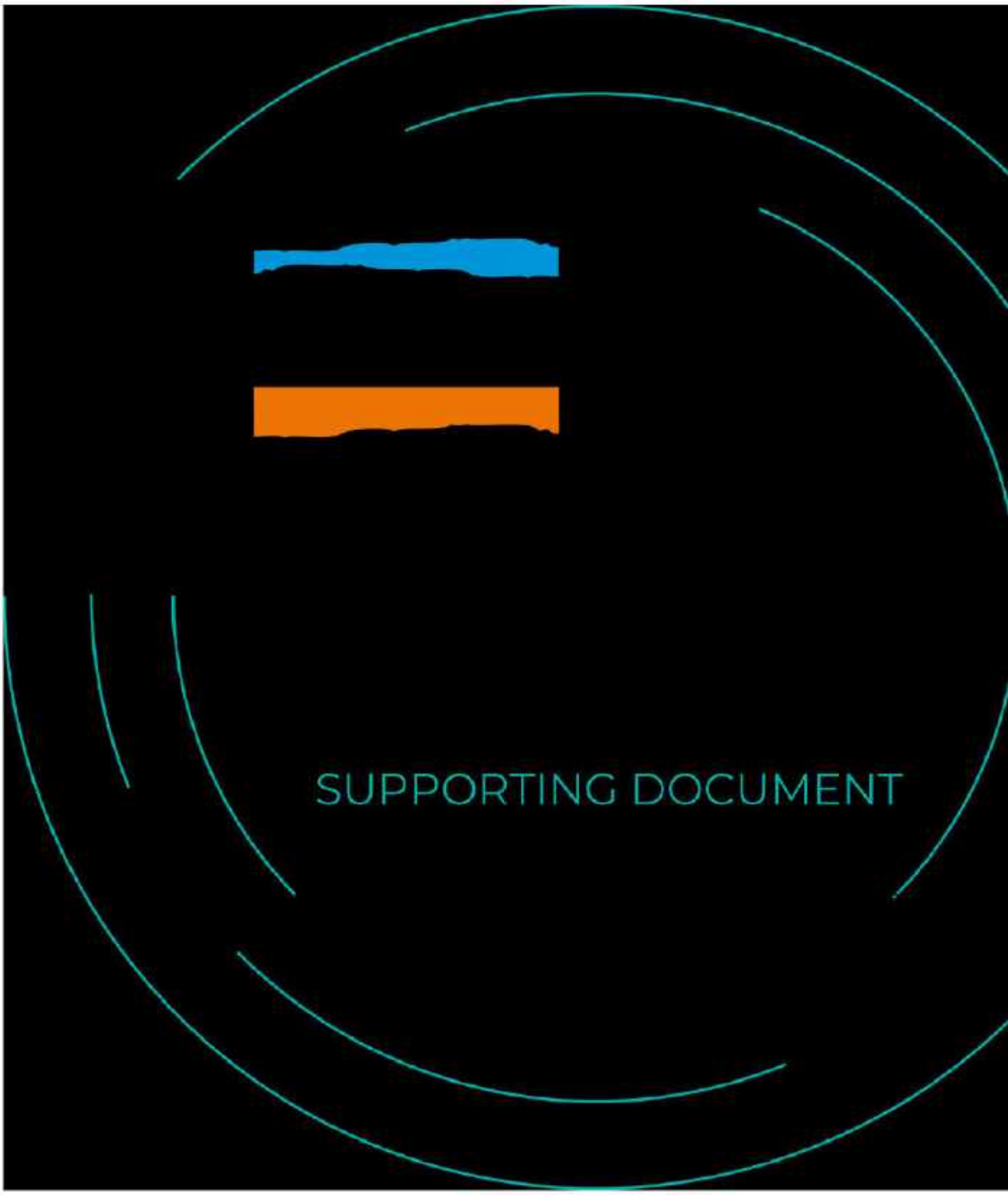
MINARA RESOURCES
A GLENCORE COMPANY

GLENCORE



Executive Summary

Murrin Murrin Operations Pty Ltd (MMO) own and operate the Murrin Murrin Nickel Cobalt Project (Murrin Murrin) located in the north-eastern Goldfields region of Western Australia. MMO is a fully owned subsidiary of Glencore plc.

Murrin Murrin consists of open pits, a processing plant and ancillary infrastructure supporting the production of nickel and cobalt briquettes from extracted nickel laterite ore. MMO operate Murrin Murrin under license L7276/1996/12 issued under the *Environmental Protection Act 1986* (EP Act) which includes ten (10) categories as described within Schedule 1 of the *Environmental Protection Regulations 1987*.

MMO submits the following information in support of a Works Approval application pursuant to Part V of the *Environmental Protection Act 1986* for activities at Murrin Murrin.

Prescribed activities are limited to Category 5 – Processing or beneficiation of metallic or non-metallic ore, as described in Schedule 1 of the *Environmental Protection Regulations 1987* and summarised in the table below.

Proposed works include construction and time limited operations of a new inpit tailings storage facility (TSF) known as the 8 Series Inpit TSF with a design capacity of 4,620,000 tonnes per year.

Activity	Category	Discharge Rate	Design Capacity	Storage Life
8 Series Inpit TSF	Category 5: Processing or beneficiation of metallic or non-metallic ore.	4,620,000 tonnes per year	17,280,000 tonnes total storage capacity	Three years and nine months

This Supporting Document provides information and attachments and should read alongside the Works Approval Application Form. The premises includes parts of tenements M 39/343, M 39/420, M 39/421, M 39/423, and M 39/424, and M 39/553.

Contents

Attachment 1A: Proof of occupier status

Register for Tenement M 39/343

Identifier: M 39/343

Status: Live
Area: 926.60000 HA
Markout: 15/11/1994 10:45:00
Received: 17/11/1994 08:59:00
Term Granted: 21 Years (Renewed)
Commence: 10/06/1997
Expiry: 09/06/2039
Death:

Rent Status

Due for Year End 09/06/2025: PAID IN FULL
Rental for Year End 09/06/2026: [redacted]

Expenditure Status

Expended Year End 09/06/2024: EXPENDED IN FULL
Current Year Commitment: [redacted]

Holders | Description | Relationships | Survey | General | Shire | Grant | Conditions | Dealings
Payments | Expenditure | Combined Reporting | Bond | Map | Native Title | Warden's Court | Documents

Current Holders | Holder Changes | Applicants On Receival

Organisation	MURRIN MURRIN OPERATIONS PTY LTD	100/100
ACN	**ABN**	

Principal Place of Business Details
Address SAME AS CORRESPONDENCE

Designated Tenement Contact (Correspondence Details)
Name MURRIN MURRIN OPERATIONS PTY LTD
Address PO BOX Z5523, ST GEORGES TERRACE, PERTH, WA, 6831
Email xxxxxxxxxxxxx@glencore.com.au
Telephone xxxxxxx459

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Register for Tenement M 39/420

Identifier: M 39/420

Status: Live
Area: 70.23000 HA
Markout: 15/12/1995 18:50:00
Received: 22/12/1995 08:40:00
Term Granted: 21 Years (Renewed)
Commence: 07/09/1999
Expiry: 06/09/2041
Death:

Rent Status

Due for Year End 06/09/2025: PAID IN FULL
Rental for Year End 06/09/2026: [redacted]

Expenditure Status

Expended Year End 06/09/2024: EXPENDED IN FULL
Current Year Commitment: [redacted]

Holders | Description | Relationships | Survey | General | Shire | Grant | Conditions | Dealings
Payments | Expenditure | Combined Reporting | Bond | Map | Native Title | Warden's Court | Documents

Current Holders | Holder Changes | Applicants On Receival

Organisation MURRIN MURRIN OPERATIONS PTY LTD 100/100

ACN 076 717 505 **ABN** 43 076 717 505

Principal Place of Business Details
Address PO BOX Z5523, ST GEORGES TERRACE, PERTH, WA, 6831
Email [redacted]
Telephone [redacted]

Designated Tenement Contact (Correspondence Details)
Name MURRIN MURRIN OPERATIONS PTY LTD
Address PO BOX Z5523, ST GEORGES TERRACE, PERTH, WA, 6831
Email [redacted]
Telephone [redacted]

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Register for Tenement M 39/421

Identifier: M 39/421

Status: Live
Area: 990.65000 HA
Markout: 19/01/1996 12:05:00
Received: 19/01/1996 14:55:00
Term Granted: 21 Years (Renewed)
Commence: 26/07/1996
Expiry: 25/07/2038
Death:

Rent Status

Due for Year End 25/07/2024: PAID IN FULL
Rental for Year End 25/07/2025: [redacted]

Expenditure Status

Expended Year End 25/07/2023: EXPENDED IN FULL
Current Year Commitment: [redacted]

Holders | Description | Relationships | Survey | General | Shire | Grant | Conditions | Dealings
Payments | Expenditure | Combined Reporting | Bond | Map | Native Title | Warden's Court | Documents

Current Holders | Holder Changes | Applicants On Receival

Organisation	MURRIN MURRIN OPERATIONS PTY LTD	100/100
ACN	076 717 505 **ABN** 43 076 717 505	

Principal Place of Business Details
Address PO BOX Z5523, ST GEORGES TERRACE, PERTH, WA, 6831
Email [redacted]
Telephone [redacted]

Designated Tenement Contact (Correspondence Details)
Name MURRIN MURRIN OPERATIONS PTY LTD
Address PO BOX Z5523, ST GEORGES TERRACE, PERTH, WA, 6831
Email [redacted]
Telephone [redacted]

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Perth Head Office Time: 05/06/2024 10:27

Logged in as [redacted]

Register for Tenement M 39/423

Identifier: M 39/423

Status: Live
Area: 999.00000 HA
Markout: 19/01/1996 12:46:00
Received: 19/01/1996 14:55:00
Term Granted: 21 Years (Renewed)
Commence: 26/07/1996
Expiry: 25/07/2038
Death:

Rent Status

Due for Year End 25/07/2025: PAID IN FULL
Rental for Year End 25/07/2026: [redacted]

Expenditure Status

Expended Year End 25/07/2024: EXPENDED IN FULL
Current Year Commitment: [redacted]

Holders | Description | Relationships | Survey | General | Shire | Grant | Conditions | Dealings
Payments | Expenditure | Combined Reporting | Bond | Map | Native Title | Warden's Court | Documents

Current Holders | Holder Changes | Applicants On Receival

Organisation MURRIN MURRIN OPERATIONS PTY LTD 100/100

ACN 076 717 505 **ABN** 43 076 717 505

Principal Place of Business Details
Address PO BOX Z5523, ST GEORGES TERRACE, PERTH, WA, 6831
Email [redacted]
Telephone [redacted]

Designated Tenement Contact (Correspondence Details)
Name MURRIN MURRIN OPERATIONS PTY LTD
Address PO BOX Z5523, ST GEORGES TERRACE, PERTH, WA, 6831
Email [redacted]
Telephone [redacted]

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Register for Tenement M 39/424

Identifier: M 39/424

Status: Live
Area: 62.93500 HA
Markout: 19/01/1996 12:46:00
Received: 19/01/1996 14:55:00
Term Granted: 21 Years (Renewed)
Commence: 07/09/1999
Expiry: 06/09/2041
Death:

Rent Status

Due for Year End 06/09/2025: PAID IN FULL
Rental for Year End 06/09/2026: [redacted]

Expenditure Status

Expended Year End 06/09/2024: EXPENDED IN FULL
Current Year Commitment: [redacted]

Holders | Description | Relationships | Survey | General | Shire | Grant | Conditions | Dealings
Payments | Expenditure | Combined Reporting | Bond | Map | Native Title | Warden's Court | Documents

Current Holders | Holder Changes | Applicants On Receival

Organisation MURRIN MURRIN OPERATIONS PTY LTD 100/100

ACN 076 717 505 **ABN** 43 076 717 505

Principal Place of Business Details
Address PO BOX Z5523, ST GEORGES TERRACE, PERTH, WA, 6831
Email [redacted]
Telephone [redacted]

Designated Tenement Contact (Correspondence Details)
Name MURRIN MURRIN OPERATIONS PTY LTD
Address PO BOX Z5523, ST GEORGES TERRACE, PERTH, WA, 6831
Email [redacted]
Telephone [redacted]

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Register for Tenement M 39/553

Identifier: M 39/553

Status: Live
Area: 432.80000 HA
Markout: 04/09/1997 11:17:00
Received: 11/09/1997 11:15:00
Term Granted: 21 Years (Renewed)
Commence: 17/09/1999
Expiry: 16/09/2041
Death:

Rent Status

Due for Year End 16/09/2025: PAID IN FULL
Rental for Year End 16/09/2026: [redacted]

Expenditure Status

Expended Year End 16/09/2024: EXPENDED IN FULL
Current Year Commitment: [redacted]

Holders | Description | Relationships | Survey | General | Shire | Grant | Conditions | Dealings
Payments | Expenditure | Combined Reporting | Bond | Map | Native Title | Warden's Court | Documents

Current Holders | Holder Changes | Applicants On Receival

Organisation MURRIN MURRIN OPERATIONS PTY LTD 100/100

ACN 076 717 505 **ABN** 43 076 717 505

Principal Place of Business Details
Address PO BOX Z5523, ST GEORGES TERRACE, PERTH, WA, 6831
Email [redacted]
Telephone [redacted]

Designated Tenement Contact (Correspondence Details)
Name MURRIN MURRIN OPERATIONS PTY LTD
Address PO BOX Z5523, ST GEORGES TERRACE, PERTH, WA, 6831
Email [redacted]
Telephone [redacted]

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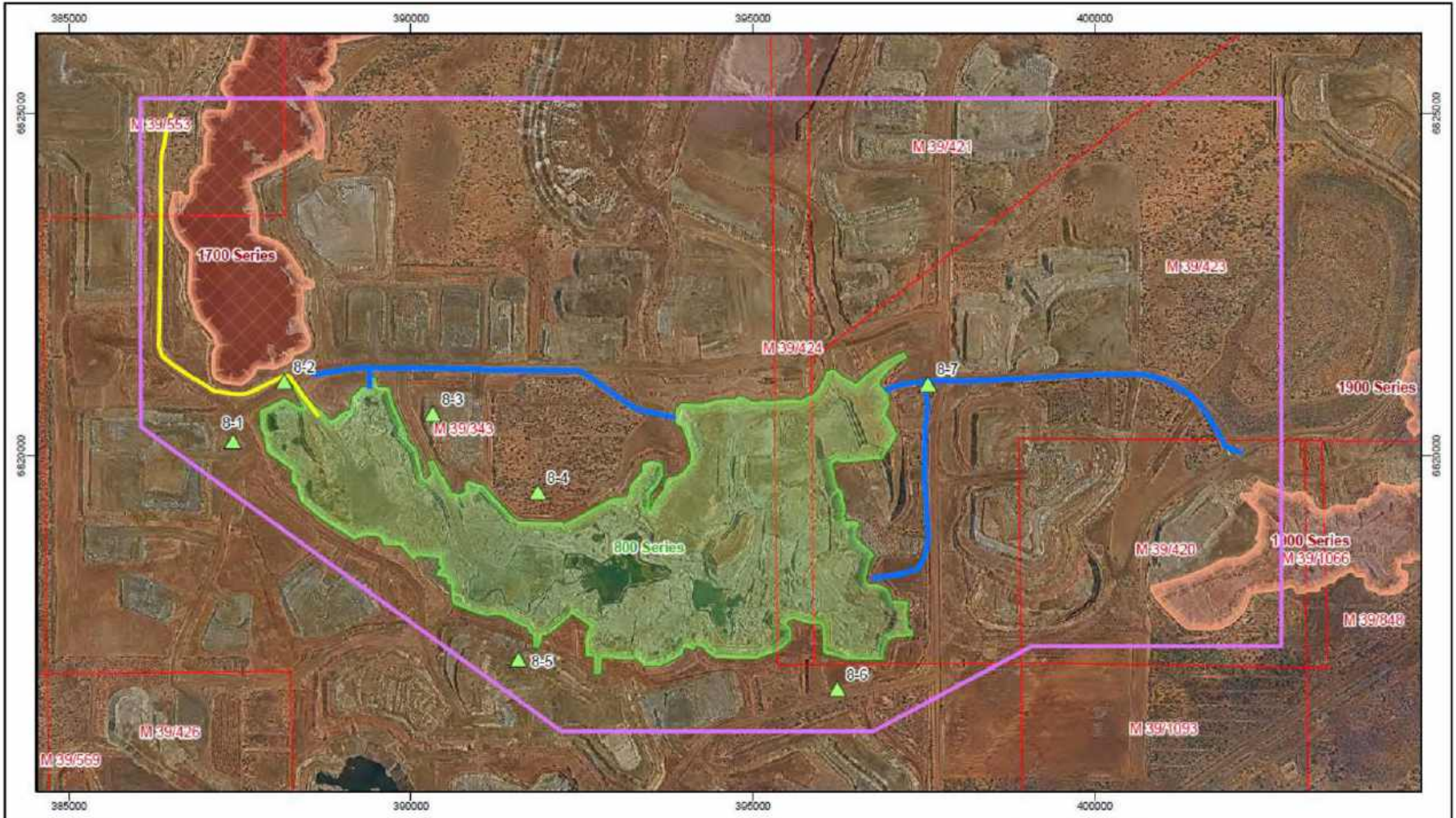
Attachment 1B: ASIC company extract

Extracted from ASIC's database at AEST 08:33:02 on 30/05/2024

Company Summary	
Name:	MURRIN MURRIN OPERATIONS PTY LTD
ACN:	076 717 505
ABN:	43 076 717 505
Registration Date:	10/12/1996
Next Review Date:	07/07/2024
Former Name(s):	ANACONDA OPERATIONS PTY LTD, MURRIN MURRIN OPERATIONS PTY LIMITED, MURRIN MURRIN PTY LIMITED
Status:	Registered
Type:	Australian Proprietary Company, Limited By Shares
Locality of Registered Office:	SYDNEY NSW 2000
Regulator:	Australian Securities & Investments Commission

Further information relating to this organisation may be purchased from ASIC.

Attachment 2: Premises map



MINARA

Murrin Murrin Operations

8 Series Inpit TSF Pipeline and Monitoring Bores

Projection : GDA 1994 MGA Zone 51
Datum : GDA 1994

- Tenements
- 8 Series Inpit TSF
- Active In Pit Tailings
- Proposed Monitoring Bores
- Deposition Pipeline
- Decant Pipeline
- Prescribed Premises Boundary

N

Meters
0 250500 1000 1500 2000

1:73,973

Originator :	
Department : Environment	Date : 17/06/2025
Drawn By : [redacted]	Revision : 0

File : J:\EAP\Environment\GIS\ArcGISProProjects\DS\General Map\General Map.aprx
Map : A4 Landscape

Minara Resources Pty Ltd ACN 060 378 783

Attachment 3B: Proposed activities

Proposed Activities

Inpit TSF

Murrin Murrin Operations (MMO) is proposing to construct a new in-pit tailings storage facility (TSF) for continued storage of tailings from its Murrin Murrin Nickel Cobalt Project (Murrin Murrin). Murrin Murrin is located in the eastern Goldfields region of Western Australia and is already licensed to operate multiple inpit and paddock TSFs for discharge and storage of tailings and decant liquor. The 8 Series Inpit TSF will have a material discharge rate of 4,620,000 tonnes per year, in line with current tailings production capacity. Discharge of tailings will occur via multiple spigots at one end of the pit to progressively develop and push the supernatant pond at the opposite pit side and close to the pit access ramp(s). The facility will have an expected total design capacity of 17,280,000 tonnes and has an indicative storage life of three years and nine months. The design report / geotechnical assessment for 8 Series Inpit TSF is provided in Attachment 8B – TSF Design Report.

Activity category details are summarised in Table 1 below.

TABLE 1: WORKS APPROVAL ACTIVITIES

Activity	Category	Discharge Rate	Design Capacity	Storage Life
8 Series Inpit TSF	Category 5: Processing or beneficiation of metallic or non-metallic ore.	4,620,000 tonnes per year	17,280,000 tonnes total storage capacity	Three years and nine months

Pipelines

Tailings will be transported from the processing plant via the existing 19 Series Inpit TSF, to the 8 Series Inpit TSF via large diameter steel or high density polyethylene (HDPE) pipeline. An emergency deposition pipeline, that will also be utilised during the top up phase, will tie into the existing 17 Series Inpit TSF deposition line slightly to the north. Pipeline corridors will have a nominal width of 10 m (comprising a 5 m wide pipeline bunding corridor and an access track of 5 m width). All pipelines will have telemetry and be installed in accordance with Australian Standards. Containment bunds along both sides of the pipeline corridor will have a minimum height of 0.6 m.

The containment bunds will be constructed with suitable mine waste. No moisture conditioning and testing are required for this fill material. The access track will be constructed with traffic compacted suitable mine waste (nominal 0.3 m thick) (Tetra Tech Coffey, 2024).

Additional detail including the general arrangement and typical section of the pipeline bunding corridor and access track around the inpit TSF is provided in Attachment 8B – TSF Design Report.

Water Recovery

Supernatant water liberated from tailings slurry will be recovered by dedicated pumps situated at locations along access ramps at the western end of the facility. Initially water will be decanted at relatively lower points of these access ramps, and as the tailings level increases, the water recovery points will move upward along the access ramps.

The tailings deposition plan has been designed to position the supernatant water pond adjacent to the access ramp into the TSF, from where the decant pump will be situated. The supernatant pond is expected to develop progressively at the opposite side of the discharge point(s).

As tailings and water levels rise within the TSF, the supernatant water pond will move up the access ramp, with the decant pump to be withdrawn up the ramp. The ramp will provide access to the decant pump for operation and maintenance purposes. Water recovered from the facility will be returned to the processing plant via the pipeline corridor for re-use. The new decant recovery pipework will tie into the existing 17 Series Inpit TSF pipeline. Water shall not be allowed to accumulate in the pit (Tetra Tech Coffey, 2024).

Monitoring Bores

Seepage indication bores shall be installed on the perimeter of the proposed 8 Series Inpit TSF. Previous bore installations (at existing inpit TSFs) have been 100 mm in diameter to enable the bores to be equipped for seepage recovery. However, recent advice from the Department of Water and Environmental Regulation (DWER) relating to the 17 Series Inpit TSF is that *"monitoring bores should be kept separate from seepage recovery to ensure continuity and reliability of monitoring data. Conversion of monitoring bores into seepage recovery bores will therefore not be accepted."*

Seven new seepage indication bores of 50 mm shall be constructed at a distance where they will not be unreasonably impacted by seepage due to proximity. This spacing also allows for the establishment of a purpose-built 100 mm seepage recovery bore between the seepage indication bore and inpit TSF, if required. There are also multiple existing seepage indication bores located in the vicinity for the purpose of monitoring the 804 and 17 Series Inpit TSFs, located adjacent to the proposed 8 Series Inpit TSF. A map of the proposed seepage indication bores is provided in Attachment 2 – Premises Map.

Seepage indication bores shall be strategically located to ensure spatial coverage while also targeting the main structural features identified in the geological architecture reports, which may serve as primary pathways for seepage migration (Tetra Tech Coffey, 2024).

Baseline monitoring shall be conducted at the seepage indication bores prior to commencement of tailings deposition into the proposed inpit TSF. Ongoing quarterly groundwater monitoring will then be undertaken in accordance with the monitoring requirements specified in L7276/1996/12.

Construction Activities

Preliminaries & Site Preparation
Activities will commence with construction of the pipeline corridor and required scour sumps and access road (495 m x 10 m approx. for corridor and 400 m^2 x 2 sumps).

No clearing of vegetation will be required as part of this Works Approval.

Earthworks
Construction earthworks will include the following:

- Construct pipeline corridors and scour sump areas.
- Excavate scour sumps (12 m x 12 m x 2.5 m deep).
- Borrow, transport and compact 0.6 m high earthen bund to both sides of pipeline corridor.
- Grade and make smooth 5 m wide access track to the pipeline corridors.
- Sheet access roads with 10 mm aggregate sheeting material.

Tailings and Decant Pipework
Pipework installation will include the following:

- Supply and install requisite tailings pipework.
- Supply and install pumps on access ramps to enable water recovery.
- Supply and install requisite decant return pipework.

Monitoring Bores
Drill and construct seven new bores at designated areas around the 8 Series Inpit TSF.

Environmental Commissioning

No environmental commissioning activities are proposed.

Time Limited Operations

To streamline the approvals process and enable proposed activities to commence following construction, MMO requests that the prescribed activities are authorised as Time Limited Operations (TLO). The TLO period is requested to be set at 180 calendar days to allow for an assessment of the Licence Application. It is noted that the planned TLO activities will not be different from future licensed operations. MMO understands that conditions will be included in the Works Approval to regulate emissions and discharges that arise during the TLO phase. These conditions will be based on an assessment of the Prescribed Premises design performance provided in this Works Approval Application.

Licence Amendment

MMO will submit a Licence Amendment to L7276/1996/12 following the completion of works in accordance with the conditions of the Works Approval. This Licence Amendment will be submitted

once the Environmental Compliance Report is provided to DWER and TLO commences. Operation under Licence conditions will commence when the Licence is granted (prior to the expiry of the Works Approval).

Attachment 5: Other approvals and consultation

Environmental Protection Act 1986 – Part IV

MMO has been previously assessed by the Environmental Protection Authority (EPA) under Part IV of the EP Act and is subject to several environmental conditions under Ministerial Statement 418, 444, 445 and 506 approvals.

Any required clearing will be completed as authorised by Schedule 6 of the EP Act, which allows clearing of native vegetation undertaken as part of a proposal implementation assessed by the EPA.

MMO has successfully implemented inpit tailings disposal under the Original Proposal and as a result the Paddock TSF is no longer operational, resulting in observed decrease in groundwater levels and seepage volumes recovered. Further implementation of the Original Proposal allows MMO to continue utilising inpit tailings disposal where possible, minimising the requirement to construct a "Central Thickened Discharge" facility per condition 5 of Ministerial Statement 506.

Mining Act 1978

Numerous mining proposals have been submitted and approved under the *Mining Act* 1978 since commencement of MMO in 1999. A mining proposal for 8 Series Inpit TSF was approved in January 2025 to enable conversion of the existing pit to a TSF. Disposal of tailings into 8 Series Inpit TSF will not occur without securing both a Works Approval and Mining Proposal. An updated Mine Closure Plan was also approved alongside the Mining Proposal in January 2025.

Rights in Water and Irrigation Act 1914

MMO has existing Licenses to Take Water pursuant to s5C of the *Rights in Water and Irrigation Act 1914*, authorising the abstraction of groundwater from the borefields and mine abstraction areas, subject to the terms and conditions of the Licence. Licenses include GWL206312(2); GWL66584(8); GWL61171(11); GWL154363(10) and GWL206313(2).

Attachment 6A: Emissions and discharges

Tailings

Tailings Properties

Murrin Murrin was commissioned in 1999 and currently mines and processes approximately 4.5 million tonnes (Mt) of nickel laterite ore per year to produce 48,000 t/yr of nickel and 3,000 t/yr of cobalt briquettes. The operation uses open-pit mining techniques and processes ore using high-pressure acid leach technology as well as heap leach to recover nickel and cobalt. Approximately 4.5 Mt of (dry solid) tailings are produced each year from processing operations. TSFs include paddock and inpit, with supernatant liquor sent to evaporation ponds. Calcrete is mined to neutralise waste material and water for processing is abstracted from various borefields. Other existing facilities include accommodation village, landfill, wastewater treatment plant and roads.

Tailings deposited into 8 Series Inpit TSF will have relatively similar geochemical properties as tailings deposited into other existing inpit TSFs at Murrin Murrin. Tailings are partially neutralised when they leave the processing plant and have a pH of approximately 2.3. Previous testing of MMO tailings liquor indicates that it is typically hyper-saline with total dissolved solids (TDS) around 180,000 mg/L and enriched in Iron (Fe), Magnesium (Mg), Manganese (Mn), and Nickel (Ni) (Coffey, 2020).

Seepage

A hydrogeological assessment for 8 Series Inpit TSF was prepared by Saprolite Environmental and is provided in Attachment 8C. Extensive monitoring data has been collected from a network of 54 seepage indication bores situated on the perimeter of existing inpit TSFs, including quarterly water level measurements and water chemistry laboratory analysis. Water chemistry data highlights five bores within the monitoring network which exhibit notable seepage, characterised by elevated concentrations of nickel, cobalt, and TDS (Saprolite, 2024).

A thorough examination of available data was conducted for the proposed 8 Series Inpit TSF. Drawing on previous experience with the weathering profiles and hydrogeology in the Murrin Murrin North mining area, information has been synthesised from geological architecture reports, and case-study evidence and other supportive work undertaken at existing inpit TSFs to anticipate seepage migration potential (Saprolite, 2024). The analysis concludes the following general findings regarding seepage potential:

- The weathering profile comprises layers of widely differing permeability and storage. Complex chemical processes have led to the removal of large quantities of soluble material, some of which, such as silica, iron, magnesium carbonate and calcium carbonate have been re-deposited elsewhere.
- Water levels may be rapidly affected at proposed inpit TSF monitoring sites, particularly during early stages of deposition. Highly variable water level mounding at existing TSFs indicates the likelihood of directional groundwater flow.

- Structural features (e.g., faults, shears, and contact zones) can most readily be identified from the distribution of certain elements or lithology domains in the regolith profile. These features may act as preferential pathways for seepage migration.
- Structural features within the saprolite have been variably filled by remobilised silica, which is likely to connect migratory/leaching zones to some degree. The structural features are likely to continue into the underlying semi-weathered ultramafic protolith, however these units are modelled below the depth of mining and are unlikely to represent seepage pathways.
- Saprolite comprises the majority of the walls and floor of the pits of interest and is typically high in magnesium. It is expected that the saprolite will have neutralising properties when exposed to potentially acidic tailings, providing some degree of mitigation for falls in pH.
- There is potential for shallower flow paths to be established should water levels return to or rise above their pre-mining elevation as a result of natural groundwater inflow or from tailings deposition within the pits.
- The geological architecture report for the 8 Series Pits identified several distinct structural features:
    - Two foliated ultramafic units which intersect the proposed pit void and coincide with zones of deeper weathering.
    - An E-W to N-S trending felsic volcanic unit intersects the northern pit wall and extends northwards to the western boundary of existing inpit TSF 8/4, and north westward to the eastern boundary of the 17 Series Inpit TSF.
    - A mafic intrusive intersects the top of the proposed pit void between pits 8/6 and 8/7.
    - Additional structure zones were identified in the south-eastern corner of the pit series. (Saprolite, 2024).

Contaminated Stormwater

Consideration for surface runoff water from external upstream catchments around proposed 8 Series Inpit TSF is not required based on a desktop review of the site's topography and ground condition – i.e., it is surrounded by the existence of roads and trenches that limit the water flowing into the pits.

However, it is assessed that minor surface runoff from adjacent small areas is likely to occur and flow into the pit. For the freeboard calculation purposes, allowance has been made to account for the minor surface runoff from adjacent small areas above the inpit TSF impoundment area (Tetra Tech Coffey, 2024).

Dust

Dust is generated from clearing activities, plant operations, heavy machinery and unsealed roads. Excessive dust can increase local ambient atmospheric particulate levels, impacting sensitive receptors surrounding vegetation. Management measures are in place to minimise dust impacts including dust suppression via water cart and avoiding clearing during periods of strong winds. There is also a significant buffer of 30 km to the nearest sensitive receptor, Mount Margaret Community.

Minimal dust generation is expected from the TSF surface. Once topping up is complete and settling has concluded, the TSF will be appropriately capped and rehabilitated in accordance with MMO's closure strategy.

Noise

The effects of noise during construction and operations of 8 Series Inpit TSF will be minimal as only mobile diesel generators and vehicular movement is entailed. There is also a significant buffer of 30 km to the nearest sensitive receptor, Mount Margaret Community therefore this aspect was considered to not pose a risk during TSF operations.

Attachment 7: Siting and location

Climate

Murrin Murrin is situated within the Goldfields region of Western Australia, experiencing an arid to semi-arid climate with hot, dry summers and cool, wet winters (Cowan, 2001). The nearest Bureau of Meteorology (BOM) weather station is located 50 km west at Leonora Airport (Station ID 012241) (BOM, 2024).

The area experiences average maximum temperature of 37 °C, and average minimum temperature of 6.1 °C. Annual average rainfall is 236.7 mm, with a mean of 28.9 days of rain per year (≥1 mm). Rainfall is highest in February at 30.9 mm and lowest in September at 8.9 mm (BOM, 2024). Mean monthly rainfall values and evaporation values are shown in Figure 1. Average annual rainfall of 236 mm and annual evaporation of 3473 mm were adopted for design purposes.

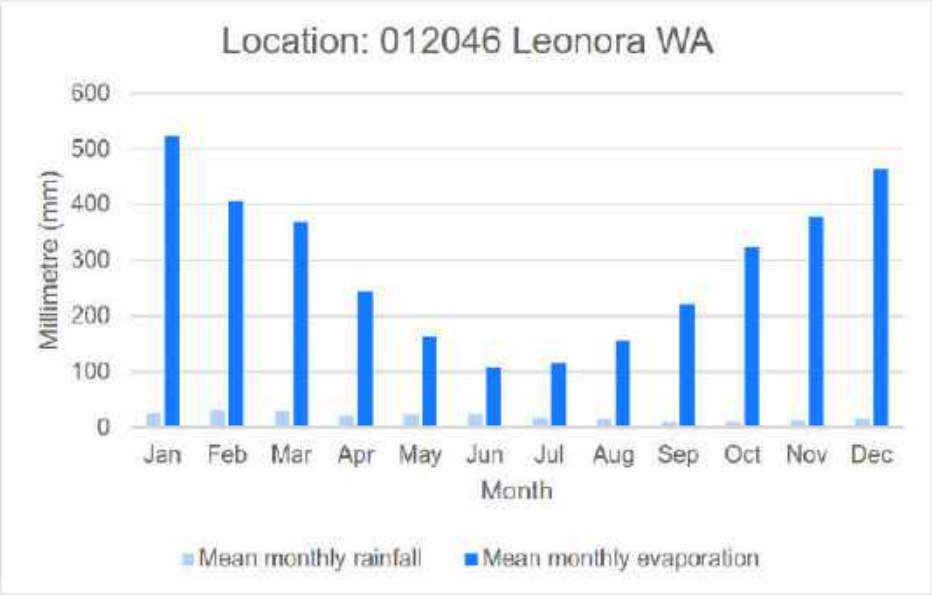


FIGURE 1: MEAN MONTHLY RAINFALL (1898-2013)

The rainfall intensity-frequency-duration (IFD) chart pertaining to MMO is presented in Figure 2. Based on the IFD chart, a 1:100-year annual exceedance probability, 72-hour storm event can be expected to generate approximately 200 mm of rainfall (BOM, 2024).

Across the average year, humidity levels are highest in June (am 70%, pm 45%) and lowest in December (am 34%, pm 20%). Morning wind conditions measured are predominantly easterly, and between 7 and 12 kilometres per hour (km/hr). Average afternoon wind direction is more variable, with easterlies slightly prevailing (BOM, 2024).

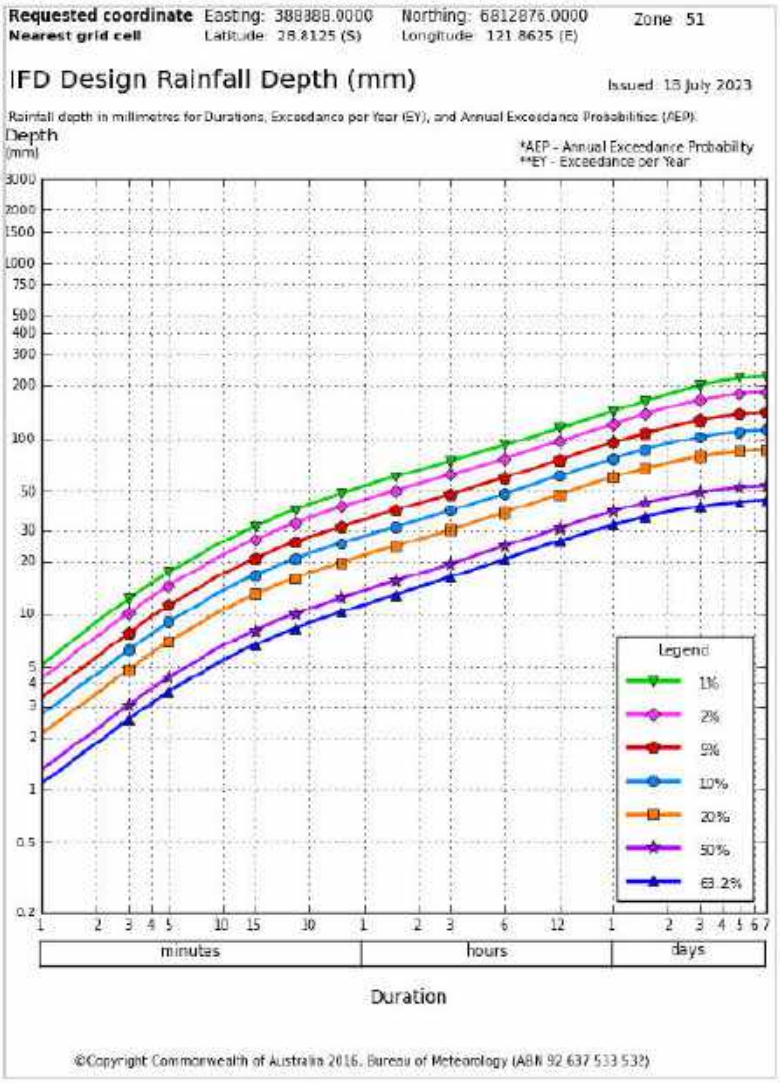


FIGURE 2: RAINFALL IFD CHART

Surface Water

Murrin Murrin is situated in a region of low relief, a consequence of extensive alluvial and colluvial materials which have blanketed areas around MMO deposits (Wells, 2003). These alluvial sediments form part of an extensive NW orientated paleodrainage, bounded by the Lake Carey system and the Lake Raeside system to the NE and SW respectively (Golder Associates, 2004). MMO deposits straddle a drainage divide between these lake systems (Saprolite Environmental, 2020).

