28

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TEST PIT: **TP29**	
Sheet 1 of 1	*Rev*

JOB NUMBER: PE801-137/18

DEPTH (m)	USC	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE
0	SC		**SAND**, clayey, silty, fine to medium grained, red brown, dry to slightly mosit, loose to medium dense.	
0.2m	SC		TOPSOIL Sand particles are fine to medium, sub rounded.	
0.5			**SAND**, clayey, silty, fine to medium grained, red brown, mosit, medium dense. Clay content increase with depth. ALLUVIUM Sand particles are fine to medium, sub rounded.	
1.0				
1.5				
2.0				
2.5				
3.0				
3m			Test pit TP29 terminated at depth 3 m	
3.5				
4.0				
4.5				
5.0				

NOTES:
1. **Hole stopped at 3.0 m. Target depth.**
2. **Few small to large sized roots to 0.2m depth.**
3. **No samples.**
4. **No seepage.**
5. **Pit stable.**
6. **Coordinate system: MGA94, zone 51**

CONTRACTOR : Rapid Dam
MACHINE : 45 T Excavator

LOGGED BY : BZ
CHECKED BY :

DATE EXCAVATED:
DATE PROFILED:
EXCAVATION SIZE: 2.5mx7.5m

EASTING: 330333 m
NORTHING: 6595047 m
ELEVATION: m

KP_TP_2013_REV_0_PE801-00137_TP LOGS 2017 SI.GPJ KP_DATATEMPLATE_TP_2013.GDT 7-4-17

Plate 154: Test Pit TP-29

Plate 155: Test Pit TP-29

Plate 156: Test Pit TP-29

Plate 157: Test Pit TP-29

Plate 158: Test Pit TP-29

Plate 159: Test Pit TP-29

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TEST PIT: **TP30**	
Sheet 1 of 1	*Rev*

JOB NUMBER: PE801-137/18

DEPTH (m)	USC	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE
0.0	SC		**SAND**, clayey, silty, fine to medium grained, red brown, dry to slightly moist, loose to medium dense. TOPSOIL	
0.3m	SC		Sand particles are fine to medium, sub rounded. **SAND**, clayey, silty, fine to medium grained, red brown, moist, medium dense. Clay content increase with depth. ALLUVIUM Sand particles are fine to medium, sub rounded.	
1.5m	CL		**CLAY**, sandy, silty, low plasticity, red brown, moist, firm to stiff. ALLUVIUM Sand particles are fine to medium, sub rounded.	
2.1m			Test pit TP30 terminated at depth 2.1 m	

NOTES:
1. **Hole stopped at 2.1 m. Target depth.**
2. **Few small to large sized roots to 0.2m depth.**
3. **No samples.**
4. **No seepage.**
5. **Pit stable.**
6. **Coordinate system: MGA94, zone 51**

CONTRACTOR : Rapid Dam
MACHINE : 45 T Excavator

LOGGED BY : BZ
CHECKED BY :

DATE EXCAVATED:
DATE PROFILED:
EXCAVATION SIZE: 2.5mx7.5m

EASTING: 330509 m
NORTHING: 6595048 m
ELEVATION: m

KP_TP_2013_REV_0_PE801-00137 TP LOGS 2017 SI.GPJ KP_DATATEMPLATE_TP_2013.GDT 7-4-17

Plate 160: Test Pit TP-30

Plate 161: Test Pit TP-30

Plate 162: Test Pit TP-30

Plate 163: Test Pit TP-30

Plate 164: Test Pit TP-30

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TEST PIT: **TP31**	
Sheet 1 of 1	*Rev*

JOB NUMBER: PE801-137/18

DEPTH (m)	USC	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE
0	SC		**SAND**, clayey, silty, fine to medium grained, red brown, dry to slightly mosit, loose to medium dense.	
0.2m	SC		TOPSOIL Sand particles are fine to medium, sub rounded.	
0.5			**SAND**, clayey, silty, fine to medium grained, red brown, mosit, medium dense. Clay content increase with depth. ALLUVIUM Sand particles are fine to medium, sub rounded.	
1.0				
1.5				
2.0				
2.5				
3.0			Test pit TP31 terminated at depth 3 m	
3.5				
4.0				
4.5				
5.0				

NOTES:
1. **Hole stopped at 3.0 m. Target depth.**
2. **Few small to large sized roots to 0.2m depth.**
3. **No samples.**
4. **No seepage.**
5. **Pit stable.**
6. **Coordinate system: MGA94, zone 51**

CONTRACTOR : Rapid Dam
MACHINE : 45 T Excavator

LOGGED BY : BZ
CHECKED BY :

DATE EXCAVATED:
DATE PROFILED:
EXCAVATION SIZE: 2.5mx7.5m

EASTING: 330659 m
NORTHING: 6595048 m
ELEVATION: m

KP_TP_2013_REV_0_PE801-00137_TP LOGS 2017 SI.GPJ KP_DATATEMPLATE_TP_2013.GDT 7-4-17

Plate 165: Test Pit TP-31

Plate 166: Test Pit TP-31

Plate 167: Test Pit TP-31

Plate 168: Test Pit TP-31

Plate 169: Test Pit TP-31

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TEST PIT: **TP32**	
Sheet 1 of 1	*Rev*

JOB NUMBER: PE801-137/18

DEPTH (m)	USC	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE
0	SC		**SAND**, clayey, silty, fine to medium grained, red brown, dry to slightly mosit, loose to medium dense.	
	SC		0.2m TOPSOIL Sand particles are fine to medium, sub rounded.	
0.5			**SAND**, clayey, silty, fine to medium grained, red brown, mosit, medium dense. Clay content increase with depth. ALLUVIUM Sand particles are fine to medium, sub rounded.	
1.0				
1.5				
2.0				
2.5				
	CL		2.8m **CLAY**, sandy, silty, low plasticity, red brown, moist, firm to stiff. ALLUVIUM	
3.0			3m Sand particles are fine to medium, sub rounded. Test pit TP32 terminated at depth 3 m	
3.5				
4.0				
4.5				
5.0				

NOTES:
1. **Hole stopped at 3.0 m. Target depth.**
2. **Few small to large sized roots to 0.2m depth.**
3. **No samples.**
4. **No seepage.**
5. **Pit stable.**
6. **Coordinate system: MGA94, zone 51**

CONTRACTOR : Rapid Dam	**DATE EXCAVATED:**	**EASTING: 330209 m**
MACHINE : 45 T Excavator	**DATE PROFILED:**	**NORTHING: 6594947 m**
LOGGED BY : BZ		
CHECKED BY :	**EXCAVATION SIZE: 2.5mx7.5m**	**ELEVATION: m**

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Plate 170: Test Pit TP-32

Plate 171: Test Pit TP-32

Plate 172: Test Pit TP-32

Plate 173: Test Pit TP-32

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TEST PIT: **TP33**	
Sheet 1 of 1	*Rev*

JOB NUMBER: PE801-137/18

DEPTH (m)	USC	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE
0	SC		**SAND**, clayey, silty, fine to medium grained, red brown, dry to slightly mosit, loose to medium dense.	
	SC		0.2m TOPSOIL Sand particles are fine to medium, sub rounded.	
0.5			**SAND**, clayey, silty, fine to medium grained, red brown, mosit, medium dense. Clay content increase with depth. ALLUVIUM Sand particles are fine to medium, sub rounded.	
1.0				
1.5				
2.0				
2.5				
	CL		2.7m **CLAY**, sandy, silty, low plasticity, red brown, moist, firm to stiff. ALLUVIUM	BULK
3.0			3m Sand particles are fine to medium, sub rounded. Test pit TP33 terminated at depth 3 m	
3.5				
4.0				
4.5				
5.0				

NOTES:
1. **Hole stopped at 3.0 m. Target depth.**
2. **Few small to large sized roots to 0.2m depth.**
3. **Large bulk sample taken as indicated.**
4. **No seepage.**
5. **Pit stable.**
6. **Coordinate system: MGA94, zone 51**

CONTRACTOR : Rapid Dam	**DATE EXCAVATED:**	**EASTING:**	**330409 m**
MACHINE : 45 T Excavator	**DATE PROFILED:**	**NORTHING:**	**6594948 m**
LOGGED BY : BZ			
CHECKED BY :	**EXCAVATION SIZE:** 2.5mx7.5m	**ELEVATION:**	**m**

KP_TP_2013_REV_0_PE801-00137_TP LOGS 2017 SI.GPJ KP_DATATEMPLATE_TP_2013.GDT 7-4-17

Plate 174: Test Pit TP-33

Plate 175: Test Pit TP-33

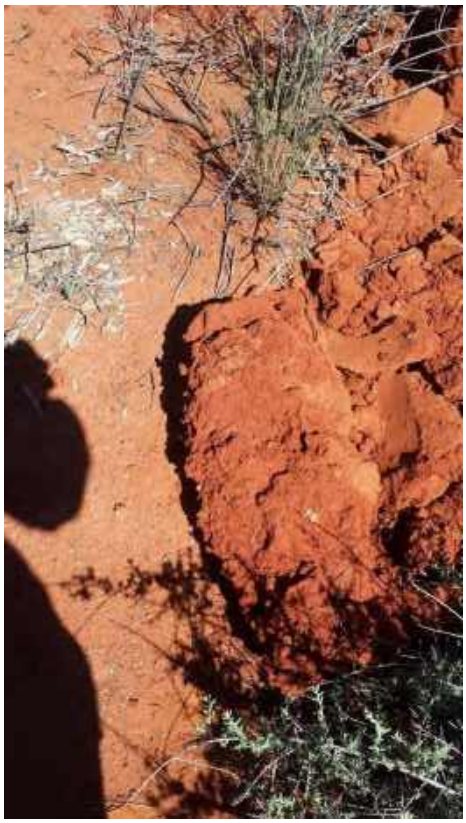

Plate 176: Test Pit TP-33

Plate 177: Test Pit TP-33

Plate 178: Test Pit TP-33

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TEST PIT: **TP34**	
Sheet 1 of 1	*Rev*

JOB NUMBER: PE801-137/18

DEPTH (m)	USC	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE
0	SC		**SAND**, clayey, silty, fine to medium grained, red brown, dry to slightly mosit, loose to medium dense.	
0.2m	SC		TOPSOIL Sand particles are fine to medium, sub rounded.	
0.5			**SAND**, clayey, silty, fine to medium grained, red brown, mosit, medium dense. Clay content increase with depth. ALLUVIUM Sand particles are fine to medium, sub rounded.	
1.0				
1.5				
2.0				
2.5				
3.0			Test pit TP34 terminated at depth 3 m	
3m				
3.5				
4.0				
4.5				
5.0				

NOTES:
1. **Hole stopped at 3.0 m. Target depth.**
2. **Few small to large sized roots to 0.2m depth.**
3. **No samples.**
4. **No seepage.**
5. **Pit stable.**
6. **Coordinate system: MGA94, zone 51**

CONTRACTOR : Rapid Dam	**DATE EXCAVATED:**	**EASTING:**	**330609 m**
MACHINE : 45 T Excavator	**DATE PROFILED:**	**NORTHING:**	**6594947 m**
LOGGED BY : BZ			
CHECKED BY :	**EXCAVATION SIZE:** **2.5mx7.0m**	**ELEVATION:**	**m**

KP_TP_2013_REV_0_PE801-00137_TP LOGS 2017 SI.GPJ KP_DATATEMPLATE_TP_2013.GDT 7-4-17

Plate 179: Test Pit TP-34

Plate 180: Test Pit TP-34

Plate 181: Test Pit TP-34

Plate 182: Test Pit TP-34

Plate 183: Test Pit TP-34

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EAST PERTH WA 6004
Australia

Mungari TSF Cell3 Project
evolution mining
TSF Cell3

Australia, Kalgoorlie

TEST PIT: **TP35**	
Sheet 1 of 1	*Rev*

JOB NUMBER: PE801-137/18

DEPTH (m)	USC	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE
0	SC		**SAND**, clayey, silty, fine to medium grained, red brown, dry to slightly moist, loose to medium dense. TOPSOIL	
	SC		0.3m Sand particles are fine to medium, sub rounded.	
0.5			**SAND**, clayey, silty, fine to medium grained, red brown, moist, medium dense. Clay content increase with depth. ALLUVIUM	BULK
1.0			Sand particles are fine to medium, sub rounded.	
1.5				
2.0				
2.5				
	CL		2.6m **CLAY**, sandy, silty, low plasticity, red brown, moist, firm to stiff. ALLUVIUM	
3.0			Sand particles are fine to medium, sub rounded.	
			3m Test pit TP35 terminated at depth 3 m	
3.5				
4.0				
4.5				
5.0				

NOTES:
1. **Hole stopped at 3.0 m. Target depth.**
2. **Few small to large sized roots to 0.2m depth.**
3. **Large bulk sample taken as indicated.**
4. **No seepage.**
5. **Pit stable.**
6. **Coordinate system: MGA94, zone 51**

CONTRACTOR : Rapid Dam
MACHINE : 45 T Excavator

LOGGED BY : BZ
CHECKED BY :

DATE EXCAVATED:
DATE PROFILED:
EXCAVATION SIZE: 2.5mx7.0m

EASTING: 330809 m
NORTHING: 6594947 m
ELEVATION: m

KP_TP_2013_REV_0_PE801-00137_TP LOGS 2017 SI.GPJ KP_DATATEMPLATE_TP_2013.GDT 7-4-17

Plate 184: Test Pit TP-35

Plate 185: Test Pit TP-35

Plate 186: Test Pit TP-35

Plate 187: Test Pit TP-35

Plate 188: Test Pit TP-35

Plate 189: Test Pit TP-35

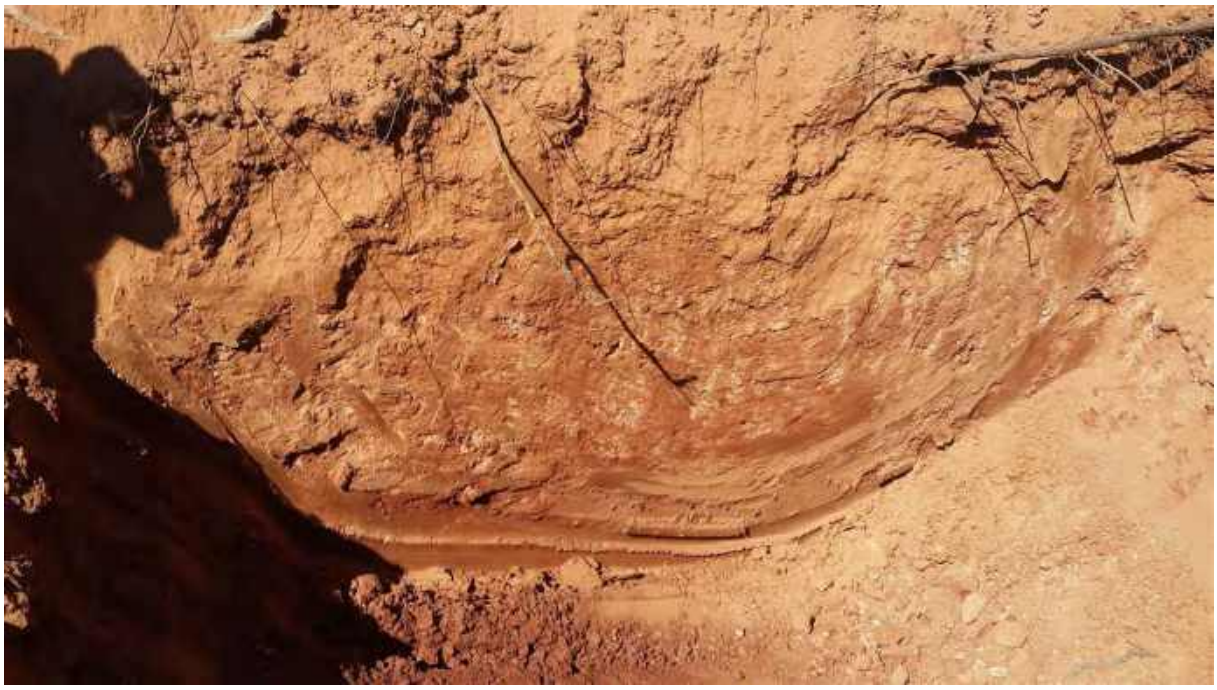


Plate 190: Test Pit TP-35

Plate 191: Test Pit TP-35

Plate 192: Test Pit TP-35

APPENDIX C

Laboratory Testing Reports

Knight Piésold
CONSULTING

Perth
Unit 3, 34 Sphinx Way
Bibra Lake
WA 6163

[redacted]

E-Precision Laboratory

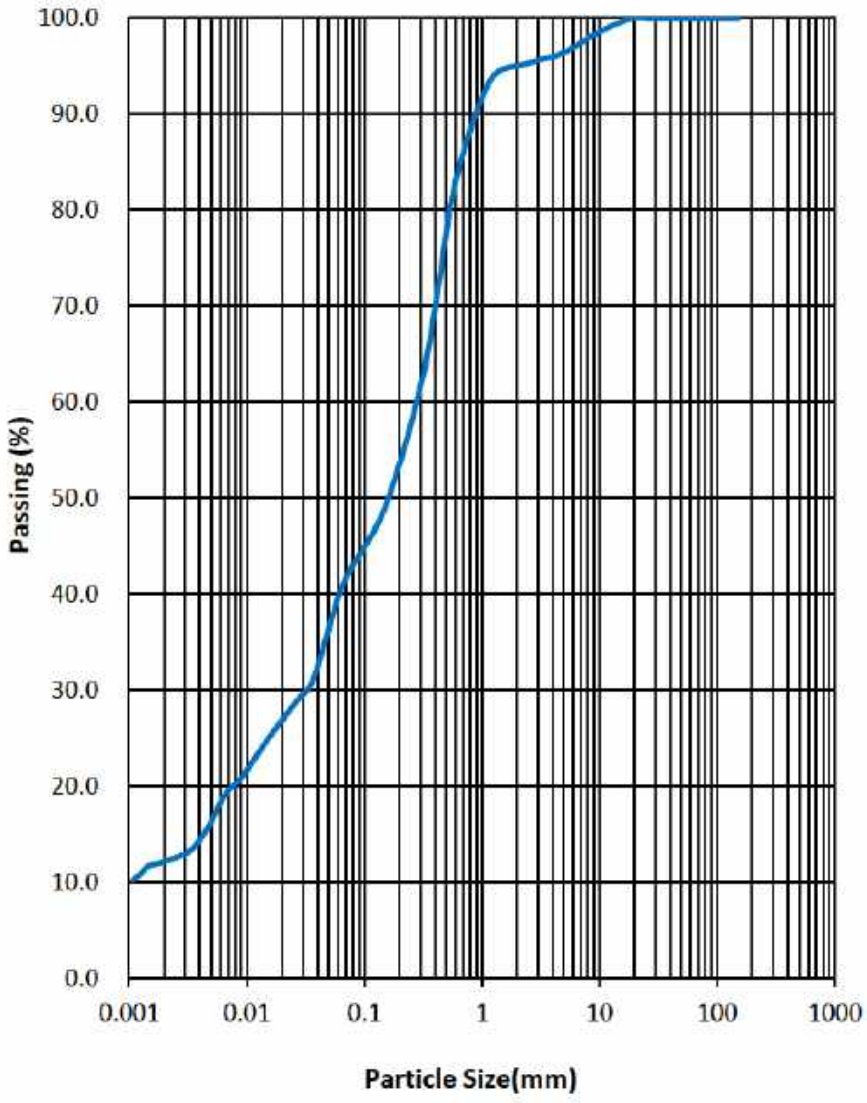
PARTICLE SIZE DISTRIBUTION TEST REPORT

Test Method: AS 1289 3.6.3, 3.5.1

Client:	Knight Piesold	Date Tested:	3/04/2017
Project:	Mungari Gold Project	EP Lab Job Number:	KP
Sample No:	TSF Cell 3 BH03	Depth(m):	3.50 - 4.00
Lab ID:	TSF_BH01_KP01_PSD	Room Temperature at Test:	19°C
Tested by:	Reggie	2.36mm Particle Density (t/m³):	2.54
Checked by:	Phil		

Sieve Size (mm)	Passing %
150	100.0
75	100.0
53	100.0
37.5	100.0
26.5	100.0
19	100.0
9.5	98.4
4.75	96.3
2.36	95.2
1.18	93.5
0.6	83.1
0.425	71.9
0.3	61.6
0.15	49.1
0.075	42.4
0.06046	39.8
0.05081	36.8
0.03625	31.0
0.02572	28.7
0.01754	26.0
0.01285	23.7
0.00912	21.0
0.00647	19.1
0.00459	15.6
0.00326	13.3
0.00191	12.1
0.00147	11.7
0.00127	11.0
0.00116	10.6
0.00107	10.2

PSD Graph



Notes:
Stored and Tested the Sample as received
Samples supplied by the Client

Authorized Signatur [redacted]

The results of tests performed apply only to the specific sample at time of test unless otherwise clearly stated. Reference should be made to E-Precision Laboratory's "Standard Terms and Conditions" E-Precision Laboratory ABN 431 559 578 87

Perth
Unit 3, 34 Sphinx Way
Bibra Lake
WA 6163
[redacted]

E-Precision Laboratory

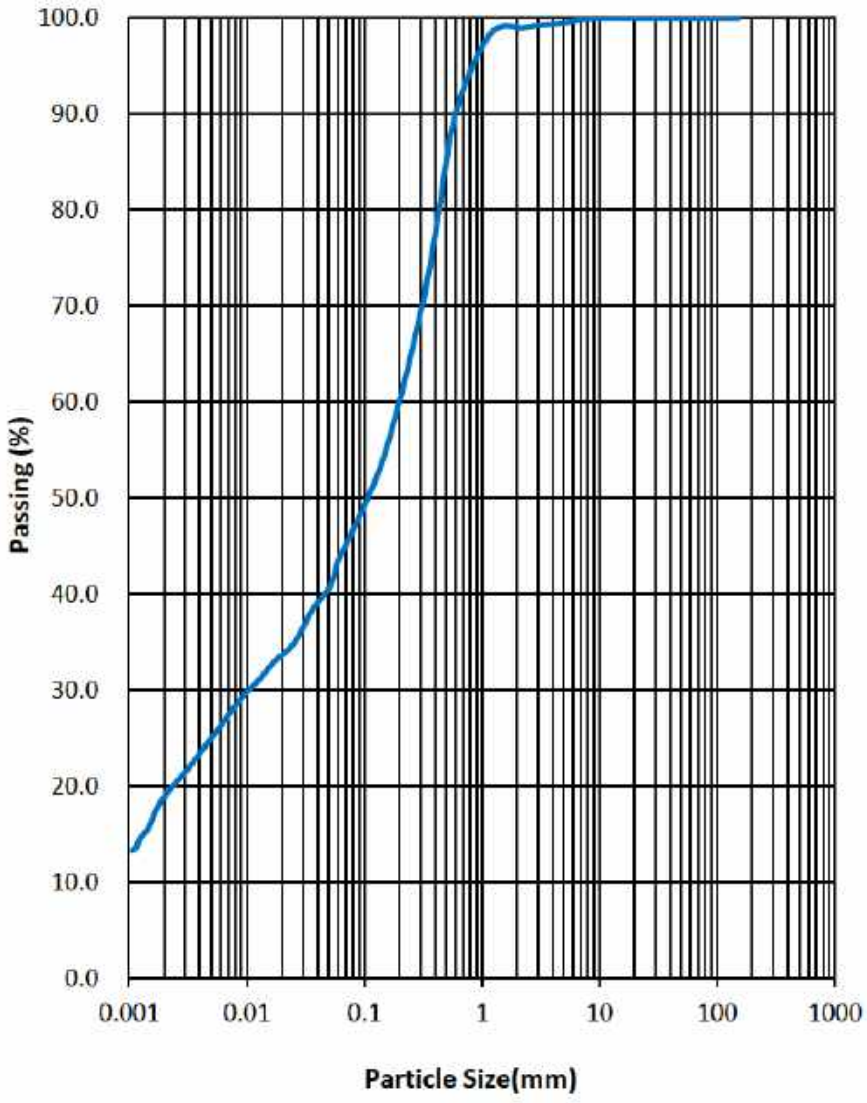
PARTICLE SIZE DISTRIBUTION TEST REPORT

Test Method: AS 1289 3.6.3, 3.5.1

Client:	Knight Piesold	Date Tested:	3/04/2017
Project:	Mungari Gold Project	EP Lab Job Number:	KP
Sample No:	TSF Cell 3 BH03	Depth(m):	4.50 - 5.00
Lab ID:	TSF_BH02_KP01_PSD	Room Temperature at Test:	19°C
Tested by:	Reggie	2.36mm Particle Density (t/m³):	2.56
Checked by:	Phil		

Sieve Size (mm)	Passing %
150	100.0
75	100.0
53	100.0
37.5	100.0
26.5	100.0
19	100.0
9.5	100.0
4.75	99.5
2.36	99.0
1.18	98.3
0.6	90.2
0.425	79.4
0.3	69.2
0.15	54.7
0.075	45.9
0.06067	43.7
0.05092	40.8
0.03611	38.4
0.02564	35.0
0.01745	33.1
0.01277	31.1
0.00905	29.2
0.00642	26.8
0.00455	24.4
0.00323	22.0
0.00190	18.6
0.00146	15.7
0.00126	14.7
0.00116	13.8
0.00106	13.3

PSD Graph



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Bibra Lake
WA 6163
[redacted]

E-Precision Laboratory

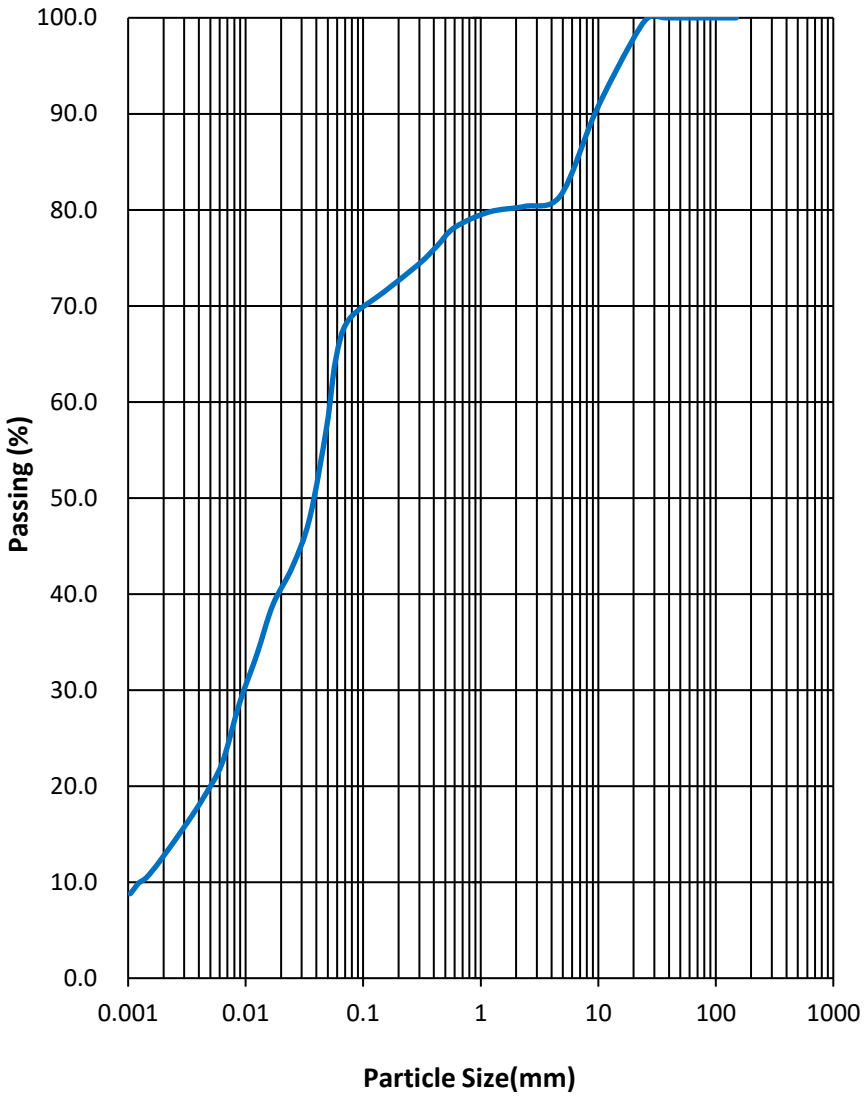
PARTICLE SIZE DISTRIBUTION TEST REPORT

Test Method: AS 1289 3.6.3, 3.5.1

Client:	Knight Piesold	Date Tested:	5/04/2017
Project:	Mungari Gold Project	EP Lab Job Number:	KP
Sample No:	TSF Cell 3 BH03	Depth(m):	7.00 - 7.50
Lab ID:	TSF_BH02_B_KP01_PSD	Room Temperature at Test:	19°C
Tested by:	Reggie	2.36mm Particle Density (t/m³):	2.64
Checked by:	Phil		

Sieve Size (mm)	Passing %
150	100.0
75	100.0
53	100.0
37.5	100.0
26.5	100.0
19	97.4
9.5	90.2
4.75	81.4
2.36	80.4
1.18	79.8
0.6	78.2
0.425	76.2
0.3	74.4
0.15	71.4
0.075	68.5
0.05831	64.4
0.04912	57.6
0.03509	47.9
0.02495	42.8
0.01701	38.8
0.01249	33.7
0.00887	28.6
0.00631	22.4
0.00447	19.0
0.00317	16.2
0.00186	12.2
0.00143	10.5
0.00124	9.9
0.00113	9.4
0.00104	8.8

PSD Graph



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Samples supplied by the Client

Authorized S [redacted]

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Unit 3, 34 Sphinx Way
Bibra Lake
WA 6163
[redacted]

E-Precision Laboratory

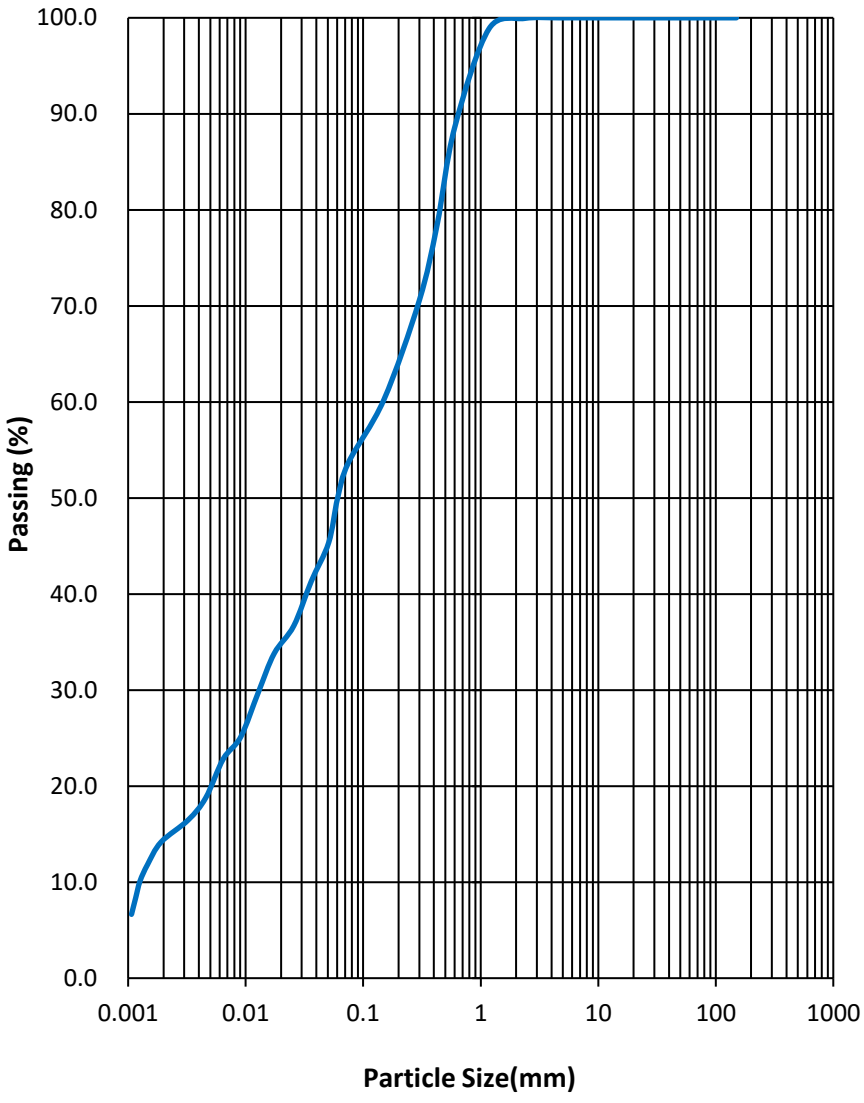
PARTICLE SIZE DISTRIBUTION TEST REPORT

Test Method: AS 1289 3.6.3, 3.5.1

Client:	Knight Piesold	Date Tested:	3/04/2017
Project:	Mungari Gold Project	EP Lab Job Number:	KP
Sample No:	TSF Cell 3 BH03	Depth(m):	4.45 - 4.95
Lab ID:	TSF_BH03_KP01_PSD	Room Temperature at Test:	19°C
Tested by:	Reggie	2.36mm Particle Density (t/m³):	2.57
Checked by:	Phil		

Sieve Size (mm)	Passing %
150	100.0
75	100.0
53	100.0
37.5	100.0
26.5	100.0
19	100.0
9.5	100.0
4.75	100.0
2.36	99.9
1.18	98.9
0.6	88.6
0.425	78.4
0.3	70.6
0.15	60.2
0.075	53.7
0.06056	50.0
0.05089	45.4
0.03613	41.3
0.02567	36.7
0.01748	33.8
0.01281	29.8
0.00910	25.1
0.00644	22.8
0.00457	18.8
0.00324	16.5
0.00190	14.2
0.00146	11.8
0.00126	10.1
0.00116	8.4
0.00107	6.6

PSD Graph



Notes:
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Samples supplied by the Client

Authorized Signature: [redacted]

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Perth
Unit 3, 34 Sphinx Way
Bibra Lake

[redacted]

E-Precision Laboratory

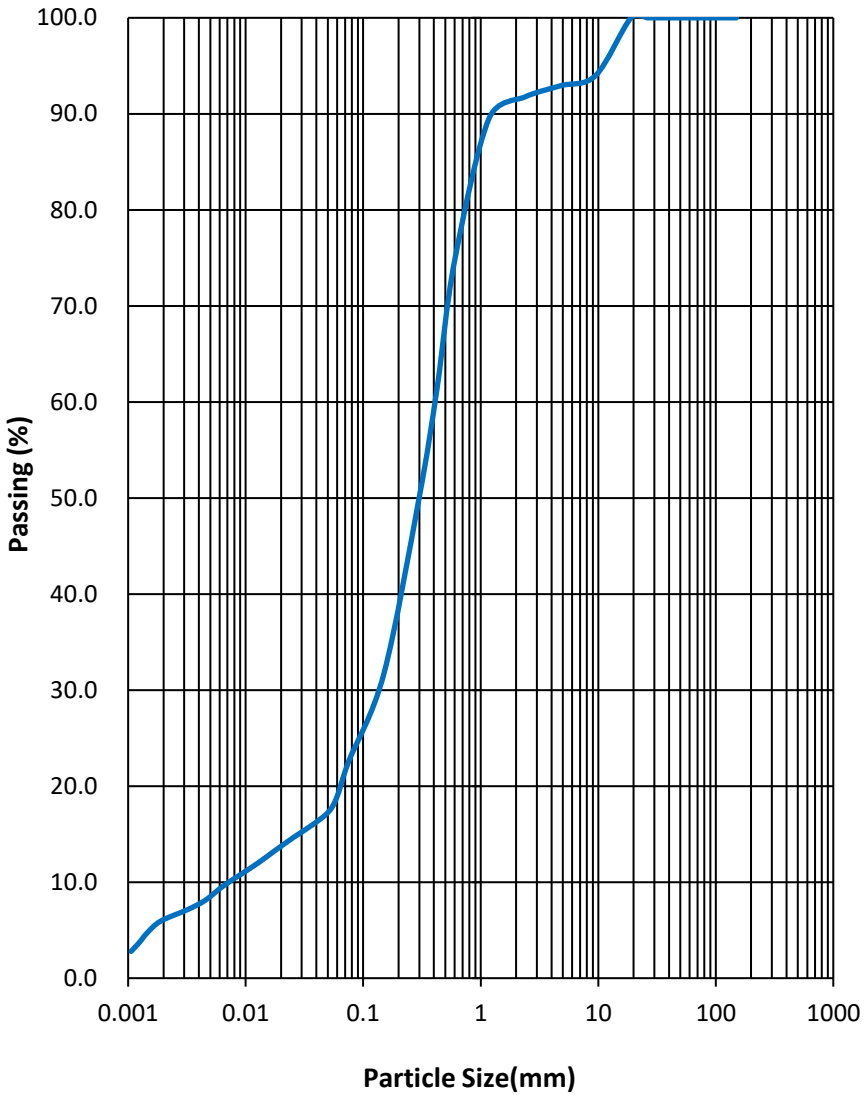
PARTICLE SIZE DISTRIBUTION TEST REPORT

Test Method: AS 1289 3.6.3, 3.5.1

Client:	Knight Piesold	Date Tested:	5/04/2017
Project:	Mungari Gold Project	EP Lab Job Number:	KP
Sample No:	TSF Cell 3 BH03	Depth(m):	4.45 - 4.95
Lab ID:	TSF_BH04_KP01_PSD	Room Temperature at Test:	19°C
Tested by:	Reggie	2.36mm Particle Density (t/m³):	2.60
Checked by:	Phil		

Sieve Size (mm)	Passing %
150	100.0
75	100.0
53	100.0
37.5	100.0
26.5	100.0
19	100.0
9.5	94.0
4.75	92.9
2.36	91.7
1.18	89.6
0.6	74.7
0.425	61.4
0.3	50.1
0.15	31.7
0.075	22.5
0.06039	19.0
0.05071	17.3
0.03598	15.9
0.02551	14.7
0.01738	13.2
0.01273	12.0
0.00902	10.8
0.00640	9.6
0.00454	8.1
0.00321	7.1
0.00189	5.9
0.00145	4.7
0.00125	3.8
0.00115	3.3
0.00106	2.8

PSD Graph



Notes:
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Samples supplied by the Client

Authorized Signat

[redacted]

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Unit 3, 34 Sphinx Way
Bibra Lake
WA 6163
[redacted]

E-Precision Laboratory

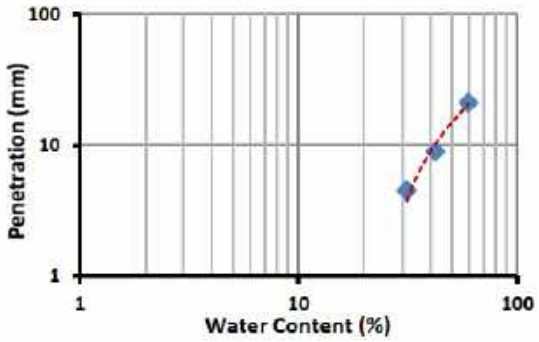
ATTERBERG LIMITS TEST REPORT

Test Method: BS1377 AS1289.2.1.1 7.1.1 3.1.1 3.2.1 3.4.1

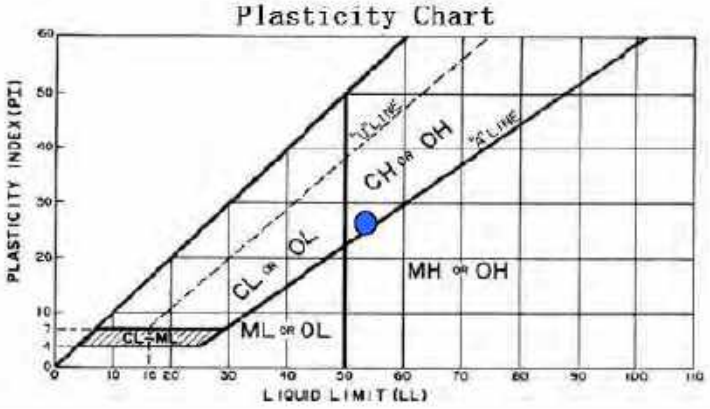
Client:	Knight Piesold	**Date Tested:**	5/04/2017
Project:	Mungari Gold Project	**Lab:**	EPLAB
Sample No:	TSF Cell 3	**Job Number:**	KP
Lab ID:	TSF_BH01_KP01_ATT		
Depth(m):	3.50 - 4.00	**Room Temperature at Test:**	20°C
Tested by:	Reggie	**Sample Description:**	-
Moisture Content (%):	25.2	**Wet Density (t/m³):**	-
		Dry Density (t/m³):	-

Liquid Limit (%):	53.94
Plastic Limit (%):	28.39
Plasticity Index (%):	25.55
Liquidity Index (%):	-0.13
Shrinkage Limit (%):	19.39
Linear Shrinkage(%):	13.54

Results Chart



Plasticity Chart



Notes: The sample/s were tested oven dried, dry sieved and in a 125-250mm mould.

Stored and Tested the Sample as received

Samples supplied by the Client

Authorised Signature [redacted]

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Integrity Precision Innovation

Perth
Unit 3, 34 Sphinx Way
Bibra Lake
WA 6163

[redacted]

E-Precision Laboratory

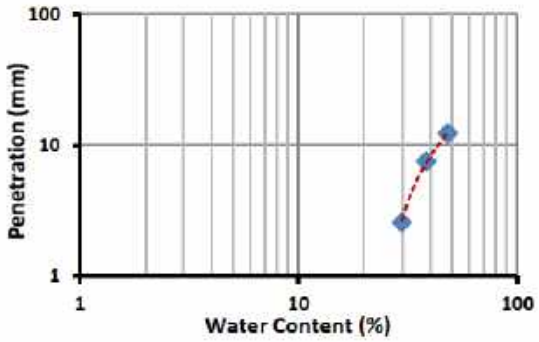
ATTERBERG LIMITS TEST REPORT

Test Method: BS1377 AS1289.2.1.1 7.1.1 3.1.1 3.2.1 3.4.1

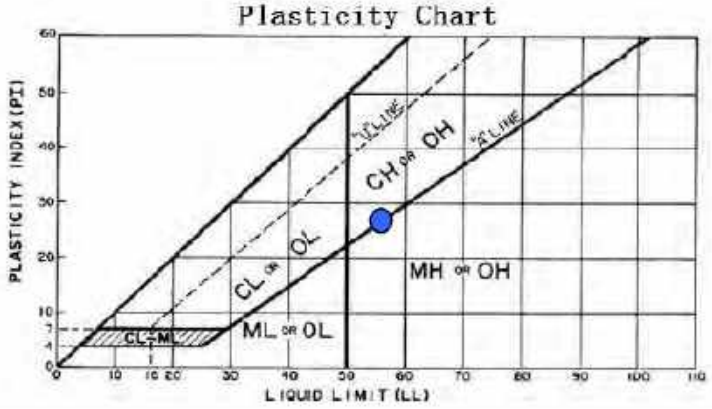
Client:	Knight Piesold	**Date Tested:**	5/04/2017
Project:	Mungari Gold Project	**Lab:**	EPLAB
Sample No:	TSF Cell 3	**Job Number:**	KP
Lab ID:	TSF_BH02_KP01_ATT		
Depth(m):	4.50 - 5.00	**Room Temperature at Test:**	20°C
Tested by:	Reggie	**Sample Description:**	-
Moisture Content (%):	37.6	**Wet Density (t/m³):**	-
		Dry Density (t/m³):	-

Liquid Limit (%):	56.67
Plastic Limit (%):	28.50
Plasticity Index (%):	28.16
Liquidity Index (%):	0.32
Shrinkage Limit (%):	18.88
Linear Shrinkage(%):	17.16

Results Chart



Plasticity Chart



Notes: The sample/s were tested oven dried, dry sieved and in a 125-250mm mould.

Stored and Tested the Sample as received

Samples supplied by the Client

Authorised Signatur [redacted]

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Integrity Precision Innovation

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Unit 3, 34 Sphinx Way
Bibra Lake
WA 6163
[redacted]

E-Precision Laboratory

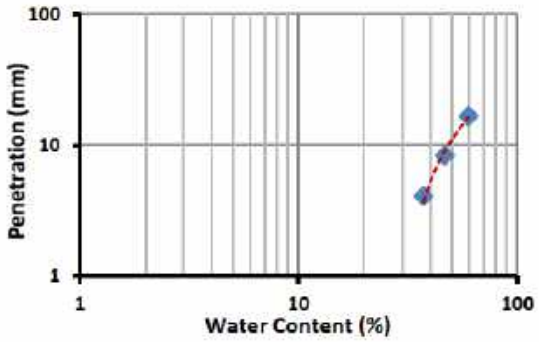
ATTERBERG LIMITS TEST REPORT

Test Method: BS1377 AS1289.2.1.1 7.1.1 3.1.1 3.2.1 3.4.1

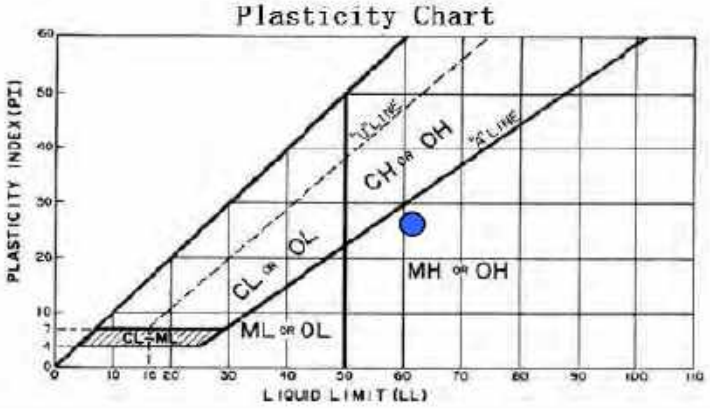
Client:	Knight Piesold	**Date Tested:**	5/04/2017
Project:	Mungari Gold Project	**Lab:**	EPLAB
Sample No:	TSF Cell 3	**Job Number:**	KP
Lab ID:	TSF_BH02_B_KP01_ATT		
Depth(m):	7.00 - 7.50	**Room Temperature at Test:**	20°C
Tested by:	Reggie	**Sample Description:**	-
Moisture Content (%):	42.3	**Wet Density (t/m³):**	-
		Dry Density (t/m³):	-

Liquid Limit (%):	61.10
Plastic Limit (%):	34.31
Plasticity Index (%):	26.79
Liquidity Index (%):	0.30
Shrinkage Limit (%):	22.86
Linear Shrinkage(%):	11.31

Results Chart



Plasticity Chart



Notes: The sample/s were tested oven dried, dry sieved and in a 125-250mm mould.

Stored and Tested the Sample as received

Samples supplied by the Client

Authorised Signature [redacted]

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Perth
Unit 3, 34 Sphinx Way
Bibra Lake
WA 6163
[redacted]

E-Precision Laboratory

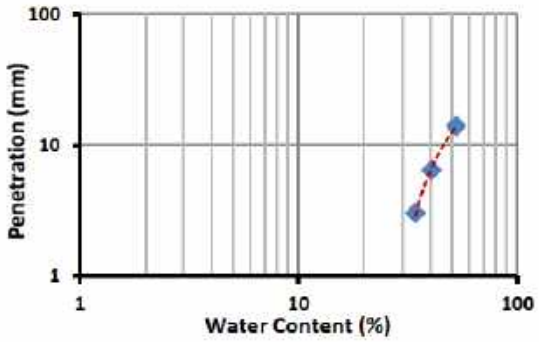
ATTERBERG LIMITS TEST REPORT

Test Method: BS1377 AS1289.2.1.1 7.1.1 3.1.1 3.2.1 3.4.1

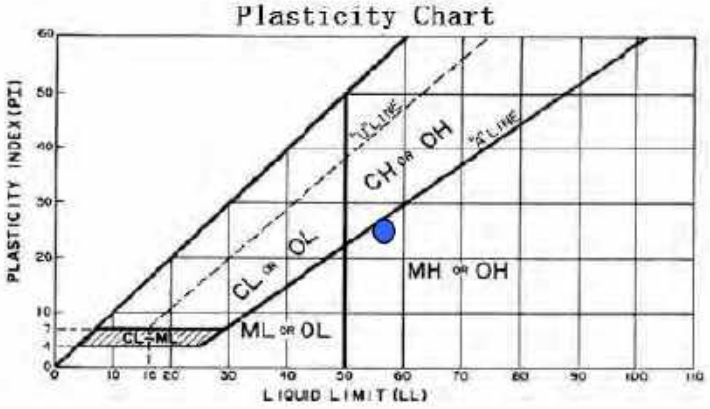
Client:	Knight Piesold	**Date Tested:**	5/04/2017
Project:	Mungari Gold Project	**Lab:**	EPLAB
Sample No:	TSF Cell 3	**Job Number:**	KP
Lab ID:	TSF_BH03_KP01_ATT		
Depth(m):	4.45 - 4.95	**Room Temperature at Test:**	20°C
Tested by:	Reggie	**Sample Description:**	-
Moisture Content (%):	30.7	**Wet Density (t/m³):**	-
		Dry Density (t/m³):	-

Liquid Limit (%):	57.80
Plastic Limit (%):	32.86
Plasticity Index (%):	24.93
Liquidity Index (%):	-0.09
Shrinkage Limit (%):	22.44
Linear Shrinkage(%):	17.67

Results Chart



Plasticity Chart



Notes: The sample/s were tested oven dried, dry sieved and in a 125-250mm mould.

Stored and Tested the Sample as received

Samples supplied by the Client

Authorised Signat [redacted]

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Integrity Precision Innovation

Perth
Unit 3, 34 Sphinx Way
Bibra Lake

[redacted]

E-Precision Laboratory

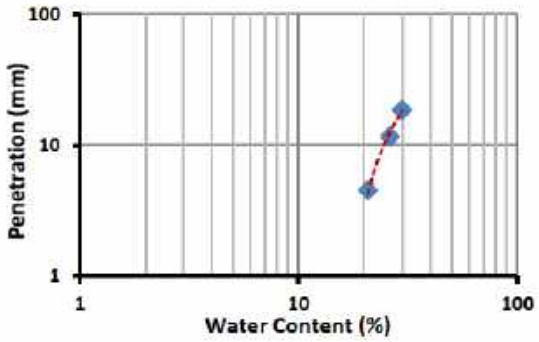
ATTERBERG LIMITS TEST REPORT

Test Method: BS1377 AS1289.2.1.1 7.1.1 3.1.1 3.2.1 3.4.1

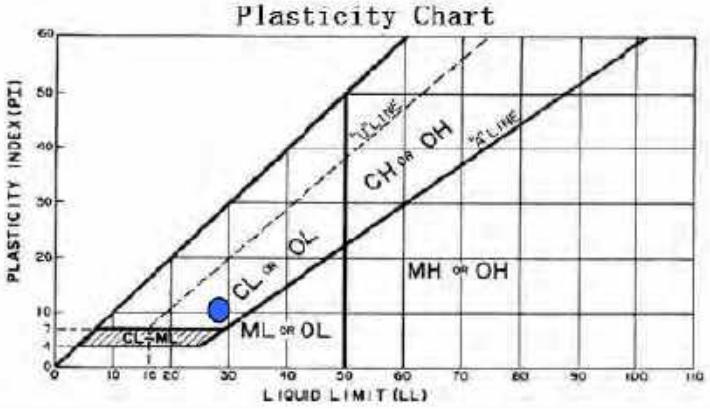
Client:	Knight Piesold	**Date Tested:**	5/04/2017
Project:	Mungari Gold Project	**Lab:**	EPLAB
Sample No:	TSF Cell 3	**Job Number:**	KP
Lab ID:	TSF_BH04_KP01_ATT		
Depth(m):	4.45 - 4.95	**Room Temperature at Test:**	20°C
Tested by:	Reggie	**Sample Description:**	-
Moisture Content (%):	11.0	**Wet Density (t/m³):**	-
		Dry Density (t/m³):	-

Liquid Limit (%):	29.10
Plastic Limit (%):	19.41
Plasticity Index (%):	9.70
Liquidity Index (%):	-0.86
Shrinkage Limit (%):	16.57
Linear Shrinkage(%):	6.23

Results Chart



Plasticity Chart



Notes: The sample/s were tested oven dried, dry sieved and in a 125-250mm mould.

Stored and Tested the Sample as received

Samples supplied by the Client

Authorised Signature [redacted]

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Integrity Precision Innovation

STATS WA Pty Ltd
Unit 1/24 Baile Road
Canning Vale WA 6155

[redacted]

Test Certificate

Emerson Class Report

Client :	E-Precision Laboratory	Report Number:	PE-101055 - 1/1
Address :	Unit 3/34 Sphinx Way, Bibra Lake, WA, 6163	Report Date :	13/04/2017
Project Name :	Mungari Gold Project	Order Number :	
Project Number :	PE-101055	Test Method :	AS1289.3.8.1
Location:	Mungari	Page 1 of 1	

Sample Number :	S17-260	S17-261	S17-262	
Test Number :	1	2	3	
Sampling Method :	As Received	As Received	As Received	
Date Sampled :	7/04/2017	7/04/2017	7/04/2017	
Date Tested :	11/04/2017	11/04/2017	11/04/2017	
Material Type :	Soil Sample	Soil Sample	Soil Sample	
Material Source :	Bore Hole	Bore Hole	Bore Hole	
Lot Number :				
Sample Location :	BH01 - (3.50-4.00m)	BH03 - (4.45-4.95m)	BH02 - (7.00-7.50m)	
Primary Water Type :	Distilled Water	Distilled Water	Distilled Water	
Primary Soil Description :	Clayey SAND	Silty SAND	Sandy CLAY	
Primary Temperature :	25	25	25	
Primary Emerson Class Number :	**Class 6**	**Class 6**	**Class 4**	
Secondary Water Type :				
Secondary Soil Description :				
Secondary Temperature :				
Secondary Emerson Class Number :				
Remarks :				

NATA
WORLD RECOGNISED ACCREDITATION

Accredited for compliance with ISO/IEC 17025 - Testing.

[redacted]

STATS WA Pty Ltd
Unit 1 / 24 Baile Road
Canning Vale WA 6155
Phone: (08) 9455 3654

STATS WA PTY LTD

TEST CERTIFICATE

CLIENT:	E-Precision	PROJECT NUMBER:	PE-101055
ADDRESS:	Unit 3/34 Sphinx Way, Bibra Lake , WA6163	REPORT NUMBER:	PE-101055 - 2/1
PROJECT:	Mungari Gold Project	REPORT DATE:	13/04/2017
LOCATION:	Mungari	ORDER NUMBER:	

Calcium Carbonate Content
WA915.1

Sample Number:	S17-	262			
Sample Identification:		BH02			
Sample Depth:		7-7.5m			
Description:		Sandy CLAY			
Date Sampled:		Apr-17			
Date Tested:		11/04/2017			
Test Number:		3			
Calcium Carbonate Content: %		9.4			

Remarks: Sample Supplied by client.

[redacted]

Approved By: B. Riordan

Date: Nov-2016

au.ind.admin@sgs.com
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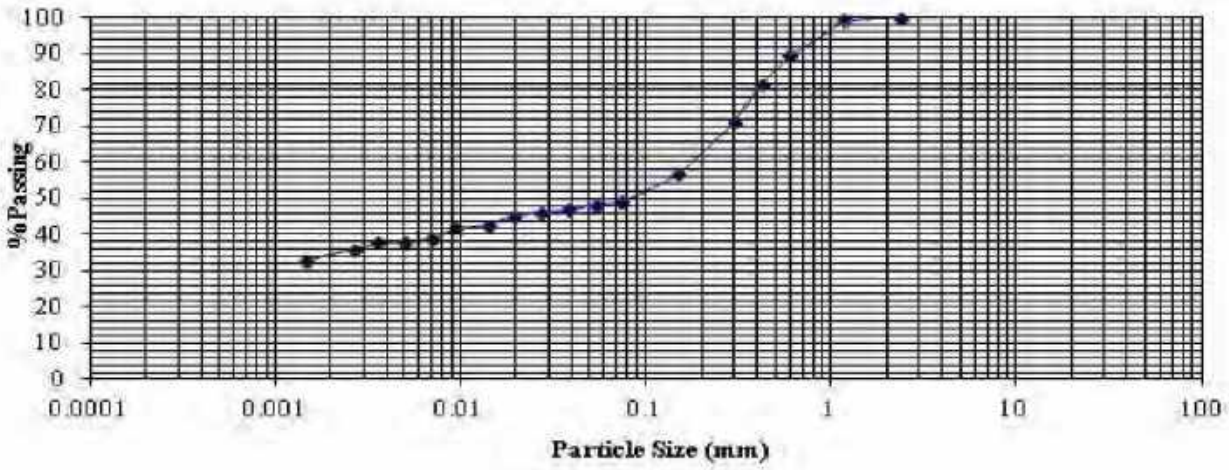
SGS Australia Pty Ltd
Perth Laboratory
112 Mulgul Road
Malaga WA 6090

Client:	Knight Piesold Pty Ltd	Client Job No:	
Project:	Mungari TSF Cell 3 SI	Order No:	
Location:	Mungari	Tested Date:	27/04/2017
SGS Job Number:	17-01-680	Sample No:	17-MT-2613
Lab:	Perth Laboratory	Sample ID:	TP05 2.5 to 2.9 17-KG-654

PARTICLE SIZE DISTRIBUTION - SIEVING AND HYDROMETER ANALYSIS

AS1289.3.6.1 & AS1289.3.6.3



SIEVING	(AS1289.3.6.1)	HYDROMETER	(AS1289.3.6.3)
Sieve Size	Passing	Particle Diameter	Finer
(mm)	%	(mm)	%
53.0		0.0548	48
37.5		0.0388	47
19.0		0.0275	46
9.5		0.0194	45
4.75		0.0143	43
2.36	100	0.0095	42
1.18	99	0.0072	39
0.600	90	0.0051	38
0.425	82	0.0036	38
0.300	71	0.0027	36
0.150	57	0.0015	33
0.075	49		

Method of Dispersion : Mechanical ; Hydrometer Used : Glass, -5 to 60g/l soil Colloids

Loss after Pretreatment: No Pretreatment

Note: Sample supplied by client.

Auth
Sign [redacted]

Date: 4/05/2017

ilac-MRA NATA

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SGS Australia Pty Ltd
Perth Laboratory
112 Mulgul Road
Malaga WA 6090

Client:	Knight Piesold Pty Ltd	Client Job No:	
Project:	Mungari TSF Cell 3 SI	Order No:	
Location:	Mungari	Tested Date:	24/04/2017
SGS Job Number:	17-01-680	Sample No:	17-MT-2613
Lab:	Perth Laboratory	Sample ID:	TP05 2.5 to 2.9 17-KG-654

Determination of Emerson Class Number

AS1289.3.8.1

Soil Description	Red Sandy Clay
Type of water used:	De Ionised
Temperature of water (C):	22
Emerson Class Number:	**5**

Note: Sample supplied by client.

[redacted]

Date: 24/04/2017

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Perth Laboratory
112 Mulgul Road
Malaga WA 6090

Client:	Knight Piesold Pty Ltd	Client Job No:	
Project:	Mungari TSF Cell 3 SI	Order No:	
Location:	Mungari	Tested Date:	28/04/2017
SGS Job Number:	17-01-680	Sample No:	17-MT-2613
Lab:	Perth Laboratory	Sample ID:	TP05 2.5 to 2.9 17-KG-654

FINE PARTICLE DENSITY

AS1289.3.5.1

FINE FRACTION

SOIL APPARENT PARTICLE DENSITY (g/cc)	**2.50**
at temperature	25 ° C

Note: Sample supplied by client.

[redacted]

Date: 1/05/2017

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SGS Australia Pty Ltd
Perth Laboratory
112 Mulgul Road
Malaga WA 6090

Client:	Knight Piesold Pty Ltd	Client Job No:	
Project:	Mungari TSF Cell 3 SI	Order No:	
Location:	Mungari	Tested Date:	27/04/2017
SGS Job Number:	17-01-680	Sample No:	17-MT-2613
Lab:	Perth Laboratory	Sample ID:	TP05 2.5 to 2.9 17-KG-654

PERMEABILITY: FALLING HEAD

AS1289.6.7.2 Remoulded sample

MDD:	Max Dry Density (t/m³):
Max. Dry Density :	1.70 t/m³
Optimum Moisture Content	19.0 %
Dry Density	1.62 t/m³
Dry Density Ratio :	95.3 %
Moisture Content:	19.1 %
Moisture Ratio:	100.5 %
Surcharge (kPa):	0.0
Hydraulic Head:	1,622 mm
Hydraulic Gradient:	16
Sieve Size (mm):	4.75
Percentage Retained:	0

COEFFICIENT OF PERMEABILITY

m/sec at 20 ° C	**1.E-10**

Note: Sample supplied by client.

[redacted]

Date: 9/05/2017

Site No.: 2411
Cert No.: 17-MT-2613-S800
Form No.

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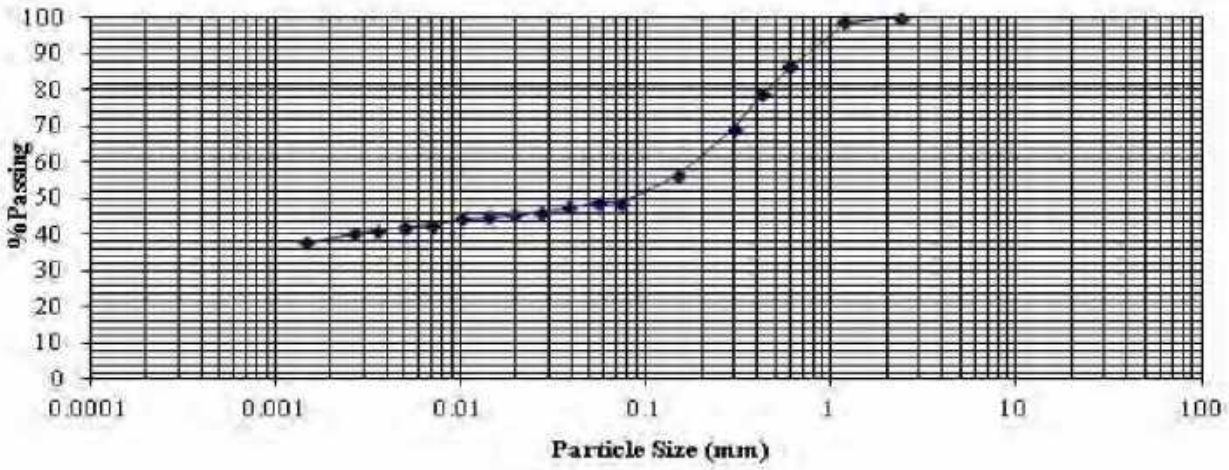
SGS Australia Pty Ltd
Perth Laboratory
112 Mulgul Road
Malaga WA 6090

Client:	Knight Piesold Pty Ltd	Client Job No:	
Project:	Mungari TSF Cell 3 SI	Order No:	
Location:	Mungari	Tested Date:	27/04/2017
SGS Job Number:	17-01-680	Sample No:	17-MT-2614
Lab:	Perth Laboratory	Sample ID:	TP11 2.0 to 2.7 17-KG-656

PARTICLE SIZE DISTRIBUTION - SIEVING AND HYDROMETER ANALYSIS

AS1289.3.6.1 & AS1289.3.6.3



SIEVING	(AS1289.3.6.1)	HYDROMETER	(AS1289.3.6.3)
Sieve Size	Passing	Particle Diameter	Finer
(mm)	%	(mm)	%
53.0		0.0549	49
37.5		0.0389	48
19.0		0.0275	46
9.5		0.0195	45
4.75		0.0143	45
2.36	100	0.0101	44
1.18	99	0.0071	43
0.600	87	0.0050	42
0.425	79	0.0036	41
0.300	69	0.0027	40
0.150	56	0.0015	38
0.075	49		

Method of Dispersion : Mechanical ; Hydrometer Used : Glass, -5 to 60g/l soil Colloids

Loss after Pretreatment: No Pretreatment

Note: Sample supplied by client.

[redacted]

Date: 4/05/2017

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SGS Australia Pty Ltd
Perth Laboratory
112 Mulgul Road
Malaga WA 6090

Client:	Knight Piesold Pty Ltd	Client Job No:	
Project:	Mungari TSF Cell 3 SI	Order No:	
Location:	Mungari	Tested Date:	24/04/2017
SGS Job Number:	17-01-680	Sample No:	17-MT-2614
Lab:	Perth Laboratory	Sample ID:	TP11 2.0 to 2.7 17-KG-656

Determination of Emerson Class Number

AS1289.3.8.1

Soil Description	Red Sandy Clay
Type of water used:	De Ionised
Temperature of water (C):	22
Emerson Class Number:	**5**

Note: Sample supplied by client.

[redacted]

Date: 24/04/2017

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Perth Laboratory
112 Mulgul Road
Malaga WA 6090

Client:	Knight Piesold Pty Ltd	Client Job No:	
Project:	Mungari TSF Cell 3 SI	Order No:	
Location:	Mungari	Tested Date:	28/04/2017
SGS Job Number:	17-01-680	Sample No:	17-MT-2614
Lab:	Perth Laboratory	Sample ID:	TP11 2.0 to 2.7 17-KG-656

FINE PARTICLE DENSITY

AS1289.3.5.1

FINE FRACTION

SOIL APPARENT PARTICLE DENSITY (g/cc)	**2.49**
at temperature	25 ° C

Note: Sample supplied by client.

[redacted]

Date: 1/05/2017

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112 Mulgul Road
Malaga WA 6090

Client:	Knight Piesold Pty Ltd	Client Job No:	
Project:	Mungari TSF Cell 3 SI	Order No:	
Location:	Mungari	Tested Date:	28/04/2017
SGS Job Number:	17-01-680	Sample No:	17-MT-2614
Lab:	Perth Laboratory	Sample ID:	TP11 2.0 to 2.7 17-KG-656

PERMEABILITY: FALLING HEAD

AS1289.6.7.2 Remoulded sample

MDD:	Max Dry Density (t/m³):
Max. Dry Density :	1.77 t/m³
Optimum Moisture Content	19.0 %
Dry Density	1.67 t/m³
Dry Density Ratio :	94.2 %
Moisture Content:	19.9 %
Moisture Ratio:	104.5 %
Surcharge (kPa):	0.0
Hydraulic Head:	1,612 mm
Hydraulic Gradient:	16
Sieve Size (mm):	4.75
Percentage Retained:	0

COEFFICIENT OF PERMEABILITY

m/sec at 20 ° C	**4.E-11**

Note: Sample supplied by client.

[redacted]

Date: 9/05/2017

Client Address: Level 1, 184 Adelaide Terrace East Perth WA 6004

Site No.: 2411
Cert No.: 17-MT-2614-S800
Form No.

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SGS Australia Pty Ltd
Perth Laboratory
112 Mulgul Road
Malaga WA 6090

Client:	Knight Piesold Pty Ltd	Client Job No:	
Project:	Mungari TSF Cell 3 SI	Order No:	
Location:	Mungari	Tested Date:	27/04/2017
SGS Job Number:	17-01-680	Sample No:	17-MT-2615
Lab:	Perth Laboratory	Sample ID:	TP12 0.5 to 1.0 17-KG-657

PERMEABILITY: FALLING HEAD

AS1289.6.7.2 Remoulded sample

MDD:	Max Dry Density (t/m³):
Max. Dry Density :	1.72 t/m³
Optimum Moisture Content	18.5 %
Dry Density	1.64 t/m³
Dry Density Ratio :	95.6 %
Moisture Content:	19.6 %
Moisture Ratio:	106.0 %
Surcharge (kPa):	0.0
Hydraulic Head:	1,538 mm
Hydraulic Gradient:	15
Sieve Size (mm):	4.75
Percentage Retained:	3

COEFFICIENT OF PERMEABILITY

m/sec at 20 ° C **5.E-08**

Note: Sample supplied by client.

[redacted]

Client Address: Level 1, 184 Adelaide Terrace East Perth WA 6004

Date: 2/05/2017
Site No.: 2411
Cert No.: 17-MT-2615-S800
Form No.

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SGS Australia Pty Ltd
Perth Laboratory
112 Mulgul Road
Malaga WA 6090

Client:	Knight Piesold Pty Ltd	Client Job No:	
Project:	Mungari TSF Cell 3 SI	Order No:	
Location:	Mungari	Tested Date:	28/04/2017
SGS Job Number:	17-01-680	Sample No:	17-MT-2616
Lab:	Perth Laboratory	Sample ID:	TP16 0.5 to 1.0 17-KG-659

PERMEABILITY: FALLING HEAD

AS1289.6.7.2 Remoulded sample

MDD:	Max Mod. Dry Density (t/m³):
Max. Dry Density :	1.74 t/m³
Optimum Moisture Content	16.5 %
Dry Density	1.65 t/m³
Dry Density Ratio :	94.8 %
Moisture Content:	16.5 %
Moisture Ratio:	100.5 %
Surcharge (kPa):	0.0
Hydraulic Head:	1,580 mm
Hydraulic Gradient:	16
Sieve Size (mm):	4.75
Percentage Retained:	6

COEFFICIENT OF PERMEABILITY

m/sec at 20 ° C	**4.E-08**

Note: Sample supplied by client.

[redacted]

Client Address: Level 1, 184 Adelaide Terrace East Perth WA 6004

Date: 2/05/2017

Site No.: 2411
Cert No.: 17-MT-2616-S800
Form No.

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SGS Australia Pty Ltd
Perth Laboratory
112 Mulgul Road
Malaga WA 6090

Client:	Knight Piesold Pty Ltd	Client Job No:	
Project:	Mungari TSF Cell 3 SI	Order No:	
Location:	Mungari	Tested Date:	28/04/2017
SGS Job Number:	17-01-680	Sample No:	17-MT-2617
Lab:	Perth Laboratory	Sample ID:	TP27 0.5 to 1.0 17-KG-661

PERMEABILITY: FALLING HEAD

AS1289.6.7.2 Remoulded sample

MDD:	Max Mod. Dry Density (t/m³):
Max. Dry Density :	1.78 t/m³
Optimum Moisture Content	15.0 %
Dry Density	1.69 t/m³
Dry Density Ratio :	94.9 %
Moisture Content:	15.0 %
Moisture Ratio:	99.5 %
Surcharge (kPa):	0.0
Hydraulic Head:	1,597 mm
Hydraulic Gradient:	16
Sieve Size (mm):	4.75
Percentage Retained:	2

COEFFICIENT OF PERMEABILITY

m/sec at 20 ° C **3.E-09**

Note: Sample supplied by client.

[redacted]

Date: 2/05/2017

Client Address: Level 1, 184 Adelaide Terrace East Perth WA 6004

Site No.: 2411
Cert No.: 17-MT-2617-S800
Form No.

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SGS Australia Pty Ltd
Perth Laboratory
112 Mulgul Road
Malaga WA 6090

Client:	Knight Piesold Pty Ltd	Client Job No:	
Project:	Mungari TSF Cell 3 SI	Order No:	
Location:	Mungari	Tested Date:	28/04/2017
SGS Job Number:	17-01-680	Sample No:	17-MT-2618
Lab:	Perth Laboratory	Sample ID:	TP35 0.5 to 1.0 17-KG-663

PERMEABILITY: FALLING HEAD

AS1289.6.7.2 Remoulded sample

MDD:	Max Mod. Dry Density (t/m³):
Max. Dry Density :	1.91 t/m³
Optimum Moisture Content	11.0 %
Dry Density	1.81 t/m³
Dry Density Ratio :	94.7 %
Moisture Content:	10.9 %
Moisture Ratio:	99.0 %
Surcharge (kPa):	0.0
Hydraulic Head:	1,599 mm
Hydraulic Gradient:	16
Sieve Size (mm):	4.75
Percentage Retained:	1

COEFFICIENT OF PERMEABILITY

m/sec at 20 ° C **2.E-07**

Note: Sample supplied by client.

[redacted]

Date: 2/05/2017

Client Address: Level 1, 184 Adelaide Terrace East Perth WA 6004

Site No.: 2411
Cert No.: 17-MT-2618-S800
Form No.

AU.IND.Admin@sgs.com
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SGS Australia Pty Ltd
Kalgoorlie Soils Laboratory
Rear of 17 Stockyard Way
West Kalgoorlie WA 6430

Client:	Knight Piesold Pty Ltd	Client Job No:	
Project:	Mungari TSF Cell3 SI	Order No:	
Location:	Mungari	Tested Date:	19/04/2017
SGS Job Number:	17-03-221	Sample No:	17-KG-654
Lab:	Kalgoorlie Soils Laboratory	Sample ID:	TP05 2.5 to 2.9

Atterberg Limits (1 Point Casagrande) with Linear Shrinkage

AS 1289.3.1.2(Liquid Limit), 3.2.1(Liquid Limit), 3.3.1(Plasicity Index), 3.4.1(Linear Shrinkage)

Liquid Limit (%):	**27**
Plastic Limit (%):	**16**
Plastic Index (%):	**11**
Linear Shrinkage (%):	**5.5**
Nature of shrinkage:	Flat
Length of Mould (mm):	250
History of Sample:	Air Dried
Method of Preparation:	Dry Sieved

Note: Sample supplied by client.

[redacted]

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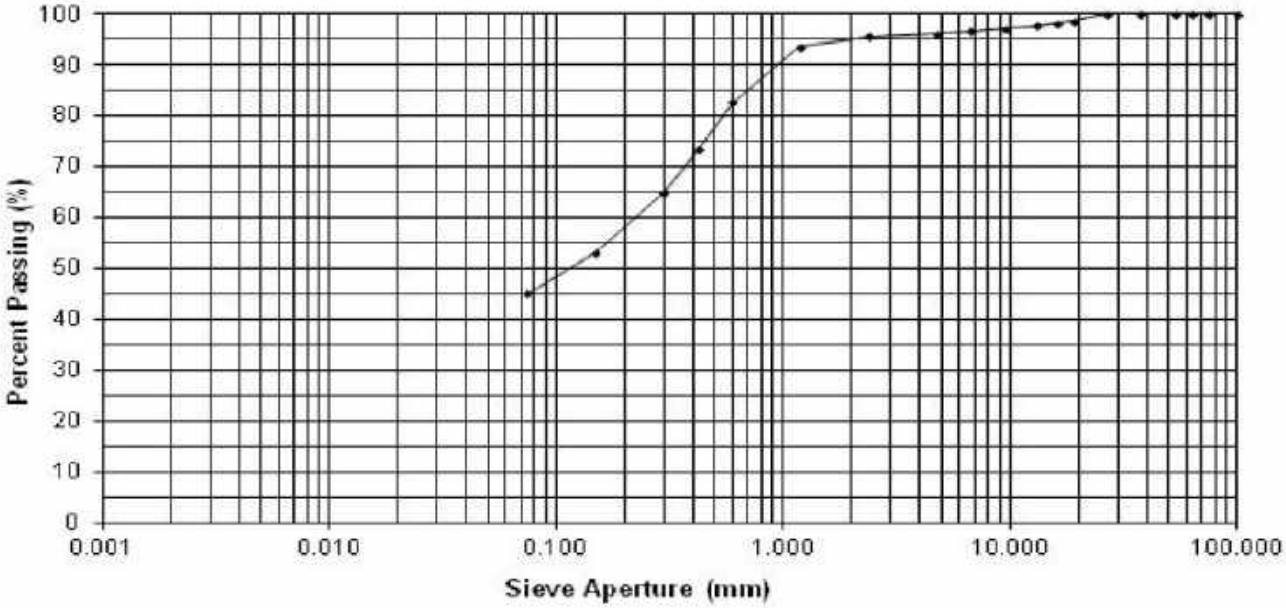
Kalgoorlie Soils Laboratory
Rear of 17 Stockyard Way
West Kalgoorlie WA 6430

Client:	Knight Piesold Pty Ltd	Client Job No:	
Project:	Mungari TSF Cell3 SI	Order No:	
Location:	Mungari	Tested Date:	14/04/2017
SGS Job Number:	17-03-221	Sample No:	17-KG-655
Lab:	Kalgoorlie Soils Laboratory	Sample ID:	TP07 2.0 to 2.3

Particle Size Distibution of a Soil

AS1289.3.6.1



Sieve Size (mm)	% Passing	Sieve Size (mm)	% Passing
100	100	9.5	97
75	100	6.7	97
63	100	4.75	96
53	100	2.36	96
37.5	100	1.18	94
26.5	100	0.6	83
19.0	99	0.425	73
16.0	98	0.300	65
13.2	98	0.150	53
		0.075	45

Note: Sample supplied by client.

[redacted]

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Kalgoorlie Soils Laboratory
Rear of 17 Stockyard Way
West Kalgoorlie WA 6430

Client:	Knight Piesold Pty Ltd	Client Job No:	
Project:	Mungari TSF Cell3 SI	Order No:	
Location:	Mungari	Tested Date:	18/04/2017
SGS Job Number:	17-03-221	Sample No:	17-KG-655
Lab:	Kalgoorlie Soils Laboratory	Sample ID:	TP07 2.0 to 2.3

Atterberg Limits (1 Point Casagrande) with Linear Shrinkage

AS 1289.3.1.2(Liquid Limit), 3.2.1(Liquid Limit), 3.3.1(Plasicity Index), 3.4.1(Linear Shrinkage)

Liquid Limit (%):	**73**
Plastic Limit (%):	**26**
Plastic Index (%):	**47**
Linear Shrinkage (%):	**17.0**
Nature of shrinkage:	Cracked
Length of Mould (mm):	250
History of Sample:	Air Dried
Method of Preparation:	Dry Sieved

Note: Sample supplied by client.

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Client:	Knight Piesold Pty Ltd	Client Job No:	
Project:	Mungari TSF Cell3 SI	Order No:	
Location:	Mungari	Tested Date:	18/04/2017
SGS Job Number:	17-03-221	Sample No:	17-KG-656
Lab:	Kalgoorlie Soils Laboratory	Sample ID:	TP11 2.0 to 2.7

Atterberg Limits (1 Point Casagrande) with Linear Shrinkage

AS 1289.3.1.2(Liquid Limit), 3.2.1(Liquid Limit), 3.3.1(Plasicity Index), 3.4.1(Linear Shrinkage)

Liquid Limit (%):	**59**
Plastic Limit (%):	**21**
Plastic Index (%):	**38**
Linear Shrinkage (%):	**13.5**
Nature of shrinkage:	Curled
Length of Mould (mm):	254
History of Sample:	Air Dried
Method of Preparation:	Dry Sieved

Note: Sample supplied by client.

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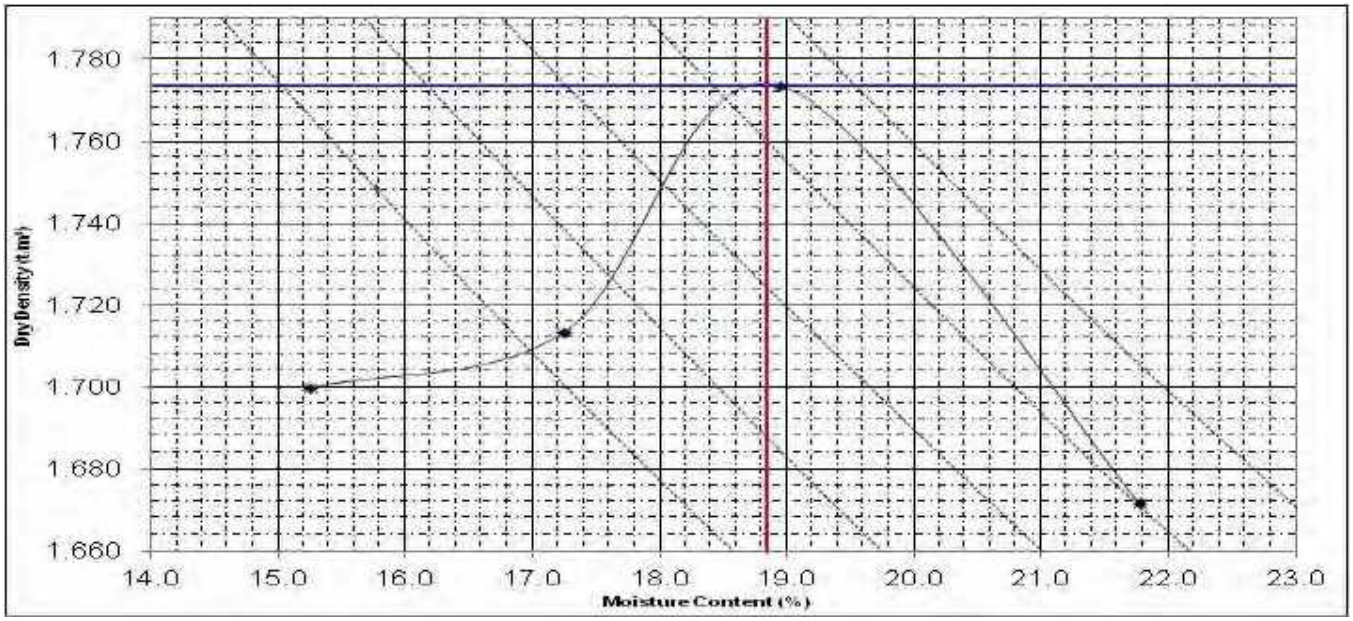
Rear of 17 Stockyard Way
West Kalgoorlie WA 6430

Client:	Knight Piesold Pty Ltd	Client Job No:	
Project:	Mungari TSF Cell3 SI	Order No:	
Location:	Mungari	Tested Date:	6/04/2017
SGS Job Number:	17-03-221	Sample No:	17-KG-656
Lab:	Kalgoorlie Soils Laboratory	Sample ID:	TP11 2.0 to 2.7

DRY DENSITY / MOISTURE RELATIONSHIP OF A SOIL

AS1289.5.2.1 (Modified Compactive Effort)



Sample Description:	Clay
Modified MDD (t/m3)	**1.77**
Modified OMC (%)	**19.0**
Oversize Sieve (mm)	19.0
Percent Wet Oversize (%)	0
Moisture Content Method	AS1289.2.1.1

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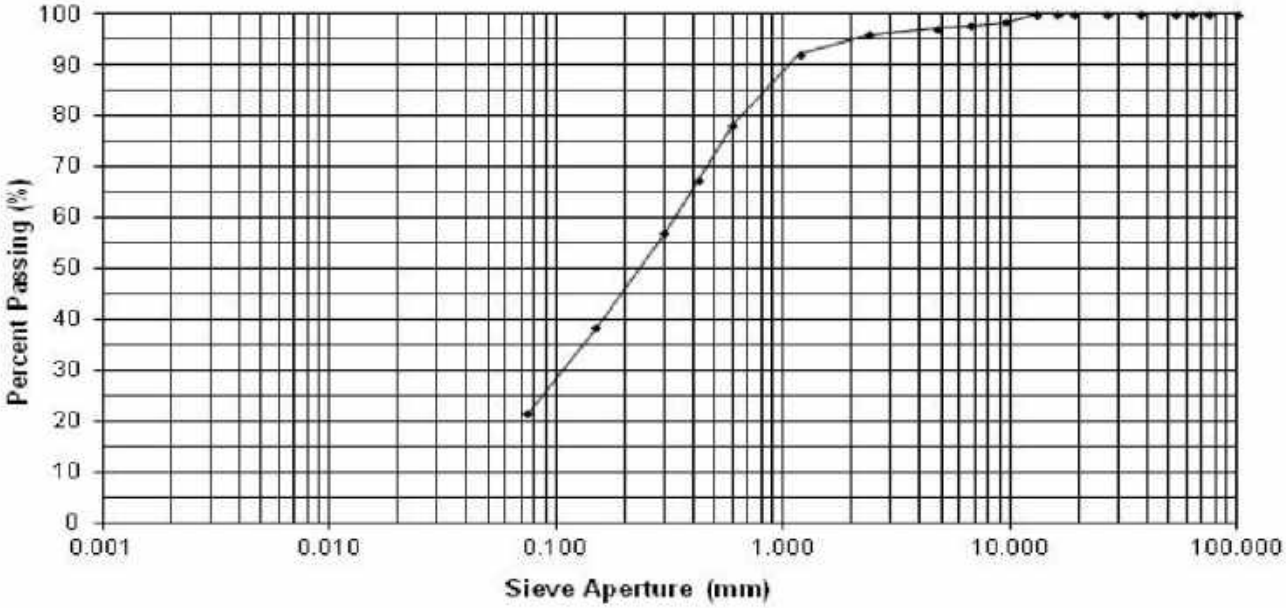
Client:	Knight Piesold Pty Ltd	Client Job No:	
Project:	Mungari TSF Cell3 SI	Order No:	
Location:	Mungari	Tested Date:	14/04/2017
SGS Job Number:	17-03-221	Sample No:	17-KG-657
Lab:	Kalgoorlie Soils Laboratory	Sample ID:	TP12 0.5 to 1.0

Particle Size Distibution of a Soil

AS1289.3.6.1



Sieve Size (mm)	% Passing	Sieve Size (mm)	% Passing
100	100	9.5	98
75	100	6.7	98
63	100	4.75	97
53	100	2.36	96
37.5	100	1.18	92
26.5	100	0.6	78
19.0	100	0.425	67
16.0	100	0.300	57
13.2	100	0.150	38
		0.075	21

Note: Sample supplied by client.
Moisture mass less than 300 grams

[redacted]

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Client:	Knight Piesold Pty Ltd	Client Job No:	
Project:	Mungari TSF Cell3 SI	Order No:	
Location:	Mungari	Tested Date:	18/04/2017
SGS Job Number:	17-03-221	Sample No:	17-KG-657
Lab:	Kalgoorlie Soils Laboratory	Sample ID:	TP12 0.5 to 1.0

Atterberg Limits (1 Point Casagrande) with Linear Shrinkage

AS 1289.3.1.2(Liquid Limit), 3.2.1(Liquid Limit), 3.3.1(Plasicity Index), 3.4.1(Linear Shrinkage)

Liquid Limit (%):	**42**
Plastic Limit (%):	**25**
Plastic Index (%):	**17**
Linear Shrinkage (%):	**9.0**
Nature of shrinkage:	Cracked
Length of Mould (mm):	250
History of Sample:	Air Dried
Method of Preparation:	Dry Sieved

Note: Sample supplied by client.

[redacted]

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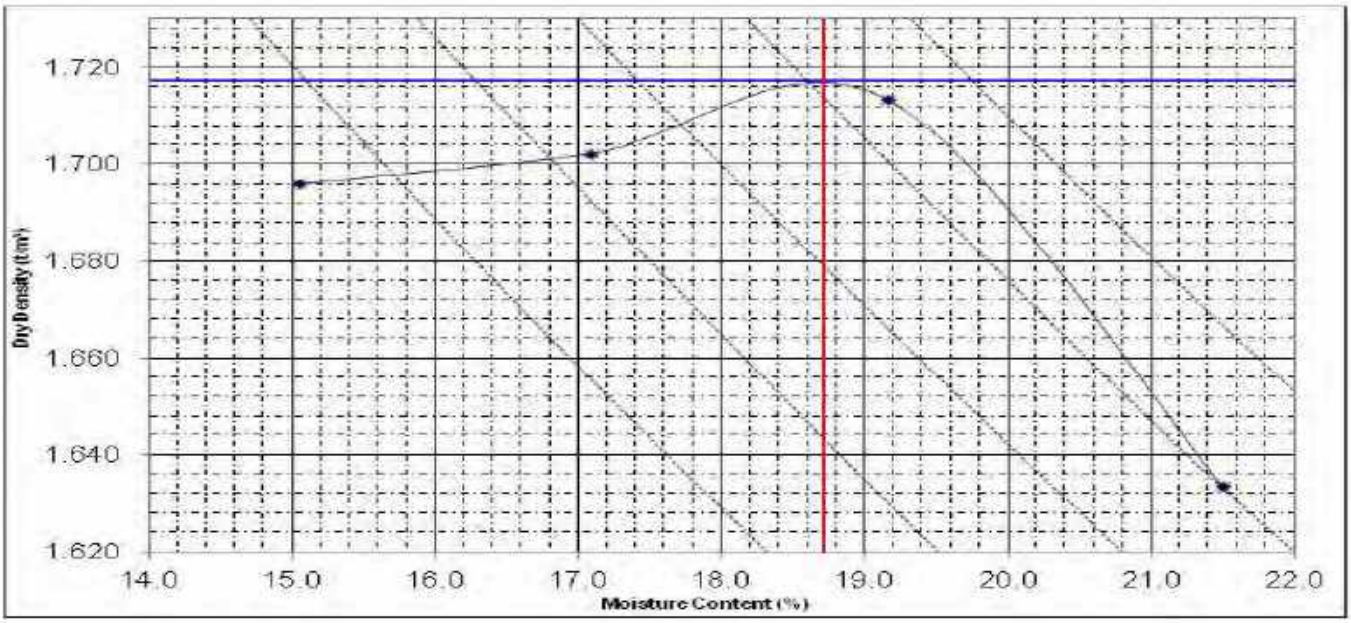
Client:	Knight Piesold Pty Ltd	Client Job No:	
Project:	Mungari TSF Cell3 SI	Order No:	
Location:	Mungari	Tested Date:	6/04/2017
SGS Job Number:	17-03-221	Sample No:	17-KG-657
Lab:	Kalgoorlie Soils Laboratory	Sample ID:	TP12 0.5 to 1.0

DRY DENSITY / MOISTURE RELATIONSHIP OF A SOIL

AS1289.5.2.1 (Modified Compactive Effort)



Sample Description:	Clay
Modified MDD (t/m3)	**1.72**
Modified OMC (%)	**18.5**
Oversize Sieve (mm)	19.0
Percent Wet Oversize (%)	0
Moisture Content Method	AS1289.2.1.1

[redacted]

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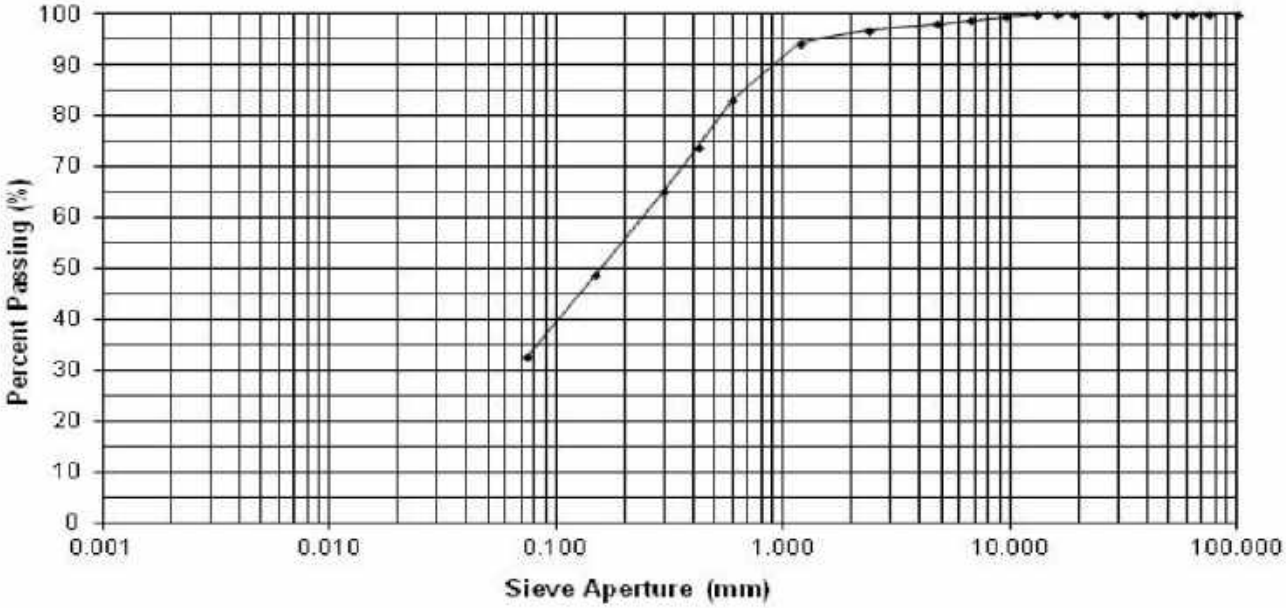
Client:	Knight Piesold Pty Ltd	Client Job No:	
Project:	Mungari TSF Cell3 SI	Order No:	
Location:	Mungari	Tested Date:	14/04/2017
SGS Job Number:	17-03-221	Sample No:	17-KG-658
Lab:	Kalgoorlie Soils Laboratory	Sample ID:	TP120.5 to 1.0 Reconstituted Material From MMDD

Particle Size Distibution of a Soil

AS1289.3.6.1



Sieve Size (mm)	% Passing	Sieve Size (mm)	% Passing
100	100	9.5	99
75	100	6.7	99
63	100	4.75	98
53	100	2.36	97
37.5	100	1.18	94
26.5	100	0.6	83
19.0	100	0.425	74
16.0	100	0.300	65
13.2	100	0.150	49
		0.075	33

Note: Sample supplied by client.

[redacted]

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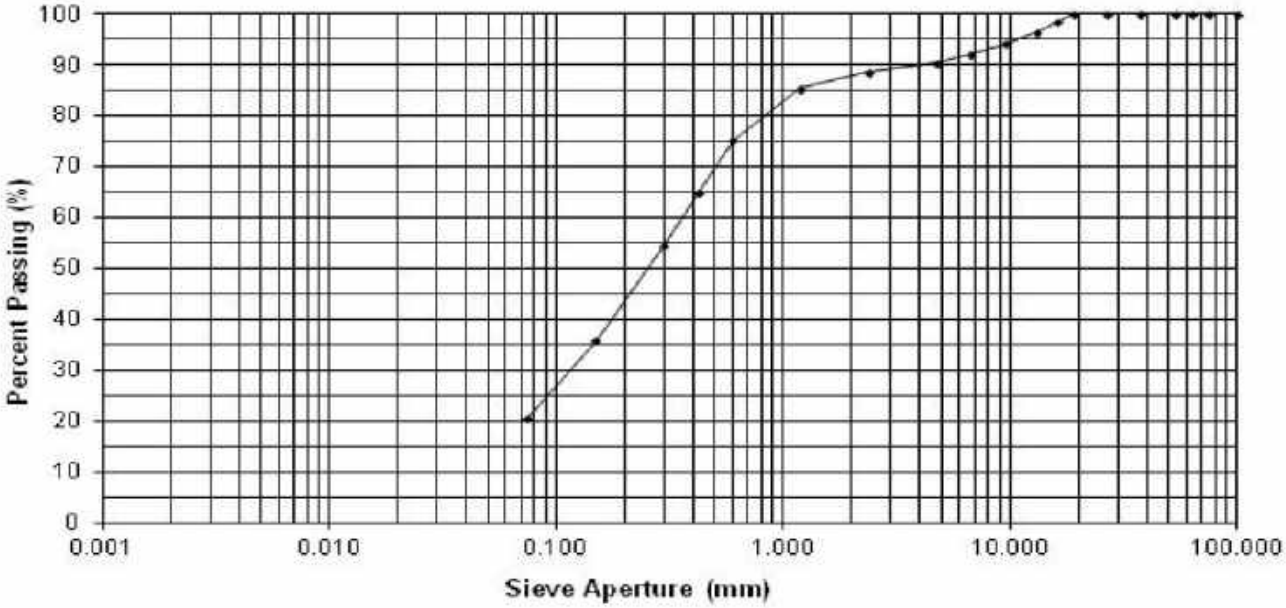
Client:	Knight Piesold Pty Ltd	Client Job No:	
Project:	Mungari TSF Cell3 SI	Order No:	
Location:	Mungari	Tested Date:	14/04/2017
SGS Job Number:	17-03-221	Sample No:	17-KG-659
Lab:	Kalgoorlie Soils Laboratory	Sample ID:	TP16 0.5 to 1.0

Particle Size Distibution of a Soil

AS1289.3.6.1



Sieve Size (mm)	% Passing	Sieve Size (mm)	% Passing
100	100	9.5	94
75	100	6.7	92
63	100	4.75	90
53	100	2.36	89
37.5	100	1.18	85
26.5	100	0.6	75
19.0	100	0.425	65
16.0	98	0.300	54
13.2	97	0.150	36
		0.075	21

Note: Sample supplied by client.

[redacted]

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Client:	Knight Piesold Pty Ltd	Client Job No:	
Project:	Mungari TSF Cell3 SI	Order No:	
Location:	Mungari	Tested Date:	18/04/2017
SGS Job Number:	17-03-221	Sample No:	17-KG-659
Lab:	Kalgoorlie Soils Laboratory	Sample ID:	TP16 0.5 to 1.0

Atterberg Limits (1 Point Casagrande) with Linear Shrinkage

AS 1289.3.1.2(Liquid Limit), 3.2.1(Liquid Limit), 3.3.1(Plasicity Index), 3.4.1(Linear Shrinkage)

Liquid Limit (%):	**44**
Plastic Limit (%):	**23**
Plastic Index (%):	**21**
Linear Shrinkage (%):	**8.5**
Nature of shrinkage:	Cracked
Length of Mould (mm):	250
History of Sample:	Air Dried
Method of Preparation:	Dry Sieved

Note: Sample supplied by client.

[redacted]

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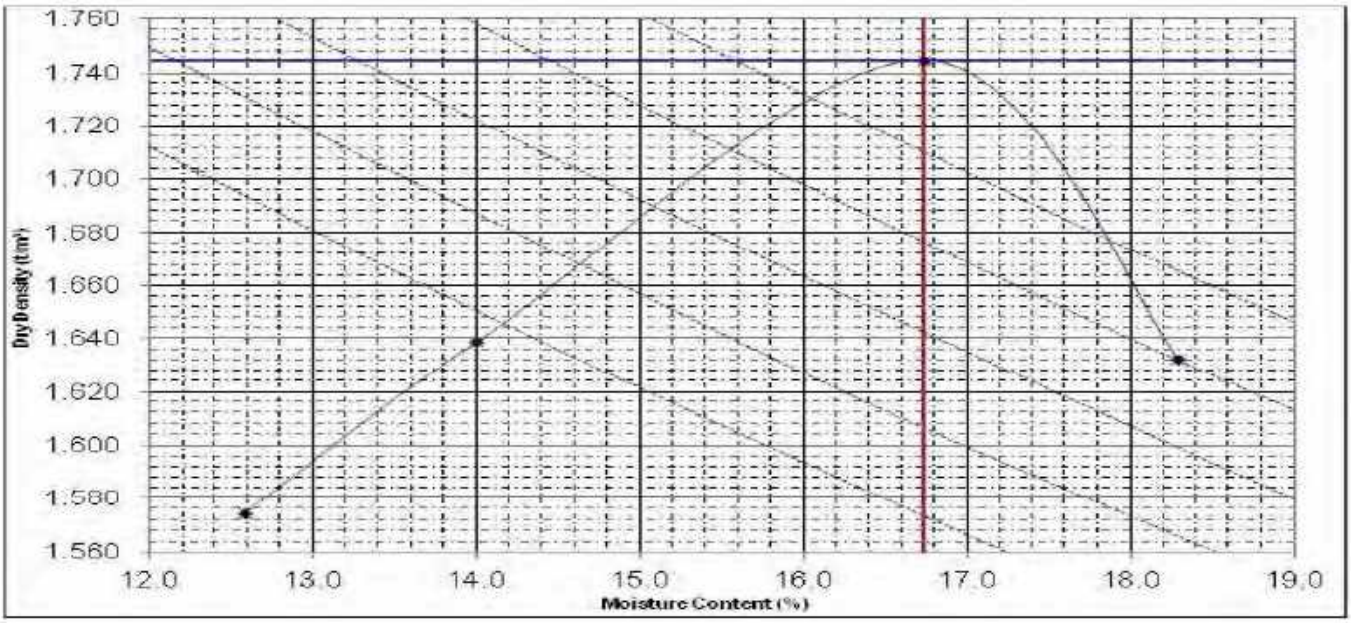
Client:	Knight Piesold Pty Ltd	Client Job No:	
Project:	Mungari TSF Cell3 SI	Order No:	
Location:	Mungari	Tested Date:	6/04/2017
SGS Job Number:	17-03-221	Sample No:	17-KG-659
Lab:	Kalgoorlie Soils Laboratory	Sample ID:	TP16 0.5 to 1.0

DRY DENSITY / MOISTURE RELATIONSHIP OF A SOIL

AS1289.5.2.1 (Modified Compactive Effort)



Sample Description:	Fine Clay
Modified MDD (t/m3)	**1.74**
Modified OMC (%)	**16.5**
Oversize Sieve (mm)	19.0
Percent Wet Oversize (%)	0
Moisture Content Method	AS1289.2.1.1

[redacted]

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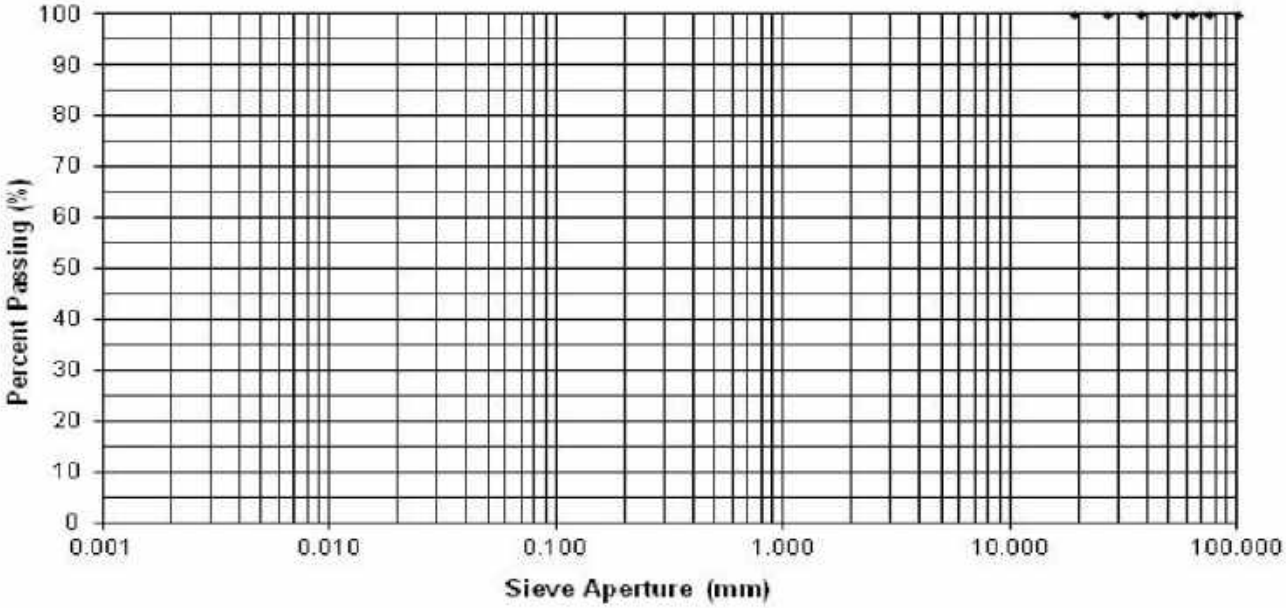
Client:	Knight Piesold Pty Ltd	Client Job No:	
Project:	Mungari TSF Cell3 SI	Order No:	
Location:	Mungari	Tested Date:	14/04/2017
SGS Job Number:	17-03-221	Sample No:	17-KG-660
Lab:	Kalgoorlie Soils Laboratory	Sample ID:	TP16 0.5 to 1.0 Reconstituted Material From MMDD

Particle Size Distibution of a Soil

AS1289.3.6.1



Sieve Size (mm)	% Passing	Sieve Size (mm)	% Passing
100	100	9.5	
75	100	6.7	
63	100	4.75	
53	100	2.36	
37.5	100	1.18	
26.5	100	0.6	
19.0	100	0.425	
16.0		0.300	
13.2		0.150	
		0.075	

Note: Sample supplied by client.

[redacted]

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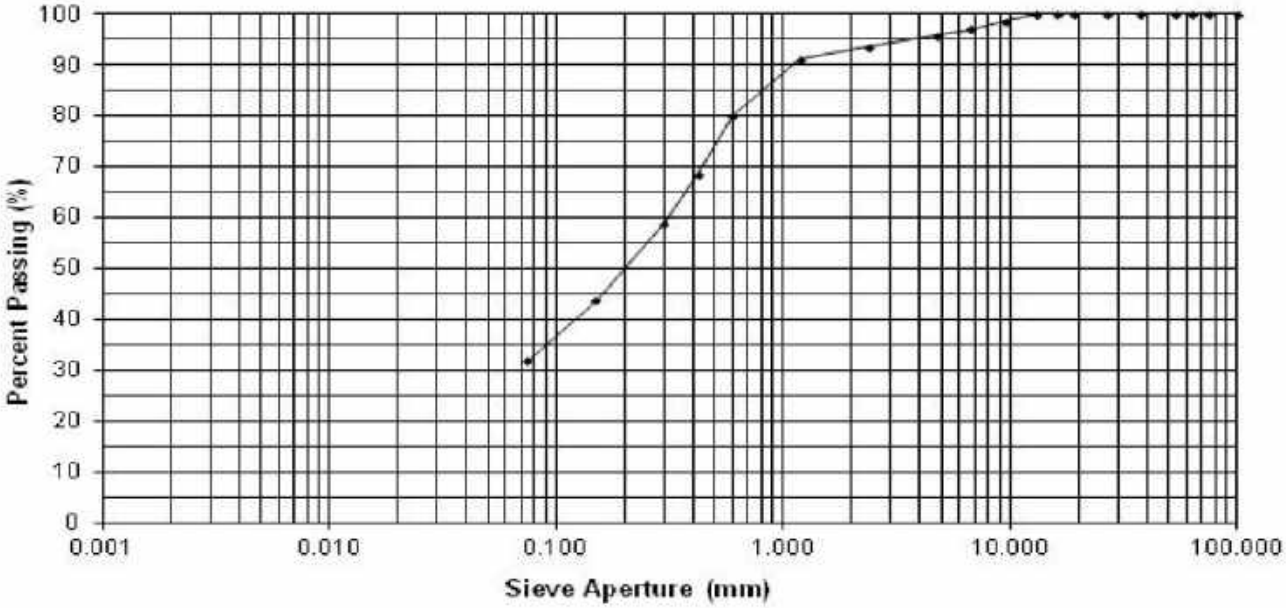
Rear of 17 Stockyard Way
West Kalgoorlie WA 6430

Client:	Knight Piesold Pty Ltd	Client Job No:	
Project:	Mungari TSF Cell3 SI	Order No:	
Location:	Mungari	Tested Date:	14/04/2017
SGS Job Number:	17-03-221	Sample No:	17-KG-661
Lab:	Kalgoorlie Soils Laboratory	Sample ID:	TP27 0.5 to 1.0

Particle Size Distibution of a Soil

AS1289.3.6.1



Sieve Size (mm)	% Passing	Sieve Size (mm)	% Passing
100	100	9.5	99
75	100	6.7	97
63	100	4.75	96
53	100	2.36	94
37.5	100	1.18	91
26.5	100	0.6	80
19.0	100	0.425	69
16.0	100	0.300	59
13.2	100	0.150	44
		0.075	32

Note: Sample supplied by client.

[redacted]

Date: 20/04/2017

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SGS Australia Pty Ltd
Kalgoorlie Soils Laboratory
Rear of 17 Stockyard Way
West Kalgoorlie WA 6430

Client:	Knight Piesold Pty Ltd	Client Job No:	
Project:	Mungari TSF Cell3 SI	Order No:	
Location:	Mungari	Tested Date:	18/04/2017
SGS Job Number:	17-03-221	Sample No:	17-KG-661
Lab:	Kalgoorlie Soils Laboratory	Sample ID:	TP27 0.5 to 1.0

Atterberg Limits (1 Point Casagrande) with Linear Shrinkage

AS 1289.3.1.2(Liquid Limit), 3.2.1(Liquid Limit), 3.3.1(Plasicity Index), 3.4.1(Linear Shrinkage)

Liquid Limit (%):	**37**
Plastic Limit (%):	**18**
Plastic Index (%):	**19**
Linear Shrinkage (%):	**8.0**
Nature of shrinkage:	Cracked
Length of Mould (mm):	250
History of Sample:	Air Dried
Method of Preparation:	Dry Sieved

Note: Sample supplied by client.

[redacted]

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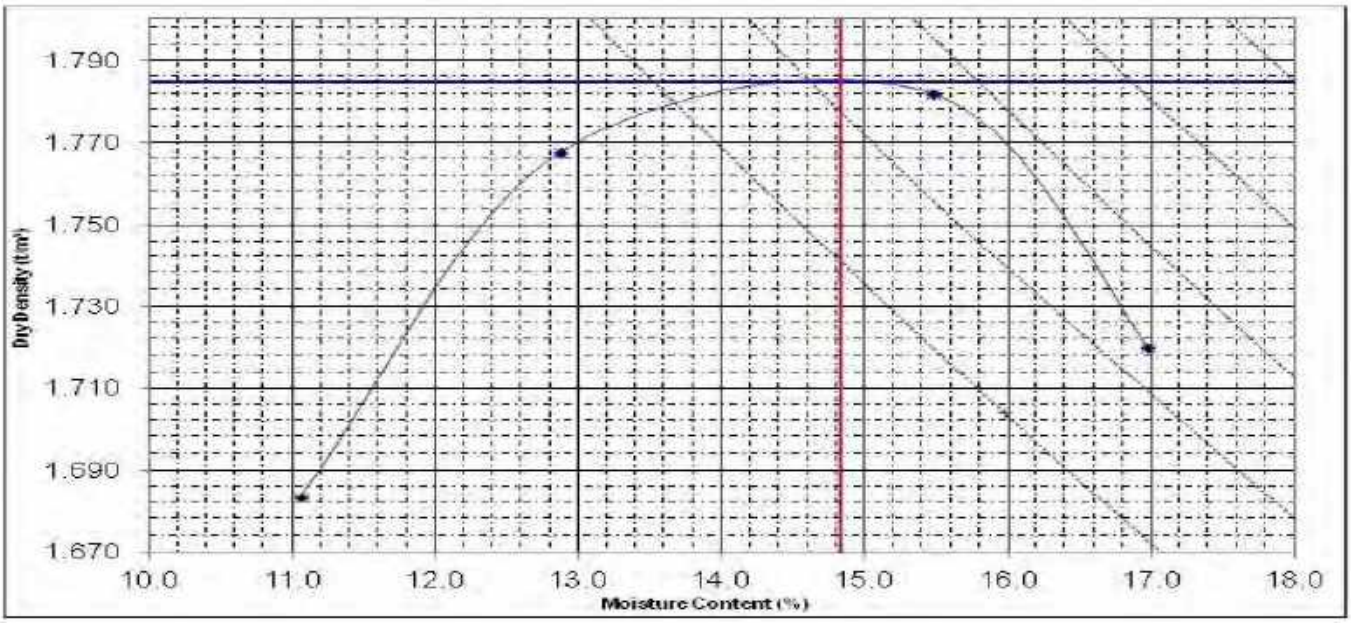
Kalgoorlie Soils Laboratory
Rear of 17 Stockyard Way
West Kalgoorlie WA 6430

Client:	Knight Piesold Pty Ltd	Client Job No:	
Project:	Mungari TSF Cell3 SI	Order No:	
Location:	Mungari	Tested Date:	6/04/2017
SGS Job Number:	17-03-221	Sample No:	17-KG-661
Lab:	Kalgoorlie Soils Laboratory	Sample ID:	TP27 0.5 to 1.0

DRY DENSITY / MOISTURE RELATIONSHIP OF A SOIL

AS1289.5.2.1 (Modified Compactive Effort)



Sample Description:	Fine Clay
Modified MDD (t/m3)	**1.78**
Modified OMC (%)	**15.0**
Oversize Sieve (mm)	19.0
Percent Wet Oversize (%)	0
Moisture Content Method	AS1289.2.1.1

[redacted]

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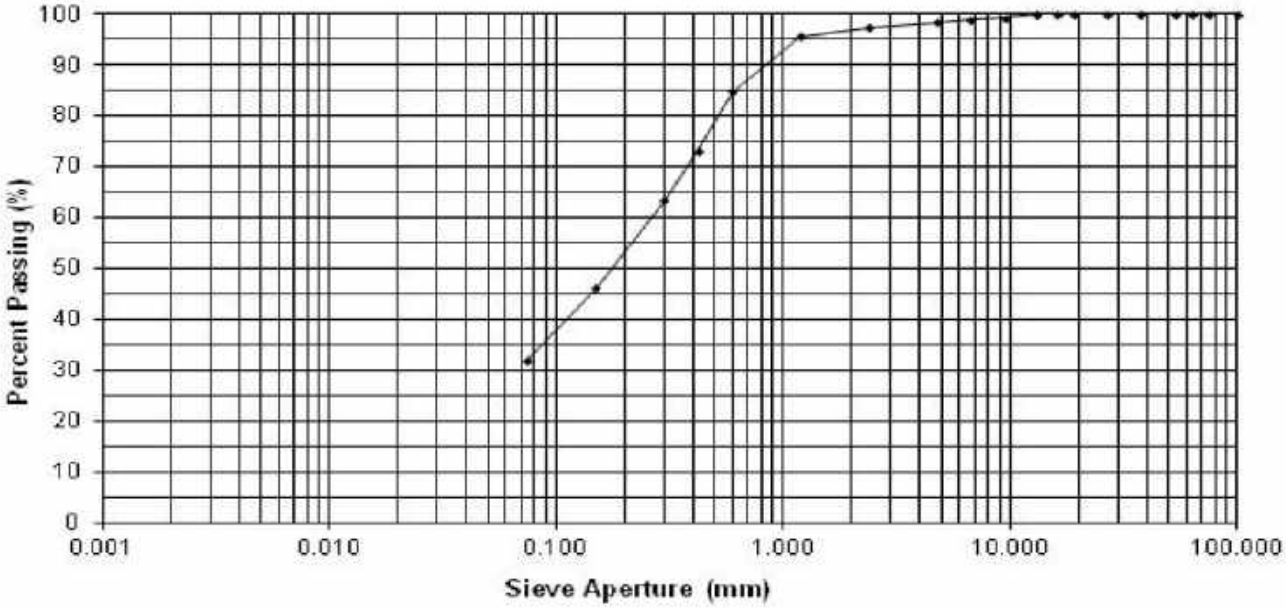
SGS Australia Pty Ltd
Kalgoorlie Soils Laboratory
Rear of 17 Stockyard Way
West Kalgoorlie WA 6430

Client:	Knight Piesold Pty Ltd	Client Job No:	
Project:	Mungari TSF Cell3 SI	Order No:	
Location:	Mungari	Tested Date:	14/04/2017
SGS Job Number:	17-03-221	Sample No:	17-KG-662
Lab:	Kalgoorlie Soils Laboratory	Sample ID:	TP27 0.5 to 1.0 Reconstituted Material From MMDD

Particle Size Distibution of a Soil

AS1289.3.6.1



Sieve Size (mm)	% Passing	Sieve Size (mm)	% Passing
100	100	9.5	99
75	100	6.7	99
63	100	4.75	98
53	100	2.36	97
37.5	100	1.18	96
26.5	100	0.6	85
19.0	100	0.425	73
16.0	100	0.300	63
13.2	100	0.150	46
		0.075	32

Note: Sample supplied by client.

[redacted]

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Kalgoorlie Soils Laboratory
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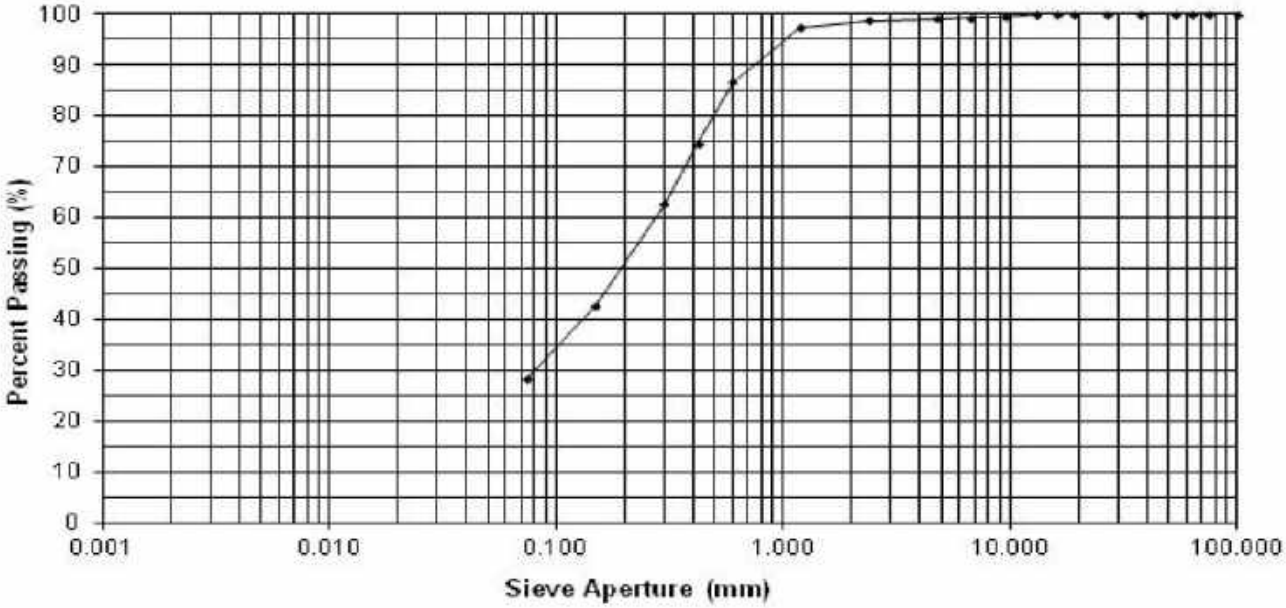
West Kalgoorlie WA 6430

Client:	Knight Piesold Pty Ltd	Client Job No:	
Project:	Mungari TSF Cell3 SI	Order No:	
Location:	Mungari	Tested Date:	14/04/2017
SGS Job Number:	17-03-221	Sample No:	17-KG-663
Lab:	Kalgoorlie Soils Laboratory	Sample ID:	TP35 0.5 to 1.0

Particle Size Distibution of a Soil

AS1289.3.6.1



Sieve Size (mm)	% Passing	Sieve Size (mm)	% Passing
100	100	9.5	100
75	100	6.7	99
63	100	4.75	99
53	100	2.36	99
37.5	100	1.18	97
26.5	100	0.6	87
19.0	100	0.425	75
16.0	100	0.300	63
13.2	100	0.150	43
		0.075	28

Note: Sample supplied by client.

[redacted]

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Kalgoorlie Soils Laboratory
Rear of 17 Stockyard Way
West Kalgoorlie WA 6430

Client:	Knight Piesold Pty Ltd	Client Job No:	
Project:	Mungari TSF Cell3 SI	Order No:	
Location:	Mungari	Tested Date:	18/04/2017
SGS Job Number:	17-03-221	Sample No:	17-KG-663
Lab:	Kalgoorlie Soils Laboratory	Sample ID:	TP35 0.5 to 1.0

Atterberg Limits (1 Point Casagrande) with Linear Shrinkage

AS 1289.3.1.2(Liquid Limit), 3.2.1(Liquid Limit), 3.3.1(Plasicity Index), 3.4.1(Linear Shrinkage)

Liquid Limit (%):	**29**
Plastic Limit (%):	**15**
Plastic Index (%):	**14**
Linear Shrinkage (%):	**6.0**
Nature of shrinkage:	Cracked
Length of Mould (mm):	254
History of Sample:	Air Dried
Method of Preparation:	Dry Sieved

Note: Sample supplied by client.

[redacted]

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Kalgoorlie Soils Laboratory
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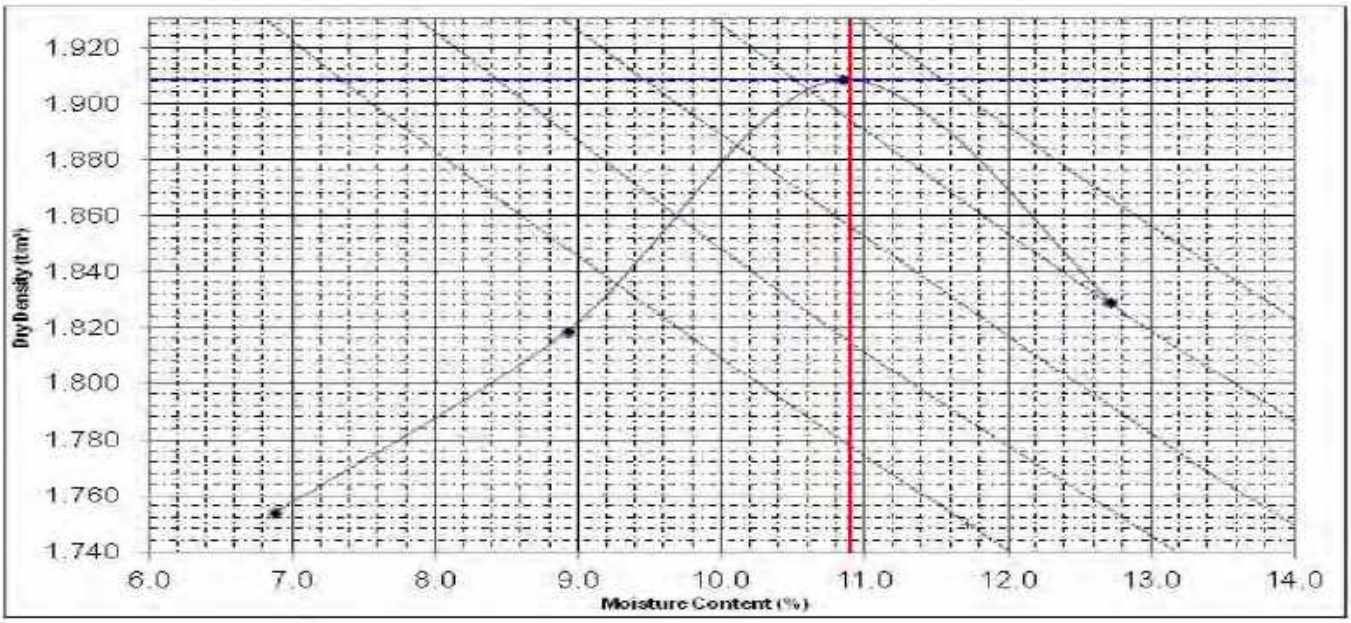
Client:	Knight Piesold Pty Ltd	Client Job No:	
Project:	Mungari TSF Cell3 SI	Order No:	
Location:	Mungari	Tested Date:	6/04/2017
SGS Job Number:	17-03-221	Sample No:	17-KG-663
Lab:	Kalgoorlie Soils Laboratory	Sample ID:	TP35 0.5 to 1.0

DRY DENSITY / MOISTURE RELATIONSHIP OF A SOIL

AS1289.5.2.1 (Modified Compactive Effort)



Sample Description:	Fine Clay
Modified MDD (t/m3)	**1.91**
Modified OMC (%)	**11.0**
Oversize Sieve (mm)	19.0
Percent Wet Oversize (%)	0
Moisture Content Method	AS1289.2.1.1

[redacted]

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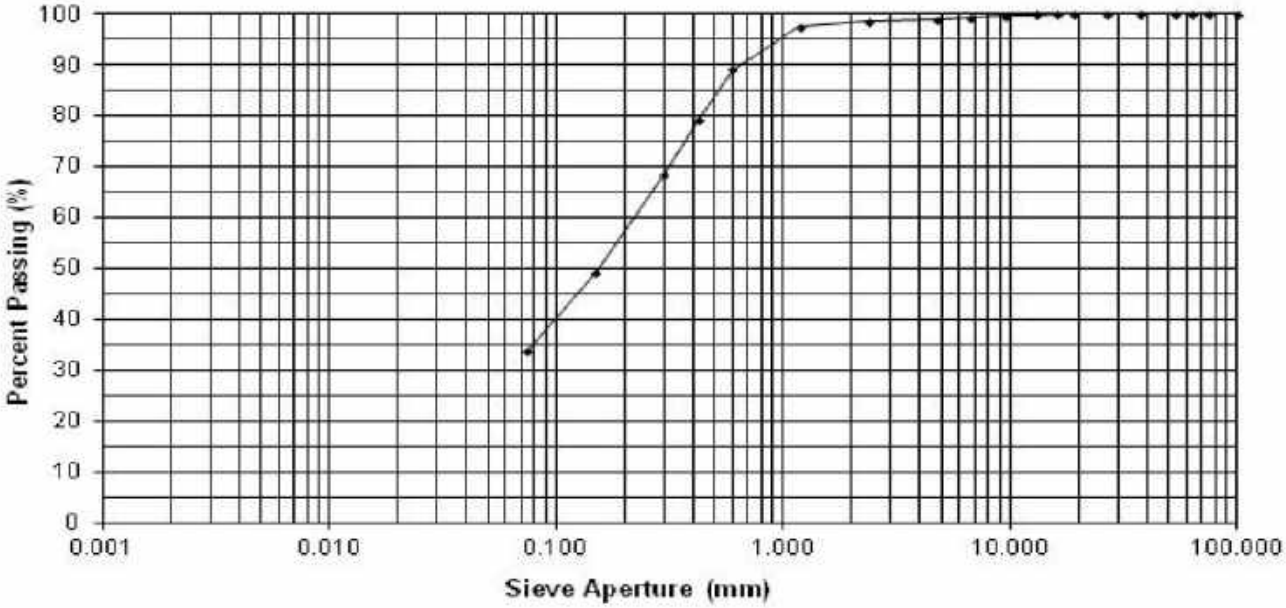
Kalgoorlie Soils Laboratory
Rear of 17 Stockyard Way
West Kalgoorlie WA 6430

Client:	Knight Piesold Pty Ltd	Client Job No:	
Project:	Mungari TSF Cell3 SI	Order No:	
Location:	Mungari	Tested Date:	14/04/2017
SGS Job Number:	17-03-221	Sample No:	17-KG-664
Lab:	Kalgoorlie Soils Laboratory	Sample ID:	TP35 0.5 to 1.0 Reconstituted Material From MMDD

Particle Size Distibution of a Soil

AS1289.3.6.1



Sieve Size (mm)	% Passing	Sieve Size (mm)	% Passing
100	100	9.5	100
75	100	6.7	99
63	100	4.75	99
53	100	2.36	99
37.5	100	1.18	98
26.5	100	0.6	89
19.0	100	0.425	79
16.0	100	0.300	69
13.2	100	0.150	49
		0.075	34

Note: Sample supplied by client.

