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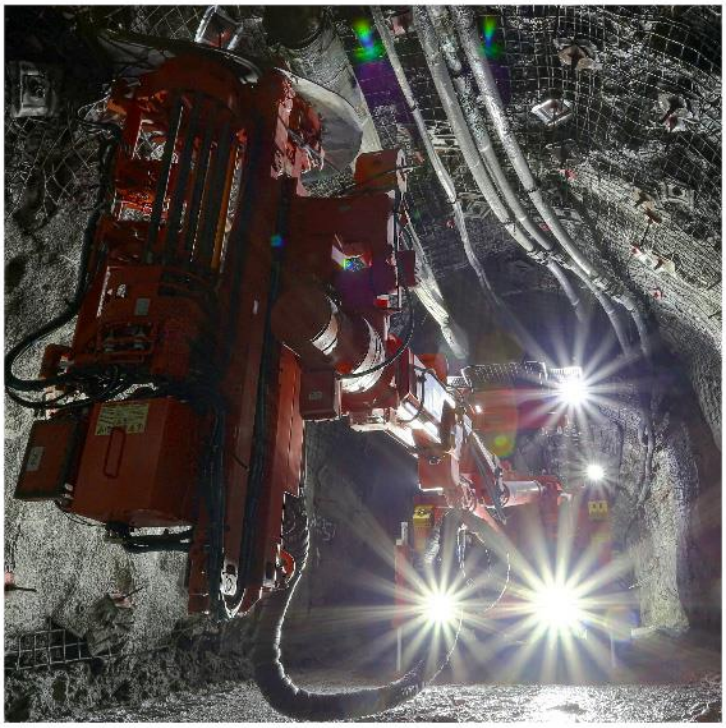

Mineral Projects Pty Ltd.

Dianne Copper Mine – Final Landform & Cover Design

November 2024

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

1 INTRODUCTION

1.1 Project Description

The Dianne Copper Mine is located in Cape York Peninsula, Queensland, approximately 165 kilometres northwest of Cairns and 100 km southwest of Cooktown (Figure 1). The Dianne Copper Mine comprises Mining Leases ML 2810, ML 2811, ML 2831, ML 2832, ML 2833, and ML 2834. The mine has been under care and maintenance since copper mining activities ceased in 1982. The proponents for the Dianne Copper Mine are Mineral Projects Pty Ltd (MPP) and Tableland Resources Pty Ltd.

The Dianne Copper Mine consists of the following infrastructure, of which key features are shown in Figure 1.

- A small open cut pit
- Historic underground portal (backfilled in 1983)
- Waste rock stockpile
- Settling dam, drainage channels, spillway, and other water management infrastructure
- Run of mine laydown areas
- Main access road and internal mine roads
- Old mine camp building concrete footings and associated remnant infrastructure
- Rehabilitation areas

The mine was developed for copper in the 1970s and operations ceased in 1982 when the mine was put under care and maintenance due to the global fall of copper prices. At this time, all processing infrastructure, administration, and accommodation were removed from site and rehabilitation of some areas of the site was carried out.

Figure 1: Site location and existing layout

The proponents plan to re-establish Dianne Copper Mine. The mine will be a traditional truck and shovel hard rock mine and processing facility. It will consist of the following elements, which are shown in Figure 2:

- Reprocessing and disposing of Legacy Ore from previous mining operations;
- Mining Overburden, Waste Rock and Ore from the pit;
- Crushing and beneficiating Ore;
- Acid leaching of copper metal in gravity heaps;
- Solvent extraction of the leach liquor for purification and concentration of copper and subsequent recycling of acid to leaching;
- Electrowinning of high purity copper cathodes from the concentrated SX solution;
- Ancillary operations such as maintenance and camp facilities.

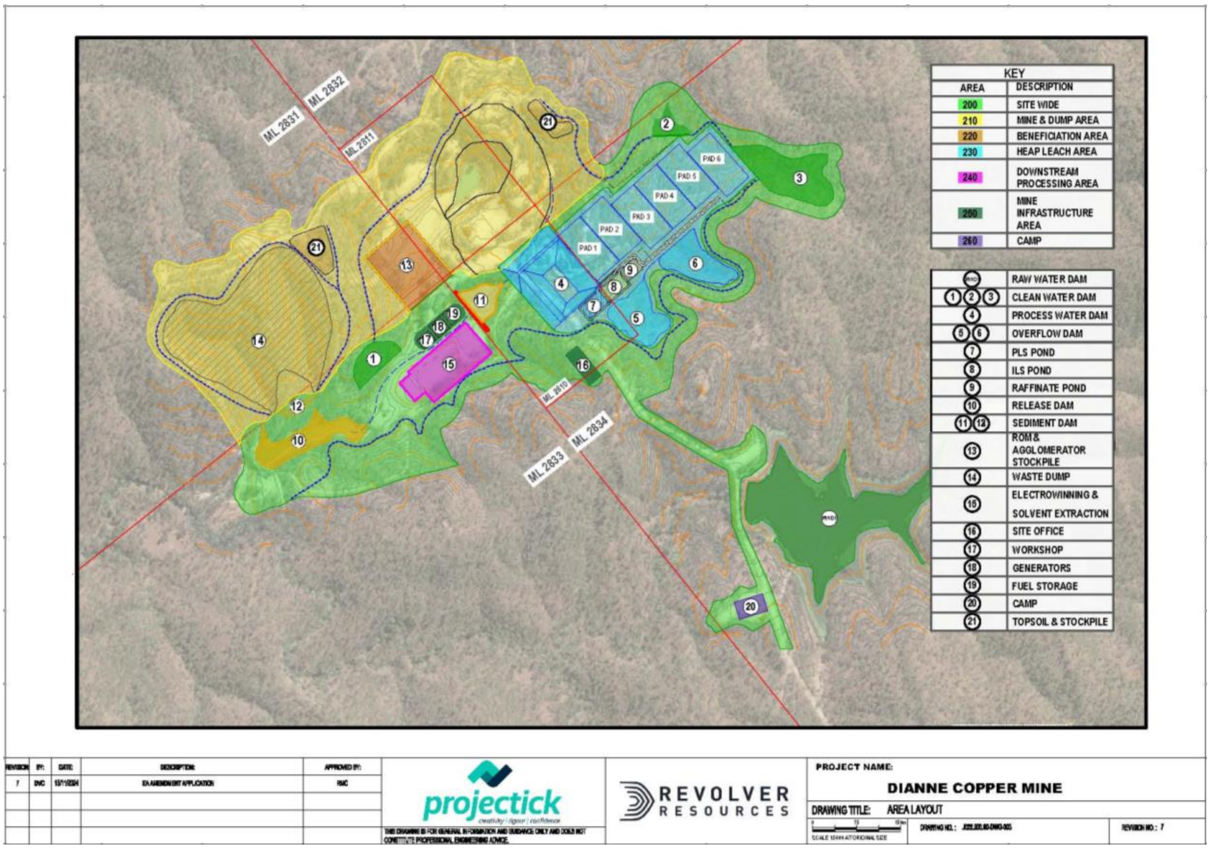

Figure 2: Planned site layout

1.2 Purpose & Scope

As part of the Progressive Rehabilitation and Closure Plan (PRCP) development, MEC was requested to complete stability analysis of the final landform design for the Waste Rock Dump (WRD) and to provide a conceptual cover design for waste rock storage in line with the Guideline for PRC plans developed by the Queensland Department of Environment and Science (Depart of Environment and Science, 2023). MEC personnel completed the stability analysis, while the conceptual cover design was completed by Environmental Geochemistry International (EGI) and a technical memo was provided to MEC. This report summarises both the stability analysis and the conceptual cover design. Recommendations have been included to address any gaps between the work completed and the guideline.

2 FINAL LANDFORM DESIGN

A final landform design is a key component of rehabilitation and closure planning. The final landform design must be based on the proposed Post Mining Land Uses (PMLU) and Non-Use Management Areas (NUMA) and demonstrate that the land will be safe and structurally stable (Depart of Environment and Science, 2023). As part of the rehabilitation planning MEC was requested to review the geotechnical stability of the final landform design for the Waste Rock Dump for the Dianne Copper Mine.

2.1 Scope of Work

MEC undertook the following tasks in reviewing the geotechnical stability of the Waste Rock Dump (WRD) as provided by MPP. MEC did not undertake any components of design for the WRD.

1. Reviewed supplied data, including previous reports and drilling data
2. Carried out 2D stability assessments for the proposed WRD
3. Provided geotechnical testing recommendations for the foundation of WRD and the waste rock materials
4. Reported results/findings and recommendations

It should be noted that this is a conceptual-level study, as no foundation or WRD material investigation has been previously undertaken. Material parameters from the literature are used in the stability assessments based on the information provided by the client and in the Waste Management Plan (Revolver Resources, 2024). Additionally, the geochemical characterisation of WRD material is outside the scope of this study.

The conclusions reached and recommendations provided in this report are based on data and information provided by MPP, including emails, meetings, and phone calls. While geotechnical assessment and recommendations provided in this study will reduce exposure to risk, no geotechnical assessment can eliminate risk as there may be local variations in ground conditions and material characteristics. MPP should follow risk assessments when conducting any work in and around WRD, as operational practices play a significant role in the early identification and management of geotechnical hazards.

