Report on

WINU HDTSF 5H 10 Mtpa PRE-FEASIBILITY ERD DESIGN REPORT

Water, Waste & Land
Consulting Engineers and Scientists

* *Tailings dam engineering and management*
* *Landform engineering and erosion assessment*
* *Geotechnical engineering*
* *Flood assessment*
* *Dam break assessment*
* *Construction verification*

Prepared for

RIO TINTO

REPORT NO. 127-032-1-ERD-Rev B

NOVEMBER 2025

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Revision	Date	Description	Issuer
A	12 Nov 25	Draft ERD report issued for discussion	GMcP
B	14 Nov 25	Draft updated with Rio Tinto comments	GMcP

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NOVEMBER 2025

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WINU HDTSF 5H PRE-FEASIBILITY ERD DESIGN REPORT

1 INTRODUCTION

Rio Tinto (RT) are carrying out evaluations of a copper-gold prospect in the Pilbara region of northern Western Australia. The project entails an open cut mine and a mineral processing plant to produce copper concentrate. Processing is to take place at a nominal plant capacity of 10 Mtpa, with a total of 283 Mt to be processed over 28 years. The tailings generated during processing is to be stored in a tailings storage facility (TSF) that is split into four cells. Two cells will store low sulfur (LS) tailings and two will store high sulfur (HS) tailings.

The TSF design has evolved over time to incorporate heritage, environmental and stakeholder requirements and has considered a variety of site locations, configurations and storage capacity and throughput requirements. Based on these prior assessments, site “5H” was selected as the TSF location.

Design and engineering for the Site 5H TSF has progressed to the pre-feasibility study (PFS) design stage. Further assessments have been conducted to evaluate alternative methods of tailings management that include storage in earth fill impoundments and high-density slurry discharge. As the facility has been designed to store high-density tailings, it is also referred to as a “High Density Tailings Storage Facility” (HDTSF). The assessments indicate that the preferred approach is to store the tailings within embankments constructed of mine pre-strip material and within the adjoining waste rock landform, forming an integrated waste storage facility.

This report has been prepared to support the Environmental Review Document (ERD) submittal for the project. This report summarises the PFS Design, including the design basis, site conditions, TSF layout and storage characteristics, surface water management design, and engineering analyses performed for the TSF. The TSF Closure Design Report is included as a separate appendix within the ERD submittal.

Additional design and engineering work is underway to progress the TSF design to a Feasibility Study (FS) level. This process will result in further refinements to the design based on additional information.

2 BASIS OF DESIGN

The TSF design basis incorporates guidance from a range of documents, notably:

- DMIRS Guide to Departmental Requirements for the Management and Closure of Tailings Storage Facilities (TSFs) dated August 2015 as well as the Guideline for Preparing Mine Closure Plans dated November 2025. In terms of these documents, it is necessary to prepare the TSF landforms such that they will be safe, stable, non-polluting, erosion-resistant and self-sustaining, and their completed condition is acceptable to key stakeholders.
- Rio Tinto's Group Standard D5 Management of Tailings and Water Storage Facilities.
- Global Industry Standard for Tailings Management.

Key elements forming the Basis of Design (BOD) are as follows:

- Target site: Site "5H" which is located west of the proposed waste rock landform (WRL) which is northwest of the proposed processing plant location and the open pit.
- Nominal tailings generation rate: 10Mtpa.
- Total ore processed 283Mt over 28 years.
- Slurry consistency: 68% solids by weight for LS tailings and 14% solids by weight for the HS tailings.
- Particle size: 80% less than 106 microns for the LS tailings and 35 microns for the HS tailings.
- Settled average dry density:
  - LS tailings: 1.55 t/m^3
  - HS tailings: 1.36 t/m^3
- Starter embankment capacity: 2-years tailings storage capacity
- Operational Footprint area: 620Ha.
- Closure Footprint area: 717Ha.

Figure 1 shows a schematic of the ore processing and tailings storage process.

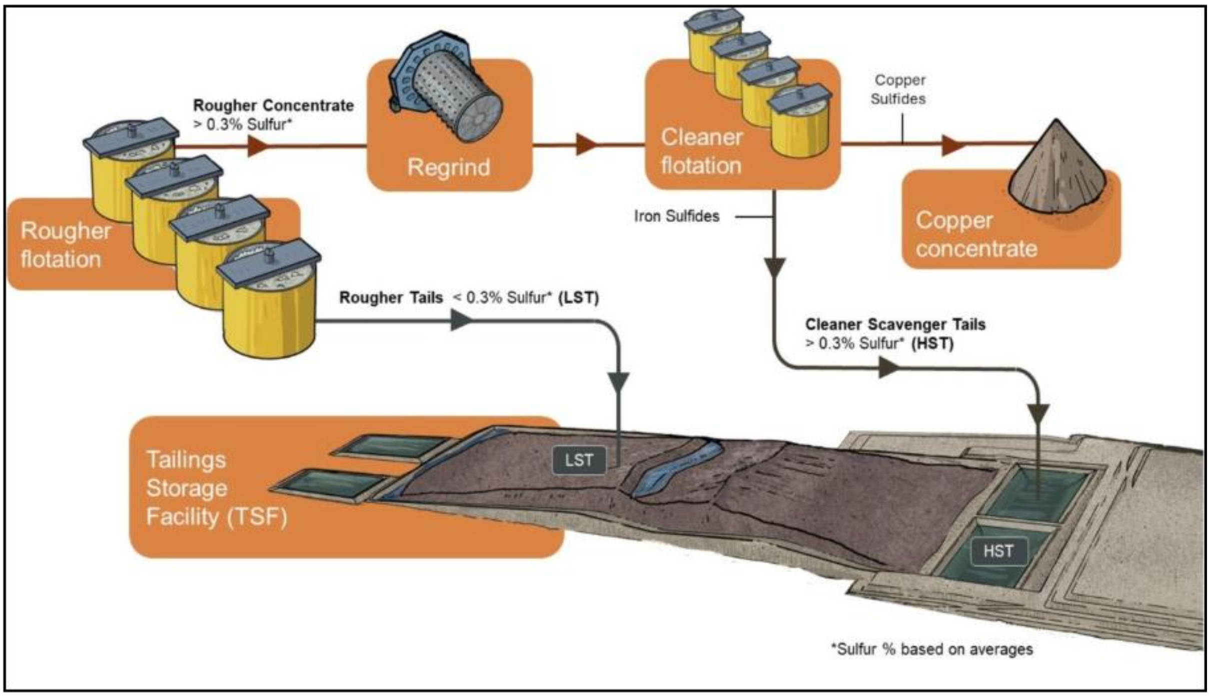

Figure 1: Schematic of ore processing

3 SITE GEOLOGY

3.1.1 OVERVIEW

The following site geology description is extracted from the Worley H3 Hydrogeological Assessment Report (Ref. 4), which incorporates findings from previous studies conducted by Mining One (2019) and Golder (2022).

The Winu study area is situated within the Anketell Shelf sub-division of the Canning Basin, which comprises of metasedimentary and igneous intrusive rocks.

The Winu project area is located along the eastern margin of the Anketell fault, which forms a distinct structural boundary separating the stratigraphic units of the Barnicarndy Graben (previously named Waukarlycarly Embayment by GSWA in 2021) in the west, to those of the Anketell Shelf in the east. Regional tectonic movement and development of the present-day Anketell Shelf and Barnicarndy Graben created structural, brittle deformations within the Proterozoic basement (metasediments). The brittle deformations are inferred to have enhanced permeability in both the fresh and weathered metasediments.

A broad scale bedrock geology and structural map of the north-eastern Paterson Province encompassing the Winu project area has been produced by RTX (2016).

A detailed geological description is provided in the "H3 Hydrogeological Assessment of the Winu Project" report, (Ref.4).

3.1.2 LITHOLOGY

There are six (6) key identified geological units at Winu; these are described in Table 1 from youngest to oldest, along with unit thicknesses based on drilling data acquired during the field campaigns.

Table 1 Lithological descriptions of the main geological units encountered at the Winu study area

Lithology	Thickness (m)	Description
Quaternary aeolian sand	0 – 10	Very fine to medium grained aeolian sand, typically reddish-brown, well sorted, minor silt.
Unconfined sandstone and silcrete	10 – 30	Silty sandstone with high silt content reducing with depth, quartz sand grains, colour ranges between white to pink, fine to coarse grained, poorly sorted, subangular to subrounded grains. Silcrete and hematitic silcrete (ferricrete) typically occur within the top 10 to 20 m of the interval, colour ranges between white to reddish brown.
Permian Mudstone	0 - 500	Very Fine, reduced to oxidised Mudstone, present to the west of the main Winu area. Regional interpretations of Czarnota et al. (2009), report the depth to basement to the west of the Anketell Shelf as generally less than 250 m, whilst the interpretation by Alavi (2013) notes a depth of up to 500 m. This unit pinches out to the east and is a discontinuous, low permeability unit, incorporating clay, claystone, diamictite, and conglomerate (fine-grained, matrix supported) facies.
Mafic intrusions within the Proterozoic metasediments	5 – 40	Black to grey, fine grained, slightly weathered to fresh, hornblende phenocrysts, micaceous/schistose in some intervals.
Granite and felsic intrusions within the Proterozoic metasediments	5 – 80	Moderately weathered to highly weathered granite/felsic intervals, typically occurring between 20 and 80 m BGL, light brown to tan, occurs as variably consolidated sandy silt comprising quartz and feldspar

Lithology	Thickness (m)	Description
		grains, with little to no biotite visible, and fines content reducing with depth as weathering decreases.
Proterozoic metasediment	> 300	Moderately weathered to fresh metasedimentary intervals, medium grained, dark grey, biotitic, Metasiltstones and Metasandstones

4 GEOTECHNICAL INVESTIGATION

4.1 SITE INVESTIGATION

The geotechnical site investigation for the HDTSF 5H site has been completed and laboratory testing is currently underway to support the design. Site investigation data indicates that the geologic stratigraphy underlying the 5H site is similar to a previously investigated TSF site immediately to the south of the HDTSF 5H site. The information presented below is therefore taken from the previous site investigation. The results of laboratory testing will be into the ongoing FS design as they become available.

4.2 FIELD AND LABORATORY TESTING RESULTS

Field and laboratory investigation work completed in the previous site investigation included:

- Rotary core drilling and sampling.
- Trial pit excavation and sampling.
- Cone penetrometer testing.
- Laboratory testing.

The laboratory testing included:

- Particle Size Distribution (PSD) tests with Hydrometer Analysis and Particle Density on 12 samples.
- Atterberg Limits test with Linear Shrinkage on 12 samples.
- Moisture density tests on four samples.
- Pinhole tests on three samples.
- Cation-anion exchange tests on three.
- 3-stage multistage constant head permeability tests in triaxial cell on four samples.
- 8-stage oedometer tests with 2 stages unloading on four samples.

- Triaxial consolidated undrained tests on two undisturbed and remoulded samples (four in total).
- Triaxial consolidated drained tests on two undistributed and remoulded samples (four in total).
- Shear box tests on four samples.
- Direct Simple Shear testing on two samples.
- Cyclic direct simple shear testing on two samples.
- Soil moisture characteristic testing with void ratio measurements on two samples

4.3 GEOTECHNICAL MATERIAL PARAMETERS

A programme of geotechnical investigation involving drilling, trial hole excavation, cone penetrometer testing and geophysical assessment as well as laboratory testing has been carried out. Material parameters from the investigation are indicated in Table 2 and Table 3 which summarise geotechnical properties as applied in the design of the embankments. These parameters will be verified and updated as appropriate based on the results of ongoing laboratory testing and further work performed in the FS design.

Table 2: Atterberg limits

Material		LL (%)	PL (%)	PI (%)	Observations
Aeolian sands		22	12	0-10	Zones of aeolian sands have sufficient clay content to show PI but generally the sands have no plasticity

Abbreviations:

LL: Liquid Limit, PL: Plastic Limit, PI: Plasticity Index

Table 3: Unit weight, permeability, consolidation and shear strength properties

Material		Unit weight (kN/m3)	Ky (m/s)	VWC	m_v (1/kPa)	Effective cohesion, C' (kPa)	Drained effective friction angle, f' (°)
Aeolian Sands		20	2.5E-05	0.33	6.25E-06	0	36.5
Cemented Sands		21	7.5E-06	0.30	1.80E-07	123	44
2A		19	5E-08	0.29	2.10E-05	0	35
2B		20	5E-08	0.31	3.21E-05	0	35
4A		21	1E-06	0.22	9.53E-05	0	38
4B		22	6E-06	0.22	9.10E-05	0	38
Tailings		18	1.7E-08	0.60	2.24E-04	0	32

Abbreviations:

K_y: Vertical hydraulic conductivity, m_v: Compressibility modulus

5 SITE HYDROGEOLOGY

Various hydrogeological assessments have been completed for the site, including by Worley (2024) and previously by Golder Associates (2020). The groundwater system at Winu is multi-layered consisting of an upper unconfined sandstone and a mudstone aquitard overlying a confined metasedimentary aquifer. The water table near Winu occurs around 50 to 60 m below ground level, near the base of the unconfined aquifer.