[redacted]

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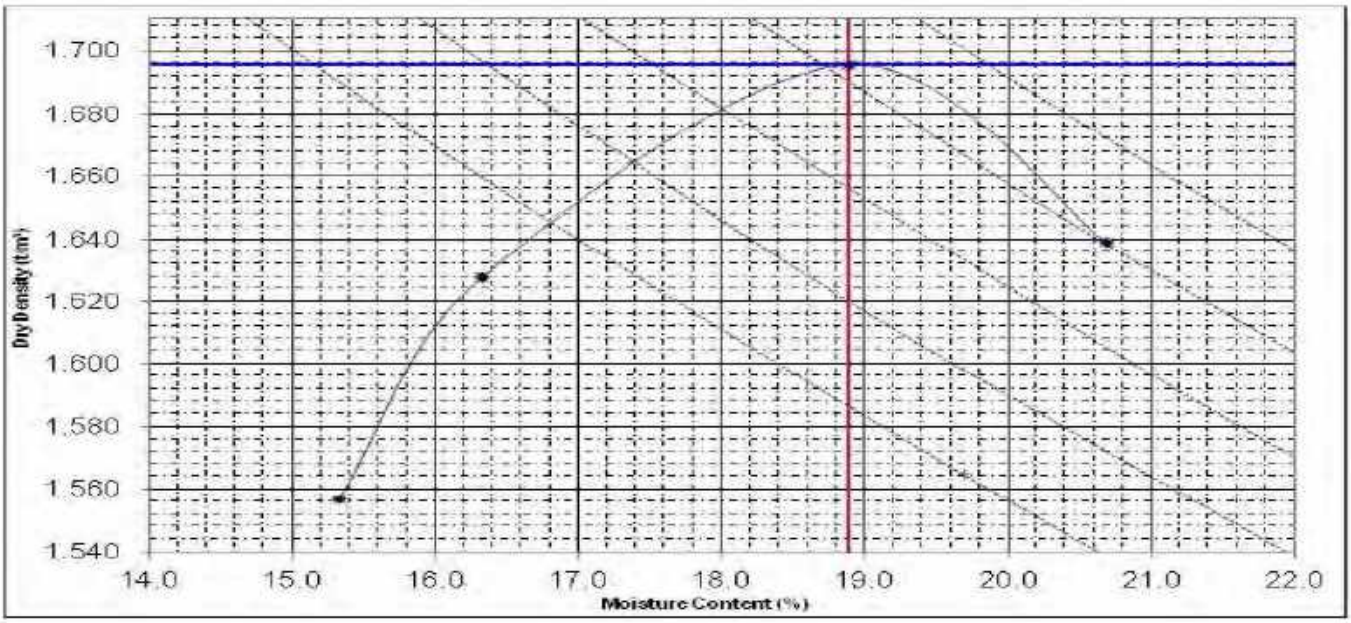
Kalgoorlie Soils Laboratory
Rear of 17 Stockyard Way
West Kalgoorlie WA 6430

Client:	Knight Piesold Pty Ltd	Client Job No:	
Project:	Mungari TSF Cell3 SI	Order No:	
Location:	Mungari	Tested Date:	18/04/2017
SGS Job Number:	17-03-221	Sample No:	17-KG-870
Lab:	Kalgoorlie Soils Laboratory	Sample ID:	TP4 2.5-2.8

DRY DENSITY / MOISTURE RELATIONSHIP OF A SOIL

AS1289.5.2.1 (Modified Compactive Effort)



Sample Description:	Sandy Clay
Modified MDD (t/m3)	**1.7**
Modified OMC (%)	**19.0**
Oversize Sieve (mm)	19.0
Percent Wet Oversize (%)	0
Moisture Content Method	AS1289.2.1.1

[redacted]

Date: 20/04/2017

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Unit 3, 34 Sphinx Way
Bibra Lake
WA, 6163

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E-Precision Laboratory

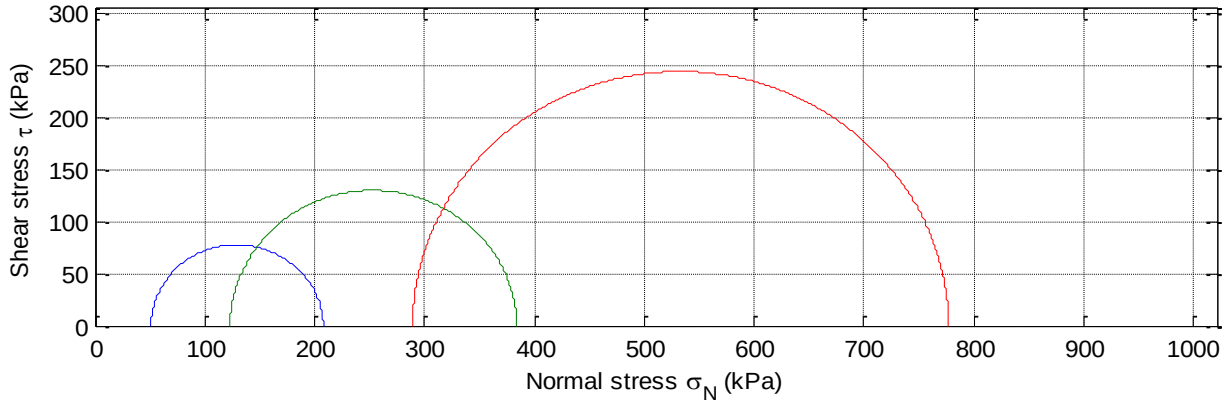
MULTI-STAGE CONSOLIDATED UNDRAINED TRIAXIAL TEST

Method: AS1289.6.4.2 / In-house Method

Client:	Knight Piesold			Date Tested:	3/04/2017
Project:	Mungari Gold Project			EP Lab Job Number:	KP
Sample No:	TSF Cell 3			Lab:	EPLab
Sample ID:	TSF_BH02_KP01_CU3				
Depth (m):	4.50 - 5.00			Room Temperature at Test:	~ 18°c
Tested by:	PHIL	Initial Moisture (%):	37.39	Strain Rate (mm/min):	0.007
Height (mm):	133.59	Final Moisture (%):	33.21	Skempton's (B):	0.99
Diameter (mm):	63.94	Bulk Density (t/m³):	1.87	Geology:	-
L/D Ratio:	2.09	Dry Density (t/m³):	1.36		

Failure Criteria used: Peak Principle Stress Ratio

Mohr Circle Diagram



Interpretations conducted using Matlab

Interpretation from Mohr Circle:	Stage 1 & 2	Stage 1 & 3	Stage 2 & 3
Cohesion C' (kPa):	26.65	27.83	30.16
Angle of Shear Resistance Φ' (Degrees) :	24.80	24.23	23.75

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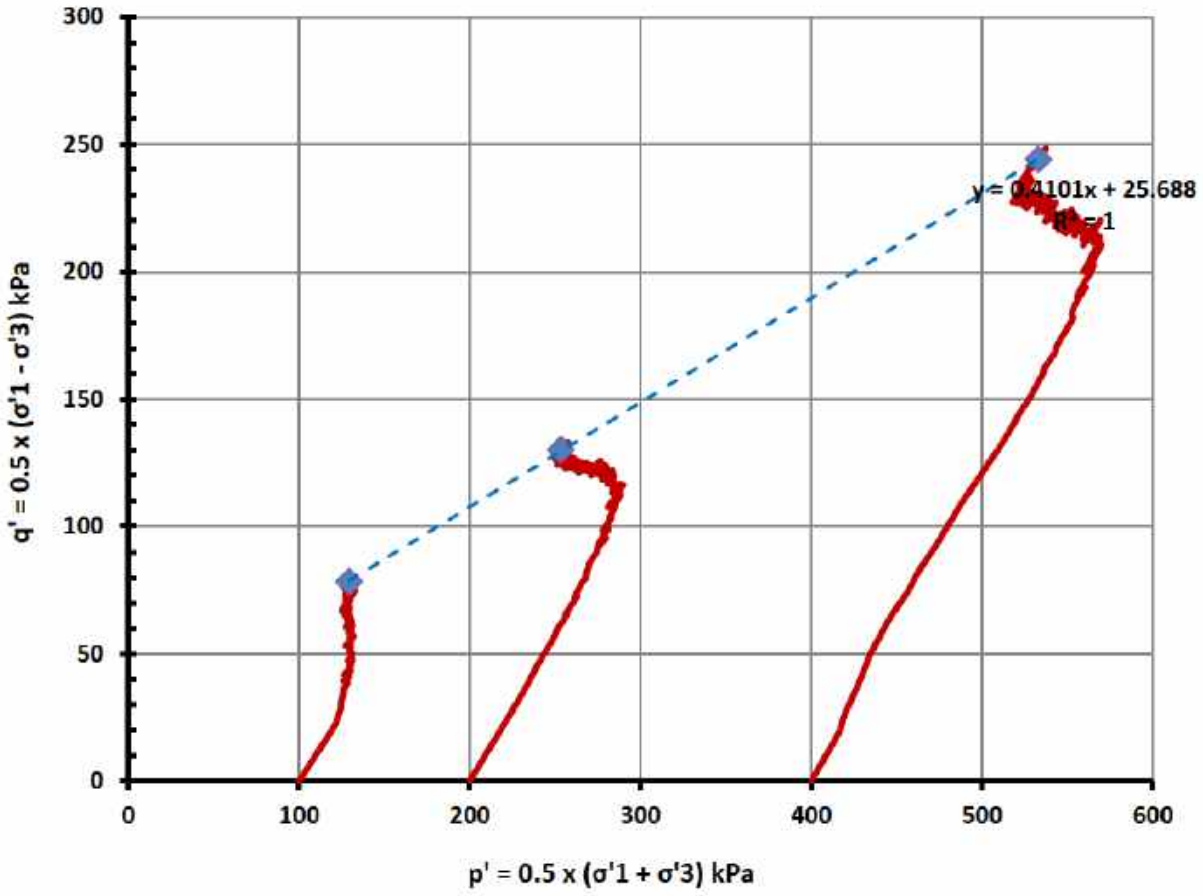
MULTI-STAGE CONSOLIDATED UNDRAINED TRIAXIAL TEST

Method: AS1289.6.4.2 / In-house Method

Client:	Knight Piesold	Date Tested:	3/04/2017
Project:	Mungari Gold Project	EP Lab Job Number:	KP
Sample No:	TSF Cell 3	Lab:	EPLab
Sample ID:	TSF_BH02_KP01_CU3		
Depth (m):	4.50 - 5.00	Room Temperature at Test:	~ 18°C

MIT Effective Stress Path (q' vs p' diagram)



MIT Stress Path - Using Stress Path Tangency Method

Cohesion C' (kPa) :	26.94
Angle of Shear Resistance Φ' (Deg) :	24.65

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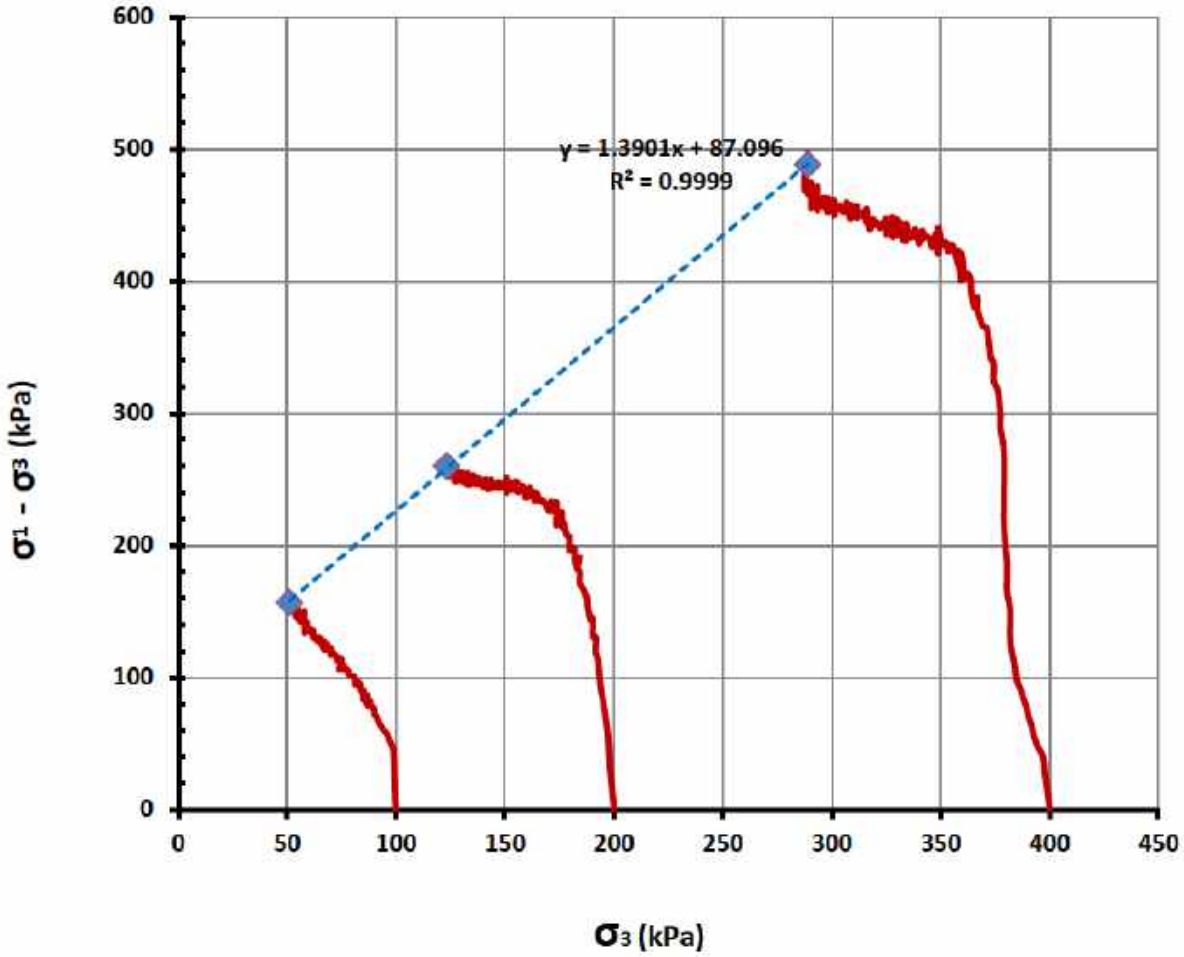
E-Precision Laboratory

MULTI-STAGE CONSOLIDATED UNDRAINED TRIAXIAL TEST

Method: AS1289.6.4.2 / In-house Method

Client:	Knight Piesold	Date Tested:	3/04/2017
Project:	Mungari Gold Project	EP Lab Job Number:	KP
Sample No:	TSF Cell 3	Lab:	EPLab
Sample ID:	TSF_BH02_KP01_CU3		
Depth (m):	4.50 - 5.00	Room Temperature at Test:	~ 18°C

Modified Mohr Coulomb Stress Path



Modified Mohr Coulomb Path - Using Stress Path Tangency Method

Cohesion C' (kPa) :	26.93
Angle of Shear Resistance Φ' (Deg) :	24.64

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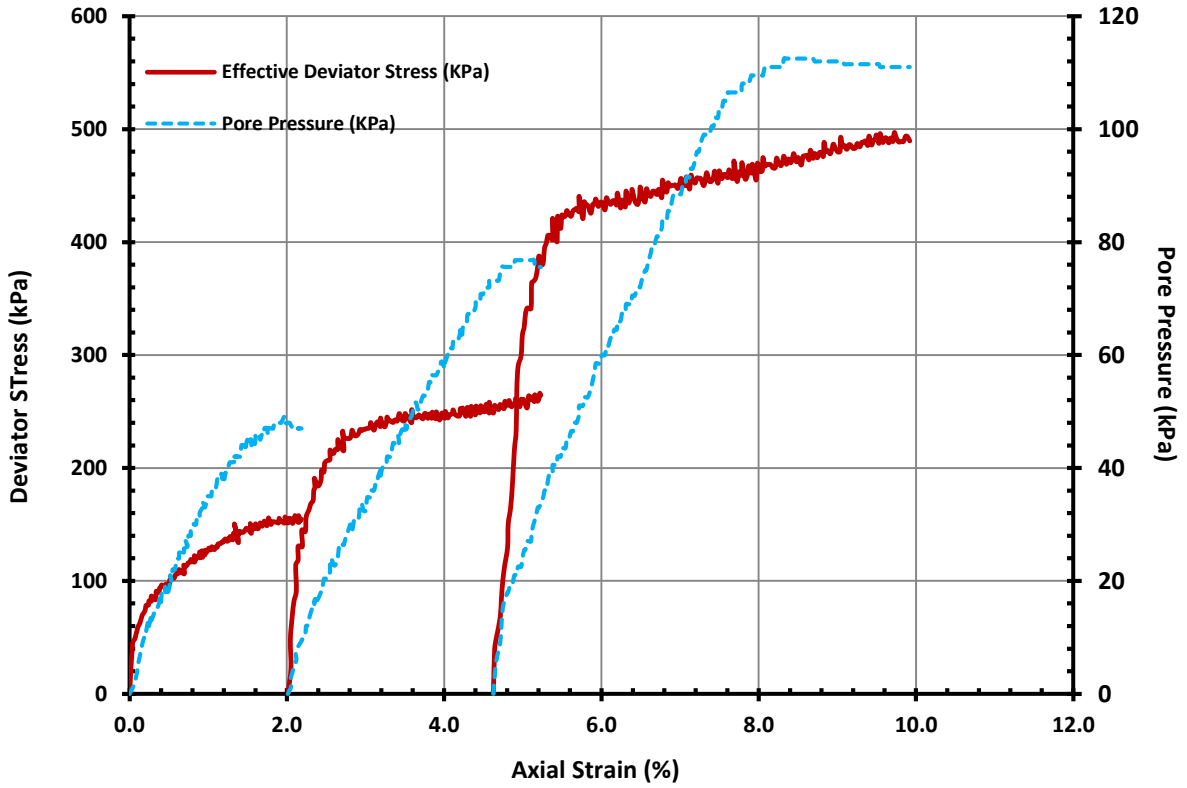
MULTI-STAGE CONSOLIDATED UNDRAINED TRIAXIAL TEST

Method: AS1289.6.4.2 / In-house Method

Client:	Knight Piesold	Date Tested:	3/04/2017
Project:	Mungari Gold Project	EP Lab Job Number:	KP
Sample No:	TSF Cell 3	Lab:	EPLab
Sample ID:	TSF_BH02_KP01_CU3		
Depth (m):	4.50 - 5.00	Room Temperature at Test:	~ 18°C

Deviator Stress Vs Strain Diagram



SHEAR STAGE DATA AND STRESS MEASUREMENTS (kPa)

Shear Stage	Confining Pressure	U'0	U'f	Principal Effective Stresses			σ'1 - σ'3	Strain (%)
				σ'1	σ'3	σ'1 / σ'3		
1	100	0	49	208	51	4.07	157	1.98
2	200	0	77	384	123	3.11	260	4.99
3	400	0	111	777	289	2.69	488	9.58

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E-Precision Laboratory

MULTI-STAGE CONSOLIDATED UNDRAINED TRIAXIAL TEST

Method: AS1289.6.4.2 / In-house Method

Client:	Knight Piesold	Date Tested:	3/04/2017
Project:	Mungari Gold Project	EP Lab Job Number:	KP
Sample No:	TSF Cell 3	Lab:	EPLab
Sample ID:	TSF_BH02_KP01_CU3		
Depth (m):	4.50 - 5.00	Room Temperature at Test:	~ 18°C

Photo After Test

Sample ID: TSF Cell 3 **Depth (m):** 4.50 - 5.00
Lab ID: TSF_BH02_KP01_CU3 **Date Tested:** 3/04/2017

Failure Mode: Shear Failure to Vertical @ 23.7°

Notes:
Stored and Tested the Sample as received
Samples supplied by the Client

[redacted]

NATA: 19078

Authorised Signatory (Geotechnical Engineer):

NATA ACCREDITATION NO: 19078

The results of tests performed apply only to the specific sample at time of test unless otherwise clearly stated. Reference should be made to E-Precision Laboratory's "Standard Terms and Conditions" E-Precision Laboratory ABN 431 559 578 87

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WA, 6163

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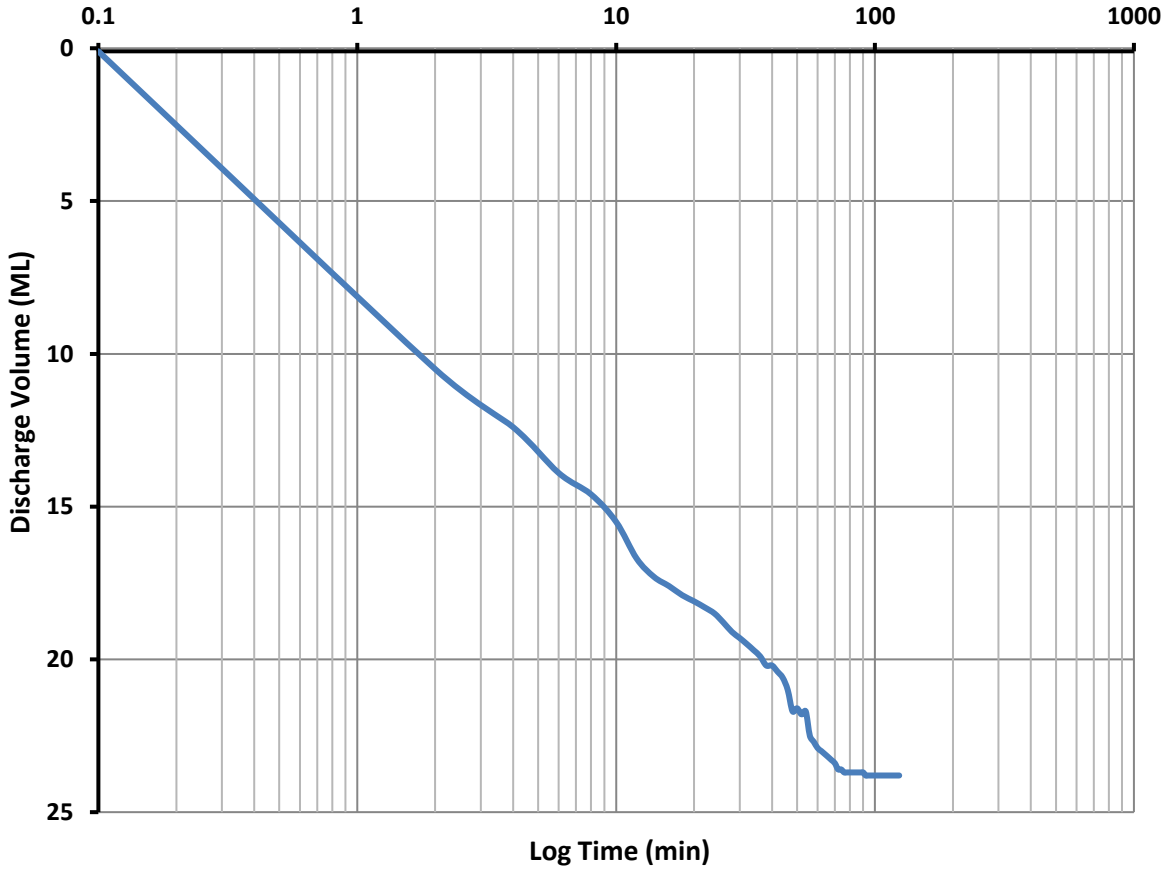
E-Precision Laboratory

MULTI-STAGE CONSOLIDATED UNDRAINED TRIAXIAL TEST

Method: AS1289.6.4.2 / In-house Method

Client:	Knight Piesold	Date Tested:	3/04/2017
Project:	Mungari Gold Project	EP Lab Job Number:	KP
Sample No:	TSF Cell 3	Lab:	EPLab
Sample ID:	TSF_BH02_KP01_CU3		
Depth (m):	4.50 - 5.00	Room Temperature at Test:	~ 18°C

Discharge Volume (ML) Vs Log Time (min)



Cv (cm²/s): 0.016 based on t_{90}

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MULTI-STAGE CONSOLIDATED UNDRAINED TRIAXIAL TEST

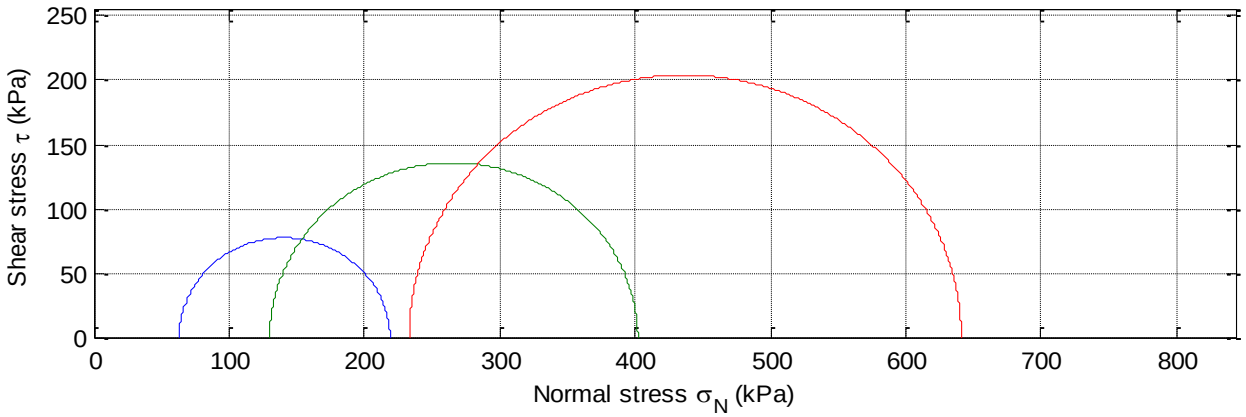
Method: AS1289.6.4.2 / In-house Method

Client:	Knight Piesold	Date Tested:	3/04/2017
Project:	Mungari Gold Project	EP Lab Job Number:	KP
Sample No:	TSF Cell 3	Lab:	EPLab
Sample ID:	TSF_BH03_KP01_CU3		
Depth (m):	4.45 - 4.95	Room Temperature at Test:	~ 18°c

Tested by:	PHIL	Initial Moisture (%):	30.73	Strain Rate (mm/min):	0.005
Height (mm):	125.50	Final Moisture (%):	25.87	Skempton's (B):	0.99
Diameter (mm):	63.59	Bulk Density (t/m³):	2.00	Geology:	-
L/D Ratio:	1.97	Dry Density (t/m³):	1.53		

Failure Criteria used: Peak Principle Stress Ratio

Mohr Circle Diagram



Interpretations conducted using Matlab

Interpretation from Mohr Circle:	Stage 1 & 2	Stage 1 & 3	Stage 2 & 3
Cohesion C' (kPa):	14.20	19.87	32.94
Angle of Shear Resistance Φ' (Degrees) :	27.65	25.17	23.41

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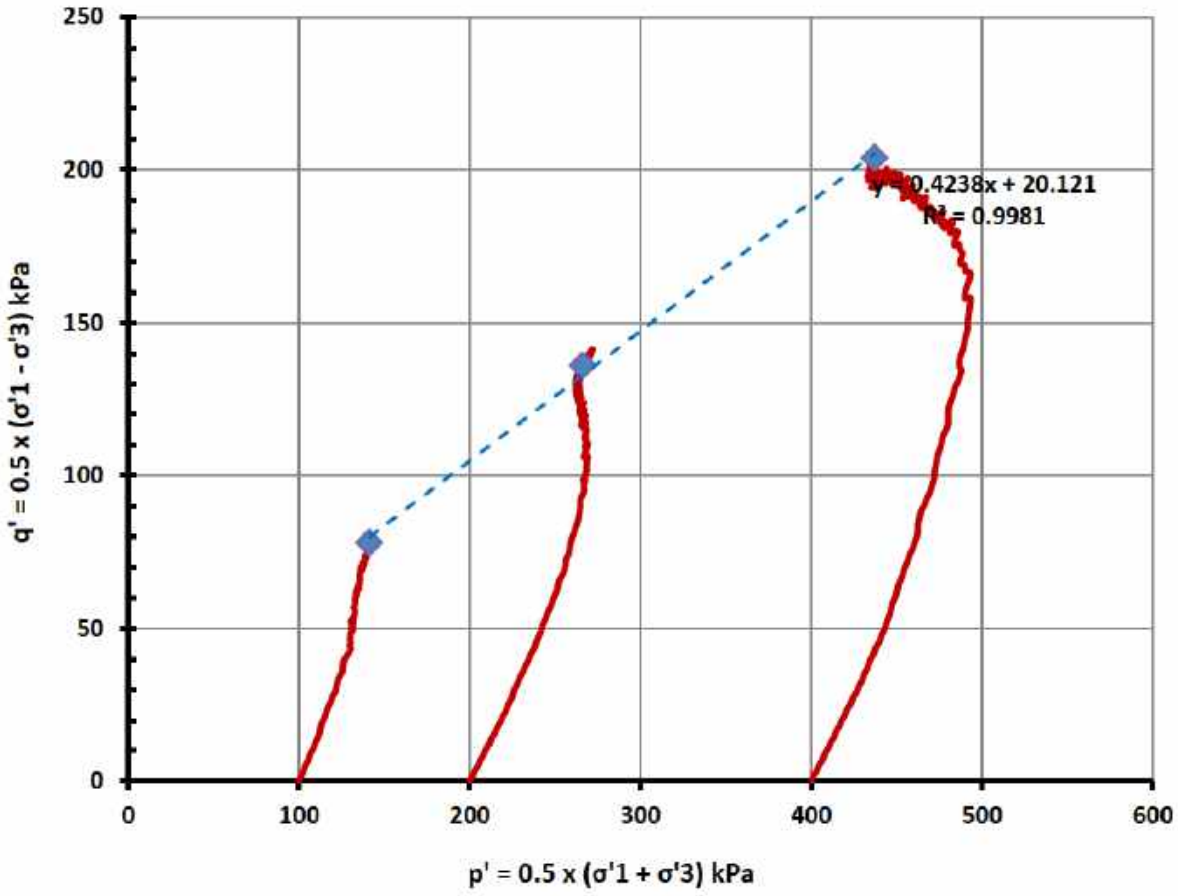
MULTI-STAGE CONSOLIDATED UNDRAINED TRIAXIAL TEST

Method: AS1289.6.4.2 / In-house Method

Client:	Knight Piesold	Date Tested:	3/04/2017
Project:	Mungari Gold Project	EP Lab Job Number:	KP
Sample No:	TSF Cell 3	Lab:	EPLab
Sample ID:	TSF_BH03_KP01_CU3		
Depth (m):	4.45 - 4.95	Room Temperature at Test:	~ 18°C

MIT Effective Stress Path (q' vs p' diagram)



MIT Stress Path - Using Stress Path Tangency Method

Cohesion C' (kPa) :	21.27
Angle of Shear Resistance Φ' (Deg) :	18.95

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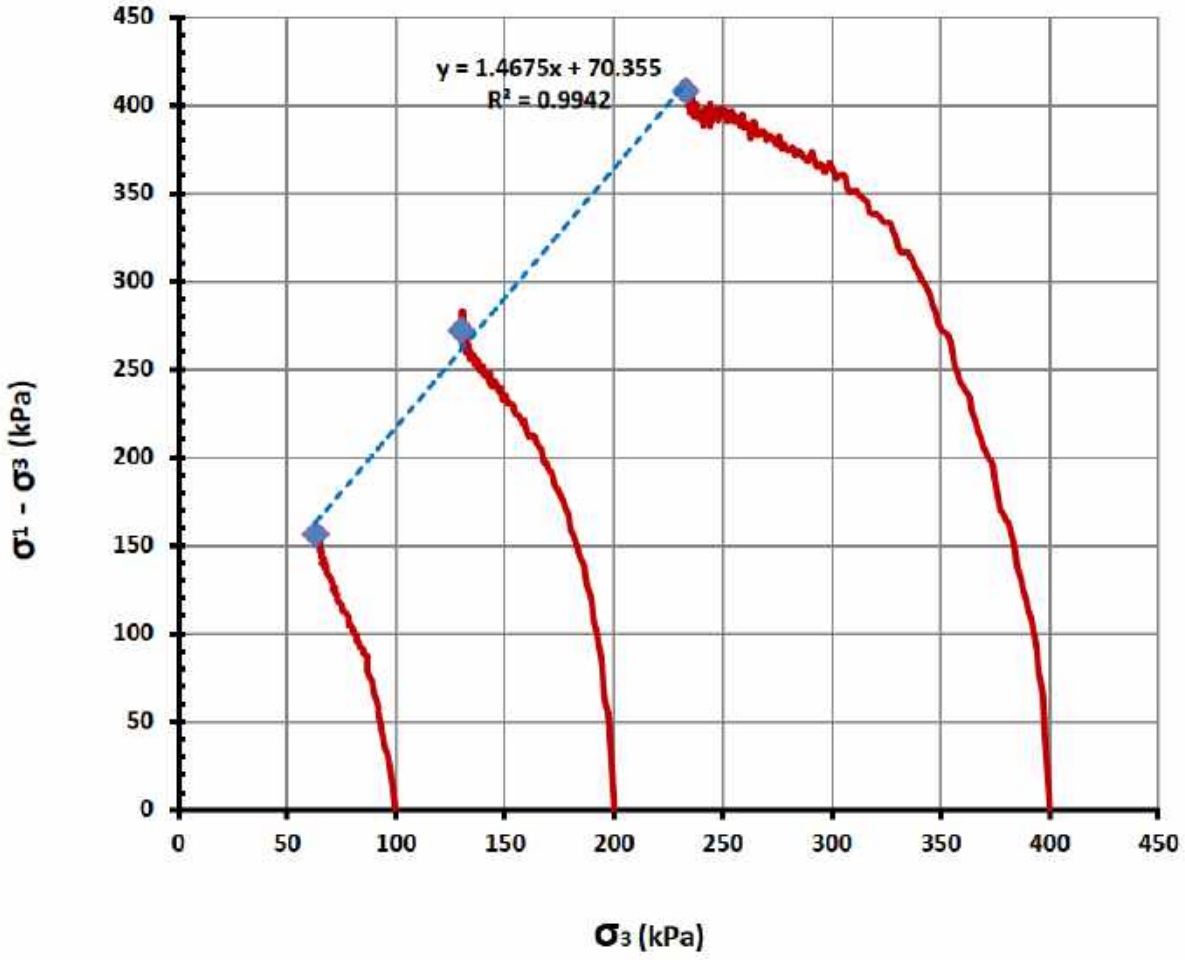
MULTI-STAGE CONSOLIDATED UNDRAINED TRIAXIAL TEST

Method: AS1289.6.4.2 / In-house Method

Client:	Knight Piesold	Date Tested:	3/04/2017
Project:	Mungari Gold Project	EP Lab Job Number:	KP
Sample No:	TSF Cell 3	Lab:	EPLab
Sample ID:	TSF_BH03_KP01_CU3		
Depth (m):	4.45 - 4.95	Room Temperature at Test:	~ 18°C

Modified Mohr Coulomb Stress Path



Modified Mohr Coulomb Path - Using Stress Path Tangency Method

Cohesion C' (kPa) :	22.38
Angle of Shear Resistance Φ' (Deg) :	25.06

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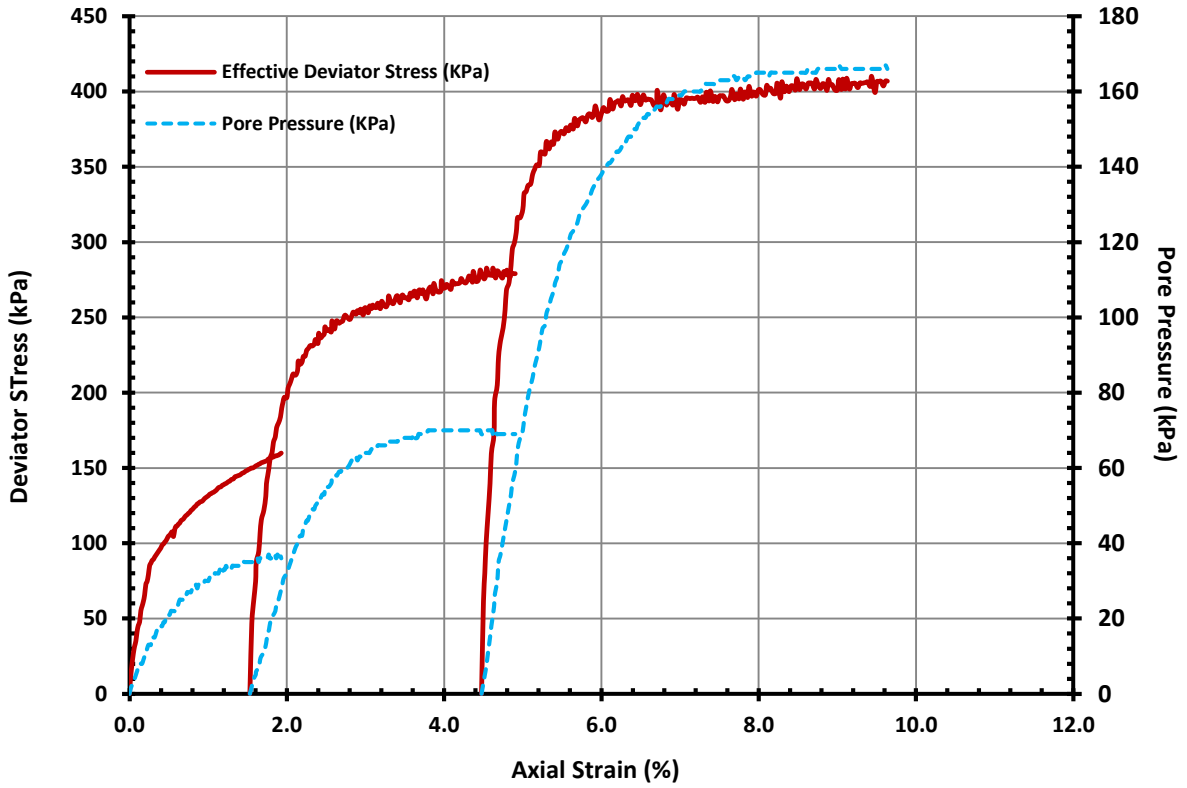
MULTI-STAGE CONSOLIDATED UNDRAINED TRIAXIAL TEST

Method: AS1289.6.4.2 / In-house Method

Client:	Knight Piesold	Date Tested:	3/04/2017
Project:	Mungari Gold Project	EP Lab Job Number:	KP
Sample No:	TSF Cell 3	Lab:	EPLab
Sample ID:	TSF_BH03_KP01_CU3		
Depth (m):	4.45 - 4.95	Room Temperature at Test:	~ 18°C

Deviator Stress Vs Strain Diagram



SHEAR STAGE DATA AND STRESS MEASUREMENTS (kPa)

Shear Stage	Confining Pressure	U'0	U'f	Principal Effective Stresses			σ'1 - σ'3	Strain (%)
				σ'1	σ'3	σ'1 / σ'3		
1	100	0	37	219	63	3.48	156	1.77
2	200	0	70	402	130	3.09	272	4.13
3	400	0	167	641	233	2.75	408	9.02

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MULTI-STAGE CONSOLIDATED UNDRAINED TRIAXIAL TEST

Method: AS1289.6.4.2 / In-house Method

Client:	Knight Piesold	Date Tested:	3/04/2017
Project:	Mungari Gold Project	EP Lab Job Number:	KP
Sample No:	TSF Cell 3	Lab:	EPLab
Sample ID:	TSF_BH03_KP01_CU3		
Depth (m):	4.45 - 4.95	Room Temperature at Test:	~ 18°C

Photo After Test

Sample ID: TSF Cell 3 **Depth (m):** 4.45 - 4.95
Lab ID: TSF_BH03_KP01_CU3 **Date Tested:** 3/04/2017

Failure Mode: Bulging Failure

Notes:
Stored and Tested the Sample as received
Samples supplied by the Client

NATA: 19078

Authorised Signatory (Geotechni [redacted]

NATA ACCREDITATION NO: 19078

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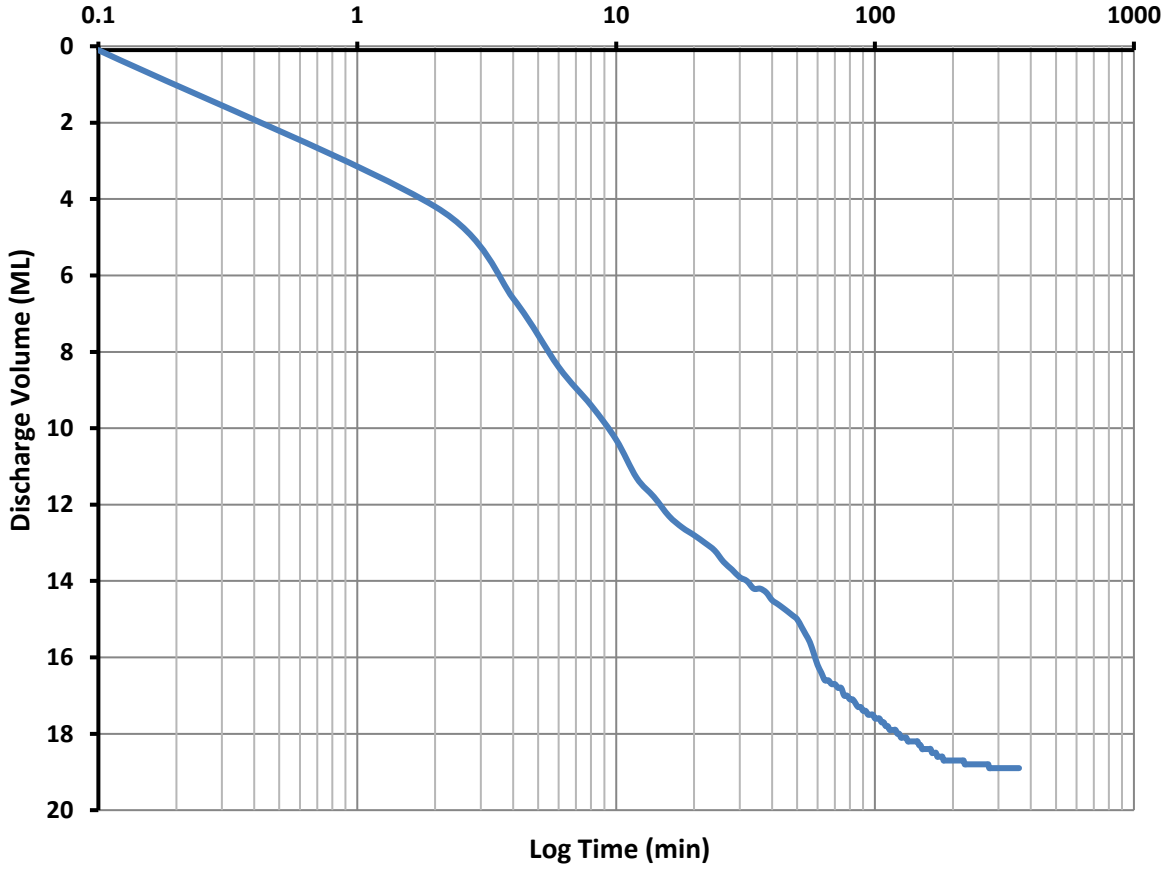
MULTI-STAGE CONSOLIDATED UNDRAINED TRIAXIAL TEST

Method: AS1289.6.4.2 / In-house Method

Client:	Knight Piesold	Date Tested:	3/04/2017
Project:	Mungari Gold Project	EP Lab Job Number:	KP
Sample No:	TSF Cell 3	Lab:	EPLab
Sample ID:	TSF_BH03_KP01_CU3		
Depth (m):	4.45 - 4.95	Room Temperature at Test:	~ 18°C

Discharge Volume (ML) Vs Log Time (min)



Cv (cm²/s): 0.005 based on t_{90}

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MULTI-STAGE CONSOLIDATED UNDRAINED TRIAXIAL TEST

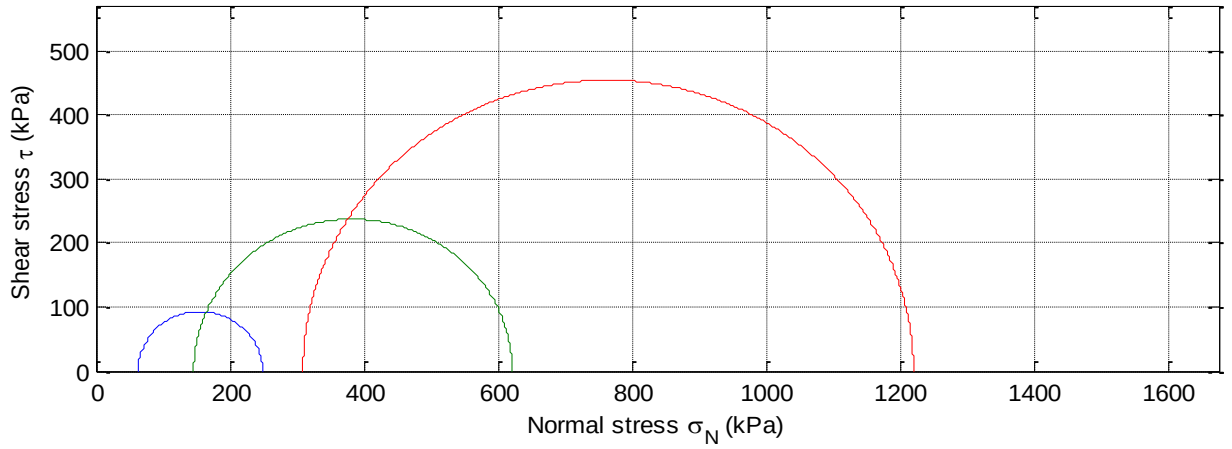
Method: AS1289.6.4.2 / In-house Method

Client:	Knight Piesold	Date Tested:	3/04/2017
Project:	Mungari Gold Project	EP Lab Job Number:	KP
Sample No:	TSF Cell 3	Lab:	EPLab
Sample ID:	TSF_BH04_KP01_CU3		
Depth (m):	4.45 - 4.95	Room Temperature at Test:	~ 18°c

Tested by:	PHIL	Initial Moisture (%):	9.93	Strain Rate (mm/min):	0.005
Height (mm):	118.89	Final Moisture (%):	8.21	Skempton's (B):	0.99
Diameter (mm):	62.91	Bulk Density (t/m³):	2.14	Geology:	-
L/D Ratio:	1.89	Dry Density (t/m³):	1.95		

Failure Criteria used: Peak Principle Stress Ratio

Mohr Circle Diagram



Interpretations conducted using Matlab

Interpretation from Mohr Circle:	Stage 1 & 2	Stage 1 & 3	Stage 2 & 3
Cohesion C' (kPa):	-	0.15	22.28
Angle of Shear Resistance Φ' (Degrees) :	-	36.54	34.61

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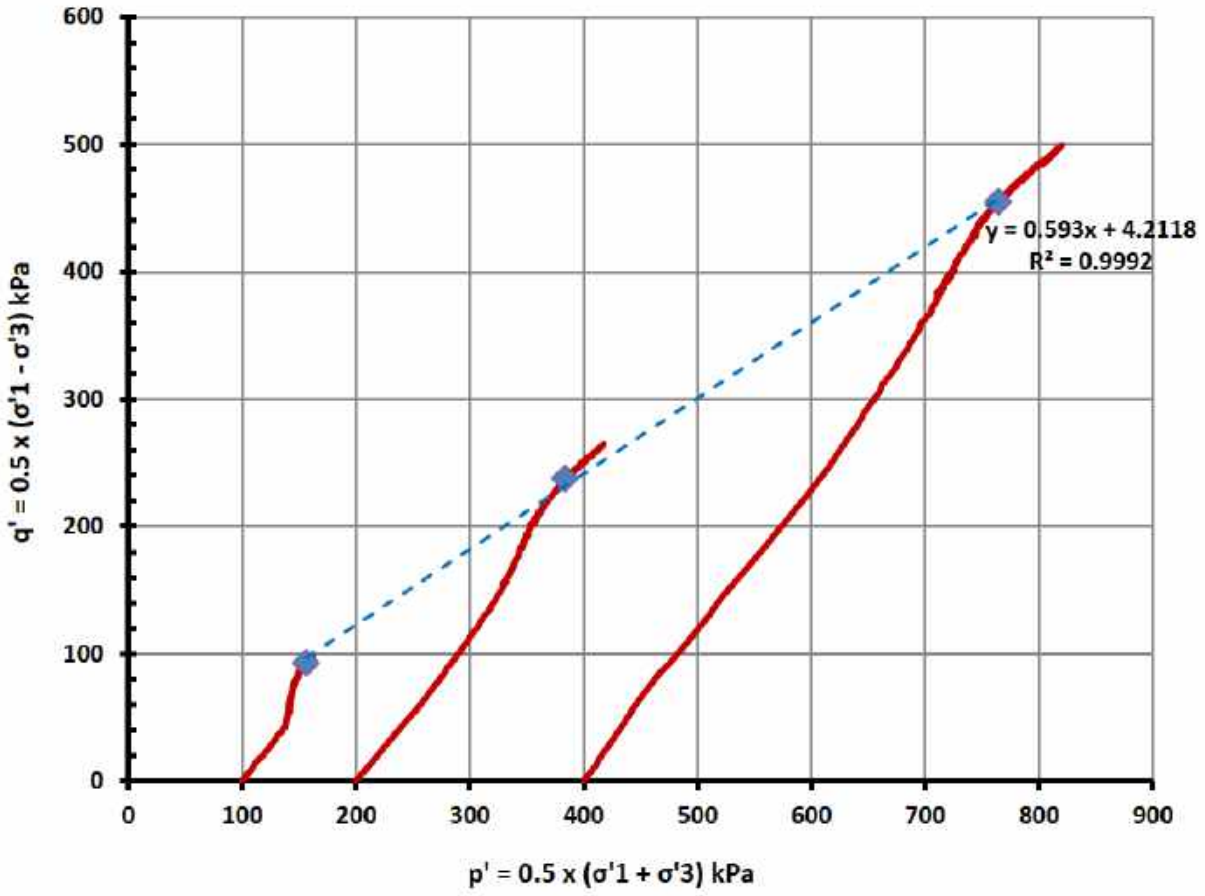
MULTI-STAGE CONSOLIDATED UNDRAINED TRIAXIAL TEST

Method: AS1289.6.4.2 / In-house Method

Client:	Knight Piesold	Date Tested:	3/04/2017
Project:	Mungari Gold Project	EP Lab Job Number:	KP
Sample No:	TSF Cell 3	Lab:	EPLab
Sample ID:	TSF_BH04_KP01_CU3		
Depth (m):	4.45 - 4.95	Room Temperature at Test:	~ 18°C

MIT Effective Stress Path (q' vs p' diagram)



MIT Stress Path - Using Stress Path Tangency Method

Cohesion C' (kPa) :	5.22
Angle of Shear Resistance Φ' (Deg) :	36.37

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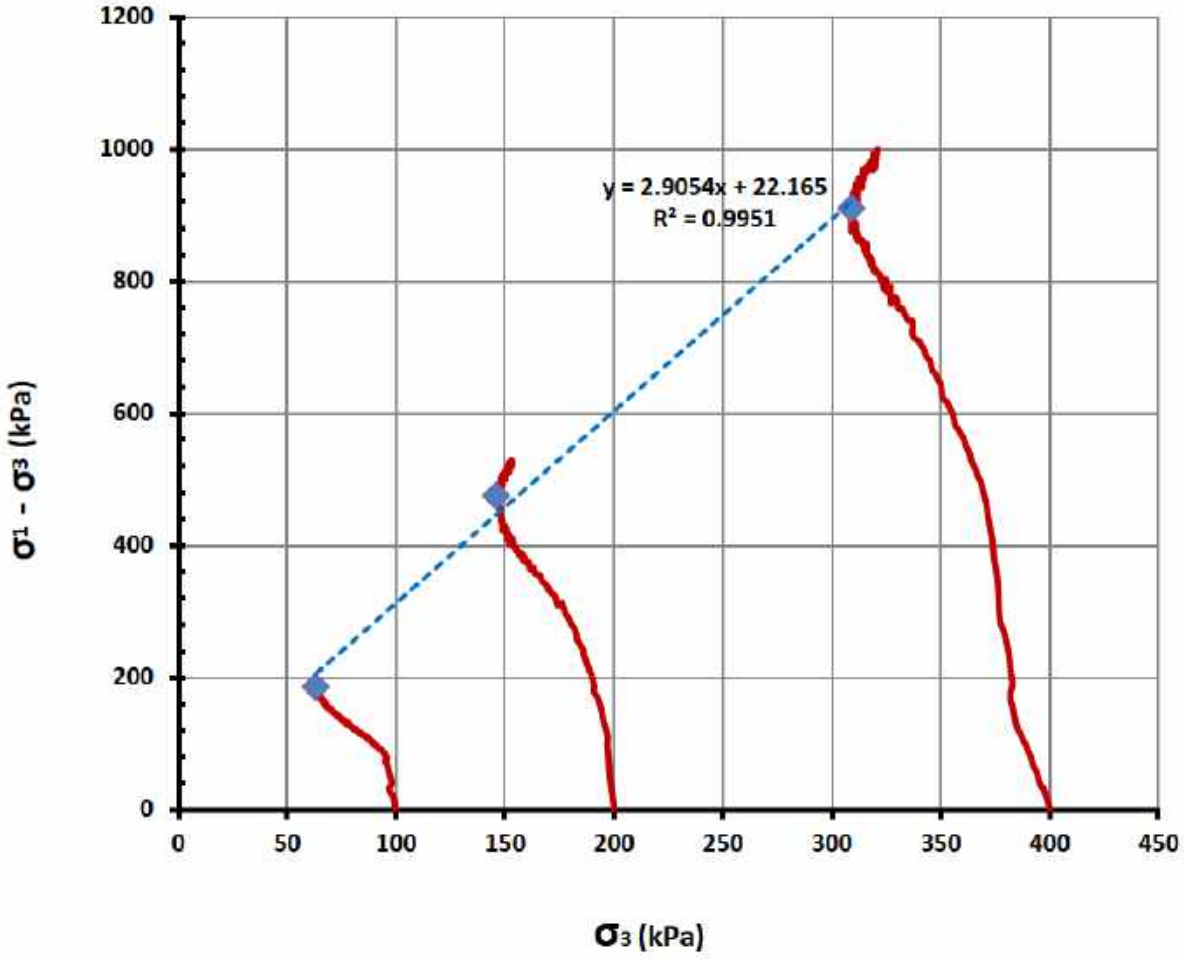
MULTI-STAGE CONSOLIDATED UNDRAINED TRIAXIAL TEST

Method: AS1289.6.4.2 / In-house Method

Client:	Knight Piesold	Date Tested:	3/04/2017
Project:	Mungari Gold Project	EP Lab Job Number:	KP
Sample No:	TSF Cell 3	Lab:	EPLab
Sample ID:	TSF_BH04_KP01_CU3		
Depth (m):	4.45 - 4.95	Room Temperature at Test:	~ 18°C

Modified Mohr Coulomb Stress Path



Modified Mohr Coulomb Path - Using Stress Path Tangency Method

Cohesion C' (kPa) :	5.61
Angle of Shear Resistance Φ' (Deg) :	36.35

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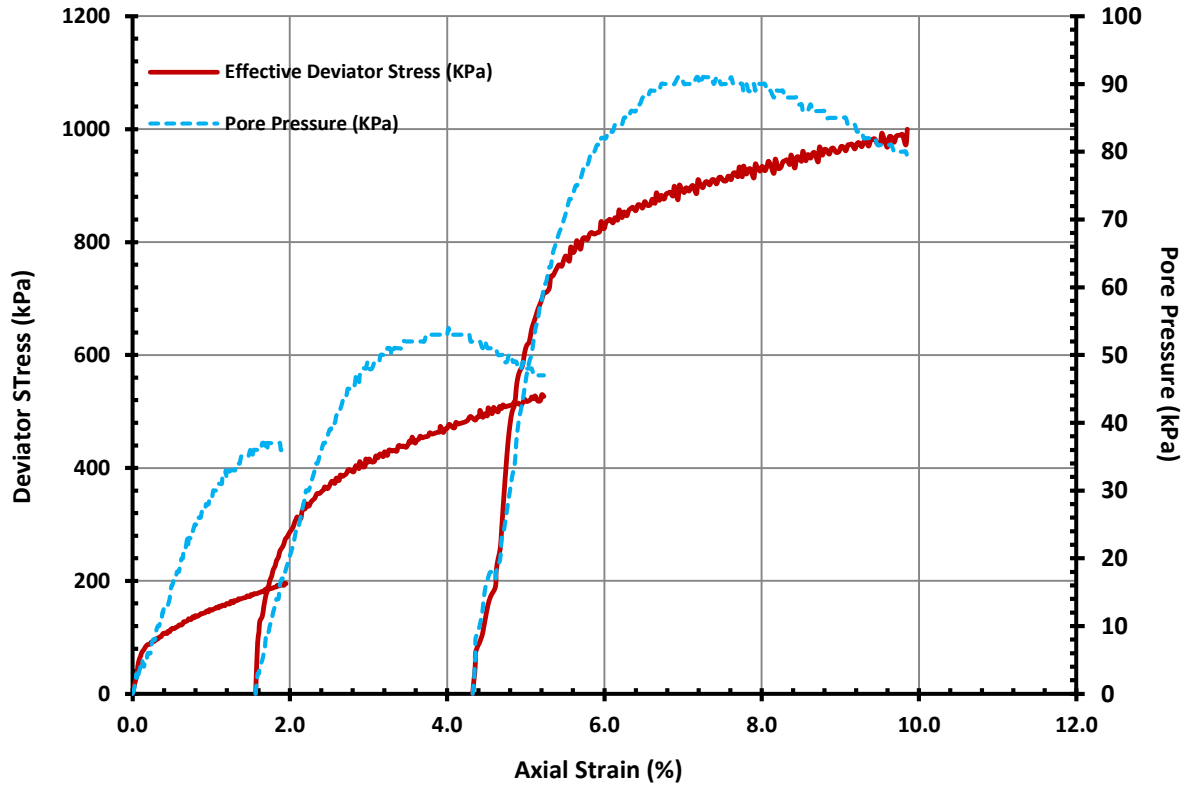
MULTI-STAGE CONSOLIDATED UNDRAINED TRIAXIAL TEST

Method: AS1289.6.4.2 / In-house Method

Client:	Knight Piesold	Date Tested:	3/04/2017
Project:	Mungari Gold Project	EP Lab Job Number:	KP
Sample No:	TSF Cell 3	Lab:	EPLab
Sample ID:	TSF_BH04_KP01_CU3		
Depth (m):	4.45 - 4.95	Room Temperature at Test:	~ 18°C

Deviator Stress Vs Strain Diagram



SHEAR STAGE DATA AND STRESS MEASUREMENTS (kPa)

Shear Stage	Confining Pressure	U'0	U'f	Principal Effective Stresses			σ'1 - σ'3	Strain (%)
				σ'1	σ'3	σ'1 / σ'3		
1	100	0	37	249	63	3.95	186	1.75
2	200	0	54	621	146	4.26	475	4.02
3	400	0	91	1219	309	3.95	910	7.19

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MULTI-STAGE CONSOLIDATED UNDRAINED TRIAXIAL TEST

Method: AS1289.6.4.2 / In-house Method

Client:	Knight Piesold	Date Tested:	3/04/2017
Project:	Mungari Gold Project	EP Lab Job Number:	KP
Sample No:	TSF Cell 3	Lab:	EPLab
Sample ID:	TSF_BH04_KP01_CU3		
Depth (m):	4.45 - 4.95	Room Temperature at Test:	~ 18°C

Photo After Test

Sample ID:	TSF Cell 3	**Depth (m):**	4.45 - 4.95
Lab ID:	TSF_BH04_KP01_CU3	**Date Tested:**	3/04/2017

Failure Mode: Bulging Failure

Notes:

Stored and Tested the Sample as received

Samples supplied by the Client

NATA: 19078

Authorised Signatory (Geotechni [redacted]

NATA ACCREDITATION NO: 19078

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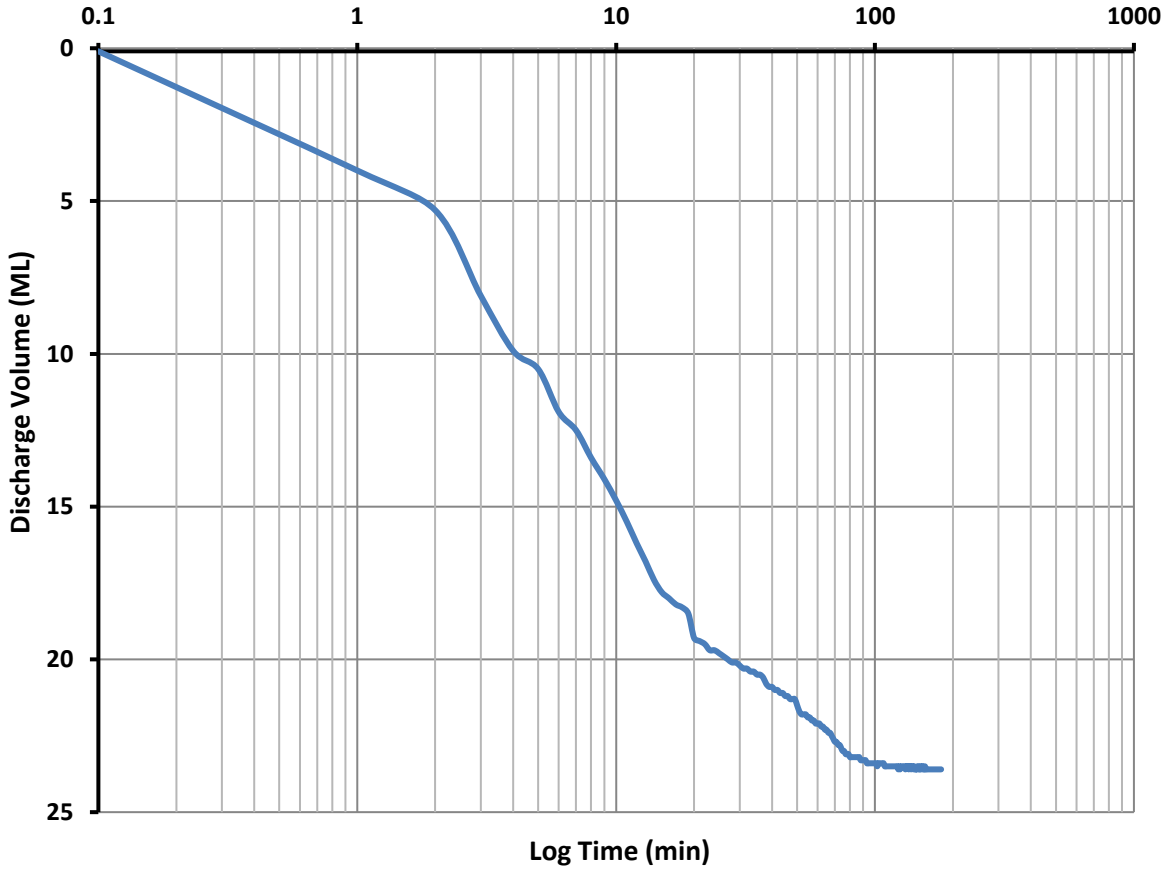
MULTI-STAGE CONSOLIDATED UNDRAINED TRIAXIAL TEST

Method: AS1289.6.4.2 / In-house Method

Client:	Knight Piesold	Date Tested:	3/04/2017
Project:	Mungari Gold Project	EP Lab Job Number:	KP
Sample No:	TSF Cell 3	Lab:	EPLab
Sample ID:	TSF_BH04_KP01_CU3		
Depth (m):	4.45 - 4.95	Room Temperature at Test:	~ 18°C

Discharge Volume (ML) Vs Log Time (min)



Cv (cm²/s): 0.049 based on t_{90}

APPENDIX D

Seismic Hazard Assessment

Knight Piésold CONSULTING

Knight Piésold CONSULTING

MEMORANDUM

To: Evolution Mining [redacted]	**Date:** 31 October 2019
	Our Ref: PE19-01182
	KP File Ref.: PE801-00137/36-A jl M19020
[redacted]	[redacted]

RE: MUNGARI GOLD PROJECT – SEISMIC HAZARD ASSESSMENT - 2019 UPDATE

1. INTRODUCTION

A preliminary seismic hazard assessment was carried out for the Mungari Gold Project in 2013 (Ref 1) as part of the existing TSF design. There are ongoing developments in earthquake hazard research in Australia, including recently published attenuation functions and seismic hazard assessment by Geoscience Australia (GA) in 2012/2013 (Ref 2) and 2018 (Ref 3). The latest national seismic hazard assessment (NSHA18) map was published by GA in October 2018. ANCOLD published the "Guidelines for Design of Dams and Appurtenant Structures for Earthquake" (Ref. 19) in 2019.

The NSHA18 results were compared with the 2013 probabilistic assessment conducted by Knight Piésold (KP). This memorandum presents the recommendations of seismic design parameters based on NSH18 and latest ANCOLD guidelines.

2. PREVIOUS PROBABILISTIC ANALYSIS

A computer program EZ-FRISK (Fugro Risk Engineering, Inc., 2011, Ref. 3) was used to develop a probabilistic seismic hazard model for the site in 2013. The Australian source model was primarily comprised of sources from the Australian nationwide zonation, developed by Gaull et al. (1990). Earthquake hazard maps for the Australian continent and continental margins were prepared in 1990 using these data. A user-defined Kalgoorlie seismic source zone had been input into the EZ-FRISK seismic hazard software. Based on a desktop probabilistic analysis of these earthquakes in the Kalgoorlie area, it is believed that the maximum magnitude for earthquakes in the Kalgoorlie region is M5.9 and the Mungari Gold Project is located within this region.

Attenuation functions developed for the central and eastern North America and the Somerville (2009) ground motion model developed specifically for the Yilgarn Craton were adopted in the probabilistic analysis.

The predicted values for the site in terms of earthquake return period, probability of exceedance for a range of design lives (5, 10, 25 and 50 years) and Peak Ground Acceleration (PGA) are summarised in Table 2.1.

Table 2.1: Summary of 2013 probabilistic seismic hazard analysis

Return Period (years)	Annual Frequency of Exceedance	Probability of Exceedance				Peak Ground Acceleration (g)
		8 Year Design Life	12 Year Design Life	25 Year Design Life	50 Year Design Life	
50	0.02	15%	21%	39%	63%	0.016
100	0.01	8%	11%	22%	39%	0.029
200	0.005	4%	6%	12%	22%	0.051
500	0.002	1.6%	2.4%	5%	10%	0.101
1,000	0.001	0.8%	1.2%	2.5%	5%	0.158
2,500	0.0004	0.3%	0.5%	1.0%	2%	0.265
5,000	0.0002	0.2%	0.24%	0.5%	1%	0.375
10,000	0.0001	0.08%	0.12%	0.2%	0.5%	0.513

Note: Project operational life currently expected to be 8 years

The maximum accelerations presented in this memorandum report are based on rock site conditions, with an average shear wave velocity of 760 m/s over the upper 30 m. Peak ground accelerations within the tailings deposit and within the embankment dam may be higher due to amplification of ground motion through the tailings facility. Typically, ground accelerations may amplify by a factor of about 1.5 to 3.0 depending on the PGA on rock site. The ability of the embankment fill and tailings materials to transmit high seismic ground motions is dependent on their dynamic stiffness and damping characteristics. Dynamic site response analyses should be carried out to determine the amplification of ground motions as seismic waves propagate through the foundation materials and used as inputs for the deformation analysis.

3. NSHA18

Geoscience Australia (GA) has recently released the National Seismic Hazard Assessment (NSHA18) Map with an updated catalogue of Australian earthquakes in October 2018. This map will become a key component of Australia's earthquake standard, AS1170.4.

Epistemic uncertainty was modelled through the use of logic trees where expert-assigned weights are given to different possible parameterisations. In total, 16 alternative seismic source models were adopted, consisting of eight developed by Geoscience Australia (Leonard, 2008; Burbidge, 2012; Griffin et al., 2016) and eight by third party contributors (Hall et al., 2007; Cuthbertson, 2016; Dimas et al., 2016; Dimas and Venkatesan, 2016; Sinadinovski and McCue, 2016; Mote et al., 2017).

Nineteen attenuation models were considered and weights were assigned for each neotectonic super-domain (cratonic, non-cratonic, extended and subduction zone regions) according to the expert elicitation methodology.

The seismic hazard assessment was published as PGA maps for earthquake with return periods of 475 and 2,475 years. In addition, PGAs at other return periods can be approximately interpolated from the published data using an interpolation programme provided by Geoscience Australia.

Figure 3.1 shows the PGA map with a return period of 475 years, in which Mungari is located in a 0.05 – 0.06g zone. Figure 3.2 shows the PGA map with a return period of 2,475 years, in which Mungari is in a 0.2 – 0.3g zone.

Table 3.1 presents the comparison of the NSHA18 PGA versus the KP 2013 results. The location Lat -30.76 and Long 121.234 was used in the GA provided program.

Table 3.1: Comparison of NSHA seismic hazard analysis

Return Period (yrs)	NSHA18 (g)*	2013 KP (g)
100	0.008	0.029
500	0.059	0.101
1,000	0.117	0.158
2,500	0.238	0.265
5,000	0.372	0.375
10,000	0.552	0.513

Note: * interpolated using GA's python interpolation program, Mean hazard.

The NSHA18 also included Kalgoorlie as a reported locality with the 500 and 2,500 Year PGA of 0.09g and 0.545g respectively. It is noted the Mungari TSF is 21 km to the west of the NSHA18 Kalgoorlie location which constitutes a local higher seismic zone than its surrounds.

4. SEISMIC DESIGN PARAMETERS

4.1 SEISMIC DESIGN CATEGORIES

Consistent with current ANCOLD (2019) guidelines on tailings dams, three levels of design earthquake are typically considered: the Operating Basis Earthquake (OBE) for normal operations; the Safety Evaluation Earthquake (SEE) for extreme (dam safety) conditions during operations; and the Maximum Credible Earthquake (MCE) for post closure stability. Table 4.1 summarises the recommended Annual Exceedance Probability (AEP) corresponding to different earthquakes and failure consequences categories.

Table 4.1: Recommended Design Earthquake Loadings (AEP)

Dam Consequence Category	Operating Basis Earthquake OBE[1]	Safety Evaluation Earthquake SEE[2,8]
Extreme Consequence Category Dams	Commonly 1 in 475 AEP up to 1 in 1,000 AEP	The greater of: Ground motion from MCE on known active faults[3] or Probabilistic ground motion Extreme: 1 in 10,000 AEP[4]
High A, B and C Consequence Category Dams	Commonly 1 in 475 AEP up to 1 in 1,000 AEP	Probabilistic ground motion[5,6,7]: High A: 1 in 10,000 AEP High B: 1 in 5,000 AEP High C: 1 in 2,000 AEP
Significant Consequence Category Dams	Commonly 1 in 475 AEP	Probabilistic ground motion[5,6]: 1 in 1,000 AEP
Low Consequence Category Dams	Commonly 1 in 475 AEP	Probabilistic ground motion[5,6]: 1 in 1,000 AEP

From ANCOLD (2019), Guidelines for Design of Dams and Appurtenant Structures for Earthquake
(1) To be determined by the Owner and other Stakeholders in consultation with the Consultant.
(2) The design of the dam should be such that there will be a low likelihood of the dam failing given the SEE.
(3) Active faults are as defined in ANCOLD (2019). Use the 85th percentile of the hazard from the deterministic MCE. This represents the stand deviation of the random variability about the best estimate of the hazard level from that single earthquake scenario.
(4) 85th fractile. This is required so that the design is more likely to have a sufficiently low likelihood of failure given the SEE, than if the median loading was used.
(5) Median, 50th fractile.
(6) For High B, High C, Significant, and Low Dam Failure Consequence Category dams, if the structure is susceptible to liquefaction or has components that will fail at ground motions only a little greater than those presented in the Table, check the design for the critical ground motion and assess the adequacy of the design using risk assessment methods.
(7) Adoption of these SEE criteria for High B and High C Dam Failure Consequence Category dams may not provide an acceptable level of risk in accordance with ANCOLD risk management guidelines. It is therefore recommended that some level of risk assessment should be undertaken in these cases before adopting the AEP stated in the table. If it cannot be demonstrated that an acceptable level of risk would be achieved, an AEP of 1 in 10,000 should be adopted.
(8) Post closure, tailings dams should be designed in accordance with the Guidelines on Tailings Dams, ANCOLD (2012).

The TSF has been assessed to have a SIGNIFICANT hazard which is covered under a separate report.

4.2 OPERATING BASIS EARTHQUAKE

The OBE is typically determined using probabilistic seismic hazard analysis to select an acceptable level of risk, based on the probability of exceedance over the design life of the facility. Consideration is also given to the consequence category of the facility, which considers the consequences of dam failure. This assessment includes the consideration of the potential loss of life and environmental and economic impacts due to failure of the tailings dam (ICOLD, 1989 and ANCOLD, 2012). The recommended return period for the OBE as a significant hazard is 475-years according to latest 2019 ANCOLD earthquake guidelines.

Based on NSHA18, the 1 in 475-year earthquake (as per ANCOLD 2019) PGA is 0.1g. A design earthquake magnitude of 4.10 at a distance of 5.5 km is appropriate for the OBE (mean value Allen 2012 attenuation).

Dams should remain serviceable under the OBE; the OBE is generally expected to cause limited damage/deformations that could be repaired without significantly disrupting operations.

4.3 MAXIMUM DESIGN EARTHQUAKE

An appropriate Safety Evaluation Earthquake (SEE) for a TSF is typically determined based on the Consequence Category of the facility. The recommended return period for the SEE as a significant hazard is the 1,000-years as per latest 2019 ANCOLD earthquake guidelines.

Based on NSHA18, the 1 in 1,000-year earthquake PGA was estimated to be 0.12g. A design earthquake magnitude of 4.67 at a distance of 8 km is appropriate for the SEE (mean value Allen 2012 attenuation).

Limited deformation of the tailings dam is acceptable under seismic loading from the SEE, provided that the overall stability and integrity of the facility is maintained and that there is no release of stored tailings or water.

4.4 MAXIMUM CREDIBLE EARTHQUAKE

The MCE is considered to be the maximum credible acceleration that can occur, on the basis of available seismic and tectonic information. The MCE is calculated deterministically and, therefore, is not associated with a return period. The MCE is the maximum ground motions attributable to all large magnitude earthquakes that could ever occur at the site (ANCOLD, 2012).

While the general consensus among Australian Seismologists is that the maximum credible magnitude of an earthquake in Australia could be M7.5 (ANCOLD, 1998), the seismic source zone that controls the design of the Mungari Gold Project is not amongst source zones capable of such magnitudes. The user-designed Kalgoorlie seismic source in 2013 KP assessment was developed to address the 90 earthquakes that have occurred within 30 km of the Mungari Gold Project between 1955 and 2013, while 78 of these earthquakes had magnitudes less than M3.5 and only three had magnitudes greater than M4.0; this source zone was created to more aptly address the site specific seismic hazard. Based on a desktop probabilistic assessment, this seismic source zone has been formulated with a maximum magnitude of M5.9.

Therefore, for the MCE it has been assumed that M5.9 earthquake occurs at a distance of 15 km from the site, causing a peak ground acceleration of 0.49g (PGA plus one standard deviation value).

The long term drained properties of the tailings should be taken into account when considering the stability under the MCE. This could include lowered phreatic surface and increased strength from consolidation and possible chemical bonding (ANCOLD, 2012).

5. SUMMARY

The NSHA18 seismic hazard analyses results at the Mungari Gold Project is compared with the KP 2013 assessment and presented in Table 5.1. The seismic

design parameters have been determined based on SIGNIFICANT hazard category of the TSF.

Table 5.1: Comparison of Seismic Parameters

Scenario	Operational Phase	Return Period	Distance (source to site)	Magnitude	PGA (g)
KP 2013	OBE	100	10	4.1	0.03
	SEE	1,000	6.5	4.67	0.16
NSHA18	OBE	475	5.5	4.1	0.10
	SEE	1,000	8	4.67	0.12
MCE		10,000+	15	5.9	0.49

It is recommended to adopt the values from the NSHA18 assessment for design despite being smaller than the previous assessment for SEE condition. The recommended Seismic parameters are shown in Table 5.2.

Table 5.2: Recommended Seismic Parameters

Scenario	Operational Phase	Return Period	Distance (source to site)	Magnitude	PGA (g)
NSHA18	OBE	475	5.5	4.1	0.10
	SEE	1,000	8	4.67	0.12
MCE		10,000+	15	5.9	0.49

We trust that this memorandum is sufficient for your current needs. Please contact us should you have any queries.

[redacted]

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2. Australian Government – Geoscience Australia, The 2012 Australian Earthquake Hazard Map
3. Australian Government – Geoscience Australia, The 2018 National Seismic Hazard Assessment for Australia, Record 2018/33EZ-FRISK (2011), Software for Earthquake Ground Motion Estimation, Version 7.62, Risk Engineering, Inc., Boulder, Colorado, USA.
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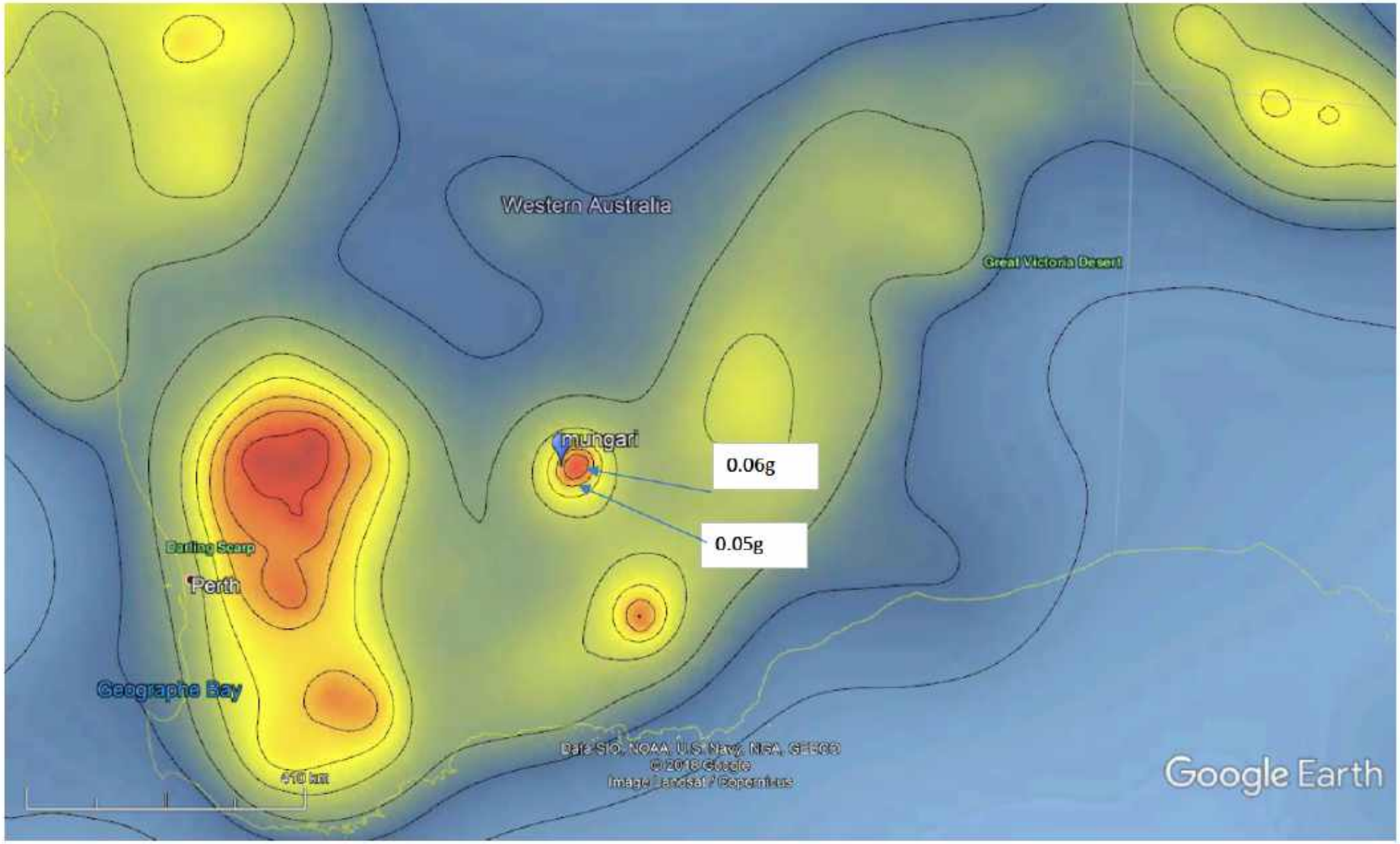
FIGURES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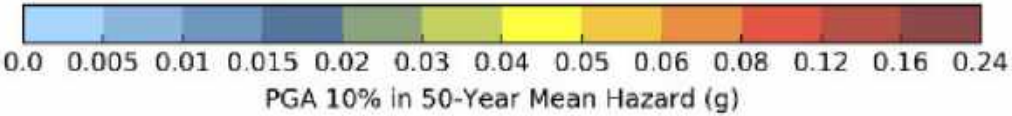
Mungari
0.06g
0.05g
Darling Scarp
Perth
Geographe Bay
410 km
Image Landsat / Copernicus
Google Earth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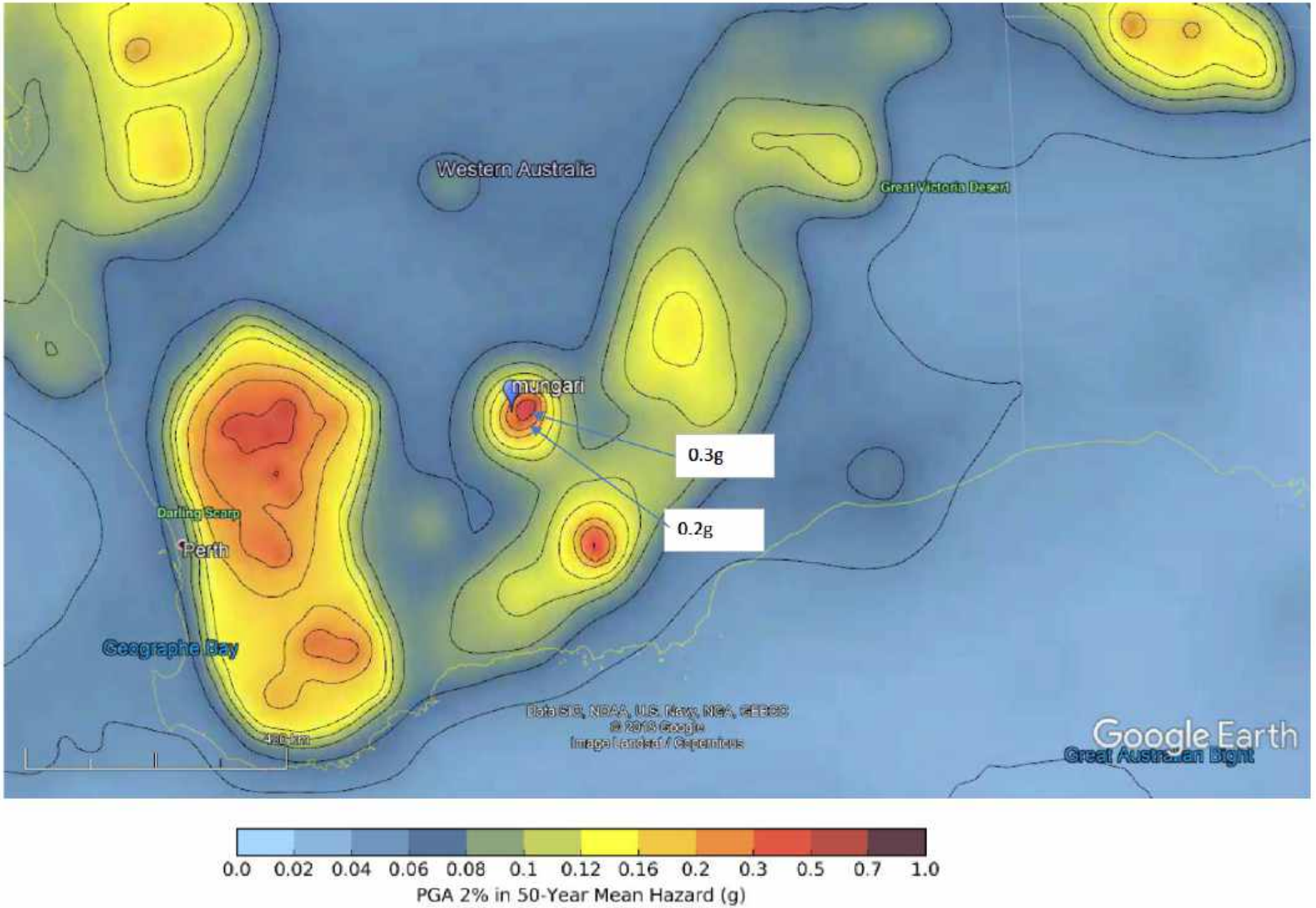
PGA 10% in 50-Year Mean Hazard (g)


Western Australia
Great Victoria Desert
mungari
0.3g
0.2g
Darling Scarp
Perth
Geographe Bay
Great Australian Bight
Google Earth
0.0 0.02 0.04 0.06 0.08 0.1 0.12 0.16 0.2 0.3 0.5 0.7 1.0
PGA 2% in 50-Year Mean Hazard (g)

APPENDIX E

Dam Break Assessment

Knight Piésold CONSULTING

Knight Piésold CONSULTING

MEMORANDUM

To: Evolution Mining [redacted]	**Date:** 17 April 2019 **Our Ref:** PE19-00405 **KP File Ref.:** PE801-00137/29-A bas M19004
cc:	[redacted] [redacted]

RE: MUNGARI GOLD MINE – TSF 2 DAM BREAK AND CLASSIFICATION

Knight Piesold (KP) was engaged by Evolution Mining (EM) to undertake the definitive feasibility study for a new Tailings Storage Facility (TSF) at the Mungari Gold operation. The facility shall comprise two cells, namely Cell 3 and Cell 4, located adjacent and west of the existing TSF (Cells 1 and 2) that was commissioned in 2014.

As part of the design a dam break assessment has been carried out for the new facility. This includes a review of the Population at Risk (PAR), business risk and environmental impact in the event of a dam failure. The inundation mapping produced below can also be used for a site Emergency Action Plan (EAP) and locating muster points on site.

This memorandum shall be read in conjunction with the dam break assessment conducted for Cells 1 and 2 (Ref. 1).

1. INTRODUCTION

The key design parameters and associated drawings which relate to the dam break assessment are as follows:

- The layout, topography and local infrastructure around the TSF is shown on Figure 1.1;
- The facility will be a four sided two cell paddock style facility with a central divider embankment. The perimeter embankments will have similar geometry on all sides, except the shared east wall;
- The cross section consists of a starter embankment, one downstream raise, one centreline raise and several upstream raises onto the tailings beach. A typical cross section is shown on Figure 1.2;
- The basin will include an underdrainage and toe drain system;
- A central decant tower with causeway access in each cell will pump water back to the plant;
- A downstream footprint area of 95 Ha;
- Design throughput of 2.0 Mtpa for 9 years;
- An ultimate level of RL 363.15 m for a maximum height of 20 m; and
- No emergency spillway exists as part of the TSF design.

Other information provided for the update consists of the following:

- An explosives storage facility exists immediately to the south of Cell 2, at the south east corner of Cell 3;
- Digital Lidar survey of the greater area consisting of 1.0 m contours dated 31/05/2018, with the Cells 1 and 2 Stage 4 embankment complete;

- An associated satellite image of the above area using Google Earth imagery dated 13th September 2018;
- Digital Lidar survey consisting of 1.0 m contours dated 09/02/2018, of the Western waste dump to the south of the TSF; and
- Cells 3 and 4 final proposed embankment profile shown.

2. DAM BREAK ASSESSMENT

2.1 GENERAL

A tailings inundation exercise was conducted for the dam break scenario of Cell 3 or Cell 4 of the TSF. Dam break methods were obtained from ANCOLD (Ref. 2) and other publications. As these methods are structured to water dams in defined creeks or rivers, the method was modified to suit the tailings solids in very flat topography. The modelled inundation assists in determining the impact areas and PAR due to a dam break. A significant failure of the embankment will result in a release of tailings and water depending on the location of the breach, its size and the cause. For the analysis, the end conditions, regardless of the cause, were assessed as follows:

- Tailings discharge resulting from an embankment breach (modelled at final height) in a relatively dry condition from the south east embankment of Cell 3; and
- Tailings discharge resulting from an embankment breach (modelled at final height) in a relatively dry condition from the south embankment of Cell 4.

A breach on the north side of the facility will not impact on infrastructure to the south any more than the southern breaches; therefore it was not modelled for this assessment.

2.2 EMBANKMENT SOLIDS BREACH

An embankment breach resulting in a release of slurry/solids was analysed from the ultimate facility height. A number of methods of analysing the flow of slurry and run out from a breached tailings dam have been presented over the years. These have been based on reviews of past failures and attempts to predict the flow slides using analytical means and simple correlations with facility geometry. The correlations proposed by Rico in 2007 (Ref. 3) were used to correlate outflow volume from stored volume followed by correlating runout distance estimates from the outflow volume. In addition a breach volume estimation methodology developed by KP was applied to the dam to provide an additional estimate for outflow volume. This methodology takes into account the stage storage of the TSF, the downstream topography and the assumed failure surface slope.

The tailings deposition modelling software Rift TD was used to superimpose the tailings mass on the downstream digital terrain model surface to determine the potential inundation maps.

Rico et al. (Ref. 3) proposed a correlation between stored volume at the time of failure and the outflow volume from a historical data set of twenty nine tailings dam failures of varying embankment configurations, tailings consistency and stored volumes. An empirical relationship with a good correlation ($r^2 = 0.86$) was found that indicates that approximately 37% of the stored tailings and water is released. The formula developed by Rico et al. is as follows:

$$V_F = 0.354 \times V_T^{1.01}$$

Where V_F is the failure volume in cubic meters and V_T is the total tailings volume of the TSF in million cubic meters. It is noted that the solids breach was increased by 0.4 Mm^3, which is the assumed supernatant pond volume. For the Mungari TSF Cells 3 and 4, the LOM V_T assumed for each was 6.5 Mm^3 and the resulting V_F was calculated as 2.4 Mm^3.

The methodology developed by KP was applied to the Mungari TSF. The logic behind the methodology is that the stronger the tailings mass the steeper the assumed tailings breach will be. If the breach slope is very steep, then at a certain elevation the released tailings will block the outlet preventing further tailings from being released. An example of this concept for two slopes is shown on Figure 2.1.

The KP methodology was used for three assumed slopes at the two assessed breach locations: 50H:1V, 100H:1V and 150H:1V. Slopes flatter than 150H:1V were not assessed as the natural grade of the topography downstream of the TSF is greater than this.

RiftTD models were run for the two breach locations and the three breach slopes. The point at which the released tailings would prevent the further release of tailings was found for each case. The volume released is found by finding the elevation which gives the same volume for the inverted TSF stage storage and the breach stage storage as shown on Figure 2.2.

Figure 2.2 also includes the failure volume calculated using the equation developed by Rico et al (Ref. 3). The results of this assessment are summarised in Table 2.1.

Table 2.1: KP Methodology Volume of Failures

Breach Location	Assumed Slope	Volume of Failure (Mm^3)	Percentage Released
Cell 3	50H:1V	2.75	45%
Cell 3	100H:1V	4.61	76%
Cell 3	150H:1V	5.29	87%
Cell 4	50H:1V	2.95	48%
Cell 4	100H:1V	4.45	72%
Cell 4	150H:1V	4.87	77%

As shown in Table 2.1, the volume of failure estimated using the KP methodology is slightly higher than what was estimated using the methodology developed by Rico.

In deciding what failure volume to assume, a number of variables were brought into consideration. The topography downstream of the facility is gently sloped, which would facilitate the flow of tailings away from the facility. Additionally the tailings (if at or near saturation) has the potential to be susceptible to flow liquefaction (Ref. 4). Due to these factors it was decided to use the conservative estimates of tailings release calculated using the KP methodology.

2.3 INUNDATION RESULTS

For a failure occurring in the southeast corner of Cell 3, the results indicate the flows will continue in a south east direction. Water discharge will be directed toward Kopai Lake through the manmade diversion channel running west to east but it was considered unlikely that solids would initially travel this far. The explosives storage facility located south east of the facility and the tailings reclamation pad south of Cell 1 will likely be inundated in the event of failure. Flow is constrained from heading further

south by both the existing Western waste dump and a slight elevation in the road and topography between the TSF and the plant. The Cell 3 breach is shown on Figure 2.3.

For a failure occurring from the south embankment of Cell 4, the results indicate the flows will inundate the explosives storage facility south east of Cell 3. Flow will encroach on the Kurrawang Lake and proposed Cutters Ridge Access Road south of the facility. The Cell 4 breach is shown on Figure 2.4.

2.4 DAM BREAK CONCLUSION

The impacts from a dam break of the TSF is not dependent on the specific embankment or direction of failure. As a combined effect, the dam break is considered to have the following impacts:

- The explosives storage facility is at risk of being inundated;
- The access road to the TSF and the haul road from the pit is at risk of being cut off, including the (currently conceptual) cutters ridge access road south;
- The tailings reclamation area is at risk of being inundated;
- The open pit does not appear to be at risk due to the presence of a surface water drain directing flow to Kopai Lake;
- Kopai Lake is at risk of receiving discharge water;
- Kurrawang Lake is at risk of receiving residual tailings which could be carried with runoff water;
- The plant site does not appear to be at risk due to the Western waste dump and slight rise in topography;
- No notable infrastructure is located to the north or west of the TSF.

The tailings inundation depth is likely to be relatively thin and not concentrated in one location due to the flat topography. It is suggested if there are no muster points currently near the TSF, one should be located on the road to the TSF, located south of the middle scour pit (south west of the Western waste dump) outside of the inundation areas.

The intersection of the Cutters Ridge Access Road and TSF access road should form the limit if access for the EAP. The EAP will require am update if any new infrastructure is proposed to be located in the vicinity of the TSF.

3. POPULATION AT RISK ASSESSMENT

As part of the calculation of the hazard/consequence category, an assessment of the PAR was undertaken for the dam break results. There are a number of factors impacting the PAR calculation as follows:

- The tailings solids indicate low health risk thus dust from the facility does not pose a short term or long term health risk;
- The water may have some residual cyanide in solution and is hypersaline which may impact vegetation growth;
- The explosives storage facility is located south east of Cell 3 and is accessed by staff typically on a daily basis;
- Once per shift inspections by Processing Department are expected at the TSF which requires access along the pipeline access road;
- In general, during annual construction phases, offices are set up at the downstream toe of Cell 1 for a small construction team; and
- No notable public roads, camps, tracks, permanent offices are located within the immediate catchment area to the south.

A breakdown of estimated staff working within the inundation area as a whole was determined from discussions with EM as shown in Table 3.1. It is not anticipated that all of the staff would be at the downstream of the TSF at the same time; hence a percentage estimate of each role was approximated. The released tailings would expect to inundate the explosives storage facility as previously mentioned. A total PAR was then calculated and is only an indication of the potential PAR.

Table 3.1: Inundation Area Population at Risk

Staff	Number	Approximate percent at base of TSF (%)	PAR
Construction Equipment (Graders, Dozers Etc.)*	5	5	0.25
Drill And Blast (Day only)	2	10	0.2
De-Watering (Day only)	1	5	0.05
Support Staff (Day only)	1	20	0.2
Total	**9**	**-**	**0.7**

*Construction Equipment only operational during TSF construction raises.

Based on the above estimate, the PAR can be restricted to potential loss of life due to the physical outcomes resulting from a facility failure (i.e. dam break events) and not health or environmental issues. On this basis the PAR category is defined as '< 1'.

4. DMIRS HAZARD RATING

The TSF category was assessed by the methods set out in the DMIRS (formally DMP) Code of Practice (Ref. 5). The hazard rating was determined first by investigating the potential adverse impacts or damage from either embankment or structural failure, or controlled/ uncontrolled release or seepage of tailings/water. The likelihood of occurrence is not considered in the evaluation. The storage category was determined based on embankment >15 m as the maximum final embankment height is ~20 m.

Table 4.1: DMIRS Hazard Rating

Type of impact or damage	Hazard Rating
Loss of Human Life or personal injury The dam break could enter the explosives storage facility which has staff operating at specific periods during the day. The possibilities exist for the TSF operation/inspection personnel or construction staff to be impacted by embankment failure.	**High**
Adverse human health due to direct physical impact or contamination of the environment (e.g. chemical or radiation denigration of water, soil, air) Supernatant water quality is similar to groundwater, hypersaline and requires treatment prior to consumption. The water may contain cyanide. Contamination of habitable areas is expected as the supernatant water quality from seepage or water release does not pass drinking water guidelines. There is also potential for limited human exposure and temporary adverse health effects.	**Low**
Loss of assets due to direct physical impact or contamination of the environment (e.g. chemical or radioactive pollution of water, soil or air) Contamination of water for livestock is expected as the water quality from seepage or water release does not pass drinking water guidelines. Groundwater is hypersaline and is unsuitable for livestock use. There may be potential for temporary loss of assets of mine infrastructure located downstream of the main embankment in the event of a dam break. Loss of TSF storage capacity is possible but repair is practicable relatively quickly at a cost for earthworks.	**Medium**
Damage to items of environmental, heritage or historical value due to direct physical impact or contamination of the environment (e.g. chemical or radioactive pollution of water, soil or air) The site does not contain any Threatened Ecological or Priority Ecological Communities. Temporary adverse effects on fauna and flora is possible. Temporary damage of items of heritage or historical value is possible. Vegetation impacts of hypersaline water	**Low**

The TSF category is a function of the highest hazard rating identified above and the maximum embankment or structure height using the matrix provided in Table 2 of DMP (2013). As a result, the facility is considered a "**HIGH Category 1**" facility.

5. ANCOLD CONSEQUENCE CATEGORY

An assessment has been conducted to determine the severity level of impacts based on ANCOLD (Ref. 6). An assessment to determine the severity level of impacts from a large scale failure of the facility "Dam Failure Severity Level" and a spillway flow or other water release "Environmental Spill Severity Level" was conducted. Similar to the

DMIRS Hazard Rating, the likelihood of failure is not considered in the ANCOLD Consequence Category Assessment. The Dam Failure Severity Level is presented in Table 5.1.

Table 5.1: ANCOLD Guideline on Severity Level (Dam Failure)

Damage Type	Dam Failure Severity Level
Infrastructure (dam, houses, commerce, farms, community) Damage to the storage itself is expected to be repairable relatively quickly but at a cost for earthworks (<$10M). Site roads, pipework and power supply cables may be inundated but repairs are expected to be minor.	**Minor**
Business Importance Processing operations could continue as the second TSF cell would likely be operational but tailings may report to the explosives storage facility with loss of mining production and equipment. Extreme discontent due to (potential) loss of life. Significant costs in recovering/replacing equipment and re-establishing working areas. There would likely be severe reaction from the community and some loss of business credibility hence “crippling to business” was selected but bankruptcy unlikely.	**Major**
Public Health No contamination of habitable areas is expected as there are no structures or recognised camping areas located in the vicinity. Emergency management costs associated with response to inundation of explosives storage facility and clean-up.	**Minor**
Social Dislocation There are no structures or public facilities located in the vicinity of the TSF.	**Minor**
Impact Area The embankment solids breach inundation is immediately downstream of the embankment. Less than 5 km^2 is expected.	**Medium**
Impact Duration Released tailings can be recovered and affected areas remediated in a short period of time with no long-term environmental damage. Impact not expected to exceed 1 year in duration.	**Minor**
Impact on Natural Environment Potential of tailings to inundate surface water features used by native fauna.	**Medium**

A secondary assessment of an Environmental Spill consequence has been assessed for the case of water spilling during flood events, extreme wet weather or operator error. As there is no spillway, the effect would be similar to a tailings breach due to erosion of the perimeter embankment. The severity level would be considered ‘MAJOR’ due to Business Importance.

Hence, based on a PAR of <1 and the ‘MAJOR’ Dam Failure Severity Level, the facility would be rated as **SIGNIFICANT** for the Dam Failure Consequence Category. Based

on a PAR of <1 and the 'MAJOR' Environmental Spill Severity Level, the facility would be rated as **SIGNIFICANT** for the Dam Spill Consequence Category.

6. CONCLUSION

The release of solids or water due to a dam break has the potential inundate the explosives storage facility. In addition, discharge exposes construction staff, drill and blast staff and support staff to risk, whereas the flow can cause local environmental damage.

The result of the dam break and subsequent category determination define the design criteria to be used for design. The TSF is considered to be **HIGH Category 1** and **SIGNIFICANT** for the DMIRS and ANCOLD guidelines respectively.

The PAR would need to be reassessed for each embankment design stage or new TSF cell to ensure that no new infrastructure has been constructed downstream or is proposed in the future.

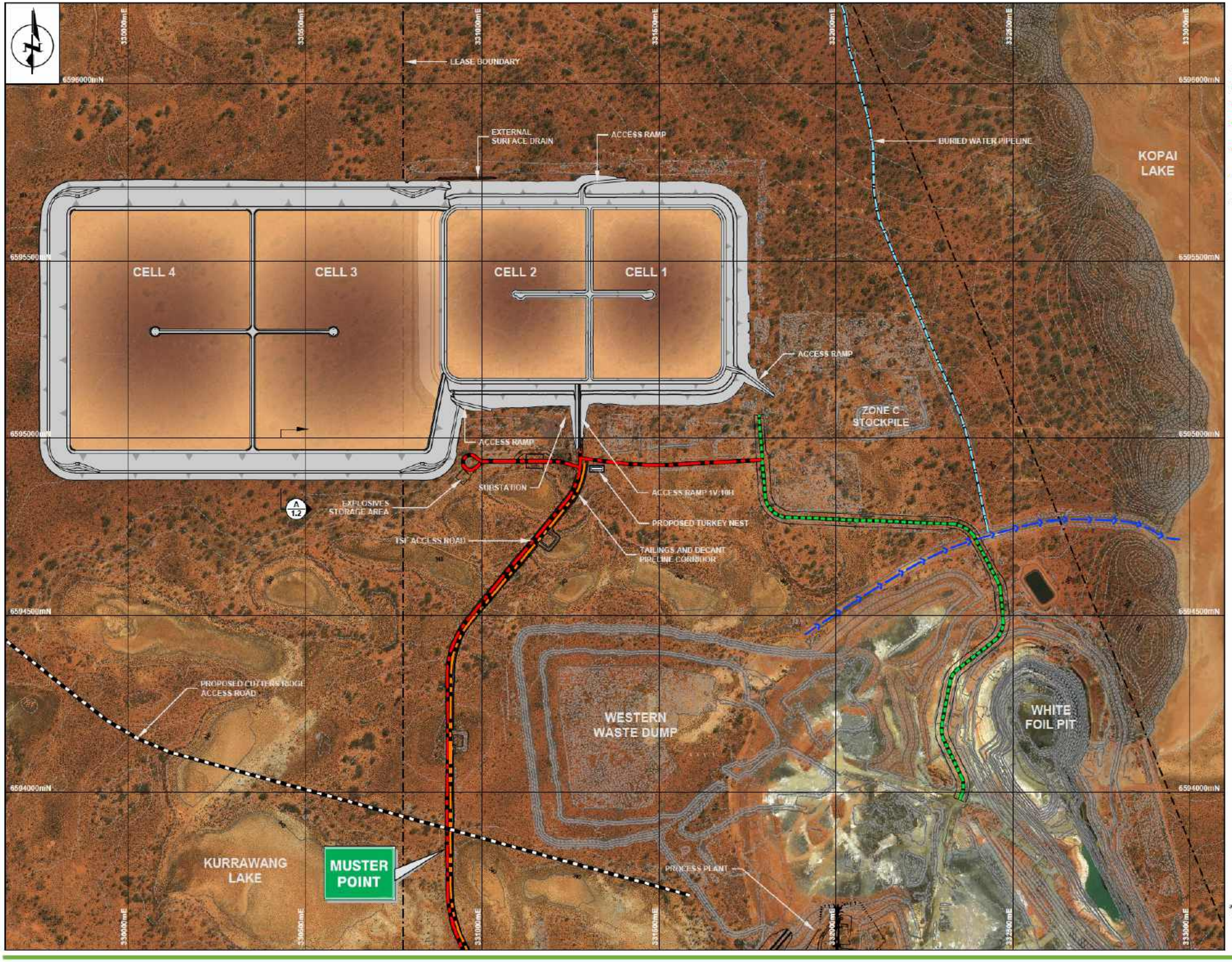
We trust this is sufficient information for your current requirements. Please do not hesitate to contact us should you require any further information.

[redacted]

REFERENCES

1. Knight Piesold, Memorandum PE18-00735, *Mungari Gold Mine – TSF Dam Break and Classification Update*, 6th August 2018.
2. ANCOLD "*Guidelines on The Consequence Categories for Dams*" October 2012.
3. Rico M., Benito G., and Díez-Herrero A. "*Floods from tailings dam failures (Science Direct: Journal of Hazardous Materials)*" 2007.
4. Knight Piesold "*Mungari Cell 2 CPT Testing Report*" Rev 0, Ref: PE801-00137/25, June 2018.
5. Department of Mines and Petroleum "*Code of Practice – Tailings storage facilities in Western Australia*" 2013.
6. ANCOLD "*Guidelines on Tailings Dams, Planning, Design, Construction, Operation and Closure*" May 2012.

FIGURES



LEGEND:

- LEASE BOUNDARY
- BURIED WATER PIPELINE
- SITE ACCESS ROAD
- SITE HAUL ROAD
- TAILINGS AND DECANT RETURN PIPELINE CONTAINMENT CORRIDOR
- DIVERSION CHANNEL
- PROPOSED CUTTERS RIDGE ACCESS ROAD
- MUSTER POINT — RECOMMENDED MUSTER POINT LOCATION

NOTES:

1. ALL COORDINATES SHOWN IN GRID PROJECTION MGA94 ZONE 51.
2. 1.0m CONTOUR INTERVALS SHOWN. EXTERNAL TOPOGRAPHICAL DATA PROVIDED BY EVOLUTION, 31st MAY, 2018.
3. WESTERN WASTE DUMP DATA PROVIDED BY EVOLUTION, 9th FEBRUARY, 2018.

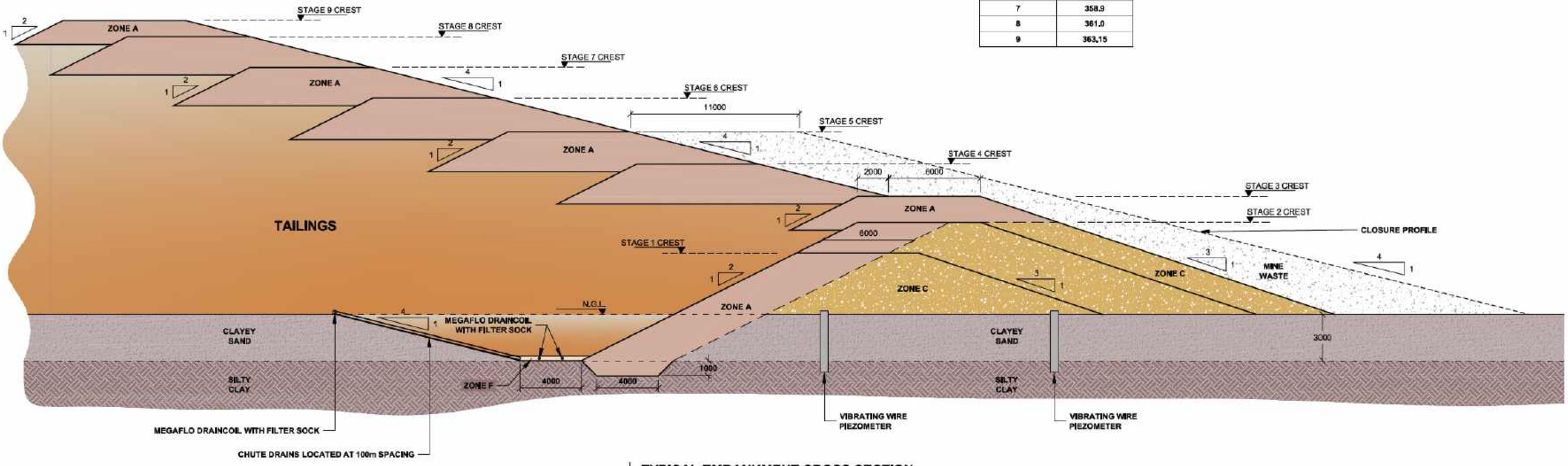
SCALE (METRES) 1:10,000 (A3)

Knight Piésold CONSULTING

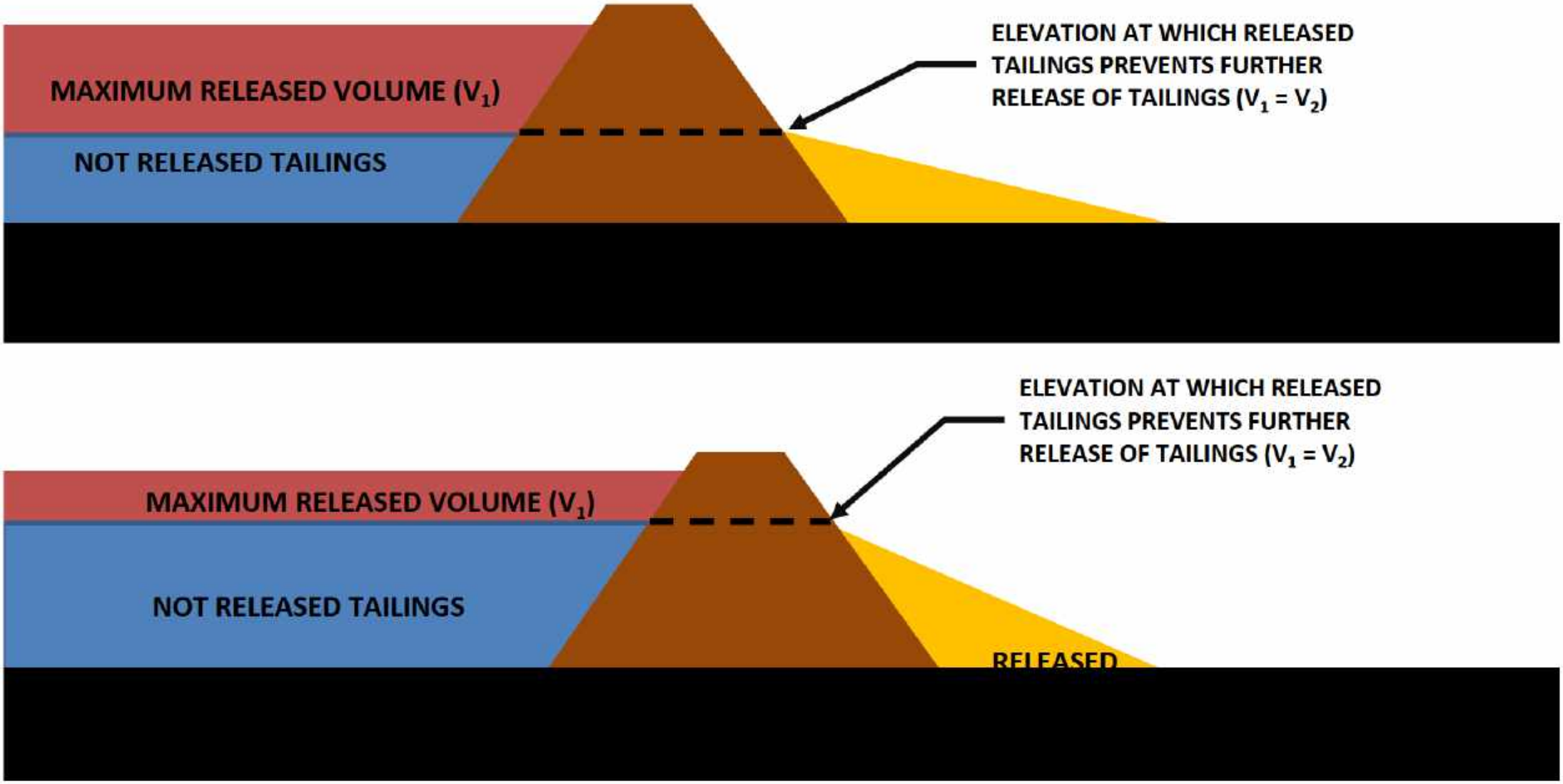
MUNGARI GOLD PROJECT
DAM BREAK ASSESSMENT
GENERAL ARRANGEMENT

PE801-00137 M19004
Figure 1.1

TABLE No. 1	
STAGE	ELEVATION (mR.L.)
1	347.6
2	349.5
3	351.2
4	353.1
5	355.0
6	356.9
7	358.9
8	361.0
9	363.15



TYPICAL EMBANKMENT CROSS SECTION



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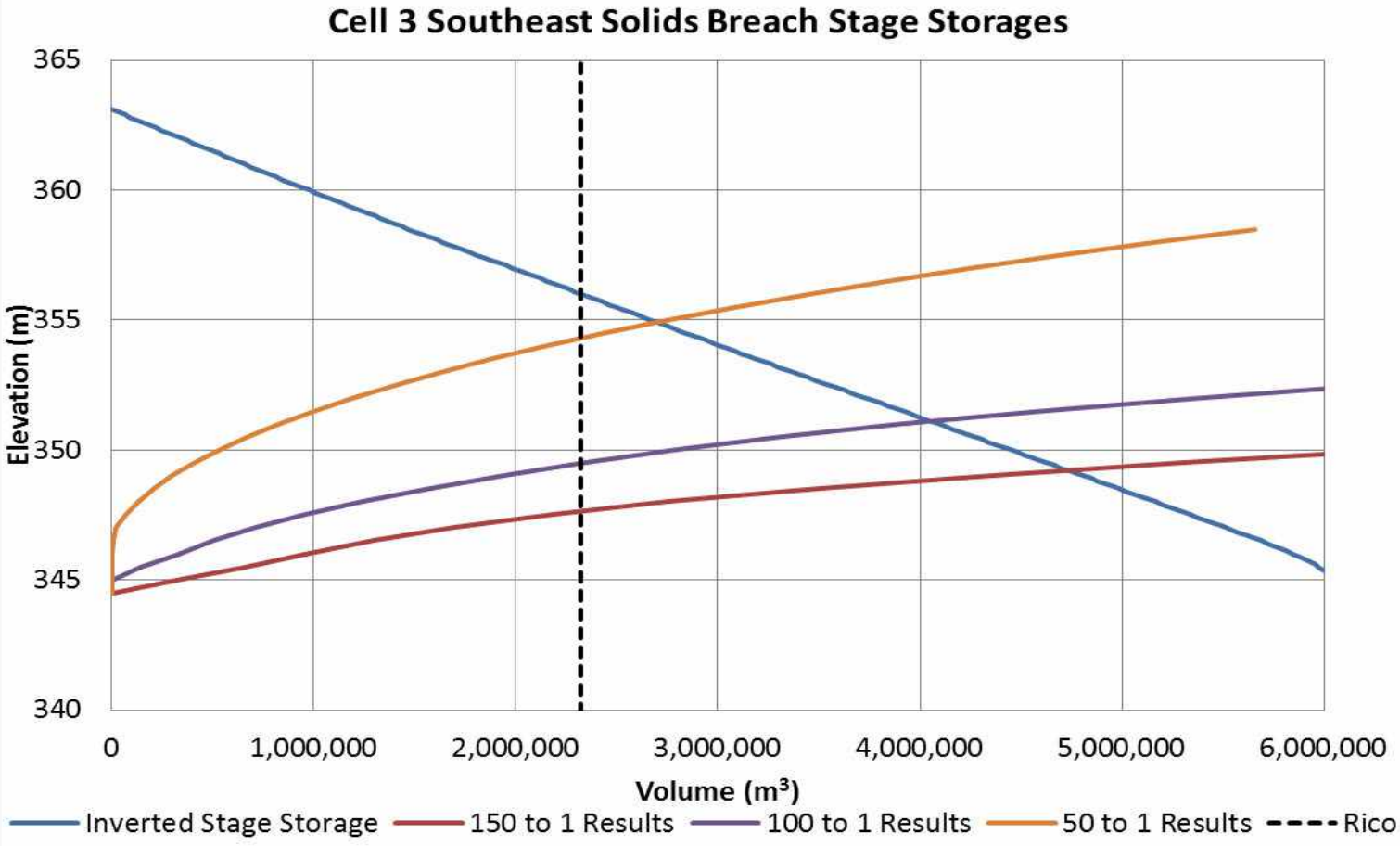
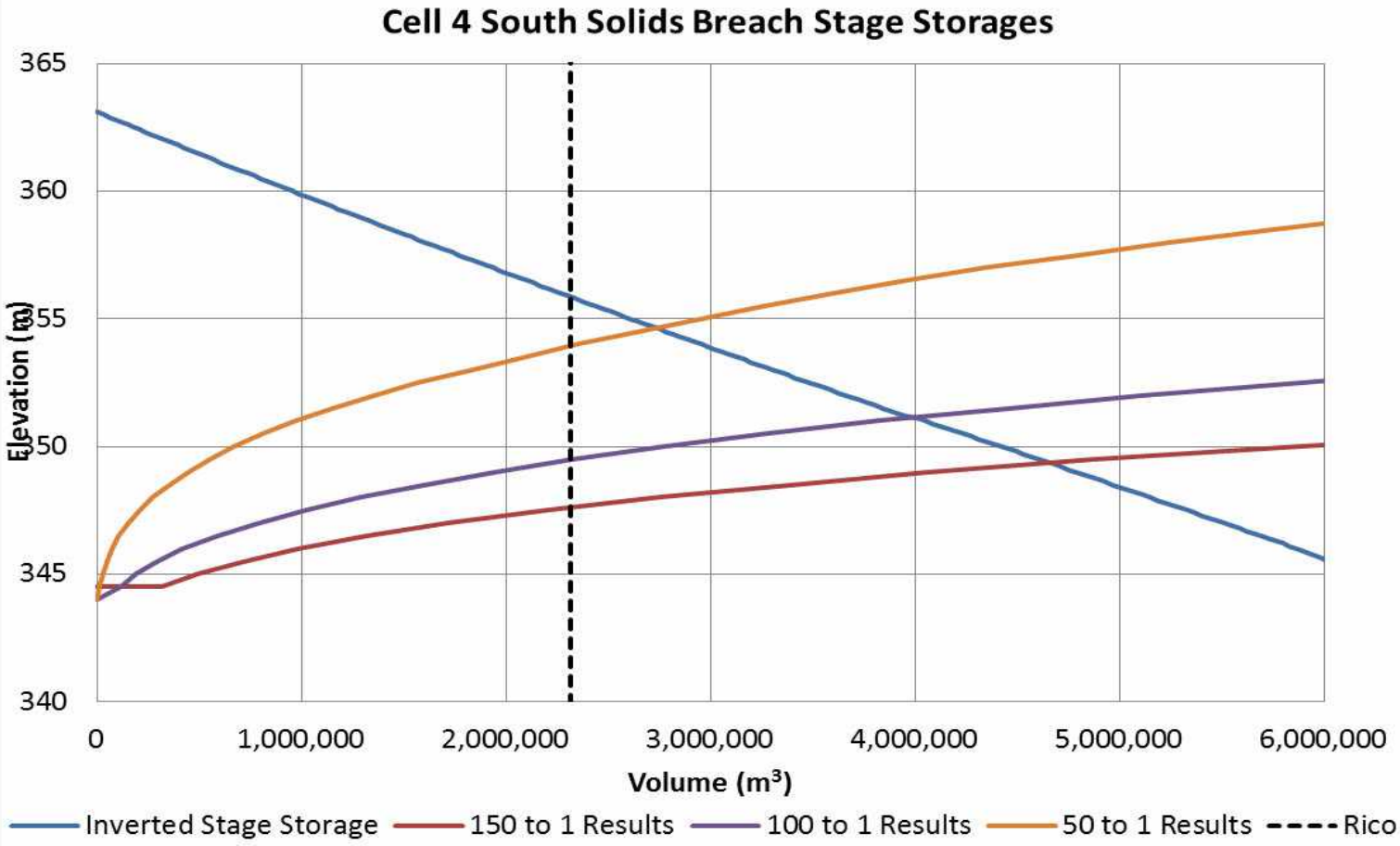
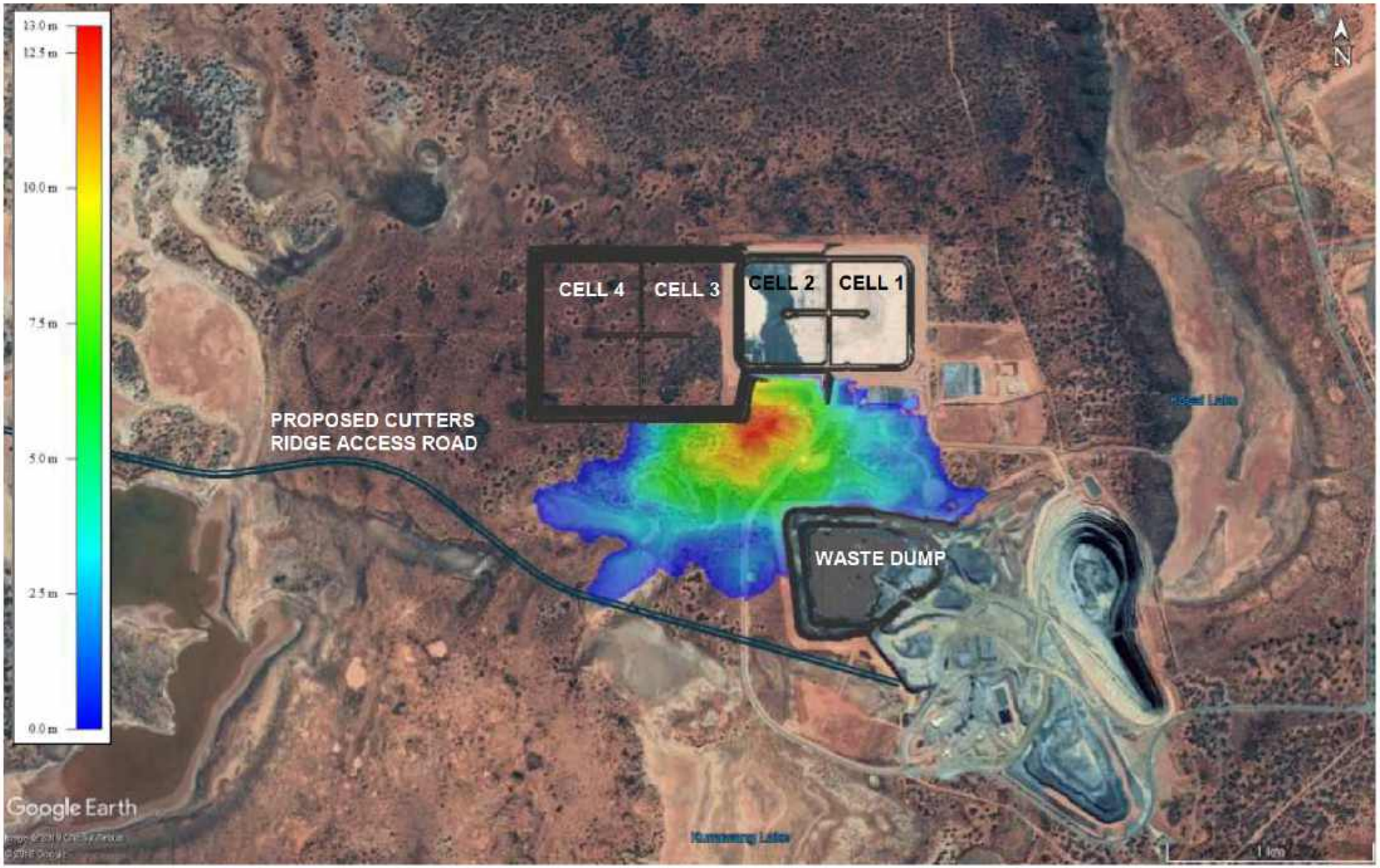
MUNGARI GOLD PROJECT
DAM BREACH ASSESSMENT
KP BREACH VOLUME ESTIMATION METHOD

PE801-00137 M19004
Figure 2.1


Cell 3 Southeast Solids Breach Stage Storages
365
360
355
350
345
340
Elevation (m)
0
1,000,000
2,000,000
3,000,000
4,000,000
5,000,000
6,000,000
Volume (m³)
Inverted Stage Storage
150 to 1 Results
100 to 1 Results
50 to 1 Results
Rico


Cell 4 South Solids Breach Stage Storages
365
360
355
350
345
340
Elevation (m)
0
1,000,000
2,000,000
3,000,000
4,000,000
5,000,000
6,000,000
Volume (m³)
Inverted Stage Storage
150 to 1 Results
100 to 1 Results
50 to 1 Results
Rico



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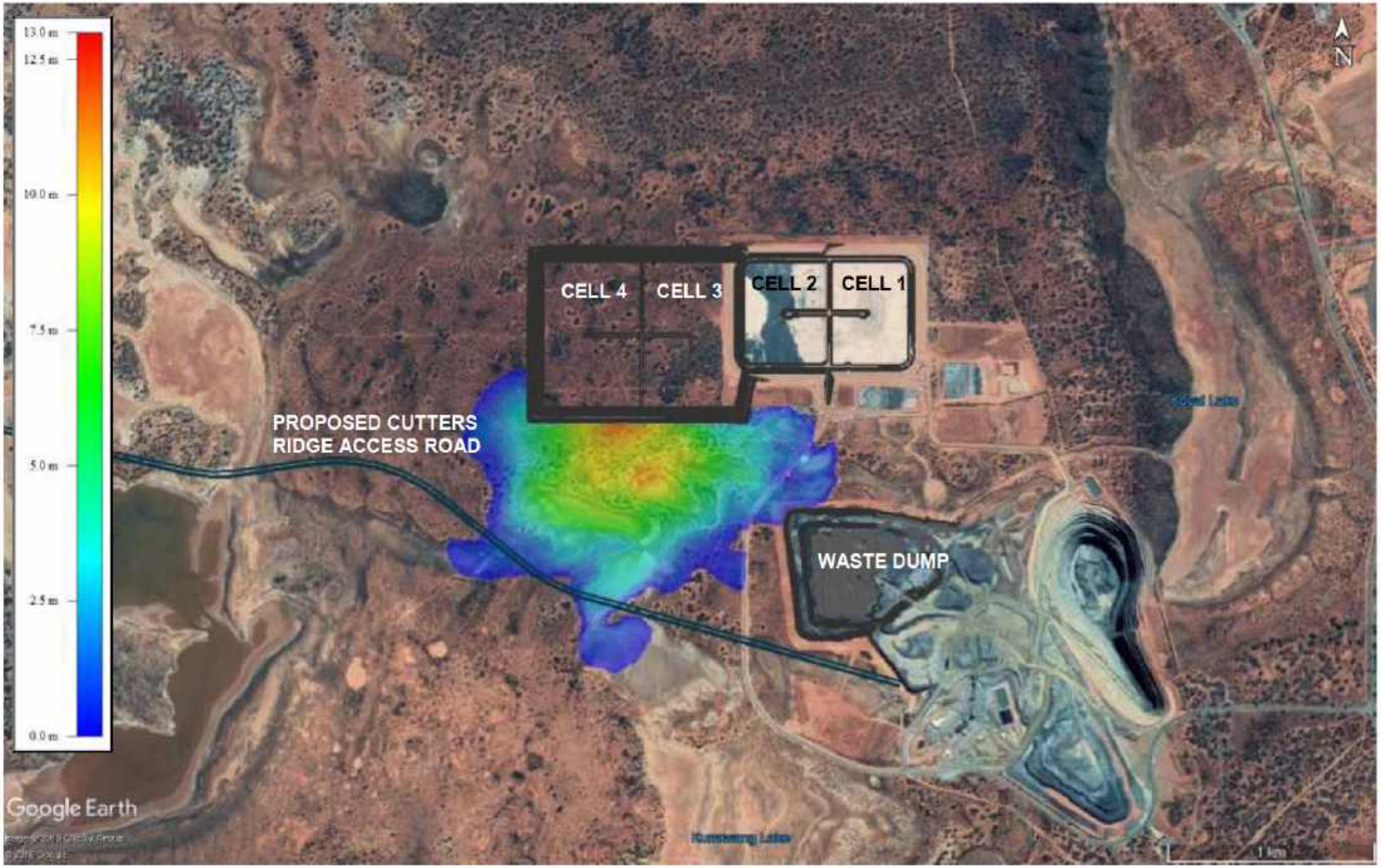
MUNGARI GOLD PROJECT
DAM BREAK ASSESSMENT
CELL 3 EMBANKMENT BREACH

PE801-00137 M19004
Figure 2.3


12.5 m
10.0 m
7.5 m
5.0 m
2.5 m
0.0 m
CELL 4
CELL 3
CELL 2
CELL 1
PROPOSED CUTTERS
RIDGE ACCESS ROAD
WASTE DUMP
N
Google Earth
1 km

APPENDIX F

Tailings Physical and Geochemical Testing

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SOILWATER CONSULTANTS

MEMO

[redacted]	COMPANY:	KNIGHT PIESOLD PTY LTD	
	PROJECT TITLE:	TSF COVER SYSTEM - MATERIALS CHARACTERISATION	
DATE: 5 July 2019	PROJECT & DOCUMENT NO:	JN0677	001
SUBJECT: Materials Characterisation - Summary and Discussion of Results			

Dean,

This memo summarises and discusses the test results obtained for the various tailings and proposed cover materials submitted to Soilwater in May 2019. The samples submitted were obtained from the Mungari (Gold) Mine and are listed in Table 1. The testing undertaken on the various materials is provided in Table 2.

Table 1: Samples submitted to Soilwater for material characterisation

ID	Minesite	Replicates	Material Description
Proposed Cover Materials			
Cap Material 2	Mungari	Zone C 1 Zone C 2 Zone C 3	Pallid to slightly mottled saprolite, typical of the regolith profile dervied from ultramafic parent rocks
Cap Material 3	Mungari	1	Blasted underground rock, ultramafic
Tailings Materials			
Tailings 1a	Mungari	1	Dark grey to black, ultrafine clay (supplied in green bag)
Tailings 1b		1	Dark olive green to grey, silty loam (suuplied in green bag)
Tailings 2	Mungari	1 2	Tank 8 Discharge, Not Screened (supplied in buckets)

Table 2: Testing completed on the submitted samples

Samples	Replicates	SWCC†	Particle Density	PSD‡ (Pipette)	Gravel Content	Gravel Fractionation	Saturated Hydraulic Conductivity
Proposed Cover Materials							
Cap Material 2	Zone C1	✓	✓	✓	✓	-	✓
	Zone C2	✓	✓	✓	✓	-	✓
	Zone C3	✓	✓	✓	✓	-	✓
Cap Material 3	Fresh Rock	-	-	-	✓	✓	-
Tailings Materials							
Mungari	Tailings 1a	✓	✓	✓	-	-	✓
	Tailings 1b	✓	✓	✓	-	-	✓
	Tailings 2	✓	✓	✓	-	-	✓

† SWCC = Soil Water Characteristic Curve; ‡ PSD = Particle Size Distribution

Summary and Discussion of Results

Gravel Content and Size Distribution

The fresh rock contains a relatively even distribution of particle sizes, and thus is ideal for use as a capillary break or for incorporation into a cover material to help stabilise and prevent erosion from occurring.

The oxide cover materials from the Mungari Mine contain appreciably less gravels, with <10 % gravels recorded, and together their high silt and clay fraction they are not suitable for use as a cover material on sloping surfaces, and should only be used on flat surfaces.

Table 3: Gravel contents for the tailings and proposed cover system materials

ID	Replicates	Description	Size Fraction (%)	
			>2.36mm	<2.36mm
Cap Material 2	Zone C 1	Saprolite	5	95

	Zone C 2		8	92
	Zone C 3		1	99
Cap Material 3	1	Fresh Rock	100	0
Tailings 1a	1	Dark Grey to Black Tailings	0	100
Tailings 1b	1	Dark Olive Grey Tailings	0	100
Tailings 2	1	Grey 'Salty' Tailings	0	100
	2		0	100

The fresh rock contains a relatively even distribution of particle sizes, and thus is ideal for use as a capillary break or for incorporation into a cover material to help stabilise and prevent erosion from occurring.

Table 4: Gravel size distribution proposed cover system materials

Size Fraction (mm)	% of Sample
	Cap Material 3 (Fresh Rock)
>125	4
100	5
90	8
75	15
53	3
37.5	7
26.5	10
19.0	7
.0	5
13.2	6
9.5	6
6.7	10
4.75	6
2.36	8

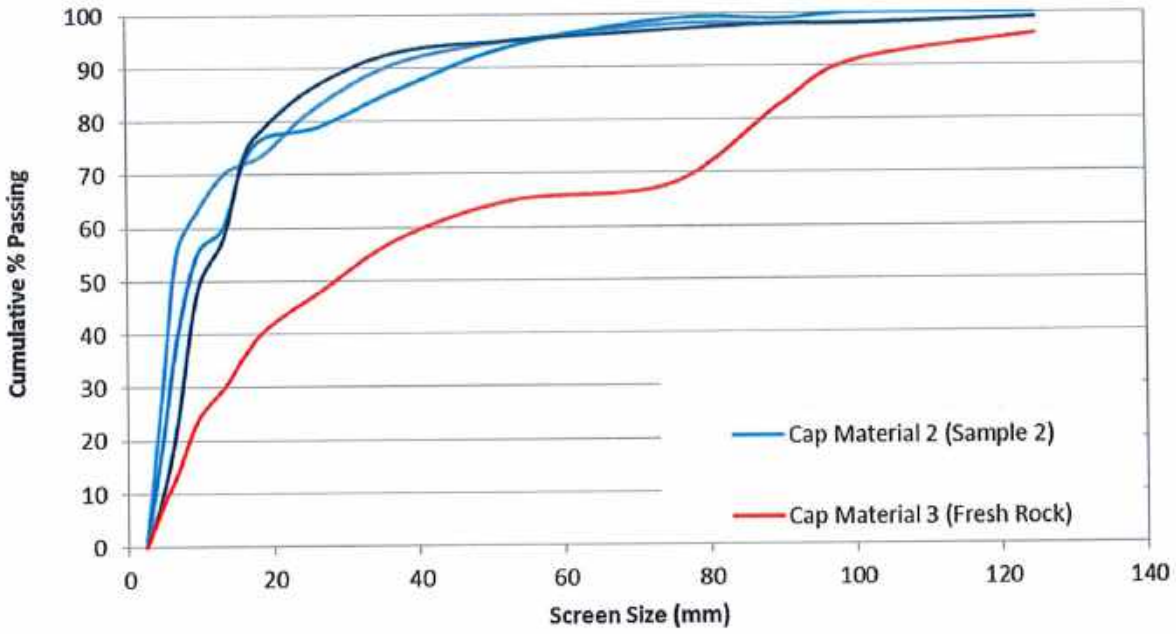


Figure 1: Gravel size distribution for the proposed cover system materials

Particle Size Distribution

The particle size distibution for the various cover system and tailings materials are presented in Table 5. All of the proposed cover system materials are classified as Loams, with the oxide materials from the Mungari Mine considered Clay Loams. In contrast, the tailings materials are generally classified as Clay Loams to Clays, with > 55 % Silt + Clay fractions.

Table 5: Particle size distribution of the cover system and tailings materials

ID	Replicate	Particle Size Distribution*			Texture
		% Sand	% Silt	% Clay	
Cap Material 2	Zone C 1	46	19	35	Clay Loam - Silty Clay Loam
	Zone C 2	55	15	30	Sandy Clay Loam
	Zone C 3	42	31	27	Clay Loam
Cap Material 3	1	-	-	-	-
Tailings 1a	1	8	48	44	Medium Clay
Tailings 1b	1	14	51	35	Silty Clay Loam
Tailings 2	1	32	39	29	Clay Loam
	2	45	32	23	Loam

* Sand represents the >20µm size fraction, Silt represents the 20 - 2µm size fraction, whilst Clay represents the <2µm fraction

Particle Density

The particle density data for the various materials tested are presented in Table 6. As expected the particle density of the materials is influence by the Silt + Clay content, with the clayey oxide cover materials has an average particle density of 2.44 g/cm^3. The relatively clayey tailings materials have an average particle density of 2.3 g/cm^3 reflecting the high clay (kaolinite) content.

Table 6: Particle density values for the various cover system and tailings materials tested

ID	Replicates	Description	Particle Density (g/cm3)
Cap Material 2	Zone C 1	Saprolite	2.38
	Zone C 2		2.59
	Zone C 3		2.35
Cap Material 3	1	Fresh Rock	-
Tailings 1a	1	Dark Grey to Black Tailings	2.22
Tailings 1b	1	Dark Olive Grey Tailings	2.28
Tailings 2	1	Grey 'Salty' Tailings	2.32
	2		2.36

Saturated Hydraulic Conductivity

The saturated hydraulic conductivity values obtained for the various materials are presented in Table 7. The saturated permeability of the ironstone cover materials averages 0.93 m/day (or 1.1×10^{-5} m/s), whilst the more clayey oxide cover materials have an average permeability of 0.5 m/day (or 5.8×10^{-6} m/s). The saturated hydraulic conductivity of the various tailings materials varies from 0.01 m/day to 0.17 m/day, with an average of 0.08 m/day (or 9.3×10^{-7} m/s).

Table 7: Saturated hydraulic conductivity for the various cover system and tailings materials

ID	Replicates	Description	Ksat	
			m/d	m/s
Cap Material 2	Zone C 1	Saprolite	0.6	6.94E-06
	Zone C 2		0.6	6.94E-06
	Zone C 3		0.3	3.47E-06
Cap Material 3	1	Fresh Rock	-	-
Tailings 1a	1	Dark Grey to Black Tailings	0.01	1.16E-07
Tailings 1b	1	Dark Olive Grey Tailings	0.06	6.94E-07
Tailings 2	1	Grey 'Salty' Tailings	0.15	1.74E-06
	2		0.17	1.97E-06

When the above saturated hydraulic conductivity data is combined with the water retention data presented below, the derived Hydraulic Conductivity Function (HCF) is shown in Figure 2. As can be seen, the permeability of all materials decreasing significantly as they dry, such that at field capacity the permeability of the materials has dropped to between 10^{-7} and 10^{-8} m/s,

These results have important implications when it comes to the hydraulic functioning of the cover system and of the tailings during closure. For the cover materials, the appreciable decrease in permeability as the materials dry means that infiltration-excess overland flow or temporary ponding will occur with rainfall events > 8 mm/day, and if these materials are located on sloping surfaces, with erosion protection, it will likely result in considerable erosion occurring.

For the tailings material, the significant drop in permeability as it dries or dewaters to field capacity means that it will take a considerable period of time to drain-down, and even at field capacity there is still appreciable tailings liquor available for upward capillary movement, and thus the risks to closure due to salinisation of the cover system will remain for a prolonged period of time.

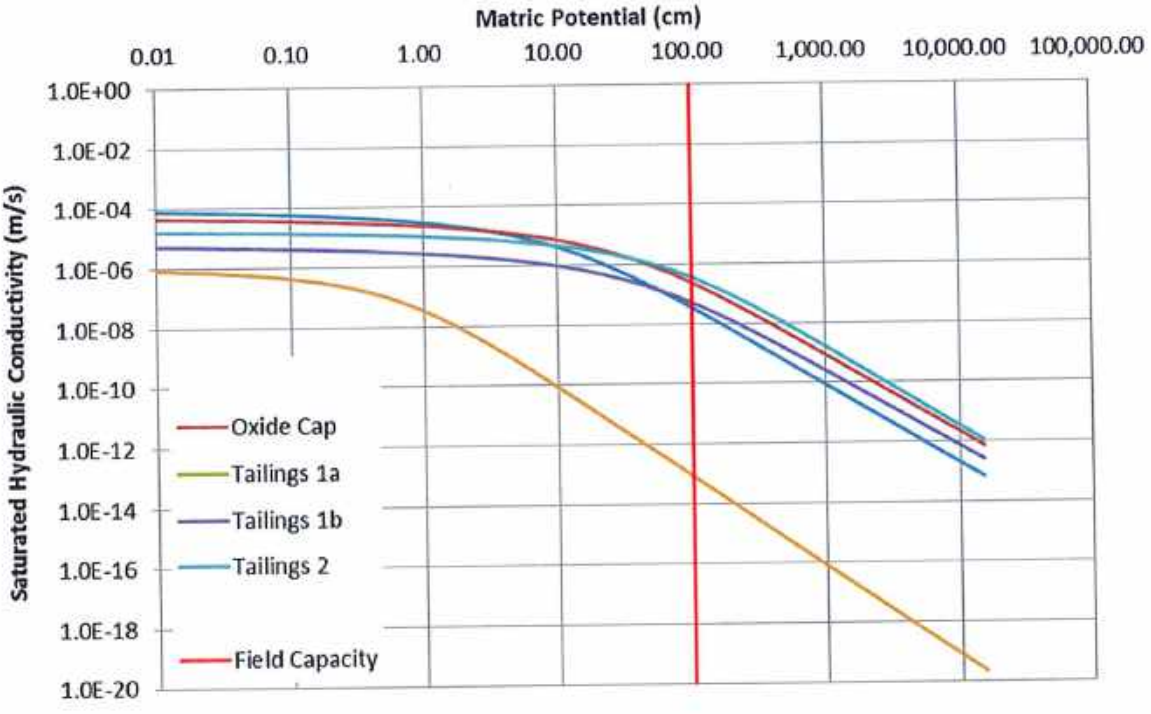


Figure 2: Hydraulic Conductivity Function (HCF) for the various cover and tailings materials

Water Retention Properties

The water retention properties for the various cover system and tailings materials, and the derived van Genuchten parameters are provided in Table 8 and Table 9.

The water retention data shows that the Plant Available Water Content (PAWC) for the ironstone and oxide cover materials averages 180 mm/m and 137 mm/m, respectively. Given these values, and knowing the transpiration rates of various rehabilitation species, these PAWC will only support small shrubs in rehabilitation if a 1 m deep cover system is reconstructed.

Table 8: Water retention data for the various cover and tailings materials

ID	Replicates	Particle Density (g/cm3)	Bulk Density (g/cm3)	Matric Suction (cm)				
				0	100	330	1,000	15,000
Cap Material 2	Zone C 1	2.38	1.5	0.37	0.32	0.28	0.24	0.18
	Zone C 2	2.59	1.5	0.42	0.34	0.31	0.25	0.21
	Zone C 3	2.35	1.5	0.36	0.33	0.31	0.26	0.19
Cap Material 3	1	-		-	-	-	-	-
Tailings 1a	1	2.22	1.4	0.37	0.3	0.28	0.22	0.19
Tailings 1b	1	2.28	1.4	0.39	0.35	0.31	0.28	0.19
Tailings 2	1	2.32	1.4	0.40	0.35	0.3	0.24	0.17
	2	2.36	1.4	0.41	0.36	0.31	0.27	0.19

Table 9: Derived van Genuchten parameters for the various cover and tailings materials

ID	Replicates	Derived van Genuchten paramaters			
		α	n	θs	θr
Cap Material 2	Zone C 1	0.017	1.241	0.37	0.112
	Zone C 2	0.027	1.299	0.42	0.165
	Zone C 3	0.008	1.197	0.36	0.079
Cap Material 3	1	-	-	-	-
Tailings 1a	1	0.024	1.309	0.369	0.152
Tailings 1b	1	0.014	1.228	0.386	0.151
Tailings 2	1	0.009	1.367	0.396	0.125
	2	0.014	1.207	0.407	0.085

Should you have any queries regarding this report, please do not hesitate to contact us.

Yours sincerely,

[redacted]

Knight Piésold
CONSULTING

MEMORANDUM

To:	**La Mancha Resources Australia Pty Ltd**	**Date:**	5th July 2013
Attn:	Marcus Binks	**Our Ref:**	PE13-00546
		KP File Ref.:	**PE801-00137/05 AL M13011**
cc:		**From:**	Dean Sawyer

RE: MUNGARI PROJECT – TAILINGS PHYSICAL AND GEOCHEMICAL TESTING

La Mancha Resources is investigating the development of the Mungari Gold Project located 20km west of Kalgoorlie, Western Australia. The project will incorporates both the White Foil and Frog's Leg orebodies. The project development will require a Tailings Storage Facility (TSF) to store the tailings product. This memo discusses the physical and geochemical testwork of a laboratory generated sample.

1. SAMPLE DESCRIPTIONS AND TESTWORK

Two 20L buckets of slurry samples labelled Frogs Leg Composite and White Foil Composite were supplied by La Mancha Resources to the Knight Piésold (KP) laboratory in October 2011. The samples will be referred to as the Frogs Leg and White Foil tailings for this memo. The sample was prepared at approximately 47% solids

The following tests were carried out on the samples received:

i. Classification tests to determine:
   - Particle size distribution of the tailings;
   - Supernatant liquor density;
   - Liquid and plastic limits of the tailings solids;
   - Tailings solids particle density.

ii. Undrained and drained sedimentation tests;
iii. Air drying tests;
iv. Permeability tests;
v. High strain consolidation tests;
vi. Geochemical Characterisation.

During laboratory testing it is Knight Piésold's normal practice to duplicate each test as a means to verify the consistency of the test results. The results of each individual test are plotted on the corresponding figures. The interpreted mean values are given in the tables and text of the document. A brief description of the method employed in each test is also provided.

2. PHYSICAL TESTING

The following discusses the physical testing results for the tailings samples. Predicted tailings behaviour is discussed in Section 3; however, it should be noted that field results are also dependent on the processing plant operation, layout and design of the proposed storage facilities and blending of the different ore types.

2.1 CLASSIFICATION TESTING

Classification testing was completed by SGS Australia in Perth. Where appropriate, classification tests were conducted in accordance with relevant Australian Standards. The results of the classification tests and relevant Australian Standards are summarised in Table 2.1. The SGS Australia laboratory test reports are presented in Appendix A.

Table 2.1: Classification testing – results and relevant standards

Test	Frogs Leg	White Foil	AS1289
Particle Density	2.82	2.84	3.5.1 (1995)
Supernatant Density	1.12	1.12	(hydrometer)
Supernatant pH	7.7	7.8	(pH meter)
Liquid Limit (%)	-	-	3.1.2 (1995)
Plastic Limit (%)	NP	NP	3.2.1 (1995)
Plasticity Index (%)	NP	NP	3.3.1 (1995)

* NP – Non Plastic

The particle size analysis was completed in accordance with AS1289 3.6.3 - 2003. The measured particle size distribution is presented in Table 2.2 and the grading curve for the sample is shown on Figure 2.1.

Table 2.2: Particle size distribution

Fraction	Particle Size (µm)	Percent Passing (%)	
		Frogs Leg	White Foil
Sand	600	100	100
	200	97	97
Silt	75	80	81
	20	41	40
	6	21	19
Clay	2	10	9

Using the Unified Soil Classification System (Geotechnical Site Investigations, AS1726-1993), both samples can be classified as silt with sand (ML). Both samples P_{80} is around 75µm.

2.2 SEDIMENTATION TESTS

Drained and undrained sedimentation tests were carried out to determine the settling rate, volume of supernatant, and settled dry density of the tailings.

In the undrained sedimentation test, tailings slurry is allowed to settle in a measuring cylinder. This is equivalent to the deposition of tailings under water. The results indicate the expected rate and quantity of supernatant release and enable the minimum dry density of the tailings to be determined.

In the drained sedimentation, test tailings slurry is allowed to settle and drain in a cylinder with a fine sand filter drain at the base. This simulates the deposition of tailings where both settling and free drainage can occur. The results indicate the relative quantities of supernatant and underdrainage released by the settling slurry and enables the dry density of the drained tailings to be determined. The underdrainage values are maximum values,

as the drainage layer is free-draining without back pressure and the tailings is deposited directly over the drainage medium.

The results of the sedimentation tests are presented in figures 2.2 to 2.5. Table 2.3 presents a summary of the measured sedimentation data.

Table 2.3: Sedimentation test results

Sample	Test	Initial Solids (%)	Supernatant (% of initial water volume)	Underdrainage (% of initial water volume)	Time to Achieve Final Density (days)	Final Dry Density (t/m^3)	Final Void Ratio	Figure
Frogs Leg	Undrained	44.4	56	-	1	1.18	1.39	2.2
	Drained	46.2	43	24	1	1.45	0.88	2.3
White Foil	Undrained	45.0	57	-	1	1.21	1.33	2.4
	Drained	44.7	38	28	1	1.40	1.02	2.5

The tests indicate that both samples have similar settling characteristics. The tailings samples have moderate settling speed characteristics. The sample released approximately 56% of the water in slurry to supernatant for the undrained case, reducing to 40% supernatant release for the drained case. There is an approximately 19% increase in the settled density, increasing from 1.2 t/m³ to 1.4 t/m³. The settled densities achieved are moderate, with a resulting void ratio of approximately 1.

2.3 AIR DRYING TESTS

Air drying tests were carried out on slurry samples to determine the effect of air drying on the tailings after initial settling and removal of supernatant liquor, thereby simulating conditions expected following sub-aerial deposition. Continuous monitoring of the weight and volume of each specimen was carried out in order to quantify the relationship between dry density, moisture content, volumetric change and the degree of saturation of the tailings.

A direct relationship exists between dry density and moisture content up to a breakaway point, at which the degree of saturation falls below 100%. At this point, negative pore water pressures are developed, which further consolidates the tailings. Drying below a limiting saturation produces no further consolidation, and the density at this point represents the maximum that can be achieved via air drying of the tailings.
The results of air drying tests are presented in figures 2.6 to 2.9 and are summarised in Table 2.4.

Table 2.4: Results of air drying tests

Sample	Moisture Content at Breakaway Point (%MC)	Dry Density at Breakaway Point (t/m3)	Limiting Saturation Value (%Sat)	Final Dry Density (t/m^3)	Figures
Frogs Leg	40	1.45	90	1.55	2.6, 2.7
White Foil	40	1.50	80	1.55	2.8, 2.9

The two tailings samples achieved higher dry densities of around 1.55 t/m^3 over a drying time of approximately 15 days at an evaporation rate of 7.5mm/day. The formation of a significant salt layer slowed down the rate of evaporation from the sample. The air drying tests increased the final dry density by only 10% above the drained sedimentation test. This indicates the tailings initial settlement provides the majority of the dry density result over the space of only a few days, with air drying providing a slight improvement in density over a much longer period.

2.4 PERMEABILITY TESTS

Falling head permeability tests were completed on saturated tailings samples with drainage through the drained sedimentation sample being measured. In addition, permeability values were derived from the results of consolidation tests. Results are summarised in Table 2.5 and presented in figures 2.10 and 2.11.

Table 2.5: Permeability test results

Sample	Test Type	Dry Density (t/m^3)	Permeability (m/s)
Frogs Leg	Falling Head	1.50	4.0×10^{-7}
	Consolidation Test	1.31 1.36 1.40	5.3×10^{-6} 1.0×10^{-6} 4.0×10^{-7}
White Foil	Falling Head	1.41	7.5×10^{-7}
	Consolidation Test	1.19 1.25 1.30	5.5×10^{-5} 7.9×10^{-7} 3.7×10^{-7}

These results represent the permeability of saturated tailings prior to additional consolidation due to additional deposition loading or air-drying. In the range of expected settled densities, the permeability of both the tailings is similar at approximately 4×10^{-7} m/s.

2.5 CONSOLIDATION TESTS

The consolidation of the tailings can be quantified in terms of the compression index C_C and the coefficient of consolidation C_V. The compression index relates the void ratio or tailings density to the effective stress of the tailings sample. The larger the value of C_C, the more compressible the tailings. The coefficient of consolidation defines the rate of excess pore water dissipation, and hence the rate of increase in effective stress within the tailings. Higher values of C_V indicate more rapid consolidation of the sample.

The settlement with respect to time and the variation in permeability with density for the test is presented in figures 2.10 and 2.11 and the results of the consolidation tests are summarised in Table 2.6.

Table 2.6: Consolidation test results

Sample	Dry Density (t/m^3)	Stress Range (kPa)	Coeff. of Consolidation C_V (m^2/y)	Coeff.of Volume Decrease M_V (m^2/kN)	Comp. Index C_C
Frogs Leg	1.28 – 1.40	1.55 – 4.95	110	0.02	0.37
White Foil	1.17 – 1.30	1.33 – 4.55	56	0.03	0.44

Results indicate that the samples have moderate compressibility and will consolidate quickly.

3. GEOCHEMISTRY

3.1 GEOCHEMISTRY TESTWORK

3.1.1 Acid Base Accounting

Acid base accounting (ABA) assesses the sample's potential to form acid from oxidation of sulfides and the ability to neutralise acid by the dissolution of minerals, especially carbonates, contained in the sample.

The ABA test work was conducted by Genalysis, Perth. Total sulfur, total carbon and total inorganic carbon were determined by LECO induction furnace, with infrared detection. Sulfate sulfur was determined by 10% Na_2CO_3 extraction, with $BaSO_4$ precipitation. The test work methods used are based on the ABA methodology defined in the Mine Environment Neutral Drainage (MEND) Acid Rock Drainage Prediction Manual (Ref. 1) and Guidelines for Metal Leaching and Acid Rock Drainage at Mine Sites in British Columbia (Ref. 2).

Acid Neutralising Capacity (ANC) was determined by digestion in a standard solution of HCl, followed by back titration with NaOH to determine the amount of acid consumed. The technique used was based on Sobek *et al.* (Ref. 3).

The results of the ABA test work are used to calculate the Maximum Potential Acidity (MPA) which is a measure of the maximum amount of sulfuric acid which can be produced from the total oxidation of all sulfides within the sample, assuming all sulfide is present as pyrite.

3.1.2 Static Net Acid Generation

Static Net Acid Generation (NAG) test work is a direct measure of the sample's ability to produce acid through sulfide oxidation. The addition of hydrogen peroxide to samples causes rapid oxidation of the contained sulfides to produce sulfuric acid.

NAG test work was conducted by Genalysis. The procedure employed is based upon the Static NAG Test (Ref. 4 & 5). Fifteen percent hydrogen peroxide solution was adjusted to pH 4.5 before addition to the samples. The samples were then left to stand overnight at room temperature before pH measurement. The samples are then boiled for 2 to 3 hours and allowed to cool before being made back up to 250 mL followed by pH measurement and titration to pH 7.0.

3.1.3 Acid Formation Potential

The acid formation potential of a sample is calculated based on the acid base accounting, i.e. the balance between a sample's ability to produce acid from the oxidisation of sulfide minerals (Maximum Potential Acidity, MPA) and the sample's ability to neutralise acid by the dissolution of alkaline minerals contained within the sample (Acid Neutralising Capacity, ANC). The balance between the MPA and the ANC is termed the Net Acid Producing Potential (NAPP), where a negative NAPP indicates an excess of acid neutralising capacity and the positive NAPP indicates an excess potential acidity.

Historically a safety margin was applied to ratio between the ANC and MPA to allow for variability in the rates of acid production and neutralisation processes and the potential for geographic separation of the acid producing and acid neutralising phases. This safety margin was generally set by industry at 2 in North America and 3 in Australia.
With recent advances in the understanding and acceptance of the NAG test there has been a move away from this method of classifying materials based solely on the ANC and

MPA as these calculated parameter do not take into consideration the true availability of acid producing and acid neutralising phases.
Knight Piésold prefers to utilise the results of the Acid Base Accounting in combination with the NAG testing results to classify the acid formation potential of materials. Knight Piésold's classification system is given in Table 3.1 and is based on the Australian Government's guidelines on Managing Acidic and Metalliferous Drainage (Ref. 6) and is broadly similar to the classification system contained within the AMIRA ARD Test Handbook (Ref. 7), which is advocated by the Global Acid Rock Drainage Guidelines (Ref. 8).