2.2 Site Characteristics

2.2.1 Site Layout

The site layout is shown in Figure 2, and the reviewed WRD layout in Figure 3. The wireframes used in this study are provided in Table 1. Elevation of the in-situ ground (terrain) at the base of the WRD ranges approximately between 384mRL and 424mRL, with up to 20° slope inclination. The proposed WRD crest is at 433mRL. The height of the proposed WRD is approximately 10m on the western, 8m on the northern, 15m on the eastern, and between 30-50m on the southern side. The size of the proposed WRD is approximately 280m along west-east and 250m along north-south directions.

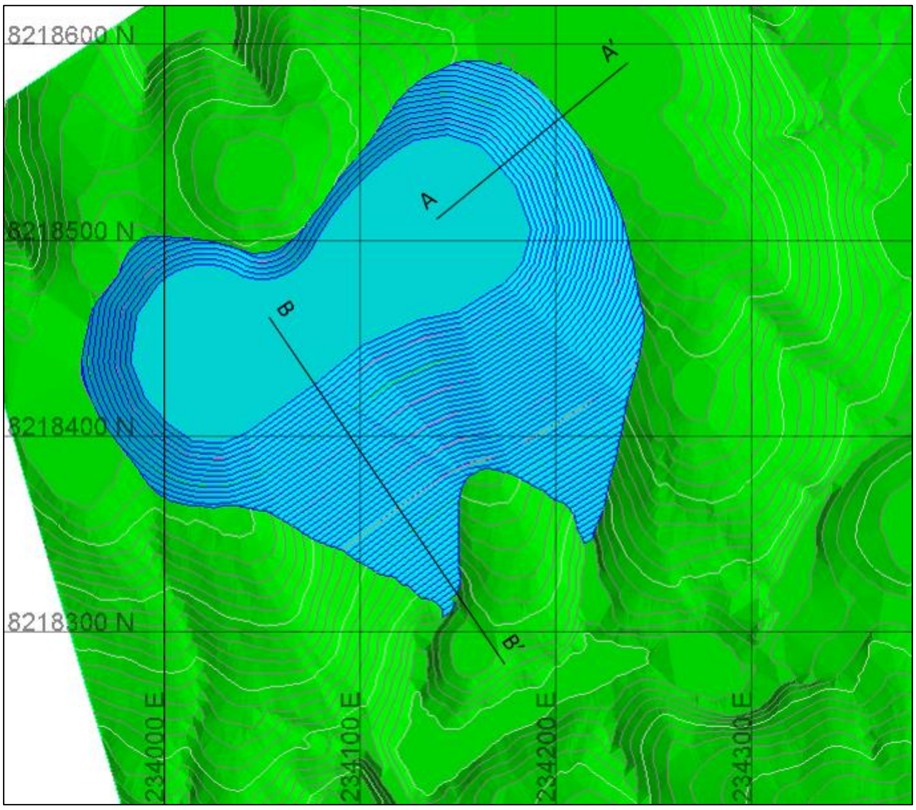

Figure 3: WRD layout

Table 1: Topography and WRD Wireframes

Wireframe Name	Description
Topo_SKE-001-02	Local Topography
WD_DWG-001-04	Proposed WRD Design

2.2.2 WRD Foundation

No geotechnical testing or sampling was previously carried out for the foundation assessment. Recommendations for testing and sampling are provided in Section 2.5 of this report.

C&R Consulting (2024) carried out soil characterisation assessments at ten (10) locations across the site, two (2) of which were at the foundation of the WRD, SS7 and SS8. The depth of samples was 65mm for SS7 and 60mm for SS8. The soils were characterised as clayey loams overlaying a finer texture, light to medium clays. Emerson aggregate testing indicates that soils are subject to swelling, but no slaking was observed. Both samples were given an Emerson ranking of 7, providing a low erosion risk. The thickness and type of the overburdened soil that underlies the WRD can substantially impact the WRD's stability and must be investigated (Hawley and Cunning, 2017).

Three (3) historic vertical groundwater borehole logging data were provided in 2022 to MEC for the Progressive Rehabilitation and Closure Plans (PRCP) Assistance study, which were used in evaluating the site geology (MEC, 2022). The depth of those boreholes ranged between 58m and 87m. The following rock types were observed in those boreholes from ground surface to depth:

- weathered fine-grained sandstone (~ 4m)
- slightly weathered sandstone/siltstone (~9m)
- fresh sandstone siltstone (bedrock)

Reverse Circulation (RC) percussion drilling was also carried out in 2020, with four (4) boreholes drilled in the Greenhill zone. Two (2) of those boreholes were 120m, one (1) was 105m, and one (1) was 79m in length. A section of a report and logging data of those boreholes was provided to MEC for the current study. The rock types in the first 20m of those holes were primarily Shale, Greywacke (Sandstone), and Silt, consistent with the observation in the historic groundwater boreholes.

2.2.3 Groundwater

As mentioned in the previous section, historic groundwater boreholes were provided for an earlier study carried out by MEC (MEC, 2022). The groundwater level in those boreholes varied between 340 and 391mRL. Based on conservative values from the groundwater logs, the groundwater level at around 390mRL will be used in the stability models.

2.2.4 Seismicity

The peak ground acceleration (PGA) in the mine site is a maximum of 0.025g (10% in 50-year mean hazard). The PGA value is used in the pseudo-static stability assessment as horizontal loading.

2.3 Dump Materials and Placement

The Revolver Resources (2024) report provides that overburden material excavated from the pit, material from heap leaching, and spent ore will be placed in the dump. The report also mentions that non-hazardous general waste will be dumped within an excavated enclosure in the WRD's footprint, and subsequently, mining waste from the final landform will be dozed over it. Thus, the quality of material in the WRD will vary, and conservative parameters will be adopted for the stability assessments.

The properties of excavated rock material can change over time due to weathering, hydration, slaking, chemical and other processes (Hawley and Cunning, 2017). Thus, at least five (5) samples from the overburden, planned to be placed in the WRD, are recommended to be collected, and slake durability testing is performed on those samples.

Low-strength materials such as soils or heap leach materials should not be placed at the base of the WRD or as a continuous surface where they may act as a slip plane and significantly impact the stability. Those weak materials should be locked within high-strength material or placed in areas less critical to stability (e.g., the northern face of the WRD). Alternatively, blending low-strength material with higher-quality waste can be adopted. High-strength and permeable materials should be used on downstream faces where possible.

Generally, well-graded materials with a high percentage of coarse and angular particles and a low percentage of fines have higher shear strength than poorly graded, fine-grained materials such as soils. Additionally, saturated fine materials may be susceptible to generating excess pore pressures during dumping, resulting in undrained failure. Uniformly graded fill materials with a low clay content and rounded particles may also be susceptible to liquefaction.

2.4 Stability Assessments

2.4.1 Methodology

2D limit equilibrium analyses with commercial software Rocscience Slide 2 version 9.034 were carried out on two representative sections. The locations of those sections are shown in Figure 3, and the sections are provided in Figure 4. The proposed WRD slopes are designed at 20°. The models incorporated a weak 0.5m thick soil layer at the base of the WRD, and the groundwater level was modelled around 390mRL per the information provided in Section 2.2.3. Groundwater sensitivity analysis was also carried out by modelling Section B—B' (north-south) with no groundwater (dry).

The design acceptance criteria adopted for the assessments are provided in Table 2, which are values for closure studies. Pseudo-static assessments were also carried out for those sections.

Table 2: Adopted Design Acceptance Criteria Factor of Safety (FoS)

Condition	Minimum Factor of Safety	Source
Static	1.50	Hawley and Cunning, 2017
Pseudo-static	1.15	Hawley and Cunning, 2017