The region has low topographic relief and low groundwater gradients. The regional groundwater levels within the sandstone aquifer are presented in Figure 2. The overall groundwater gradients are to the northwest, towards the coast. However, due to pit dewatering and development, the open pit will form a groundwater sink post-closure and seepage losses from the TSF would flow to the pit lake.

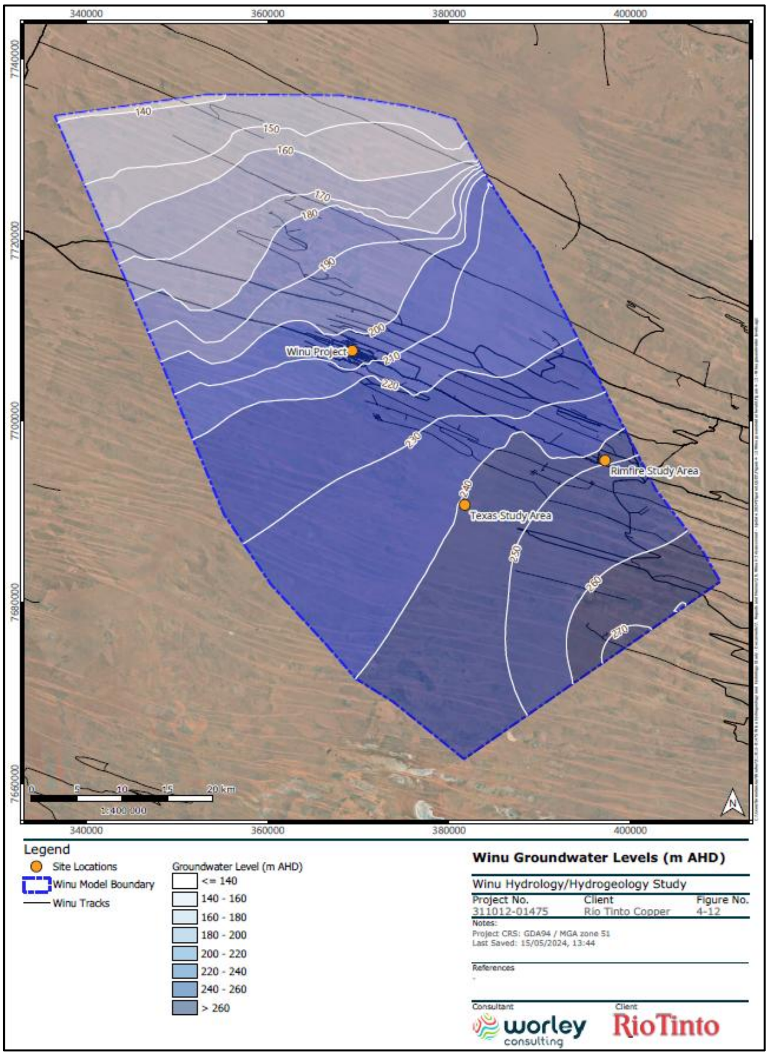

Figure 2: Winu Groundwater levels (m AHD)

6 SITE HYDROLOGY

The site's hydrology has been assessed by Worley (2024) and previously by Golder Associates (2020). The evaluation incorporates rainfall and evaporation data, as detailed in two key reports: the Worley Report (REP-HG-025 Winu H3 Hydrological Assessment, 2024) and the Golder Associates Report (20136763-001-R-Rev 0 Hydrological Design Basis – Winu Project, April 2020). These reports provide comprehensive records of average monthly and annual rainfall at Telfer Mine, as depicted in Figure 3, and outline the rainfall characteristics summarized in Table 4. Telfer is approximately 130km south southeast of the Winu project site.

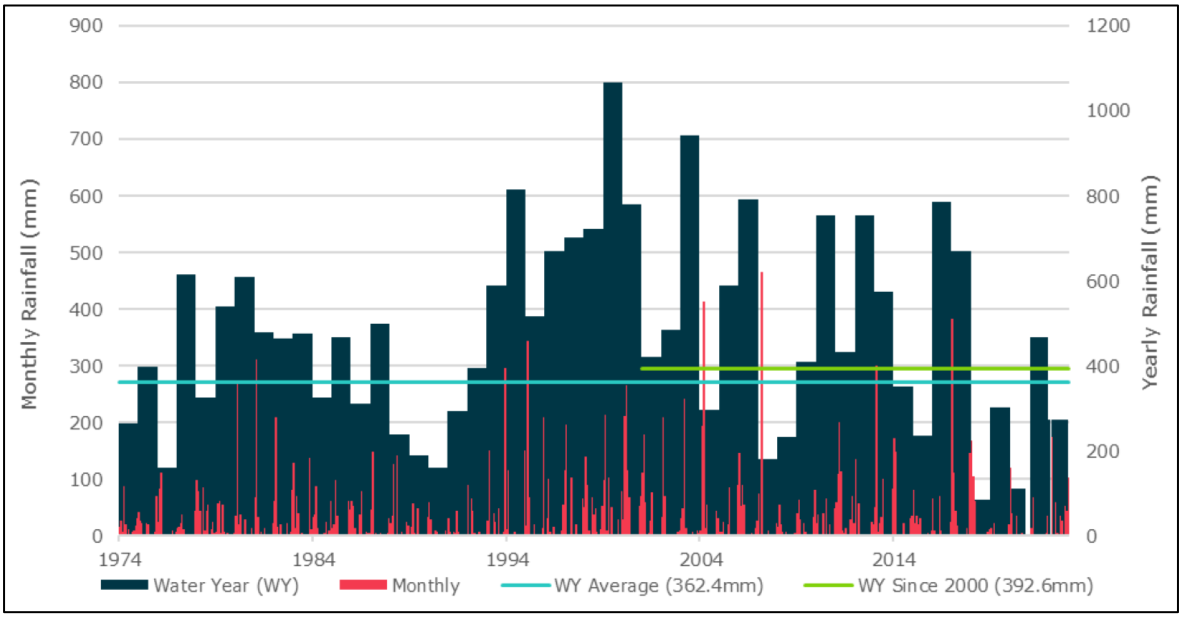

Figure 3: Average monthly and annual rainfall (by water year) recorded at Telfer Aero (Bureau of Meteorology identification no. 13030) (Worley, 2024c)

Table 4: Rainfall depths (mm) for selected durations and Annual Exceedance Probabilities (AEPs) at Winu

Duration	63%	50%	20%	10%	5%	2%	1%	0.5%	0.2%	0.1%	0.05%	PMP
15 min	15.7	18.1	25.6	30.6	35.6	42.1	47.0	53.4	63.0	70.7	78.7	260
30 min	22.2	25.6	36.0	43.0	49.9	58.8	65.7	74.5	87.7	98.3	109	370
1 hour	28.8	33.2	47.0	56.3	65.4	77.3	86.4	98.0	115	129	143	540
2 hour	35.5	41.2	59.2	71.5	83.6	99.8	112	128	150	168	187	680
3 hour	39.6	46.2	67.3	81.9	96.6	116	132	150	176	198	220	760
6 hour	47.2	55.8	83.8	104	124	153	176	199	236	265	296	970
9 hour	52.2	62.2	95.1	119	144	179	207	235	278	314	350	1030
12 hour	56.1	67.0	104	131	160	199	231	263	311	350	391	1100
24 hour	66.0	79.7	126	161	198	248	288	327	385	432	481	1290
30 hour	69.3	83.9	133	170	210	262	304	347	407	451	496	1440
36 hour	72.1	87.3	139	178	219	272	315	359	420	462	506	1580
48 hour	76.4	92.7	148	188	231	286	329	372	432	474	517	1860
72 hour	82.4	100	158	201	245	299	340	382	439	482	527	2340
96 hour	86.7	105	165	209	253	306	346	387	440	486	532	2620
120 hour	90.1	109	171	215	259	312	351	391	443	491	537	2760
144 hour	93.0	113	176	220	265	318	357	397	448	497	542	-
168 hour	95.6	116	181	226	271	325	366	404	455	504	548	-

7 TAILINGS DISPOSAL STRATEGY

The approach adopted in the design of the Winu TSF to safely contain HS and LS tailings is as follows:

- Both the HS and the LS tailings are to be stored separately within geomembrane lined impoundments formed using compacted borrow materials.
- The HS tailings are to be deposited sub-aqueously with the maintenance of a water cover over the tailings at all times to reduce oxidation of the tailings.
- The LS tailings will be deposited sub-aerially as a high density slurry.
- The LS tailings impoundment is equipped with an over-liner filter drainage system to promote consolidation of the deposited tailings and reduce hydraulic heads on the geomembrane liner.
- The TSF is located adjacent to the waste rock landform (WRL) so that there is an adequate source of cover materials in close proximity at closure.

8 TSF SITE LOCATION AND LAYOUT

Figure 4 shows the proposed TSF site location relative to the open pit. The site is west of the processing plant and WRL sites. Noteworthy features of the layout are as follows:

- The TSF comprises two LST Cells and two HST cells.
- The proposed filling sequence is to begin with HST Cell 1 to final elevation followed by LST Cell 2.
- The HS cells will be operated with a minimum depth of water of 1m (0.5m minimum at the discharge locations) at all times to reduce the potential for acid generation, including periods when the HS cells are being raised.

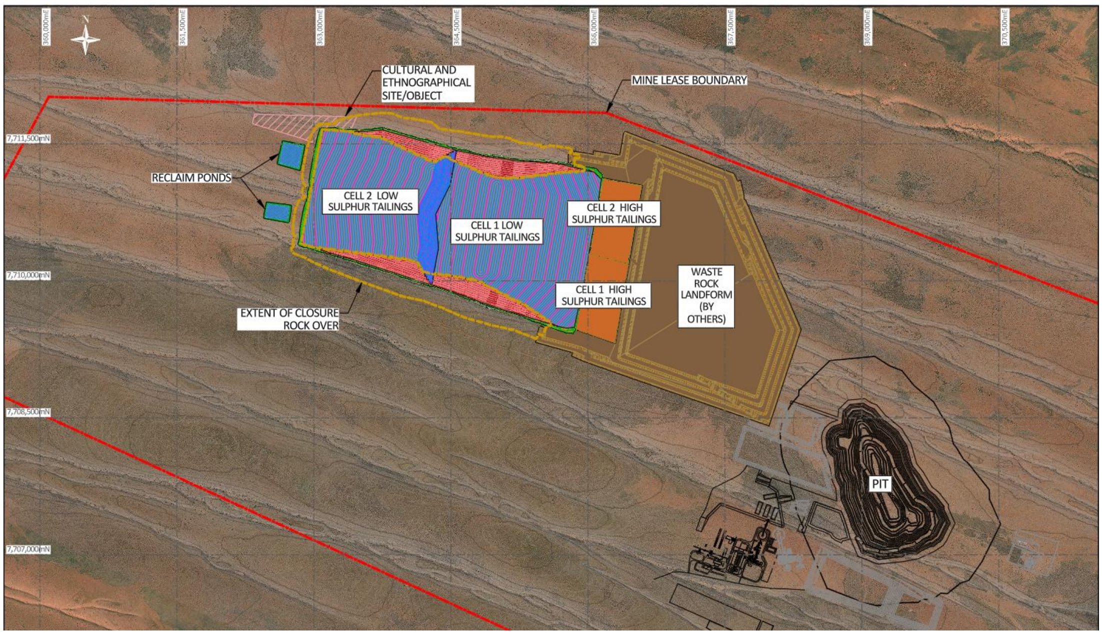

Figure 4: TSF site location relative to the open pit

9 PROPOSED LAYOUT, TYPICAL SECTIONS AND DETAILS

9.1 PROPOSED LAYOUT AND TYPICAL SECTION THROUGH HDTSF 5H

Figure 5 shows the proposed layout of HDTSF 5H and Figure 6 shows typical sections.