Table 3.1: Acid Formation Potential Classification System

Acid Formation Potential Class	NAPP (kg H_2SO_4 /t)	NAG pH
Potentially Acid Forming (PAF)	>10	<4.5
Potentially Acid Forming – Low Capacity (PAF-LC)	0 to 10	<4.5
Non Acid Forming (NAF)	Negative	≥4.5
Acid Consuming (AC)	Less than -100	≥4.5
Uncertain (UC)	Positive	≥4.5
	Negative	<4.5

3.1.4 Multi Element Analysis

Multi-element analysis of the samples was conducted to assess elemental enrichments within the samples. The testing was conducted by Genalysis in Perth. The acid digestion method employed resulted in near total digestion of the samples to assess the geochemistry of the samples

Multi-element analysis results were compared to the average crustal abundance to give the geochemical abundance indices. The Geochemical Abundance Index (GAI) quantifies an assay result for a particular element in terms of average crustal abundance. The GAI is calculated from the following formula:

$$GAI = Log_2 (C_n / (1.5 \times B_n))$$

Where:
Cn = measured concentration of element in sample
Bn = average crustal abundance (Bowen, (Ref. 9))

The GAI is expressed on a scale of 0 to 6, with 0 indicating the concentration of the element is less than or similar to average crustal abundance. A GAI of 3 corresponds to a 12 fold increase above the average crustal abundance, and so forth up to a GAI of 6 which represents a 96 fold increase or greater.

Knight Piésold has assigned an arbitrary scale to the GAI with indices of 0 and 1 being unenriched, indices of 2 being classified as slightly enriched, indices of 3 and 4 being classed as significantly enriched and indices of 5 and 6 being classified as highly enriched.

3.1.5 Supernatant Water Quality

Characterization of the tailings supernatant was conducted to assess the potential for the supernatant to cause environmental impacts to surface water or near surface

groundwater. These tests differ from the multi-element tests in that they only record the readily soluble elements whereas the multi-element tests give the total elemental enrichment of the tailings solids.

The supernatant characterisation was conducted at Genalysis Laboratories in Perth. A sample of slurry was sent to the laboratory. The pH and the conductivity of the slurry were measured and the bottles left to stand for a minimum of 3 hours. The supernatant was siphoned off and filtered through 0.45 µm membrane before preservation of the solution by acid addition prior to analysis. The analysis was by Inductively Coupled Plasma Mass Spectrometry or Inductively Coupled Plasma Optical Emission Spectrometry depending on the element being analysed and the detection limits required.

The supernatant water quality test results were compared to a set of reference water quality standards, which are detailed in the following section.

3.1.6 Reference Water Quality Standards

To allow assessment of the results of the supernatant analysis a set of reference values has been established. These reference values were compiled from internationally accepted guidelines for water quality for release from mining operations (IFC environmental, health and safety guidelines (Ref. 10 & 11) and the ANZECC water quality guideline for livestock drinking water (Ref. 12). The use of several guidelines is required as no single guideline contains target concentrations for all parameters. Where a target concentration for a specific element is at different levels in more than one guideline the lowest concentration has been adopted. These reference values are given in Table 3.2.

The establishment of these reference water quality values is to allow for evaluation only and it is not implied by production of the reference water quality values that the Mungari project will be required to meet these reference levels or that these reference levels should be used as the regulatory framework. The regulatory requirements for the project will be determined by the relevant regulatory authorities during the environmental design phase of the project.

These reference levels are to be used for a preliminary assessment of water quality only. More detailed assessment of the impact of any release from the mine site may be required in later design stages to assess the impact on receiving environments, such as aquatic systems, where different water quality requirements may be applicable.

Table 3.2: Reference Release Water Quality Standards

Parameter	Unit	ANZECC Livestock	IFC 2004	IFC 2007	Adopted Reference Level
pH	S.U.		6 to 9	6 to 9	6 to 9
TDS	mg/kg	2000			2000
Aluminum	mg/L	5			5
Antimony	mg/L				N/G
Arsenic	mg/L	0.5	0.1	0.1	0.1
Barium	mg/L				N/G
Boron	mg/L	5			5
Cadmium	mg/L	0.01	0.1	0.05	0.01
Calcium	mg/L	1000			1000
Chloride	mg/L				N/G
Chromium	mg/L	1			1
Chromium (Cr^{+6})	mg/L		0.1	0.1	0.1
Cobalt	mg/L	1			1
Copper	mg/L	0.4	0.5	0.3	0.3
Cyanide-Total	mg/L			1	1
Cyanide-Free	mg/L			0.1	0.1
Cyanide-WAD	mg/L		0.5	0.5	0.5
Fluoride	mg/L	2	20		2
Iron	mg/L		3.5	2	2
Lead	mg/L	0.1	0.1	0.2	0.1
Magnesium	mg/L	2000			2000
Manganese	mg/L				N/G
Mercury	mg/L	0.002	0.01	0.002	0.002
Molybdenum	mg/L	0.15			0.15
Nickel	mg/L	1	0.5	0.5	0.5
Phosphorus	mg/L				N/G
Selenium	mg/L	0.02	0.1		0.02
Silver	mg/L		0.5		0.5
Sodium	mg/L				N/G
Sulfate	mg/L	1000			1000
Tin	mg/L				N/G
Uranium	mg/L	0.2			0.2
Vanadium	mg/L				N/G
Zinc	mg/L	20	2	0.5	0.5

N/G – No guideline

3.2 GEOCHEMICAL CHARACTERISTICS

Laboratory test certificates for all the tailings analytical testing conducted by Genalysis are provided in Appendix B, with the results presented and discussed in the following sections. As part of the quality control and assurance program conducted by the laboratory, a duplicate run of all tests were conducted on the Frogs Legs tailings and supernatant samples. The results of the Frogs Legs tailings and supernatant samples presented in the following sections are the average values of the initial and duplicate tests.

3.2.1 Tailings Acid Base Accounting

The total sulfur content of the tailings was determined by Leco combustion. In addition, the samples were analysed for Na_2CO_3 soluble sulfate. The difference between these two

values was assumed to be equal to the sulfide content of the samples. The results of the analysis are given in Table 3.3.

Table 3.3: Tailings Sulfur Analysis Results

Sample	Total Sulfur (%)	Sulfate Sulfur (%)	Sulfide Sulfur (%)	Maximum Potential Acidity (kg H_2SO_4 /t)
Frogs Legs	1.85	0.21	1.64	50.4
White Foil	1.40	0.19	1.21	40.0

The results of the analysis indicate that the total sulfur content of the tailings samples ranged from 1.40 to 1.85% which is high. The sulfide content of the samples was calculated as between 1.21 and 1.64%, corresponding to a high content. The results of the speciated sulfur analysis indicate that the majority sulfur is present as sulfide. Accordingly, the maximum potential acidity calculated from the sulfide sulfur content ranged from 40.0 to 50.4 kg H_2SO_4 / tonne of tailings, which is also high.

The acid neutralising capacity (ANC) of the samples was determined along with the carbonate content. The two results can be used as a check against one another and to identify the contribution of ANC from carbonates and other non carbonate minerals. The results of the analysis are given in Table 3.4.

Table 3.4: Summarised Tailings Carbonate and Acid Neutralising Capacity Results

Sample	Carbonate Carbon (%)	CO_3-ANC [1] (kg H_2SO_4 /t)	ANC [2] (kg H_2SO_4 /t)
Frogs Legs	5.0	50.4	98.5
White Foil	4.0	40.0	58.0

[1]Calcuated ANC from carbonate content, [2]Measured Sobek ANC

The results of the carbonate analyses indicate that the tailings samples had a carbonate content of between 4.0 and 5.0%, which is high. The results also indicate that both samples have additional neutralising capacity available from non-carbonate minerals when subjected to strongly acidic conditions, especially the Frogs Legs sample. The measured acid neutralising capacity of the samples ranged from high (58.0%) to very high (98.5%).

The Net Acid Producing Potential (NAPP) of the samples was calculated from the MPA and the ANC and is given in Table 3.5 along with the ANC/MPA ratio. The net acid producing potential of both samples was negative with ANC/MPA ratios of 1.6 and 2.0, indicating that there is excess neutralising capacity in the samples, particularly the Frogs Legs sample.

Table 3.5: Tailings Net Acid Producing Potential Results

Sample	ANC (kg H_2SO_4 /t)	MPA (kg H_2SO_4 /t)	NAPP (kg H_2SO_4 /t)	ANC/MPA (unit less)
Frogs Legs	98.5	50.2	-48.3	2.0
White Foil	58.0	40.0	-21.0	1.6

3.2.2 Tailings Net Acid Generation

The net acid generation (NAG) test aids in interpretation of acid formation potential classifications. It also identifies if the sulfides and neutralising minerals contained in the samples are readily available to produce or consume acid.

The results of the net acid generation test are given in Table 3.6 and indicate that no measurable acid was produced by either sample when exposed to extreme oxidising conditions. The final NAG pH of the tailings after complete oxidation was between 8.95 and 9.4, indicating that weak alkaline pH conditions are likely to prevail within the tailings pore waters, should complete oxidation of the tailings solids occur.

Table 3.6: Tailings Net Acid Generation Results

Sample	NAG (7.0) (kg H_2SO_4/t)	NAG pH
Frogs Legs	0	8.95
White Foil	0	9.4

3.2.3 Tailings Acid Formation Potential

The acid formation potential is determined based on the acid base accounting results and the NAG test. Both samples recorded negative net acid producing potentials, with the NAG test resulting in a NAG pH of 8.9 and 9.4. The samples were therefore classified as Non Acid Forming. The classification of both samples is shown in Figure 3.1.

3.2.4 Tailings Solids Geochemical Enrichments

Multi-element analysis of the tailings solids was conducted to assess elemental enrichments within the solid portion of the tailings material. Multi-element analysis results were compared to the average crustal abundance to give the geochemical abundance indices. The Geochemical Abundance Index (GAI) quantifies an assay result for a particular element in terms of average crustal abundance.

The assay results, average crustal abundance (ACA) and corresponding geochemical abundance indices (GAI) are given in tables 3.7 and 3.8. The results of the analysis show that the White Foil tailings solids had a low number of elemental enrichments, with the Frogs Legs tailings having a moderate level of enrichment. Both samples were found to be enriched in a similar set of elements.

Arsenic, chloride and sulfur were classed as highly enriched in both samples, with carbon found to be significantly enriched in both samples. Cadmium, lead, antimony and selenium were also found to be significantly enriched in the Frogs Legs sample. Silver, boron, bismuth were found to be slightly enriched in both samples, with cadmium found to be slightly enriched in the White Foil sample and zinc found to be slightly enriched in the Frogs Legs sample.

The results of the analysis have also been compared to a set of soil intervention guidelines compiled from Australian National Environmental Protection Measures investigations levels for assessment of site contamination (Ref. 13) and Netherlands National Institute of Public Health and Environment intervention levels for soil (Ref. 14) and ecological threshold concentrations for antimony in water and soil published by the European Centre for Risk Assessment (Ref. 15). The results of the comparison are given in Table 3.9 and indicate that arsenic, barium, manganese and sulfur exceed the guideline values in both samples, with the Frogs Legs sample also exceeding the guideline values for cadmium, copper, nickel, vanadium and zinc. The results of this comparison indicate that a cover system would likely be required on closure to isolate the tailings from the environment

Table 3.7: Tailings Multi-Element Results & Geochemical Abundance Indices

Element	Unit	Multi-Element Analysis Result	
		Frogs Legs	White Foil
Ag	ppm	0.6	0.5
Al	ppm	71896	59803
As	ppm	667	83
B	ppm	69	53
Ba	ppm	352	500
Be	ppm	0.88	1.3
Bi	ppm	0.31	0.24
C	ppm	7550	5100
Ca	ppm	49458	32361
Cd	ppm	3.2	0.47
Cl	ppm	96600	91700
Co	ppm	35	22
Cr	ppm	110	18
Cu	ppm	107	19
F	ppm	305	407
Fe	ppm	60250	84500
Hg	ppm	0.02	0.01
K	ppm	18150	12717
Mg	ppm	20607	10111
Mn	ppm	1204	1223
Mo	ppm	1.2	1.6
Na	ppm	18706	30060
Ni	ppm	68.5	11
P	ppm	373	1083
Pb	ppm	164	28
S	ppm	18500	14000
Sb	ppm	3.5	0.84
Se	ppm	0.92	0.21
Sn	ppm	1.9	2.2
Sr	ppm	182	193
Th	ppm	2.4	10
U	ppm	0.65	2.5
V	ppm	155	27
Zn	ppm	411	130

Table 3.8: Tailings Multi-Element Results & Geochemical Abundance Indices

Element	Average Crustal Abundance	Geochemical Abundance Index	
		Frogs Legs	White Foil
Ag	0.07	2	2
Al	82000	0	0
As	1.5	6	5
B	10	2	2
Ba	500	0	0
Be	2.6	0	0
Bi	0.048	2	2
C	480	3	3
Ca	41000	0	0
Cd	0.11	4	2
Cl	130	6	6
Co	20	0	0
Cr	100	0	0
Cu	50	1	0
F	950	0	0
Fe	41000	0	0
Hg	0.05	0	0
K	21000	0	0
Mg	23000	0	0
Mn	950	0	0
Mo	1.5	0	0
Na	23000	0	0
Ni	80	0	0
P	1000	0	0
Pb	14	3	0
S	260	6	5
Sb	0.2	4	1
Se	0.05	4	1
Sn	2.2	0	0
Sr	370	0	0
Th	12	0	0
U	2.4	0	0
V	160	0	0
Zn	75	2	0

Slightly enriched
Significantly enriched
Highly enriched

Table 3.9: Tailings Solid Multi-Element Results & Site Contamination Guidelines

Element	Ecological Investigation - interim Urban[1] (ppm)	Health Investigation levels - Category A[2] (ppm)	Intervention Values for Soil [3] (ppm)	Most Conservative	Multi-Element Analysis Results (ppm)	
					Frogs Legs	White Foil
Antimony			15	15	3.5	0.8
Arsenic	20	100	55	20	**667**	**83**
Barium	300		625	300	**352**	**500**
Beryllium		20	30	20	0.88	1.3
Boron		3000		3000	69	53
Cadmium	3	20	12	3	**3.2**	0.47
Chromium (total)			380	380	110	18
Cobalt		100	240	100	35	22
Copper	100	1000	190	100	**107**	19
Lead	600	300	530	300	164	28
Manganese	500	1500		500	**1204**	**1223**
Mercury (inorganic)	1	15	10	1	0.02	0.01
Molybdenum			200	200	1.15	1.6
Nickel	60	600	210	60	**69**	11
Phosphorus	2000			2000	373	1083
Selenium			100	100	0.92	0.21
Silver			15	15	0.56	0.50
Sulfur	600			600	**18500**	**14000**
Sulfate	2000			2000	**2100**	1900
Tin			900	900	1.9	2.2
Vanadium	50		250	50	**155**	27
Zinc	200	7000	720	200	**411**	130

1 = National Environmental Protection Council - National Environmental Protection Measures – Soil Investigation levels for assessment of site contamination 2 = Netherlands National Institute of Public Health and Environment, 3 = European Centre for Risk Assessment.

3.2.5 Supernatant Water Quality

The supernatant water quality was assessed to examine the solubility of the various parameters which will occur when the ore is processed within the process plant. The results of the testing give an indication of the water quality which is likely within the supernatant pond during operation, but cannot be used to predict long term seepage quality from the facility. This would require leach and/or kinetic testing of the tailings solids which is beyond the scope of this initial geochemical assessment.

The results of the supernatant testing have been compared to the reference water quality standard for release of water from mining operations and livestock drinking water, as detailed in Table 3.2. The results of the supernatant testing are provided in Table 3.10.

The Frogs Legs and White Foil supernatant was found to be hypersaline, with a total dissolved solids (TDS) value of 163,599 and 171,448 mg/kg respectively. As a result, the samples had to be diluted by the laboratory to enable the analysis to be completed and, consequently, the detection limits of many elements were increased. Therefore, the limit of detection for numerous elements (namely chromium, copper, mercury, nickel and zinc) exceeded the assessment criteria. As such, even though several determinants were found to be below the laboratory limits of detection, it is not possible to ascertain whether they exceed the assessment criteria. Further, where an element is indicated to below the detection limit in the laboratory results, Knight Piésold conservatively assumes that the element is present at the detection limit concentration. This is also how the results are presented in Table 3.10, with elements highlighted in blue indicating that the laboratory limit of detection exceeds the reference water quality value and elements highlighted in red indicating that the element genuinely exceeds the criteria value.

The results indicate that the TDS, arsenic, magnesium, selenium and sulfate concentrations exceed the reference values in both samples, with the Frogs Legs sample also exceeding the reference vales for lead and the White Foil sample exceed the assessment criteria for boron, cyanide-total, cyanide-WAD and silver. The results also indicate that the highest exceedances were recorded for TDS and selenium (both samples) and silver (White Foil only). In addition, although there are no guideline values for chloride or sodium, the concentrations of these determinants were found to be extremely high, which is indicative of hypersaline water.

It is understood that the regional groundwater is very saline, and that this groundwater was used as process water to produce the tailings samples. Therefore, it is probable that this has resulted in the supernatant also becoming hypersaline. Nevertheless, it is recommended that the facility is equipped with a basal liner with an underdrainage system also constructed (above the liner) to minimise seepage from the facility and potential contamination of surface water or near surface groundwater. The facility will also need to be fenced to prevent access by stock or terrestrial wildlife which may be adversely affected by drinking the supernatant/seepage water. A cover system should also be constructed on closure to minimise any water ingress and resulting seepage.

Table 3.10: Supernatant Comparison to Release and Livestock Guidelines

Parameter	Reference Value (mg/L)	Assay Results (mg/L)	
		Frogs Legs	White Foil
pH	6 to 9 (S.U.)	7.40	7.10
TDS	2000 (mg/Kg)	**163,599**	**171,448**
Aluminum	5	**1.0**	**1.0**
Antimony	N/G	0.044	0.008
Arsenic	0.1	**0.24**	**0.21**
Barium	N/G	0.11	0.17
Boron	5	**1.0**	1.0
Cadmium	0.01	**0.002**	**0.002**
Calcium	1000	845	892
Chloride	N/G	93,881	93,354
Chromium (total)	1	**1.0**	**1.0**
Cobalt	1	0.08	0.03
Copper	0.3	**1.0**	**1.0**
Cyanide-Total	1	0.75	**1.6**
Cyanide-Free	0.1	N/D	N/D
Cyanide-WAD	0.5	**0.5**	**1.0**
Fluoride	2	0.1	0.1
Iron	2	1.0	1.0
Lead	0.1	**0.05**	**0.05**
Magnesium	2000	**7,684**	**7,770**
Manganese	N/G	30	4.0
Mercury	0.002	**0.01**	**0.01**
Molybdenum	0.15	0.043	0.032
Nickel	0.5	**1.0**	**1.0**
Phosphorus	N/G	10	10
Selenium	0.02	**0.78**	**0.76**
Silver	0.5	**0.001**	0.004
Sodium	N/G	49,275	49,955
Sulfate	1000	**16,179**	**15,722**
Tin	N/G	0.01	0.01
Uranium	0.2	0.002	0.005
Vanadium	N/G	1.0	1.0
Zinc	0.5	**1.0**	**1.0**

Note: Elements highlighted in **blue** indicate that the laboratory limit of detection exceeds the reference water quality value and elements highlighted in **red** indicate that an element genuinely exceeds the criteria value. Elements in **green** indicate detection limits were reached but criteria values were still not exceeded.

3.3 IMPLICATIONS FOR DESIGN

Results of the geochemical testing on two samples of tailings from the proposed Mungari project indicate the following:

- The acid formation potential of each tailings sample was determined based on the acid base accounting results and the net acid generation test. Both samples were classified as Non Acid Forming.

- Multi-element analysis results of the solids were compared to the average crustal abundance to calculate geochemical abundance indices. The results of the analysis show that the White Foil tailings solids had a low number of elemental enrichments, with the Frogs Legs tailings having a moderate level of enrichment. Arsenic, chloride and sulfur were classed as highly enriched in both samples, with carbon found to be significantly enriched in both samples. Cadmium, lead, antimony and selenium were also found to be significantly enriched in the Frogs Legs sample.

- The multi-element analyses of the solids were also compared to a set of soil intervention values. The results of this comparison indicate several metals to be present at elevated concentrations (namely arsenic, barium, manganese and sulfur in both samples, and cadmium, copper, nickel, vanadium and zinc in the Frogs Legs sample) and, as such, a cover system would likely be required on closure to isolate the tailings from the environment.

- The supernatant water quality has been compared with reference water quality standards for release from mining operations and livestock and wildlife drinking water. The Frogs Legs and White Foil supernatant was found to be hypersaline, with a total dissolved solids (TDS) value of 163,599 and 171,448 mg/kg respectively. Further, the results indicate that the arsenic, magnesium, selenium and sulfate concentrations exceed the reference values in both samples, with the Frogs Legs sample also exceeding the reference vales for lead and the White Foil sample exceed the assessment criteria for boron, cyanide-total, cyanide-WAD and silver.

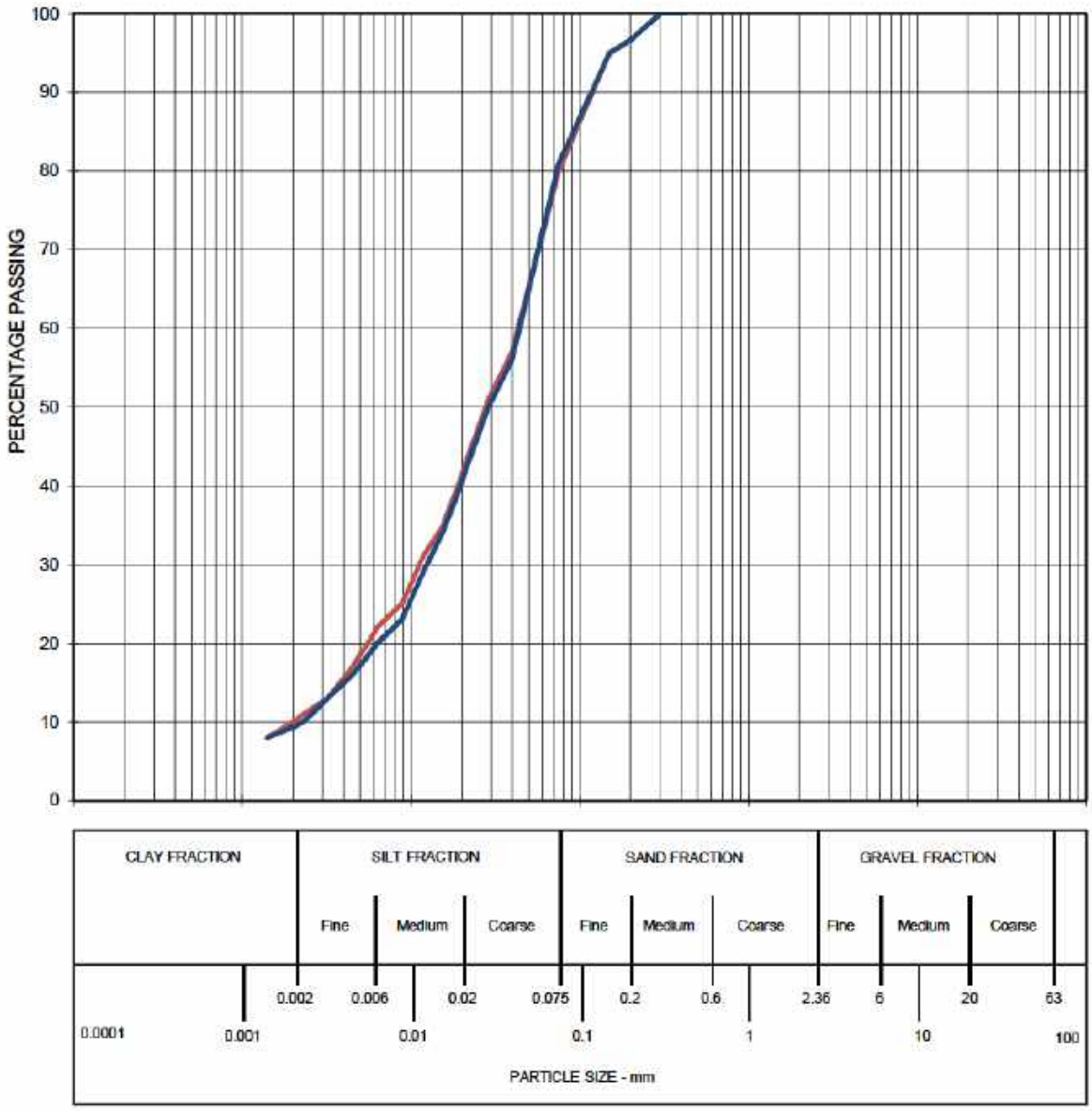
- In view of the supernatant results, it is recommended that the facility is equipped with a basal liner and underdrainage system to minimise seepage from the facility and potential contamination of surface water or near surface groundwater. The facility will also need to be fenced to prevent access by stock or terrestrial wildlife which may be adversely affected by drinking the supernatant/seepage water. A cover system should also be constructed on closure to minimise any water ingress and resulting seepage.

- It is understood that the regional groundwater is very saline, and that this groundwater was used as process water to produce the tailings samples. Therefore, it is probable that this has resulted in the supernatant also becoming hypersaline. As such, it is recommended that the results of the supernatant analyses are compared to regional groundwater quality data to allow the actual impact of the mineral processing to be assessed.

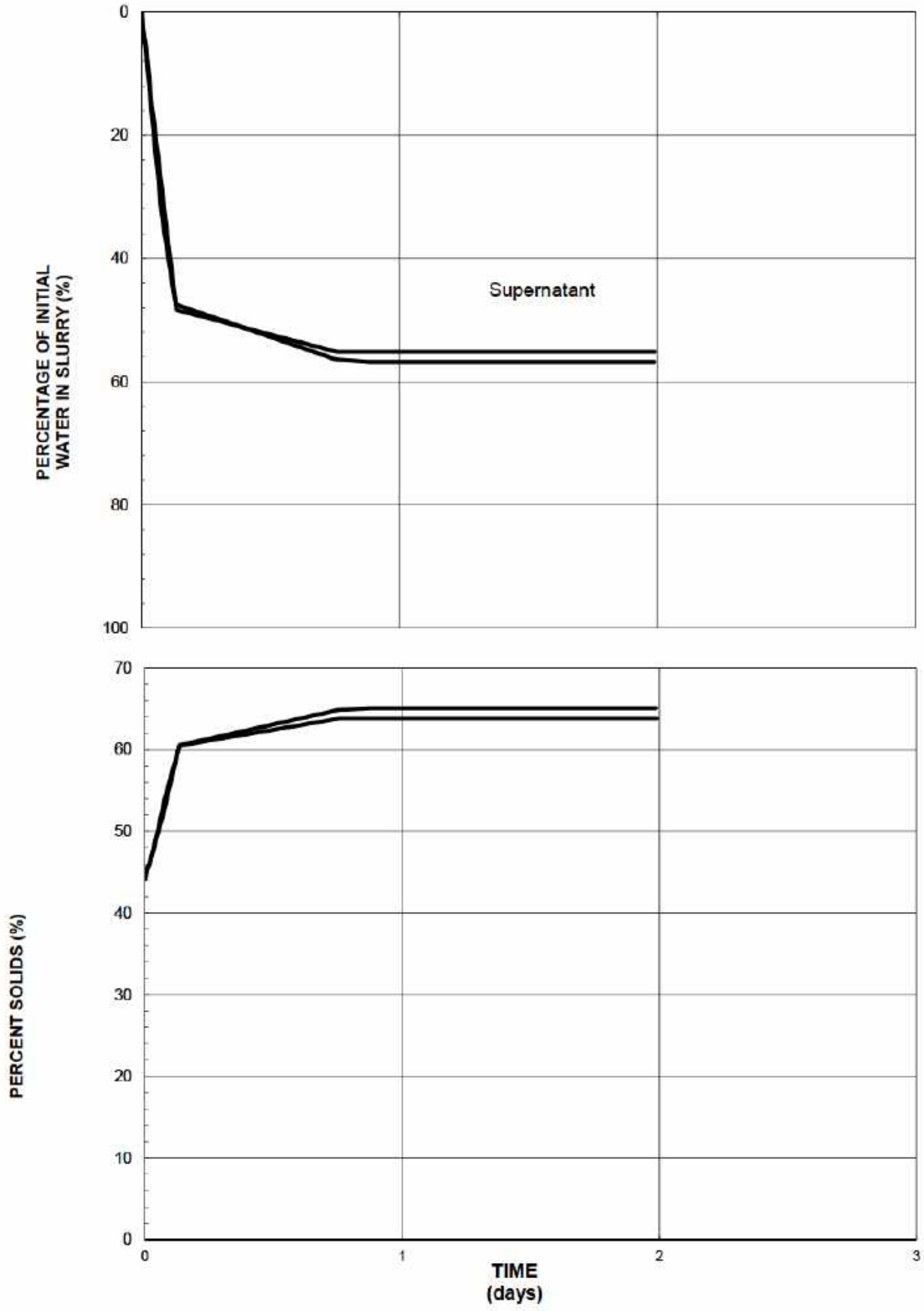
[redacted]

FIGURES

PARTICLE SIZE DISTRIBUTION



SYMBOL	SOIL DESCRIPTION	LIQUID LIMIT	PLASTICITY INDEX	SPECIFIC GRAVITY
	FROGS LEG COMP	NP	NP	2.82
	WHITE FOIL COMP	NP	NP	2.84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40
60
80
100
Supernatant
PERCENT SOLIDS (%)
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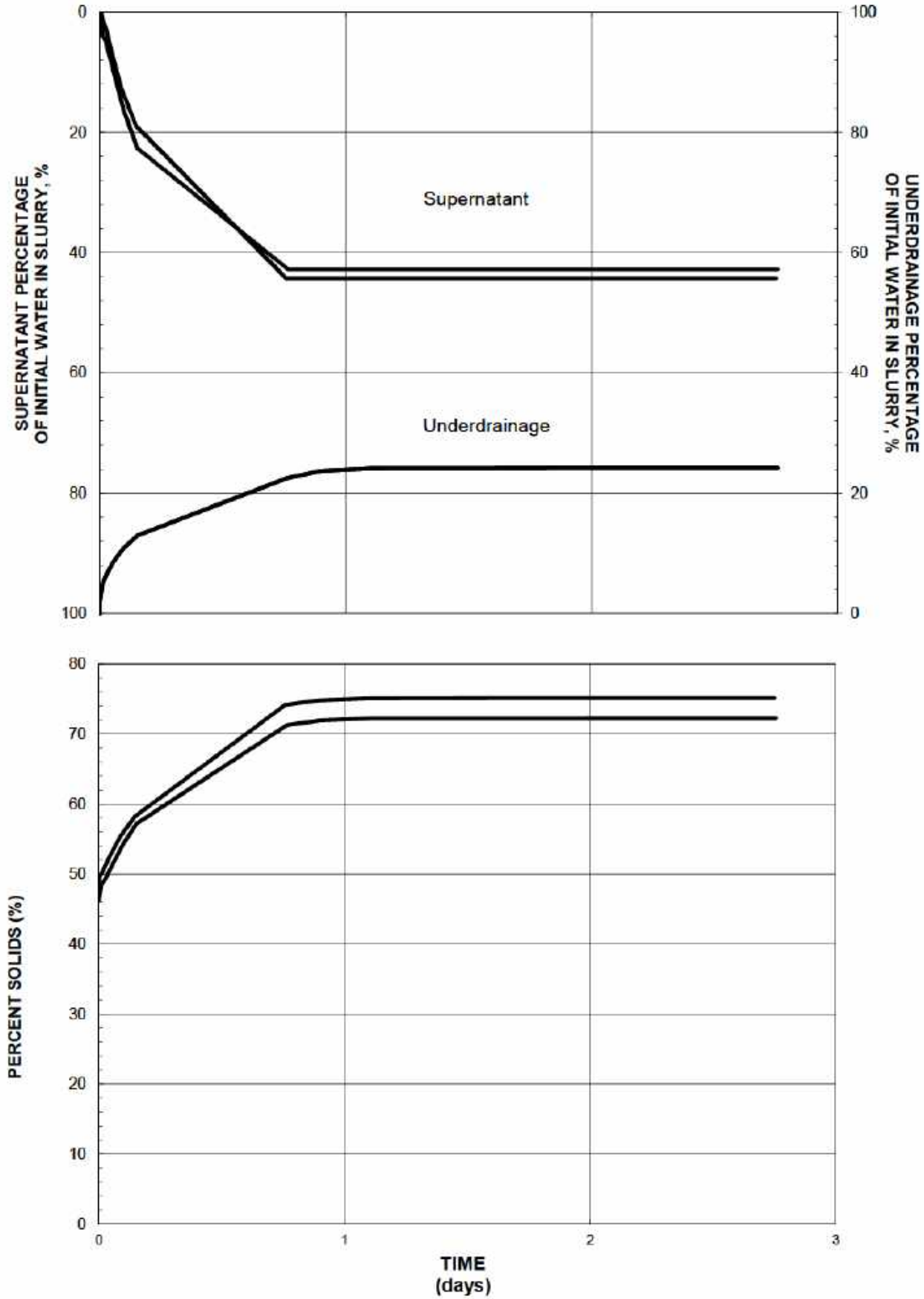
40
30
20
10
0
0
1
2
3
TIME (days)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UNDERDRAINAGE PERCENTAGE OF INITIAL WATER IN SLURRY, %
Supernatant
Underdrainage
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40
60
80
100
PERCENT SOLIDS (%)
TIME (days)
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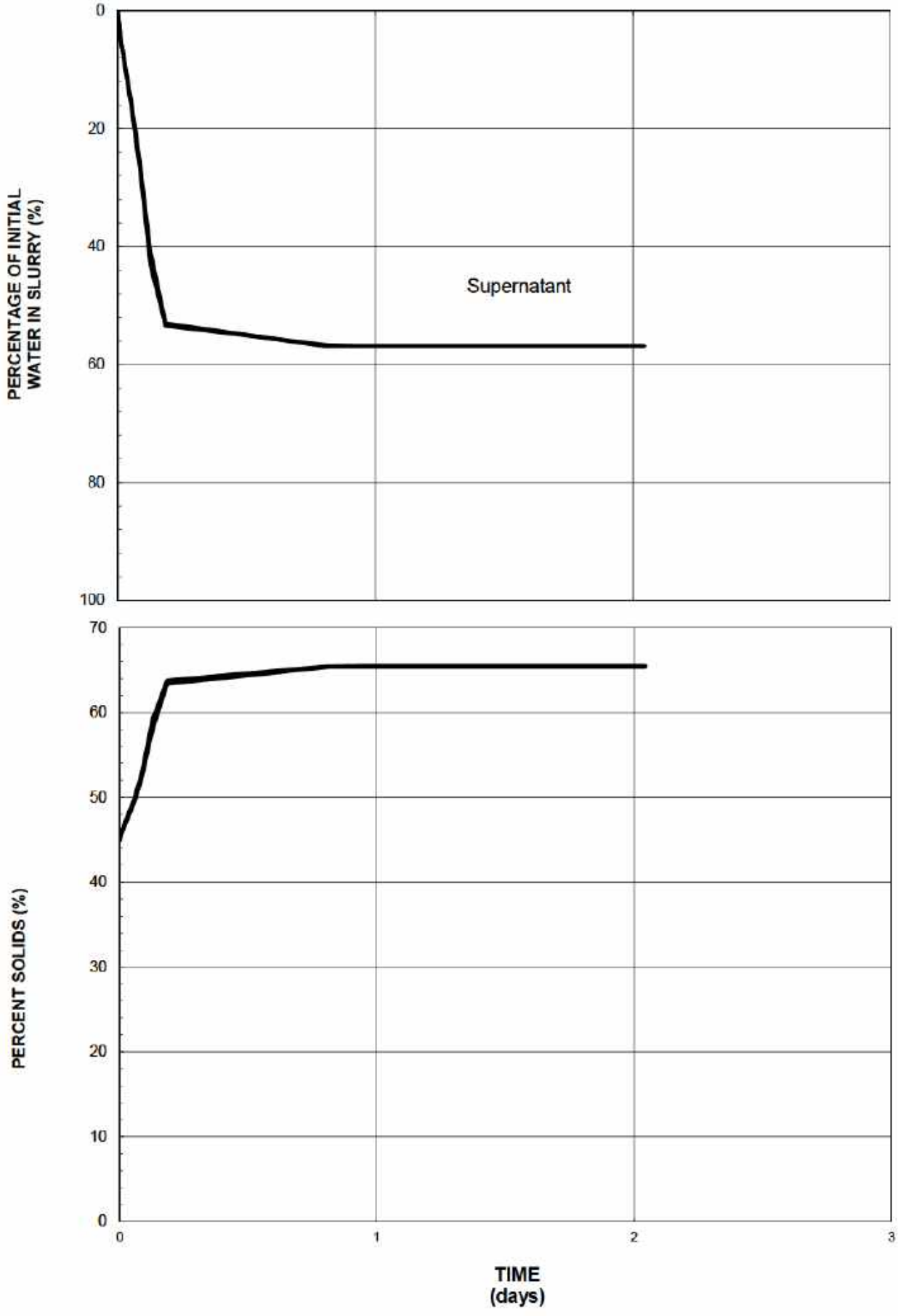
2
3
10
30
50
70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40
60
80
100
Supernatant
PERCENT SOLIDS (%)
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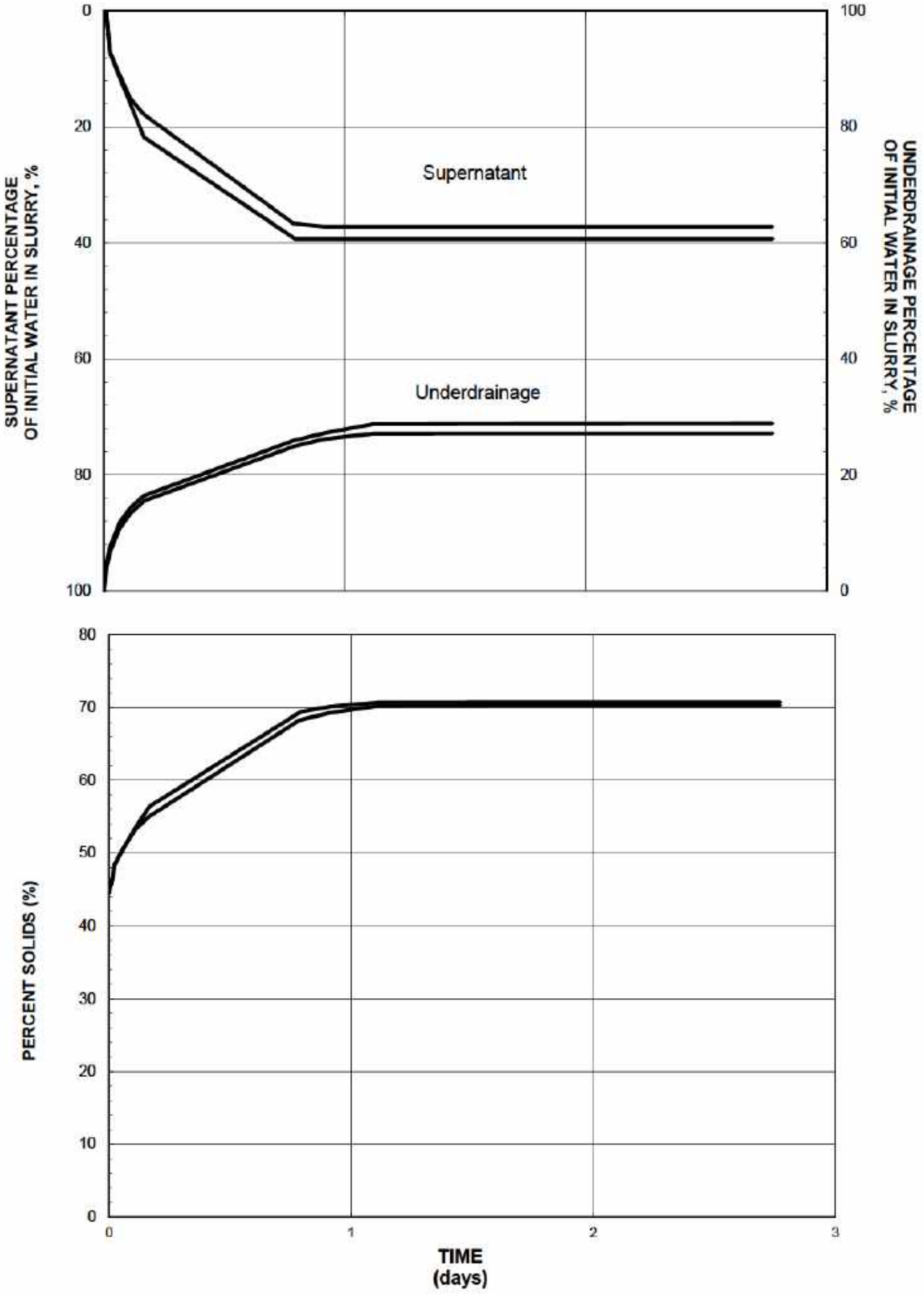
60
50
40
30
20
10
0
0
1
2
3
TIME
(days)


SUPERNATANT PERCENTAGE OF INITIAL WATER IN SLURRY, %
UNDERDRAINAGE PERCENTAGE OF INITIAL WATER IN SLURRY, %
Supernatant
Underdrainage
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20
40
60
80
100
PERCENT SOLIDS (%)
TIME (days)
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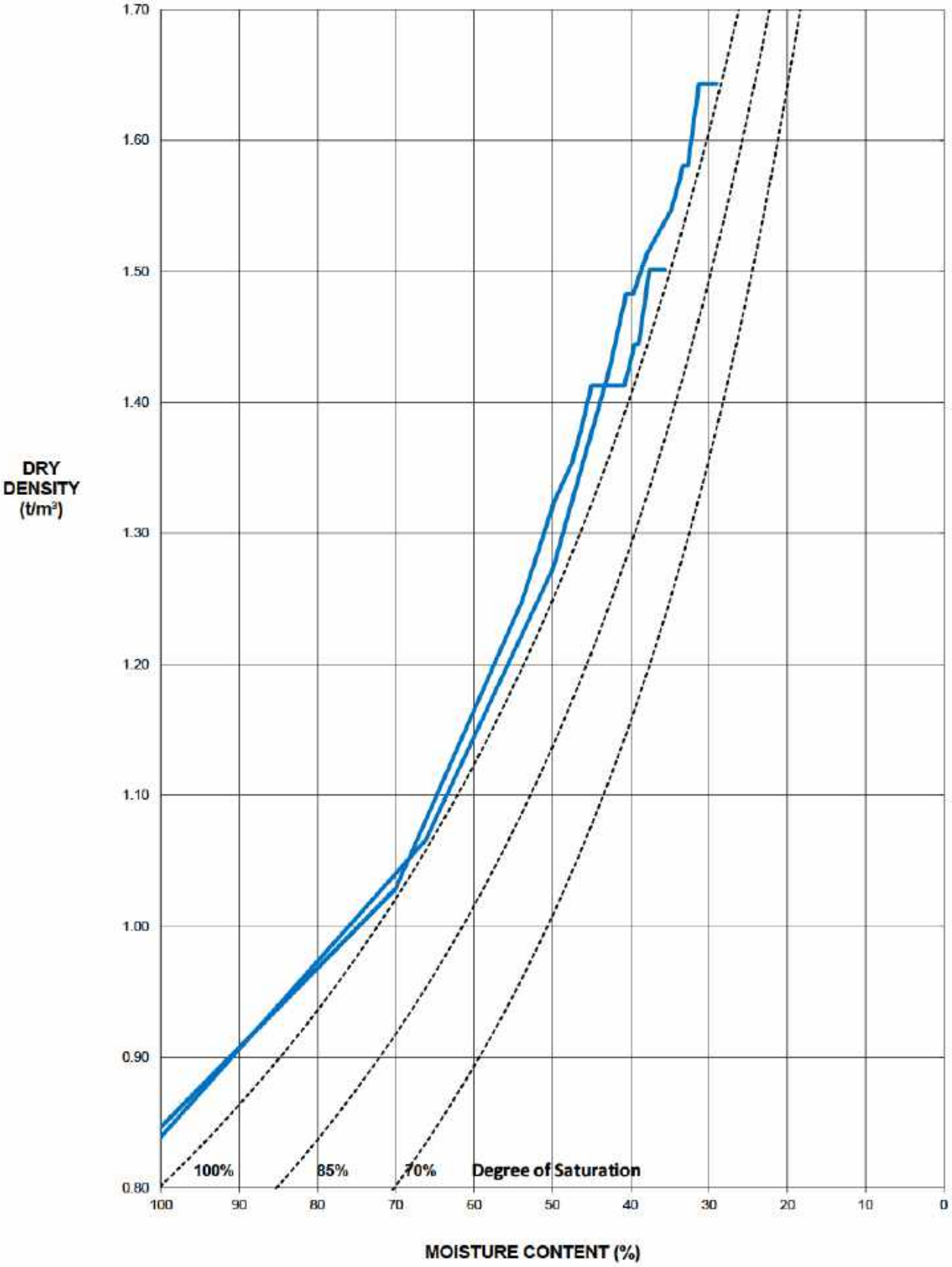
1
2
3
10
30
50
70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1.60
1.50
1.40
1.30
1.20
1.10
1.00
0.90
0.80
100%
85%
70%
Degree of Saturation
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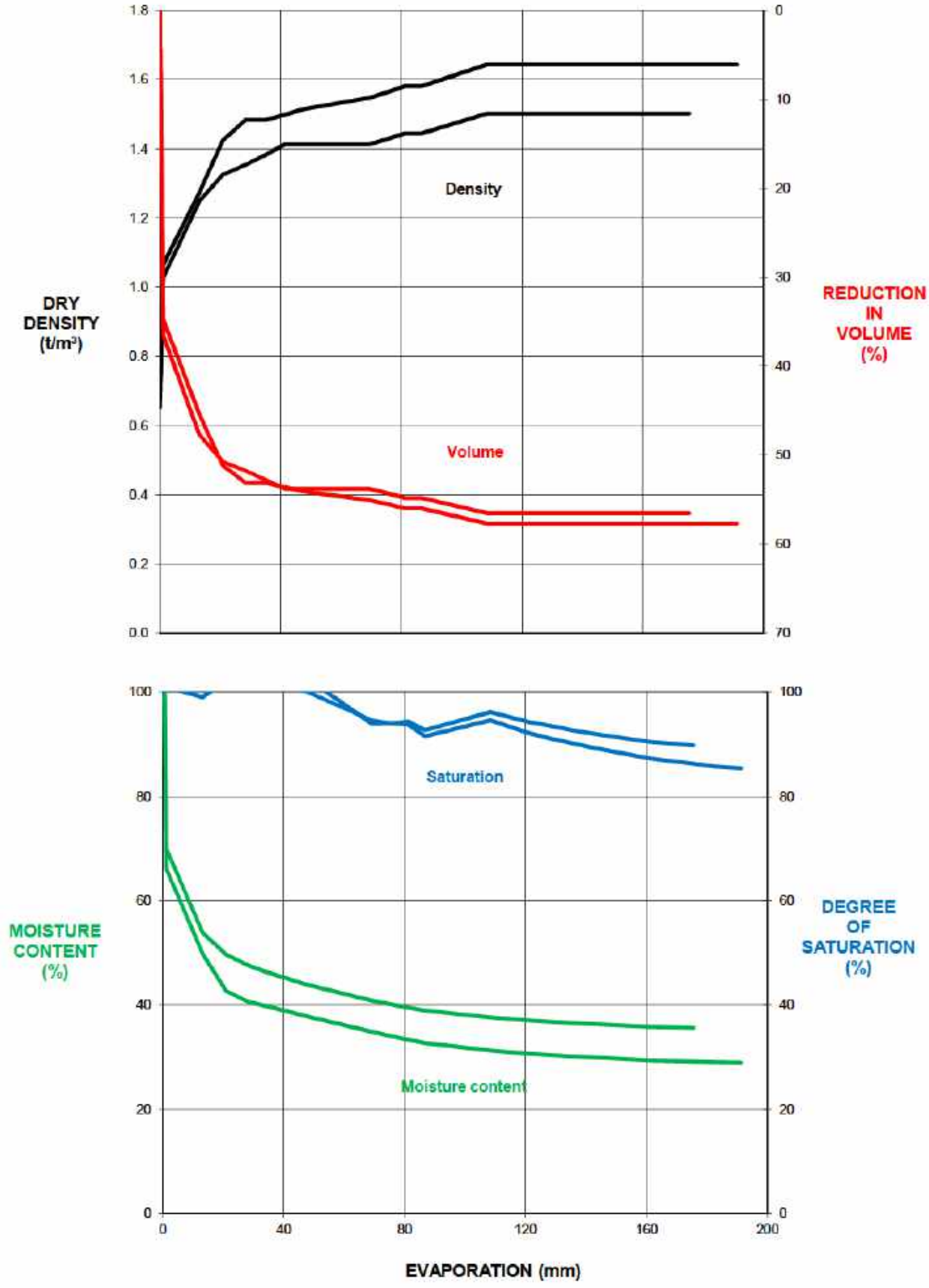
90
80
70
60
50
40
30
20
10
0
MOISTURE CONTENT (%)


DRY DENSITY (t/m³)
REDUCTION IN VOLUME (%)
Density
Volume
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1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
0
10
20
30
40
50
60
70
MOISTURE CONTENT (%)
DEGREE OF SATURATION (%)
Saturation
Moisture content
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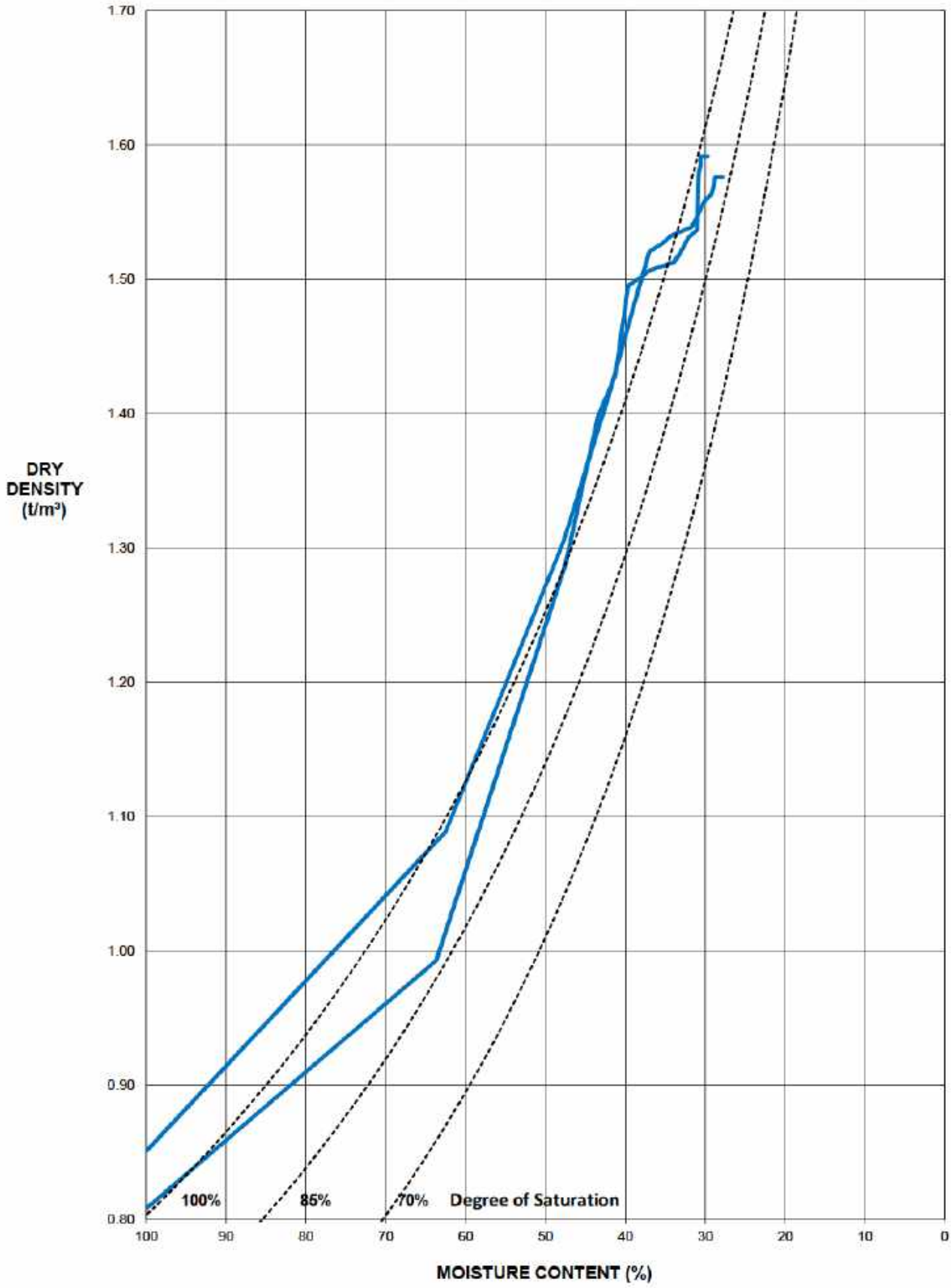
80
60
40
20
0
0
40
80
120
160
200
EVAPORATION (mm)


1.70
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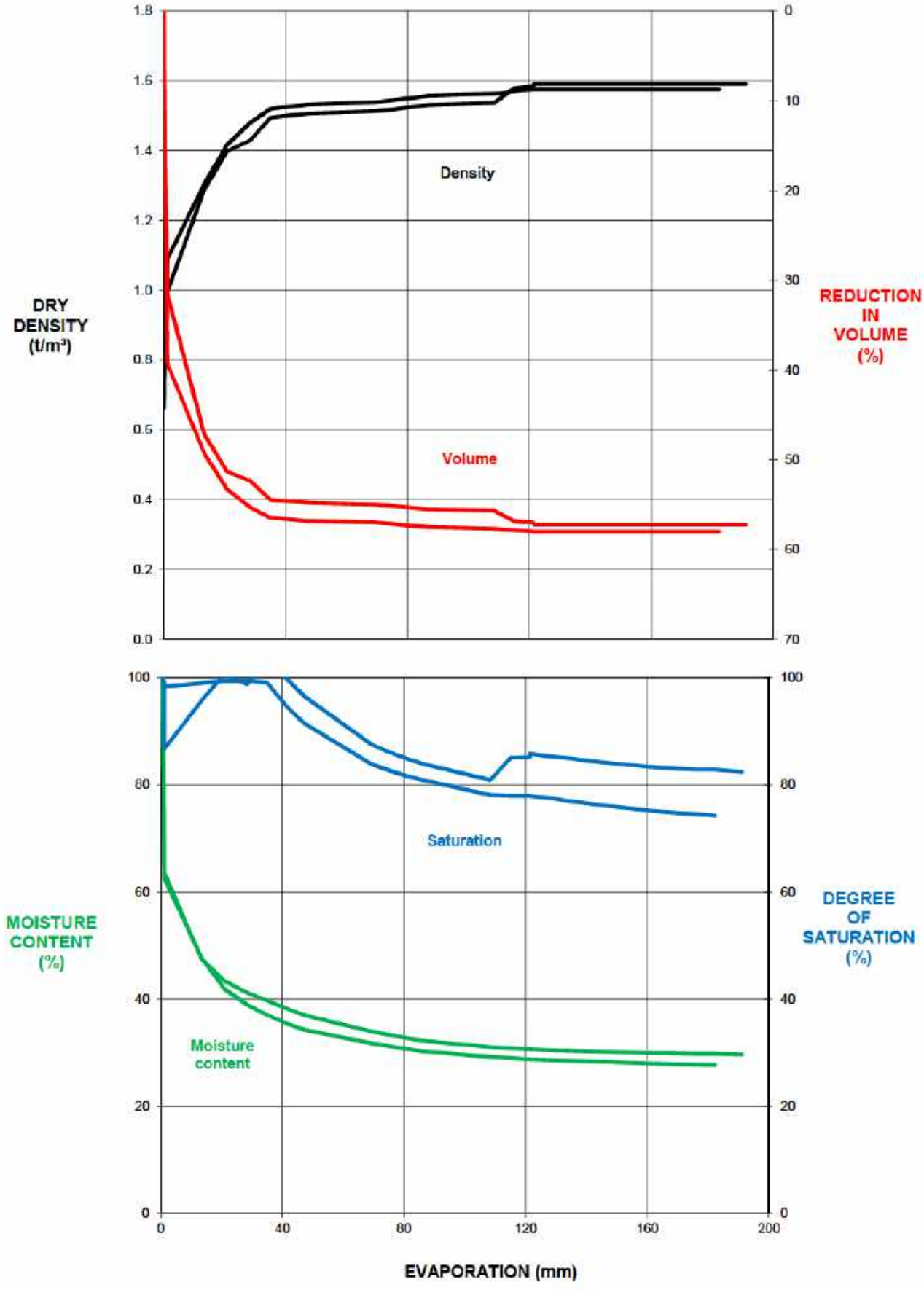
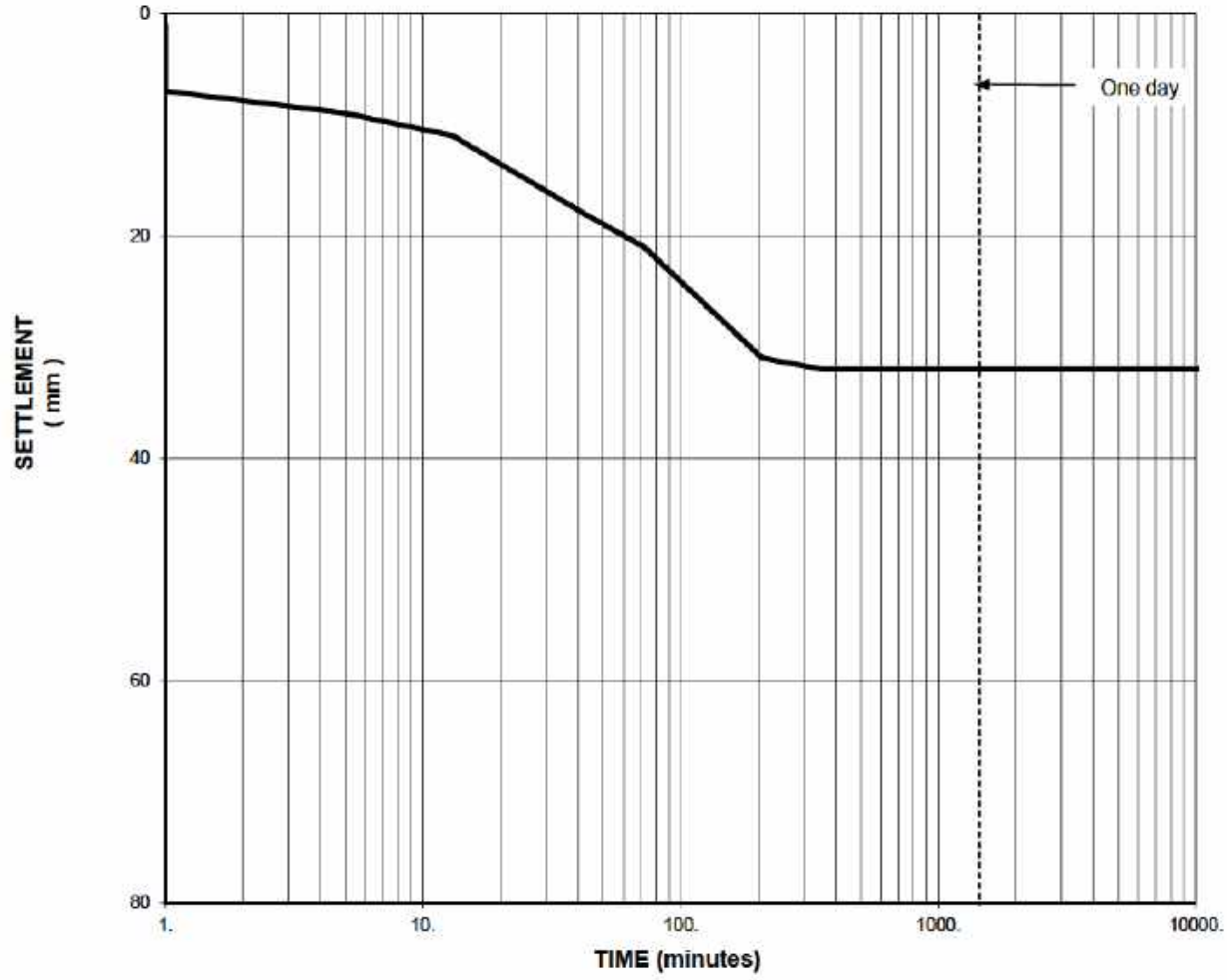
1.50
1.40
1.30
1.20
1.10
1.00
0.90
0.80
DRY DENSITY (t/m³)
100%
85%
70%
Degree of Saturation
100
90
80
70
60
50
40
30
20
10
0
MOISTURE CONTENT (%)


DRY DENSITY (t/m³)
REDUCTION IN VOLUME (%)
Density
Volume
MOISTURE CONTENT (%)
DEGREE OF SATURATION (%)
Saturation
Moisture content
EVAPORATION (mm)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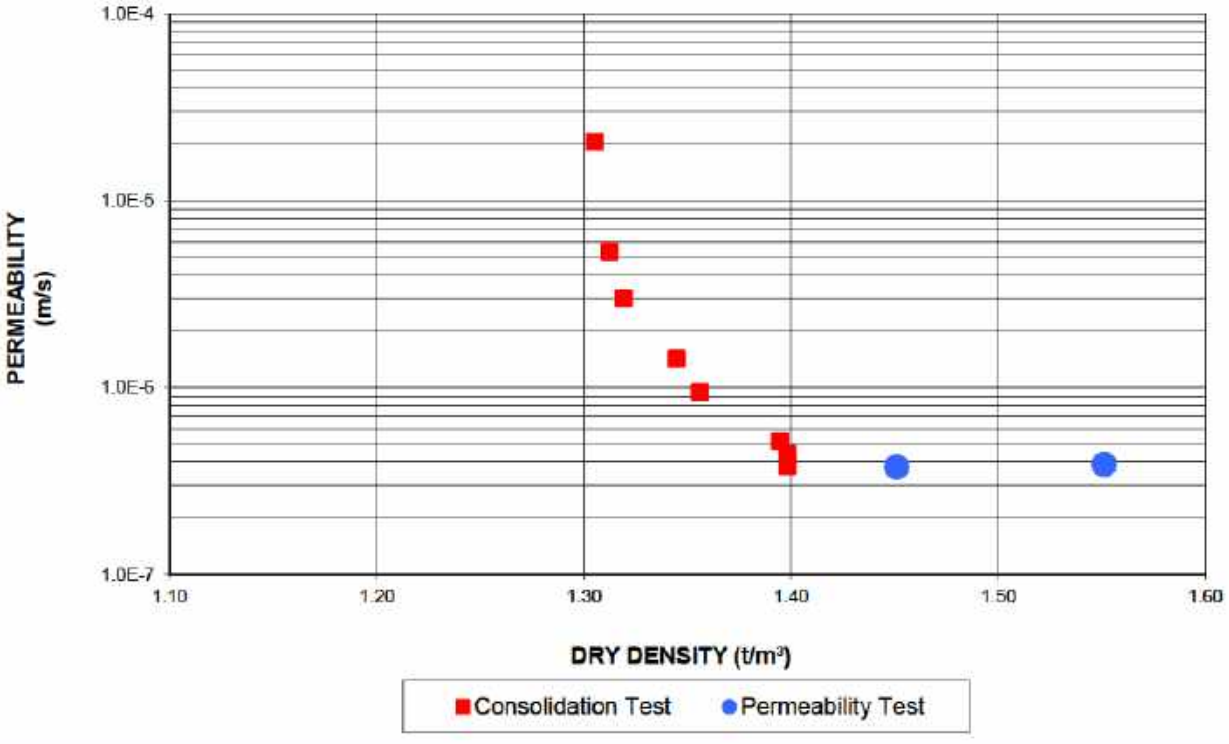
20
40
60
80
One day
1.
10.
100.
1000.
10000.
TIME (minutes)


PERMEABILITY (m/s)
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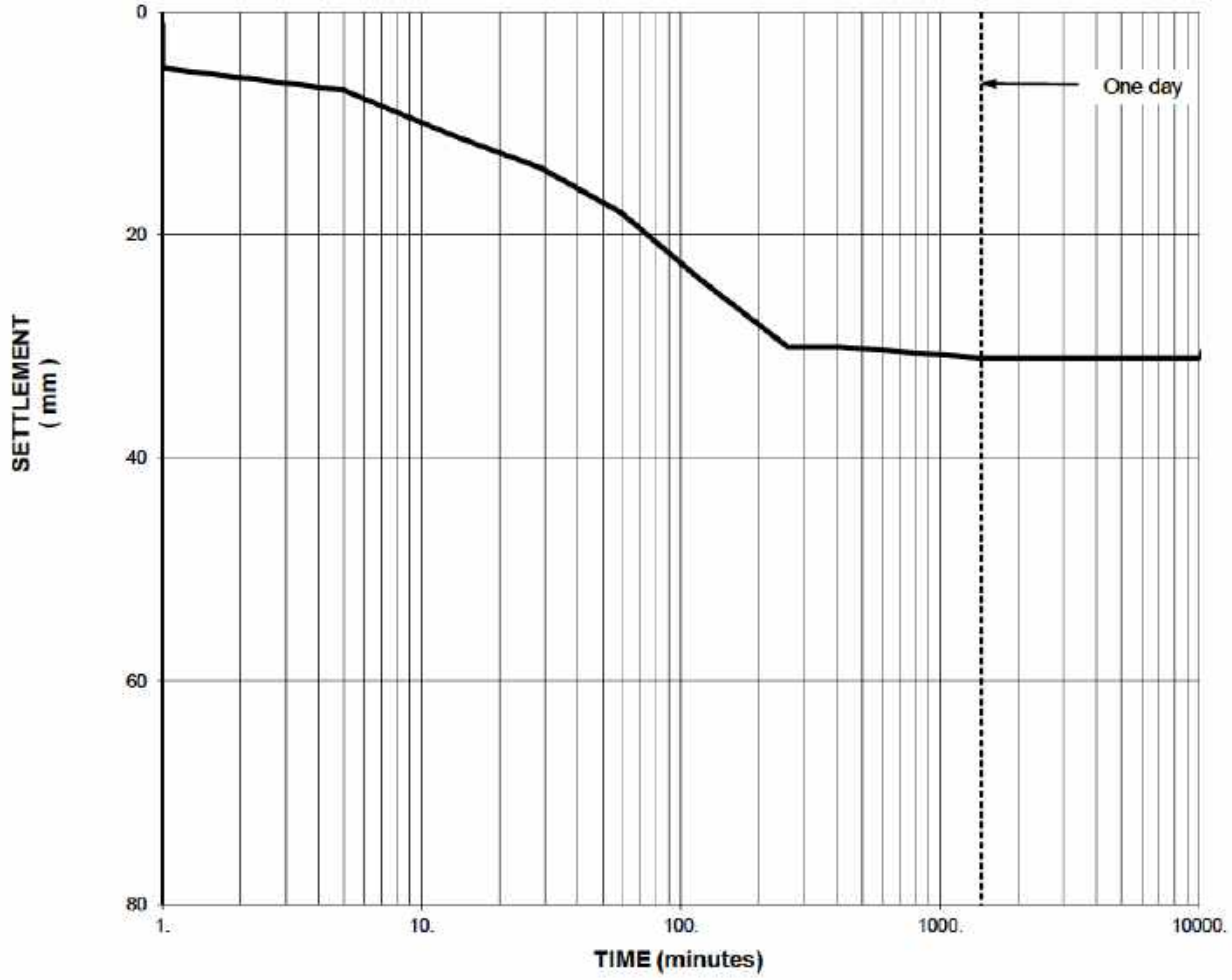
1.20
1.30
1.40
1.50
1.60
DRY DENSITY (t/m³)
Consolidation Test
Permeability Test


0
20
40
60
80
SETTLEMENT (mm)
One day
1.
10.
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1000.
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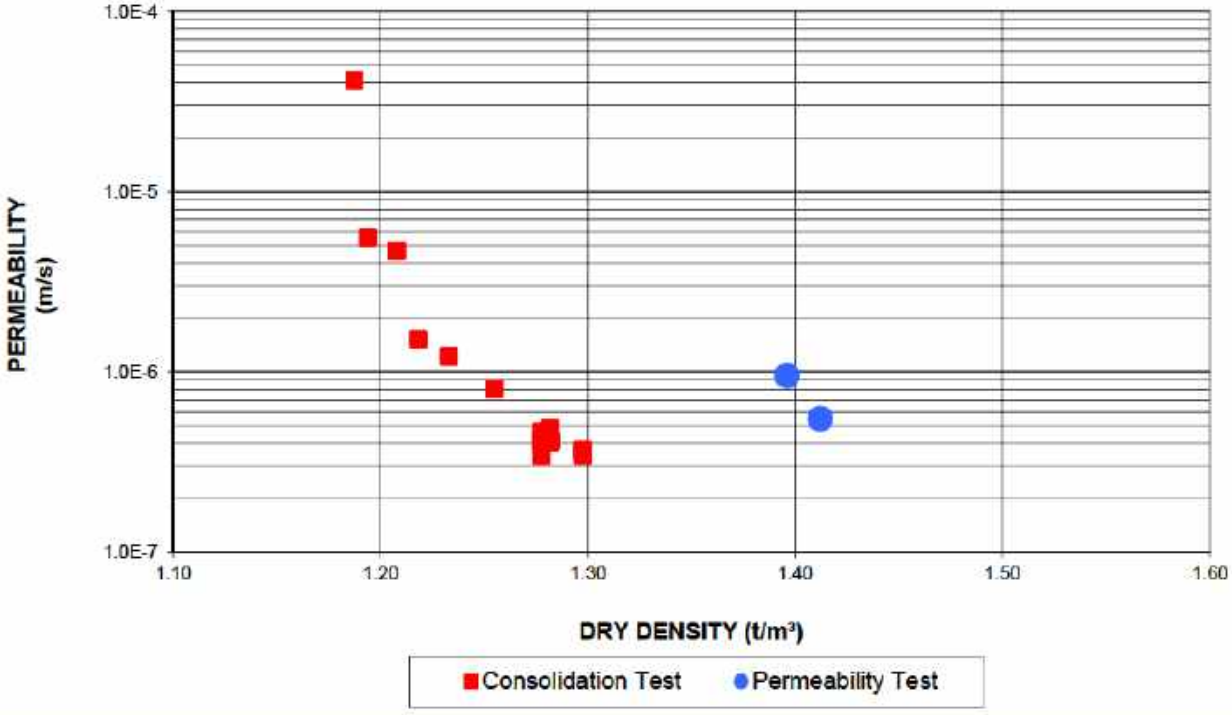
TIME (minutes)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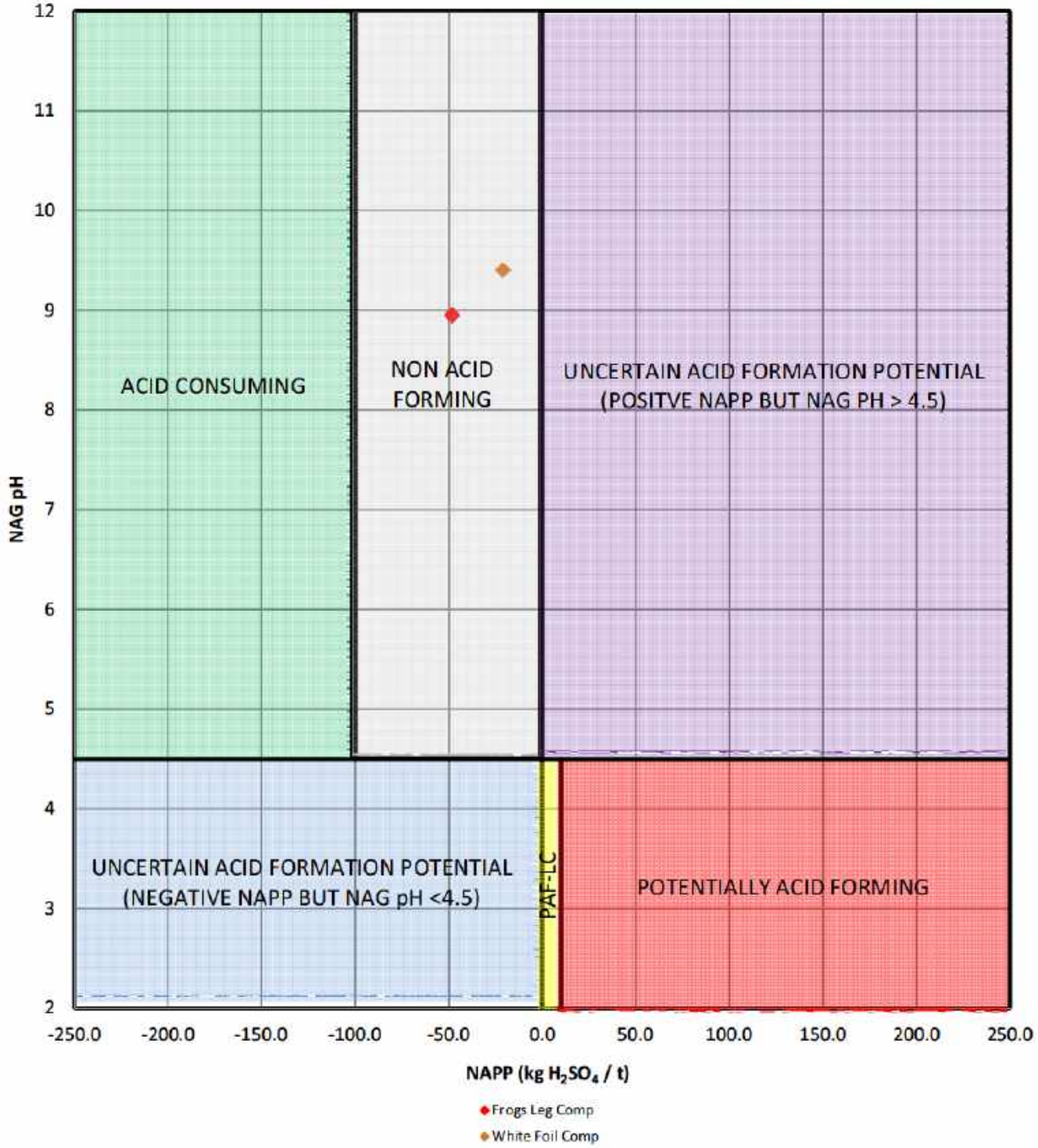
1.0E-5
1.0E-6
1.0E-7
PERMEABILITY (m/s)
1.10
1.20
1.30
1.40
1.50
1.60
DRY DENSITY (t/m³)
Consolidation Test
Permeability Test

Acid Formation Potential



Acid Formation Potential	NAPP (kg H_2SO_4 / t)	NAG pH
Potential Acid Forming (PAF)	>10	<4.5
Potential Acid Forming - Low Capacity (PAF - LC)	0 to 10	<4.5
Non Acid Forming (NAF)	Negative	≥4.5
Acid Consuming (AC)	Less than - 100	≥4.5
Uncertain	Positve	≥4.5
	Negative	<4.5

APPENDIX A

SGS Laboratory Testing

ABN: 44 000 964 278
ph: 1300 781 744
fx: (08) 9458 3700

TEST CERTIFICATE

This document is issued by the Company subject to its General Conditions of Service (www.sgs.com/terms_and_conditions.htm). Attention is drawn to the limitations of liability, indemnification and jurisdictional issues established therein.

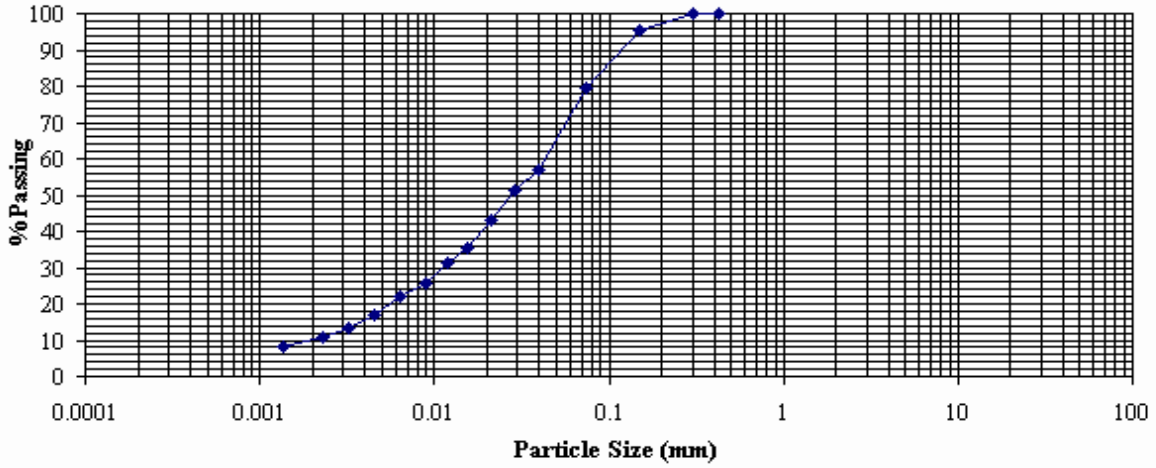
This document is to be treated as an original within the meaning of UCP 600. Any holder of this document is to be advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law.

SGS Australia Pty Ltd
PO Box 219 Bentley WA 6982
36 Railway Parade
Welshpool WA 6106

Client:	Knight Piesold Pty Ltd	Client Job No:	PE801-00137
Order No:	PO9307	Project:	Mungari Poject
Tested Date:	13/12/2011	Location:	
SGS Job Number:	11-01-2096	Sample No:	11-MT-12625
Lab:	Welshpool	Sample ID:	Frogs Leg Comp

PARTICLE SIZE DISTRIBUTION - SIEVING AND HYDROMETER ANALYSIS

AS1289.3.6.1 & AS1289.3.6.3



SIEVING	(AS1289.3.6.1)	HYDROMETER	(AS1289.3.6.3)
Sieve Size	Passing	Particle Diameter	Finer
(mm)	%	(mm)	%
53.0		0.0396	57
37.5		0.0288	51
19.0		0.0212	43
9.5		0.0155	35
4.75		0.0118	31
2.36	100	0.0088	25
1.18		0.0063	22
0.600		0.0045	17
0.425	100	0.0032	13
0.300	100	0.0023	11
0.150	95	0.0014	8
0.075	80		

Method of Dispersion : Mechanical ; Hydrometer Used : Glass, -5 to 60g/l soil Colloids
Loss after Pretreatment: No Pretreatment

Note: Sample supplied by client.

[redacted]

Date: 23/12/2011

ABN: 44 000 964 278
ph: 1300 781 744
fx: (08) 9458 3700

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SGS Australia Pty Ltd
PO Box 219 Bentley WA 6982
36 Railway Parade
Welshpool WA 6106

Client:	Knight Piesold Pty Ltd	Client Job No:	PE801-00137
Order No:	PO9307	Project:	Mungari Poject
Tested Date:	22/12/2011	Location:	
SGS Job Number:	11-01-2096	Sample No:	11-MT-12625
Lab:	Welshpool	Sample ID:	Frogs Leg Comp

PLASTICITY INDEX

AS 1289.3.9.2(Single Point Cone Method), 3.2.1(Plastic Limit), 3.3.2(Plasticity Index), 3.4.1(Linear Shrinkage)

AS 1289.3.9.2

AS 1289.3.2.1

Plastic Limit (%) **NP**

AS 1289.3.3.2

Plasticity Index (%) **NP**

AS 1289.3.4.1

History of Sample Oven Dried at <50ºC

Method of preparation Dry Sieved

Note: Sample supplied by client.

[redacted]

Date: 22/12/2011

ABN: 44 000 964 278
ph: 1300 781 744
fx: (08) 9458 3700

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SGS Australia Pty Ltd
PO Box 219 Bentley WA 6982
36 Railway Parade
Welshpool WA 6106

Client:	Knight Piesold Pty Ltd	Client Job No:	PE801-00137
Order No:	PO9307	Project:	Mungari Poject
Tested Date:	20/12/2011	Location:	
SGS Job Number:	11-01-2096	Sample No:	11-MT-12625
Lab:	Welshpool	Sample ID:	Frogs Leg Comp

FINE PARTICLE DENSITY

AS1289.3.5.1

FINE FRACTION

SOIL APPARENT

PARTICLE DENSITY (g/cc) **2.82**

at temperature 25 º C

Note: Sample supplied by client.

[redacted]

Date: 23/12/2011

Accredited for compliance with ISO/IEC 17025

ABN: 44 000 964 278
ph: 1300 781 744
fx: (08) 9458 3700

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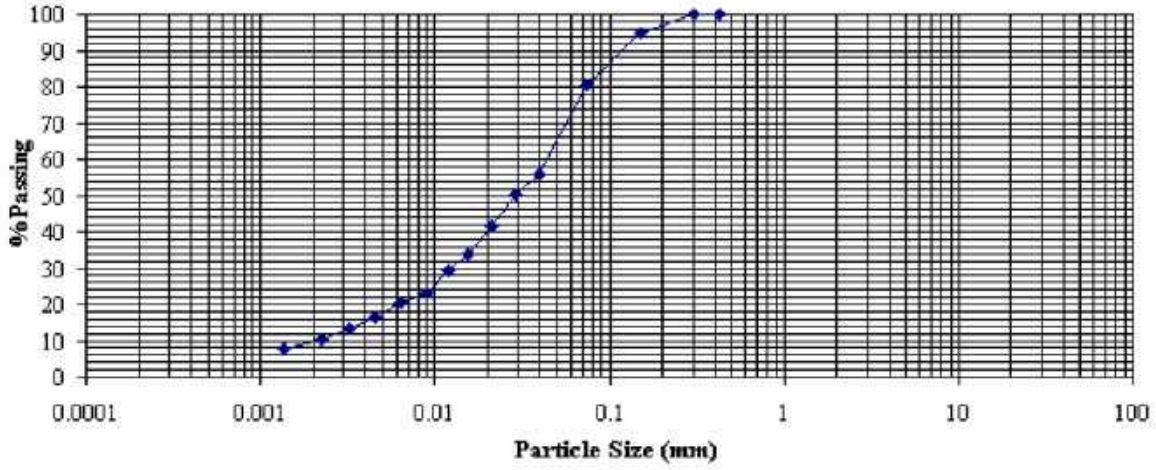
SGS Australia Pty Ltd
PO Box 219 Bentley WA 6982
36 Railway Parade
Welshpool WA 6106

Client:	Knight Piesold Pty Ltd	Client Job No:	PE801-00137
Order No:	PO9307	Project:	Mungari Poject
Tested Date:	13/12/2011	Location:	
SGS Job Number:	11-01-2096	Sample No:	11-MT-12626
Lab:	Welshpool	Sample ID:	White Foil Comp

PARTICLE SIZE DISTRIBUTION - SIEVING AND HYDROMETER ANALYSIS

AS1289.3.6.1 & AS1289.3.6.3



SIEVING	(AS1289.3.6.1)	HYDROMETER	(AS1289.3.6.3)
Sieve Size	Passing	Particle Diameter	Finer
(mm)	%	(mm)	%
53.0		0.0394	56
37.5		0.0287	50
19.0		0.0211	42
9.5		0.0154	34
4.75		0.0118	29
2.36	100	0.0088	23
1.18		0.0063	20
0.600		0.0045	16
0.425	100	0.0032	13
0.300	100	0.0023	10
0.150	95	0.0014	8
0.075	81		

Method of Dispersion : Mechanical ; Hydrometer Used : Glass, -5 to 60g/l soil Colloids
Loss after Pretreatment: No Pretreatment

Note: Sample supplied by client.

[redacted]

Date: 23/12/2011

Accredited for compliance with ISO/IEC 17025

ABN: 44 000 964 278
ph: 1300 781 744
fx: (08) 9458 3700

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SGS Australia Pty Ltd
PO Box 219 Bentley WA 6982
36 Railway Parade
Welshpool WA 6106

Client:	Knight Piesold Pty Ltd	Client Job No:	PE801-00137
Order No:	PO9307	Project:	Mungari Poject
Tested Date:	22/12/2011	Location:	
SGS Job Number:	11-01-2096	Sample No:	11-MT-12626
Lab:	Welshpool	Sample ID:	White Foil Comp

PLASTICITY INDEX

AS 1289.3.9.2(Single Point Cone Method), 3.2.1(Plastic Limit), 3.3.2(Plasticity Index), 3.4.1(Linear Shrinkage)

AS 1289.3.9.2

AS 1289.3.2.1

Plastic Limit (%)	**NP**

AS 1289.3.3.2

Plasticity Index (%)	**NP**

AS 1289.3.4.1

History of Sample	Oven Dried at <50°C
Method of preparation	Dry Sieved

Note: Sample supplied by client.

[redacted]

Date: 22/12/2011

Accredited for compliance with ISO/IEC 17025

ABN: 44 000 964 278
ph: 1300 781 744
fx: (08) 9458 3700

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SGS Australia Pty Ltd
PO Box 219 Bentley WA 6982
36 Railway Parade
Welshpool WA 6106

Client:	Knight Piesold Pty Ltd	Client Job No:	PE801-00137
Order No:	PO9307	Project:	Mungari Poject
Tested Date:	20/12/2011	Location:	
SGS Job Number:	11-01-2096	Sample No:	11-MT-12626
Lab:	Welshpool	Sample ID:	White Foil Comp

FINE PARTICLE DENSITY

AS1289.3.5.1

FINE FRACTION

SOIL APPARENT	
PARTICLE DENSITY (g/cc)	**2.84**
at temperature	25 ° C

Note: Sample supplied by client.

[redacted]

Date: 23/12/2011

Accredited for compliance with ISO/IEC 17025

APPENDIX B

Genalysis Laboratory Testing

ANALYTICAL REPORT

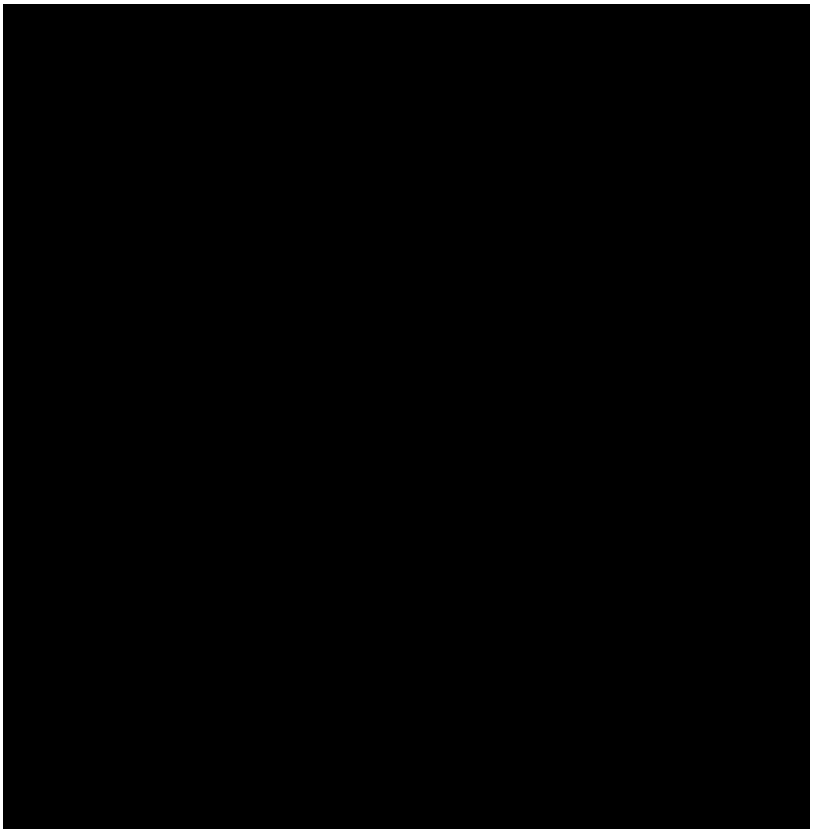
D SAWYER
KNIGHT PIESOLD PTY LIMITED
PO Box 6837
EAST PERTH, W.A. 6892
AUSTRALIA

JOB INFORMATION

JOB CODE	:	752.0/1117465
No. of SAMPLES	:	2
No. of ELEMENTS	:	44
CLIENT O/N	:	P09351 :1/2 (Job 1 of 2)
SAMPLE SUBMISSION No.	:	PE801-00137
PROJECT	:	Mungari Project
STATE	:	Slurry
DATE RECEIVED	:	10/11/2011
DATE COMPLETED	:	29/12/2011
DATE PRINTED	:	29/12/2011
PRIMARY LABORATORY	:	Genalysis Main Laboratory

LEGEND

X	= Less than Detection Limit
N/R	= Sample Not Received
*	= Result Checked
( )	= Result still to come
I/S	= Insufficient Sample for Analysis
E6	= Result X 1,000,000
UA	= Unable to Assay
>	= Value beyond Limit of Method
OV	= Value over-range for Package



SAMPLE DETAILS

DISCLAIMER

Genalysis Laboratory Services Pty Ltd wishes to make the following disclaimer pertaining to the accompanying analytical results.

Genalysis Laboratory Services Pty Ltd disclaims any liability, legal or otherwise, for any inferences implied from this report relating to either the origin of, or the sampling technique employed in the collection of, the submitted samples.

SIGNIFICANT FIGURES

It is common practice to report data derived from analytical instrumentation to a maximum of two or three significant figures. Some data reported herein may show more figures than this. The reporting of more than two or three figures in no way implies that the third, fourth and subsequent figures may be real or significant.

Genalysis Laboratory Services Pty Ltd accepts no responsibility whatsoever for any interpretation by any party of any data where more than two or three significant figures have been reported.

SAMPLE STORAGE DETAILS

GENERAL CONDITIONS

SAMPLE STORAGE OF SOLIDS

Bulk Residues and Pulps will be stored for 60 DAYS without charge. After this time all Bulk Residues and Pulps will be stored at a rate of $3.30 per cubic metre per day until your written advice regarding collection or disposal is received. Expenses related to the return or disposal of samples will be charged to you at cost. Current disposal cost is charged at $100.00 per cubic metre.

SAMPLE STORAGE OF SOLUTIONS

Samples received as liquids, waters or solutions will be held for 60 DAYS free of charge then disposed of, unless written advice for return or collection is received.

ANALYSIS

ELEMENTS	Ag	Al	ANC	As	B	Ba
UNITS	ppm	ppm	kgH2SO4/t	ppm	ppm	ppm
DETECTION LIMIT	0.01	50	1	0.5	5	0.1
DIGEST	4AB/	4AB/	ANCx/	4AB/	4AB/	4AB/
ANALYTICAL FINISH	MS	OE	VOL	MS	OE	MS
SAMPLE NUMBERS						
0001 Frogs Leg Comp	0.55	7.10%	97	669.6	69	351.5
0002 White Foil Comp	0.50	5.98%	58	82.5	53	500.1
CHECKS						
0001 Frogs Leg Comp	0.57	7.28%	100	665.3	69	353.3
STANDARDS						
0001 0.5%NaCl						
0002 HgSTD-4						
0003 MA-1b						
0004 OREAS 97.01						
0005 PD-1						
0006 STSD-2						
0007 SY-4	0.07	9.99%		1.1	55	321.1
BLANKS						
0001 Control Blank	X	X	-1	X	9	X
0002 Control Blank						
0003 Control Blank						
0004 Control Blank						
0005 Acid Blank	0.03	X		X	X	X
0006 Control Blank						

ANALYSIS

ELEMENTS	Be	Bi	C	Ca	Cd	Cl
UNITS	ppm	ppm	%	ppm	ppm	%
DETECTION LIMIT	0.05	0.01	0.01	50	0.02	0.02
DIGEST	4AB/	4AB/		4AB/	4AB/	CL1/
ANALYTICAL FINISH	MS	MS	/CSA	OE	MS	COL
SAMPLE NUMBERS						
0001 Frogs Leg Comp	0.81	0.31	0.74	4.89%	3.11	9.58
0002 White Foil Comp	1.30	0.24	0.51	3.24%	0.47	9.17
CHECKS						
0001 Frogs Leg Comp	0.95	0.31	0.77	5.00%	3.25	9.74
STANDARDS						
0001 0.5%NaCl						0.32
0002 HgSTD-4						
0003 MA-1b			2.44			
0004 OREAS 97.01						
0005 PD-1						
0006 STSD-2						
0007 SY-4	3.13	0.02		5.64%	0.08	
BLANKS						
0001 Control Blank	X	0.01	X	X	X	X
0002 Control Blank						
0003 Control Blank						
0004 Control Blank						
0005 Acid Blank	X	X		X	X	
0006 Control Blank						

ANALYSIS

ELEMENTS	Co	ColourChange	Cr	Cu	F	Fe
UNITS	ppm	NONE	ppm	ppm	ppm	%
DETECTION LIMIT	0.1	0	5	1	50	0.01
DIGEST	4AB/	ANCx/	4AB/	4AB/	FC7/	4AB/
ANALYTICAL FINISH	MS	QUAL	OE	OE	SIE	OE
SAMPLE NUMBERS						
0001 Frogs Leg Comp	34.6	No	114	106	322	5.95
0002 White Foil Comp	21.7	No	18	19	407	8.45
CHECKS						
0001 Frogs Leg Comp	34.6	No	106	107	287	6.10
STANDARDS						
0001 0.5%NaCl						
0002 HgSTD-4						
0003 MA-1b						
0004 OREAS 97.01						
0005 PD-1						
0006 STSD-2					1071	
0007 SY-4	2.5		X	5		4.41
BLANKS						
0001 Control Blank	0.1	No	X	X	69	X
0002 Control Blank						
0003 Control Blank						
0004 Control Blank						
0005 Acid Blank	X		X	X		X
0006 Control Blank						

ANALYSIS

ELEMENTS	Final-pH	Fizz-Rate	Hg	K	Mg	Mn
UNITS	NONE	NONE	ppm	ppm	ppm	ppm
DETECTION LIMIT	0.1	0	0.01	20	20	1
DIGEST	ANCx/	ANCx/	HG1/	4AB/	4AB/	4AB/
ANALYTICAL FINISH	MTR	QUAL	CV	OE	OE	OE
SAMPLE NUMBERS						
0001 Frogs Leg Comp	1.5	2	0.02	1.77%	2.02%	1181
0002 White Foil Comp	1.4	2	X	1.27%	1.01%	1223
CHECKS						
0001 Frogs Leg Comp	1.5	2	0.02	1.86%	2.10%	1227
STANDARDS						
0001 0.5%NaCl						
0002 HgSTD-4			0.29			
0003 MA-1b						
0004 OREAS 97.01						
0005 PD-1						
0006 STSD-2						
0007 SY-4				1.45%	2850	804
BLANKS						
0001 Control Blank	1.2	0	X	X	X	X
0002 Control Blank			X			
0003 Control Blank						
0004 Control Blank						
0005 Acid Blank				X	X	X
0006 Control Blank						

ANALYSIS

ELEMENTS	Mo	Na	NAG	NAGpH	NAG(4.5)	Ni
UNITS	ppm	ppm	kgH2SO4/t	NONE	kgH2SO4/t	ppm
DETECTION LIMIT	0.1	20	1	0.1	1	1
DIGEST	4AB/	4AB/	NAGx/	NAGx/	NAGx/	4AB/
ANALYTICAL FINISH	MS	OE	VOL	MTR	VOL	OE
SAMPLE NUMBERS						
0001 Frogs Leg Comp	1.1	1.86%	0	8.9	0	68
0002 White Foil Comp	1.6	3.01%	0	9.4	0	11
CHECKS						
0001 Frogs Leg Comp	1.2	1.88%	0	9.0	0	69
STANDARDS						
0001 0.5%NaCl						
0002 HgSTD-4						
0003 MA-1b						
0004 OREAS 97.01						
0005 PD-1						
0006 STSD-2						
0007 SY-4	0.3	5.03%				7
BLANKS						
0001 Control Blank	X	26	0	4.6	0	X
0002 Control Blank						
0003 Control Blank						
0004 Control Blank						
0005 Acid Blank	X	29				X
0006 Control Blank						

ANALYSIS

ELEMENTS	P	Pb	pH Drop	S	S-SO4	Sb
UNITS	ppm	ppm	NONE	%	%	ppm
DETECTION LIMIT	50	0.5	0.1	0.005	0.01	0.05
DIGEST	4AB/	4AB/	ANCx/		S71/	4AB/
ANALYTICAL FINISH	OE	MS	MTR	/CSA	OE	MS
SAMPLE NUMBERS						
0001 Frogs Leg Comp	366	163.4	X	1.800	0.21	3.33
0002 White Foil Comp	1083	28.1	2.9	1.400	0.19	0.84
CHECKS						
0001 Frogs Leg Comp	380	165.2	X	1.900	0.21	3.68
STANDARDS						
0001 0.5%NaCl						
0002 HgSTD-4						
0003 MA-1b				1.130		
0004 OREAS 97.01						
0005 PD-1					4.56	
0006 STSD-2						
0007 SY-4	506	10.9				X
BLANKS						
0001 Control Blank	X	X	X	0.010	X	X
0002 Control Blank						
0003 Control Blank					X	
0004 Control Blank						
0005 Acid Blank	X	X				X
0006 Control Blank					X	

ANALYSIS

ELEMENTS	Se	Sn	Sr	Th	TIC	U
UNITS	ppm	ppm	ppm	ppm	%	ppm
DETECTION LIMIT	0.01	0.1	0.05	0.01	0.01	0.01
DIGEST	SE1/	4AB/	4AB/	4AB/	C72/	4AB/
ANALYTICAL FINISH	MS	MS	MS	MS	CSA	MS
SAMPLE NUMBERS						
0001 Frogs Leg Comp	0.97	1.8	178.90	2.36	0.55	0.65
0002 White Foil Comp	0.21	2.2	192.55	10.07	0.48	2.53
CHECKS						
0001 Frogs Leg Comp	0.86	1.9	184.74	2.36	0.66	0.65
STANDARDS						
0001 0.5%NaCl						
0002 HgSTD-4						
0003 MA-1b						
0004 OREAS 97.01	0.63					
0005 PD-1						
0006 STSD-2						
0007 SY-4		7.5	1206.28	1.28		0.49
BLANKS						
0001 Control Blank	0.01	X	X	X		X
0002 Control Blank						
0003 Control Blank						
0004 Control Blank	X					
0005 Acid Blank		X	0.09	X		X
0006 Control Blank						

ANALYSIS

ELEMENTS	V	Zn
UNITS	ppm	ppm
DETECTION LIMIT	2	1
DIGEST	4AB/	4AB/
ANALYTICAL FINISH	OE	OE
SAMPLE NUMBERS		
0001 Frogs Leg Comp	154	409
0002 White Foil Comp	27	130
CHECKS		
0001 Frogs Leg Comp	155	412
STANDARDS		
0001 0.5%NaCl		
0002 HgSTD-4		
0003 MA-1b		
0004 OREAS 97.01		
0005 PD-1		
0006 STSD-2		
0007 SY-4	6	84
BLANKS		
0001 Control Blank	X	2
0002 Control Blank		
0003 Control Blank		
0004 Control Blank		
0005 Acid Blank	X	2
0006 Control Blank		

METHOD CODE DESCRIPTION

/CSA Genalysis Main Laboratory

Induction Furnace Analysed by Infrared Spectrometry

4AB/MS Genalysis Main Laboratory

Multi-acid digest including Hydrofluoric, Nitric, Perchloric and Hydrochloric acids in Teflon Beakers. Analysed by Inductively Coupled Plasma Mass Spectrometry.

4AB/OE Genalysis Main Laboratory

Multi-acid digest including Hydrofluoric, Nitric, Perchloric and Hydrochloric acids in Teflon Beakers. Analysed by Inductively Coupled Plasma Optical (Atomic) Emission Spectrometry.

ANCx/MTR Genalysis Main Laboratory

Acid Neutralizing Capacity Digestion Procedure. Analysed with Electronic Meter Measurement

ANCx/QUAL Genalysis Main Laboratory

Acid Neutralizing Capacity Digestion Procedure. Analysed by Qualitative Inspection

ANCx/VOL Genalysis Main Laboratory

Acid Neutralizing Capacity Digestion Procedure. Analysed by Volumetric Technique.

C72/CSA Genalysis Main Laboratory

Digestion by hot acid(s) Analysed by Infrared Spectrometry

CL1/COL Genalysis Main Laboratory

Carbonate leach specific for Chlorine. Analysed by UV-Visible Spectrometry.

FC7/SIE Genalysis Main Laboratory

Alkaline fusion (Nickel crucible) specific for Fluorine. Analysed by Specific Ion Electrode.

HG1/CV Genalysis Main Laboratory

Low temperature Perchloric acid digest specific for Mercury. Analysed by Cold Vapour Generation Atomic Absorption Spectrometry.

NAGx/MTR Genalysis Main Laboratory

Net Acid Generation Extraction of samples with H2O2 Analysed with Electronic Meter Measurement

NAGx/VOL Genalysis Main Laboratory

Net Acid Generation Extraction of samples with H2O2 Analysed by Volumetric Technique.

S71/OE Genalysis Main Laboratory

Digestion to eliminate sulphides. Analysed by Inductively Coupled Plasma Optical (Atomic) Emission Spectrometry.

SE1/MS Genalysis Main Laboratory

Aqua-Regia digest followed by Precipitation and Concentration. Specific for Selenium. Analysed by Inductively Coupled Pl

ANALYTICAL REPORT

Tim ROWLES
KNIGHT PIESOLD PTY LIMITED
PO Box 6837
EAST PERTH, W.A. 6892
AUSTRALIA

JOB INFORMATION

JOB CODE	:	752.0/1117466
No. of SAMPLES	:	2
No. of ELEMENTS	:	38
CLIENT O/N	:	P09351 :2/2 (Job 2 of 2)
SAMPLE SUBMISSION No.	:	PE801-00137
PROJECT	:	Mungari Project
STATE	:	Solutions
DATE RECEIVED	:	10/11/2011
DATE COMPLETED	:	29/12/2011
DATE PRINTED	:	29/12/2011
PRIMARY LABORATORY	:	Genalysis Main Laboratory

LEGEND

X	= Less than Detection Limit
N/R	= Sample Not Received
*	= Result Checked
( )	= Result still to come
I/S	= Insufficient Sample for Analysis
E6	= Result X 1,000,000
UA	= Unable to Assay
>	= Value beyond Limit of Method
OV	= Value over-range for Package

SAMPLE DETAILS

DISCLAIMER

Genalysis Laboratory Services Pty Ltd wishes to make the following disclaimer pertaining to the accompanying analytical results.

Genalysis Laboratory Services Pty Ltd disclaims any liability, legal or otherwise, for any inferences implied from this report relating to either the origin of, or the sampling technique employed in the collection of, the submitted samples.

SIGNIFICANT FIGURES

It is common practice to report data derived from analytical instrumentation to a maximum of two or three significant figures. Some data reported herein may show more figures than this. The reporting of more than two or three figures in no way implies that the third, fourth and subsequent figures may be real or significant.

Genalysis Laboratory Services Pty Ltd accepts no responsibility whatsoever for any interpretation by any party of any data where more than two or three significant figures have been reported.

SAMPLE STORAGE DETAILS

GENERAL CONDITIONS

SAMPLE STORAGE OF SOLIDS

Bulk Residues and Pulps will be stored for 60 DAYS without charge. After this time all Bulk Residues and Pulps will be stored at a rate of $3.30 per cubic metre per day until your written advice regarding collection or disposal is received. Expenses related to the return or disposal of samples will be charged to you at cost. Current disposal cost is charged at $100.00 per cubic metre.

SAMPLE STORAGE OF SOLUTIONS

Samples received as liquids, waters or solutions will be held for 60 DAYS free of charge then disposed of, unless written advice for return or collection is received.

NOTES

1. Please note the samples have an EC reading greater than 200 mS/cm and a correct reading can'be given

ANALYSIS

ELEMENTS	Ag	Al	As	B	Ba	Be	Bi	Ca	Cd	Cl
UNITS	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
DETECTION LIMIT	0.001	1	0.01	1	0.005	0.01	0.001	1	0.002	5
DIGEST										
ANALYTICAL FINISH	/MS	/OE	/MS	/OE	/MS	/MS	/MS	/OE	/MS	/VOL
SAMPLE NUMBERS										
0001 Frogs Leg Comp	X	X	0.24	X	0.110	X	X	838	X	93705
0002 White Foil Comp	0.004	X	0.21	1	0.168	X	X	892	X	93354
CHECKS										
0001 Frogs Leg Comp	0.001	X	0.23	X	0.105	X	X	852	X	94056
STANDARDS										
0001 Alcoa-High4-MS	0.019		0.10		0.020	0.02	0.019		0.020	
0002 SOLN-001										
BLANKS										
0001 Control Blank	X	2	X	X	X	X	X	X	X	

ANALYSIS

ELEMENTS	CN-Tot	CN-WAD	Co	Cr	Cu	F	Fe-Sol	Hg	K	Mg
UNITS	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
DETECTION LIMIT	0.01	0.01	0.01	1	1	0.1	1	0.01	10	1
DIGEST										
ANALYTICAL FINISH	/COL	/COL	/MS	/OE	/OE	/SIE	/OE	/MS	/OE	/OE
SAMPLE NUMBERS										
0001 Frogs Leg Comp	1.50	1.00	0.08	X	X	X	X	X	317	7612
0002 White Foil Comp	1.60	1.00	0.03	X	X	0.1	X	X	459	7770
CHECKS										
0001 Frogs Leg Comp			0.08	X	X	X	X	X	291	7755
STANDARDS										
0001 Alcoa-High4-MS			1.03					0.02		
0002 SOLN-001						0.9				
BLANKS										
0001 Control Blank			X	X	X	X	X	X	X	1

ANALYSIS

ELEMENTS	Mn	Mo	Na	Ni	P	Pb	pH	S	SO4	Sb
UNITS	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	NONE	mg/l	mg/l	mg/l
DETECTION LIMIT	1	0.005	10	1	10	0.05	0.1	10	30	0.001
DIGEST										
ANALYTICAL FINISH	/OE	/MS	/OE	/OE	/OE	/MS	/MTR	/OE	/CALC	/MS
SAMPLE NUMBERS										
0001 Frogs Leg Comp	3	0.044	48457	X	X	X	7.4	5263	15766	0.044
0002 White Foil Comp	4	0.032	49955	X	X	X	7.1	5248	15722	0.008
CHECKS										
0001 Frogs Leg Comp	3	0.042	50093	X	X	0.06	7.4	5539	16592	0.043
STANDARDS										
0001 Alcoa-High4-MS		0.020				X				0.021
0002 SOLN-001										
BLANKS										
0001 Control Blank	X	X	X	X	X	X		12	37	X

ANALYSIS

ELEMENTS	Se	Sn	Sr	TDSEva	Th	U	V	Zn
UNITS	mg/l	mg/l	mg/l	mg/Kg	mg/l	mg/l	mg/l	mg/l
DETECTION LIMIT	0.05	0.01	0.002	20	0.001	0.001	1	1
DIGEST								
ANALYTICAL FINISH	/MS	/MS	/MS	/GR	/MS	/MS	/OE	/OE
SAMPLE NUMBERS								
0001 Frogs Leg Comp	0.81	X	13.900	164784	X	0.002	X	X
0002 White Foil Comp	0.76	X	13.195	171448	X	0.005	X	X
CHECKS								
0001 Frogs Leg Comp	0.75	X	13.619	162413	X	0.002	X	X
STANDARDS								
0001 Alcoa-High4-MS	0.10	0.02	1.021		0.020	0.020		
0002 SOLN-001								
BLANKS								
0001 Control Blank	X	X	0.004	X	X	X	X	X

METHOD CODE DESCRIPTION

/CALC Genalysis Main Laboratory

No digestion or other pre-treatment undertaken. Results Determined by calculation from other reported data.

/COL Genalysis Main Laboratory

No digestion or other pre-treatment undertaken. Analysed by UV-Visible Spectrometry.

/GR Genalysis Main Laboratory

Analysed by Gravimetric Technique.

/MS Genalysis Main Laboratory

No digestion or other pre-treatment undertaken. Analysed by Inductively Coupled Plasma Mass Spectrometry.

/MTR Genalysis Main Laboratory

No digestion or other pre-treatment undertaken. Analysed with Electronic Meter Measurement

/OE Genalysis Main Laboratory

Analysed by Inductively Coupled Plasma Optical (Atomic) Emission Spectrometry.

/SIE Genalysis Main Laboratory

No digestion or other pre-treatment undertaken. Analysed by Specific Ion Electrode.

/VOL Genalysis Main Laboratory

No digestion or other pre-treatment undertaken. Analysed by Volumetric Technique.

Knight Piésold
CONSULTING

MEMORANDUM

To:	**La Mancha Resources Australia Pty Ltd**	**Date:**	1st September 2015
[redacted]		**Our Ref:**	PE15-00887
		KP File Ref.:	**PE801-00137/10-A dss M15009**
cc:		**From:**	[redacted]

RE: MUNGARI PROJECT – MAY 2015 OPERATING SAMPLE TAILINGS PHYSICAL TESTING

La Mancha Resources has been operating the Mungari Gold Project located 20 km west of Kalgoorlie, Western Australia since 2014. Pilot plant samples of tailings (White Foil and Frog's Leg orebodies) were tested for physical properties as part of the original TSF design in 2011. As part of the annual audit of the TSF, an operating sample was requested to validate some of the design assumptions.

The physical tests were performed to determine the rate of settling, achieved density and rate of water release of the tailings. In addition, air drying, permeability, consolidation and strength tests were performed. This memo discusses the physical test work of the May 2015 Operating sample as well as a high level comparison with the previous results. Geochemical testing was also conducted but is reported in a separate memorandum.

1. SAMPLE DESCRIPTIONS AND TESTWORK

An operating plant sample (May 2015) was provided (in two 10 L buckets) by La Mancha Resources to the Knight Piésold (KP) laboratory in May 2015. The sample will be referred to as the "Operating Sample" for this memo. The sample arrived at approximately 40% solids (w/w). It was sampled direct from the tailings delivery pipeline at the plant.

The following tests were carried out on the sample received:

i. Classification tests to determine:
   - Particle size distribution of the tailings;
   - Supernatant liquor density;
   - Liquid and plastic limits of the tailings solids; and
   - Tailings solids particle density.

ii. Undrained and drained sedimentation tests;
iii. Air drying tests;
iv. Permeability tests;
v. High strain consolidation tests;
vi. Strength test.

During laboratory testing it is Knight Piésold's normal practice to duplicate each test as a means to verify the consistency of the test results. The results of each individual test are plotted on the corresponding figures. The interpreted mean values are given in the tables and text of the document. A brief description of the method employed in each test is also provided.

2. PHYSICAL TESTING

The following section discusses the physical testing results for the tailings samples. Predicted tailings behaviour is discussed in Section 3; however, it should be noted that field results are also dependent on the processing plant operation, layout and operation of the actual storage facilities and blending of the different ore types.

2.1 CLASSIFICATION TESTING

Classification testing was completed by Trilab in Perth. Where appropriate, classification tests were conducted in accordance with relevant Australian Standards. The results of the classification tests together with the results from the 2011 Frogs Leg and White Foil samples, and relevant Australian Standards are summarised in Table 2.1. The Trilab laboratory test reports for the Operating Sample are presented in Appendix A.

Table 2.1: Classification testing – results and relevant standards

Test	Operating Sample	Frogs Leg	White Foil	AS1289
Particle Density	2.89	2.82	2.84	3.5.1 (1995)
Supernatant Density	1.12	1.12	1.12	(hydrometer)
Supernatant pH	7.81	7.7	7.8	(pH meter)
Liquid Limit (%)	19	-	-	3.1.2 (1995)
Plastic Limit (%)	15	NP	NP	3.2.1 (1995)
Plasticity Index (%)	4	NP	NP	3.3.1 (1995)

* NP – Non Plastic

The classification tests of three samples are similar with the only difference the low plasticity of operating sample compared to the other two samples which are non plastic. The particle size analysis was completed in accordance with AS1289 3.6.3 - 2003. The measured particle size distribution is presented in Table 2.2 and the grading curve for the Operating Sample compared to the two previous results are shown on Figure 2.1.

Table 2.2: Particle size distribution

Fraction	Particle Size (µm)	Percent Passing (%)		
		Operating Sample	Frogs Leg	White Foil
Sand	600	100	100	100
	200	92	97	97
Silt	75	75	80	81
	20	46	41	40
	6	23	21	19
Clay	2	18	10	9
P_{80}		96	75	75

Using the Unified Soil Classification System (Geotechnical Site Investigations, AS1726-1993), the operating sample would be classified as a SILT with clay/sand (ML). The other two samples would be classified as SILT with sand and a trace of clay (ML). Both the Frog Legs and White Foil P_{80} size are around 75µm, whereas the Operating Sample P_{80} is around 96µm. Otherwise, all three samples are considered relatively similar but with the operating sample having slightly higher clay content.

2.2 SEDIMENTATION TESTS

Drained and undrained sedimentation tests were carried out to determine the settling rate, volume of supernatant, and settled dry density of the tailings.

In the undrained sedimentation test, tailings slurry is allowed to settle in a measuring cylinder. This is equivalent to the deposition of tailings under water. The results indicate the expected rate and quantity of supernatant release and enable the minimum dry density of the tailings to be determined.

In the drained sedimentation, test tailings slurry is allowed to settle and drain in a cylinder with a fine sand filter drain at the base. This simulates the deposition of tailings where both settling and free drainage can occur. The results indicate the relative quantities of supernatant and underdrainage released by the settling slurry and enables the dry density of the drained tailings to be determined. The underdrainage values are maximum values, as the drainage layer is free-draining without back pressure and the tailings is deposited directly over the drainage medium.

The results of the sedimentation tests are presented in figures 2.2 and 2.3. Table 2.3 presents a summary of the measured sedimentation data.

Table 2.3: Sedimentation test results

Sample	Test	Initial Solids (%)	Supernatant (% of initial water volume)	Underdrainage (% of initial water volume)	Time to Achieve Final Density (Days)	Final Dry Density (t/m^3)	Final Void Ratio	Figure
Operating Sample	Undrained	42	54	-	1	1.09	1.65	2.2
	Drained	42	38	27	1	1.31	1.20	2.3
Frogs Leg	Undrained	44	56	-	1	1.18	1.39	-
	Drained	47	43	24	1	1.45	0.88	
White Foil	Undrained	45	57	-	1	1.21	1.33	-
	Drained	45	38	28	1	1.40	1.02	

The test indicate the Operating Sample settles rapidly, similar to the original testwork, although to a slightly lower final dry density. The sample released approximately 54% of the water in slurry to supernatant for the undrained case, reducing to 38% supernatant release for the drained case. There is an approximately 20% increase in the settled density with the inclusion of underdrainage. The settled densities achieved are moderate, with a resulting void ratio of approximately 1.2 to 1.6.

2.3 AIR DRYING TESTS

Air drying tests were carried out on slurry samples to determine the effect of air drying on the tailings after initial settling and removal of supernatant liquor, thereby simulating conditions expected following sub-aerial deposition. Continuous monitoring of the weight and volume of each specimen was carried out in order to quantify the relationship between dry density, moisture content, volumetric change and the degree of saturation of the tailings.

A direct relationship exists between dry density and moisture content up to a breakaway point, at which the degree of saturation falls below 100%. At this point, negative pore water pressures are developed, which further consolidates the tailings. Drying below a

limiting saturation produces no further consolidation, and the density at this point represents the maximum that can be achieved via air drying of the tailings.

The results of air drying tests are presented in figures 2.4 and 2.5 and are summarised in Table 2.4.

Table 2.4: Results of air drying tests

Sample	Moisture Content at Breakaway Point (%MC)	Dry Density at Breakaway Point (t/m^3)	Limiting Saturation Value (%Sat)	Final Dry Density (t/m^3)
Operating Sample	55	1.23	95	1.25
Frogs Leg	40	1.45	90	1.55
White Foil	40	1.50	80	1.55

The Operating Sample achieved a low final dry density, relative to the previous tailings samples, of around 1.25 t/m^3. This occurred over a short drying time of approximately 5 days at an evaporation rate of 5 mm/day. When the results of the Operating Sample are compared against those of the earlier testwork (Figures 2.4), it can be seen that the initial drying characteristics were similar. However shrinkage and loss of moisture stopped much earlier in the Operating Sample due to the formation of a significant salt layer which slowed down the rate of evaporation from the sample. It took a number of weeks to reduce the moisture content down to 45%. The air drying tests increased the final dry density by 14% when compared to the drained sedimentation test, however the test also resulted in a lower density than the drained test which is not typical tailings behaviour.

In situ measurements from the TSF have been reviewed. An assessment of density determined that the in situ dry density is of the order 1.5 t/m^3 (ref. KP Memo PE15-00353). A comparison of moisture contents obtained from the operating beach by LMR indicated lower moisture contents within the tailings mass than those measured in the laboratory. Moisture contents of around 32% were obtained from samples taken directly from the TSF beach.

Considering the available data in its entirety, it is assessed that the final dry density of tailings at the Mungari TSF will be of the order 1.5 t/m^3. Evaporation from the recently-tested Operating Sample was inhibited by the formation of a thick salt crust which prevented sufficient moisture loss in the laboratory when compared to field conditions. On site, there is progressive removal of the salt layer on the surface of the tailings by wind, rain and/or cyclic deposition which allows additional evaporation when compared to laboratory testing.

In future tailings testwork, it would be beneficial to run a drained air drying test (where water in slurry is allowed to drain from the base of the sample) which may reflect site conditions more closely by removing the saline water from the sample.

2.4 CONSOLIDATION TESTS

The consolidation of the tailings can be quantified in terms of the compression index C_C and the coefficient of consolidation C_V. The compression index relates the void ratio or tailings density to the effective stress of the tailings sample. The larger the value of C_C, the more compressible the tailings. The coefficient of consolidation defines the rate of excess pore water dissipation, and hence the rate of increase in effective stress within the tailings. Higher values of C_V indicate more rapid consolidation of the sample.

The settlement with respect to time for the test is presented in Figure 2.6 and the results of the consolidation tests are summarised in Table 2.5.

Table 2.5: Consolidation test results

Sample	Dry Density (t/m^3)	Stress Range (kPa)	Coeff. of Consolidation C_V (m^2/y)	Coeff.of Volume Decrease M_V (m^2/kN)	Comp. Index C_C
Operating Sample	1.10 - 1.24	1.39 - 4.74	55	0.03	0.56
Frogs Leg	1.28 – 1.40	1.55 – 4.95	110	0.02	0.37
White Foil	1.17 – 1.30	1.33 – 4.55	56	0.03	0.44

Results indicate that the sample has reasonably high compressibility and will consolidate moderately quickly. The results are similar to the previous test work.

2.5 PERMEABILITY TESTS

Falling head permeability tests were completed on saturated tailings samples with drainage through the drained sedimentation sample being measured. In addition, permeability values were derived from the results of consolidation tests. Results are summarised in Table 2.6 and also presented in Figure 2.6.

Table 2.6: Permeability test results

Sample	Test Type	Dry Density (t/m^3)	Permeability (m/s)
Operating Sample May 2015	Falling Head	1.31	3.6×10^{-7}
	Consolidation Test	1.12	1.3×10^{-7}
		1.18	1.1×10^{-7}
		1.24	4.0×10^{-7}
Frogs Leg	Falling Head	1.5	4.0×10^{-7}
	Consolidation Test	1.31	5.3×10^{-6}
		1.36	1.0×10^{-6}
		1.4	4.0×10^{-7}
White Foil	Falling Head	1.41	7.5×10^{-7}
	Consolidation Test	1.19	5.5×10^{-5}
		1.25	7.9×10^{-7}
		1.3	3.7×10^{-7}

These results represent the permeability of saturated tailings prior to additional consolidation due to additional deposition loading or air-drying. In the range of expected settled densities, the permeability of the Operating tailings is similar to those of the 2 previous tailings samples at approximately 4×10^{-7} m/s.

2.6 STRENGTH TESTS

Preliminary undrained shear strength testing was undertaken on the Operating Sample to determine the relationship between undrained shear strength, saturation, and moisture

content of the tailings. The test is designed to determine the effect of air drying on the undrained shear strength of the tailings solids, after initial settling.

The sample of the tailings slurry was allowed to settle with supernatant water removed then air dried on the bench before the test commenced. The unconfined compressive strength of the tailings was measured over the following several days as the tailings dried further and began to gain strength. A dial pocket penetrometer with varying size footings was utilised to determine the undrained shear strength of the tailings during desiccation.

The results of the undrained strength testing from various containers (same sample) is presented in Figure 2.7 and summarised in Table 2.7.

Table 2.7: Observed increase in strength

Moisture Content (%)	Nominal strength (kPa)
47	1
45	5
43	30
41	70
38	100
35	200+

Although the testwork is not suitable to determine strength parameters for stability modelling, it indicates that the tailings surface may be trafficable by foot by the time the moisture content drops below 43%. This correlates with site experience where the beach moisture content is around 33% and is trafficable by light equipment. In situ testing should be conducted during the design phase (to determine detailed strength, liquefaction and pore pressure parameters) for any upstream construction proposed.

3. SUMMARY

An Operating Tailings Sample from Mungari Gold Mine has undergone laboratory testwork to determine physical characteristics. The results overall indicate that the Operating Sample is similar to the previously tested White Foil and Frog's Leg orebody samples and no significant variations to the design parameters were identified.

A lower than expected air drying density (compared to previous testwork and measurements on site) was attributed to the build-up of a salt crust which inhibited drying. Drained air drying tests are recommended for future testing to overcome issues with the salt build-up.

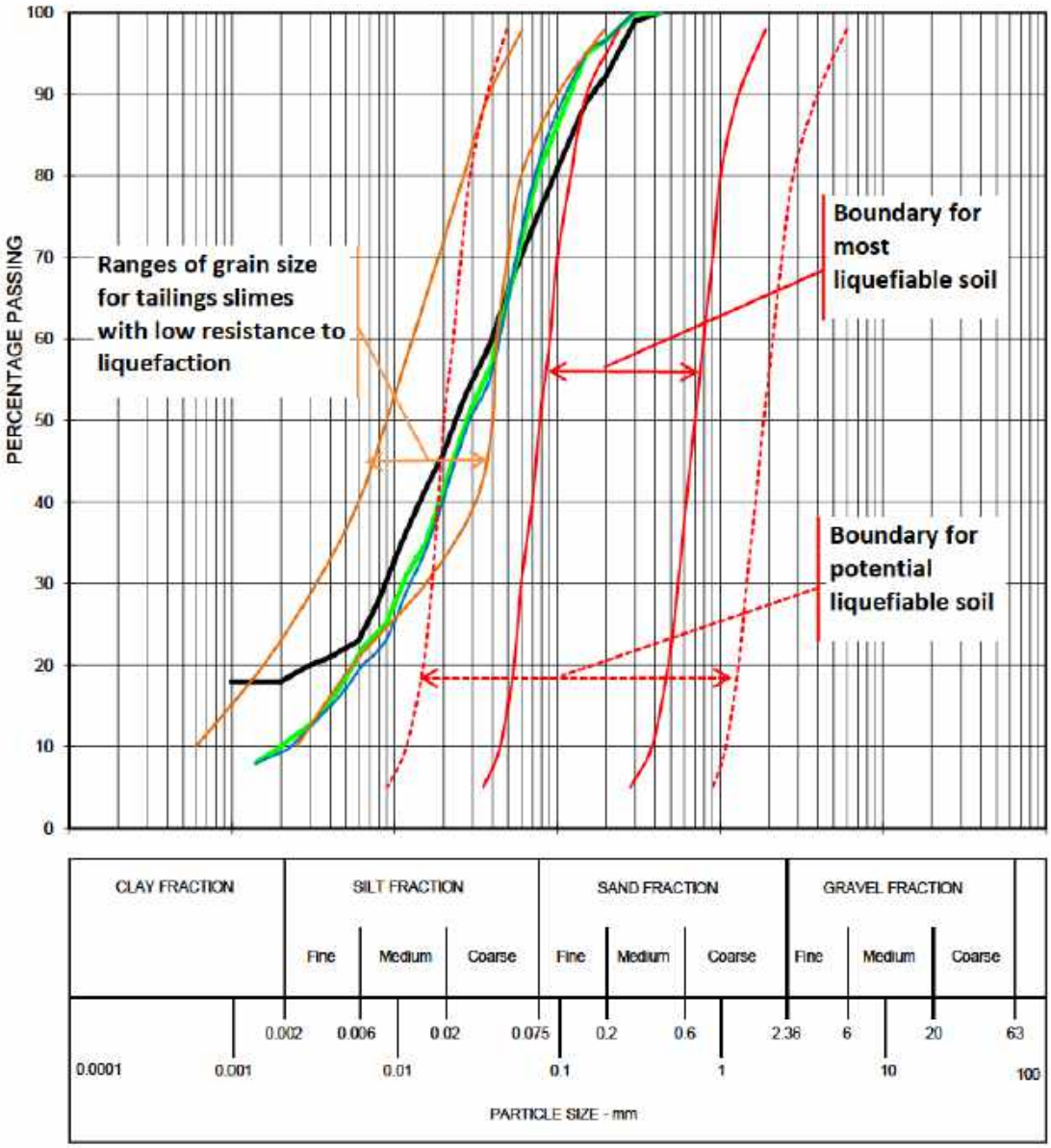
The anticipated physical properties of the tailings remain largely unchanged from earlier assessments and are provided here for reference:

Table 3.1: Tailings design parameters

Parameter	Value
Maximum Air Dried Density	1.50 t/m^3
P_{80}	95 µm
Solids Content	42-45%
Supernatant Release	30-35%
Underdrainage Release	5-10%
Vertical Permeability	5x10^{-7} m/s
Horizontal Permeability	5x10^{-6} m/s
Coeff. Of Consolidation (c_v)	80 m^2/yr
Coeff. Of Volume Decrease (m_v)	0.025 m^2/kN
Compression Index (c_c)	0.5

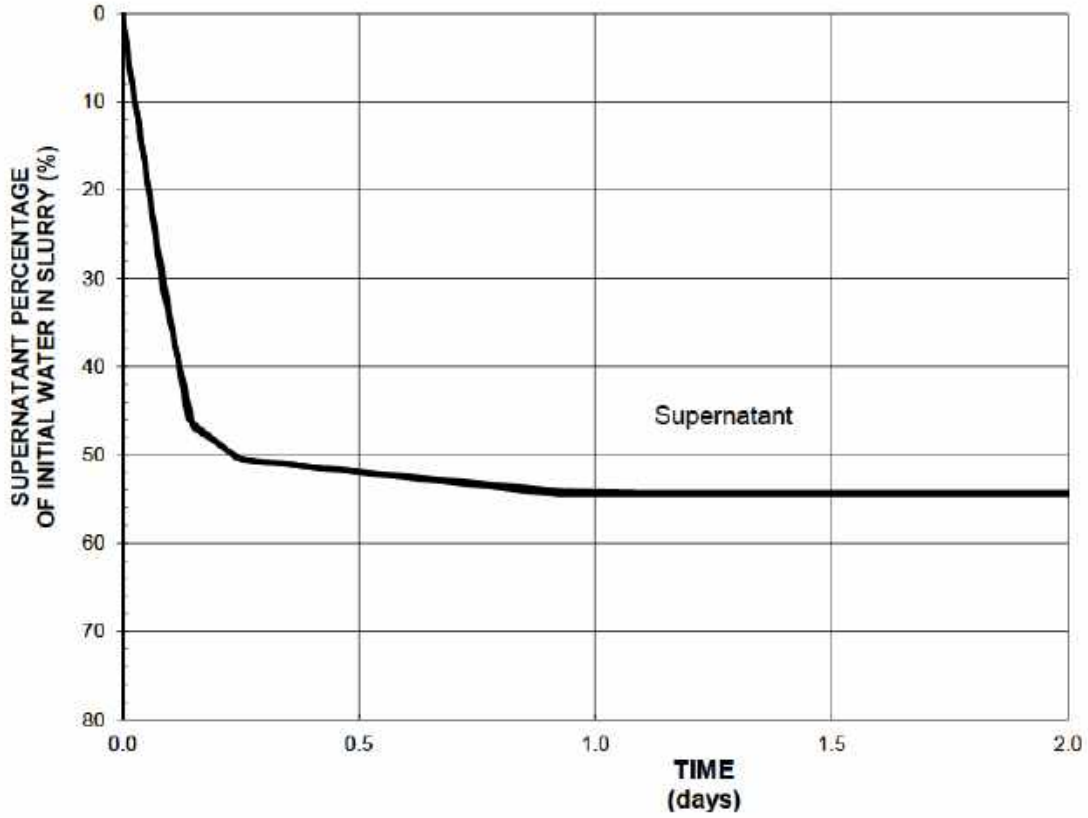
FIGURES

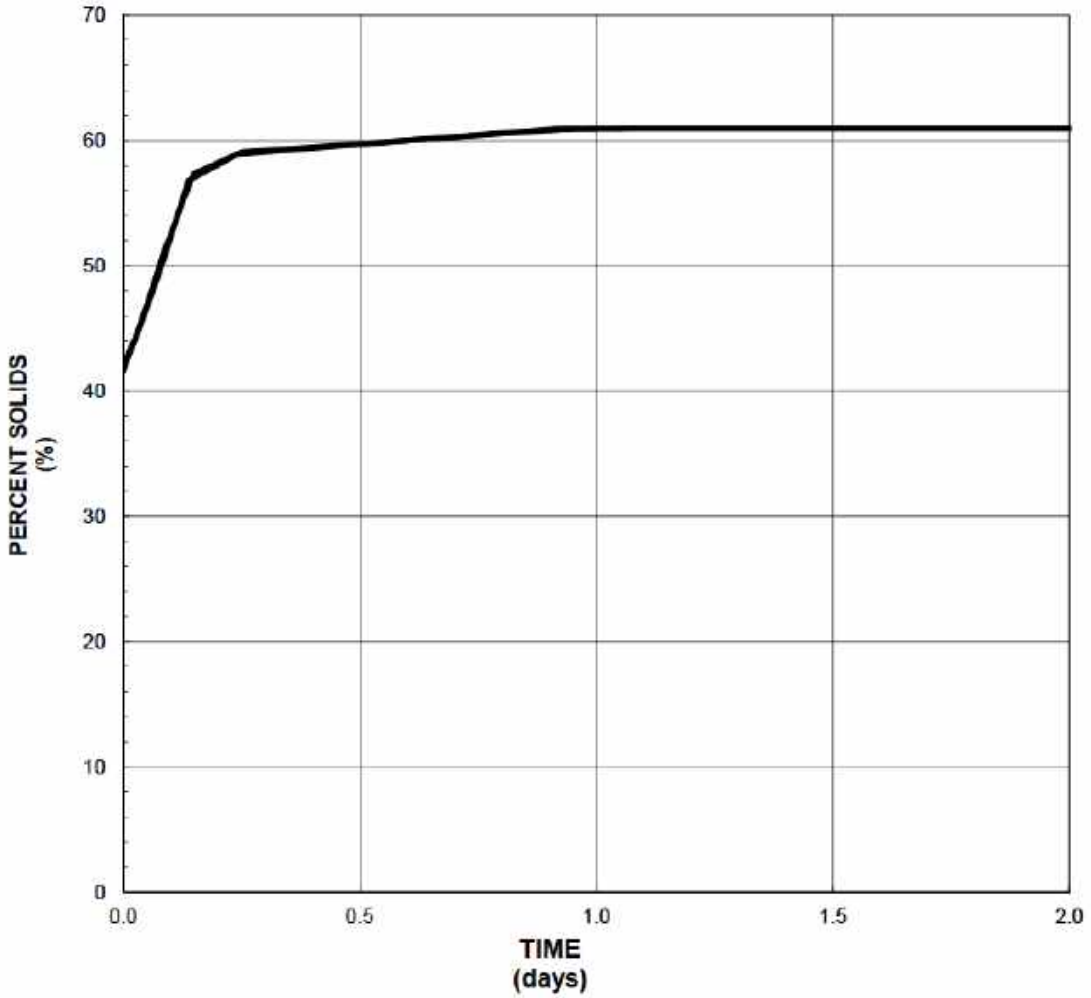
PARTICLE SIZE DISTRIBUTION



SYMBOL	SOIL DESCRIPTION	LIQUID LIMIT	PLASTICITY INDEX	SPECIFIC GRAVITY
———	Operating Sample May 2015	19	4	2.89
———	Frogs Legs	NP	NP	2.82
———	White Foil	NP	NP	2.84

Note:
Liquefiable and potentially liquefiable soil limits suggested by USNRC 1985.
Data obtained from Figure 12.15 and 12.16 of Geotechnical Engineering of Dams, Fell 2005


SUPERNATANT PERCENTAGE OF INITIAL WATER IN SLURRY (%)
0
10
20
30
40
50
60
70
80
Supernatant
0.0
0.5
1.0
1.5
2.0
TIME
(days)


PERCENT SOLIDS (%)
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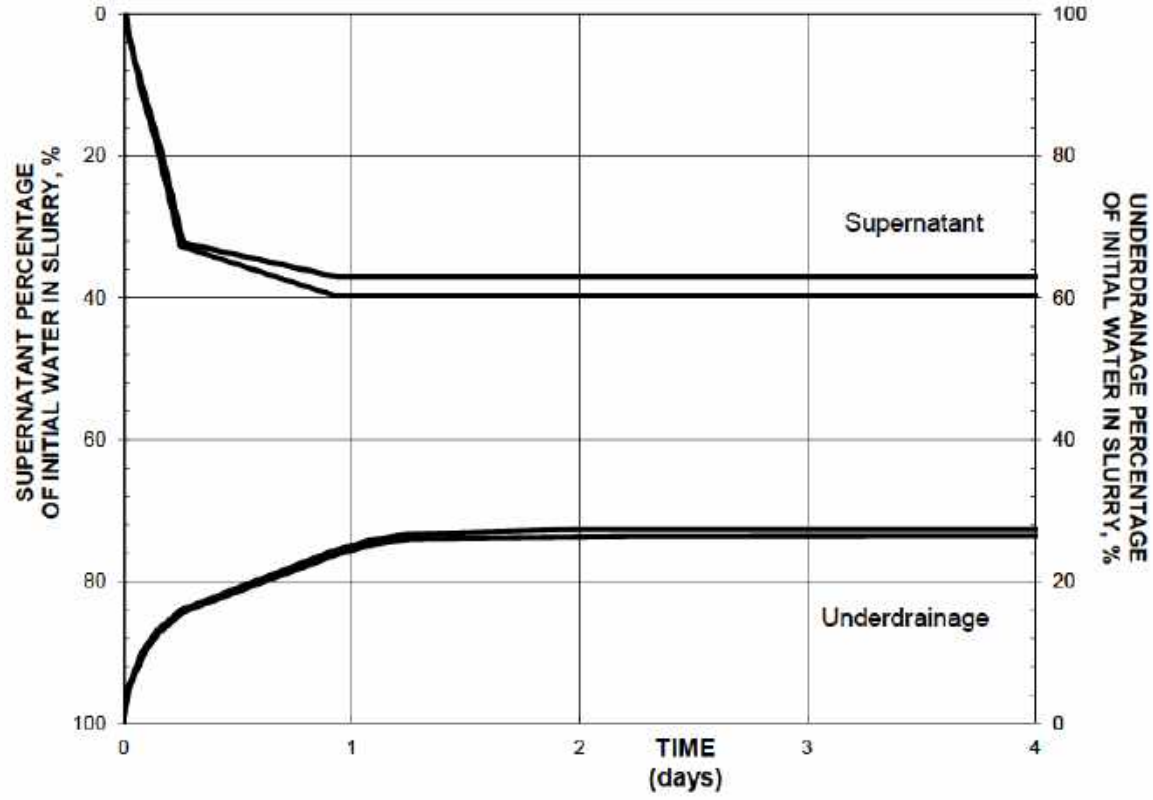
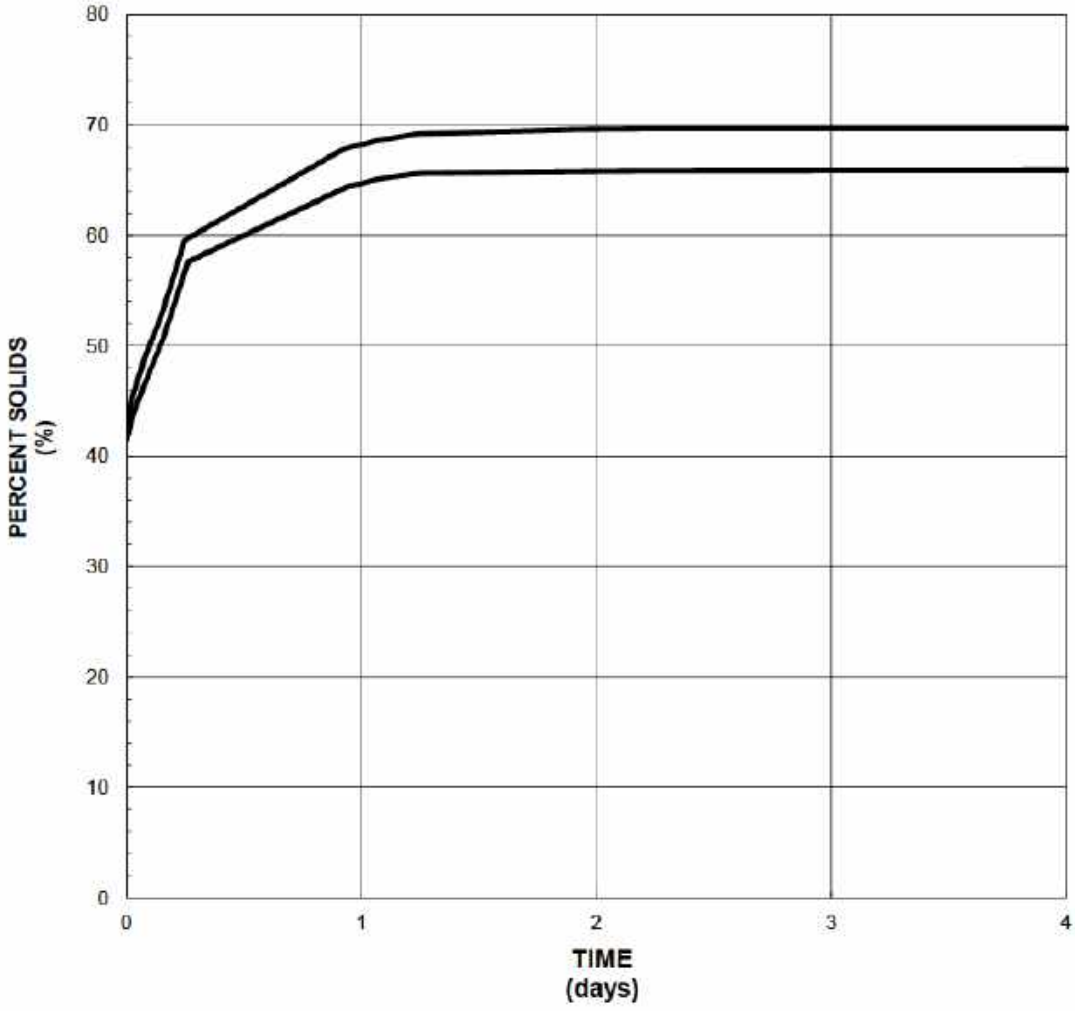
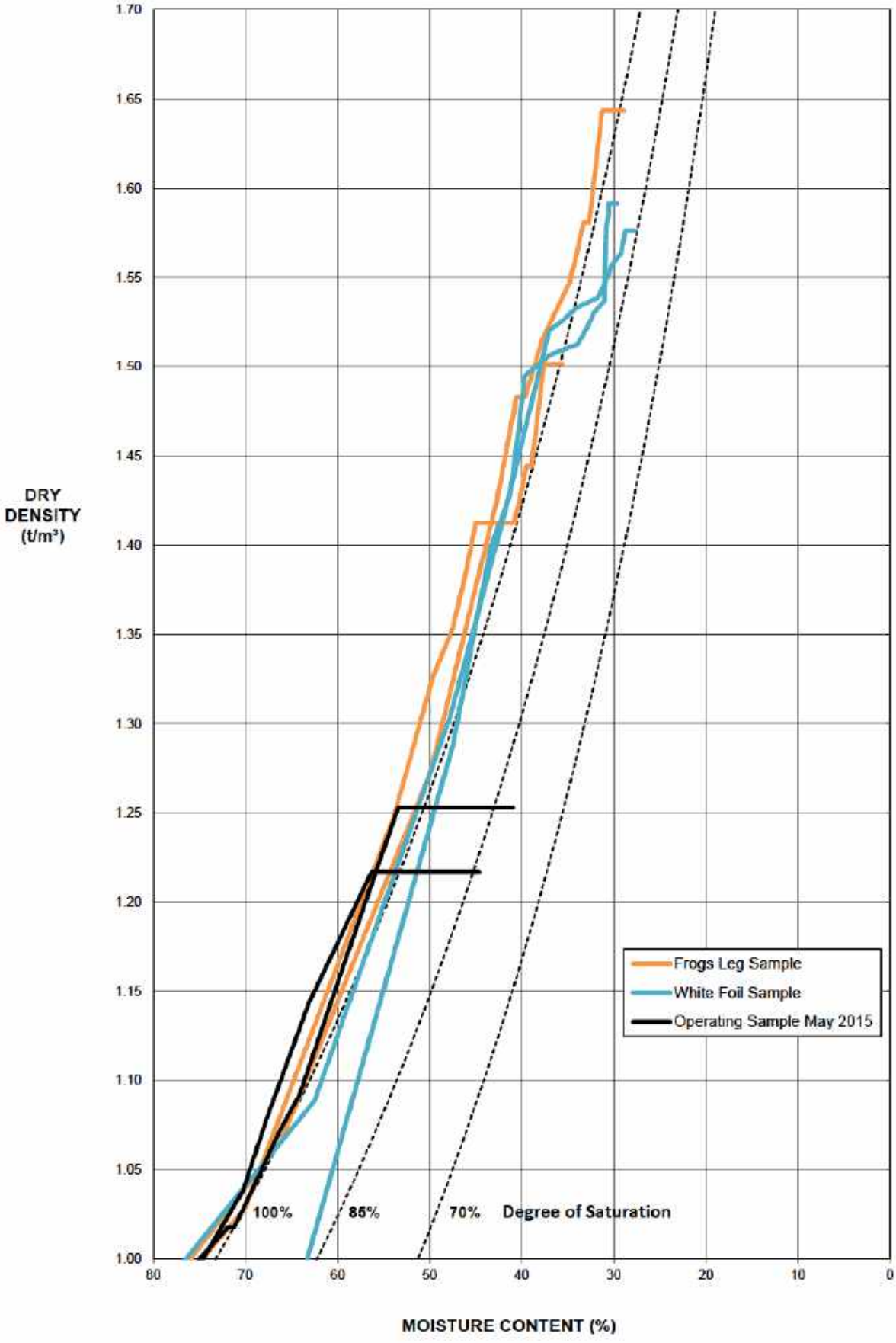
60
50
40
30
20
10
0
0.0
0.5
1.0
1.5
2.0
TIME
(days)


SUPERNATANT PERCENTAGE OF INITIAL WATER IN SLURRY, %
UNDERDRAINAGE PERCENTAGE OF INITIAL WATER IN SLURRY, %
Supernatant
Underdrainage
TIME (days)
0
20
40
60
80
100
0
1
2
3
4


PERCENT SOLIDS (%)
TIME (days)
0
10
20
30
40
50
60
70
80
0
1
2
3
4


DRY DENSITY (t/m³)
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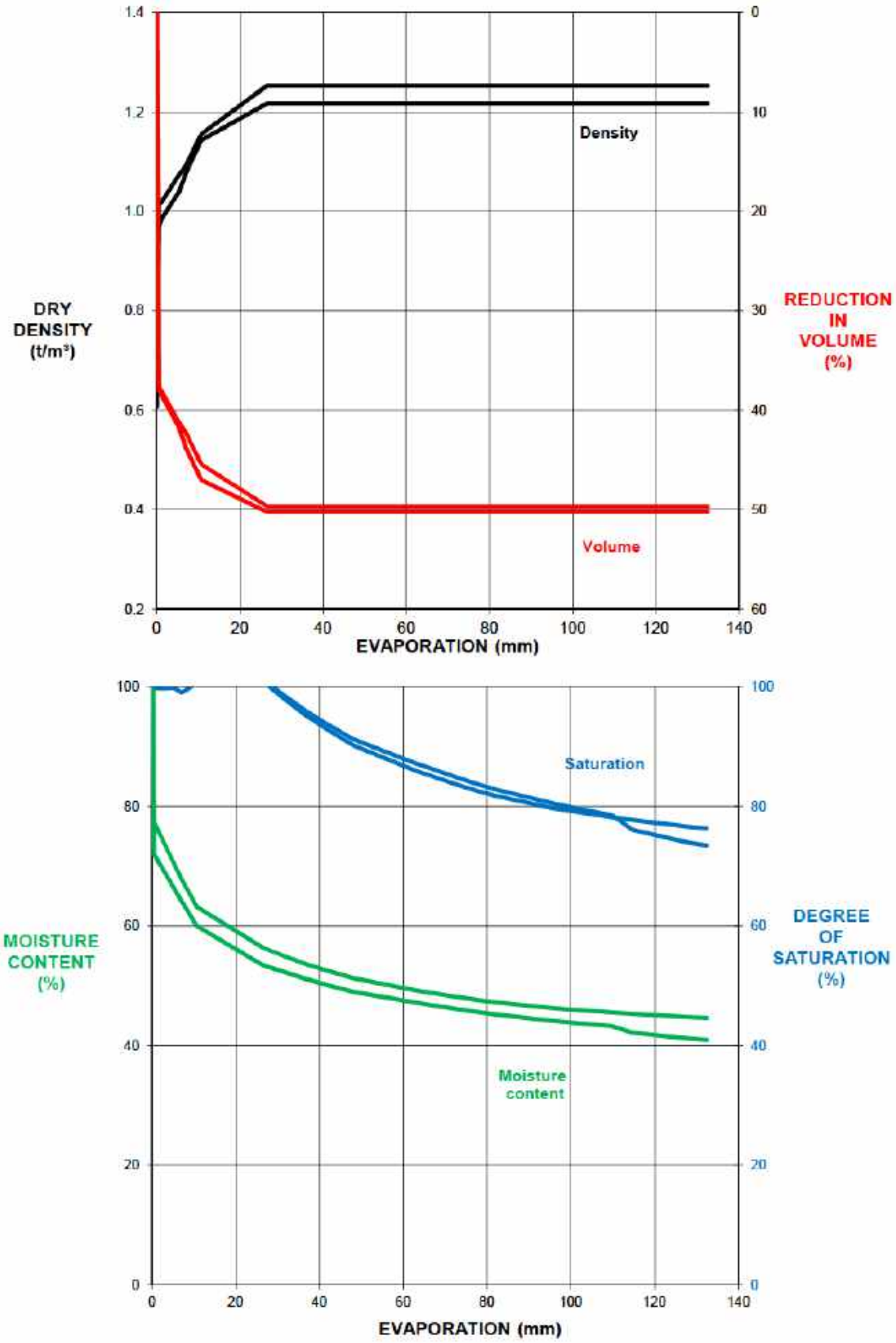
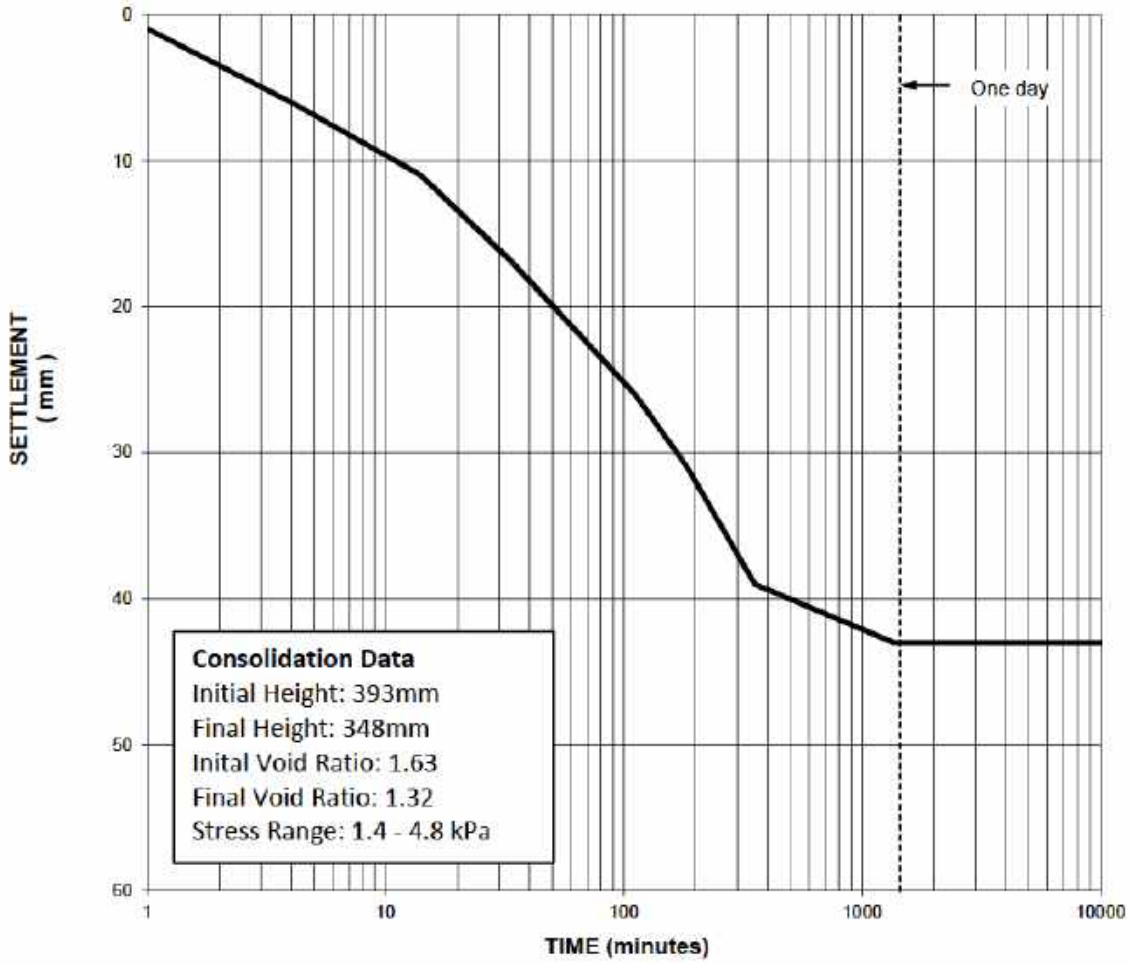
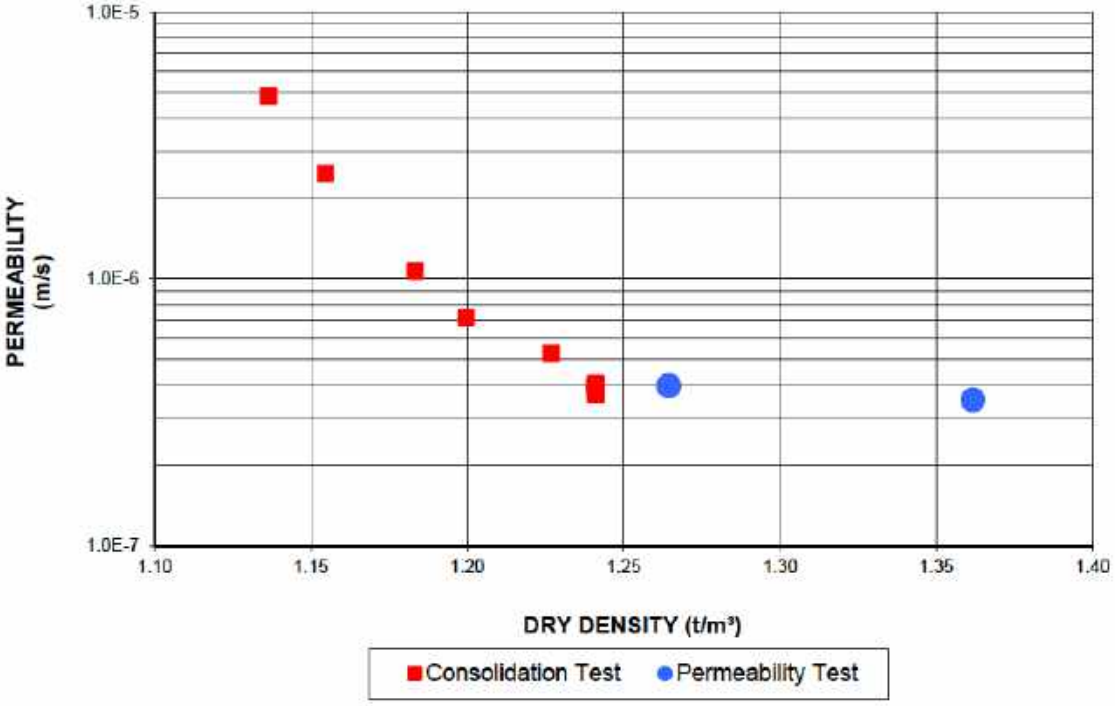
1.65
1.60
1.55
1.50
1.45
1.40
1.35
1.30
1.25
1.20
1.15
1.10
1.05
1.00
80
70
60
50
40
30
20
10
0
MOISTURE CONTENT (%)
100%
85%
70%
Degree of Saturation
Frogs Leg Sample
White Foil Sample
Operating Sample May 2015


DRY DENSITY (t/m³)
REDUCTION IN VOLUME (%)
Density
Volume
EVAPORATION (mm)
MOISTURE CONTENT (%)
DEGREE OF SATURATION (%)
Saturation
Moisture content
EVAPORATION (mm)


SETTLEMENT (mm)
0
10
20
30
40
50
60
One day
Consolidation Data
Initial Height: 393mm
Final Height: 348mm
Inital Void Ratio: 1.63
Final Void Ratio: 1.32
Stress Range: 1.4 - 4.8 kPa
1
10
100
1000
10000
TIME (minutes)


PERMEABILITY (m/s)
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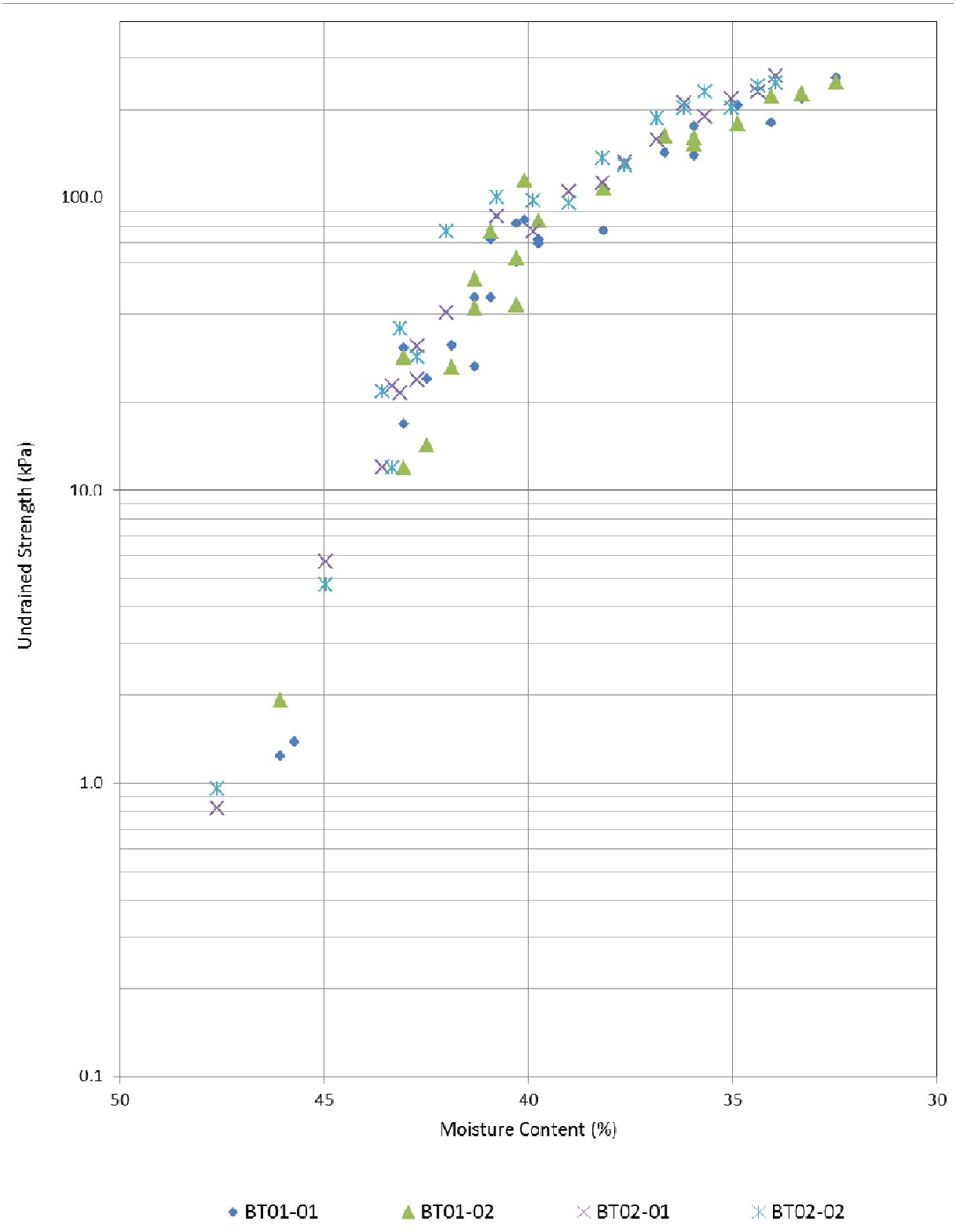
1.0E-6
1.0E-7
1.10
1.15
1.20
1.25
1.30
1.35
1.40
DRY DENSITY (t/m³)
Consolidation Test
Permeability Test


Undrained Strength (kPa)
100.0
10.0
1.0
0.1
50
45
40
35
30
Moisture Content (%)
BT01-01
BT01-02
BT02-01
BT02-02

APPENDIX A

Trilab Laboratory Testing

Trilab
Soil Rock Calibration

Brisbane
346A Bilsen Road,
Geebung
QLD 4034
Ph: +61 7 3265 5656

Perth
2 Kimmer Place,
Queens Park
WA 6107
Ph: +61 8 9258 8323

ATTERBERG LIMITS TEST REPORT

Test Method: AS 1289 2.1.1, 3.9.1, 3.2.1, 3.3.1, 3.4.1

Client	Knight Piesold Pty Ltd	**Report No.**	15060743-AL
Project	Hope Downs 4, Mahenge, Mungari	**Test Date**	19/6/15-20/6/15
		Report Date	22/06/2015

Sample No.	15060743	15060744	-	-	-	-
Client ID	Mahenge Tailings Sample	Mungari Operating Sample May 2015	-	-	-	-
Depth (m)	Not Supplied	~53% MC	-	-	-	-
Liquid Limit (%)	29	19	-	-	-	-
Plastic Limit (%)	21	15	-	-	-	-
Plasticity Index (%)	8	4	-	-	-	-
Linear Shrinkage (%)	1.0	0.5	-	-	-	-
Moisture Content (%)	70.0	85.4	-	-	-	-

NOTES/REMARKS: The samples were tested oven dried, dry sieved and in a 125-250mm mould.