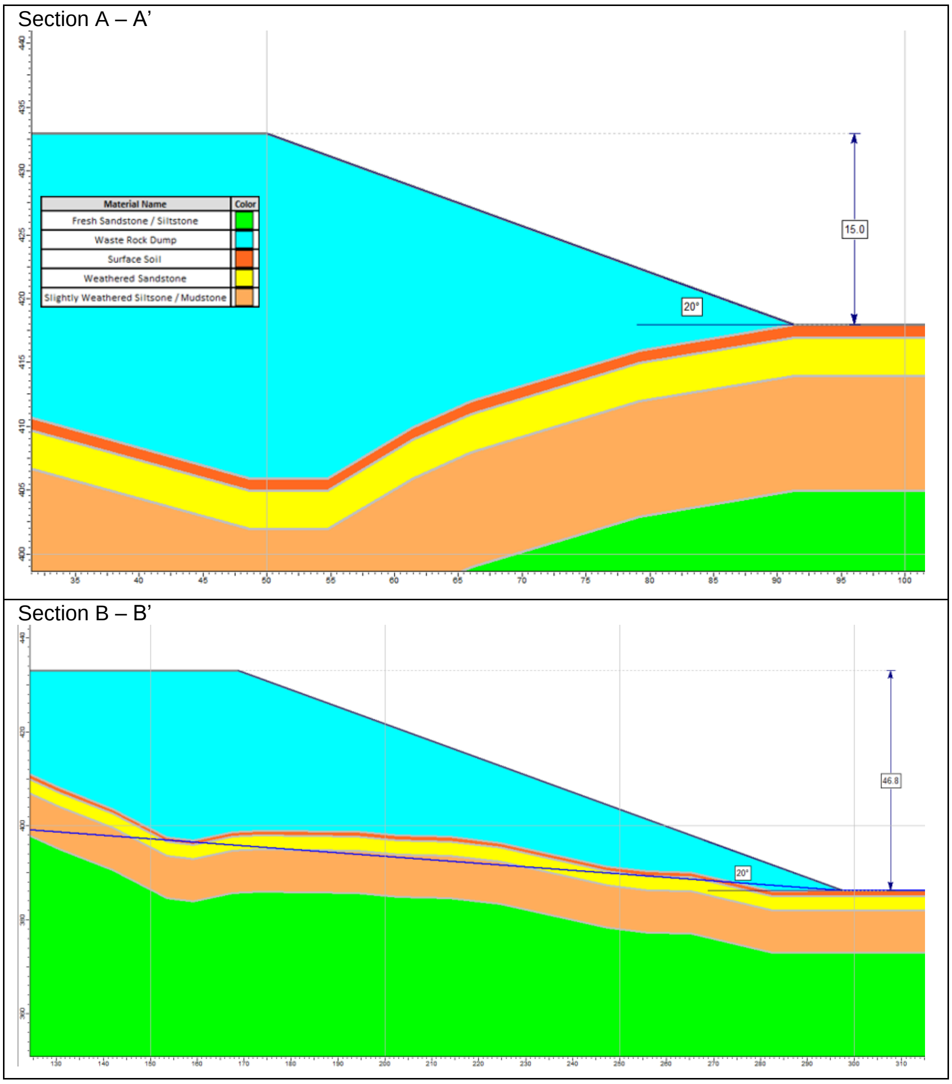

Figure 4: Sections used in the stability analysis

Stability models were run with the following assumptions:

- Surface options were run with both circular mode, using an Auto Refine Search method, and non-circular mode, using Cuckoo search.
- For circular mode, divisions along the slope were set to 20, circles per division to 10, number of iterations to 10, and division to use in the next iteration to 50%. A total of 19,000 surfaces were computed. Composite surfaces were also included.
- For non-circular mode, the initial number of surface vertices was set to 8, maximum iterations to 500, and number of nests to 50.
- Models were run using both the Bishop Simplified and GLE Morganstern methods. Results are provided for whichever method gave minimum FoS.

2.4.2 Adopted Material Properties

Material parameters are provided in Table 3. Conservative parameters are used since no site investigation or geotechnical testing was conducted.

Table 3: Adopted Material Parameters

Material	Unit Weight γ (kN/m³)	Cohesion c' (kPa)	Friction Angle ϕ' (°)	Source
WRD	20	20	25	Simmons and McManus (2004)
Surface Soil	20	5	20	-
Weathered Sandstone	26	27	27	Goodman (1980)
Slightly Weathered Siltstone/Mudstone	27	38	14	Goodman (1980)
Fresh Sandstone/Siltstone	Infinite strength			

2.4.3 Stability Results

Slope stability results for both sections are provided in Table 4. The B – B' section (north-south) did not meet the design acceptance criteria with a 20° slope angle, so the slope angle was reduced to 14° for the southern slopes. The failure surface of the initial design, which is shown in Figure 5, indicates that the strength and thickness of the Surface Soil, Weathered Sandstone, and Slightly Weathered Siltstone/Mudstone units are critical for the stability of the WRD. Thus, at least one borehole should be drilled to evaluate the thicknesses of those units in the area and to collect samples for geotechnical testing.

Table 4: Stability Results

Section	Slope Angle (°)	FoS Static (circular)	FoS Static (non-circular)	FoS Pseudo-static (circular)	FoS Pseudo-static (non-circular)
A - A'	20	1.98	1.89	1.84	1.76
B – B'	20	1.24	1.20	1.15	1.11
B – B' dry	20	1.39	1.33	1.27	1.23
B – B'	14	1.54	1.51	1.38	1.35

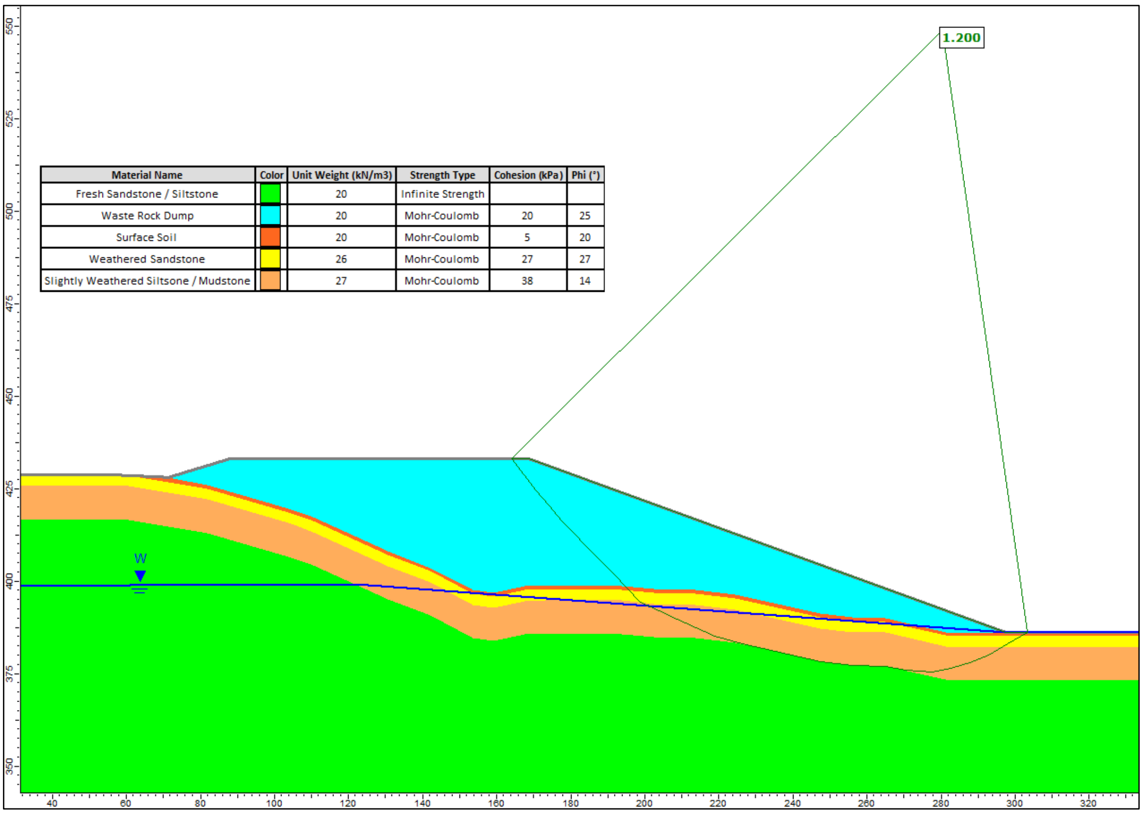

Figure 5: Predicted failure surface for Section B – B' static non-circular model run

2.4.4 Updated Waste Rock Design

After completion of the stability analysis, an updated waste rock dump design was completed that included the reduced slope angle of 14 degrees on the southern slopes to align with the recommendations from the analysis. MEC has not completed additional stability analysis on the updated design. This design is shown in Figure 6.