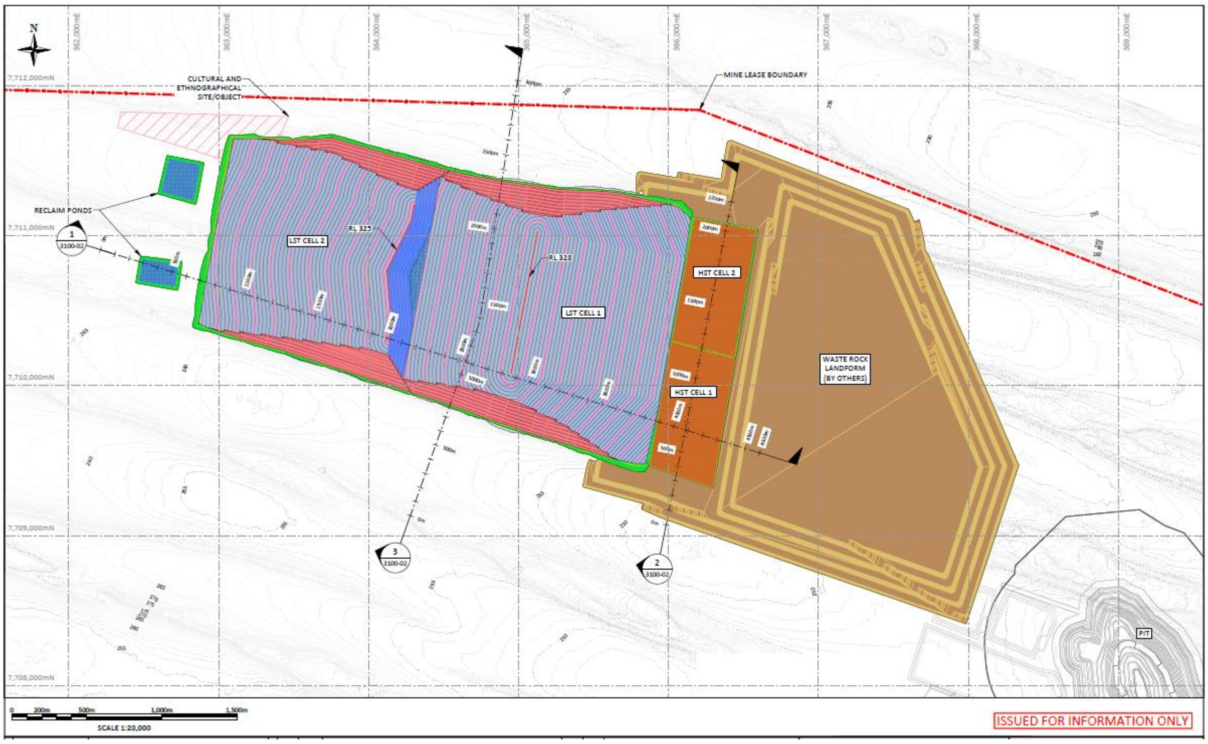

Figure 5: Proposed layout of HDTSF 5H

Notable features of the proposed deposition and construction sequence are as follows:

- Tailings are deposited into both LST Cells in one direction, from east to west.
- The LST Cell 1 north and south perimeter embankments are raised on an upstream basis and supported by a rockfill wedge.
- The LST Cell 2 east embankment (divider embankment with the future LST Cell 1) and part of the southern embankment are raised on an upstream basis.
- Embankments located adjacent to pond areas are raised on a downstream basis.
- The HST cells are flanked by the waste rock landform to the north, east and south and by LST Cell 1 to the west ensuring that the confining embankments are supported.

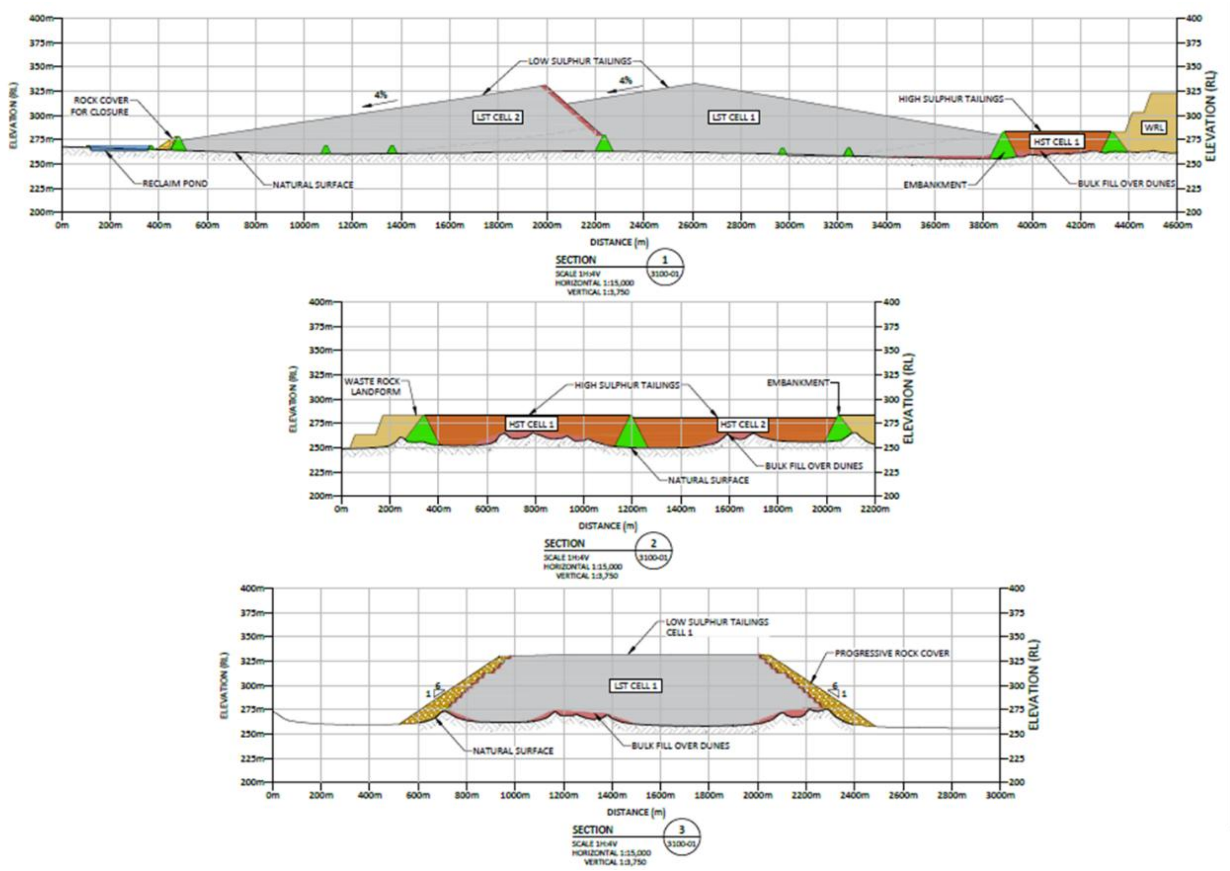

Figure 6: Typical sections through HDTSF 5H

9.2 TYPICAL PERIMETER EMBANKMENT CROSS SECTIONS FOR THE HST CELLS AND LST CELL 2

Figure 7 shows a typical embankment cross section through downstream-constructed external embankment to be applied to the HST cells, and part of LST Cell 2, and indicates the zoning of embankment materials. This cross section also applies to starter embankments. This configuration may be further refined during the FS stage as additional information is obtained regarding borrow material availability, suitability and foundation characteristics.

The embankment materials are as follows:

- Zone 4A which comprises selected finer grained pit waste material to be placed and compacted in 500mm thick layers. Each layer will have been moisture conditioned immediately before receiving the next layer and compacted by truck traffic as the next layer is hauled in.
- Zone 4B which comprises general pit waste material that will have been placed and compacted in 1m to 2m thick layers, with the agreed thickness dependent of the payload of the haul trucks.

- Zone 2A is Zone 4A material compacted in thinner layers.
- Zone 2B is selected fine grained material with Plasticity Index (PI) of not less than 15. Zone 2B materials occur in the top 10m of the material to be stripped on the open pit.

Detailed material specifications have been generated as part of the PFS design.

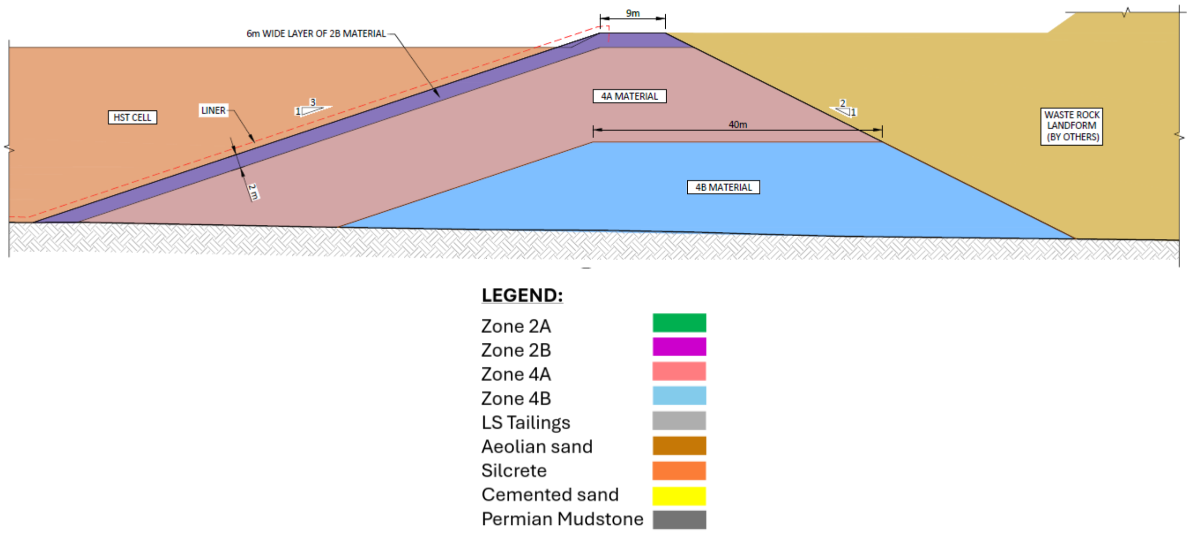

Figure 7: Typical downstream-constructed external embankment cross section

Figure 8 shows a typical internal embankment cross section between the HST cells and LST Cell 1 and Figure 9 shows a typical section through the full width of an HST Cell.

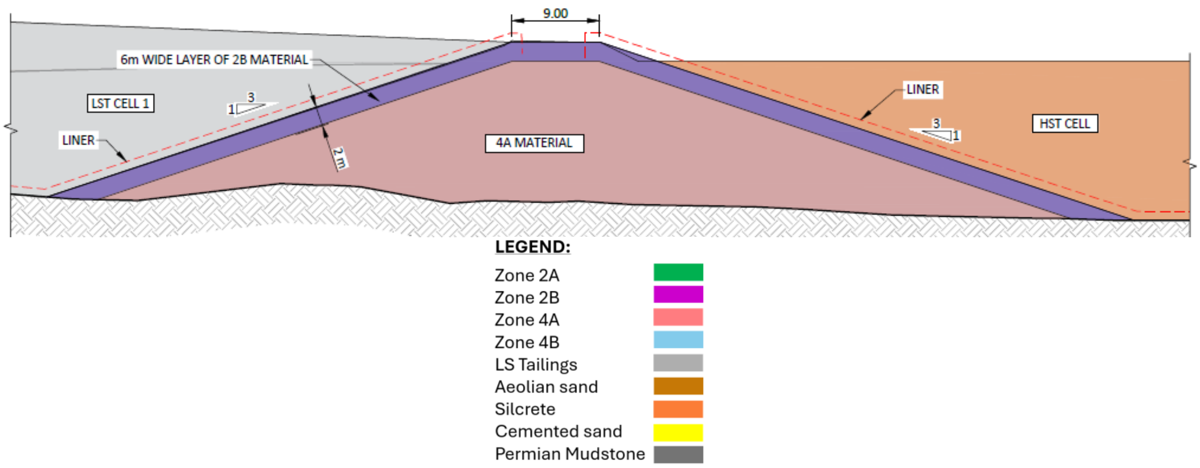

Figure 8: Typical internal embankment cross section between LS and HS cells

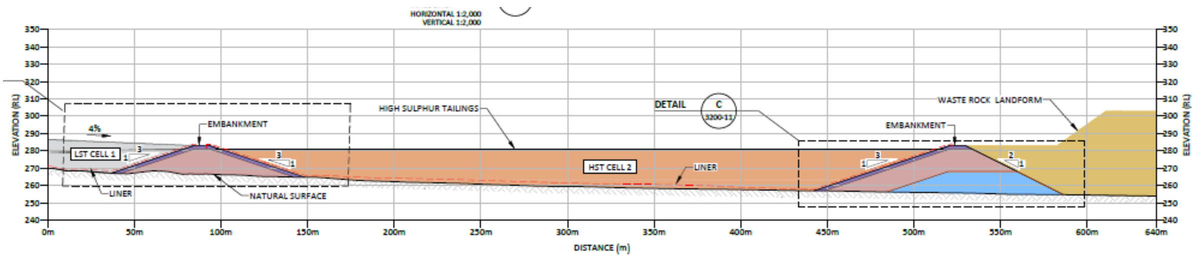

Figure 9: Typical section through the HS cell and WRL

As presented in the prior figures, geomembrane liner will be placed within the HST Cells and will mitigate seepage from the HST cell entering the WRL.

9.3 TYPICAL SECTION THROUGH LST CELL 1 AND THE DIVIDER EMBANKMENT WITH LST CELL 2

Figure 10 shows a typical cross section through the upstream-constructed external embankments located along the north and south sides of the LST Cells. A notable feature of the section is the rockfill wedge that is formed progressively as the TSF is raised. This forms the closure profile for the TSF, allowing progressive rehabilitation of these outer slopes during operations.