Sample/s supplied by the client * Cracking occurred + Curling occurred

Accredited for compliance with ISO/IEC 17025.
The results of the tests, calibrations, and/or measurements included in this document are traceable to Australian/National Standards.

Tested at Trilab Brisbane Laboratory

[redacted]

NATA TECHNICAL COMPETENCE

Laboratory No. 9926

The results of calibrations and tests performed apply only to the specific instrument or sample at the time of test unless otherwise clearly stated.
Reference should be made to Trilab's "Standard Terms and Conditions of Business" for further details.
Trilab Pty Ltd ABN 25 065 630 506

ACCURATE QUALITY RESULTS FOR TOMORROW'S ENGINEERING

Trilab
Soil Rock Calibration

Brisbane
346A Bilsen Road,
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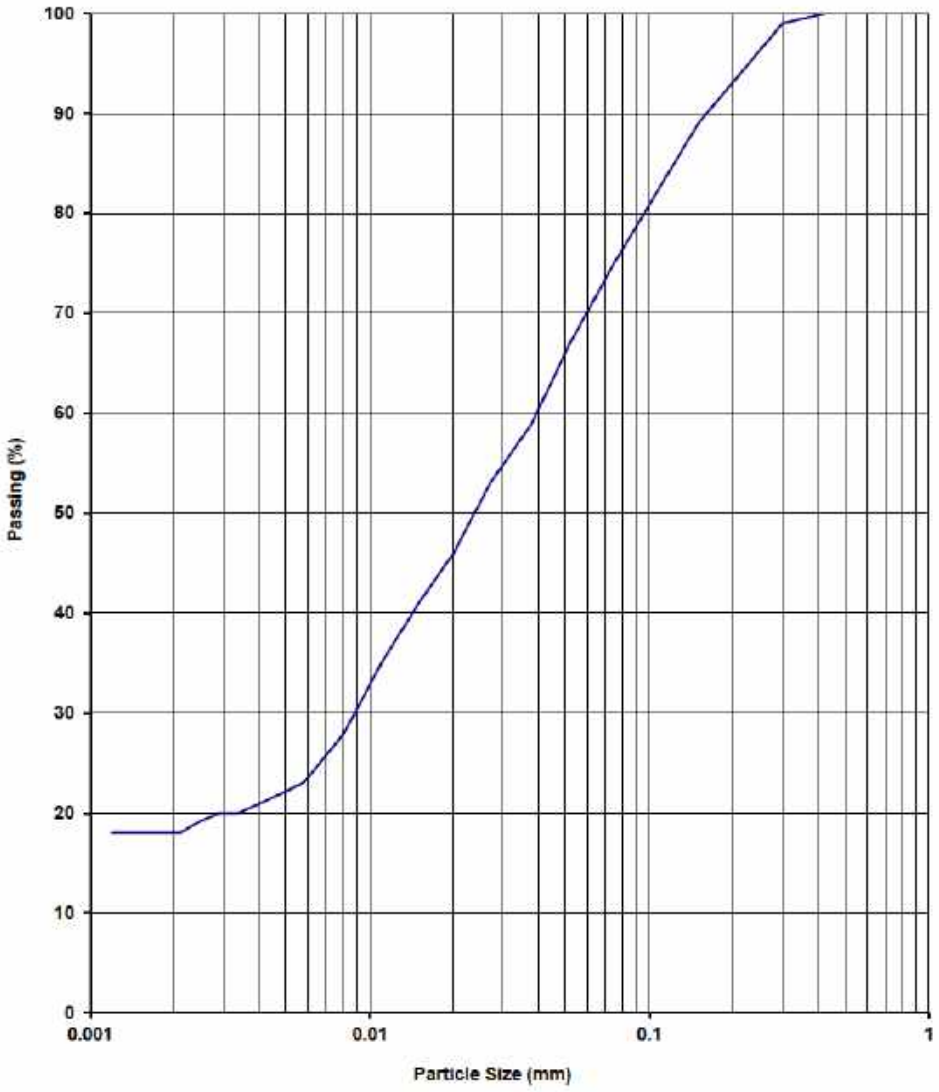
Ph: +61 8 9258 8323

PARTICLE SIZE DISTRIBUTION TEST REPORT

Test Method: AS 1289 3.6.3, 3.5.1

Client	Knight Piesold Pty Ltd	**Report No.**	P 15060008-G
Project	Hope Downs 4, Mahenge, Mungari	**Test Date**	16/06/2015-19/06/2015
		Report Date	19/06/2015
Client ID	Mungari Operating Sample May 2015	**Depth (m)**	~53% MC

Sieve Size (mm)	Passing %
150.0	
75.0	
53.0	
37.5	
26.5	
19.0	
9.5	
4.75	
2.36	
1.18	
0.600	
0.425	100
0.300	99
0.150	89
0.075	75
0.052	67
0.038	59
0.027	53
0.02	46
0.015	41
0.011	35
0.008	28
0.006	23
0.004	21
0.003	20
0.003	20
0.002	19
0.002	18
0.001	18



NOTES/REMARKS:

Moisture Content 85.4% -2.36mm Soil Particle Density(t/m^3) 2.89

Sample/s supplied by the client

Accredited for compliance with ISO/IEC 17025.
The results of the tests, calibrations, and/or measurements included in this document are traceable to Australian/National Standards.

Tested at Trilab Perth Laboratory

[redacted]

NATA
TECHNICAL COMPETENCE

Laboratory No. 9926

The results of calibrations and tests performed apply only to the specific instr otherwise clearly stated.
Reference should be made to Trilab's "Standard Terms and Conditions of Business" for further details.
Trilab Pty Ltd ABN 25 065 630 506

ACCURATE QUALITY RESULTS FOR TOMORROW'S ENGINEERING

Knight Piésold
CONSULTING

MEMORANDUM

To:	**Evolution Mining Ltd**	**Date:**	12th October 2015
Attn:	[redacted]	**Our Ref:**	PE15-01016
		KP File Ref.:	**PE801-00137/10-A dss M15011**
cc:		**From:**	[redacted]

RE: MUNGARI PROJECT – MAY 2015 OPERATING SAMPLE TAILINGS GEOCHEMICAL CHARACTERISATION

1. INTRODUCTION

Evolution Mining Ltd has been operating the Mungari Gold Project located 20 km west of Kalgoorlie, Western Australia since 2014. Pilot plant samples of tailings (White Foil and Frog's Leg orebodies) were tested for geochemical properties as part of the original TSF design in 2011. As part of the annual audit of the TSF, an operating sample was requested to validate some of the design assumptions.

An operating plant sample was provided by La Mancha Resources to the Knight Piésold (KP) laboratory in May 2015. The sample is referred to as the "Operating Sample" for this memo. The sample arrived at approximately 40% solids (w/w). It was sampled direct from the tailings delivery pipeline at the plant and dosed with potassium permanganate prior to shipping to prevent leaching.

The Mungari Mill processes a blend of ore from both White Foil and Frog's Leg Mines. The ratios of each vary on a daily basis. The Operating Sample is therefore a mix of material from both ore bodies.

This memorandum provides details of the tailings geochemical testwork conducted on the Operating Sample. Physical tailings behaviour characteristics testwork is reported separately.

2. GEOCHEMISTRY TESTWORK

2.1 ACID BASE ACCOUNTING

Acid base accounting (ABA) assesses the sample's potential to form acid from oxidation of sulfides and the ability to neutralise acid by the dissolution of minerals, especially carbonates, contained in the sample.

The ABA test work was conducted by Genalysis, Perth. Total sulfur, total carbon and total inorganic carbon were determined by LECO induction furnace, with infrared detection. Sulfate sulfur was determined by 10% Na_2CO_3 extraction, with $BaSO_4$ precipitation. The test work methods used are based on the ABA methodology defined in the Mine Environment Neutral Drainage (MEND) Acid Rock Drainage Prediction Manual (Ref. 1) and Guidelines for Metal Leaching and Acid Rock Drainage at Mine Sites in British Columbia (Ref. 2).

Acid Neutralising Capacity (ANC) was determined by digestion in a standard solution of HCl, followed by back titration with NaOH to determine the amount of acid consumed. The technique used was based on Sobek *et al.* (Ref. 3).

The results of the ABA test work are used to calculate the Maximum Potential Acidity (MPA) which is a measure of the maximum amount of sulfuric acid which can be produced from the total oxidation of all sulfides within the sample, assuming all sulfide is present as pyrite.

2.2 STATIC NET ACID GENERATION

Static Net Acid Generation (NAG) test work is a direct measure of the sample's ability to produce acid through sulfide oxidation. The addition of hydrogen peroxide to samples causes rapid oxidation of the contained sulfides to produce sulfuric acid.

NAG test work was conducted by Genalysis. The procedure employed is based upon the Static NAG Test (Ref. 4 and 5). Fifteen percent hydrogen peroxide solution was adjusted to pH 4.5 before addition to the samples. The samples were then left to stand overnight at room temperature before pH measurement. The samples are then boiled for 2 to 3 hours and allowed to cool before being made back up to 250 mL followed by pH measurement and titration to pH 7.0.

2.3 ACID FORMATION POTENTIAL

The acid formation potential of a sample is calculated based on the acid base accounting, i.e. the balance between a sample's ability to produce acid from the oxidisation of sulfide minerals (Maximum Potential Acidity, MPA) and the sample's ability to neutralise acid by the dissolution of alkaline minerals contained within the sample (Acid Neutralising Capacity, ANC). The balance between the MPA and the ANC is termed the Net Acid Producing Potential (NAPP), where a negative NAPP indicates an excess of acid neutralising capacity and the positive NAPP indicates an excess potential acidity.

Historically a safety margin was applied to ratio between the ANC and MPA to allow for variability in the rates of acid production and neutralisation processes and the potential for geographic separation of the acid producing and acid neutralising phases. This safety margin was generally set by industry at 2 in North America and 3 in Australia.

With recent advances in the understanding and acceptance of the NAG test there has been a move away from this method of classifying materials based solely on the ANC and MPA as these calculated parameters do not take into consideration the true availability of acid producing and acid neutralising phases.

Knight Piésold prefers to utilise the results of the Acid Base Accounting in combination with the NAG testing results to classify the acid formation potential of materials. Knight Piésold's classification system is given in Table 2.1 and is based on the Australian Government's Guidelines on Managing Acidic and Metalliferous Drainage (Ref. 6) and is broadly similar to the classification system contained within the AMIRA ARD Test Handbook (Ref. 7), which is advocated by the Global Acid Rock Drainage Guidelines (Ref. 8).

Table 2.1: Acid Formation Potential Classification System

Acid Formation Potential Class	NAPP (kg H_2SO_4 /t)	NAG pH
Potentially Acid Forming (PAF)	>10	<4.5
Potentially Acid Forming – Low Capacity (PAF-LC)	0 to 10	<4.5
Non Acid Forming (NAF)	Negative	≥4.5
Acid Consuming (AC)	Less than -100	≥4.5
Uncertain (UC)	Positive	≥4.5
	Negative	<4.5

2.4 MULTI-ELEMENT ANALYSIS

Multi-element analysis of the samples was conducted to assess elemental enrichments within the samples. The testing was conducted by Genalysis in Perth. The acid digestion method employed results in near total digestion of the samples to assess the geochemistry of the samples.

Multi-element analysis results were compared to the average crustal abundance to give the geochemical abundance indices. The Geochemical Abundance Index (GAI) quantifies an assay result for a particular element in terms of average crustal abundance. The GAI is calculated from the following formula:

$$\mathbf{GAI = Log_2 (C_n / (1.5 \times B_n))}$$

Where:

Cn = measured concentration of element in sample

Bn = average crustal abundance (Bowen, (Ref. 9))

The GAI is expressed on a scale of 0 to 6, with 0 indicating the concentration of the element is less than or similar to average crustal abundance. A GAI of 3 corresponds to a 12 fold increase above the average crustal abundance, and so forth up to a GAI of 6 which represents a 96 fold increase or greater.

Knight Piésold has assigned an arbitrary scale to the GAI with indices of 0 and 1 being unenriched, indices of 2 being classified as slightly enriched, indices of 3 and 4 being classed as significantly enriched and indices of 5 and 6 being classified as highly enriched.

2.5 SUPERNATANT WATER QUALITY

Characterisation of the tailings supernatant was conducted to assess the potential for the supernatant to cause environmental impacts to surface water or near surface groundwater. These tests differ from the multi-element tests in that they only record the readily soluble elements whereas the multi-element tests give the total elemental enrichment of the tailings solids.

The supernatant characterisation was conducted at Genalysis Laboratories in Perth. A sample of slurry was sent to the laboratory. The pH and the conductivity of the slurry were measured and the bottles left to stand for a minimum of 3 hours. The supernatant was siphoned off and filtered through 0.45 µm membrane before preservation of the solution by acid addition prior to analysis. The analysis was by Inductively Coupled Plasma Mass Spectrometry or Inductively Coupled Plasma Optical Emission Spectrometry depending on the element being analysed and the detection limits required.

The supernatant water quality test results were compared to a set of reference water quality standards, which are detailed in the following section.

2.6 REFERENCE WATER QUALITY STANDARDS

To allow assessment of the results of the supernatant analysis a set of reference values has been established. These reference values were compiled from internationally accepted guidelines for water quality for release from mining operations (IFC environmental, health and safety guidelines (Ref. 10 & 11) and the ANZECC water quality guideline for livestock drinking water (Ref. 12). The use of several guidelines is required as no single guideline contains target concentrations for all parameters. Where a target concentration for a specific element is at different levels in more than one guideline the lowest concentration has been adopted. These reference values are given in Table 2.2. In addition, because the local groundwater is hypersaline, a comparison with the existing groundwater concentrations was made.

The establishment of these reference water quality values is to allow for evaluation only and it is not implied by inclusion of these that the Mungari project will be required to meet these reference levels or that these reference levels should be used as the regulatory framework.

Table 2.2: Reference Release Water Quality Standards

Parameter	Unit	ANZECC Livestock	IFC 2004	IFC 2007	Adopted Reference Level	Local Groundwater*
pH	S.U.		6 to 9	6 to 9	6 to 9	6.97
TDS	mg/kg	2000			2000	192650
Aluminum	mg/L	5			5	0.19
Antimony	mg/L				N/G	N/D
Arsenic	mg/L	0.5	0.1	0.1	0.1	0.025
Barium	mg/L				N/G	N/D
Boron	mg/L	5			5	N/D
Cadmium	mg/L	0.01	0.1	0.05	0.01	0.006
Calcium	mg/L	1000			1000	826
Chloride	mg/L				N/G	99500
Chromium	mg/L	1			1	0.022
Cobalt	mg/L	1			1	0.018
Copper	mg/L	0.4	0.5	0.3	0.3	0.035
Cyanide-Total	mg/L			1	1	N/D
Cyanide-Free	mg/L			0.1	0.1	N/D
Cyanide-WAD	mg/L		0.5	0.5	0.5	N/D
Fluoride	mg/L	2	20		2	N/D
Iron	mg/L		3.5	2	2	1.61
Lead	mg/L	0.1	0.1	0.2	0.1	0.052
Magnesium	mg/L	2000			2000	8300
Manganese	mg/L				N/G	0.97
Mercury	mg/L	0.002	0.01	0.002	0.002	N/D
Molybdenum	mg/L	0.15			0.15	N/D
Nickel	mg/L	1	0.5	0.5	0.5	0.014
Phosphorus	mg/L				N/G	N/D
Selenium	mg/L	0.02	0.1		0.02	0.019
Silver	mg/L		0.5		0.5	N/D
Sodium	mg/L				N/G	56400
Sulfate	mg/L	1000			1000	17200
Tin	mg/L				N/G	N/D
Uranium	mg/L	0.2			0.2	N/D
Vanadium	mg/L				N/G	N/D
Zinc	mg/L	20	2	0.5	0.5	0.17

N/G – No guideline.
N/D – Element not determined in the groundwater testing.
*Groundwater sample from White Foil pit sump (average concentration from January 2010 to August 2011).

3. GEOCHEMICAL CHARACTERISTICS

3.1 GENERAL

Laboratory test certificates for all the tailings analytical testing conducted by Genalysis on the Operating Sample are provided in Appendix A, with the results presented and discussed in the following sections.

It is noted that the results of the tests on the Operating Sample are the average values of initial and duplicate tests. These are compared against the earlier Frog's Leg and White Foil test results. Full details of the earlier testwork are presented in KP Memorandum PE13-00546.

3.2 TAILINGS ACID BASE ACCOUNTING

The total sulfur content of the tailings was determined by Leco combustion. In addition, the samples were analysed for Na_2CO_3 soluble sulfate. The difference between these two values was assumed to be equal to the sulfide content of the samples. The results of the analysis are given in Table 3.1.

Table 3.1: Tailings Sulfur Analysis Results

Sample	Total Sulfur (%)	Sulfate Sulfur (%)	Sulfide Sulfur (%)	Maximum Potential Acidity (kg H_2SO_4 /t)
Frog's Leg	1.85	0.21	1.64	50.4
White Foil	1.40	0.19	1.21	37.0
Operating Sample	1.55	0.23	1.32	40.4

The results of the analysis indicate that the total sulfur content of the tailings samples ranged from 1.40 to 1.85%. The sulfide content of the samples was calculated as between 1.21 and 1.64%, considered to be a high content. The results of the speciated sulfur analysis indicate that the majority sulfur is present as sulfide. Accordingly, the maximum potential acidity calculated from the sulfide sulfur content ranged from 37.0 to 50.4 kg H_2SO_4 / tonne of tailings, which is also high. The results of the Operating Sample and the historical samples from Frogs Leg and White Foil are similar.

The acid neutralising capacity (ANC) of the samples was determined along with the carbonate content. The two results can be used as a check against one another and to identify the contribution of ANC from carbonates and other non carbonate minerals. The results of the analysis are given in Table 3.2.

Table 3.2: Summarised Tailings Carbonate and Acid Neutralising Capacity Results

Sample	Carbonate (as % Calcite)	CO_3-ANC [1] (kg H_2SO_4 /t)	ANC [2] (kg H_2SO_4 /t)
Frog's Leg	5.0	50.4	98.5
White Foil	4.0	40.0	58.0
Operating Sample	4.2	41.7	76.0

[1] Calculated ANC from carbonate content, [2] Measured Sobek ANC

The results of the carbonate analyses indicate that the tailings samples had a carbonate content of between 4.0 and 5.0%, which is high. The results also indicate that all samples have additional neutralising capacity available from non-carbonate minerals when subjected to strongly acidic conditions. The measured acid neutralising capacity of the samples ranged from high (58.0 kg H_2SO_4/t) to very high (98.5 kg H_2SO_4/t). The results of

the Operating Sample and the historical samples from Frog's Leg and White Foil are similar.

The Net Acid Producing Potential (NAPP) of the samples was calculated from the MPA and the ANC and is given in Table 3.3 along with the ANC/MPA ratio. The net acid producing potential of the samples was negative with ANC/MPA ratios of 1.6 and 2.0, indicating that there is excess neutralising capacity in the samples. The results of the Operating Sample and the historical samples from Frogs Leg and White Foil are similar.

Table 3.3: Tailings Net Acid Producing Potential Results

Sample	ANC (kg H_2SO_4 /t)	MPA (kg H_2SO_4 /t)	NAPP (kg H_2SO_4 /t)	ANC/MPA (-)
Frog's Leg	98.5	50.2	-48.3	2.0
White Foil	58.0	37.0	-21.0	1.6
Operating Sample	76.0	40.4	-35.6	1.9

3.3 TAILINGS NET ACID GENERATION

The net acid generation (NAG) test aids in interpretation of acid formation potential classifications. It also identifies if the sulfides and neutralising minerals contained in the samples are readily available to produce or consume acid.

The results of the net acid generation test are given in Table 3.4 and indicate that no measurable acid was produced by any of samples when exposed to extreme oxidising conditions. The final NAG pH of the tailings after complete oxidation was between 8.3 and 9.4, indicating that weak alkaline pH conditions are likely to prevail within the tailings pore waters, should complete oxidation of the tailings solids occur. The results of the Operating Sample and the historical samples from Frogs Leg and White Foil are similar.

Table 3.4: Tailings Net Acid Generation Results

Sample	NAG (7.0) (kg H_2SO_4/t)	NAG pH
Frog's Leg	0	9.0
White Foil	0	9.4
Operating Sample	0	8.3

3.4 TAILINGS ACID FORMATION POTENTIAL

The acid formation potential is determined based on the acid base accounting results and the NAG test. All three samples recorded negative net acid producing potentials, with the NAG test resulting in a NAG pH of 8.3 and 9.4. The samples are therefore classified as NON ACID FORMING. The classification of the samples is shown in Figure 3.1.

3.5 TAILINGS SOLIDS GEOCHEMICAL ENRICHMENTS

Multi-element analysis of the tailings solids was conducted to assess elemental enrichments within the solid portion of the tailings material. Multi-element analysis results were compared to the average crustal abundance to give the geochemical abundance indices. The Geochemical Abundance Index (GAI) quantifies an assay result for a particular element in terms of average crustal abundance.

The assay results, average crustal abundance (ACA) and corresponding geochemical abundance indices (GAI) are given in Table 3.5. The results of the analysis show that the

tailings samples have low to moderate levels of enrichments. All three samples were found to be enriched in a similar set of elements.

Arsenic, chloride and sulfur were classed as highly enriched in all samples. The Frog's Leg sample had a significant enrichment of cadmium, lead, antimony and selenium. The Operating Sample was found to have a higher level of enrichment in boron, being classified as significantly enriched in this element.

Table 3.5: Tailings Multi-Element Results & Geochemical Abundance Indices

Element	Unit	Frog's Leg		White Foil		Operating Sample	
		Assay Result	GAI	Assay Result	GAI	Assay Result	GAI
Ag	ppm	0.6	2	0.5	2	0.2	0
Al	ppm	71896	0	59803	0	72161	0
As	ppm	667	6	83	6	273.0	6
B	ppm	69	2	53	2	173	3
Ba	ppm	352	0	500	0	570	0
Be	ppm	0.88	0	1.3	0	1.4	0
Bi	ppm	0.31	2	0.24	2	0.19	1
Ca	ppm	49458	0	32361	0	41898	0
Cd	ppm	3.2	4	0.47	2	1.3	2
Cl	ppm	96600	6	91700	6	8000	5
Co	ppm	35	0	22	0	26.2	0
Cr	ppm	110	0	18	0	76	0
Cu	ppm	107	1	19	0	81	0
F	ppm	305	0	407	0	377	0
Fe	ppm	60250	0	84500	0	71100	0
Hg	ppm	0.02	0	0.01	0	0.03	0
K	ppm	18150	0	12717	0	18803	0
Mg	ppm	20607	0	10111	0	14199	0
Mn	ppm	1204	0	1223	0	1346	0
Mo	ppm	1.2	0	1.6	0	1	0
Na	ppm	18706	0	30060	0	18988	0
Ni	ppm	68.5	0	11	0	38	0
P	ppm	373	0	1083	0	738	0
Pb	ppm	164	3	28	0	37.0	0
S	ppm	18500	6	14000	5	15500	5
Sb	ppm	3.5	4	0.84	1	2.3	2
Se	ppm	0.92	4	0.21	1	0.52	2
Sn	ppm	1.9	0	2.2	0	2.4	0
Sr	ppm	182	0	193	0	199	0
Th	ppm	2.4	0	10	0	6.4	0
U	ppm	0.65	0	2.5	0	1.8	0
V	ppm	155	0	27	0	91	0
Zn	ppm	411	2	130	0	269	1

Legend

GAI = 0 or 1	Non Enriched
GAI = 2	Slightly Enriched
GAI = 3 or 4	Significantly Enriched
GAI = 5 or 6	Highly Enriched

The results of the analysis have also been compared to a set of soil intervention guidelines compiled from Australian National Environmental Protection Measures investigations levels for assessment of site contamination (Ref. 13), the Netherlands National Institute of Public Health and Environment intervention levels for soil (Ref. 14), and ecological threshold concentrations for antimony in water and soil published by the European Centre for Risk Assessment (Ref. 15).

The results of the comparison are given in Table 3.6 and indicate that arsenic and sulfur exceed the guideline values in all samples. The Frog's Leg and Operating Sample also exceeding the guideline values for sulfate. However overall the three samples were similar.

The results of this comparison indicate that a cover system would likely be required on closure to isolate the tailings from the environment.

Table 3.6: Tailings Solid Multi-Element Results & Site Contamination Guidelines

Element	Ecological - interim Urban[1] (ppm)	Health levels - Category A[2] (ppm)	Intervention Values for Soil [3] (ppm)	Level adopted for site assessment	Multi-Element Analysis Results (ppm)		
					Frog's Leg	White Foil	Operating Sample
Antimony			15	15	3.5	0.8	2.26
Arsenic	20	100	55	55	667	83	273
Barium	300		625	625	352	500	569.8
Beryllium		20	30	20	0.88	1.3	1.4
Boron		3000		3000	69	53	173
Cadmium	3	20	12	12	3.2	0.47	1.3
Chromium (total)			380	380	110	18	76
Cobalt		100	240	100	35	22	26.2
Copper	100	1000	190	190	107	19	81
Lead	600	300	530	300	164	28	37
Manganese	500	1500		1500	1204	1223	1346
Mercury (inorganic)	1	15	10	1	0.02	0.01	0.03
Molybdenum			200	200	1.15	1.6	1.3
Nickel	60	600	210	210	69	11	38
Phosphorus	2000			2000	373	1083	738
Selenium			100	100	0.92	0.21	0.52
Silver			15	15	0.56	0.50	0.2
Sulfur	600			600	18500	14000	15500
Sulfate	2000			2000	2100	1900	2300
Tin			900	900	1.9	2.2	2.4
Vanadium	50		250	250	155	27	91
Zinc	200	7000	720	720	411	130	269

1 = National Environmental Protection Council - National Environmental Protection Measures – Soil Investigation levels for assessment of site contamination 2 = Netherlands National Institute of Public Health and Environment, 3 = European Centre for Risk Assessment.

3.6 SUPERNATANT WATER QUALITY

The supernatant water quality was assessed to examine the solubility of the various parameters when the ore is processed within the process plant. The results of the testing

give an indication of the water quality which is likely within the supernatant pond during operation, but cannot be used to predict long term seepage quality from the facility. This would require leach and/or kinetic testing of the tailings solids which is beyond the scope of this geochemical assessment.

The results of the supernatant testing have been compared to the reference water quality standard for release of water from mining operations and livestock drinking water, as detailed in Table 2.2. The results of the supernatant testing are provided in Table 3.7.

As expected from the use of hypersaline water in the process all supernatant samples were found to be hypersaline, with a total dissolved solids (TDS) value of between 183,231 and 200,320 mg/L. As a result, the samples had to be diluted by the laboratory to enable the analysis to be completed and, consequently, the detection limits of many elements were increased. Therefore, the limit of detection for numerous elements exceeded the assessment criteria. As such, even though several determinants were found to be below the laboratory limits of detection, it is not possible to ascertain whether they exceed the assessment criteria. Further, where an element is indicated to be below the detection limit in the laboratory results, Knight Piésold conservatively assumes that the element is present at the detection limit concentration. This is also how the results are presented in Table 3.7, with elements highlighted in orange indicating that the laboratory limit of detection exceeds the reference water quality value and elements highlighted in red indicating that the testwork confirms the element genuinely exceeds the criteria value.

The results indicate that the TDS, Magnesium and Sulfate exceed the release guidelines in all three samples. Total cyanide and WAD cyanide were found to exceed release guidelines in the White Foil and Operating Sample. Arsenic and Selenium exceed the guidelines in the Frog's Leg and White Foil samples but were found to be below the guideline in the Operating Sample. Parameters which were in question in the past assessment because of poor detection limits achieved by the laboratory, namely copper, mercury and zinc were found to be below guideline concentration in the Operating Sample when the laboratory was able to achieve lower detection limits. In addition, although there are no guideline values for chloride or sodium, the concentrations of these determinants were found to be extremely high, which is indicative of hypersaline water.

A comparison of the supernatant water results with the local groundwater quality was also carried out to identify any elements which were found to be elevated in the supernatant compared to the groundwater, as shown in Table 3.8.

The results of the comparison indicate that the supernatant pH, TDS, calcium, chloride, lead, magnesium, sodium and sulfate concentrations were similar to the average groundwater concentrations (i.e. within approximately 10%). However, some elements were found to have higher concentrations in the supernatant when compared to the groundwater. These elements were as follows:

- Arsenic and selenium were found to be high in the Frog's Leg and White Foil samples but similar to groundwater in the Operating Sample.
- Chromium, copper and nickel had high detection limits in the Frog's Leg and White Foil samples making drawing a conclusion from these results impossible. However the detection limit for the recent sample was lower and indicates that chromium, copper and nickel are elevated in the supernatant when compared to groundwater.
- Cobalt and manganese were found to be elevated compared to groundwater in all three samples.

- There was uncertainty about aluminium and zinc in the Frog's Leg and White Foil samples due to high detection limits but the concentrations of these elements were found to be similar to groundwater in the Operating Sample.

The results indicate that the supernatant is of a similar quality to the local groundwater, with only a limited number of elements being elevated in the supernatant when compared to the groundwater.

Table 3.7: Supernatant Comparison to Release and Livestock Guidelines

Parameter	Reference Value (mg/L)	Assay Results (mg/L)		
		Frog's Leg	White Foil	Operating Sample
pH	6 to 9	7.40	7.10	7.40
TDS	2000	**183231***	**192022***	**200320***
Aluminum	5	1	1	0.1
Antimony	N/G	0.044	0.008	0.018
Arsenic	0.1	**0.24**	**0.21**	0.03
Barium	N/G	0.11	0.17	0.28
Boron	5	1	1	0.1
Cadmium	0.01	0.002	0.002	0.0023
Calcium	1000	845	892	**2225**
Chloride	N/G	93881	93354	104949.5
Chromium (total)	1	1	1	0.1
Cobalt	1	0.08	0.03	0.2025
Copper	0.3	**1**	**1**	0.15
Cyanide-Total	1	0.75	**1.6**	**3**
Cyanide-Free	0.1	N/D	N/D	<0.1
Cyanide-WAD	0.5	0.5	**1**	**0.6**
Fluoride	2	0.1	0.1	0.6
Iron	2	1	1	0.1
Lead	0.1	0.06	0.05	0.005
Magnesium	2000	**7684**	**7770**	**4173**
Manganese	N/G	3	4	9.3
Mercury	0.002	**0.01**	**0.01**	0.001
Molybdenum	0.15	0.043	0.032	0.050
Nickel	0.5	**1**	**1**	0.55
Phosphorus	N/G	10	10	1.5
Selenium	0.02	**0.78**	**0.76**	0.014
Silver	0.5	0.001	0.004	0.0072
Sodium	N/G	49275	49955	61764.5
Sulfate	1000	**16179**	**15722**	**5328**
Tin	N/G	0.01	0.01	0.005
Uranium	0.2	0.002	0.005	0.0013
Vanadium	N/G	1	1	0.15
Zinc	0.5	**1**	**1**	0.1

Notes:
Elements highlighted in **orange** indicate that the laboratory limit of detection exceeds the reference water quality value and elements highlighted in **red** indicate that an element genuinely exceeds the criteria value.
N/D = Not determined.
* TDS results converted to mg/L based on supernatant density of 1.12 kg/L.

Table 3.8: Supernatant Comparison to Local Groundwater

Parameter	Average Groundwater (mg/L)	Assay Results (mg/L)		
		Frog's Leg	White Foil	Operating Sample
pH	6.97	7.40	7.10	7.40
TDS	192650	183231*	192022*	200320*
Aluminum	0.19	**1**	**1**	0.1
Antimony	N/D	0.044	0.008	0.018
Arsenic	0.025	**0.24**	**0.21**	0.03
Barium	N/D	0.11	0.17	0.28
Boron	N/D	1	1	0.1
Cadmium	0.006	0.002	0.002	0.0023
Calcium	826	845	892	2225
Chloride	99500	93881	93354	104949
Chromium (total)	0.02	**1**	**1**	**0.1**
Cobalt	0.02	**0.08**	**0.03**	**0.203**
Copper	0.035	**1**	**1**	**0.15**
Cyanide-Total	N/D	0.75	1.6	3
Cyanide-Free	N/D	N/D	N/D	<0.1
Cyanide-WAD	N/D	0.5	1	0.6
Fluoride	N/D	0.1	0.1	0.6
Iron	1.61	1	1	0.1
Lead	0.05	0.06	0.05	0.005
Magnesium	8300	7684	7770	4173
Manganese	0.97	**3**	**4**	**9.3**
Mercury	N/D	0.01	0.01	0.001
Molybdenum	N/D	0.04	0.03	0.050
Nickel	0.01	**1**	**1**	**0.55**
Phosphorus	N/D	10	10	1.5
Selenium	0.02	**0.78**	**0.76**	0.014
Silver	N/D	0.001	0.004	0.0072
Sodium	56400	49275	49955	61765
Sulfate	17200	16179	15722	5328
Tin	N/D	0.01	0.01	0.005
Uranium	N/D	0.002	0.005	0.0013
Vanadium	N/D	1	1	0.15
Zinc	0.17	**1**	**1**	0.1

Notes:
Elements highlighted in **orange** indicate that the laboratory limit of detection exceeds the average groundwater monitoring concentration and elements highlighted in **red** indicate that an element exceeds the average groundwater monitoring concentration.
N/D = Not determined. * indicated converted from mg/kg to mg/L based on supernatant SG of 1.2

4. CONCLUSIONS

Results of the geochemical testing of the sample of from the Mungari Gold Mine indicate the following:

- The Operating Sample has very similar properties to the pre-production samples provided from the Frog's Leg and White Foil deposits.
- The Operating Sample was found to be non-acid forming and have similar sulfur contents, acid neutralising capacities and carbonate contents, net acid producing potential and ANC/MPA ratio as the pre-production samples tested from the Frog's Leg and White Foil deposits.
- Multi-element analysis results of the solids were compared to the average crustal abundance to calculate geochemical abundance indices. The results of the analysis show that the sample had a similar number of enrichments in similar elements as the pre-production samples tested from the Frog's Leg and White Foil deposits.
- The supernatant water quality has been compared with reference water quality standards for release from mining operations and livestock and wildlife drinking water. All samples were found to be hypersaline and have a range of elements above the guideline values making the supernatant unsuitable for release.
- The supernatant water quality was also compared with local groundwater. The results of the comparison indicate that the supernatant is of a similar quality to the local groundwater, with only arsenic, manganese and selenium found to be significantly higher in the supernatant than in the groundwater.
- The current level of seepage control meets the geochemical assessment requirements.
- The testing has verified original design assumptions and no changes to the TSF design are considered necessary.

We trust the above information is suitable for your current requirements however should you require further please contact the undersigned.

[redacted]

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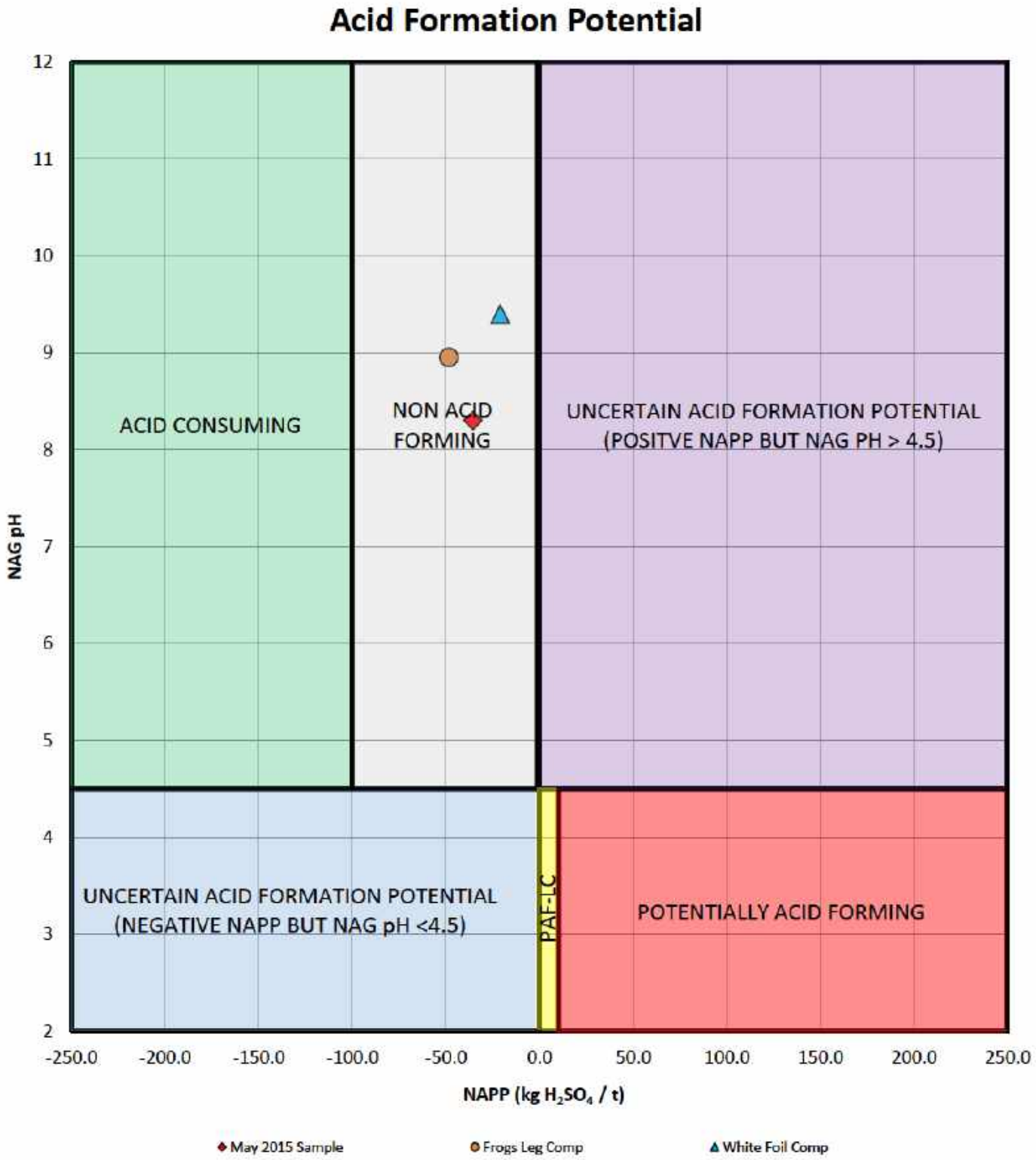
FIGURE

Figure 3.1 AFP



Acid Formation Potential	NAPP (kg H_2SO_4 / t)	NAG pH
Potential Acid Forming (PAF)	>10	<4.5
Potential Acid Forming - Low Capacity (PAF - LC)	0 to 10	<4.5
Non Acid Forming (NAF)	Negative	≥4.5
Acid Consuming (AC)	Less than - 100	≥4.5
Uncertain	Positve	≥4.5
	Negative	<4.5

APPENDIX A

Genalysis Results

ANALYTICAL REPORT

KNIGHT PIESOLD PTY LIMITED
PO Box 6837
EAST PERTH, W.A. 6892
AUSTRALIA

JOB INFORMATION

JOB CODE	:	752.0/1508119
No. of SAMPLES	:	2
No. of ELEMENTS	:	46
CLIENT O/N	:	P13942 (Job 1 of 2)
SAMPLE SUBMISSION No.	:	PE301-00552/01&PE801-00137/10
PROJECT	:	MUNGARI&MAHENGE
STATE	:	Taillings
DATE RECEIVED	:	23/06/2015
DATE COMPLETED	:	27/07/2015
DATE PRINTED	:	27/07/2015
ANALYSING LABORATORY	:	Intertek Genalysis Perth

LEGEND

X	= Less than Detection Limit
N/R	= Sample Not Received
*	= Result Checked
( )	= Result still to come
I/S	= Insufficient Sample for Analysis
E6	= Result X 1,000,000
UA	= Unable to Assay
>	= Value beyond Limit of Method
OV	= Value over-range for Package

Results are not intended for commercial settlement purposes

SAMPLE DETAILS

DISCLAIMER

Intertek Genalysis wishes to make the following disclaimer pertaining to the accompanying analytical results.

All work is performed in accordance with the Intertek Minerals Standard Terms and Conditions of work http://www.intertek.com/terms/

This report relates specifically to the sample(s) that were drawn and/or provided by the client or their nominated third party. The reported result(s) provide no warranty or verification on the sample(s) representing any specific goods and/or shipment and only relate to the sample(s) as received and tested. This report was prepared solely for the use of the client named in this report. Intertek accepts no responsibility for any loss, damage or liability suffered by a third party as a result of any reliance upon or use of this report.

The results provided are not intended for commercial settlement purposes.

SIGNIFICANT FIGURES

It is common practice to report data derived from analytical instrumentation to a maximum of two or three significant figures. Some data reported herein may show more figures than this. The reporting of more than two or three figures in no way implies that the third, fourth and subsequent figures may be real or significant.

Intertek Genalysis accepts no responsibility whatsoever for any interpretation by any party of any data where more than two or three significant figures have been reported.

SAMPLE STORAGE DETAILS

GENERAL CONDITIONS

SAMPLE STORAGE OF SOLIDS

Bulk Residues and Pulps will be stored for 60 DAYS without charge. After this time all Bulk Residues and Pulps will be stored at a rate of $4.00 per cubic metre per day until your written advice regarding collection or disposal is received. Expenses related to the return or disposal of samples will be charged to you at cost. Current disposal cost is charged at $150.00 per cubic metre.

SAMPLE STORAGE OF SOLUTIONS

Samples received as liquids, waters or solutions will be held for 60 DAYS free of charge then disposed of, unless written advice for return or collection is received.

NOTES

1. Note: Detection Limit only apply when TDS <100mg/l for MS and TDS<5000mg/l for OES except when indicated in spreadsheet

Results are not intended for commercial settlement purposes

ANALYSIS

ELEMENTS	Ag	Al	ANC	As	B	Ba
UNITS	ppm	ppm	kgH2SO4/t	ppm	ppm	ppm
DETECTION LIMIT	0.1	50	1	1	50	0.1
DIGEST	4AB/	4AB/	ANCx/	4AB/	FP1/	4AB/
ANALYTICAL FINISH	MS	OE	VOL	MS	OE	MS
SAMPLE NUMBERS						
0001 Mungari (PE301-00552/01)- May 2015	0.2	7.22%	76	273	173	569.8
0002 Mahenge (PE801-00137/10)- Tails Sample	1.0	5.57%	5	13	96	1850.6
CHECKS						
0001 Mahenge (PE801-00137/10)- Tails Sample	0.9	5.65%	5	13	97	1844.3
STANDARDS						
0001 0.5%NaCl						
0002 AMIS0343						
0003 HgSTD-6						
0004 OREAS 185					X	
0005 OREAS 45e						
0006 OREAS 922	0.9	7.44%		7		474.7
0007 OREAS 97.01						
0008 PD-1						
BLANKS						
0001 Control Blank	X	X	0	X	X	0.2
0002 Control Blank	X	X		X	X	0.8
0003 Acid Blank	X	X		X	X	X

ANALYSIS

ELEMENTS	Be	Bi	C	Ca	Cd	Cl
UNITS	ppm	ppm	%	ppm	ppm	%
DETECTION LIMIT	0.1	0.01	0.01	50	0.1	0.02
DIGEST	4AB/	4AB/		4AB/	4AB/	CL1/
ANALYTICAL FINISH	MS	MS	/CSA	OE	MS	COL
SAMPLE NUMBERS						
0001 Mungari (PE301-00552/01)- May 2015	1.4	0.19	0.57	4.19%	1.3	0.80
0002 Mahenge (PE801-00137/10)- Tails Sample	1.3	0.12	0.15	1073	X	X
CHECKS						
0001 Mahenge (PE801-00137/10)- Tails Sample	1.3	0.12	0.15	1099	0.2	X
STANDARDS						
0001 0.5%NaCl						0.33
0002 AMIS0343						
0003 HgSTD-6						
0004 OREAS 185						
0005 OREAS 45e			0.54			
0006 OREAS 922	2.3	10.20		4916	0.3	
0007 OREAS 97.01						
0008 PD-1						
BLANKS						
0001 Control Blank	X	X	X	60	X	X
0002 Control Blank	X	0.01	X	X	X	
0003 Acid Blank	X	X		X	X	

Results are not intended for commercial settlement purposes

ANALYSIS

ELEMENTS		ColourChange	Cr	Cu	EC	F
UNITS	ppm	NONE	ppm	ppm	mS/cm	ppm
DETECTION LIMIT	0.1	0	5	1	0.01	50
DIGEST	4AB/	ANCx/	4AB/	4AB/	Paste/	FC7/
ANALYTICAL FINISH	MS	QUAL	OE	OE	MTR	SIE
SAMPLE NUMBERS						
0001 Mungari (PE301-00552/01)- May 2015	26.2	No	76	81	31.30	377
0002 Mahenge (PE801-00137/10)- Tails Sample	4.6	No	209	104	0.09	503
CHECKS						
0001 Mahenge (PE801-00137/10)- Tails Sample	4.7	No	173	104		506
STANDARDS						
0001 0.5%NaCl						
0002 AMIS0343						2307
0003 HgSTD-6						
0004 OREAS 185						
0005 OREAS 45e						
0006 OREAS 922	20.6		72	2199		
0007 OREAS 97.01						
0008 PD-1						
BLANKS						
0001 Control Blank	X		X	2		X
0002 Control Blank	X		X	2		
0003 Acid Blank	X		X	X		

ANALYSIS

ELEMENTS	Fe	Final-pH	Fizz-Rate	Hg	K	Mg
UNITS	%	NONE	NONE	ppm	ppm	ppm
DETECTION LIMIT	0.01	0.1	0	0.01	20	20
DIGEST	4AB/	ANCx/	ANCx/	HG1/	4AB/	4AB/
ANALYTICAL FINISH	OE	MTR	QUAL	CV	OE	OE
SAMPLE NUMBERS						
0001 Mungari (PE301-00552/01)- May 2015	7.11	1.8	1.0000000	0.03	1.88%	1.42%
0002 Mahenge (PE801-00137/10)- Tails Sample	2.53	1.8	0.0000000	0.05	1.41%	3366
CHECKS						
0001 Mahenge (PE801-00137/10)- Tails Sample	2.53	1.8	0.0000000	0.05	1.40%	3398
STANDARDS						
0001 0.5%NaCl						
0002 AMIS0343						
0003 HgSTD-6				1.61		
0004 OREAS 185						
0005 OREAS 45e						
0006 OREAS 922	5.49				2.53%	1.56%
0007 OREAS 97.01						
0008 PD-1						
BLANKS						
0001 Control Blank	X	1.5		X	X	X
0002 Control Blank	X				X	X
0003 Acid Blank	X				X	X

Results are not intended for commercial settlement purposes

ANALYSIS

ELEMENTS	Mn	Mo	Na	NAG	NAGpH	NAG(4.5)
UNITS	ppm	ppm	ppm	kgH2SO4/t	NONE	kgH2SO4/t
DETECTION LIMIT	1	0.1	20	1	0.1	1
DIGEST	4AB/	4AB/	4AB/	NAGx/	NAGx/	NAGx/
ANALYTICAL FINISH	OE	MS	OE	VOL	MTR	VOL
SAMPLE NUMBERS						
0001 Mungari (PE301-00552/01)- May 2015	1346	1.3	1.90%	0	8.3	0
0002 Mahenge (PE801-00137/10)- Tails Sample	120	35.7	1402	1	5.8	0
CHECKS						
0001 Mahenge (PE801-00137/10)- Tails Sample	120	36.3	1384	1	5.8	0
STANDARDS						
0001 0.5%NaCl						
0002 AMIS0343						
0003 HgSTD-6						
0004 OREAS 185						
0005 OREAS 45e						
0006 OREAS 922	855	0.8	4290			
0007 OREAS 97.01						
0008 PD-1						
BLANKS						
0001 Control Blank	X	X	43	5	4.6	0
0002 Control Blank	X	X	73			
0003 Acid Blank	X	X	67			

Results are not intended for commercial settlement purposes

ANALYSIS

ELEMENTS	Ni	P	Pb	pH	pH Drop	S
UNITS	ppm	ppm	ppm	NONE	NONE	%
DETECTION LIMIT	1	50	2	0.1	0.1	0.01
DIGEST	4AB/	4AB/	4AB/	Paste/	ANCx/	
ANALYTICAL FINISH	OE	OE	MS	MTR	MTR	/CSA
SAMPLE NUMBERS						
0001 Mungari (PE301-00552/01)- May 2015	38	738	37	7.7	3.0	1.55
0002 Mahenge (PE801-00137/10)- Tails Sample	77	975	16	7.8		0.07
CHECKS						
0001 Mahenge (PE801-00137/10)- Tails Sample	77	1004	17			0.07
STANDARDS						
0001 0.5%NaCl						
0002 AMIS0343						
0003 HgSTD-6						
0004 OREAS 185						
0005 OREAS 45e						0.06
0006 OREAS 922	37	654	61			
0007 OREAS 97.01						
0008 PD-1						
BLANKS						
0001 Control Blank	X	X	X			X
0002 Control Blank	X	X	X			0.01
0003 Acid Blank	X	X	X			

Results are not intended for commercial settlement purposes

ANALYSIS

ELEMENTS	S-SO4	Sb	Se	Sn	Sr	Th
UNITS	%	ppm	ppm	ppm	ppm	ppm
DETECTION LIMIT	0.01	0.05	0.01	0.1	0.05	0.01
DIGEST	S71/	4AB/	SE1/	4AB/	4AB/	4AB/
ANALYTICAL FINISH	OE	MS	MS	MS	MS	MS
SAMPLE NUMBERS						
0001 Mungari (PE301-00552/01)- May 2015	0.23	2.26	0.52	2.4	198.71	6.39
0002 Mahenge (PE801-00137/10)- Tails Sample	0.04	0.11	8.46	1.4	86.52	12.91
CHECKS						
0001 Mahenge (PE801-00137/10)- Tails Sample	0.04	0.17	8.44	1.4	87.28	13.08
STANDARDS						
0001 0.5%NaCl						
0002 AMIS0343						
0003 HgSTD-6						
0004 OREAS 185						
0005 OREAS 45e						
0006 OREAS 922		1.38		9.9	58.57	17.35
0007 OREAS 97.01			0.66			
0008 PD-1	4.26					
BLANKS						
0001 Control Blank	X	X	0.01	X	0.18	X
0002 Control Blank		X	X	X	0.24	0.01
0003 Acid Blank		X	X	X	X	X

ANALYSIS

ELEMENTS	TIC	U	V	Zn
UNITS	%	ppm	ppm	ppm
DETECTION LIMIT	0.01	0.01	2	1
DIGEST	C72/	4AB/	4AB/	4AB/
ANALYTICAL FINISH	CSA	MS	OE	OE
SAMPLE NUMBERS				
0001 Mungari (PE301-00552/01)- May 2015	0.50	1.79	91	269
0002 Mahenge (PE801-00137/10)- Tails Sample	0.01	23.26	834	58
CHECKS				
0001 Mahenge (PE801-00137/10)- Tails Sample	0.03	23.90	829	61
STANDARDS				
0001 0.5%NaCl				
0002 AMIS0343				
0003 HgSTD-6				
0004 OREAS 185				
0005 OREAS 45e				
0006 OREAS 922		3.36	93	267
0007 OREAS 97.01				
0008 PD-1				
BLANKS				
0001 Control Blank		X	X	45
0002 Control Blank		X	X	2
0003 Acid Blank		X	X	X

Results are not intended for commercial settlement purposes

METHOD CODE DESCRIPTION

Method Code	Analysing Laboratory	NATA Scope of Accreditation

/CSA Intertek Genalysis Perth

Induction Furnace Analysed by Infrared Spectrometry

4AB/MS Intertek Genalysis Perth **4AB/ : MPL_W001, MS : ICP_W003**

Multi-acid digest including Hydrofluoric, Nitric, Perchloric and Hydrochloric acids in Teflon Beakers. Analysed by Inductively Coupled Plasma Mass Spectrometry.

4AB/OE Intertek Genalysis Perth **4AB/ : MPL_W001, OE : ICP_W004**

Multi-acid digest including Hydrofluoric, Nitric, Perchloric and Hydrochloric acids in Teflon Beakers. Analysed by Inductively Coupled Plasma Optical (Atomic) Emission Spectrometry.

ANCx/MTR Intertek Genalysis Perth

Acid Neutralizing Capacity Digestion Procedure. Analysed with Electronic Meter Measurement

ANCx/QUAL Intertek Genalysis Perth

Acid Neutralizing Capacity Digestion Procedure. Analysed by Qualitative Inspection

ANCx/VOL Intertek Genalysis Perth

Acid Neutralizing Capacity Digestion Procedure. Analysed by Volumetric Technique.

C72/CSA Intertek Genalysis Perth **ENV_W017, CSA : ENV_W017**

Digestion by hot acid(s) Analysed by Infrared Spectrometry

CL1/COL Intertek Genalysis Perth **ENV_W014, COL : ENV_W014**

Carbonate leach specific for Chlorine. Analysed by UV-Visible Spectrometry.

FC7/SIE Intertek Genalysis Perth **ENV_W012, SIE : ENV_W012**

Alkaline fusion (Nickel crucible) specific for Fluorine. Analysed by Specific Ion Electrode.

FP1/OE Intertek Genalysis Perth **FP1/ : MPL_W011, OE : ICP_W004**

Sodium peroxide fusion (Zirconia crucibles) and Hydrochloric acid to dissolve the melt. Analysed by Inductively Coupled Plasma Optical (Atomic) Emission Spectrometry.

HG1/CV Intertek Genalysis Perth

Low temperature Perchloric acid digest specific for Mercury. Analysed by Cold Vapour Generation Atomic Absorption Spectrometry.

NAGx/MTR Intertek Genalysis Perth

Net Acid Generation Extraction of samples with H2O2 Analysed with Electronic Meter Measurement

NAGx/VOL Intertek Genalysis Perth

Net Acid Generation Extraction of samples with H2O2 Analysed by Volumetric Technique.

Paste/MTR Intertek Genalysis Perth

Water Extraction using a specific sample:water ratio. Analysed with Electronic Meter Measurement

S71/OE Intertek Genalysis Perth

Digestion to eliminate sulphides. Analysed by Inductively Coupled Plasma Optical (Atomic) Emission Spectrometry.

METHOD CODE DESCRIPTION

Method Code	Analysing Laboratory	NATA Scope of Accreditation
SE1/MS	Intertek Genalysis Perth	

Aqua-Regia digest followed by Precipitation and Concentration. Specific for Selenium. Analysed by Inductively Coupled Plasma Mass Spectrometry.

ANALYTICAL REPORT

KNIGHT PIESOLD PTY LIMITED
PO Box 6837
EAST PERTH, W.A. 6892
AUSTRALIA

JOB INFORMATION

JOB CODE	:	752.0/1508121
No. of SAMPLES	:	2
No. of ELEMENTS	:	39
CLIENT O/N	:	P13942 (Job 1 of 1)
SAMPLE SUBMISSION No.	:	PE301-00552/01&PE801-00137/10
PROJECT	:	MUNGARI&MAHENGE
STATE	:	Solutions
DATE RECEIVED	:	23/06/2015
DATE COMPLETED	:	02/10/2015
DATE PRINTED	:	02/10/2015
ANALYSING LABORATORY	:	Intertek Genalysis Perth

LEGEND

X	= Less than Detection Limit
N/R	= Sample Not Received
*	= Result Checked
( )	= Result still to come
I/S	= Insufficient Sample for Analysis
E6	= Result X 1,000,000
UA	= Unable to Assay
>	= Value beyond Limit of Method
OV	= Value over-range for Package

SAMPLE DETAILS

DISCLAIMER

Intertek Genalysis wishes to make the following disclaimer pertaining to the accompanying analytical results.

All work is performed in accordance with the Intertek Minerals Standard Terms and Conditions of work http://www.intertek.com/terms/

This report relates specifically to the sample(s) that were drawn and/or provided by the client or their nominated third party. The reported result(s) provide no warranty or verification on the sample(s) representing any specific goods and/or shipment and only relate to the sample(s) as received and tested. This report was prepared solely for the use of the client named in this report. Intertek accepts no responsibility for any loss, damage or liability suffered by a third party as a result of any reliance upon or use of this report.

The results provided are not intended for commercial settlement purposes.

SIGNIFICANT FIGURES

It is common practice to report data derived from analytical instrumentation to a maximum of two or three significant figures. Some data reported herein may show more figures than this. The reporting of more than two or three figures in no way implies that the third, fourth and subsequent figures may be real or significant.

Intertek Genalysis accepts no responsibility whatsoever for any interpretation by any party of any data where more than two or three significant figures have been reported.

SAMPLE STORAGE DETAILS

GENERAL CONDITIONS

SAMPLE STORAGE OF SOLIDS

Bulk Residues and Pulps will be stored for 60 DAYS without charge. After this time all Bulk Residues and Pulps will be stored at a rate of $4.00 per cubic metre per day until your written advice regarding collection or disposal is received. Expenses related to the return or disposal of samples will be charged to you at cost. Current disposal cost is charged at $150.00 per cubic metre.

SAMPLE STORAGE OF SOLUTIONS

Samples received as liquids, waters or solutions will be held for 60 DAYS free of charge then disposed of, unless written advice for return or collection is received.

NOTES

1. Note: Detection Limit only apply when TDS <100mg/l for MS and TDS<5000mg/l for OES except when indicated in spreadsheet

Results are not intended for commercial settlement purposes

ANALYSIS

ELEMENTS	Ag	Al	As	B	Ba	Be
UNITS	ug/l	mg/l	ug/l	mg/l	ug/l	ug/l
DETECTION LIMIT	0.1	0.1	1	0.1	0.5	1
DIGEST						
ANALYTICAL FINISH	/MS	/OE	/MS	/OE	/MS	/MS
SAMPLE NUMBERS						
0001 Mungari (PE301-00552/01)- May 2015	7.5	X	25	X	286.3	9
0002 Mahenge (PE801-00137/10)- Tails Sample	X	0.1	X	0.5	192.3	X
CHECKS						
0001 Mungari (PE301-00552/01)- May 2015	6.9	X	27	X	275.8	6
STANDARDS						
0001 Alcoa12-OES		1.9		1.0		
0002 MSC-5						
0003 SOLN-001						
0004 TMDW	X		X		X	X
BLANKS						
0001 Control Blank	X	X	X	X	X	X

ANALYSIS

ELEMENTS	Bi	Ca	Cd	Cl	Co	Cr
UNITS	ug/l	mg/l	ug/l	mg/l	ug/l	mg/l
DETECTION LIMIT	0.05	0.1	0.2	2	1	0.1
DIGEST						
ANALYTICAL FINISH	/MS	/OE	/MS	/COL	/MS	/OE
SAMPLE NUMBERS						
0001 Mungari (PE301-00552/01)- May 2015	0.75	2205.0	2.4	105389	205	0.1
0002 Mahenge (PE801-00137/10)- Tails Sample	X	17.1	X	66	X	X
CHECKS						
0001 Mungari (PE301-00552/01)- May 2015	0.69	2245.0	2.2	104510	200	X
STANDARDS						
0001 Alcoa12-OES		50.1				0.5
0002 MSC-5						
0003 SOLN-001						
0004 TMDW	X		X		X	
BLANKS						
0001 Control Blank	X	X	X	X	X	X

ANALYSIS

ELEMENTS	Cu	EC	F	Fe-Sol	Hg	K
UNITS	mg/l	mS/cm	mg/l	mg/l	ug/l	mg/l
DETECTION LIMIT	0.1	0.01	0.1	0.1	1	1
DIGEST						
ANALYTICAL FINISH	/OE	/MTR	/SIE	/OE	/MS	/OE
SAMPLE NUMBERS						
0001 Mungari (PE301-00552/01)- May 2015	0.2	>10000.00	0.5	X	X	634
0002 Mahenge (PE801-00137/10)- Tails Sample	X	0.37	0.8	X	X	3
CHECKS						
0001 Mungari (PE301-00552/01)- May 2015	X	>10000.00	0.7	0.1	1	665
STANDARDS						
0001 Alcoa12-OES	0.5			2.0		4
0002 MSC-5						
0003 SOLN-001			1.1			
0004 TMDW					X	
BLANKS						
0001 Control Blank	X		X	X	X	X

ANALYSIS

ELEMENTS	Mg	Mn	Mo	CN-Tot	CN-WAD	FreeCN
UNITS	mg/l	mg/l	ug/l	mg/l	mg/l	mg/l
DETECTION LIMIT	0.1	0.1	0.5	0.1	0.1	0.1
DIGEST						
ANALYTICAL FINISH	/OE	/OE	/MS	/COL	/COL	/COL
SAMPLE NUMBERS						
0001 Mungari (PE301-00552/01)- May 2015	4141.1	9.1	50.3	3.0	0.6	X
0002 Mahenge (PE801-00137/10)- Tails Sample	3.5	X	69.4	0.2	0.2	X
CHECKS						
0001 Mungari (PE301-00552/01)- May 2015	4204.8	9.5	48.7			
STANDARDS						
0001 Alcoa12-OES	47.7	0.5				
0002 MSC-5						
0003 SOLN-001						
0004 TMDW			X			
BLANKS						
0001 Control Blank	X	X	X	X	X	X

ANALYSIS

ELEMENTS	Na	Ni	P	Pb	pH	S
UNITS	mg/l	mg/l	mg/l	ug/l	NONE	mg/l
DETECTION LIMIT	1	0.1	1	5	0.1	1
DIGEST						
ANALYTICAL FINISH	/OE	/OE	/OE	/MS	/MTR	/OE
SAMPLE NUMBERS						
0001 Mungari (PE301-00552/01)- May 2015	61068	0.5	1	X	7.4	1761
0002 Mahenge (PE801-00137/10)- Tails Sample	52	X	X	X	7.8	5
CHECKS						
0001 Mungari (PE301-00552/01)- May 2015	62461	0.6	2	X	7.4	1796
STANDARDS						
0001 Alcoa12-OES	243	0.5	1			20
0002 MSC-5						
0003 SOLN-001						
0004 TMDW				X		
BLANKS						
0001 Control Blank	X	X	X	X		X

ANALYSIS

ELEMENTS	Sb	Se	Sn	Sr	TDSEva	Th
UNITS	ug/l	ug/l	ug/l	ug/l	mg/Kg	ug/l
DETECTION LIMIT	0.1	5	1	0.2	20	0.05
DIGEST						
ANALYTICAL FINISH	/MS	/MS	/MS	/MS	/GR	/MS
SAMPLE NUMBERS						
0001 Mungari (PE301-00552/01)- May 2015	18.3	12	3	18052.8	167780	0.45
0002 Mahenge (PE801-00137/10)- Tails Sample	0.1	X	X	101.4	209	X
CHECKS						
0001 Mungari (PE301-00552/01)- May 2015	17.0	16	7	17905.0	166087	0.45
STANDARDS						
0001 Alcoa12-OES						
0002 MSC-5					1497	
0003 SOLN-001						
0004 TMDW	X	X	X	X		X
BLANKS						
0001 Control Blank	X	X	X	X	X	X

ANALYSIS

ELEMENTS	U	V	Zn
UNITS	ug/l	mg/l	mg/l
DETECTION LIMIT	0.05	0.1	0.1
DIGEST			
ANALYTICAL FINISH	/MS	/OE	/OE
SAMPLE NUMBERS			
0001 Mungari (PE301-00552/01)- May 2015	1.25	0.2	X
0002 Mahenge (PE801-00137/10)- Tails Sample	0.71	X	X
CHECKS			
0001 Mungari (PE301-00552/01)- May 2015	1.30	0.1	X
STANDARDS			
0001 Alcoa12-OES		0.5	0.5
0002 MSC-5			
0003 SOLN-001			
0004 TMDW	X		
BLANKS			
0001 Control Blank	X	X	X

METHOD CODE DESCRIPTION

Method Code	Analysing Laboratory	NATA Scope of Accreditation

/COL Intertek Genalysis Perth

No digestion or other pre-treatment undertaken. Analysed by UV-Visible Spectrometry.

/GR Intertek Genalysis Perth

Analysed by Gravimetric Technique.

/MS Intertek Genalysis Perth

No digestion or other pre-treatment undertaken. Analysed by Inductively Coupled Plasma Mass Spectrometry.

/MTR Intertek Genalysis Perth

No digestion or other pre-treatment undertaken. Analysed with Electronic Meter Measurement

/OE Intertek Genalysis Perth

Analysed by Inductively Coupled Plasma Optical (Atomic) Emission Spectrometry.

/SIE Intertek Genalysis Perth

No digestion or other pre-treatment undertaken. Analysed by Specific Ion Electrode.

APPENDIX G

Seepage Assessment

Knight Piésold CONSULTING

APPENDIX G – SEEPAGE ANALYSIS

G.1 GENERAL

The seepage analysis program SEEP/W (Ref. G.1) was used to assess the order of magnitude seepage losses and drainage volumes from the TSF, as well as the potential location of the phreatic surface through the tailings and embankment. Seepage analyses were undertaken specifically to evaluate the following aspects of the design:

- The total seepage losses from the TSF to provide an indication of the potential environmental impact from operation of the TSF.
- The volume of water collected in the basin underdrainage and toe drain systems for a range of drainage scenarios.
- The effect of underdrainage system on the overall phreatic surface in the facility;
- Predicted flows through the embankment and into the underdrainage for a range of drainage scenarios.
- Figures illustrating the predicted phreatic surface in the tailings mass and embankment to be used during operation verification.

G.2 MODEL ASSUMPTIONS

The cross-section adopted for the modelling through the TSF embankment at stages 3, 5, 7 and 10 (final) were based on Drg. No. 801-137-C3000-302. The section was aligned to include the embankment with the maximum height (north embankment, based on ground topography information) as well as the centre of the cell, assuming maximum pond depth. An axisymmetric model was then developed with the assumption that the shape of the cell can be approximated to a circle to determine the 3D flow rate calculation.

Initially, modelling was completed on the transect assuming zero pressure head to reflect the basin underdrainage and toe drain systems both fully operational. This was followed by an incremental reduction in toe drain capacity to develop phreatic profiles which are dependent on the extraction rate from the toe drains.

The subsurface conditions were assumed based on the geotechnical site investigations conducted in April 2013 and June 2018 (Ref. G.2 and G.3). The following components were modelled for the assessment:

- Tailings at a 120H:1V beach slope;
- Zone A material – low permeability fill;
- Zone C material – structural fill;

- Zone C1 – waste rock, photo shown in Plate G.1;
- Underdrainage system, including toe drain and basin drain;
- Clayey SAND (0 to 3 m deep);
- Sandy CLAY (3 to 7 m deep);
- Silty CLAY (7 to 30 m deep);
- Extremely weathered – distinctly weathered (XW – DW) Rock (30 m and deeper);

The cross-sections for each seepage model at stages 3, 5, 7 and 10 are shown on Figure G.1.

G.3 MATERIAL PARAMETERS

The material types and the saturated hydraulic conductivity parameters used in the modelling are based on the geotechnical site investigations (Ref. G.2 and G.3) and tailings physical testing undertaken in September 2015 (Ref. G.4). These are summarised in Table G.1.

The permeability determined through tailings physical testing represents a uniform grade. It is evident from the results obtained through cone penetration testing (Ref. G.6) of in-situ tailings material within Cells 1 and 2 that material is coarser adjacent to the perimeter embankment. Hence, a transitional parameter was adopted for the seepage analysis from coarse to fine tailings further from the embankment.

For unsaturated flow characteristics, functions determined for similar materials, as provided by SEEP/W, were used.

Table G.1: Summary of Material Permeabilities

Material Type	Material Layer Thickness	Saturated Permeability (m/s)
Tailings	N/A	K_h = 9 x 10^{-7} to 1 x 10^{-5} (A)
Zone A	N/A	1 x 10^{-8}
Zone C	N/A	1 x 10^{-7}
Zone C1	N/A	Free Draining
Clayey Sand	3 m	1 x 10^{-7}
Sandy Clay	4 m	1 x 10^{-8} (B)
Silty Clay	23 m	1 x 10^{-8}
XW - DW Rock	N/A	5 x 10^{-8}

Note:
(A) Vertical to horizontal permeability K_v/K_h = 0.1 was assumed for tailings, allowing for vertical segregation; Transition of higher permeability closer to the embankment and lower permeability further away from the embankment was assumed, simulating horizontal segregation.
(B) Basin liner comprising sandy clay or silty clay was merged into this layer in the seepage model.

G.4 BOUNDARY CONDITIONS

The following boundary conditions were assumed in the analyses:

- A pond constant head boundary was assumed, i.e. 100 m radius pond size for average climatic conditions and 200 m radius pond size for a 1% AEP 72-hour storm event. Note that for modelling purposes, the pond size is measured from the centre to the boundary of the pond.
- A constant head boundary has been assumed at the downstream extents of the TSF model to simulate the existing groundwater with the pressure head set to the expected elevation of 10 m below natural ground.
- Drains, including toe drain and basin underdrain, were firstly modelled as zero pressure nodes and assessed for flux rate at full extraction capacity. A reduction in toe drain capacity was then applied to the toe drain based on the assessed flux rate.
- If necessary, nodes on the downstream side of embankment were set as flux (Q) review nodes, with the nodes being reviewed by elevation to allow for possible seepage through the embankment face or the waste rock material.
- With reference to KP's geotechnical investigation, the natural groundwater table was conservatively assumed to be located 10 m below natural ground.

G.5 SCENARIO MODELLED

The seepage models were evaluated for scenarios as summarised in Table G.2. Due to the large number of combinations of basin drain and toe drain operation, critical scenarios were considered (i.e. significant rise in water level in response to extraction rate reduction).

Table G.2: Seepage Model Scenarios

Pond Size (m)	Stage	Basin Drain Percentage Capacity (%)	Toe Drain Percentage Capacity (%)
100	3	100	0
		75	0
		0	0
	5	100	0
		75	0
		0	100
		0	75
		0	25
	7	100	0
		75	0
		0	100
		0	75
		0	25
	10	100	0
		75	0
		0	100
		0	75
		0	25
200	3	100	100
		100	75
		100	0
		75	0
		0	100
		0	75
	5	100	100
		100	75
		100	0
		0	100
		0	75
	7	100	100
		100	75
		100	0
		0	100
		0	75
	10	100	100
		100	75
		100	0
		0	100
		0	75

G.7 MODELLING RESULTS

The results of the seepage analysis are summarised in Table G.3, and illustrated in figures as referenced within the table.

Table G.3: Seepage Model Results Summary

Pond Size (m)	Stage	Basin Drain Percentage Capacity (%)	Toe Drain Percentage Capacity (%)	Axisymmetric Flow Rate into Drains (m3/s/rad)		Flow Rate (L/hour)		Axisymmetric Seepage Loss (m3/s/rad)	Seepage Loss (L/hour)	Figure
				Basin Drain	Toe Drain	Basin Drain	Toe Drain			
100	3	100	0	3.87E-04	0.00E+00	8,800	-	3.32E-05	800	G.2
		75	0	2.90E-04	0.00E+00	6,600	-	4.95E-05	1,200	
		0	0	0.00E+00	0.00E+00	-	-	5.53E-05	1,300	
	5	100	0	5.00E-04	0.00E+00	11,400	-	5.11E-05	1,200	G.3
		75	0	3.75E-04	0.00E+00	8,500	-	7.17E-05	1,700	
		0	100	0.00E+00	3.66E-05	-	900	8.54E-05	2,000	
		0	75	0.00E+00	2.75E-05	-	700	9.62E-05	2,200	
		0	25	0.00E+00	9.16E-06	-	300	1.04E-04	2,400	
	7	100	0	5.71E-04	0.00E+00	13,000	-	7.55E-05	1,800	G.4
		75	0	4.28E-04	0.00E+00	9,700	-	1.07E-04	2,500	
		0	100	0.00E+00	1.15E-04	-	2,700	9.48E-05	2,200	
		0	75	0.00E+00	8.66E-05	-	2,000	1.09E-04	2,500	
		0	25	0.00E+00	2.89E-05	-	700	1.39E-04	3,200	
	10	100	0	6.37E-04	0.00E+00	14,500	-	9.12E-05	2,100	G.5
		75	0	4.78E-04	0.00E+00	10,900	-	1.33E-04	3,100	
		0	100	0.00E+00	2.64E-04	-	6,000	1.03E-04	2,400	
		0	75	0.00E+00	1.98E-04	-	4,500	1.40E-04	3,200	
		0	25	0.00E+00	6.59E-05	-	1,500	2.14E-04	4,900	

Pond Size (m)	Stage	Basin Drain Percentage Capacity (%)	Toe Drain Percentage Capacity (%)	Axisymmetric Flow Rate into Drains (m3/s/rad)		Flow Rate (L/hour)		Axisymmetric Seepage Loss (m3/s/rad)	Seepage Loss (L/hour)	Figure
				Basin Drain	Toe Drain	Basin Drain	Toe Drain			
200	3	100	100	5.10E-04	1.30E-04	11,600	3,000	9.21E-05	2,100	G.6
		100	75	5.10E-04	9.71E-05	11,600	2,200	1.00E-04	2,300	
		100	0	5.11E-04	0.00E+00	11,600	-	1.16E-04	2,700	
		75	0	3.83E-04	0.00E+00	8,700	-	1.17E-04	2,700	
		0	100	0.00E+00	1.31E-04	-	3,000	9.31E-05	2,200	
		0	75	0.00E+00	9.71E-05	-	2,200	1.01E-04	2,300	
	5	100	100	6.75E-04	4.11E-04	15,300	9,300	3.67E-05	900	G.7
		100	75	6.75E-04	3.10E-04	15,300	7,100	1.18E-04	2,700	
		100	0	6.75E-04	0.00E+00	15,300	-	1.73E-04	4,000	
		0	100	0.00E+00	4.13E-04	-	9,400	1.07E-04	2,500	
		0	75	0.00E+00	3.10E-04	-	7,100	1.22E-04	2,800	
	7	100	100	8.27E-04	7.95E-04	18,800	18,000	1.03E-04	2,400	G.8
		100	75	8.27E-04	5.96E-04	18,800	13,500	1.38E-04	3,200	
		100	0	8.19E-04	0.00E+00	18,600	-	2.77E-04	6,300	
		0	100	0.00E+00	5.98E-04	-	13,600	1.22E-04	2,800	
		0	75	0.00E+00	4.49E-04	-	10,200	2.67E-04	6,100	
	10	100	100	1.01E-03	1.50E-03	22,800	34,100	1.31E-04	3,000	G.9
		100	75	1.01E-03	1.16E-03	22,900	26,300	1.91E-04	4,400	
		100	0	1.02E-03	0.00E+00	23,200	-	5.26E-04	11,900	
		0	100	0.00E+00	1.54E-03	-	35,000	1.36E-04	3,100	
		0	75	0.00E+00	1.16E-03	-	26,200	2.05E-04	4,700	

The modelling above indicates that the operation of the drainage system (including basin underdrain and toe drain) becomes more critical with height. There is a general increasing trend with future stages and for large ponds. With drains at full capacity it is expected to limit the seepage loss from the facility at Stage Final to approximately 3,000 L/hour under the 200 m pond. With toe drains turned off, the seepage loss for the 200 m pond case is considerably larger compared to when the basin drain is turned off.

The maximum underdrainage water extraction rate for each cell with the underdrainage system fully operational is expected to be 34,100 L/hour into the toe drain and 22,800 L/hour into the basin underdrain at Stage Final. Accounting for the four underdrainage sumps per cell, it is recommended that pumps are sized based on 5 L/s and 20 L/s for each toe drain sump and each basin underdrain sump respectively. These will be lower during early operation life but will be monitored over time for performance.

Overall, the operation of all drains is critical for the reduction of seepage loss and phreatic surface control. However, it is noted that the inclusion of the underdrainage system improves seepage interception through the embankment, reduces the phreatic surface, improves the stability of the structural zone of the embankment and improves tailings consolidation.

Operation of the drainage system, the resulting phreatic levels and impact on stability are discussed in Appendix H.

G.8 CONCLUSIONS

Based on the assessment, the following conclusions are made for the proposed design configuration:

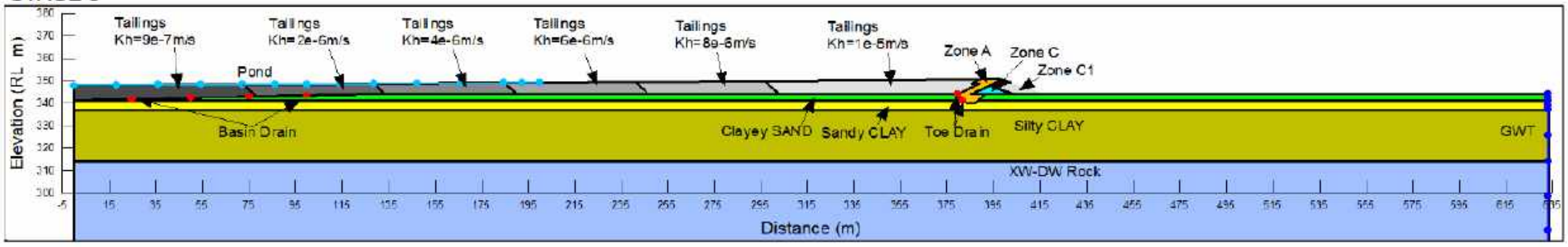
- The seepage loss is considered moderate (~0.8 kL/ha/day) with both basin underdrain and toe drain operational with an average pond; The seepage loss may be high (~4.4 kL/ha/day) when the toe drain is non-operational at Stage Final with a large pond.
- Pumps should be sized to allow for a minimum flow rate of 5 L/s for each toe drain riser and 20 L/s for each basin underdrain tower. This allows for the maximum underdrainage produced from the tailings while operating intermittently.
- Phreatic levels produced in seepage assessment are used in the stability assessment.

G.9 REFERENCES

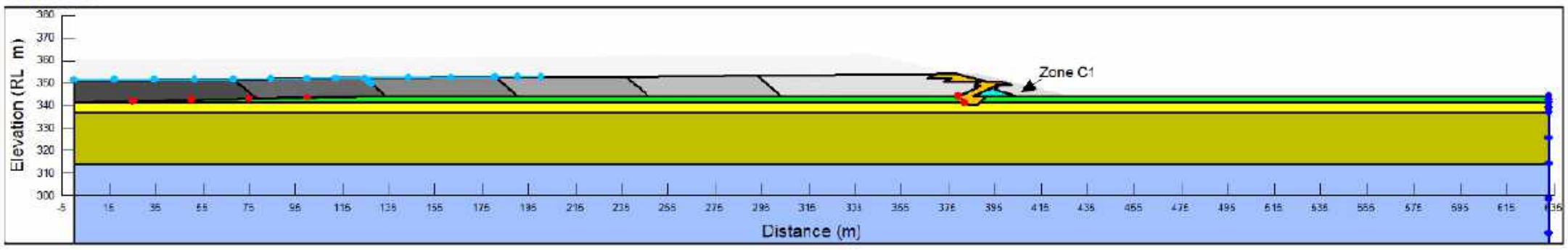
1. GEO-SLOPE International Ltd.,“SEEP/W”, 2016.
2. Knight Piésold, “Tailings Storage Facility, Geotechnical Investigation Report”, Report No. PE801-00137/05, 2013.
3. Knight Piésold, “Tailings Storage Facility Cell 3 Geotechnical Investigation Report”, Report No. PE801-00137/23, 2018.
4. Knight Piésold, “Mungari Project – May 2015 Operating Sample Tailings Physical Testing”, Memorandum No. PE801-00137/10-A dss M15009.
5. Knight Piésold, “TSF Cell 2, 2018 Cone Penetration Testing and Vibrating Wire Piezometer Programme”, Report No. PE801-00137/25, 2018.

APPENDIX G – FIGURES

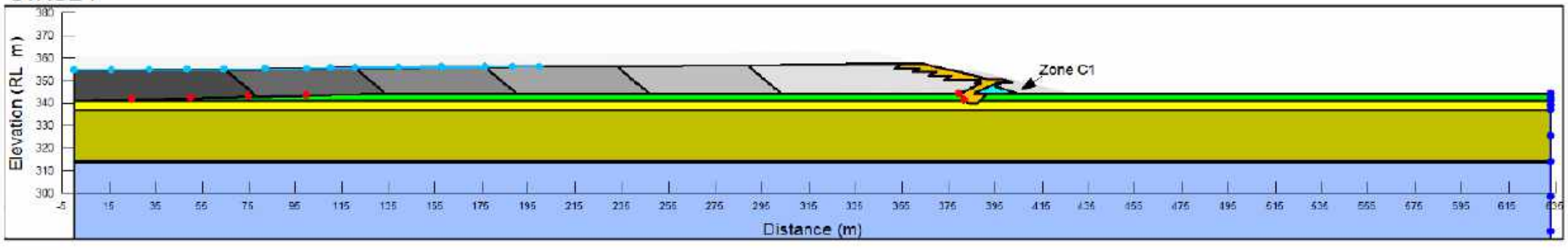
STAGE 3



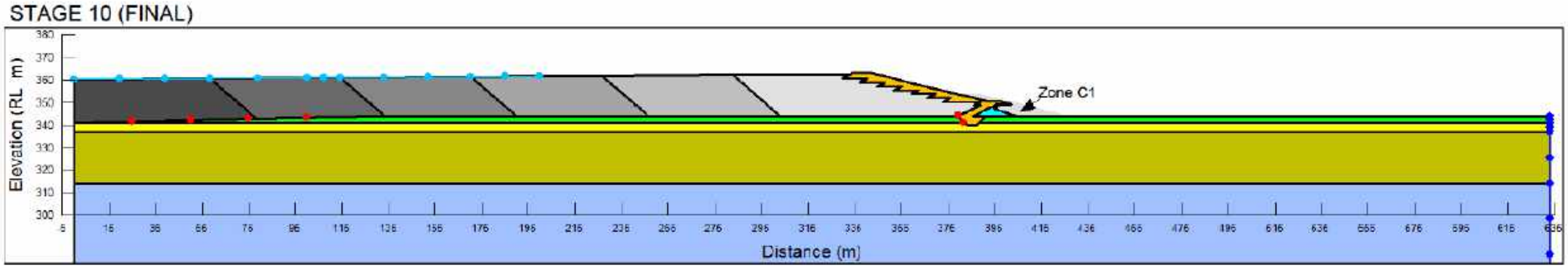
STAGE 5



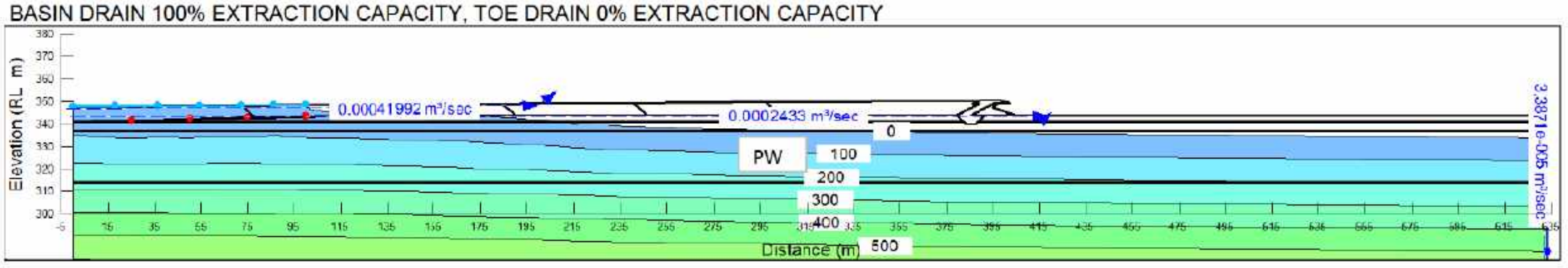
STAGE 7



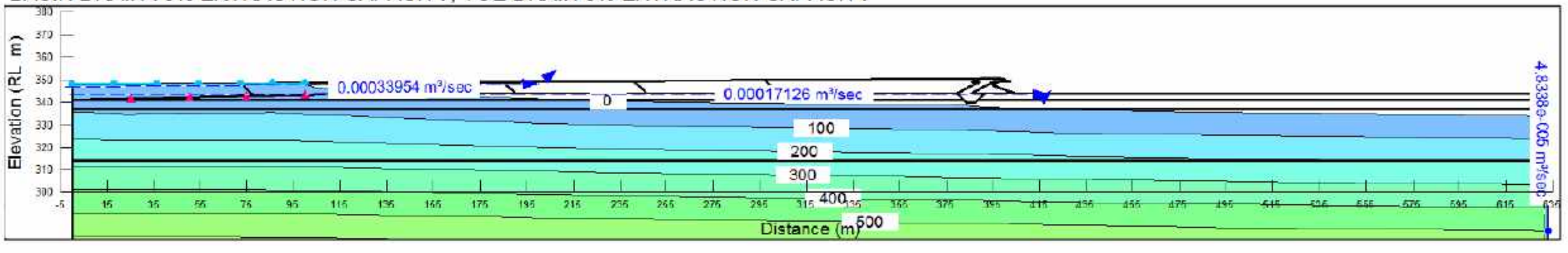
STAGE 10 (FINAL)



BASIN DRAIN 100% EXTRACTION CAPACITY, TOE DRAIN 0% EXTRACTION CAPACITY



BASIN DRAIN 75% EXTRACTION CAPACITY, TOE DRAIN 0% EXTRACTION CAPACITY



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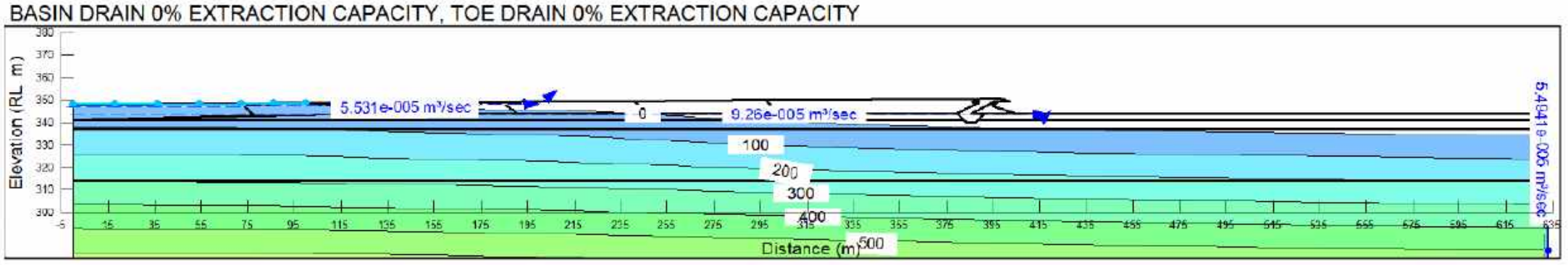
BASIN DRAIN 0% EXTRACTION CAPACITY, TOE DRAIN 0% EXTRACTION CAPACITY



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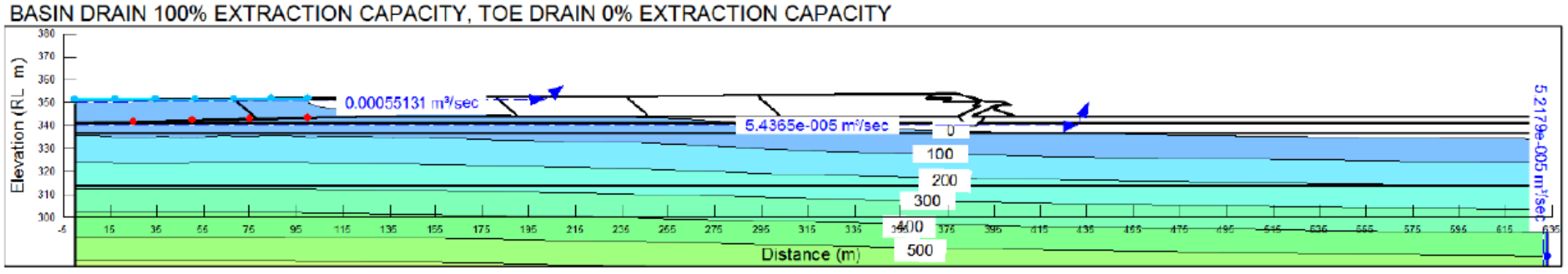

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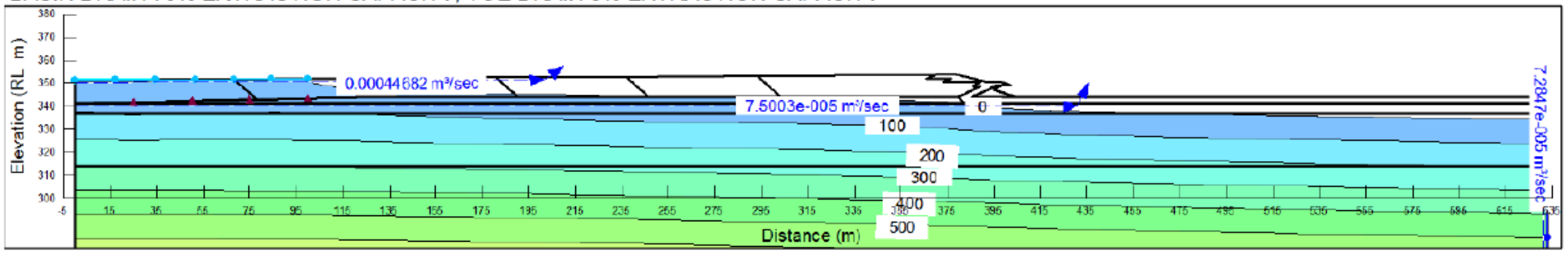

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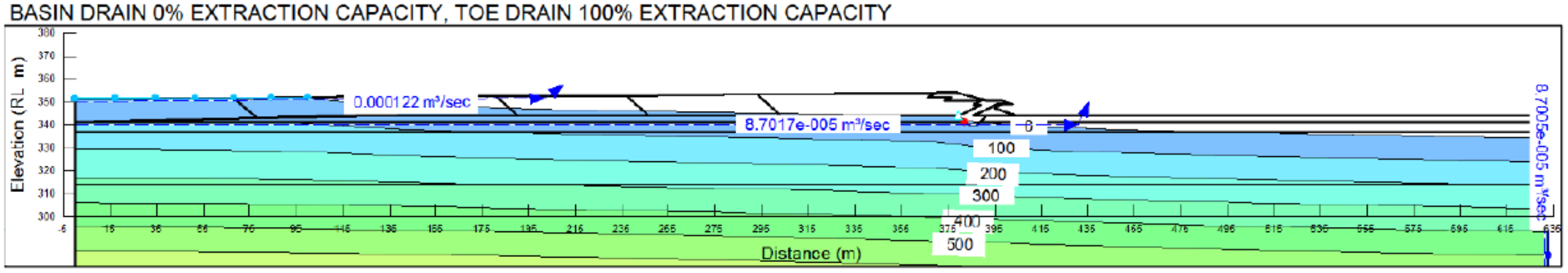

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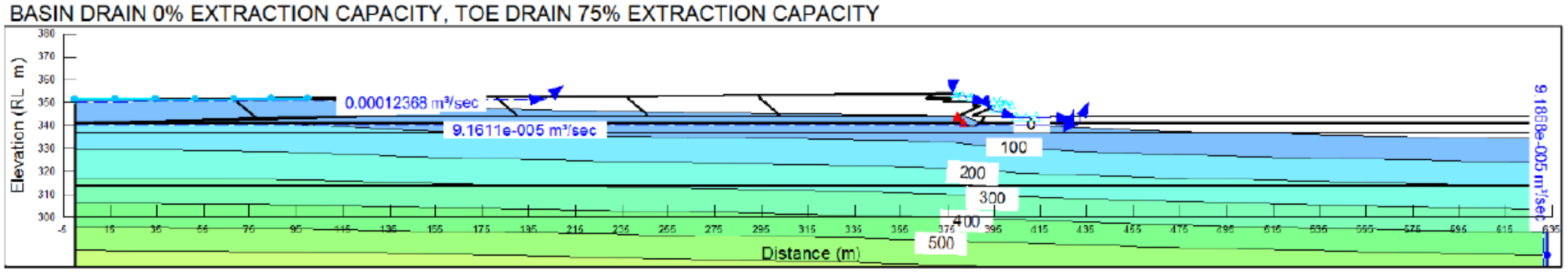

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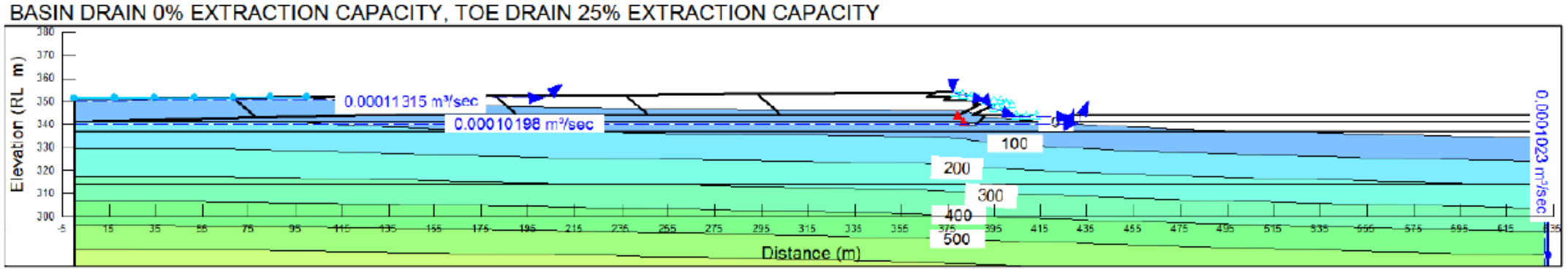

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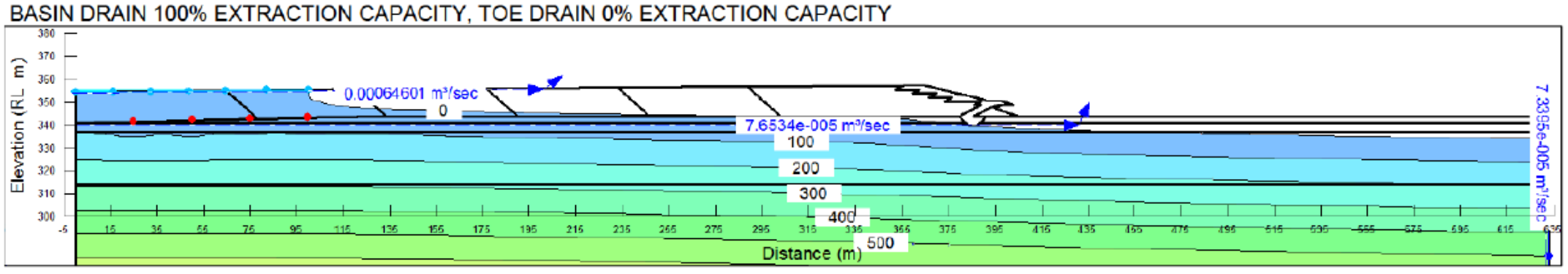

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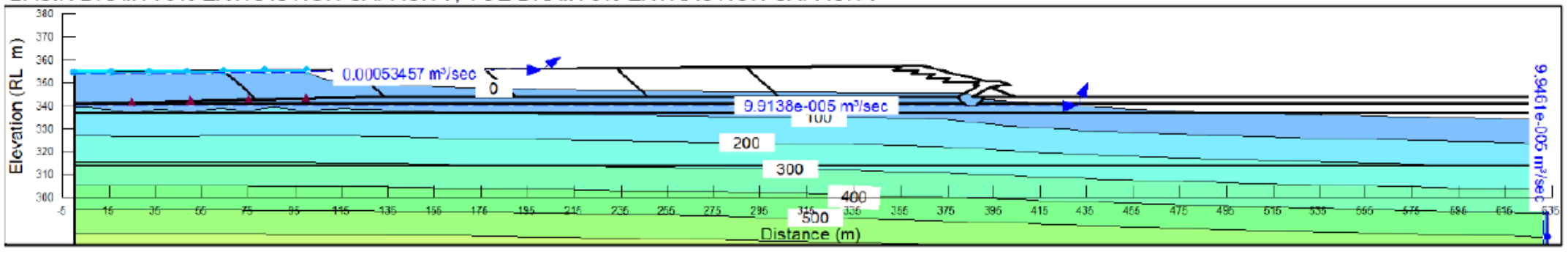

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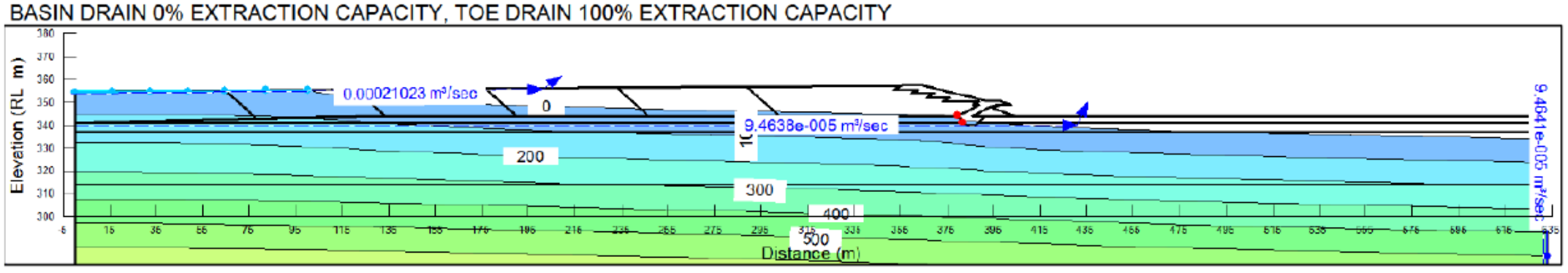

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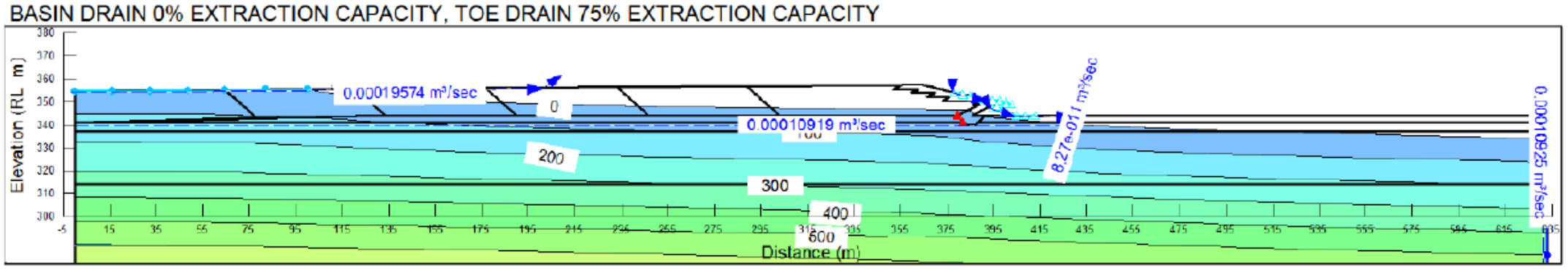

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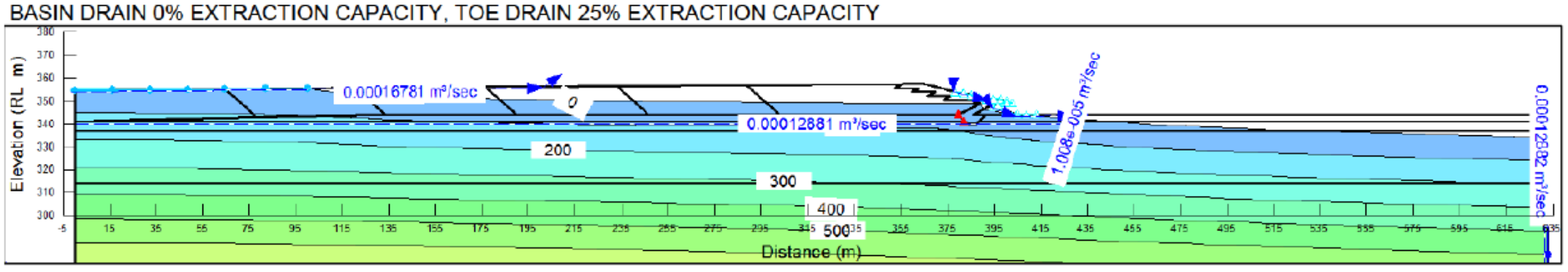

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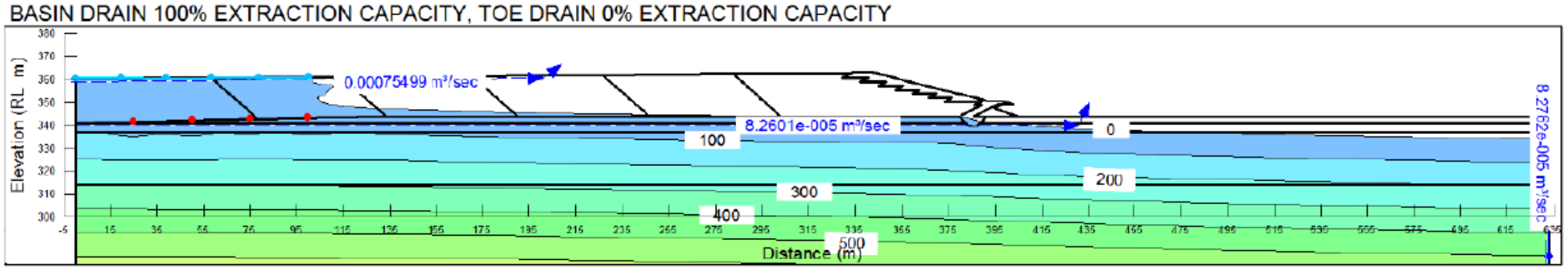

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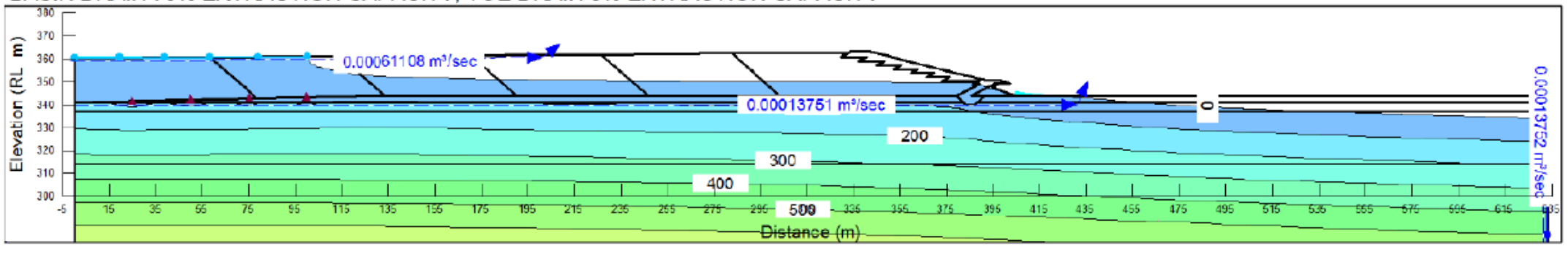

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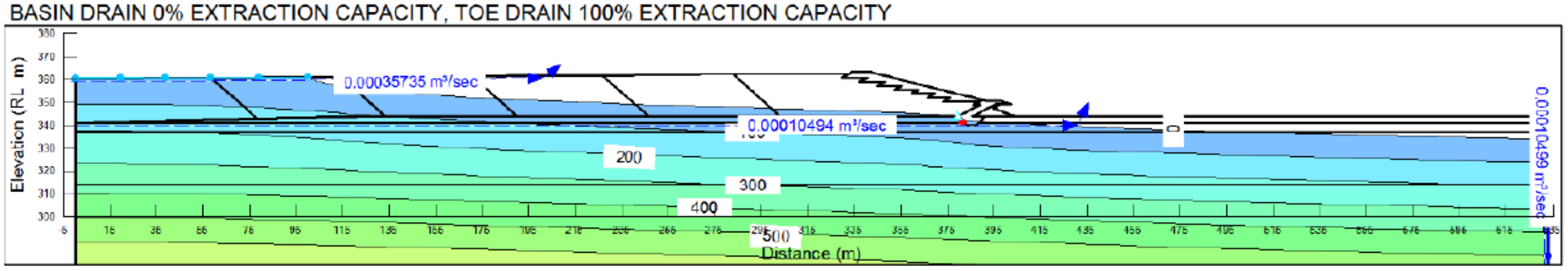

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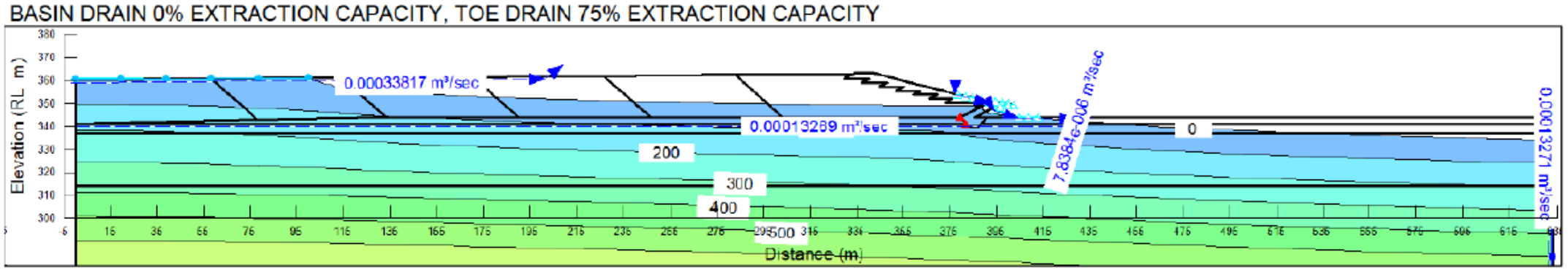

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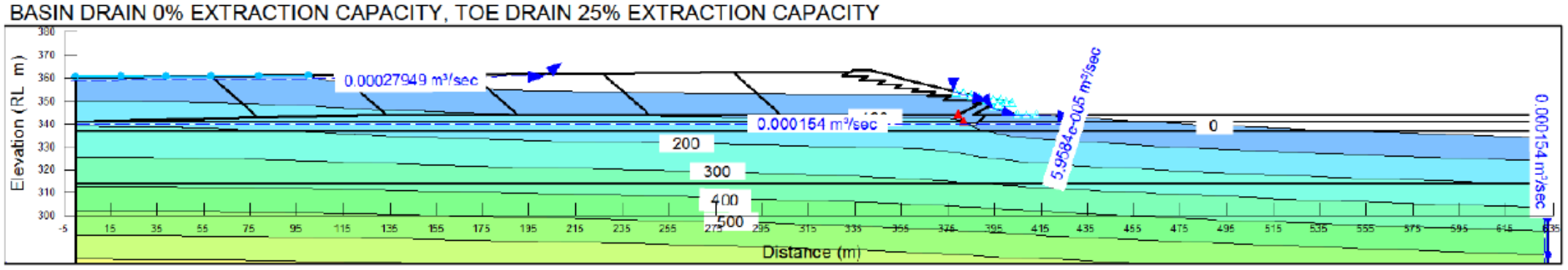

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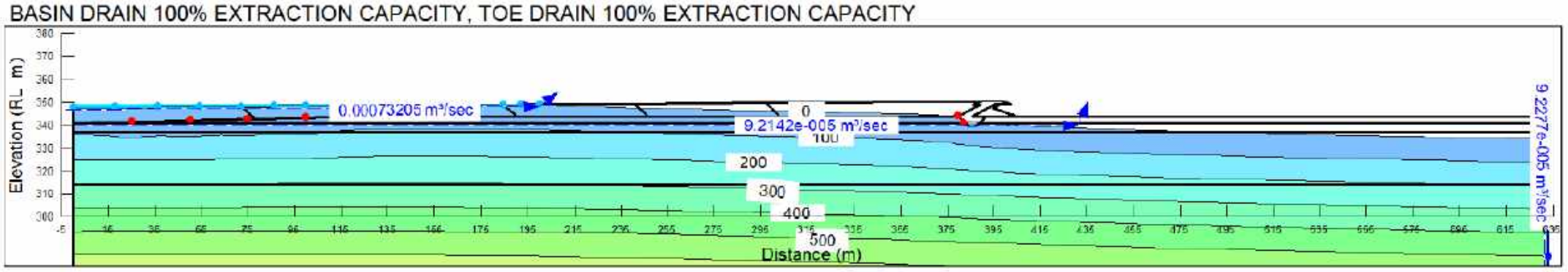

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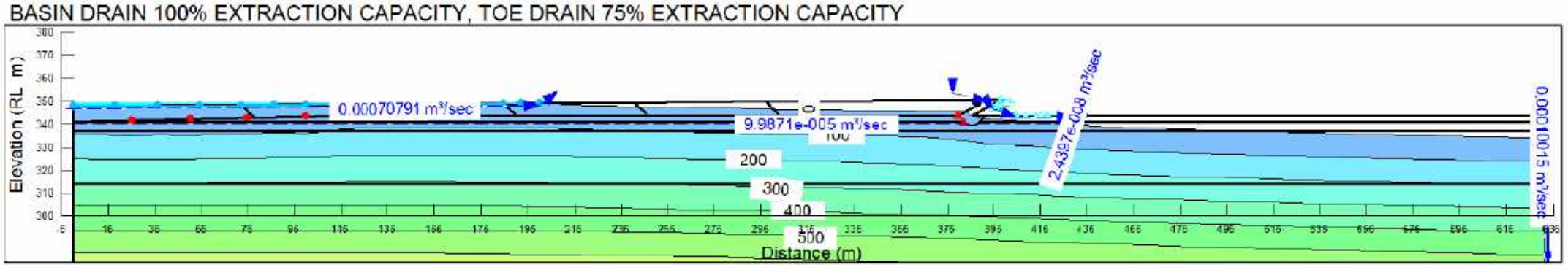

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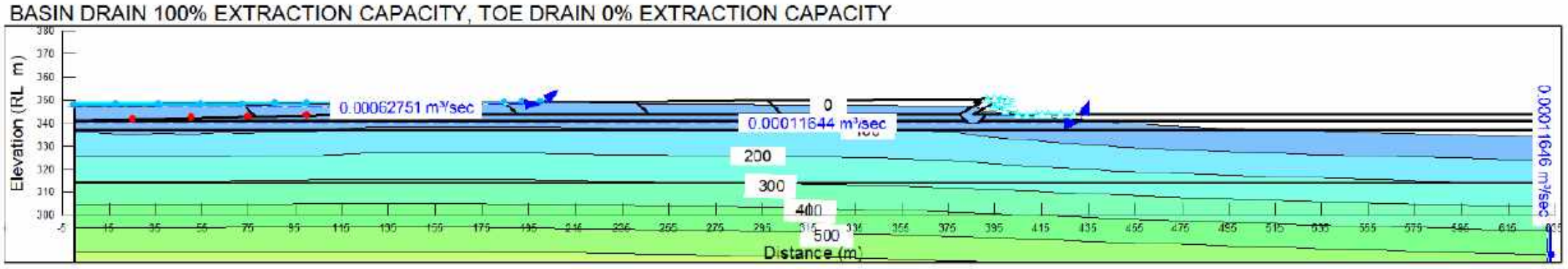

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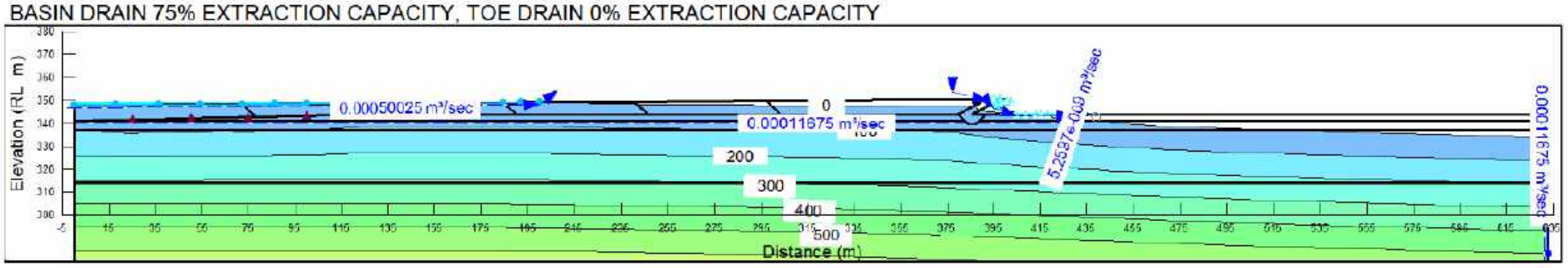

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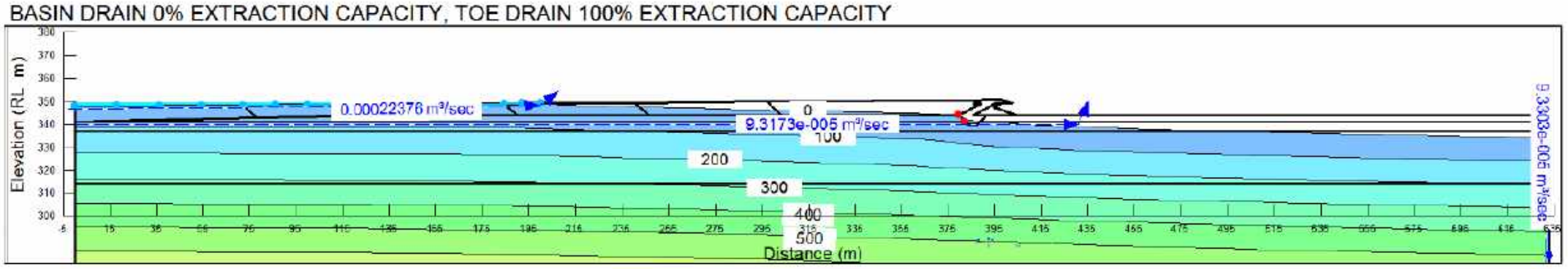

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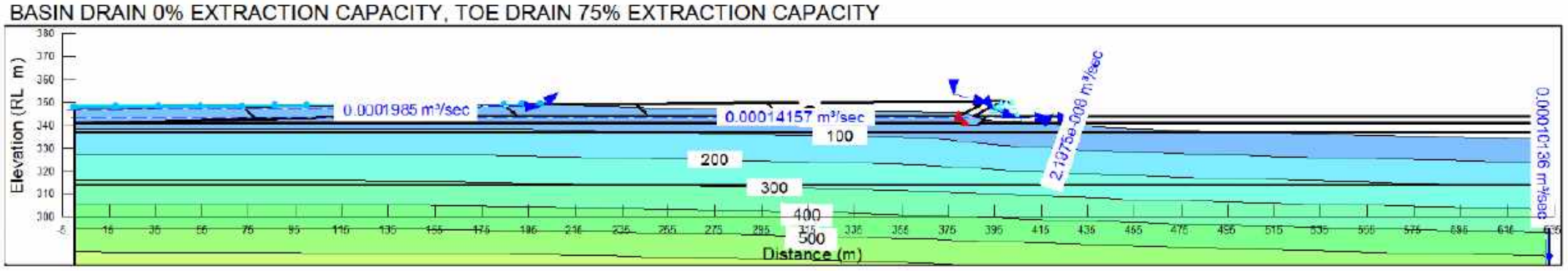

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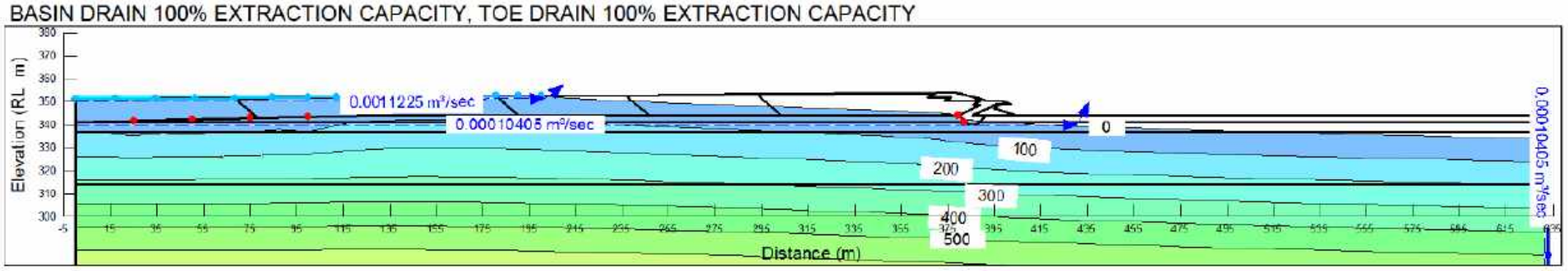

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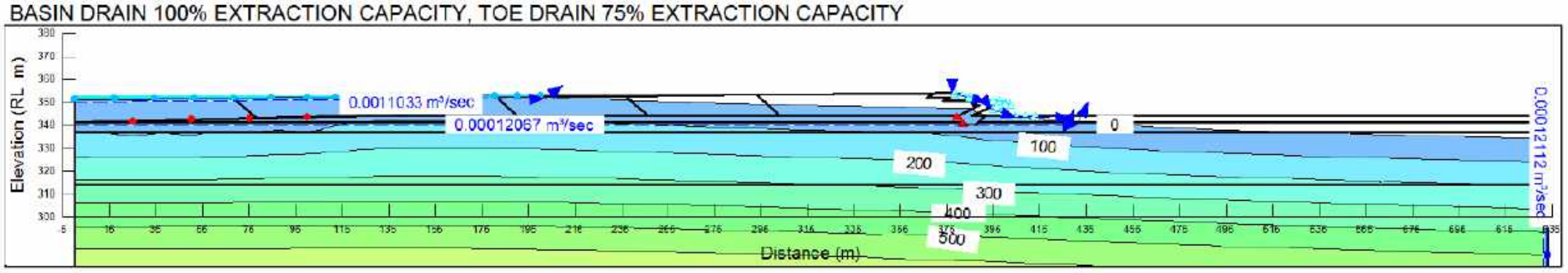

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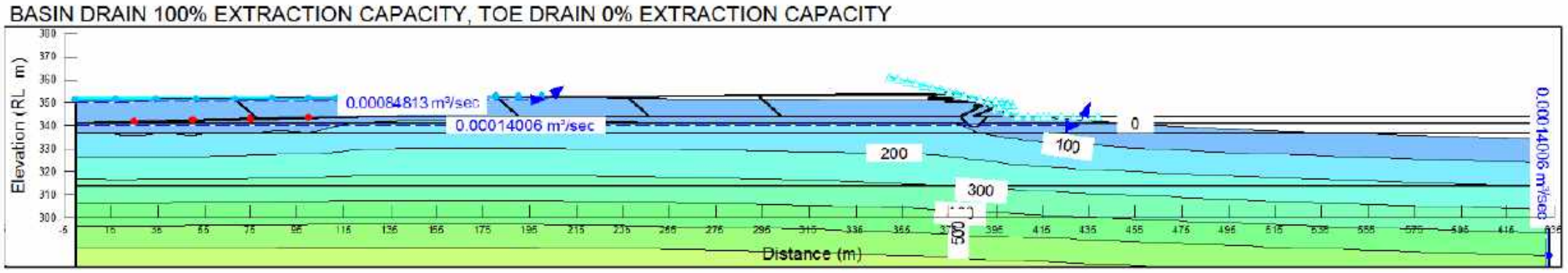

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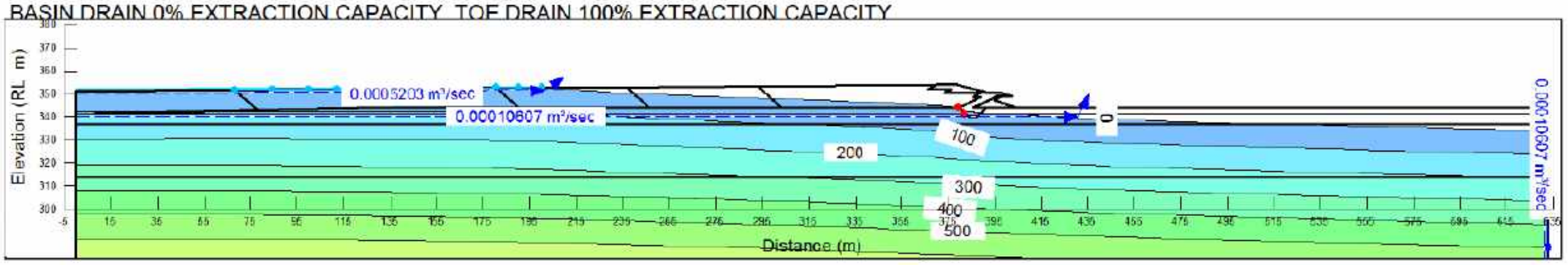

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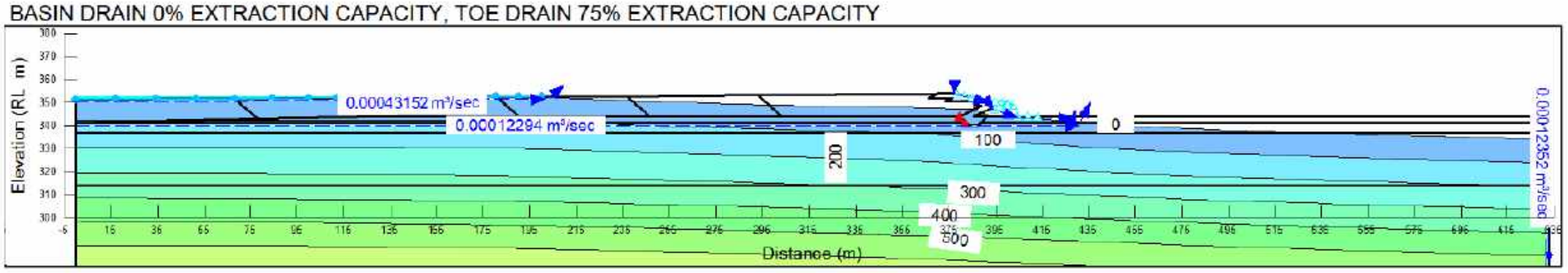

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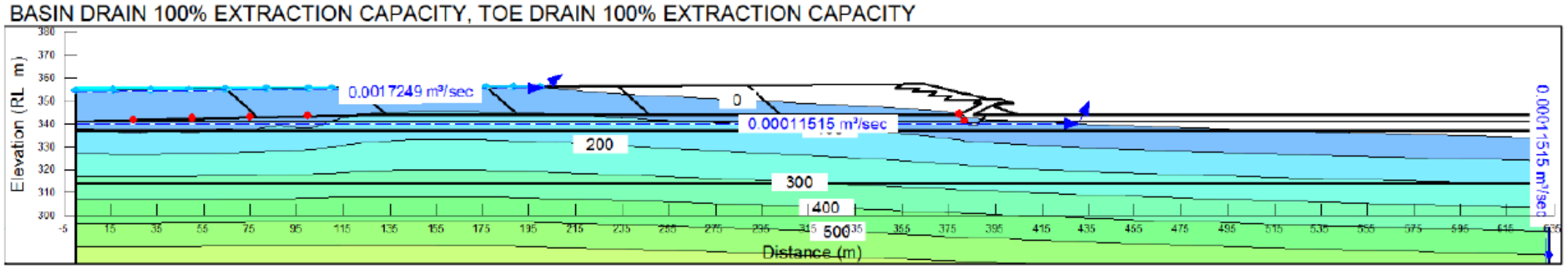

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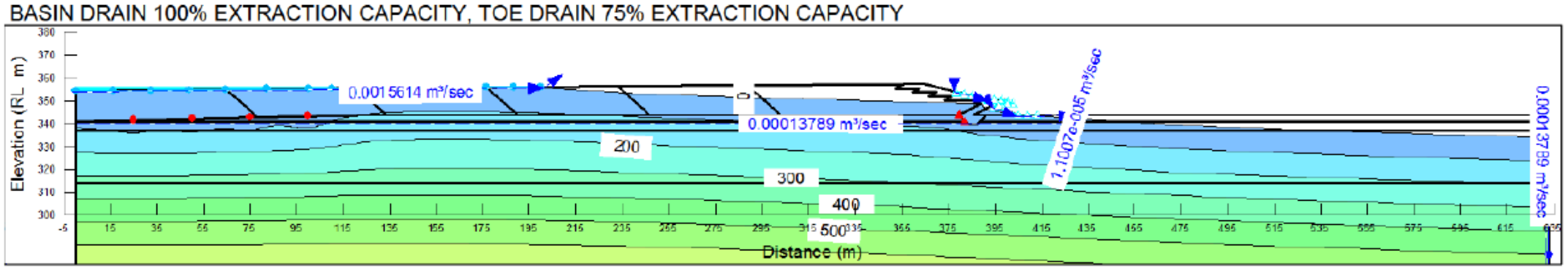

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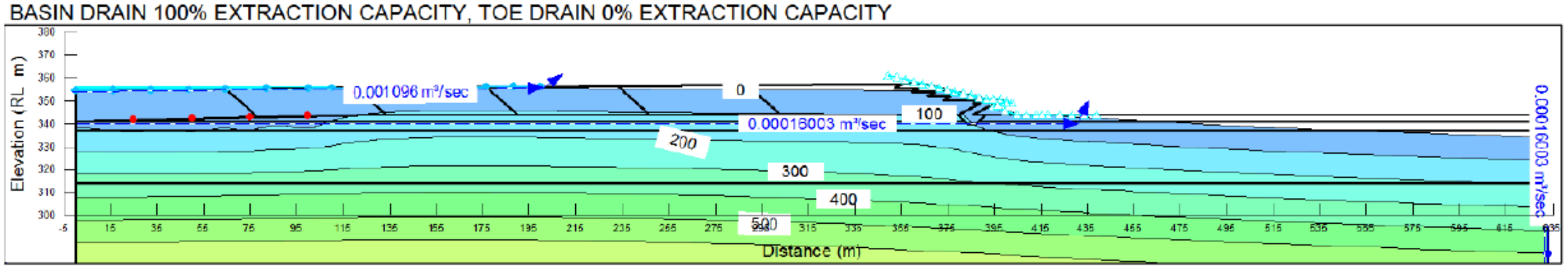

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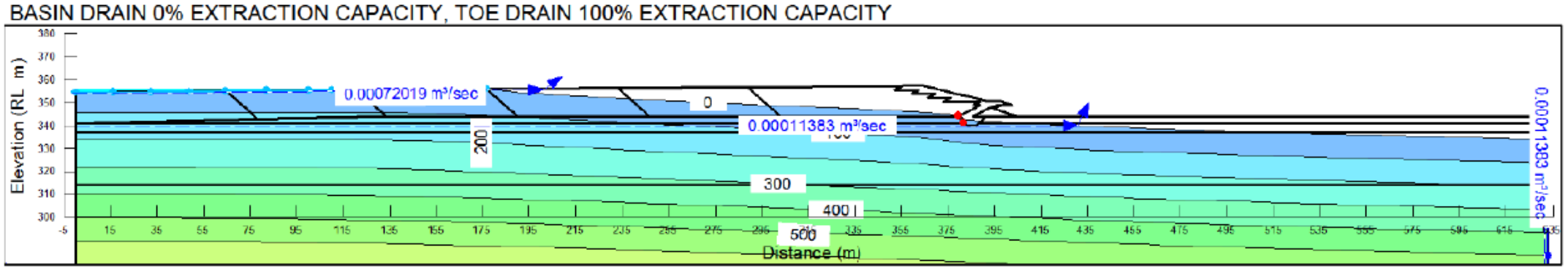

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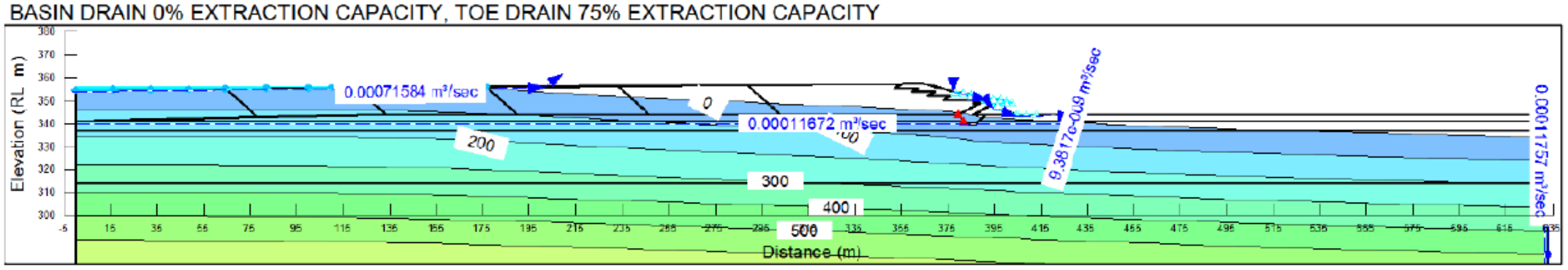

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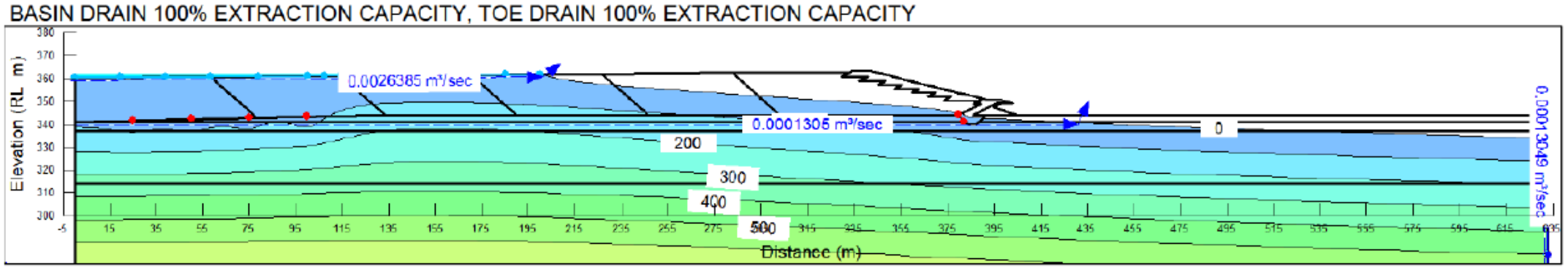

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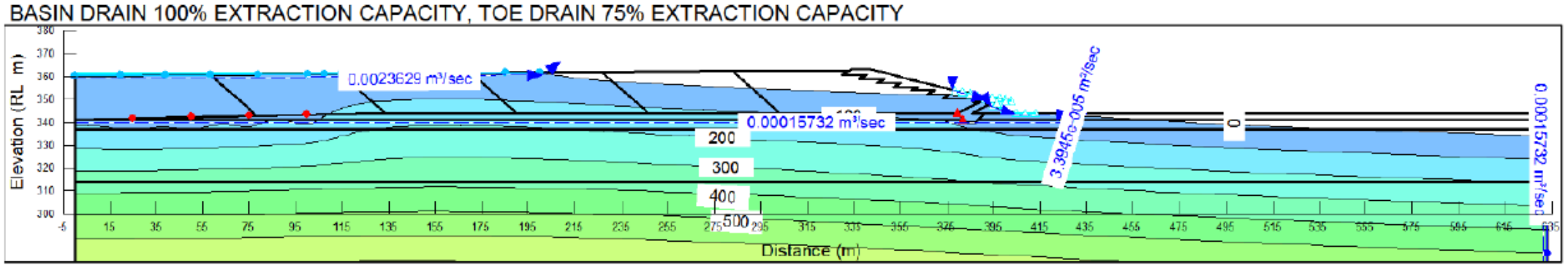

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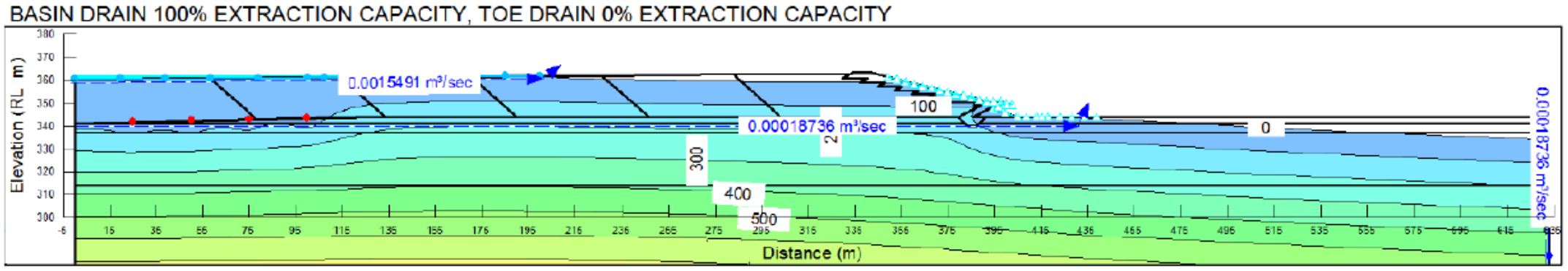

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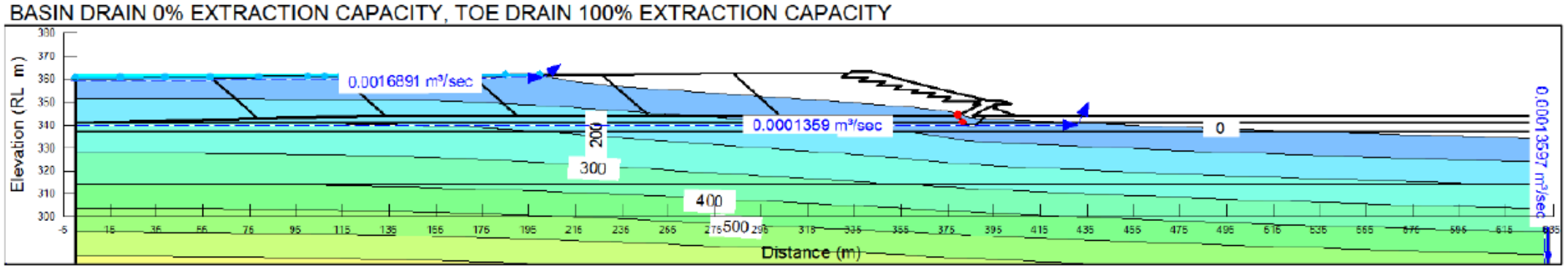

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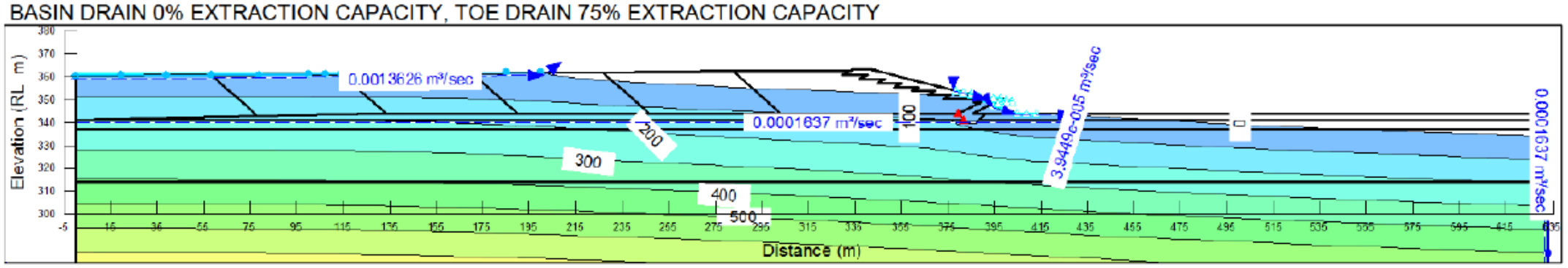


APPENDIX H

Stability Assessment

Knight Piésold CONSULTING

APPENDIX H – STABILITY MODELLING

H.1 GENERAL

Slope stability modelling has been carried out for the Tailings Storage Facility (TSF) Cells 3 & 4 external embankments. The modelling assessed stability of the embankment under long-term drained, short-term undrained and post-seismic loading conditions. For the case where the assessed Factor of Safety (FoS) does not meet ANCOLD (2019) stability requirements (Ref. H.1), buttressing of the embankment at Stage 5 has been recommended as outlined in the following sections.