MMN is crossed by a number of waterways in two major catchments of Cement Creek and Katata Creek. Cement Creek lies within the regional Lake Carey Catchment and generally drains in a south easterly direction towards Lake Carey, which is approximately 25 km downstream of the mine. Katata Creek is located within the regional Lake Raeside Catchment and generally drains in a south westerly direction towards Lake Raeside.

Modification of natural surface water regime has occurred due to Murrin Murrin. Drainage structures have been designed to duplicate existing natural channel characteristics where practicable and sediment traps have been installed to reduce downstream impacts on water quality. Progressive rehabilitation of site seeks to stabilise landforms against erosion by surface water flows.

Groundwater

Major aquifers in the region consist of palaeo-tributary systems, which drain into regional palaeo-drainage structures. These aquifers consist of valley fill deposits infilling old drainage systems incised into Archaean bedrock. Within these deposits aquifers generally consist of quartz sand overlying granitoid basement. Orientation of these systems is generally consistent with that of present-day salt lakes. Regional groundwater flows in the vicinity of Murrin Murrin are generally parallel to present day surface drainage as both present day and palaeo-drainage catchments are controlled by basement outcrop. Recharge is relatively low due to low rainfall, high evaporation, heavy soils, and well-developed vegetation cover (Saprolite, 2022).

Considerable monitoring data has been collected from monitoring bores adjacent to existing inpit TSFs, including water chemistry laboratory analysis and water level measurements. Impacts from groundwater abstraction at MMN appear localised to already disturbed areas of current and future mining. Interpreted potentiometric water level contouring at MMN, as of June 2022, illustrates groundwater mounding near TSFs and completed and active inpit tailings storage facilities. Groundwater mounding relates to anticipated effects of tailings deposition on site, where groundwater abstraction from mining area is not considered as a causal factor. Historical water level contour plans indicate variable water levels across MMN, which reflect various dewatering and discharge operations (Saprolite, 2022).

Groundwater pH between 6 and 8.5 has been sampled at most monitoring sites. Laboratory analysis has indicated high concentrations of dissolved magnesium at a number of sites. It is expected that

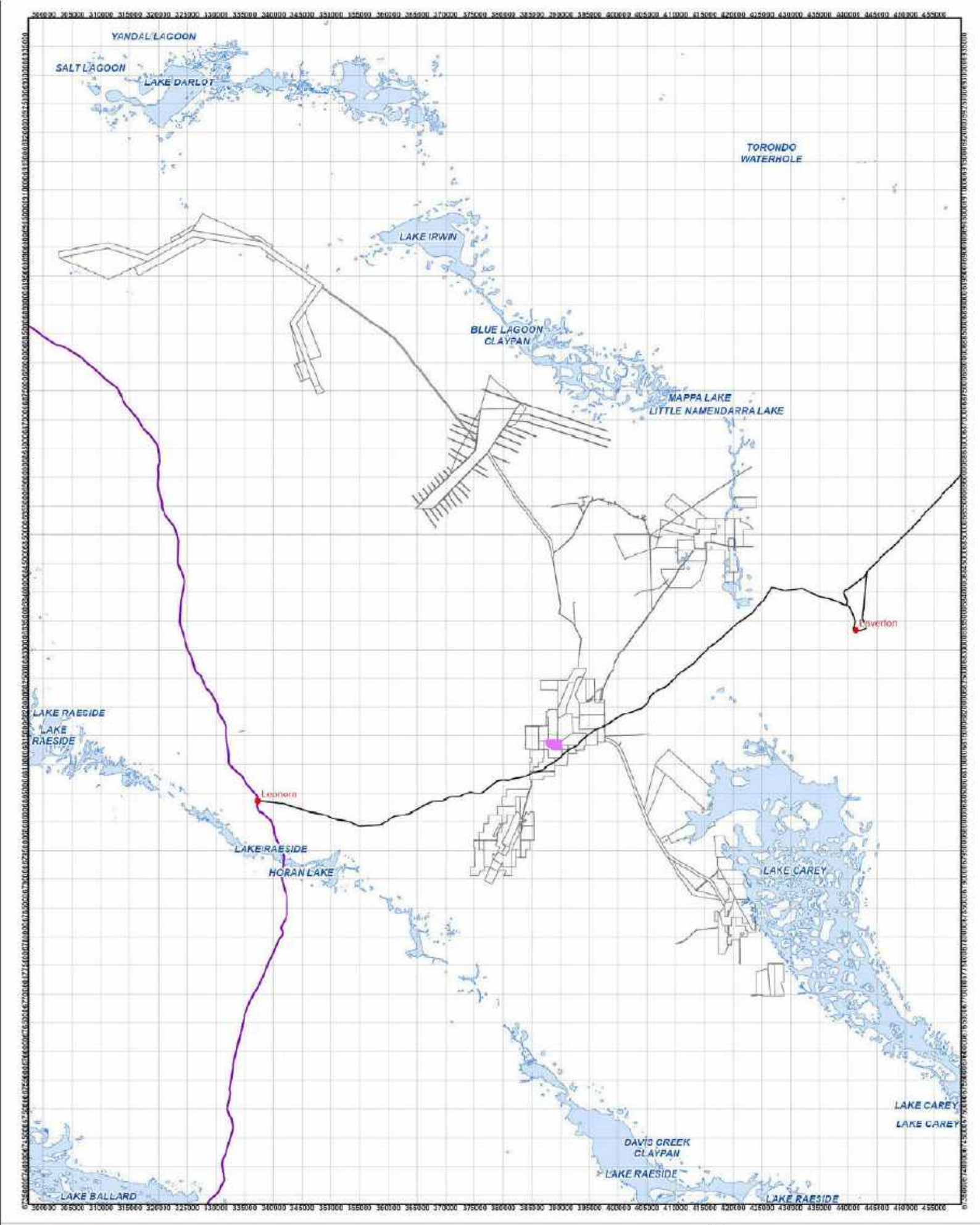
prevalence of magnesium carbonate within weathering profile is providing buffering capacity for acidity, mitigating significant falls in pH (Saprolite, 2022).

Aboriginal Heritage

A comprehensive program of Aboriginal studies and surveys has been completed across areas of mine development. Identification and management of Aboriginal heritage sites was incorporated in approval of the Murrin Murrin Expansion Project Public Environmental Review, approved under Part IV of the *Environmental Protection Act 1986* (EP Act) in 1999.

MMO acknowledges its obligations under the *Aboriginal Heritage Act 1972*. Section 18 approvals under the *Aboriginal Heritage Act 1972* have been previously obtained for all sites which have been disturbed by mine development. No new impacts to Aboriginal heritage sites will occur as part of implementation of this Works Approval.

The Murrin Murrin Aboriginal Environmental Liaison Committee (MMAELC) was established in accordance with EPA Stage 1 approvals. Ministerial Statement 506 conditioned the MMAELC with the objective to regularly meet with community members to keep informed on the environmental performance of the Project.



MINARA

Murrin Murrin Operations

Siting and Location

Projection : GDA 1994 MGA Zone 51
Datum : GDA 1994

Lakes
MMO Tenements
Prescribed Premises Boundary

N

7 3.5 0 7 14 21 28 kms

Originator :	
Department : Environment	Date : 05/09/2025
Drawn By : [redacted]	Revision : 0
File : J:\EAP\Environment\GIS\ArcGISPanProjects\2025\General Map\General Map.aprx	A3
Map : Layout1	

Attachment 8A: Conceptual Site Model

The following table provides a conceptual site model for 8 Series Inpit TSF. More information can be found in TSF Operations Manual provided in Appendix H of Attachment 8B – TSF Design Report.

Source / Activities	*Potential emissions, pollutants, or contaminants of concern*	*Potential pathway*	*Potential receptors*	*Potential impacts*	*Proposed controls and contingencies*
TSF deposition of tailings	Supernatant potentially containing concentrations of elements with environmental significance such as cyanide.	Seepage / infiltration.	Groundwater.	Reduced groundwater quality.	Seepage indication bores, seepage recovery bores if required.
		Groundwater mounding.	Vegetation – No significant flora or vegetation recorded in vicinity of 8 Series Inpit TSF.	Reduced vegetation health.	
Decant pipeline and/or tailings delivery pipeline failure	Decant water potentially containing concentrations of elements with environmental significance such as cyanide.	Direct discharge, infiltration into soil or groundwater.	Surface water – Drainage lines include Cement Creek and Katata Creek.	Reduced surface water quality.	Telemetry, bunding, routine inspections, clean-up response, reporting, spill containment measures.
			Vegetation.	Reduced vegetation health.	
Stormwater	Sediment laden runoff. Potentially contaminated stormwater.	Overland runoff.	Surface water.	Reduced surface water quality.	Stormwater infrastructure, diversion drains, trenches, monitoring.
			Vegetation.	Reduced vegetation health.	

TSF overtopping	Tailings potentially containing concentrations of cyanide.	Unplanned direct discharge of tailings into the environment.	Surface water.	Reduced surface water quality.	Freeboard, routine inspections, water balance.
			Vegetation.	Reduced vegetation health.	
Dust	Dust (dried tailings) potentially containing contaminants.	Windblown dust transport through air then deposition.	Vegetation.	Health/amenity impacts.	Dust suppression activities, no clearing during periods of high wind.
		Air/wind dispersion.	Sensitive receptors – Mount Margaret Community located 30 km away.		

Attachment 8B: Geotechnical Assessment / Design Report

Murrin Murrin Operations
In-Pit TSFs 815, 7 Series and 8 Series Design

Design Report (Geotechnical Assessment)

Minara Resources Pty Ltd

Reference: 754-PERGE318544_MMO IPTSFs 815_7_8 Series DR_Rev0

5 April 2024

MURRIN MURRIN OPERATIONS – IPTSFS 815, 7 SERIES AND 8 SERIES

Design Report (Geotechnical Assessment)

Report reference number: 754-PERGE318544
5 April 2024

PREPARED FOR

Minara Resources Pty Ltd
Murrin Murrin Operations
Level 3, 30 The Esplanade
Perth, WA 6000
ABN: 43 076 717 505

PREPARED BY

Tetra Tech Coffey
Level 1, Bishops See, 235 St Georges Terrace
Perth
WA 6000 Australia
p: +61 8 6218 2100
f: +61 8 6218 2222
ABN 55 139 460 521

QUALITY INFORMATION

Revision history

Revision	Description	Date	Author	Reviewer	Approver
A	Issued for client review	24/02/2024	AL / AM	DKN / FvdL	FvdL
0	Issued as final	05/04/2024	AL / AM	DKN / FvdL	FvdL

Distribution

Report Status	No. of copies	Format	Distributed to	Date
Draft	1	PDF	Murrin Murrin Operations	24/02/2024
Final	1	PDF	Murrin Murrin Operations	05/04/2024

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EXECUTIVE SUMMARY[1]

Minara Resources Ltd (Minara) proposes to use and develop the Pits 815, 7 Series and 8 Series as the In-Pit Tailings Storage Facilities (IPTSFs) at the Murrin Murrin Operations (MMO) located approximately 60 km east of Leonora, Western Australia (WA).

The advantages of using IPTSF comprise:

- Meeting sustainability objectives by using an existing void and not creating a larger mining footprint. It is noted that IPTSF has been undertaken for many years in WA and is now seen as a "leading practice".
- Increased recovery of water when compared with an above-ground TSF.
- Significantly lower construction costs when compared with an above-ground TSF.
- Lower overall risks (in terms of operations and closure) when compared with an above-ground TSF.

This report presents the design of the proposed IPTSFs in support of the regulatory submissions. The IPTSFs design details are in general accordance with the following regulatory guidelines:

- Department of Mines, Industry Regulation and Safety (DMIRS, 2013), *'Code of practice: tailings storage facilities in Western Australia'*;
- DMIRS (2015a), *'Guide to the preparation of a design report for TSFs'*;
- DMIRS (2015b) *'Guide to departmental requirements for the management and closure of TSFs'*; and
- ANCOLD (2019), *'Guidelines on Tailings Dams Planning, Design, Construction, Operation and Closure'*.

Based on classification criteria outlined in Tables 1 and 2 of DMIRS (2013), the proposed IPTSFs have been assigned a hazard rating of '**Low - Category 3**' (regarding IPTSF). While based on Tables 1 and 2 of ANCOLD (2019), the proposed IPTSFs have been assigned with a Dam Failure Consequence Category (DFCC) of '**Very Low**' due to '**Minor**' impact / damage level and a population at risk (PAR) of < 1. It is not practical to consider an IPTSF failure will occur, and then the tailings and water will spill out, impact people, destroy the assets, and damage the environment.

The design and operation of the proposed IPTSFs (815, 7 Series and 8 Series) aims to:

- Minimise environmental impacts (i.e., using the existing disturbed area, filling the pit void, and reducing seepage water losses);
- Allow the facility to function with minimal daily input;
- Maximise storage capacity and provide adequate stormwater storage allowance;
- Optimise water recovery from the facility; and
- Ensure an adequate monitoring program is in place.

It is advised that the tailings deposited into the proposed IPTSFs (815, 7 Series and 8 Series) will have relatively similar geochemical properties as the tailings deposited into other existing IPTSFs at MMO. As per the existing report (Coffey, 2020), the tailings are partially neutralised when they leave the plant and have a pH of approximately 2.3. Testing of the tailings liquor indicates that it is typically hyper-saline (TDS around 180,000 mg/L) and enriched in Iron (Fe), Magnesium (Mg), Manganese (Mn), and Nickel (Ni). A review of the Graeme Campbell and Associates memorandum (GCA, 2009) indicates that based on testing of site-waste-regolith materials, pit wall materials are likely to have minimal capacity to consume acid. GCA (2009) characterised the tailings acidity is not extreme and storage of tailings in the pits is acceptable from a geochemical viewpoint.

[1] This executive summary must be read in the context of the full report and the attached limitations.

Engineering tailings properties are from historical lab test results conducted in 2008, 2012 and 2016 by Coffey, MMO and Malvern Instruments, respectively. The laboratory test results adopted and used for the proposed IPTSFs (815, 7 Series and 8 Series) design are as outlined in Section 5.2.

The proposed IPTSFs (815, 7 Series and 8 Series) are located 2 to 4 km west and south-west of the plant. The advantage of utilising these pits is that they are located near existing active IPTSFs (Pits 9/5, 18/3, 18/6 and 17 Series) and hence the cost of extending pipework and other infrastructure is reduced. The proposed IPTSFs geometry and storage characteristics are summarised in the following table:

In-Pit TSF	Indicative Pit Geometry	Pit Surface Area (ha)	Approx. Max. Tailings depth (m)	Indicative Tailings Storage Volume (Mm^3)*	Indicative Tailings Storage Capacity (Mt)*	Indicative Storage Life (years)*
815	Width 430 m; Length 465 m Orientation: West – East Min. pit rim: RL 462.2 m (West) Max. pit rim: RL 472.5 m (North-East) Max. Depth 42.2 m to 52.5 m	38.1	41.9	3.64	2.91	0.63
7 Series	Width 400 m; Length 2170 m Orientation: West – East Min. pit rim: RL 443.0 m (East) Max. pit rim: RL 456.6 m (West) Max. Depth 29.0 m to 42.6 m	100.0	32.0	6.33	5.07	1.10
8 Series	Width 600 m; Length 2000 m Orientation: East – West Min. pit rim: RL 447.5 m (West) Max. pit rim: RL 466.0 m (East) Max. Depth 45.5 m to 64.0 m	177.0	48.2	21.6	17.28	3.74

*Note: Storage volume was based on the tailings deposition modelling with an assumed tailings beach slope of 1:300 (V:H). Storage capacity and life were conservatively calculated based on the adopted tailings (dry) density of 0.8 t/m^3 and tailings production of 4.62 Mtpa.

Based on the design pit shells (provided by Minara), the proposed IPTSFs (815, 7 Series and 8 Series) are capable to store approximately of 2.91 Mt, 5.07 Mt and 17.28 Mt of tailings respectively, based on the adopted tailings dry density of approximately 0.8 t/m^3. This corresponds to a storage life of 0.63, 1.10 and 3.74 years based on a tailings production of 4.62 Mtpa. As-built survey and confirmation of the storage capacity shall be carried out after the pits are completely mined out.

The top tailings surface of the IPTSF will assume a "wedge formation", with a beach sloping towards the decant / supernatant pond location. The IPTSF is designed such that the stormwater volume from a 1:100-year Annual Exceedance Probability (AEP), 72-hour storm event (i.e., runoff water from the impoundment pit surface areas) can be temporarily stored on top of the facility and above the normal operating pond. The facility will be operated such that a minimum pit wall freeboard of 0.5 m (vertical height between the stormwater and minimum pit rim levels) should be maintained at all times. That is, an equivalent total freeboard of minimum 1.4 m, 2.3 m and 1.9 m (vertical height between the normal operating pond and minimum pit rim levels) for IPTSF 815, 7 Series and 8 Series respectively, should always be maintained. It should be noted that critical freeboard criteria are particularly relevant when the tailings beach level approaches the pit rim level, that is when the facility is almost full and at closure stage.

Tailings will be deposited into the IPTSF from movable discharge point(s) at one end of the pit to progressively develop and push the supernatant pond at the opposite pit side and close to the pit access ramp(s). The pit access ramp(s) will be utilised as part of water recovery operations. Pontoon-mounted pump(s) will be deployed and moved up the pit access ramp(s) when the tailings and water levels rise within the pit, to recover water from the facility and return it to the processing plant for re-use. Operating procedures are briefed in Section 11 and detailed the Operations Manual (Appendix H).

The proposed IPTSFs (815, 7 Series and 8 Series) will not include an underdrainage system due to potential clogging of the drainage pipework with fine tailings and relatively good consolidation characteristics of the tailings, as well as relatively short storage life.

Geotechnical desktop assessment for the pit wall stability of Pits 815, Series 7 and Series 8 was assessed by Minara Resources. The assessment indicated that the pits are suitable for tailings storages. The groundwater modelling (by others) indicated that the Pits 815, 7 Series and 8 Series would not encounter groundwater at the design pit depths. The hydrogeological assessment of Pits 815, Series 7 and Series 8 will need to be reviewed when they are completely mined out.

Existing and proposed monitoring bores (MBs) located surrounding the proposed IPTSFs (815, 7 Series and 8 Series) will need to be implemented to enable monitoring of the IPTSFs performance. Locations of proposed MBs will be confirmed / determined by a qualified hydrogeologist. Proposed MBs will be designed and constructed such that they can be used as recovery bores, if required.

The tailings deposited into the IPTSFs are expected to consolidate and form a stable mass gradually. The IPTSFs are expected to undergo a rehabilitation program in line with the MMO's Mine Closure Plan (MCP) that will include the identification of appropriate capping materials and methods to revegetate the facility's surface area. Rehabilitation work for the IPTSFs is expected to be delayed for years post completion of tailings deposition to allow consolidation of the deposited tailings and to develop a "surface crust" for safe access.

The IPTSFs civil design drawings are attached as Appendix E. These drawings also form part of the Scope of Works (SoW) for civil earthworks construction of the bunding pipeline corridor and access track / road around the IPTSFs, attached as Appendix F. Water balance analysis with the estimated annual average water volume available for recovery from the IPTSFs is presented in Appendix G. An Operations Manual for the TSF and IPTSFs is prepared and attached as Appendix H. Further details of the IPTSFs design can be found in the Appendices.

CONTENTS

LIST OF TABLES

LIST OF FIGURES

APPENDICES

ACRONYMS/ABBREVIATIONS

Acronyms/Abbreviations	Definition
AEP	Annual Exceedance Probability
ANCOLD	Australian National Committee on Large Dams
BoM	Bureau of Meteorology
C_v	Consolidation Coefficient
DFCC	Dam Failure Consequence Category
DMIRS	Department of Mines, Industry Regulation and Safety (formerly Department of Petrolium (DMP)
DSA	Design Storm Storage Allowance
DWER	Department of Water and Environment Regulation
EAP	Emergency Action Plan
IPTSFs	In-Pit Tailings Storage Facilities
IFD	Intensity-Frequency-Duration
k_z	Vertical Permeability
M_v	Compressibility
mbgl	Meter below ground level
MBs	Groundwater Monitoring Bores
MC	Moisture Content
MMO	Murrin Murrin Operation
Mtpa	Million tonnes per annum
Minara	Minara Resources Ltd
PSD	Particle Size Distribution
SG	Specific Gravity
TDS	Total Dissolved Solids
Tetra Tech Coffey or TT Coffey or Coffey	Tetra Tech Coffey Pty Ltd
TSDS	Tailings Storage Data Sheet
WA	Western Australia
WRD	Waste Rock Dump

1. INTRODUCTION

1.1 GENERAL

Minara Resources Ltd (Minara) proposes to use and develop the Pits 815, 7 Series and 8 Series as In-Pit Tailings Storage Facilities (IPTSFs) at the Murrin Murrin Operations (MMO). MMO located approximately 60 km east of Leonora, Western Australia (WA). Figure 1 shows the MMO location with site tenement boundaries.

This document presents the details required by the Department of Mines, Industry Regulation and Safety (DMIRS, 2013 and 2015) for preparation of a geotechnical assessment report for the IPTSFs 815, 7 Series and 8 Series design.

This report was compiled in general accordance with the following guidelines:

- DMIRS (2013), *'Code of practice: tailings storage facilities in Western Australia'*;
- DMIRS (2015a), *'Guide to the preparation of a design report for TSFs''*;
- DMIRS (2015b) *'Guide to departmental requirements for the management and closure of TSFs'*; and
- ANCOLD (2019), *'Guidelines on Tailings Dams Planning, Design, Construction, Operation and Closure'*.

In accordance with Tables 1 and 2 of DMIRS (2013), the proposed IPTSFs (815, 7 Series and 8 Series) have been classified a hazard rating of '**Low - Category 3**'. Based on classification outlined in Tables 1 and 2 of ANCOLD (2019), the proposed IPTSFs (815, 7 Series and 8 Series) have been assigned with Dam Failure Consequence Category (DFCC) of '**Very Low**' due to '**Minor**' impact / damage level and a population at risk (PAR) of < 1.

The following figures and appendices complete this report.

Table 1: List of Figures and Appendices

Figures	Appendices
Figure 1: MMO Location with Site Tenement Boundaries	Appendix A: Limitations
Figure 2: Mean Monthly Rainfall Chart (1898 – 2013) (BoM, 2023)	Appendix B: Tailings Storage Data Sheet (TSDS)
Figure 3: Rainfall Intensity Frequency-Duration (IFD) Chart	Appendix C: Maps of Proposed IPTSFs Locations
Figure 4: Regional Geology of Murrin Murrin Ni-Co Project	Appendix D: Tailings Settlement Assessment
Figure-5: Regional Geology and Structural Interpretation of Murrin Murrin Ni-Co Project	Appendix E: Civil Drawings for IPTSFs
Figure-6: Generic Weathering Profile of the Murrin Murrin Nickel Laterite Deposits	Appendix F: Civil Scope of Works for IPTSF
Figures 7, 8 & 9: Tailings Storage Capacity Curves for IPTSFs 815, 7 Series and 8 Series	Appendix G: IPTSF Water Balance Analysis
Figure 10: Freeboard Nomenclature (DMIRS, 2015)	Appendix H: Operations Manual for TSF & IPTSF
Figures 11, 12 & 13: Supernatant Pond Storage Curves for IPTSFs 815, 7 Series and 8 Series	
Figure 14: Conceptual Capping Profile at Closure	

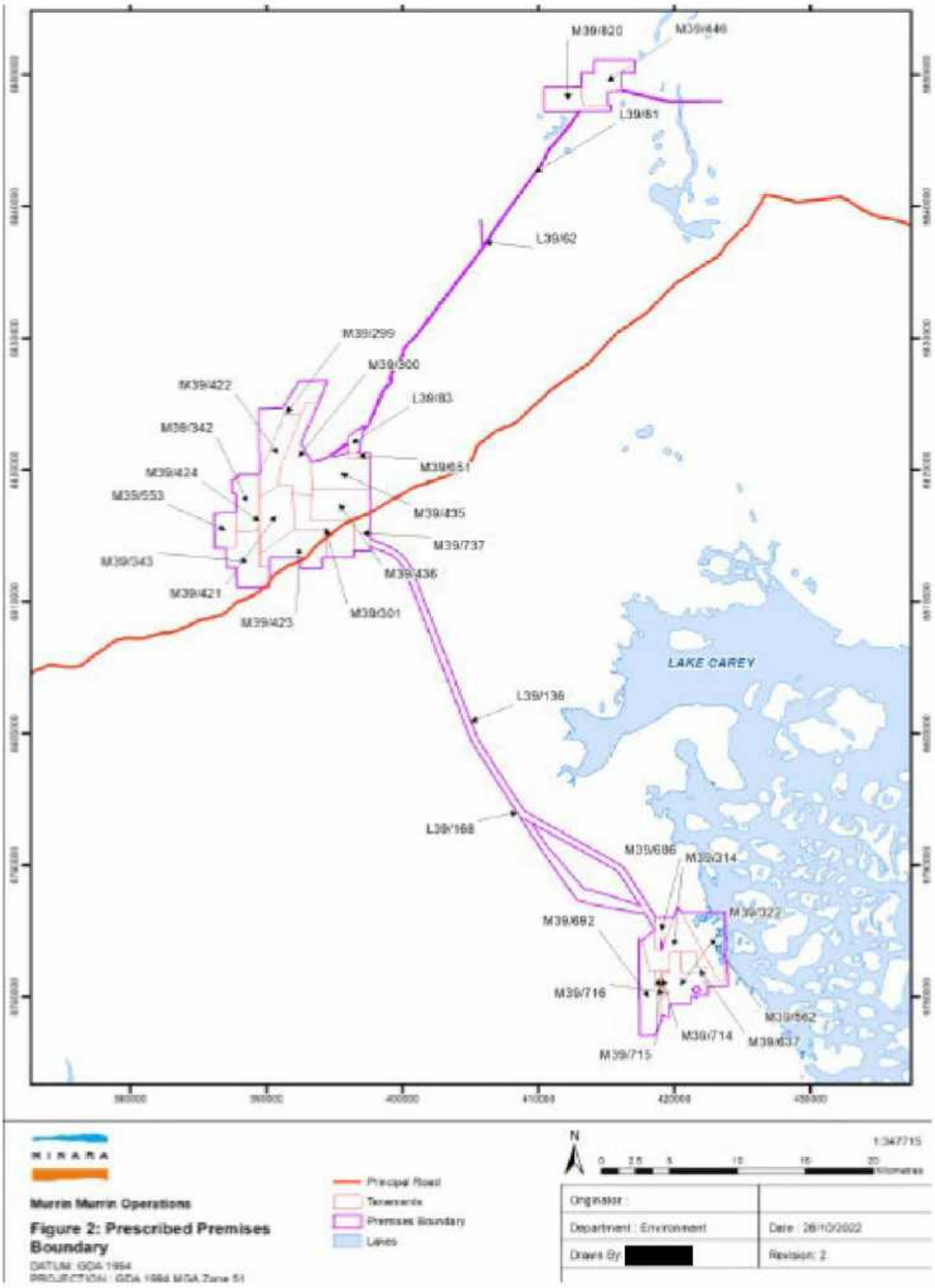

Figure 1. MMO Location with Site Tenement Boundaries

1.2 SCOPE OF WORKS

The scope of works for the IPTSFs design presented in this report included the following:

- Review existing relevant documents.
- Compile a design report, including:
  - Pit wall stability desktop assessment, including consideration of wall performance post-mining (with geological inputs from Minara's Mining Department).
  - Review of groundwater monitoring information, with comment on groundwater management and details of monitoring / recovery bores.
  - IPTSF civil design.
  - Input to IPTSF closure concept.
- Assist MMO with their work approval application (WAA) and Mining Proposal (MP).

The works excluded (i) all mechanical, pumping, piping and electrical design, and (ii) hydrogeological assessment and groundwater modelling. These works will be conducted by others.

2. BACKGROUND

2.1 LOCATION

The Murrin Murrin Nickel Cobalt Project (project) prescribed premises consists of Mining Tenements M39/446, M39/820, L39/81, L39/62, L39/83, M39/299, M39/651, M39/300, M39/301, M39/435, M39/436, M39/421, M39/422, M39/423, M39/424, M39/342, M39/343, L39/136, L39/168, M39/314, M39/322, M39/562, M39/637, M39/686, M39/692, M39/714, M39/715, M39/716 & M39/737 (as shown in Figure 1). The Murrin Murrin North project area lies within the Mt Morgans district of the Mt. Margaret Mineral field, between the towns of Leonora and Laverton, WA at latitude 28°50´S and longitude 121°54´E.

The proposed IPTSF 815 lies within mining tenement M39/421, IPTSF 7 Series lie within mining tenement M39/423, and IPTSF 8 Series lie within mining tenements M39/424 and M39/420.

2.2 OWNERSHIP

The project is owned and operated by Minara Resources.

2.3 HISTORY

Operations at MMO commenced in 1999 and are based on the mining and processing of laterite ore for the extraction of Nickel (Ni) and Cobalt (Co). Conventional open pit mining techniques are used, followed by ore processing comprising pressure acid leaching, mixed sulphide precipitation, cobalt refining and nickel refining. The production process also produces ammonium sulphate as a by-product, which is sold to the Western Australian fertiliser market.

2.4 EXISTING FACILITIES

The existing facilities at the project site include processing plant, four (4) cells of evaporation ponds, an above-ground paddock type TSF (North Cell and South Cell) comprising two cells with an area of approximately 500ha, nine (9) IPTSFs, namely, Pits 2/2-2/4, 2/3, 8/4, 8/5-9/4, 9/2, 9/5, 18/3, 18/6 and 17 Series, and waste rock dumps (WRDs).

Based on the most recent Annual Audit Report (TT Coffey, 2023), the primary active TSFs were IPTSFs 2/2, 2/4, 9/2, 9/5, 18/6 and 17 Series. Return water from the IPTSFs is pumped directly to the evaporation ponds. The currently active IPTSFs 2/2, 2/4, 9/2, 9/5, 18/6 and 17 Series are projected to be filled and would have remaining storage life of approximately 18.6 months based on FY22 tailings throughput of 4.62 Mtpa.

2.5 DEVELOPMENT OF NEW IPTSFS

Minara proposes to use and develop the Pits 815, 7 Series and 8 Series as IPTSFs for continued tailings storages. The development and use of these pits for tailings storages will utilise existing disturbed areas and allow the voids to be filled, which would otherwise remain open. Utilising these pits also reduces the requirement to disturb new land for construction of new above ground TSFs (paddock type). In addition, utilising these pits reduces the cost of extending pipework and other infrastructure due to proximity to existing active IPTSFs (9/5, 18/3,18/6 and 17 Series). Refer to Section 8 for further details of IPTSF design.

It is noted that Pit 815 just comprises a single pit. While Pit 7 Series comprises of ten (10) pits of which mining has been completed for five (5) pits and future mining is proposed for another five (5) pits. Pit 8 Series comprises of six (6) pits of which mining has been completed in one (1) pit, active in four (4) pits and planned for the remaining pit. These pits are located in the Murrin Murrin North project area. The tailings storage data sheets (TSDS) of proposed IPTSFs (815, 7 Series and 8 Series) are in Appendix B. Overview maps of Pits 815, 7 Series and 8 Series showing the completed, active and future mining pits are in Appendix C.

3. INFORMATION SUPPLIED

The following information was supplied by MMO:

- Surveying data (AutoCAD.dxf files) for Pits 815, 7 Series and 8 Series.
- Plans showing lease boundaries, existing MBs locations, infrastructures, and access corridors around Pits 815, 7 Series and 8 Series.
- Monitoring information (ground water level, surface water level and ground water quality).
- TSF Closure Concept in the 2020 MCP.
- Maps of mining plans for Pits 815, 7 Series and 8 Series (in pdfs).
- Geological Architecture Reports for Pits 815, 7 Series and 8 Series.

4. GENERAL INFORMATION

4.1 PROCESS TYPE

Ore is processed using pressure acid leaching, mixed sulphide precipitation, cobalt refining and nickel refining.

4.2 RATED THROUGHPUT

Based on previous report (Coffey Mining, 2016), the process plant was previously generating approximately 4.15 Mt (dry) of tailings per annum (Mtpa). According to the most recent Annual Audit Report (TT Coffey, 2023), the tailings production rate is 4.62 Mtpa. This figure is adopted for the proposed IPTSFs (815, 7 Series and 8 Series) design.

4.3 ORE TYPE

The ore type comprises predominantly laterite ore for the extraction of nickel and cobalt.

4.4 ENVIRONMENTAL PERFORMANCE

Based on the 2019 to 2022 audit and management review reports (Coffey, 2020, 2022 and 2023), the TSF and IPTSFs were generally being adequately managed. Water management on the evaporation ponds was also adequately managed.

Based on the recently supplied data (latest as February 2023), the surface water levels (SWLs) of all monitoring bores (MBs) were below the 4 m limit and 6 m target, as per the DWER license conditions. A groundwater recovery plan was not necessary.

The groundwater quality was found from recent recording (supplied by client) showed compliance with the DWER license L7276/1996/11. The pH levels for all monitoring bores were within the range of 6.8 and 8.2. The stipulated pH level is 3.5. The highest TDS level recorded was 25000 mg/L.

5. TAILINGS PROPERTIES

5.1 GEOCHEMISTRY

It is advised that the tailings deposited into the proposed IPTSFs (815, 7 Series and 8 Series) will have relatively similar geochemical properties as the tailings deposited into other existing IPTSFs at MMO. As per the existing report (Coffey, 2020), the tailings are partially neutralised when they leave the plant and have a pH of approximately 2.3. Previous testing of the tailings liquor indicates that it is typically hyper-saline (TDS around 180,000 mg/L) and enriched in Iron (Fe), Magnesium (Mg), Manganese (Mn), and Nickel (Ni).

A review of the Graeme Campbell and Associates memorandum (GCA, 2009) indicates that based on testing of site-waste-regolith materials, pit wall materials are likely to have minimal capacity to consume acid. GCA (2009) characterised the acidity is not extreme and storage of tailings in the pits is acceptable from a geochemical viewpoint.

5.2 PHYSICAL PROPERTIES

5.2.1 Lab Testing

Previously, tailings laboratory testing was conducted on several occasions throughout the life of the operations. No testing has been undertaken for this report. Tables 2 and 3 show a comparison of geotechnical results from testing conducted in 2008 as part of an IPTSF study (for Pits 9/1, 9/2 and 9/7) by Coffey, testing in May 2012 by MMO, additional testing by Coffey in October 2012 and most recently, testing by Malvern Instruments conducted in May 2016.

Table 2: PSD Properties of MMO Tailings

Particle Size Distribution (PSD)	2008 (Coffey)	May 2012 (MMO)	Oct 2012 (Coffey)	May 2016 (Malvern Instruments)	May 2016 (Malvern Instruments)	May 2016 (Malvern Instruments)
% Passing 80µm	95%	85%	83%	75%	70%	68%
% Passing 25µm	82%	54%	74%	51%	50%	50%
% Passing 5µm	48%	9%	47%	11%	12%	12%
% Passing 2µm	29%	3%	31%	5%	4%	4%

Table 3: Results of Undrained Settling Test of MMO Tailings

Undrained Settling Test	2008 (Coffey)	May 2012 (MMO)
Water available for recovery – 10 days after deposition – 20 days after deposition	 20% 30%	 31% 36%
Dry Density – 20 days after deposition	 0.47 t/m^3	 0.55 t/m^3
Water available for recovery – 10 days after deposition	 39%	
Dry Density – 10 days after deposition – 23 days after deposition	 0.54 t/m^3 0.60 t/m^3	

The test results indicated that the May 2012 tailings sample was coarser than the 2008 sample and had slightly higher settled densities with slightly more water available. The testing in 2016 indicates that the tailings sample was even coarser than the 2012 testing.

When the 2012 results are compared to testing by Golder in 2004 on a tailings sample with 70 to 85% fines (passing the 75-micron sieve), which returned a settled density of 0.64 t/m^3 (dry), the 2012 results returned lower settled densities.

5.2.2 Reconciliation of in-situ Tailings Density

A reconciliation of in-situ tailings density within the tailings storages was previously undertaken. Site surveyors periodically estimate remaining void volumes within the pits and paddock TSF. The reconciled density for tailings deposited into Pit 2/3 and the South Cell was collectively estimated at 0.85 t/m^3. The reconciled density for tailings deposited into Pit 8/5-9/4 was estimated at 0.97 t/m^3. The reconciled density for tailings across the site was assessed at approximately 0.92 t/m^3. These densities are similar to values adopted in recent in-pit design report submissions to DMIRS. It is noted that, for the IPTSF 17 Series design purpose, a more conservative tailings density of 0.8 t/m^3 (dry) was adopted (TT Coffey, 2020b). For conservative design purpose, a tailings density of 0.8 t/m^3 (dry) was also adopted for the IPTSFs 815, 7 Series and 8 Series design.