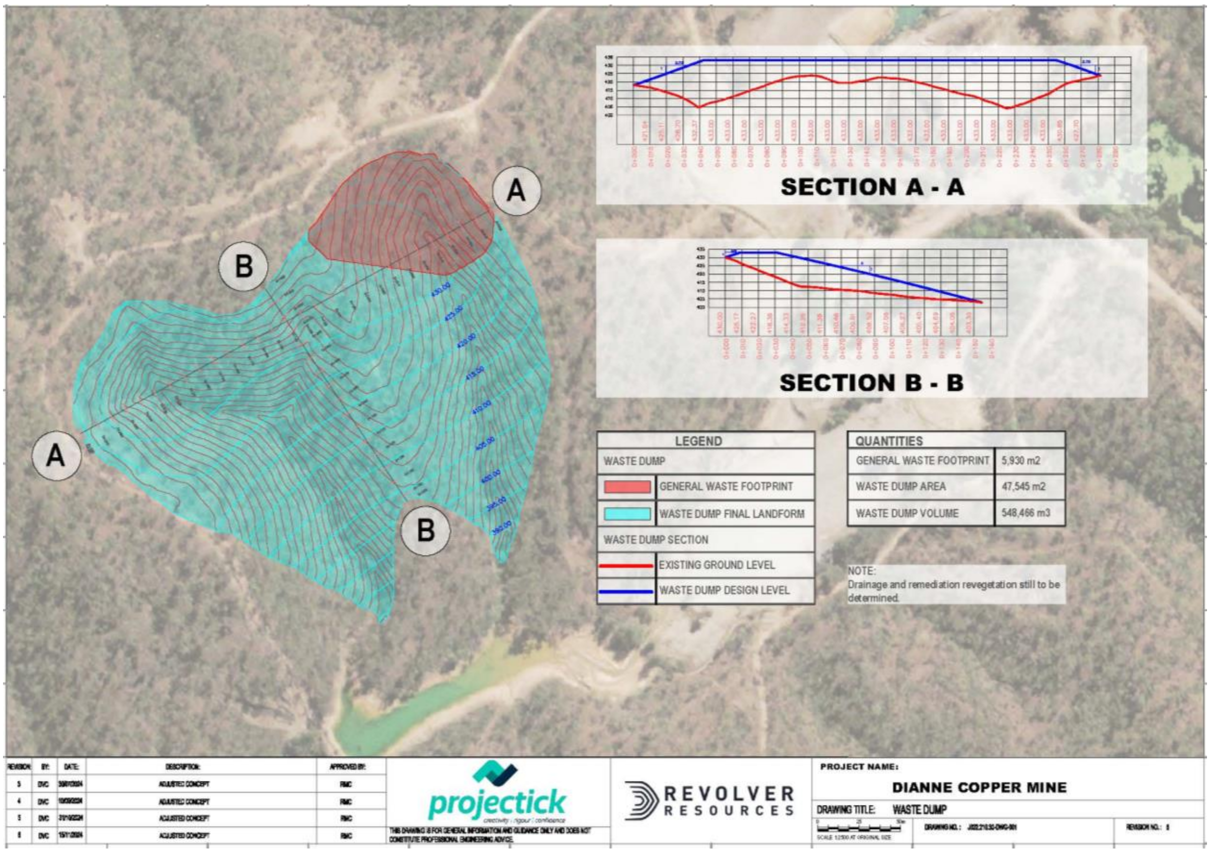

Figure 6: Final waste dump design with reduced southern slopes

2.5 Recommendations

2.5.1 Foundation Characterisation

- A site investigation is recommended to evaluate the foundation of the proposed WRD. The investigation will require site walkover, surface mapping, test pitting or auger drilling, a borehole, and sampling for laboratory testing. Test pits collapse can occur, and extreme caution and safe work procedures must be followed during the investigation.
- An engineering geologist or geotechnical engineer should carry out a site walkover and investigate whether the site is prone to natural hazards. This should include assessing whether there are any tension cracks at or near the top of the hill. This work can be accompanied by surface mapping of the rock outcrops (if any). The following information should be collected:
    - recording of the location and size of any tension cracks.
    - location of the rock outcrops, rock type and weathering conditions, and dip and dip direction.

- Further investigation is not recommended before completing the site walkover, surface mapping, and assessing the terrain's suitability for the construction of the WRD.
- For the foundation assessment, geotechnical logging and sampling in at least five (5) locations, four (4) test pits, and one (1) borehole are recommended. Indicative locations are provided in Figure 7, which can be moved 10m in each direction or to locations with better access. However, southern slopes should be targeted.
- At least 3m deep, four (4) test pits are recommended where an excavator can access. Otherwise, an auger can be used to:
    - carry out geotechnical logging
    - identify the depth to bedrock or competent ground
    - record groundwater level if encountered
    - photograph all test pit trenches (stratigraphy should be visible)
    - collect samples for geotechnical laboratory testing
- Test pits are generally recommended to be excavated between 3 and 7m, or to refusal, as the soil assessment report indicates that bedrock may be encountered in shallower depths (C&R Consulting, 2024). If equipment is available, in-situ Field Vane Testing (FVT) should also be carried out to obtain the undrained shear strength of clays.
- Recommended geotechnical testing types and numbers are provided in Table 6. Samples should be collected for those tests, and testing should be carried out in a NATA-accredited laboratory.

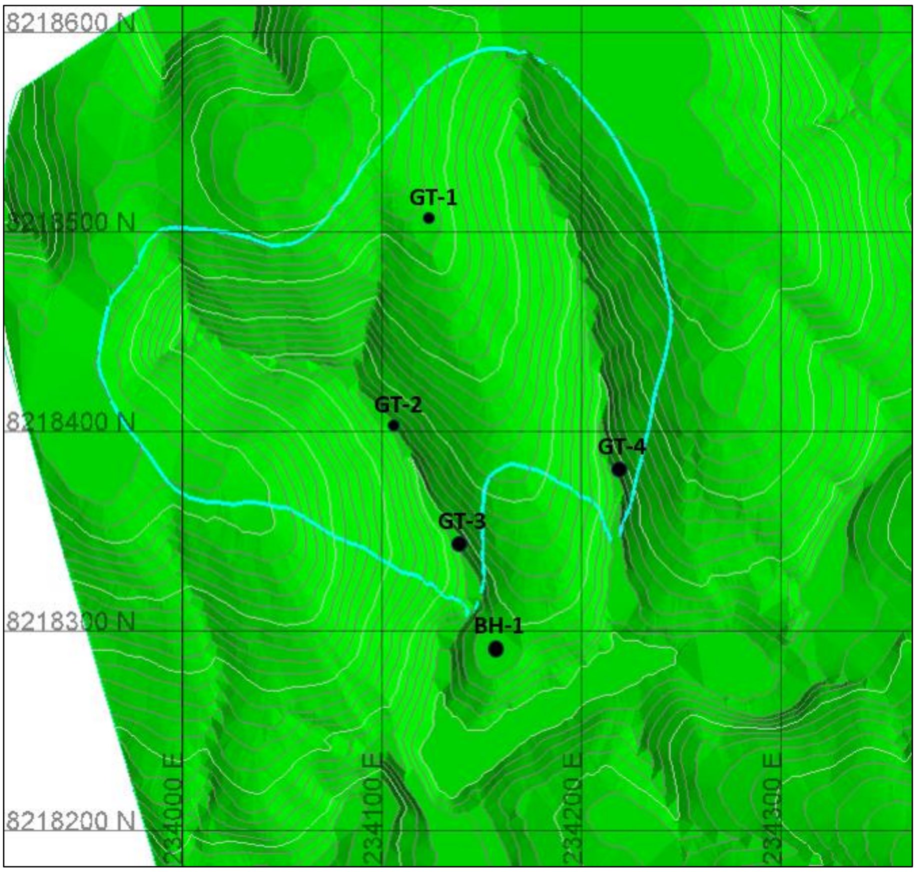

Figure 7: Indicative locations for test pits (or auger) and a borehole

Table 5: Recommended Testing Locations

Location ID	Easting	Northing	Elevation (mRL)	Depth (m)
GT-1	234126.2	8218504.0	422.5	3 – 7
GT-2	234105.5	8218400.8	392.0	3 – 7
GT-3	234143.1	8218341.0	388.4	3 – 7
GT-4	234216.0	8218384.9	388.0	3 – 7
BH-1	234155.0	8218291.5	388.0	3m below the top of bedrock (fresh Sandston/Siltstone)

Table 6: Recommended geotechnical laboratory testing

Test Type	Location	Minimum Number of Tests
Particle Size Distribution (including moisture content)	Test pits from varying depth & material types (from at least 0.5 below ground surface)	3
Atterberg Limits	Same as above	3
Consolidated Undrained (CU) Triaxial (Undisturbed)	Borehole or test pits (from Weathered Sandstone)	3
Unconfined Compressive Strength (UCS)	Borehole (Slightly Weathered Siltstone/Mudstone)	3

2.5.2 Dump Material Characterisation

As noted in Section 2.3, at least five (5) samples from the overburden material planned to be placed in the WRD should be collected and slake durability testing should be performed on those samples.

2.5.3 Erosion Assessment

Prior to construction of the waste dump, a detailed erosion assessment should be undertaken. This should include an evaluation of the interactions between soil erodibility, rainfall erosivity, landform height, gradient and vegetation cover to ensure long-term stability of the final landform.

3 CONCEPTUAL COVER SYSTEM

Environmental Geochemistry International (EGI) completed a conceptual cover system options assessment for the waste storage landforms planned for the Dianne Copper Mine which is outlined in this report (Environmental Geochemistry International, 2024).

Guidelines published by the Queensland Department of Environment and Science (DES) on general rehabilitation practices require placement of a cover system on any waste landform where waste has the potential for acid mine drainage (AMD), neutral mine drainage (NMD), or saline mine drainage. In accordance with these guidelines, the design of cover system must take into account the following:

- Geochemical and physical characteristics of the waste material being covered.
- Site conditions.
- Availability of suitable cover material in terms of both quality and quantity.
- Design criteria for discharge (i.e. to protect environmental values).
- Suitable vegetation.

The intent of this conceptual cover system options assessment is to complete the following key tasks in a manner that provides a preliminary basis for the above-mentioned requirements:

- Selection of appropriate cover type(s) for the climate regime prevalent at Dianne Copper Mine considering the site-specific climate classification, rainfall and evaporation.
- Conceptual development of three cover system layering options using reference material properties.
- 1D numerical modelling of the conceptual cover systems to assess performance.
- Preparation of a technical memorandum to document methods and key findings of the conceptual cover system and the preferred option.

3.1 Climate

The Dianne Copper Mine is situated in the Queensland dry tropics region, characterized by highly seasonal rainfall and elevated temperatures. The wet season typically spans from November to April, while the dry season extends from May to October (Engeny 2024).

Rainfall and pan evaporation statistics for the site have been derived from daily climate data from 1971 to 2024 sourced from the SILO Climate Database (https://www.longpaddock.qld.gov.au/silo/gridded-data/) for grid point 16.10 °S, 144.50 °E. The average annual rainfall is 943 mm with an average annual evaporation of 1967 mm, resulting in an average evaporation to rainfall ratio of 2.1. Over 80 % of the average annual rain falls within between the months of December and March with minimal to no rainfall during the dry season.

Historical annual and monthly average climate data for the site are presented in Figure 8 and Figure 9.