The stability of the TSF embankment was assessed using “SLOPE/W” (Ref. H.2), a limiting equilibrium program, and performed using the modified Morgenstern-Price method.

H.2 ASSUMPTIONS

The following assumptions were made as part of the stability model:

- The TSF embankment is a zoned earth-fill dam comprising:
  - Zone A low-permeability material on the upstream face of the embankment;
  - Zone C structural fill located behind Zone A; and
  - Zone C1 mine waste placed by direct mine dumping.
- The stratigraphic profile of material beneath the facility comprises the following as mentioned in Appendix G of seepage assessment:
  - Clayey SAND (0 to 3 m deep);
  - Sandy CLAY (3 to 7 m deep);
  - Silty CLAY (7 to 30 m deep);
  - Extremely weathered – distinctly weathered (XW – DW) Rock (30 m and deeper).
- Stage 1 and 2 TSF embankment will be built via downstream construction methods, with an upstream slope of 2H:1V and downstream slope of 3H:1V, to a crest elevation of RL349.1 m. Stage 3 embankment will be built via Modified Centreline (MCL) construction methods to a crest elevation of RL350.7 m. Stage 4 through to Stage 10 (Final) embankment will be built via upstream construction methods, with an upstream slope of 2H:1V and downstream slope of 4H:1V, reaching crest RL363.15 m at Stage 10.

- The Stage 1 TSF embankment is approximately 5 m high at the lowest ground elevation. The Stage 10 embankment is approximately 20 m high at the lowest ground elevation.
- Embankment construction materials shall be compacted to a minimum of 98% of Standard Maximum Dry Density (SMDD) for Zone A and 95% of SMDD for Zone C as determined by laboratory soil testing. Zone A and Zone C materials will comprise Sandy CLAY and Clayey SAND respectively, with permeability properties as indicated in the seepage assessment located in Appendix G. Zone C1 will be mine waste rock placed by direct mine dumping.
- The sub-surface conditions and layer thickness in the foundation materials are based on the KP geotechnical site investigations (Ref. H.3 and H.4).

H.3 MODELLING DETAILS

The cross-sections used for the stability analyses are illustrated in figures G.1 to G.4 for stages 3, 5, 7 and 10 (Final).

The SLOPE/W program calculates the magnitude of the mobilising forces in the embankment slope and compares them to the resisting forces which are a function of the shear strength of the soil structure. The ratio of the resisting forces to the mobilising forces is the factor of safety. When the de-stabilising forces are equal to the strength of the structure, this ratio (the factor of safety) is equal to one and the embankment is considered to be “just stable”.

The stability of the embankment was assessed using static and post seismic analyses. Phreatic profiles utilised derived from seepage modelling contained in Appendix G, where different underdrainage capacities were assumed.

The target factors of safety, based on ANCOLD design guidelines (Ref. H.1), are presented in Table H.1.

Table H.1: Minimum factors of safety for design

Loading Condition	FOS
Long-term drained	1.5
Short-term undrained (potential loss of containment)	1.5
Short-term undrained (no potential loss of containment)	1.3
Post-Seismic	1.0 – 1.2(A)

Note:
(A) FoS range for Post-Seismic loading condition to be related to the confidence in selection of residual shear strength.

In scenarios where the assessed FoS did not meet ANCOLD requirements, a buttress (10 m wide crest, 4H:1V slope) at downstream of the embankment was added in order to meet FoS requirements.

H.4 MATERIAL PROPERTIES

The index and shear strength properties for the subgrade and embankment materials are based on the geotechnical investigation carried out in 2018 (Ref. H.4) as well as cone penetrometer (CPT) testing undertaken in 2018 (Ref. H.5). The drained shear strength parameters are summarised in Table H.2 and the material zones are labelled in Figure G.1 of Appendix G.

The tailings are considered susceptible to undrained behaviour (Ref. H.5) under certain conditions. Shear strength parameters used in the undrained analysis are summarised in Table H.3. Because of the upstream-dominated embankment raise design, additional conservative assumptions were placed on the tailings properties due to the variable drained/undrained tailings strength behaviour above and below the phreatic surface.

The state parameter Ψ within CPT testing is defined as the difference between the in-situ void ratio and the void ratio at critical state, at the same mean effective stress, is used to infer the susceptibility of materials to strain softening behaviour and flow liquefaction. Materials with a state parameter of less than -0.05 (Ψ < -0.05) are dilative and will strain harden during undrained shear. Drained shear strength is recommended for such material. Conversely, materials with a state parameter greater than -0.05 (Ψ > -0.05) are contractive and will strain soften during undrained shear, and thus may be susceptible to flow liquefaction. Undrained shear strength is suggested in this case as it presents the most conservative approach.

The CPT test as well as on-site observation suggests the top tailings layer (~2 m thick) is dense (over consolidated) in nature and could be considered drained due to air drying, but has been ignored. Considering the capillary effects within the tailings, two scenarios were considered for the undrained loading condition:

- More conservatively, assuming all tailings behave undrained with consideration of the susceptibility of tailings to undrained behaviour.
- Less conservatively, assume the capillary rise affects the tailings zone 2 m above the water level. In this case, tailings were considered undrained within 2 m above the phreatic profile and drained for the remainder.

The relatively low permeability materials were modelled in the post-seismic analysis using 80% of the drained/undrained shear strength parameters. Based on CPT testing (Ref. H.5), the tailings material was considered unlikely liquefiable under 1,000 years event loading and was modelled with non-liquefied shear strength. The shear strength parameters used in the post-seismic analysis are summarised in Table H.4.

Table H.2: Long-term (drained) and short-term (undrained) shear strength parameters

Material	γ_{moist} (kN/m^3)	Drained		Undrained	
		c' (kPa)	ϕ' (deg)	s_u/σ'	s_{umin} (kPa) [A]
Tailings	13.5	0	25	0.25	0
Zone A	19	0	28	0.25	50
Zone C	18	0	28	0.25	50
Zone C1	20	32	0	-	-
Clayey SAND	18	0	28	0.25	50
Sandy CLAY	18	5	28	0.25	75
Silty CLAY	19	10	25	0.25	75
XW – DW Rock	21	30	33	-	-

Note: Worst case scenario was adopted based on laboratory consolidated undrained triaxial tests and assumed strength parameters;
Note A: Minimum undrained strength sumin is capped by drained strength

Table H.4: Post-seismic shear strength parameters

Material	Drained		Undrained	
	c' (kPa)	ϕ' (deg)	s_u/σ'	s_{umin} (kPa) [A]
Tailings	-	-	0.2	0
Zone A	0	23	0.2	40
Zone C	0	23	0.2	40
Clayey SAND	0	23	0.2	40
Sandy CLAY	4	23	0.2	60
Silty CLAY	8	20.5	0.2	60

Note A: Minimum undrained strength s_{umin} is capped by drained strength

H.5 STABILITY ASSESSMENT RESULTS

The results of the slope stability analyses are summarised in Table H.5 and figures H.1 to H.12.

Table H.5: Summary of TSF stability assessment results

Stage	Pond Size (m)	Basin Drain Capacity (%)	Toe Drain Capacity (%)	Loading Condition	Assumptions	FoS (No Buttress)	FoS (Buttress to Stage 5 Crest RL)	Figure
3	200	0%	0%	Drained		1.95		H.1
				Undrained	Containment release	2.20		
					No containment release	1.83		
				Post-seismic		1.56		
5	200	0%	0%	Drained		1.76		H.2
				Undrained	Containment release	1.23	1.77	
					No containment release	1.81		
				Post-seismic		1.01	1.43	
		0%	25%	Drained		1.89		H.3
				Undrained	Containment release, tailings all undrained[Note A]	1.56		
					Containment release, tailings undrained within 2 m above phreatic level[Note A]	1.70		
					No containment release	1.82		
				Post-seismic		1.24		
		100%	0%	Drained		1.79		H.4
				Undrained	Containment release	1.32	2.00	
					No containment release	1.82		
				Post-seismic		1.30		
	100	0%	0%	Drained		2.09		H.5
				Undrained	Containment release, tailings all undrained[Note A]	1.66		
					Containment release, tailings undrained within 2 m	1.98		

Stage	Pond Size (m)	Basin Drain Capacity (%)	Toe Drain Capacity (%)	Loading Condition	Assumptions	FoS (No Buttress)	FoS (Buttress to Stage 5 Crest RL)	Figure
					above phreatic level[Note A]			
					No containment release	1.87		
				Post-seismic		1.55		
7	200	0%	100%	Drained		2.10		H.6
				Undrained	Containment release, tailings all undrained[Note A]	1.34	1.83	
					Containment release, tailings undrained within 2 m above phreatic level[Note A]	1.82		
					No containment release	1.87		
				Post-seismic		1.07	1.45	
		100%	0%	Drained		1.12	1.99	H.7
				Undrained	Containment release	0.84	1.58	
					No containment release	1.84		
				Post-seismic		0.60	1.26	
	100	0%	100%	Drained		2.14		H.8
				Undrained	Containment release, tailings all undrained[Note A]	1.34	1.83	
					Containment release, tailings undrained within 2 m above phreatic level[Note A]	1.80		
					No containment release	1.87		
				Post-seismic		1.08	1.46	
		100%	0%	Drained		2.14		H.9

Stage	Pond Size (m)	Basin Drain Capacity (%)	Toe Drain Capacity (%)	Loading Condition	Assumptions	FoS (No Buttress)	FoS (Buttress to Stage 5 Crest RL)	Figure
				Undrained	Containment release, tailings all undrained[Note A]	1.34	1.83	
					Containment release, tailings undrained within 2 m above phreatic level[Note A]	1.91		
					No containment release	1.87		
				Post-seismic		1.08	1.45	
10	200	0%	100%	Drained		2.00		H.10
				Undrained	Containment release, tailings all undrained	1.19	1.34	
					Containment release, tailings undrained within 2 m above phreatic level	1.58		
					No containment release	1.85		
				Post-seismic		0.95	1.07	
	100	0%	100%	Drained		2.00		H.11
				Undrained	Containment release, tailings all undrained[Note A]	1.19	1.34	
					Containment release, tailings undrained within 2 m above phreatic level[Note A]	1.58		
					No containment release	1.87		
				Post-seismic		0.95	1.08	
		100%	0%	Drained		2.00		H.12

Stage	Pond Size (m)	Basin Drain Capacity (%)	Toe Drain Capacity (%)	Loading Condition	Assumptions	FoS (No Buttress)	FoS (Buttress to Stage 5 Crest RL)	Figure
				Undrained	Containment release, tailings all undrained[Note A]	1.19	1.34	
					Containment release, tailings undrained within 2 m above phreatic level[Note A]	1.71		
					No containment release	1.94		
				Post-seismic		0.95	1.07	

Note:

(A) As discussed in section H.4, two scenarios were considered for tailings undrained behaviour above phreatic surface level, 1) all tailings undrained and 2) undrained within 2 m above phreatic profile.

(B) Where the assessed FoS satisfied ANCOLD requirements, FoS by improved drainage conditions were considered satisfactory.

Table H.5 indicates that Stage 3 satisfies ANCOLD stability requirements without operating drains due to being predominantly downstream. This suggests that up to this stage, the embankment is expected to have sufficient tolerance to a high phreatic surface level but should still be avoided. With the proposed buttress (to Stage 5 crest RL at 10 m crest width and 4H:1V downstream slope), Stage 5 is expected to have satisfactory FoS in the event the tow drain is not operational. This could be deferred if the phreatic surface is effectively managed. The results indicate that up to Stage 7 the embankment is required to be buttressed to be tolerant to reduced toe drain flows and large ponds.

For Stage 10 (Final) under the undrained loading condition, the assessed FoS was below ANCOLD requirements under all drainage conditions with buttresses. This suggests that the conservatively assumed tailings all being undrained behaviour is the key factor for Stage 8 to Stage 10 stability. If tailings material above the water table is confirmed to be prone to undrained shearing behaviour, buttress construction to a higher level than shown may be proposed. However, if tailings material above the water table is confirmed to act in a drained shearing behaviour, a buttress to Stage 5 level may give satisfactory FoS. This needs to be assessed and confirmed during operations with in situ testing.

The assessment on settlement under seismic loading conditions hasn't been conducted at this stage as it will require a more detailed site-specific investigation program and numerical modelling to assess site response in the event of an earthquake. In-situ CPT

testing is recommended to obtain relevant parameters in combining with specialised laboratory testing to determine he tailings critical state parameters.

H.6 RECOMMENDATIONS

Following the conclusions drawn from this study, KP recommends the following:

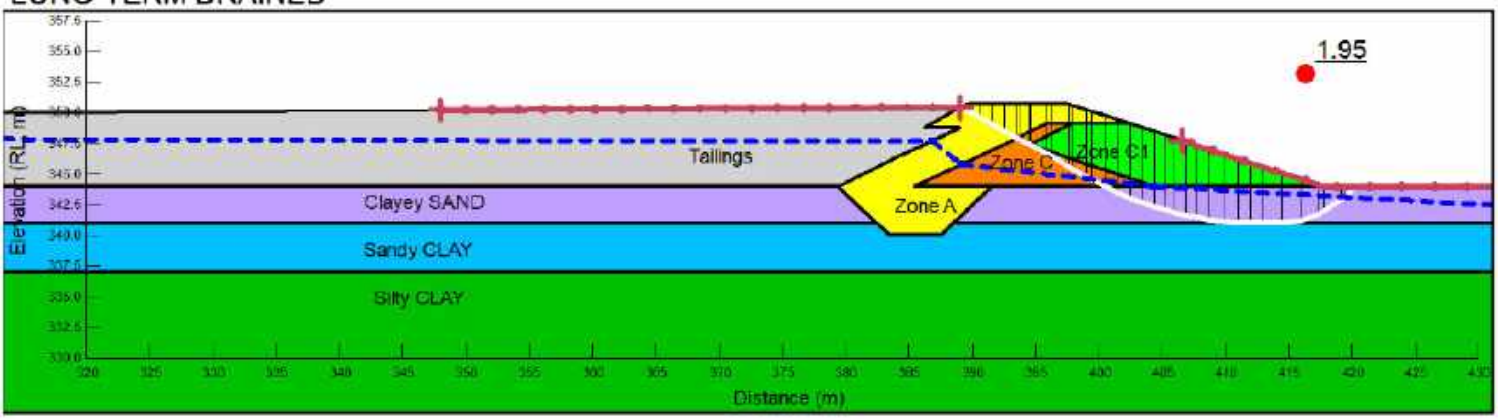
- Closely monitor phreatic levels within the tailings and embankment during construction, operation and closure. This can be implemented via:
  - Install Vibrating Wire Piezometers (VWP) under the embankment base prior to Stage 1 downstream construction. Two positions are recommended, immediately behind the low permeability Zone A core and downstream beneath the Zone C structural fill.
  - Install Standpipe Piezometers (PZ) from the Stage 3 crest to obtain additional phreatic profile information within the embankment.
  - Install VWPs within the tailings mass immediately upstream to the crest from Stage 3 onwards.
  - Perform CPT testing and laboratory testing on the tailings materials after the completion of the Stage 3 embankment construction and tailings deposition within the Stage 2 basin. Repeat the CPT program typically every 2 stages to verify on-going variation in tailings properties and in situ state, while also assessing if additional VWPs are required.
- Assess the dilative/contractive behaviour of tailings by CPT specifically above the phreatic surface. This will provide further information on the drained/undrained shearing behaviour of tailings, which is key for future stages more than initial stages.
- Check the susceptibility of tailings to liquefaction through in situ testing, specifically what the liquefied strength estimate would be.
- Since the later stage embankment is upstream dominated, numerical modelling is required for settlement assessment in the future, following confirmation of tailings seismic parameters from in situ testing.

H.7 REFERENCES

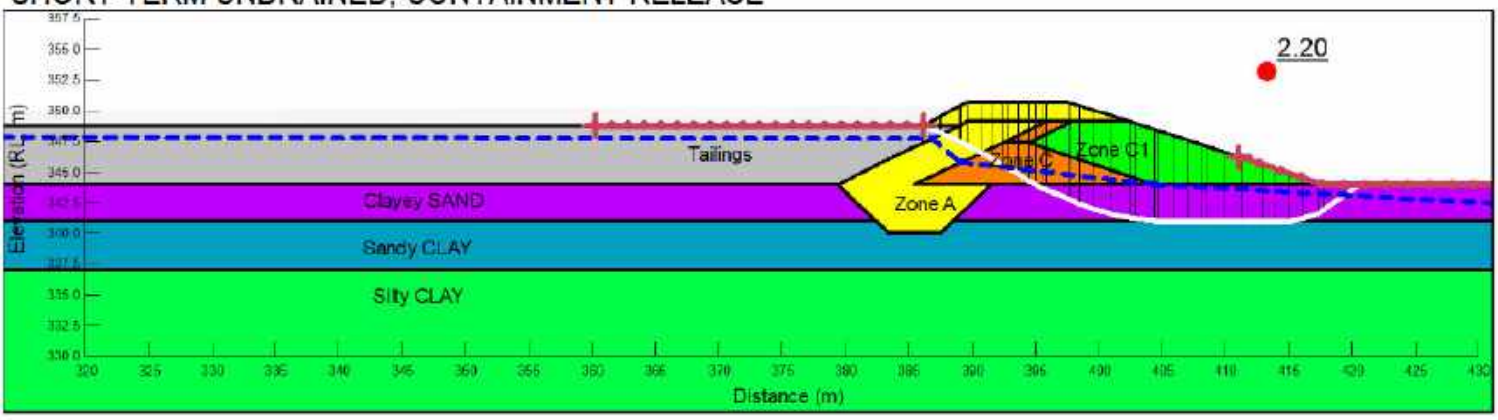
1. ANCOLD - Australian National Committee on Large Dams (2019). “Guidelines on Tailings Dams”, July 2019.
2. GEO-SLOPE International Ltd., “SLOPE/W”, 2018.
3. Knight Piésold, “Tailings Storage Facility, Geotechnical Investigation Report”, Report No. PE801-00137/05, 2013.
4. Knight Piésold, “Tailings Storage Facility Cell 3 Geotechnical Investigation Report”, Report No. PE801-00137/23, 2018.
5. Knight Piésold, “TSF Cell 2, 2018 Cone Penetration Testing and Vibrating Wire Piezometer Programme”, Report No. PE801-00137/25, 2018.

APPENDIX H - FIGURES

LONG-TERM DRAINED



SHORT-TERM UNDRAINED, CONTAINMENT RELEASE



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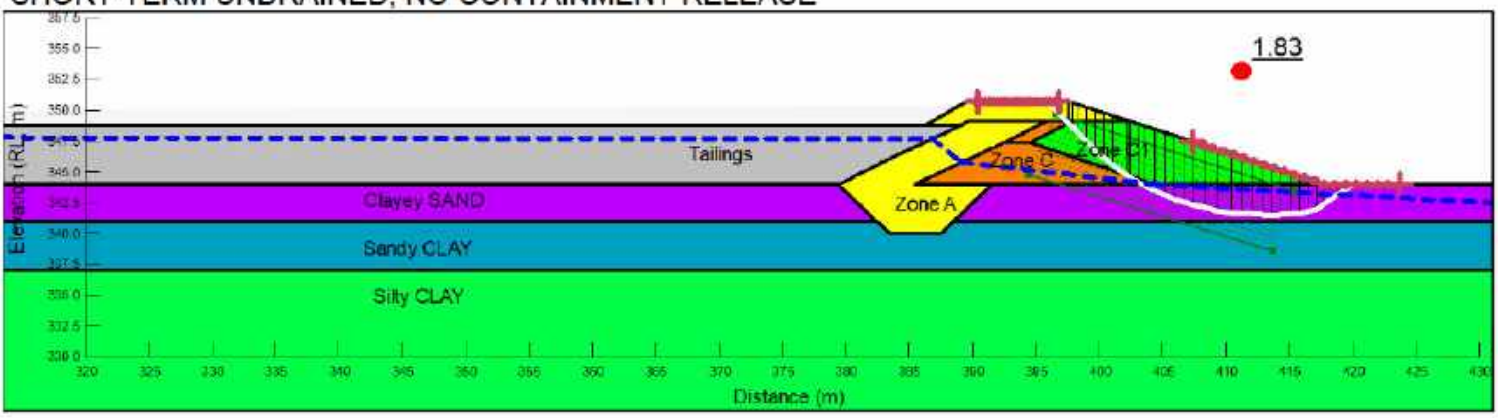

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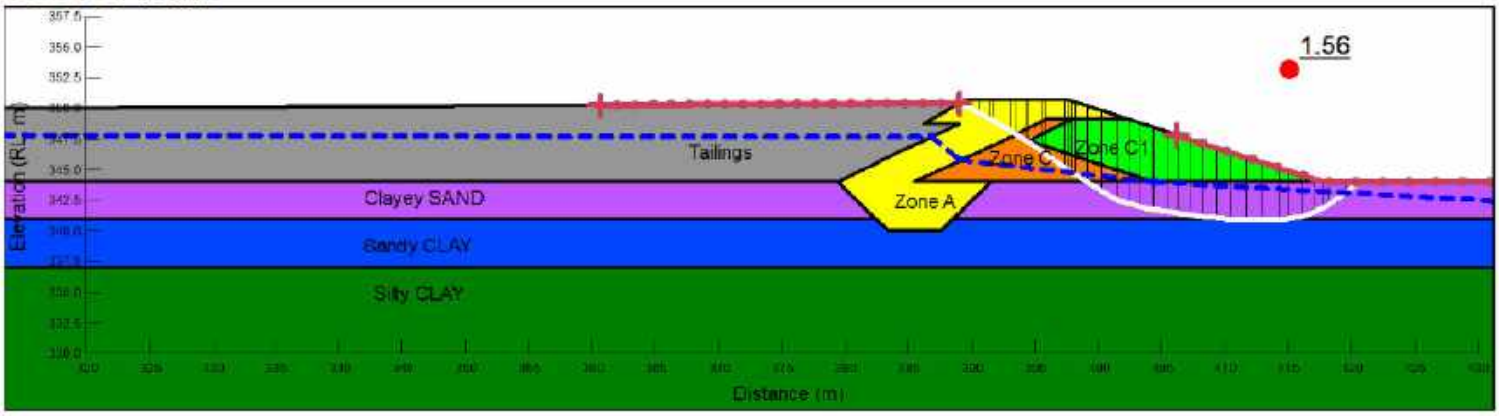

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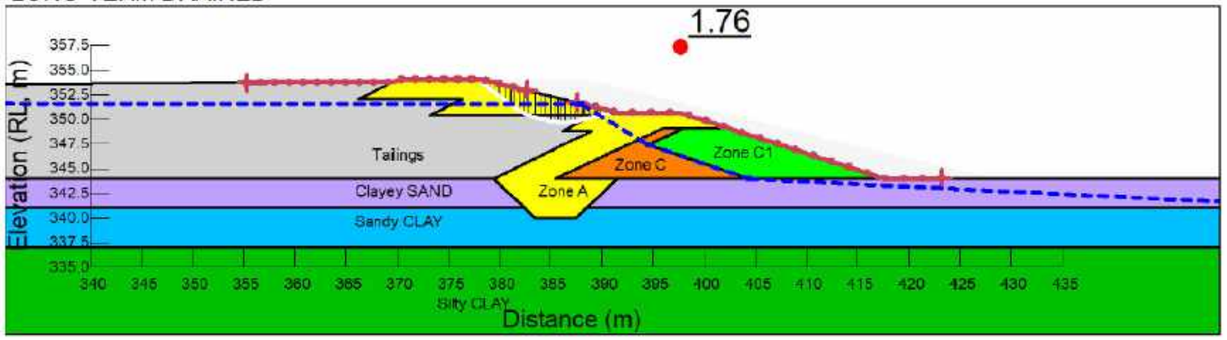

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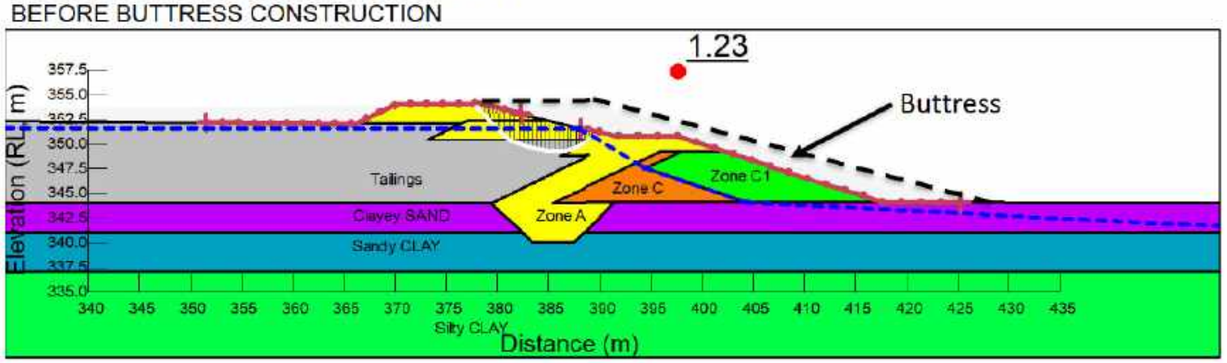

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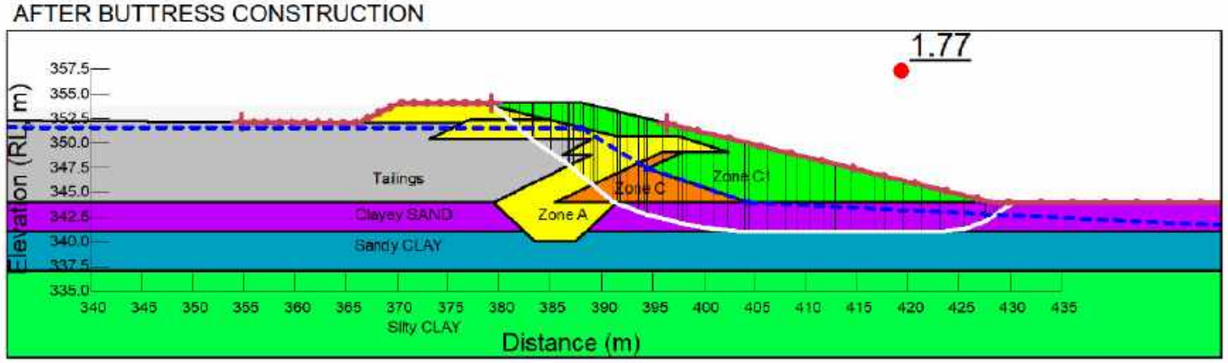

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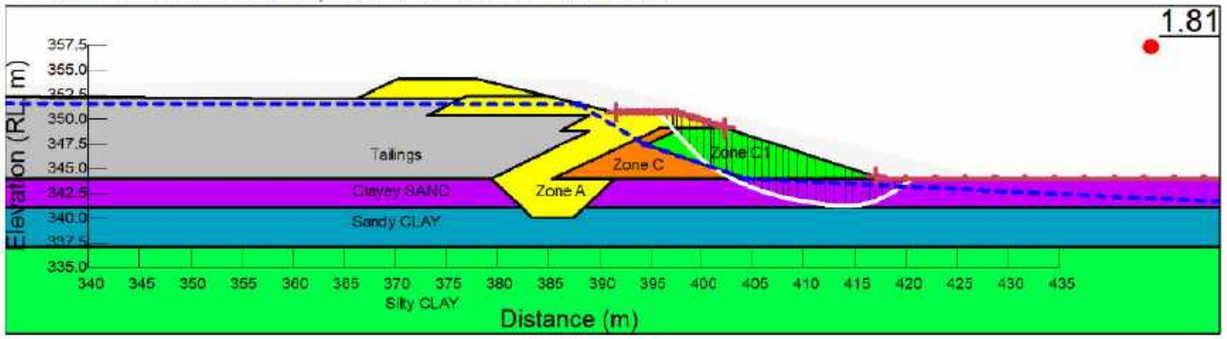

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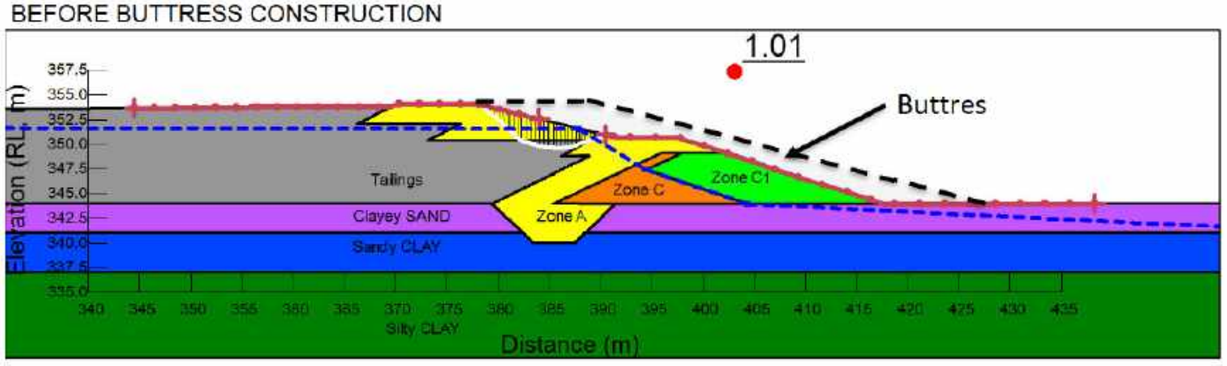

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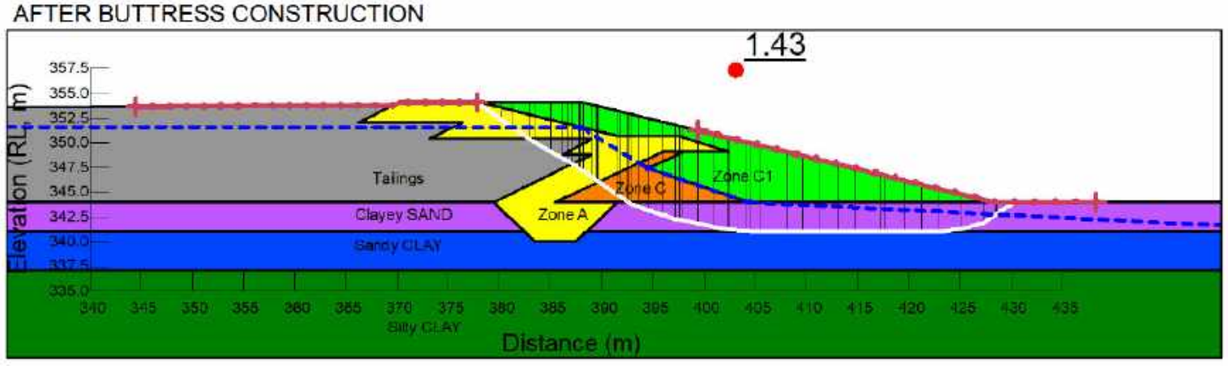

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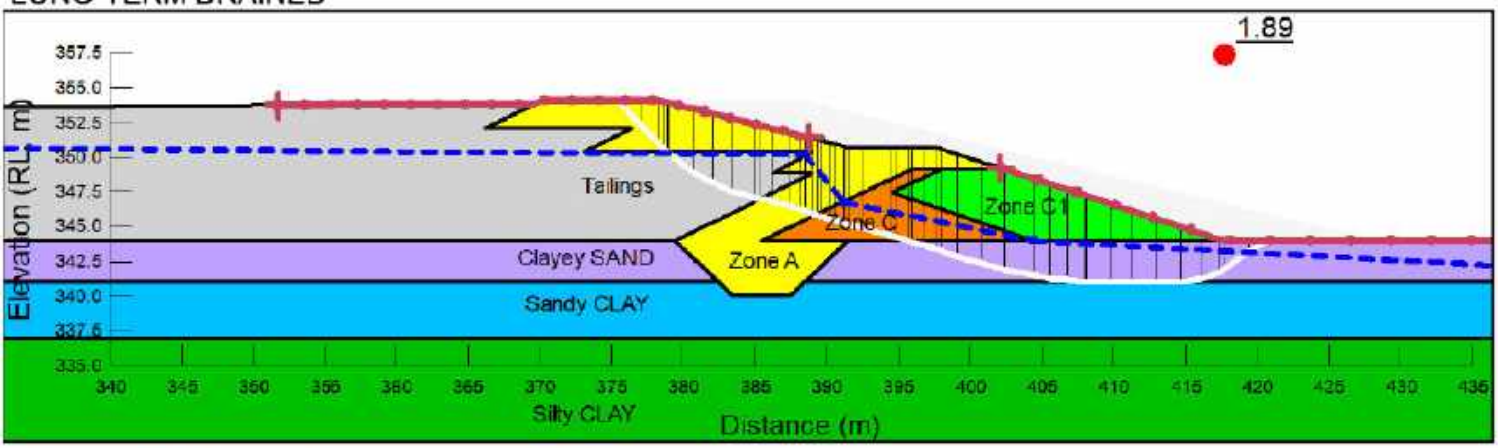

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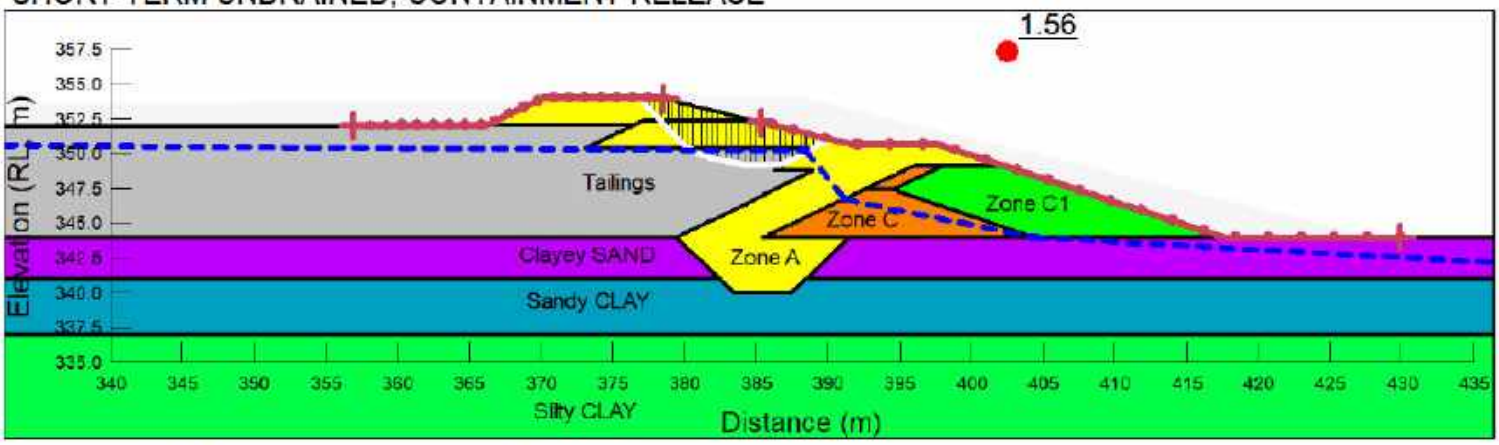

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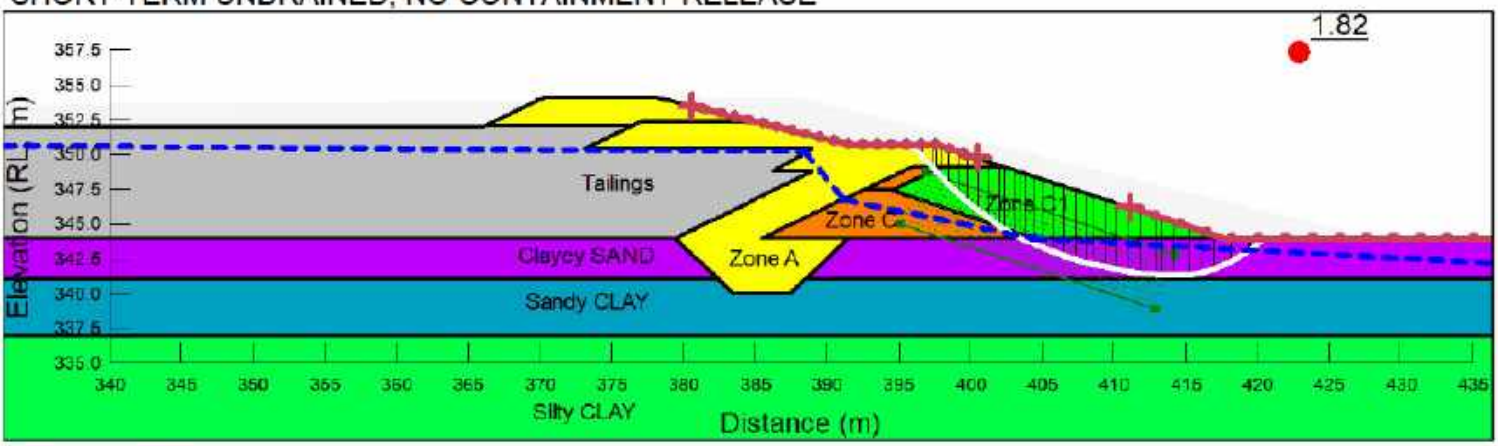

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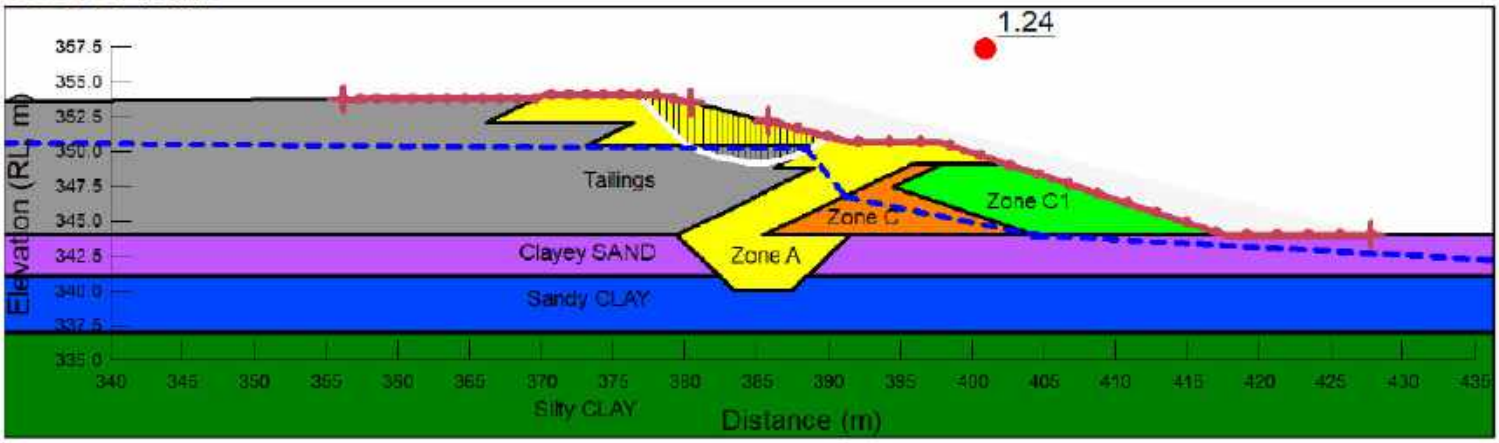

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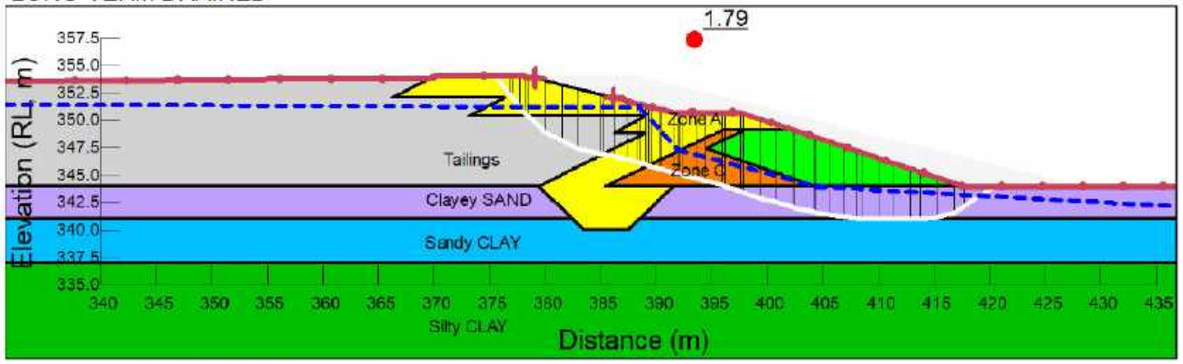

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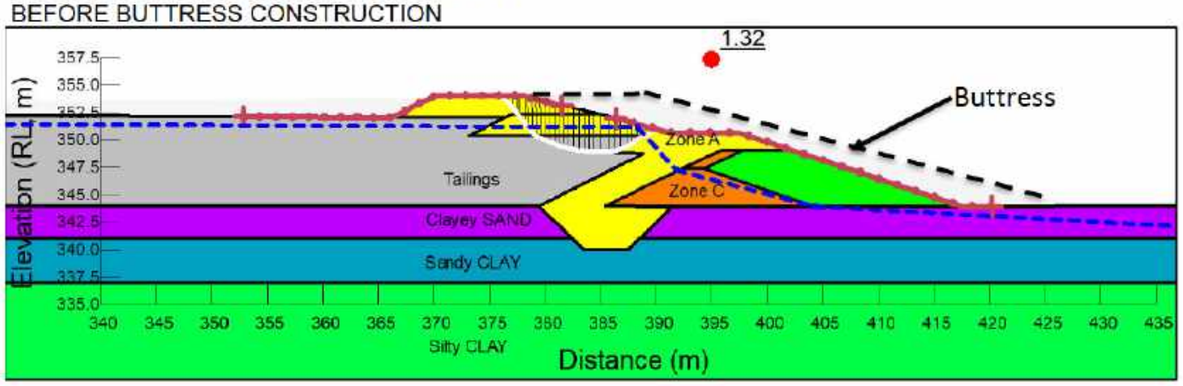

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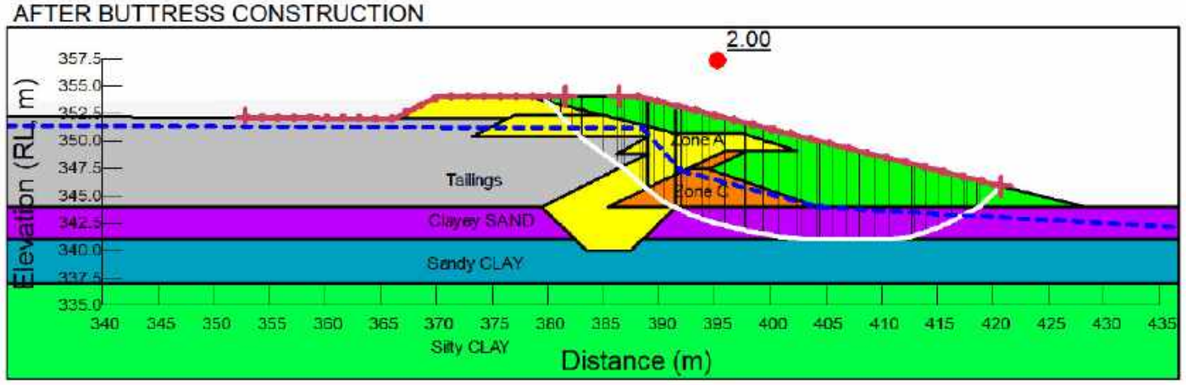

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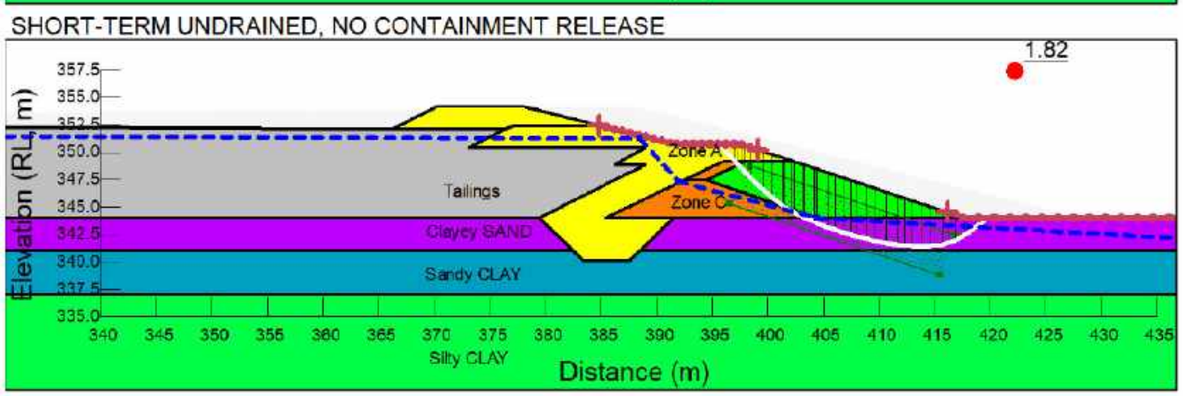

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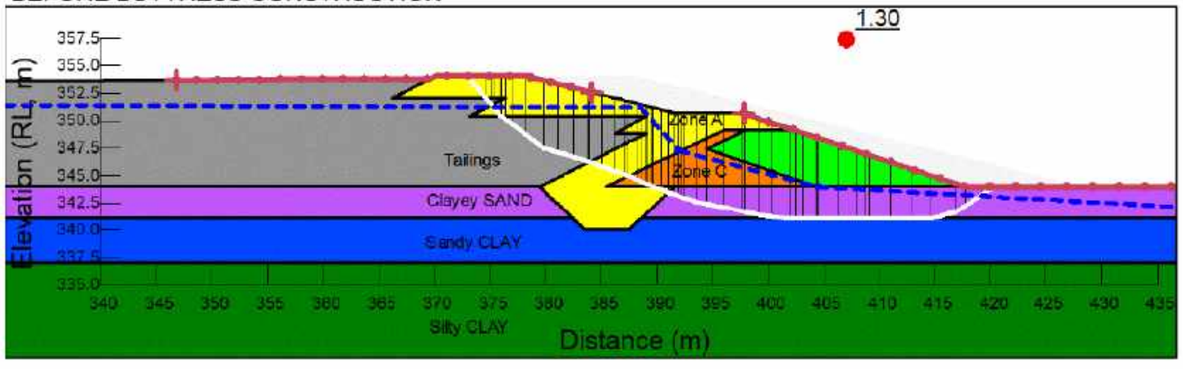

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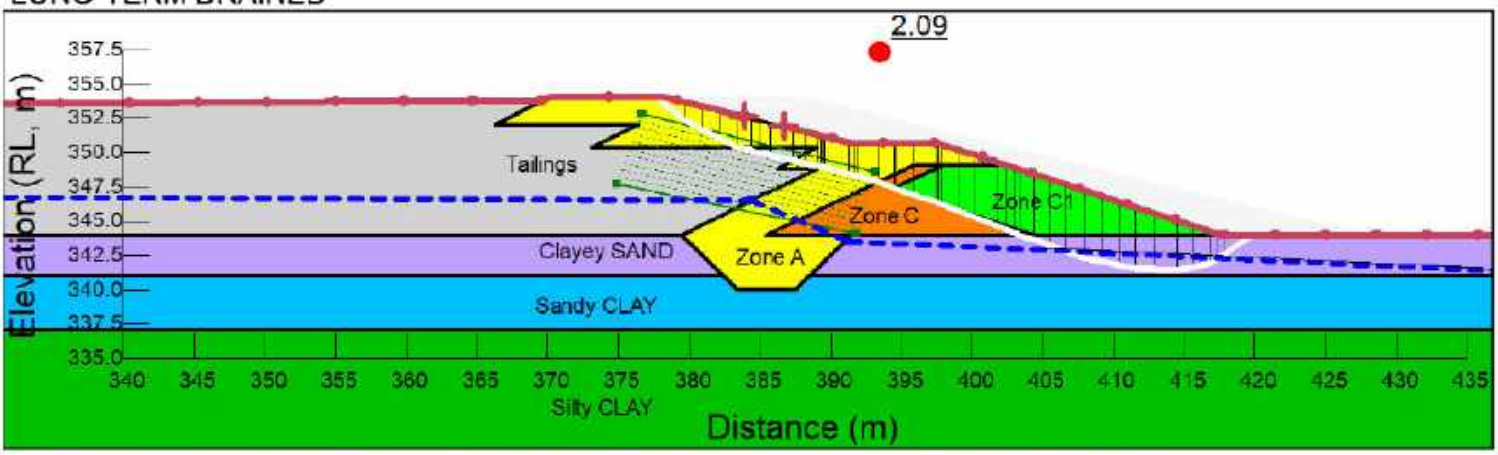

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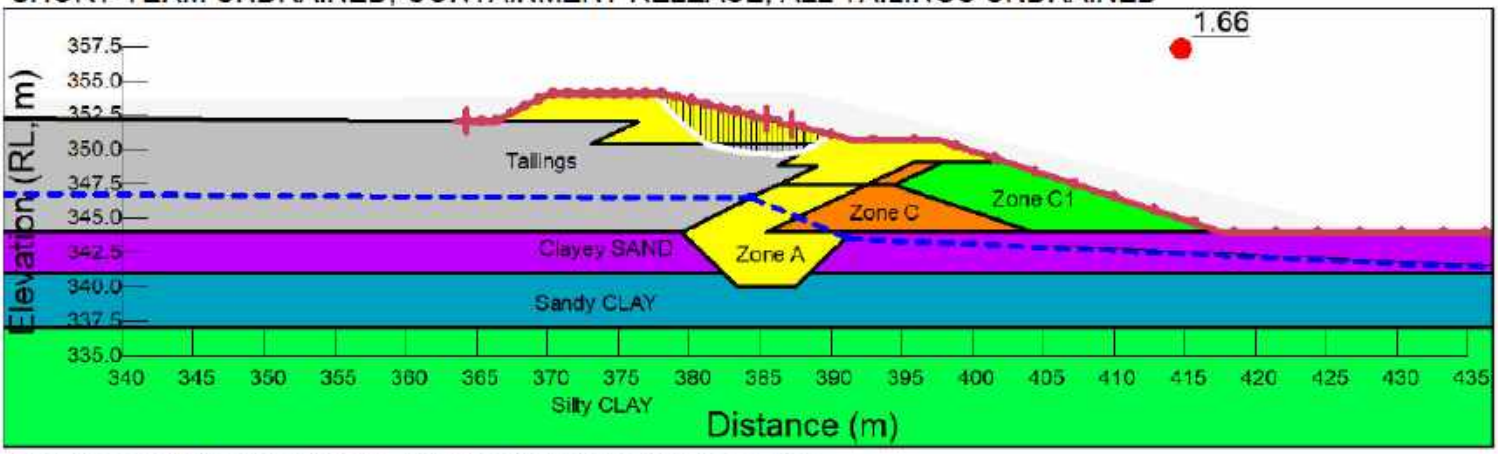

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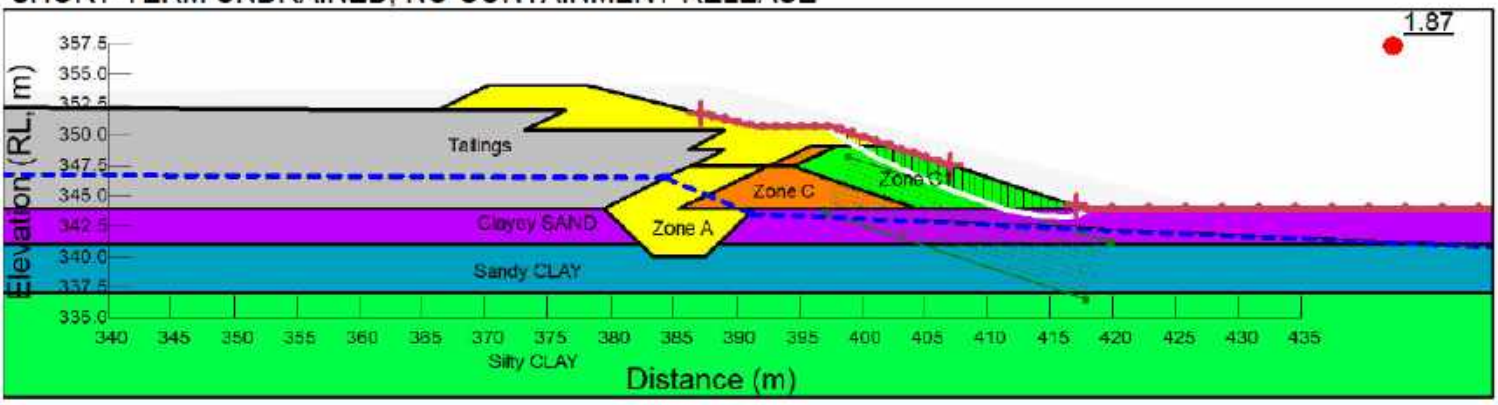

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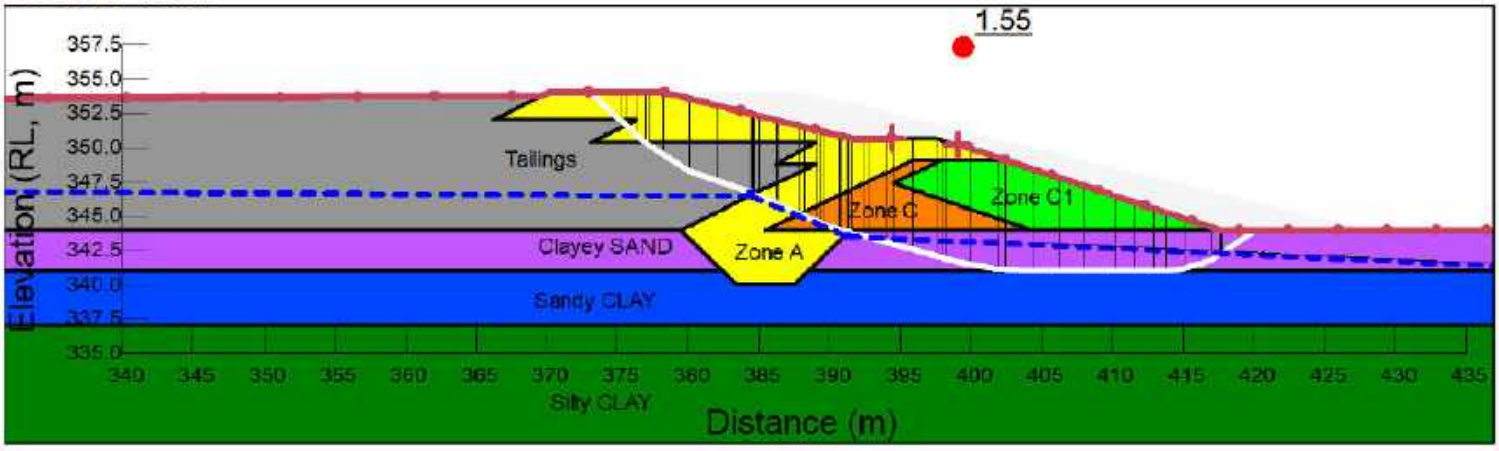

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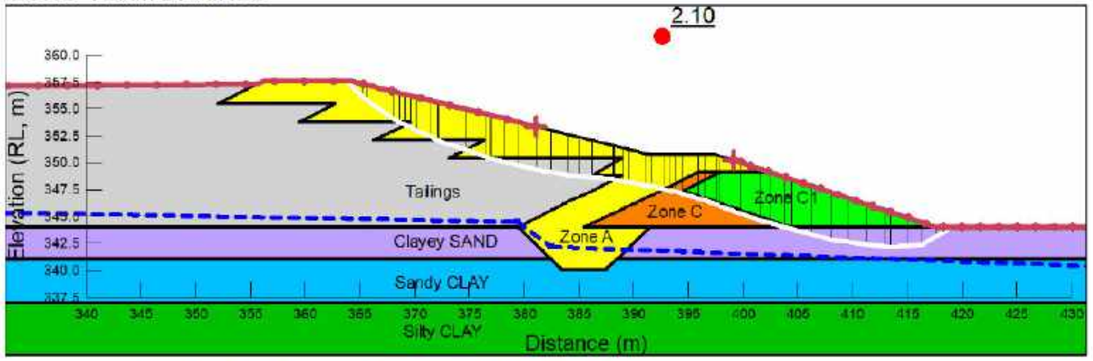

SHORT-TERM UNDRAINED, CONTAINMENT RELEASE
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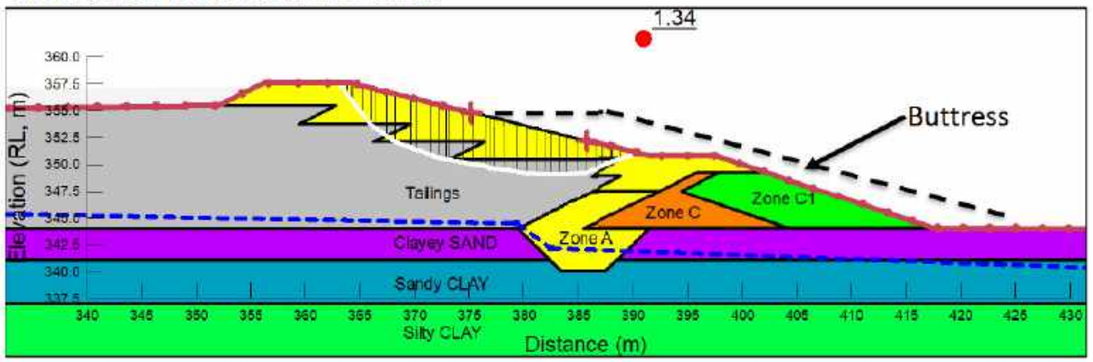

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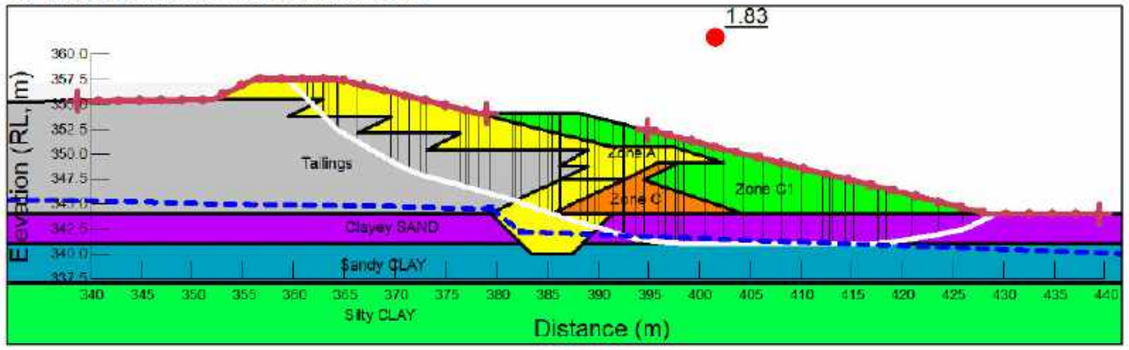

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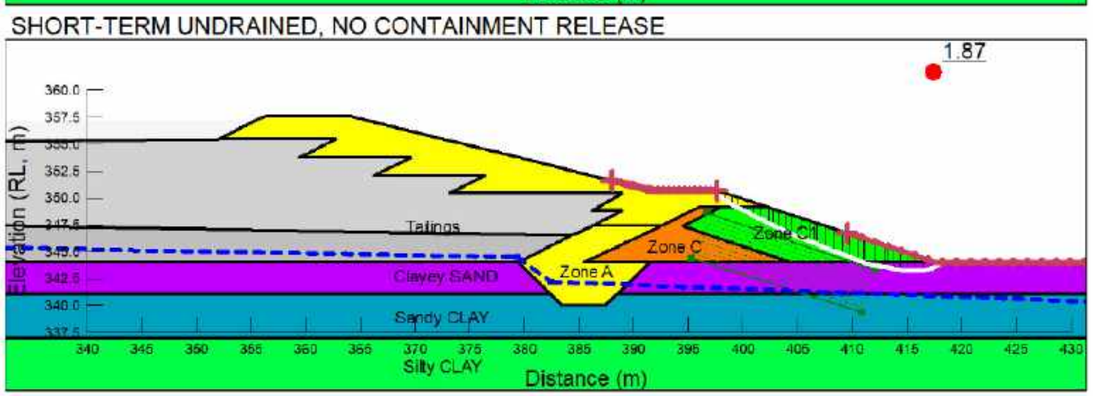

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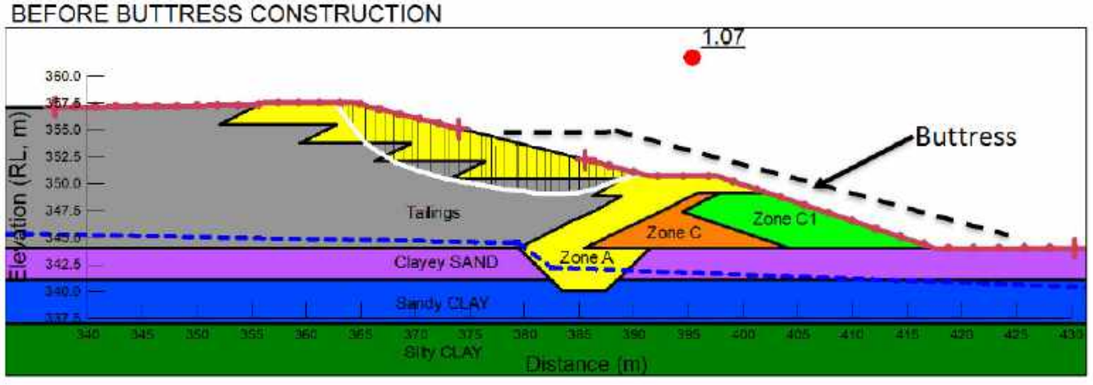

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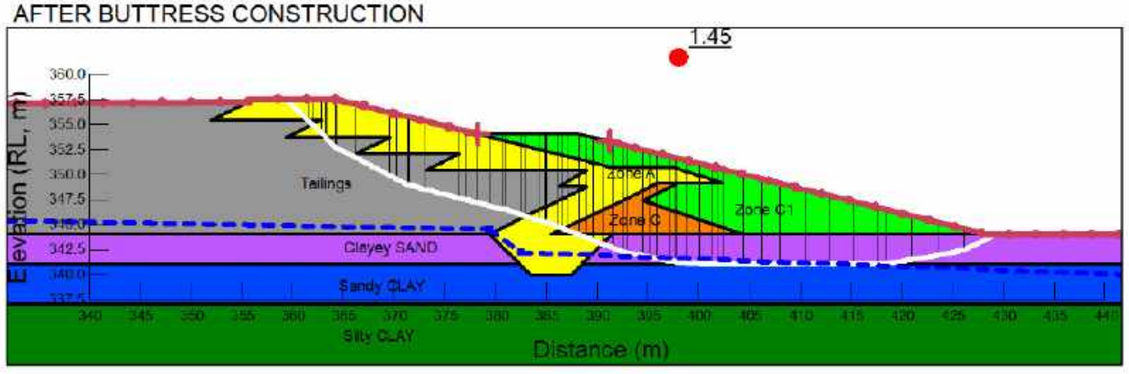

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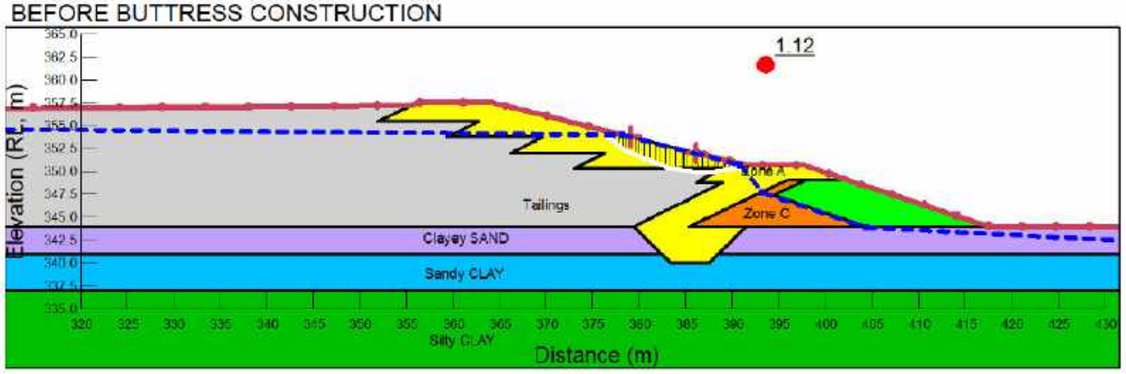

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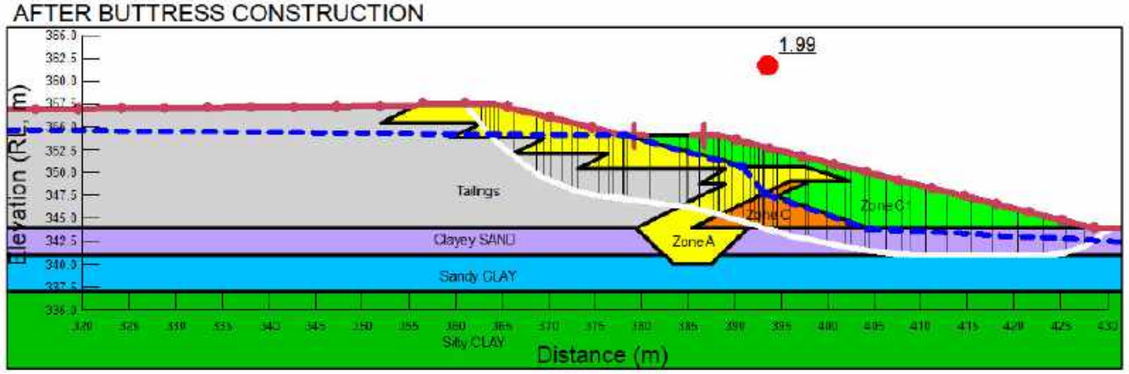

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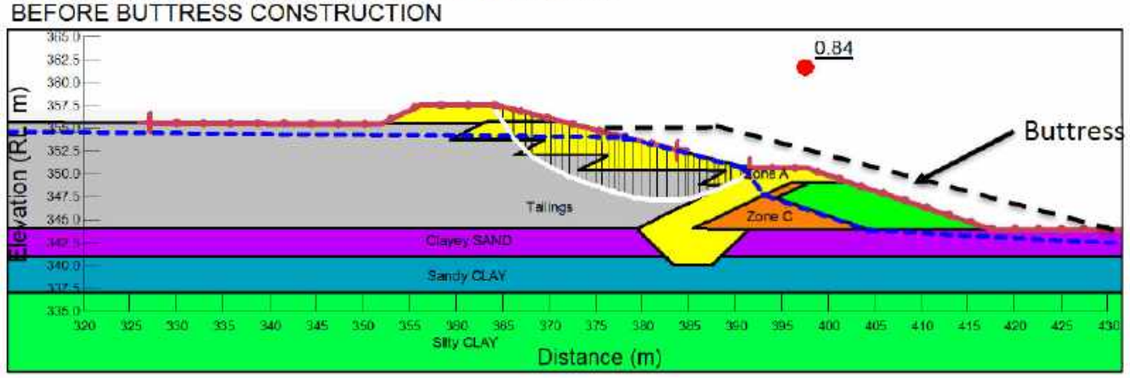

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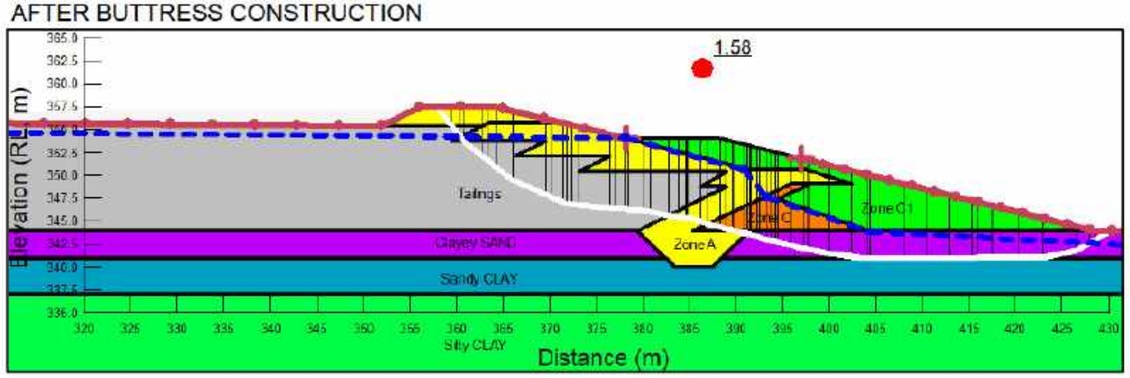

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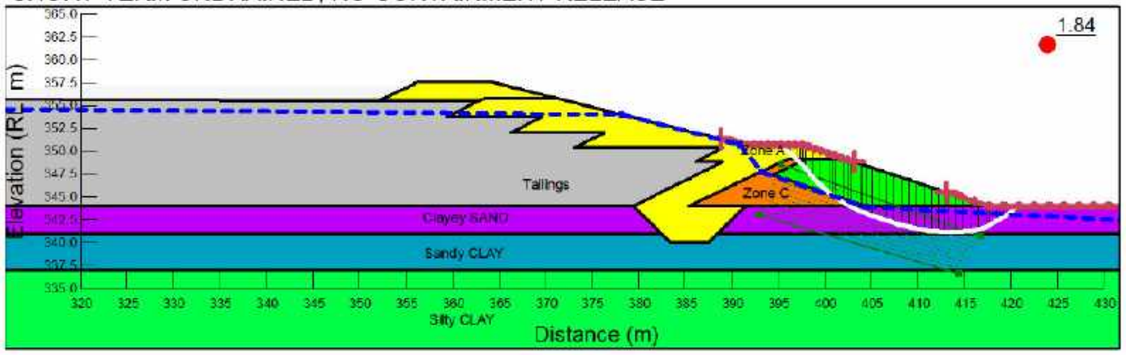

POST-SEISMIC

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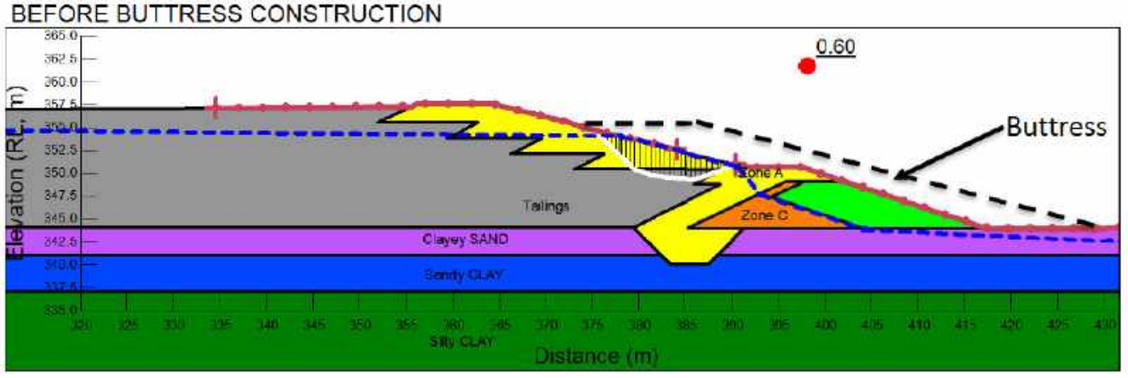

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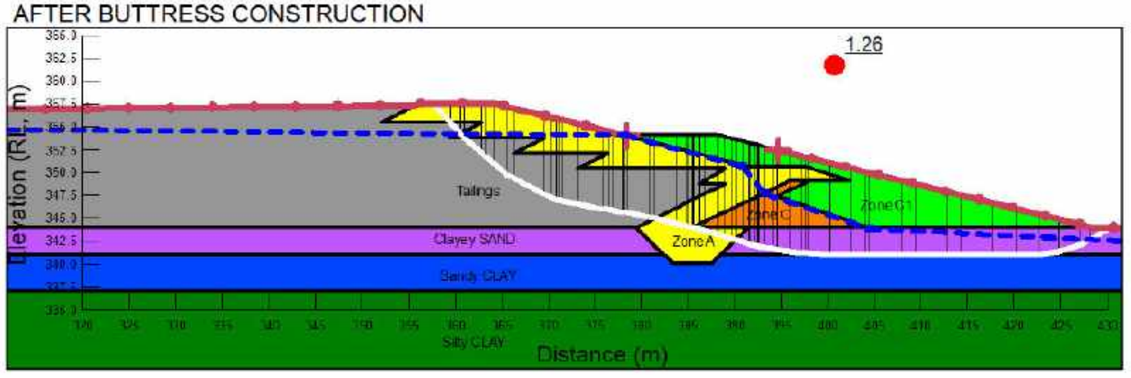

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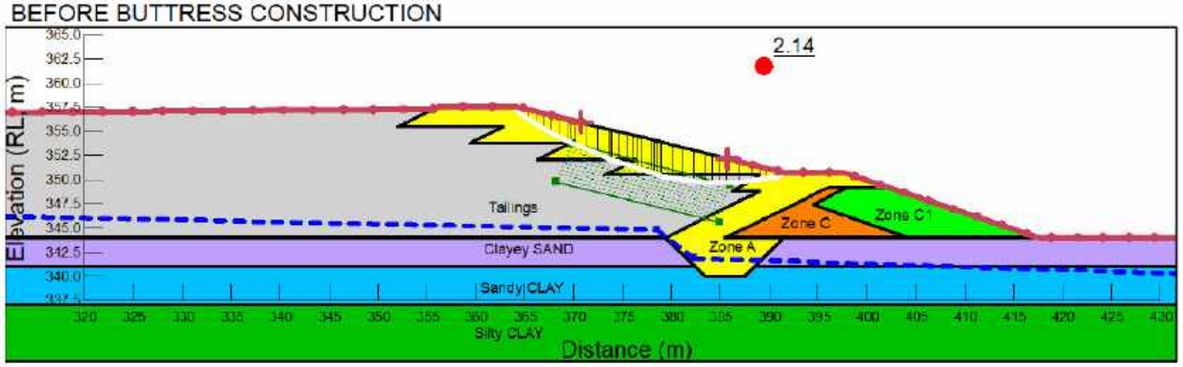

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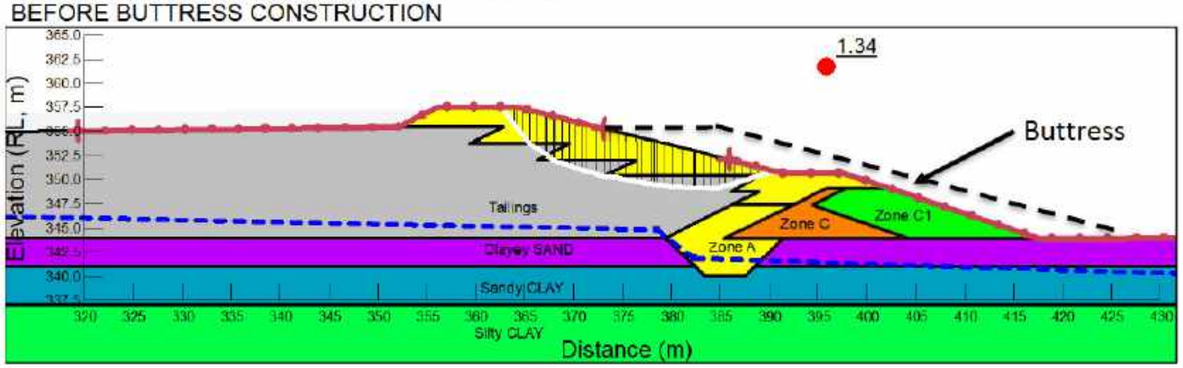

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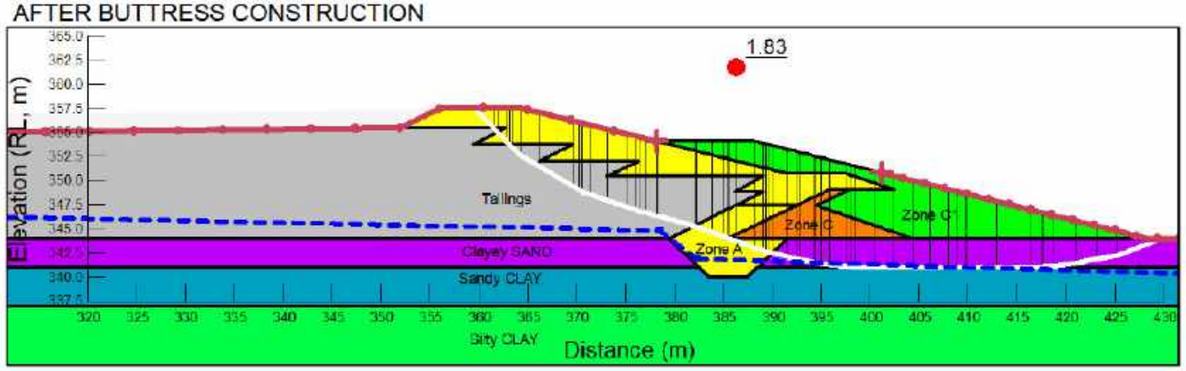

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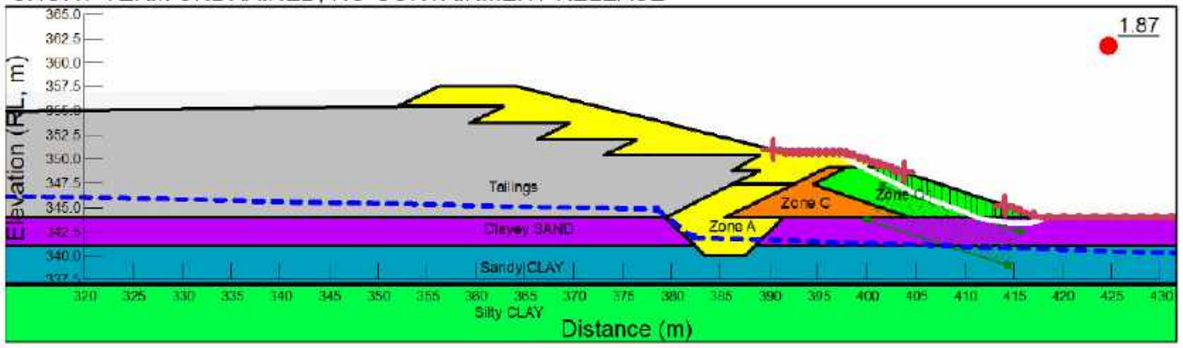

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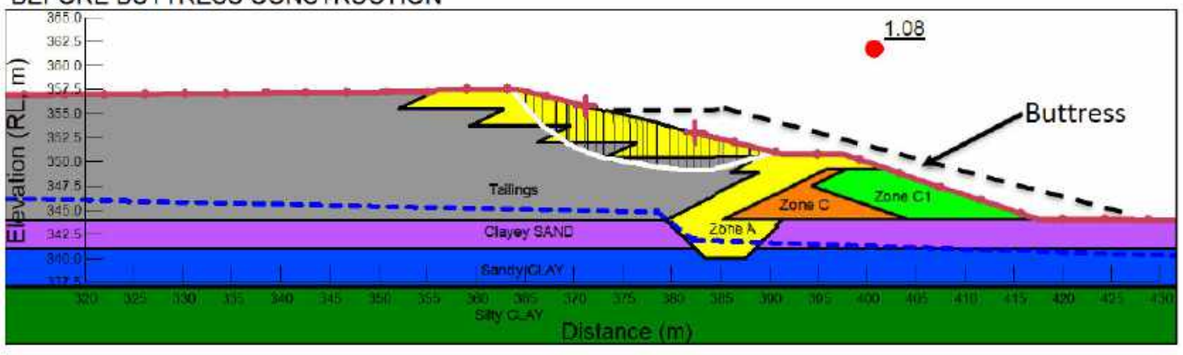

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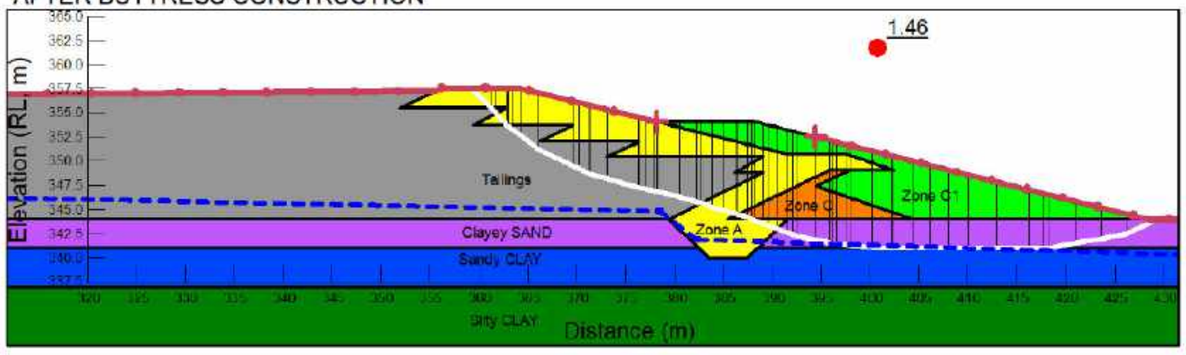

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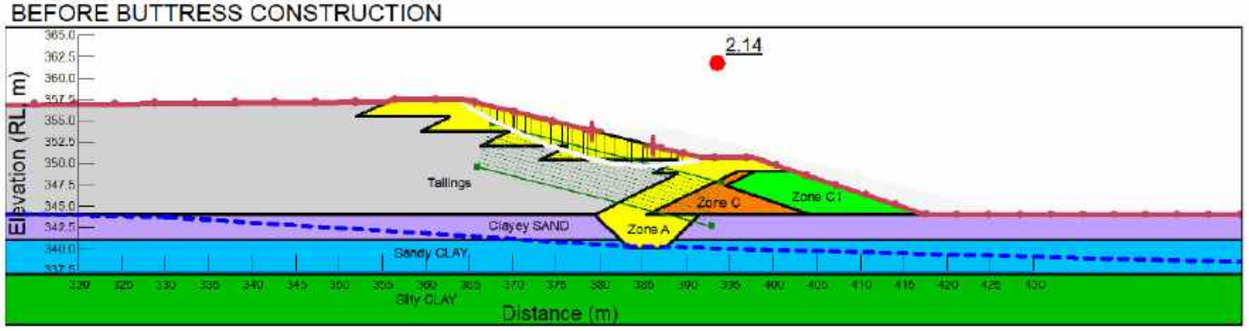

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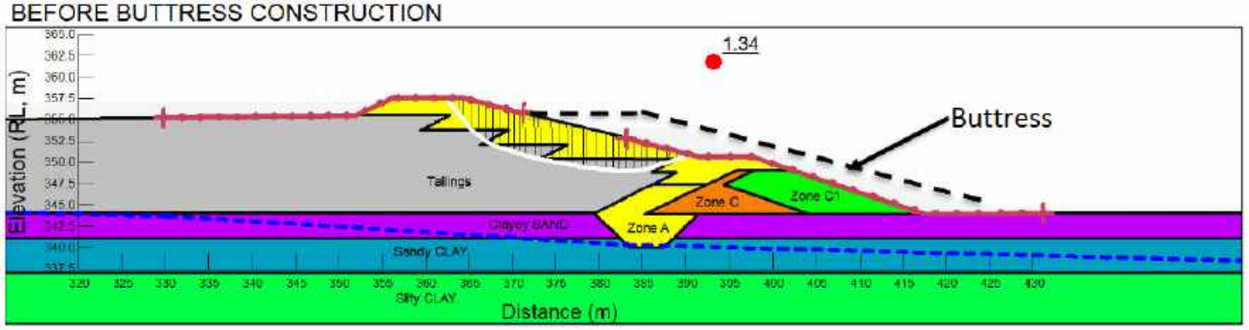

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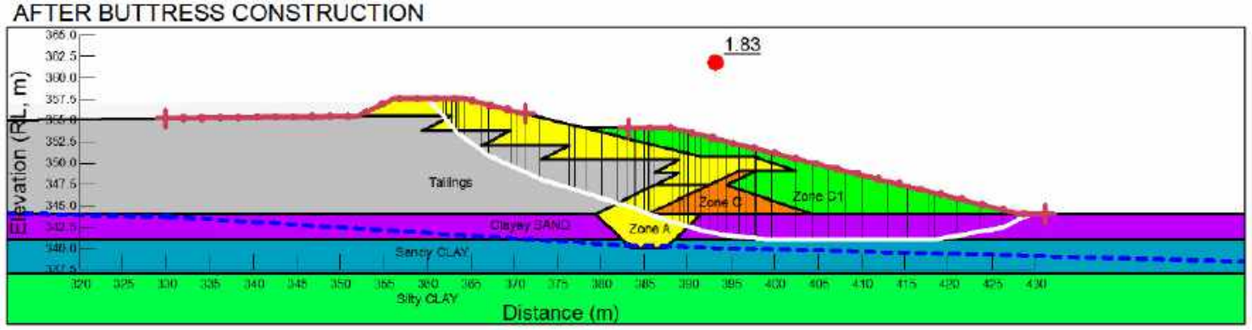

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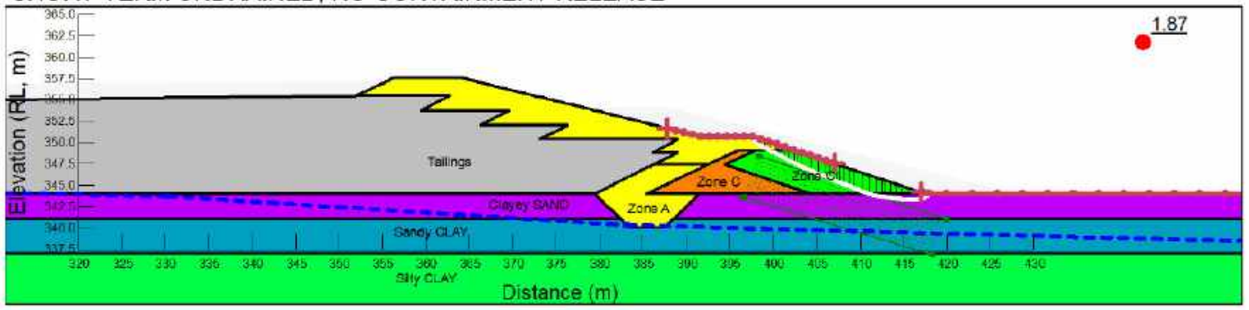

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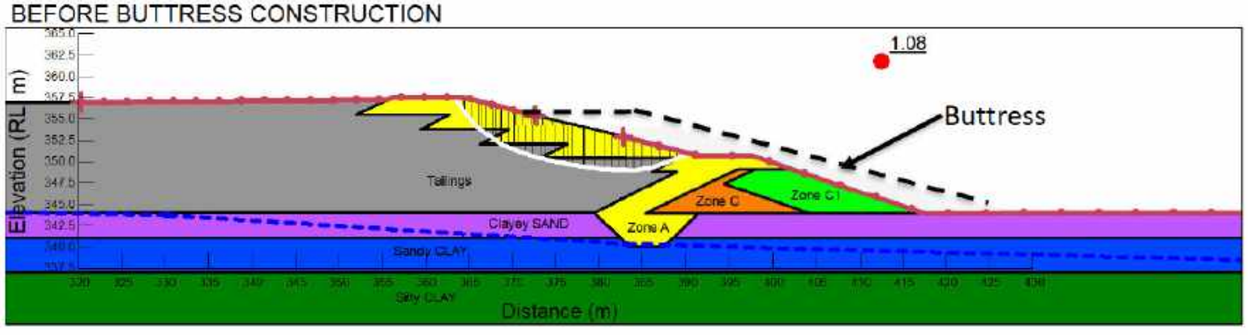

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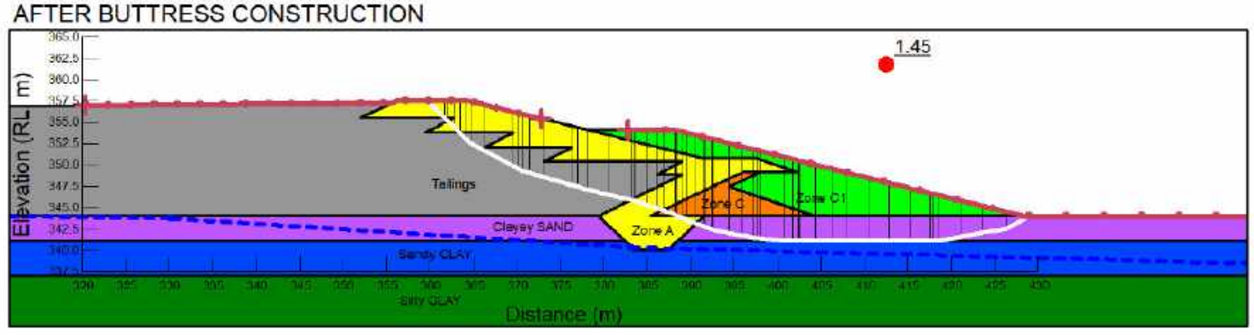

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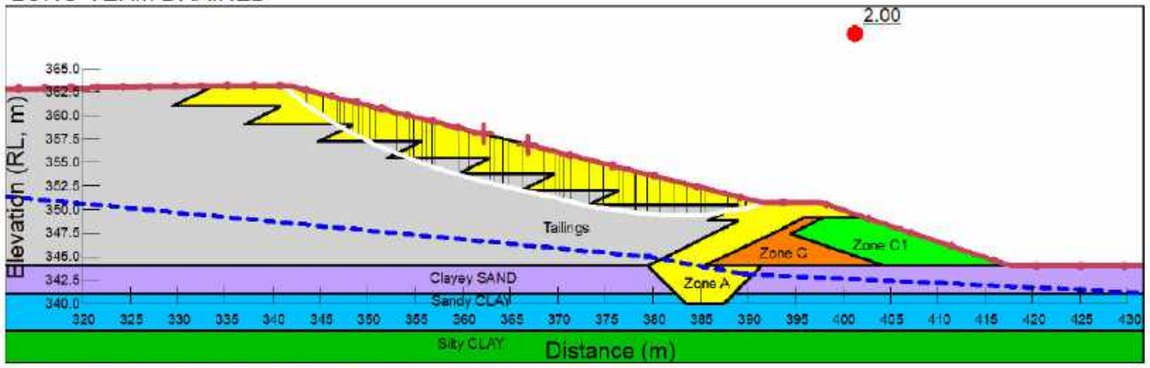

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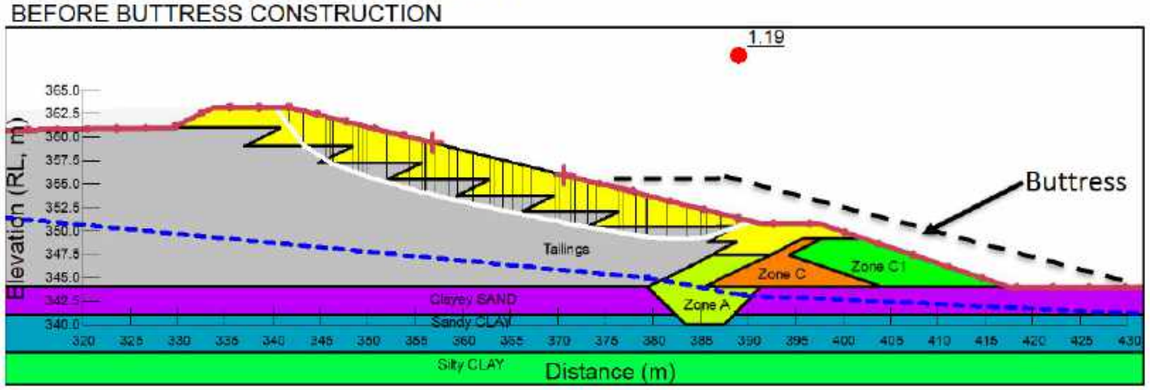

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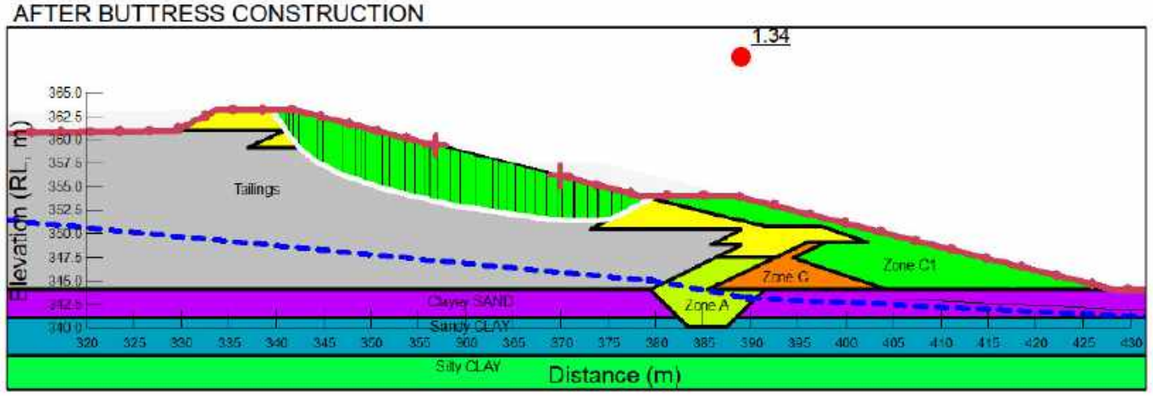

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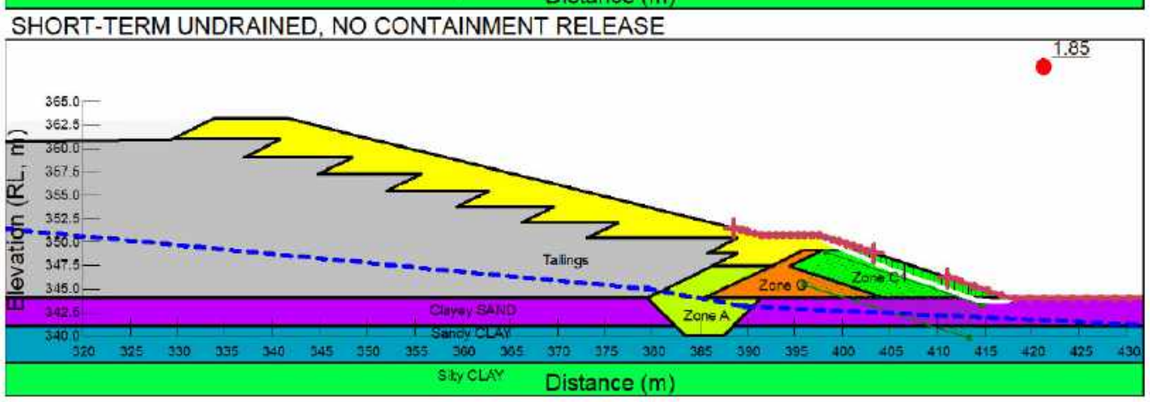

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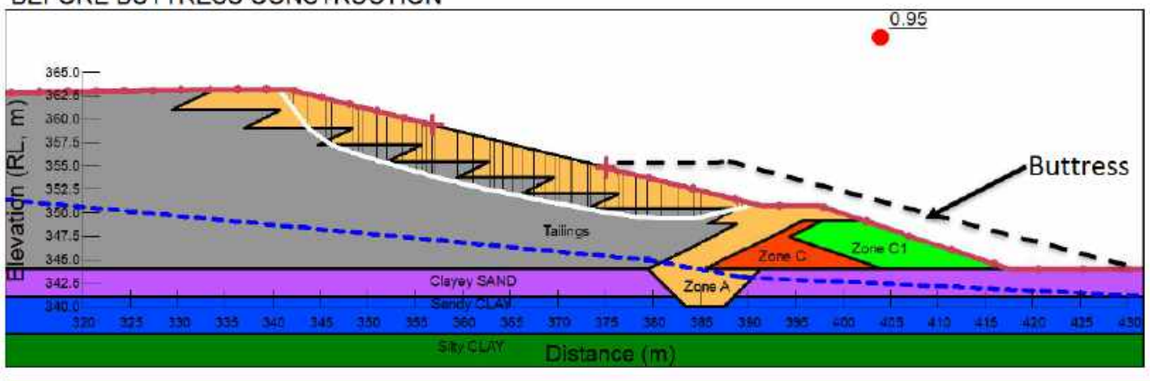

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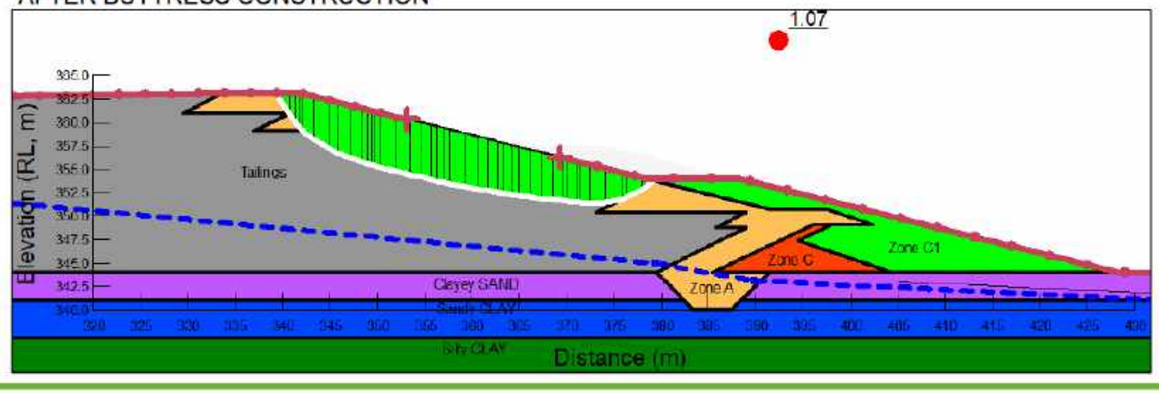

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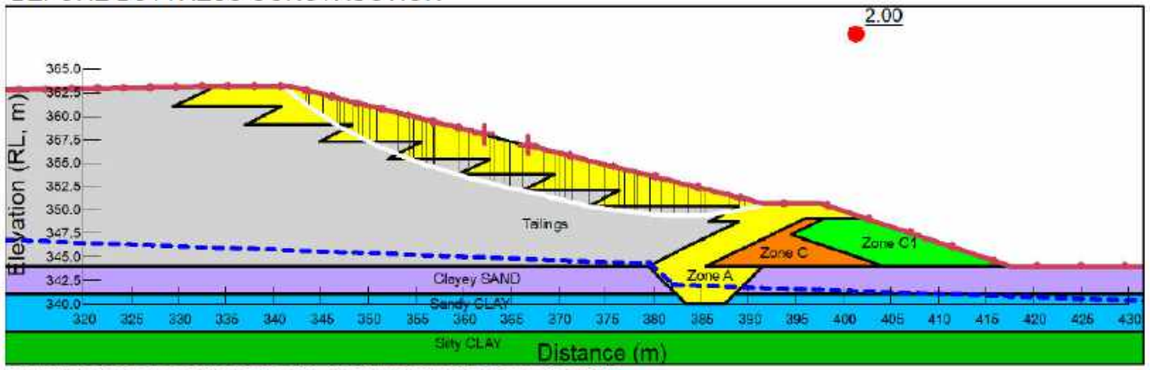

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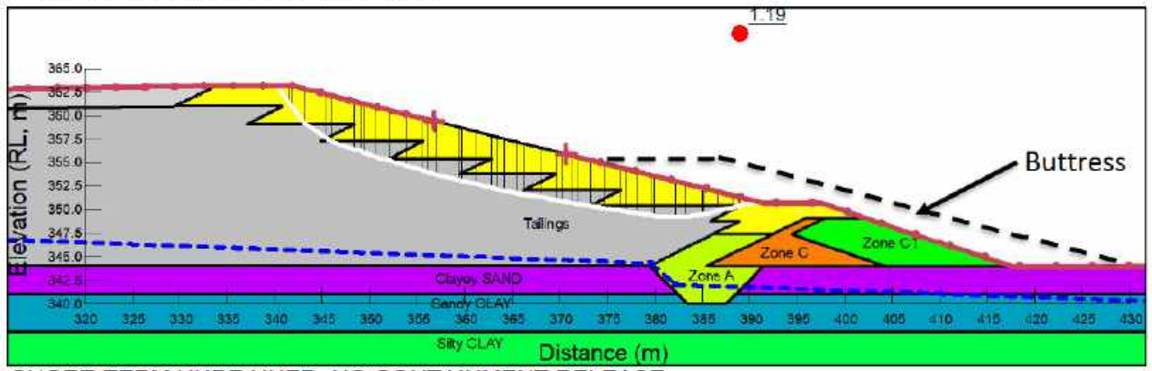

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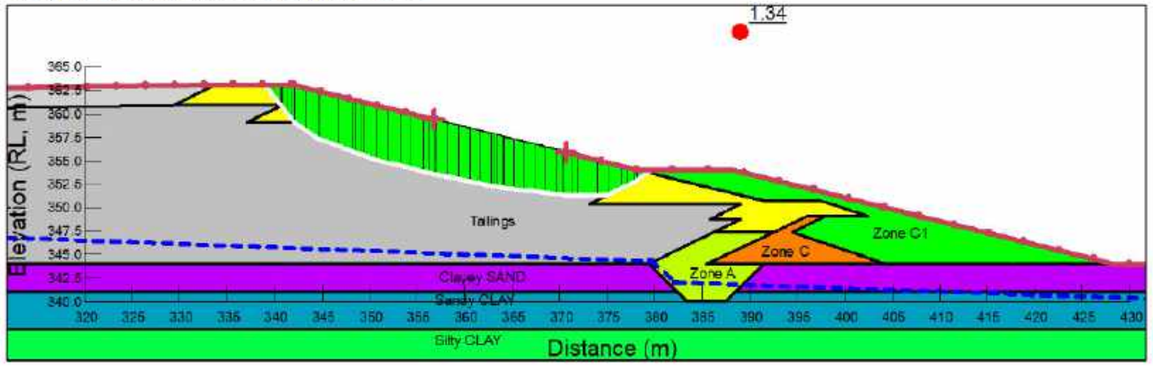

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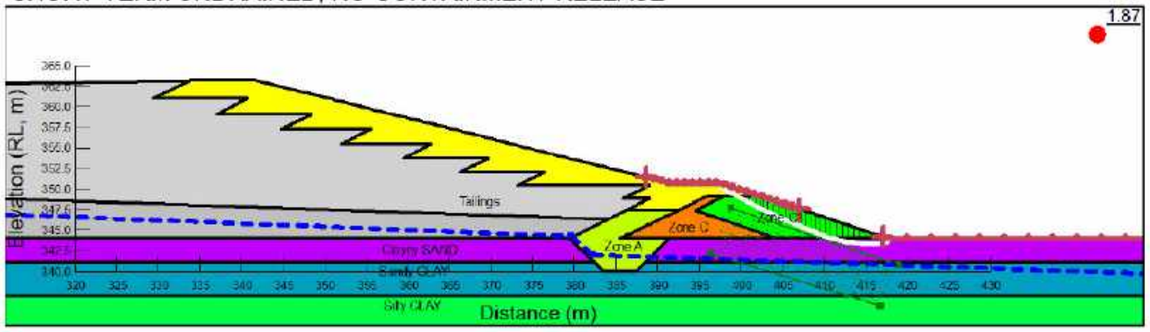

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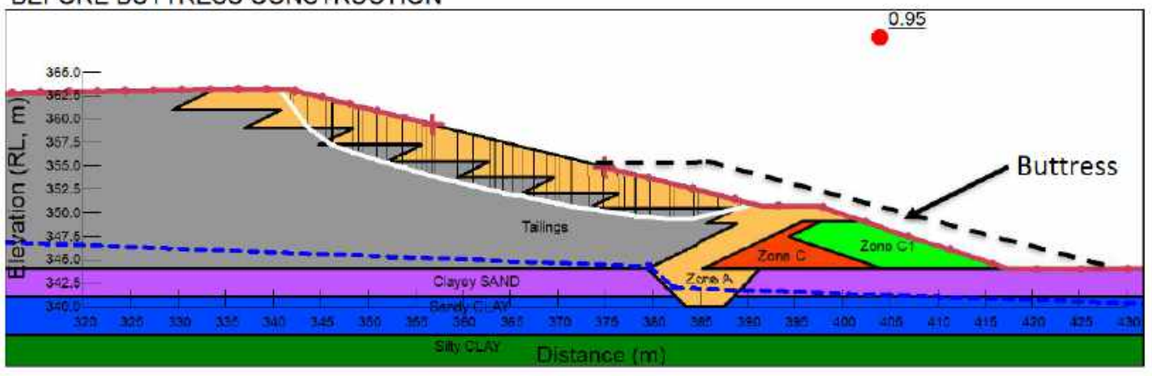

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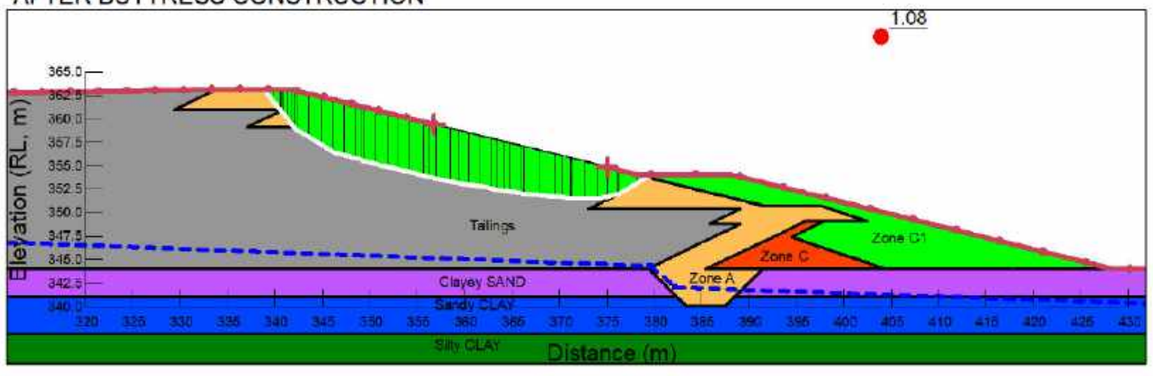

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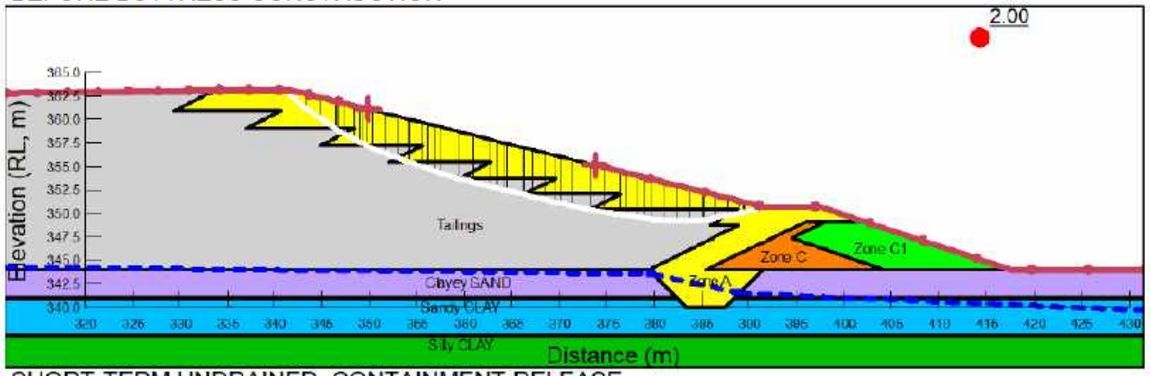

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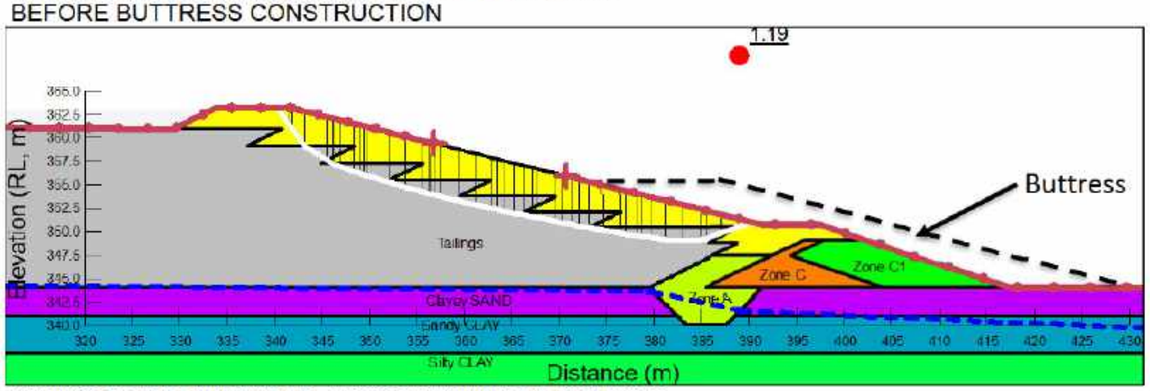

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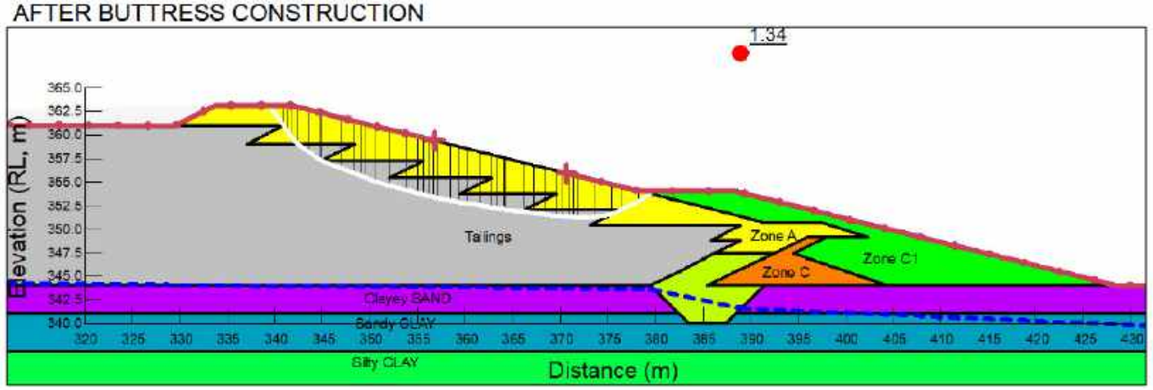

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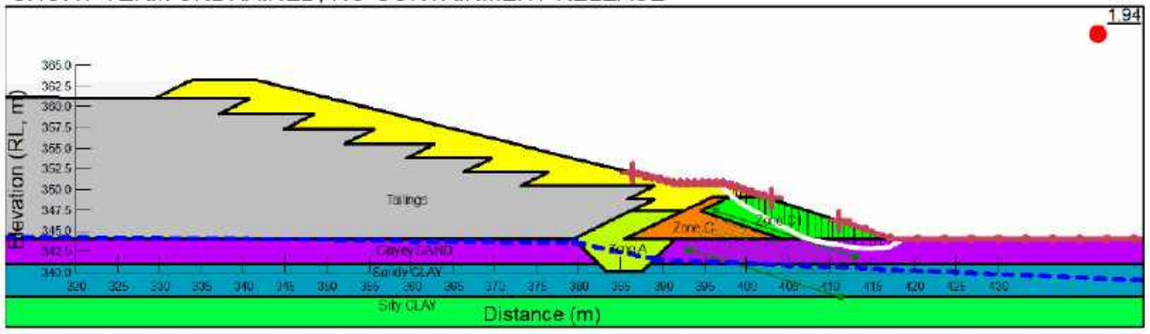

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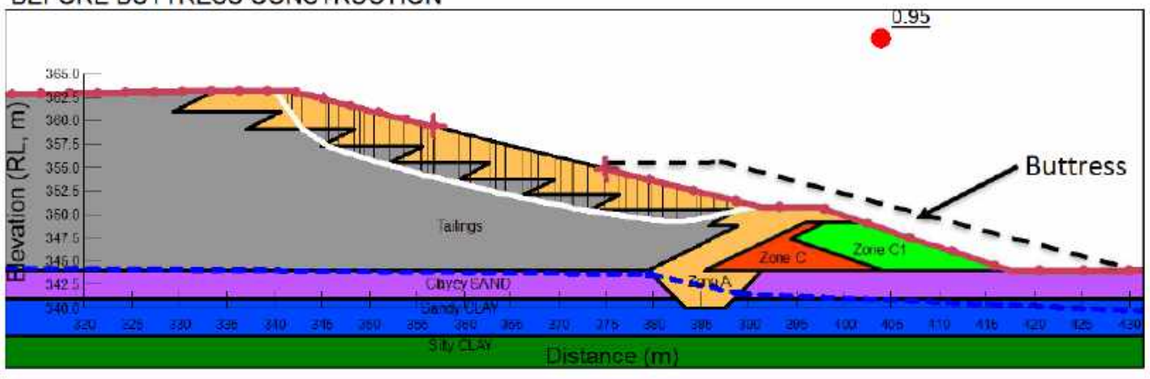

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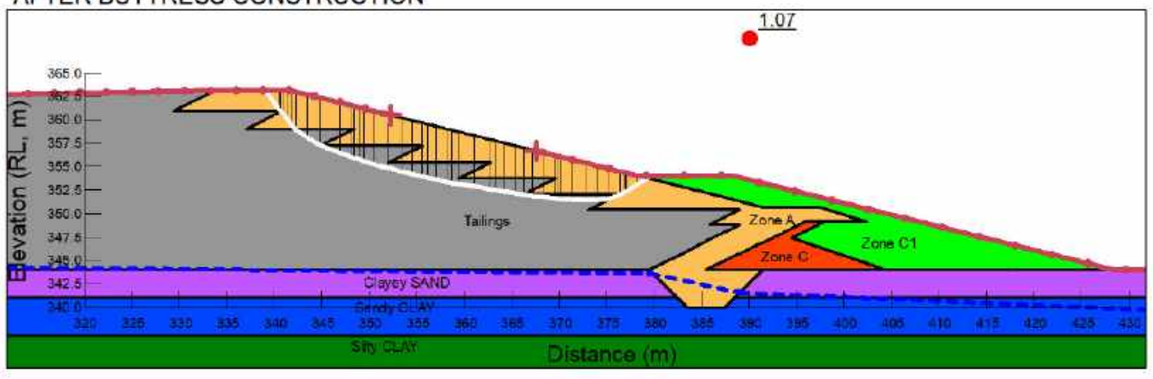


APPENDIX I

Water Management Modelling

Knight Piésold CONSULTING

APPENDIX I – WATER BALANCE MODELLING

I.1. INTRODUCTION

The management of water is critical in terms of the process plant operation, TSF design and return water pumping requirements. A water management model was developed in order to understand the site water flows, to estimate water demand related to tailings and to determine the design embankment crest levels to maintain containment.

The primary objectives of the water balance modelling are summarised below:

- Estimate settled tailings densities.
- Establish the filling rate for tailings solids within the TSF.
- Determine net flows and average supernatant pond volumes within the TSF throughout operation.
- Determine supernatant pond volumes following design rainfall events and extreme rainfall sequences.
- Determine staged embankment crest elevations, to ensure containment of tailings and prevent discharge of supernatant water for design rainfall events and sequences.
- Determine the magnitude of recycle water shortfalls during design dry rainfall sequences.

For the water management model the following inputs into the TSF were included:

- Water in the tailings slurry from the plant.
- Rainfall runoff from the tailings and pond surface and surrounding catchments.

Outputs from the TSF included:

- Evaporation losses.
- Seepage losses.
- Water returned to the plant as process make-up water (pumped system).

The water balance model uses the design tailings throughput together with estimated tailings settled densities to determine the tailings level at various stages in the life of the facility. In addition, the pond volume and pond elevation within the facility are estimated under average climatic conditions. A range of extreme rainfall events were modelled to determine supernatant pond volumes, embankment stage crest levels, and make-up water shortfalls under wet and dry climatic conditions.

The model was run using monthly time-steps for the duration of the operating life. Modelled flows do not represent the design duties for pumps and pipelines or peak flows for rainfall as they are averaged over the month and do not take into account efficiency and availability of the infrastructure.

The current operating strategy for the existing facility assumes a constant throughput is deposited into one cell until capacity is met at which point deposition is transferred into the alternate cell.

For Cells 3 and 4, the same assumption was made given that Cell 3 is likely to be built in advance of Cell 4 thereby receiving the full throughput for an expected 12 months. Given that each cell is near identical in size and will not operate concurrently, only one cell was modelled to assess the water return rates expected. This also provides a conservative estimate on the expected tailings density.

I.2. WATER BALANCE MODELLING PARAMETERS

I.2.1 TAILINGS CHARACTERISTICS

As detailed in a separate memorandum, tailings laboratory testing was carried out on an operating sample in 2015 by KP in order to determine the physical characteristics of the tailings, and assist in estimating the behavioural characteristics of the tailings mass. The key information used for the water balance modelling is presented in Table I.2.1.

Table I.2.1: Tailings characteristics

Parameter	Tailings Sample
Tailings % Solids	42
Settled Tailings Density	
- Minimum (undrained)	1.21 t/m^3
- Maximum (air dried)	1.50 t/m^3
Supernatant Release	
- Minimum	30% of water in slurry
- Maximum	35% of water in slurry
Vertical Permeability	5.0 x 10^{-7} m/s

Tailings production data are provided in Table I.2.2.

Table I.2.2: Tailings production data

Parameter	Value (Single Cell / Total)
Total Throughput	12.5 Mt / 25 Mt
Life of Mine	10 years
Annual Throughput Rate	2.5 Mtpa

I.2.2 RUNOFF COEFFICIENTS

Runoff coefficients used in water balance modelling are presented in Table I.2.3.

Table I.2.3: Runoff coefficients

Parameter	Adopted Value
Runoff Coefficients (monthly model)	
- tailings beach (drying)	0.8
- tailings beach (active)	1.0
- supernatant pond	1.0
Runoff Coefficients (short duration storm)	
- all areas	1.0

I.2.3 ADDITIONAL PARAMETERS

Additional modelling data used in the model for the TSF are listed in Table I.2.4.

Table I.2.4: Additional modelling parameters

Parameter	Value
TSF catchment	50 Ha (One Cell Only)
Tailings % Solids	42%
Operating Hours	8000 h/year
Tailings beach slope	0.83%
Minimum supernatant pond volume	8,000 m^3
TSF basin permeability	1 x 10^{-8} m/s
Commissioning month	January
Minimum Raw Water Requirement	10% of total water in slurry
Maximum TSF Recycle Rate	95% of total water in slurry

The minimum operating supernatant pond operating volume is based on a minimum pond depth of approximately 1 m at the deepest location of the pond.

I.3. WATER BALANCE MODELLING RESULTS

For water management modelling, various rainfall conditions were modelled for selected operational years. The following rainfall sequences were modelled:

- Average climatic conditions.
- 1% Annual Exceedance Probability (AEP), 1 year dry rainfall sequence.
- 1% AEP, 1 year wet rainfall sequence.
- 1% AEP, 72 hour duration storm event superimposed over average rainfall sequence.

Monthly rainfall and evaporation values are presented in Appendix B, including design wet and dry rainfall sequences.

I.3.1 AVERAGE CONDITIONS

Water management modelling using average climatic conditions allows general trends in the behaviour of the water management system to be determined.

Modelling results for the TSF under average conditions are shown on Figure I.1, showing the tailings and supernatant pond elevations within the TSF on a monthly time step. Supernatant pond volumes and associated shortfalls for average conditions modelling are shown on Figure I.2. Observations from the average conditions modelling are summarised below:

- The water balance is negative throughout operation, without storing any water in the TSF each operational year under average conditions. The supernatant pond volume operates at its minimum capacity of 8,000 m^3 throughout the life of the operation.
- Under average conditions, the distance between the TSF main embankment and the supernatant pond is typically 200 to 350 metres.
- The supernatant pond will be centred in each cell through the life of the facility if operated correctly.
- The average recycle rates presented in Table I.3.1 represent the average monthly recycle volume under average rainfall conditions. The maximum and minimum rates show the range of monthly values throughout each year.

- A recycle water shortfall occurs during each month of operation. The largest shortfall occurs in January whilst the minimum shortfall occurs during August.

Table I.3.1: Average conditions – TSF recycle rates

Year	Total Recycle Volume (m^3/year)	Average Monthly Recycle Rate (m^3)	Maximum Monthly Recycle Rate (m^3)	Minimum Monthly Recycle Rate (m^3)
2021	1,018,000	85,000	100,000	64,000
2022	1,025,000	86,000	101,000	70,000
2023	1,033,000	87,000	101,000	70,000
2024	1,036,000	87,000	101,000	70,000
2025	1,038,000	87,000	101,000	70,000
2026	1,040,000	87,000	101,000	71,000
2027	1,043,000	87,000	101,000	71,000
2028	1,044,000	87,000	100,000	71,000
2029	1,049,000	88,000	101,000	71,000
2030	1,050,000	88,000	101,000	71,000
	Average	87,000	101,000	70,000
	Min	85,000	100,000	64,000
	Max	88,000	102,000	71,000

Average conditions modelling results were used to determine the TSF embankment crest elevations throughout the operation.

I.3.2 DESIGN DRY CONDITIONS

Modelling of design dry rainfall sequences was completed for each year of TSF operation. The design case considered was:

- 1% AEP 12 month dry rainfall sequence.

The results from dry condition modelling are plotted in Figure I.3.

TSF recycle rates for design dry conditions modelling are summarised in Table I.3.2. The average recycle rates presented in Table I.3.2 represent the average monthly recycle volume for a 1% AEP, dry annual rainfall sequence occurring during each year of operation. The maximum and minimum rates show the range of monthly values throughout each year.

Table I.3.2: Dry conditions – TSF recycle rates (1% AEP)

Year	Total Recycle Volume (m^3/year)	Average Monthly Recycle Rate (m^3)	Maximum Monthly Recycle Rate (m^3)	Minimum Monthly Recycle Rate (m^3)
2021	957,000	80,000	96,000	65,000
2022	957,000	80,000	94,000	65,000
2023	967,000	81,000	94,000	70,000
2024	967,000	81,000	93,000	70,000
2025	970,000	81,000	93,000	70,000
2026	972,000	81,000	93,000	70,000
2027	975,000	82,000	93,000	71,000
2028	975,000	82,000	93,000	71,000
2029	979,000	82,000	93,000	71,000
2030	982,000	82,000	93,000	71,000
	Average	82,000	94,000	70,000
	Min	80,000	93,000	65,000
	Max	82,000	96,000	71,000

Under dry rainfall modelling conditions there is a plant short fall each month throughout the life of the facility.

Key observations from the dry condition modelling are as follows:

- If the 1% AEP, dry annual rainfall sequence occurs in any year of TSF operation, the TSF supernatant pond volume will operate at its minimum capacity of 8,000m^3.

I.3.3 DESIGN WET CONDITIONS

Modelling of design wet rainfall sequences was completed for each year of TSF operation.

The design cases considered were:

- 1% AEP, 12 month wet rainfall sequence.
- 1% AEP, 72 hour duration storm event superimposed over average rainfall sequence.

The results from wet condition modelling are plotted in Figure I.4.

The average recycle rates presented in Table I.3.3 represent the average monthly recycle volume for a 1% AEP, wet annual rainfall sequence occurring during each year of operation. The maximum and minimum rates show the range of monthly values throughout each year.

Table I.3.3: Wet conditions – TSF recycle rates (1% AEP)

Year	Total Recycle Volume (m^3/year)	Average Monthly Recycle Rate (m^3)	Maximum Monthly Recycle Rate (m^3)	Minimum Monthly Recycle Rate (m^3)
2021	1,136,000	95,000	125,000	63,000
2022	1,123,000	95,000	122,000	63,000
2023	1,148,000	95,000	121,000	69,000
2024	1,148,000	95,000	121,000	69,000
2025	1,149,000	95,000	121,000	69,000
2026	1,149,000	96,000	121,000	69,000
2027	1,150,000	96,000	120,000	70,000
2028	1,150,000	96,000	120,000	70,000
2029	1,156,000	97,000	120,000	70,000
2030	1,156,000	97,000	120,000	70,000
	Average	96,000	122,000	69,000
	Min	95,000	120,000	63,000
	Max	97,000	125,000	70,000

For all design wet cases, the TSF supernatant pond accumulates runoff and grows in volume during the wet season, then reduces in volume during the subsequent dry season back to its minimum operating volume. Peak supernatant pond volumes are provided in Table I.3.4. For short-term storm event modelling, the design event (1% AEP, 72 hour storm event) was added to the wettest month of the year under average conditions. Peak pond volumes occur in June of each year for all design wet rainfall sequences.

Table I.3.4: Wet conditions – Peak TSF supernatant pond volume

Year	Average Conditions Peak Pond Volume (m^3)	1% AEP Wet Peak Pond Volume (m^3)	Average Conditions + 72-hour 1% AEP Peak Pond Volume (m^3)
1	8,000	8,300	120,000
2	8,000	8,300	130,000
3	8,000	8,300	130,000
4	8,000	8,300	125,000
5	8,000	8,300	122,000
6	8,000	8,300	120,000
7	8,000	8,300	118,000
8	8,000	8,300	116,000
9	8,000	8,300	114,000
10	8,000	8,300	112,000

Key observations from the wet condition modelling are as follows:

- The embankment crest elevations are governed by the tailings deposition elevation for all stages and not pond levels.
- The supernatant pond does not exceed the tailings deposition level at any stage of operation.
- The supernatant pond grows in size during each wet season for a design recurrence interval wet period and then reduces back to its minimum operating volume during the dry season of the design scenarios.

I.4. CONCLUSIONS AND RECOMMENDATIONS

Water balance modelling results are summarised in Table I.4.1.