5.3 CONSOLIDATION TESTING

It is advised that tailings will have the identical properties as per the Rowe Cell testing performed in 2012 to confirm tailings consolidation characteristics. Table 4 summarises the results, indicating the tailings have poor consolidation characteristics, with C_v values around an order of magnitude lower than estimated from CPT testing (C_v range 33.5 to 84); that is, consolidation would be likely to occur more slowly than that indicated by CPT testing.

Table 4: Tailings' consolidation characteristics

Stage	M_v (m^2/KN)	C_v (m^2/yr)	Dry Density (t/m^3)
Initial (20 kPa)	5.0 x 10^{-3}	4.75	0.89
Final (640 kPa)	1.9 x 10^{-4}	4.2	1.20

Note: Initial Stress 10 to 20 kPa, final stress 320 to 640 kPa

5.4 SUMMARY OF ENGINEERING PROPERTIES

The engineering properties of the tailings are summarised in Table 5.

Table 5: Engineering Properties for Design Purposes

Property type	Unit	Value	Remarks
Slurry density ex-plant (average)	%	27	Coffey, 2016
Final tailings density (average) (adopted for conservative design purpose)	t/m³	0.8	Coffey, 2016
Angle of internal friction (Φ) (deposited tailings)	°	35	Coffey, 2020
Angle of internal friction (Φ) (compacted tailings)	°	35	Coffey, 2020
Particle size distribution	% passing 75 microns	70 to 85	Coffey, 2020
Coefficient of consolidation	m^2/y	4.2 to 4.75	Coffey, 2020
Tailings beach slope*	V : H	1 in 300	Coffey, 2020

*Note: Based on observation of the tailings beach slope on the existing and operating IPTSFs.

6. SITE SELECTION

6.1 CLIMATE

The following climatic data from Bureau of Meteorology (BOM, 2023) was used in the IPTSFs 815, 7 Series and 8 Series design:

- The nearest BoM weather station to the MMO site is Leonora WA (Station Number 012046), which has collected rainfall data since 1898 to 2013, and the evaporation data was extracted from Department of Primary Industries and Regional Development – *Evaporation data for Western Australia* with the selection of Leonora station (GJ Luke, KL Burke and TM O'Brien, 2003). The mean monthly rainfall values and evaporation values are shown on Figure 2. Average annual rainfall of 236 mm and annual evaporation of 3473 mm were adopted for design purposes;
- The rainfall intensity intensity-frequency-duration (IFD) chart pertaining to the MMO site is presented on Figure 3. Based on the IFD chart, a 1:100-year AEP, 72-hour storm event can be expected to generate approximately 200 mm of rainfall.

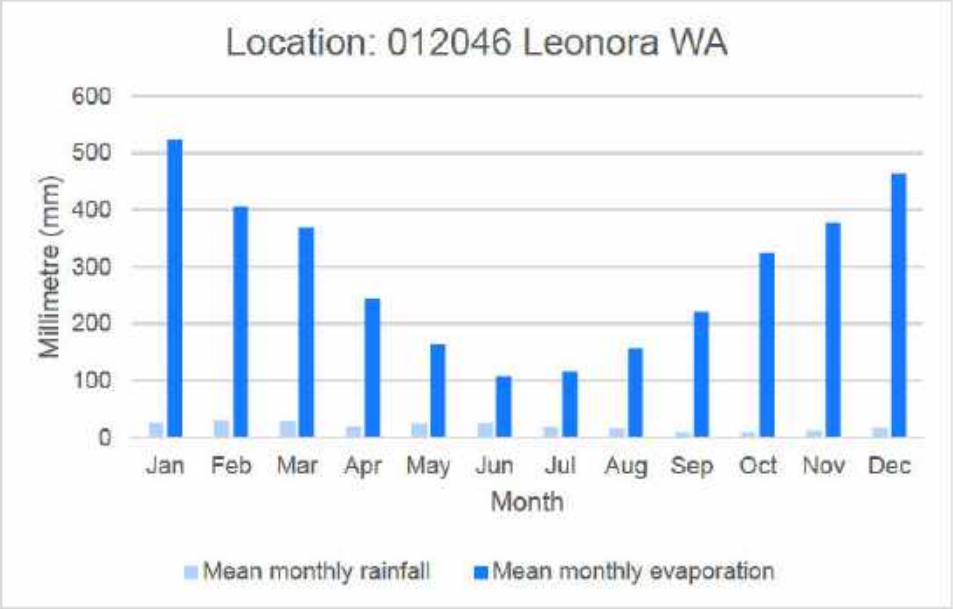

Figure 2. Mean Monthly Rainfall Chart (1898 - 2013) (BoM, 2023)

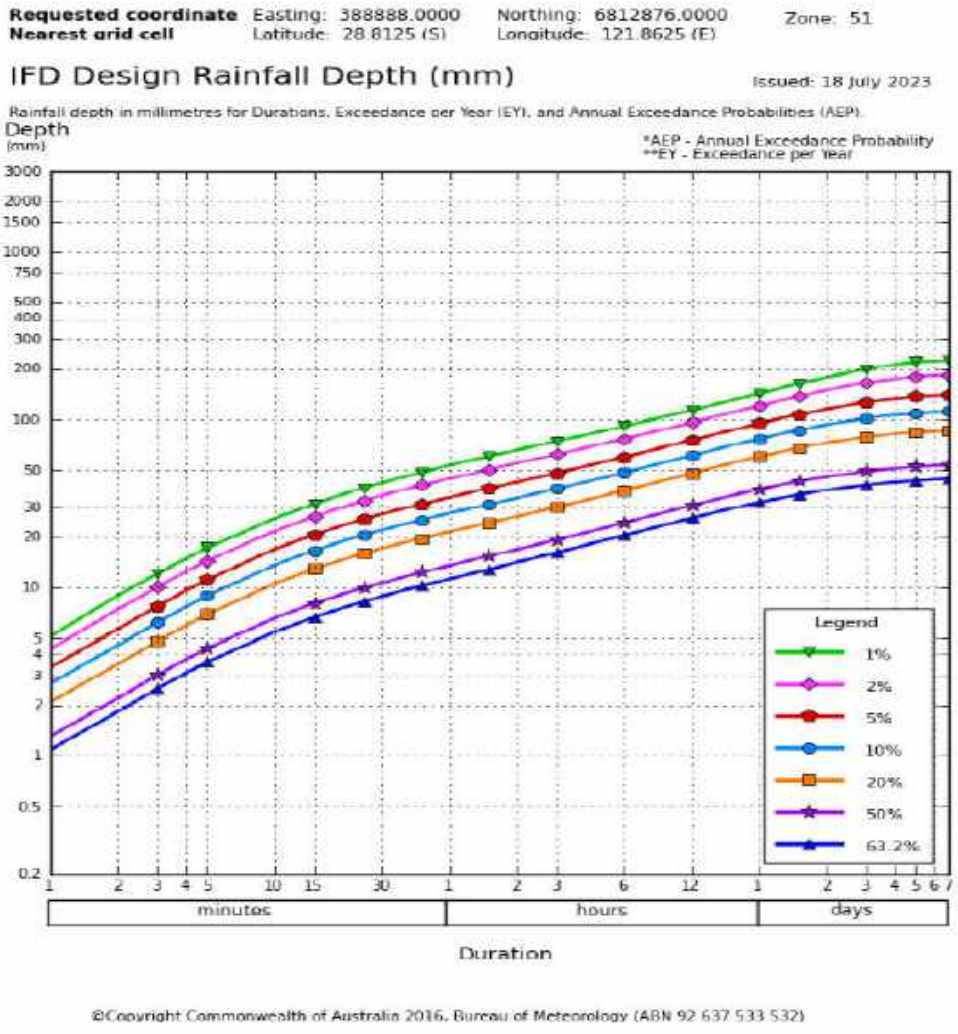

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Figure 3. Rainfall Intensity Frequency-Duration (IFD) Chart (BoM, 2023)

6.2 LANDFORM

The original terrain around the Pit 815 grades to the south-west, with the highest point at the north-eastern tip (approximately +472.00 mRL) which dip gradually to about +462.00 mRL at the south-western tip.

The original terrain around the Pit 7 Series grades to the east, with the highest point at the west tip (approximately +467.00 mRL) which dip gradually to about +451.00 mRL at the east tip.

The original terrain around the Pit 8 Series grades to the south-west, with the highest point at the eastern tip (approximately +466.00 mRL) which dip gradually to about +448.00 mRL at the western tip.

6.3 GEOLOGY AND SOILS

6.3.1 Regional Geology

The regional geology of the Murrin Murrin North project area (Figure 4) lies within the Mt Morgans district of the Mt. Margaret Mineral field (Markwell T., 1999), between the towns of Leonora and Laverton, WA; Laverton 1:250,000 map sheet (Wells MA., 2003).

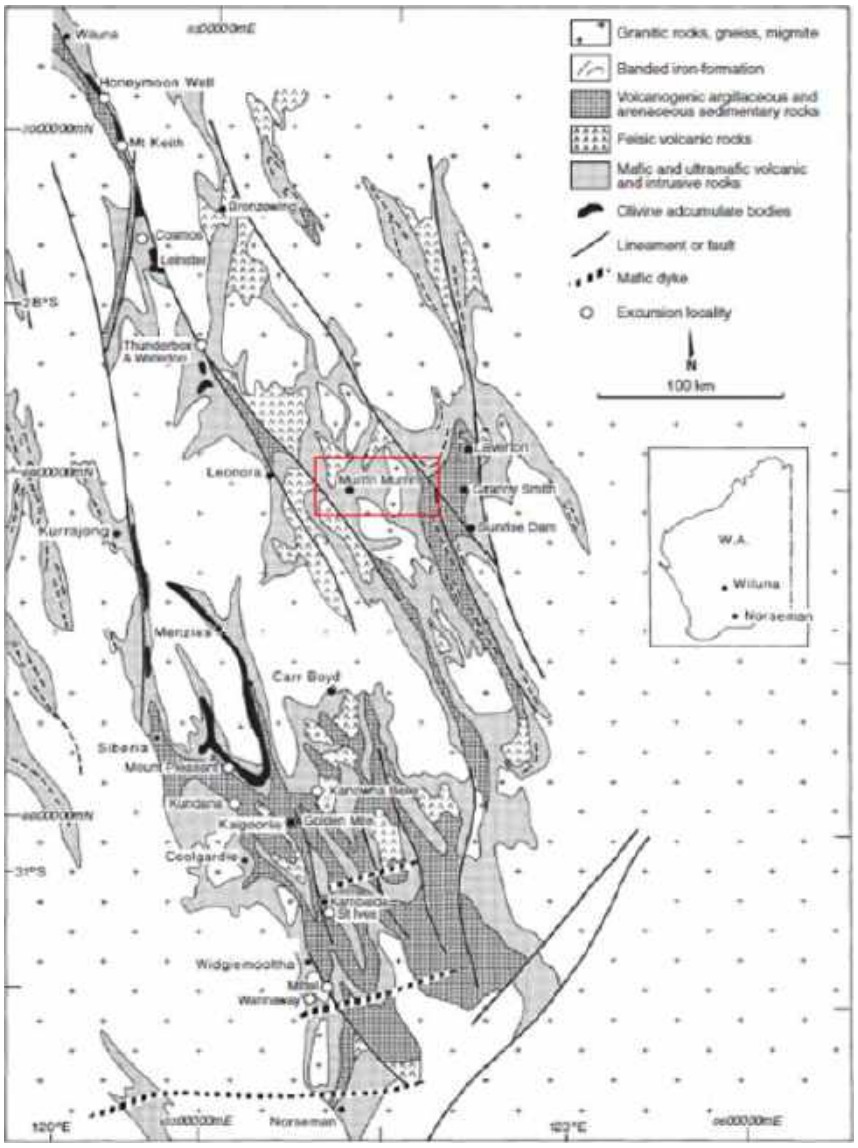


Figure 4. Regional Geology of Murrin Murrin Ni-Co Project

The Ni-Co ore deposits of the Murrin Murrin North project area are positioned over serpentinised peridotite komatiitic lava flows (Hill et al., 1990) which occur low in the stratigraphy within a sequence of felsic volcaniclastics, clastic sediments, mafic volcanics and related intrusives in the upper parts of the stratigraphic sequence (Monti and Fazakerley, 1996). The serpentinised peridotite protolith has been folded and faulted around the Kilkenny Syncline (Markwell T., 1999) (Figure 5).

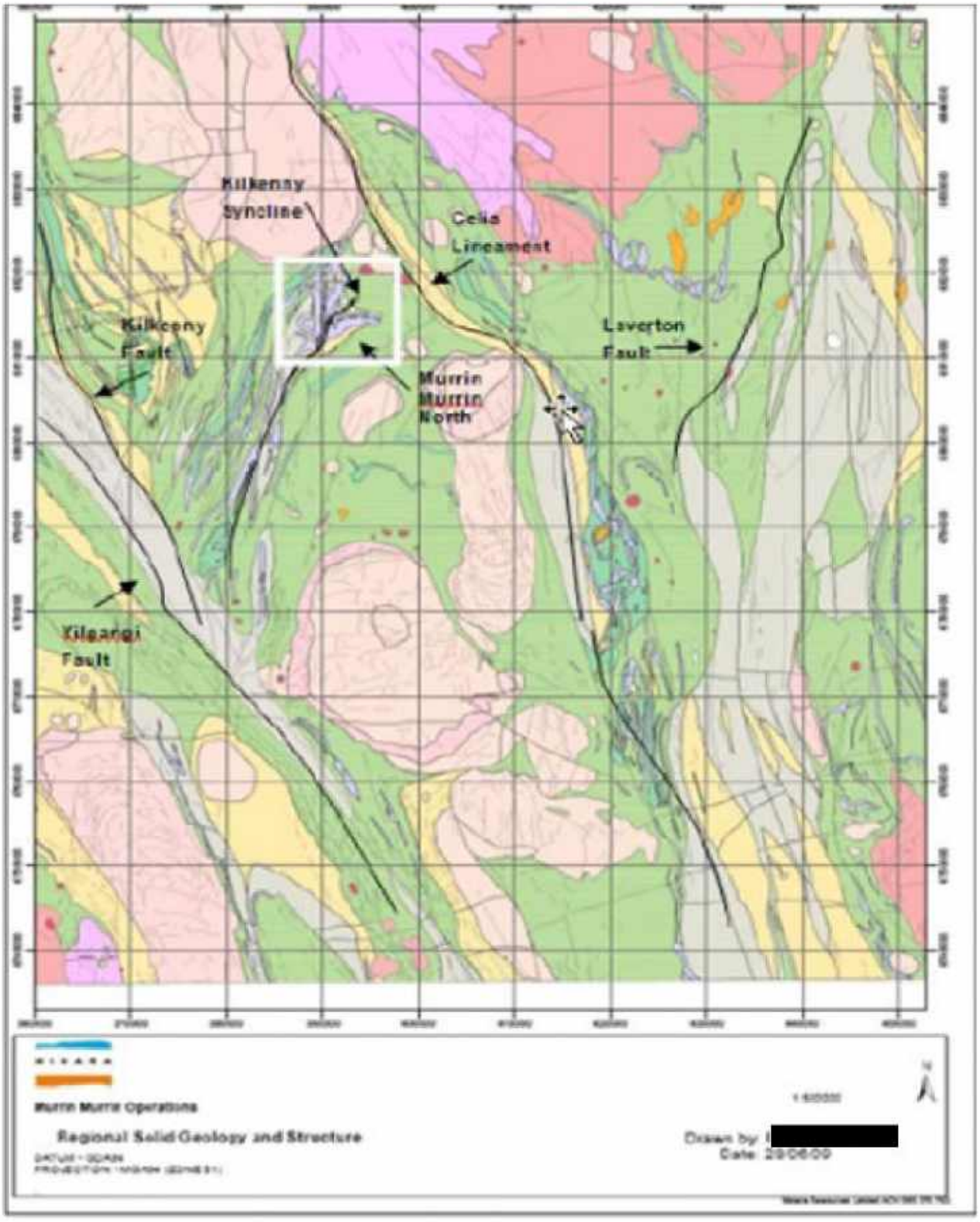


Figure 5. Regional Geology and Structural Interpretation of Murrin Murrin Ni-Co Project

6.3.2 Lithology

The following is an overview of lithology outlined in the Geological Architecture Reports for Pits 815, 7 Series and 8 Series (Minara, 2023a, b and c):

General

The regolith profile at Murrin Murrin North project area can be broadly divided into 5 main geological units produced through lateritic weathering (Figure 6):

1. *The basal unit is slightly weathered locally silicified ultramafic (**UM**) (Elias M., 2006), that grades upward into,*
2. *Saprolite (**SA**) zone which is commonly magnesium and silica rich,*
3. *Smectite (**SM**) is the main nickel bearing unit of the profile (Elias M., 2006). This is overlain by,*
4. *Ferruginous zone (FZ) which is dominantly comprised of kaolinite Fe oxides (typically goethite and hematite) (Wells M., 2003) and is commonly silica rich which is in turn capped with,*
5. *Colluviums and mixed chlorite-kaolinite plastic clays (**PC**) (Elias M., 2006), also referred to as the mottled zone. The ultramafic regolith profiles are commonly bound by weathered felsic and/or mafic volcanic and intrusive rock.*

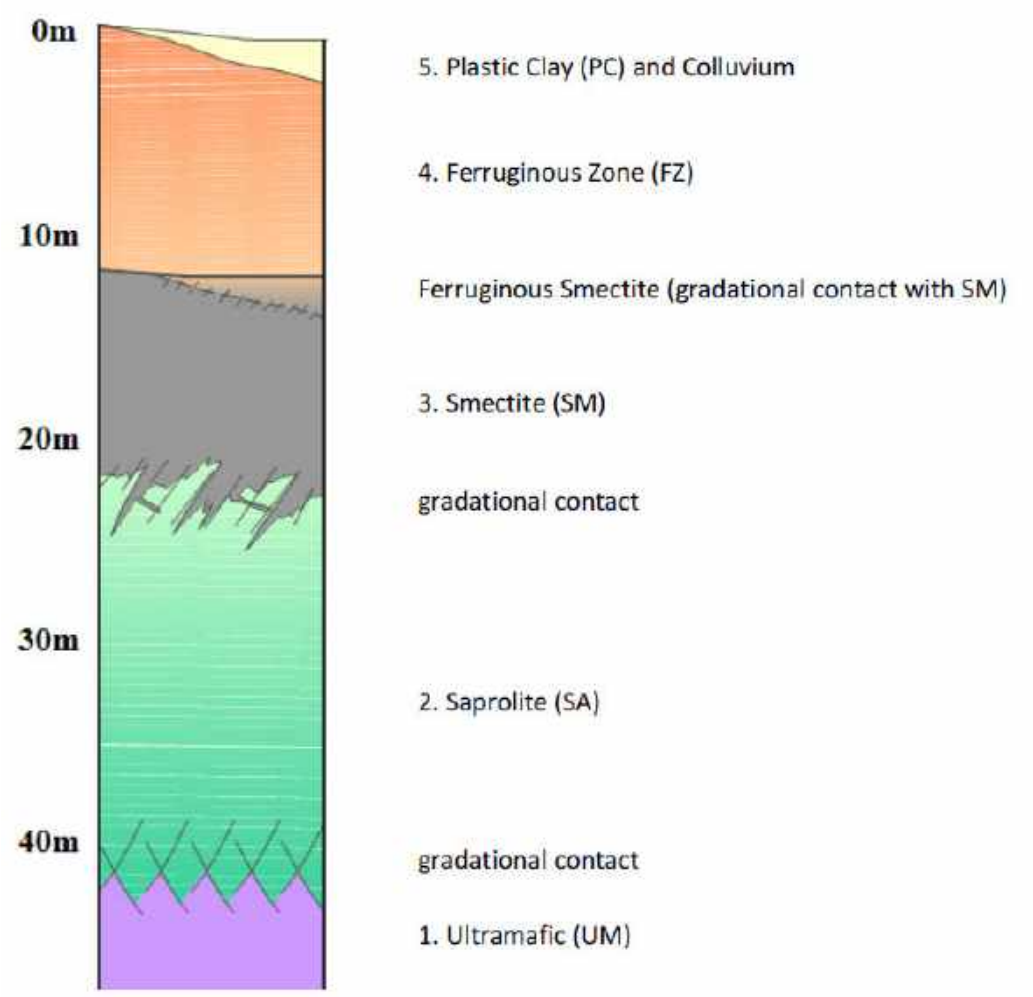


Figure 6. Generic Weathering Profile of the Murrin Murrin Nickel Laterite Deposits (MR, 2023)

Pit 815 (Minara, 2023a)

The weathering profile of exposed Pit 815 generally conforms to the basic laterite sequence whereby it is bounded at the base predominantly by saprolite (SA). The joints within the saprolite are filled by remobilised silica, which is considered usual when compared to the typical Murrin Murrin geology. This joint sets are expected to continue into the underlying semi-weathered ultramafic protolith but will be unlikely to be exposed at the completion of the pit. The walls and floors of the pits are approximately 70% SA or SSA by surface area exposure. The SA zones are generally high in magnesium with average grade of 9.2% Mg across the pit. It is expected that the SA will have a neutralising effect when exposed to potentially acidic tailings as magnesium is an acid consuming element.

The SA is overlain by a clay rich ore zone which is characterised by a package of inter-fingered transitional units including soft, finer-grained clay and nickel rich saprolite, waxy textured smectite clays and ferruginous smectite material. The final pit 815 design shows significant exposures of low magnesium smectite clays in the pit walls and floors, indicating a structurally controlled zone such as shear zones or faults where increased fluid flow results in a relatively deep weathering profile.

FZ is generally exposed in the upper 20m of the pit wall overlying the ore zone, although can be over 40 m deep in some areas within the pit. Where these zones follow lineaments, they are an indicative of structural features such as shear zones or faults (FUM).

A distinctive pink/red and white mottled texture up to 15 m thick, intersecting high in the west pit wall and a thin cap of semi-consolidated transported zone, is the PC, located at the upper most unit(s). PC is characterised by elevated Al (10%) and TZS with a more elevated Fe grade with less Al (5-10%).

Minor magnesite (MAG) lenses intersect the final pit wall. Resource definition and grade control drilling defines N-S trending felsic volcanic units to the east of the pit. Weathered felsic volcanics are intersected outside the eastern wall of pit 815 and will not endure pit 815 developing into an in-pit tailings facility.

Pit 7 Series (Minara, 2023b)

The pit 7 series weathering profile generally follows the basic laterite sequence, featuring fresh ultramafic at its base. The saprolite exhibits differing degrees of jointing and shearing, with the joints filled variably by remobilised silica – a common occurrence when compared to typical Murrin Murrin North geology. It is likely that these joint sets will extend into the underlying semi-weathered ultramafic protolith, where no exposure is expected upon pit completion. The final pit designs reveal that over 50% of the surface area exposure consists of saprolite. The saprolite zones are characterised by a high magnesium richness, with an average grade <13% Mg across the pit. It also has neutralising properties when exposed to potentially acidic tailings, making it beneficial in the MMO processing plant where magnesium acts as an acid consuming element.

The saprolite is covered by a clay rich ore zone that exhibits distinct features such as packages or inter-fingered transitional units including soft, finer-grained clay and nickel rich saprolite, waxy textured smectite clays and ferruginous smectite material. In the current pit design, there are relatively low exposures of lower magnesium (typically < 6% Mg), smectite clays in the pit walls and floors, accounting less than 15% of the surface area, and would be even lesser at the base of the final design. Smectite is modelled to depths of up to 50 m below surface in the NE section of the area. This suggests a structurally controlled zone such as shear zones of faults where increased fluid flow results in a relatively deep weathering profile (and correspondingly the deepest part of the pits).

Above the ore zone lies the ferruginous zone (FZ), characterized by coarse-grained, iron-rich, red/brown clay horizons containing dispersed hematite nodules. The ferruginous zone is typically exposed in the upper 20 m of the pit wall, constituting < 20% of the pit surface area. However, in certain areas within the pit, it can extend up to 30 m in depth. The alignment of these zones along lineaments suggests a connection to structural features such as shear zones or faults.

The upper most unit(s) of the laterite profile consist of Plastic Clay (PC-mottled zone), with a thickness of up to 15 m. This layer exhibits a distinct pink/red and white mottled texture and intersects at higher levels in the pit walls, constituting < 1% of the pit surface area. Additionally, there is a thin cap of semi-consolidated Transported Zone (TZ-colluvial floodplain material), typically less than 5 m thick. The PC is characterized by elevated Al (>10%), while the TZ features a higher Fe grade with less Al (5-10%).

Resource definition and grade control drilling have identified NW-SE trending felsic/mafic volcanic units in the central to north-western areas of the pit 7 series complex. The overall trend of the underlying ultramafic rocks is oriented WSW-ENE.

Pit 8 Series (Minara, 2023c)

The weathering profile of pit 8 series generally conforms to the basic laterite sequence whereby it is bounded at the base predominantly by saprolite (SA). The joints within the saprolite are filled by remobilised silica, which is considered usual when compared to the typical Murrin Murrin geology. This joint sets are expected to continue into the underlying semi-weathered ultramafic protolith but will be unlikely to be exposed at the completion of the pit. The walls and floors of the final pit design are > 50% saprolite or siliceous saprolite by surface area exposure. The SA zones are generally high in magnesium with average grade of 9.2% Mg across the pit. It is expected that the SA will have a neutralising effect when exposed to potentially acidic tailings as magnesium is an acid consuming element in the MMO processing plant.

The saprolite is covered by a clay rich ore zone that exhibits distinct features such as packages or inter-fingered transitional units including soft, finer-grained clay and nickel rich saprolite, waxy textured smectite clays and ferruginous smectite material. In the current pit design, there are relatively significant exposures of lower magnesium (typically < 2% Mg), smectite clays in the pit walls and floors, accounting more than 40% of the surface area, but would be lesser at the base of the final design. The coverage is similar to the area in the western half of the open pit shape, where pit 0803 is completed. Smectite is modelled to depths of up to 55 m below surface near foliated ultramafic. This suggests a structurally controlled zone such as shear zones of faults where increased fluid flow results in a relatively deep weathering profile (and correspondingly the deepest part of the pits).

Above the ore zone lies the ferruginous zone (FZ), characterized by coarse-grained, iron-rich, red/brown clay horizons containing dispersed hematite nodules. The ferruginous zone is typically exposed in the upper 20 m of the pit wall, constituting < 10% of the pit surface area. However, in certain areas within the pit, it can extend up to 40 m in depth. The alignment of these zones along lineaments suggests a connection to structural features such as shear zones or faults.

The upper most unit(s) of the laterite profile consist of Plastic Clay (PC-mottled zone), with a thickness of up to 15 m. This layer exhibits a distinct pink/red and white mottled texture and intersects at higher levels in the pit walls, constituting < 5% of the pit surface area. Additionally, there is a thin cap of semi-consolidated Transported Zone (TZ-colluvial floodplain material), typically less than 5 m thick. The PC is characterized by elevated Al (>10%), while the TZ features a higher Fe grade with less Al (5 - 10%).

Minor magnesite (MAG) lenses (<1%) intersect the final pit wall.

Resource definition and grade control drilling have delineated E-W to N-S trending felsic volcanic units located to the north of the pit 8 series complex. These units merge into the western boundary of the pit complex's Tailings Storage Facility (TSF). Additionally, a parallel boundary of weathered felsic volcanics is present to the south of the pits, situated well outside the southern wall of the pit complex. This weathered volcanic zone does not interact with the pits as it serves as a tailings facility.

6.4 HYDROGEOLOGY

Based on the Geological Architecture Reports for Pits 815, 7 Series and 8 Series (Minara, 2023a, b and c), the standing water table is currently modelled about 15 m from the base of Pit 815 design (RL 433 m to RL 435 m). For Pit 7 Series design, the standing water table is modelled between RL 421 m to RL 423 m across the entire pit complex. While for Pit 8 series, the standing water table is modelled about RL 419/420 m (west) to RL 426 m (east) below the base of some of the Pit 8 Series design. As these pits are adjacent to other existing IPTSFs, water levels in the surrounding inter-pit pillars / pit walls should be monitored periodically as the pit progresses. The hydrogeological assessment of Pits 815, Series 7 and Series 8 will need to be reviewed when they are completely mined out.

6.5 SURFACE WATER MANAGEMENT

Consideration for surface runoff water from the external upstream catchments around the proposed IPTSFs (815, 7 Series and 8 Series) is not required based on a desktop review of the site's topography and ground condition – i.e. these pits are surrounded by the existence of roads and trenches that limit the water flowing into the pits.

However, it is assessed that minor surface runoff from adjacent small areas is likely to occur and flow into these pits. For the freeboard calculation purposes, allowance has been made to account for the minor surface runoff from adjacent small areas above the IPTSF impoundment area .

6.6 FLORA AND FAUNA

The proposed IPTSFs will be in the mined-out pit voids. The pipeline corridor for the slurry and return water pipelines will be along existing tracks / accessways. Minor clearing will be required along the pipeline corridor to widen the existing track at some locations and to construct the pipeline corridor where required. This will result in limited clearing of scrub and low trees, mostly regrowth, along the track and pipeline corridor alignment. Large trees will be preserved.

7. GEOTECHNICAL ASSESSMENT

7.1 ASSESSMENT OF THE PIT WALL

The pit wall performance of the Pits 815, 7 Series and 8 Series has been assessed based on the information provided in the Geological Architecture Reports (Minara, 2023a, b and c) and no site inspection was conducted. Most of the pit complex is only partially complete, and the final design are yet to be disclosed. However, the overall understanding of the weathering process of nickel laterite at MMO provides a reasonable level of confidence in the geological pit wall interpretation. The general continuity and knowledge of the weathering process contribute to the reliability of the outlined conclusions. The pit wall performance of the Pits 815, 7 Series and 8 Series will need to be re-assessed / inspected when they are completely mined out by an experienced Mining / Geotechnical Engineer.

The followings are noted in the Geological Architecture Reports by Minara (2023a, b and c):

Pit 815 (Minara, 2023a)

- *Saprolite, siliceous Saprolite and Smectite form the main rock types exposed in the floor and walls of the pits. The average Mg content for these two lithologies is at 8%, which likely provides a neutralising effect when exposed to potentially acidic tailings.*

- *The observation that weathering has developed to significant depths below the current pit floor is indicative of structurally controlled zones of increased fluid flow. The main structural zones observed from modelling are through the middle of 0809 (west) and 0810 (central), may provide a preferential pathway for fluid flow (east and southward) towards the central potential tailings area. The structural zones in the southeast corner of the pit series may be a preferential conduit for fluid flow to continue south and east.*

Pit 7 Series (Minara, 2023b)

- *Saprolite and Smectite form the main rock types exposed in the floor and walls of the pits. The average Mg content for these two lithologies is >9%, which likely provides a neutralising effect when exposed to potentially acidic tailings.*
- *The observation that weathering has developed to significant depth below the current pit floor is indicative of a structurally controlled zone of increased fluid flow. The structural zone observed from modelling is outside of the pit complex, therefore reducing the likelihood of fluid flow along this preferential pathway.*

Pit 8 Series (Minara, 2023c)

- *Saprolite, siliceous Saprolite and Smectite form the main rock types exposed in the floor and walls of the pits. The average Mg content for these two lithologies is at 10% which can be expected to provide a neutralising effect when exposed to potentially acidic tailings.*
- *The observation that weathering has developed to significant depths below the current pit floor is indicative of structurally controlled zones of increased fluid flow. The main structural zone observed from modelling, is through the middle of 0815 and may provide a preferential pathway for fluid flow (southward) towards other existing in-pit tailings facilities.*

7.2 STRUCTURAL FEATURES OF THE EXPOSED MINED PITS

The following is an overview of the structural features of Pits 815, Series 7 and Series 8 outlined in the Geological Architecture Reports (Minara, 2023a, b and c):

Pit 815 (Minara, 2023a)

Economic mineralisation at the Murrin Murrin Ni-Co project is contained within the weathered profile of the ultramafic protolith, resulting in the mined pits rarely exposing fresh ultramafic rock to allow for detailed investigation of the structural features of the deposit. However, as these structural features have acted as conduits for fluid flow or as areas of increased permeability during the formation of the laterite profile they tend to be revealed in the distribution of certain elements or lithology domains in the regolith profile. The most effective elements for delineating structural features in 0815 are Si below the ferruginous zone and the general location of Foliated Ultramafic (FUM-a lithology feature with elevated Al and Mg and moderate Fe). Little of these domains can be seen in the development of the pit (to date), therefore the geological interpretation must be relied upon for the structural features of the deposit.

FUM coincides with a zone of deep weathering through the centre of the pit and follows a trend southeast with a westward dip. This zone is likely to represent a weathered fault or shear which has acted as a conduit for fluid flow resulting in the development of deeper weathering.

The lower part of the mineralisation (throughout the pit) becomes more siliceous, representing silica infill and/or replacement of SA at or near a relatively stable water table at this current limit of the weathering process.

During mineralisation, shears, joints and contacts provide vital conduits for fluid migration enhancing the chemical mobilisation and leaching processes within the weathering profile. Therefore, such structures may act as zones for potential tailings leakage.

Pit 7 Series (Minara, 2023b)

Economic mineralisation at the Murrin Murrin Ni-Co project is contained within the weathered profile of the ultramafic protolith, resulting in the mined pits rarely exposing fresh ultramafic rock to allow for detailed investigations of the structural features of the deposit. However, as these structural features have acted as conduits for fluid flow or as areas of increased permeability during the formation of the laterite profile, they are recognisable in the distribution of certain elements or lithology domains in the regolith profile. The most effective method for delineating structural features in rz07 is observation of areas of deepened weathering profile.

A zone of deep weathering on the eastern margin of the pit complex trends North- South with a vertical dip. This zone is likely to represent a weathered fault that acts as a conduit for fluid flow resulting in the development of the deeper weathering.

During mineralisation, faults, joints and contacts provide vital conduits for fluid migration enhancing the chemical mobilisation and leaching processes within the weathering profile. Therefore, such structures may act as zones for potential tailings leakage. The only obvious fault zone is outside the eastern edge of the proposed pit, reducing the likelihood of leakage.

Pit 8 Series (Minara, 2023c)

Economic mineralisation at the Murrin Murrin Ni-Co project is contained within the weathered profile of the ultramafic protolith, resulting in the mined pits rarely exposing fresh ultramafic rock to allow for detailed investigations of the structural features of the deposit. However, as these structural features have acted as conduits for fluid flow or as areas of increased permeability during the formation of the laterite profile they are recognisable in the distribution of certain elements or lithology domains in the regolith profile. The most effective elements for delineating structural features in rz08w are Si below the ferruginous zone and the general location of Foliated Ultramafic, Mafic and Felsic (FUM- a lithology feature with elevated Al/Mg and moderate Fe, MAF- elevated Al, low Mg and mod. Fe, FEL- elevated Al and low Mg/Fe). Little of these domains can be seen in the development of the pit (to date), therefore the geological interpretation must be relied upon for the structural features of the deposit.

TLC/FUM coincides with a zone of deep weathering through the centre of the pit and follows a trend south and southeast with a westward dip from 0809 to 0807 pit. This zone is likely to represent a weathered faults or shears that act as conduits for fluid flow resulting in the development of deeper weathering.

The lower part of the mineralisation (throughout the pit) becomes more siliceous, representing silica infill and/or replacement of SA at or near a relatively stable water table at this current limit of the weathering process.

During mineralisation, shears, joints and contacts provide vital conduits for fluid migration enhancing the chemical mobilisation and leaching processes within the weathering profile. Therefore, such structures may act as zones for potential tailings leakage, especially in the southeast corner of the pit complex.

7.3 IMPLICATIONS WITH RESPECT TO TAILINGS DEPOSITION

When the Pits 815, 7 Series and 8 Series are completely mined out, groundwater could be anticipated at the bottom of the pits. From a geotechnical perspective, the main issue that will be influencing pit wall stability is the increase in excess pore water pressures in the pit walls due to the lowering of water levels. Dewatering of the pit may initiate some pit wall slumping due to these excess pore pressures. These failures may be circular slip-type failures or failures due to the presence of structural features (i.e. planar features) in the pit walls.

It should be noted that the pit wall stability will be improved as a result of tailings deposition, with the deposited tailings abutting the toe of the walls and increasing factors of safety for any existing potential failure zones.

The following aspects are relevant to management of an in-pit TSF:

1. During dewatering of the pit, slumping of the pit walls may be apparent. Personnel considering entry to the pit should inspect the pit rim area and conduct HAZOPS before entering the pit. Construction activities at the base of the pit are not envisaged other than establishing decant pumps. After the tailings level exceeds the groundwater level, this will no longer be a concern.
2. Tailings will be deposited into the IPTSF from movable discharge point(s) at one end of the pit to progressively develop and push the supernatant pond at the opposite pit side and close to the pit access ramp(s). Deposition locations have been considered to optimise the storage capacity of the pit voids whilst enabling the use of the existing access ramp and pump (designed by others) for water recovery.
3. The ponds of supernatant water, liberated from the tailings slurry, will be located adjacent to the pit access ramps. Pumps will be deployed from the access ramps will allow recovery of supernatant water. The pumps will be moved up the ramps as the tailings and water levels rise within the pit to recover water from the facility and return it to the processing plant for re-use. Water should not be allowed to accumulate in the pit, i.e., as water recovery will increase factors of safety against wall instability and reduce seepage when the pit is nearly full.