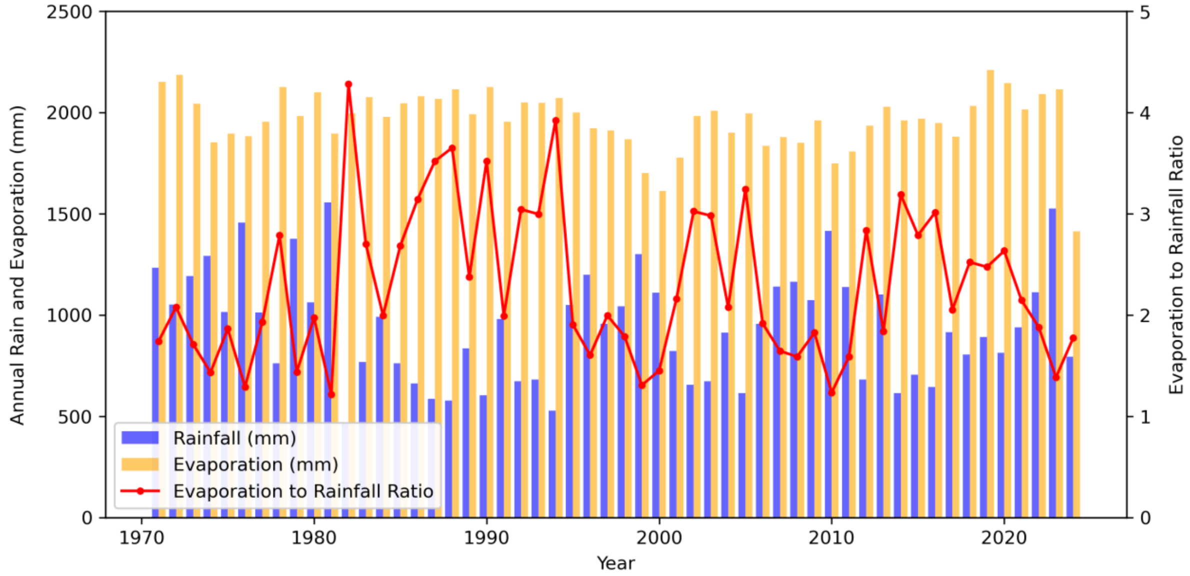

Figure 8: Annual rainfall and pan evaporation data record for the site from 1971 to 2024

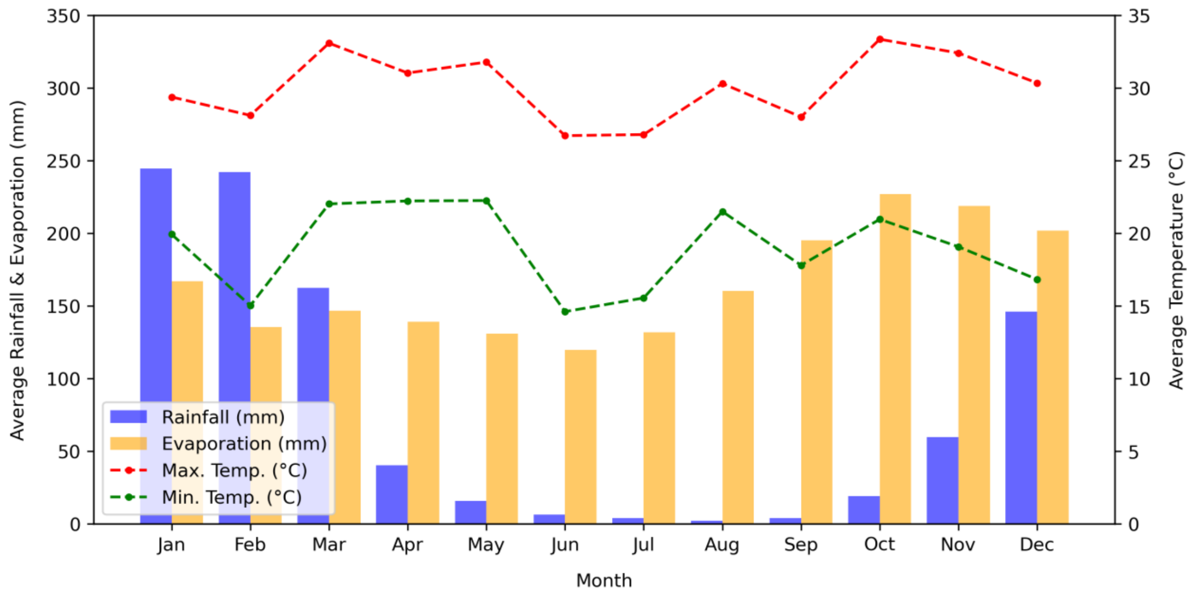

Figure 9: Monthly average climate data for the site from 1971 to 2024

3.2 Cover System Modelling

3.2.1 Recommended Cover Type

The climate at Dianne Copper Mine is considered to be challenging in terms of cover system design with an average annual precipitation of 943 mm and evaporation of 1967 mm. Over 80% of the precipitation occurs during the summer wet season (between December and March), with evaporation dominating the climate (evaporation to rainfall) ratio in all other months of the year.

Based on the Global Acid Rock Drainage (GARD) guidance on climate and cover systems shown in Figure 10 the Dianne Copper Mine climate is classified as semi-arid, for which a store-and-release type cover is considered most suitable. For this cover type, water infiltrates into the cover during periods of high precipitation and is stored until atmospheric and biotic demands are able to remove the water through evaporation and transpiration. In order to prevent the transport of any acid and metalliferous drainage (AMD) developed in the emplaced material, it is important for store-and-release covers to limit percolation of rainfall into the waste rock layer. In instances where relatively short-duration seasonal rainfall events may exceed the storage capacity of the store-and-release layer, additional infiltration barrier layers may be incorporated into the cover system to prevent percolation into the waste rock material.

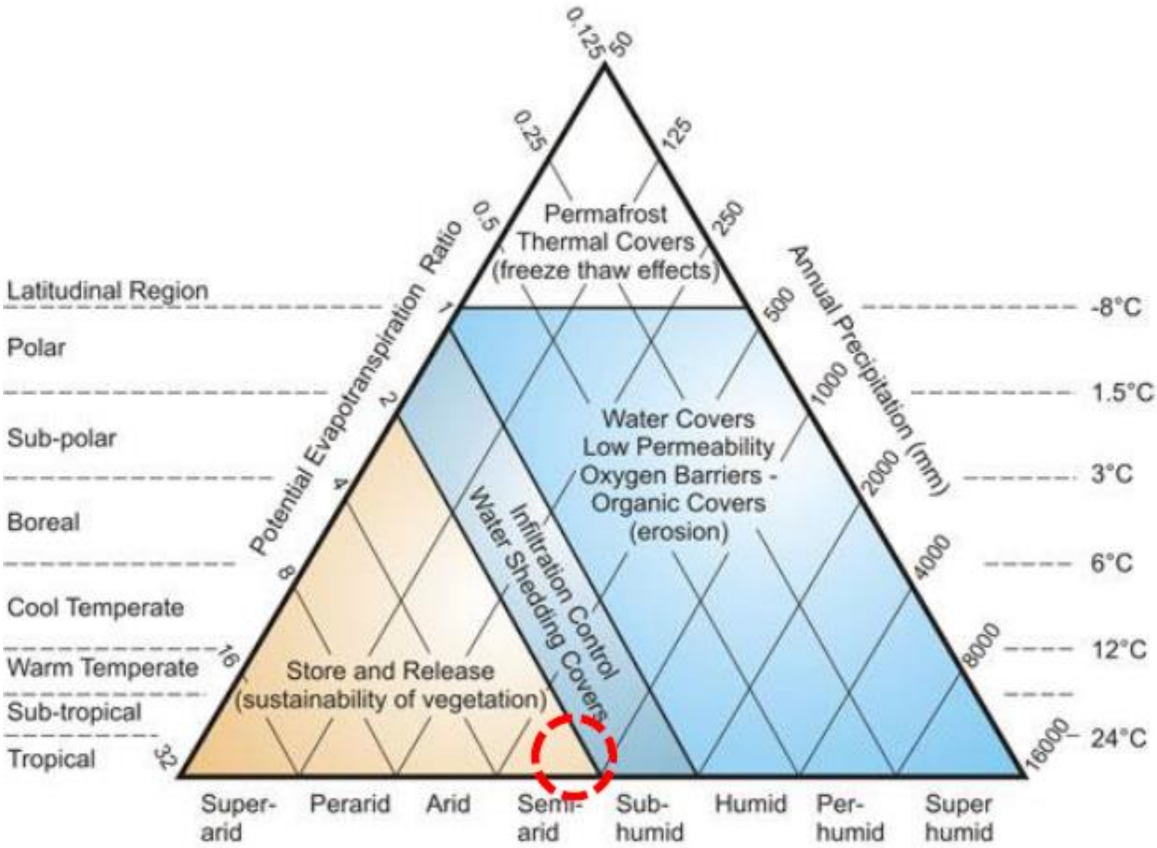

Figure 10: Cover systems and climate types (INAP 2009), the red circle area highlights the region applicable to this cover type

The purpose of the soil cover systems implemented at Dianne Copper Mine should be to:

- Sustain vegetation
- Manage run-off and resist erosion during intense storms
- Limit the percolation of rainfall into the waste rock material, thereby limiting the transport of any acid and metalliferous drainage (AMD) developed from emplaced materials

3.2.2 Cover System Concepts

Considering the general objectives of the cover system and uncertainty of available materials, the focus of the preliminary modelling has been on three variations of a store and release cover over waste rock:

- Cover #1: Store and Release.
- Cover #2: Store and Release with Vegetation.
- Cover #3: Store and Release with Infiltration Barrier Layer.