Table I.4.1: Water balance modelling summary

	Design Conditions			
	Average Rainfall Conditions	1% AEP Dry Year Rainfall Conditions	1% AEP Wet Year Rainfall Conditions	Average Conditions + 72-hour 1% AEP Storm
Peak Monthly Supernatant Pond Volume (m^3)	8,000	8,000	8,300	130,000
Average TSF Recycle Rate (m^3)	87,000	82,000	96,000	-
Maximum Monthly TSF Recycle Rate (m^3)	101,000	94,000	122,000	-
Minimum Monthly TSF Recycle Rate (m^3)	70,000	70,000	69,000	-

Based on the modelling undertaken, a number of conclusions can be drawn:

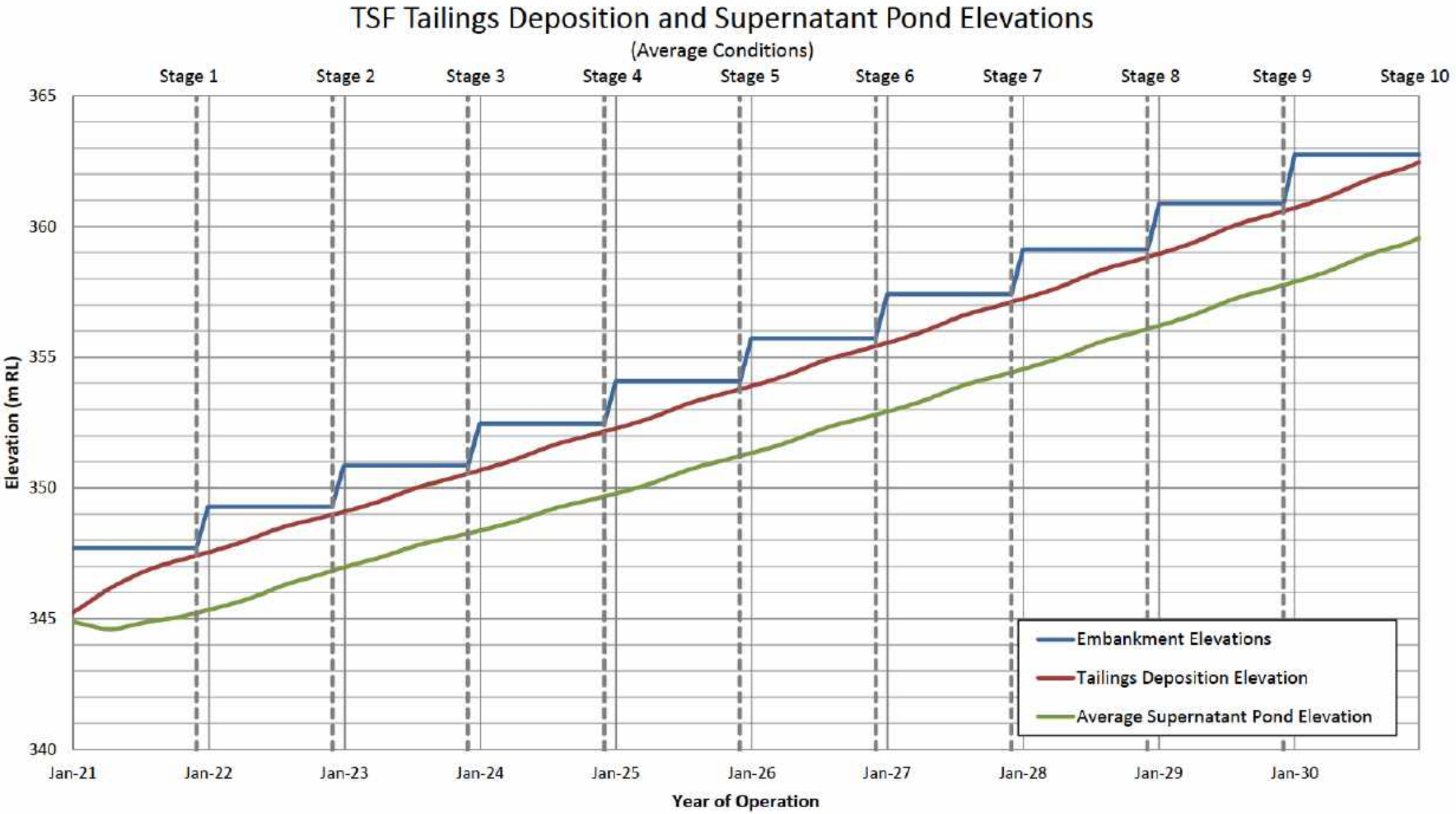
- There is sufficient stormwater storage capacity on the TSF to accommodate all design storm events and rainfall sequences, with sufficient freeboard to comply with regulations.
- A typical year of TSF recycle is shown in Table I.4.2. Year 6 of operation has been nominally selected.

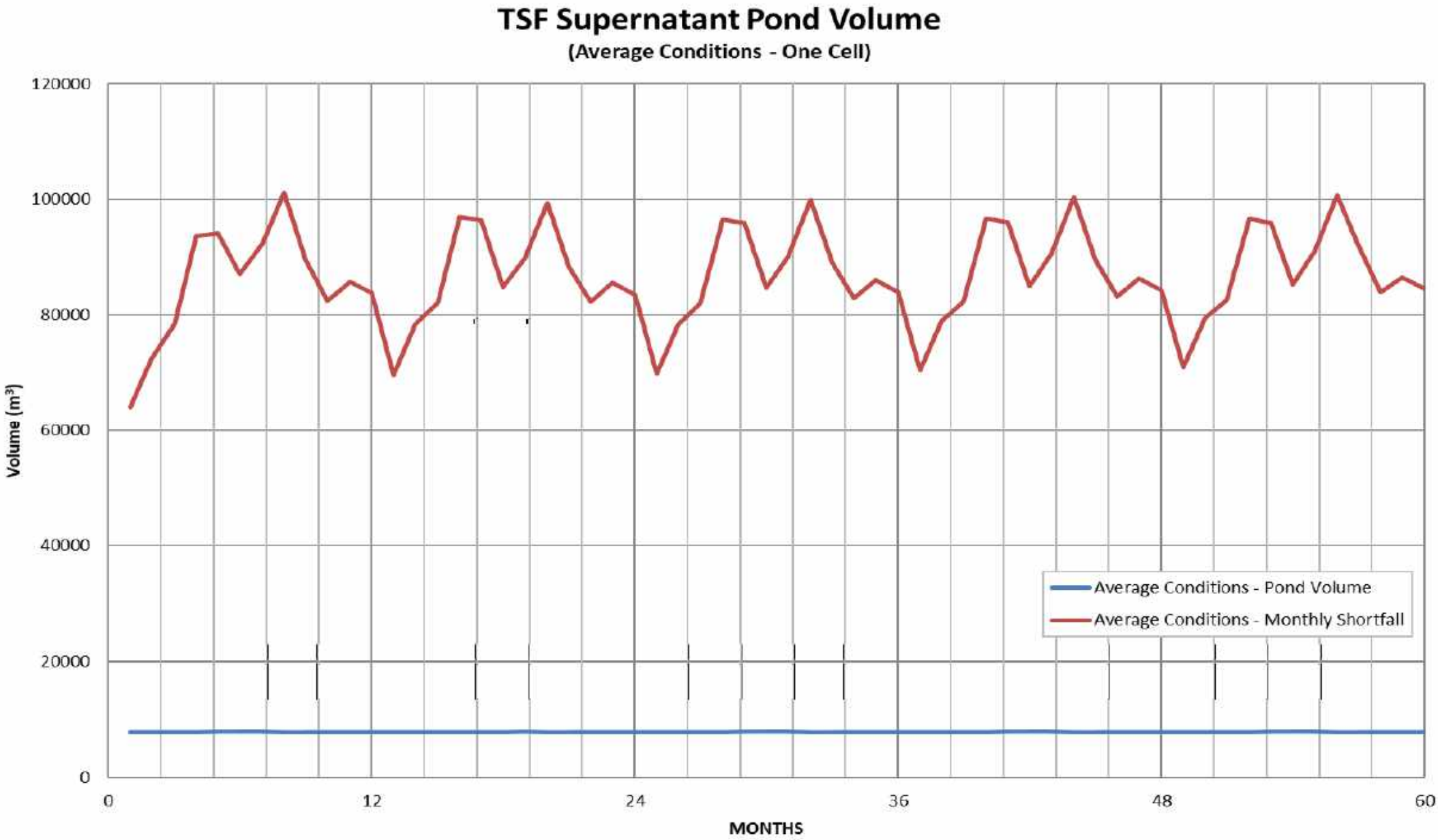
Table I.4.2: Monthly recycle rates – Year 6

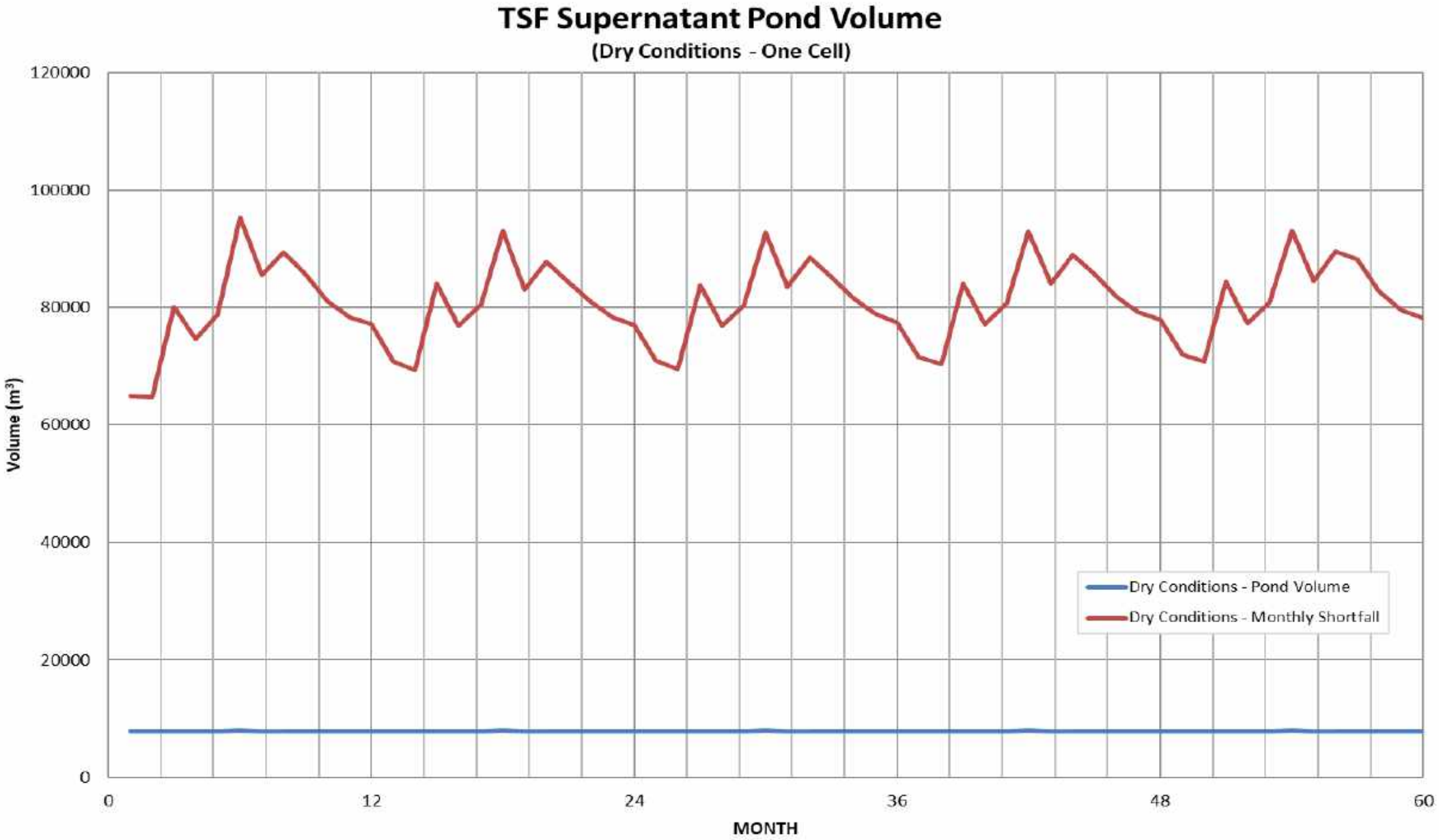
Month	Recycle Rate (m^3/month)		
	Average Rainfall Conditions	1% AEP Dry Year Rainfall Conditions	1% AEP Wet Year Rainfall Conditions
January	70,000	72,000	69,000
February	79,000	70,000	79,000
March	82,000	84,000	119,000
April	97,000	77,000	111,000
May	96,000	81,000	116,000
June	85,000	93,000	122,000
July	91,000	84,000	85,000
August	101,000	89,000	118,000
September	89,000	86,000	99,000
October	83,000	82,000	86,000
November	87,000	79,000	78,000
December	84,000	78,000	78,000

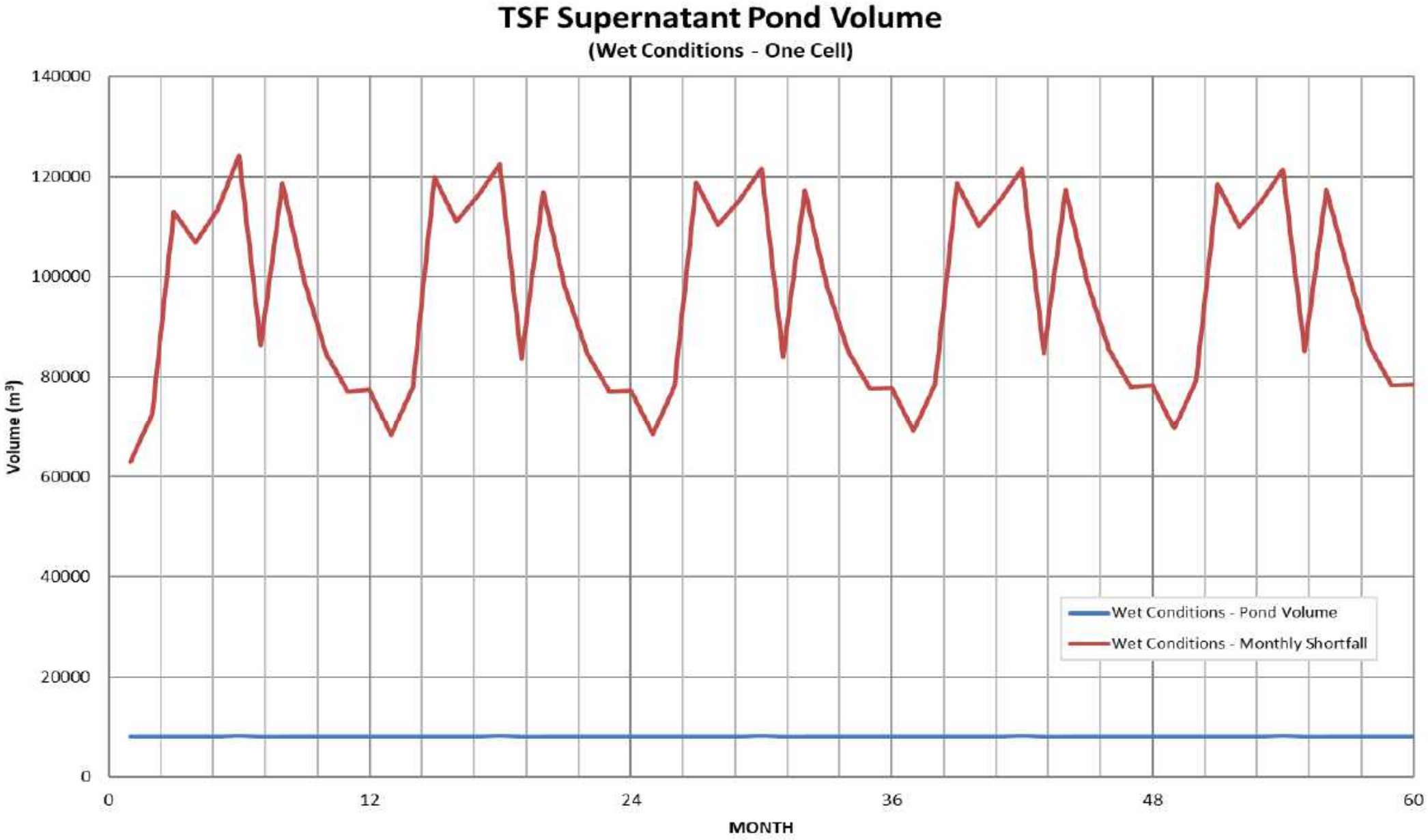
- Under average conditions, a recycle water shortfall (maximum 2,057,000 m^3 over 12 months in Year 1) occurs during each month of operation throughout the life of the facility.
- The maximum annual recycle water shortfall for 1% AEP dry conditions is 2,129,000 m^3 (occurring over a 12 month period), during Year 2 of operation. The maximum monthly recycle water shortfall in this period is 193,000 m^3 occurring in the first month of operation.
- The maximum annual recycle water shortfall for 1% AEP wet conditions is 1,959,000 m^3 (occurring over a 12 month period), during the second year of operation. The maximum monthly recycle water shortfall in this period is 195,000 m^3 occurring in the first month of operation.
- Due to the low but relatively consistent recycle rates throughout each year of operation, it is recommended that any external water supply be based on an annual 25 - 35% recycle from the TSF, but with the capacity to pump with no recycle for short periods.
- It is recommended that the decant return pump capacity be designed for maximum recycle from the TSF, i.e.95% of water in slurry.

APPENDIX I – FIGURES


TSF Tailings Deposition and Supernatant Pond Elevations
(Average Conditions)
Stage 1
Stage 2
Stage 3
Stage 4
Stage 5
Stage 6
Stage 7
Stage 8
Stage 9
Stage 10
365
360
355
350
345
340
Elevation (m RL)
Jan-21
Jan-22
Jan-23
Jan-24
Jan-25
Jan-26
Jan-27
Jan-28
Jan-29
Jan-30
Year of Operation
Embankment Elevations
Tailings Deposition Elevation
Average Supernatant Pond Elevation


TSF Supernatant Pond Volume
(Average Conditions - One Cell)
120000
100000
80000
60000
40000
20000
0
Volume (m³)
0
12
24
36
48
60
MONTHS
Average Conditions - Pond Volume
Average Conditions - Monthly Shortfall


TSF Supernatant Pond Volume
(Dry Conditions - One Cell)
120000
100000
80000
60000
40000
20000
0
Volume (m³)
0
12
24
36
48
60
MONTH
Dry Conditions - Pond Volume
Dry Conditions - Monthly Shortfall


TSF Supernatant Pond Volume
(Wet Conditions - One Cell)
Volume (m³)
140000
120000
100000
80000
60000
40000
20000
0
0
12
24
36
48
60
MONTH
Wet Conditions - Pond Volume
Wet Conditions - Monthly Shortfall

APPENDIX J

Life of Mine Quantities

Knight Piésold CONSULTING

Mungari Gold Project

TSF Cell 3 and Cell 4 LOM Quantities Rev B

ITEM	Description	Unit	Stage 1		Stage 2		Stage 3		Stage 4		Stage 5		Stage 6		Stage 7		Stage 8		Stage 9		Stage 10		Closure
			Cell 3	Cell 4	Cell 3	Cell 4	Cell 3	Cell 4	Cell 3	Cell 4	Cell 3	Cell 4	Cell 3	Cell 4	Cell 3	Cell 4	Cell 3	Cell 4	Cell 3	Cell 4	Cell 3	Cell 4	
			Qty		Qty		Qty		Qty		Qty		Qty		Qty		Qty		Qty		Qty		Qty
1	**PRELIMINARY AND GENERAL**																						
1.01	Mobilisation	item	1		1		1		1		1		1		1		1		1		1		
1.02	Deliverables	item	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
1.03	Management, supervision and staff recurring costs	weeks	18	18	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	
1.04	Demobilisation	item		1		1		1		1		1		1		1		1		1		1	
2	**MATERIALS SUPPLY**																						
2.01	Excavate from waste rock stockpiles, process, haul and place in stockpile adjacent to TSF - Zone E	m^3	1,670	1,610																			
2.02	Excavate from waste rock stockpiles, process, haul and place in stockpile adjacent to TSF - Zone F1	m^3	5,680	5,590																			
2.03	Excavate from waste rock stockpiles, process, haul and place in stockpile adjacent to TSF - Zone F2	m^3	1,700	1,700																			
2.04	Excavate from waste rock stockpiles, process, haul and place in stockpile adjacent to TSF - Zone G	m^3	1,800	1,800	800	800	700	700	800	800	800	800	800	800	800	800	800	800	900	900	900	900	
2.05	Excavate from waste rock stockpiles, process, haul and place in stockpile adjacent to TSF - Wearing Course	m^3	4,210	3,020	4,310	3,120	4,210	3,120	4,200	3,120	4,100	3,130	4,000	3,030	3,990	3,030	3,890	3,040	3,880	3,040	3,880	3,490	
3	**SITE PREPARATION**																						
3.01	Clear and grub vegetation from topsoil stockpile area footprint	Ha	2.3	2.1																			
3.02	Clear and grub vegetation from subsoil stockpile area footprint	Ha	9.2	8.4																			
3.03	Clear and grub vegetation from TSF area. Load, haul and place material in designated stockpile areas. Includes allowance for downstream construction	Ha	80.1	99.5																			
3.04	Strip topsoil within 100 mm depth. Load, haul and place material in designated stockpile areas. Assumes 2 metre maximum topsoil stockpile height	m^3	80,100	99,500																			
3.05	Strip subsoil within 400 mm depth. Load, haul and place material in designated stockpile areas. Assumes 2 metre maximum topsoil stockpile height	m^3	320,400	397,800																			
3.06	Excavate unsuitable material from formation. Load, haul and place material in designated stockpile areas. (Provisional)	m^3	6,500	8,000																			
4	**EMBANKMENT FOUNDATION PREPARATION AND CUT OFF TRENCH**																						
4.01	Excavate embankment cutoff trench to 1 metre depth, haul and place in embankment fill as Zone C material	m^3	24,900	22,900																			
4.02	Excavate embankment cut off trench to 4 metres depth, haul and place in stockpile as Zone A material	m^3	49,700	45,800																			
4.03	Scarify, moisture condition and compact insitu subgrade in cutoff trench	m^2	9,500	8,700																			
4.04	Win from basin borrow, haul, spread, moisture condition and compact Zone A in cutoff trench	m^3	74,600	68,700																			
5	**EMBANKMENT CONSTRUCTION**																						
5.01	Proof roll embankment footprint area	m^2	59,000	55,000	16,000	20,000	9,000	12,000	0	0	20,000	25,000	0	0	0	0	0	0	0	0	0	0	
5.02	Win from in-facility tailings borrow, load, haul, place, spread and compact tailings as Zone T material as embankment footprint (PROVISIONAL)	m^3	0	0	0	0	3,200	2,200	9,900	10,500	6,900	6,700	6,800	6,600	7,200	6,600	7,300	6,500	7,700	7,300	7,400	7,200	
5.03	Win from borrow, spread, moisture conditon and compact Zone A fill in embankment	m^3	60,900	43,700	32,100	22,500	22,900	21,300	51,400	57,100	49,800	55,000	49,400	54,600	53,000	58,500	53,100	58,100	56,900	62,100	55,500	61,600	
5.04	Win from borrow, spread, moisture conditon and compact Zone C fill in embankment (TSF Basin or borrow area north of Cells 1 & 2)	m^3	127,000	90,000	99,000	10,000																	
5.05	Win from stockpile, spread, moisture conditon and compact mine waste fill in embankment	m^3			80,000	90,000	80,000	80,000	20,000	0	20,000	0	20,000	0	20,000	0	20,000	0	20,000	0	20,000	0	
5.06	Win from stockpile, spread, moisture condition and compact mine waste rock as buttress at Stage 5	m^3									139,000	188,000											
5.07	Win from stockpile, load, haul, place and compact wearing course on embankment crest (typically 150 mm thick)	m^3	3,800	2,600	3,900	2,700	3,800	2,700	3,800	2,700	3,700	2,700	3,600	2,600	3,600	2,600	3,500	2,600	3,500	2,600	3,500	2,600	
5.08	Win from basin borrow, load, haul and place Zone D material to form safety bund along embankment crest	m^3	1,600	1,100	1,600	1,200	1,600	1,200	1,600	1,100	1,600	1,100	1,500	1,100	1,500	1,100	1,500	1,100	1,500	1,100	1,500	1,100	
5.09	Win from stockpile, spread, moisture conditon and compact Zone C fill to form southern access ramp	m^3	5,000		5,000		5,000		5,000		5,000		5,000		5,000		5,000		5,000		5,000		
6	**UPSTREAM TOE DRAIN SYSTEM**																						
6.01	Excavate lower toe drain, haul, spread and compact material as Zone A in cut-off trench	m^3	800	800																			
6.02	Supply and install draincoil to lower toe drain, with tees, bends, joints inclusive for toe drain	lin m	3,100	2,900																			
6.03	Win from stockpile, load, haul and place Zone F1 material to lower toe drain	m^3	620	580																			
6.04	Supply and install A14 bidim geotextile fabric to lower toe drain surrounds	m^2	4,960	4,700																			
6.05	Install geonet along upstream face of cut-off trench, feeding into lower toe drain	m^2	17,400	16,400																			
6.06	Supply and install draincoil to upper toe drain, with tees, bends, joints inclusive for toe drain	lin m	3,100	2,900																			
6.07	Win from stockpile, load, haul and place Zone F1 material to upper toe drain	m^3	750	700																			
6.08	Supply and install A14 bidim geotextile fabric to upper toe drain surrounds	m^2	5,960	5,640																			
6.09	Win from stockpile, load, haul and place Zone E erosion protection material to upper toe drain	m^3	930	870																			
6.10	Excavate toe drain riser sump, haul and place in embankment fill as Zone A material	m^3	4,080	4,080																			
6.11	Compact base of toe drain tower sump.	m^2	36	36																			
6.12	Supply and install A24 Bidim geotextile in underdrainage sump	m^2	5,400	5,400																			
6.13	Win from stockpile, load, haul, place and spread Zone F1 drainage medium in sump (including drain to lower toe drain)	m^3	3,300	3,300																			
6.14	Win from stockpile, load, haul, place and spread Zone F2 drainage medium in sump	m^3	1,700	1,700																			
6.15	Excavate and shape underdrainage riser channel, haul to stockpile	m^3	40	40	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	
6.16	Supply and install 450 mm diameter HDPE underdrainage riser pipe (slotted), including all fittings and wearsheets	m	20	20																			
6.17	Supply and install 450 mm diameter HDPE underdrainage riser pipe (solid), including all fittings and wearsheets	m	40	40	16	16	15	15	15	15	16	16	16	16	17	17	17	17	17	17	17	17	
7	**COMPACTED SOIL LINER (CSL) AND UNDERDRAINAGE SYSTEM**																						
7.01	Excavate and shape underdrainage area from basin to 1 metre depth, haul and place in embankment fill as Zone C material	m^3	44,000	40,000																			
7.02	Excavate and shape underdrainage area from basin to 4 metre depth at the centroid, haul and place in embankment fill as Zone A material with excess placed as Zone C material	m^3	87,000	80,000																			
7.03	Scarify, moisture condition and compact to 300 mm depth in-situ soil to form low permeability soil liner	m^2	565,000	537,000																			
7.04	Supply and install 160 mm draincoil to collector drains with tees, bends and joints	m	740	740																			
7.05	Win from stockpile, load, haul, place and spread Zone F1 for collector drains	m^3	340	340																			
7.06	Supply and install A14 bidim geotextile fabric to toe collector drain surrounds	m^2	5,230	5,230																			
7.07	Win from stockpile, load, haul, place and spread Zone E erosion protection layer to collector drains	m^3	740	740																			
7.08	Excavate and shape finger drains, place material as bund adjacent	m^3	440	440																			
7.09	Supply and install 100 mm draincoil to finger drains with tees, bends and joints	m	4,280	4,280																			
7.10	Win from stockpile, load, haul, place and spread Zone F1 for finger drains	m^3	670	670																			
7.11	Supply and install A14 bidim geotextile fabric to finger drain surrounds	m^2	9,000	9,000																			
8	**UNDERDRAINAGE COLLECTION TOWER**																						
8.01	Excavate underdrainage tower sump. Backfill against tower on completion. Haul and place surplus fill as Zone A in TSF Embankment.	m^3	40	40																			
8.02	Supply and install 75 mm thick blinding concrete to tower base.	No.	1	1																			
8.03	Supply and install 25 MPa concrete base including formwork and reinforcement	No.	1	1																			
8.04	Supply and install 1200 mm diameter solid reinforced concrete pipes to underdrainage tower including all joints and pipe connections.	lin m	7	7	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	
9	**DECANT SYSTEM**																						
9.01	Excavate decant tower sump. Backfill against tower on completion. Haul and place surplus fill as Zone A in TSF Embankment.	m^3	80	80																			
9.02	Supply and install 75 mm thick blinding concrete to tower base.	No.	1	1																			
9.03	Supply and install 25 MPa concrete base including formwork and reinforcement	No.	1	1																			
9.04	Supply and install 1800 mm diameter solid reinforced concrete pipes to decant tower including all joints and pipe connections.	m	7	7	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	
9.05	Win from stockpile, load, haul and place Zone G selected clean rockfill decant surround	m^3	1,800	1,800	800	800	700	700	800	800	800	800	800	800	800	800	800	800	900	900	900	900	
9.06	Win from borrow, load, haul and place Zone C material to decant access causeway embankment (TSF Basin or borrow area north of Cells 1 & 2)	m^3	27,000	24,000	8,000	8,000	7,000	7,000	7,000	8,000	8,000	8,000	8,000	7,700	8,000	9,000	8,000	9,000	8,000	10,000	8,000	10,000	
9.07	Win from stockpile, load, haul, place and compact wearing course to decant access causeway embankment (typically 150 mm thick)	m^3	410	420	410	420	410	420	400	420	400	430	400	430	390	430	390	440	380	440	380	890	
9.08	Win from borrow, load, haul and place Zone D material as safety bund on decant access causeway embankment	m^3	200	200	200	200	200	200	200	200	200	300	200	300	200	300	200	300	200	300	200	500	
10	**TAILINGS AND DECANT RETURN PIPELINE TRENCH AND MAINTENANCE ROAD**																						
10.01	Scarify, condition and compact in-situ subgrade along trench alignment	m^2	2,900																				
10.02	Scarify, condition and compact in-situ subgrade for road alignment prior to fill placement	m^2	10,300																				
10.03	Win from stockpile, moisture condition, load, haul, place, spread and compact general fill (Zone D) along trench and road alignment	m^3	17,000																				
10.04	Win from stockpile, moisture condition, load, haul, place, spread and compact wearing course (typically 100 mm thick)	m^3	700																				
10.05	Win from borrow or stockpile, load, haul and place Zone D material as safety bund	m^3	260																				
10.06	Supply and install guide posts along road alignment	No.	5																				
10.07	Supply and install road signs along road alignment	No.	2																				
10.08	Supply and install 900mm diameter reinforced concrete culvert including excavation, formation preparation, bedding, surround and backfill	m	30																				
10.09	Scarify, condition and compact in-situ subgrade for TSF access road perimeter alignment	m^2	74,000																				
10.10	Win from adjacent stockpile, moisture condition, load, haul, place, spread and compact wearing course (typically 100 mm thick) on TSF access road perimeter alignment	m^2	6,700																				
10.11	Win from borrow or stockpile, load, haul and place Zone D material as safety bund on TSF access road	m^3	1,700																				
11	**MISCELLANEOUS**																						
11.01	Supply and install vibrating wire piezometer	No.	6	9			9	9															
11.02	Supply and install monitoring boreholes	No.	4	4																			
11.03	Supply and install standpipe piezometers	No.					4	6															
11.04	Decommission exisiting survey pins	No.			7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	
11.05	Supply and install survey pins	No.	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	
11.06	Supply and install tailings delivery pipeline	m	2,600																				
11.07	Supply and install tailings deposition pipeline	m	3,200	3,000	3,200	3,000	3,200	3,000	3,200	3,000	3,100	3,000	3,100	3,000	3,100	3,000	3,000	3,000	3,000	2,900	3,000	2,900	
11.08	Supply and install decant water return pipeline	m	2,250	350																			
11.09	Supply and install 110 mm spigot offtake reducing tee	No.	128	120																			
11.10	Supply and install steel T-bolt clamps	No.	128	120																			
11.11	Supply and install 150 mm diameter slotted stormwater polypipe as spigot dropper.	m	1,260	1,190	490	460	460	430	480	450	490	460	490	460	520	490	520	490	550	510	550	510	
11.12	Supply and install end caps to base of spigot droppers.	No.	128	120	128	120	128	120	128	120	128	120	128	120	128	120	128	120	128	120	128	120	
11.13	Supply and install 1.5 metre length water discharge hose (102mm NB).	No.	128	120	128	120	128	120	128	120	128	120	128	120	128	120	128	120	128	120	128	120	
11.14	Supply and install 1 metre wide 1.5 mm smooth HDPE geomembrane liner as wearsheet	m^2	1,260	1,190	490	460	460	430	480	450	490	460	490	460	520	490	520	490	550	510	550	510	
11.15	Supply and install steel stakes	No.	768	720	768	720	768	720	768	720	768	720	768	720	768	720	768	720	768	720	768	720	
12	**SURFACE WATER MANAGEMENT**																						
12.01	Excavate to form diversion channel, load, haul and place in embankment fill as Zone C material	m^3	10,200																				
12.02	Excavate to form diversion ponds, load, haul and place in embankment fill as Zone C material	m^3	2,000																				
13	**CLOSURE**																						
13.01	Win from stockpile, load, haul, place and spread topsoil along downstream embankment face (300 mm)	m^3																					104,200
13.02	Revegetate downstream embankment face (100 mm)	m^2																					34,800
13.03	Win from borrow, spread, moisture conditon and compact NAF material on tailings surface (600 mm)	m^3																					583,500
13.04	Win from stockpile, load, haul, place and spread topsoil on top surface (300 mm)	m^3																					291,800
13.05	Revegetate top surface (100 mm)	m^2																					97,300
	SUMMARY																						
1	**PRELIMINARY AND GENERAL**																						
2	**MATERIALS SUPPLY**																						
3	**SITE PREPARATION**																						
4	**EMBANKMENT FOUNDATION PREPARATION AND CUT OFF TRENCH**																						
5	**EMBANKMENT CONSTRUCTION**																						
6	**UPSTREAM TOE DRAIN SYSTEM**																						
7	**COMPACTED SOIL LINER (CSL) AND UNDERDRAINAGE SYSTEM**																						
8	**UNDERDRAINAGE COLLECTION TOWER**																						
9	**DECANT SYSTEM**																						
10	**TAILINGS AND DECANT RETURN PIPELINE TRENCH AND MAINTENANCE ROAD**																						
11	**MISCELLANEOUS**																						
12	**SURFACE WATER MANAGEMENT**																						
13	**CLOSURE**																						
	TOTAL TSF CELL 3 AND CELL 4 LOM QUANTITIES																						

APPENDIX K

Evolution TSF Closure and Rehabilitation Design and Specification – Executive Summary

Knight Piésold CONSULTING

WHITE FOIL TSF – CLOSURE AND REHABILITATION DESIGN AND SPECIFICATIONS

EXECUTIVE SUMMARY

A preliminary final landform design has been developed for the White Foil Tailings Storage Facility.

This design utilises baseline data currently available, considers regulatory guidelines on TSF design and construct and includes consideration of regional examples of good practice and successful facility rehabilitation.

Objectives are established for the design consistent with La Mancha environmental standards and existing plans.

The design assumes the tailings will be NAF though saline in nature and that oxide waste for the top surface cover, armouring mine waste for the final batters and topsoil to cover the entire facility are available in stockpile or through the mine schedule to fulfill the design.

The key specifications for the TSF are:

Top and Final Cover

- The top surface drainage will be configured to be water harvesting via the construction of perimeter bunds (1m) and cell bunding (0.7m) such that no water discharges onto batter slopes during severe rain events

- A cover of oxide and rock mine waste will be placed over the dried and consolidated tailings after operations have ceased. Where options for oxide material exist, material that is less saline and less sodic should be preferentially selected.

- The purpose of the cover is to limit dusting of the tailings surface and provide growth media for establishment of suitable revegetation ecology. The depth of the cover will be a minimum of 600mm.

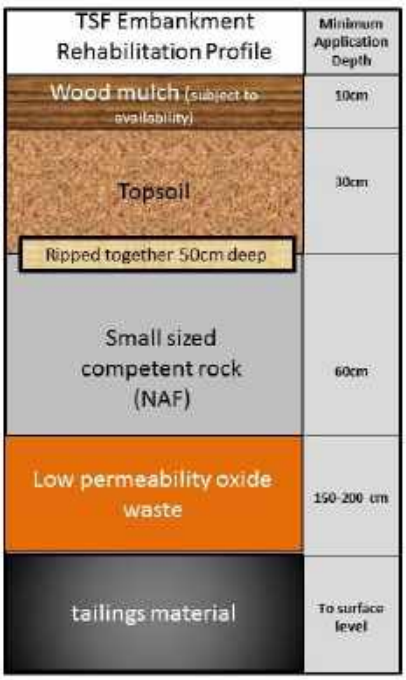
- Topsoil will be spread over the cover to a depth of 300mm prior to ripping and seeding.

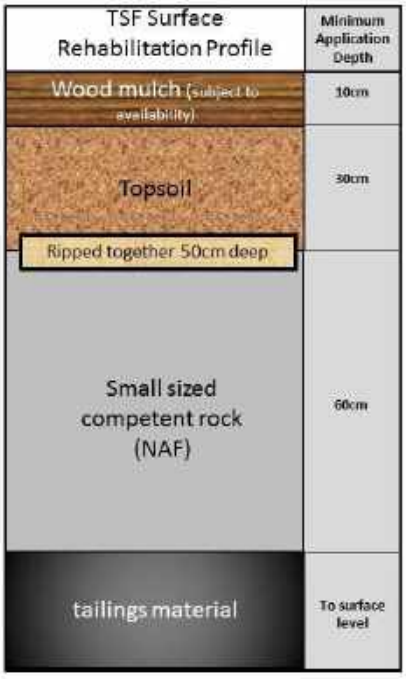
Batters and Berms

- The final batters should be profiled to a final average grade of not greater than 14 degrees. The batters are to be rehabilitated to the designs shown below.

TSF Design Parameters

TSF Design	
Maximum TSF height	20 - m
Maximum bench per slope	2
First Bench Height	353.15 - RL
Second Bench Height	363.15 - RL
Berm Width	7-10m
Maximum face slope angle	14º
Min. Surface composition- fresh rock : topsoil	60cm fresh rock : 30cm topsoil
Design top of TSF	Water holding





- Each lift shall not exceed 10m in height and berms shall be back sloping to 0.5m depth and 7m wide as a minimum.

Perimeter

- Seepage interception trenches or abstraction bores can be removed at closure and the land around the perimeter reprofiled to marry to natural surface and the battered toe, topsoiled and revegetated.

- Where there is the potential for surface flow from the local catchments with erosive velocity, this should be permanently diverted away from the toe of the closed facility

APPENDIX L

Tailings Storage Data Sheet

Knight Piésold CONSULTING

Tailings Storage Data Sheet

Project operator	Evolution Mining Ltd		
Project Name	Mungari Gold Project	Date	September 2019
TSF name	Mungari TSF	Commodity	Gold
Name of data provider	Knight Piésold	Phone	08 9223 6300
TSF centre co-ordinates (GDA 94)			
6595307 m North		330082 m East	
Mining Tenement and Holder(s) details		Mungari West - M15/830 and Evolution Mining Mungari East - M15/829 and Evolution Mining	
TSF data			
TSF status: Proposed ☒ Active ☐ Rehabilitated ☐ Closed ☐		Non Active ☐ Decommissioned ☐	
Type of TSF: [1] Paddock		Number of cells: [2] 2	
Hazard rating: [3] Medium		TSF category: [4] Category 1	
Catchment area: [5] 115 ha (Stage 1)		Nearest water course: Kurrawang and Kopai Salt Lakes	
Date deposition started (mm/yy):		Date of deposition completed (mm/yy)	
Tailings discharge method: [6] Multi-spigots		Water recovery method: [7] Pumped central decant	
Bottom of facility sealed or lined? Y / ~~N~~		Type of seal or liner: [8] Compacted soil	
Depth to original groundwater level >10 m			
Current groundwater level		Original groundwater TDS/pH 90-140,000 mg/l / 3-6	
Ore process: [9] Gravity separation, Alkali Leaching, CIP		Tailings Deposition rate: [10] 2.5 Mtpa	
Impoundment volume (present)		Expected maximum 18 Mm^3	
Mass of solids stored (present)		Expected maximum 25 Mtons	
Above ground facilities			
Foundation soils Sandy/silty Clay		Foundation rocks Metadolerite	
Starter bund construction materials: [11] Sandy/silty Clay and Silty/clayey Sand		Wall lifting by: Upstream ☒ Downstream ☒ Centre line ☒	
Wall construction method/materials:		Wall lifting material: [12] Sandy/silty Clay and highly weathered rock mechanically ☒ hydraulically ☐	
Present maximum wall height agl: [13]		Expected maximum 19.5 m	
Crest length (present)		Expected maximum 3,850 m (Stage 3)	
Impoundment area (present)		Expected maximum 91 ha (Stage 3)	
Properties of tailings and return water			
TDS 85,000 mg/l	8.3 pH	Solids content 42%	Deposited density 1.4 t/m^3
Potentially hazardous substances: [14] Cyanide; Caustic soda; lead; Iron Sulphide; Mercury		WAD CN 50 mg/l	Total CN 200 mg/l
		Any other NPI listed substances in the TSF? [15] Y / ~~N~~ Arsenic	

Tailings Storage Data Sheet

Explanatory notes for completing tailings storage data sheet

The following notes are provided to assist the proponent to complete the tailings storage data sheet.

1. Paddock (ring-dyke), cross-valley, side-hill, in-pit, depression, waste fill, central thickened discharge, stacked tailings.
2. Number of cells operated using the same decant arrangement.
3. See Table 1 – Hazard rating system in the Code of practice.
4. See Table 2 – Matrix of hazard ratings in the Code of practice.
5. Internal for paddock (ring-dyke) type, internal plus external catchment for other facilities.
6. End of pipe, (fixed), end of pipe (movable) single spigot, multi-spigots, cyclone, central thickened discharge (CTD).
7. Gravity feed decant, pumped central decant, floating pump, wall/side mounted pump.
8. Clay, synthetic.
9. See list below for ore process method.
10. Tonnes of solids per year.
11. Record only the main material(s) used for construction, e.g. clay, sand, silt, gravel, laterite, fresh rock, weathered rock, tailings, clayey sand, clayey gravel, sandy clay, silty clay, gravelly clay or any combination of these materials.
12. Any one or combination of the materials listed under item 11 above.
13. Maximum wall height above the ground level (not AHD or RL).
14. Arsenic, Asbestos, Caustic soda, Copper sulphide, Cyanide, Iron sulphide, Lead, Mercury, Nickel sulphide, Sulphuric acid, Xanthates, radioactive elements.
15. NPI – National pollution inventory (contact Department of Environmental Protection for information on NPI listed substances).

Ore process methods

The ore process methods may be recorded as follows:

Acid leaching (Atmospheric)	Flotation
Acid leaching (Pressure)	Gravity separation
Alkali leaching (Atmospheric)	Heap leaching
Alkali leaching (Pressure)	Magnetic separation
Bayer process	Ore sorters
Becher process	Pyromet
BIOX	SX/EW (Solvent extraction/Electro wining)
Crushing and screening	Vat leaching
CIL/CIP	Washing and screening

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MUNGARI GOLD PROJECT

TAILINGS STORAGE FACILITY
CELL 3 AND CELL 4 STAGE 4 TO STAGE 9/10
DESIGN REPORT

PREPARED FOR:

Evolution Mining
Kundana Road
Kalgoorlie WA 6430
Australia

PREPARED BY:

Knight Piésold Pty Limited
Level 1, 184 Adelaide Terrace
East Perth, WA 6004, AUSTRALIA

PE801-00137/63
Rev 2
August, 2025

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EXECUTIVE SUMMARY

Introduction

This report contains the design details for additional tailings storage at the Mungari Gold Project to meet a processing throughput of 2.1 Mtpa over a 10 year mine life. The TSF design comprises of raising the existing Cell 3 and Cell 4 via upstream construction, to achieve a total capacity of 27.7 Mt and 133 Ha in outer footprint size.

Site Characteristics

The climate at the site can be described as semi-arid with hot summers and mild winters. The average annual rainfall is 269 mm while the average annual pan evaporation is 2,608 mm. The location of the TSF is close to the boundary of two drainage areas, namely, Kopai Lake and Kurrawang Lake which are both salt lakes. The topography is relatively flat but elevated from the lakes, with drainage generally sloping away from the TSF footprint.

TSF Consequence Assessment

A dam break and category assessment was completed for the final stage of the TSF based on two guidelines. The TSF is assessed to be HIGH Category 1 for the DMIRS Code of Practice, SIGNIFICANT for ANCOLD guidelines and SIGNIFICANT for the GISTM.

Geotechnical Site Investigations

A geotechnical site investigation of the TSF footprint was undertaken in 2017 and 2020. The in situ basin materials were deemed suitable for use as Zone A and Zone C fill during Stage 1 construction. Material is typically clayey sand to a depth of 3 metres overlain by approximately 500 mm of topsoil/subsoil.

Laboratory testing of foundation material was undertaken during Cell 3 and Cell 4 Stage 1 construction, to verify material strength parameters used in design.

Tailings Characteristics

The dry densities of tailings to be deposited into the facility can be predicted from laboratory testing. Assuming the TSF is efficiently operated it is estimated that the average field density will be approximately 1.40 t/m^3, similar to Cell 1 and Cell 2. CPT programmes have also been conducted throughout operation to measure in situ tailings strength parameters within the facility. Additional tailings laboratory testing will be required during operation to verify tailings strength parameters used in design.

Facility Design

The TSF is located west of Cell 1 and Cell 2. It consists of two rectangular cells operated separately, until the storage capacity is met.

The facility consists of a multi-zoned perimeter embankment with an initial starter embankment (Stage 1, completed), one downstream lift (Stage 2, completed), one centreline lift (Stage 3, approved) and 4 upstream stages (Stage 4, Stage 5/6, Stage 7/8 and Stage 9/10 being submitted for approval with this document).

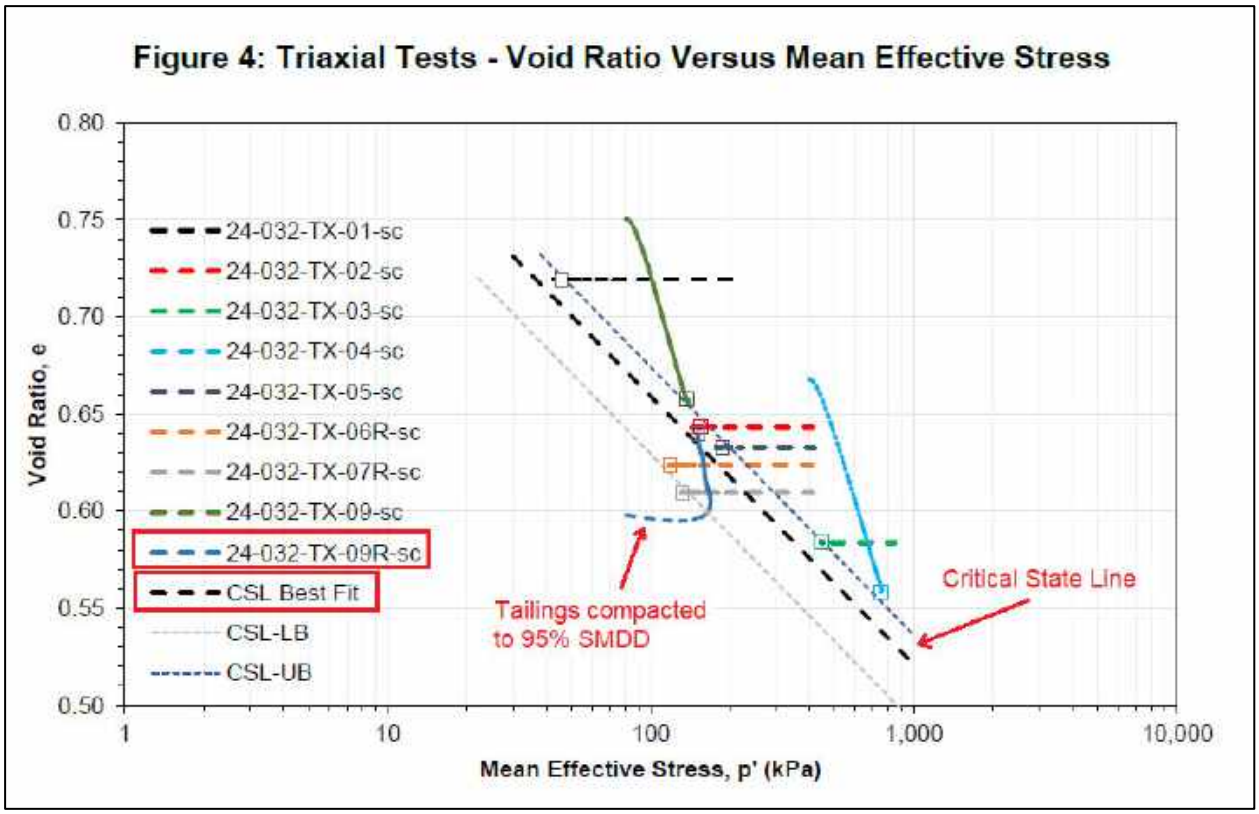
Deposition of tailings is designed such that the ponds are maintained in the centre of each cell around a centralised decant tower. Access to the decant towers is from causeways extending to the centre of each cell. Supernatant water is removed from the TSF via submersible pumps located within the decant towers. Supernatant water is pumped back to the plant for re-use in the process circuits.

The design incorporates an existing central basin underdrainage system (network of finger drains, collector drains and toe drains) over the entire TSF basin to reduce seepage, increase tailings densities, and improve the geotechnical stability of the facility. Each system gravity feeds to sumps located at the base of abstraction infrastructure, for water removal to reduce the pressure head on the facility.

Upstream Construction

As outlined in the Stage 1 Feasibility Study, validation testing would be required on the tailings beach prior to upstream construction. CPT programmes were conducted in 2018 for Cell 1/Cell 2 and 2023/2024 for Cell 4, to measure in situ tailings parameters. It is noted that tailings layers are evident within the basin, in line with the staged raise development (i.e. different degrees of tailings densification due to exposure to air drying).

In Figure 4 (extracted from laboratory testwork by a third party), the compacted tailings is plotted in v-p' space. At 95% SMDD, tailings material is below the critical state line (CSL) and clearly demonstrates that the compacted tailings is dilative and therefore a minimum density of 98% SMDD has been specified in the construction technical specifications. The Engineer will be undertaking quality control during construction to ensure that the Technical Specifications are achieved.



The laboratory test results for tailings samples show that the particle size distribution falls within the envelope for potential flow liquefaction. Seepage modelling of the facility over the mine life demonstrates that the phreatic surface remains close to the pond area and that the tailings mass will not saturate. Whilst the grading of the tailings falls within a potentially liquefiable category, the moisture contents over the mine life and post closure are expected to be below that required to cause static or seismically-induced liquefaction. As such it was concluded that the tailings are unlikely to liquefy and upstream construction techniques could be adopted.

Erosion protection material has also been incorporated on the upstream and downstream faces to limit erosion of the embankment due to runoff and/or operational discharge.

Water Balance

There is sufficient stormwater storage capacity on the TSF to accommodate all design storm events (including 72 hour PMP) and rainfall sequences, with sufficient freeboard to comply with regulations (providing that the facility is operated in accordance with the design intent).

Due to low recycle rates during the drier months of each year, it is recommended that any external water supply design should be based on an average 25 - 35% recycle from the TSF. It is also recommended that the decant pump capacity is designed for maximum recycle from the TSF, i.e. 95% of water in slurry.

Stability Modelling

Continual operation of the TSF underdrainage system is required to reduce the phreatic surface within the TSF. Modelling has indicated downstream buttressing will be required when the phreatic surface within the facility meets a set trigger level. The water level within the facility shall be monitored through use of a series of vibrating wire and standpipe piezometers within the tailings mass and embankment.

Monitoring

A monitoring programme for the TSF has been developed which meets operational, compliance and performance aspects. Compliance monitoring includes (but is not limited to):

- Survey pins to check embankment movement.
- Piezometers to monitor the phreatic surface.
- Monitoring bores downstream of the TSF.

A Trigger Action Response Plan (TARP) will be developed for most parameters to provide an early indication of deviations from predicted design assumptions.

Surface Water Management

Surface drains were constructed around the perimeter of the facility during Stage 1, feeding into sedimentation basins at the west and south-east extents of the facility.

Construction QA/QC

Construction will be undertaken by a qualified civil earthworks contractor under the supervision of an experienced Engineer (KP), in accordance with the Technical Specification and Drawings. QA/QC is designed to ensure construction quality aligns with the design intent, with monitoring and testing focused on material selection, moisture conditioning, and compaction. A comprehensive QA/QC Manual supports these activities.

1. INTRODUCTION

1.1 GENERAL

Evolution Mining Ltd (Evolution) operates the Mungari Gold Mine. The site is located approximately 20 km west of the town of Kalgoorlie in Western Australia.

Evolution currently stores tailings generated by the operation in a Tailings Storage Facility (TSF) comprising four cells, namely Cell 1, Cell 2, Cell 3 and Cell 4. Cell 1 and Cell 2 were constructed in 2013 and have reached capacity at Stage 5 in 2021 with no further raises planned. Cell 3 and Cell 4 are located immediately west of these cells. Cell 3 Stage 1 was completed in May 2021, Cell 4 Stage 1 was completed in January 2022, Cell 3 Stage 2 was completed in December 2022 and Cell 4 Stage 2 was completed in November 2023. Stage 3 of Cell 3 and Cell 4 is scheduled to be constructed over the coming year.

Evolution engaged Knight Piésold Pty Ltd (KP) to undertake the design of 4 No. upstream raises on Cell 3 and Cell 4, above the approved Stage 3 design. This is scheduled to meet a processing throughput of 2.1 Mtpa over a 10 year mine life, as outlined in the Tailings Management Plan (Ref. 1). The TSF design includes Cell 3 and Cell 4, and has a total capacity of 27.7 Mt (Stages 1 through to 10) and 133 Ha in outer footprint size.

The site general arrangement is shown on Drg. No. 801-137-C3006-050.

1.2 DESIGN OBJECTIVES

The design objectives for the TSF are summarised as follows:

- Permanent and secure containment of all solid tailings materials generated over the life of the project.
- Continual removal and reuse of free water from the facility.
- Provide excess water storage capacity to retain design storm events.
- Incorporate safety into the design, construction and operation of the facility.
- Reduced environmental impact with rapid and effective rehabilitation.
- Provide ease of operation.

A summary of the key policies and guidance documents used for the design of the tailings storage are summarised as follows:

- Guidelines on the Consequence Categories for Dams, ANCOLD, October 2012 (Ref. 2).
- Guidelines on Tailings Dams – Planning, Design, Construction, Operation and Closure, ANCOLD, July 2019 (Ref. 3).

- Guidelines for Design of Dams and Appurtenant Structures for Earthquake, ANCOLD, May 2019 (Ref. 4).
- Department of Mines Industry Regulation and Safety (DMIRS) “Code of Practice
  - Tailings Storage Facilities in Western Australia” 2013 (Ref. 5).
- Guide to Preparation of a Design Report for Tailings Storage Facilities (TSFs) - DMIRS, August 2015 (Ref. 6).
- Guide to Departmental Requirements for the Management and Closure of Tailings Storage Facilities (TSFs) - DMP, August 2015 (Ref. 7).
- Global Industry Standard on Tailings Management, August 2020 (Ref. 8).

1.3 AVAILABLE DATA

The following site information is available and has been used in the TSF design:

- Site topographical data (supplied by Evolution April 2024).
- Heritage Layers (provided by Evolution from publicly available registers).
- Lease boundaries (provided by Evolution).
- Proposed clearance extents, stockpile areas and infrastructure (supplied and recommended by Evolution).
- Soil characterisation (supplied by Soilwater Group Ref. 9).
- Flora and vegetation survey map (undertaken by Native Vegetation Solutions Ref. 10).

The design parameters shown in Table 1.1 were developed during the feasibility design phase and updated for this report.

Table 1.1: TSF Design Parameters

Parameter	Value	Source
Total Tonnage	27.7 Mt	Evolution
Average Throughput	2.1 Mtpa	Evolution
Tailings Percent Solids	42% w/w	Evolution
Number of Cells	2	KP nominated
Tailings Beach Slope	1V:120H	Survey
Tailings Dry Density	1.40 t/m^3	KP back calculation
Raise Technique	Downstream for 2 stages (constructed) Centreline for 1 stage (approved and planned) Upstream for 4 stages	KP nominated
Maximum Embankment	RL363.15 m	KP nominated

2. SITE CHARACTERISTICS

2.1 CLIMATE

The climate at the site can be described as semi-arid with hot summers and mild winters. The average annual rainfall is 269 mm while the average annual pan evaporation is 2,608 mm.

A detailed baseline climatology assessment for the project is provided in Appendix A with design storms for the 1% Annual Exceedance Probability (AEP) 72 hour event of 203 mm and the 72 hour duration Probable Maximum Precipitation (PMP) of 900 mm.

2.2 FLORA AND FAUNA

2.2.1 Flora

A Flora and Vegetation Survey was undertaken by Native Vegetation Solutions in 2017 (Ref. 10) within the mining lease M15/829 that encapsulates the Cell 3 and Cell 4 TSF footprint. A vegetation map was developed for the lease area and four vegetation zones identified as follows:

i. Mixed Eucalyptus Woodlands over sclerophyll shrublands.

ii. Eucalyptus Salubris woodlands.

iii. Casuarina pauper over sclerophyll shrublands.

iv. Eucalyptus oleosa thicket over sclerophyll shrublands.

The study also indicated the following:

"No threatened or Priority Flora were recorded in the survey area. No Threatened Ecological Communities (TECs) or Priority Ecological Communities (PECs) were recorded within the survey area."

"The proposed clearing of vegetation will result in the loss of some individuals from the local area; however, the impact will not be great enough to remove whole communities or populations. Most of the species and communities recorded during this survey are widespread throughout the Eastern Goldfields subregion and adjoining regions, and therefore the loss of a small proportion from this area will not be significant."

2.2.2 Fauna

A fauna survey was undertaken by Terrestrial Ecosystems in March 2010 (Ref. 11) during the design phase of Cell 1 and Cell 2 TSF. The conclusion from the study was that it was unlikely that significant fauna will be impacted by the extent of the clearing proposed.

The study also recommended minimising impacts on the salt lake and to avoid creating any residual isolated patches of vegetation. As the TSF is a single area and is situated north of the salt lake these conditions will be met by the TSF design. During construction, measures are taken to control soil erosion and sediment runoff which may impact surrounding areas.

A vertebrate fauna assessment has also been completed within the mining lease M15/829 that encapsulates the Cell 3 and Cell 4 TSF footprint. No conservation significant vertebrate fauna were detected.

2.3 TOPOGRAPHY AND DRAINAGE

The proposed TSF area is located above a drainage area feeding into the Kurrawang Lake which is a salt lake located to the south.

Catchment areas reporting to the TSF site total some 110 Ha and lie to the north of the TSF. The facility itself is a paddock design and run-on of surface water is not considered an issue in terms of water management of the TSF. However, flows reporting to the toe of the embankments are controlled and diverted around the TSF.

2.4 GEOLOGY

2.4.1 Soils

A study of soils across the site was undertaken by Soilwater Group in January 2019 (Ref. 9). The assessment established that *"there is little physical or chemical differentiation between the topsoil and subsoil material".* Viable topsoil/subsoil is present across the TSF area to a maximum depth of approximately 1,500 mm. The average topsoil/subsoil depth across the Cell 3 and Cell 4 TSF footprint was 500 mm.

2.4.2 Solid Geology

The following geological description is taken from the RPS Group memorandum (Ref. 12):

The Kalgoorlie area is underlain by Archaean bedrock locally incised by a series of Tertiary aged palaeochannel deposits and overlain by widespread alluvium, colluvium and lake deposits.

Based on regional geology and detailed foundation investigations at Cells 1 and 2, TSF Cell 3 is underlain by volcanoclastic sediments.

Five geotechnical investigation boreholes (BH-TSF-01 to BH-TSF-05) were drilled to 30 mbgl as part of the foundation investigation at Cells 1 and 2.

The drilling intersected a thin veneer of cover material (clayey sand), to a maximum depth of 3m (below ground), overlying saprolites (extremely weathered basement rocks - predominantly clay). The saprolite clay extends some 16m to 30m below ground and overlies transition zone weathered metadolerite and dolerite.

The geotechnical site investigation at the Cell 3 and Cell 4 location undertaken by KP in 2017 and 2020 included the drilling of four (4) boreholes. The results are shown in Appendix B, with each borehole comprising a soil profile comparable to that identified in the Cell 1 and Cell 2 geotechnical site investigation.

2.5 HYDROGEOLOGY

2.5.1 General

Hydrogeological studies for the mine site were undertaken by RPS Group in 2017 (Ref. 12). The following sections describing the hydrogeological context are extracted from that memorandum.

2.5.2 Regional Hydrogeology

The regional basement rocks form part of the Yilgarn Goldfields fractured-rock groundwater province. The fractured bedrock is characterized by secondary permeability resulting from tectonic and decompression fracturing enhanced by chemical dissolution along fracture lines. Fractured-bedrock aquifers occur more commonly in mafic, ultramafic, and granitic rocks than in the sedimentary or felsic volcanic and volcaniclastic rocks.

The Tertiary paleochannels form major aquifers in the region, and have supported significant groundwater abstractions from a number of borefields. There are two tributary paleochannels in close proximity to the Project, one to the north and one to the south. The southern tributary was also used in the past for aquifer injection of excess dewatering production from the Mungari pit and for water disposal during extended test pumping of trial dewatering bores at Frog's Leg.

The weathered profile (regolith) is largely composed of clays (saprolite) and generally forms a low permeability aquifer/aquitard in the region although the transition zone between the saprolite and fresh rock can be highly permeable and form local aquifers (e.g. at Frog's Leg, the transition zone required dewatering by a number of pit perimeter bores).

Temporary, intermittent perched aquifers can develop in shallow cover horizons immediately following major rainfall events. Groundwater recharge is by the infiltration of rainfall runoff. Only a very small proportion of rainfall contributes to groundwater recharge with most of the rainfall being directly evaporated or used by the vegetation.

Direct recharge to the basement rock aquifers principally occurs where the bedrock outcrops beneath surface drainages. Recharge to the paleochannel aquifers occurs upstream and to the west of the Project where the paleochannel sands subcrop beneath cover material.

A regional watertable occurs and the depth to the watertable ranges from less than 1m in playa-lake environments to more than 40 m in elevated areas. Groundwater flow is towards the major palaeodrainages and modern playa lakes where the watertable is close to the surface. Groundwater discharge occurs mainly by evaporation from playa lakes, with a relatively small amount of discharge via flow through the palaeochannels. There will also be discharge as baseflow to local drainages (from shallow aquifers) when the water table is elevated immediately following significant rainfall events.

Groundwater is mainly saline to hypersaline. The salinity ranges from around 1,000 mg/L TDS in some shallow aquifers in cover or saprolite adjacent to basement outcrops and in intermittent perched aquifers following rainfall, to as much as 200,000 mg/L TDS in the palaeochannels, adjacent playa-lake sediments, and in fractured and weathered bedrock.

2.5.3 Local Hydrogeology

Mineral exploration drilling, prior to the development of the Mungari [White Foil] Pit, intersected variable water returns in all lithologies, although the wetter holes tended to be towards the north, and associated with the contact between the Quartz Gabbro and the Black Flag Beds.

During initial mining of the Mungari [White Foil] Pit, there were major seepage zones associated with the Quartz Gabbro – Black Flag Beds contact zone and with the main NE-SW fault zone in the NE wall of the pit. There were also numerous seepage zones on the Hanging Wall (i.e. W wall in Black Flag Beds) associated with minor shear zones, and minor seepage zones in the footwall (i.e. Gabbro).

In-pit grade control drill holes that intersected the Quartz Gabbro – Black Flag Beds contact were observed to 'flow' and deeper in-pit investigation holes that intersected the contact experienced high water inflow problems.

The first significant inflows from the pit walls appeared when the pit intersected the transition zone between weathered and fresh basement rocks (gravelly clays / clayey gravels made up of a mix of saprolite and fresh rock fragments). During more recent mining, most pit inflows appear to be from the zone where the NE-SW fault zone intersects the SE pit wall.

2.6 SEISMICITY

A seismic hazard assessment using probabilistic and deterministic methods was undertaken for the site. Details are provided in Appendix C.

Based on the design criteria listed in Section 3.2 (ANCOLD SIGNIFICANT) below and the seismic assessment, the parameters for use in the TSF design are presented in Table 2.1.

Table 2.1: Seismic Design Parameters

Scenario	Design Case	Return Period (yr)	Peak Ground Acceleration (PGA)
NSHA18	OBE	475	0.10g
	SEE	1,000	0.12g
MCE		>10,000	0.49g

3. FACILITY CLASSIFICATION AND DESIGN CRITERIA

3.1 TSF CONSEQUENCE / HAZARD ASSESSMENT

As part of the design a hazard rating for the TSF was completed in accordance with the requirements of the ANCOLD document "Guidelines on Tailings Dam Planning, Design, Construction, Operation and Closure" (Ref. 3), the DMIRS Code of Practice (Ref. 5) and the Global Industry Standard on Tailings Management – GISTM (Ref. 8). The hazard rating is derived by considering the potential impacts in terms of safety, environmental and economic factors as well as with respect to the embankment maximum height.

Under a dam break scenario, the following implications may apply to the Mungari TSF:

- Kopai Lake and Kurrawang Lake are at risk of receiving residual tailings which could be carried with runoff water.
- The water may have some residual cyanide in solution and is hypersaline which may impact vegetation growth.
- The access road to the TSF and the haul road from the pit is at risk of being cut off, including the cutters ridge access road south.
- The decommissioned tailings reclamation area is at risk of being inundated.

The dam break assessment is contained in Appendix D.

The result of the dam break and subsequent category determination define the design criteria to be used for design. The TSF is considered to be **"HIGH Category 1",** based on the DMIRS Code of Practice.

Using the ANCOLD guidelines, the TSF is classified as a **"SIGNIFICANT"** facility for dam failure and environmental spill scenarios.

Using the GISTM, the TSF is classified as **"SIGNIFICANT".**

3.2 DESIGN CRITERIA

The overall minimum design criteria for this study are summarised in Table 3.1. These design criteria are in accordance with the DMIRS Code of Practice (Ref. 5) and ANCOLD guidelines (Ref. 3) where criteria are given. Other parameters were adopted on the basis of industry best practice and client requirements.

Table 3.1: Tailings Storage Facility design criteria and specifications

HYDRAULICS	
Design Storm Storage Allowance (Appendix 5, DMIRS)	1% AEP, 72 hour duration storm with no release, evaporation or decant.
Freeboard (Appendix 5, DMIRS)	Total Freeboard of at least 0.5 m or wave plus 0.3 m; Operational Freeboard to be the greater of 0.3 m or the predicted crest deformation due to the maximum seismic event.
Operating Spillway	None.
Closure Spillway	None.
Diversion structures during operation	2% AEP storm
STABILITY	
Earthquake loading (Table 7 ANCOLD 2019)	OBE 475 Year SEE 1,000 Year Post Closure MCE
Minimum Factor of Safety (Table 8 ANCOLD 2019)	Long term drained 1.5 Short term undrained (tailings release) 1.5 Short term undrained (no release) 1.3 Post Seismic 1.1
DAM SAFETY / INSPECTION FREQUENCY	
Inspection Frequency	• Comprehensive inspection by Dam Designer or equivalent qualified Engineer after first year and then every 2 years. • Annual intermediate inspections by Dam Engineer. • Routine daily by operations personnel.

4. GEOTECHNICAL SITE INVESTIGATIONS

4.1 SCOPE OF WORK

A geotechnical site investigation was undertaken at the Cell 3 and Cell 4 TSF site in 2017 and 2020 respectively. The work and findings are presented in KP Report PE801-00137/23 (attached as Appendix B1).

The purpose of the investigation was to:

- Assess ground conditions for the proposed TSF site.
- Assess the suitability of site materials for TSF construction.

The geotechnical investigation comprised the following scope:

- Drilling of 4 No. boreholes using diamond coring techniques including in situ SPT and permeability testing.
- Excavation of 50 No. test pits at the TSF site.
- Laboratory testing of samples obtained from the boreholes and test pits. Tests included:
  - Particle Size Distribution.
  - Atterberg Limits.
  - Linear Shrinkage.
  - Remoulded Permeability.
  - Emerson Dispersion.
  - Consolidated Undrained Triaxial Testing (effective strength parameters, consolidation, and permeability).

4.2 SUB-SURFACE CONDITIONS

Sub-surface conditions as determined from the exploratory holes are summarised in Table 4.1.

Table 4.1: Summary of sub-surface conditions – boreholes BH-TSF-01 to 04

Depth		Material Description	Consistency / Weathering
From	To		
0	3	Clayey SAND	Medium Dense
3	7	Sandy CLAY	Stiff
7	30	Silty CLAY	Very Stiff
30	EOH	Metadolerite	Extremely to Distinctly Weathered

4.3 INVESTIGATION FINDINGS AND GEOTECHNICAL DESIGN PARAMETERS

The following conclusions were drawn from the investigation in relation to material suitable for use during construction:

- Excavation of the near surface profile is achievable with conventional earthmoving equipment, as no rock was encountered and material typically comprised firm to stiff clayey sands and silty clays. The TSF cut-off trench extends through this layer to reduce horizontal seepage through the foundation.
- The in-situ materials in the TSF basin were deemed suitable for use as Zone A and Zone C material during Stage 1 construction. However, clay in the silty clay layer, possibly due to the presence of calcrete or gypsum, is potentially dispersive. This was accounted for during construction and encapsulated with a compacted clay layer to prevent direct contact with water/ tailings.
- Based on the site investigation, a significant borrow area was developed within each basin during construction of Stage 1.

4.4 CELL 3 AND CELL 4 STAGE 1 FOUNDATION LABORATORY TESTWORK

During Stage 1 construction of Cell 3 and Cell 4, block samples were taken of the embankment foundation and sent to an off-site laboratory for index testing, direct simple shear (DSS) testing and oedometer testing. Findings and factual reports are presented in Appendix B2 and summarised in the Cell 4 Stage 1 construction report (Ref. 13):

- The Cell 3 samples are classified as medium plasticity sandy CLAY. The Cell 4 samples are classified as medium plasticity sandy CLAY to clayey SAND.
- The DSS tests were terminated at a maximum shear strain of 30% - 35%. The majority of tests did not show a decrease of strength at the end of shearing, without developing a residual strength, which indicated the ductility of the foundation soil.
- The DSS results in general do indicate a change in consolidation behaviour with increasing stress analogous with transition between over-consolidated (OC) to normally consolidated (NC) behaviour. This transition to NC conditions occurs at a stress of approximately 300 kPa, which is close to the in-situ stress where the depth of soil overburden is greater than 15 m.
- A profile with minimum strength of 80 kPa and NC strength ratio of 0.29 is a reasonable fit for the lower quartile data.
- The compression index is in the range of 0.109 to 0.236. The swelling index is in the range of 0.005 to 0.034. The pre-consolidation pressure is in the range of 10 to 94 kPa.

The results of the monotonic DSS testing and oedometer testing are presented graphically on figures 4.1 and 4.2 respectively.

From the findings of the investigations and soil testwork to date, the geotechnical design parameters for in situ materials were determined, as shown in Table 4.2. It is noted that lower bound parameters have been applied to ensure design conservatism.

Embankment material geotechnical design parameters are provided in Appendix F.

Table 4.2: Geotechnical design parameters for in situ materials

Material	Bulk Density γ_{moist}	Drained		Undrained		Drained (post seismic)		Undrained (post seismic)		Saturated Permeability
	(kN/m^3)	c' (kPa)	ϕ' (deg)	s_{umin} (kPa)	s_u/σ_v'	c' (kPa)	ϕ' (deg)	s_{umin} (kPa)	s_u/σ_v'	(m/s)
Clayey SAND	18	0	28	50	0.25	0	23	40	0.2	1×10^{-7}
Sandy CLAY	18	5	28	75	0.25	4	23	60	0.2	1×10^{-8}
Silty CLAY	19	10	25	75	0.25	8	20.5	60	0.2	1×10^{-8}
XW – DW Rock	21	30	33	-	-	30	33	-	-	5×10^{-8}

XW = extremely weathered; DW = distinctly weathered

5. TAILINGS CHARACTERISTICS

5.1 GENERAL

Tailings physical testing and geochemical analysis were conducted on tailings samples in 2011 (contained in Appendix E) during the Cell 1 and Cell 2 detailed design phase. To verify the design capacity of the TSF and parameters used in the design, an operating sample was obtained and tested in 2015, as well as 2022/2023 (contained in Appendix E).

It is also noted that tailings were tested in 2018 to assess the suitability of embankment fill in upstream raises, as well as further testwork in 2024 as part of the CPT programme (also contained in Appendix E).

The following physical tests were carried out on the samples:

i. Classification tests to determine:
   - Particle size distribution of the tailings.
   - Supernatant liquor density.
   - Liquid and plastic limits of the tailings solids.
   - Tailings solids particle density.

ii. Undrained and drained sedimentation tests.

iii. Air drying tests.

iv. Permeability tests.

v. Consolidation tests.

vi. Geochemistry tests.

vii. Acid generation potential.

viii. Multi element analysis.

ix. Supernatant water quality.

Full details of the tests undertaken, the results and interpretation are provided in Appendix E. A summary of the design parameters and associated implications for design are provided in the following sections.

An additional tailings sample was provided in 2019, with testing undertaken to determine material properties for closure purposes. The results are also included in Appendix E.

5.2 DESIGN PARAMETERS

The deposition methodology and design uses expected tailings material types and properties based on laboratory testing of bench scale samples in design and a

subsequent operating sample in 2015. Material properties will differ daily and over the life of the project. Material properties which may affect deposition methodology include particle size distribution, percent solids of discharge, slurry flow rate and specific gravity of solids and liquids.

The tailings design parameters are summarised in Table 5.1.

Table 5.1: Tailings Material Properties

Parameter	Value
Maximum Air Dried Density	1.60 t/m^3
P_{80}	160 µm
Beach Slope	1V : 120H
Solids Content	42 – 47%
Supernatant Release	36 – 53%
Underdrainage Release	5 - 10%
Vertical Permeability	4x10^{-7} m/s
Horizontal Permeability	5x10^{-6} m/s
Coeff. Of Consolidation (Cv)	55 – 110 m^2/yr
Coeff. Of Volume Decrease (Mv)	0.020 – 0.039 m^2/kN
Compression Index (Cc)	0.4 – 0.6

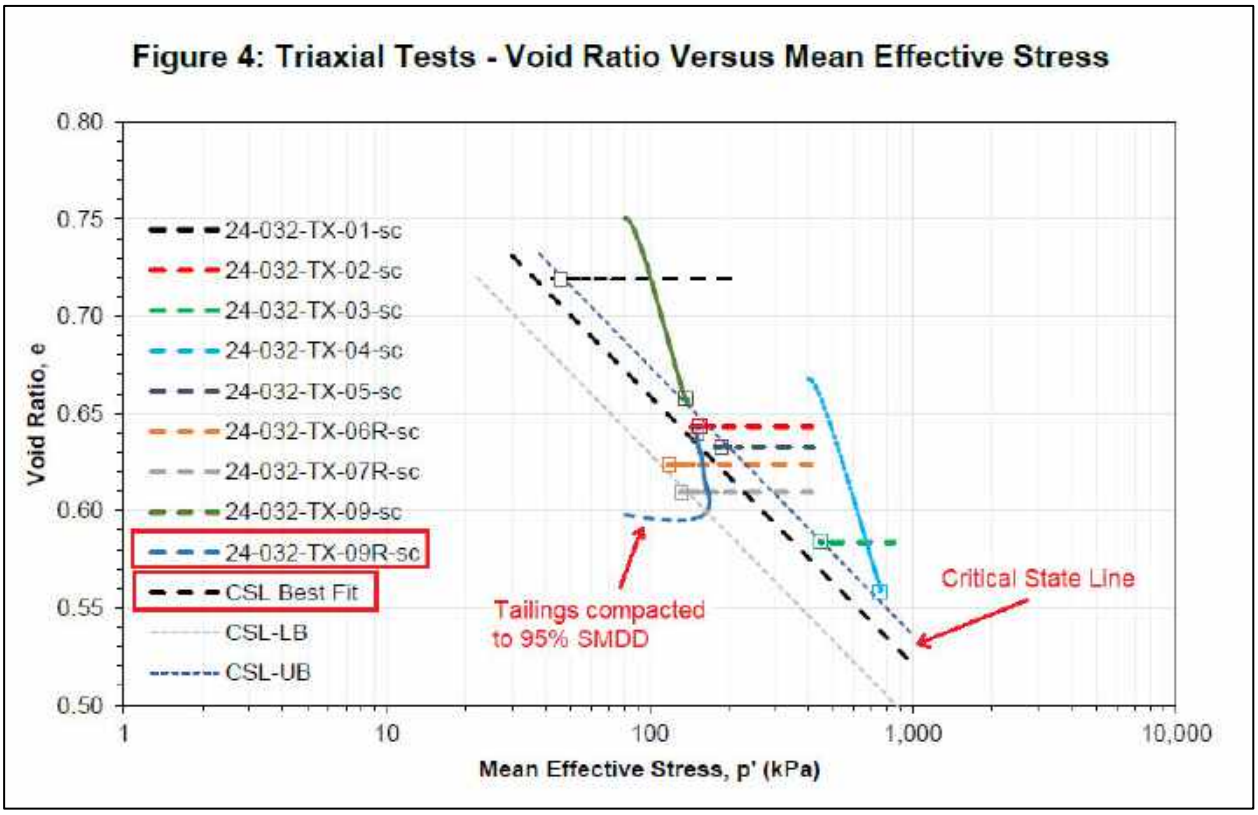
In addition, CPT programmes have been conducted in 2018 for Cell 1/Cell 2 (Ref. 14) and 2023/2024 for Cell 4 (Ref. 15), to measure in situ tailings parameters within the facility. It is noted that tailings layers are evident within the basin, in line with the staged raise development (i.e. different degrees of tailings consolidation pending the exposure to air drying).

The following conclusions have been drawn from the CPT programme (Ref. 15):

- Tailings classification testwork:
  - A standard maximum dry density (SMDD) of 1.88 t/m3 and optimum moisture content (OMC) of 12.5%.
- Tailings shear strength parameters:
  - The constant volume friction angles for the tailings were assessed using the CSL triaxial testing to be between 30.3° and 35.5°. A representative value of φ'_{cv} = 33.7° was adopted for the tailings. Figure 5.1 illustrates the CSL.
  - The Robertson (2022) method results in 20th percentile friction angle for the sand-like materials varied between 32°and 34° with a weighted average of 32°.

- The undrained triaxial tests indicate peak undrained shear strength ratios between 0.28 and 0.35 at a state parameter between 0.09 and 0.02, as shown in Figure 5.2. The residual strength of the primary tailings is between 0.13 and 0.32, as shown in Figure 5.3.
- Triaxial testwork on a representative sample of tailings compacted to 95% of SMDD (Sample I.D 24-032-TX-09R-sc) demonstrates that the material will exhibit dilative behaviour, as it falls below the critical state line (CSL). This is shown in Figure 4 (extracted from laboratory testwork by a third party), whereby the compacted tailings is plotted in v-p' space. Based on these findings, a minimum density of 98% SMDD has been specified in the construction technical specifications contained in Section 11.

Figure 4: Triaxial Tests - Void Ratio Versus Mean Effective Stress



- Residual soil shear strength parameters:
  - The residual undrained shear strength ratio of the residual soil was estimated with the Robertson (2022) method to be in the range of 0.78 to 0.86 with a weighted average value of 0.80.
  - The tailings material's undrained shear strength ratios are excessively high due to over-consolidation and suction, thus should not be directly used for strength profile in design. The undrained shear strength have been capped at the drained strength to avoid relying on the suction.

- Erosion Potential: The tailings are highly dispersive based on the pinhole dispersion test.

Subsequently, the adopted tailings design parameters are shown in Table 5.2. It is noted that lower bound parameters have been applied to ensure design conservatism.

Table 5.2: Geotechnical design parameters for tailings

Material	Bulk Density γ_{moist} (kN/m^3)	Drained		Undrained		Drained (post seismic)		Undrained (post seismic)	
		c' (kPa)	ϕ' (deg)	s_{umin} (kPa)	s_u/σ_v'	c' (kPa)	ϕ' (deg)	s_{umin} (kPa)	s_u/σ_v'
Zone T (Ref. 15)	19	0	30	0	0.3	0	24.8	0	0.24
Tailings (Top 1 m depth from surface)*	13.5	0	25	0	0.25	0	20.5	0	0.20
Tailings (Second 1 m depth from surface)*	13.5	0	25	0	0.25	0	20.5	0	0.10
Tailings (Remaining depth to next stage)*	13.5	0	25	0	0.20	0	20.5	0	0.05

*Derived from the 2023 Cell 4 CPT Testwork (Ref. 15)

5.3 IMPLICATIONS FOR DESIGN

Results of the geochemical testing on samples of tailings from the Mungari project indicate the following:

- The tailings are Non Acid Forming (NAF).
- The multi-element analyses of the solids indicate several metals to be present at elevated concentrations (namely arsenic, chromium, nickel, sulfur, antimony and selenium). As such, a cover system will be required on closure to isolate the tailings from the environment.
- Testing of the supernatant water quality shows a number of exceedances of reference values for release from mining operations and livestock and wildlife drinking water. As such, measures are incorporated into the design to reduce seepage from the basin and release of supernatant to the environment.
- The supernatant and seepage is hypersaline due to the use of hypersaline groundwater in the processing of ore. The groundwater in the vicinity of the TSF is hypersaline. As such it is not expected that seepage from the facility will result in an increase in groundwater salinity.
- A cover system will be constructed on closure to reduce any water ingress and resulting seepage.

6. TAILINGS STORAGE FACILITY DESIGN

6.1 GENERAL

The Mungari site already has extensive existing infrastructure from the previous development including process plant, pits, waste dumps and stockpiles.

The existing TSF is located west of TSF Cell 1 and Cell 2, which is north of Kurrawang Lake.

The TSF consists of two rectangular cells operated separately, until the storage capacity is met. The site layout is shown on Drawing No. PE801-137-C3006-050.

It is noted that Cell 3 and Cell 4 have each been constructed to the Stage 2 elevation, with Stage 3 approved and to be constructed in the coming year. This design comprises Stage 4 to Stage 9/10, whereby upstream construction raises are proposed.

6.2 DESIGN PARAMETERS

Design criteria are listed in Section 3.2. Geotechnical design parameters are summarised in Section 4.3 and design parameters for tailings are presented in Section 5.2.

Typically, construction shall be sequenced to allow for 12 - 18 months of storage capacity across each cell. To achieve this, staged raises have been combined in this design (i.e Stage 5/6, Stage 7/8 and Stage 9/10). Once Stage 4 for each cell has been constructed, raises of each cell can be on an annual basis.

6.3 TSF MATERIAL SOURCES

Zone A borrow material for facility raises shall be sourced from areas previously identified north and east of Cell 1 and Cell 2. Zone T material forming the bulk of upstream raises will be sourced from adjacent borrows within the tailings beach. Mine waste will also be utilised by direct hauling of primary rock from the mine.

6.4 TSF DEPOSITION MODELLING

During the Stage 1 Feasibility Study (Ref. 16), a tailings deposition and density model was generated for the facility to determine the tailings beach level and hence TSF cell embankment levels over the life of the operation.

At the request of Evolution, the Stage 4 to Stage 9/10 design (this report) has combined stages to minimise the associated costs with undertaking embankment raises annually. Consequently, Stage 5/Stage 6 have been merged, as well as Stage 7/Stage 8 and Stage 9/Stage 10.

The as built survey for Stage 1 and Stage 2 have been utilised to validate the storage capacity within each cell. Notably, the tonnages achieved to date are greater than the feasibility study design, due to increased borrow from the Cell 1 basin and effective operational performance by Evolution.

The proposed embankment crest elevations, with corresponding tonnages are summarised in Table 6.1 below.

Table 6.1: Embankment crest elevations and cumulative tonnages

Stage	Crest Elevation (mRL)	Crest Raise Height (m)	Cell 3 Volume (Mm^3)	Cell 4 Volume (Mm^3)	Average Densities (t/m^3)	Cell 3 Tonnage (Mt)	Cell 4 Tonnage (Mt)	Rate of Rise (m/year)
1	347.40	-	1.32	1.64	1.40	1.85	2.30	-
2	349.10	1.70	2.27	2.55	1.40	3.18	3.57	-
3	350.70	1.60	3.23	3.47	1.40	4.52	4.86	-
4	352.35	1.65	4.19	4.39	1.40	5.87	6.15	2.63
5/6	355.75	3.40	6.09	6.17	1.40	8.53	8.64	2.77
7/8	359.35	3.60	8.03	7.97	1.40	11.24	11.16	2.89
9/10	363.15	3.80	9.99	9.78	1.40	13.99	13.69	3.02
							27.7	

Deposition into each cell is balanced throughout the operational life to promote air drying and improve tailings densities through consolidation.

No spillway is allowed for in the TSF operational design. A freeboard allowance of 0.3 m was used to determine embankment crest levels and this will allow storage of a 72 hour duration PMP storm event on the facility.

Review of crest levels will be undertaken each year ahead of construction so that any adjustments for achieved densities, throughputs and beach slopes can be accommodated.

Access to Cell 3 and Cell 4 will be via existing access ramps, upstream of the subsoil/topsoil stockpiles. Ramps will be raised as required during the life of mine.

6.5 EMBANKMENT PROFILE

The perimeter and divider embankments and the decant causeways will be constructed in annual stages. Staged embankment crest elevations were determined based on the deposition/density results as outlined in Table 6.1.

The perimeter embankment consists of an initial starter embankment (Stage 1, completed), one downstream lift (Stage 2, completed), one centreline lift (Stage 3, approved for construction) and 4 upstream stages (Stage 4, Stage 5/6, Stage 7/8 and

Stage 9/10) as shown on Drawing PE801-137-C3006-301. The divider embankment and decant causeways will be raised at each stage as shown on Drawing No. PE801-137-C3006-302 and PE801-137-C3006-506 respectively. The perimeter embankment will have an upstream slope of 1V:2H and downstream slope of 1V:4H for each raise. A crest width of 8 m will be provided for each stage.

The divider embankment will have an upstream and downstream slope of 1V:2H and a crest width of 7 metres.

The decant causeways will have slopes of 1V:2H with crest widths of 12 m.

The Stage 4 to Stage 9/10 perimeter embankment will be zoned with an upstream tailings zone (Zone T) constructed from suitable tailings material within the basin and a low permeability zone (Zone A) constructed from suitable material from borrow areas external to the facility.

Erosion protection (Zone E) will be provided on the upstream and downstream faces of the upstream raises. The downstream buttress (Zone H) will be constructed from mine waste from the open pit. It is anticipated this will be constructed by the mining fleet.

The decant causeways will be constructed from borrow material, overburden or run of mine waste (Zone H) as available at the time of construction.

6.6 USE OF TAILINGS MATERIAL FOR EMBANKMENT RAISES

During upstream raise construction from Stage 4 and beyond, the facility will be raised on the tailings beach, with Stage 5/6 to Stage 9/10 comprising Zone T material as part of the upstream component of the embankment. It is anticipated that this material shall be won from tailings adjacent to the area, with an offset of at least 10 metres to ensure borrow and embankment stability are met. The material is anticipated to be coarser in nature (in comparison to an operational sample from the Plant) toward the embanbkment toe, due to segregation of particles during deposition.

The use of tailings results in efficiencies due to the significantly shorter haul distance compared to solely Zone A raise construction, as opposed to a civil contractor winning mined natural material from borrow. The suitability of tailings for use in embankment construction has been assessed by using data gathered from previous testwork to date (Ref. 14 and Ref. 15). It is noted that an initial assessment conducted in 2018 (Ref. 17) found that the tailings permeability was generally an order of magnitude higher than the current Zone A hence could not fully replace this zone.

CPT findings (Ref. 15) indicate that tailings layers are evident within the facility basin, in line with the staged raise development (i.e. different degrees of tailings consolidation due

to exposure to air drying). Dilative layers exhibit a higher degree of consolidation, indicating that with sufficient engineering controls (i.e. compaction and moisture specification) in place, the use of compacted tailings for embankment construction shall produce a material that exhibits dilative behaviour, thus reducing the potential for liquefaction occurring. This is outlined further in Section 5.2, whereby it is noted that a tailings sample compacted to a minimum 95% of SMDD will be dilative.

The proposed engineering controls to ensure Zone T meets the required specifications are outlined in Table 11.3, noting a compactive requirement of 98% SMDD. Ongoing tailings field and laboratory testwork by the Engineer during construction will validate the tailings material properties used in the design. Further details on QA/QC requirements are outlined in Section 11 and Appendix J. Zone E material will also be constructed on the upstream face to limit erosion of the Zone T material from rain events and operational spigotting.

Zone A material and Zone E material will be constructed on the downstream face of the facility to aid with erosion and also form a barrier between the tailings and the surrounding environment.

6.7 FUTURE EMBANKMENT BUTTRESS REQUIREMENTS

Allowance for a buttress has been made, with the timing of construction dependent on the development of the phreatic surface within the corresponding cell. The buttress fill extends to RL354.0 m and will have a bench width of 11 m and downstream slope at 1V:4H as shown on Drawing No. PE801-137-C3006-302.

It is noted that the requirement for buttress construction is conceptual at this stage and will be dependent on the following:

- Phreatic surface development through ongoing monitoring via extensive instrumentation (vibrating wire piezometers, standpipe piezometers, monitoring bores) at regular intervals. A trigger action response plan will be developed which will outline timing of buttress requirements based on the phreatic surface within the facility.
- Material strength parameters (through laboratory and in-situ testwork).
- Ongoing stability assessment revisions based on facility performance and any material changes identified.

Buttress construction will form part of the closure profile, with material to be accounted for by Evolution in the LoM waste schedule.

6.8 DECANT AND RETURN WATER SYSTEM

Abstraction of water from the supernatant ponds is required to supply water to the process plant and to control pond levels in the facility. Deposition of tailings is designed such that the ponds are maintained in the centre of each cell around a centralised decant tower.

A tower decant in each cell comprises a rockfill surround and a vertical tower type arrangement to reduce the fines entering the tower and provide a simple mechanism to locate the inlet of the pump above the tailings level (refer to Drawing No. PE801-137-C3006-506 to PE801-137-C3006-507 inclusive). Submersible pumps are installed in the towers to recover the supernatant and return it to the Process Plant. As tailings levels increase the tower and access causeway will be raised. The pump and pipework design, including power provision, has been addressed by the Client's mechanical and electrical design team.

Under normal operating conditions it is expected that the decant system will run continuously and only under an extended dry period would the pumping rate from the facility be reduced. It is envisaged only one pump system will cycle between the two cells however a duty and standby pump would be required to ensure continuity in return water.

6.9 SEEPAGE CONTROL

6.9.1 General

The main functions of the seepage control system are to:

- Reduce seepage through the basin and under/through the embankment. This is beneficial both in terms of environmental performance and embankment stability.
- Drain the tailings mass, thus increasing the density of the tailings and providing a more efficient facility in terms of storage.
- Collect supernatant and return the water to the processing plant.
- Increase the strength of the tailings mass immediately adjacent to the embankment.

The major components of the existing seepage control system are:

- Basin foundation.
- Cut-off (key) trench at the embankments.
- Basin underdrainage collection system.
- Embankment toe drains.
- Recovery infrastructure.

6.9.2 Basin Foundation

This was constructed during Stage 1 and is not applicable to this design report.

6.9.3 Cut-off Trench

This was constructed during Stage 1 and is not applicable to this design report.

6.9.4 Basin Underdrainage Collection System

This was constructed during Stage 1 and is not applicable to this design report.

6.9.5 Embankment Toe Drain

This was constructed during Stage 1 and is not applicable to this design report.

6.9.6 Underdrainage Towers

The existing vertical tower systems comprise reinforced concrete pipe which will be extended each raise. Submersible pumps operate within the sumps at the base of the towers drawing seepage water build up out of the facility.

The underdrainage tower has been constructed at the centre of each cell, accessible by the decant access causeway, shown on Drg No. PE801-137-C3006-506.

The control of the pumps is configured so that the entire underdrainage system operates at atmospheric pressure as much as practicable to reduce the pressure head on the basin and embankment and therefore reduce seepage. The pump design has been addressed by the Client's mechanical design team.

A total of 2 pump systems are in operation (i.e. no cycling between infrastructure). This ensures full time operation of all towers even during periods of no tailings deposition.

Discharge from the underdrainage systems are pumped directly to the decant tower in the active cell for recovery to the Plant.

6.9.7 Toe Drain Collection Sumps

Four (4) toe drain collection sumps were excavated in each cell during Stage 1 construction. The sumps collect solution from the existing toe drains and collected solution is abstracted by a submersible pump situated at the base of a riser pipe running up the embankment upstream face.

One 450 mm diameter HDPE riser pipe runs from the base of the sump, on the embankment upstream face to the crest elevation. As part of the Stage 4 raise, the riser pipe terminates on a platform situated on the downstream batter of the perimeter embankment, as shown on Drg No. PE801-137-C3006-508.

It is noted that placed Zone A material will abut the riser pipe(s) as part of Stage 4 earthworks. Adequate compaction adjacent to the riser pipe shall be ensured through

plate compactors (in the immediate vicinity) and pad foot compactors to meet the required Technical Specification, mitigating the risk of piping through the embankment. Monitoring of the phreatic level through piezometers along each embankment will also ensure each area remains dry and limit potential erosion adjacent to the riser pipe.

A submersible pump (bore pump style) is situated at the base of the riser pipe, within the collection sump. The pump operates with a level control adjusted to ensure the water level is maintained below original ground level. The control of the pumps is configured such that the entire system operates at atmospheric pressure as much as practicable to reduce the pressure head on the basin and embankment and therefore reduce seepage. The pump design has been addressed by the Client's mechanical design team.

A total of 8 pump systems are required i.e. no cycling between infrastructure. This ensures full time operation of all systems even during periods of no tailings deposition. Discharge from the toe drain systems is pumped directly to the decant tower in the active cell for recovery to the Plant.

6.10 EMBANKMENT ZONING COMPATIBILITY

The following as constructed details, description and information have been compiled for the Mungari TSF:

- The upstream zone of the starter embankment consists of a 6 m wide Zone A material. This was selectively sourced from basin and external borrow areas with a minimum 25% fines passing 75 µm and plasticity greater than 10%.
- Zone A was compacted in 300 mm layers at -1% > Optimum Moisture Content (OMC)% > 2% and to 98% Standard Maximum Dry Density (SMDD).
- A total of 75 No. Zone A Particle Size Distribution (PSD) tests were conducted during Stage 1 (refer Figure 6.1). These indicated the fines content ranged from 25 - 60% with an average of 43%.
- The Stage 1 downstream zone of the embankment consists of Zone C material. This was sourced from borrow areas comparable to Zone A, compacted in 500 mm layers to 95% SMDD.
- A total of 54 No. Zone C PSD tests were conducted (refer Figure 6.2). These indicated the fines content ranged from 20 – 50% with an average of 32%.
- The Stage 1 upstream toe drain consists of slotted draincoil pipe (300 Megaflo), wrapped in geotextile sock (A14 Bidim Geotextile) and surrounded by filter sand Zone F1. This was covered in an erosion protection material prior to tailings then

covering the toe drain. It was expected that the erosion protection will not provide any filter function to the toe drain system.

- A total of 24 No. Zone F1 PSD tests were conducted during construction. Results are shown on Figure 6.3.
- Existing operating tailings PSDs (contained in Appendix E) were available to compare with the as constructed Zone F1.

The 2017 revision of Chapter 26 of Soils Engineering National Engineering Handbook (Ref. 18) was used to assess filter compatibility. It is noted the procedure does not consider similar materials adjacent to each other (developed primarily for determining drainage sand and gravel specifications).

The following was determined:

- The average of the Stage 1 embankment Zone A is a 'Category 2' (as defined by Ref. 18) material following regrading to 4.75 mm. The Stage 1 Zone C material is filter compatible with the average Zone A material. The results are shown on Figure 6.3. As the Zone C is overall on the finer side and not intended to act as a drain, it is considered that the filter compatibility is met.
- The tailings is a non-dispersive Category 1 material with no regrading required. The Zone F1 material meets the design bands as shown on Figure 6.5.
- The Zone F1 is considered filter compatible with the geotextile around the draincoil as the opening size (110 µm) is less than the D50 of 2 mm of the sand.
- The tailings limits were compared against the Zone A PSDs for the instance where they are in direct contact. The filtering criteria is met for all samples, as shown on Figure 6.6. Segregation of the Zone A fill is not considered an issue based on layer thickness, fines content and plasticity of the material.

Using the as constructed PSD data, the Stage 1 filter compatibility is considered adequate for all material types.

It is noted that a filter compatibility check has not been undertaken on Zone A material against Zone H material, as no PSD data were readily available for the Zone H mine waste. As the phreatic level is expected to remain below the Stage 1 crest elevation (outlined further in Section 6.10) prior to buttress construction, the filter compatibility between these two material types is considered to be non-critical for the design (however this will need to be reviewed during the future development).

6.11 SEEPAGE ASSESSMENT

6.11.1 Feasibility Study Seepage Analysis

A seepage analysis was completed during the Feasibility Study (Ref. 16), to assess order of magnitude seepage losses and drainage volumes from the TSF and the location of the phreatic surface through the tailings, embankment and foundation.

The key outputs of the analysis are summarised as follows:

- Seepage flows through the embankment and in the underdrainage systems increase over the stages as driving head increases. Seepage flows also increase substantially when a larger pond is present on the facility, putting more pressure on the toe drain performance.
- Predicted flows through the embankment and in the underdrainage (including toe drain and basin underdrain), for a range of drainage capacities were determined. It is recommended a 5 L/s pump is installed in each toe drain riser and 20 L/s pump installed in each underdrainage tower to account for final stage predicted values.
- The water pressure head through the tailings and embankment (highlighting the predicted location of the phreatic surface), for varied drainage capacities is sensitive to the performance of the drains. These need to be monitored with both in tailings Vibrating Wire Piezometers (VWP) and embankment VWPs to verify the actual phreatic surface during operation.

The following conclusions were drawn for the facility configuration:

- The seepage loss is considered moderate (~0.8 kL/Ha/day) with both basin underdrains and toe drains operating with the average pond.
- The seepage loss will be high (~4.4 kL/Ha/day) if the toe drain is not operated to the design intent and a large pond is maintained.

Overall, the operation of all drains is critical for the reduction of seepage loss and phreatic surface control. However, it is noted that the inclusion of the underdrainage system improves seepage interception through the embankment, reduces the phreatic surface, improves the stability of the structural zone of the embankment and improves tailings consolidation.

6.11.2 Final Stage Phreatic Conditions

As part of the Stage 4 to Stage 9/10 design update, a range of phreatic surfaces were applied to the final embankment geometry in order to develop trigger levels for embankment stability. This included raising the phreatic surface incrementally (~1 metre) to determine the impact on the facilities factor of safety.

Operational phreatic surfaces for each embankment shall be determined by the water level readings obtained from extensive monitoring instrumentation located within the TSF (piezometers within tailings and the embankment) at regular intervals as outlined in the monitoring programme.

6.12 ASSESSMENT OF LIQUEFACTION POTENTIAL

Liquefaction may develop at any depth in a silt or sand deposit where a critical combination of in-situ density and cyclic deformation occurs. The higher the void ratio of the material and the lower the confining pressure the more readily liquefaction will occur.

Fine grained soils that develop high pore-water pressure at low strain, and loose sand-like materials that contract during shear, are most prone to strain softening and flow liquefaction.

6.12.1 TSF Fill Materials

The TSF fill materials are clayey sand/sandy clay being compacted to a high relative compaction when compared to the maximum dry density determined in a compaction test. In addition, the use of underdrainage and maintenance of a small pond will ensure low moisture contents in the fill materials. The liquefaction potential of the TSF shell is considered very low.

Atterberg limit tests for the subsurface material identified that the fines fraction tends to plot above the A-line indicating low to medium plasticity. The dry climate and a groundwater level at significant depth will result in low in situ moisture contents.

6.12.2 Tailings Material

The state parameter, which is defined as the difference between the in-situ void ratio and the void ratio at critical state, at the same mean effective stress, is used to infer the susceptibility of materials to strain softening behaviour and flow liquefaction. Material with a state parameter of less than -0.05 (Ψ < -0.05) is characterised as dilative, exhibiting strain hardening behaviour during undrained shear. Conversely, materials with a state parameter greater than -0.05 (Ψ > -0.05) are characterised as contractive, exhibiting strain softening during undrained shear, and may be susceptible to flow liquefaction.

The results from the 2023/2024 CPT programme (Ref. 15) indicate that the tailings profile at Mungari typically comprises:

- A top tailings layer less than 1 m deep with typical dilative behaviour (Ψ < -0.05).

- Bottom 1 – 4 m tailings layer mainly showing contractive behaviour (Ψ > -0.05) and many thin dilative layers embedded within contractive layers.

The dilative layers are a result of air drying and adequate consolidation of tailings material, indicating that if the material is in a dense state, it is not susceptible to liquefaction and will exhibit dilative behaviour.

The laboratory test results for tailings samples (provided as Figure 6.7) show that the particle size distribution falls within the boundaries for potential flow liquefaction as defined in Fell et. al. (Ref. 19). Seepage modelling of the facility over the mine life demonstrates that the phreatic surface remains close to the pond area and that the tailings mass will not saturate. Whilst the grading of the tailings falls within a potentially liquefiable category, the moisture contents over the mine life and post closure are expected to be below that required to cause static or seismically-induced liquefaction. As such it was concluded that the tailings are unlikely to liquefy and upstream construction techniques can be adopted.

Liquefaction risk can be mitigated further by controlling the embankment rate of raise and monitoring pore-water pressure dissipation during construction.

6.13 STABILITY ASSESSMENT

6.13.1 General

The modelling assessed stability of the embankment under long-term drained, short-term undrained (potential/no potential loss of containment and post-seismic loading conditions. For the case where the assessed Factor of Safety (FoS) does not meet ANCOLD stability requirements (Ref. 3 and Ref. 4), a buttress design to crest elevation RL354.0 m has been included. A summary of the stability assessment is included in Appendix F.

6.13.2 Conclusions

The assessment includes varied phreatic profiles within the facility at 1 metre height increments based on the associated impacts to the embankment stability, with and without a buttress.

The analysis indicated that up to Stage 5/6 satisfies stability requirements without a buttress in place (assuming the phreatic surface remains below RL348.8 m). Inclusion of a downstream buttress (to crest RL354.0 m at 10 m crest width and 4H:1V downstream slope) will be required if the phreatic surface reaches RL347.1 m at Stage 7/8, or RL346.1 m at Stage 9/10; whichever occurs first.

The buttress shall form part of the closure profile so the material will need to be accounted for in the LoM waste schedule.

Recommendations based on the analysis are as follows:

- Closely monitor phreatic levels within the tailings and embankment during construction, operation and closure. This can be implemented via:
  - Ongoing monitoring of VWPs that were installed under the embankment base of Stage 1 and within the TSF basin as part of the recent CPT programme.
  - Install Standpipe Piezometers (PZ) from the Stage 3 crest to obtain additional phreatic profile information within the embankment (to be undertaken in the coming year).
  - Install VWPs within the tailings mass immediately upstream of the crest from Stage 3 onwards (to be undertaken in the coming year).
  - Allow planning of buttressing in the mine schedule as part of the LoM requirements, should the phreatic surface increase to a level which does not satisfy stability requirements.
  - Conduct CPT programmes every 2 stages (i.e Stage 4 and Stage 7/8) to verify tailings properties and in situ state, while also assessing if additional VWPs are required.
  - Deformation analyses should be conducted if the CPT test results indicate lower strength parameters than those adopted in previous analyses.
- Since the later stage embankment is upstream dominated, numerical modelling is required for settlement assessment in the future, following confirmation of tailings seismic parameters from in situ testing.

6.14 FREEBOARD

6.14.1 General

The TSF is designed to operate without the need for a spillway. A minimum Total Freeboard (water) of 500 mm shall be maintained on the facility after a storm event together with a minimum Operational Freeboard (solids) of 300 mm, as outlined in the DMIRS Code of Practice (Ref. 5).

Freeboard allowances are set such that a 72 hour duration PMP event can be retained on the facility without breach of the perimeter embankments. Following high rainfall events, increased decant return to the Plant will be used to lower the pond level and increase available storm storage capacity.

Definitions for freeboard are provided below:

Operational Freeboard (for solids) is the vertical height between the lowest elevation of the perimeter embankment and the tailings beach immediately inside the embankment. The operational freeboard varies over the course of a deposition cycle as the storage is raised and fills with tailings. The operational freeboard becomes critically important at the end of a deposition cycle, particularly to reduce the potential for back flow and overtopping as a result of mounding of tailings at discharge points. The Operational Freeboard is 300 mm.

Total Freeboard (for water) is the vertical height between the lowest elevation of the perimeter embankment and the pond level **AFTER** a 1% AEP 72 hour storm event assuming no decant return or evaporation. As a result, it is difficult to visualise operationally if the storm event hasn't taken place. Hence the maximum pond level before the design event is determined mathematically to account for the potential inflow. The Total Freeboard after the event is then 500 mm.

Beach Freeboard is the vertical height between the normal operating pond level and the point on the beach where the operational freeboard is measured i.e. the exposed beach extent. The Beach Freeboard can vary significantly during the life of the storage and depends upon beach length, slurry/tailings characteristics and deposition methodology.

When a 1% AEP 72 hour storm event is superimposed on either cell during the deposition sequence, the pond level will remain greater than 200 mm in vertical height below the maximum tailings elevation. Due to this, the operational freeboard of 300 mm will dictate the maximum tailings elevation for each raise, as shown in Table 6.2.

6.15 TAILINGS DISTRIBUTION AND DECANT RETURN CORRIDOR

The TSF is serviced by an existing tailings distribution and decant return corridor which includes a pipe trench for distribution and decant pipework, the main 12 m wide access haul road and electrical power distribution powerlines.

The bunded pipe trench has been constructed by localised cut-to-fill with longitudinal grades such that any rainwater or accidental release of fluids from the pipelines will report to the emergency containment basin located along the corridor leading to Cell 1 and Cell 2. The base of the trench and bunds are compacted to reduce permeability and limit seepage from the trench in the event of leaks.

The access haul road allows inspection and maintenance of the pipelines and powerlines. As rock products for erosion protection and decant tower surround are to be sourced from existing waste stockpiles, the road will also serve as the haul route for construction traffic moving engineering fill materials.

7. WATER BALANCE MODELLING

7.1 GENERAL

The management of water within the Mungari Project area is a critical aspect of the design. In order to understand (and enable control) the flow of water around the site, a TSF water balance model has been developed.

The primary objectives of the water balance modelling are summarised below:

- Estimate settled tailings densities.
- Establish the filling rate for tailings solids within the TSF.
- Determine net flows and average supernatant pond volumes within the TSF throughout operation.
- Determine supernatant pond volumes following design rainfall events and sequences.
- Determine staged embankment crest elevations, to ensure containment of tailings and prevent discharge of supernatant water for design rainfall events and sequences.
- Determine the magnitude of recycle water shortfalls during design dry rainfall sequences.

For the water management model the following inputs into the TSF were included:

- Water in the tailings slurry from the plant.
- Rainfall runoff from the tailings and pond surface (refer to Appendix A for the site climatology assessment).

The production data for modelling are summarised in Table 7.1.

Table 7.1: Tailings production data

Parameter	Value (Single Cell / Total)
Total Throughput	13.8 Mt / 27.7 Mt
Life of Mine	13.0 years
Annual Throughput Rate	2.1 Mtpa

The following rainfall sequences were modelled:

- Average climatic conditions.
- 1% AEP, 1 year dry rainfall sequence.
- 1% AEP, 1 year wet rainfall sequence.
- 1% AEP, 72 hour duration storm event superimposed over average rainfall sequence.

Outputs from the TSF included:

- Evaporation losses.
- Seepage losses.
- Water returned to the plant as process make-up water (pumped system).

The model allows for the build-up of tailings area, calculation of tailings densities, supernatant release, and rainfall and evaporation losses from various surfaces.

The TSF water balance modelling was based on a monthly time step and undertaken using a density model. Full details of the modelling process and results are presented in Appendix G. A summary of the key results and conclusions is provided below.

7.2 RESULTS AND CONCLUSIONS

The operating strategy for the facility assumes a constant throughput is deposited into one cell until that stage capacity is met at which point deposition is transferred into the alternate cell. Therefore, one cell was modelled to assess the water return rates expected. This also provides a conservative estimate of the expected tailings density noting improvements will be made by cycling between both active cells when available. Water balance modelling results are summarised in Table 7.2.

Table 7.2: Water balance modelling summary

	Design Conditions		
	Average Rainfall Conditions	1% AEP Dry Year Rainfall Conditions	Average Conditions + 72-hour 1% AEP Storm
Peak Monthly Supernatant Pond Volume (m^3)	52,000	8,000	179,000
Average TSF Recycle Rate (m^3)	99,000	146,000	-
Maximum Monthly TSF Recycle Rate (m^3)	120,000	171,000	-
Minimum Monthly TSF Recycle Rate (m^3)	71,000	121,000	-

Based on the modelling undertaken, a number of conclusions can be drawn:

- There is sufficient stormwater storage capacity on the TSF to accommodate design storm events (including 72 hour duration PMP) and rainfall sequences, with sufficient freeboard to comply with regulations. This requires the supernatant pond to be maintained within acceptable operating limits.

- Under average conditions, a recycle water shortfall occurs during each month of operation throughout the life of the facility. The maximum annual shortfall is approximately 1,715,000 m^3.
- The maximum annual recycle water shortfall for 1% AEP dry conditions is 1,750,000 m^3 per cell.
- Due to the low but relatively consistent recycle rates throughout each year of operation, it is recommended that planning for process water supply be based on approximately 25 - 35% of the annual demand being recycled from the TSF.

It is recommended that the pump capacity be designed for maximum recycle from the TSF, i.e. 95% of water in slurry. It should be noted that during operations there will be periods where only one cell is operated e.g. during embankment raises. For these periods, sufficient pumping and pipework capacity should be made available to discharge the total plant tailings throughput to one cell and return the total decant volume from one decant tower.

8. MONITORING AND MAINTENANCE

8.1 MONITORING PROGRAMME

As part of the TSF operation, extensive monitoring of all aspects of the operation will be undertaken to ensure the TSF design intent is met. This monitoring will comprise three basic types. These are:

- Operation monitoring

  This will include items such as spigot offtake location, whether pipe joints are leaking, etc. This level of monitoring is directed at ensuring that the facility is operating smoothly.

- Compliance monitoring

  This includes items such as checking survey pins for movement, monitoring bores for contamination, etc. This monitoring is required to ensure that the project is meeting all its commitments in regard to a safe and secure operation.

- Performance monitoring

  This will include items such as tailings level surveys and water flow measurements, etc. This monitoring is necessary to assess the performance of the facility and refine future embankment lift levels and final extents.

The monitoring programme for the facility is summarised in Table 8.1 and further details on compliance and performance monitoring are provided in Sections 8.2 and 8.3.

Table 8.1: Monitoring programme

Area	Monitoring Requirement	Frequency*
Operation Monitoring		
TSF	Outer perimeter area and embankments	Daily
	Condition of roads and ramps	Daily
	Tailings pipeline integrity	Daily
	Tailing behaviour at deposition point	Daily
	Visual check on tailings and water levels versus embankment crest	Daily
	Offtake location	Daily
	Blockage or damage of discharge	Daily
	Monitoring Instrumentation	Daily
TSF Decant System	Size of supernatant pond	Daily
	Location of supernatant pond	Daily
	Return Water Pipeline integrity	Daily
	Blockage of decant tower	Daily
	Visual check on decant tower operation	Daily
TSF Underdrainage, Toe Drains, Seepage Trench and groundwater recovery bores	Blockage of towers/pipes	Daily
	Visual checks of water level in towers/pipes	Daily
	Visual check of pipeline integrity	Daily
Compliance Monitoring		
TSF Embankment	Survey pins	Monthly
TSF Basin	Water volume and level	Weekly
	Tailings beach-head level	Weekly
Monitoring Bores	Water level	Monthly
	Water quality – Basic	Monthly
	Water quality – Intermediate	Quarterly
	Water quality – Comprehensive	Annually
Standpipe and VWPs	Water level/Pore water pressure	Monthly
Performance Monitoring		
Climatic (Kalgoorlie Bureau of Meteorology station 12038)	Precipitation, Evaporation, Maximum - minimum temperatures, Wind direction and speed	Daily
Tailings	Tailings solids (tonnes)	Weekly
	Water in tailings (tonnes or m^3)	Weekly
	Average tailings flow (m^3/s)	Weekly
	Tailings surface survey	Quarterly
	Tailings geochemistry testing	Annually (Or as per any change to tailings characteristics)
Water	Outflow from decant pumps	Daily
	Outflow from toe drain, underdrainage and recovery bores	Daily
	SG of Decant Water	Daily
TSF	Processing Manager Inspection	Monthly
Technical Audit	Independent Geotechnical Engineer	Annually

*Or as specified in permit conditions

8.2 COMPLIANCE MONITORING

8.2.1 Survey Pins

Survey pins installed at regular intervals along the upstream side of the TSF embankment crest will be regularly monitored to assess embankment movement. The details of each pin (date of installation, survey pin ID, Northing, Easting and RL) will be recorded on installation and included in the construction report.

Each survey pin location will be measured as outlined in the monitoring programme. Any displacement of the embankment which is considered excessive or ongoing may indicate embankment stability problems and will require investigation by the EoR. Remedial action will be undertaken if required based on the conclusions drawn from such an investigation.

A recommended trigger action response plan for excessive displacement survey pins is as follows:

- Standard monitoring frequency as per Table 8.1.
- A change of greater than 10 mm (in one direction) between readings or 20 mm between three readings (in one direction) will require an immediate resurvey.
- If confirmed, survey pin reading frequency will increase to weekly and the EoR notified and informed of each reading.
- If movement continues, additional survey pins are to be installed and full detailed embankment survey pickup conducted. Frequency of survey pin readings to increase to daily. Any further remedial action recommended by the EoR to be implemented, such as additional monitoring equipment, removing surcharge, reducing supernatant pond volume, etc..
- If settlement stabilises, continue revised increased monitoring frequency as directed by the EoR.
- Revert to standard monitoring frequency only after approved by the EoR.

8.2.2 Monitoring Bores

Eight groundwater monitoring stations were installed downstream of the Cell 3 and Cell 4 TSF perimeter embankment to facilitate early detection of changes in groundwater level and/or quality, both during operation and following TSF decommissioning. These are labelled as MG-TSF-MB-08 to MG-TSF-MB-15, which are suffixed with D (deep) or S (shallow).

Three levels of testing will be undertaken at the frequencies listed in Table 8.1. The test parameters are detailed in Table 8.2.

Table 8.2: Monitoring bore testing parameters

Level	Parameters to be Tested
Basic	Level, pH, Electrical Conductivity (EC)/Total Dissolved Solids (TDS)
Intermediate	Basic + WAD and Total cyanide
Comprehensive	Intermediate+ Ca, Mg, Na, K, CO_3, Cl, SO_4, Al, As, Cd, Cr, Cu, Fe, Mn, Ni, Zn, Pb and Co.

Each monitoring bore station consists of one shallow bore, extending to a depth of approximately 8 to 10 m in the surface horizon, and one deep bore terminating at approximately 30 m into bedrock. The shallow bore is intended to detect any seepage from the facility flowing within the surface sediment, whilst the deep bore will monitor the chemical composition of the groundwater. Each borehole was cased and screened over an interval set in the field during installation, and sealed back to surface with low permeability grout. The casing for the monitoring bores is 100 mm diameter so that each monitoring bore can be converted to a de-watering bore if required.

Monitoring bores will be monitored for water level and quality at regular intervals by the environmental department.

A recommended trigger action response plan for excessive increase in water level in monitoring bores is as follows:

- Standard monitoring frequency as per tables 8.1 and 8.2.
- A change in water level of greater than 1 m between readings, or 2 m between three readings, will require an immediate re-measure.
- If confirmed, water levels to be cross-checked against typical seasonal fluctuations for the region by a qualified hydrogeologist. Survey frequency to increase to weekly and the EoR notified and informed of each reading.
- If the increase continues to within 4 m of natural ground level (compliance limit), additional monitoring bores are to be considered and a detailed assessment of the source and extent to be determined. Any further remedial action recommended by the EoR is to be implemented. A pumping test should be conducted with a view to returning water from the bore to the TSF.
- If water levels stabilise, continue revised increased monitoring frequency as directed by the EoR.
- Revert to standard monitoring frequency only after approved by the EoR.

In the event that water quality measurements are outside of the normal range (based on historical data) the following actions should be taken by the environmental department:

- Notify the EoR of the non-compliant measurements.
- Increase frequency of level, TDS and pH readings to weekly.
- Increase frequency of major component analysis of samples from the monitoring bores for testing to weekly.
- Report the findings to the DWER as per licence conditions.
- If the elevated readings continue and sample indicates higher than typical constituent levels, a site visit by the EoR should be arranged.

8.2.3 Vibrating Wire Piezometers

Pore water pressures will be monitored at several locations within the perimeter embankment to assess the performance of the underdrainage system and construction activities and ensure that stability is not compromised. Currently 17 No. VWPs are installed beneath the embankment footprints in Cell 3 and Cell 4, with a further 12 No. installed in the Cell 4 basin during the recent site investigation (Ref. 15). The VWPs are connected to a telemetry network which can be read online.

The level was recorded at the time of installation to allow the reference point for measured porewater pressure to be converted to an absolute phreatic surface. The cable was run out sideways through the embankment into a data logger at the downstream embankment toe.

The VWPs will be monitored at regular intervals as outlined in the monitoring programme and any increases in water level noted. The porewater pressure should be monitored to ensure that the phreatic surface indicates that the underdrainage system is operating effectively.

Additional vibrating wire piezometers will also be installed into the Cell 3 basin in 2024.

8.2.4 Standpipe Piezometers

Standpipe piezometers will be installed at ten locations on the Stage 3 TSF embankment.

Each piezometer will consist of a 50 mm diameter PVC tube slotted at the base or supplied with a filter tip. The slotted section will be surrounded by sand, and bentonite pellets will be placed above the sand to provide a seal.

The remainder of the hole will be sealed with a bentonite/cement grout. The top of the piezometer will be provided with a lockable cap to prevent tampering or vandalism. The base of each piezometer will be located within the embankment fill to ensure that the

phreatic surface within the embankment, as opposed to natural groundwater level, is being measured.

The piezometers will be monitored at regular intervals as outlined in the monitoring programme and any rises in water level noted. Increases of greater than 10% of the embankment height should be referred to a qualified geotechnical engineer for further investigation. The piezometer levels should be monitored to ensure that the phreatic surface does not reduce the overall stability of the embankments below acceptable levels. Remedial action will be undertaken if increases in pore water pressure are unacceptably high.

8.3 PERFORMANCE MONITORING

Performance monitoring of the TSF will include monitoring of the following variables on a daily basis:

- Solids tonnage to the TSF.
- Percent solids of tailings slurry.
- Any additional water inputs to the TSF.
- Rainfall and evaporation at the TSF - sourced from BOM Kalgoorlie or Mungari weather station.
- Water return from the TSF to Plant Site.
- Collection efficiency of the underdrainage systems based on sump pump monitoring.

Monitoring of tailings moisture contents and densities, and survey of the tailings beach and supernatant pond locations will be conducted quarterly. The daily monitoring of the above information in conjunction with the beach survey and resulting density and level measurements will be used to calibrate the water balance model. This will allow ongoing projections of tailings and supernatant pond levels against time relative to the original design assumptions and proposed embankment raise schedule.

8.4 TECHNICAL AUDIT

In accordance with the requirements of the ANCOLD "*Guidelines on Tailings Dam Planning, Design, Construction, Operation and Closure*" (Ref. 3) and DMIRS (Ref. 5), the TSF will require annual audits by the EoR to ensure that the facility is operating in a safe and efficient manner. The audit should include, but not be limited to, the following items:

- Tailings beach survey showing spot elevations along embankments and across tailings beaches.

- Reconciliation of stored tailings volume and calculated densities with the expected design values, and assessment of available capacity remaining in terms of volume and time.
- Assessment of in situ tailings properties, including particle size distribution, in situ strength, density and moisture properties.
- Water balance studies with approximate reconciliations of slurry volumes, solids content, decant recovery, site rainfall and evaporation. In conjunction with contained moisture information, this will provide an indication of possible seepage losses.
- Validation of storage design, using input parameters derived from site measurements and testing, implications for future storage if present trends are continued, and recommendations for any necessary operational or design modifications.
- Presentation and interpretation of monitoring results, proposals for additional monitoring of identified areas, changes to operational procedures resulting from monitoring results and proposals for any necessary seepage recovery systems.
- General description of TSF, complete review of tailings and water management practices and operating manual procedures, their problems, failures and successes, and any alteration to the facility or operating procedures that are proposed.
- A complete description of the previous embankment raise with as-built drawings and design proposals for the next embankment raise (as appropriate) based on the recorded data.

A comprehensive Geotechnical Audit Report will be prepared and submitted to the Client and DMIRS following each annual audit site visit.

8.5 MAINTENANCE PROGRAMME

Inspection and maintenance of the TSF is largely aimed at mitigating potential problems by dealing with them before they can develop into major problems.

Some aspects of the maintenance programme, such as inspections, can be integrated into the monitoring programme. If problems are detected, then the problem is either to be corrected immediately or to be noted on the inspection checklist and the relevant maintenance request form filled in. The maintenance request form will generally allow for varying levels of urgency depending on the gravity of the situation. The assessment of urgency should be based on the potential for the problem to affect the operation or

integrity of the facility. The maintenance will then be integrated with the overall site maintenance programme.

Table 8.3 outlines the maintenance requirements for each area of the TSF. Modifications to the maintenance programmes should be made as a result of emergency situations or annual audits (if required).

Table 8.3: Maintenance programme

Area	Maintenance Requirement	Frequency
Pipeline	Inspect pipeline for pipe bursts and leaking joints.	Daily
	Inspect off-take(s) for potential blockages, failure etc. before occurring. Repair and/or replace as necessary. Re-locate off-take(s) to new location and check that flow at new location is acceptable.	Each shift
	Inspect the pipeline containment ramp for signs of potential leakage or rainfall erosion.	Daily
	Break pipeline at selected locations and observe wear on valves, fittings and pipes. Remove any accumulated material from valves etc. Rotate pipeline if excessive wear is occurring along invert of pipe (flanges date stamped).	Annually during programmed plant shut down
	Carry out maintenance on valves and fittings as recommended by suppliers. Test leak detection system on tailings and reclaim water line.	Biannually
Embankment	Check general structural integrity and visual signs of seepage through perimeter embankment.	Daily
	Detailed inspection for slips, erosion problems including around survey pins, tension cracks etc. Problems to be referred to qualified geotechnical engineer for assessment.	Weekly
	Inspect discharge location or downstream face for erosion or damage. Repair as appropriate.	Daily
Decant	Inspect supernatant pond and location. Adjust discharge location to maintain pond around decant tower.	Daily
	Detailed inspection of decant system for damage or debris.	Weekly or after significant rain events
Underdrainage System	Detailed inspection of collector, finger and toe drains for damage, collapse or ingress of material until covered by tailings.	Monthly or after significant rain events
	Detailed inspection for erosion damage to protection layer and soil liner.	Monthly or after significant rain events
Instrumentation	Inspect all instrumentation and repair / replace as required.	Monitoring frequency specified
Run-off collection channels/ponds	Check general structural integrity and visual signs of erosion.	Daily
	Inspect discharge location for erosion or damage. Repair as appropriate.	Daily
General	General inspection of TSF and all structures.	Daily
	General assessment of dust emissions.	Daily

8.6 INCIDENT REPORTING

During TSF operation, there are many potential incidents that should be recorded; however, the reporting of such incidents are split into two categories:

- Reportable internally – these are incidents that may impact day to day TSF operations and are generally relatively minor. These consist of ongoing company specific safety and environment reports. The Responsible Engineer should be notified of these incidents summarised as part of annual audits.
- Reportable externally – these are serious incidents that impact or could have impacted the environment and the health and safety of employees and/or the public. The DWER and/or DMIRS is to be informed of all reportable incidents associated with the TSF within 24 hours of occurrence. The Responsible Engineer should also be notified and specialist advice sought if the incidents relate to the operation and integrity of the TSF.

Reporting of incidents is required in accordance with the Mine Safety and Inspection Act (Ref. 20).

In the event that an incident occurs, the Evolution Incident Reporting system should be followed and a report completed and submitted to the relevant parties within 24 hours of the occurrence of the incident. Additionally, should the license conditions be breached then an incident will be externally reportable.

Regardless of the reportable status, any incident will fall under one of the following three general categories:

- Environmental.
- Structural.
- Health and Safety (Personnel or Public).

Reporting of incidents is an extremely important task as part of the safe TSF operation. It is recommended that the reporting procedure include, but not necessarily be limited to, the following:

i. Which reporting category is appropriate to the incident?

ii. If external reporting is appropriate, review specific procedure and implement as appropriate.

iii. For internal reporting, the following should be considered:

- Which general category is appropriate to the incident?

- Description of the incident including: location, date, time, weather conditions, result (damage) and potential cause of the incident.

iv. Description of remedial actions to be taken to rectify the incident.

v. Description of precautionary measures to be taken to prevent re-occurrence of the incident.

vi. Review of remedial and precautionary measures once initiated, to assess whether they are achieving the desired result.

It is recommended that an incident and reporting register is established prior to the TSF being commissioned and a basic reporting pro-forma developed. This will assist in the reporting of minor incidents, which are more likely to occur during the initial stages of operation and will assist in preventing the minor incidents from re-occurring.

9. DEPOSITION MANAGEMENT

9.1 DEPOSITION OBJECTIVES

The tailings deposition strategy was designed and will be managed throughout the life of the facility to meet the following objectives:

- Deposition of a basin lining within the inundation area.
- Maintenance of freeboard against the upstream embankment face.
- Discharge to improve sub-aerial deposition and consolidation of tailings.
- Deposition to effectively utilise the net available storage capacity.
- Effective management of the size and location of the supernatant pond.
- Reduce the volume of water stored on the facility at any time.
- Reduce the operating costs of the tailings distribution system.
- Reduce down time by providing operational flexibility.
- Facilitate the implementation of the storage closure strategy.
- Reduce potential for dust generation.

9.2 DEPOSITION INFRASTRUCTURE

Tailings is delivered to the storage facility by HDPE delivery pipe and distributed to offtake spigots by HDPE distribution pipe.

The tailings delivery line runs along the main access road to the TSF in a containment channel. Flow meters are installed at the plant and the TSF to provide real time monitoring of the tailings discharge pipeline, connected via telemetry directly to the alarm system at the Plant.

Emergency dump ponds have been installed at low points of the tailings pipeline to contain a minor pipe burst and limit the spillage of tailings to the environment. The dump ponds have been designed to store the volume of tailings within the section of the pipeline between each high and low point, as well as the volume of slurry likely to be pumped between the period of leak detection and pump shutdown.

The tailings delivery pipeline connects to a distribution pipeline on the crest of the facility. The distribution pipelines extend around the full perimeter of the TSF and across the divider embankment. The pipework is located on the upstream side of the embankment crest behind the road safety bund so that any leakage will flow into the TSF basin and not be released to the external environment.

The distribution pipeline is fitted with spigot offtakes, located at 25 m intervals along the main embankment crest. Nominally 6 to 8 spigots will be in operation during each cycle.

Each offtake consists of a flanged spool connected into the main tailing distribution line with a HDPE offtake branch. A valve is connected to each offtake allowing the deposition location to be controlled. A 1.5 m length of water delivery pipe is connected to the spigot offtake and discharges into a uPVC storm water drainpipe, slotted along the pipe soffit. This directs the tailings down the upstream face of the embankment, reducing erosion.

Note that design of the delivery and distribution pipelines are not included in this report.

When embankments are to be raised the distribution pipeline and associated offtakes will be removed from the crest to allow earthworks to progress. Once the new crest level has been reached the pipework will be reinstalled on the crest and recommissioned.

9.3 DEPOSITION TECHNIQUE

The deposition of tailings into the facility is sub-aerially from the embankments. Sub-aerial deposition allows for the maximum amount of water removal from the facility by the formation of a large beach for drying and draining. Together with keeping the pond size small, sub-aerial deposition increases the settled density of the tailings, and hence improves the storage potential and efficiency of the facility.

Deposition occurs from multiple spigots inserted along the tailings line. The deposition locations are moved progressively along the delivery line as required to control the location of the supernatant pond. As the facility is now in operation, a suitable cycle time has been determined in order to evenly deposit the tailings around the facility perimeter, thereby maintaining the supernatant pond at a central location within each cell.

The tailings are deposited in the facility from the embankment in such a way as to encourage the formation of beaches over which the slurry will flow in a laminar non-turbulent manner.

The solids settle as deposition continues and water is released to form a thin film on the surface of the tailings. This water will evaporate or flow to the supernatant pond from where it is removed from the storage area.

Deposition of the tailings is carried out on a cyclic basis with the tailings being deposited over one area of the storage until the required layer thickness has been built up. Deposition is then be moved to an adjacent part of the storage to allow the deposited layer to dry and consolidate. This is repeated around the perimeter of the facility until the first deposition point is reached after which the process will be repeated. This facilitates maximum storage to be achieved over the whole facility by allowing the greatest possible drying times for the tailings.

After deposition on a particular area of beach ceases and settling of the tailings has been completed, further de-watering will take place due partly to drainage into the underdrainage system but mainly due to evaporation. As water evaporates and the moisture content drops the volume of tailings will reduce to maintain a condition of full saturation within the tailings. This process will continue until interaction between the tailings particles hinders volume reduction.

Whilst deposition is ongoing, the underdrainage and toe drain sumps require pumping to prevent build-up of supernatant within the underdrainage and promote tailings settlement.

Rates of rise of tailings are expected to be reasonably low and of the order 2 - 3 m per year. Combined with high evaporation rates, a small supernatant pond volume, high tailings permeability and the presence of underdrainage within the facility, it is not expected that there will be any issues with excessive saturation of tailings or poor consolidation.

9.4 DEPOSITION CONTROL

Deposition occurs from all sides of each cell such that a tailings beach that slopes from the perimeter of each cell into the centre where the decant tower is located is formed.

As the Stage 4 construction window approaches, deposition will cease in one of the cells to allow the tailings beach a month or so to dry prior to construction (timeframe estimated based on past experience at Mungari TSF Cell 1 and Cell 2 and shall be confirmed during operation). Once the first cell is raised, all deposition will be directed to the enlarged cell thereby allowing the second cell time to dry before its embankments are raised.

9.5 OPERATIONAL FLEXIBILITY

The facility design and proposed deposition process is based on laboratory test data and a number of assumptions. In addition, the properties of the tailings will vary as different source rocks are used and the processing operation is refined. As such the design includes for flexibility to enable changes to be made to the TSF to suit the characteristics of the tailings.

Continual monitoring of the location of the decant pond will be undertaken during operation of the TSF. Whilst the deposition sequence will be planned in a cyclic manner around the facility, if the pond starts to move away from the decant location then deposition will need to be adjusted to push the pond back to its correct location. There will be multiple discharge points around the facility to allow control of beach development and pond location.

Since the embankments will be constructed in stages, the performance of the tailings will be monitored to allow the timing of future embankment stages to be modified to suit the measured performance of the tailings in the storage facility.

9.6 DEPOSITION INTO TAILINGS BORROW AREAS POST RAISE CONSTRUCTION

Following completion of raise construction utilising Zone T (tailings) material, borrow areas adjacent to the embankment will be apparent, with dimensions to be determined during construction based on field conditions.

To ensure the flow of tailings toward the supernatant pond upon recommencing deposition into the cell, spigots shall extend into the borrow areas to limit erosion of tailings adjacent to the embankment. Drainage channels from the downstream side of the borrow area(s) shall also be implemented to allow for water to freely drain toward the supernatant pond.

Cyclic deposition shall be maintained in order to facilitate consolidation of tailings within the borrow areas, such that the areas will be suitable for the next upstream embankment raise.

Details of borrow dimensions and techniques shall be outlined in construction documentation as part of the raise campaigns.

10. SURFACE WATER MANAGEMENT DESIGN

10.1 GENERAL

The TSF is a paddock arrangement and rainfall onto the facility is managed through the water management plan (water balance) and appropriate freeboard allowances. There are no inflows from external catchments that report to the TSF basin.

For this site, surface water management comprises management of run-off reporting to the toe of the facility in order to prevent ponding and/or erosion of the embankments.

10.2 UPSTREAM CATCHMENTS

The total catchment area contributing runoff to the existing diversions is approximately 110 Ha. General topography in the TSF area falls from northeast to southwest towards Kurrawang Salt Lake.

10.3 TSF EMBANKMENT TOE PROTECTION

Prevention of erosion of the TSF embankment toe by surface flows during rainfall events is achieved through the use of protective engineered fill material. Coarse mine waste material (Zone H) shall form the downstream component of the embankment through a buttress and provides adequate erosion protection.

The downstream embankment face shall also comprise erosion protection, with Zone E material placed during Stage 5/6 to Stage 9/10.

In addition, there will be regular monitoring of the TSF embankments and maintenance undertaken as necessary to ensure safe operation of the facility.

10.4 EXTERNAL SURFACE DRAINAGE

Surface water catchment areas that currently report to Cell 1 and Cell 2 are directed into shallow surface drains located downstream of the north embankments.

As part of the Cell 3 and Cell 4 design, a run-off collection trench was constructed along the downstream toe of Cell 3 and Cell 4. This flows into sedimentation basins west of Cell 4 and south east of Cell 3.

10.5 TAILINGS DISTRIBUTION AND DECANT RETURN CORRIDOR

The existing access corridor includes bunds and road pavement above natural ground level, which will be extended adjacent to the Cell 3 downstream toe as part of this design. In high rainfall events some localised ponding of water against the corridor will occur but it is expected that the water will naturally dissipate in a short period of time. Ponding water should not affect the integrity or operation of the corridor.

The corridor ties into the corridor that leads to Cell 1 and Cell 2, using the same dimensions for road and trench widths.

Emergency containment basins have been allowed for in the event of pipeline rupture, for containment of tailings or return water.

Should excessive ponding occur, then culverts will be installed at critical locations along the corridor to reduce the occurrence of ponding water.

11. TECHNICAL SPECIFICATION AND CONSTRUCTION QA/QC

11.1 GENERAL

TSF construction will be undertaken by a civil earthworks contractor, overseen by a suitably qualified Engineer (KP) in accordance with the Technical Specification and Issued for Construction Drawings which provide specific and detailed, material and construction requirements for each stage of the TSF construction.

The implementation of the Technical Specification during construction is essential to ensure the facility will function according to the design intent.

The following aspects, in particular, will be monitored during earthworks construction:

- Embankment foundation preparation.
- Selection of suitable embankment fill.
- Moisture conditioning and compaction of embankment fill materials.

Earthworks quality control tests including gradation, moisture content and density tests will be undertaken throughout construction to ensure compliance with the Technical Specification requirements.

A detailed QA/QC Manual is provided as Appendix J.

11.2 FILL MATERIALS

11.2.1 General

Fill materials sourced from designated stockpile/borrow areas shall be durable and shall not, except as otherwise specified, contain more than a small proportion, as determined by the Engineer, of flaky particles and shall be free from organic, vegetable and other unsuitable matter. Except as otherwise specified, the particles shall be hard and resistant to breakdown during handling.

Fill materials shall be well graded within the specified gradation limits contained within the following sections, i.e. they shall contain a good distribution of all sizes of particles from the coarsest to the finest being placed at any given time, without there being a significant deficiency in any size or group of sizes determined by the Engineer.

The specified gradation limits given shall apply to the materials when they are placed and spread on the embankment prior to any specified compaction.

The Contractor shall construct the Works by placing, spreading and compacting the fill material in continuous layers of the specified thickness which are approximately horizontal.

11.2.2 Zone A

The fill material for the low permeability Zone A shall be low permeability waste sourced from stockpiles or borrows provided by Evolution as directed by the Engineer. The material shall be verified by the Engineer prior to use by the Contractor.

It is expected that the in situ moisture of the Zone A material will be outside the moisture content range specified in Table 11.3 therefore the material may require reworking, blending and additional conditioning prior to compaction. In addition, the material excavated may be in large clods and hence will require additional reworking to break the clods down, blend or expose suitable material for moisture conditioning.

The Contractor shall develop and conduct the filling operations in such a manner that a thorough blending of materials takes place during the excavation and placement of the material.

The Zone A material shall have a gradation conforming to the limits given in Table 11.1, except as otherwise approved by the Engineer in writing.

Table 11.1: Zone A grading requirements

Sieve Size (mm)	Percent Passing	
	Minimum	Maximum
200	100	100
19	80	100
0.425	35	100
0.075	20	80

The Contractor shall, where necessary, condition the material, either by wetting or drying, to obtain the moisture content required for placing and compaction. The Contractor must expect to either moisture condition the Zone A material in the stockpile/borrow area or on the embankment crest (by blending). Due to the low permeability of Zone A material, it will be relatively difficult to obtain quick penetration of moisture. For this reason, a tilling and spraying technique is recommended where it is necessary to raise the moisture content of the material. Drying of the Zone A material shall be undertaken by exposing thin layers of material to wind and sun. Moisture conditioned Zone A shall be of uniform moisture content throughout the layer. Dry and wet pockets of Zone A shall be rejected. If necessary, the Contractor shall allow time for the material to mature in order to achieve the uniform distribution of moisture through the material.

11.2.3 Zone T

During upstream construction from Stage 5 onward, tailings is proposed for use in the upstream component of the embankment. Tailings cannot be used as a substitute for Zone A low permeability material.

Zone T shall be won from the TSF beach a minimum 10 m offset from the upstream toe of the embankment raise. Material immediately adjacent to the embankment may be unsuitable for use as tailings infill. In these instances, the Contractor will be required to win suitable material from other locations along the tailings beach.

Low shear strength materials may be encountered on the tailings beach area and adequate precautions with regard to equipment selection, excavation and fill placement should be taken.

It is likely that the field moisture of the tailings will be outside the moisture content range specified in Table 11.3. Therefore, the material may require reworking, blending and additional conditioning prior to compaction.

The Contractor shall develop and conduct the filling operations in such a manner that a thorough blending of materials takes place during the excavation and placement of the material.

The tailings material shall have a gradation conforming to the limits given in Table 11.1.

The Contractor shall, where necessary, condition the material, either by wetting or drying, to obtain the moisture content required for placing and compaction. Moisture conditioned tailings shall be of uniform moisture content throughout the layer. Dry and wet pockets of tailings shall be rejected. If necessary, the Contractor shall allow time for the material to mature in order to achieve the uniform distribution of moisture through the material.

11.2.4 Zone D

Zone D is general fill material used in the construction of safety bunds. The material shall be sourced from borrow areas provided by Evolution as directed by the Engineer. The material shall be verified by the Engineer prior to use by the Contractor.

11.2.5 Zone G

Zone G material is intended for use in the decant surrounds. The material shall be sourced from stockpiles provided by Evolution as directed by the Engineer. The stockpiled material shall be verified by the Engineer prior to use by the Contractor.

Due to the intended purpose of the zone, the placed material shall comprise clean rockfill and have a general particle size of between 50 mm and 500 mm and little or no fines (less than 5% passing 0.075 mm sieve) except as otherwise approved by the Engineer

in writing. To achieve this, the Contractor may be required to selectively excavate or sort at the stockpile location, or screen bulk materials using a suitably sized grizzly.

11.2.6 Zone H (Mine Waste)

Selected mine waste (Zone H) is intended for use as structural fill. The material shall be sourced from stockpiles provided by Evolution as directed by the Engineer. The placed material shall comprise of well graded rockfill and have less than 20% passing 0.075 mm sieve except as otherwise approved by the Engineer in writing.

11.2.7 Wearing Course

Wearing course shall consist of durable, select laterite/gravel or other suitable material approved by the Engineer. The Contractor shall obtain the material from borrow areas near to the project site or, if deemed necessary, by importing from off-site. The wearing course shall be free from cobbles, stumps, roots, sticks, vegetation and other deleterious matter. The placed material shall have a maximum particle size of 50 mm and minimal fines (less than 5% passing 0.075 mm sieve). To achieve this the Contractor may be required to screen bulk materials using a suitably sized grizzly.

11.2.8 Backfill

Unless shown otherwise on the Drawings or directed by the Engineer, material excavated from trenches and small foundations shall be used for backfill. Particular attention shall be paid to the compaction of material adjacent to concrete structures to ensure intimate contact of the backfill material with the structures.

Where the backfill material is other than the material excavated, any supports shall be removed before or during filling of the replacement material such that the material from the walls of the excavation does not contaminate any of the replacement material.

Mud or excavation spoil shall not be allowed to contaminate concrete, drainage medium, bedding material or any other items of the permanent Works.

11.2.9 Compaction Density

During the initial construction of each embankment raise, compaction trials will be conducted to establish the optimum compaction characteristics of the materials. The trials will involve varying the moisture content and the number of passes of the compaction equipment. Tests will be undertaken during the trials and approved by the Engineer.

Fill materials shall be compacted to the densities and moisture contents specified in Table 11.2.

Table 11.2: Material compaction requirements

Zone	Material Type	Maximum Uncompacted Layer Thickness	Moisture Content[4]	Minimum Density (SMDD[1])
Zone A	Low permeability fill	300 mm	-1% < OMC[2] <+2%	98%
Zone D	General fill (in safety bunds)	500 mm	n/a	92%
Zone E	Clean rockfill erosion protection	300 mm	n/a	Uniform density (bucket tamped)
Zone G	Clean rockfill	n/a	n/a	Uniform density free from voids
Zone T	Recovered tailings	300 mm	-2% < OMC[2] <+3%	98%
Selected Mine Waste (Zone H)	Small sized rockfill (NAF[5])	n/a	n/a	Well graded Engineer approval
Backfill[4]	Ex-excavation	200 mm	n/a	95%
Wearing Course	Selected gravel	150 mm	0% < OMC[2] <+3%	95%

[1]SMDD denotes: Standard Maximum Dry Density
[2]OMC denotes: Optimum Moisture Content
[3]n/a denotes: not applicable
[4]Where no moisture content limits are specified, moisture conditioning of the material may still be required in order to achieve the minimum specified density.
[5]NAF = Non Acid Forming

11.3 EARTHWORKS TESTING METHODS

Testing of the material to be used in construction of the works shall be conducted by methods given in Table 11.3.