Routine (daily) pit rim inspections during the operation of the IPTSFs 815, 7 Series and 8 Series, with particular emphasis on the pit crest/rim, its slopes above the access path (i.e. haul ramp) to the decant pump infrastructure and pit slopes surrounding the decant pump infrastructure, is essential.

7.4 TAILINGS SETTLEMENT

The results of tailings settlement assessment (based on traditional consolidation theory) are summarised and presented in Table 6. The results of the settlement assessment are presented in Appendix D. Settlement within the IPTSF is expected to occur both during and post deposition of tailings, as the tailings consolidate to form a stable mass. The actual settlement at any point within the pit will vary depending on (i) the thickness of tailings, (ii) the rate of tailings placement within the pit, (iii) the rate of supernatant water removal during and after each deposition cycle, and (iv) the efficiency of the topping up process.

Table 6: Summary of Estimated Tailings Settlement in IPTSFs

In-Pit TSF	Approx. Operation Time (year)	Approx. Maximum Tailings Depth (m)	Approx. Settlement During Operation (m)	Approx. Settlement Post Operation (m)	Approx. Total Settlement (m)	Estimated Time for > 90% Consolidation (year)
815 IPTSF	0.63	41.9	3.36	1.10	4.46	During and after operations: 4 years After operations: 3.4 years
7 Series IPTSFs	1.10	32.0	2.51	0.88	3.39	During and after operations: 4 years After operations: 2.9 years
8 Series IPTSFs	3.74	48.2	4.28	0.87	5.15	During and after operations: 6 years After operations: 2.3 years

The final remaining settlement within the IPTSFs is expected to be less than that identified in Table 6, due to the plan to implement a topping up process upon completion of each deposition cycle once supernatant water has been removed.

8. IPTSF CIVIL DESIGN

8.1 GENERAL

The tailings storage data sheets (TSDS) of the proposed IPTSFs (815, 7 Series and 8 Series) design are presented in Appendix B. The civil design for the IPTSFs 815, 7 Series and 8 Series is based on the information presented in Sections 3, 4, 5 and 6 and is similar to other IPTSFs at MMO, in that it incorporates a surface return water recovery system and perimeter monitoring bores (MBs) located in proximity and around the pits.

Refer to the following sections for details.

8.2 HAZARD RATING AND DESIGN CRITERIA

Hazard rating / consequence category is utilised to establish various criteria for design and assess the risk of IPTSFs failure to a level appropriate to the consequences of such a failure.

8.2.1 DMIRS Hazard Rating

Based on classification criteria outlined in Tables 1 and 2 of DMIRS (2013).the proposed IPTSFs (815, 7 Series and 8 Series) have been assigned a hazard rating of '**Low - Category 3'** (regarding IPTSF). It is not practical to consider an IPTSF failure will occur, then the tailings and water will spill out and impact people, destroy the assets and damage the environment. '**Low**' damage type for the IPTSFs is characterised by following:

- No potential for loss of life or injury;
- Limited or no potential for human exposure;
- Limited or no potential for destruction or loss of assets (mine infrastructure and IPTSFs, if any);
- Insignificant loss of tailings storage capacity;
- Limited potential for damage to natural environment (neutralised tailings-solids samples);
- Limited potential for adverse effects on flora and fauna; and
- Limited or no potential for damage of items of heritage or historical value.

Note that there will be no perimeter / containment embankments around the IPTSFs, therefore no dam break analysis is required.

8.2.2 ANCOLD Consequence Category

Based on the ANCOLD (2019), the Dam Failure Consequence Category (DFCC) for the proposed IPTSFs (815, 7 Series and 8 Series) is deemed '**Very Low**' due to '**Minor**' impact / damage level and a population at risk (PAR) of < 1 (refer Tables 1 and 2 of ANCOLD, 2019). '**Minor**' impact / damage level for the IPTSFs is characterised by:

- Loss of infrastructure < $10M;
- Some restrictions to business (i.e. the mine)l
- Public health < 100 people affected;
- Social dislocation: < 100 people or 20 business months;
- Impact area < 1 km^2;
- Impact duration < 1 year; and
- Limited effects on cleared land, ephemeral streams and non-endangered local flora and fauna. Remediation is possible.

It is assessed that the impact severity on the natural environment from the IPTSFs' tailings and water spill is '**Minor**' (i.e., neutralised tailings-solids samples), and spilling of water from the IPTSFs during a 1:100-year AEP, 72-hour duration storm event is unlikely), with a PAR of < 1 (assigned to the IPTSFs tailings and water spill event), therefore the Environmental Spill Consequence Category (ESCC) for the IPTSFs is also deemed '**Very Low**'.

8.2.3 Design Criteria

The following criteria were adopted for the proposed IPTSFs (815, 7 Series and 8 Series) design based on the hazard rating assessment:

- Recommended freeboard criteria and design water storage allowance (DSA):
  - Based on DMIRS (2015a), for a '**Low - Category 3**' hazard rating, the IPTSFs will be designed to be capable of temporarily storing rainfall from a 1:100-year Annual Exceedance Probability (AEP), 72-hour storm event plus a minimum pit wall freeboard of 0.5 m (vertical height between the stormwater and minimum pit rim levels).

    Note that these criteria are applicable or the case without upstream catchment above the IPTSFs (i.e. the existence of roads and trenches that limit the water flowing into the pits)
  - Based on ANCOLD (2019), for a '**Very Low**' DFCC / ESCC, the DSA and contingency freeboard are not required. Therefore, the DSA and freeboard requirements for the IPTSFs are just based on the DMIRS guidelines (2015a).
- Recommended design earthquake loading:
  - DMIRS (2015a) prefers ANCOLD guidelines (2019). Based on ANCOLD (2019), for a '**Very Low**' DFCC, the recommended Operating Basic Earthquake (OBE) and Safety Evaluation Earthquake (SEE) loadings are not assigned. Earthquake loading is also considered not applicable for the IPTSFs design as there will be no perimeter / containment embankments around the pit.

8.2.4 Reporting and Inspection Criteria

Reporting and operating requirements for the proposed IPTSFs (815, 7 Series and 8 Series), classified as '**Low - Category 3**' (based on DMIRS, 2015a), includes the following:

- Design (including site investigation): report prepared by a competent person. Completion of tailings storage data sheet (TSDS).
- Construction: constructed by a competent person. Provision of detailed construction report with as-built drawings.
- Operations: inspection and audit every 3 years by competent person.
- Pre-closure: inspection report by competent person confirming the current status and intended decommissioning, rehabilitation and monitoring strategies with as-built drawings.
- Relinquishment: final report by a competent person confirming closure objectives have been achieved.

Based on ANCOLD (2019), for a '**Very Low**' DFCC, the inspection type and frequency are not required. Therefore, the inspection type and frequency requirements for the IPTSFs are just based on the DMIRS guidelines (2015a).

It is highly recommended that routine daily inspection by site personnel and annual audit by a competent person (TSF Engineer of Record) should be implemented to avoid major operational / environmental problems and provide appropriate remedial actions in due course.

8.3 DRAWINGS

The following drawings are provided for the proposed IPTSFs (815, 7 Series and 8 Series) design and are presented in Appendix E.

Title	Indicative Pit Geometry
Site Layout Plan	754-PERGE318544-DD-01
Tailings and Decant Return Water Pipeline Routes	754-PERGE318544-DD-02
Monitoring Bore Locations	754-PERGE318544-DD-03
Typical Sections and Details	754-PERGE318544-DD-04
Deposition Plan for Pit 815	754-PERGE318544-DD-05
Deposition Plan for Pit 7 Series	754-PERGE318544-DD-06
Deposition Plan for Pit 8 Series	754-PERGE318544-DD-07

8.4 STORAGE CHARACTERISTICS

Based on the design pit shells (provided by Minara) and the tailings deposition modelling results (using Muk3d program), the IPTSFs storage characteristics is summarised and presented in Table 7.

It is noted that the storage capacity and life are calculated based on the conservatively adopted tailings (dry) density of 0.8 t/m^3 and a tailings production of 4.62 Mtpa. The topping-up process is not likely to significantly increase the IPTSF storage life. An assumed tailings beach slope of 1:300 (V:H) and the stormwater volume (from a 1:100-year AEP, 72-hour storm event) temporally stored on top of the IPTSFs and above the normal operating pond level were considered in the calculations. For further clarification, tailings storage capacity curves for the IPTSFs 815, 7 Series and 8 Series are presented in Figures 7, 8 and 9 respectively.

Table 7: Summary of IPTSFs Storage Characteristics

In-Pit TSF	Indicative Pit Geometry	Pit Surface Area (ha)	Approx. Max. Tailings depth (m)	Indicative Tailings Storage Volume (Mm^3)*	Indicative Tailings Storage Capacity (Mt)*	Indicative Storage Life (years)*
815	Width 430 m; Length 465 m Orientation: West – East Min. pit rim: RL 462.2 m (West) Max. pit rim: RL 472.5 m (North-East) Max. Depth 42.2 m to 52.5 m	38.1	41.9	3.64	2.91	0.63
7 Series	Width 400 m; Length 2170 m Orientation: West – East Min. pit rim: RL 443.0 m (East) Max. pit rim: RL 456.6 m (West) Max. Depth 29.0 m to 42.6 m	100.0	32.0	6.33	5.07	1.10
8 Series	Width 600 m; Length 2000 m Orientation: East – West Min. pit rim: RL 447.5 m (West) Max. pit rim: RL 466.0 m (East) Max. Depth 45.5 m to 64.0 m	177.0	48.2	21.6	17.28	3.74

*Note: Storage volume was based on the tailings deposition modelling with an assumed tailings beach slope of 1:300 (V:H). Storage capacity and life were conservatively calculated based on the adopted tailings (dry) density of 0.8 t/m^3 and tailings production of 4.62 Mtpa.

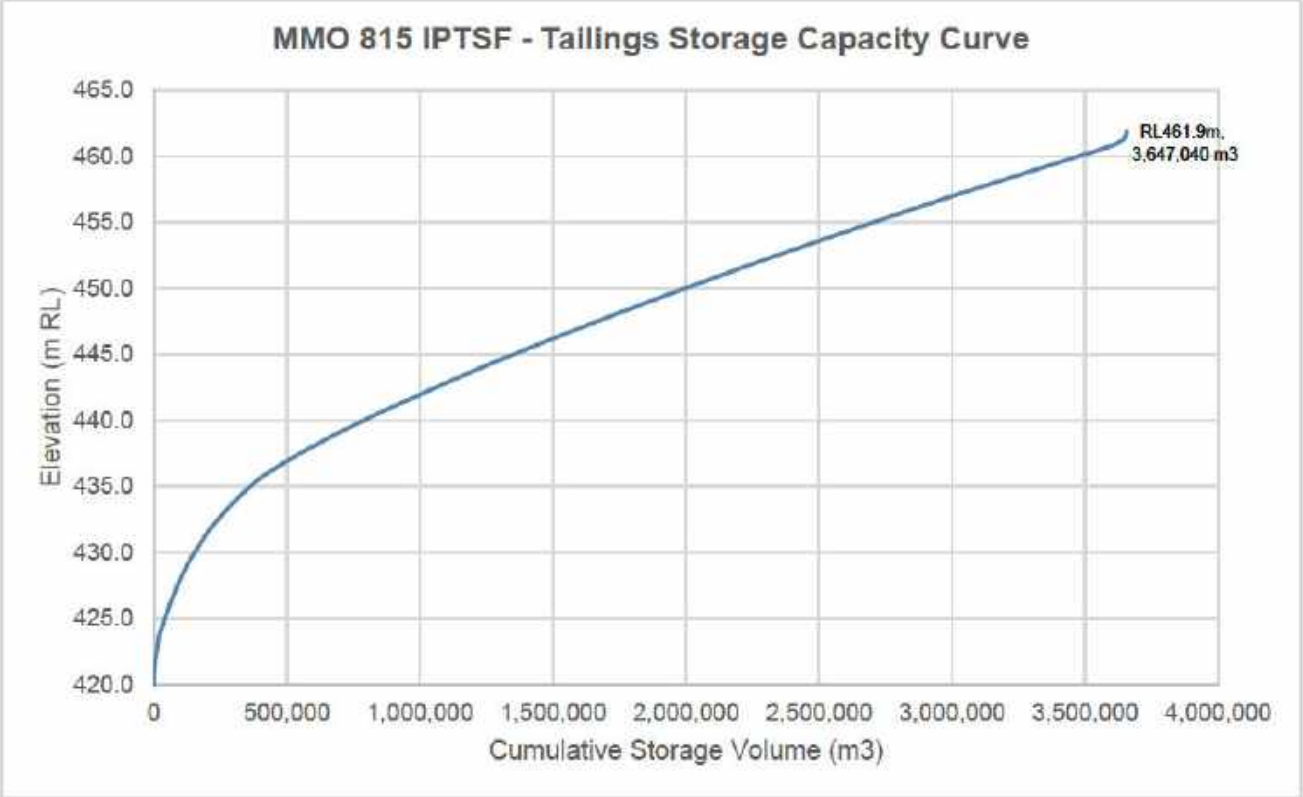


Figure 7. IPTSF 815 - Tailings Storage Capacity Curve

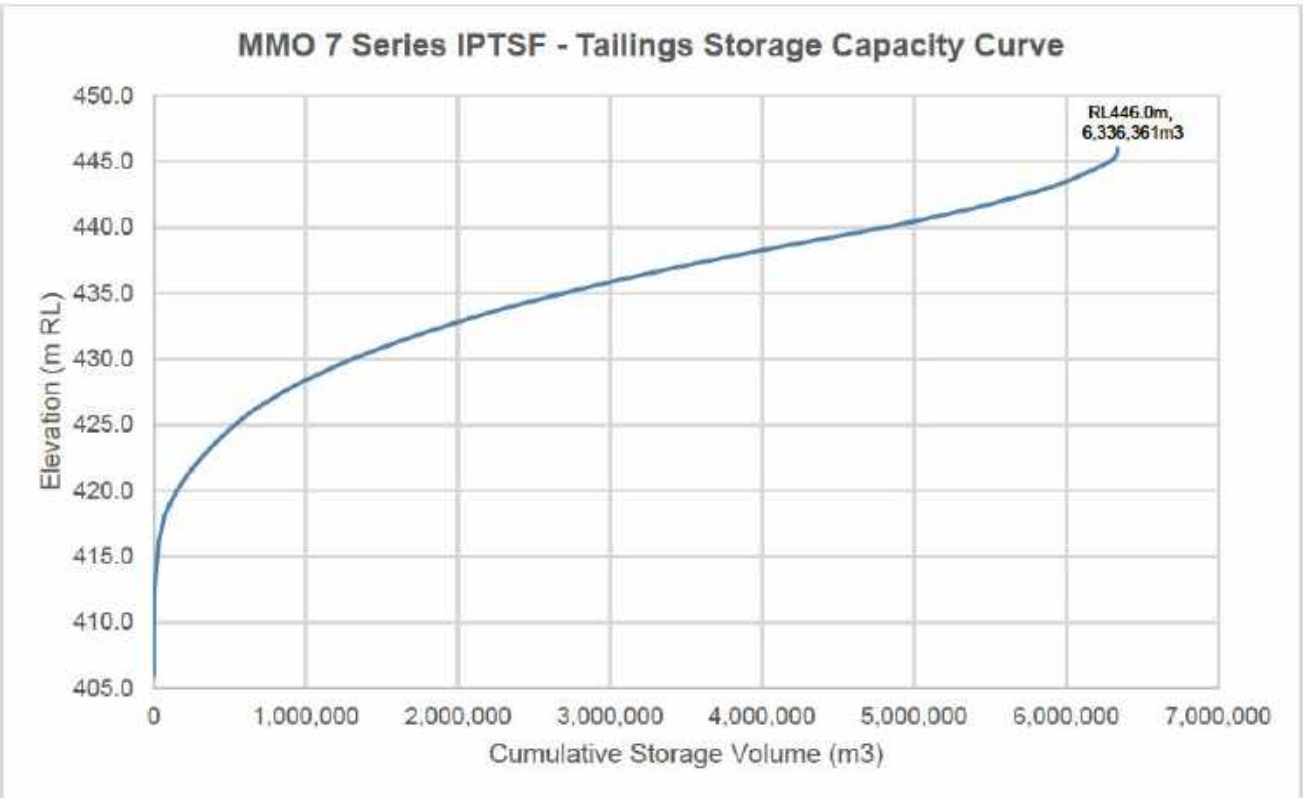


Figure 8. IPTSF 7 Series - Tailings Storage Capacity Curve

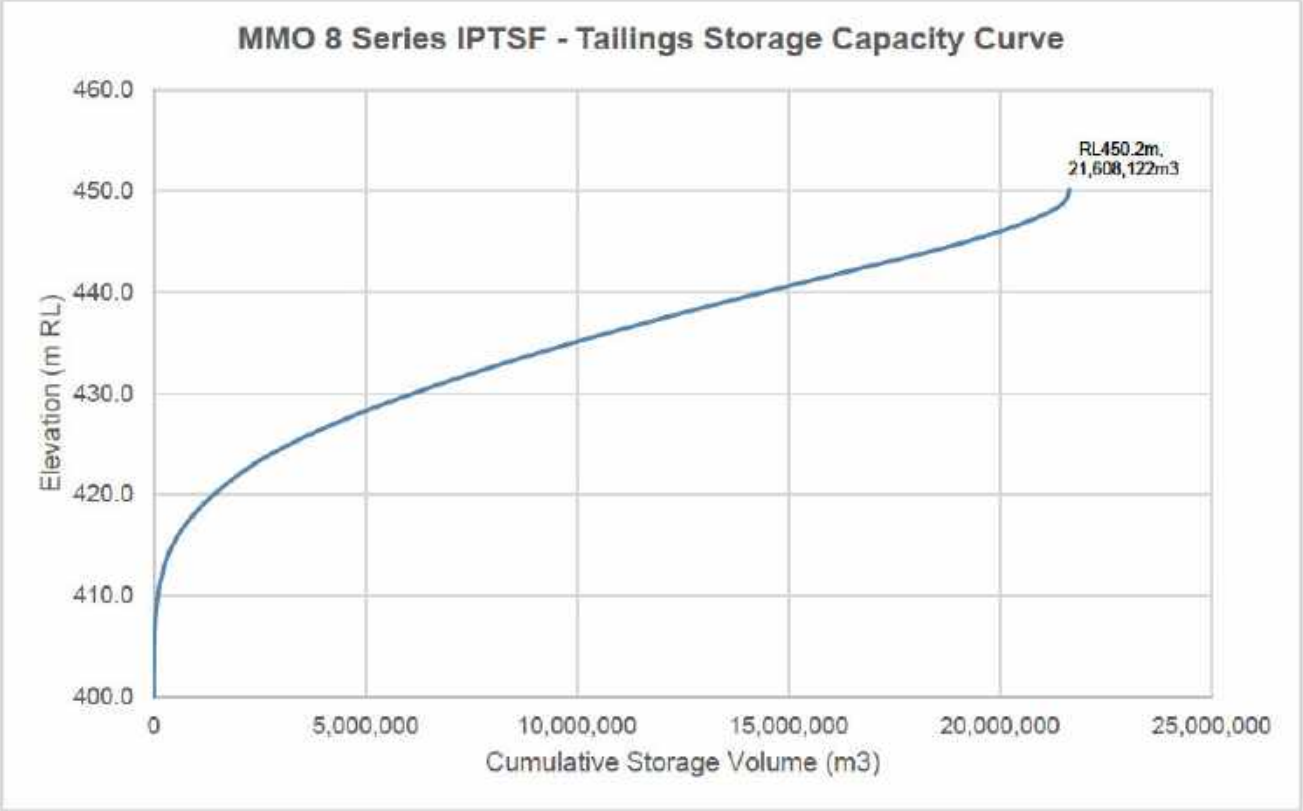


Figure 9. IPTSF 8 Series - Tailings Storage Capacity Curve

8.5 FREEBOARD REQUIREMENTS

Aside from supernatant water from tailings slurry, the primary ingress of water into the proposed IPTSFs (815, 7 Series and 8 Series) will be from incident rainfall. However, as mentioned in Section 6.5, it is assessed that minor surface runoff from adjacent small areas is likely to occur and flow into these pits. For the freeboard calculation purposes, allowance has been made to account for the minor surface runoff from adjacent small areas above the IPTSF impoundment area.

Flood and freeboard requirements for each IPTSF have been designed in accordance with DMIRS (2015) guidelines as follows. DMIRS freeboard criteria are summarised in Table 8, with freeboard requirements illustrated in Figure 10.

- The top tailings surface of the IPTSF will assume a "wedge formation", with a beach sloping towards the decant pond location. The IPTSF is designed to temporarily hold the stormwater volume from a 1:100-year AEP, 72-hour storm event on top of the facility and above the normal operating pond level.
- The normal operating pond level / extent is adopted at 20% to 25% of the tailings surface area under normal operating conditions.
- Provision is made for a minimum total freeboard of 0.5 m (vertical height between the stormwater and minimum pit rim levels).

  Note that these criteria are applicable or the case without upstream catchment above the IPTSFs (i.e. the existence of roads and trenches around the pits that limit the water flowing into the pits)

It should be noted that the DFCC / ESCC for the IPTSFs is deemed **'Very Low'**, hence DSA and contingency freeboard are not required (ANCOLD, 2019). The DSA and freeboard requirements for the IPTSFs are just based on the DMIRS guidelines (2015a).

Table 8: DMIRS Freeboard Requirements (2015)

IPTSF	1:100-year AEP, 72-hr Storm Event*	Total Freeboard (above the Storm Water Level and below the minimum Pit Rim Level)*	Equivalent Storm Water Depth (above the Normal Operating Pond Level)	Equivalent Total Freeboard (above the Normal Operating Pond Level and below the minimum Pit Rim Level)
815	0.2 m	Minimum 0.5 m	0.9 m	Minimum 1.4 m
7 Series	0.2 m	Minimum 0.5 m	1.8 m	Minimum 2.3 m
8 Series	0.2 m	Minimum 0.5 m	1.4 m	Minimum 1.9 m

*Note: These DMIRS criteria are applicable for the case without upstream catchment above the IPTSF (i.e., existence of roads and trenches around the pits that limit the water flowing into the pits).

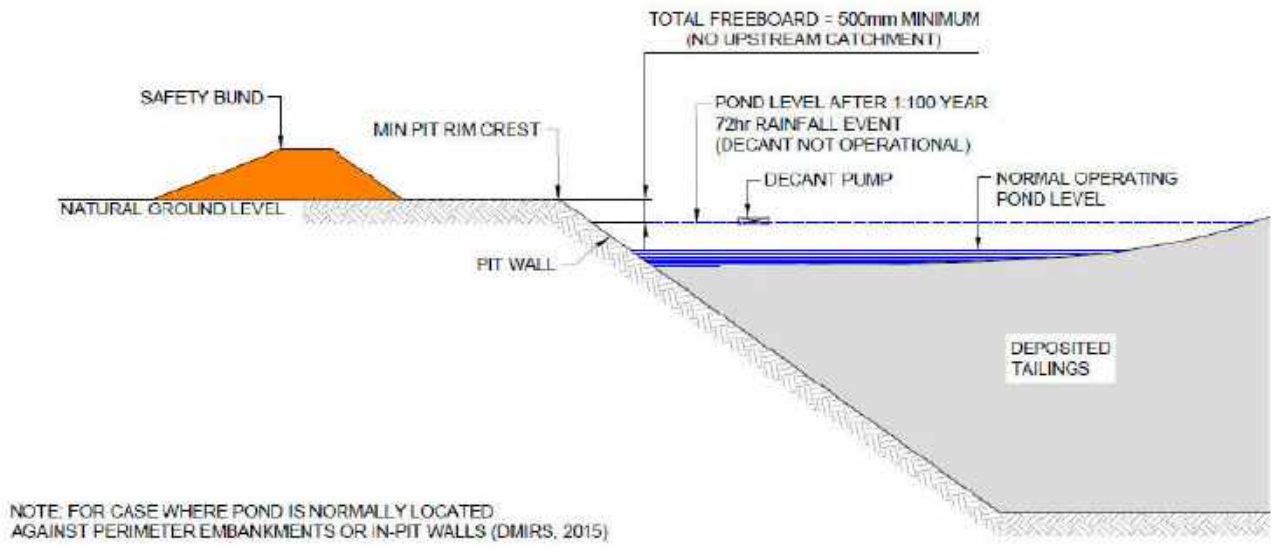


Figure 10. Freeboard Nomenclature (DMIRS, 2015)

The approximate catchment area for the proposed IPTSFs (815, 7 Series and 8 Series) and the stormwater volume within the facilities are given in Table 9. A conservative runoff coefficient of 1.0 for the wetted tailings surface (under extreme storm events) was adopted to calculate the stormwater volume within the facility. Details of the design water storage allowance (DSA) / available "wedge formation" volume above the normal operating pond within each facility are also presented in Table 9 to check the pit wall overtopping risk.

Table 9: Summary of Stormwater Volume and DSA Volume at Final Stage

IPTSF	Min Pit Rim RL (m)	Discharge point(s) RL (m)**	Catchment area (ha)	Stormwater Volume (m^3) from a 1:100-yr, 72-hr event	Design Water Storage Allowance (m^3)*
815	462.2 (West)	461.9 (West)	38.1	76,200	93,600
7 Series	443.0 (East)	446.0 (West)	100.0	200,000	345,000
8 Series	447.5 (West)	450.2 (East)	177.0	354,000	512,000

Notes:
*The DSA / available "wedge formation" volume was calculated based on the final tailings surface and considered above the normal operating pond level and below the maximum water level (at 0.5 m below the minimum pit rim level).
**The discharge point(s) for each IPTSF are detailed in Drawings 854-PERGE318544-DD-05, 06 & 07.

Based on the calculations in Table 9, the DSA within each IPTSF is greater than the stormwater volume associated with a 1:100-year AEP, 72-hour storm event. Thus, pit wall overtopping is assessed to be unlikely. For further clarification, the supernatant pond storage curves with the remained available freeboard following an extreme storm event are shown on Figures 11, 12 and 13 for IPTSFs 815, 7 Series and 8 Series, respectively.

The design assumes correct operational controls are adhered to and water is continually removed, such that minimum freeboard allowances are maintained. Adherence to this level will ensure adequate stormwater storage within the facility and that freeboard criteria are met, in addition to the normal operating decant pond. The freeboard may not be critical during operations. It should be noted that critical freeboard criteria are particularly relevant when the tailings beach level approaches the pit rim level, that is when the facility is almost full and at closure.

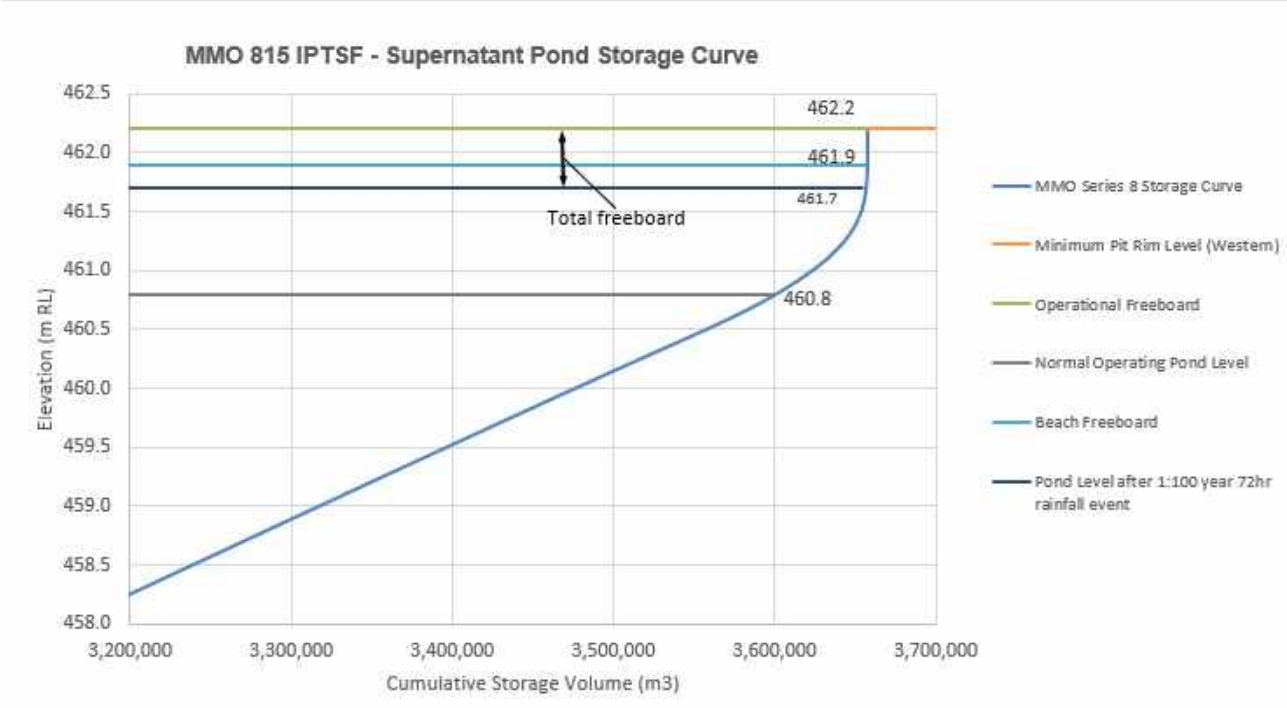


Figure 11. IPTSF 815 – Supernatant Pond Storage Curve

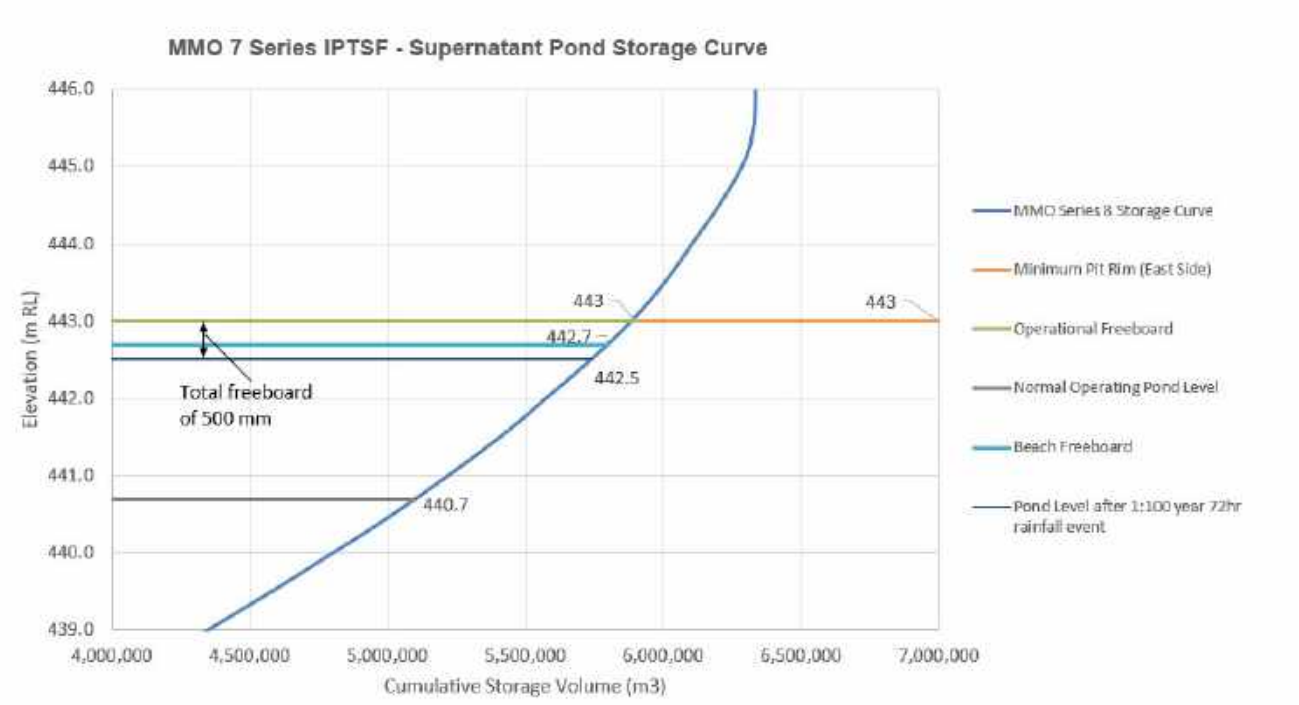


Figure 12. IPTSF 7 Series - Supernatant Pond Storage Curve

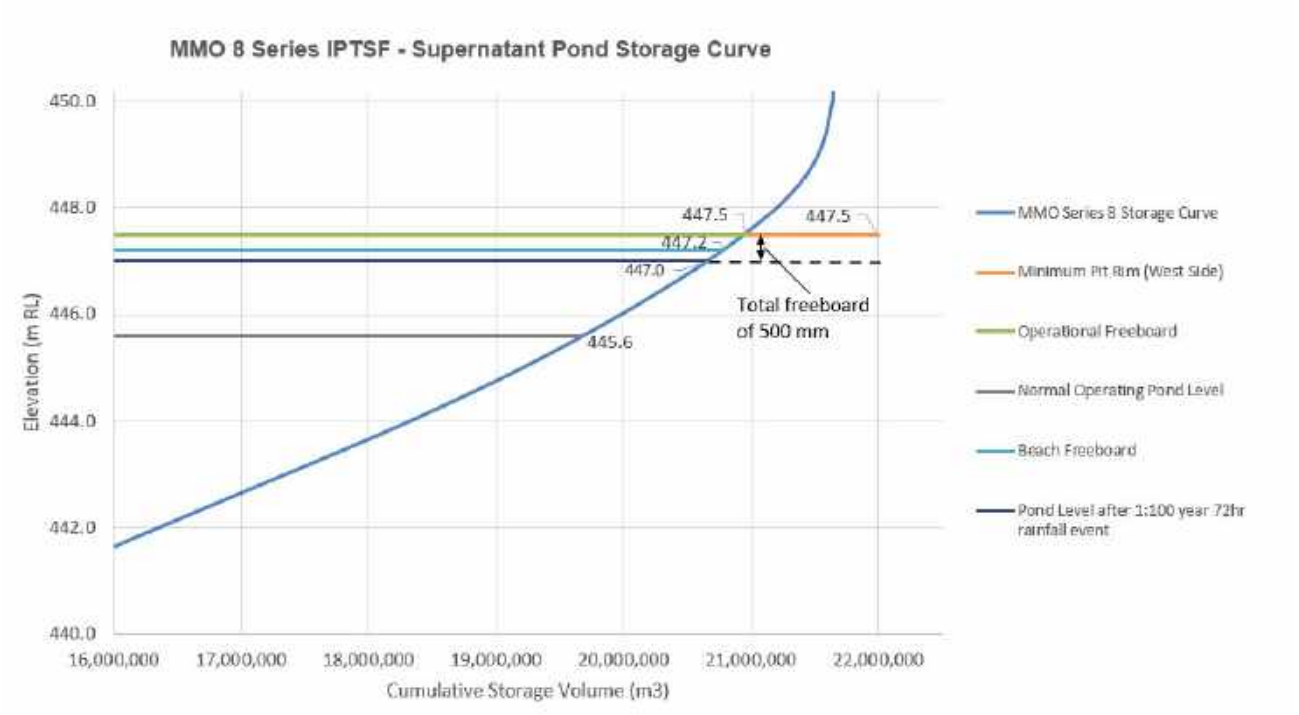


Figure 13. IPTSF 8 Series - Supernatant Pond Storage Curve

8.6 TAILINGS DEPOSITION

8.6.1 Normal Operations

Tailings will be transported from the processing plant to the proposed IPTSFs via large diameter steel or HDPE pipe. The tailings distribution pipeline is required to be bunded with the return water pipeline. All tailings and decant return water piping and pumping design are conducted by others.

Tailings will be deposited into the IPTSF from movable discharge point(s) at one end of the pit to progressively develop and push the supernatant pond at the opposite pit side and close to the pit access ramp(s). The pit access ramp(s) will be utilised as part of water recovery operations. Pontoon-mounted pump(s) will be deployed and moved up the pit access ramp(s) when the tailings and water levels rise within the pit, to recover water from the facility and return it to the processing plant for re-use.

Locations of discharge points at each IPTSF are shown on the Drawings 754-PERGE318544-DD-05, 06 and 07. It is noted that during operations, the discharge point locations may need to be moved/justified after reviewing the progressive tailings beach development and supernatant pond formation to optimise water recovery. Refer to Section 10 for details of operating procedures.

8.6.2 Topping up Process

Given the expected consolidation within each facility during and post operation, a topping up process is expected to be required prior to decommissioning. The topping up process will enable the storage capacity of IPTSFs to be maximised by filling in any depressions on the tailing surface (due to consolidation) and by depositing tailings from around the perimeter of the pit where excess freeboard remains.