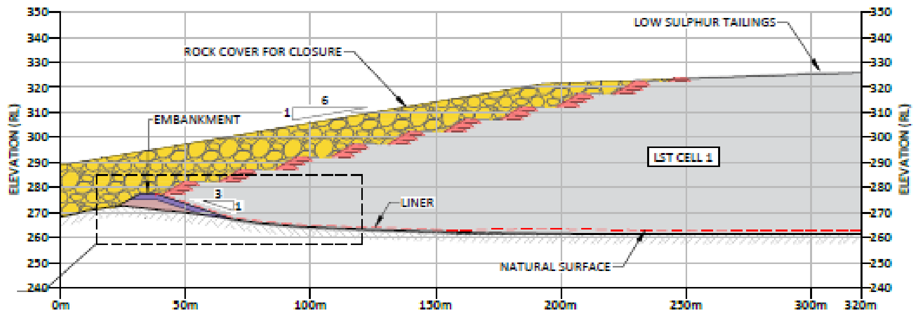

Figure 10: Typical section through upstream constructed embankment

Figure 11 shows the LST Cell 2 starter embankment and upstream lift arrangement dividing the two LST cells.

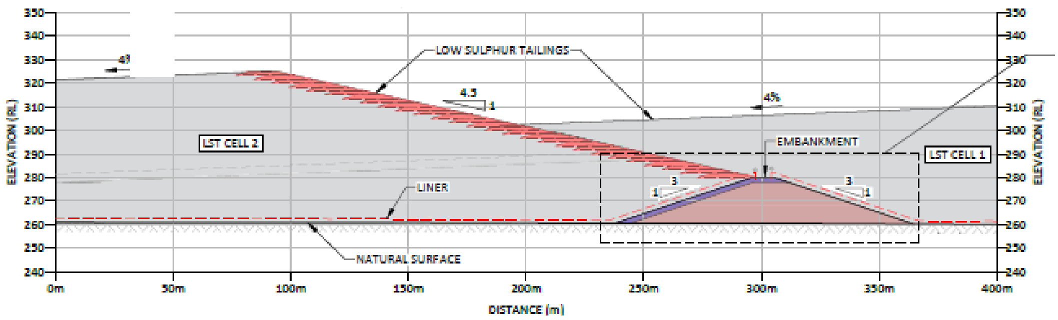

Figure 11: Typical section through the LS 1 & 2 dividing embankment

9.4 TSF CLASSIFICATION

The TSF may be classified as follows:

- DMIRS classification: Category 1 (high hazard) (DMP, 2015).
- ANCOLD classification: High C (ANCOLD, 2022).
- Rio Tinto D5 standard: Major (Rio Tinto, 2017).
- GISTM: High (GISTM, 2020)

The above classifications have been used to define geotechnical and hydrotechnical design as set out in the basis of design.

9.5 STAGE-CAPACITY CHARACTERISTICS

The stage capacity characteristics of the cells are summarised in Figure 12 which shows the planned elevations of the LST and HST cells with time subject to further refinement based on operational parameters.

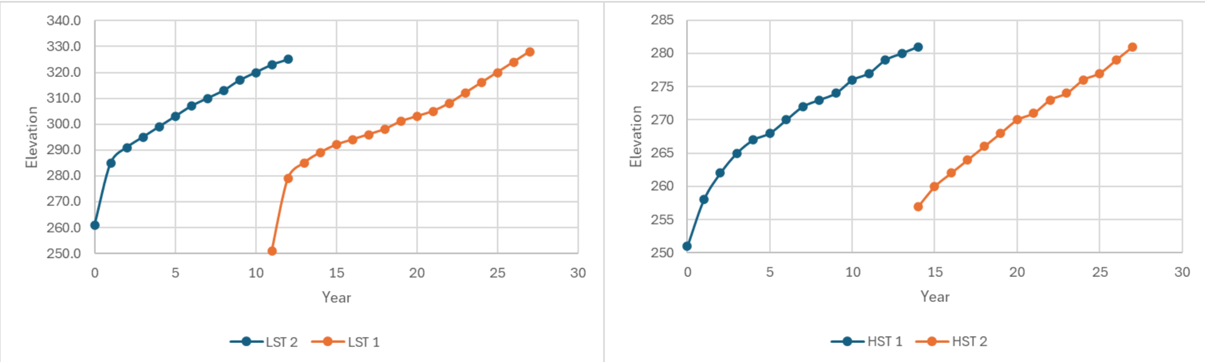

Figure 12: Stage capacity characteristics of the cells

9.6 TSF LINER SYSTEM

9.6.1 LINER REQUIREMENTS

Liner will be placed in the HST Cells to maintain a water cover and to limit the potential for surface and groundwater contamination by acidic tailings liquor. Liner will be placed in the LST Cells to conserve water as well as to limit groundwater contamination potential. The liner systems have the following performance requirements:

- Capable of accommodating substrate movements induced by consolidation settlement and earthquakes.
- Sufficient chemical and UV resistance

The liner placed in the LST cells must also be capable of accommodating over-liner filter drain construction activities, in combination with the use of over-liner protective materials and limits on construction activities defined in the specifications.

Liner alternatives that have been considered include:

- High density polyethylene (HDPE) and its derivatives, linear low-density polyethylene (LLDPE) and very and very low-density polyethylene VLDPE.
- Geosynthetic clay liners (GCL)
- Bituminous geomembranes (BGM).

Liner chemical compatibility testing has been carried out by a specialist laboratory, TRI Australasia, over a four-to-six-month period of exposure to the HST liquor at elevated temperatures and it has been found that the HDPE and LLDPE will be suitable for application in the HST Cells as well as the LST Cells. BGM would not be suitable for the HST Cells but would provide acceptable chemical resistance for use in the LST Cells.

Liner evaluations have progressed through the PFS stage and are continuing in the FS stage of the project. Through this work, for the applications at Winu it has become evident that:

- HDPE or equivalent with appropriate subgrade would be most suitable for use in the HST Cells. It is able to accommodate the settlements of embankments, particularly at the corners, and has the required chemical resistance to the HST liquor.
- HDPE or equivalent liner with appropriate subgrade would be most suitable for the LST Cells.

Additional liner testing is proposed for the FS stage of the project to verify the preferred liner type and select specific liner products for use in the Winu TSF.

9.7 FILTER DRAINAGE TO PROMOTE LS TAILINGS CONSOLIDATION

To promote consolidation of the LS tailings in the long term and reduce the hydraulic heads on the liner, a filter drainage system has been incorporated above the liner. Figure 13 shows the layout of filter drainage pipework laid above the liner in the LS cells. The drainage pipes drain to drainage sumps in the topographic low points in the floor of each of the LS cells. Above the drainage pipes a continuous sand filter layer is placed over the entire cell floors. Work is currently underway as part of the FS stage of design to further refine the filter drain design.

Figure 14 shows typical sections through the filter drainage pipes as well as Figure 15 shows typical sections through the collection sump. The sump will be equipped with a pump which will lift drainage water out of the sump and discharge this into the pond area from where the water will be pumped to the processing plant along with the reclaimed supernatant water.

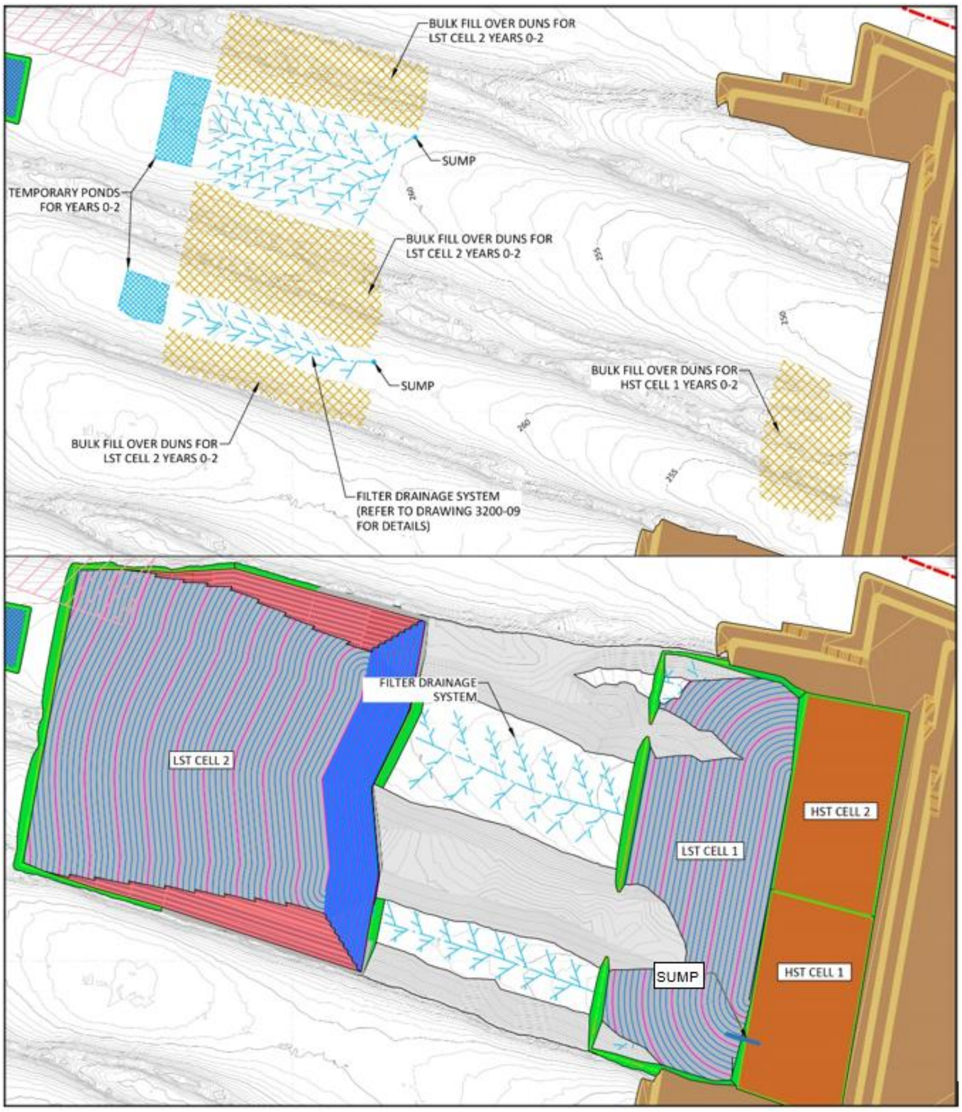

Figure 13: Layout indicating the locations of filter drainage blankets

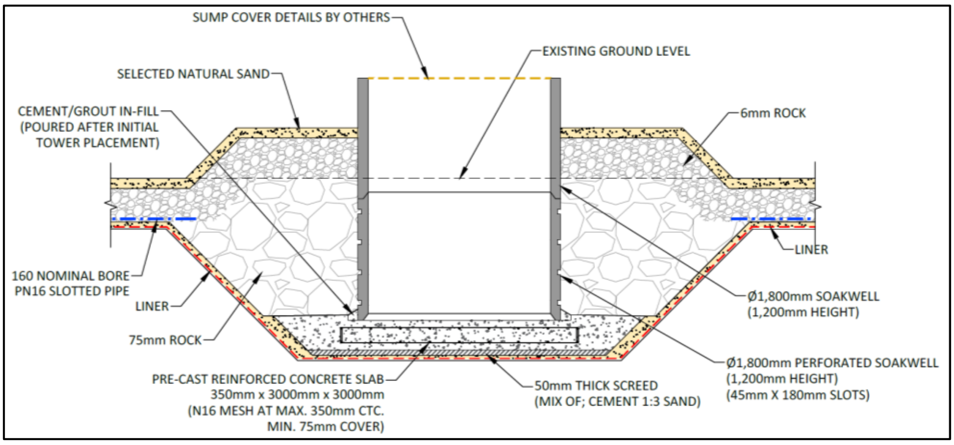

Figure 14: Sections through filter drain sump

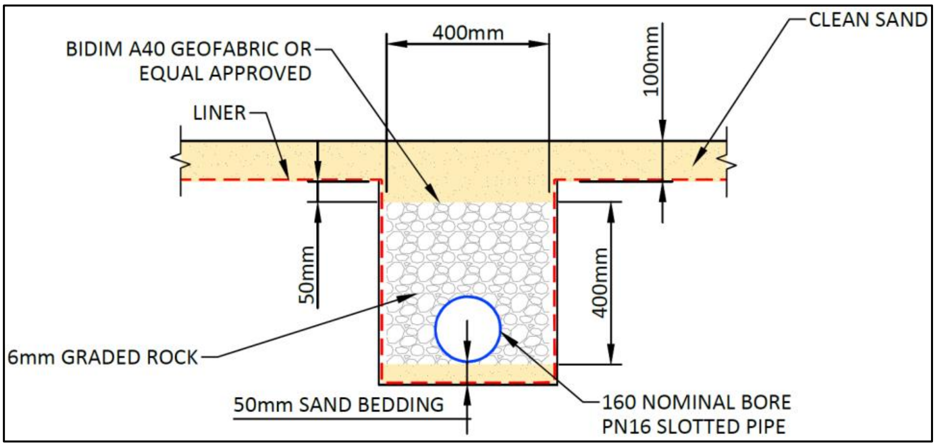

Figure 15: Section through over-liner filter drainage system

Figure 16 shows a section through the access platform and indicates the locations of the drainage sump. The sump is raised with each lift of the embankment.