The conceptual layering of these variations at closure is presented in Figure 11.

Figure 11: Closure conceptual layering for modelled store and release cover variations

3.2.3 Modelled Climate Data

A SILO patch-point grid dataset between January 1971 and October 2024 was used to estimate average daily rainfall, evaporation, maximum temperature, and relative humidity. These conditions are shown in Table 7 and Figure 12. Based on the long-term data, a simulation period of five years was selected including:

- Three years of median rainfall and evaporation data resulting in development of a soil moisture condition likely to be representative of the long-term average soil moisture condition.
- One year of ‘wet’ rainfall data including a 5% annual exceedance probability (AEP) rainfall event to simulate cover performance under extremely wet conditions where a wetting front would be expected to move downwards towards the waste material.
- One year of ‘dry’ rainfall including 25th percentile rainfall to simulate cover performance under conditions where evaporation exceeds rainfall and the cover would be expected to ‘release’ moisture to the atmosphere.

Table 7: Simulated Climate Conditions for the Five-Year Modelling Period

Simulation Period (years)	Climate Type	Selected Year for Data	Rainfall (mm)	Evaporation (mm)
3	Median Rain	1997	957.2	1911.9
1	Wet (5% AEP)	1976	1457.8	1882.6
1	Dry (25 percentile Rain)	1993	683.1	2047.0

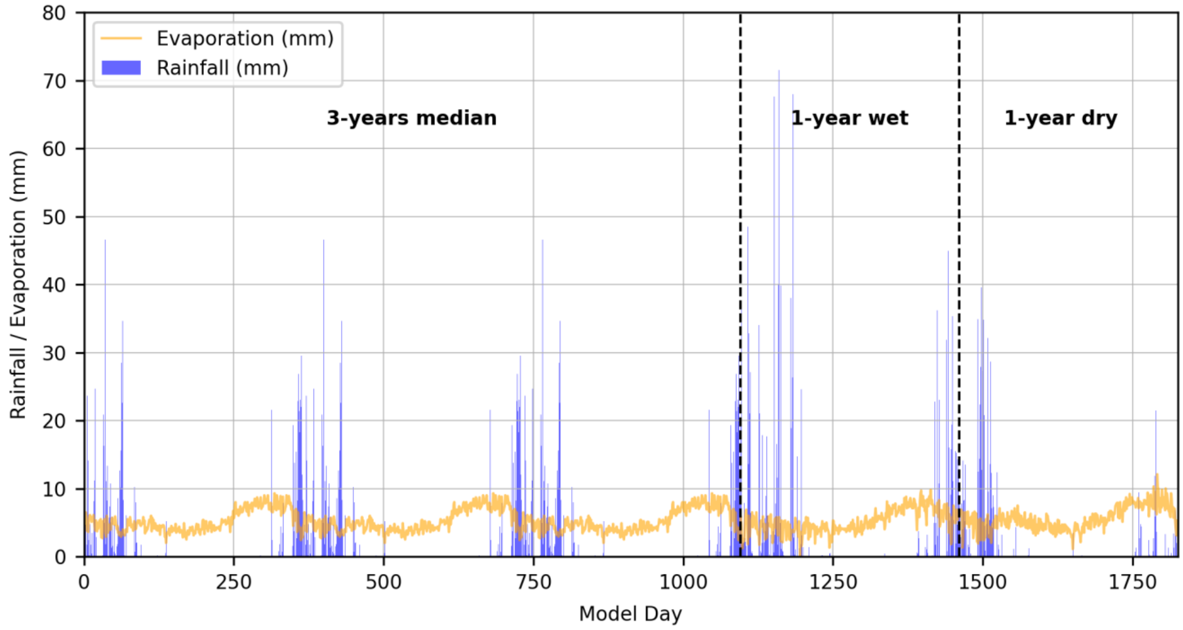

Figure 12: Modelled climate data

3.2.4 Model Selection

SoilCover is a 1D, finite element soil-atmosphere flux model that predicts the evaporative flux from saturated and unsaturated soil surfaces based on atmospheric conditions, vegetative cover, soil properties and antecedent soil conditions. It is an EXCEL VBA-driven product that uses input climate data (including precipitation, evaporation, relative humidity and temperature) to predict field responses from an in-place cover system on-daily time steps. Field responses refer to conditions that develop within the cover including changes in water content; changes in degree of saturation; changes in soil temperature; actual evaporation-transpiration from the cover; runoff; and water flow through the cover.

It should be noted that numerical modelling requires field validation, as discussed by Fredlund and Wilson (2006), to be confidently relied on for detailed design work. The authors state that case histories with sufficient field measurements are important as they provide confidence that the theories are being applied correctly in engineering design. In the absence of the validation process, it is possible for engineering design to develop a false confidence or become too optimistic in its predictions.

Due to limited site-specific information, SoilCover modelling was conducted using reference material properties. The input parameters for numerical modelling included the following:

- The input porosity for the store and release the input porosity were typical values indicated in Morris and Johnson (1967).
- Soil water characteristic curves (SWCCs) for each of the cover materials were prepared using the SoilCover software's capability based on the particle size analysis for similar reference materials. Waste rock is considered highly variable material between sites and also within the same site, and therefore the SWCC was sourced from EGi's internal database for the purpose of modelling. The SWCC curves are presented in Figure 13.
- The saturated hydraulic conductivity (Ksat) for the store and release cover material was set to 1×10^{-6} m/s based on field permeability tests for similar reference materials. For other materials, Ksat were used based on the typical values in Domenico and Schwartz (1990). Hydraulic conductivity functions for different materials are shown in Figure 14.
- Waste rock material was assumed to be dry at approximately 5% volumetric water content. Other cover materials were assumed to be placed at approximately 30% of the saturated moisture content.
- The model was run for five years with a daily timestep using the median annual precipitation and evaporation data applied for each year.
- The total depth of the store-and-release layer was modelled as 2 m for all cover options, while the infiltration model was modelled as 0.5 m for option #3.

For the infiltration analysis, it is assumed that the vegetation will have a growing season extended over most of the year and that, over time, a quality ground cover will establish. SoilCover's vegetation algorithm requires a Leaf area index (LAI) function which is an indication of how much radiation energy is intercepted by plant surface area versus ground surface area. In addition, it was assumed the vegetation had a root depth of 2m. Model parameters are identified in Table 8.

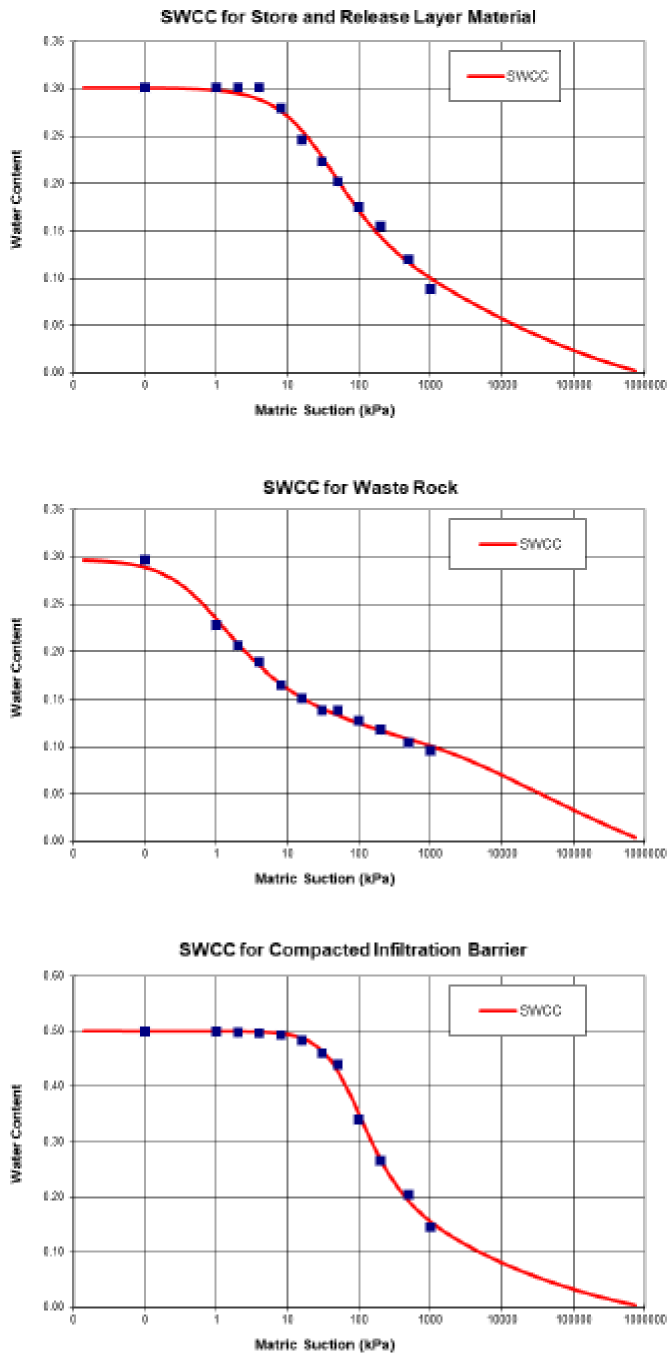

Figure 13: Soil Water Characteristics Curves (SWCC) considered for different materials used