8.7 WATER RECOVERY

Supernatant water liberated from the tailings slurry will be recovered by dedicated pumps (designed by others) located at locations along access ramps at the sides of the pit. Initially water will be decanted at relatively lower points of these access ramps, which will be followed by pumping from the higher points of the access ramps. As the tailings level increases, the water recovery point will move upward along the access ramps.

The tailings deposition plan has been designed to position the supernatant water pond adjacent to the access ramp into the pit, from where the decant pump will be deployed. The pond is expected to be progressively developed and located at the opposite side of the discharge point(s).

As the tailings and water levels rise within the pit, the supernatant water pond will move up the access ramp, with the decant pump to be withdrawn up the ramp. The ramp will provide access to the decant pump for operation and maintenance purposes. Refer to Section 10 for details of operating procedures.

8.8 UNDERDRAINAGE

No under-drainage system is proposed for the MMO IPTSFs due to the following factors:

- High potential risk for blockage of the under-drainage system due to the fine particle size distribution of the tailings (i.e. 71% passing 80-micron sieve based on the 2016 laboratory test work).
- Pit floors are relatively small and narrow, which would prohibit the installation and efficiency of the under-drainage system.

8.9 SAFETY BUND

The pit will need to be made safe to humans and animals during the post closure period, safety bunds shall be designed in accordance with Department of Industry and Resources '*Safety Bund Walls Around Abandoned Open Pit Mines'* (formerly DoIR, currently DMIRS 1997), specifically to pits that are access-possible to the community. If required, safety bunds around the IPTSFs will have a minimum height of 2 m, minimum side slopes of 1:1 (V:H) and a nominal base width of 5 m. The safety bund should be constructed 10 m outside the zone of potential instability. If no study of potential instability zone is conducted with respect to the pits, it is recommended that the potential instability zone has a minimum offset distance of 50 m from the pit rim.

The detailed design of the safety bund around the proposed IPTSFs (815, 7 Series and 8 Series) will be prepared by the MMO's Mining Engineer.

8.10 PIPELINE BUNDING CORRIDOR AND ACCESS TRACK

Pipeline bunding corridor and access road / track associated with the proposed IPTSFs (815, 7 Series and 8 Series) will have a nominal width of 10 m (comprising a 5 m wide pipeline bunding corridor and an access road / track of 5 m wide). Containment bunds along both sides of the pipeline corridor will have a minimum height of 0.6 m.

Minor clearing of isolated vegetation is required to facilitate the construction of the corridors around the IPTSFs. All clearing and ground disturbance will be managed in line with existing site processes.

The containment bunds will be constructed with suitable mine waste. No moisture conditioning and testing are required for this fill material. The access road / track will be constructed with traffic compacted suitable mine waste (nominal 0.3 m thick).

The general arrangement and typical section of the pipeline bunding corridor and access road / track around the IPTSFs are shown in Drawings 754-PERGE319755-DD-02 and 04, respectively.

8.11 LINERS

No artificial liners are proposed, nor should they be required in construction of the IPTSFs 815, 7 Series and 8 Series. In addition, the walls and floors of the exposed pits are characterised by extensive magnesite development. It is expected that this material will have a neutralising effect when exposed to potentially acidic tailings as magnesium is an acid consuming element. The groundwater quality of the MBs around the existing IPTSFs confirmed that and showed compliance with the DWER license L7276/1996/11 (pH levels for all MBs were above 3.5).

8.12 CONSTRUCTION

A civil Scope of Works (SoW) for the construction of safety bunds and bunding pipeline corridors around the proposed IPTSFs (815, 7 Series and 8 Series) is in Appendix F. The civil SoW also includes a schedule of quantities (SoQ) which is provided to allow material requirements to be gauged for the construction.

It is noted that the design of the tailings and return water pumps, pipelines and the bunding corridor from the processing plant to the IPTSFs was/will be conducted by other party. The proposed piping layout is indicated on Drawing 754-PERGE318544-DD-02, and the typical sections and details are presented in Drawing 754-PERGE318544-DD-04. The pipeline corridor is laid out such that it follows the existing tracks to the pit locations, and the tailings and decant return water pipelines will locate at opposite side of the pits to allow water recovery. Slurry and return water pipes will be installed within a bunded corridor. A SoW for the construction of these features will be prepared by an appropriately qualified engineer.

9. WATER BALANCE ANALYSIS FOR IPTSF

9.1 ANALYSIS METHOD AND INPUT PARAMETERS

Water balance analyses for the proposed IPTSFs (815, 7 Series and 8 Series) during operations have been undertaken using a mathematical simulation to examine the expected inflows and outflows from the facility. Inflows and outflows for the facility were estimated on a month basis and under average climatic conditions. Inflows into the facility include rainfall and slurry water. Outflows include evaporation, seepage losses and water retained in the tailings (pore pressure).

The analyses examined the annual/monthly rainfall and evaporation under average climatic conditions for the year-to-year operations from the IPTSFs. The following assumptions / parameters were used in the analyses:

- Average annual rainfall: 236 mm (Section 6.1);
- Average annual evaporation: 3473 mm (Section 6.1);
- Slurry inputs: 4.62 Mtpa at 27% solids (Sections 4.2 and 5.4);
- Runoff coefficient: 0.5 (adopted based on the IPTSF 17 Series design – TT Coffey, 2020b);
- Evaporation pan factor of 0.66 (GJ Luke, KL Burke and TM O'Brien, 2003);
- Pit impoundment area:
  - Pit 815: 38 ha
  - Pit 7 Series: 100 ha
  - Pit 8 Series: 177 ha
- Decant pool area (under normal operating conditions) slightly varies for staged operation based on tailings deposition modelling (using Muk3d software): adopted 20% to 25% of the staged tailings surface area;
- Running beach area slightly varies for staged operation based on tailings deposition modelling (using the Muk3d software): adopted 50% to 75% of the staged tailings surface area remaining wet;
- Retained tailings moisture content: 40% (Section 5.4)
- The average hydraulic conductivity (permeability) of the pit floor: 1×10^{-7} m/s (adopted based on the IPTSF 17 Series design – TT Coffey, 2020b)

9.2 RESULTS AND COMMENTS

Water balance and charts are included in Appendix G. The results of the analyses (under average climatic conditions) suggest the following:

815 IPTSF:

- An annual average water return of approximately 82% of tailings slurry water deposited into the IPTSF 815 will be available for recovery during 8 months of operations.
- The average water available for recovery from the IPTSF 815 during 8 months of operations will be approximately 6,850,000 m^3.

7 Series IPTSF:

- An annual average water return of approximately 78% of tailings slurry water deposited into the IPTSF 7 Series will be available for recovery during 1 year of operations.
- The average water available for recovery from the IPTSF 7 Series during 1 year of operations will be approximately 9,695,000 m^3/year.

8 Series IPTSF:

- An annual average water return of approximately 64% to 77% of tailings slurry water deposited into the IPTSF 8 Series will be available for recovery during 3.75 years of operations.
- The annual average water available for recovery from the IPTSF 8 Series for Years 1 to 3 will vary approximately from 9,566,000 m^3/year down to 7,971,000 m^3/year, with Year 4 (only 9 months of operations) water recovery of 5,966,000 m^3.

The results also indicate that the water recovery will vary according to the IPTSF management, specifically, the pond size and running beachers. To maximise the water recovery, the IPTSF should be operated to ensure the water pond around the decant facility area is as small as practical and located at the proposed decant pump facility. In addition, the actual water quantity available for return to the plant will vary depending on the following factors:

- Variations in slurry density;
- Continuity of tailings discharge;
- Distance between the discharge point and decant pond;
- Size of the decant pond and running beaches, from where evaporation is greatest;
- Climatic conditions at the time of operations; and
- The efficiency of the decant system during operations.

10. OPERATING PROCEDURES

The Operations Manual for the TSF and IPTSFs is presented in Appendix H, which provides a detailed description of the operating procedures, inspection criteria, monitoring requirements and log sheets for the tailings storages.

The following considerations relate to the operation of the IPTSFs:

- Tailings discharge/deposition into the IPTSFs will be undertaken as such to control tailings beach development and facilitate water recovery from the facility.
- Tailings will be deposited into the IPTSF from movable discharge point(s) at one end of the pit to progressively develop and push the supernatant pond at the opposite pit side and close to the pit access ramp(s). The pit access ramp(s) will be utilised as part of water recovery operations. Pontoon-mounted pump(s) will be deployed and moved up the pit access ramp(s) when the tailings and water levels rise within the pit, to recover water from the facility and return it to the processing plant for re-use.
- If possible, the pontoon-mounted pump may need to be deployed down the access ramp(s) to the pit base to reach and recover any early water pond(s) at the pit. Locations of the discharge point(s) around the proposed IPTSFs 815, Series 7 and Series 8 are shown in Drawings 754-PERGE318544-DD-05, 06 and 07, respectively.
- Each discharge pipe will be fitted with an appropriate valve (designed by others) to open / close off the discharge pipe when required during operations. Tailings should not be discharged so as to erode the pit rims and walls.
- The supernatant pond should be kept as small as practical (i.e., the pond size is kept not greater than nominally 20% of the tailings surface area under normal operating conditions). Limiting the size of the supernatant water pond will reduce seepage and evaporation from the facility and hence assist in optimising water recovery, tailings density and consolidation.

- The top tailings surface of the IPTSF will assume a “wedge formation”, with a beach sloping towards the decant location. The facility could contain considerable water during a 1:100-year AEP, 72-hr storm event (i.e., runoff water from the impoundment pit surface areas, with rainfall depth ≈0.2 m). A minimum total freeboard of 0.5 m above the stormwater level and below the minimum pit rim level should always be maintained. That is, an equivalent total freeboard of minimum 1.4 m, 2.3 m and 1.9 m (vertical height between the normal operating pond and minimum pit rim levels) for IPTSF 815, 7 Series and 8 Series respectively, should always be maintained. It should be noted that critical freeboard criteria are particularly relevant when the tailings beach level approaches the pit rim level, that is when the facility is almost full and at closure stage.
- Frequent inspections should be made of the tailings line, water return line, discharge point, water recovery system, freeboard, supernatant pond location and size, and pit wall.

  Only by regular inspection and appropriate remedial action can the performance of the water return system be optimised and operational problems be avoided.
- A suitably experienced and qualified engineer should periodically review the operation, safety and environmental aspects during an inspection. This inspection should be carried out on an annual basis.

11. INSTRUMENTATION AND MONITORING

For planning and monitoring purposes, it is recommended to install additional four (4) MBs and ten (10) MBs in proximity to the IPTSF 815 and each of the IPTSFs 7 Series and 8 Series, respectively. Locations of all proposed additional MBs around the IPTSFs are shown on Drawing 754-PERGE318544-DD-03.

The exact numbers, final locations and construction details of the proposed additional MBs will be confirmed / determined by a qualified hydrogeologist. The proposed MBs can be placed near the known structural features (if any) that go across the IPTSFs. Proposed MBs will be designed and constructed such that they can be used as recovery bores, if required.

All existing and proposed MBs will need to be implemented and integrated into the existing monitoring program to enable monitoring of the IPTSFs performance.

The water level measurements / readings and quality testing requirements (including analytes to be tested) are conducted at the following locations at the following recommended frequencies or as stipulated by the DWER licence conditions:

- Pit 815: at all existing and proposed MBs initially every month for six months, then every quarter.
- Pit 7 Series: at all existing and proposed MBs initially every month for six months, then every quarter.
- Pit 8 Series: at all existing and proposed MBs initially every month for six months, then every quarter.
- Information collected from the monitoring bores be reviewed regularly and reported in an annual audit.

12. EMERGENCY ACTION PLAN

The Operations Manual provides a description of the operating procedures for the TSF and IPTSFs and includes an Emergency Action Plan.

13. REHABILITATION

Prior to the commencement of the rehabilitation program, the facilities will undergo a topping up process. The topping up process maximises the storage capacity of the pits and reduces the impact of the final settlement of the tailings surface. Based on consolidation estimates, it is expected that rehabilitation work will not be able to commence for a period of approximately 4 years for IPTSFs 815 and 7 Series, and 6 years for IPTSF 8 Series, post completion of filling due to the expected low strength of the deposited tailings (i.e. to achieve > 90% consolidation).

Upon completion of tailings placement within each facility, the surface will undergo a rehabilitation program. The closure concept for the IPTSF domain is to:

1. Remove all infrastructure (including pontoon pumps, delivery and discharge pipes and valves, power cables, footings, etc) and dispose of in accordance with appropriate MMO standards and government regulations.
2. Construct a stable, non-polluting landform.
3. Replace the standpipes of the piezometers and ground water monitoring boreholes with ground level covers, so that they are less obtrusive, but still available for monitoring.
4. Establish a self-sustaining vegetation cover that reflects the natural vegetation communities of the area.
5. Ensure no long-term groundwater liability for MMO or the State.

The rehabilitation program will include the identification of appropriate capping material and local flora species to revegetate the surface of the facility.

A brief description of the environmental management and rehabilitation plans to be implemented at the completion of filling of the in-pit tailings facility includes:

- Monitoring the level of the tailings surface following the completion of the last tailings deposition cycle.
- As part of the topping-up process, monitoring crust formation in the facility following the completion of the last tailings cycle, prior to the deposition of new tailings. This monitoring may comprise moisture and density monitoring and shear strength testing, as appropriate.
- Once the topping-up process has been completed and little further settlement is expected, the facility will be covered and rehabilitated. The cover / capping layer will comprise suitable mine waste and topsoil materials. The capping layer will reduce the ingress of rainfall into the tailings, minimise the potential for dust generation and provide support for the topsoil / growth medium for re-vegetation of the top surface.

Geochemical testing assessment (Section 5.1) indicates the tailings samples are not extreme acidity and hypersaline, that would not support vegetation growth. As a result of capillary action in the soil, soil salinisation in the vegetation root zone may occur. Figure 14 illustrates a conceptual capping profile for the proposed IPTSFs which comprises:

- Topsoil layer / growth medium for revegetation (nominally 0.1 m thick);
- Suitable mine waste layer (nominally 1.5 m thick); and
- Laterite layer (nominally 0.3 m thick).

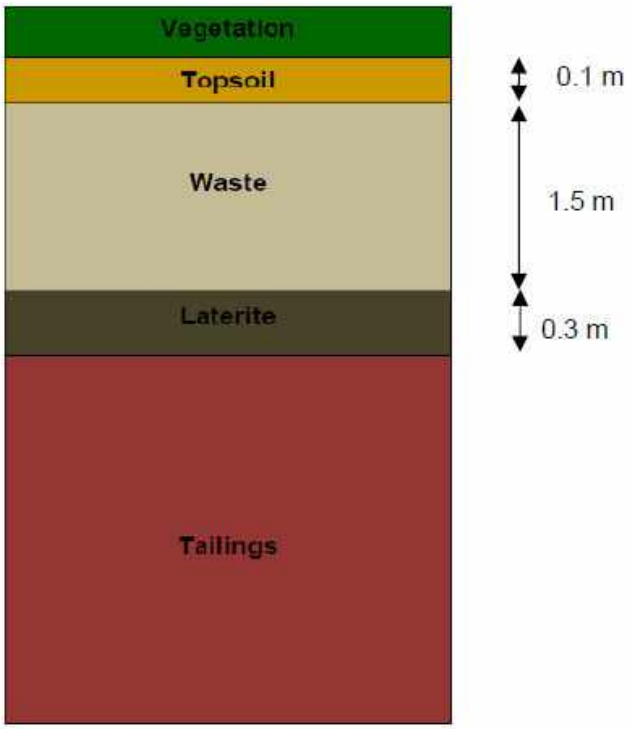
The sources of capping materials will comprise laterite, mine waste and topsoil from suitable stockpiles and waste dumps. For planning purposes, the preliminary estimated volume of the capping materials is summarised in Table 10.

Table 10: Estimate Volume of Capping Materials for IPTSFs 815, 7 Series and 8 Series

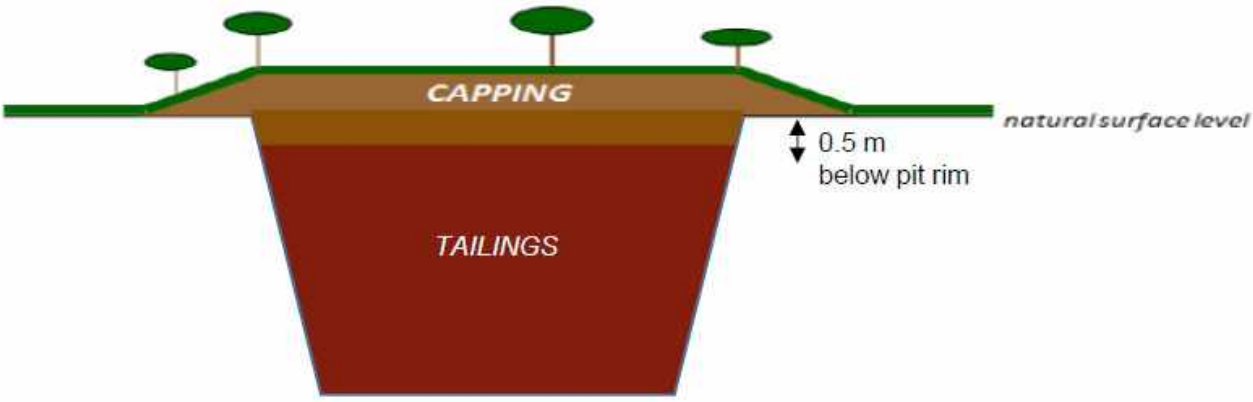
Top Surface Area (ha)	Approximate Topsoil Volume (m^3) (nominally 0.1 m thick)	Approximate Mine Waste Rock Volume (m^3) (nominally 1.5 m thick)	Approximate Laterite Volume (m^3) (nominally 0.3 m thick)
815 Pit: 18.5 ha	18,500	277,500	55,500
7 Series: 58.0 ha	58,000	870,000	174,000
8 Series: 140.0 ha	140,000	2,100,000	420,000

Recommendations for the rehabilitation of TSFs should be researched and reviewed during the life of the project under the direction of personnel from the MMO Environment team. A detailed closure/ decommissioning plan should be prepared prior to decommissioning to confirm the feasibility of the conceptual rehabilitation and closure plan, including:

- Review water balance and final closure design;
- Review and assess physical and geochemical properties of the capping materials;
- Review cover quantities, sources and cost of capping materials available;
- Contact seed suppliers and identify any issues;
- Review revegetation opportunities;
- Carry out nutrient tests of local stockpiles and topsoils; and
- Reassess the closure plan, incorporating changes based on annual reviews.



Sketch 1: Preliminary capping layer needed to prevent capillary action into the root zone.



Sketch 2: Cross-section of the MMO IPTSFs indicating rehabilitation of the capping landform.

Figure 14. Conceptual Capping Profile at Closure

14. BIBLIOGRAPHY

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APPENDIX A: LIMITATIONS

IMPORTANT INFORMATION ABOUT YOUR TETRA TECH COFFEY REPORT

As a client of Tetra Tech Coffey you should know that site subsurface conditions cause more construction problems than any other factor. These notes have been prepared by Tetra Tech Coffey to help you interpret and understand the limitations of your report.

Your report is based on project specific criteria

Your report has been developed on the basis of your unique project specific requirements as understood by Tetra Tech Coffey and applies only to the site investigated. Project criteria typically include the general nature of the project; its size and configuration; the location of any structures on the site; other site improvements; the presence of underground utilities; and the additional risk imposed by scope-of-service limitations imposed by the client. Your report should not be used if there are any changes to the project without first asking Tetra Tech Coffey to assess how factors that changed subsequent to the date of the report affect the report's recommendations. Tetra Tech Coffey cannot accept responsibility for problems that may occur due to changed factors if they are not consulted.

Subsurface conditions can change

Subsurface conditions are created by natural processes and the activity of man. For example, water levels can vary with time, fill may be placed on a site and pollutants may migrate with time. Because a report is based on conditions which existed at the time of subsurface exploration, decisions should not be based on a report whose adequacy may have been affected by time. Consult Tetra Tech Coffey to be advised how time may have impacted on the project.

Interpretation of factual data

Site assessment identifies actual subsurface conditions only at those points where samples are taken and when they are taken. Data derived from literature and external data source review, sampling and subsequent laboratory testing are interpreted by geologists, engineers or scientists to provide an opinion about overall site conditions, their likely impact on the proposed development and recommended actions. Actual conditions may differ from those inferred to exist, because no professional, no matter how qualified, can reveal what is hidden by earth, rock and time. The actual interface between materials may be far more gradual or abrupt than assumed based on the facts obtained. Nothing can be done to change the actual site conditions which exist, but steps can be taken to reduce the impact of unexpected conditions. For this reason, owners should retain the services of Tetra Tech Coffey through the development stage, to identify variances, conduct additional tests if required, and recommend solutions to problems encountered on site.

Your report will only give preliminary recommendations

Your report is based on the assumption that the site conditions as revealed through selective point sampling are indicative of actual conditions throughout an area. This assumption cannot be substantiated until project implementation has commenced and therefore your report recommendations can only be regarded as preliminary. Only Tetra Tech Coffey, who prepared the report, is fully familiar with the background information needed to assess whether or not the report's recommendations are valid and whether or not changes should be considered as the project develops. If another party undertakes the implementation of the recommendations of this report there is a risk that the report will be misinterpreted and Tetra Tech Coffey cannot be held responsible for such misinterpretation.

Your report is prepared for specific purposes and persons

To avoid misuse of the information contained in your report it is recommended that you confer with Tetra Tech Coffey before passing your report on to another party who may not be familiar with the background and the purpose of the report. Your report should not be applied to any project other than that originally specified at the time the report was issued.

Interpretation by other design professionals

Costly problems can occur when other design professionals develop their plans based on misinterpretations of a report. To help avoid misinterpretations, retain Tetra Tech Coffey to work with other project design professionals who are affected by the report. Have Tetra Tech Coffey explain the report implications to design professionals affected by them and then review plans and specifications produced to see how they incorporate the report findings.

Data should not be separated from the report

The report as a whole presents the findings of the site assessment and the report should not be copied in part or altered in any way. Logs, figures, drawings, etc. are customarily included in our reports and are developed by scientists, engineers or geologists based on their interpretation of field logs (assembled by field personnel) and laboratory evaluation of field samples. These logs etc. should not under any circumstances be redrawn for inclusion in other documents or separated from the report in any way.

Geoenvironmental concerns are not at issue

Your report is not likely to relate any findings, conclusions, or recommendations about the potential for hazardous materials existing at the site unless specifically required to do so by the client. Specialist equipment, techniques, and personnel are used to perform a geoenvironmental assessment. Contamination can create major health, safety and environmental risks. If you have no information about the potential for your site to be contaminated or create an environmental hazard, you are advised to contact Tetra Tech Coffey for information relating to geoenvironmental issues.

Rely on Tetra Tech Coffey for additional assistance

Tetra Tech Coffey is familiar with a variety of techniques and approaches that can be used to help reduce risks for all parties to a project, from design to construction. It is common that not all approaches will be necessarily dealt with in your site assessment report due to concepts proposed at that time. As the project progresses through design towards construction, speak with Tetra Tech Coffey to develop alternative approaches to problems that may be of genuine benefit both in time and cost.

Responsibility

Reporting relies on interpretation of factual information based on judgement and opinion and has a level of uncertainty attached to it, which is far less exact than the design disciplines. This has often resulted in claims being lodged against consultants, which are unfounded. To help prevent this problem, a number of clauses have been developed for use in contracts, reports and other documents. Responsibility clauses do not transfer appropriate liabilities from Tetra Tech Coffey to other parties but are included to identify where Tetra Tech Coffey's responsibilities begin and end. Their use is intended to help all parties involved to recognise their individual responsibilities. Read all documents from Tetra Tech Coffey closely and do not hesitate to ask any questions you may have.

APPENDIX B: TAILINGS STORAGE DATA SHEET (TSDS)

TETRA TECH COFFEY

TAILINGS STORAGE DATA SHEET – MMO IPTSFs

Please answer all questions, with separate sheets for cells of different ages.		Coffey Job No.:	754-PERGE318544
		Ref No.:	-

1 PROJECT DATA

1.1	Project Name:	Murrin Murrin Operations, WA	1.2	Date:	February 2024
1.3	TSF Name:	815 Pit TSF	1.4	Commodity:	Nickel, Cobalt
1.5	Name of Data Provider:	MMO / Tetra Tech Coffey	1.6	Phone:	08 6218 2100
1.7	TSF Centre Co-ordinates (AMG):	6,815,877 m North		389,695 m East	(MGA94 Zone 51J)
1.8	Lease Numbers:	M39/421			

2. TSF DATA

2.1	TSF Status:	Proposed ☒ Active ☐ Disused ☐ Rehabilitated ☐			
2.2	Type of TSF:[1]	In-Pit	2.2.1	Number of cells:[2]	1
2.3	Hazard rating:[3]	Low	2.4	TSF category:[4]	3
2.5	Catchment area:[5]	38.1 ha	2.6	Nearest watercourse:	Cement Creek
2.7	Date deposition started (mm/yy):	N/A	2.7.1	Date deposition completed (mm/yy):	N/A
2.8	Tailings discharge method:[6]	End of pipe (movable)	2.8.1	Water recovery method:[7]	Decant pump on ramp
2.9	Bottom of facility sealed or lined?:	No	2.9.1	Type of seal or liner:[8]	N/A
2.10	Depth to original groundwater level:	Unknown	2.10.1	Original groundwater TDS:	N/A
2.11	Ore process:[9]	Pressure Acid Leaching	2.12	Material storage rate:[10]	4.62 Mtpa
2.13	Impoundment volume (present):	N/A	2.13.1	Expected maximum:	3.64×10^6 m^3
2.14	Mass of solids stored (present):	N/A	2.14.1	Expected maximum:	2.91×10^6 tonnes

3. ABOVE GROUND FACILITIES

3.1	Foundation soils:	3.1.1	Foundation rocks:
3.2	Starter bund construction materials:[11]	3.2.1	Wall lifting by:[12]
3.3	Wall construction by:	3.3.1	Wall lifting material:[13]
3.4	Present maximum wall height agl:[14]	3.4.1	Expected maximum:
3.5	Crest length (present):	3.5.1	Expected maximum:
3.6	Impoundment area (present):	3.6.1	Expected maximum:

4. BELOW GROUND / IN-PIT FACILITIES

4.1	Pit depth (maximum):	~ 52.5 m	4.2	Area of pit base:	N/A
4.2	Thickness of tailings (present):	N/A	4.3	Expected maximum tailings thickness:	~ 41.9 m
4.3	Current surface area of tailings:	N/A	4.4	Final surface area of tailings:	16.3 ha

5. PROPERTIES OF TAILINGS

5.1	TDS: (tailings water sample)	180,000mg/L	5.2	pH: (tailings water sample) pH (tailings solids sample)	3.5
5.3	Solids content:	27 %	5.4	Deposited density:	0.8 t/m^3
5.5	WAD CN:	N/A	5.6	Total CN:	N/A
5.7	Potentially hazardous substances:[15]	Ni, Co, Mn, Cr			
5.8	Any other NPI listed substances in the TSF?[16]	N/A			

Not to be recorded in the database; for 1, 2, 3 etc see explanatory notes on the next page.

APPENDIX B

TETRA TECH COFFEY

TAILINGS STORAGE DATA SHEET – MMO IPTSFs

Please answer all questions, with separate sheets for cells of different ages.		Coffey Job No.:	754-PERGE318544
		Ref No.:	-

1 PROJECT DATA

1.1	Project Name:	Murrin Murrin Operations, WA	1.2	Date:	February 2024
1.3	TSF Name:	7 Series In-Pit TSF	1.4	Commodity:	Nickel, Cobalt
1.5	Name of Data Provider:	MMO / Tetra Tech Coffey	1.6	Phone:	08 6218 2100
1.7	TSF Centre Co-ordinates (AMG):	6,814,086 m North		392,839 m East	(MGA94 Zone 51J)
1.8	Lease Numbers:	M39/423			

2. TSF DATA

2.1	TSF Status:	Proposed ☒ Active ☐ Disused ☐ Rehabilitated ☐			
2.2	Type of TSF:[1]	In-Pit	2.2.1	Number of cells:[2]	1
2.3	Hazard rating:[3]	Low	2.4	TSF category:[4]	3
2.5	Catchment area:[5]	100.0 ha	2.6	Nearest watercourse:	Cement Creek
2.7	Date deposition started (mm/yy):	N/A	2.7.1	Date deposition completed (mm/yy):	N/A
2.8	Tailings discharge method:[6]	End of pipe (movable)	2.8.1	Water recovery method:[7]	Decant pump on ramp
2.9	Bottom of facility sealed or lined?:	No	2.9.1	Type of seal or liner:[8]	N/A
2.10	Depth to original groundwater level:	Unknown	2.10.1	Original groundwater TDS:	N/A
2.11	Ore process:[9]	Pressure Acid Leaching	2.12	Material storage rate:[10]	4.62 Mtpa
2.13	Impoundment volume (present):	N/A	2.13.1	Expected maximum:	6.33×10^6 m^3
2.14	Mass of solids stored (present):	N/A	2.14.1	Expected maximum:	5.07×10^6 tonnes

3. ABOVE GROUND FACILITIES

3.1	Foundation soils:	3.1.1	Foundation rocks:
3.2	Starter bund construction materials:[11]	3.2.1	Wall lifting by:[12]
3.3	Wall construction by:	3.3.1	Wall lifting material:[13]
3.4	Present maximum wall height agl:[14]	3.4.1	Expected maximum:
3.5	Crest length (present):	3.5.1	Expected maximum:
3.6	Impoundment area (present):	3.6.1	Expected maximum:

4. BELOW GROUND / IN-PIT FACILITIES

4.1	Pit depth (maximum):	~ 42.6 m	4.2	Area of pit base:	N/A
4.2	Thickness of tailings (present):	N/A	4.3	Expected maximum tailings thickness:	~ 32.0 m
4.3	Current surface area of tailings:	N/A	4.4	Final surface area of tailings:	57.4 ha

5. PROPERTIES OF TAILINGS

5.1	TDS: (tailings water sample)	180,000mg/L	5.2	pH: (tailings water sample) pH (tailings solids sample)	3.5
5.3	Solids content:	27 %	5.4	Deposited density:	0.8 t/m^3
5.5	WAD CN:	N/A	5.6	Total CN:	N/A
5.7	Potentially hazardous substances:[15]	Ni, Co, Mn, Cr			
5.8	Any other NPI listed substances in the TSF?[16]	N/A			

Not to be recorded in the database; for 1, 2, 3 etc see explanatory notes on the next page.

APPENDIX B

TETRA TECH COFFEY

TAILINGS STORAGE DATA SHEET – MMO IPTSFs

Please answer all questions, with separate sheets for cells of different ages.		Coffey Job No.:	754-PERGE318544
		Ref No.:	-

1 PROJECT DATA

1.1	Project Name:	Murrin Murrin Operations, WA	1.2	Date:	February 2024
1.3	TSF Name:	8 Series In-Pit TSF	1.4	Commodity:	Nickel, Cobalt
1.5	Name of Data Provider:	MMO / Tetra Tech Coffey	1.6	Phone:	08 6218 2100
1.7	TSF Centre Co-ordinates (AMG):	6,812,920 m North		388,813 m East	(MGA94 Zone 51J)
1.8	Lease Numbers:	M39/424 & M39/420			

2. TSF DATA

2.1	TSF Status:	Proposed ☒ Active ☐ Disused ☐ Rehabilitated ☐			
2.2	Type of TSF:[1]	In-Pit	2.2.1	Number of cells:[2]	1
2.3	Hazard rating:[3]	Low	2.4	TSF category:[4]	3
2.5	Catchment area:[5]	177.0 ha	2.6	Nearest watercourse:	Cement Creek
2.7	Date deposition started (mm/yy):	N/A	2.7.1	Date deposition completed (mm/yy):	N/A
2.8	Tailings discharge method:[6]	End of pipe (movable)	2.8.1	Water recovery method:[7]	Decant pump on ramp
2.9	Bottom of facility sealed or lined?:	No	2.9.1	Type of seal or liner:[8]	N/A
2.10	Depth to original groundwater level:	Unknown	2.10.1	Original groundwater TDS:	N/A
2.11	Ore process:[9]	Pressure Acid Leaching	2.12	Material storage rate:[10]	4.62 Mtpa
2.13	Impoundment volume (present):	N/A	2.13.1	Expected maximum:	21.6×10^6 m^3
2.14	Mass of solids stored (present):	N/A	2.14.1	Expected maximum:	17.28×10^6 tonnes

3. ABOVE GROUND FACILITIES

3.1	Foundation soils:	3.1.1	Foundation rocks:
3.2	Starter bund construction materials:[11]	3.2.1	Wall lifting by:[12]
3.3	Wall construction by:	3.3.1	Wall lifting material:[13]
3.4	Present maximum wall height agl:[14]	3.4.1	Expected maximum:
3.5	Crest length (present):	3.5.1	Expected maximum:
3.6	Impoundment area (present):	3.6.1	Expected maximum:

4. BELOW GROUND / IN-PIT FACILITIES

4.1	Pit depth (maximum):	~ 64.0 m	4.2	Area of pit base:	N/A
4.2	Thickness of tailings (present):	N/A	4.3	Expected maximum tailings thickness:	~ 48.2 m
4.3	Current surface area of tailings:	N/A	4.4	Final surface area of tailings:	107.3 ha

5. PROPERTIES OF TAILINGS

5.1	TDS: (tailings water sample)	180,000mg/L	5.2	pH: (tailings water sample) pH (tailings solids sample)	3.5
5.3	Solids content:	27 %	5.4	Deposited density:	0.8 t/m^3
5.5	WAD CN:	N/A	5.6	Total CN:	N/A
5.7	Potentially hazardous substances:[15]	Ni, Co, Mn, Cr			
5.8	Any other NPI listed substances in the TSF?[16]	N/A			

Not to be recorded in the database; for 1, 2, 3 etc see explanatory notes on the next page.

APPENDIX B

EXPLANATORY NOTES FOR COMPLETING TAILINGS STORAGE DATA SHEET

The following notes are provided to assist the proponent to complete the tailings storage data sheet.

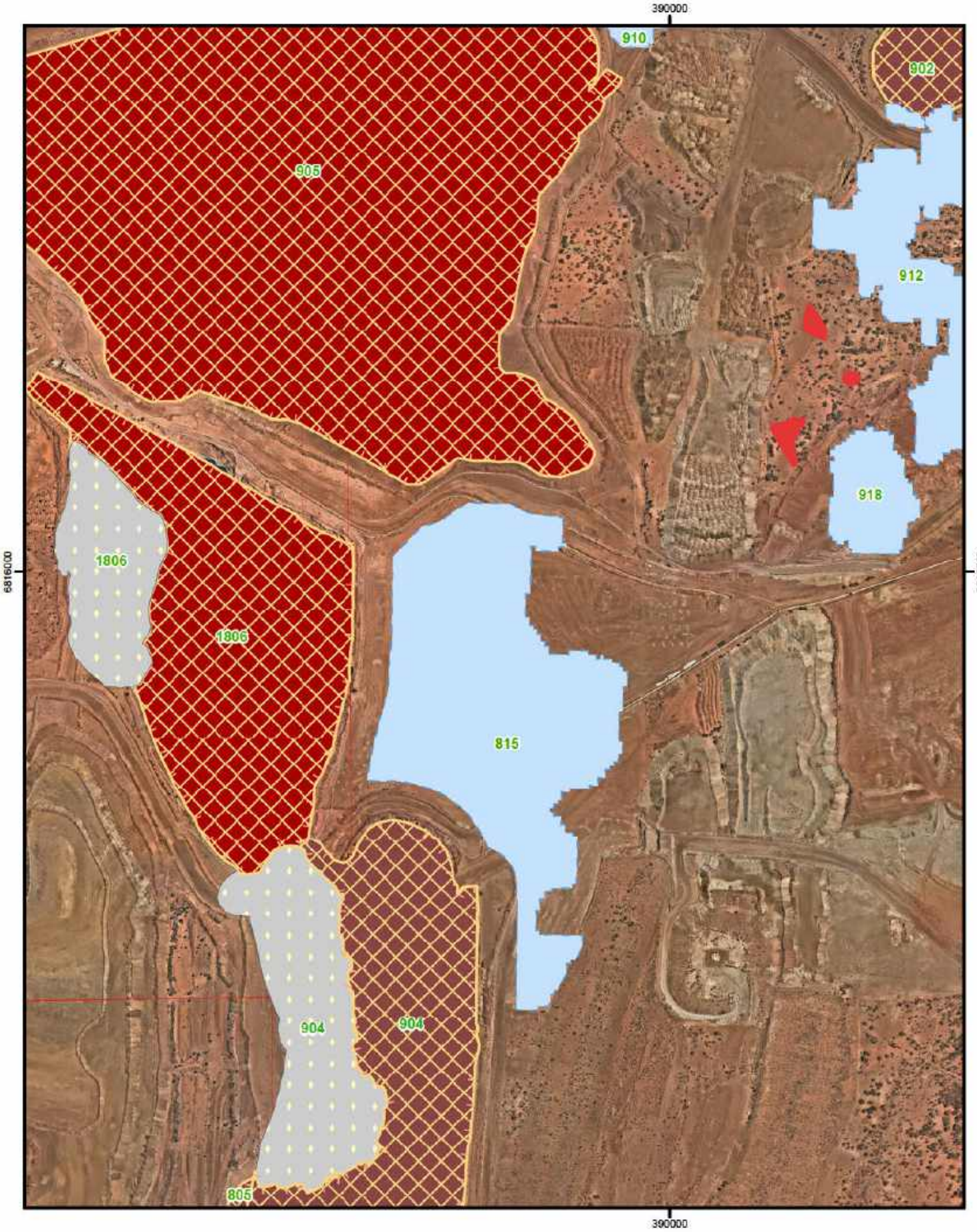
1. Paddock (ring-dyke), cross-valley, side-hill, in-pit, depression, waste fill etc.
2. Number of cells operated using the same decant arrangement.
3. See Table 1 in the Guidelines.
4. See Figure 1 in the Guidelines
5. Internal for paddock (ring-dyke) type, internal plus external catchment for other facilities.
6. End of pipe (fixed), end of pipe (movable), single spigot, multi-spigots, cyclone, CTD (Central Thickened Discharge) etc.
7. Gravity feed decant, pumped decant, floating pump etc.
8. Clay, synthetic etc.
9. See list below for ore process method.
10. Tonnes of solids per year
11. Record only the main material(s) used for construction eg: clay, sand, silt, gravel, laterite, fresh rock, weathered rock, tailings, clayey sand, clayey gravel, sandy clay, silty clay, gravelly clay, etc or any combination of these materials.
12. Wall lifting method during the reporting period, if raised.
13. If the wall has been raised during the reporting period, the wall lifting material used. Is it tailings or any other (or combination of) material(s) listed under item 11 above.
14. Maximum wall height above the ground level (not AHD or RL).
15. Arsenic, Asbestos, Caustic soda, Copper sulphide, Cyanide, Iron sulphide, Lead, Mercury, Nickel sulphide, Sulphuric acid, Xanthates etc.
16. NPI – National Pollution Inventory. Contact Dept of Environmental Protection for information on NPI listed substances.