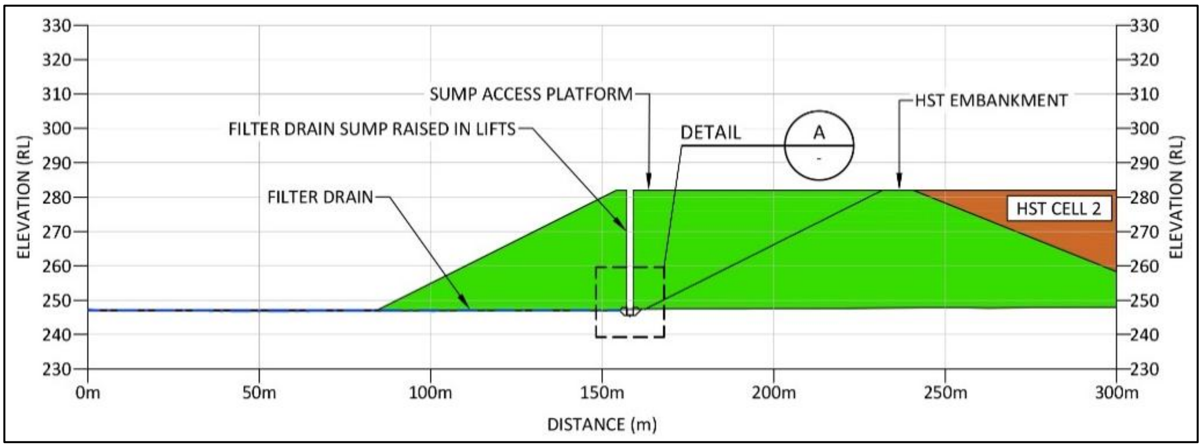

Figure 16: Section through filter drain collection sump and access platform

No filter drainage is proposed for the HS tailings as these are to be deposited sub-aqueously and a permanent cover of water is to be maintained over the tailings throughout operations.

9.8 SEEPAGE AND CONSOLIDATION MODELLING

Coupled seepage and consolidation modelling of the TSF has been conducted to estimate potential seepage rates in the event of liner degradation as well as to verify the adequacy of the drain design above the liner in the LS cells. Figure 17 shows the locations of cross sections applied in finite element modelling of seepage regimes. Figure 18 shows the predicted seepage regimes at the end of Cell 2 deposition on a section through LST Cell 2 in a north/south orientation. Modelling indicates that the high sulfur tailings have a low seepage potential due to their fine grind and low permeability

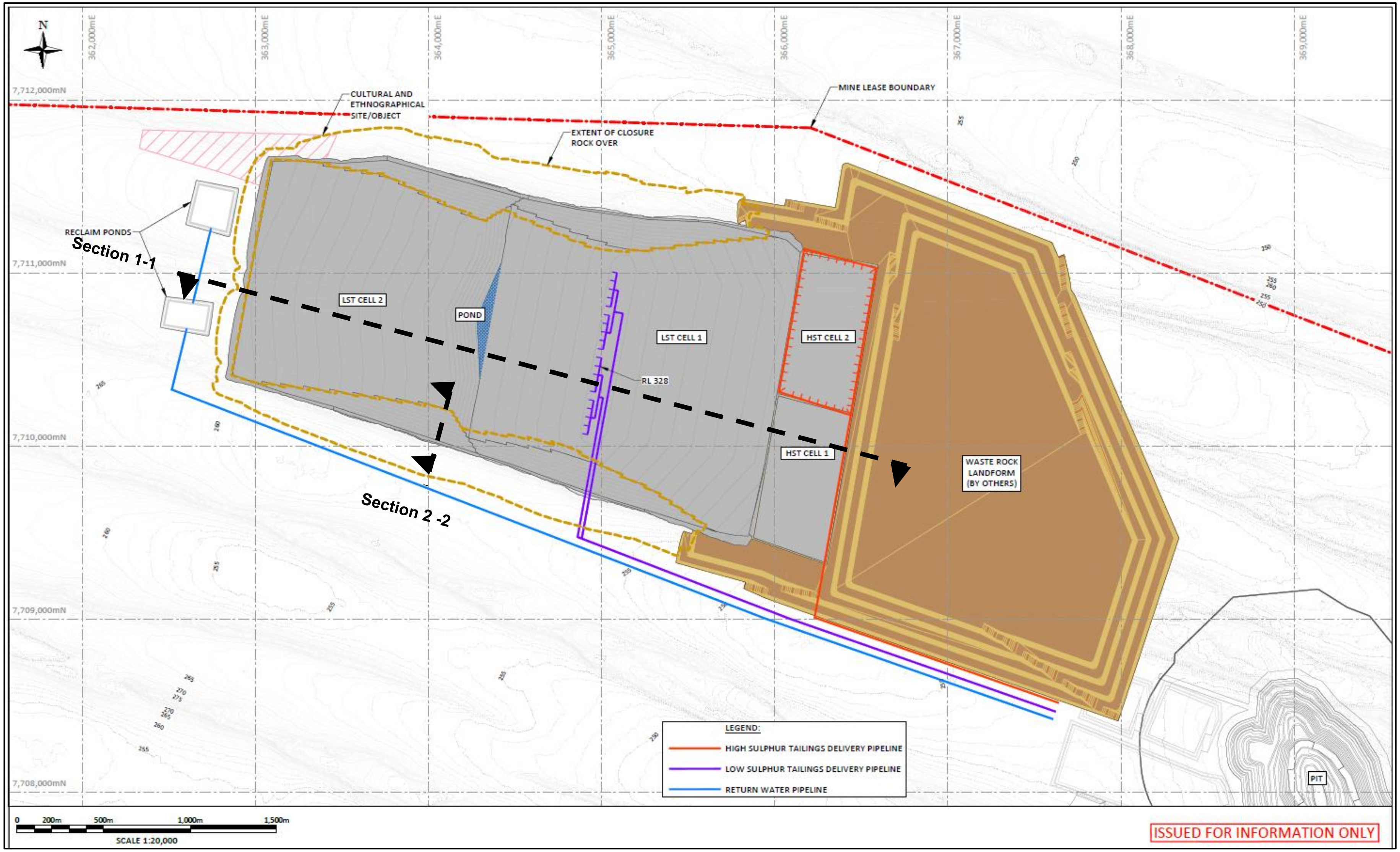

Figure 17: Locations of seepage analysis cross sections

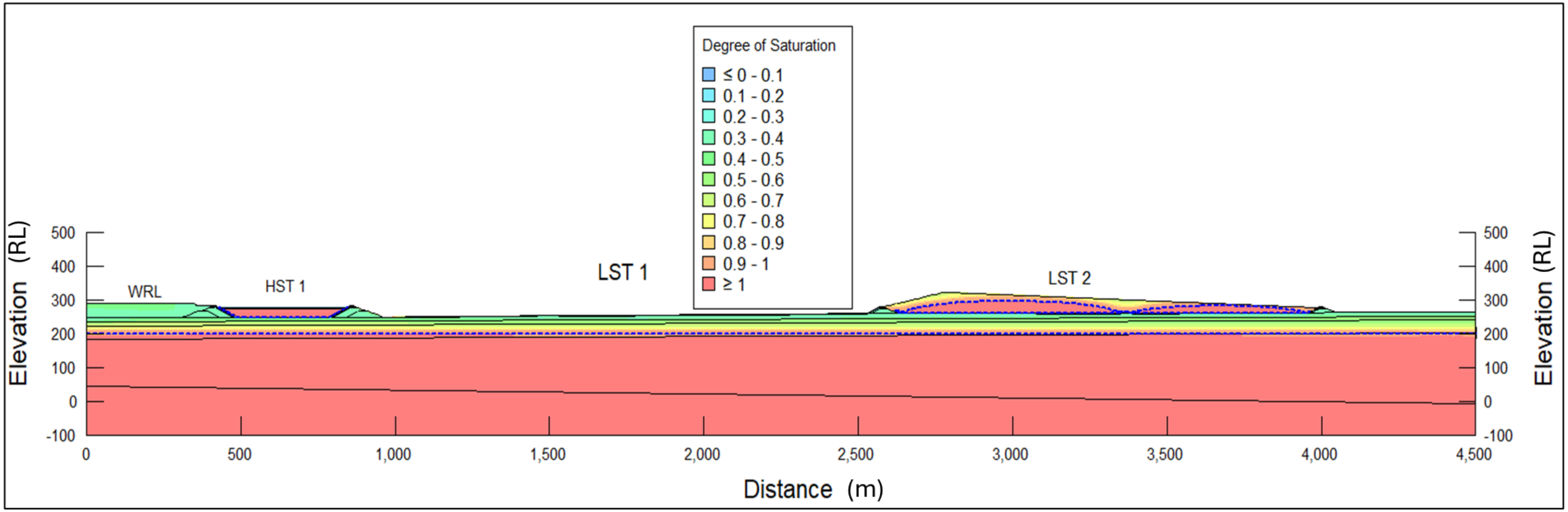

Figure 18: Section 1-1 Operation stage – degree of saturation

Figure 19 shows the seepage regimes in the upstream lifted perimeter embankment in Section 2-2. It is evident that the drainage system will be effective in controlling the seepage regimes and reducing the head on the liner systems.

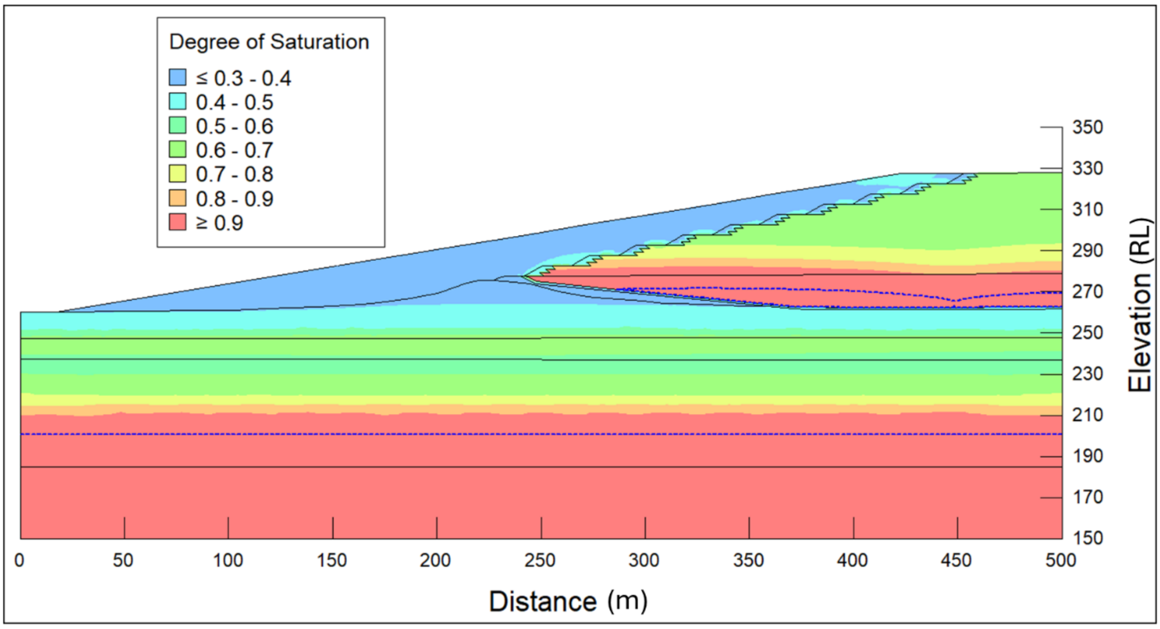

Figure 19: Section 2-2 Operation stage – degree of saturation

9.9 TAILINGS AND EMBANKMENT CONSOLIDATION SETTLEMENT MODELLING

Coupled seepage and consolidation modelling of the LS cells indicates that, because of the provision of an over-liner filter drain across the base of the LS Cells, the LS tailings will consolidate as they rise so that at the end of operations the only zone with residual consolidation occurs in the pond areas

The results indicate that the embankments and foundations will consolidate up to 0.2m.

Modelling of the HST cells during and up to the end of operations indicates that consolidation of the embankments and foundation materials should be up to 0.5m.

9.10 EMBANKMENT SLOPE STABILITY

Limited equilibrium stability analyses of the TSF outer slopes have been conducted for Sections 1-1 and 2-2, with material parameters sourced from geotechnical testing results.

Slope stability analyses were performed for the outer slopes of the HST and LST embankments considering an E-W longitudinal section through the full facility (Section 1-1) and for LST Cell 1 at the maximum location of the upstream raise (Section 2-2). The material parameters used in the analyses were sourced from the results of the geotechnical investigations.

The analyses evaluated the stability of the facility throughout the life of the facility as follows for Section 1-1:

- HST Embankment prior to the placement of LST Cell 1 (Year 12 of operations)
- Eastern face of LST Cell 2 prior to the placement of LST Cell 1 (Year 12 of operations)
- Western face of LST Cell 2 at the end of operations (Year 28 of operations)

The Section 2-2 analyses considered the stability at the end of filling of the facility at locations along the entire face of the cell.

Analyses have been conducted for the conditions as stipulated by Rio Tinto's D5 standard and set out in Table 5

Table 5: Minimum Factors of Safety for Embankment Stability

Loading condition	Minimum factor of safety
Long term, drained and/or undrained	1.5
Short term, construction loading	1.3
Post-seismic	>1.0

Table 6 provides a summary of the factors of safety determined in the stability modelling. All factors of safety exceed the required minima.