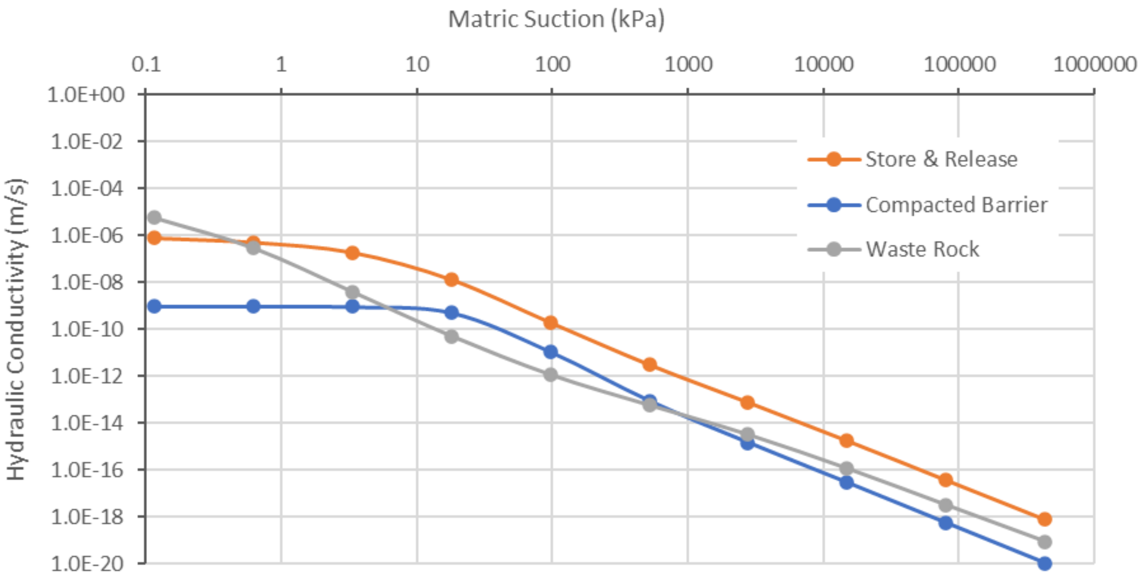

Figure 14: Hydraulic conductivity function for different materials

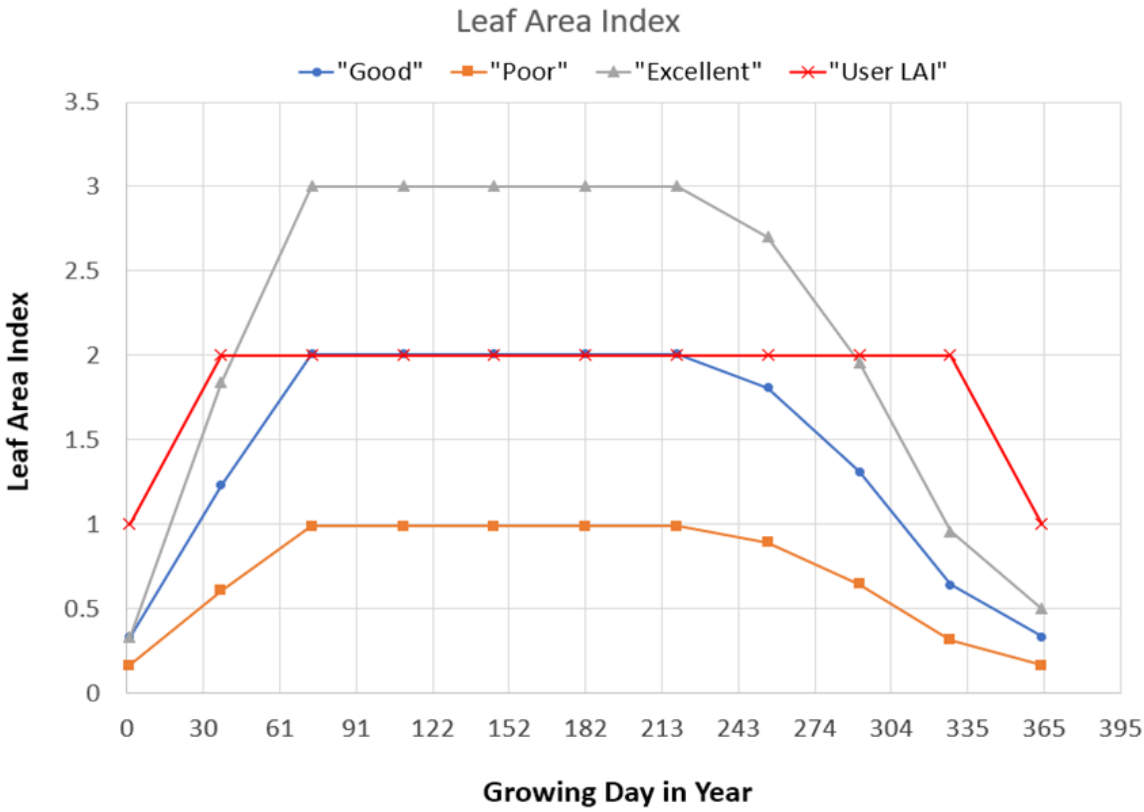

Figure 15: Leaf area index (LAI) function used for vegetation

Table 8: Model Inputs for Different Materials

Cover/Waste Material	Saturated Hydraulic Conductivity K_{sat} (m/s)	Porosity or Saturated Water Content
Saprolite (silty sand) for store-and-release layer	1.0×10^{-6}	0.30
Clay for compacted infiltration barrier	1.0×10^{-9}	0.50
Waste rock	2.0×10^{-5}	0.29

3.2.5 Modelling Performance of Design Concepts

The cumulative flux comparison for all three modelled scenarios demonstrates the effectiveness of different cover systems (Figure 16 to Figure 18). These figures have data labels for flux values end of the final year of the five-year simulation. An average of the yearly flux for the final three years of each simulation (including one median, one wet, and one dry year) was used to estimate long-term repeating performance. Excluding the first two years from the flux calculation allows for uncertainties within the initial conditions to be smoothed.

The seepage flux into the WRD decreased with increasing cover layer complexity as summarised in Table 9 and shown in Figure 16, Figure 17, and Figure 18.

Table 9: Seepage Flux into the WRD in Modelled Cover Systems

Cover/Waste Material	Total Seepage (5-year)	Annual Seepage (years 3 to 5)	Percentage of Total Rainfall as Seepage
Cover #1 - Store-and-release only	1189.5 mm	155.5 mm	23.7%
Cover #2 - Store-and-release with vegetation	747.0 mm	109.1 mm	14.9%
Cover #3 - Store-and-release with vegetation and infiltration barrier	39.5 mm	6.7 mm	0.0%

When compared to the total modelled precipitation, the results showed almost 25 % of precipitation seeping into the WRD profile under the store-and-release cover only scenario, while seepage was reduced to 15 % with the addition of vegetation. The addition of an infiltration barrier layer almost entirely eliminated seepage into the WRD.

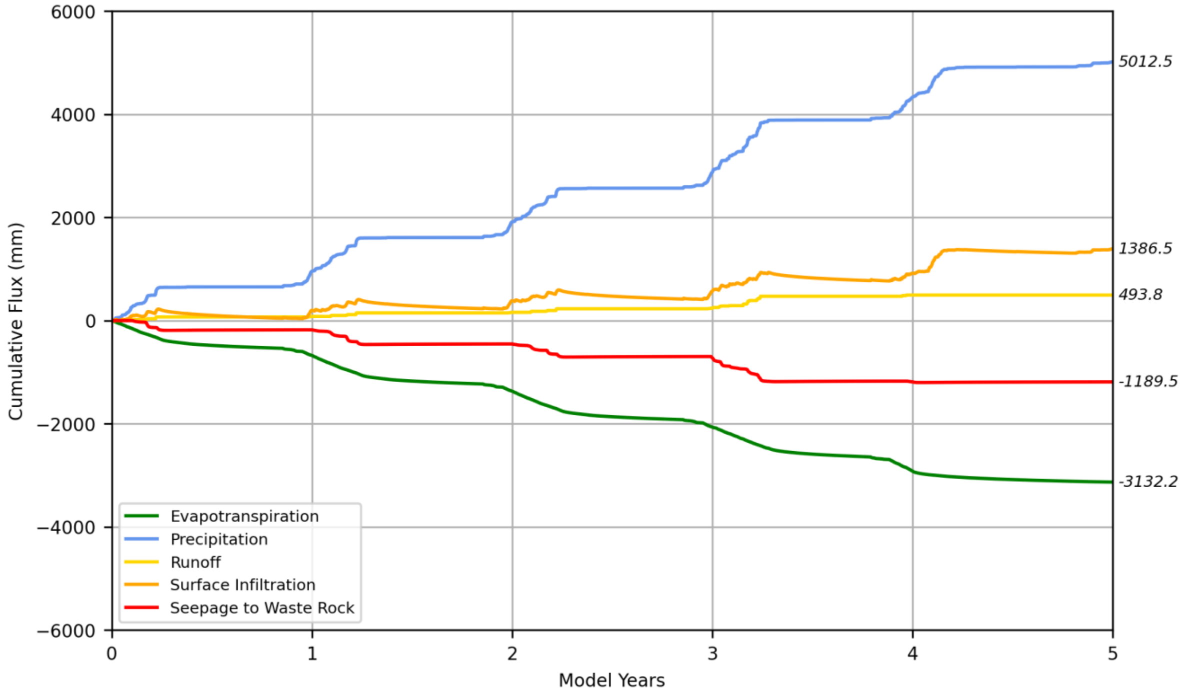

Figure 16: Net cumulative flux comparison for Cover #1 (Store-and-release only)