Table 11.3: Test Methods

Test Designation	Type of Test	Test Method
C1/R1	Atterberg Limits	AS 1289.3.1.1 to AS 1289.3.3.1
C2/R2	Moisture Content	AS 1289.2.1.1 or AS 1289.2.1.4
C3/R3	Particle Size Distribution	AS 1289.3.6.1
C4	Laboratory Compaction	AS 1289.5.1.1
R5	Nuclear Method Field Density	AS 1289.5.8.1

C – Denotes Control Tests
R – Denotes Record Tests

11.4 EARTHWORKS TESTING FREQUENCY

It is envisaged that tests will be performed at approximately the frequency shown in tables 11.4 to 11.7. Additional testing will be required if a high degree of variability in the material is encountered.

Table 11.4: Test Frequency – Zone A material

Test Designation	Type of Test	Frequency (1 per)
R1	Atterberg Limits	As per C4
R2	Moisture Content	As per R5
C3/R3	Particle Size Distribution	As per C4
C4	Laboratory Compaction	Lesser of: Soil Type or 5,000 m^3
R5	Nuclear Density	500 m^3

Table 11.5: Test Frequency – Zone E material

Test Designation	Type of Test	Frequency (1 per)
C3	Particle Size Distribution	5,000 m^3

Table 11.6: Test Frequency – Zone T material

Test Designation	Type of Test	Frequency (1 per)
R2	Moisture Content	As per R5
C3/R3	Particle Size Distribution	As per C4
C4	Laboratory Compaction	Lesser of: Soil Type or 5,000 m^3
R5	Nuclear Density	500 m^3

Table 11.7: Test Frequency – Road Wearing Course material

Test Designation	Type of Test	Frequency (1 per)
C3	Particle Size Distribution	250 m^3

12. EMERGENCY ACTION PLANS

12.1 GENERAL

Emergency situations and unforeseen natural disasters can have serious effects on the operation of the TSF. A detailed emergency action plan is provided in the operating manual (updated for each stage) for the TSF to manage emergency situations and unforeseen natural disasters. Procedures will be developed for the following emergency situations and stored in the site document control system:

- Massive embankment failure.
- Partial embankment failure.
- Excessive seepage/piping.
- Excessive surface erosion.
- Tailings delivery pipeline failure.
- Tailings distribution pipeline failure.
- Return water pipeline failure.
- Power loss/pump failure to decant system.
- Decant tower failure.
- Imminent embankment overtopping.
- Embankment overtopping.
- Excessive sub-surface seepage.

The following non-critical items are discussed in this section:

- Evacuation procedure.
- Earthquake events (major and minor).
- Extreme rainfall events.
- Tailings pipeline leakage/blockage.
- Water return pipeline leakage/blockage.
- Power failure.
- Excessive dust.

12.2 EVACUATION PROCEDURE

In the event of a failure or an impending failure occurring, the following steps should be taken:

- Notify all personnel to immediately leave the TSF area by the nearest and safest exit route and to assemble at the designated assembly point shown in

Appendix D. All nominated personnel shall gather at the assembly point in the event of an emergency; and

- Account for all personnel associated with TSF operation. If there are any persons unaccounted for, inform emergency services.

12.3 EARTHQUAKE EVENTS

The site is located in an area of low seismicity however earthquake events have occurred in the area. The TSF has been designed to stringent stability criteria and the stability of the TSF perimeter embankment should be checked annually as part of the annual audit of the TSF.

Contingency procedures to be adopted in the event of an earthquake are dependent on the intensity of the earthquake event at the site and are outlined below:

12.3.1 Major Earthquake Event (Modified Mercalli Intensity VI or Greater)

Recognition: Difficulty standing, hanging objects quiver, masonry cracks, waves on ponds, some minor injuries.

Response
i) Immediately terminate deposition of tailings into the TSF and pumping from the decant.
ii) Immediate inspection of TSF embankments and decants for obvious deformation or movement.
iii) Immediate inspection of all pipes including tailings pipeline(s) for rupture or leakage.
iv) If any damage is noted refer to Evolution Crisis Management Plans.
v) Deposition can be recommenced if no major damage to facility and pipelines has occurred and that power has been restored.
vi) Piezometers, survey pins and monitoring bores are to be read immediately after the event and all instrumentation to be read daily until readings have stabilised.

12.3.2 Minor Earthquake Event (Modified Mercalli Intensity V or Less)

Recognition Felt outdoors as well as indoors, liquid disturbed, small objects displaced, doors swing open or closed, pictures move.

Response
i) Inspect pipelines for rupture or leakage.
ii) Inspect embankments and decants for obvious deformation or movement.
iii) If any damage is noted refer to the Tailings Emergency procedures.

iv) Monitor all instrumentation immediately after the event and weekly thereafter until readings return to normal.

12.4 EXTREME RAINFALL EVENTS

The TSF is designed to operate without the need for a spillway. Regulatory freeboard is set to maintain a 500 mm depth following a 1% AEP 72 hour storm event. Water storage allowances are set such that a 72 hour duration PMP event can be retained on the facility without breach of the perimeter embankments. Following high rainfall events, increased decant return to the Plant will be used to lower the pond level and increase available storm storage capacity.

Major storm events can cause serious erosion problems as well as other damage. A system of inspections should be conducted to mitigate any potential adverse consequences of extreme rainfall.

It is recommended that access roads are designed for all weather capability to ensure inspections can be undertaken under all circumstances.

12.5 TAILINGS PIPELINE LEAKAGE/BLOCKAGE

12.5.1 General

For the tailings discharge system, the following two situations are covered below:

- Leakage in the delivery and/or distribution pipeline (including joint failure).
- Blockage of the distribution line and/or off-takes.

The tailings pipeline will be contained in a bunded trench when remote from the TSF embankment crest. A flow meter is installed at the process plant and at the toe of the TSF embankment for both the Tailings and Reclaim Water lines. These flow meters form the leak detection system and will result in automatic shutdown of either the tailings or reclaim water pumps. Consequently, these situations should not result in the release of tailings from the TSF or contamination of any surface water systems. However, the capacity of such systems to store tailings is limited and regular inspections and maintenance should be conducted.

The potential emergencies and the appropriate responses are outlined in the following sections.

12.5.2 Leakage in the Tailings Delivery/Distribution Pipeline

The most likely location for rupture is at valves, joints and fittings along the pipeline(s). Regular inspection of the pipeline(s) should be conducted. All minor leakages should be noted and the joint(s) disassembled, checked and repaired as required during the next

programmed maintenance period or plant shutdown. This procedure will prevent major problems from developing.

Should a major rupture occur, local erosion of the embankment or overtopping of the pipeline containment trench may occur. Any tailings spillages should be cleaned up and the tailings placed into the TSF. Any damage to the embankment, bund, etc., should be repaired.

12.5.3 Distribution Pipeline/Off-take Blockage

The distribution pipeline runs along the TSF perimeter embankment crest and along the causeway embankment. The procedures to be undertaken if a blockage occurs in the distribution line will comprise either moving the deposition location back along the line closer to the process plant, switching deposition to an alternate deposition line or, if this is not possible, temporarily ceasing deposition.

The failure of a spigot off-take will be treated in a similar manner to the procedures for a blockage in the distribution line. The off-take containing the blockage should be removed and the new off-take assembled and installed in its place. On replacement, deposition should be returned to its original position. Components may be salvaged from the ruptured off-take for future use.

12.6 RETURN WATER PIPELINE FAILURE

12.6.1 General

For the return water system, two potential emergency situations are possible:

- Rupture in the pipeline (including joint failure).
- Blockage of the return line.

The TSF return water pipeline is contained in a suitable erosion protected trench in areas when remote from the TSF embankment crest. Consequently, leakage should not result in the release of supernatant water from the TSF or contamination of local surface water systems. However, the capacity of such systems to store water is limited and regular inspections and maintenance should be conducted.

The potential emergencies and the appropriate responses are outlined in the following sections.

12.6.2 Leakage in the Return Water System

The most likely location for rupture is at valves, joints and fittings along the pipeline. Regular inspection of the pipeline should be conducted. All minor leakages should be noted and the joint disassembled, checked and repaired as required during the next

programmed maintenance period or plant shutdown. This procedure will prevent major problems from developing.

Should a major rupture of the TSF return water pipeline occur, local erosion of containment trench surface, or overtopping of the pipeline containment trench may occur. Any residue resulting from spillages should be cleaned up and placed into the TSF. Any damage to the pipeline containment trench, bunds, etc. should be repaired.

12.6.3 Water Return Pipeline Blockage

In the unlikely event that a blockage occurs in the return water line, the TSF decant pumps should be switched off. The section of pipeline containing the blockage should then be removed and unblocked and the pipeline re-assembled. Pumping may then re-commence.

12.7 POWER FAILURE

12.7.1 General

The tailings pumps are connected to the process plant power distribution system. In the event of a total loss of power, all systems including all pumps and automatic valves not connected to standby generators will cease operations. Systems affected could include:

- Water control and removal in the supernatant pond.
- Underdrainage pumping system.
- Tailings pumping system.

A summary of the actions required for each of these systems is summarised in the following sections.

12.7.2 Water Control and Removal in the Supernatant Pond

Shutdown of the decant pump will mean that the level of the water in the supernatant pond will slowly begin to rise if tailings continue to be discharged. Daily visual inspection of the supernatant pond level will be required. While, the available storage volume is very large, it is recommended that temporary power facilities be installed if power cannot be reinstated within seven days.

12.7.3 Underdrainage Pumping System

Shutdown of the underdrainage pump will mean that the head of water overlying the underdrainage system will increase, and consequently the potential for seepage will also increase. If the power outage is likely to be for more than seven days then an emergency plan should be initiated to supply power to the underdrainage pump.

On resumption of power all pumps and controls should be checked to ensure they are operating correctly.

12.7.4 Tailings Pumping System

Upon loss of power, the tailings pumping system will shut down. It is expected that, during normal operations / brief shutdowns, the tailings will be re-mobilised readily on re-commencing pumping. For extended shutdowns (>12 hrs) it is recommended that the pipe be flushed. In the event that the tailings cannot be re-mobilised, the pipeline(s) will need to be flushed and drained by manual valves into the Plant Site event pond or TSF.

Discontinuing tailings discharge will have no significant effect on the TSF operation. Rainfall Runoff will continue to report to the supernatant pond.

12.8 EXCESSIVE DUST

Dust is a potential hazard both to site personnel and the surrounding environment and therefore should be controlled throughout TSF operation.

There are a number of distinct operations and effects associated with TSFs that have the potential to create dust emissions. The potential sources of dust are:

- Wind.
- Movement of vehicles around the site.
- Material excavation, handling and tipping operations.
- Rehabilitation works.

The following dust measures are considered to be adequate for the control of dust emissions from the TSF. These are:

- Cyclic deposition of tailings around the entire perimeter of the facility to ensure that the tailings beach remains moist. Relocation of the discharge location on a more regular basis may be required during hot windy conditions.
- Regular and adequate employment of water spraying on unsurfaced areas to reduce dust emissions. The need for this control will be assessed continually, based upon on-site observations, weather conditions and the potential for dust emission across the site. In particular, dry conditions with high wind speeds would be a ‘high risk’ situation.
- Cessation of a particular operation or an amendment to an operational procedure, when dust cannot be controlled.
- Implementation of a speed limit around the TSF (suggested 20 km/h). This should be enforced to reduce the potential for the disturbance of “bulldust”.
- Progressive rehabilitation and establishment of vegetative cover on the perimeter embankment downstream face as soon as practicable during operation. In addition, temporary revegetation may be considered in higher dust risk areas.

If it is considered essential that operations susceptible to dust are undertaken, and personnel are to be exposed to elevated dust levels, appropriate precautions must be undertaken which can include, but are not limited to, the following:

- Small localised dust suppression, including mist spray.
- Supply and wearing of appropriate dust masks.
- Change and washdown facilities separate from other personnel.
- Personnel dust monitors.
- Restriction of working periods in elevated dust environments.

The TSF operators, or any contractors working at the TSF shall conduct regular audits of dust emissions and stop work if dust emissions are considered excessive or have the potential to cause a safety or environmental problem.

13. SAFETY IN DESIGN

13.1 GENERAL

As part of the requirements for the design of the TSF facility it is the responsibility of everyone involved to reduce risks associated with the facility as much as practicable.

The TSF will go through a number of phases in its life cycle as outlined below:

Phase 1:	Stage 4 to Stage 9/10 design.
Phase 2:	Cell 3 (Stage 4) construction including installation of equipment, pipework etc.
Phase 3:	Discharge of tailings into Cell 3 (Stage 4) and operation of water recovery and control systems.
Phase 4:	Construction of Cell 4 (Stage 4).
Phase 5:	Discharge of tailings into Cell 4 (Stage 4) and operation of water recovery and control systems.
Phases 6 to 17:	Repeat of Phases 2 to 5 for stages 5/6, 7/8 and 9/10.
Phase 18:	Review of operating data and final design of facility closure.
Phase 19:	Construction of closure components.
Phase 20:	Monitoring and reporting on compliance with closure criteria requirements.

13.2 DELINEATION OF RESPONSIBILITY

Each phase has separate requirements and may be under the control of different stakeholders. Table 13.1 provides a list of responsible parties for each of the current phases and an outline of the technical requirements for the responsible parties for future phases.

It should be noted that as the facility designer, KP will provide a design for all stages of the facility based on projected throughput and other data. This does not remove the need for design review and detailed documentation development for each future stage.

Table 13.1: Designated responsible parties

Stage	Design	Construction	Operation
1 - 3	Designer: Knight Piésold Pty Ltd Client: Evolution Mining	Geotechnical Engineer: Knight Piésold Pty Ltd Contractor: TBA Client: Evolution Mining Civil Superintendent: Evolution Mining	Operator: Evolution Mining
4 – 9/10	Designer: Knight Piésold Pty Ltd Client: Evolution Mining	Geotechnical Engineer: Knight Piésold Pty Ltd Contractor: TBA Client: Evolution Mining Civil Superintendent: Evolution Mining	Operator: Evolution Mining
Closure	To be designated (refer to Note 2 and 4)	To be designated (refer to Note 2)	Operator (refer to Note 3)

Note 1: Review of operating parameters and design of facility stages and closure requires selection of an appropriate engineering firm with experience in tailings management and civil engineering fields to act as the Engineer of Record (EoR) for the facility.

Note 2: Client Supervisor responsibility requires selection of an appropriate engineering firm with experience in supervision of civil engineering/earthworks construction.

Contractor responsibility requires selection of an appropriate construction company with experience in construction of civil engineering facilities particularly construction of dams and interaction with mining fleet operations.

Note 3: The current operator of the mine is Evolution Mining, and it is assumed that their responsibility will be extended to include the operation of the TSF.

Note 4: The designer of the closure phase will also need to include experience in the design of TSF shutdown and closure / rehabilitation requirements.

13.3 INCORPORATION OF SAFETY COMPONENTS IN DESIGN STAGE

13.3.1 General

There is a hierarchy of control measures to eliminate or reduce risks as follows:

i. Elimination.

ii. Substitution.

iii. Isolation.

iv. Engineering controls.

v. Administrative controls.

vi. Personal protective equipment.

For the storage of tailings there are a number of minimum requirements of the facility including embankments, methods for delivery of the tailings and removal of surplus water that cannot be eliminated. As a result, many of the hazards associated with the facility cannot be eliminated / substituted and engineering and administrative control systems are required.

13.3.2 Engineering Controls

The design has incorporated a number of design aspects to reduce risks associated with the facility as follows:

- The site selection resulting in a location remote to current and proposed mine and public infrastructure (Completed in the Feasibility Study).
- Downstream embankment profiles have been used for Stage 1 and Stage 2 to increase the embankment factor of safety.
- The embankment has been designed with low permeability zones to reduce seepage flow.
- A 4 metre deep cut-off trench was constructed during Stage 1 under the embankment to reduce seepage flows through the foundation material.
- Drains have been incorporated into the facility upstream toe to increase tailings densities near the embankment, reduce the phreatic surface and reduce seepage losses.
- An extensive, well graded central underdrainage system has been constructed into the facility basin to maximise water removal from the tailings mass.
- Conservative parameters and safety factors have been used in the design.
- Design includes safety berms for all embankment crest areas and access roads.
- Testing of the tailings mass in advance of upstream construction has been undertaken to demonstrate adequate strength for this form of construction.
- Erosion protection material on the outer embankment face to limit erosion potential.
- Additional embankment buttressing has been allowed for, with the timing of construction dependent on the development of the phreatic surface within the corresponding cell.
- A comprehensive monitoring instrumentation programme has been allowed for which includes monitoring bores, vibrating wire piezometers, standpipe piezometers and survey pins.
- Surface water management has been incorporated into the design to limit the catchment reporting to the downstream embankment toe.

13.3.3 Knowledge Transfer To Downstream Responsible Parties

As the designer it is necessary to provide a clear understanding to the responsible parties for the construction and operational phases regarding the assumptions made in the

design. Primarily knowledge transfer is achieved by providing various documents outlining construction requirements and management procedures.

These include:

Construction

- Provision of construction drawings for each stage of construction.
- A technical specification covering all aspects of construction of the facility including QA/QC requirements.
- Specification for QA testing separate from the Contractor.

Operation

- An operating manual for each stage outlining deposition concepts and targets, minimum monitoring and maintenance requirements and required inspection levels and frequency. The manual also has a Trigger, Action, Response Plan (TARP).

13.3.4 Ongoing Review and Design Reassessment

In order to ensure that the original design intent is met or alternatively that changes to the intent are backed up with detailed design work, the life cycle incorporates a series of regular checks on the operation and design. These include the following:

- Annual audits of the facility by a competent geotechnical engineer to comply with the requirements of the ANCOLD and DMIRS guidelines (Ref. 3 and Ref. 5 respectively).
- A design phase for each subsequent stage to involve a review of operating parameters to date and any required modifications to the design based on forward projections for the next stage.
- Testing of rehabilitation and closure requirements during the operating phase with ongoing monitoring after closure (as outlined in the closure documentation).

The ongoing review of the operation and design will ensure that the facility can be modified as required for any changes to the conditions and operation of the mine site.

14. CLOSURE AND REHABILITATION

The Closure and Rehabilitation Design for Cell 3 and Cell 4 has been included as Appendix I. This includes closure concepts, profiles, and surface water management plan from the catchments reporting to the TSF.

The closure surface water management plan should be reviewed towards the end of the life of Cell 3 and Cell 4 in order to incorporate the as built conditions of the site topography at that time.

15. RISKS AND OPPORTUNITIES

15.1 GENERAL

An evaluation of risks and opportunities for the project was conducted for the design presented in this report. The risks generally cover technical aspects of the work although some cost aspects are also addressed.

15.2 RISKS

15.2.1 Tailings Beach Slope

It was assumed that the tailings beach slope will average 0.83% (1V:120H) over the TSF, based on performance to date of the operational cells. If the beach slope is steeper than predicted or concave in shape, then for a given embankment level, the storage capacity for tailings will decrease, and the stormwater storage capacity will increase. Conversely, if the beach slope is flatter than predicted, then the storage capacity for tailings will increase, and the stormwater storage capacity will decrease.

The current TSF design can accommodate a beach slope flatter than 0.83%. However subsequent raise construction will need to be expedited if a steeper beach slope occurs. Regular beach topographical surveys will be needed to monitor beach slopes and inform planning of future embankment raises.

15.2.2 Upstream Construction

The design allows for upstream construction from Stage 4 to Stage 9/10 using tailings and natural borrow material for construction. Testing and analysis undertaken to date shows that upstream construction on the tailings beach should be practicable. There is a risk that, if there is inadequate strength gain in the tailings beach or the phreatic surfaces are too high (due to incorrect deposition sequencing or operational effectiveness), downstream or centreline construction may have to be adopted beyond Stage 3. In the event this is the case, an allowance for downstream construction has been made on the facility footprint.

It is noted that CPT programmes are planned for every 2 stages (i.e Stage 4 and Stage 7/8) to verify tailings properties and in situ state, while also assessing if additional VWPs are required.

15.2.3 Tailings Geochemistry

Geochemical testing of the tailings should be continued at points throughout the life of the facility, particularly when different ore bodies or process plant blending is occurring, to ensure that initial testing remains valid. Measurement will need to continue as part of ongoing operations to ensure information is available on the geochemical behaviour of the tailings.

15.2.4 Life of Mine Planning

Any changes to the life of mine plan may impact upon the tailings storage requirements for the site. Issues to be considered are specific proportions of tailings types and blends, facility capacity, and construction timing. Any significant increases in total tonnages may require an expansion of the current TSF which would require additional approvals. Any reductions in total tonnage will result in a lower embankment height and can be accommodated.

15.3 OPPORTUNITIES

15.3.1 Recovery of Tailings for Paste Backfill

The Cell 3 and Cell 4 design assumes no tailings will be removed from the facility during the life of mine, as a conservative approach to ensure the design meets the required capacity. Cell 1 and Cell 2 shall continue to operate to include tailings, providing additional storage capacity through tailings deposition when required (likely during construction raises of Cell 3 and Cell 4).

15.3.2 Alternate Decant System

To reduce the cost of raising the decant structure on an annual basis, an alternative method of supernatant water extraction in the form of decant turrets could be considered. The turrets are manufactured by RBH Engineering and act as a floating water intake device that can operate at shallow pond depths. In conjunction with this, a suction pump(s) would be located on the embankment adjacent to the pond and draw the water from the turret.

Limitations to the turret includes, but are not limited to:

- More frequent monitoring and control of the infrastructure to ensure the turret remains central to the supernatant pond.
- It may be difficult to extract water from a small supernatant pond which could result in bogging of the turret in the tailings.
- Operational depth of water is unknown.

15.3.3 Reduction in Embankment Final Elevation

As outlined in the previous section, additional storage capacity may become available during operations due to paste reclaim. This in turn could result in a reduction in the final crest elevation required for Cell 3 and Cell 4 and thus reduce overall construction cost.

15.3.4 Alternative Borrow Sources

For Stages 4 to 9/10 the design assumes that low permeability embankment fill material (Zone A) will be sourced from the borrow area north of Cell 3. In the event that the area

is not available, alternative borrow sources could be considered west of Cell 4 to reduce the haul distance necessary for the fill materials.

15.3.5 Surface Monitoring

Further settlement monitoring instrumentation could be implemented as part of the Cell 3 and Cell 4 design to measure settlement/movement within the embankment.

These include, but are not limited to:

- Automated Total Station Monitoring. This includes precise optical monitoring that requires total station and prisms located at various points on the embankment, linked via telemetry to processing software that will provide a live measurement.
- Embankment inclinometers and extensometers can be used to measure vertical deformation and horizontal deflection in boreholes within the embankment. These can be manual readings or permanent installations.

15.3.6 Sampling for closure design

Ongoing sampling of tailings and embankment material during TSF operation will allow for more accurate characterisation of material at the Mungari site. This will ensure accurate closure cover modelling parameters and trials can be developed based on the proposed closure and rehabilitation design.

Sampling for closure design is in progress for Cell 1 and Cell 2 which will form the basis for the closure design of Cell 3 and Cell 4.

16. REFERENCES

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DRAWINGS

MUNGARI GOLD PROJECT

TAILINGS STORAGE FACILITY
STAGE 4 TO STAGE 10

ISSUED FOR REVIEW
AUGUST, 2025

Prepared for:

EVOLUTION MINING LTD.

Evolution MINING

Prepared by:

Knight Piésold CONSULTING

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SHEET SIZE A3
REFERENCES

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REV	DATE	DESCRIPTION	DRN	DESIGN	CKD	APP	CLIENT APP
A	14/08/2024	ISSUED FOR REVIEW	TK	BJC	BJC	DJTM	
B	21/11/2024	ISSUED FOR REVIEW - NOVEMBER 2024	SGM	BJC	BJC	SDM	
C	15/08/2025	ISSUED FOR REVIEW - AUGUST 2025	RKG	BJC	BJC	DJTM	

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MUNGARI GOLD PROJECT
TAILINGS STORAGE FACILITY - STAGE 4 TO STAGE 10
TITLE PAGE

SCALE N.T.S.
STATUS: FOR REVIEW
DRAWING NUMBER: 801-137-C3006-001
REV: C

287
410

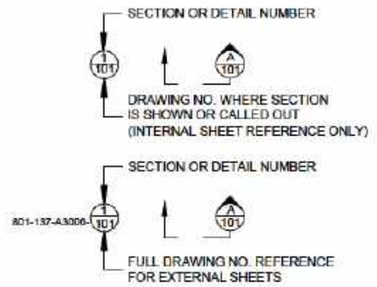
COMMON LEGEND

EXISTING GROUND SURFACE OR BOTTOM OF EXCAVATION

260 EXISTING GROUND CONTOUR AND ELEVATION (IN METRES)

SLOPE INDICATOR

SLOPE INDICATOR (HORIZONTAL TO VERTICAL)



ABBREVIATIONS

APPROX. ≈	APPROXIMATELY	N.T.S.	NOT TO SCALE
BOP	BOTTOM OF PIPE	OD	OUTSIDE DIAMETER
℄	CENTRELINE	OMC	OPTIMUM MOISTURE CONTENT
CPT	CORRUGATED POLYETHYLENE TUBING	PC	POINT OF CURVATURE
		PI	POINT OF INTERSECTION
DIA. Ø	DIAMETER	PT	POINT OF TANGENT
ELEV	ELEVATION	PVC	POLYVINYL CHLORIDE
HLF	HEAP LEACH FACILITY	RC	REINFORCED CONCRETE
HDPE	HIGH DENSITY POLYETHYLENE	RCP	REINFORCED CONCRETE PIPE
ID	INSIDE DIAMETER	REQ'D	REQUIRED
IL	INVERT LEVEL	R.L.	REDUCED LEVEL
IWL	INTEGRATED WASTE LANDFORM	SDR	STANDARD DIMENSIONAL RATIO
LCRS	LEAKAGE COLLECTION & RECOVERY SYSTEM	SCH	SCHEDULE
		SCS	SEDIMENT CONTROL STRUCTURE
LLDPE	LINEAR LOW DENSITY POLYETHYLENE	SMDD	STANDARD MAXIMUM DRY DENSITY
MH	MANHOLE	SOL	SETTING OUT LINE
MAX.	MAXIMUM	SOP	SETTING OUT POINT
MIN.	MINIMUM	TSF	TAILINGS STORAGE FACILITY
MMDD	MAXIMUM MODIFIED DRY DENSITY	TYP.	TYPICAL
NOM	NOMINAL	WSD	WATER STORAGE DAM

GENERAL NOTES

1. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.
2. ALL COORDINATES STATED IN GRID PROJECTION: MGA94 ZONE 51.
3. ALL ELEVATIONS IN METRES, RELATIVE TO MEAN SEA LEVEL.
4. DRAWINGS ARE NOT TO BE SCALED.
5. DRAWINGS TO BE READ IN CONJUNCTION WITH THE TECHNICAL SPECIFICATIONS.

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SHEET SIZE A3

REFERENCES

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B	21/11/2024	ISSUED FOR REVIEW - NOVEMBER 2024	SGM	BJC	BJC	SDM	
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MUNGARI GOLD PROJECT
TAILINGS STORAGE FACILITY - STAGE 4 TO STAGE 10
CONTENTS, COMMON LEGEND AND ABBREVIATIONS

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STATUS: FOR REVIEW
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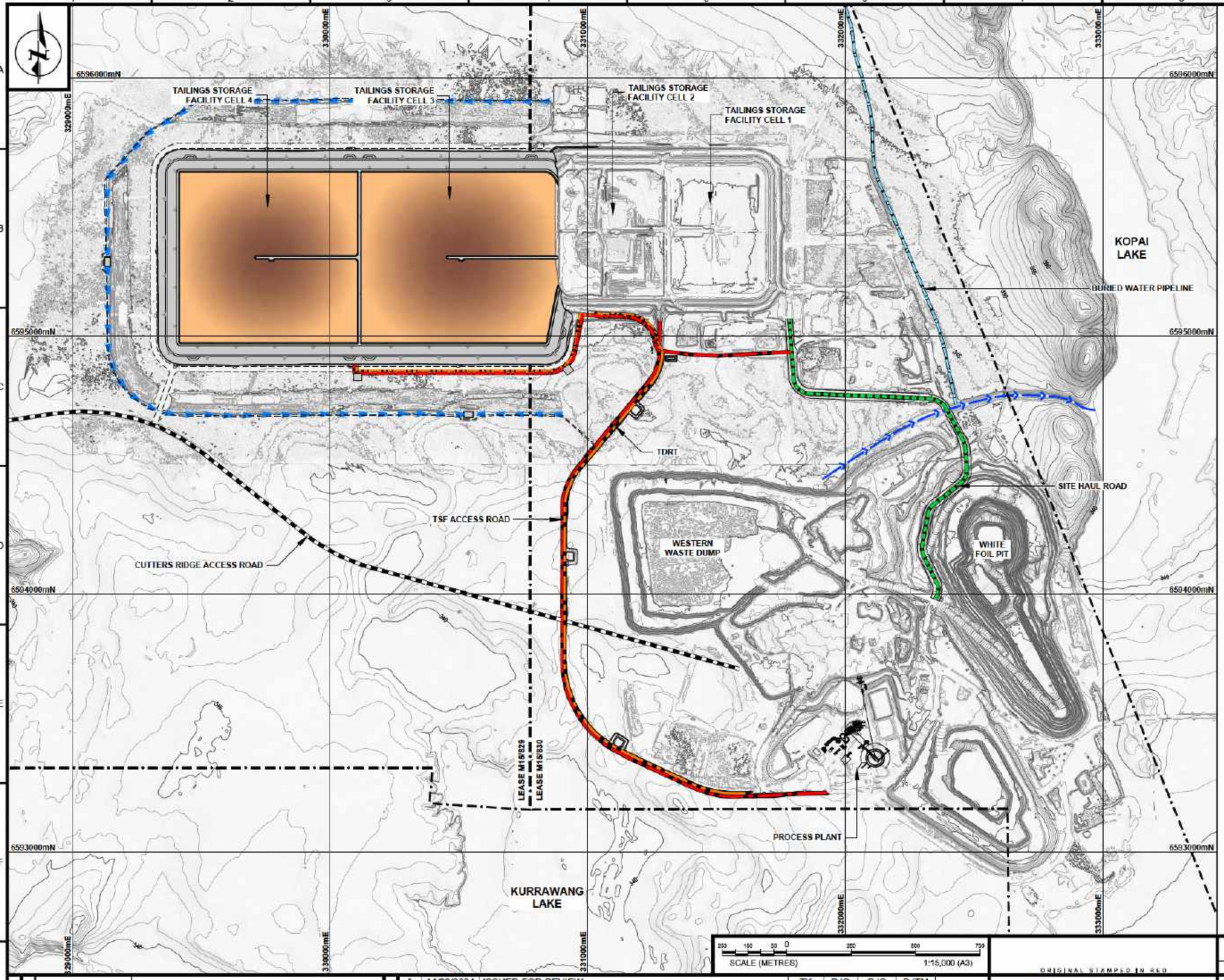
REV C

287 410



LEGEND:

- LEASE BOUNDARY
- BURIED WATER PIPELINE
- EXISTING SITE ACCESS ROAD
- EXISTING SITE HAUL ROAD
- EXISTING TAILINGS AND DECANT RETURN PIPELINE CONTAINMENT CORRIDOR (TDRT)
- DIVERSION CHANNEL
- CUTTERS RIDGE ACCESS ROAD
- TAILINGS AND DECANT RETURN PIPELINE CONTAINMENT CORRIDOR AND ACCESS ROAD

NOTES:

1. 1m CONTOUR INTERVALS SHOWN. EXTERNAL TOPOGRAPHICAL DATA PROVIDED BY EVOLUTION MINING, APRIL 2024.
2. WESTERN WASTE DUMP DATA PROVIDED BY EVOLUTION MINING, FEBRUARY 2018.
3. EXISTING TAILINGS STORAGE FACILITY CELLS 1 AND 2 FINAL (STAGE 5) EMBANKMENT SHOWN.
4. TAILINGS STORAGE FACILITY CELLS 3 AND 4 STAGE 9/10 SHOWN.

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REV	DATE	DESCRIPTION	DRN	DESIGN	CKD	APP	CLIENT APP
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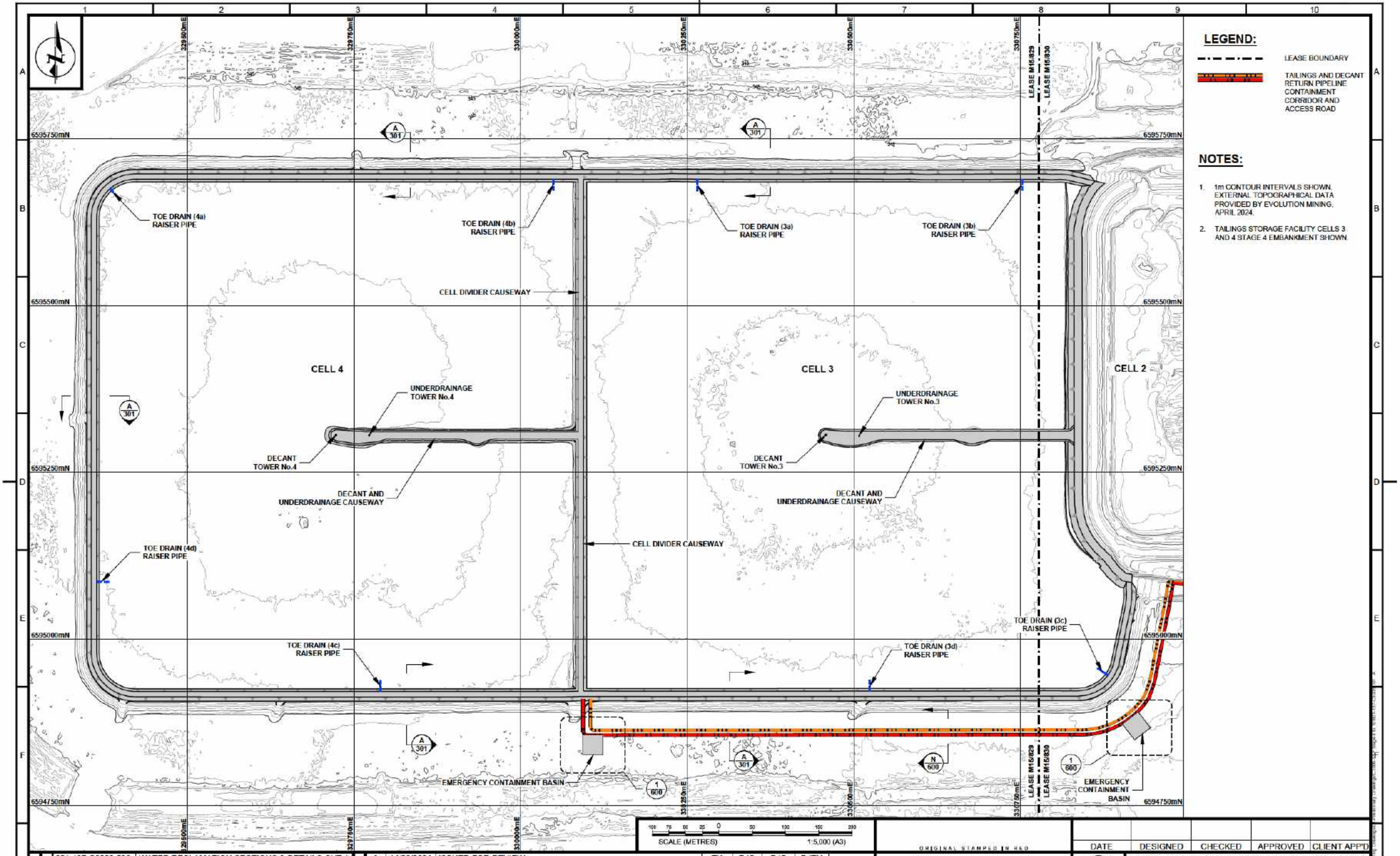
MUNGARI GOLD PROJECT
TAILINGS STORAGE FACILITY - STAGE 4 TO STAGE 10
SITE GENERAL ARRANGEMENT PLAN

SCALE 1:15,000
STATUS: FOR REVIEW
DRAWING NUMBER **801-137-C3006-050**
REV **A**

SHEET SIZE A3
REFERENCES
DRAWING No. | DRAWING TITLE
REVISIONS

287
410



LEGEND:

- LEASE BOUNDARY
- TAILINGS AND DECANT RETURN PIPELINE CONTAINMENT CORRIDOR AND ACCESS ROAD

NOTES:

1. 1m CONTOUR INTERVALS SHOWN. EXTERNAL TOPOGRAPHICAL DATA PROVIDED BY EVOLUTION MINING, APRIL 2024.
2. TAILINGS STORAGE FACILITY CELLS 3 AND 4 STAGE 4 EMBANKMENT SHOWN.

SHEET SIZE A3

REFERENCES

DRAWING No.	DRAWING TITLE
801-137-C3006-506	WATER RECLAMATION SECTIONS & DETAILS-SHT 1
801-137-C3006-507	WATER RECLAMATION SECTIONS & DETAILS-SHT 2
801-137-C3006-508	WATER RECLAMATION SECTIONS & DETAILS-SHT 3

REVISIONS

REV	DATE	DESCRIPTION	DRN	DESIGN	CKD	APP	CLIENT APP
A	14/08/2024	ISSUED FOR REVIEW	TK	BJC	BJC	DJTM	

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DATE	DESIGNED	CHECKED	APPROVED	CLIENT APP'D

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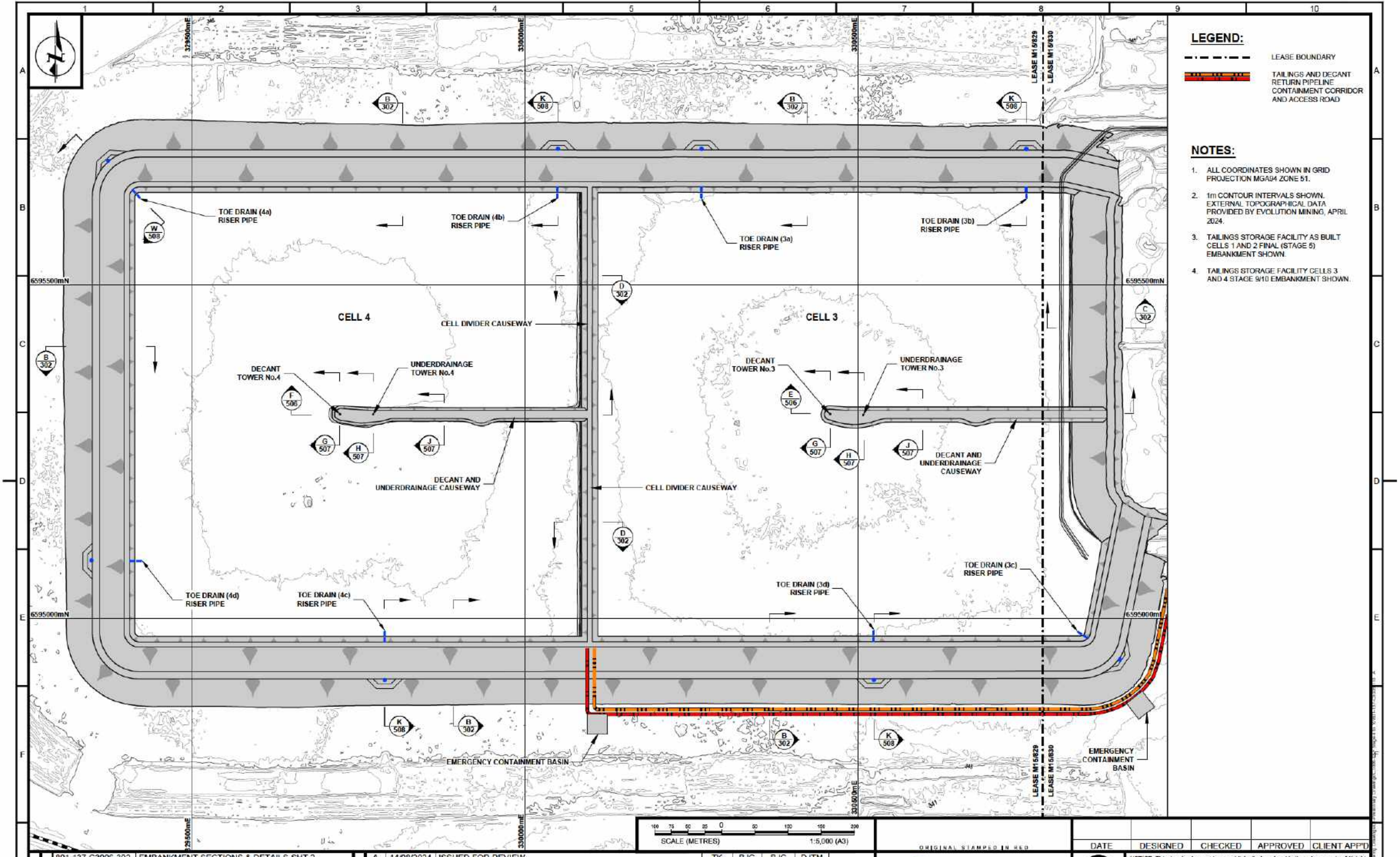
EVOLUTION MINING LTD.
MUNGARI GOLD PROJECT
TAILINGS STORAGE FACILITY - STAGE 4 TO STAGE 10
EMBANKMENT LAYOUT - STAGE 4

SCALE 1:5,000
STATUS: FOR REVIEW
DRAWING NUMBER **801-137-C3006-101**
REV **A**

287
410



LEGEND:

- LEASE BOUNDARY
- TAILINGS AND DECANT RETURN PIPELINE CONTAINMENT CORRIDOR AND ACCESS ROAD

NOTES:

1. ALL COORDINATES SHOWN IN GRID PROJECTION MGA94 ZONE 51.
2. 1m CONTOUR INTERVALS SHOWN. EXTERNAL TOPOGRAPHICAL DATA PROVIDED BY EVOLUTION MINING, APRIL 2024.
3. TAILINGS STORAGE FACILITY AS BUILT CELLS 1 AND 2 FINAL (STAGE 5) EMBANKMENT SHOWN.
4. TAILINGS STORAGE FACILITY CELLS 3 AND 4 STAGE 9/10 EMBANKMENT SHOWN.

SHEET SIZE A3

REFERENCES

DRAWING No.	DRAWING TITLE
801-137-C3006-302	EMBANKMENT SECTIONS & DETAILS-SHT 2
801-137-C3006-506	WATER RECLAMATION SECTIONS & DETAILS-SHT 1
801-137-C3006-507	WATER RECLAMATION SECTIONS & DETAILS-SHT 2

REVISIONS

REV	DATE	DESCRIPTION	DRN	DESIGN	CKD	APP	CLIENT APP
A	14/08/2024	ISSUED FOR REVIEW	TK	BJC	BJC	DJTM	

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DATE	DESIGNED	CHECKED	APPROVED	CLIENT APP'D

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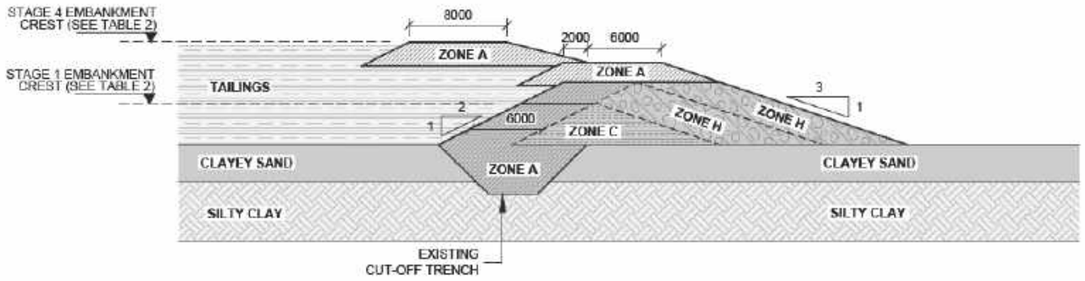
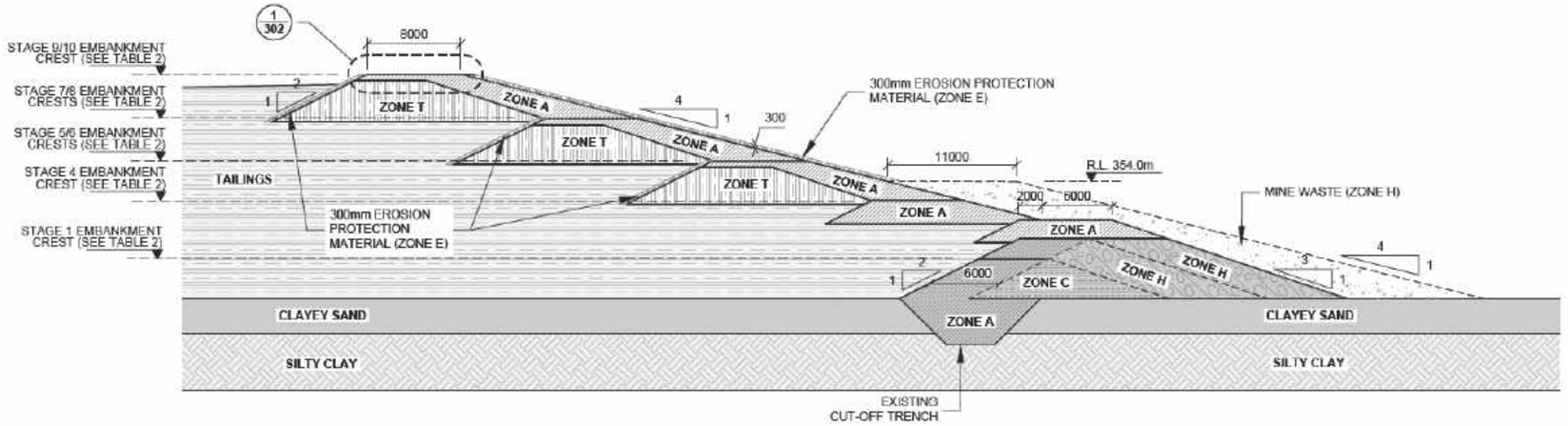
EVOLUTION MINING LTD.
MUNGARI GOLD PROJECT
TAILINGS STORAGE FACILITY - STAGE 4 TO STAGE 10
EMBANKMENT LAYOUT - STAGE 9/10 (FINAL)

SCALE 1:5,000
STATUS: FOR REVIEW
DRAWING NUMBER **801-137-C3006-110**
REV **A**

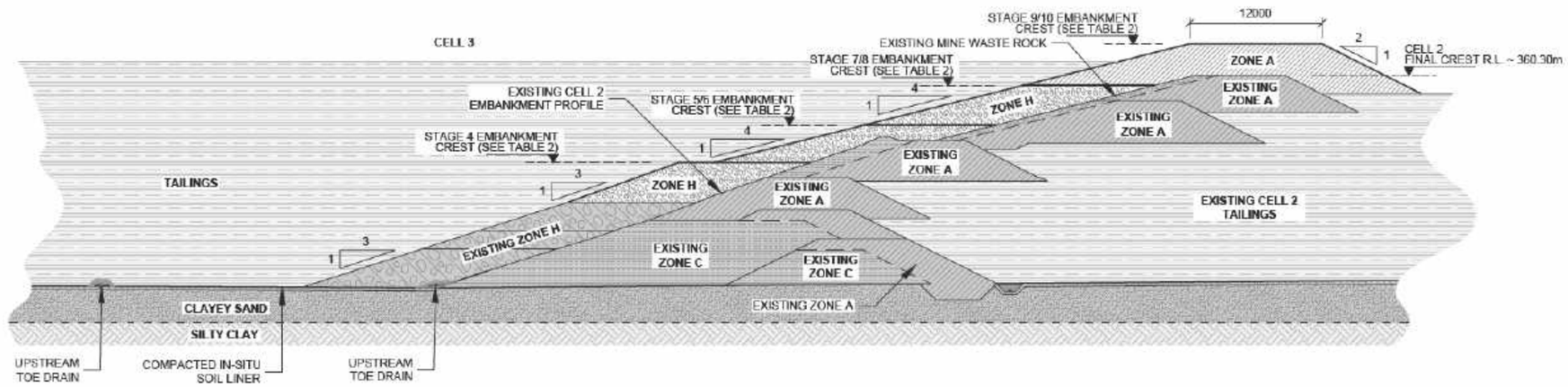
Document Set ID: 1000000000



A/110 **TYPICAL STAGE 4 EMBANKMENT SECTION**



B/110 **TYPICAL FINAL STAGE 9/10 EMBANKMENT SECTION**



C/110 **TYPICAL FINAL STAGE 9/10 EMBANKMENT SECTION ALONG EXISTING CELL 2 EMBANKMENT**

NOTES:

1. SAFETY BUND TO BE CONSTRUCTED OF ZONE D (GENERAL FILL MATERIAL). BREAKS IN UPSTREAM SAFETY BUND AT 25m CENTRES TO ALLOW FOR DRAINAGE OF RAINFALL RUNOFF.

TABLE 1:
ZONE SPECIFICATIONS SUMMARY

ZONE KEY	ZONE TYPE	DESCRIPTION	MAXIMUM LAYER THICKNESS	COMPACTION SPECIFICATION
	ZONE A	LOW PERMEABILITY FILL	300mm	98% OF STANDARD MAXIMUM DRY DENSITY -1%<OMC<+2%
	ZONE C	OXIDE WASTE	500mm	95% OF STANDARD MAXIMUM DRY DENSITY
	ZONE D	APPROVED GENERAL FILL	500mm	92% OF STANDARD MAXIMUM DRY DENSITY
	ZONE E	CLEAN ROCKFILL EROSION PROTECTION	300mm	TAMPED WITH EXCAVATOR BUCKET
	ZONE G	CLEAN COARSE ROCKFILL	N/A	UNIFORM DENSITY FREE OF VOIDS
	MINE WASTE	MINE WASTE ROCK	N/A	UNIFORM DENSITY FREE OF VOIDS
	ZONE H (SELECTED MINE WASTE)	SELECTED MINE WASTE ROCK	N/A	WELL GRADED ENGINEER APPROVAL
	ZONE T	RECOVERED TAILINGS	300mm	98% OF STANDARD MAXIMUM DRY DENSITY -2<OMC<+3%
	WEARING COURSE	SELECTED GRAVEL	N/A	D_{MAX} = 50mm % FINES < 5

TABLE 2:
STAGED EMBANKMENT DETAILS

STAGE		CREST ELEVATION (mR.L.)	RAISE HEIGHT (m)	RAISE TYPE
1	EXISTING	347.40	VARIES	DOWNSTREAM
2		349.10	1.70	
3	TO BE CONSTRUCTED	350.70	1.60	CENTRELINE
4	DESIGN PHASE	352.35	1.65	UPSTREAM
5/6		355.75	3.40	
7/8		359.35	3.60	
9/10		363.15	3.80	

SHEET SIZE A3

REFERENCES

DRAWING No.	DRAWING TITLE
801-137-C3006-110	GENERAL ARRANGEMENT PLAN-STAGE 10
801-137-C3006-302	EMBANKMENT SECTIONS & DETAILS-SHT 2

REVISIONS

REV	DATE	DESCRIPTION	DRN	DESIGN	CKD	APP	CLIENT APP
A	14/08/2024	ISSUED FOR REVIEW	TK	BJC	BJC	DJTM	
B	21/11/2024	ISSUED FOR REVIEW - NOVEMBER 2024	SGM	BJC	BJC	SDM	
C	15/08/2025	ISSUED FOR REVIEW - AUGUST 2025	RKG	BJC	BJC	DJTM	

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	DATE	DESIGNED	CHECKED	APPROVED	CLIENT APP'D

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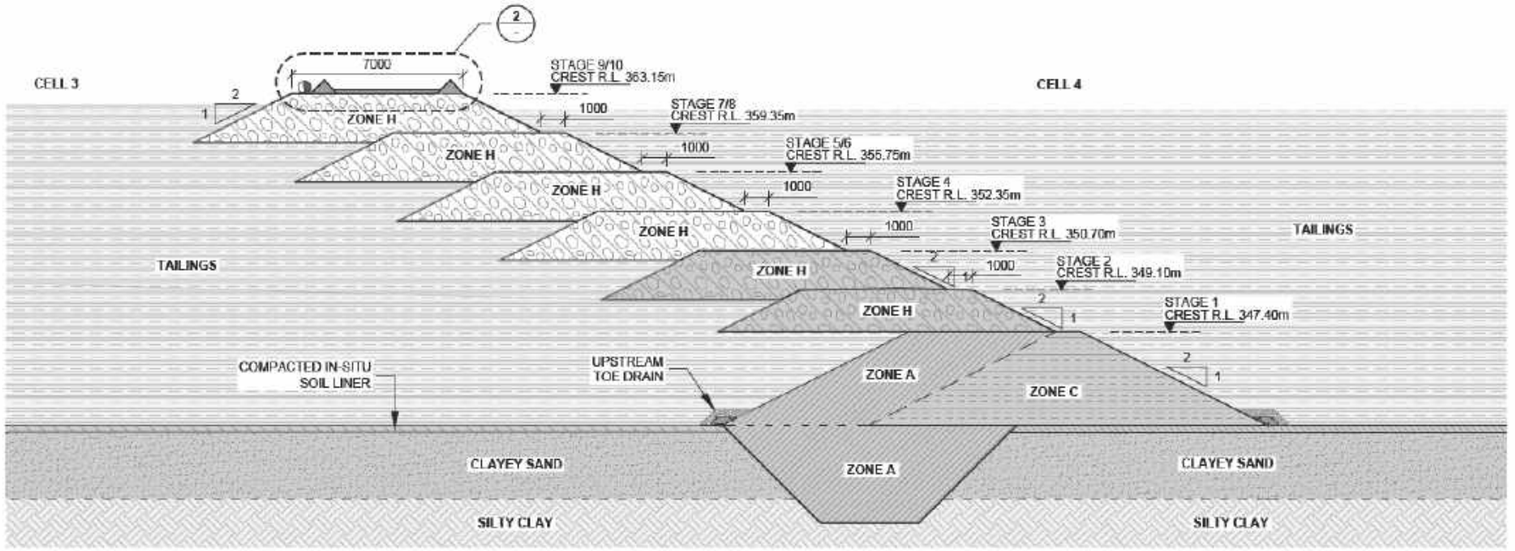
MUNGARI GOLD PROJECT
TAILINGS STORAGE FACILITY - STAGE 4 TO STAGE 10
EMBANKMENT SECTIONS AND DETAILS - SHEET 1

SCALE AS SHOWN
STATUS: FOR REVIEW
DRAWING NUMBER **801-137-C3006-301**
REV **C**

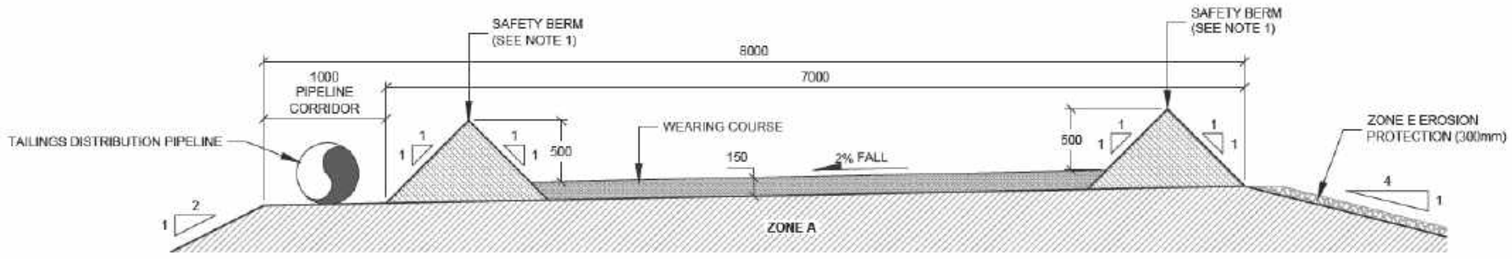
287 410



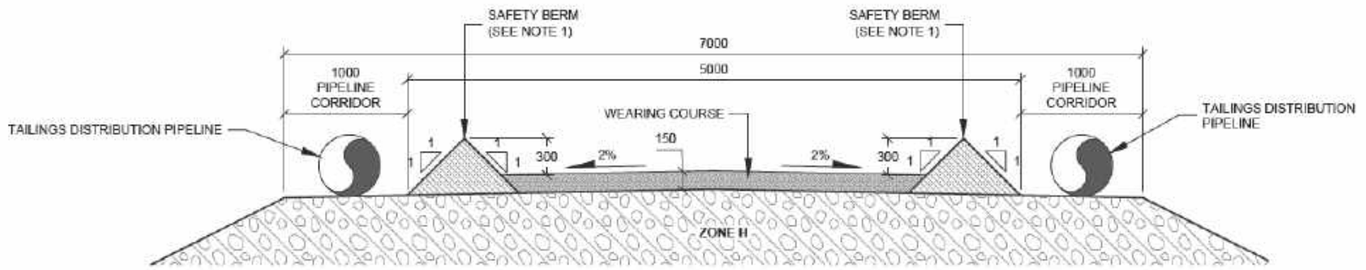
D/110 **TYPICAL FINAL STAGE 9/10 DIVIDER EMBANKMENT SECTION**
1:250

NOTES:

1. SAFETY BUND TO BE CONSTRUCTED OF ZONE D (GENERAL FILL MATERIAL). BREAKS IN UPSTREAM SAFETY BUND AT 25m CENTRES TO ALLOW FOR DRAINAGE OF RAINFALL RUNOFF.
2. FOR ZONE SPECIFICATIONS REFER TO TABLE 1 ON DRAWING 801-137-C3006-301.



1/301 **TYPICAL EMBANKMENT CREST DETAIL**
1:50



2/- **TYPICAL DIVIDER EMBANKMENT CREST DETAIL**
1:50

REFERENCES	DRAWING No.	DRAWING TITLE
SHEET SIZE A3	801-137-C3006-101	GENERAL ARRANGEMENT PLAN-STAGE 1
	801-137-C3006-301	EMBANKMENT SECTIONS & DETAILS-SHT 1

REVISIONS	REV	DATE	DESCRIPTION	DRN	DESIGN	CKD	APP	CLIENT APP
	A	14/08/2024	ISSUED FOR REVIEW	TK	BJC	BJC	DJTM	
	B	21/11/2024	ISSUED FOR REVIEW - NOVEMBER 2024	SGM	BJC	BJC	SDM	

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	DATE	DESIGNED	CHECKED	APPROVED	CLIENT APP'D

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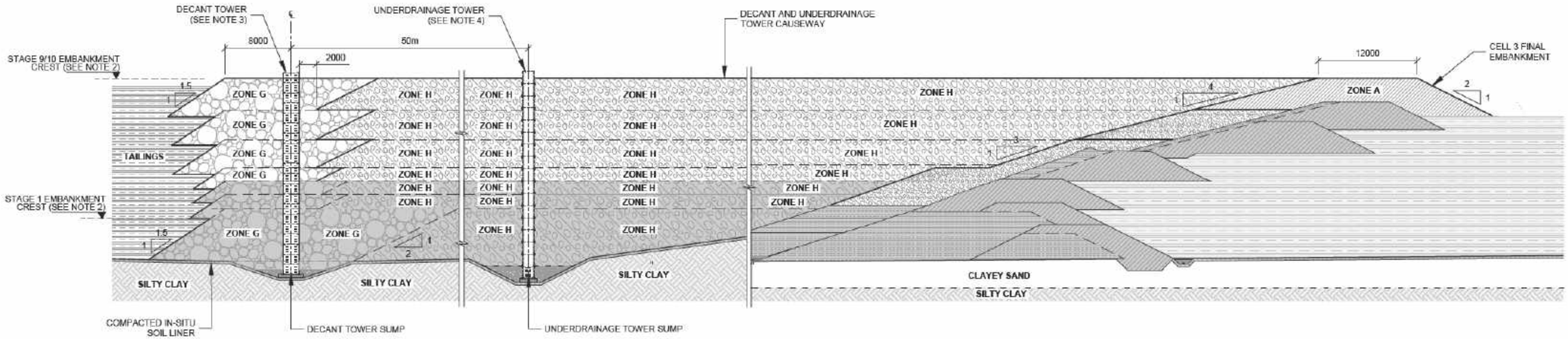
MUNGARI GOLD PROJECT
TAILINGS STORAGE FACILITY - STAGE 4 TO STAGE 10
EMBANKMENT SECTIONS AND DETAILS - SHEET 2

SCALE AS SHOWN
STATUS: FOR REVIEW
DRAWING NUMBER **801-137-C3006-302**
REV **B**

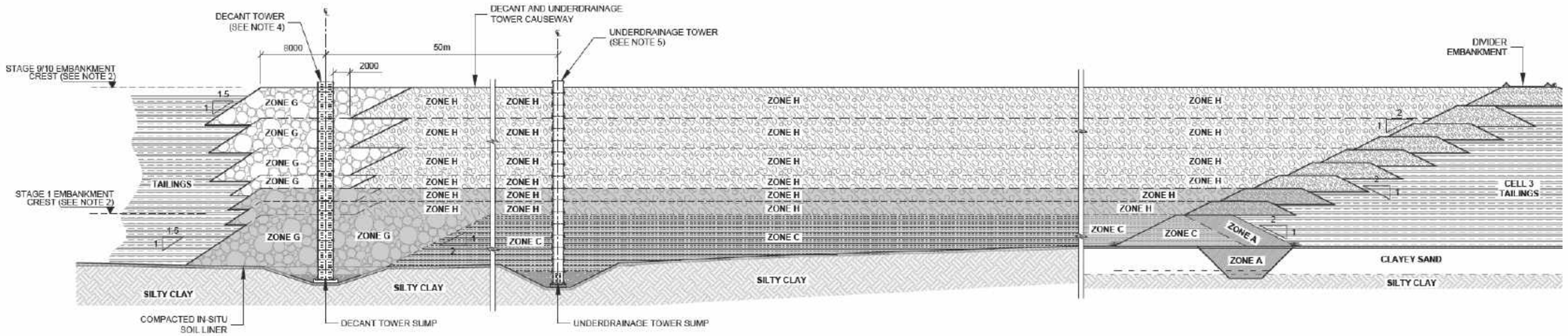
Document Path: N:\Projects\801-137\Drawings\Working\801-137-C3006-302.dwg

NOTES:

1. FOR DETAILS ON ZONE SPECIFICATIONS REFER TABLE 1 ON DRAWING 801-137-C3006-301.
2. FOR CAUSEWAY CREST ELEVATIONS REFER TABLE 2 ON DRAWING 801-137-C3006-301.
3. DECANT TOWER TO COMPRISE OF SLOTTED Ø1800mm REINFORCED CONCRETE PIPE SECTIONS.
4. UNDERDRAINAGE TOWER TO COMPRISE OF SOLID Ø1200mm REINFORCED CONCRETE PIPE SECTIONS.



E/110 **TYPICAL CELL 3 FINAL STAGE 9/10 DECANT AND UNDERDRAINAGE CAUSEWAY SECTION**
1:500



F/110 **TYPICAL CELL 4 FINAL STAGE 9/10 DECANT AND UNDERDRAINAGE CAUSEWAY SECTION**
1:500

SHEET SIZE A3	DRAWING No.	DRAWING TITLE
REFERENCES	801-137-C3006-110	GENERAL ARRANGEMENT PLAN-STAGE 10
	801-137-C3006-301	EMBANKMENT SECTIONS & DETAILS-SHT 1
	801-137-C3006-302	EMBANKMENT SECTIONS & DETAILS-SHT 2

REVISIONS	REV	DATE	DESCRIPTION	DRN	DESIGN	CKD	APP	CLIENT APP
	A	14/08/2024	ISSUED FOR REVIEW	TK	BJC	BJC	DJTM	

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	DATE	DESIGNED	CHECKED	APPROVED	CLIENT APP'D

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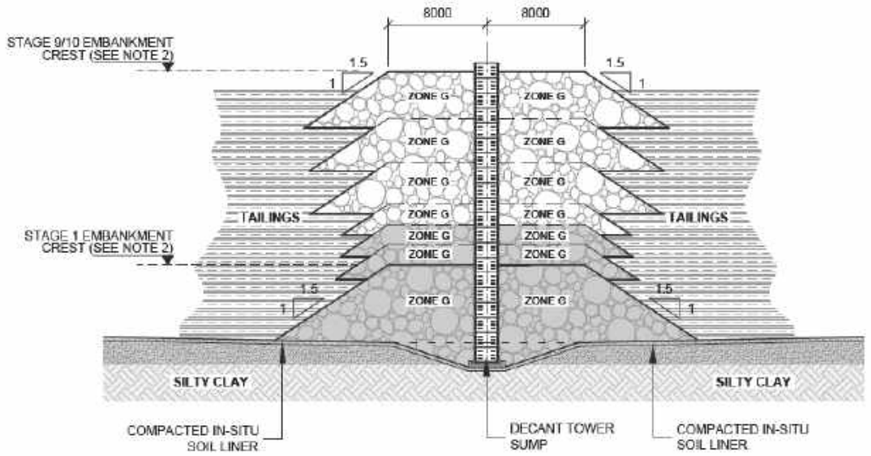
MUNGARI GOLD PROJECT
TAILINGS STORAGE FACILITY - STAGE 4 TO STAGE 10
WATER RECLAMATION SECTIONS & DETAILS - SHEET 1

SCALE AS SHOWN
STATUS: FOR REVIEW
DRAWING NUMBER 801-137-C3006-506
REV A

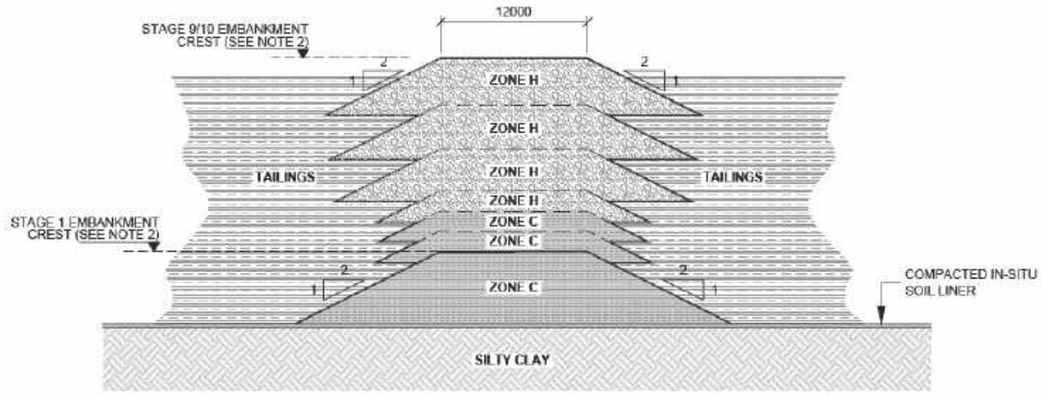
Document Path: S:\Projects\287\Engineering\Drawings\Tailings\801-137-C3006-506.dwg Plotted: 14/08/2024 by Tim Kuo



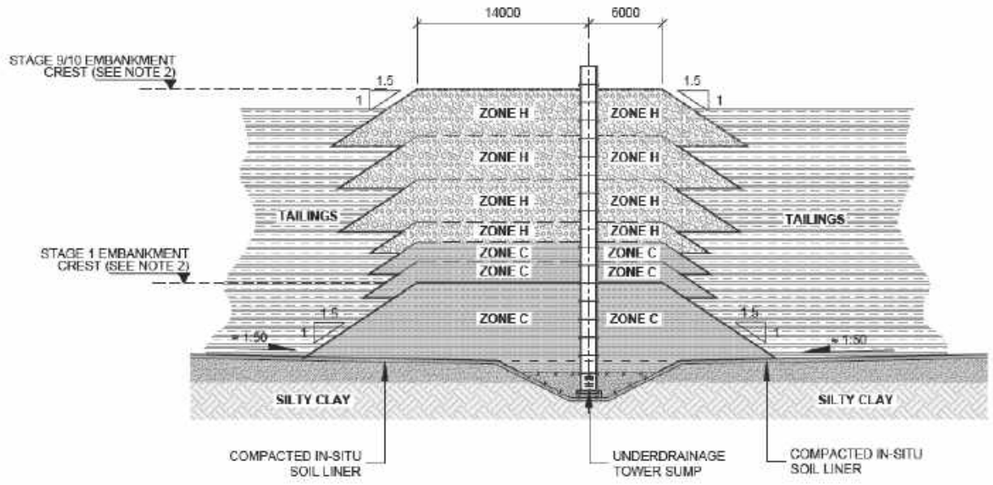
G/110 **TYPICAL FINAL STAGE 9/10 DECANT TOWER SECTION**
1:500

NOTES:

1. FOR DETAILS ON ZONE SPECIFICATIONS REFER TABLE 1 ON DRAWING 801-137-C3006-301.
2. FOR CAUSEWAY CREST ELEVATIONS REFER TABLE 2 ON DRAWING 801-137-C3006-301.
3. DECANT TOWER TO COMPRISE OF SLOTTED Ø1800mm REINFORCED CONCRETE PIPE SECTIONS.
4. UNDERDRAINAGE TOWER TO COMPRISE OF SOLID Ø1200mm REINFORCED CONCRETE PIPE SECTIONS.



J/110 **TYPICAL FINAL STAGE 9/10 DECANT AND UNDERDRAINAGE TOWER CAUSEWAY SECTION**
1:500



H/110 **TYPICAL FINAL STAGE 9/10 UNDERDRAINAGE TOWER SECTION**
1:500

SHEET SIZE A3	REFERENCES	DRAWING No.	DRAWING TITLE
		801-137-C3006-110	GENERAL ARRANGEMENT PLAN-STAGE 10
		801-137-C3006-301	EMBANKMENT SECTIONS & DETAILS-SHT 1
		801-137-C3006-302	EMBANKMENT SECTIONS & DETAILS-SHT 2

REVISIONS	REV	DATE	DESCRIPTION	DRN	DESIGN	CKD	APP	CLIENT APP
	A	14/08/2024	ISSUED FOR REVIEW	TK	BJC	BJC	DJTM	

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	DATE	DESIGNED	CHECKED	APPROVED	CLIENT APP'D

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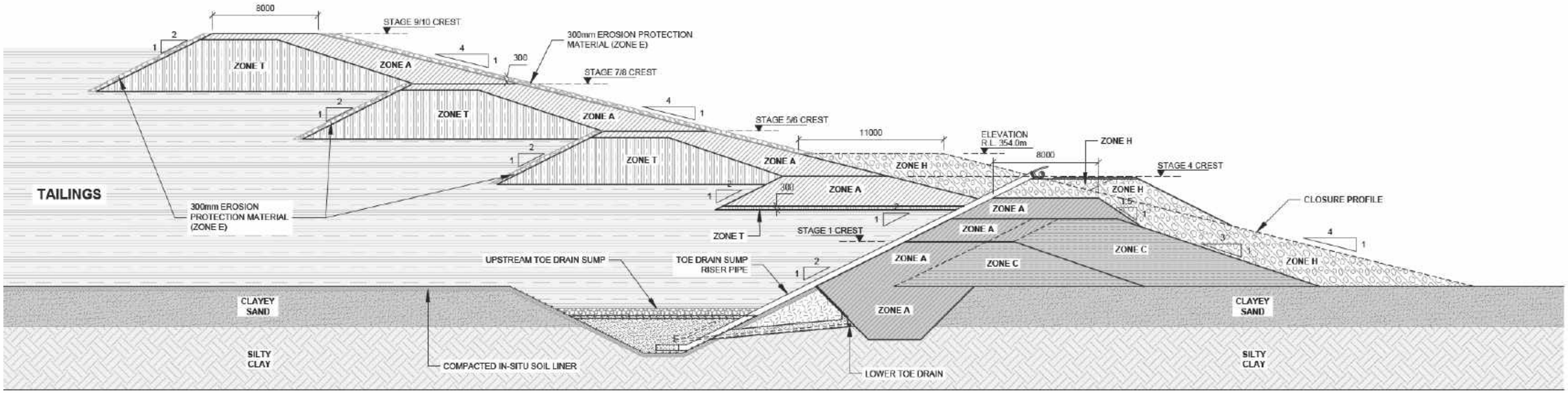
MUNGARI GOLD PROJECT
TAILINGS STORAGE FACILITY - STAGE 4 TO STAGE 10
WATER RECLAMATION SECTIONS & DETAILS - SHEET 2

SCALE AS SHOWN
STATUS: FOR REVIEW
DRAWING NUMBER 801-137-C3006-507
REV A

Document Path: C:\Users\...\801-137-C3006-507 A.dwg

NOTES:

1. FOR DETAILS ON ZONE SPECIFICATIONS REFER TABLE 1 ON DRAWING 801-137-C3005-301.



K 110 **TYPICAL FINAL STAGE 9/10 TOE DRAIN SUMP AND RISER PIPE SECTION**
1:300

REFERENCES	DRAWING No.	DRAWING TITLE
	801-137-C3006-110	GENERAL ARRANGEMENT PLAN-STAGE 10
	801-137-C3006-301	EMBANKMENT SECTIONS & DETAILS-SHT 1
	801-137-C3006-302	EMBANKMENT SECTIONS & DETAILS-SHT 2

REVISIONS	REV	DATE	DESCRIPTION	DRN	DESIGN	CKD	APP	CLIENT APP
	A	14/08/2024	ISSUED FOR REVIEW	TK	BJC	BJC	DJTM	
	B	21/11/2024	ISSUED FOR REVIEW - NOVEMBER 2024	SGM	BJC	BJC	SDM	
	C	15/08/2025	ISSUED FOR REVIEW - AUGUST 2025	RKG	BJC	BJC	DJTM	

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	DATE	DESIGNED	CHECKED	APPROVED	CLIENT APP'D

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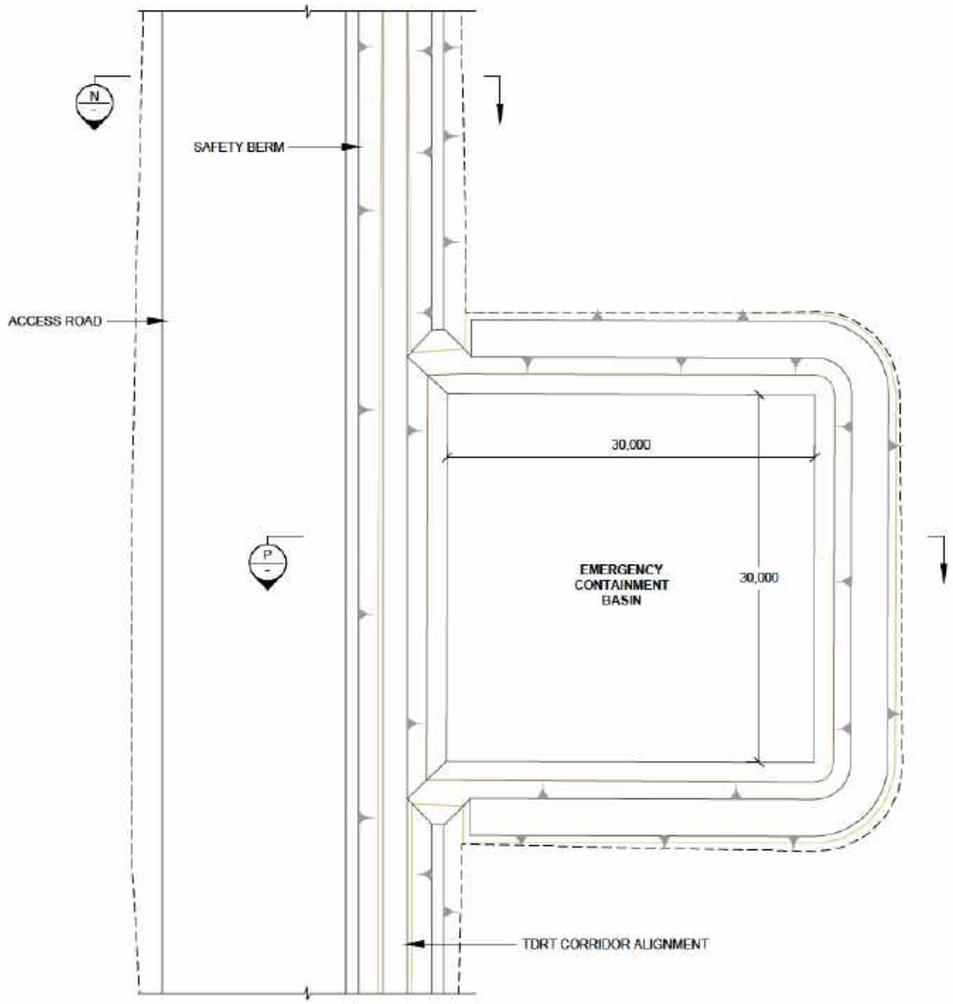
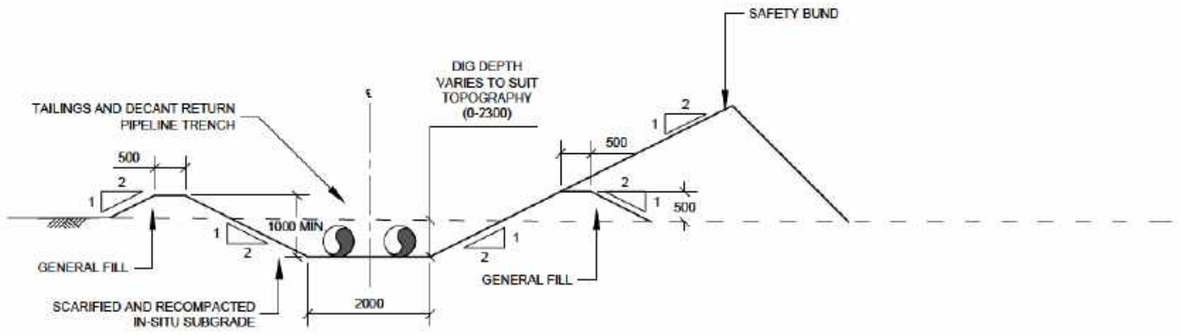
MUNGARI GOLD PROJECT
TAILINGS STORAGE FACILITY - STAGE 4 TO STAGE 10
WATER RECLAMATION SECTIONS & DETAILS - SHEET 3

SCALE AS SHOWN
STATUS: FOR REVIEW
DRAWING NUMBER 801-137-C3006-508
REV C

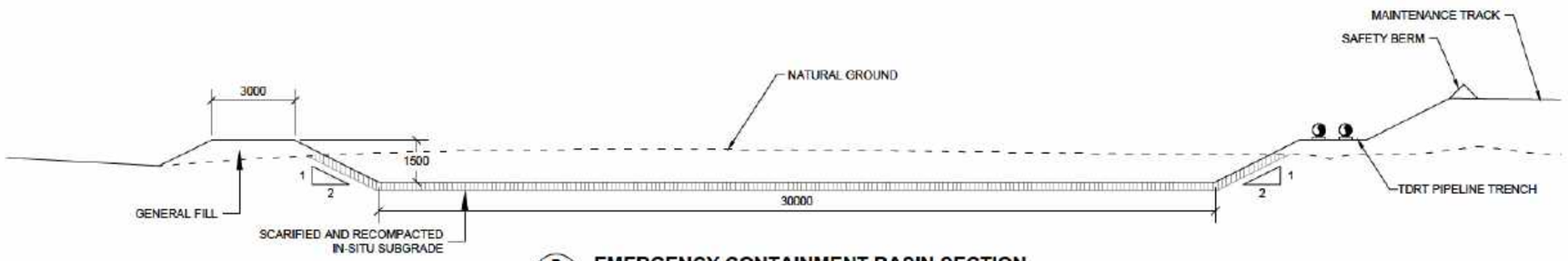
SHEET SIZE A3
287
410



1/101 **TYPICAL EMERGENCY CONTAINMENT BASIN DETAIL**
1:500



N/101 N/- **TYPICAL TDRT CORRIDOR**
1:100



P/- **EMERGENCY CONTAINMENT BASIN SECTION**
1:200

NOTES:

1. FOR ZONE SPECIFICATIONS REFER TABLE 1 ON DRAWING 801-00137-C3006-301.
2. GENERAL PAVEMENT FILL SOURCED FROM EXISTING GRANULAR WASTE DUMPS. PLACED WITH MINIMUM THICKNESS OF 300mm AND THICKNESS INCREASED AS NECESSARY TO ACHIEVE CROSSFALL. MAXIMUM PARTICLE SIZE = 200mm. COMPACTION REQUIREMENTS = MIN. 4 PASSES OF A SMOOTH DRUM VIBRATORY ROLLER (> 10T STATIC MASS). UNCOMPACTED LAYER THICKNESS NOT EXCEEDING 400mm.

REV	DATE	DESCRIPTION	DRN	DESIGN	CKD	APP	CLIENT APP
A	14/08/2024	ISSUED FOR REVIEW	TK	BJC	BJC	DJTM	

DRAWING No.	DRAWING TITLE

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DATE	DESIGNED	CHECKED	APPROVED	CLIENT APP'D

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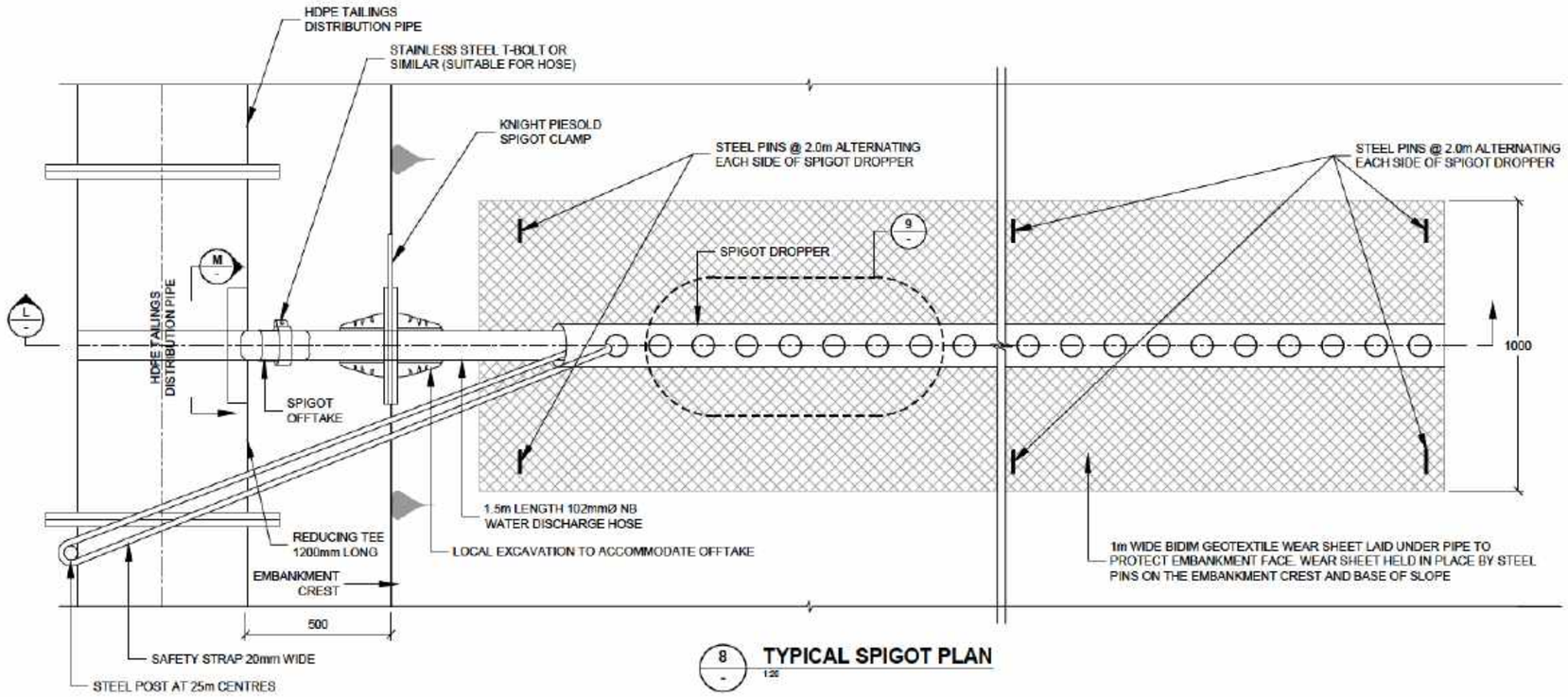
MUNGARI GOLD PROJECT
TAILINGS STORAGE FACILITY - STAGE 4 TO STAGE 10
TDRT CORRIDOR TYPICAL SECTIONS AND DETAILS

SCALE: AS SHOWN
STATUS: FOR REVIEW
DRAWING NUMBER: 801-137-C3006-600
REV: A

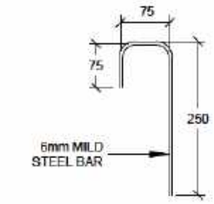
SHEET SIZE A3
REFERENCES
REVISIONS
287
410



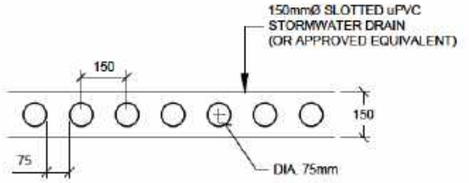
8 **TYPICAL SPIGOT PLAN**
1:20

NOTES:

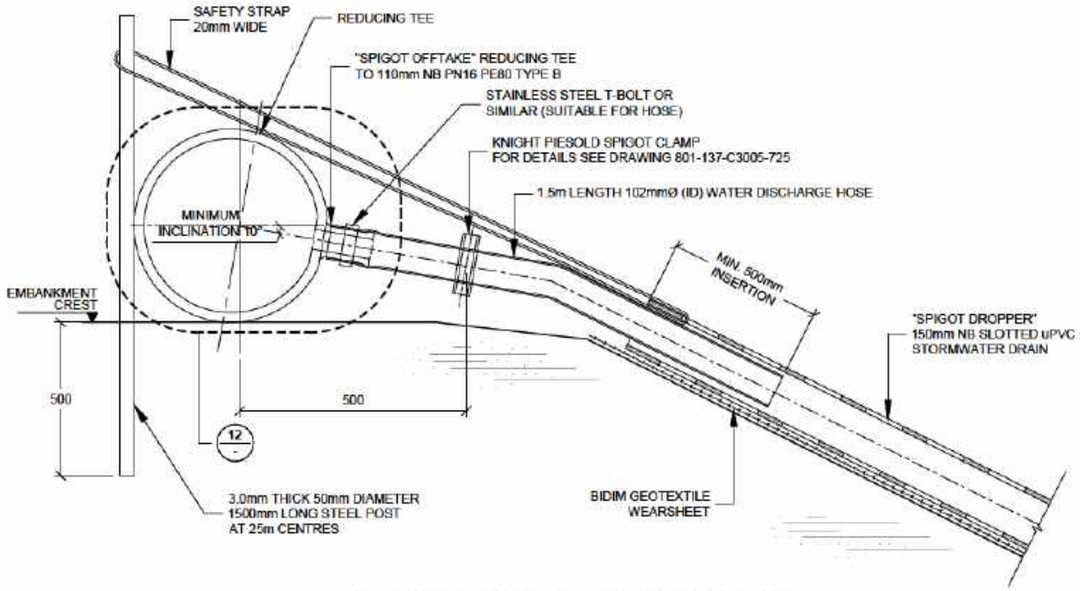
1. FOR SPIGOT CLAMP DETAILS REFER DRAWING 801-137-C3006-725.
2. BOTTOM OF SPIGOT DROPPER PERMANENTLY CAPPED/PLUGGED.
3. OFFTAKE SPACING NOMINAL 25 METRES.



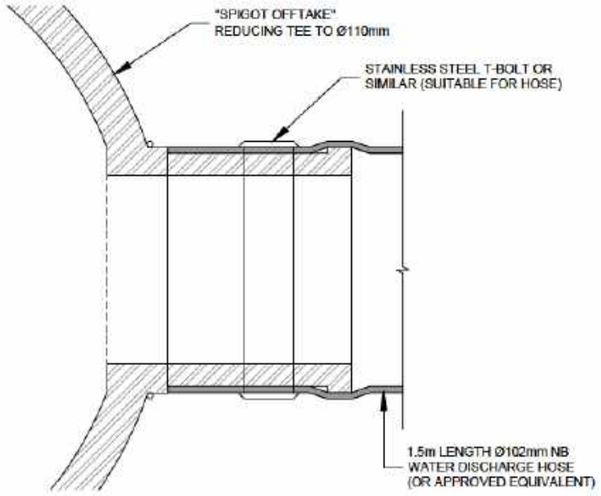
10 **STEEL PINS DETAIL**
1:10



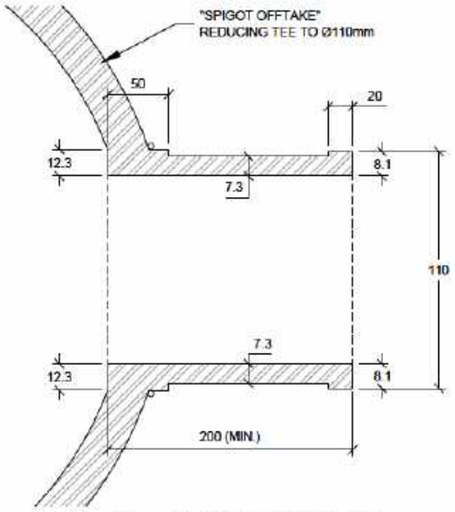
9 **SPIGOT DROPPER DETAIL**
1:20



L **TYPICAL SPIGOT PIPEWORK SECTION**
1:20



M **SPIGOT OFFTAKE AND DISCHARGE HOSE DETAIL**
1:5



12 **SPIGOT OFFTAKE DETAIL**
1:5

SHEET SIZE A3	REFERENCES		
	801-137-C3006-725	SPIGOT CLAMP DETAILS	
DRAWING No.		DRAWING TITLE	

REVISIONS								
REV	DATE	DESCRIPTION	DRN	DESIGN	CKD	APP	CLIENT APP
A	14/08/2024	ISSUED FOR REVIEW	TK	BJC	BJC	DJTM	

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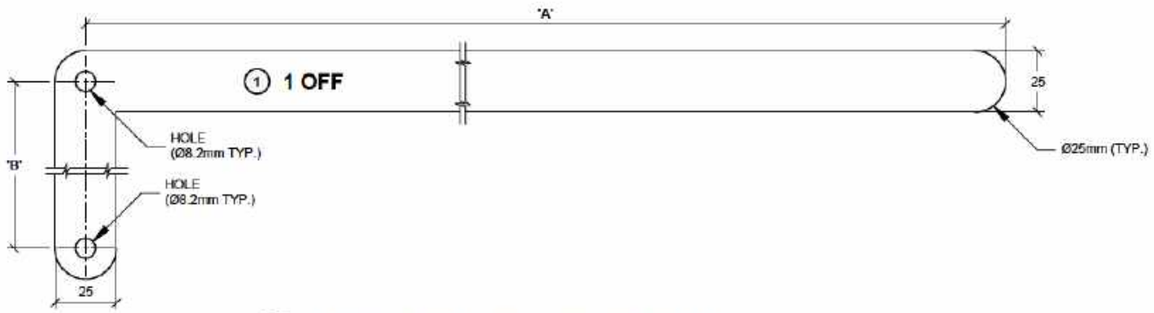
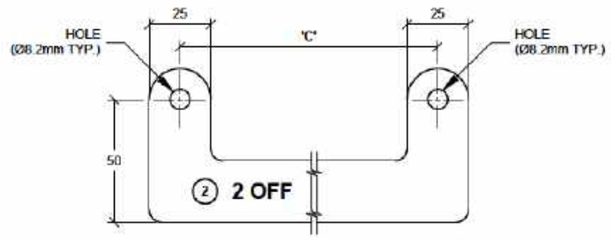
MUNGARI GOLD PROJECT
TAILINGS STORAGE FACILITY - STAGE 4 TO STAGE 10
SPIGOT PIPEWORK DETAILS

SCALE AS SHOWN
STATUS: FOR REVIEW
DRAWING NUMBER **801-137-C3006-720** REV **A**

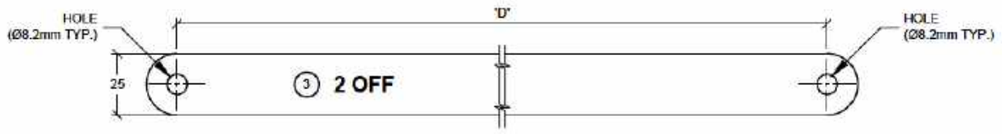
Document Set ID: 4838287 Version: 1 Version Date: 14/08/2024



1 - COMPONENT 1 FABRICATION DETAILS
N.T.S.



2 - COMPONENT 2 FABRICATION DETAILS
N.T.S.



3 - COMPONENT 3 FABRICATION DETAILS
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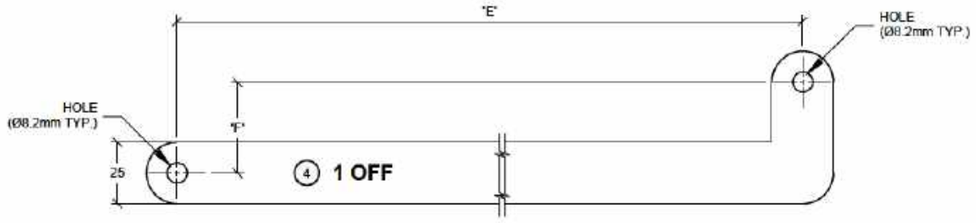

4 - COMPONENT 4 FABRICATION DETAILS
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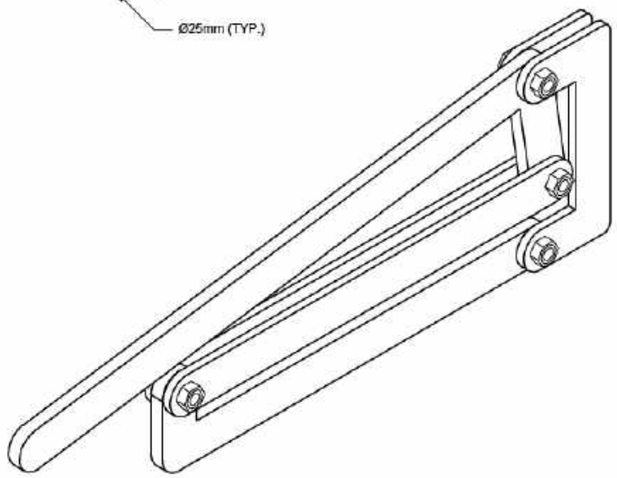
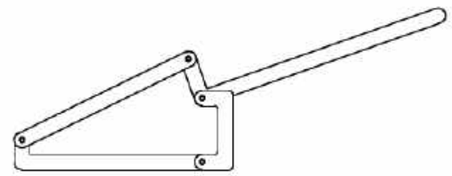


SPIGOT CLAMP - ASSEMBLED VIEW
N.T.S.



SPIGOT CLAMP - OPEN POSITION
N.T.S.

SPIGOT CLAMP - CLOSED POSITION
N.T.S.

LEGEND:

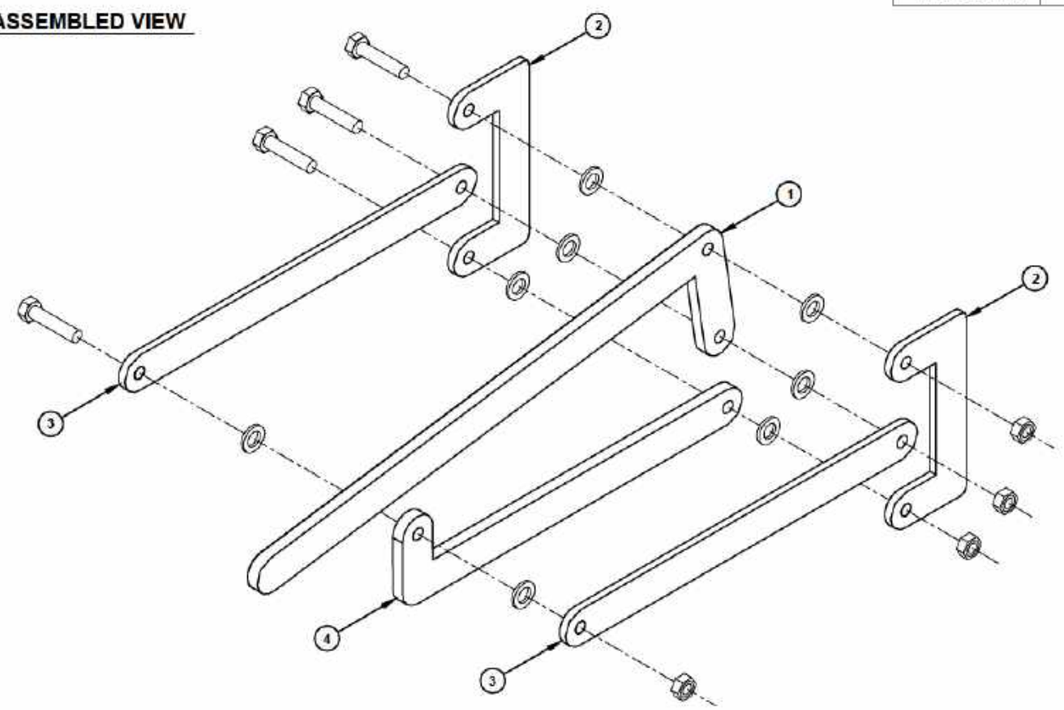
1 4	25mm x 8mm STEEL PLATE
2 3	25mm x 5mm STEEL PLATE

NOTES:

1. ASSEMBLE WITH 4 No. Ø8mm x 90mm LONG BOLTS EACH WITH 2 No. NYLON WASHERS AND ONE "LOCK ON" NUT.
2. SURFACE FINISH GALVANISED.

TABLE No.1
COMPONENT SIZING

LENGTH I.D.	LENGTH (mm)
'A'	375
'B'	73
'C'	109
'D'	265
'E'	255
'F'	36
SUITABLE HOSE SIZE	
INTERNAL HOSE Ø (mm)	110
HOSE WALL THICKNESS (mm)	T.B.A.



SPIGOT CLAMP ASSEMBLY - EXPLODED VIEW
N.T.S.

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EVOLUTION MINING LTD.
MUNGARI GOLD PROJECT
TAILINGS STORAGE FACILITY - STAGE 4 TO STAGE 10
SPIGOT CLAMP DETAILS

SCALE N.T.S.
STATUS: FOR REVIEW
DRAWING NUMBER 801-137-C3006-725
REV A

SHEET SIZE A3
REFERENCES

DRAWING No.	DRAWING TITLE

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REV	DATE	DESCRIPTION	DRN	DESIGN	CKD	APP	CLIENT APP
A	14/08/2024	ISSUED FOR REVIEW	TK	BJC	BJC	DJTM	

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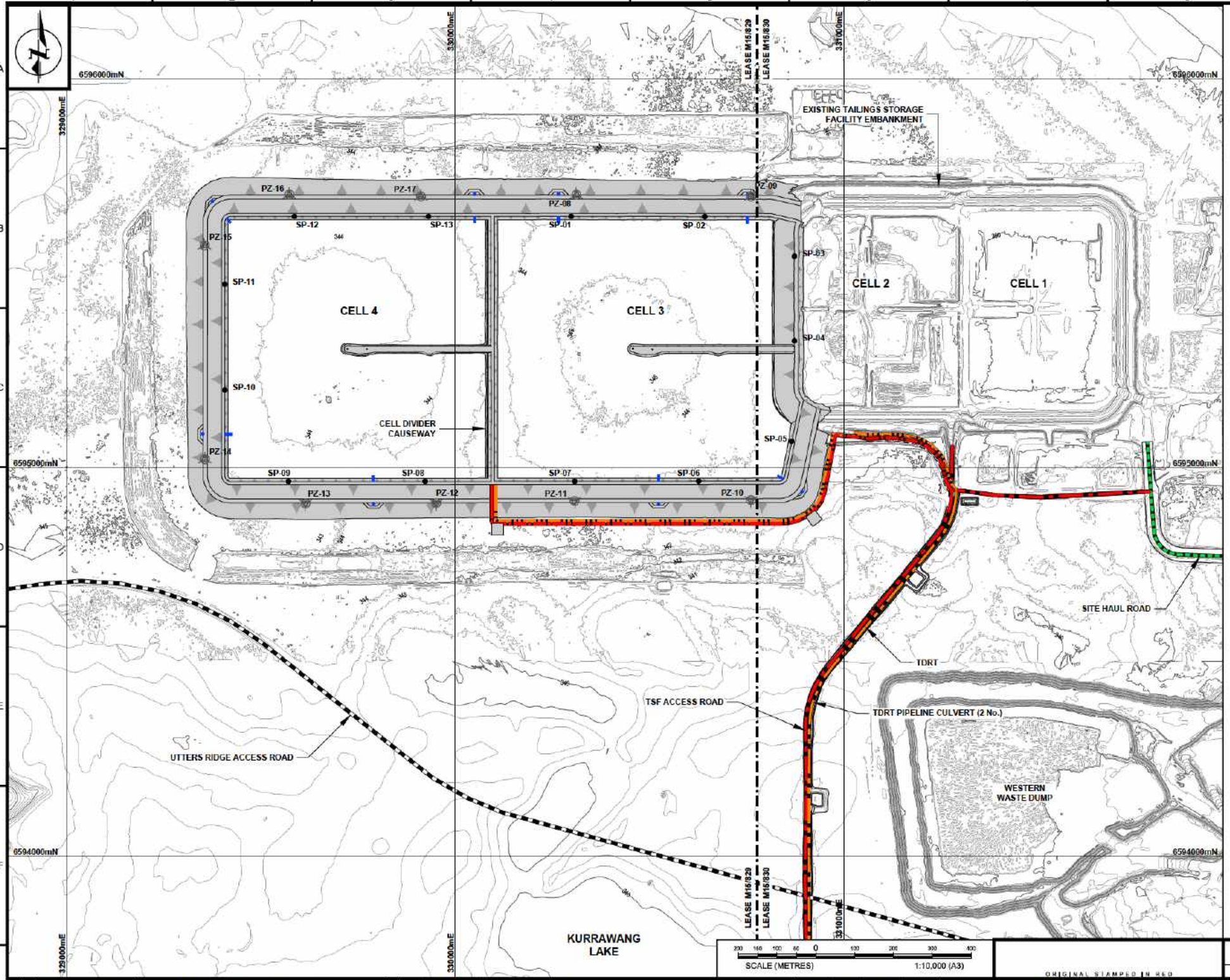
410



LEGEND:

- LEASE BOUNDARY
- EXISTING SITE ACCESS ROAD
- EXISTING SITE HAUL ROAD
- TAILINGS AND DECANT RETURN PIPELINE CONTAINMENT CORRIDOR (TDRT)
- CUTTERS RIDGE ACCESS ROAD
- TAILINGS DECANT RETURN PIPELINE CONTAINMENT CORRIDOR AND ACCESS ROAD
- PROPOSED SURVEY STATION PIN
- PROPOSED STANDPIPE PIEZOMETERS

NOTES:

1. 1m CONTOUR INTERVALS SHOWN. EXTERNAL TOPOGRAPHICAL DATA PROVIDED BY EVOLUTION MINING, MAY 2018.
2. WESTERN WASTE DUMP DATA PROVIDED BY EVOLUTION MINING, FEBRUARY 2018.
3. EXISTING TAILINGS STORAGE FACILITY CELLS 1 AND 2 FINAL (STAGE 5) EMBANKMENT SHOWN.
4. STAGE FINAL 9/10 EMBANKMENT SHOWN.

PROPOSED STANDPIPE PIEZOMETERS (ON STAGE 3)

PZ ID No.	EASTING	NORTHING	ELEVATION (m.R.L)
PZ-08	330311.9	6595702.3	350.7
PZ-09	330761.4	6595698.1	350.7
PZ-10	330761.4	6594916.6	350.7
PZ-11	330307.2	6594914.3	350.7
PZ-12	329950.8	6594908.4	350.7
PZ-13	329614.7	6594907.9	350.7
PZ-14	329355.1	6595021.6	350.7
PZ-15	329354.4	6595571.8	350.7
PZ-16	329572.6	6595702.6	350.7
PZ-17	329911.8	6595697.8	350.7

PROPOSED SURVEY STATION PINS (ON STAGE 9/10)

SP ID No.	EASTING	NORTHING	ELEVATION (m.R.L)
SP-01	330298.5	6595646.3	363.15
SP-02	330643.0	6595645.9	363.15
SP-03	330873.6	6595544.1	363.15
SP-04	330873.5	6595326.4	363.15
SP-05	330866.5	6595068.0	363.15
SP-06	330627.0	6594965.3	363.15
SP-07	330307.4	6594965.1	363.15
SP-08	329922.6	6594964.6	363.15
SP-09	329570.6	6594964.6	363.15
SP-10	329406.8	6595199.7	363.15
SP-11	329406.8	6595471.9	363.15
SP-12	329585.7	6595646.2	363.15
SP-13	329931.1	6595646.2	363.15

SHEET SIZE A3

REFERENCES

DRAWING No.	DRAWING TITLE
801-137-C3006-921	MONITORING INSTRUMENTATION DETAILS

REVISIONS

REV	DATE	DESCRIPTION	DRN	DESIGN	CKD	APP	CLIENT APP
A	14/08/2024	ISSUED FOR REVIEW	TK	BJC	BJC	DJTM	

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EVOLUTION MINING LTD.
MUNGARI GOLD PROJECT
TAILINGS STORAGE FACILITY - STAGE 4 TO STAGE 10
MONITORING INSTRUMENTATION LAYOUT

SCALE 1:10,000
STATUS: FOR REVIEW
DRAWING NUMBER 801-137-C3006-900
REV A

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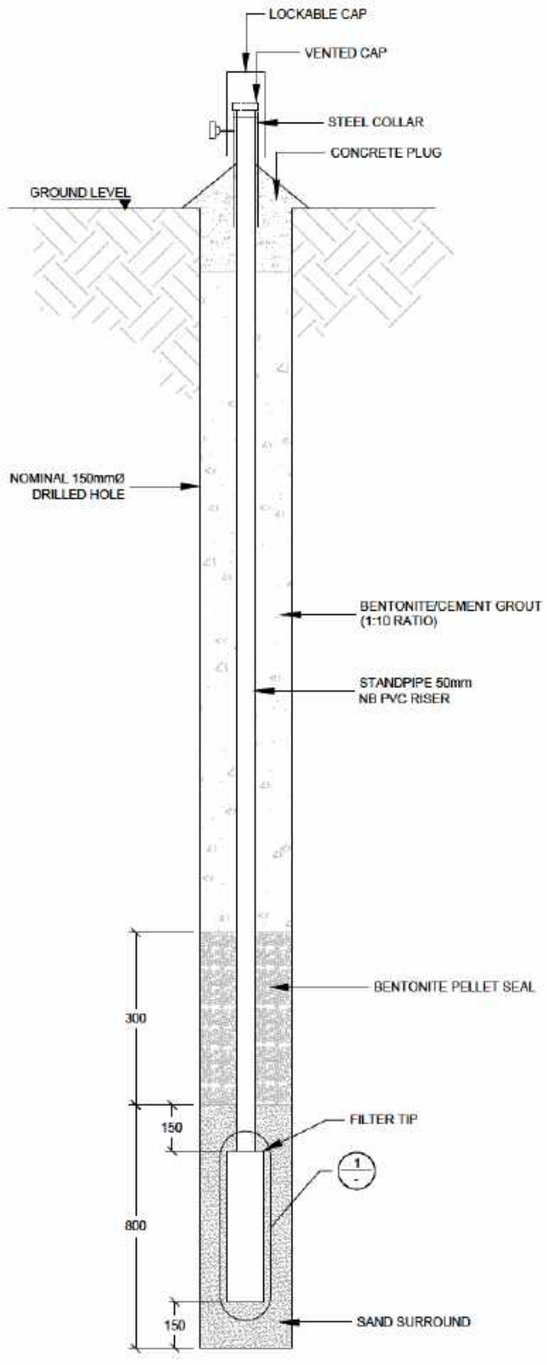
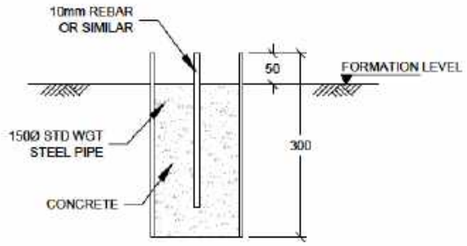
NOTES:

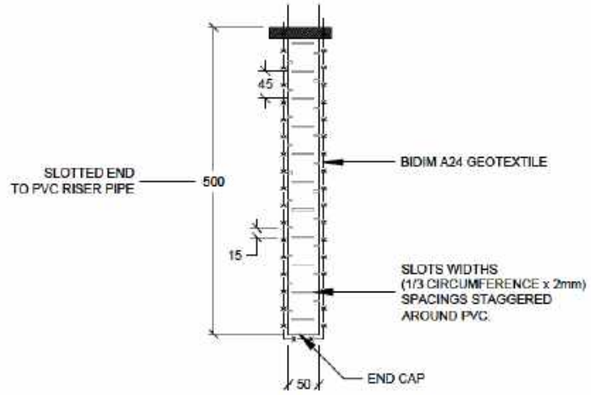
1. BOREHOLE DRILLING TO BE SUPERVISED BY ENGINEER FOR GEOLOGICAL LOGGING
2. LOCATION OF INSTRUMENTS TO BE DETERMINED BY THE ENGINEER ON SITE.



STANDPIPE PIEZOMETER
N.T.S.



TYPICAL SURVEY STATION PIN
1:10



1 / - FILTER TIP DETAIL
1:10

ORIGINAL STAMPED IN RED

	DATE	DESIGNED	CHECKED	APPROVED	CLIENT APP'D

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MUNGARI GOLD PROJECT
TAILINGS STORAGE FACILITY - STAGE 4 TO STAGE 10
MONITORING INSTRUMENTATION DETAILS

SCALE AS SHOWN
STATUS: FOR REVIEW
DRAWING NUMBER: 801-137-C3006-921
REV: A

SHEET SIZE A3
REFERENCES

DRAWING No.	DRAWING TITLE

REVISIONS

REV	DATE	DESCRIPTION	DRN	DESIGN	CKD	APP	CLIENT APP
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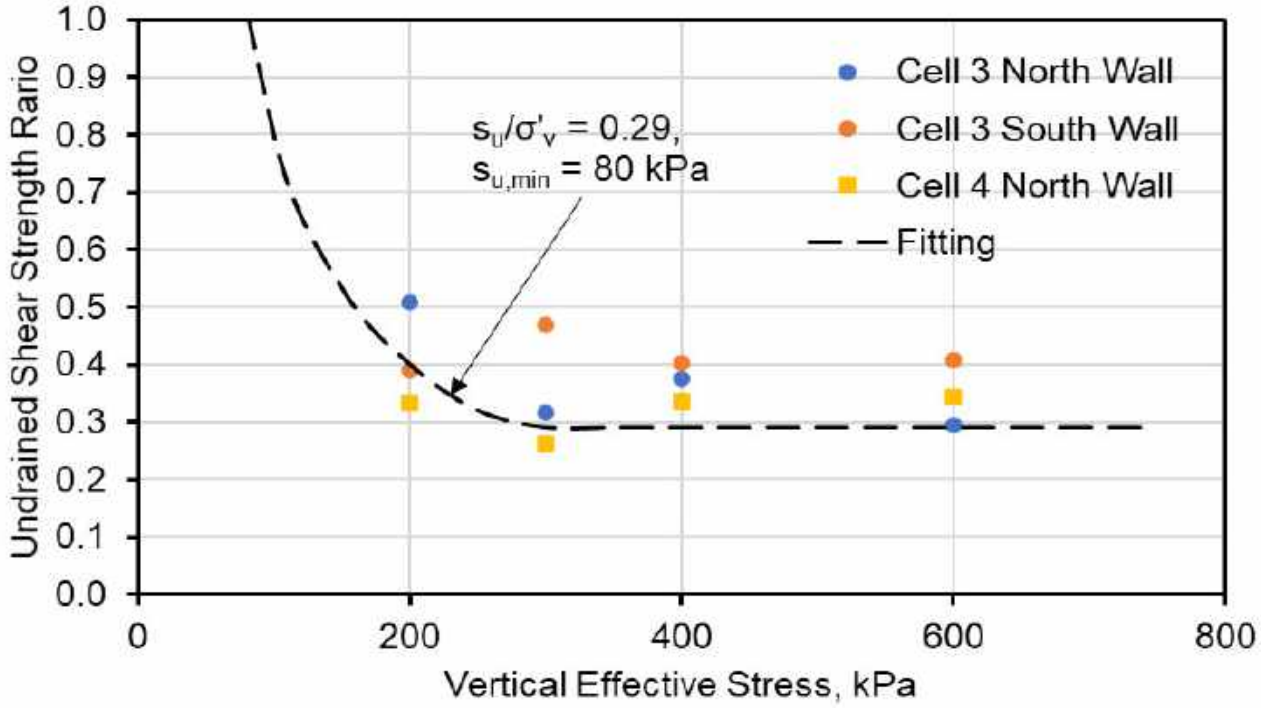
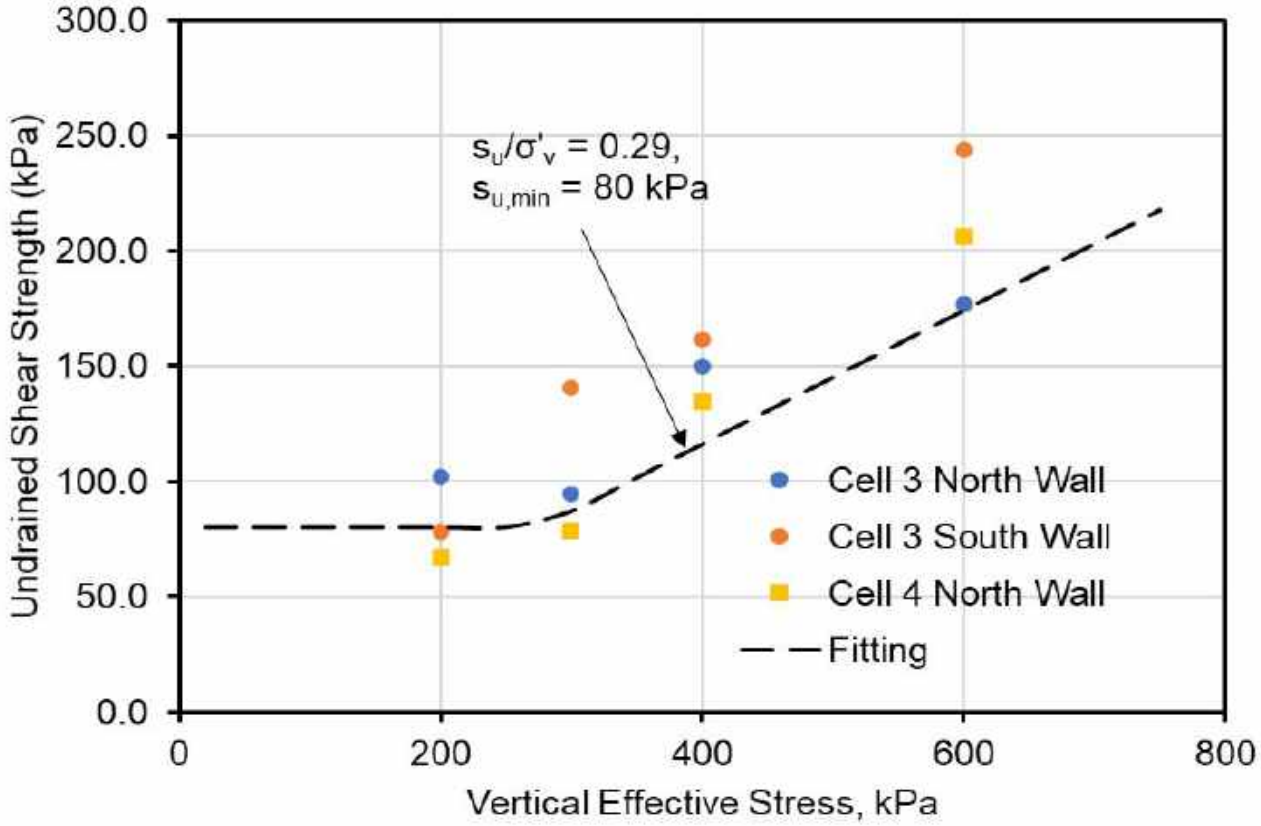
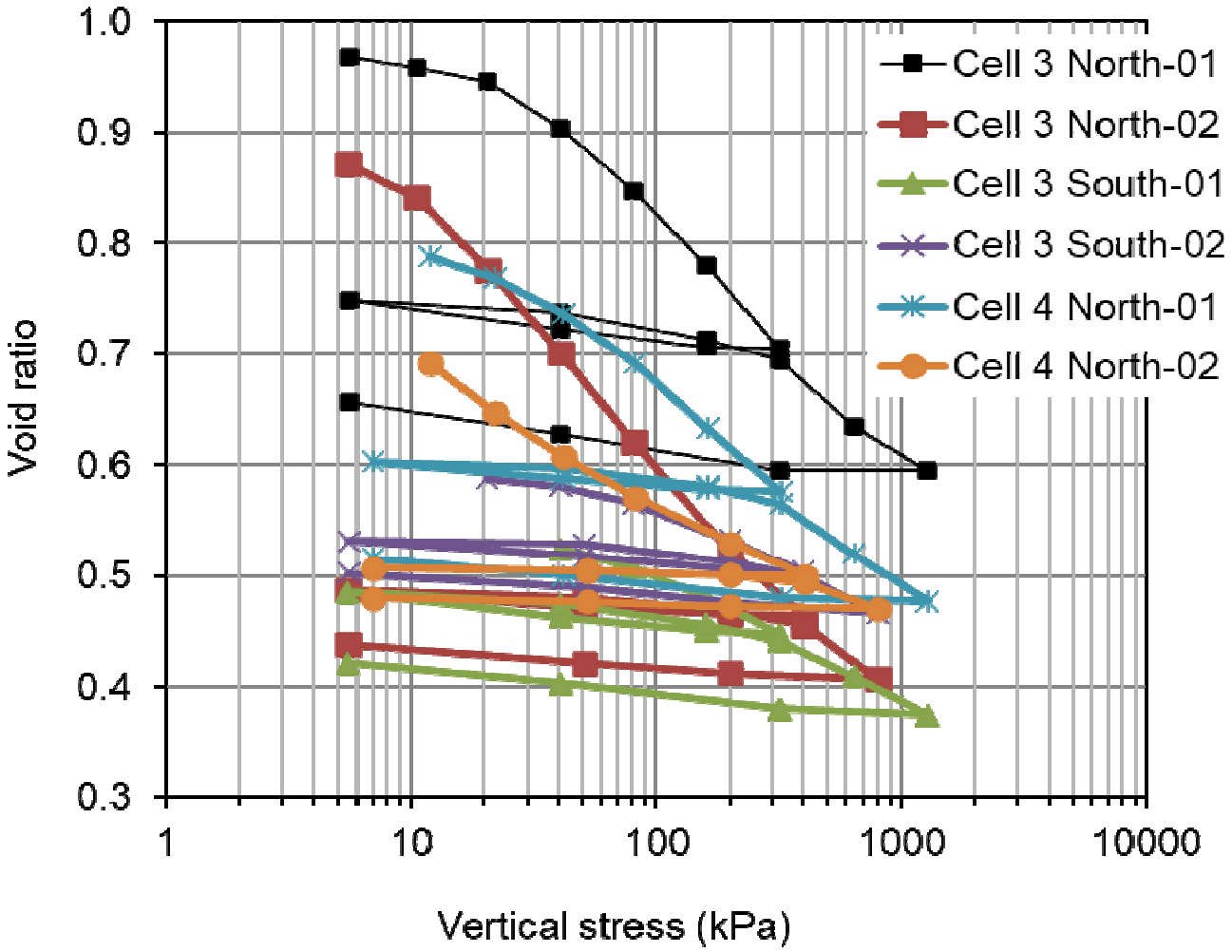
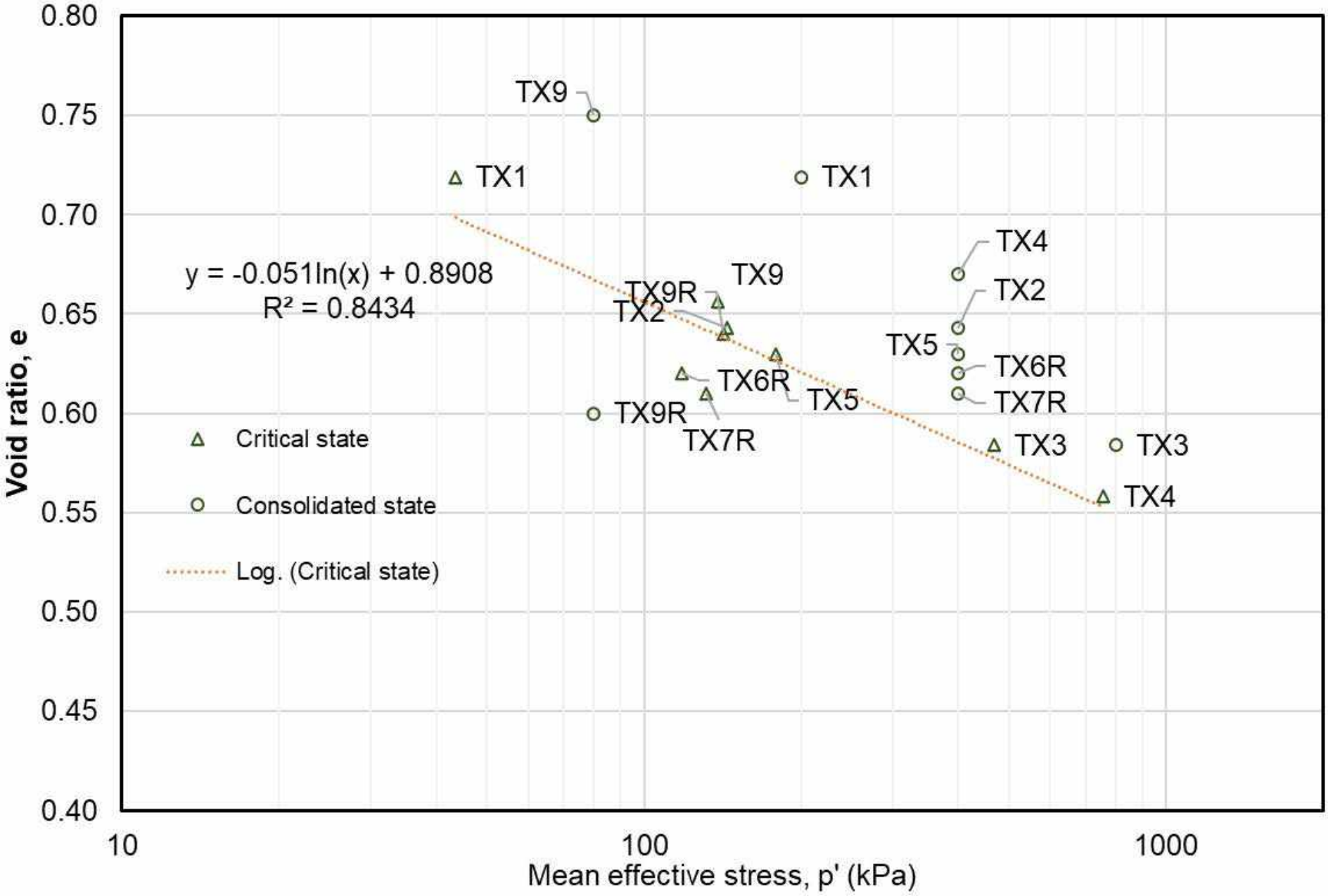
FIGURES


Undrained Shear Strength Ratio
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
0
200
400
600
800
Vertical Effective Stress, kPa
$s_u/\sigma'_v = 0.29$,
$s_{u,min} = 80$ kPa
Cell 3 North Wall
Cell 3 South Wall
Cell 4 North Wall
Fitting

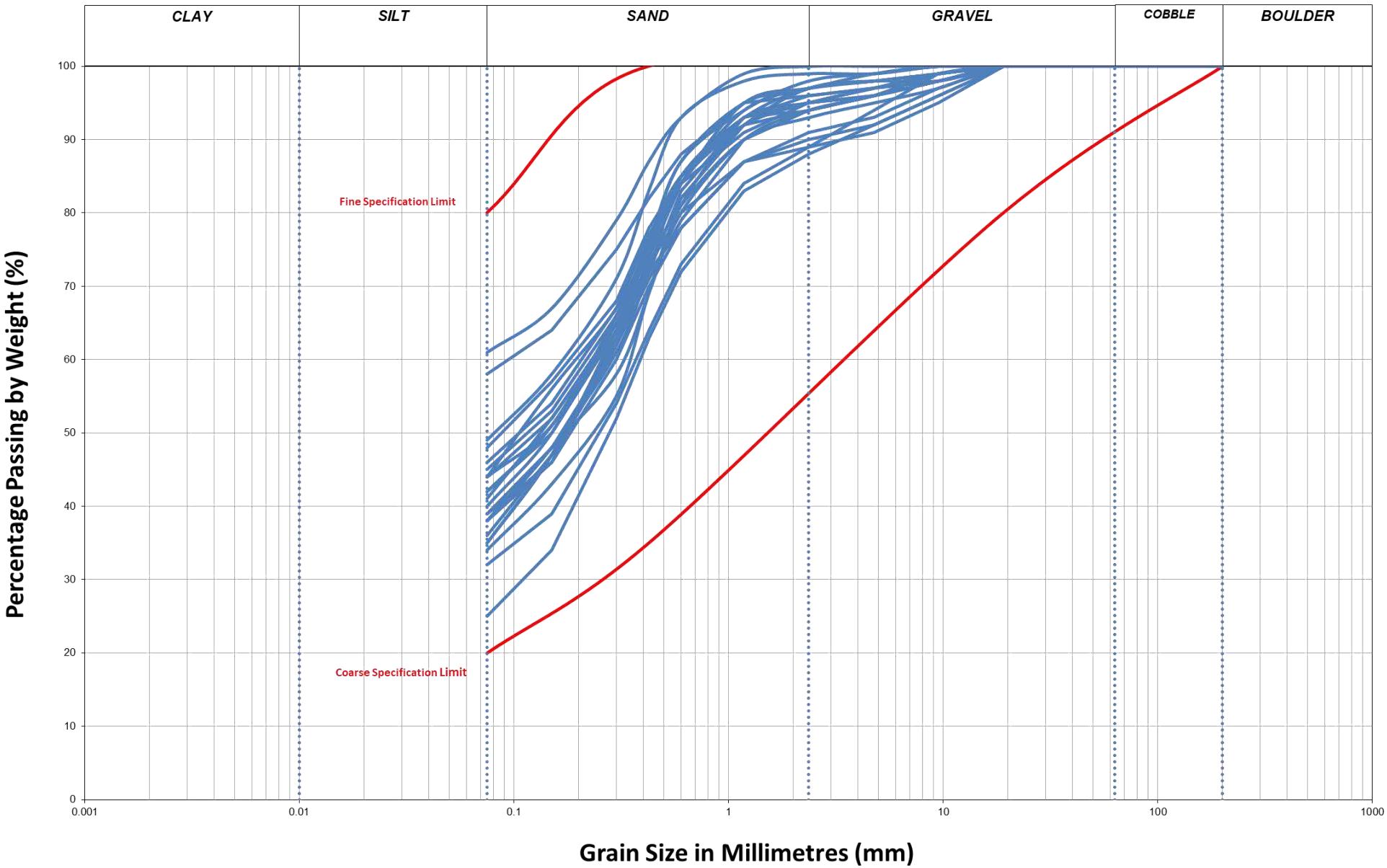

Undrained Shear Strength (kPa)
300.0
250.0
200.0
150.0
100.0
50.0
0.0
0
200
400
600
800
Vertical Effective Stress, kPa
$s_u/\sigma'_v = 0.29$,
$s_{u,min} = 80$ kPa
Cell 3 North Wall
Cell 3 South Wall
Cell 4 North Wall
Fitting


1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
Void ratio
1
10
100
1000
10000
Vertical stress (kPa)
Cell 3 North-01
Cell 3 North-02
Cell 3 South-01
Cell 3 South-02
Cell 4 North-01
Cell 4 North-02

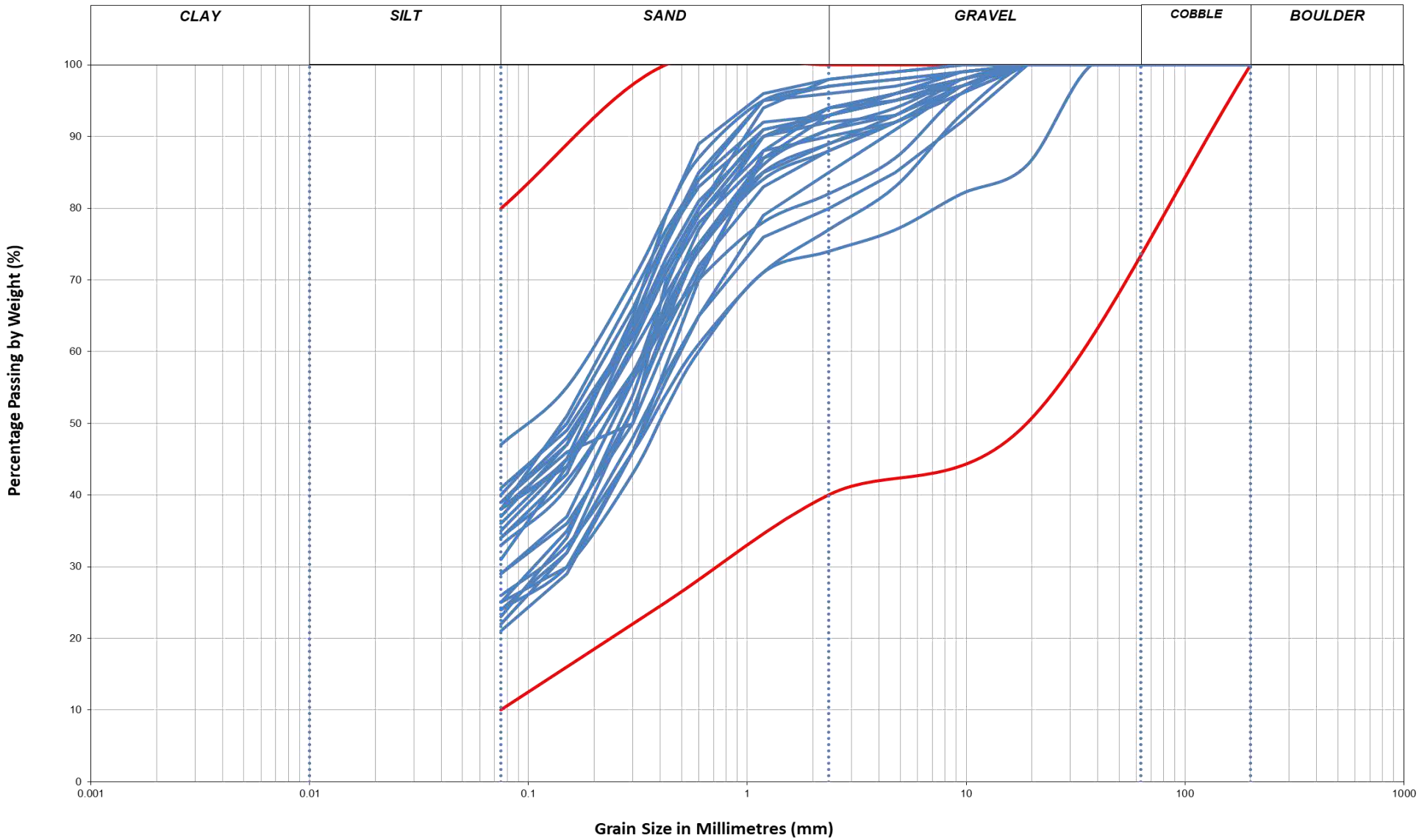

0.80
0.75
0.70
0.65
0.60
0.55
0.50
0.45
0.40
Void ratio, e
10
100
1000
Mean effective stress, p' (kPa)
y = -0.051ln(x) + 0.8908
R² = 0.8434
Critical state
Consolidated state
Log. (Critical state)
TX9
TX1
TX1
TX4
TX9
TX9R
TX2
TX2
TX5
TX6R
TX6R
TX5
TX7R
TX9R
TX7R
TX3
TX3
TX4

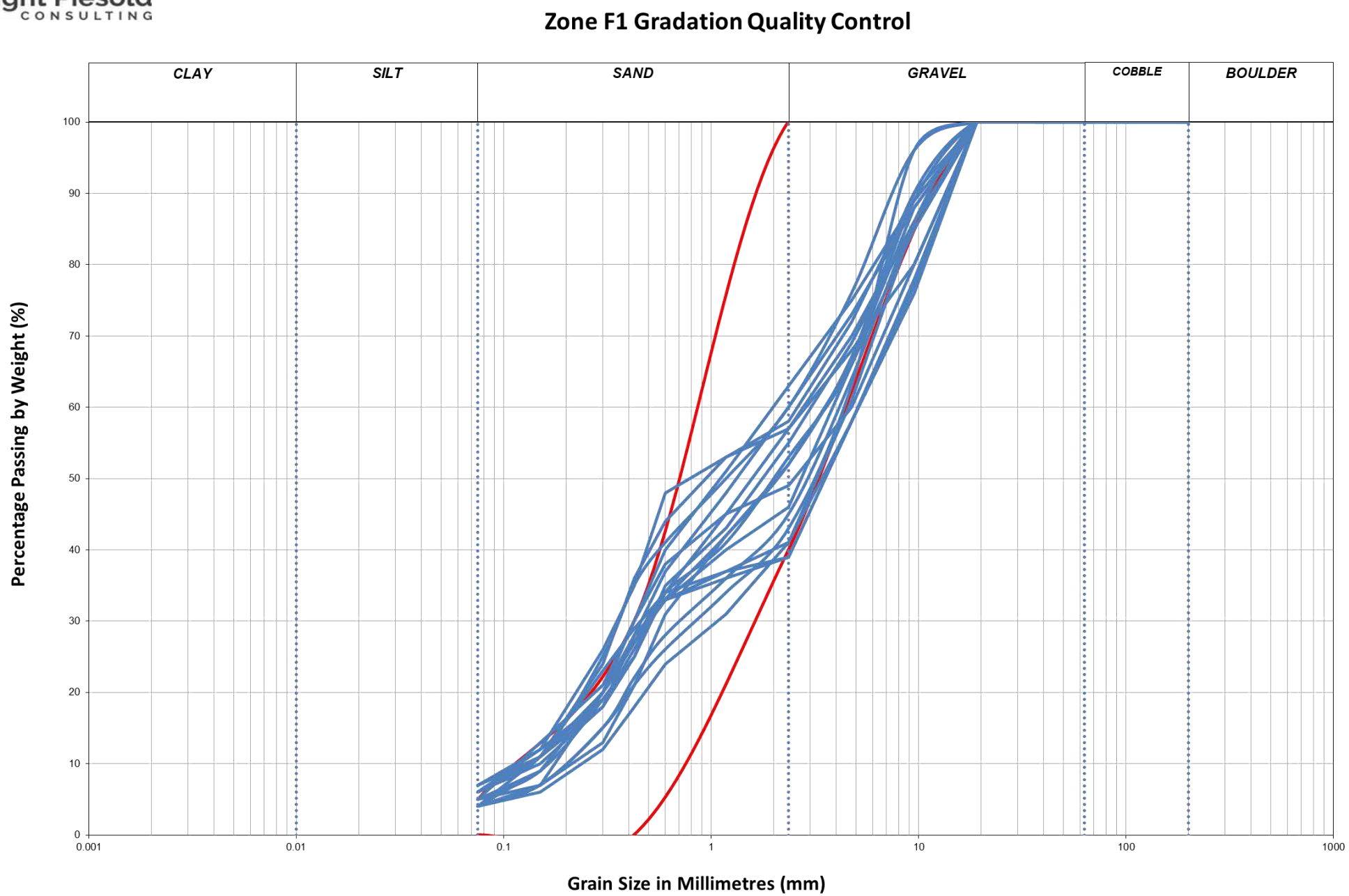
Knight Piésold CONSULTING

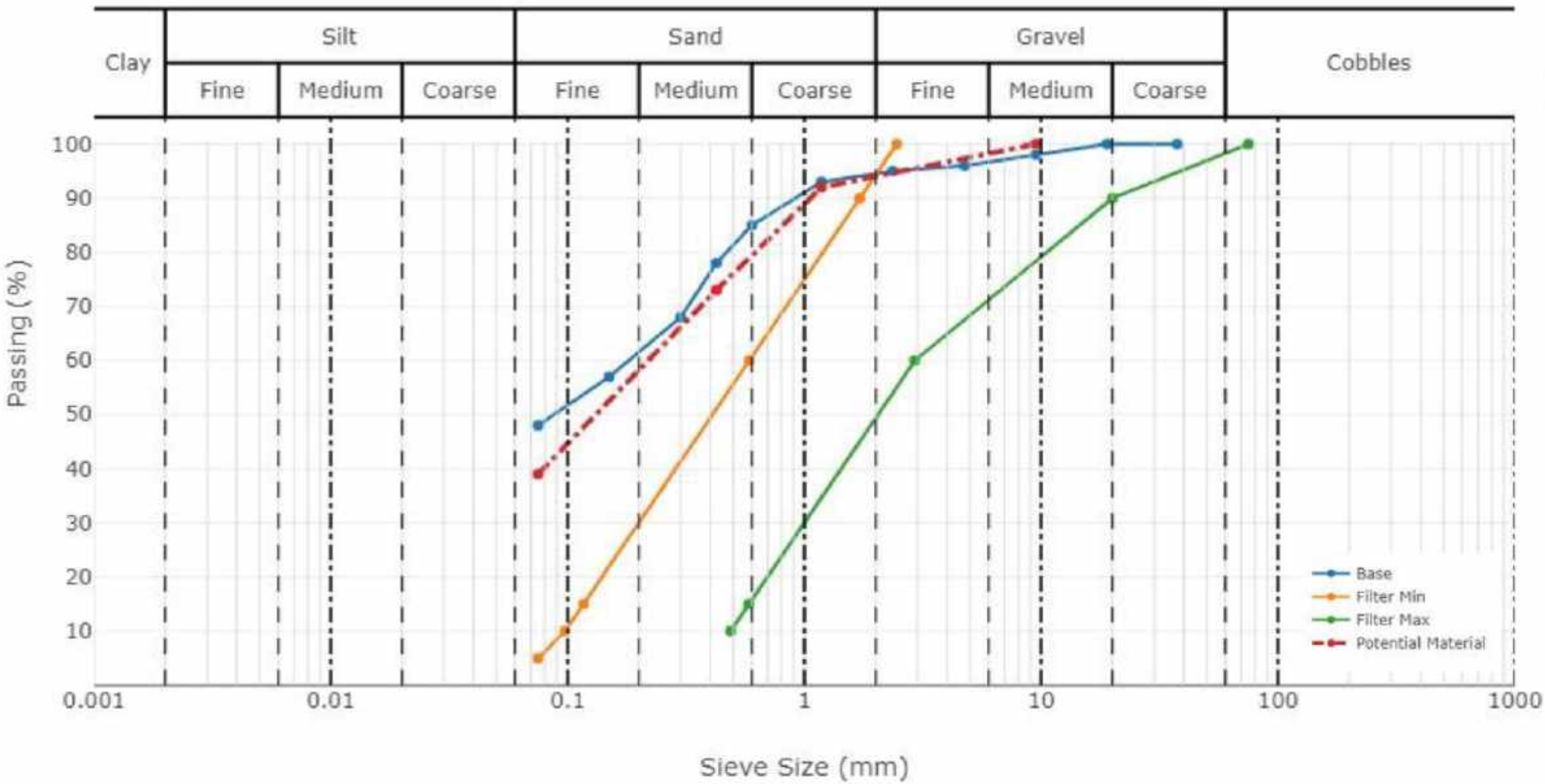
Zone A - Embankment - Gradation Quality Control

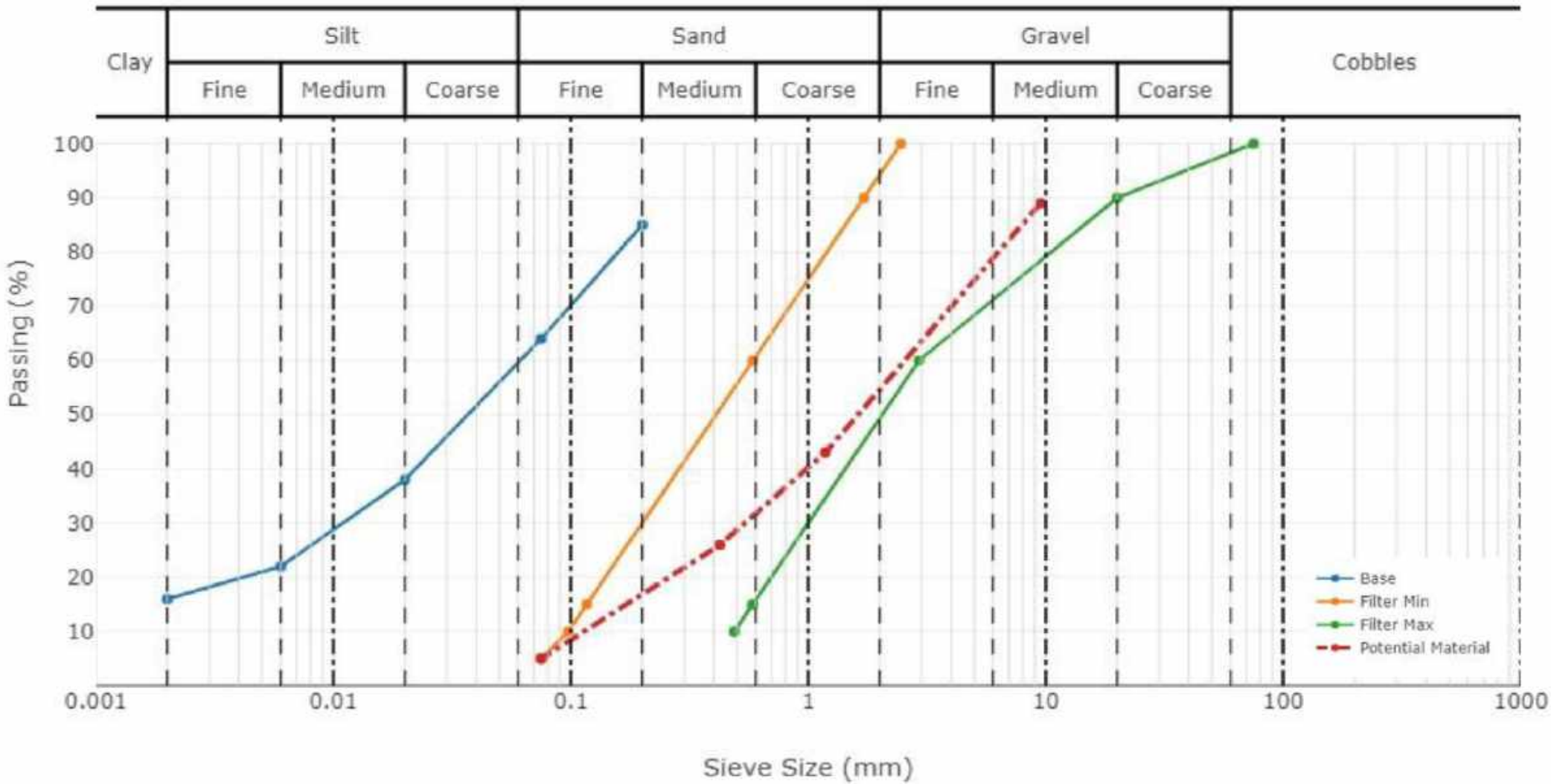


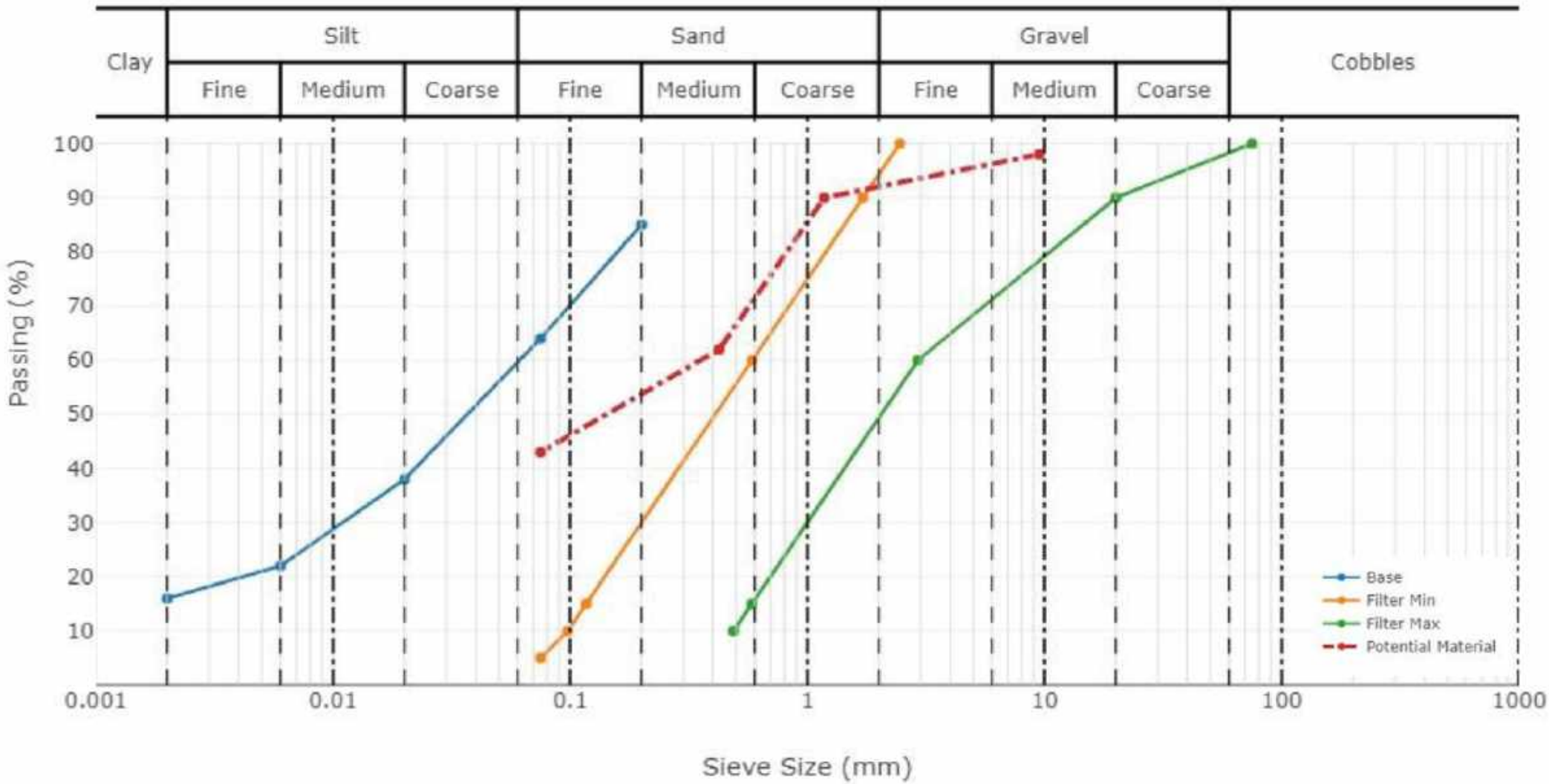
Zone C - Embankment - Gradation Quality Control



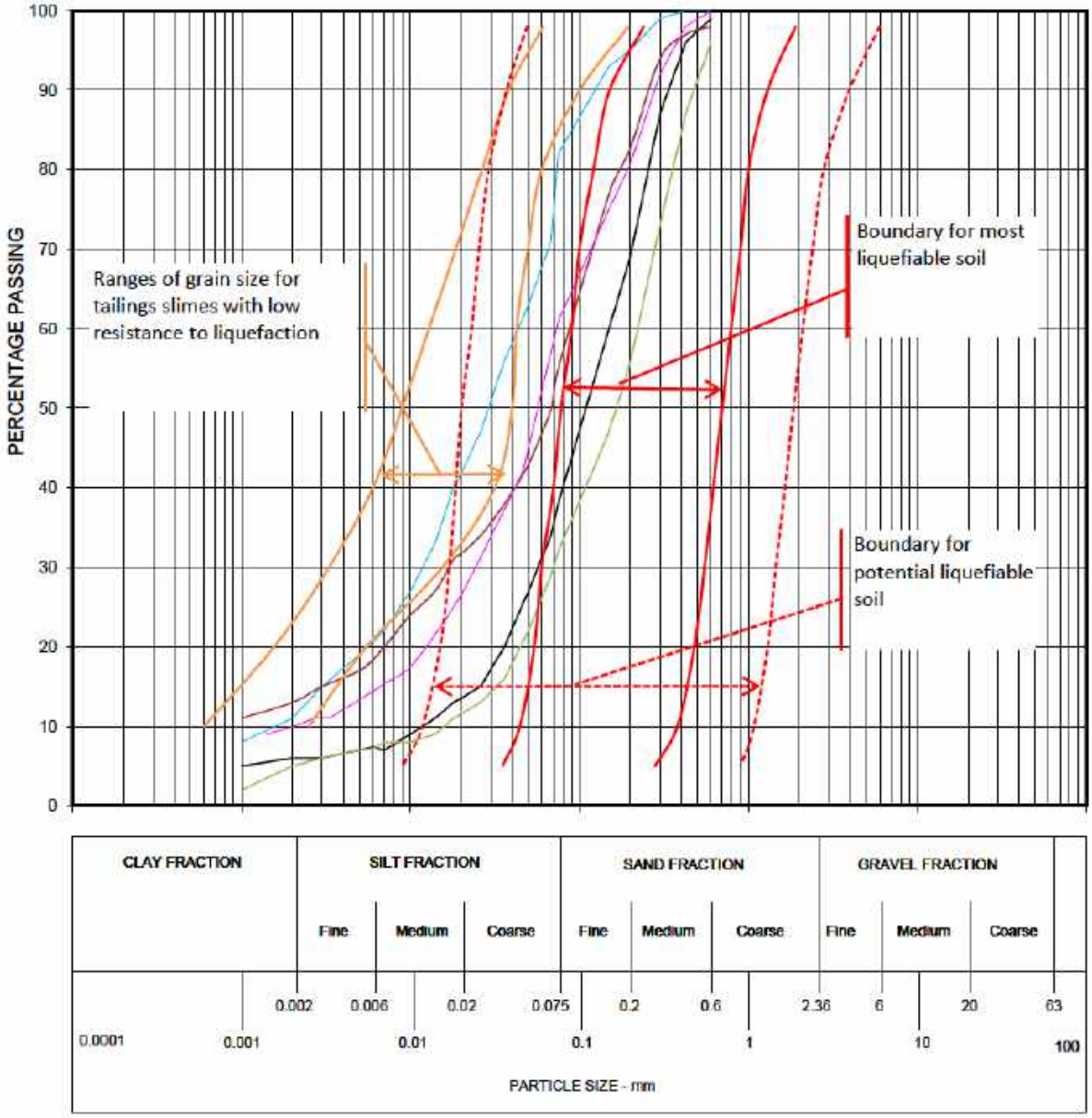

Zone F1 Gradation Quality Control
CLAY
SILT
SAND
GRAVEL
COBBLE
BOULDER
Percentage Passing by Weight (%)
100
90
80
70
60
50
40
30
20
10
0
0.001
0.01
0.1
1
10
100
1000
Grain Size in Millimetres (mm)


Clay
Silt
Sand
Gravel
Cobbles
Fine
Medium
Coarse
Fine
Medium
Coarse
Fine
Medium
Coarse
Passing (%)
100
90
80
70
60
50
40
30
20
10
0.001
0.01
0.1
1
10
100
1000
Sieve Size (mm)
Base
Filter Min
Filter Max
Potential Material


Clay
Silt
Sand
Gravel
Cobbles
Fine
Medium
Coarse
Fine
Medium
Coarse
Fine
Medium
Coarse
Passing (%)
100
90
80
70
60
50
40
30
20
10
0.001
0.01
0.1
1
10
100
1000
Sieve Size (mm)
Base
Filter Min
Filter Max
Potential Material


Clay
Silt
Sand
Gravel
Cobbles
Fine
Medium
Coarse
Fine
Medium
Coarse
Fine
Medium
Coarse
Passing (%)
100
90
80
70
60
50
40
30
20
10
0.001
0.01
0.1
1
10
100
1000
Sieve Size (mm)
Base
Filter Min
Filter Max
Potential Material

PARTICLE SIZE DISTRIBUTION



SYMBOL	SOIL DESCRIPTION	LL	PI	SG
———	TSF Cell 4- CPT59- (0.0-0.2)m	NO	NP	2.76
———	TSF Cell 4- CPT61- (0.0-0.3)m	NO	NP	2.70
———	TSF Cell 4- CPT65- (0.0-0.2)m	NO	NP	2.68
———	TSF Cell 4- CPT66- (0.0-0.3)m	NO	NP	2.71
———	Cell4-CPT63 /CPT69-(0-0.3)m	22.00	17.00	2.82

Note:

Liquefiable and potentially liquefiable soil limits suggested by USNRC 1985.