Table 6: Summary of slope stability factors of safety

Item	Section	Failure surface type/location	Peak or post seismic analysis	Factor of safety	Minimum allowable factor of safety
1	1-1	HST 1	Peak through embankment	2.42	1.5
2		LST 2 embankment before LST 1 commissioned	Peak above saturated zone	1.77	1.5
3		LST 2 starter embankment before LST 1	Peak through embankment	2.42	1.5
4	2-2	LST 1 lower bench	Peak	1.78	1.5
5			Pseudo static	1.31	1.3
6		LST 1 multiple bench	Peak	1.94	1.5

Item	Section	Failure surface type/location	Peak or post seismic analysis	Factor of safety	Minimum allowable factor of safety
7			Pseudo static	1.43	1.3
8		LST 1 full slope	Peak	2.03	1.5
9			Pseudo static	1.42	1.3
10		LST 1 full slope wedge	Peak	3.68	1.5
11			Pseudo static	2.78	1.3

9.11 DYNAMIC ANALYSIS

A dynamic analysis assuming a maximum credible earthquake (MCE) representative of the Winu project area has been carried out using the finite difference software FLAC version 7. Horizontal and vertical displacements of the HST Cell embankments are predicted to be of the order of 10cm and 15cm, respectively. Settlements in the HS tailings are predicted to be of the order of 30cm as water is released by the liquefied tailings.

Horizontal and vertical displacements of the upstream-constructed LS tailings perimeter embankments are predicted to be approximately 0.7m. The LS tailings within the structural zone of the embankment do not liquefy due to their dilatant nature as evidenced by the laboratory shear testing programme.

The predicted settlements will not significantly impact the stability of the TSF.

9.12 GEOTECHNICAL PIPING (INTERNAL EROSION) ASSESSMENT

A geotechnical piping (internal erosion) assessment has been carried out to assess the probability of developing this mechanism of failure. The assessment has been conducted for sections at the locations indicated in Figure 20.

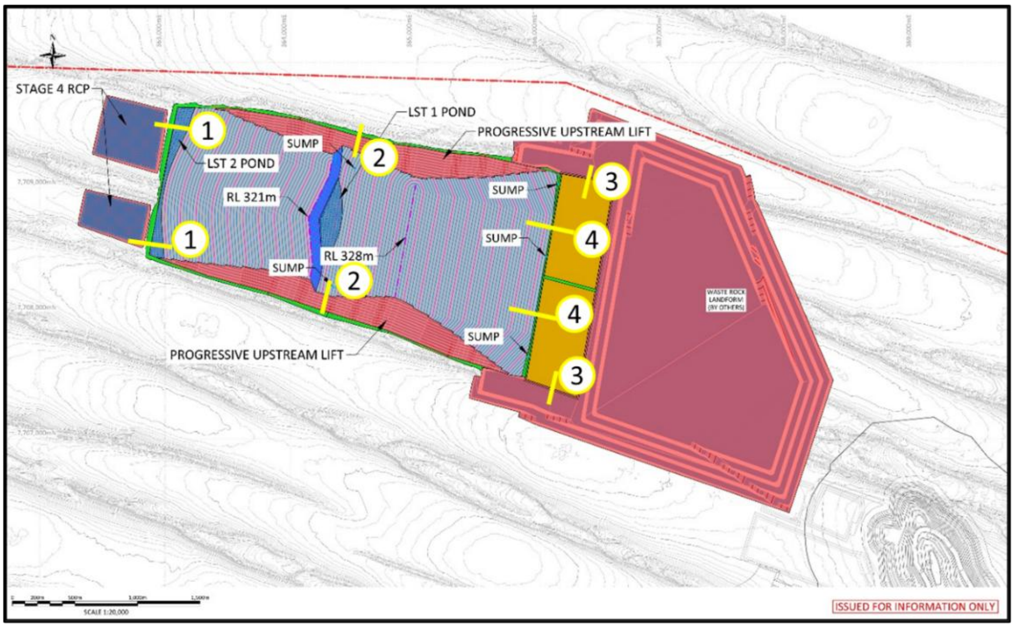

Figure 20: Locations of embankments that will retain tailings and free water

The analyses indicate that the TSF meets the ANCOLD 2022 Guideline on Risk Assessment (2023) safety and environmental risk tolerance levels.

9.13 SLURRY DELIVERY AND DISCHARGE ARRANGEMENTS

Figure 21 shows the layouts of the delivery and return water pipelines at various stages of the operation of the TSF. Magenta lines are LS tailings; red lines are HS tailings and blue lines are return water pipelines. Pipeline design is being performed by others in coordination with WWL.

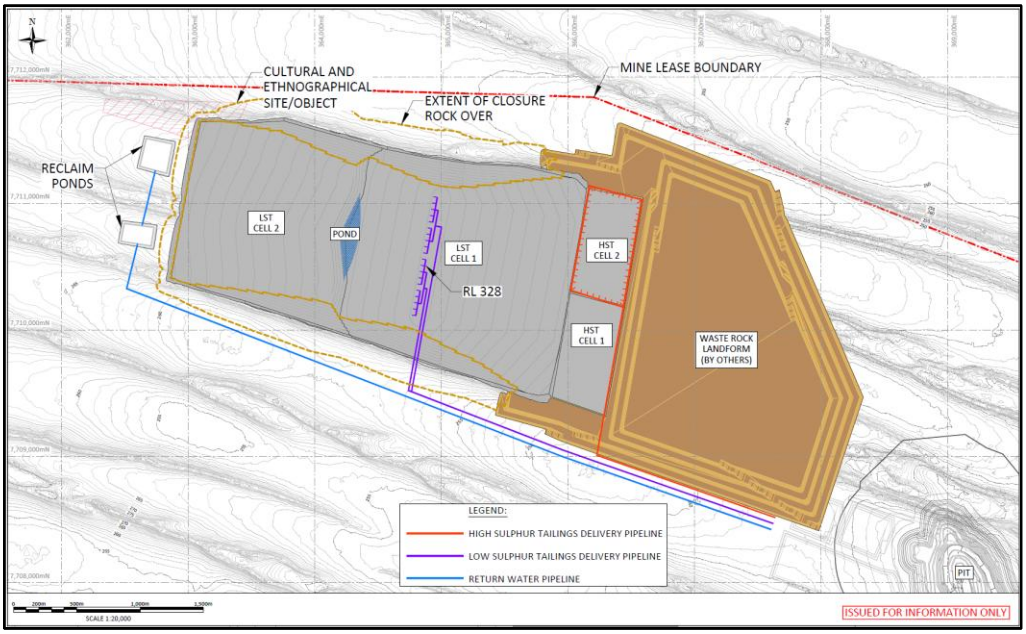

Figure 21: Layout of delivery pipelines

9.14 POND DECANT ARRANGEMENT

Decanting of water from the TSF cells as well as from the reclaim ponds will be carried out using pump systems with floating suctions.

10 SURFACE WATER MANAGEMENT

All surface water from the crest of the embankments will be directed into the TSF cells. This will reduce the risk that runoff water from the outer slopes of the embankments contacts tailings.

Water on the outer slopes of the external embankments will be captured in catchment paddocks around the toes of the TSF embankments and evaporated. These paddocks will ensure that sediment eroded from the outer slopes of the embankments are captured and controlled. The paddock embankments have been sized to ensure that water from the surrounding natural catchments are not able to flow into the catchment paddocks.

Runoff from the waste rock landform slope will be captured and evaporated in the void between the outer slope of the TSF embankment and the slope of the waste rock landform. This will be achieved using a series of paddock cross-bunds connecting the two slopes.

10.1 TSF WATER BALANCE

A GoldSim-based water balance has been developed for the TSF with the objective of determining the water make-up rates. The balance takes into consideration the following inflows:

- The slurry pumped to the TSF, assuming that sufficient water is available for processing.
- Rainfall, based on a daily historical rainfall record of 98 years provided by Golder Associates.

Outflows have been estimated on a daily basis from:

- Evaporation rates as provided by Golder Associates.
- Evaporation on pond and beach areas with appropriate pan evaporation correction factors.
- Pumped return to the processing plant.
- Estimated entrained water with the sedimented tailings.

Storage volumes and associated areas have been determined from projections of the deposited beach and the topography of the TSF cells.

The water balance has considered the use of evaporation inhibitors, which were calculated to provide a 35% and a 40% reduction in evaporation loss, if placed in the HST Cells or the

Reclaim Ponds, respectively. The use of evaporation inhibitors will be further refined in the FS stage of the project.

The water balance predicts an annual average surplus of 4.36 Gl of water that will be available for pumped return to the processing plant. More detailed site-wide water balance analyses have been performed that account for varied Open Pit dewatering rates with time over the life of mine.

10.2 STORMWATER CONTROL ON THE TSF

The Rio Tinto D5 Standard for the design and operation of tailings and water management facilities requires that spillway capacity be provided to the TSF. Hydrological modelling and analysis have been carried using the following approach:

- Hydrographs of PMP storms have been prepared based on information available on the web sites of Australian Bureau of Meteorology (BoM) and Innovyze;
- The hydrological model has been constructed in XPSWMM.
- Hydrological simulations have been carried out and flood levels and flows have been estimated.
- Rockfill detention bunds have been incorporated on decommissioned tailings surfaces and within spillway sections to detain flood flow and control the flood peaks.

The following scenarios have been assessed:

10.3 SCENARIO 1 OPERATION

During Scenario 1, only LST Cell 2 and HST Cel 1 are in operation. The confining embankments for these two cells will be maintained at an elevation able to store the 1:5000 72 hour AEP storm. This storm water will be confined between the dunes in the yet to be developed LST Cell 1 area. The layout of the TSF and a section through the TSF towards the end of Scenario 1 are indicated in Figure 22. Supernatant water and storm water reaching the western perimeter of LST Cell 2 will be discharged through spillways to the reclaim ponds. Water on HST Cell1 will be retained on the cell. Water accumulating in the future LST Cell 1 will be retained and confined by the dunes and the LST Cell 2 and HST Cell 1 embankments as well as the waste rock landform.

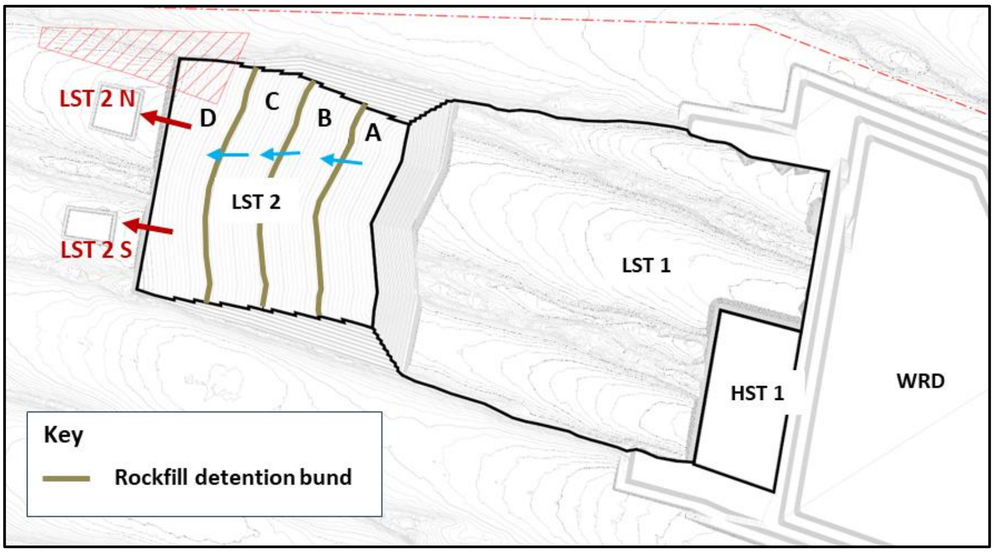

Figure 22: Scenario 1

10.4 SCENARIO 2 OPERATION

Scenario 2 commences when LST Cell 1 is commissioned. On commencement of Scenario 2 rockfill detention bunds will be constructed across LST Cell 2 to detain stormwater flowing down the beach and regulate the spillway outflow rates as indicated in Figure 23 and Figure 24.

In the flood modelling the following assumptions are made:

- The 1: 5000 72 hr AEP is retained on the HST cells as well as LST Cell 1
- The 1: 5000 72 hr AEP is decanted off LST Cell 2 via spillways. Two spillway structures will be provided each with the capacity of decanting the detained flood to the reclaim ponds.