ORE PROCESS METHODS

The ore process methods may be recorded as follows:

Atmospheric Acid Leaching
Atmospheric Alkali Leaching
Bayer process
Becher process
BIOX
CIL/CIP
Crushing and screening
Flotation
Gravity separation
Heap Leaching
Magnetic separation
Ore sorters
Pressure Acid leaching
Pressure Alkali leaching
Pyromets
SX/EW (Solvent Extraction/Electro Wining)
Vat leaching
Washing and screening

APPENDIX C: MAPS OF PROPOSED IPTSFS LOCATIONS



MINARA

Murrin Murrin Operations

Murrin Murrin
Calcrete Haul Road

DATUM: GDA 1994
PROJECTION : GDA 1994 MGA Zone 51

No Go Area
Pits
Status
Active In Pit Tailings
Backfill
Completed In Pit Tailings
Completed Mining
Current Mining
Future Mining
Water Harvesting
Mining Lease

N

1:7660

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Department : REC	Date : 10/02/2023
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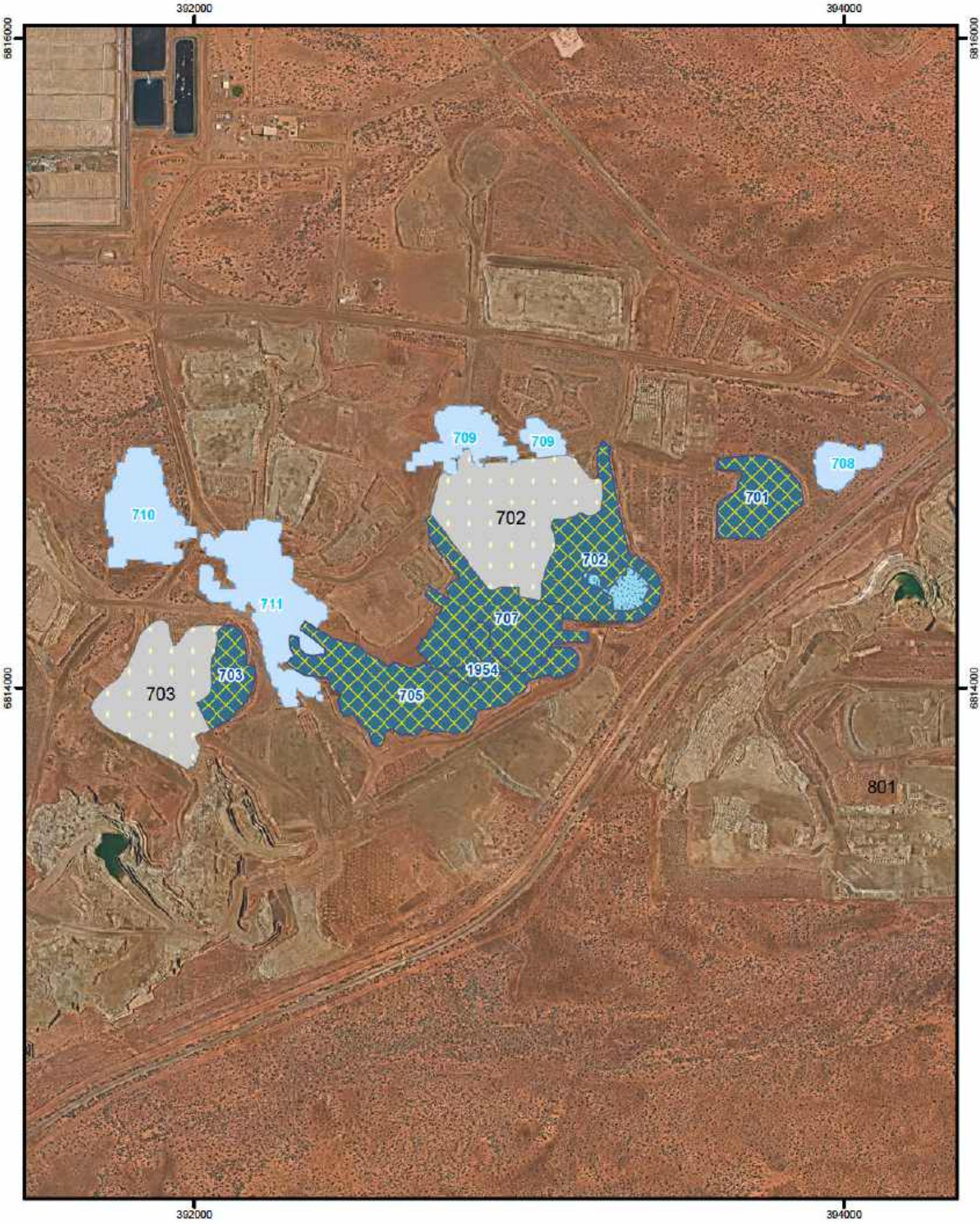
Minara Resources Pty Ltd ACN 000 370 783



MINARA

Murrin Murrin Operations

7 Series Proposed Inpit

DATUM: GDA 1994
PROJECTION : GDA 1994 MGA Zone 51

Pits
Status
- Active In Pit Tailings
- Backfill
- Completed In Pit Tailings
- Completed Mining
- Current Mining
- Future Mining
- Water Harvesting

N

1:15448

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Department : REC	Date : 10/03/2023
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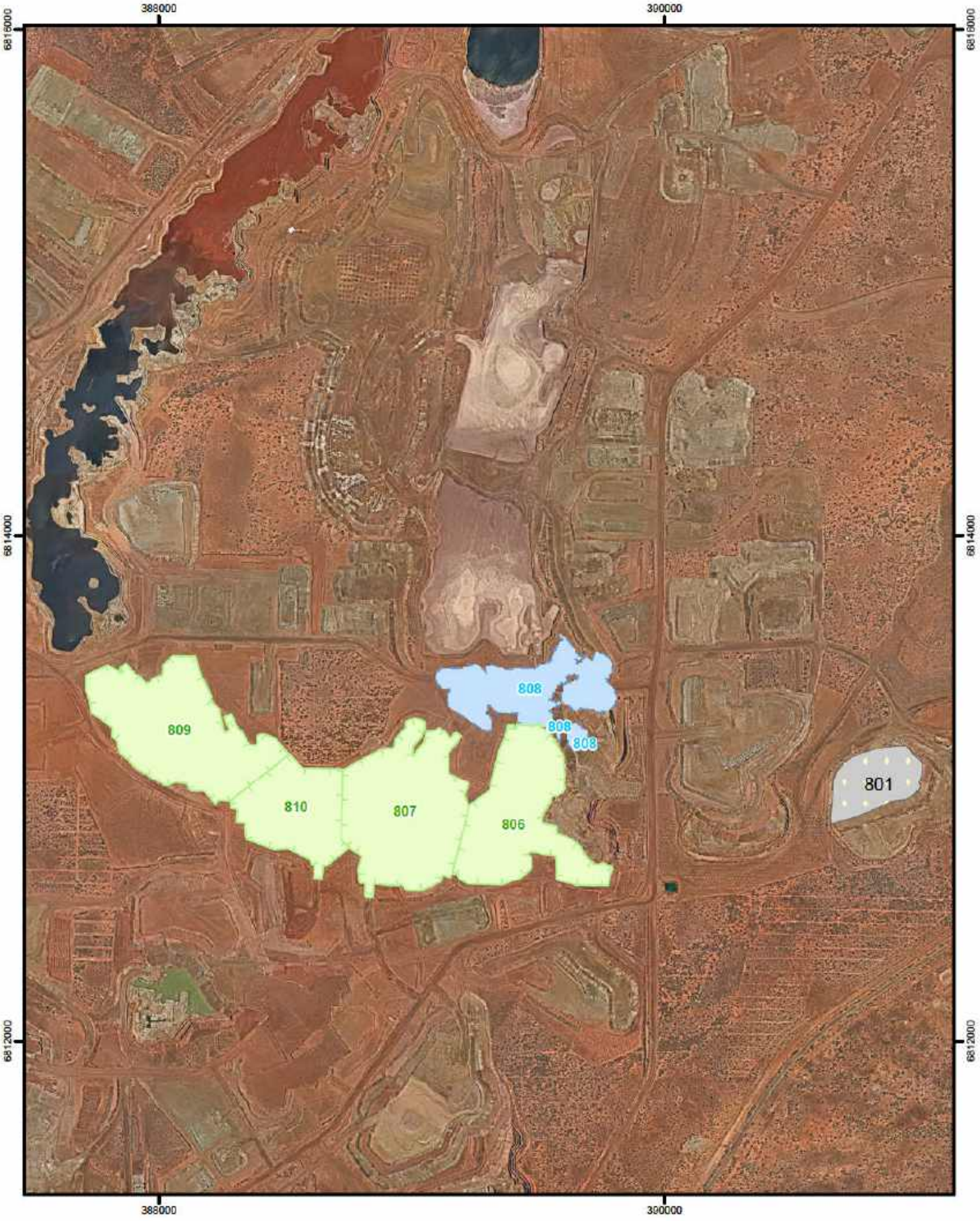
Minara Resources Pty Ltd ACN 000 370 783



MINARA

Murrin Murrin Operations

8 Series Proposed Inpit

DATUM: GDA 1994
PROJECTION : GDA 1994 MGA Zone 51

Pits
Status
- Active In Pit Tailings
- Backfill
- Completed In Pit Tailings
- Completed Mining
- Current Mining
- Future Mining
- Water Harvesting

N

1:19773

Originator :	
Department : REC	Date : 10/03/2023
Drawn By: [redacted]	Revision: 0
File : J:\EAP\Environment\GIS\MXDprojects\Generic Map for Stuff.mxd	

Minara Resources Pty Ltd ACN 000 370 783

APPENDIX D: TAILINGS SETTLEMENT ASSESSMENT

Client: Murrin Murrin Operations
Project: Geotechnical Assessment - Pit 815 Consolidation Estimation
Project No: 754-PERGE318544
Calculations: Tailings Settlement Pit 815
Date: 01/02/24

BACKGROUND INFORMATION

Ultimate settlement in over-consolidated deposits

$$\Delta H = m_v \Delta p H \ldots (1)$$

Terzaghi time factor

$$T_v = \frac{c_v t}{d^2} \ldots (2)$$

$$c_v = \frac{k}{m_v \gamma_w} \ldots (3)$$

$$m_v = -\frac{1}{1+e_0} \cdot \frac{\delta e}{\delta P} \ldots (4)$$

Average degree of consolidation

$$U_v = \frac{S_t}{S_{ult}} \ldots (5)$$

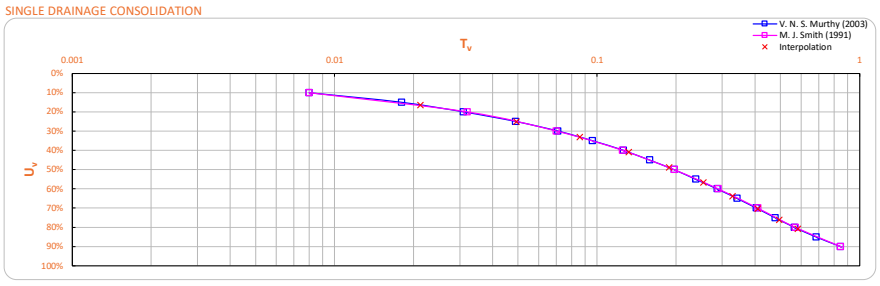
DEFINITION OF TERMS

m_v	coefficient of compressibility
c_v	coefficient of consolidation
k	permeability
γ_w	density of water
U_v	degree of consolidation
S_t	settlement after time t
S_{ult}	ultimate settlement
T_v	time factor
d	drainage path
t	time

LABORATORY RESULTS

Pressure	[kPa]	10	20	40	80	160	320
log P	[kPa]	1.000	1.301	1.602	1.903	2.204	2.505
e		3.106	2.826	2.568	2.325	2.022	1.815
c_v	[m²/y]		4.75	7.1	7.2	5.6	4.3
m_v	[m²/kN]		6.82E-03	4.37E-03	2.72E-03	1.76E-03	1.01E-03

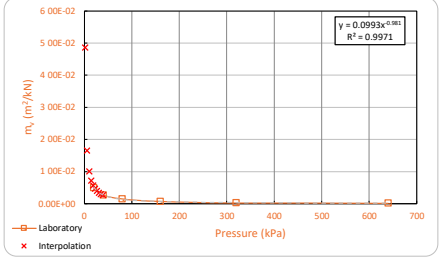
SINGLE DRAINAGE CONSOLIDATION



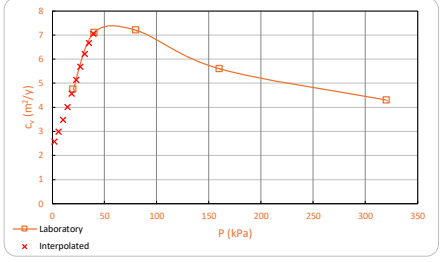
ROWE CELL TEST RESULTS

Pressure	[kPa]	20	40	80	160	320	640
m_v	[m²/kN]	5.00E-03	2.70E-03	1.50E-03	7.10E-04	2.90E-04	1.90E-04

PRESSURE vs COEFFICIENT OF COMPRESSIBILITY



PRESSURE vs COEFFICIENT OF CONSOLIDATION



SETTLEMENT APPROXIMATION

Parameters

Pit Depth:	41.9	m
No. Layers:	23	
H:	1.82	m
Duration:	0.63	y
ρ_{dry}	0.8	kg/m³
Moisture	54%	(adopted for analysis purpose - based on 17 Series IPTSF)
γ_w:	12.09	kN/m³
Pressure/z:	2.28	kPa/m
k:	1.00E-08	m/s

Calculations

Parameter	Method	Value																						
Layer		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Time (y)		0.03	0.05	0.08	0.11	0.14	0.16	0.19	0.22	0.25	0.27	0.30	0.33	0.36	0.38	0.41	0.44	0.47	0.49	0.52	0.55	0.58	0.60	0.63
P	mid-layer	2.07	6.22	10.37	14.51	18.66	22.80	26.95	31.10	35.24	39.39	43.53	47.68	51.83	55.97	60.12	64.27	68.41	72.56	76.70	80.85	85.00	89.14	93.29
c_v (m²/y)	spline	3	3	3	4	5	5	6	6	7	7	7	8	8	8	8	8	8	7	7	7	7	7	7
T_v (y)	eqn (2)	0.02	0.05	0.09	0.13	0.19	0.25	0.33	0.41	0.50	0.58	0.67	0.75	0.82	0.89	0.95	1.01	1.06	1.10	1.15	1.18	1.22	1.26	1.29
U_v	spline	16%	25%	33%	41%	49%	57%	64%	70%	76%	81%	84%	87%	89%	91%	92%	93%	94%	95%	95%	96%	96%	97%	98%
m_v (m²/kN)	spline	7.11E-03	6.69E-03	6.21E-03	5.70E-03	5.17E-03	4.64E-03	4.11E-03	3.61E-03	3.15E-03	2.75E-03	2.42E-03	2.16E-03	1.95E-03	1.80E-03	1.69E-03	1.61E-03	1.57E-03	1.53E-03	1.51E-03	1.50E-03	1.47E-03	1.45E-03	1.42E-03
m_v (m²/kN)	linest	4.86E-02	1.65E-02	1.00E-02	7.21E-03	5.63E-03	4.63E-03	3.93E-03	3.41E-03	3.02E-03	2.71E-03	2.45E-03	2.24E-03	2.07E-03	1.92E-03	1.79E-03	1.68E-03	1.58E-03	1.49E-03	1.41E-03	1.34E-03	1.27E-03	1.22E-03	1.16E-03
ΔH or S_{ult}	eqn (1)	0.18	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
S_t, t < life		0.03	0.05	0.06	0.08	0.09	0.11	0.12	0.14	0.15	0.16	0.16	0.17	0.17	0.18	0.18	0.18	0.18	0.19	0.19	0.19	0.19	0.19	0.19
S_t, t > life		0.15	0.14	0.13	0.11	0.10	0.08	0.07	0.06	0.05	0.04	0.03	0.03	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.00

Conclusion	Absolute	Relative
Total settlement	4.46	100%
Settlement during operation	3.36	75%
Settlement after operation	1.10	25%

TETRA TECH
COFFEY

Client: Murrin Murrin Operations
Project: Geotechnical Assessment - Pit 815 Consolidation Estimation
Project No: 754-PERGE318544
Calculations: Tailings Settlement Pit 7 Series
Date: 01/02/24

BACKGROUND INFORMATION

Ultimate settlement in over-consolidated deposits

$$\Delta H = m_v \Delta p H \ldots (1)$$

Terzaghi time factor

$$T_v = \frac{c_v t}{d^2} \ldots (2)$$

$$c_v = \frac{k}{m_v \gamma_w} \ldots (3)$$

$$m_v = -\frac{1}{1+e_0} \cdot \frac{\delta e}{\delta P} \ldots (4)$$

Average degree of consolidation

$$U_v = \frac{S_t}{S_{ult}} \ldots (5)$$

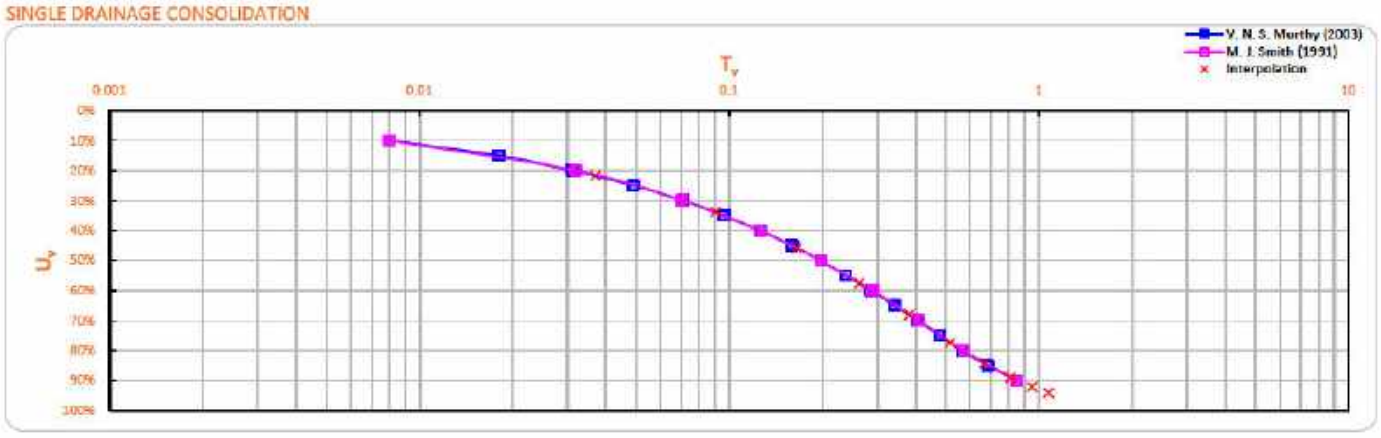
DEFINITION OF TERMS

m_v	coefficient of compressibility
c_v	coefficient of consolidation
k	permeability
γ_w	density of water
U_v	degree of consolidation
S_t	settlement after time t
S_{ult}	ultimate settlement
T_v	time factor
d	drainage path
t	time

LABORATORY RESULTS

Pressure	[kPa]	10	20	40	80	160	320
log P	[kPa]	1.000	1.301	1.602	1.903	2.204	2.505
e		3.106	2.826	2.568	2.325	2.022	1.815
c_v	[m²/y]		4.75	7.1	7.2	5.6	4.3
m_v	[m²/kN]		6.82E-03	4.37E-03	2.72E-03	1.76E-03	1.01E-03

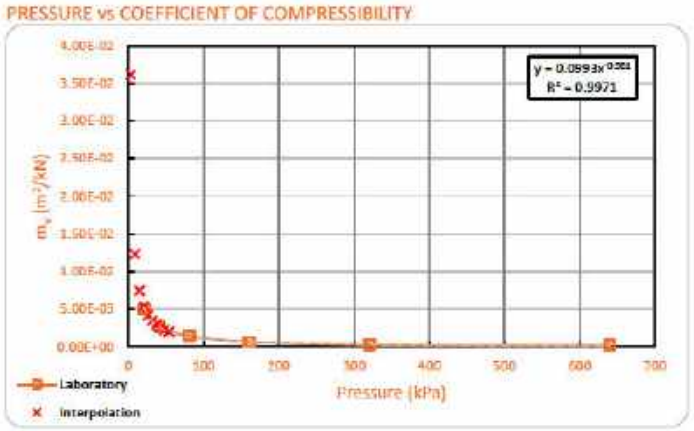
SINGLE DRAINAGE CONSOLIDATION



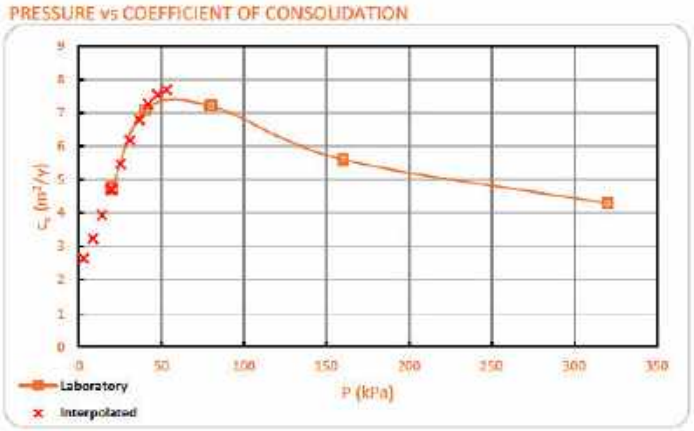
ROWE CELL TEST RESULTS

Pressure	[kPa]	20	40	80	160	320	640
m_v	[m²/kN]	5.00E-03	2.70E-03	1.50E-03	7.10E-04	2.90E-04	1.90E-04

PRESSURE vs COEFFICIENT OF COMPRESSIBILITY



PRESSURE vs COEFFICIENT OF CONSOLIDATION



SETTLEMENT APPROXIMATION

Parameters

Pit Depth: 32 m
No. Layers: 13
H: 2.46 m
Duration: 1.1 y
ρ_{dry} 0.8 kg/m³
Moisture 54% (adopted for analysis purpose - based on 17 Series IPTSF)
γ_w: 12.09 kN/m³
Pressure/z: 2.28 kPa/m
k: 1.00E-08 m/s

Calculations

Parameter	Method	Value												
Layer		1	2	3	4	5	6	7	8	9	10	11	12	13
Time (y)		0.08	0.17	0.25	0.34	0.42	0.51	0.59	0.68	0.76	0.85	0.93	1.02	1.10
P	mid-layer	2.80	8.40	14.01	19.61	25.21	30.81	36.41	42.02	47.62	53.22	58.82	64.43	70.03
c_v (m²/y)	spline	3	3	4	5	5	6	7	7	8	8	8	8	8
T_v (y)	eqn (2)	0.04	0.09	0.17	0.26	0.38	0.52	0.66	0.81	0.95	1.07	1.18	1.28	1.36
U_v	spline	22%	34%	46%	58%	68%	77%	84%	89%	92%	94%	96%	97%	99%
m_v (m²/kN)	spline	7.04E-03	6.44E-03	5.77E-03	5.05E-03	4.33E-03	3.65E-03	3.03E-03	2.54E-03	2.16E-03	1.90E-03	1.72E-03	1.61E-03	1.55E-03
m_v (m²/kN)	linest	3.62E-02	1.23E-02	7.46E-03	5.37E-03	4.19E-03	3.44E-03	2.92E-03	2.54E-03	2.25E-03	2.02E-03	1.83E-03	1.67E-03	1.54E-03
ΔH or S_{ult}	eqn (1)	0.25	0.25	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.27
S_t, t < life		0.05	0.09	0.12	0.15	0.18	0.20	0.22	0.23	0.24	0.25	0.25	0.26	0.26
S_t, t > life		0.20	0.17	0.14	0.11	0.08	0.06	0.04	0.03	0.02	0.02	0.01	0.01	0.00

Conclusion

	Absolute	Relative
Total settlement	3.39	100%
Settlement during operation	2.51	74%
Settlement after operation	0.88	26%

TETRA TECH
COFFEY

Client: Murrin Murrin Operations
Project: Geotechnical Assessment - Pit 815 Consolidation Estimation
Project No: 754-PERGE318544
Calculations: Tailings Settlement Pit 8 Series
Date: 01/02/24

BACKGROUND INFORMATION

Ultimate settlement in over-consolidated deposits

$$\Delta H = m_v \Delta p H \ldots (1)$$

Terzaghi time factor

$$T_v = \frac{c_v t}{d^2} \ldots (2)$$

$$c_v = \frac{k}{m_v \gamma_w} \ldots (3)$$

$$m_v = -\frac{1}{1+e_0} \cdot \frac{\delta e}{\delta P} \ldots (4)$$

Average degree of consolidation

$$U_v = \frac{S_t}{S_{ult}} \ldots (5)$$

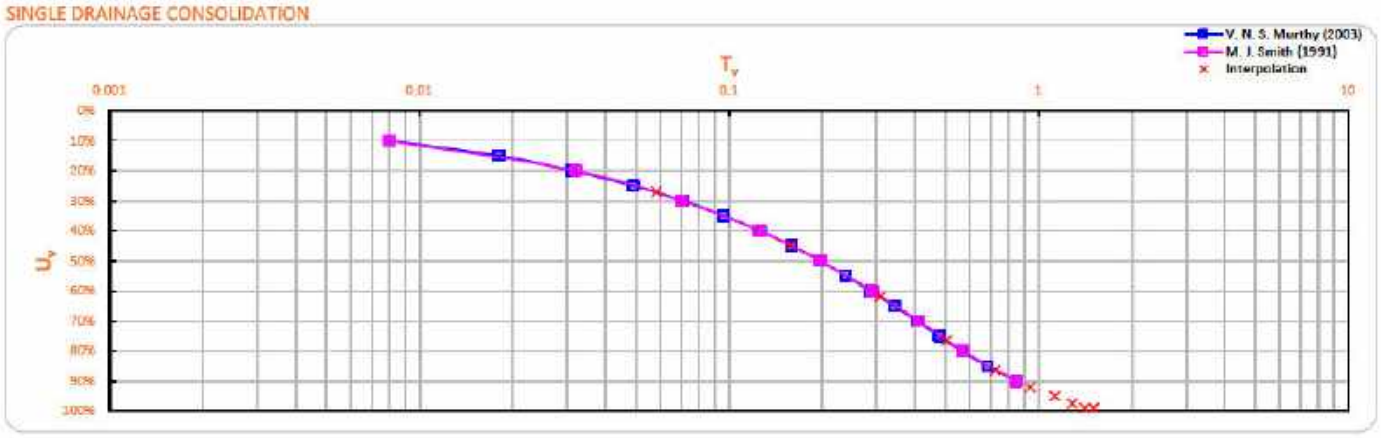
DEFINITION OF TERMS

m_v	coefficient of compressibility
c_v	coefficient of consolidation
k	permeability
γ_w	density of water
U_v	degree of consolidation
S_t	settlement after time t
S_{ult}	ultimate settlement
T_v	time factor
d	drainage path
t	time

LABORATORY RESULTS

Pressure	[kPa]	10	20	40	80	160	320
log P	[kPa]	1.000	1.301	1.602	1.903	2.204	2.505
e		3.106	2.826	2.568	2.325	2.022	1.815
c_v	[m²/y]		4.75	7.1	7.2	5.6	4.3
m_v	[m²/kN]		6.82E-03	4.37E-03	2.72E-03	1.76E-03	1.01E-03

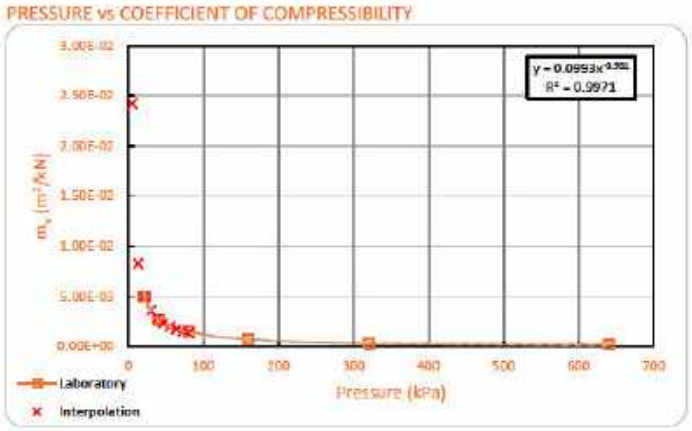
SINGLE DRAINAGE CONSOLIDATION



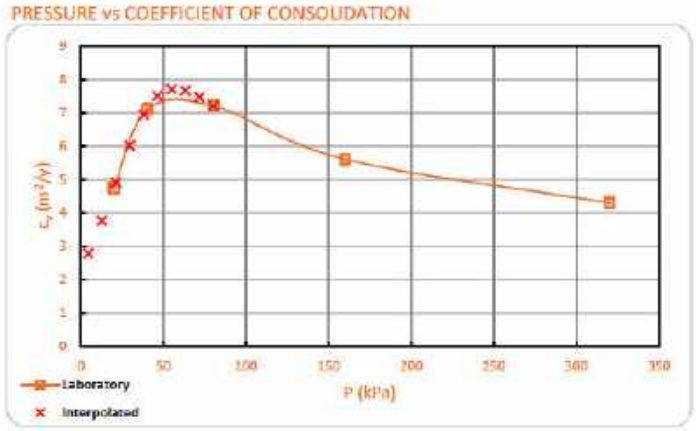
ROWE CELL TEST RESULTS

Pressure	[kPa]	20	40	80	160	320	640
m_v	[m²/kN]	5.00E-03	2.70E-03	1.50E-03	7.10E-04	2.90E-04	1.90E-04

PRESSURE vs COEFFICIENT OF COMPRESSIBILITY



PRESSURE vs COEFFICIENT OF CONSOLIDATION



SETTLEMENT APPROXIMATION

Parameters

Pit Depth:	48.2	m
No. Layers:	13	
H:	3.71	m
Duration:	3.74	y
ρ_{dry}	0.8	kg/m³
Moisture	54%	(adopted for analysis purpose - based on 17 Series IPTSF)
γ_w:	12.09	kN/m³
Pressure/z:	2.28	kPa/m
k:	1.00E-08	m/s

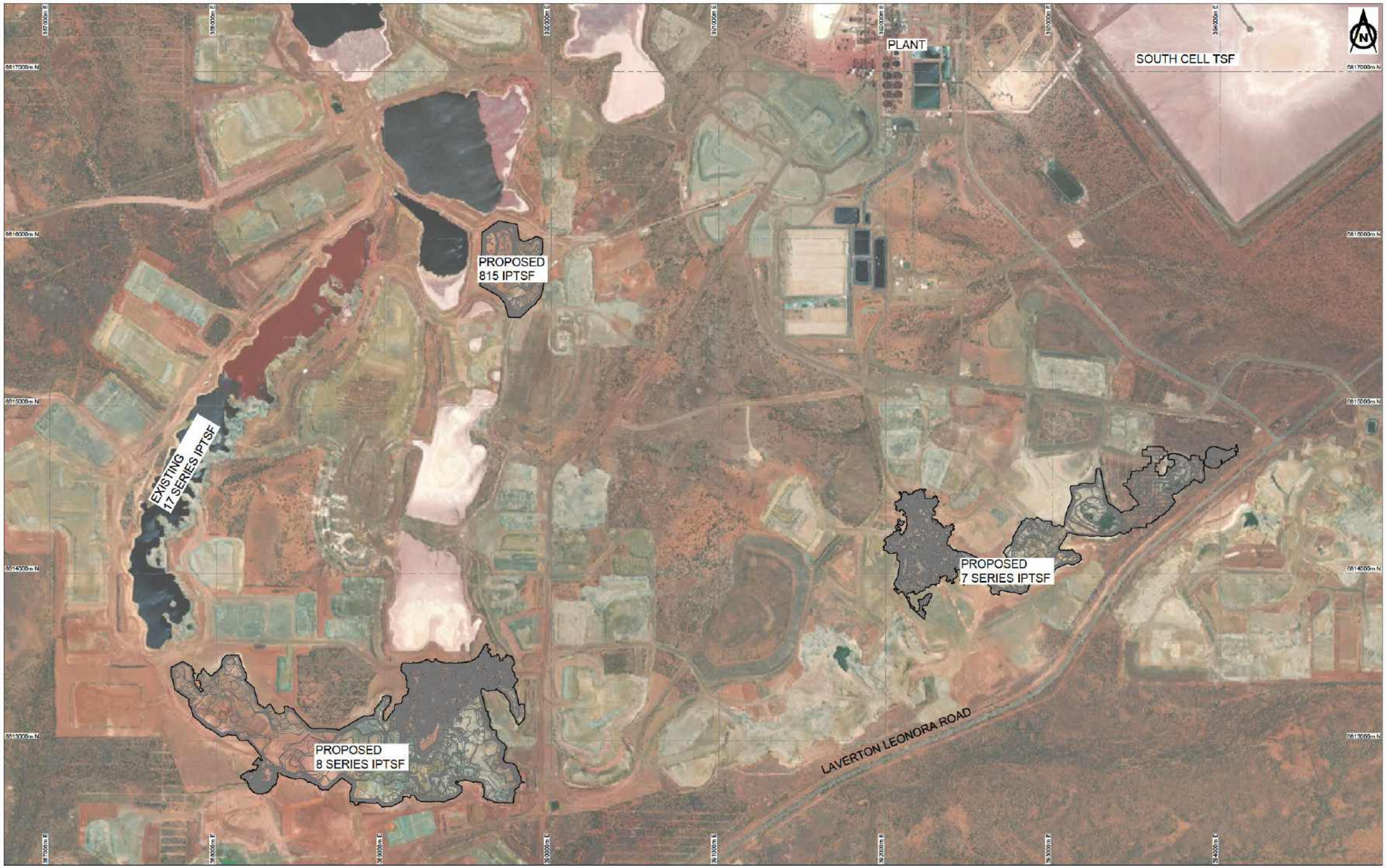
Calculations

Parameter	Method	Value												
Layer		1	2	3	4	5	6	7	8	9	10	11	12	13
Time (y)		0.29	0.58	0.86	1.15	1.44	1.73	2.01	2.30	2.59	2.88	3.16	3.45	3.74
P	mid-layer	4.22	12.66	21.10	29.53	37.97	46.41	54.85	63.29	71.73	80.16	88.60	97.04	105.48
c_v (m²/y)	spline	3	4	5	6	7	7	8	8	7	7	7	7	6
T_v (y)	eqn (2)	0.06	0.16	0.31	0.50	0.73	0.94	1.13	1.28	1.41	1.51	1.60	1.68	1.77
U_v	spline	27%	45%	62%	77%	86%	92%	95%	97%	99%	99%	99%	99%	99%
m_v (m²/kN)	spline	6.90E-03	5.94E-03	4.86E-03	3.80E-03	2.88E-03	2.23E-03	1.84E-03	1.63E-03	1.54E-03	1.50E-03	1.45E-03	1.39E-03	1.31E-03
m_v (m²/kN)	linest	2.42E-02	8.24E-03	4.99E-03	3.59E-03	2.81E-03	2.30E-03	1.96E-03	1.70E-03	1.50E-03	1.35E-03	1.22E-03	1.12E-03	1.03E-03
ΔH or S_{ult}	eqn (1)	0.38	0.39	0.39	0.39	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40
S_t, t < life		0.10	0.17	0.24	0.30	0.34	0.36	0.38	0.39	0.40	0.40	0.40	0.40	0.40
S_t, t > life		0.28	0.21	0.15	0.09	0.05	0.03	0.02	0.01	0.00	0.00	0.00	0.00	0.00

Conclusion

	Absolute	Relative
Total settlement	5.15	100%
Settlement during operation	4.28	83%
Settlement after operation	0.87	17%

APPENDIX E: CIVIL DRAWINGS FOR IPTSFS



NOTES:

SURVEY PIT 815 : MMN_0815_Pit_Surf_V1-b to topo.dxf

SURVEY PIT 7 SERIES: 7s_contours_(NO_710).dxf

SURVEY PIT 8 SERIES: 8s_Tailings_Void_Contours.dxf

200 0 200 400 600 800 1000

SCALE 1:10,000

COORDINATE SYSTEM
Map Grid of Australia Zone 51, using GDA94 datum

ISSUED WITH DESIGN REPORT
PLOTTED: Friday, 5 April 2024 10:45:03 AM

REV.	REVISION DESCRIPTION	DATE	DRAWN	APPROVED	ORIGINAL SIZE:	A1
-	-	-	-	-	DRAWN:	JB
-	-	-	-	-	DESIGNED:	
-	-	-	-	-	APPROVED:	
0	ISSUED WITH DESIGN REPORT	05/04/2024	RG	FVDL	DATE:	05/04/2024
A	ISSUED FOR CLIENT REVIEW	16/02/2024	JB	FVDL	SCALE:	1:10,000

TETRA TECH COFFEY

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CLIENT:	MURIN MURIN OPERATIONS PTY LTD
PROJECT:	GEOTECHNICAL ASSESSMENT OF 815, 7 SERIES AND 8 SERIES IN-PIT TSF DESIGN
TITLE:	SITE LAYOUT PLAN
PROJECT NO:	754-PERGE316544
DWG NO:	754-PERGE316544-CD-01
REV:	0

DWG: F:\PROJECTS_DOT\2016 DWRA\CD\Murin Murin Operations Pty Ltd\754-PERGE316544 - MMC-815_7_8 Series In-Pit TSF Design\07_Drawings\02 - Drawings\754-PERGE316544-CD-01.dwg

PLANT

SOUTH CELL TSF

SOUTHERN TAILINGS PIPELINE

PROPOSED 815 IPTSF

DECANT PIPELINE

DECANT PIPELINE

EXISTING 17 SERIES IPTSF

PROPOSED DECANT PIPELINE

TAILINGS PIPELINE

PROPOSED SCOUR SUMP

PROPOSED 7 SERIES IPTSF

PROPOSED 8 SERIES IPTSF

PROPOSED TAILINGS PIPELINE

LAVERTON LEONORA ROAD

LEGEND:

- EXISTING TAILINGS PIPELINE
- EXISTING DECANT RETURN WATER PIPELINE
- EXISTING SCOUR SUMP
- PROPOSED DECANT WATER PIPELINE
- PROPOSED TAILINGS PIPELINE
- PROPOSED SCOUR SUMP

NOTES:

1. ALL EXISTING AND PROPOSED PIPELINES AND SCOUR SUMPS ARE INDICATIVE ONLY. THE PIPELINE ROUTES AND SCOUR SUMP LOCATIONS MAY BE VARIED ON SITE TO SUIT SITE CONDITIONS.
2. ALL PROPOSED PUMPING AND PIPING (TAILINGS AND DECANT WATER RETURN) TO BE DESIGNED BY OTHERS.