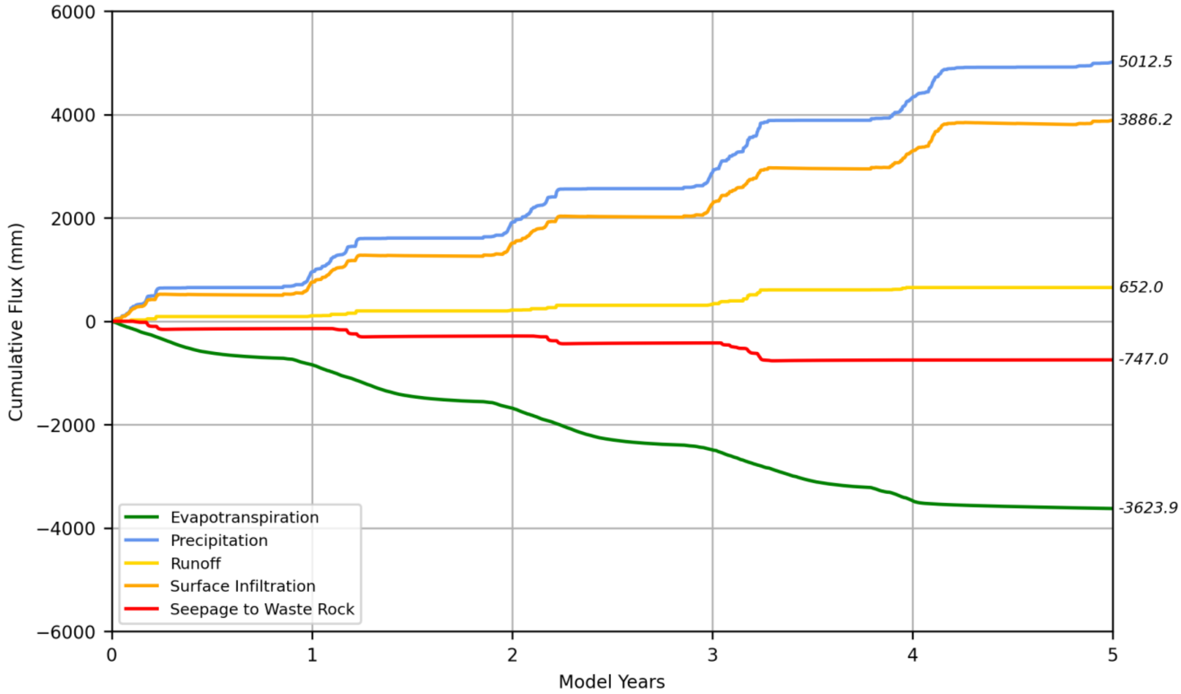

Figure 17: Net cumulative flux comparison for Cover #2 (Store-and-release with vegetation)

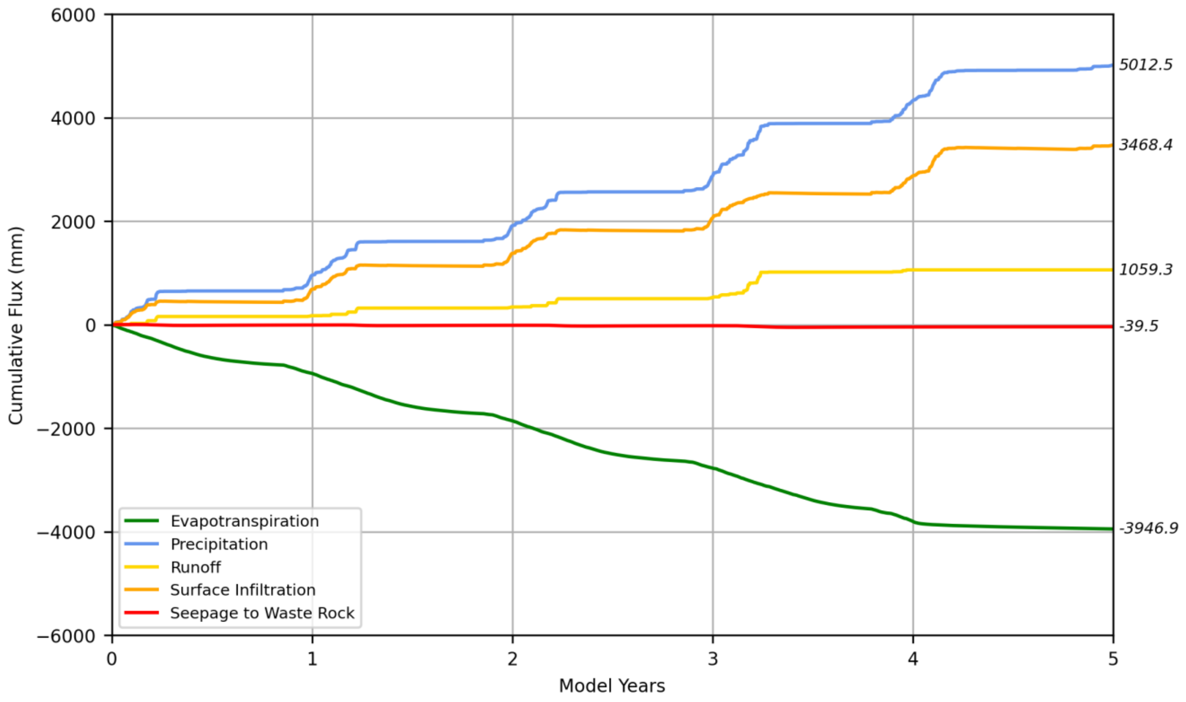

Figure 18: Net Cumulative flux comparison for Cover #3 (Store-and-release with vegetation and infiltration barrier)

3.3 Application Considerations

Selection of the most feasible cover option largely depends on the following considerations:

- Identification of suitable available materials
- Ease of construction with a preference for simple methods of emplacement
- Suitability of topsoil in terms of structural stability and growth media suitability
- Erosion characteristics of the waste rock / topsoil mulch layer
- Alignment with mine planning to minimise double handling of materials
- Transpiration properties of the vegetation in the rehabilitation layer
- Costs and effort pertaining to construction of the cover system.

The cover modelling shows that placement of a 2 m store-and-release cover using typical silty sand type material is predicted to reduce infiltration into the waste rock to 109.1 mm/yr (approximately 15 % of annual rainfall) as long as there is good vegetation established in the growth horizon (Cover #2). Much greater security can be achieved with a compacted infiltration barrier layer at the base of the store and release layer, which would help control high intensity and high duration rainfall events, and also account for the current uncertainty around re-vegetation effectiveness (Cover #3).

It has been found that for the purpose of an infiltration limiting cover at the Dianne Copper Mine over the modelled rainfall conditions for the tested concepts that:

- At this location, a store-and-release cover is recommended as a suitable cover option and is aligned with international best-practice guidelines (INAP 2009)
- Vegetation was found to be effective at enhancing the performance of the cover over the modelled period and aligns with the post mining land use objectives (revegetation with native plants)
- The store-and-release cover with an infiltration barrier (option #3) was the most effective at preventing water ingress into the underlying waste rock
- A final mine waste landform cover design will seek to minimise the following:
    - Convective oxidation of AMD waste rock and generation of high AMD loads through placement in short lifts.
    - Rainfall infiltration through waste rock piles with AMD potential to limit transport of AMD products into downgradient receptors through construction of an infiltration control cover system.
    - Capillary rise of salinity and/or metals and metalloids from the waste rock into rehabilitation growth horizons.
    - Erosion of the cover layer leading to partial failure of infiltration control and associated sediment loadings to the surrounding environment.
    - Geotechnical instability of the outer embankment materials.

3.4 Recommendations

This study presents the feasibility of a *conceptual* cover design. Prior to constructing the waste dump, and to confirm the suitability of construction material in exhibiting the characteristics expected of the store and release layer, the following recommendation are made:

- Availability and suitability of materials properties:
    - Infiltration testing should be performed using a Guelph permeameter or equivalent.
    - Test pits should also be used to examine soil structure below the surface and permeability testing by falling head tests in the test pits.
    - Geotechnical testing including of cover system material and waste rock:
        - Particle size distribution
        - Specific gravity
        - Dry density
        - Moisture content
        - Modified Proctor
        - Atterberg Limits

These tests will allow:

- Improved estimates of both saturated hydraulic conductivity and soil moisture content of available material
- Detailed calibration of seepage models and confirmation of design parameters (e.g., thickness, target compaction) for the store and release layer

Following these investigations, it is recommended that the seepage model applied in this study be calibrated to the estimated parameter values and the concept design presented in this report confirmed or updated if required.

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