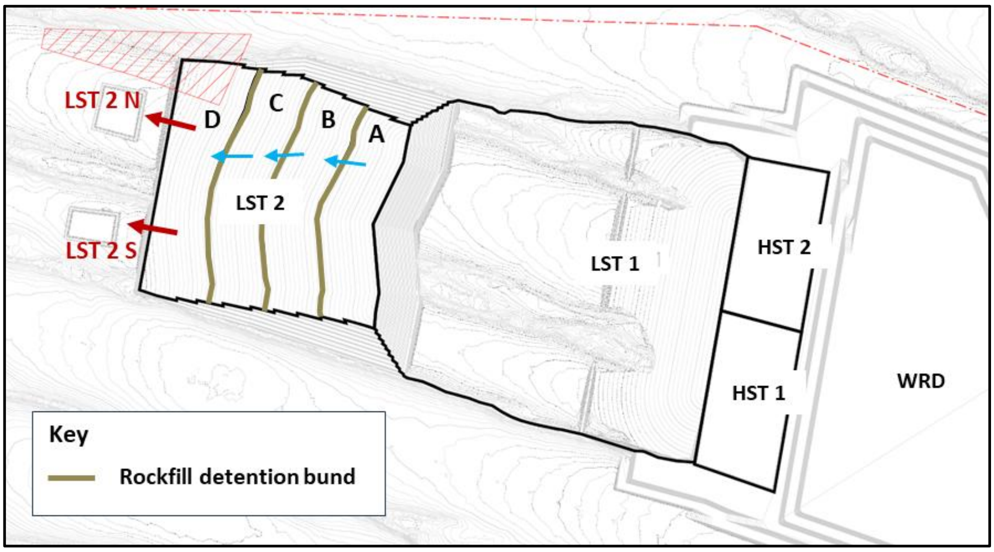

Figure 23: Scenario 2 operation

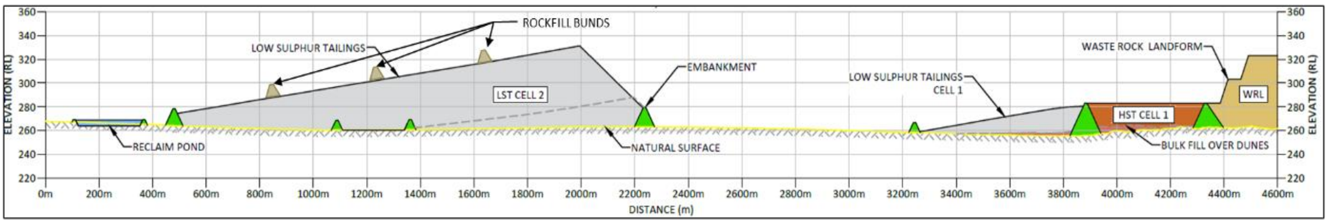

Figure 24: Section 2 – Cross section

10.5 SCENARIO 3 OPERATION

During Scenario 3, LST Cell 2 is dormant with temporary detention bunds and LST Cell 2 is in operation. As LST Cell 1 rises closure measures can be progressively constructed on the eastern slope face. As part of these closure measures detention bunds with segments of rockfill to allow flow through will be formed across the area as indicated in Figure 25 and Figure 26 In modelling the floods the following assumptions have been made:

- The 1: 5000 72 hr AEP is retained on the HST cells as well as LST Cell 1
- The 1: 5000 72 hr AEP is decanted off LST Cell 2 via a spillway. Two spillway structures will be provided each with the capacity of decanting the flood to the reclaim ponds.

The locations of the spillways are indicated in Figure 25.

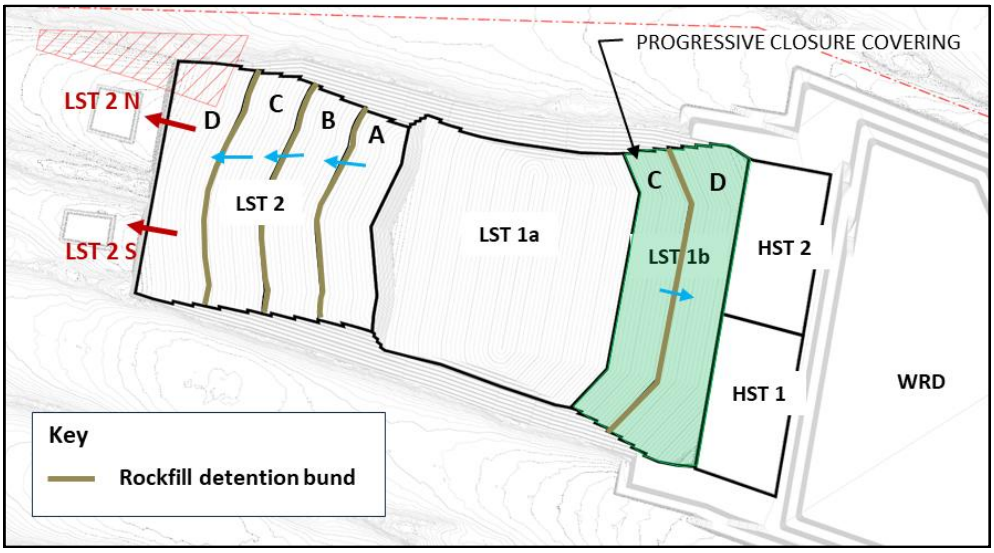

Figure 25: Scenario 3 spillway locations

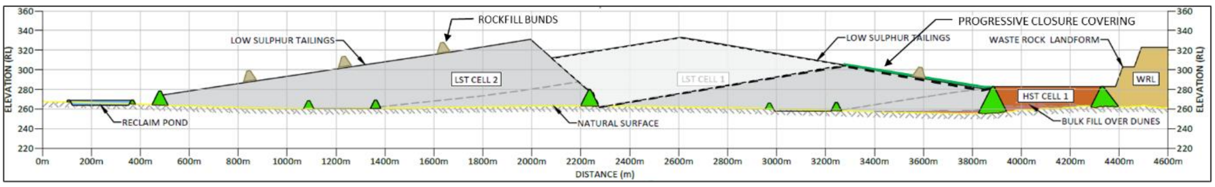

Figure 26: Section 3 – Cross section

10.6 SCENARIO 4 OPERATION - ONE YEAR BEFORE CLOSURE

During the last year of operation:

- The 1: 5000 72 hr AEP will be retained on the HST cells as well as LST Cell 1a
- The 1: 5000 72 hr AEP will be decanted off LST Cell 2 via a spillway. Two spillway structures will be provided each with the capacity of decanting the flood.
- The 1: 5000 72 hr AEP will be decanted off LST 1b via two spillways located to the north over the extension to the northern waste rock landform, and to the south over the southern extension to the waste rock landform.

The locations of the spillways are indicated in Figure 27. Figure 28 shows a section through the TSF.

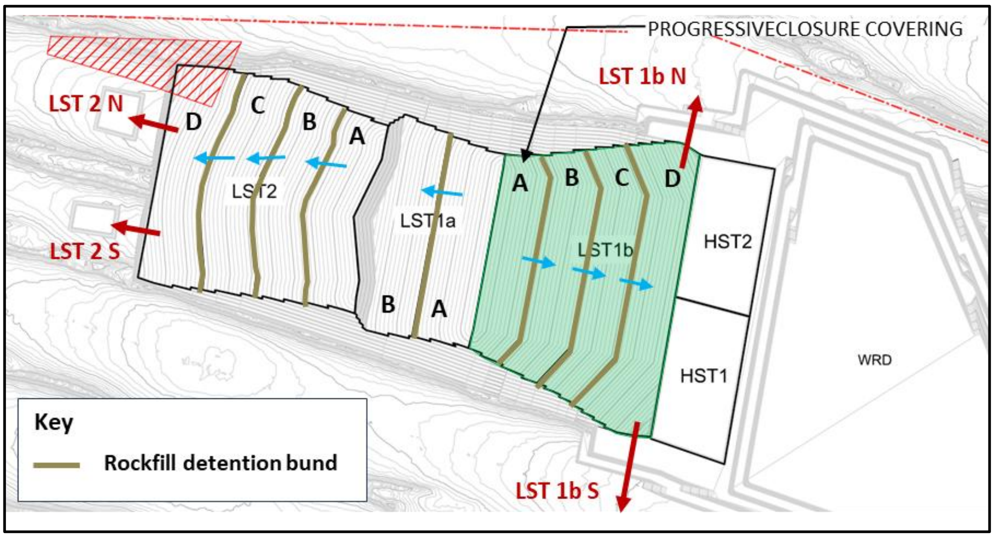

Figure 27: Scenario 4 spillway locations

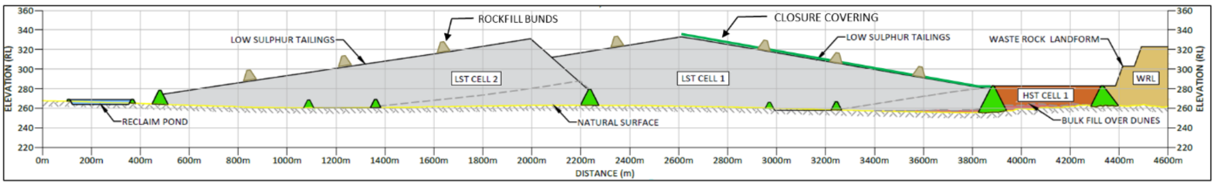

Figure 28: Scenario 4 – Cross section

10.7 FLOOD ROUTING

Flood routing of the 1:5,000 AEP and the Probable Maximum Flood (PMF) have been carried out using the programme XPSWMM which is based on the kinetic wave analysis approach. The programme evaluates a wide range of storm intensities, durations and annual exceedance probabilities (AEPs) and models infiltration over the flood duration. The principal output from the storm routing is the outflow hydrograph for each modelled catchment and this allows sizing of the spillway structures. Storms that have been considered for the PMP are:

- Ten potential rainfall hydrographs sourced from the Bureau of Meteorology (BOM) for a PMP storm event of 72 hours duration producing a total rainfall depth of 2340mm.
- Ten potential rainfall hydrographs sourced from BOM options for a PMP storm event of 120 hours duration producing a total rainfall depth of 2760mm.
- Flood routing for each scenario has been used to size and design spillways and verify freeboard adequacy.

10.8 SURFACE WATER DISCHARGE STRUCTURES OFF TSF

It is proposed to line the surface water discharge channels or TSF spillways that convey water off the TSF using durable waste rock.

The TSF spillways s will coincide with access roads/ramps and have a grade of 1:10 or flatter. Sections through the spillway channels as well as the spillway locations are indicated in Figure 29. A stilling basin will be provided at the end of the spillway.

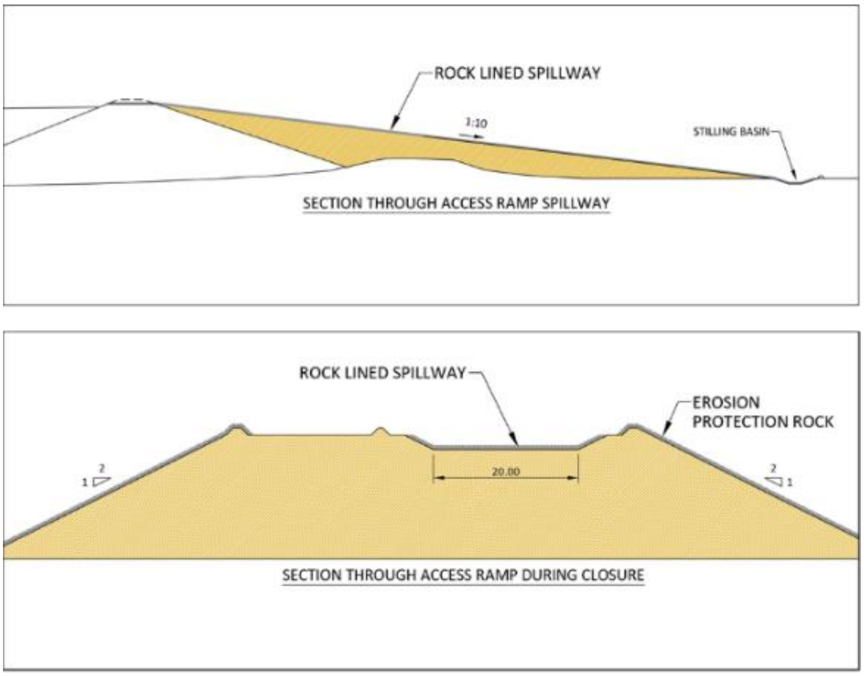

Figure 29: Typical spillway - grades and sections

Spillways serving the zone between the TSF embankments and the waste rock landform will be located within waste rock landform close to the TSF embankments. Grades on the channels will be 1: 6. Stilling basins will be provided at the ends of the spillways.

10.9 SURFACE WATER DIVERSION STRUCTURES

The dune-dominated topography over which the TSF is to be developed is flat and compartmentalised by the dunes. The TSF is to span between dune sets and while the surface water flow trends to the north west from the processing plant, the waste rock landform serves to arrest any flow and the north west trending dune lines will serve as natural diversion structures. Some temporary ponding of water against the toes of the embankments in the swales will occur.

10.10 GROUNDWATER MANAGEMENT

Seepage into the groundwater from the TSF will be minimised by the geomembrane liner. While it is recognised that, in the long term (i.e., post closure), this liner will progressively become more brittle and may exhibit cracking in areas of stress concentrations and due to deformations, such as those associated with an earthquake, the liner will not disappear and will continue to be a seepage inhibitor.

In the case of the LST cells, the over-liner filter drains will serve to minimise the head of water above the liner as documented in Section 9.8. In the case of the HST Cells the fine grind and low permeability of the HS cells these will be maintained in a saturated state to minimise oxidation. The fine grind and resulting low permeability characteristics of the HS tailings ensure that leakage rates will be minimal.