200 0 200 400 600 800 1000

SCALE 1:10,000

CONTOUR INTERVALS U.N.O.
EXISTING TOPOGRAPHY: 1m & 5m
DESIGN TOPOGRAPHY: 1m & 5m

COORDINATE SYSTEM
Map Grid of Australia Zone 51, using GDA94 datum

ISSUED WITH DESIGN REPORT
PLOTTED: Friday, 5 April 2024 12:40:00 AM

REV.	REVISION DESCRIPTION	DATE	DRAWN	APPROVED	ORIGINAL SIZE:	A1
-	-	-	-	-	DRAWN:	
-	-	-	-	-	DESIGNED:	
-	-	-	-	-	APPROVED:	
0	ISSUED WITH DESIGN REPORT	05/04/2024			DATE:	05/04/2024
A	ISSUED FOR CLIENT REVIEW	16/02/2024			SCALE:	1:10,000

TETRA TECH COFFEY

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CLIENT: MURIN MURIN OPERATIONS PTY LTD

PROJECT: GEOTECHNICAL ASSESSMENT OF 615, 7 SERIES AND 8 SERIES IN-PIT TSF DESIGN

TITLE: TAILINGS AND DECANT WATER PIPELINES ROUTES

PROJECT NO: 754-PERGE316544

DWG NO: 754-PERGE316544-DD-02

REV: 0

PLANT

BOREHOLE LOCATIONS		
NAME	NORTHING (m)	EASTING (m)
IP7-1	6814797.428	391883.050
IP7-2	6814721.583	392545.520
IP7-3	6815022.587	392885.987
IP7-4	6814910.891	393616.517
IP7-5	6814875.320	394118.918
IP7-6	6814852.796	394553.056
IP7-7	6814566.330	394173.234
IP7-8	6814240.225	393760.847
IP7-9	6813877.095	393407.795
IP7-10	6813561.496	393191.057
IP8-1	6813703.689	389748.599
IP8-2	6813281.482	389945.705
IP8-3	6813350.078	390326.039
IP8-4	6813569.899	387962.073
IP8-5	6813366.781	387596.284
IP8-6	6813000.144	387887.789
IP8-7	6812867.284	388313.327
IP8-8	6812419.208	388705.217
IP8-9	6812354.937	389237.628
IP8-10	6812027.280	389913.317
IP815-1	6816159.500	389751.345
IP815-2	6816016.652	389965.441
IP815-3	6815778.196	390020.331
IP815-4	6815458.745	389920.588

IP905-5
IP815-1
IP815-2
PROPOSED 815 IPTSF
IP1806-2
IP1806-1
IP815-3
IP904-2
IP815-4
IP904-1
IP904-3
EXISTING 17 SERIES IPTSF
IP17-10
IP17-09
IP1804-2
IP17-11
IP8-1
IP8-4
IP17-12
IP1804-3
IP1804-1
IP8-5
IP8-3
IP8-2
IP804-4
IP8-5
PROPOSED 8 SERIES IPTSF
IP8-7
IP8-10
IP8-8
IP8-9
IP7-3
IP7-4
IP7-5
IP7-6
IP7-1
IP7-2
IP702-1
IP702-2
IP7-7
IP7-8
IP702-3
PROPOSED 7 SERIES IPTSF
IP7-9
IP1901-5
IP1901-4
IP7-10
IP1901-6
LAVERTON LEONORA ROAD
IP1901-1

LEGEND:

- PROPOSED MONITORING BORES
- EXISTING MONITORING BORES

NOTES:

1. FOR CLARITY PURPOSES, ONLY EXISTING MBs AND PROPOSED MBs ARE SHOWN ON THIS DRAWING.
2. LOCATIONS OF ALL EXISTING AND PROPOSED MBs ARE APPROXIMATELY ONLY. THE PROPOSED MB LOCATIONS MAY BE VARIED ON SITE TO SUIT SITE CONDITIONS.
3. ALL PROPOSED MBs TO BE DESIGNED BY OTHERS.

200 0 200 400 600 800 1000
SCALE 1:10,000

COORDINATE SYSTEM
Map Grid of Australia Zone 51, using GDA94 datum

ISSUED WITH DESIGN REPORT
PLOTTED: Friday, 5 April 2024 12:00:56 AM

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-	-	-	-	-	APPROVED:	
0	ISSUED WITH DESIGN REPORT	05/04/2024			DATE:	05/04/2024
A	ISSUED FOR CLIENT REVIEW	16/02/2024			SCALE:	1:10,000

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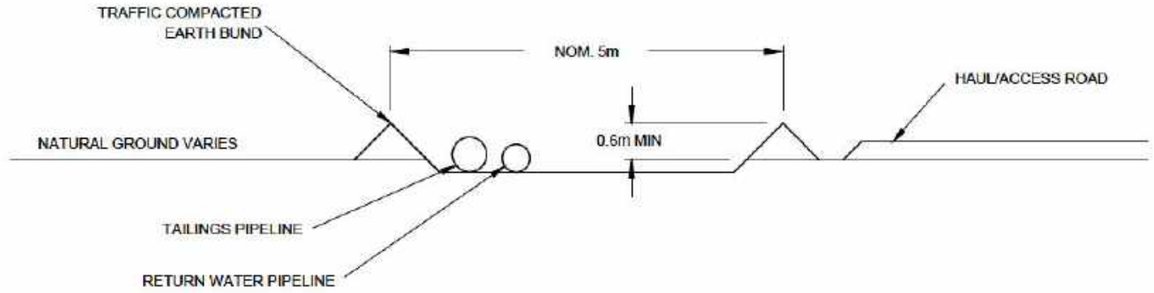
CLIENT: MURIN MURIN OPERATIONS PTY LTD

PROJECT: GEOTECHNICAL ASSESSMENT OF 615, 7 SERIES AND 8 SERIES IN-PIT TSF DESIGN

TITLE: MONITORING BORE LOCATIONS

PROJECT NO: 754-PERGE318544 | DWG NO: 754-PERGE318544-DD-03 | REV: 0



TYPICAL DETAIL 1 - PIPELINE BUNDING
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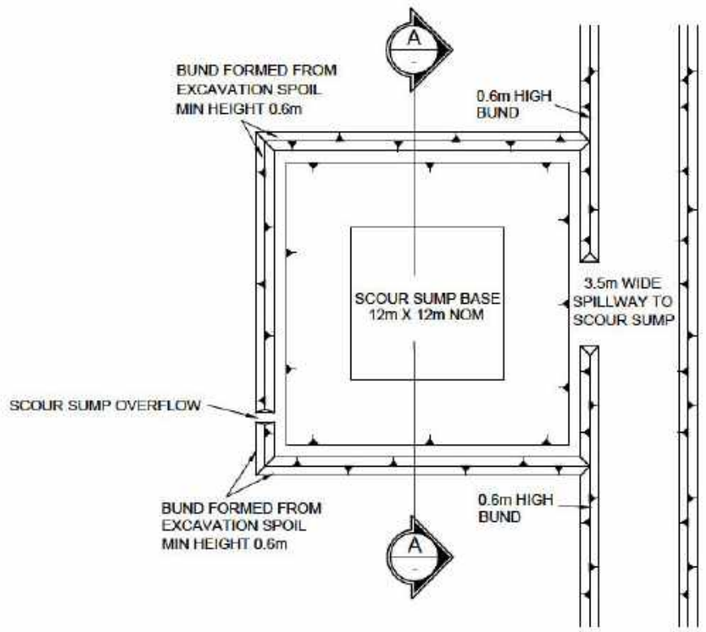
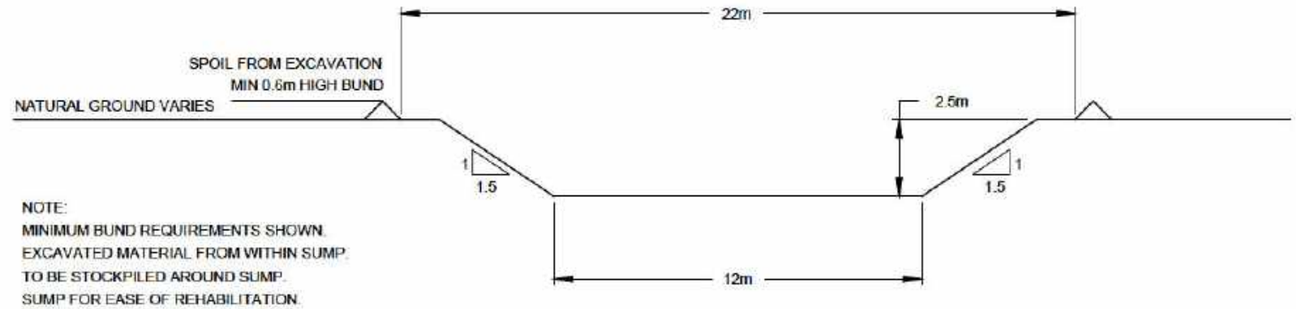
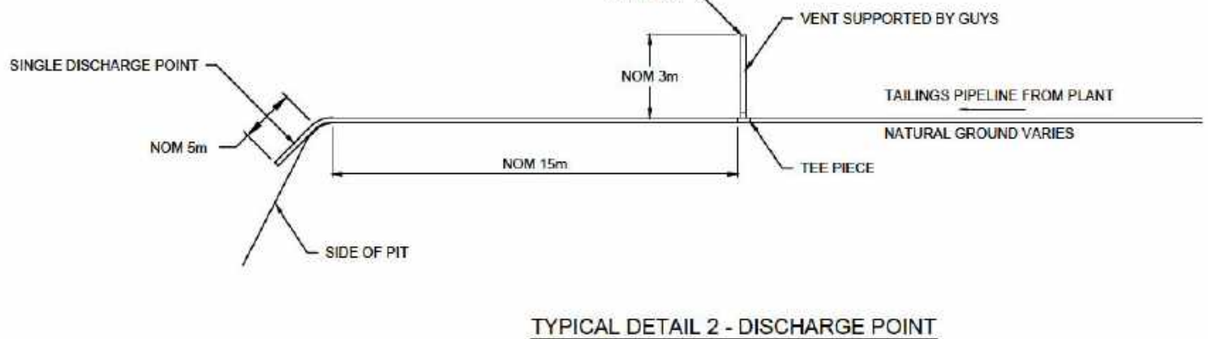


SCOUR SUMP PLAN
SCALE: NTS



NOTE:
MINIMUM BUND REQUIREMENTS SHOWN.
EXCAVATED MATERIAL FROM WITHIN SUMP
TO BE STOCKPILED AROUND SUMP.
SUMP FOR EASE OF REHABILITATION.
INDIVIDUAL SUMP SIZE MIN 530m²

A SECTION
SCALE: NTS



TYPICAL DETAIL 2 - DISCHARGE POINT
SCALE: NTS

NOTES:
1. ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE NOTED.
2. ALL PUMPING AND PIPING (TAILINGS AND WATER RETURN) TO BE DESIGNED BY OTHERS.

COORDINATE SYSTEM
Map Grid of Australia Zone 51, using GDA94 datum

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PLOTTED: Friday, 5 April 2024 10:52:14 AM

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A	ISSUED FOR CLIENT REVIEW	16/02/2024		

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DESIGNED:
APPROVED:
DATE: 05/04/2024
SCALE: NTS
ORIGINAL SIZE: A1

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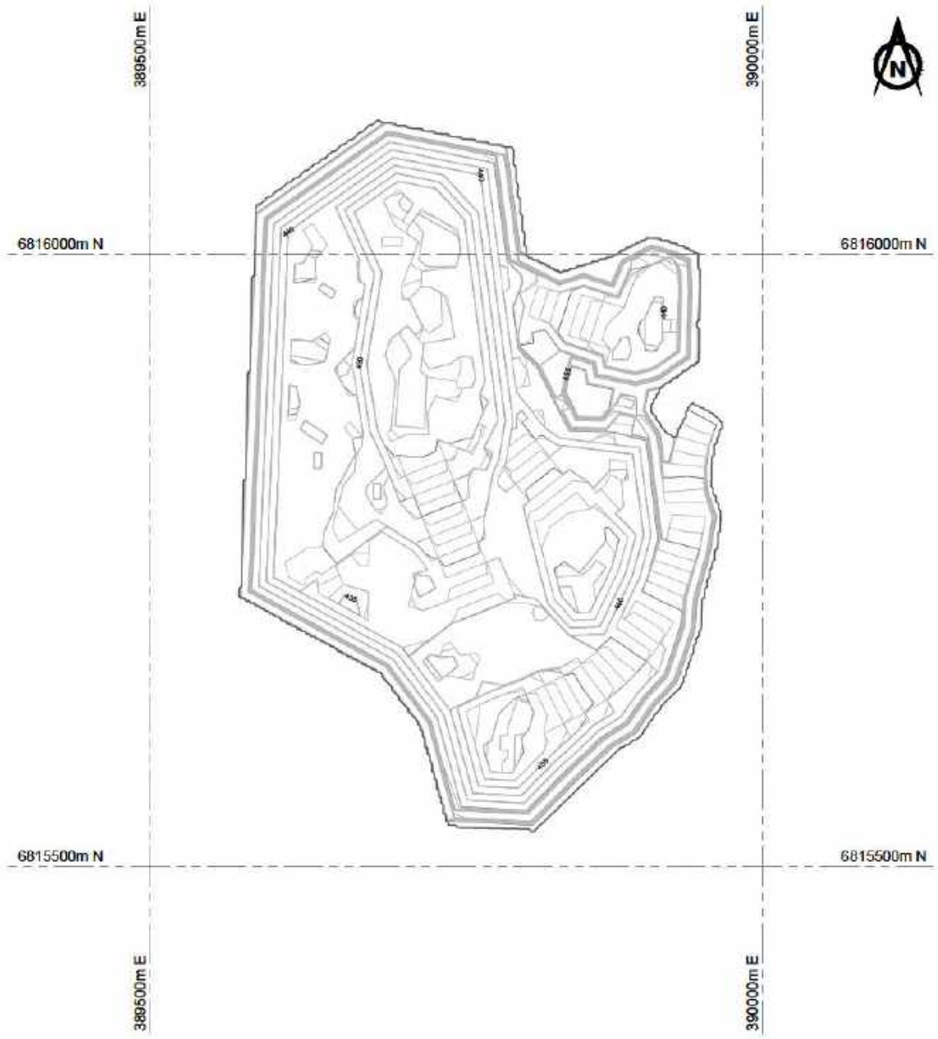
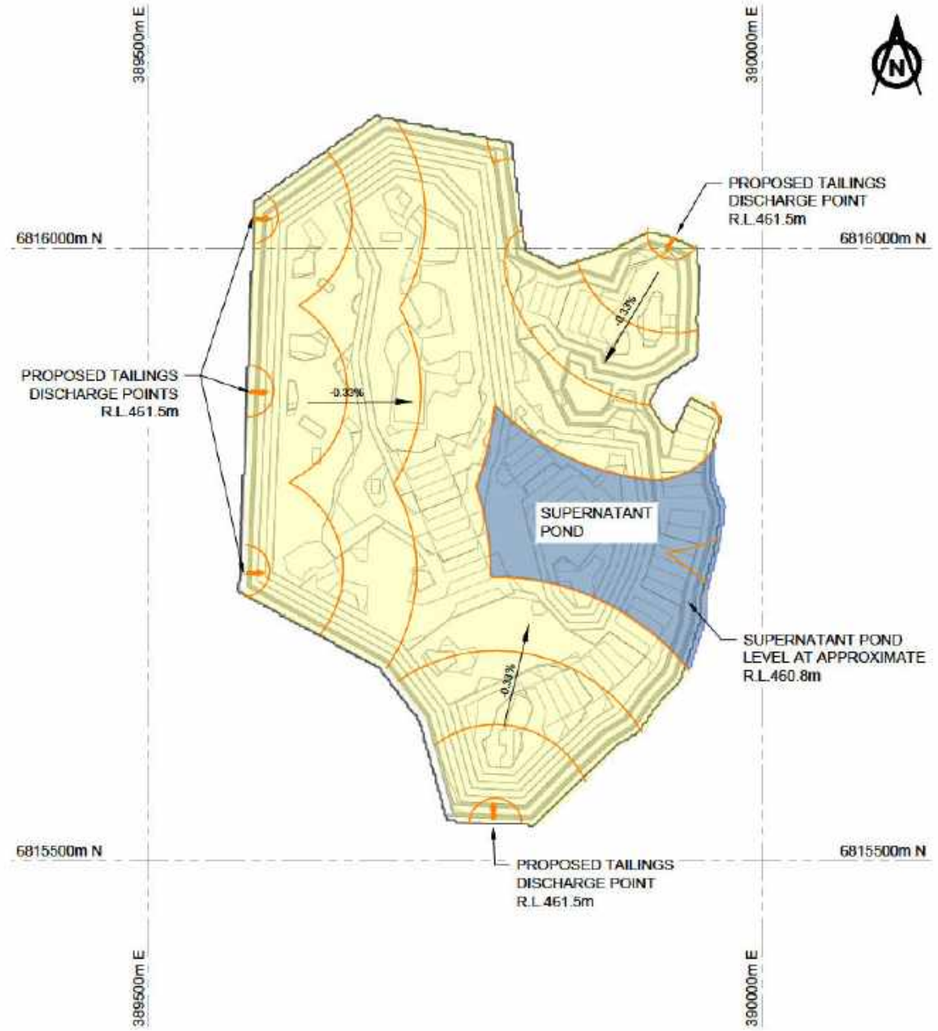
CLIENT: MURIN MURIN OPERATIONS PTY LTD
PROJECT: GEOTECHNICAL ASSESSMENT OF 615.7 SERIES AND 6 SERIES IN-PIT TSF DESIGN
TITLE: TYPICAL SECTIONS AND DETAILS (1 OF 2)
PROJECT NO: 754-PERGE316544
DWG NO: 754-PERGE316544-DD-04
REV: 0



PIT 815 PLAN
SCALE 1:2,500



DEPOSITION PLAN FOR PIT 815
SCALE 1:2,500

NOTES:

SURVEY: MMN_0815_Pit_Surf_V1-b to topo.dxf

50 0 50 100 150 200 250
SCALE 1:2,500

CONTOUR INTERVALS U.N.O.
EXISTING TOPOGRAPHY: 1m & 5m
DESIGN TOPOGRAPHY: 1m & 5m

COORDINATE SYSTEM
Map Grid of Australia Zone 51, using GDA94 datum

ISSUED WITH DESIGN REPORT
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0	ISSUED WITH DESIGN REPORT	05/04/2024			DATE:	05/04/2024
A	ISSUED FOR CLIENT REVIEW	16/02/2024			SCALE:	1:2,500

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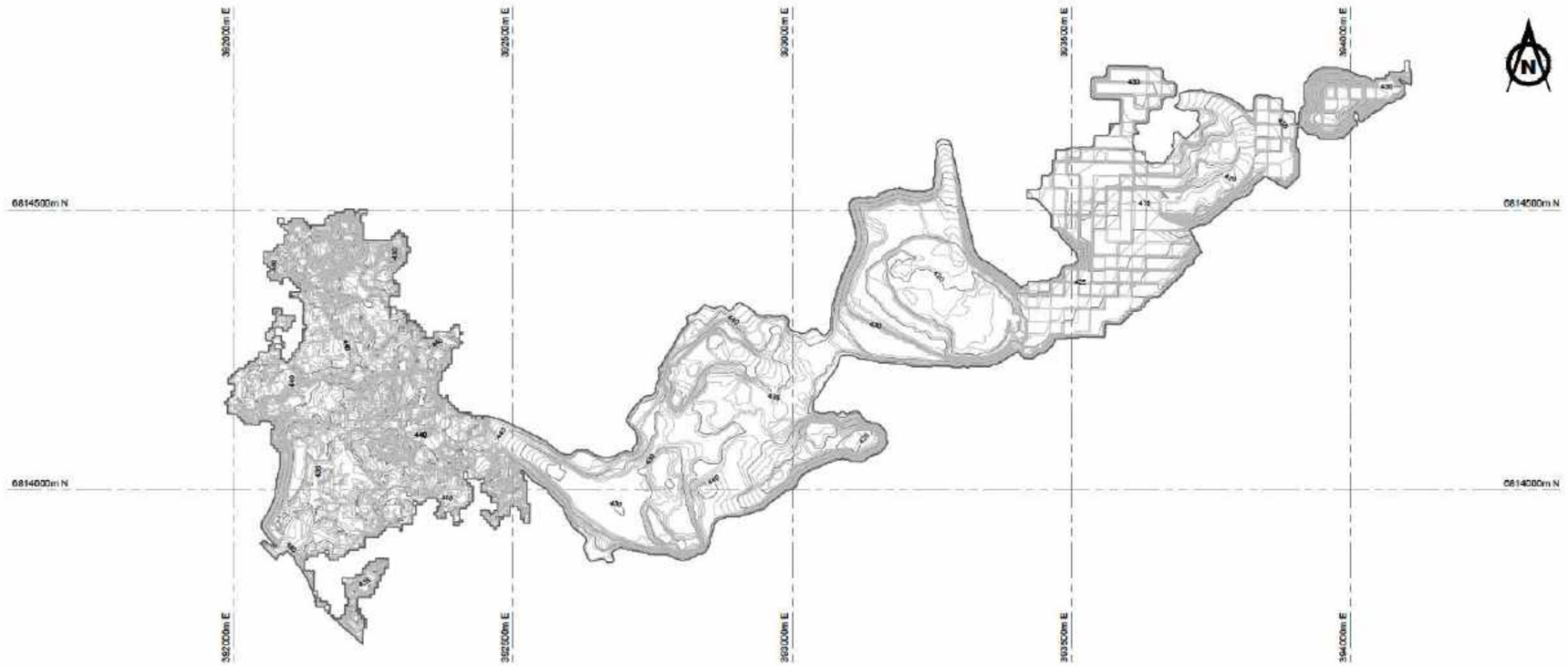
CLIENT:	MURIN MURIN OPERATIONS PTY LTD
PROJECT:	GEOTECHNICAL ASSESSMENT OF 815, 7 SERIES AND 6 SERIES IN-PIT TSF DESIGN
TITLE:	DEPOSITION PLAN FOR PIT 815
PROJECT NO:	754-PERGE316544
DWG NO:	754-PERGE316544-DD-05
REV:	0



PIT 7 SERIES PLAN
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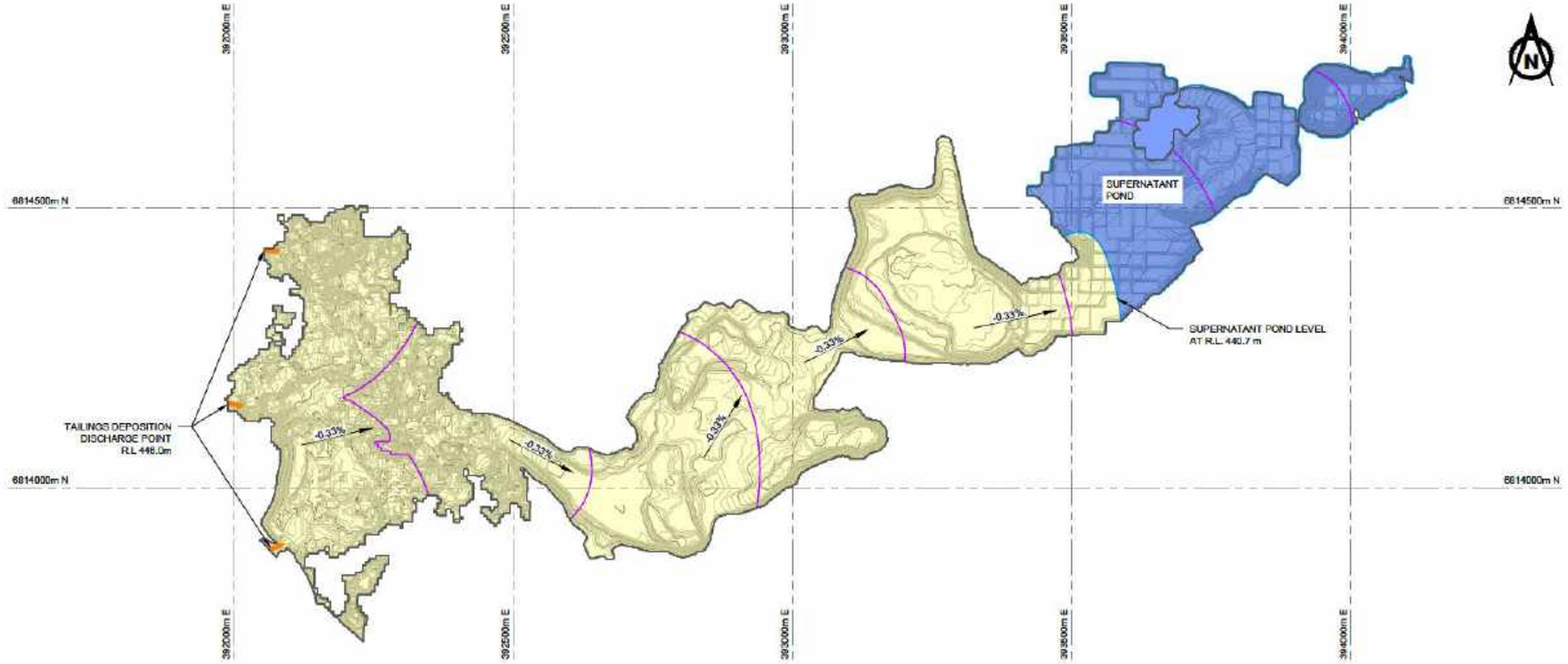

DEPOSITION PLAN FOR PIT 7 SERIES
SCALE 1:5,000

NOTES:

SURVEY: 7s_contours_(NO_716).dxt

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SCALE 1:5,000

CONTOUR INTERVALS U.N.O.
EXISTING TOPOGRAPHY: 1m & 5m
DESIGN TOPOGRAPHY: 1m & 5m

COORDINATE SYSTEM
Map Grid of Australia Zone 51, using GDA94 datum

ISSUED WITH DESIGN REPORT
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A	ISSUED FOR CLIENT REVIEW	16/02/2024		

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DATE: 05/04/2024
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ORIGINAL SIZE: A1

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PROJECT: GEOTECHNICAL ASSESSMENT OF 615, 7 SERIES AND 8 SERIES IN-PIT TSF DESIGN
TITLE: DEPOSITION PLAN FOR PIT 7 SERIES
PROJECT NO: 754-PERGE316544
DWG NO: 754-PERGE316544-DD-00
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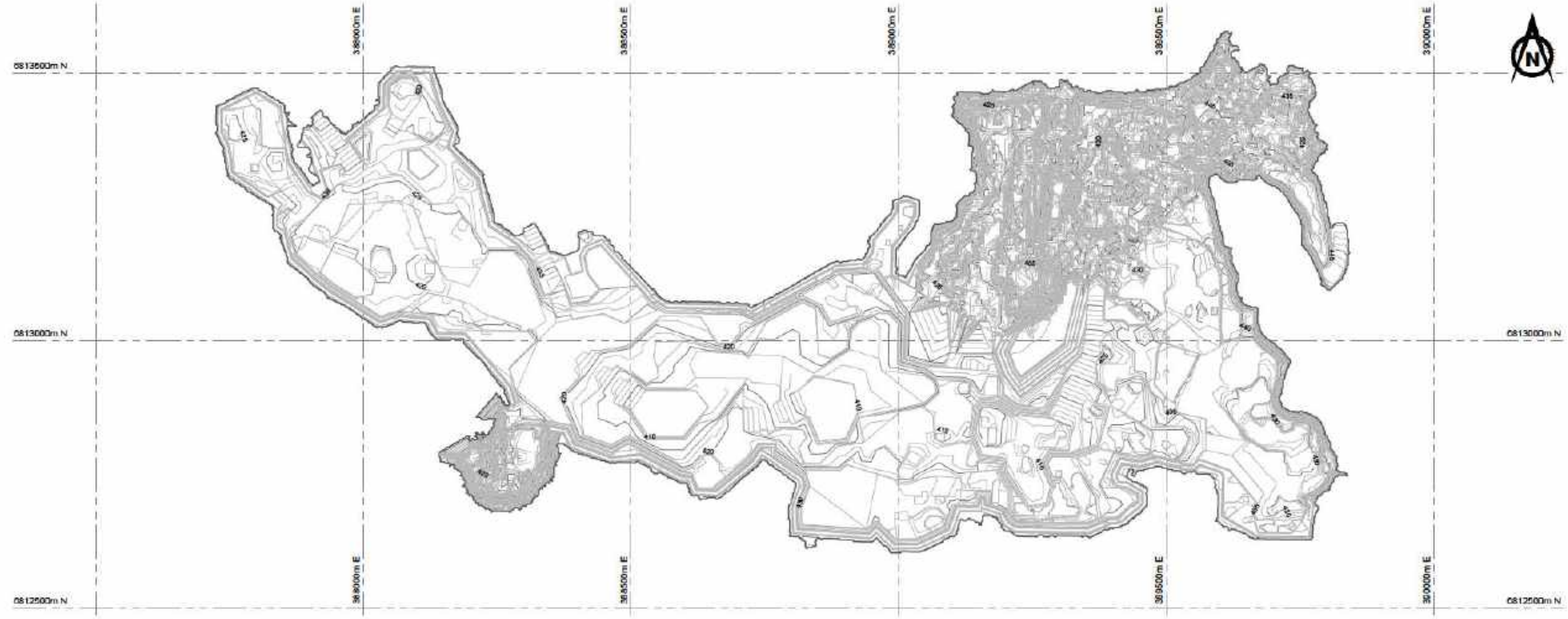
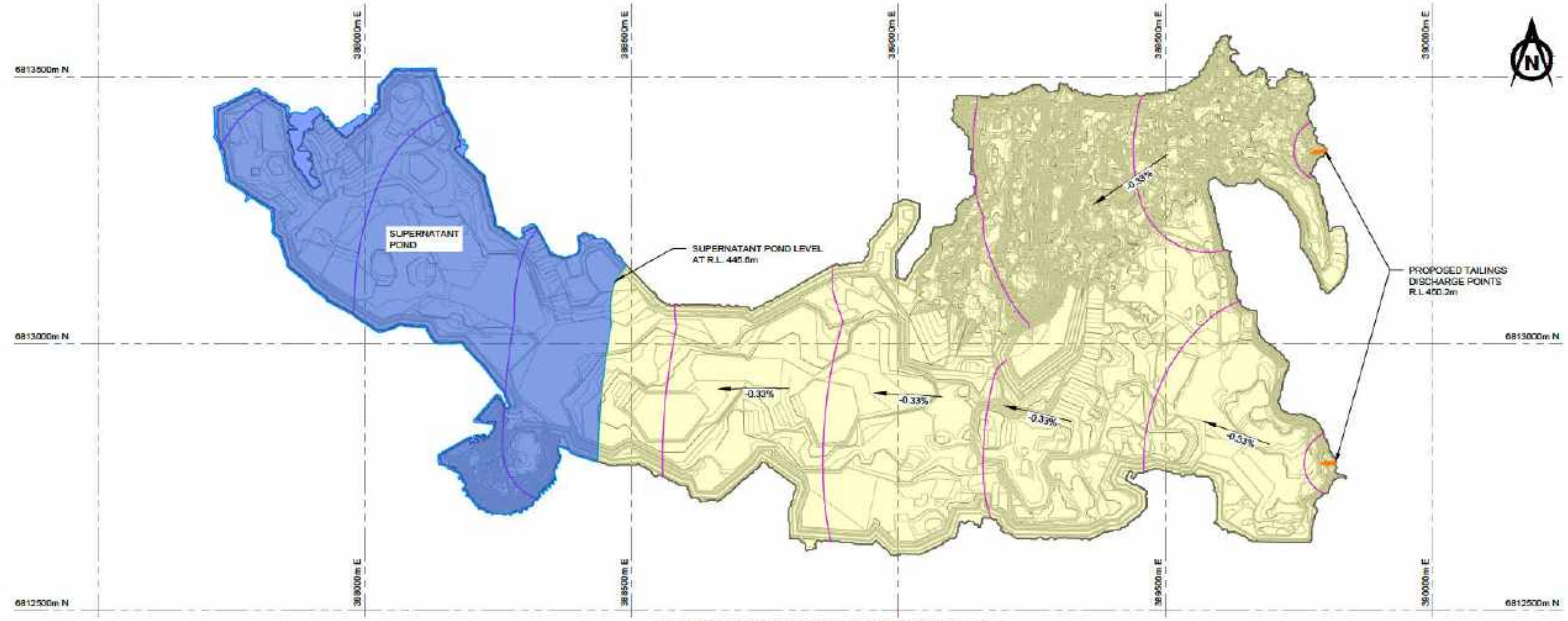


PIT 8 SERIES PLAN
SCALE 1:5,000



DEPOSITION PLAN FOR PIT 8 SERIES
SCALE 1:5,000

100 0 100 200 300 400 500
SCALE 1:5,000

NOTES:

SURVEY: 8s_Tailings_Void_Contours.dxf

CONTOUR INTERVALS U.N.O.
EXISTING TOPOGRAPHY: 1m & 5m
DESIGN TOPOGRAPHY: 1m & 5m

COORDINATE SYSTEM
Map Grid of Australia Zone 51, using GDA94 datum

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A	ISSUED FOR CLIENT REVIEW	16/02/2024	[redacted]	[redacted]	SCALE:	1:5,000
					ORIGINAL SIZE:	A1

TETRA TECH COFFEY

CLIENT:	MURIN MURIN OPERATIONS PTY LTD
PROJECT:	GEOTECHNICAL ASSESSMENT OF 815, 7 SERIES AND 8 SERIES IN-PIT TSF DESIGN
TITLE:	DEPOSITION PLAN FOR PIT 8 SERIES
PROJECT NO:	754-PERGE318544
DWG NO:	754-PERGE318544-DD-07
REV:	0

APPENDIX F: CIVIL SCOPE OF WORKS FOR IPTSFS

Murrin Murrin Operations
In-Pit TSFs 815, 7 Series and 8 Series

Civil Scope of Works

Minara Resources Pty Ltd

Reference: 754-PERGE318544_MMO IPTSFs 815_7_8 Series SoW_Rev0

5 April 2024

MURRIN MURRIN OPERATIONS – IPTSFS 815, 7 SERIES AND 8 SERIES

Civil Scope of Works

Report reference number: 754-PERGE318544_MMO IPTSFs 815_7_8 Series SoW_Rev0
5 April 2024

PREPARED FOR

Minara Resources Pty Ltd
Murrin Murrin Operations
Level 3, 30 The Esplanade
Perth, WA 6000

PREPARED BY

Tetra Tech Coffey
Level 1, Bishops See, 235 St Georges Terrace
Perth
WA 6000 Australia
p: +61 8 6218 2100
f: +61 8 6218 2222
ABN 55 139 460 521

QUALITY INFORMATION

Revision history

Revision	Description	Date	Author	Reviewer	Approver
A	Issued for client review	23/02/2024	AM / AL	DKN / FvdL	FvdL
0	Issued as final	05/04/2024	AM / AL	DKN / FvdL	FvdL

Distribution

Report Status	No. of copies	Format	Distributed to	Date
Draft	1	PDF	Murrin Murrin Operations	23/02/2024
Final	1	PDF	Murrin Murrin Operations	05/04/2024

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CONTENTS

APPENDICES

ACRONYMS/ABBREVIATIONS

Acronyms/Abbreviations	Definition
AS	Australian Standard
MMO	Murrin Murrin Operations
DMIRS	Department of Mines, Industry Regulation and Safety (formerly Department of Mines and Petroleum, DMP)
DWER	Department of Water and Environmental Regulation
IPTSFs	In-Pit Tailings Storage Facilities
LL; PL; PI	Liquid Limit; Plastic Limit; Plasticity Index
LV	Light Vehicle
m bgl	Meter below ground level
MC	Moisture Content
NATA	The National Association of Testing Authorities, Australia
OMC	Optimum Moisture Content
PSD	Particle Size Distribution
QA/QC	Quality Assurance / Quality Control
SMDD	Maximum Dry Density - Standard Compaction
SoW	Scope of Works (This Document)
Tetra Tech Coffey	Tetra Tech Coffey Pty Ltd
TSF	Tailings Storage Facility
WA	Western Australia

1. INTRODUCTION

This Scope of Works (SoW) covers the construction of the tailings delivery and return water pipeline corridors, scour sumps and the associated infrastructure for the In-Pit Tailings Storage Facilities (IPTSFs) 815, 7 Series and 8 Series and is to be read in conjunction with the Drawings. Construction mainly entails the cut to fill excavation to form the pipeline corridor and the parallel corridor containment bunds. The scour sumps will also be formed by cut to fill methods.