Data obtained from Figure 12.15 and 12.16 of Geotechnical Engineering of Dams, Fell 2005

APPENDIX A

Climatology Assessment

Knight Piésold CONSULTING

Knight Piésold CONSULTING

MEMORANDUM

To:	**Evolution Mining**	**Date:**	17 April 2019
[redacted]		**Our Ref:**	PE19-00401
		KP File Ref.:	PE801-00137/29-A M19007
		From:	[redacted]

RE: MUNGARI GOLD PROJECT – BASELINE DESIGN CLIMATOLOGY

Knight Piésold (KP) is pleased to provide the following memorandum regarding baseline design climatology that has been developed for the Mungari Gold Project site near Kalgoorlie in Western Australia. The investigation and calculations discussed herein provide the hydrologic basis for the Cell 3 & 4 Feasibility Design.

This memorandum supersedes the memorandum issued during Cell 1 and 2 Definitive Feasibility Design phase in 2013 – PE13-00494. This is due to ongoing updates in methodology and longer data sets being available.

The site is located in a region with a Köppen climate classification of Desert, hot (persistently dry) with hot dry summers and cold winters.

1. DATA SOURCE / SUMMARY

Daily historic hydrologic data for an Australian Bureau of Meteorology (BOM) climate station in the vicinity of the Mungari Gold Project was obtained for use in deriving baseline design climatology. This station, illustrated on Figure 1.1 is the Kalgoorlie-Boulder Airport (#76047) climate station. It is located 19.5 kilometres (km) east of the project.

Historic daily precipitation data from the Kalgoorlie-Boulder climate station spanning the period March 1938 – November 2018 were analysed to obtain desired design inputs for water balance modelling, namely:

- Typical variability of annual precipitation;
- Typical variability of monthly precipitation; and
- Synthetic monthly precipitation sequences for three climate scenarios:
  - 1% Annual Exceedance Probability (AEP) Wet precipitation, 1 year duration;
  - Average precipitation, 1 year duration;
  - 1% AEP Dry precipitation, 1 year duration;

Average monthly pan evaporation values were sourced from a gridded dataset developed by the BOM. The dataset was developed using daily evaporation values spanning the period January 1975 – December 2005.

Design storms were developed using the BOM 2016 IFD generating tool. Probable Maximum Precipitation (PMP) was estimated using the methods developed by the BOM (Ref. 1, 2 & 3).

2. WATER BALANCE PRECIPITATION ANALYSES

Precipitation data from the Kalgoorlie-Boulder climate station was reduced into a standardised format and then analysed on annual and monthly time scales to develop inputs for water balance modelling. The following sections detail the various analyses conducted and the results achieved.

2.1 ANNUAL ANALYSES

Daily precipitation records from the Kalgoorlie-Boulder climate station were summed to produce annual totals for the 79 years of record available. KP notes that water years of record (October through September) were excluded from the analyses if greater than 15% of the daily data from that year were missing (approximately 2 months); this was done to prevent missing records from introducing bias into computed climate statistics. Sampling statistics were computed from the annual sums to provide a broad overview of the variability of annual climate at the project site, as given in Table 2.1.

Table 2.1: Annual precipitation statistics

Selected Statistic	Precipitation Value (mm)
Average	269
Median	253
Std. Deviation	96
Minimum	115
Maximum	506
25th Percentile	200
75th Percentile	321

2.2 MONTHLY ANALYSES

Daily precipitation from the Kalgoorlie-Boulder climate station was summed in a manner similar to that described in Section 2.1 to produce monthly totals. KP notes that months of record were excluded from the analyses if greater than 25% of the daily data from that month were missing (approximately 1 week); for the same reason as given in Section 2.1. Sampling statistics were computed on the monthly sums to provide a broad overview of the variability of monthly climate at the project site, as given in Table 2.2.

Table 2.2: Monthly precipitation statistics

Month	Average	Median	Std. Dev.	Min.	Max.	25th Pct.	75th Pct.
Oct.	16	11	18	0	84	4	21
Nov.	19	15	20	0	115	3	29
Dec.	17	11	17	0	89	3	23
Jan.	28	11	40	0	186	3	37
Feb.	32	15	47	0	308	6	47
Mar.	26	10	36	0	197	3	28
Apr.	20	13	21	0	99	4	34
May	25	19	24	0	110	8	34
Jun.	27	19	29	1	186	9	37
Jul.	24	20	18	1	83	12	32
Aug.	22	16	17	2	74	11	30
Sep.	14	11	15	0	98	4	18

Note: all computed precipitation statistics are measured in (mm).

The sample statistics for monthly precipitation at the Kalgoorlie-Boulder climate station were also depicted as “box and whisker” plots to illustrate the variability of monthly values at the project site, as shown on Figure 2.1.

It is shown on Figure 2.1 that February is generally the wettest month of the year at the Kalgoorlie-Boulder station, with measureable precipitation occurring throughout the year with no other definite wet season trends observed.

2.3 SYNTHETIC WATER BALANCE SCENARIOS

KP performed frequency analysis on annual duration values (from Kalgoorlie-Boulder dataset) to estimate the statistical likelihood of experiencing extremely “Wet” or “Dry” periods of weather at the project site. Exceedance and non-exceedance probabilities were assigned to various duration totals of daily precipitation values, by sorting the values in descending (for the “Wet” series) and ascending (for the “Dry” series) order.

A number (64) of different probability distributions, e.g.: Log-Pearson 3, Generalised Extreme Value, Wakeby, Inverse Gaussian, etc. were fitted to the various sums of daily precipitation data using EasyFit 5.4 Professional software. Three of the best fits were selected for comparison in each case, as shown in the following figures:

- Wet precipitation series 1 year duration – Figure 2.2; and
- Dry precipitation series, 1 year duration – Figure 2.3.

Ideally, the distributions having the best weighted Kolmogorov-Smirnov and Anderson-Darling goodness-of-fit test ranking results will match across all scenarios, thereby providing consistent results. In this case, the goodness-of-fit test results indicated the Wakeby distribution was statistically the best fit. The resulting estimated extreme wet and dry annual precipitation depths are shown in Table 2.3.

Table 2.3: Design annual precipitation - Wet and Dry scenarios

AEP	1 Year Precipitation Totals (mm)	
	Wet	Dry
1%	526	113
2%	498	118
5%	451	131
10%	406	151
20%	351	183

In order to apportion the statistically-computed climate series precipitation totals to monthly time series for use in water balance modelling, the following observed rainfall patterns were used:

- 1 year duration Wet scenarios: October 1991 – September 1992, the wettest observed water year of record;
- 1 year duration Average scenario: October 1996– September 1997, a year closest to the median observed water year of record with no total months of rainfall that are statistical outliers; and
- 1 year duration Dry scenarios: October 1971 – September 1972, the driest observed water year of record.

Ratios of observed monthly to observed total precipitation were computed for each scenario. These ratios were then multiplied by the computed statistical totals (at the selected design frequency, 1% AEP) to form the desired synthetic climate scenarios for water balance modelling. The resulting climate scenarios are summarised (in monthly format) in Table 2.4.

Table 2.4: Annual synthetic climate scenarios

Month	Annual Climate Scenarios (mm)		
	1% AEP Dry	Average	1% AEP Wet
Oct	2.7	5.7	10.6
Nov	4.3	20.6	1.5
Dec	12.6	27.2	13.3
Jan	6.9	4.2	1.2
Feb	2.7	22.5	21.8
Mar	30.7	26.5	109.3
Apr	2.6	46.9	77.8
May	1.8	36.7	80.9
Jun	26.3	7.9	91.5
Jul	5.3	20.2	6.2
Aug	11.7	37.6	76.7
Sep	4.6	13.2	34.4

It is noted that the 1% AEP Wet year may have months where the precipitation is less than the average or the 1% AEP dry year. Similarly the 1% AEP Dry year may have months where the precipitation is greater than the average or the 1% AEP wet year. This is not an error and is due to the rainfall pattern within the specific year selected to develop the rainfall patterns.

3. DESIGN STORMS

Aside from climate scenarios for water balance modelling, design storms were derived for surface water management design and storm containment.

3.1 PROBABLE MAXIMUM PRECIPITATION (PMP)

PMP was estimated using three different methods published by BOM, depending on the duration of the candidate storm. Generally speaking, for storm durations of up to 6 hours, the Generalised Short Duration Method (GSDM) procedures (Ref. 1) are employed. However, because the Mungari Gold Project site lies in the intermediate duration limit zone, GSDM estimates are only valid up to durations of 3.5 hours.

Because the Mungari Gold Project site lies in the GSAM-GTSMR Western Australia Transition Zone, both the Generalised Southeast Australia Method (GSAM) procedures (Ref. 2) and the Generalised Tropical Storm Method, Revised (GTSMR) procedures (Ref. 3) were evaluated to determine the governing method for deriving PMP for storm durations from 24 hours to 120 hours. Seasonality was also considered as different phenomena drive precipitation behaviour at different times of the year.

Results from estimating PMP with the various methods (and seasons) were plotted to determine which results in the largest (i.e. governing) values:

- Short duration (≤ 6 hour) PMP is governed by the GSDM method and
- Long duration (> 6 hour) PMP is governed by the GTSMR Summer method.

Composite curve results for the Mungari Gold Project site are summarised in Table 3.1.

Table 3.1: Composite depth-duration relationship for PMP

Estimation Procedure	Duration (hr)	Depth (mm)
GSDM	0.25	180
	0.50	270
	0.75	340
	1.0	420
	1.5	470
	2.0	520
	2.5	560
	3.0	600
GTSMR Summer	24	660
	30	720
	36	770
	48	830
	60	850
	72	900
	96	1,020

3.2 INTENSITY / FREQUENCY / DURATION

Intensity / Frequency / Duration (IFD) and corresponding Depth / Frequency / Duration (DFD) relationships for design storms (63.2% ≤ AEP ≤ 0.05%) were sourced from the BOM 2016 IFD tool (Ref. 4) for the grid cell (30.76°S, 121.23°E). The design storm information is summarised as storm depths in Table 3.2.

Table 3.2: Design storm depths

Duration (h)	Precipitation Depth (mm) for a given AEP							
	10%	5%	2%	1%	0.5%	0.2%	0.1%	0.05%
1	28	34	43	51	59	72	84	97
2	35	42	54	63	73	90	105	121
3	40	48	62	73	84	103	120	138
6	50	62	79	94	108	132	153	177
12	64	80	103	123	140	172	199	229
24	79	100	130	156	180	221	257	297
48	94	120	157	188	220	272	317	368
72	100	129	168	**203**	242	302	355	415
96	104	133	174	210	254	319	378	445
120	106	135	177	214	260	329	390	461
144	107	136	179	217	263	333	396	469
168	108	137	180	219	264	334	396	471

A summary of all of the estimate storm depths is provided as a DFD table and an IFD Table in Appendix A. This is also shown graphically on Figures 2.4 to 2.6.

4. EVAPORATION

The average monthly pan evaporation values were sourced from the BOM gridded evaporation dataset and are summarised in Table 4.1 below.

The resulting lake evaporation was determined as per "Evaporation Data for Western Australia" (Ref. 5) estimated the annual pan factor as 0.71, also shown in Table 4.1 below.

Table 4.1: Average monthly evaporation

Month	Average Pan Evaporation (mm)	Average Lake Evaporation (mm)
Oct	253	180
Nov	304	216
Dec	367	261
Jan	387	274
Feb	304	216
Mar	268	190
Apr	172	122
May	107	76
Jun	76	54
Jul	84	60
Aug	113	80
Sept	171	121

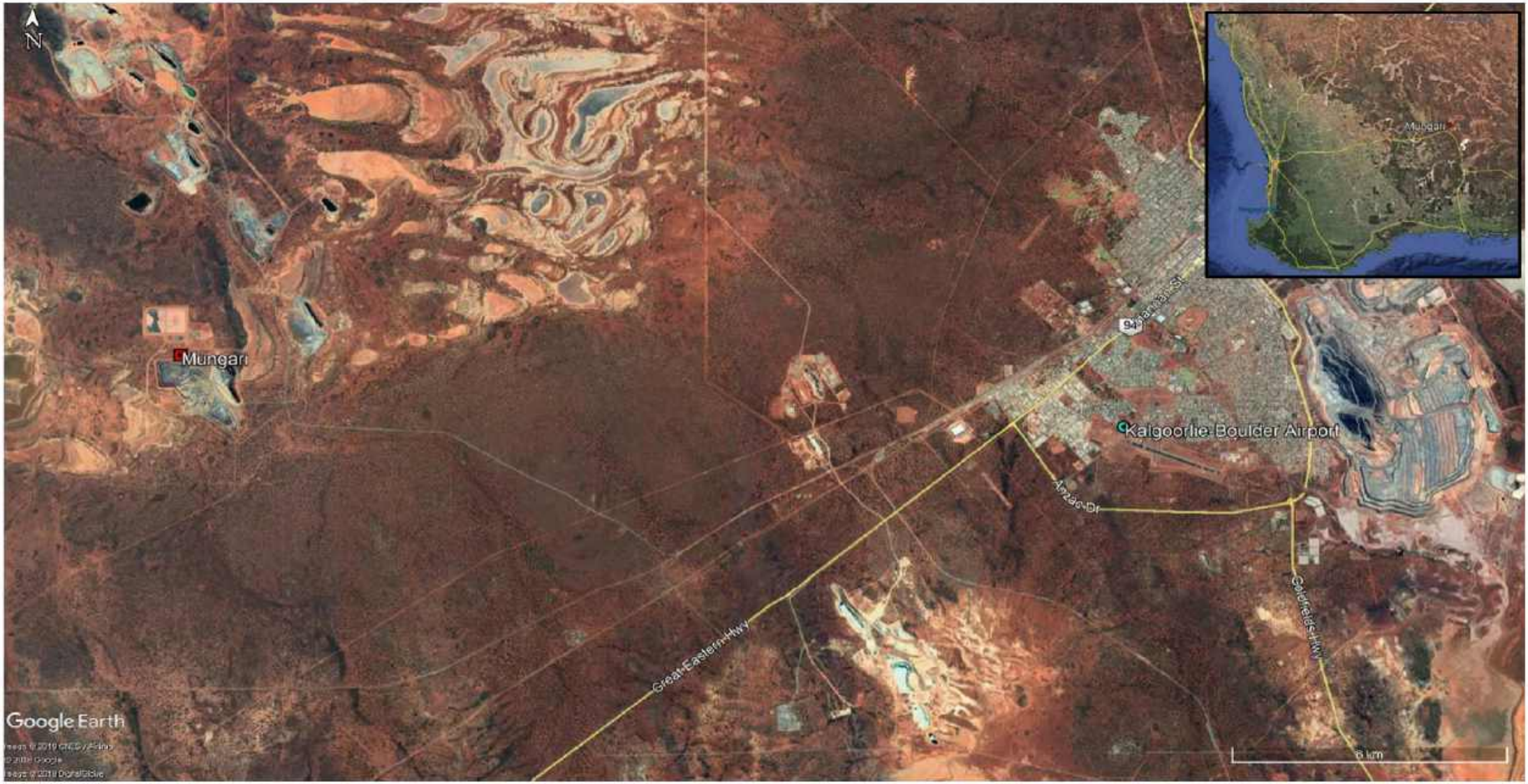
We trust that this memorandum is sufficient for your current needs. Please contact us if you have any queries.

[redacted]

REFERENCES

1. Australian Bureau of Meteorology. *"The Estimation of Probable Maximum Precipitation in Australia: Generalised Short-Duration Method*", 2003. Melbourne, VIC. Australia.
2. Australian Bureau of Meteorology. "Development of the Generalised Southeast Australia Method for Estimating Probable Maximum Precipitation, HRS Report No. 4", 1996. Melbourne, VIC. Australia
3. Australian Bureau of Meteorology. "*Revision of the Generalised Tropical Storm Method for Estimation Probable Maximum Precipitation, HRS Report No. 8*", 2003. Melbourne, VIC. Australia.
4. Bureau of Meteorology, "*Design Rainfall Data System (2016)*", http://www.bom.gov.au/water/designRainfalls/revised-ifd/?
5. Luke G.J., Burke K.L., O'Brien T.M. (1987), "Evaporation Data for Western Australia". Department of Agriculture and Food, Western Australia. Report 65.

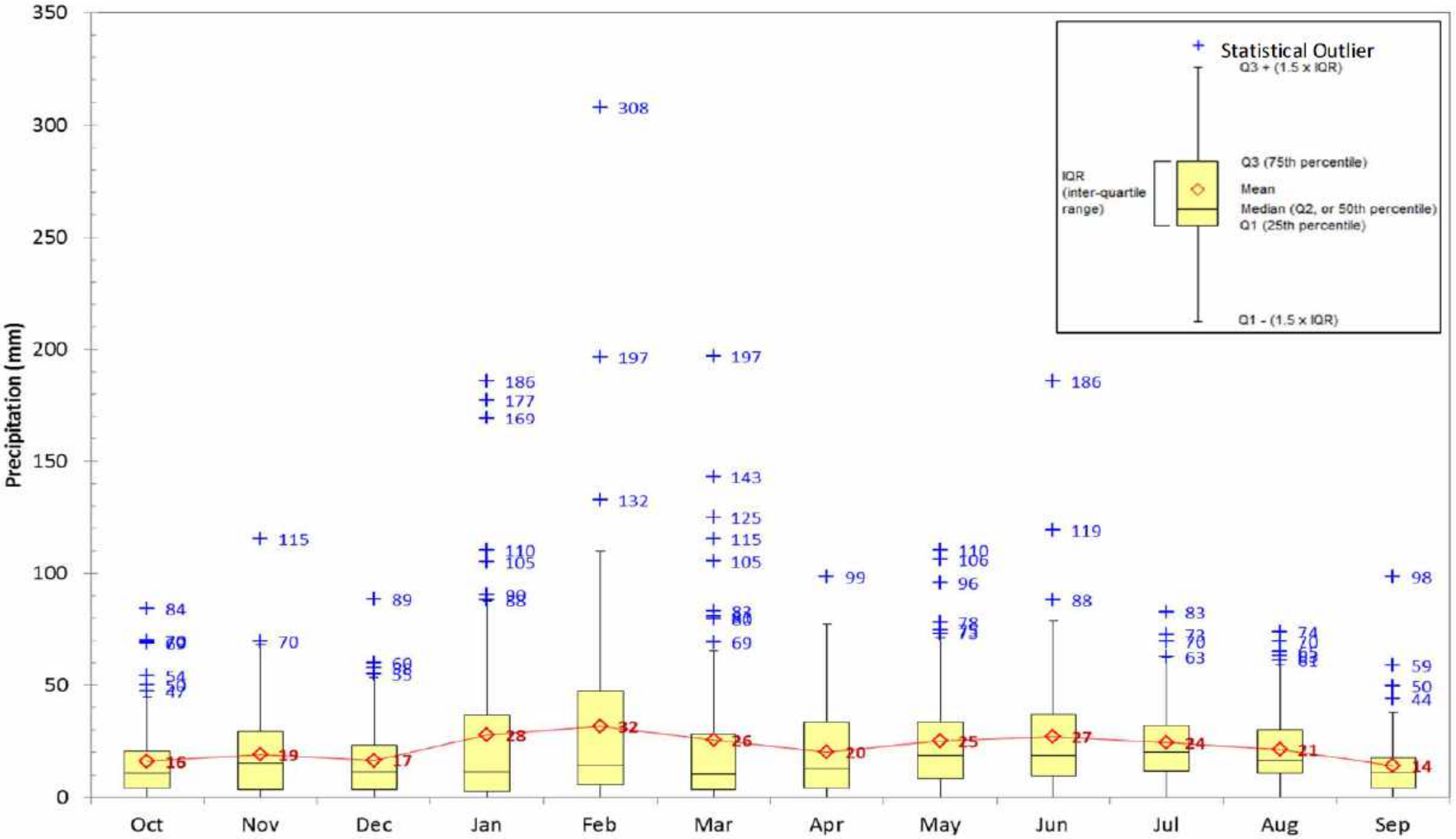
FIGURES



Knight Piésold CONSULTING

MUNGARI GOLD PROJECT
BASELINE DESIGN CLIMATOLOGY
NEARBY STATIONS

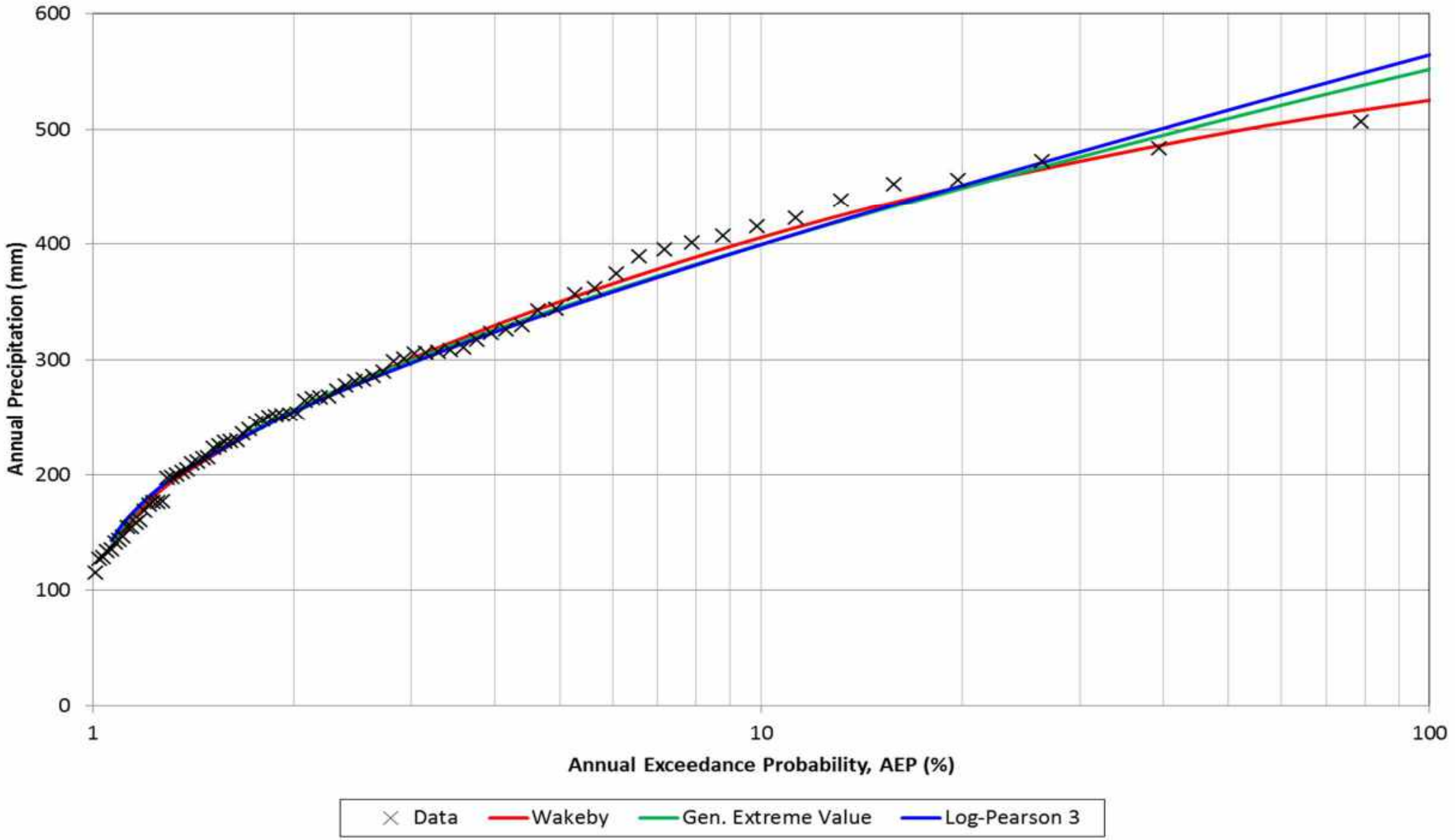
PE801-00137 M19007
Figure 1.1



Knight Piésold CONSULTING

MUNGARI GOLD PROJECT
BASELINE DESIGN CLIMATOLOGY
MONTHLY PRECIPITATION STATISTICS: KALGOORLIE BOM STATION

PE801-00137 M19007
Figure 2.1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500
400
300
200
100
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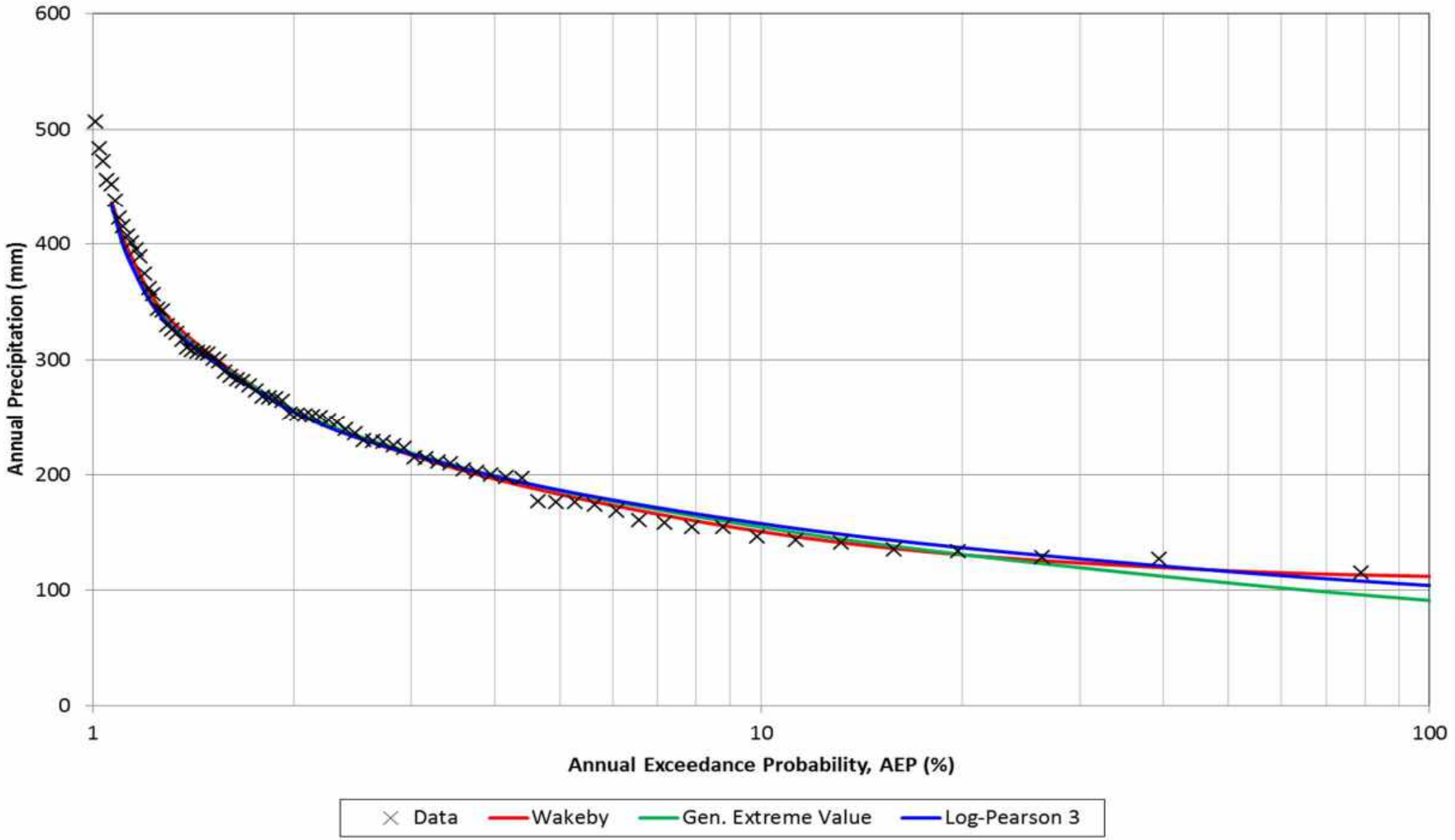
1
10
100
Annual Exceedance Probability, AEP (%)
Data
Wakeby
Gen. Extreme Value
Log-Pearson 3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500
400
300
200
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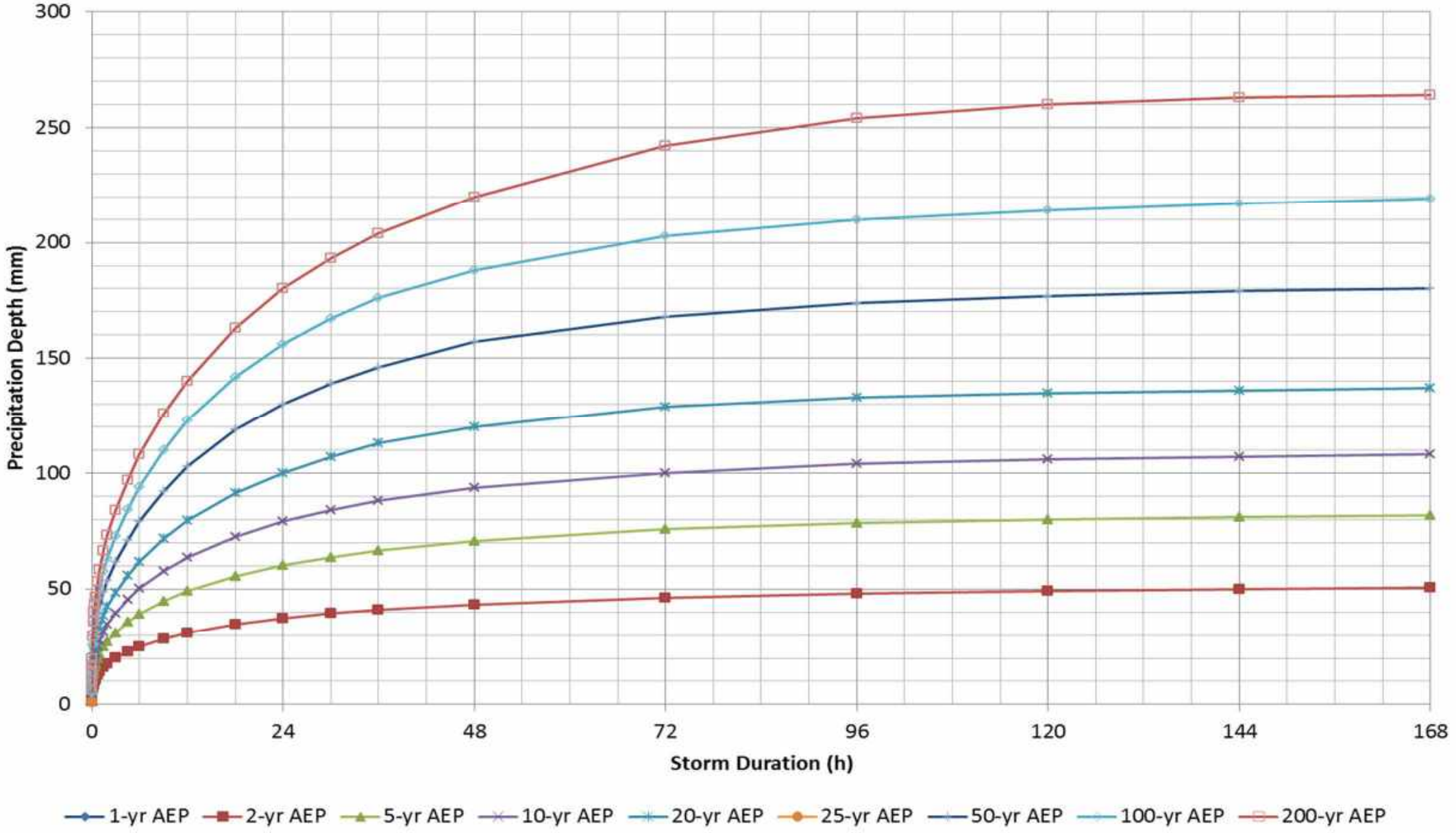
0
Annual Precipitation (mm)
1
10
100
Annual Exceedance Probability, AEP (%)
Data
Wakeby
Gen. Extreme Value
Log-Pearson 3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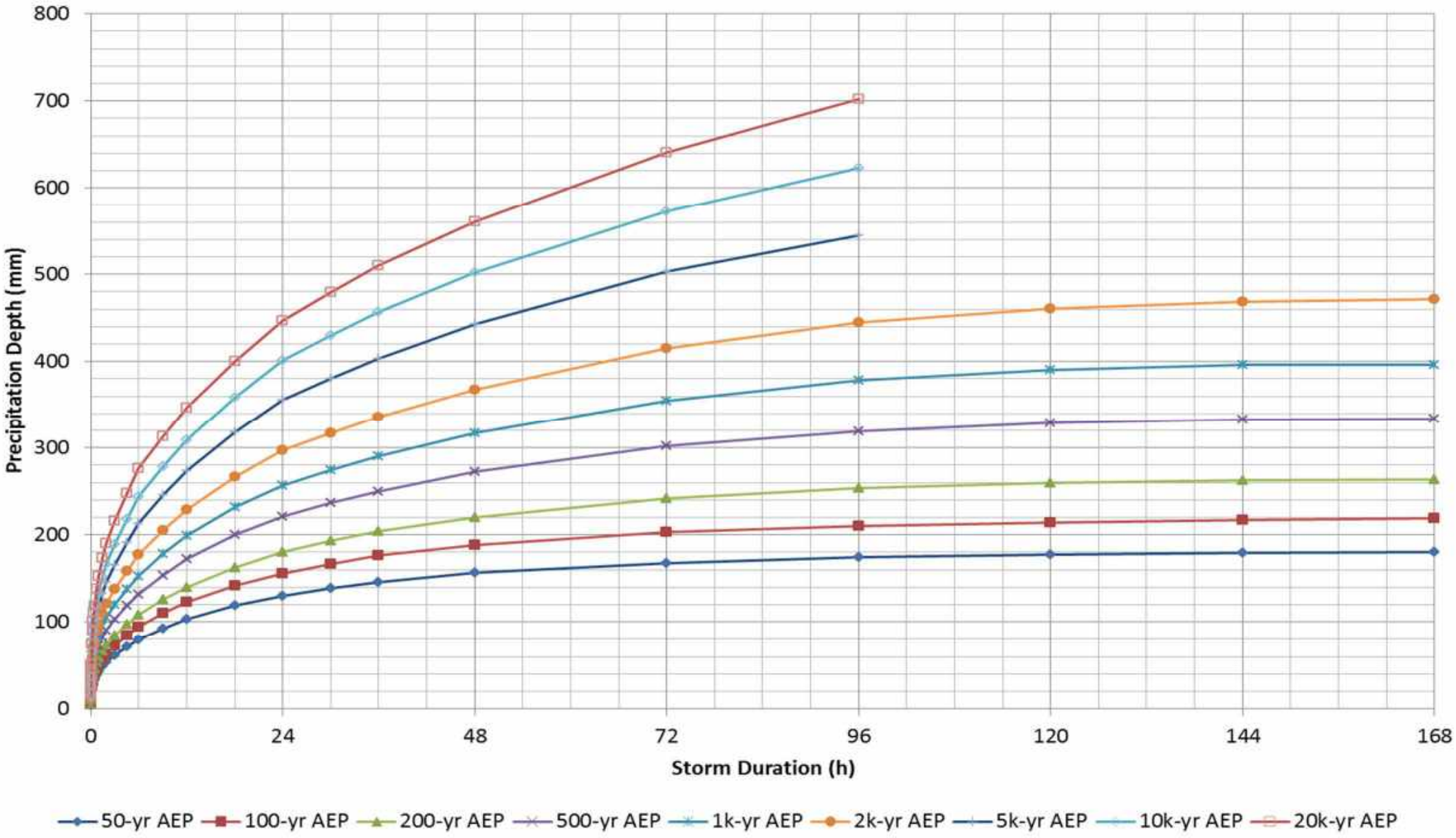
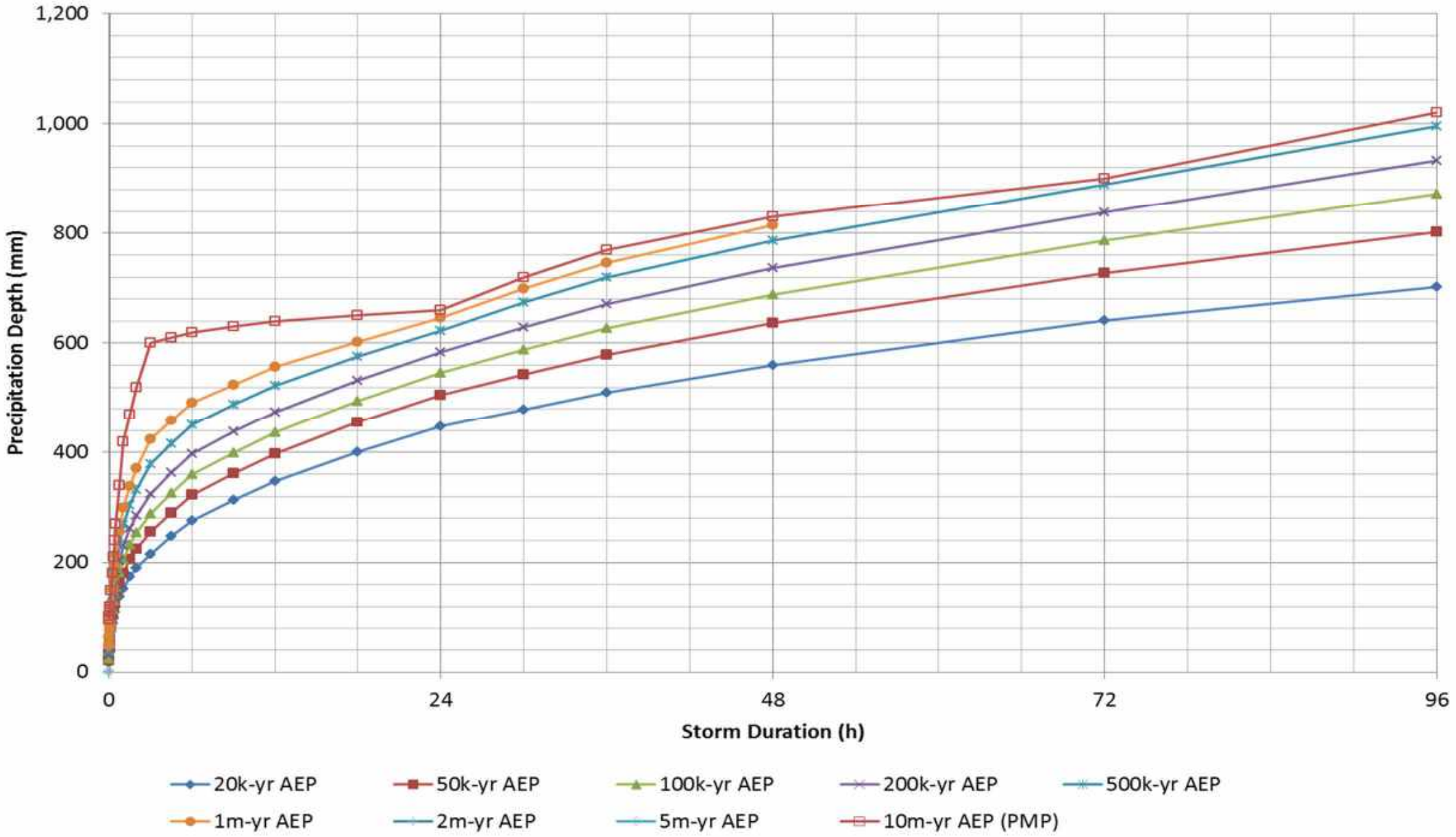
250
200
150
100
50
0
Precipitation Depth (mm)
0
24
48
72
96
120
144
168
Storm Duration (h)
1-yr AEP
2-yr AEP
5-yr AEP
10-yr AEP
20-yr AEP
25-yr AEP
50-yr AEP
100-yr AEP
200-yr AEP


800
700
600
500
400
300
200
100
0
Precipitation Depth (mm)
0
24
48
72
96
120
144
168
Storm Duration (h)
50-yr AEP
100-yr AEP
200-yr AEP
500-yr AEP
1k-yr AEP
2k-yr AEP
5k-yr AEP
10k-yr AEP
20k-yr AEP


1,200
1,000
800
600
400
200
0
Precipitation Depth (mm)
0
24
48
72
96
Storm Duration (h)
20k-yr AEP
50k-yr AEP
100k-yr AEP
200k-yr AEP
500k-yr AEP
1m-yr AEP
2m-yr AEP
5m-yr AEP
10m-yr AEP (PMP)

APPENDIX A
DFD and IFD Summary Tables

Knight Piésold CONSULTING	Subject: Evolution Mining	Made by: ACSB	Job No.: PE801-00137
	Mungari Gold Project	Checked	Date: 29/11/2018
	Design Storms	Approved	

Mungari Gold Project: Depth (mm) / Frequency (AEP) / Duration (h) Table

Storm Duration		Precipitation Depth (mm) for a given AEP (%) or ARI (yr)																				
		63.2%[1]	50%[2]	20%[3]	10%	5%	2%	1%	0.5%	0.2%	0.1%	0.05%	0.02%	0.01%	0.005%	0.002%	0.001%	0.0005%	0.0002%	0.0001%	0.00005%	0.00002%	PMP[4]
(min)	(h)	1.00	1.44	4.48	9.49	20	50	100	200	500	1,000	2,000	5,000	10,000	20,000	50,000	100,000	200,000	500,000	1,000,000	2,000,000	5,000,000	
1	0.017	1.2	1.4	2.2	2.9	3.5	4.5	5.3	6.1	7.5	8.7	10.0	12.2	14.2	16.7	20.9	25.0	30.0	38.7	47.2	58.0	77.0	96.0
2	0.033	2.1	2.5	3.9	4.9	5.9	7.4	8.7	10.2	12.6	14.7	17.0	20.6	23.8	27.6	33.4	38.7	44.7	54.2	62.8	72.6	88.1	102.0
3	0.050	2.8	3.4	5.2	6.6	8.0	10.1	11.9	13.9	17.1	19.9	23.1	28.0	32.3	37.1	44.3	50.4	57.2	67.1	75.4	84.4	97.3	108.0
4	0.067	3.4	4.1	6.3	8.0	9.8	12.5	14.7	17.0	21.0	24.4	28.2	34.0	38.9	44.4	52.3	58.9	66.0	76.1	84.3	92.8	104.7	114.0
5	0.083	3.9	4.7	7.3	9.3	11.4	14.5	17.1	19.8	24.3	28.3	32.6	39.1	44.6	50.5	59.1	66.1	73.5	83.8	91.9	100.3	111.5	120.0
10	0.167	5.8	6.9	10.8	13.8	17.0	21.7	25.6	29.5	36.1	41.9	48.3	57.9	65.7	74.1	85.6	94.7	103.8	115.8	124.6	133.0	143.2	150.0
15	0.25	7.0	8.3	13.1	16.7	20.5	26.2	31.0	35.6	43.7	50.6	58.4	70.1	79.6	89.8	103.8	114.7	125.7	140.1	150.5	160.4	172.2	180.0
20	0.33	7.9	9.4	14.7	18.8	23.1	29.5	34.9	40.1	49.2	57.1	65.9	79.1	90.0	101.5	117.7	130.3	143.2	160.3	172.9	185.0	199.9	210.0
25	0.42	8.6	10.3	16.1	20.5	25.2	32.1	37.9	43.7	53.6	62.1	71.7	86.1	98.1	111.0	129.1	143.5	158.3	178.2	193.3	208.1	226.8	240.0
30	0.50	9.2	11.0	17.2	21.9	26.9	34.2	40.4	46.6	57.2	66.4	76.7	92.3	105.3	119.3	139.2	155.3	172.1	195.0	212.6	230.3	253.3	270.0
45	0.75	10.7	12.7	19.8	25.1	30.8	39.2	46.2	53.4	65.6	76.2	88.0	105.9	121.1	137.7	161.8	181.6	202.7	232.5	256.2	280.8	314.2	340.0
60	1.0	11.8	14.1	21.8	27.6	33.8	42.9	50.6	58.6	72.0	83.7	96.7	116.6	133.7	152.8	181.0	204.8	230.8	268.6	299.9	333.5	381.3	420.0
90	1.5	13.5	16.1	24.9	31.5	38.5	48.9	57.6	66.6	82.0	95.2	110.0	132.7	152.1	173.6	205.5	232.2	261.4	303.6	338.3	375.4	427.8	470.0
120	2.0	14.8	17.6	27.3	34.5	42.3	53.7	63.3	73.2	90.0	105.0	121.0	145.5	166.5	189.8	224.5	253.7	285.7	332.3	370.9	412.4	471.8	520.0
180	3.0	16.9	20.1	31.1	39.5	48.4	61.6	72.8	83.9	103.0	120.0	138.0	165.5	189.2	215.6	254.9	288.2	324.9	378.6	423.5	472.1	542.3	600.0
270	4.5	19.2	22.9	35.6	45.3	55.8	71.2	84.3	97.0	119.0	138.0	159.0	190.9	217.8	247.3	290.1	325.3	362.9	416.1	458.6	502.7	563.2	610.0
360	6.0	21.0	25.1	39.2	50.1	61.9	79.2	94.0	108.0	132.0	153.0	177.0	213.3	243.5	276.2	322.5	359.7	398.3	450.9	491.1	531.2	582.8	620.0
540	9.0	23.8	28.4	44.8	57.6	71.8	92.3	110.0	126.0	154.0	178.0	205.0	245.3	278.4	313.4	361.9	399.7	438.0	488.1	524.8	559.7	601.9	630.0
720	12	25.9	31.0	49.1	63.6	79.6	103.0	123.0	140.0	172.0	199.0	229.0	273.5	309.5	347.0	397.9	436.6	474.7	522.7	556.3	586.5	620.2	640.0
1080	18	28.9	34.7	55.6	72.5	91.6	119.0	142.0	163.0	200.0	232.0	267.0	318.4	359.1	400.6	455.0	494.6	531.7	575.3	602.8	624.6	643.6	650.0
1440	24	31.1	37.4	60.3	79.1	100.0	130.0	156.0	180.0	221.0	257.0	297.0	355.5	401.3	447.1	505.6	546.5	583.2	623.0	645.1	659.4		660.0
1800	30	32.7	39.4	63.8	84.1	107.0	139.0	167.0	193.0	237.0	274.0	317.0	380.1	429.5	479.2	543.0	588.0	628.6	673.2	698.5	715.5		720.0
2160	36	34.0	41.0	66.6	88.0	113.0	146.0	176.0	204.0	250.0	290.0	336.0	403.6	456.7	510.1	578.8	627.2	671.0	719.2	746.6	765.0		770.0
2880	48	35.9	43.3	70.8	93.7	120.0	157.0	188.0	220.0	272.0	317.0	368.0	443.0	501.7	560.7	636.0	688.8	735.9	786.7	814.6			830.0
4320	72	38.3	46.2	75.7	100.0	129.0	168.0	203.0	242.0	302.0	355.0	415.0	503.4	572.5	641.2	727.8	786.9	838.1	889.9				900.0
5760	96	39.7	47.9	78.4	104.0	133.0	174.0	210.0	254.0	319.0	378.0	445.0	544.7	623.3	702.2	802.7	872.2	933.1	996.1				1,020.0
7200	120	40.7	49.1	80.0	106.0	135.0	177.0	214.0	260.0	329.0	390.0	461.0											
8640	144	41.5	49.9	81.1	107.0	136.0	179.0	217.0	263.0	333.0	396.0	469.0											
10080	168	42.1	50.6	81.9	108.0	137.0	180.0	219.0	264.0	334.0	396.0	471.0											

- **Estimated using the BOM IFD TOOL 2016**
- **Estimated by interpolation methodology as described in Section 3.5.2.2 of ARR 2016.**
- **Logarithmically interpolated for mid duration events**
- **Not estimated due to interpolation errors.**
- **Linearly extrapolated for short duration events**
- **Estimated using the procedures taken from "The Estimation of Probable Maximum Precipitation in Australia", June 2003 (GSDM)**
- **Estimated using the procedures taken from "Revision of the Generalised Tropical Storm Method for Estimating Probable Maximum Precipitation, HRS Report No. 8", August 2003 (GTSMR).**
- **Estimated using the procedures taken from "Development of the Generalised Southeast Australia Method for Estimating Probable Maximum Precipitation, HRS Report No. 4", August 1996 (GSAM).**

Notes:

1. 63% AEP is equivalent to 1 Exceedances per year (EY). This event of greater will occur once ever year.
2. The 50% AEP IFD does not correspond to the 2 year Average Recurrence Interval (ARI) IFD. Rather it corresponds to the 1.44 ARI.
3. The 20% AEP IFD does not correspond to the 5 year Average Recurrence Interval (ARI) IFD. Rather it corresponds to the 4.48 ARI.
4. PMP is assumed to be equivalent to a 0.00001% AEP or 10,000,000 year ARI Event.

Knight Piésold CONSULTING	Subject: Evolution Mining	Made by: ACSB	Job No.: PE801-00137
	Mungari Gold Project	Checked	Date: 29/11/2018
	Design Storms	Approved	

Mungari Gold Project: Intensity (mm/h) / Frequency (AEP) / Duration (h) Table

Storm Duration		Precipitation Intensity (mm/h) for a given AEP (%) or ARI (yr)																				
		63.2%[1]	50%[2]	20%[3]	10%	5%	2%	1%	0.5%	0.2%	0.1%	0.05%	0.02%	0.01%	0.005%	0.002%	0.001%	0.0005%	0.0002%	0.0001%	0.00005%	0.00002%	PMP[4]
(min)	(h)	1.00	1.44	4.48	9.49	20	50	100	200	500	1,000	2,000	5,000	10,000	20,000	50,000	100,000	200,000	500,000	1,000,000	2,000,000	5,000,000	
1	0.017	72.0	85.8	134.4	171.0	210.0	267.6	316.2	364.2	447.6	519.0	599.4	729.3	852.3	1,002.7	1,255.4	1,499.4	1,802.5	2,322.5	2,834.8	3,482.7	4,617.9	5,760.0
2	0.033	62.7	74.7	115.5	145.5	176.7	223.2	261.9	306.0	378.0	441.0	510.0	618.1	714.9	826.9	1,002.5	1,159.8	1,341.9	1,627.3	1,883.1	2,179.3	2,643.7	3,060.0
3	0.050	56.4	67.2	104.0	131.4	160.2	202.0	238.0	278.0	342.0	398.0	462.0	560.8	646.4	742.3	885.9	1,008.2	1,143.1	1,341.5	1,507.3	1,687.3	1,947.0	2,160.0
4	0.067	51.3	61.4	95.1	120.6	147.5	187.5	220.5	255.0	315.0	366.0	423.0	509.9	584.0	665.3	784.5	883.4	989.7	1,141.3	1,263.8	1,392.4	1,570.4	1,710.0
5	0.083	47.3	56.5	87.8	111.6	136.8	174.0	205.2	237.6	291.6	339.6	391.2	469.3	534.9	606.3	709.1	793.0	881.7	1,005.5	1,103.1	1,203.3	1,337.9	1,440.0
10	0.167	34.7	41.5	64.8	82.8	102.0	130.2	153.6	177.0	216.6	251.4	289.8	347.2	394.4	444.3	513.7	567.9	622.8	694.8	747.7	798.1	859.2	900.0
15	0.25	27.9	33.4	52.4	66.8	82.0	104.8	124.0	142.4	174.8	202.4	233.6	280.3	318.6	359.0	415.1	458.8	502.8	560.2	602.1	641.6	689.0	720.0
20	0.33	23.7	28.3	44.1	56.4	69.3	88.5	104.7	120.3	147.6	171.3	197.7	237.3	269.9	304.6	353.0	391.0	429.6	480.8	518.6	555.0	599.7	630.0
25	0.42	20.7	24.7	38.6	49.2	60.5	77.0	91.0	104.9	128.6	149.0	172.1	206.8	235.5	266.3	309.8	344.3	379.9	427.7	463.9	499.4	544.3	576.0
30	0.50	18.5	22.0	34.4	43.8	53.8	68.4	80.8	93.2	114.4	132.8	153.4	184.5	210.5	238.5	278.5	310.6	344.1	389.9	425.2	460.6	506.5	540.0
45	0.75	14.3	16.9	26.4	33.5	41.1	52.3	61.6	71.2	87.5	101.6	117.3	141.2	161.5	183.6	215.7	242.1	270.3	310.0	341.6	374.4	419.0	453.3
60	1.0	11.8	14.1	21.8	27.6	33.8	42.9	50.6	58.6	72.0	83.7	96.7	116.6	133.7	152.8	181.0	204.8	230.8	268.6	299.9	333.5	381.3	420.0
90	1.5	9.0	10.7	16.6	21.0	25.7	32.6	38.4	44.4	54.7	63.5	73.3	88.4	101.4	115.7	137.0	154.8	174.3	202.4	225.5	250.2	285.2	313.3
120	2.0	7.4	8.8	13.7	17.3	21.2	26.9	31.7	36.6	45.0	52.5	60.5	72.7	83.2	94.9	112.2	126.9	142.8	166.1	185.4	206.2	235.9	260.0
180	3.0	5.6	6.7	10.4	13.2	16.1	20.5	24.3	28.0	34.3	40.0	46.0	55.2	63.1	71.9	85.0	96.1	108.3	126.2	141.2	157.4	180.8	200.0
270	4.5	4.3	5.1	7.9	10.1	12.4	15.8	18.7	21.6	26.4	30.7	35.3	42.4	48.4	55.0	64.5	72.3	80.7	92.5	101.9	111.7	125.2	135.6
360	6.0	3.5	4.2	6.5	8.4	10.3	13.2	15.7	18.0	22.0	25.5	29.5	35.5	40.6	46.0	53.8	59.9	66.4	75.1	81.9	88.5	97.1	103.3
540	9.0	2.6	3.2	5.0	6.4	8.0	10.3	12.2	14.0	17.1	19.8	22.8	27.3	30.9	34.8	40.2	44.4	48.7	54.2	58.3	62.2	66.9	70.0
720	12	2.2	2.6	4.1	5.3	6.6	8.6	10.3	11.7	14.3	16.6	19.1	22.8	25.8	28.9	33.2	36.4	39.6	43.6	46.4	48.9	51.7	53.3
1080	18	1.6	1.9	3.1	4.0	5.1	6.6	7.9	9.1	11.1	12.9	14.8	17.7	20.0	22.3	25.3	27.5	29.5	32.0	33.5	34.7	35.8	36.1
1440	24	1.3	1.6	2.5	3.3	4.2	5.4	6.5	7.5	9.2	10.7	12.4	14.8	16.7	18.6	21.1	22.8	24.3	26.0	26.9	27.5		27.5
1800	30	1.1	1.3	2.1	2.8	3.6	4.6	5.6	6.4	7.9	9.1	10.6	12.7	14.3	16.0	18.1	19.6	21.0	22.4	23.3	23.9		24.0
2160	36	0.9	1.1	1.9	2.4	3.1	4.1	4.9	5.7	6.9	8.1	9.3	11.2	12.7	14.2	16.1	17.4	18.6	20.0	20.7	21.2		21.4
2880	48	0.7	0.9	1.5	2.0	2.5	3.3	3.9	4.6	5.7	6.6	7.7	9.2	10.5	11.7	13.3	14.3	15.3	16.4	17.0			17.3
4320	72	0.5	0.6	1.1	1.4	1.8	2.3	2.8	3.4	4.2	4.9	5.8	7.0	8.0	8.9	10.1	10.9	11.6	12.4				12.5
5760	96	0.4	0.5	0.8	1.1	1.4	1.8	2.2	2.6	3.3	3.9	4.6	5.7	6.5	7.3	8.4	9.1	9.7	10.4				10.6
7200	120	0.3	0.4	0.7	0.9	1.1	1.5	1.8	2.2	2.7	3.3	3.8											
8640	144	0.3	0.3	0.6	0.7	0.9	1.2	1.5	1.8	2.3	2.8	3.3											
10080	168	0.3	0.3	0.5	0.6	0.8	1.1	1.3	1.6	2.0	2.4	2.8											

- Estimated using the BOM IFD TOOL 2016

- Linearly extrapolated for short duration events

- Estimated by interpolation methodology as described in Section 3.5.2.2 of ARR 2016.

- Estimated using the procedures taken from "The Estimation of Probable Maximum Precipitation in Australia", June 2003 (GSDM)

- Logarithmically interpolated for mid duration events

- Estimated using the procedures taken from "Revision of the Generalised Tropical Storm Method for Estimating Probable Maximum Precipitation, HRS Report No. 8", August 2003 (GTSMR).

- Not estimated due to interpolation errors.

- Estimated using the procedures taken from "Development of the Generalised Southeast Australia Method for Estimating Probable Maximum Precipitation, HRS Report No. 4", August 1996 (GSAM).

Notes:

1. 63% AEP is equivalent to 1 Exceedances per year (EY). This event of greater will occur once ever year.
2. The 50% AEP IFD does not correspond to the 2 year Average Recurrence Interval (ARI) IFD. Rather it corresponds to the 1.44 ARI.
3. The 20% AEP IFD does not correspond to the 5 year Average Recurrence Interval (ARI) IFD. Rather it corresponds to the 4.48 ARI.
4. PMP is assumed to be equivalent to a 0.00001% AEP or 10,000,000 year ARI Event.

APPENDIX B1

Geotechnical Investigation Report

Knight Piésold CONSULTING

EVOLUTION MINING LTD
MUNGARI GOLD PROJECT

TAILINGS STORAGE FACILITY CELL 3 AND CELL 4 GEOTECHNICAL INVESTIGATION REPORT

PREPARED FOR:

Evolution Mining Ltd
Mungari Operations
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PE801-00137/23
Rev 1
May, 2020

Knight Piésold CONSULTING

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MUNGARI GOLD PROJECT

TAILING STORAGE FACILITY CELL 3 AND CELL 4

GEOTECHNICAL INVESTIGATION REPORT

KP Job No. PE801-00137/18

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1. INTRODUCTION

Knight Piésold Pty Ltd (KP) was engaged by Evolution Mining Ltd (Evolution) to undertake a geotechnical investigation on the proposed tailing storage facility (TSF) Cell 3 and Cell 4 site of the Mungari Gold Project. The site investigation was carried out from 13 - 23 March 2017 and 3 – 6 May 2020. The scope and purpose of the investigation was to:

- Assess ground conditions for the proposed TSF site; and
- Assess the suitability of site materials for TSF construction.

This report details the scope of the geotechnical investigation, presents an interpretation of ground conditions and material properties across the TSF Cell 3 and Cell 4 site and evaluates the suitability of materials for use in TSF construction. Interpretation of site conditions is based on the sub-surface lithology revealed during the investigation programme, visual assessments of the in-situ materials, the results of in situ field tests, and the results of laboratory testing carried out on selected representative samples.

All fieldwork, interpretation and terminology used in this report are in accordance with the guidelines presented in AS1726-2017 Geotechnical Site Investigation (Ref. 1).

2. SITE AREA

2.1 SITE LOCATION

The proposed TSF Cell 3 and Cell 4 site is located approximately 20 km to the west of the town of Kalgoorlie in Western Australia. Within the designated area, there are existing access roads thus the site is readily accessible.

2.2 SITE DESCRIPTION

The site is relatively flat, and is covered with shrubs and scattered with trees. Red brown clayey sand is easily identified as top soil on site. Access roads pass through the site. From site observations, the surrounding land is relatively flat with little change of the topography.

The proposed TSF Cell 3 and Cell 4 area is adjacent to the existing TSF Cell 2, located close to the boundary of two drainage areas, namely, Kopai Lake and Kurrawang Lake which are both salt lakes.

The general site layout is shown in Figure 2.1.

3. GEOTECHNICAL INVESTIGATION

3.1 GENERAL

The geotechnical investigation comprised the following scope:

- Drilling of 4 boreholes using diamond coring techniques;
- Excavation of 50 test pits; and
- Laboratory testing of samples obtained from the boreholes and test pits.

Fieldwork was supervised by a geotechnical engineer from KP. The test locations were selected following discussions between Evolution and KP prior to mobilising to site, and the locations were set out by Evolution's team. The test locations are shown in Figure 3.1.

3.2 BOREHOLE DRILLING

A total of 4 boreholes were drilled at the proposed TSF Site. The boreholes were drilled using a DE 840 drilling rig with HQ3 (OD ϕ=96 mm) coring bits supplied and operated by Top drill. The recovered core was placed into core trays and subsequently logged and photographed by a KP site representative. During the drilling of each borehole, Standard Penetration Tests (SPT) were undertaken typically at intervals of 1.5 m in order to assess the consistency and strength characteristics of the in situ material. The entire length of the each borehole was sealed with a bentonite grout mix after bore hole drilling.

Permeability tests were carried out using packer test in each bore hole.

A summary of the drilling works is presented in Table 3.1. The SPT results are presented in Table 3.2 and the SPT N values are plotted in Figure 3.2. Logs and photographs of the boreholes are presented in Appendix A.

Table 3.1: Summary of borehole drilling

Borehole ID	Drill depth (m)	Water table (m)	Easting	Northing
BH -01	25	13.9	330384	6595696
BH -02	25	2.7	329940	6595301
BH -03	25	13.3	330370	6595291
BH -04	25	9.3	330611	6594886

Table 3.2: Summary of SPT test results

Borehole	Depth (m)	SPT Blows	N Value
BH -01	1.0 to 1.45	3,5,6	11
BH -01	2.5 to 2.95	4,5,5	10
BH -01	4.0 to 4.45	2,4,2	6
BH -01	4.5 to 4.95	3,8,15	23
BH -01	7 to 7.25	50, 50/100mm (HB)	Refusal
BH -01	8.5 to 8.7	29, 50/50mm (HB)	Refusal
BH -01	10 to 10.45	6,14,15	29
BH -01	11.5 to 11.95	3,8,15	23
BH -01	16.6 to 17.05	9,17,25	42
BH -01	19.5 to 19.95	8,15,22	37
BH -01	23 to 23.45	13,32,51	83
BH- 02	1.0 to 1.45	5,7,8	15
BH- 02	2.5 to 2.95	3,4,4	8
BH- 02	4.0 to 4.45	4,7,5	12
BH- 02	7.5 to 7.95	7,12,23	35
BH- 02	9 to 9.45	5,11,15	26
BH- 02	11 to 11.45	7,11,13	24
BH- 02	13 to 13.45	4,11,18	29
BH- 02	15 to 15.45	3,7,23	30
BH- 02	17 to 17.45	6,12,13	25
BH- 02	19 to 19.45	5,8,16	24
BH- 02	20.5 to 20.95	11,25,45	70
BH- 02	22.5 to 22.95	21,47,80	Refusal
BH- 03	1.0 to 1.45	4,5,6	11
BH- 03	2.5 to 2.95	4,5,8	13
BH- 03	4.0 to 4.45	5,7,10	17
BH- 03	5.5 to 5.95	4,7,13	20
BH- 03	8 to 8.45	16,37,55	92
BH- 03	9.5 to 9.7	37, 50/50mm (HB)	Refusal
BH- 03	11 to 11.2	30, 50/50mm (HB)	Refusal
BH- 03	14 to 14.1	70/100mm (HB)	Refusal
BH- 03	17 to 17.3	21, 71/150mm (HB)	Refusal
BH- 03	20 to 20.15	62/150mm (HB)	Refusal
BH- 04	1.0 to 1.45	3,3,6	9
BH- 04	2.5 to 2.95	4,7,12	19
BH- 04	4.0 to 4.45	6,11,10	21
BH- 04	7 to 7.45	7,13,17	30
BH- 04	8.5 to 8.95	6,11,18	29

Borehole	Depth (m)	SPT Blows	N Value
BH- 04	10 to 10.45	6,12,25	37
BH- 04	11.5 to 11.95	4,9,14	23
BH- 04	13 to 13.45	6,11,20	31
BH- 04	14.5 to 14.95	4,9,16	25
BH- 04	16 to 16.45	15,70,81	Refusal
BH- 04	17.5 to 17.95	14,42,57	99
BH- 04	19 to 19.45	27,87,91	Refusal
BH- 04	22 to 22.45	26,63,95	Refusal

The SPT results in Figure 3.2 showed SPT N values increasing from approximately 10 to about 25 to 30 at about 20 m depth. The equivalent undrained shear strength is about 50 kPa to 150 kPa. This indicates the clay or silt component is generally firm to very stiff.

3.3 IN-SITU PERMEABILITY TEST

During the drilling of boreholes packer tests were undertaken in order to assess the in situ permeability characteristics. Each test was carried out by inserting a wireline gas-inflated packer at the top of the section to be tested, and then measuring the volume of water acceptance into that section of borehole at 5minute intervals and at varying water pressures.

The results and interpretation of the packer testing are summarised in Table 3.3.

Table 3.3: Summary of packer and falling head test results

BH No.	Test Depth (m)	Permeability k (m/s)	Note	Material
BH- 01	5m to 7m	7×10^{-08}	Single Packer test	Silty Clay
BH- 02	7m to 9m	5×10^{-08}	Single Packer test	Silty Clay
BH- 03	6m to 8m	4×10^{-08}	Single Packer test	XW rock, gravel
BH- 04	4m to 7m	2×10^{-06}	Single Packer test	Clay

3.4 TEST PITS

Fifty test pits were excavated at the proposed TSF Cell 3 and Cell 4 site to depths of between 2.1 m and 4.2 m using either a 5 ton Kubota excavator, 45 ton or 24 ton excavator, supplied and operated by Kirkby Bobcat & Excavation and Raywell Contracting respectively. Each test pit was logged and photographed by a KP site representative and bulk samples were collected for laboratory testing. All test pits were backfilled with the excavated spoil on completion of logging and sampling. A summary of the test pitting works is presented in Table 3.4.

Table 3.4: Summary of test pitting

Test Pit ID	Location	Depth (m)	Easting	Northing
TP-01	TSF	2.8	330009	6595598
TP-02	TSF	2.9	330179	6595639
TP-03	TSF	3.0	330372	6595639
TP-04	TSF	2.8	330582	6595639
TP-05	TSF	3.0	330759	6595598
TP-06	TSF	2.9	330106	6595533
TP-07	TSF	3.0	330365	6595518
TP-08	TSF	3.0	330643	6595518
TP-09	TSF	2.9	330009	6595447
TP-10	TSF	3.0	330183	6595439
TP-11	TSF	3.0	330100	6595339
TP-12	TSF	2.7	330333	6595347
TP-13	TSF	2.8	330509	6595348
TP-14	TSF	2.7	330658	6595347
TP-15	TSF	2.8	330759	6595397
TP-16	TSF	2.7	330009	6595297
TP-17	TSF	3.0	330209	6595297
TP-18	TSF	2.8	330393	6595259
TP-19	TSF	2.7	330591	6595220
TP-20	TSF	2.7	330759	6595197
TP-21	TSF	3.0	330009	6595147
TP-22	TSF	3.05	330159	6595173
TP-23	TSF	3.0	330333	6595147
TP-24	TSF	3.0	330509	6595148
TP-25	TSF	2.5	330638	6595129
TP-26	TSF	3.0	330775	6595111
TP-27	TSF	3.0	330009	6594998
TP-28	TSF	3.0	330159	6595047
TP-29	TSF	3.0	330333	6595047
TP-30	TSF	2.1	330509	6595048
TP-31	TSF	3.0	330659	6595048
TP-32	TSF	3.0	330209	6594947
TP-33	TSF	3.0	330409	6594948
TP-34	TSF	3.0	330609	6594947
TP-35	TSF	3.0	330809	6594947
TP-36	TSF	4.0	329860	6595600
TP-37	TSF	3.5	329713	6595597
TP-38	TSF	4.0	329560	6595600
TP-39	TSF	3.8	329410	6595600
TP-40	TSF	3.9	329435	6595400
TP-41	TSF	3.9	329633	6595388
TP-42	TSF	3.9	329835	6595400
TP-43	TSF	4.2	329655	6595300
TP-44	TSF	3.9	329839	6595200
TP-45	TSF	3.8	329632	6595195

Test Pit ID	Location	Depth (m)	Easting	Northing
TP-46	TSF	4.0	329439	6595195
TP-47	TSF	4.1	329413	6595000
TP-48	TSF	4.1	329568	6595000
TP-49	TSF	3.9	329710	6595003
TP-50	TSF	3.5	329877	6594990

Logs and photographs of the test pits are presented in Appendix B.

3.5 LABORATORY TESTING

Representative samples of the in situ soils are taken from the test pits and boreholes and delivered to the SGS and E-Precision Laboratory for testing. The purpose of the testing was to classify and characterise the soils in order to assess their behaviour characteristics under foundation loading and their suitability for use in earthworks.

Tests were carried out in accordance with Australian Standard AS1289: Methods of Testing Soil for Engineering Purposes (Ref. 2). A summary of the laboratory test results is presented in tables 3.5 and 3.6, and the laboratory test reports are presented in Appendix C.

Table 3.5: Summary of laboratory test results on TEST PIT bulk samples

Facility	Test Pit Ref. No	Sample Depth (m)	Soil description	Particle size distribution			Atterberg limits				USCS symbol	Emerson Class	Compaction				Permeability
				Gravel (%)	Sand (%)	Silt/Clay (%)	LL (%)	PL (%)	PI (%)	Linear Shrinkage (%)			MMDD t/m^3	SMDD t/m^3	OMC (%)	Dry Density Ratio (%)	k (m/s)
Cell 3	TP05	2.5 - 2.9	CLAY, Sandy	0	51	49	27	16	11	5.5	CL	5	1.70		19.0	95.3	1 x 10^{-10}
	TP07	2.0 - 2.3	CLAY, Sandy	4	51	45	73	26	47	17	CH						
	TP11	2.0 - 2.7	CLAY, Sandy	0	51	49	59	21	38	13.5	CH	5	1.77		19.0	94.2	4 x 10^{-11}
	TP12	0.5 - 1.0	SAND, Clayey	4	75	21	42	25	17	9	SC		1.72		18.5	95.6	5 x 10^{-8}
	TP16	0.5 - 1.0	SAND, Clayey	11	68	21	44	23	21	8.5	SC		1.74		16.5	94.6	4 x 10^{-8}
	TP27	0.5 - 1.0	SAND, Clayey	6	62	32	37	18	19	8	SC		1.78		15.0	94.9	3 x 10^{-9}
	TP35	0.5 - 1.0	SAND, Clayey	1	71	28	29	15	14	6	SC		1.91		11.0	94.7	2 x 10^{-7}
Cell 4	TP36	1.0 -1.5	SAND, Clayey								SC	5		1.78	16.0	98.0	3 x 10^{-8}
	TP36	3.8 -4.0	CLAY, Sandy	13	53	34	40	26	14	11	CI			1.70	20.5	98.0	8 x 10^{-8}
	TP39	0.8-1.3	CLAY, Sandy	6	47	47					CL	5					
	TP39	3.5-3.8	CLAY, Sandy				41	27	14	12	CL			1.69	20.0	98.0	10 x 10^{-8}
	TP40	3.3-3.9	CLAY, Sandy	15	52	34	44	25	18	11	CL	2		1.68	21.5	98.0	7 x 10^{-8}
	TP42	3.5-3.9	CLAY, Sandy	11	53	37	45	28	18	14	CL			1.63	21.0	98.0	8 x 10^{-8}
	TP44	0.5-1.0	CLAY, Sandy	5	44	50					CL	5					
	TP45	0.5-1.0	CLAY, Sandy	1	52	47					CL	5					
	TP47	0.8-1.3	SAND, Clayey				44	26	17	10	SC	5		1.68	18.5	98.0	3 x 10^{-8}
	TP47	3.5-4.0	CLAY, Sandy	1	62	38	40	24	15	7	CI			1.68	18.5	98.0	5 x 10^{-8}
	TP49	3.5-3.9	CLAY, Sandy				56	35	22	14	MH	2					
	TP50	3.0-3.5	CLAY, Sandy	2	55	43	61	34	26	13.5	MH	5		1.61	24.0	98.0	5 x 10^{-8}

Notes:

LL – liquid limit, PL – plastic limit, PI – plasticity index, LS – linear shrinkage
USCS – universal soil classification system
SMDD – Standard Maximum Dry Density, MMDD – Modified Maximum Dry Density, OMC – Optimum Moisture Content

Table 3.6: Summary of laboratory testing results on BOREHOLES

Facility	Sample Ref. Number	Sample Depth (m)	Soil description	Particle size distribution				Atterberg Limits				USCS symbol	Moisture Content (%)	Emerson Class	Calcium Carbonate Content (%)	Triaxial Test Results		
				Gravel (%)	Sand (%)	Silt (%)	Clay (%)	LL (%)	PL (%)	PI (%)	Linear shrinkage (%)					c' (kPa)	Φ (degs)	Cv (m^2/year)
TSF	TSF_BH02_KP01	4.50 - 5.00	CLAY, Sandy	1	53.1	26.9	19	57	29	28	17.16	CH/MH	37.6	5		26.93	24.65	0.016
	TSF_BH02_B_KP01	7.00 – 7.50	CLAY, Sandy	19.6	11.9	56	12.5	61.1	34.3	26.8	11.31	MH	42.3	4	9.4			
	TSF_BH03_KP01	4.45 - 4.95	SAND, Silty	0.1	46.2	39.5	14.2	57.8	32.9	24.9	17.67	MH	30.7	6		22.38	25.06	0.005
	TSF_BH04_KP01	4.45 - 4.95	SAND, clayey	8.3	69.2	16.6	5.9	29.1	19.4	9.7	6.23	CL	11	5		5.61	36.35	0.049
	TSF_BH01_KP01	3.50 - 4.00	SAND, clayey	4.8	52.8	30.3	12.1	53.9	28.4	25.5	13.54	CH	25.2	6				

4. INVESTIGATION FINDINGS

4.1 REGIONAL GEOLOGY

The regional geological assessment of the site area is based on reference to the Geological Survey of Western Australia, 1:250,000 scale geological plans for Kalgoorlie (sheet SH51-9, Ref. 3). The map records the near surface geology at the TSF Cell 3 and Cell 4 site comprises sand, silt and gypsum in stabilised dunes adjacent to playas (Cztd) and evaporate interbedded with clay and sand in playas (Czts).

4.2 SITE CONDITIONS

4.2.1 Surface Conditions

In general, the geotechnical investigation in TSF areas shows the ground has little or no disturbance at the time of investigation. Red-brown clayey sand is easily identified as top soil on site and ground is covered by shrubs and scattered trees of various sizes.

4.2.2 Sub-surface Conditions

Within the TSF Site, boreholes were drilled and test pits were excavated in order to determine the sub-surface conditions.

In general terms the sub-surface conditions of natural ground comprise the following:

- Clayey SAND overlying;
- Silty CLAY with sand/ Sandy CLAY; and
- Metadolerite sills.

Clayey SAND

The thickness of top Clayey SAND layer varies from 2.5 m to 4.5 m. Clayey SAND recorded an average particle size distribution of 4% gravel, 59 % sand and 37% fines. Atterberg limit tests (average PI=23% and average LL=46%) identified the fines fraction tended to be above A-line and to be generally low to medium plasticity. CLAY component becomes more dominant at depths. Figure 4.1 and 4.2 plots particle size distribution results for the test pit and borehole samples respectively. Figure 4.3 summarises the Atterberg test results for all samples tested.

SPT values in this layer vary between 9 and 21 with an average value of 12. The Clayey SAND is medium dense.

Figures 4.4 and 4.5 illustrate the compaction test results, while Figure 4.6 presents the permeability with respect to fines fraction results.

The Emerson tests indicate that Clayey SAND has an Emerson Class of 5, suggesting that soil dispersion in this layer should not be a major concern.

Only two of the Emerson tests (TP40---3.3m to 3.9m and TP49---3.5m to 3.9m) showed that the deeper clayey soil layer within TSF Cell4 has an Emerson Class of 2.

Silty CLAY

Silty CLAY underlies the Clayey SAND with a thickness varying between 17 m and 23 m. Based on the current and previous geotechnical investigations (Ref.4), it appears to have the same, or similar, characteristics and properties to Silty CLAY underlying the existing TSF cell foundation. The CLAY predominantly has medium to high plasticity (some clayey soil has low to medium plasticity within the Cell 4 footprint).

SPT values in this layer increase with depth, varying between 20 and refusal, indicating a very stiff to hard consistency.

Permeability in this layer is generally low; the in-situ packer tests indicated permeability in the range 7 x 10^{-8} m/s to 4 x 10^{-8} m/s.

Soil dispersion tests indicated an Emerson class number of between 4 and 6. However, two of the Emerson tests from the 2020 site investigation indicated an Emerson class number of 2. This suggests that some of the materials, possibly due to existence of calcrete or gypsum in this layer, are potentially dispersive. This will be considered during TSF design and maintenance.

Table 4.1 summarises the subsurface profiles.

Table 4.1: Summary of sub-surface conditions – boreholes BH-TSF-01 to 05

Depth		Material Description	Consistency / Weathering
From	To		
0	2.5-4.5	Clayey SAND	Medium Dense
2.5-4.5	20	Silty CLAY	Stiff to Very Stiff
20	EOH	Metadolerite	Extremely to Distinctly Weathered

5. GEOTECHNICAL ASSESSMENT

5.1 SOIL PARAMETERS

Table 5.1 provides the suggested TSF design soil shear strength and permeability parameters based on current and previous geotechnical investigation works.

Permeability values are based on in-situ packer tests, laboratory test results, and previous geotechnical investigations.

Unit weight values are based on laboratory test results and typical values for these materials.

Friction angles are based on triaxial test results and test results from previous geotechnical investigations. The cohesions reflect the degree of over-consolidation and cementation within the in situ materials.

Table 5.1: Adopted average shear strength parameters

Material	ɣ (kN/m^3)	c' (kPa)	Φ' (deg)	Permeability (m/s)
Clayey Sand	18	15	25	5x10^{-8}
Silty Clay/Clayey Silt	19	20	25	1x10^{-8}
XW-DW rock	21	50	33	5x10^{-8}

XW = extremely weathered; DW = distinctly weathered

5.2 CONSTRUCTION CONSIDERATIONS

5.2.1 Workability of Near Surface Materials

Near surface materials are likely to comprise clayey sand or sandy clay with silty clay at depths. Conventional earthmoving equipment, such as dozers, excavators and graders will be capable of excavating the near surface materials. A cutoff trench should extend through this layer to reduce horizontal seepage through the foundation.

5.2.2 Excavated Material as Backfill

It is expected that substantial soil fill quantities will be required for the TSF construction. The top 2.5 m to 4.5 m clayey sand in the proposed TSF basin could be used for this purpose.

Zone A Fill – Low permeability Zone A material is required for the low permeability section of the TSF embankment. This material should ideally have a fines content of ≥ 35 %, a remoulded permeability of ≤ 1 x 10^{-8} m/s or ≤ 1 x 10^{-9} m/s, a plasticity index of > 8% and be workable to achieve a level of compaction of 98% of SMDD.

With selective excavation, the top layer of clayey sand could meet this specification; Zone A material could be won from the clayey sand and silty clay layers in the proposed TSF basin.

Zone C materials – Zone C material is required for the general construction of the TSF embankment. No specific requirements are placed on this material with the exception that it should be workable to achieve a compaction of 95% SMDD. The top clayey sand layer is suitable for use as Zone C.

However, attention should be paid to the presence of calcrete or gypsum in the sandy/silty clay layer in localized zones. Dispersion testing undertaken for in situ materials indicated an Emerson class number between 2 and 4, and this should be considered during TSF design and maintenance; these layers should be encapsulated with a compacted clay layer to prevent direct contact with water/tailings.

5.2.3 Groundwater

Water level was measured in the BHs on 20 to 22 March 2017 during the investigation. Water level was measured as 2.7 m in BH2 and 9.3 m in BH4 respectively, however, it is understood that these water table may be perched water or retained drilling fluid in the BHs. Based on previous investigations and monitoring data from existing bore, which have indicated groundwater levels of 12.0 m to 19.4 m below natural ground with some seasonal fluctuation, it is unlikely that groundwater will be encountered during construction. However, care must be taken when excavating near Cell 2 as seepage has been reported at surface indicating shallow ground water. A new network of monitoring bores would be required as part of the Cell 3 and Cell 4 facility to benchmark the groundwater level and quality.

6. CONCLUSIONS AND RECOMMENDATIONS

KP undertook a site investigation of at the proposed Mungari Gold Project TSF Cell 3 and Cell 4 site. The following conclusions have been drawn from the site investigation:

- The areas investigated are predominantly undisturbed and relatively flat;

  The near surface profile can be excavated with conventional earthmoving equipment. A cutoff trench should extend through this layer to reduce horizontal seepage through the foundation;
- The site is suitable for the proposed TSF;
- Suggested design parameters are incorporated into the body of the report. These include shear strength and permeability parameters; and
- The in situ materials in the proposed TSF basin are generally suitable for use a Zone A and Zone C material during construction. However, clay in the sandy/silty clay layer, possibly due to the presence of calcrete or gypsum, is potentially dispersive. This should be accounted for during construction should be encapsulated with a compacted clay layer to prevent direct contact with water/ tailings.

7. LIMITATIONS

This report was prepared by Knight Piésold Pty Ltd (hereafter referred to as KP) for Evolution Mining Ltd (hereafter referred to as Client) for purpose of Mungari Gold Project to provide geotechnical input to the design of TSF Cell 3 and Cell 4. This report is confidential, may only be used and relied on by the Client and must not be used for any other purpose. It must not be copied to, used by, or relied on by any person other than the Client. KP and its employees have no responsibility to any person other than the Client arising from or in connection with this report.

This report as a whole presents the findings of the geotechnical investigation works, it should not be altered, amended or abbreviated, issued in part or issued incomplete in any manner whatsoever without prior consent from KP. The logs, figures, table and drawings should not be redrawn and included in any other documents and drawings etc. KP expressly disclaims responsibility for any liability which may arise from circumstances of issuance and quotation of this report in part, or incomplete, or its modification in any way whatsoever.

Subsurface conditions are variable and may change with time. The interpretation presented in this report is based on factual information, obtained at a specific period of time and specific points of the site, and engineering judgement. As such, the interpretations in this report will have a level of uncertainty due to the limited works and services undertaken. The works and services undertaken by KP in connection with preparing this report were limited to those detailed in the scope of works in Section 1 of this report.

KP has prepared this report on the basis of information provided by the Client, which KP has not independently verified or checked (unverified information). KP expressly disclaims responsibility in connection with the unverified information, including (but not limited to) errors in, or omissions from, this report that were caused or contributed to by errors in, or omissions from, the unverified information.

The opinions, conclusions and recommendations contained in this report are based on, but not limited to, assumptions described in this report when undertaking works, services and preparing this report. The assumptions cannot be substantiated until the project implementation has commenced and necessary verification works, including, but not limited to, instrumentation monitoring works, have been carried out according to KP's recommendations. KP expressly disclaims responsibility for any error in, or omission from, this report arising from or in connection with any of the unverified assumptions being incorrect. If another party undertakes the implementation of, or construction according to, the opinion, conclusion and recommendations contained in

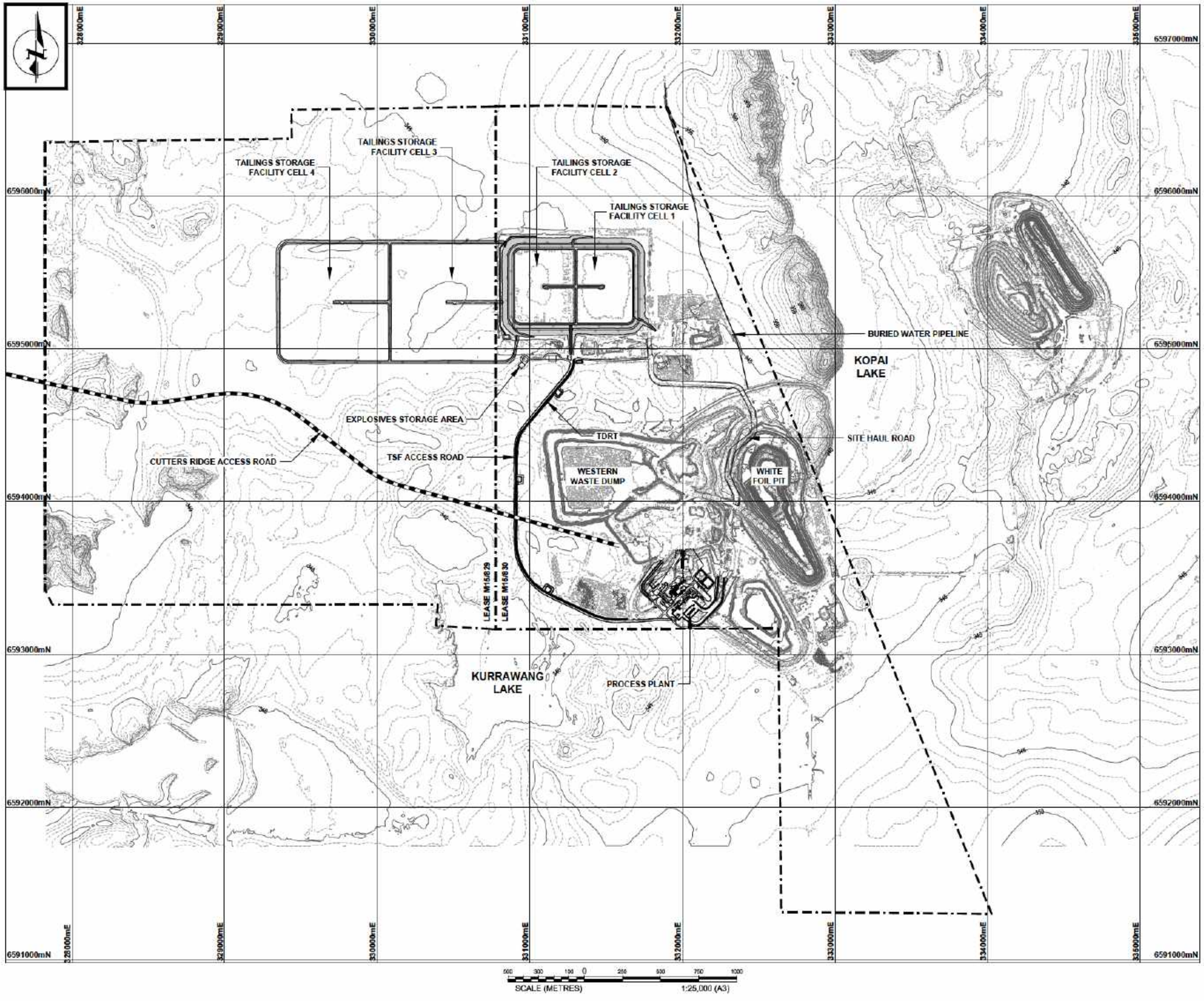
this report, there is a risk that the same may be misinterpreted and KP cannot be held responsible for such misinterpretation.

The opinions, conclusions and any recommendations in this report are based on information obtained from, and investigation undertaken at or in connection with, specific investigation points at site. Site conditions at other parts of the site may be different from the site conditions found at the specific investigation points. Actual site conditions may differ from those inferred to exist due to hidden conditions unrevealed and/or changes after the date of acquisition of information on which this report is based. The Client should retain the service of KP through all development phases to carry out further investigations, if required, to identify any variance during construction/implementation and to search for solutions to problems due to the same.

8. REFERENCES

1. Geotechnical Site Investigations – AS 1726 – 2017. Australian Standards.
2. Methods of Testing Soils for Engineering Purposes, AS 1289.0 – 2000. Australian Standards.
3. Geological Survey of Western Australia, 1:250,000 scale geological plans for Kalgoorlie.
4. Knight Pièsold, “Tailing Storage Facility Geotechnical Investigation Report (Ref PE801-00137/05 Rev A), April 2013.

FIGURES



LEGEND:

LEASE BOUNDARY

NOTES:

1. 1m CONTOUR INTERVALS SHOWN. EXTERNAL TOPOGRAPHICAL DATA PROVIDED BY EVOLUTION MINING, MAY 2018.
2. WESTERN WASTE DUMP DATA PROVIDED BY EVOLUTION MINING, FEBRUARY 2018.
3. EXISTING TAILINGS STORAGE FACILITY CELLS 1 AND 2 FINAL (STAGE 6) EMBANKMENT SHOWN.
4. TAILINGS STORAGE FACILITY CELLS 3 AND 4 STAGE 1 SHOWN.

LEGEND:

- LEASE BOUNDARY
- TEST PIT LOCATION
- BOREHOLE LOCATION

NOTES:

1m CONTOUR INTERVALS SHOWN. EXTERNAL TOPOGRAPHICAL DATA PROVIDED BY EVOLUTION MINING, MAY 2018.

SCALE (METRES) 1:5,000 (A3)

TEST PIT LOCATIONS

TEST PIT I.D.	EASTING	NORTHING
TP-01	330009	6595598
TP-02	330179	6595639
TP-03	330373	6595639
TP-04	330582	6595639
TP-05	330759	6595598
TP-06	330106	6595534
TP-07	330364	6595518
TP-08	330644	6595518
TP-09	330009	6595448
TP-10	330184	6595439
TP-11	330100	6595340
TP-12	330334	6595348
TP-13	330509	6595348
TP-14	330659	6595348
TP-15	330759	6595398
TP-16	330009	6595298
TP-17	330209	6595298
TP-18	330393	6595260
TP-19	330591	6595220
TP-20	330759	6595198
TP-21	330009	6595148
TP-22	330159	6595174
TP-23	330334	6595148
TP-24	330509	6595148
TP-25	330638	6595129
TP-26	330775	6595111
TP-27	330009	6594998
TP-28	330159	6595048
TP-29	330334	6595048
TP-30	330509	6595048
TP-31	330659	6595048
TP-32	330209	6594948
TP-33	330409	6594948
TP-34	330609	6594948
TP-35	330809	6594948
TP-36	329860	6595600
TP-37	329713	6595597
TP-38	329560	6595600
TP-39	329410	6595600
TP-40	329435	6595400
TP-41	329633	6595388
TP-42	329835	6595400
TP-43	329655	6595300
TP-44	329839	6595200
TP-45	329632	6595195
TP-46	329439	6595195
TP-47	329413	6595000
TP-48	329568	6595000
TP-49	329710	6595003
TP-50	329877	6594990

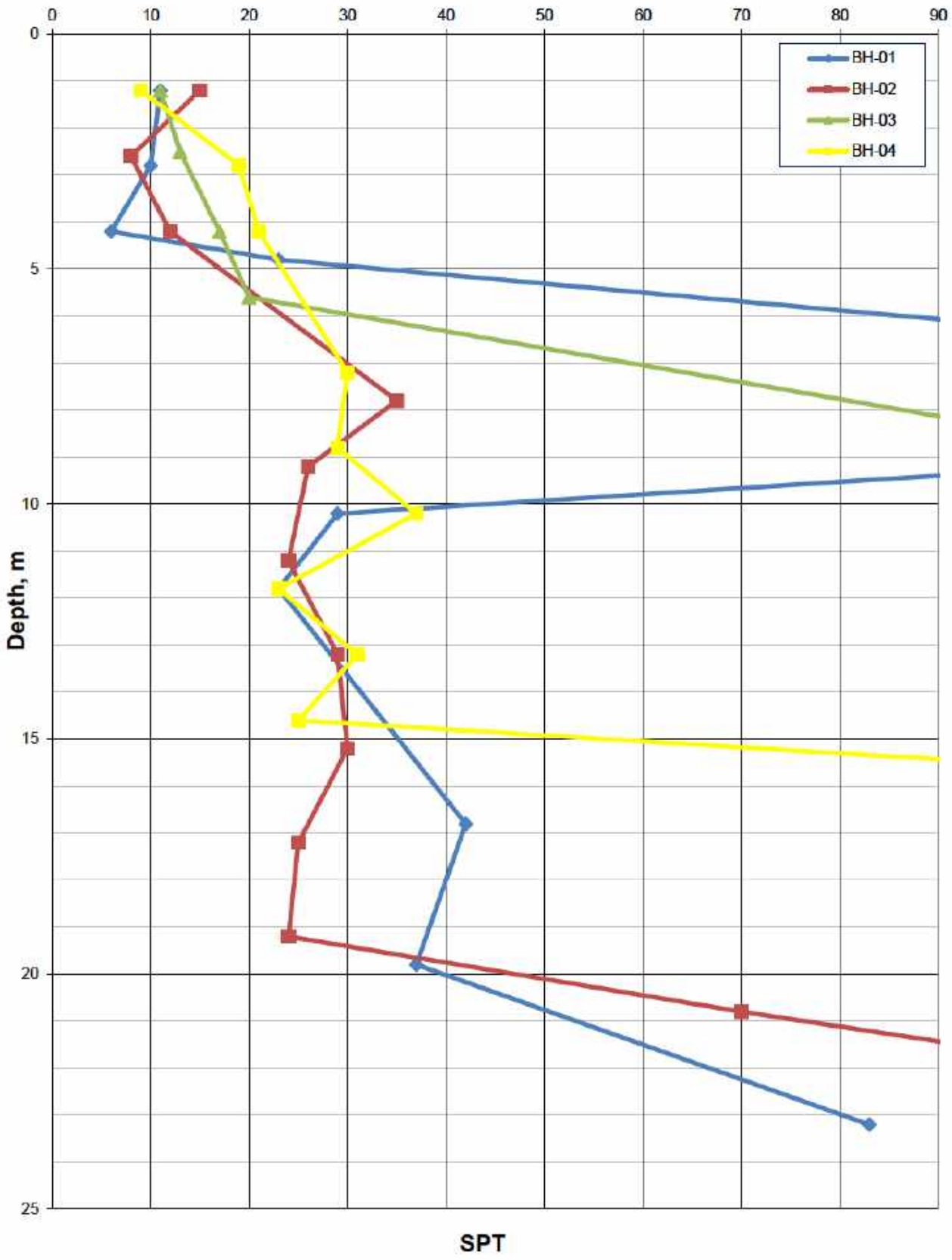
BOREHOLE LOCATIONS

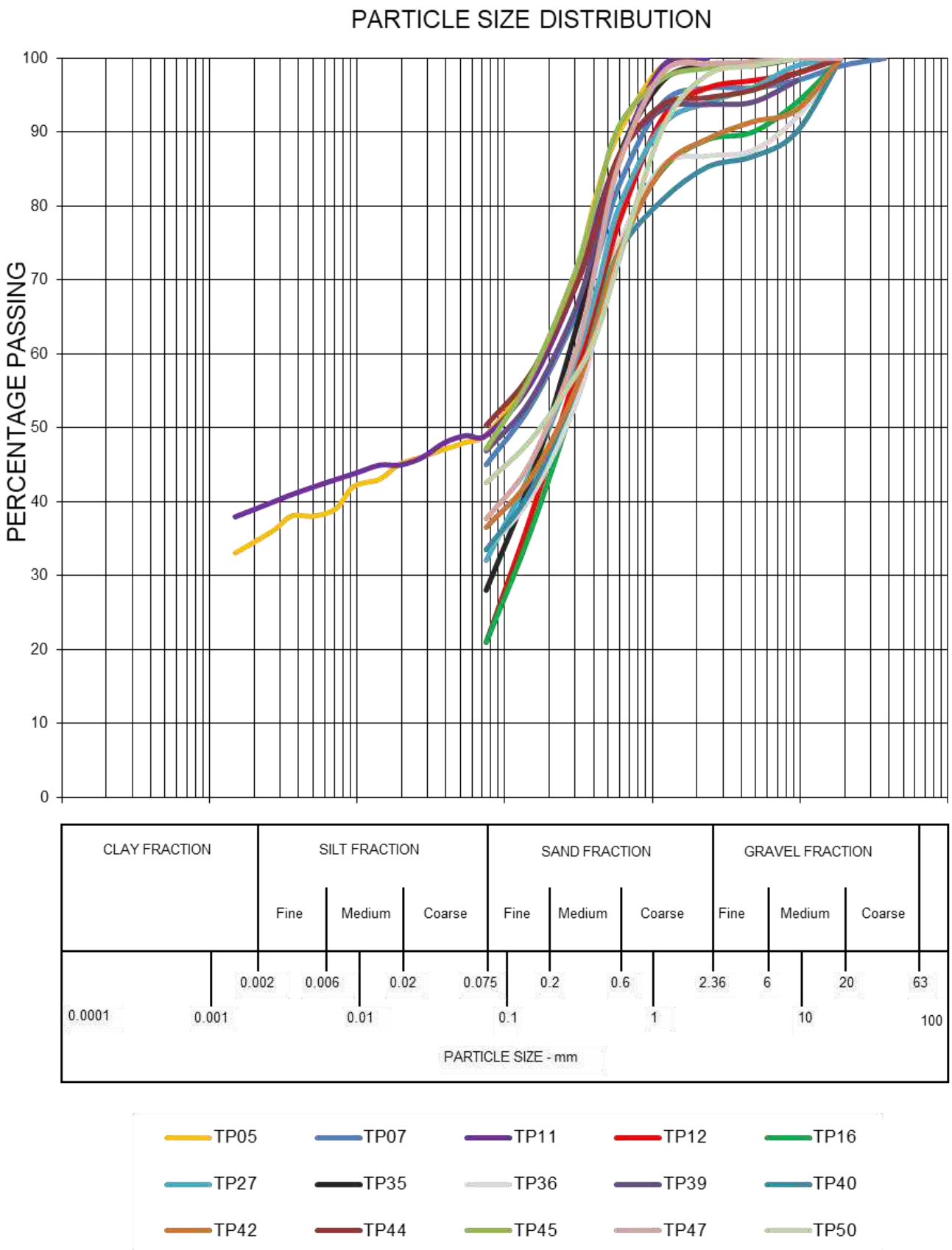
BOREHOLE I.D.	EASTING	NORTHING
BH-01	330384	6595697
BH-02	329941	6595301
BH-03	330370	6595292
BH-04	330612	6594887

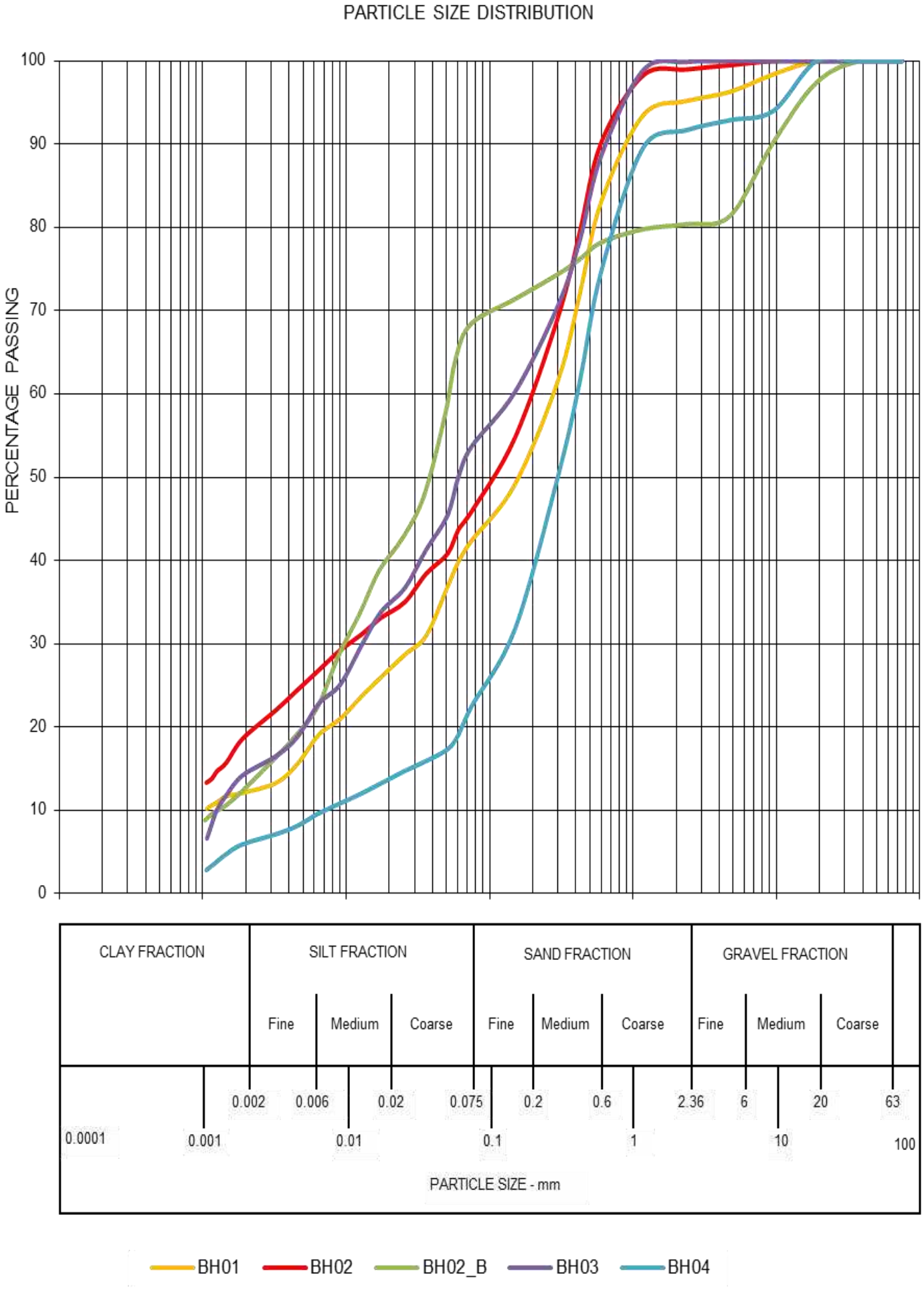
Knight Piésold CONSULTING

MUNGARI GOLD PROJECT
TAILINGS STORAGE FACILITY - CELL 3 AND CELL 4
SITE INVESTIGATION LAYOUT

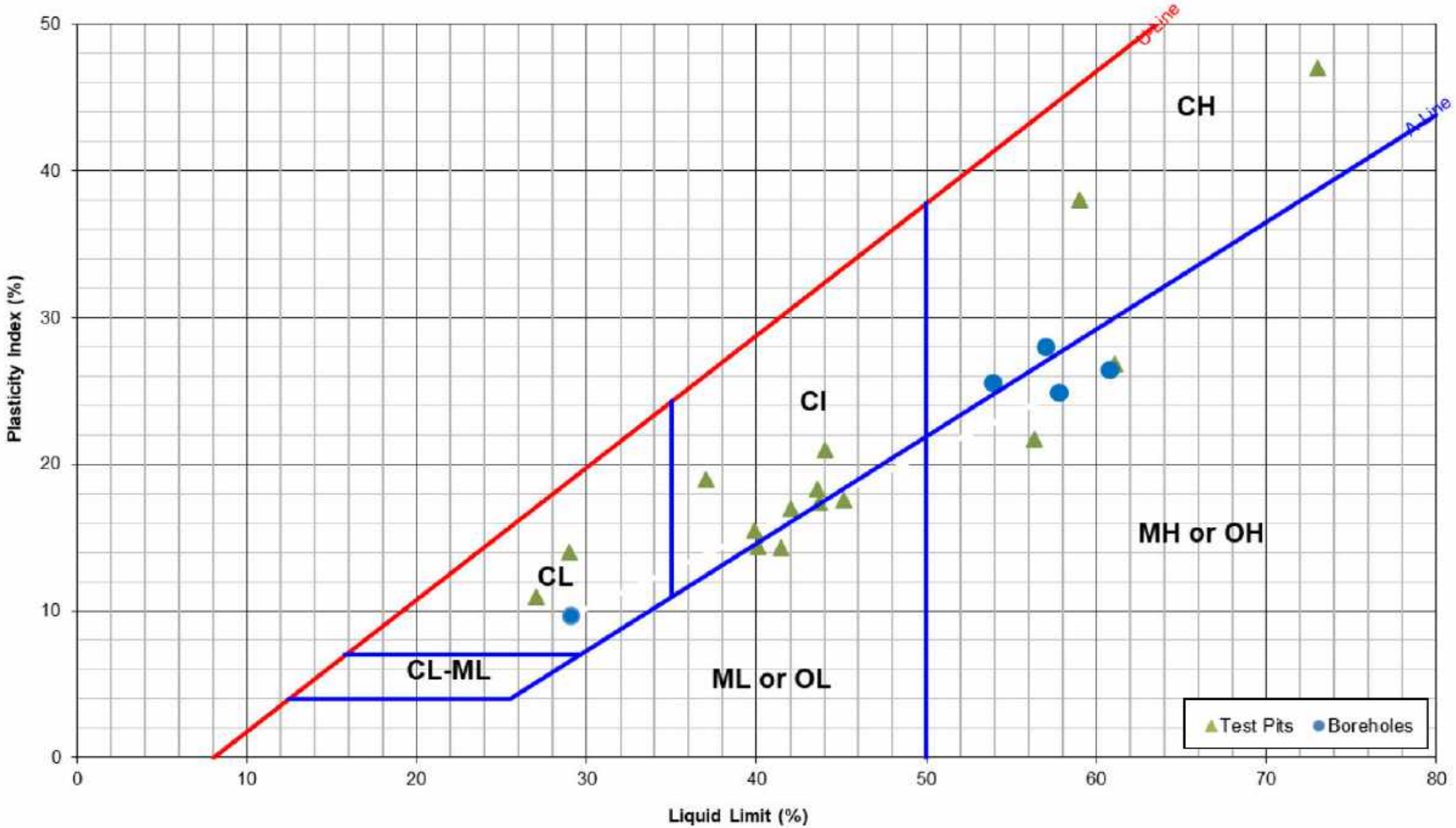
PE801-00137/23
Figure 3.1

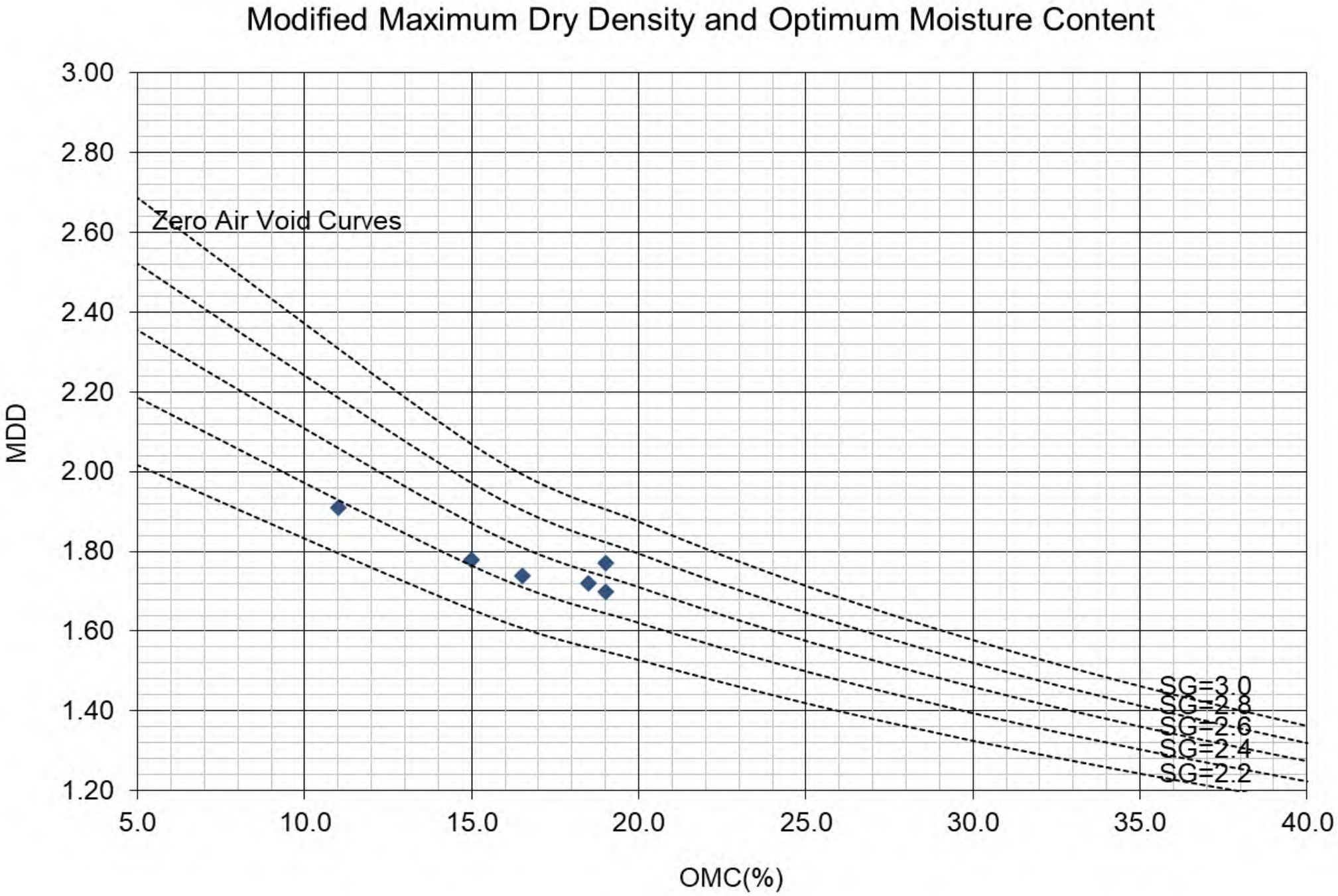

SPT Blow Count with Depth
0
10
20
30
40
50
60
70
80
90
0
5
10
15
20
25
Depth, m
SPT
BH-01
BH-02
BH-03
BH-04

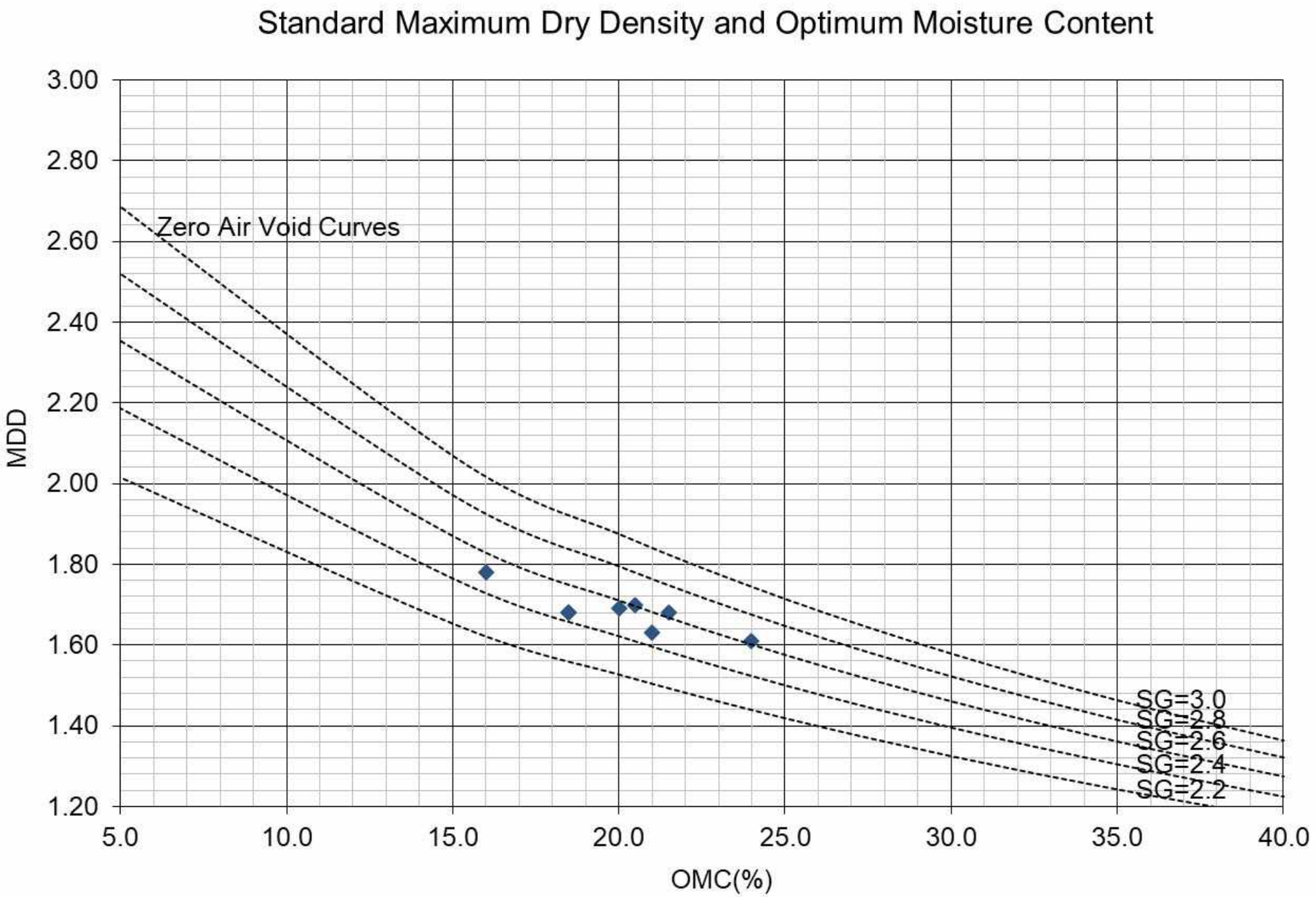

PARTICLE SIZE DISTRIBUTION
PERCENTAGE PASSING
100
90
80
70
60
50
40
30
20
10
0
CLAY FRACTION
SILT FRACTION
SAND FRACTION
GRAVEL FRACTION
Fine
Medium
Coarse
Fine
Medium
Coarse
Fine
Medium
Coarse
0.0001
0.001
0.002
0.006
0.01
0.02
0.075
0.1
0.2
0.6
1
2.36
6
10
20
63
100
PARTICLE SIZE - mm
TP05
TP07
TP11
TP12
TP16
TP27
TP35
TP36
TP39
TP40
TP42
TP44
TP45
TP47
TP50

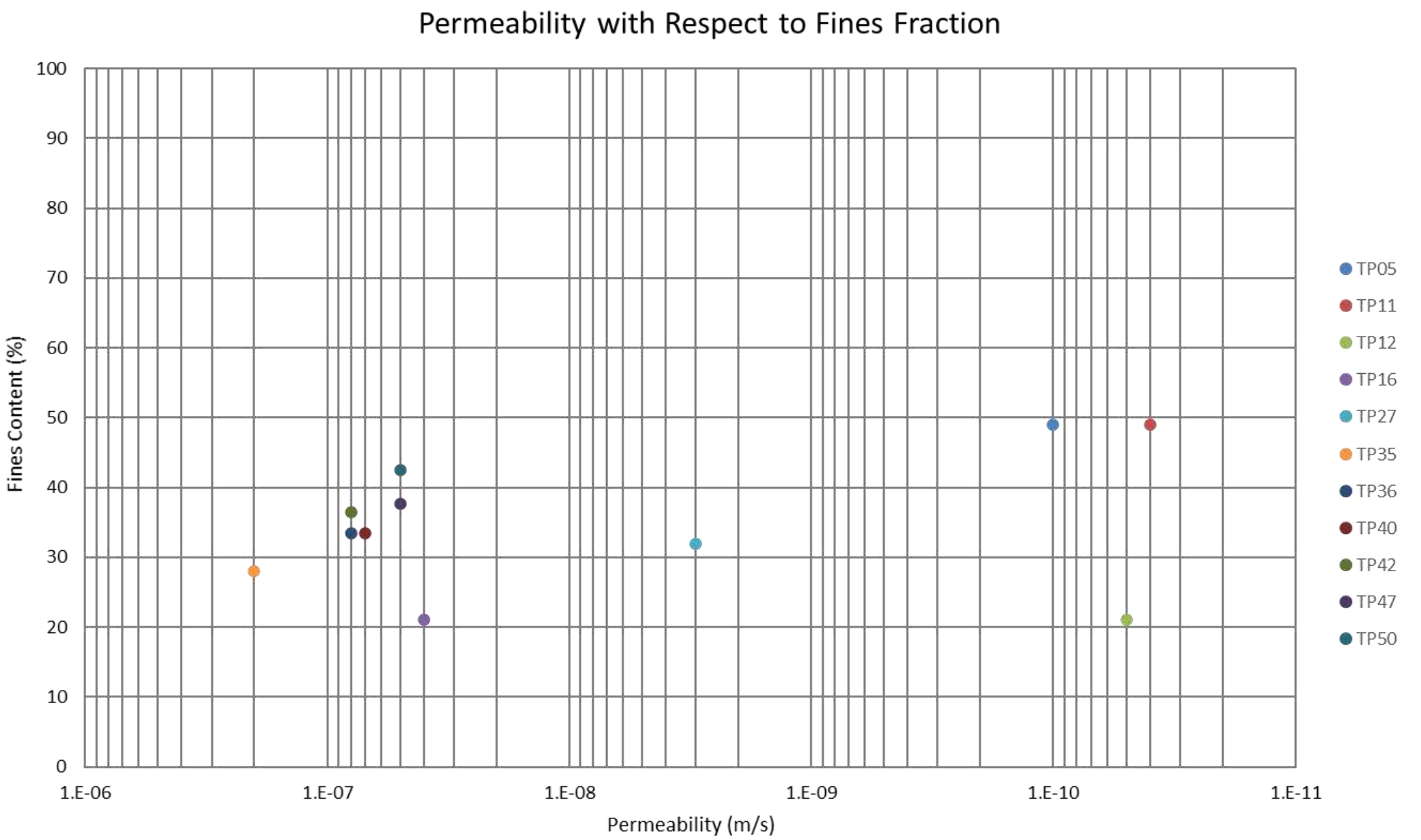

PARTICLE SIZE DISTRIBUTION
PERCENTAGE PASSING
100
90
80
70
60
50
40
30
20
10
0
CLAY FRACTION
SILT FRACTION
SAND FRACTION
GRAVEL FRACTION
Fine
Medium
Coarse
Fine
Medium
Coarse
Fine
Medium
Coarse
0.0001
0.001
0.002
0.006
0.01
0.02
0.075
0.1
0.2
0.6
1
2.36
6
10
20
63
100
PARTICLE SIZE - mm
BH01
BH02
BH02_B
BH03
BH04

Testing Results
Soil Classification by Plasticity Index




Modified Maximum Dry Density and Optimum Moisture Content
Zero Air Void Curves
SG=3.0
SG=2.8
SG=2.6
SG=2.4
SG=2.2
MDD
OMC(%)
3.00
2.80
2.60
2.40
2.20
2.00
1.80
1.60
1.40
1.20
5.0
10.0
15.0
20.0
25.0
30.0
35.0
40.0


Standard Maximum Dry Density and Optimum Moisture Content
3.00
2.80
2.60
2.40
2.20
2.00
1.80
1.60
1.40
1.20
MDD
Zero Air Void Curves
SG=3.0
SG=2.8
SG=2.6
SG=2.4
SG=2.2
5.0
10.0
15.0
20.0
25.0
30.0
35.0
40.0
OMC(%)


Permeability with Respect to Fines Fraction
Fines Content (%)
100
90
80
70
60
50
40
30
20
10
0
1.E-06
1.E-07
1.E-08
1.E-09
1.E-10
1.E-11
Permeability (m/s)
TP05
TP11
TP12
TP16
TP27
TP35
TP36
TP40
TP42
TP47
TP50

APPENDIX A

Borehole Logs and Core Photographs

Knight Piésold CONSULTING

Knight Piesold Pty Limited
A.C.N. 001 040 419
Level 1, 184 Adelaide Terrace
EAST PERTH WA 6004
Australia

MUNGARI GOLD PROJECT
Evolution Mining
TSF
AUSTRALIA

HOLE: **BH 01**	
Sheet 1 of 3	*Rev*
JOB NUMBER: PE801-00137	

TCR (%)	SCR (%)	RQD (%)	FRACTURE FREQUENCY	GRAPHIC LOG	DEPTH (m)	MATERIAL DESCRIPTION	STRENGTH/ CONSISTENCY	WEATHERING	DEFECTS/ADDITIONAL COMMENTS	IN SITU TESTING	SAMPLING (DEPTH IN m)
0.9	0.9	-	-		0m	**SAND**, clayey, non to low plastic, red brown, moist, medium dense. Sand particles are fine to medium, sub rounded.	MD				
-	-	-	-		1					3, 5, 6 N =11	
0.55	0.55	-	-		2						
-	-	-	-		2.5m	**CLAY**, sandy, trace gravel, low to medium plasticity, red brown, grey, moist, stiff to very stiff. Sand particles are fine to medium, sub rounded.	F - St			4, 5, 5 N =10	
0.45	0.45	-	-		3						3.5
-	-	-	-		4						
Push Tube	-	-	-							2, 4, 2 N =6	4
0.5	0.5	-	-		4.5m	**CLAY**, silty, low to medium plasticity, light brown, grey, cream white, moist, very stiff to hard.	VSt - H			3, 8, 15 N =23	
1.3	1.3	-	-		5						
0.5	0.5	-	-		6						
-	-	-	-		7					50, 50/100mm (HB), - N =Refusal	
1.25	1.25	-	-		7.5m	**CLAY**, silty, low plasticity, light brown, grey, cream white, moist, very stiff to hard.					
-	-	-	-		8						
1.3	1.3	-	-		9					29, 50/50mm (HB), - N =Refusal	

NOTES:

Undisturbed Sample

Standard Penetration Test

CONTRACTOR : **Top Drill**
MACHINE : **De840 Rig6**
LOGGED BY : **BZ**
CHECKED BY :

DATE STARTED : **15/03/2017**
DATE PROFILED : **17/03/2017**
HOLE SIZE : **HQ**

NORTHING : **6595696**
EASTING : **330384**
ELEVATION : **-**

INCLINATION: -90

KP_BH_2013_REV_0_PE801-00137_BH LOGS 2017 SI GEI KP_DATATEMPLATE_BH_2013.GDT 17/4/20

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HOLE: **BH 01**	
Sheet 2 of 3	*Rev*
JOB NUMBER: PE801-00137	

TCR (%)	SCR (%)	RQD (%)	FRACTURE FREQUENCY	GRAPHIC LOG	DEPTH (m)	MATERIAL DESCRIPTION	STRENGTH/ CONSISTENCY	WEATHERING	DEFECTS/ADDITIONAL COMMENTS	IN SITU TESTING	SAMPLING (DEPTH IN m)
-	-	-	-		10					6, 14, 15 N =29	
1.05	1.05	-	-		11						
										3, 8, 15 N =23	
2	2	-	-		12						
					13						
1.5	1.5	-	-		14						
					15	15m **CLAY**, silty, low plasticity, light brown, grey, cream white moist firm to stiff.					
1.6	1.6	-	-		16						
-	-	-	-		17					9, 17, 25 N =42	
0.35	0.35	-	-			17.5m **CLAY**, silty, low plasticity, light brown, grey, cream white moist stiff to very stiff.					
1.2	1.2	-	-		18						
					19						
0.4	0.4	-	-								
-	-	-	-		20					8, 15, 22 N =37	
1.1	1.1	-	-			20.3m **CLAY**, silty, low plasticity, grey, greenish grey moist hard.					
					21						
0.2	0.2	-	-								

KP_BH_2013_REV_0_PE801-00137_BH LOGS 2013 SLOG1_KP_DATATEMPLATE_BH_2013.GDT 17/4/20

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HOLE: **BH 01**	
Sheet 3 of 3	*Rev*
JOB NUMBER: PE801-00137	

TCR (%)	SCR (%)	RQD (%)	FRACTURE FREQUENCY	GRAPHIC LOG	DEPTH (m)	MATERIAL DESCRIPTION	STRENGTH/ CONSISTENCY	WEATHERING	DEFECTS/ADDITIONAL COMMENTS	IN SITU TESTING	SAMPLING (DEPTH IN m)
1.2	1.2	-	-		22						
					23					13, 32, 51 N =83	
1	1	-	-		24						
1	1	-	-		25	Borehole BH 01 terminated at 25 m depth.					
					26						
					27						
					28						
					29						
					30						
					31						
					32						
					33						

KP_BH_2013_REV_0_PE801-00137_BH LOGS 2017 SLG21_KP_DATATEMPLATE_BH_2013.GDT 17/4/20

Plate 1: Borehole BH-01 – 0.0 to 4.45 m

Plate 2: Borehole BH-01 – 4.45 to 7.0 m

Plate 3: Borehole BH-01 – 7.0 to 11.5 m

Plate 4: Borehole BH-01 – 11.5 to 15.0 m

Plate 5: Borehole BH-01 – 15.0 to 20 m

Plate 6: Borehole BH-01 – 20 to 23.45 m

Plate 7: Borehole BH-01 – 23.45 to 25.0 m

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HOLE: **BH 02**	
Sheet 1 of 3	*Rev*
JOB NUMBER: PE801-00137	

TCR (%)	SCR (%)	RQD (%)	FRACTURE FREQUENCY	GRAPHIC LOG	DEPTH (m)	MATERIAL DESCRIPTION	STRENGTH/ CONSISTENCY	WEATHERING	DEFECTS/ADDITIONAL COMMENTS	IN SITU TESTING	SAMPLING (DEPTH IN m)
1	1	-	-		0m	**SAND**, clayey, non to low plastic, red brown moist, medium dense. Sand particles are fine to medium, sub rounded.	MD			5, 7, 8 N =15	
-	-	-	-		1						
1.05	1.05	-	-		2					3, 4, 4 N =8	
-	-	-	-		3						
0.3	0.3	-	-		4					4, 7, 5 N =12	
-	-	-	-								4.5
Push Tube	-	-	-		4.5m	**CLAY**, sandy, trace gravel, low to medium plasticity, red brown, grey moist, stiff to very stiff. Sand particles are fine to medium, sub rounded.	VSt - H				5
0.5	0.5	-	-		5						
0.2	0.2	-	-		6						
0.6	0.6	-	-		6.5m	**CLAY**, silty, low to medium plasticity, light brown, grey, cream white moist, stiff to very stiff					7
Push Tube	-	-	-		7						
-	-	-	-		7.5m	**CLAY**, silty, trace gravel, low plasticity, red brown, cream white moist, stiff to very stiff. Sand particles are fine to medium, sub rounded.				7, 12, 23 N =35	7.5
0.85	0.85	-	-		8						
-	-	-	-		9					5, 11, 15 N =26	
0.55	0.55	-	-								

NOTES:

■ Undisturbed Sample

⊠ Standard Penetration Test

CONTRACTOR : **Top Drill**
MACHINE : **De840 Rig6**
LOGGED BY : **BZ**
CHECKED BY :

DATE STARTED : **17/03/2017**
DATE PROFILED : **19/03/2017**
HOLE SIZE : **HQ**

NORTHING : **6595301**
EASTING : **329940**
ELEVATION : **-**

INCLINATION: -90

KP_BH_2013_REV_0_PE801-00137_BH LOGS 2017.GPJ KP_DATATEMPLATE_BH_2013.GDT 17/4/20

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HOLE: **BH 02**	
Sheet 2 of 3	*Rev*
JOB NUMBER: PE801-00137	

TCR (%)	SCR (%)	RQD (%)	FRACTURE FREQUENCY	GRAPHIC LOG	DEPTH (m)	MATERIAL DESCRIPTION	STRENGTH/ CONSISTENCY	WEATHERING	DEFECTS/ADDITIONAL COMMENTS	IN SITU TESTING	SAMPLING (DEPTH IN m)
0.95	0.95	-	-		11					7, 11, 13 N =24	
-	-	-	-								
1.3	1.3	-	-		12						
-	-	-	-		13					4, 11, 18 N =29	
0.65	0.65	-	-		14						
-	-	-	-		15					3, 7, 23 N =30	
0	0	-	-		16						
-	-	-	-		17					6, 12, 13 N =25	
0.4	0.4	-	-		18						
0.6	0.6	-	-			18.2m **CLAY**, silty, low plasticity, grey, greenish grey, moist, hard.					
-	-	-	-		19					5, 8, 16 N =24	
-	-	-	-								
0.4	0.4	-	-		20						
100	100	-	-								
-	-	-	-		21					11, 25, 45 N =70	
-	-	-	-								
100	100										
1.15	1.15	-	-								

KP_BH_2013_REV_0_PE801-00137_BH LOGS 2013 SLOG1 KP_DATATEMPLATE_BH_2013.GDT 17/4/20

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HOLE: **BH 02**	
Sheet 3 of 3	*Rev*
JOB NUMBER: PE801-00137	

TCR (%)	SCR (%)	RQD (%)	FRACTURE FREQUENCY	GRAPHIC LOG	DEPTH (m)	MATERIAL DESCRIPTION	STRENGTH/ CONSISTENCY	WEATHERING	DEFECTS/ADDITIONAL COMMENTS	IN SITU TESTING	SAMPLING (DEPTH IN m)
100	100	-	-		22						
-	-	-	-		23					21, 47, 80 N = 127	
1	1	-	-		24						
					25	Borehole BH 02 terminated at 25 m depth.					
					26						
					27						
					28						
					29						
					30						
					31						
					32						
					33						

KP_BH_2013_REV_0_PE801-00137_BH LOGS 2017 SLG21_KP_DATATEMPLATE_BH_2013.GDT 17/1/20

Plate 8: Borehole BH-02 – 0.0 to 5.6 m

Plate 9: Borehole BH-02 – 5.6 to 9.0 m