The 50m unsaturated zone between the base of the TSF and the groundwater table will serve to minimise seepage due to the low permeability of the unsaturated materials as indicated in Section 9.8.

After closure, the groundwater gradient will continue to be towards the open pit which will continue to act as a sink should seepage from the TSF migrate to the groundwater table as documented in the Worley groundwater study report.

11 DRAWINGS, QUANTITIES AND TECHNICAL SPECIFICATIONS

Pre-feasibility level drawings and schedules of quantities for construction of the works in the development stages have been prepared. Schedules of construction quantities as well as the construction technical specifications have also been produced.

12 TSF OPERATION AND MAINTENANCE

It is proposed to carry out monitoring of the geotechnical and environmental performance of the TSF as follows:

- Piezometers will be used to monitor pore pressures in the tailings above the liner.

- Settlement plates located along the crests of the embankments will be measured to monitor consolidation settlement of the embankments.
- INSAR satellite-based movement measurement will be applied to monitor the movements of the embankments.
- Boreholes will be drilled down gradient from the TSF to monitor groundwater pressures and quality.

13 EMERGENCY PREPAREDNESS PLAN

A draft emergency preparedness plan has been developed. The plan identifies the safety muster points in the event of an emergency on the TSF, the contact details of responsible personnel and regulators and sets out four levels of response depending on the scale of the emergency.

14 CLOSURE CONSIDERATIONS

The Closure design for the TSF has been developed and is documented in a separate Design Report that is included as a separate appendix within the ERD submittal.

15 PRELIMINARY DAM BREAK AND FLOW SLIDE ASSESSMENTS

Preliminary dam break and flow slide assessments appropriate for a pre-feasibility level of study have been conducted for both the LST cells and the HST Cells. The assessments include a sensitivity assessment on the potential shear strength and rheological characteristics of the liquefied slurry. The shear strength characteristics influence the volume of liquefied slurry released and the outflow hydrograph while the rheological characteristics influence the run out extent.

The assessments identify inundation areas, flow depths and arrival times for each dam break scenario.

Figure 30 shows the potential dam break locations evaluated in the assessment for the HST cells. These are limited to the period when HST Cell 1 is in operation prior to the commissioning of LST Cell 1. During other periods, the HST cells are confined by waste rock landforms and by LST Cell 1 and a dam break scenario is not credible. Figure 31 shows the dam break locations evaluated in the assessment for the LST cells.

The locations of stockpiles during operations are indicated in Figure 30 and Figure 31. Flow path 4 has been modelled both with and without stockpile geometry.

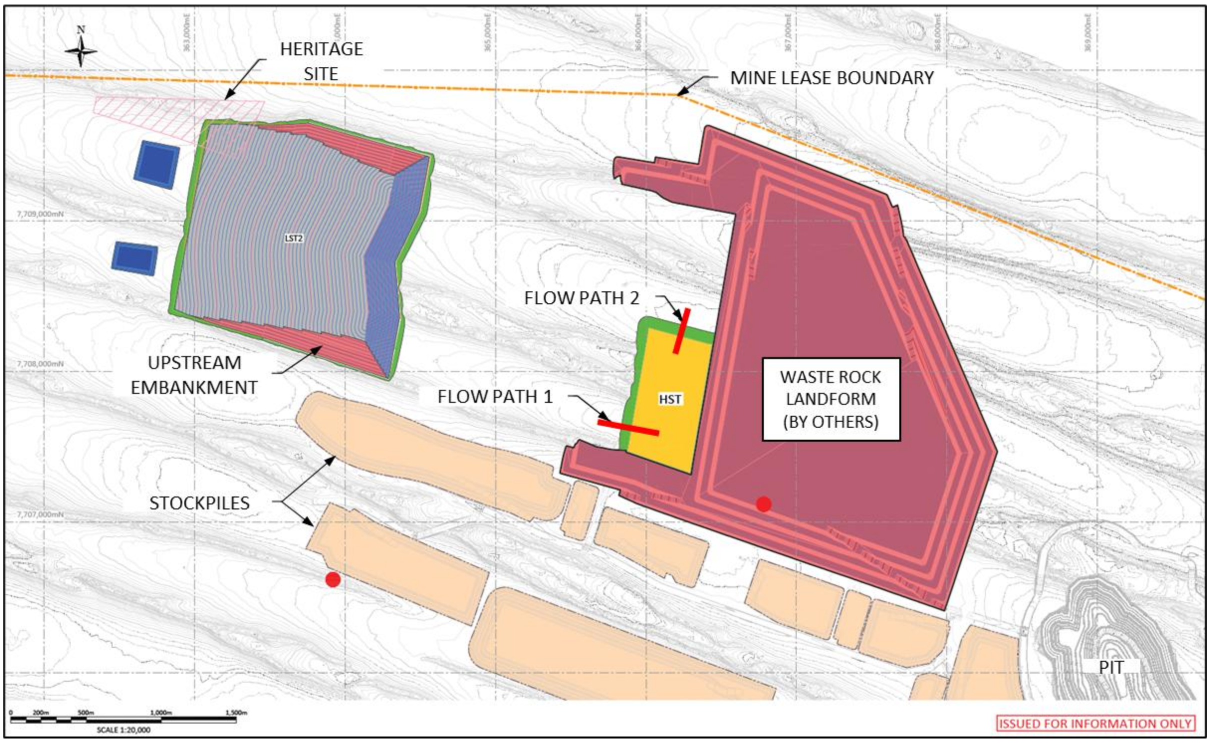

Figure 30: Flow path locations from HST Cell 1

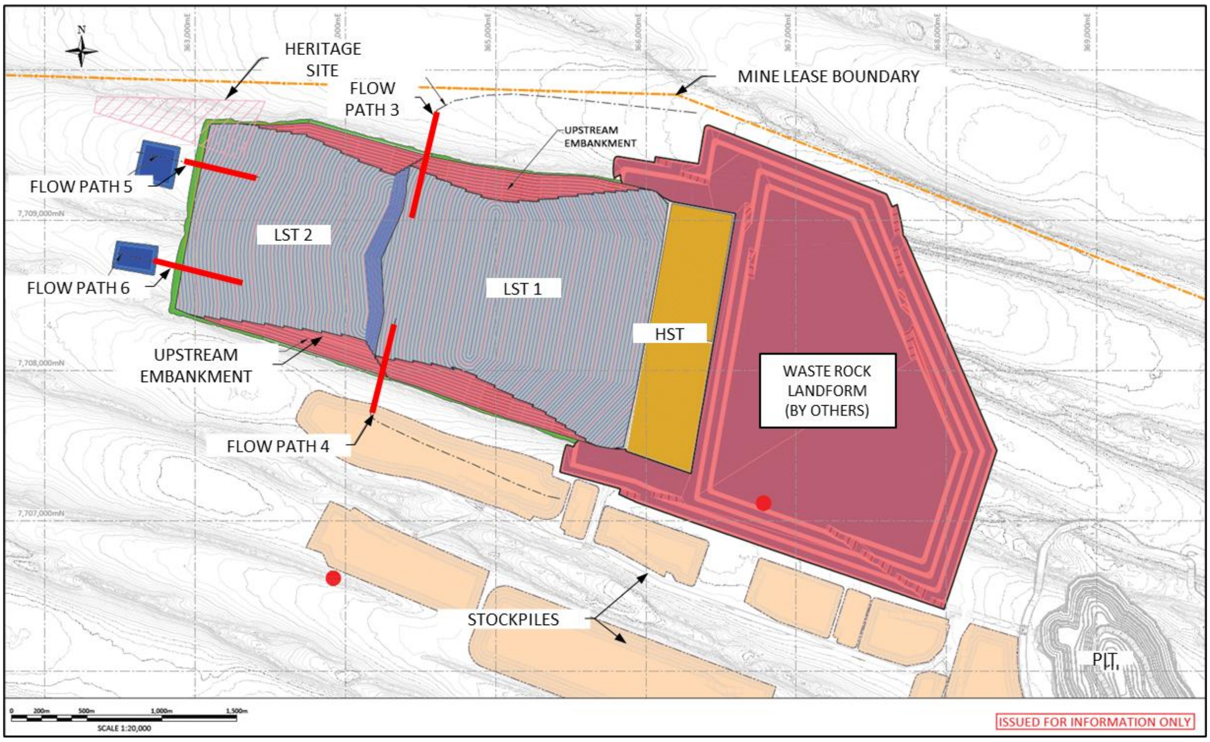

Figure 31: Flow path locations from LST Cells 1 and 2

The assessment results indicate the following:

- Flows emanating from HST Cell 1 will remain within the LST Cell 1 footprint area due to the confinement offered by the dunes and the stockpiles.

- Flows emanating from LST Cell 1 to the north and south will remain confined by the adjacent set of dunes and extend only as far as the TSF footprint length.
- Flows to the west from LST 2 will extend only as far as the reclaim ponds.

These results are considered highly conservative for the LST cells as the deposited tailings are expected to have a low phreatic surface and exhibit higher resistance to flow than was assumed in the assessment. This will be further evaluated during the FS stage.

16 CONCLUSIONS

This report summarises the information presented in the pre-feasibility study design report incorporating the Basis of Design, layout, sizing, development, operation, and management of the proposed TSF for Winu. The design has been executed to separately manage LS and HS tailings while taking advantage of mine pre-strip activities and materials. The cells making up the TSF are to be developed and raised in stages using a combination of downstream and upstream construction for embankment raises. Groundwater contamination risk is reduced through the incorporation of geomembrane liners over the floor and the inner side slopes of the starter embankments of the LST cells and over the floor and inner side slopes of the HST cells. Importantly, the geomembrane liners under the LS cells also improve water conservation. Underdrainage systems are provided above the liners to reduce phreatic levels and promote consolidation of the LS tails. Slurry discharge and pond management arrangements have been set out together with surface water control measures as well as dam break considerations. All details have been set out in drawings and schedules of quantities together with an associated construction specification. A draft operating manual and emergency procedures plan have been developed.

The Closure design for the TSF has been developed and is documented in a separate Design Report that is included as a separate appendix within the ERD submittal.

17 REFERENCES

The following information has been referenced in preparing this report:

Ref. N°	Title	Type	Author
Ref. 1	Rio Tinto: Climate *Projection Summary Winu.*	Report	Rio Tinto, Feb 2024.
Ref. 2	127-032/2 *Winu 5H HDTSF Pre-feasibility Design Report*	Report	WWL, May 2024
Ref. 3	Rio Tinto Memo: *Tailings Storage Facility - Conceptual Seepage Model*	Memorandum	Rio Tinto, May 2024

Ref. N°	Title	Type	Author
Ref. 4	Winu H3 Hydrogeological Assessment	Report	Worley, August 2024
Ref. 5	Rio Tinto: Winu Waste Characterisation - Tailings	Report	Rio Tinto, June 2024
Ref. 6	GB Geotechnics Group Report: *Geophysical Investigation at Proposed Infiltration Pond, Processing Plant and Tailings Storage Facility Sites*	Report	GB, June 2024
Ref. 7	Okane consulting Report: *Winu Tailings Storage Facility High Sulfur Tailings Cover System Numerical Modelling*	Report	Okane, June 2024
Ref. 8	SIBERIA Landform Evolution Modelling – Winu Project	Report	Landloch, Jan 2021
Ref. 9	20136763-001-R-Rev 0 *Hydrological design basis. This report has been superseced with Ref. 2*	Report	Golder Associates, April 2020
Ref. 10	Okane consulting Memorandum: *Winu Copper Project, Conceptual Cover System Modelling*	Memorandum	Okane, Aug 2020
Ref. 11	Golder Associates report 20136763-023-R--RevA Winu Water Studies – Updated Flood Risk Assessment and Operational Surface Water Management Plan	Report	Golder, Aug 2020
Ref. 12	Golder Associates report 20136763-009-Rev0 *Winu Water Studies - Groundwater Assessment*	Report	Golder, Aug 2020
Ref. 13	Probabilistic Seismic Hazard Analysis Report	Report	ATC, July 2020
Ref. 14	WINU TSF Water balance – 5H	Report	WWL, April 2024
Ref. 15	Guide to the preparation of a design report for tailings storage facilities (TSFs). August 2015	Guideline	Department of Minerals and Petroleum (DMP
Ref. 16	Guidelines on Tailings Dams, July 2019	Guideline	ANCOLD.
Ref. 17	Management of tailings and water storage facilities (D5 Standard). January 2021	Standard	Rio Tinto
Ref. 18	ICMM Integrated Mine Closure Good Practice Guide (2019)	Guideline	ICMM
Ref. 19	Global Industry Standard for Tailings Management	Standard	ICMM, UNEP, PRI
Ref. 20	Tailings Management: Good Practice Guide	Guideline	ICMM
Ref. 21	Closure Study Definition Guidance	Guidance note	Rio Tinto
Ref. 22	WWL report 127-008-2 Winu TSF Design dated July 2021	Report	WWL
Ref 23	ANCOLD Guidelines on Risk Assessment 202	Guideline	ANCOLD

Dr G I McPHAIL MIEAust CPEng

For and on behalf of

Water, Waste and Land Australia Pty Ltd

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