The SoW shall comprise the provision of all material, construction plant, equipment, labour, supervision, tools, services, warehousing if required, testing equipment, and each and every item of expense necessary for the construction, and preparing of 'as built' drawings and documents for work shown in the Drawings, Schedules and Specifications forming part of the Contract for the construction of the IPTSFs 815, 7 Series and 8 Series at Murrin Murrin Operations (MMO), located approximately 60 km east of Leonora, Western Australia (WA).

All works shall be constructed complete and operational except as specifically excluded and shall include all necessary auxiliary works, accessories and the incorporation of all miscellaneous material, minor parts and other such items, whether or not the items are specified, where it is clearly the intent of the Contract that they should be supplied or where they are required and necessary to complete and commission the work.

1.1 CONTRACT DRAWINGS

The following drawings complete this SoW:

Drawing Title	Drawing No.
Site Layout Plan	754-PERGE318544-DD-01
Tailings and Decant Return Water Pipelines Routes	754-PERGE318544-DD-02
Typical Sections and Details	754-PERGE318544-DD-04

1.2 CODE OF PRACTICE

Unless otherwise specified, or shown on the Drawings, the Contractor is to provide all materials and carry out all the work in accordance with the latest revisions of the relevant Australian Standards (AS).

All work under this Contract shall be performed strictly in accordance with the following Specifications, Drawings and other documents, which by this reference forms part of this Contract, unless expressly noted otherwise.

- AS 1289: Methods of testing soils for engineering purposes
- AS1181-1982: Method of measurement of civil engineering works and associated building works
- Western Australian Mines Safety Act and Regulations

The Works shall be carried out to comply with the latest revision of the Drawings, Codes and Standards specified, or where no standards are specified, to Australian Standards, or to the appropriate British or other recognised Standards.

Before making any change in any work under the Contract to comply with any revisions to the relevant codes and standards, the Contractor shall give to the Principal written notice specifying the reason therefore and requesting their direction thereon. The Principal shall decide whether a change is necessary and issue an order accordingly under the provisions of the General Conditions of Contract.

1.3 SITE INSPECTION

The Contractor shall inspect the site and must allow for the following factors in their price:

- The nature and requirements of the work to be done.
- All conditions on and adjacent to the site.
- Access to the site.
- The types of soil and vegetation present on the site.
- The expected or known water table.
- The nearest sources of suitable fill material which complies with this Specification.
- The source of water for construction purposes.
- Location of any heritage sites in or near the work area.

1.4 SAFETY

The Contractor shall:

- Carry out the works in a safe manner.
- Conform to all relevant Acts or Statutes of Parliament, Regulations, By-Laws or Orders relating to the safety of persons and property on or about the site.

1.5 SITE LOCATION AND DESCRIPTION

MMO is located approximately 60 km east of Leonora, Western Australia (WA). The landform at MMO is slightly undulating. Numerous open pits are located throughout the site, many of which are non-operational. Stockpiles of topsoil, oxidised mine waste material and ore are located at various locations across the site.

2. DESCRIPTION OF WORK – SPECIFIC

The SoW shall include, but is not necessarily limited to the following:

2.1 GENERAL

The Contractor shall:

- Attend a Site Induction before the commencement of works.
- Carry out all works indicated or implied in the Drawings or in the Specification.
- Supply all labour, plant, and materials (except those indicated as being supplied by the Principal) necessary for completion of the works.
- Maintain all works as required by the Contract documents and for the period stated therein.

All construction shall be to the minimum lines and grades shown on the Drawings or as required by the Principal's Representative as work progresses.

During the progress of the works, the Principal's Representative may find it necessary to revise the lines, levels, and grades of any part of the works because of the conditions revealed by the works.

The Contractor shall accept reasonable delays due to inspection and checking of any part of the works to determine grades and levels.

2.2 SURVEY

2.2.1 General

The Contractor shall:

- Perform all ground surveys using conventional and agreed surveying techniques.
- Survey and set out the works based on the datum points provided by the Principal's Representative.
- Be responsible for the protection of all permanent and temporary beacons or bench marks.
- Be wholly responsible for the setting out of the works in accordance with the terms of the specification. Although the Principal's Representative will cause such setting out to be checked from time to time, such checking will not relieve the Contractor of full responsibility for the accuracy of such setting out.
- Carry out surveys prior to the commencement of the item of work and at the completion of the item of work.
- Carry out a post construction survey of the works by a competent surveyor to verify that the works were constructed within the specified tolerances and submit to the Principal's Representative.
- Submit their survey data and calculations to the Principal's Representative.
- Ensure initial and/or final surveys are undertaken and approved by the Principal's Representative prior to the removal or placement of any material, especially where such action will destroy or cover the surface just surveyed. All survey checks or quantity measurements must be supplied to the Principal's Representative. Suitable time must be given to the Principal's Representative to allow such calculations to be checked and approved prior to the works being covered or removed.

The Principal's Representative may undertake their own survey of any item, either in conjunction with the Contractor, or separately. The Contractor and Principal's Representative shall agree on the results of measurement surveys that are carried out prior to any works being covered up or within seven (7) days of a survey being undertaken. Should agreement not be reached, the difference shall be documented such that the matter can be later decided without disruption to the Contractor's programme.

2.2.2 Construction Tolerances

The maximum permissible horizontal deviation from the finished lines or zone boundaries shall be -0 m to +0.2 m.

Vertical deviation shall be -0 m to +0.2 m for areas of fill and -0.2 m to +0.0 m for excavation areas, provided no abrupt changes in slope or level are present on any finished surface.

Construction slopes are not steeper (for earthworks) or shallower (for drainage) than the designated slopes shown on the Drawings, as applicable.

2.2.1 Measurement

Measurement for payment of all embankment fill material shall be made for the compacted material, measured in place and only to the lines and grades required.

Measurement for payment of excavations shall be made only to the lines and depths required.

Measurement in either metre (m), square metres (m^2) or cubic metres (m^3) is defined in the schedule of quantities. The Principal may inspect or check any setting out or measurements at any time, and the Contractor shall allow for delays while any works are checked.

At the completion of the works, the Principal shall provide all survey details in an electronic format (usually in DXF/DWG format). The Contractor shall provide all as-built and layout details and information necessary to the Principal, as well as a concise quantity summary of all construction items.

2.3 CLEARING AND ESTABLISHMENT WORKS

The Contractor shall, as appropriate:

- If required, remove all vegetable matter and scrub from the area of the proposed tailings pipeline corridor and scour sumps. The area to be cleared shall extend approximately 1.0 m past the footprint of the pipeline corridor where necessary. All stripped vegetation should be pushed into heaps in locations as indicated by the Principal's Representative. Site clearing area is to be confirmed on Site.
- If required, remove all solid obstructions, tree stumps, roots, and logs from beneath the footprint of the pipeline corridor and proposed scour sump locations.
- If required, strip all topsoil (minimum 0.1 m thick) from the area of the proposed tailings pipeline corridor and scour sumps. The area to be stripped topsoil shall extend approximately 1.0 m past the footprint of the pipeline corridor where necessary. All stripped topsoil should be pushed into heaps in locations as indicated by the Principal's Representative. Stockpiles shall have a maximum height of 2.0 m and side slopes of 1 (vertical) to 1.5 (horizontal). It should be noted that if the stripped topsoil materials are salt scalded, then they should be stockpiled separately as they are not suitable for rehabilitation. It is noted that topsoil stripping thickness will be confirmed on Site
- If required, clear the agreed routes of access roads of all vegetation standing and fallen. Push vegetation into heaps as approved by the Principal's Representative.
- If required, form up, lay base course as is necessary and do all things necessary to form and maintain haul roads linking the borrow area to the construction area and other haul roads necessary for the works and which are approved by the Principal's Representative.
- Keep all roads sprayed and wetted to prevent the generation of airborne dust during the course of construction and road usage.

2.4 EARTHWORKS

2.4.1 General

The Contractor shall, as appropriate:

- Construct the pipeline corridors and scour sumps by using cut to fill method. The access track shall be formed by cut and fill works where required. As an alternative, bunding may be formed by using mine waste from the adjacent waste dump or pit areas.
- The containment bunds shall be watered, and traffic compacted.
- If there is a shortfall in cut materials the Principal's Representative will advise suitable waste dump or borrow area locations.
- Ensure borrow materials are stockpiled, transported and placed in such a manner as to minimise segregation.
- Allow for maintaining the borrow areas free of large accumulations of water.

2.4.2 Pipeline Corridors

The Contractor shall, as appropriate:

- Construct the pipeline corridors associated with the proposed IPTSFs 815, 7 Series and 8 Series to the details shown on the Drawings. The alignment of the corridors may vary on site, as directed by the Principal's Representative, to limit clearing of trees. All surplus excavated material shall be stockpiled adjacent to the pipeline corridor for future rehabilitation purposes.
- Excavate and form the new pipeline corridors from the plant to the proposed IPTSFs, including the scour sumps, and place spoil material to form the parallel containment bunds.
- Grade the surface of the pipeline corridor smooth and free of projections that could damage the pipework.

2.5 COMPLETION

The Contractor shall:

- Clean up all rubbish, remove all plant and supply materials, trim all banks neatly, spread all excavated material not specified to be removed from the site and leave the site in a clean and tidy condition.

2.6 CONSTRUCTION SEQUENCE

The Contractor shall liaise with the Principal's Representative to agree a sequence for the works. The Contractor shall endeavour to complete the works in the sequence agreed.

2.7 LIMITS OF THE CONTRACT

The limits of the Contract are as shown on the Drawings.

3. EXCLUSIONS

The following works shall be performed by the Principal simultaneously to the Works in this Contract:

- Supply and installation of tailings delivery pipework.
- Decant pipework and pump installation, and any associated electrical works.
- Installation of control and telemetry systems.
- Installation of all instrumentation comprising MBs around the proposed IPTSFs.

The Contractor shall fully cooperate with the Principal and work in with their activities at all times.

4. PRINCIPAL-SUPPLIED ITEMS

4.1 SURVEY

The Principal will provide coordinates and levels of survey marks within the vicinity of the Works. The Contractor shall set out all lines and levels using the survey marks provided.

4.2 MATERIALS

If required, the Principal will supply appropriate open pit or waste dump locations for bund fill material.

The Principal will supply crushed aggregate for the access track sheeting.

4.3 WATER

Water will be made available to the Contractor at no charge. Supply will be from a standpipe located near the plant site. Access to the standpipe will not be exclusive to the Contractor. The Contractor shall determine the type and suitability of the water supplies for use in this Contract.

The Contractor shall make their own arrangements for loading and hauling water.

Note: Potable water supplies are limited, and the Principal may, from time to time, direct the Contractor to use alternative sources.

5. INSPECTION

The Principal's Representative will at all times be entitled to inspect, examine, and test the materials and workmanship be provided under the Contract. Such inspection, examination, or testing, if made, shall not release the Contractor from any obligation under the Contract.

The Contractor shall cooperate with and provide full opportunity to the Principal's Representative to monitor the progress of the Works of the Contractor and their subcontractors, regularly, to the detailed extent necessary to satisfy progress relative to the Construction Program.

All pertinent information to enable the Principal's Representative to determine the adequacy of advanced planning for material procurement, machine, and manpower resources to meet the Construction Program shall be made freely available to the Principal's Representative.

These requirements shall be incorporated in orders placed with Subcontractors.

6. PERMITS, LICENCES AND APPROVALS

Further to the General Conditions of Contract, the Principal will obtain approval from the Department of Mines, Industry Regulation and Safety (DMIRS) and Department of Water and Environmental Regulation (DWER) to conduct the Works.

All other necessary permits, licenses and approvals shall be obtained by the Contractor in liaison with the Principal's Representative.

7. SUBSTITUTIONS

The Contractor shall:

- Not substitute any alternative to the equipment and materials included in the Works without the prior written consent of the Principal.
- Make diligent efforts to utilise the specified materials to be incorporated into the Works but where the Contractor considers there are commercial or other advantages to be derived by the Principal, the Contractor may submit a proposal for a substitute material for approval by the Principal prior to commencement of the work. Such proposal for substitution shall be in writing and state reasons for and (if applicable) advantages of the substitute material. The Principal shall determine whether the substitute material will be permitted, and such determination shall be binding and conclusive upon the Contractor. Approval of a substitution will be given as a variation under of the General Conditions of Contract incorporating any adjustment to the Contract Sum.

8. TEMPORARY SERVICES AND FACILITIES

8.1 FURNISHED BY PRINCIPAL

This section provides a list of Principal-furnished services other than those items listed in Section 4.0.

Any services or materials not specifically identified as being provided by the Principal shall be provided by the Contractor.

8.1.1 Materials

Where the Principal agrees to supply Materials to the Contractor in the performance of the Contract then the following conditions will apply:

- The items shall be included in the Contractor's materials procurement schedules. The Contractor shall, upon arrival at Site to commence work, check and ensure that Principal-Supplied Materials are available and will not cause any delay to the Contractor's work progress.
- Items stored by the Principal shall be removed from the Principal's store or storage area by the Contractor when required by him or when directed by the Superintendent (whichever is sooner). However, no items shall be removed from the Principal's store or storage area by the Contractor without first obtaining authority from the Principal's Representative and the Contractor shall sign receipts or other documentation required acknowledging receipt of the Free Issue Materials.
- From the time the Principal-Supplied Materials are removed from the Principal's store or storage area or are delivered to the site the Contractor shall be responsible for and shall keep safely and in good order all those Principal Supplied Materials including any returnable packing or containers.
- The Contractor shall account for all Principal-Supplied Materials used and shall return to the Principal in good order and condition any Principal-Supplied Materials remaining unused on completion of the work. Subject to any insurance cover the Contractor shall be responsible for the cost of replacement or repair of any Principal-Supplied Materials lost or damaged while they are responsible.
- The Contractor shall immediately notify the Principal's Representative of any damage to or loss of any of those Principal-Supplied Materials at any time and shall as soon as possible specify the extent and circumstances of the damage or loss as soon as possible.
- Principal-Supplied Materials used by the Contractor are used at the sole risk of the Contractor. Any failure to perform the Contract by the Contractor shall not be excused by any matter or thing arising from or incidental to the use of Principal-Supplied Materials.

9. DATA REQUIREMENTS

The Contractor shall submit the following data in addition to the data requirements detailed elsewhere in this Specification to the Principal as part of the Work.

The Contractor shall show the reference Contract Number and identifying item numbers, if applicable, on all data submitted.

9.1 AS-BUILT DRAWINGS

Further to the General Conditions of Contract, the Contractor shall supply as-built drawings within 14 days of the issue of a Certificate of Practical Completion and a detailed list of quantities.

10. CONSTRUCTION PROGRAMME

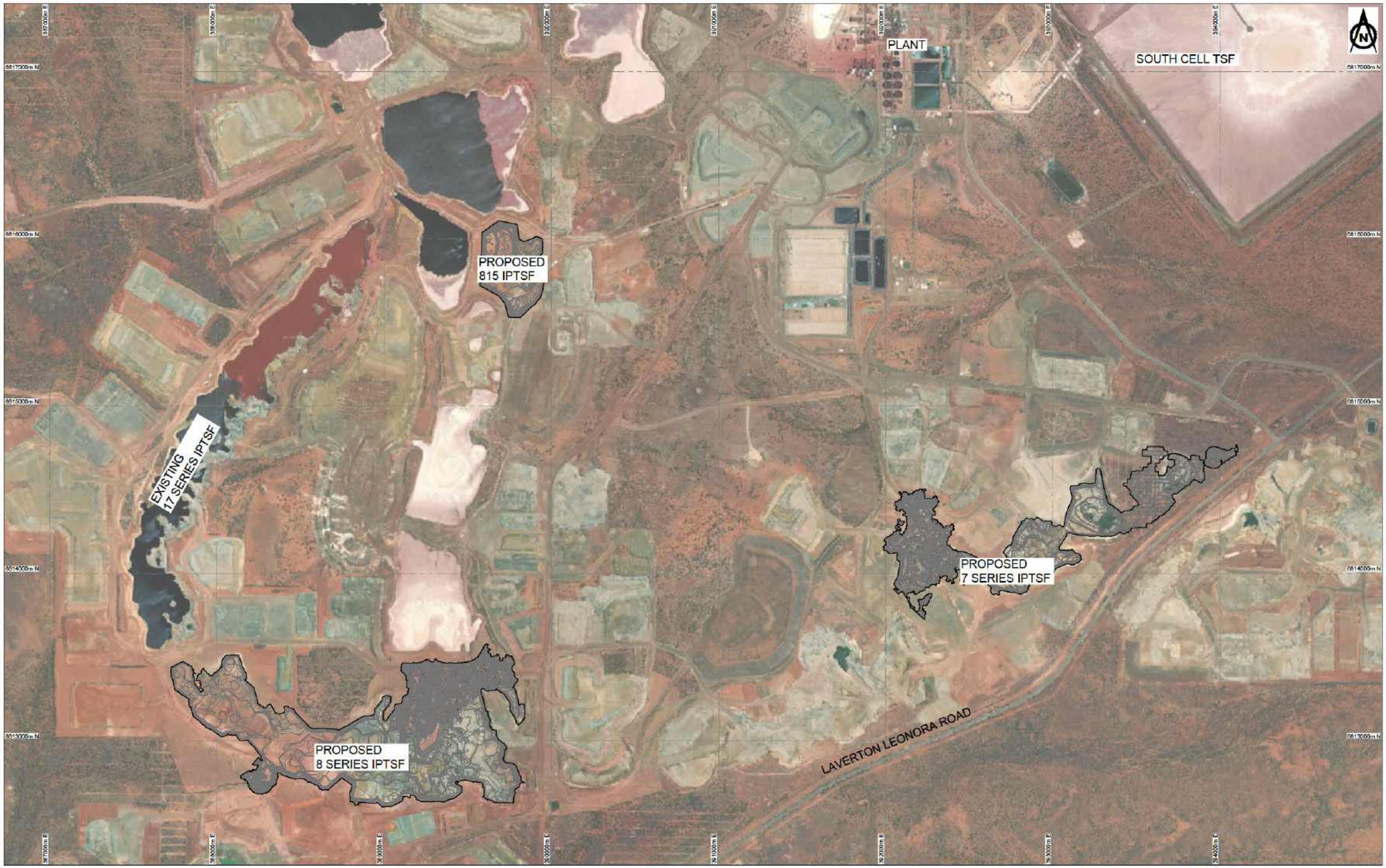
The Contractor shall provide a construction programme and indicate the following milestone dates.

- Contract Award
- Notice to Proceed with the Fieldwork
- Principle Completion Date
- Final Completion Date

11. ESTIMATE OF QUANTITIES

An estimate of quantities has been provided to allow material requirements to be gauged for the construction (Appendix B). The figures have not been calculated by a Quantity Surveyor and are provided for convenience only.

APPENDIX A: DRAWINGS



NOTES:

SURVEY PIT 815 : MMN_0815_Pit_Surf_V1-b to topo.dxf

SURVEY PIT 7 SERIES: 7s_contours_(NO_710).dxf

SURVEY PIT 8 SERIES: 8s_Tailings_Void_Contours.dxf

200 0 200 400 600 800 1000

SCALE 1:10,000

COORDINATE SYSTEM
Map Grid of Australia Zone 51, using GDA94 datum

ISSUED WITH DESIGN REPORT
PLOTTED: Friday, 5 April 2024 12:45:03 AM

REV.	REVISION DESCRIPTION	DATE	DRAWN	APPROVED	ORIGINAL SIZE:	A1
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-	-	-	-	-	DESIGNED:	
-	-	-	-	-	APPROVED:	
0	ISSUED WITH DESIGN REPORT	05/04/2024			DATE:	05/04/2024
A	ISSUED FOR CLIENT REVIEW	16/02/2024			SCALE:	1:10,000

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CLIENT:	MURIN MURIN OPERATIONS PTY LTD
PROJECT:	GEOTECHNICAL ASSESSMENT OF 815, 7 SERIES AND 8 SERIES IN-PIT TSF DESIGN
TITLE:	SITE LAYOUT PLAN
PROJECT NO:	754-PERGE316544
DWG NO:	754-PERGE316544-CD-01
REV:	0

DWG: F:\PROJECTS_GOT\2016 GWA\CAD\Murin Murin Operations Pty Ltd\754-PERGE316544 - MMC-815_7_8 Series In-Pit TSF Design\P_Drawings\00 - Drawings\754-PERGE316544-CD-01.dwg

PLANT

SOUTH CELL TSF

SOUTHERN TAILINGS PIPELINE

PROPOSED 815 IPTSF

DECANT PIPELINE

DECANT PIPELINE

EXISTING 17 SERIES IPTSF

PROPOSED DECANT PIPELINE

TAILINGS PIPELINE

PROPOSED SCOUR SUMP

PROPOSED 7 SERIES IPTSF

PROPOSED 8 SERIES IPTSF

PROPOSED TAILINGS PIPELINE

LAVERTON LEONORA ROAD

LEGEND:

- EXISTING TAILINGS PIPELINE
- EXISTING DECANT RETURN WATER PIPELINE
- EXISTING SCOUR SUMP
- PROPOSED DECANT WATER PIPELINE
- PROPOSED TAILINGS PIPELINE
- PROPOSED SCOUR SUMP

NOTES:

1. ALL EXISTING AND PROPOSED PIPELINES AND SCOUR SUMPS ARE INDICATIVE ONLY. THE PIPELINE ROUTES AND SCOUR SUMP LOCATIONS MAY BE VARIED ON SITE TO SUIT SITE CONDITIONS.
2. ALL PROPOSED PUMPING AND PIPING (TAILINGS AND DECANT WATER RETURN) TO BE DESIGNED BY OTHERS.

200 0 200 400 600 800 1000

SCALE 1:10,000

CONTOUR INTERVALS U.N.O.
EXISTING TOPOGRAPHY: 1m & 5m
DESIGN TOPOGRAPHY: 1m & 5m

COORDINATE SYSTEM
Map Grid of Australia Zone 51, using GDA94 datum

ISSUED WITH DESIGN REPORT
PLOTTED: Friday, 5 April 2024 12:40:00 AM

REV.	REVISION DESCRIPTION	DATE	DRAWN	APPROVED	ORIGINAL SIZE:	A1
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-	-	-	-	-	DESIGNED:	
-	-	-	-	-	APPROVED:	
0	ISSUED WITH DESIGN REPORT	05/04/2024			DATE:	05/04/2024
A	ISSUED FOR CLIENT REVIEW	16/02/2024			SCALE:	1:10,000

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CLIENT: MURIN MURIN OPERATIONS PTY LTD

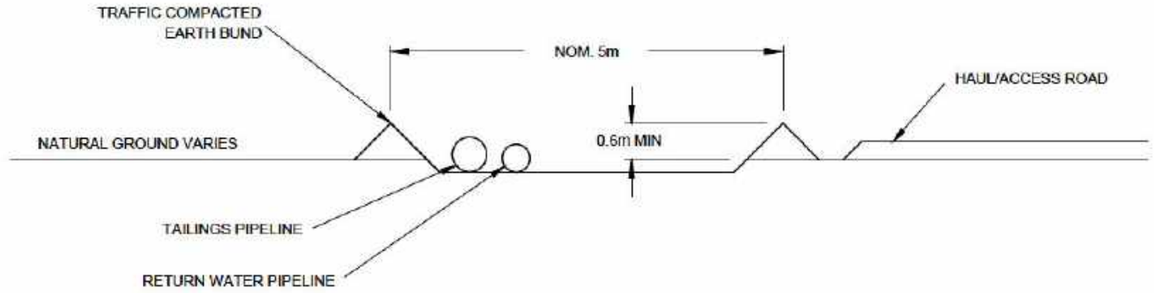
PROJECT: GEOTECHNICAL ASSESSMENT OF 615, 7 SERIES AND 8 SERIES IN-PIT TSF DESIGN

TITLE: TAILINGS AND DECANT WATER PIPELINES ROUTES

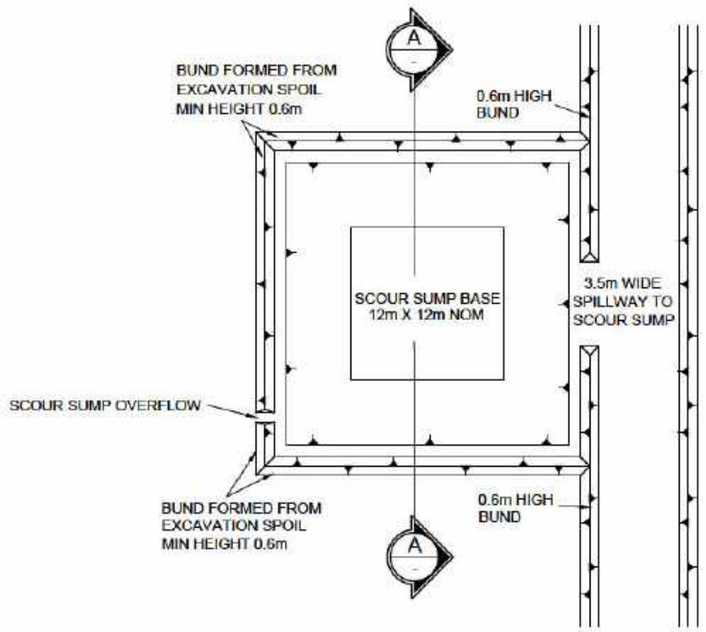
PROJECT NO: 754-PERGE316544

DWG NO: 754-PERGE316544-DD-02

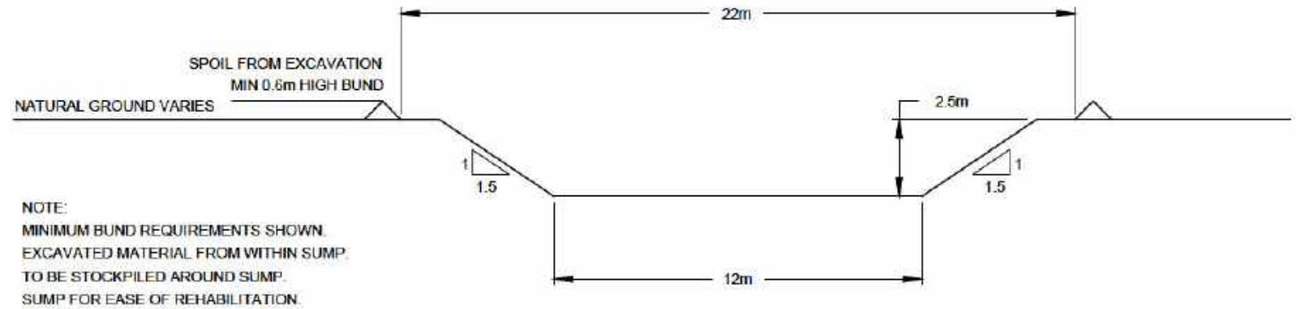
REV: 0



TYPICAL DETAIL 1 - PIPELINE BUNDING
SCALE: NTS

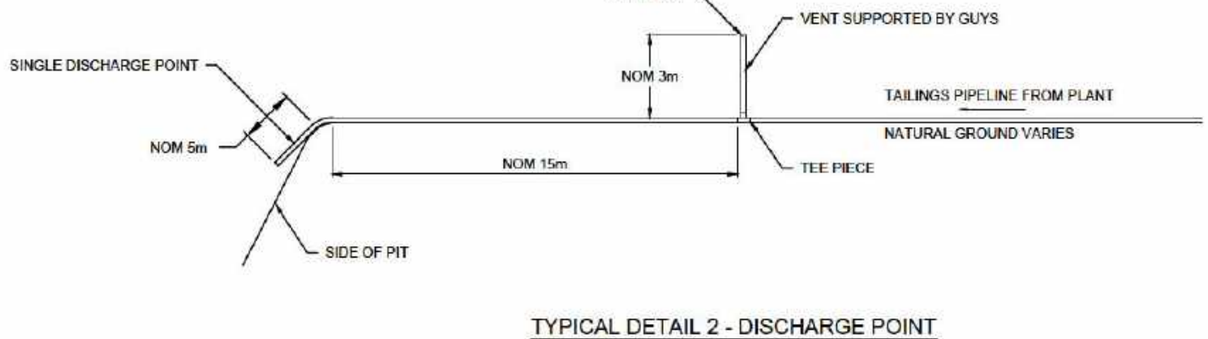


SCOUR SUMP PLAN
SCALE: NTS



NOTE:
MINIMUM BUND REQUIREMENTS SHOWN.
EXCAVATED MATERIAL FROM WITHIN SUMP
TO BE STOCKPILED AROUND SUMP.
SUMP FOR EASE OF REHABILITATION.
INDIVIDUAL SUMP SIZE MIN 530m²

A SECTION
SCALE: NTS



TYPICAL DETAIL 2 - DISCHARGE POINT
SCALE: NTS

NOTES:
1. ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE NOTED.
2. ALL PUMPING AND PIPING (TAILINGS AND WATER RETURN) TO BE DESIGNED BY OTHERS.

COORDINATE SYSTEM
Map Grid of Australia Zone 51, using GDA94 datum

ISSUED WITH DESIGN REPORT
PLOTTED: Friday, 5 April 2024 10:52:14 AM

REV.	REVISION DESCRIPTION	DATE	DRAWN	APPROVED
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-	-	-	-	-
-	-	-	-	-
0	ISSUED WITH DESIGN REPORT	05/04/2024		
A	ISSUED FOR CLIENT REVIEW	16/02/2024		

DRAWN:
DESIGNED:
APPROVED:
DATE: 05/04/2024
SCALE: NTS
ORIGINAL SIZE: A1

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CLIENT: MURIN MURIN OPERATIONS PTY LTD
PROJECT: GEOTECHNICAL ASSESSMENT OF 615.7 SERIES AND 6 SERIES IN-PIT TSF DESIGN
TITLE: TYPICAL SECTIONS AND DETAILS (1 OF 2)
PROJECT NO: 754-PERGE316544
DWG NO: 754-PERGE316544-DD-04
REV: 0

APPENDIX B: ESTIMATE OF QUANTITIES

PROJECT	**Murrin Murrin Mine Site**	Date	23/02/2024
		Job No	754-PERGE318544
CLIENT	**Murrin Murrin Operations Pty Ltd**	Revision	A
		Page	1 of 1
LOCATION	**near Leonora, WA**		
SUBJECT	**MMO 815 IN-PIT TSF EARTHWORKS QUANTITIES**		

Item	Description	Unit	Quantity	Rate	Amount
	ALLOWANCE FOR TAILINGS AND RETURN WATER PIPELINE CONSTRUCTION				
1.0	**Preliminaries & Site Preparation**				
1.1	Site establishment, including all preliminaries, insurances etc, mobilisation, demobilisation, borrow management, maintenance of existing tracks	Item			$ -
1.2	Site clearing including grubbing and stockpiling of vegetation from the pipeline corridor, scour sump and access road (495m x 6m approx for cooridor and 400m^2 x 2 sumps)	ha	0.4		$ -
2.0	**Earthworks**				
2.1	Strip topsoil (0.1m depth) from the pipeline corridors and scour sump areas and stockpile seperately from vegetation	m^3	420		$ -
2.2	Excavate scour sumps (12m x 12m x 2.5 deep)	m^3	1,450		$ -
2.3	Borrow, transport and traffic compact 600mm high earth bund to both sides of pipeline corridor (2no. Bunds)	m^3	390		$ -
2.4	Grade and make smooth 5m wide access track to the pipeline corridors	m	495		$ -
2.5	Sheet Access Roads width 10mm aggregate sheeting material	m	495		$ -
3.0	**Tailings Pipework**				
3.1	Supply and install requisite tailings pipework	m	410		$ -
4.0	**Decant Pipework**				
4.1	Supply and install pontoon mounted pump to enable water recovery	No.	1		$ -
4.2	Supply and install requisite decant return pipework	m	140		$ -
	SUBTOTAL				**$ -**
5.0	**Ancilliary Items**				
5.1	Airfares for Contractors / Superintendant personnel	No.			$ -
5.2	Accomodation and meals for Contractors	Person days			$ -
5.3	Fuel supplied by Principal	L			$ -
5.4	Construction monitoring costs (Superintendant and vehicle incl misc)	Item			$ -
5.5	QA/QC Geotechnical Testing	Days			$ -
	SUBTOTAL				**$ -**
	Contingency 10%				**$ -**
	TOTAL BUDGET CONSTRUCTION COST				**$ -**

Notes:
1. The above quantities have not been calculated by a Quantity Surveyor. Quantities can be slightly varied and confirmed on site.

PROJECT	**Murrin Murrin Mine Site**	Date	23/02/2024
		Job No	754-PERGE318544
CLIENT	**Murrin Murrin Operations Pty Ltd**	Revision	A
		Page	1 of 1
LOCATION	**near Leonora, WA**		
SUBJECT	**MMO 7 SERIES IN-PIT TSF EARTHWORKS QUANTITIES**		

Item	Description	Unit	Quantity	Rate	Amount
	ALLOWANCE FOR TAILINGS AND RETURN WATER PIPELINE CONSTRUCTION				
1.0	**Preliminaries & Site Preparation**				
1.1	Site establishment, including all preliminaries, insurances etc, mobilisation, demobilisation, borrow management, maintenance of existing tracks	Item			$ -
1.2	Site clearing including grubbing and stockpiling of vegetation from the pipeline corridor, scour sump and access road (7045m x 6m approx for cooridor and 400m^2 x 11 sumps)	ha	5.1		$ -
2.0	**Earthworks**				
2.1	Strip topsoil (0.1m depth) from the pipeline corridors and scour sump areas and stockpile seperately from vegetation	m^3	5,140		$ -
2.2	Excavate scour sumps (12m x 12m x 2.5 deep)	m^3	7,930		$ -
2.3	Borrow, transport and traffic compact 600mm high earth bund to both sides of pipeline corridor (2no. Bunds)	m^3	5,580		$ -
2.4	Grade and make smooth 5m wide access track to the pipeline corridors	m	7,045		$ -
2.5	Sheet Access Roads width 10mm aggregate sheeting material	m	7,045		$ -
3.0	**Tailings Pipework**				
3.1	Supply and install requisite tailings pipework	m	3,620		$ -
4.0	**Decant Pipework**				
4.1	Supply and install pontoon mounted pump to enable water recovery	No.	1		$ -
4.2	Supply and install requisite decant return pipework	m	4,130		$ -
	SUBTOTAL				**$ -**
5.0	**Ancilliary Items**				
5.1	Airfares for Contractors / Superintendant personnel	No.			$ -
5.2	Accomodation and meals for Contractors	Person days			$ -
5.3	Fuel supplied by Principal	L			$ -
5.4	Construction monitoring costs (Superintendant and vehicle incl misc)	Item			$ -
5.5	QA/QC Geotechnical Testing	Days			$ -
	SUBTOTAL				**$ -**
	Contingency 10%				**$ -**
	TOTAL BUDGET CONSTRUCTION COST				**$ -**

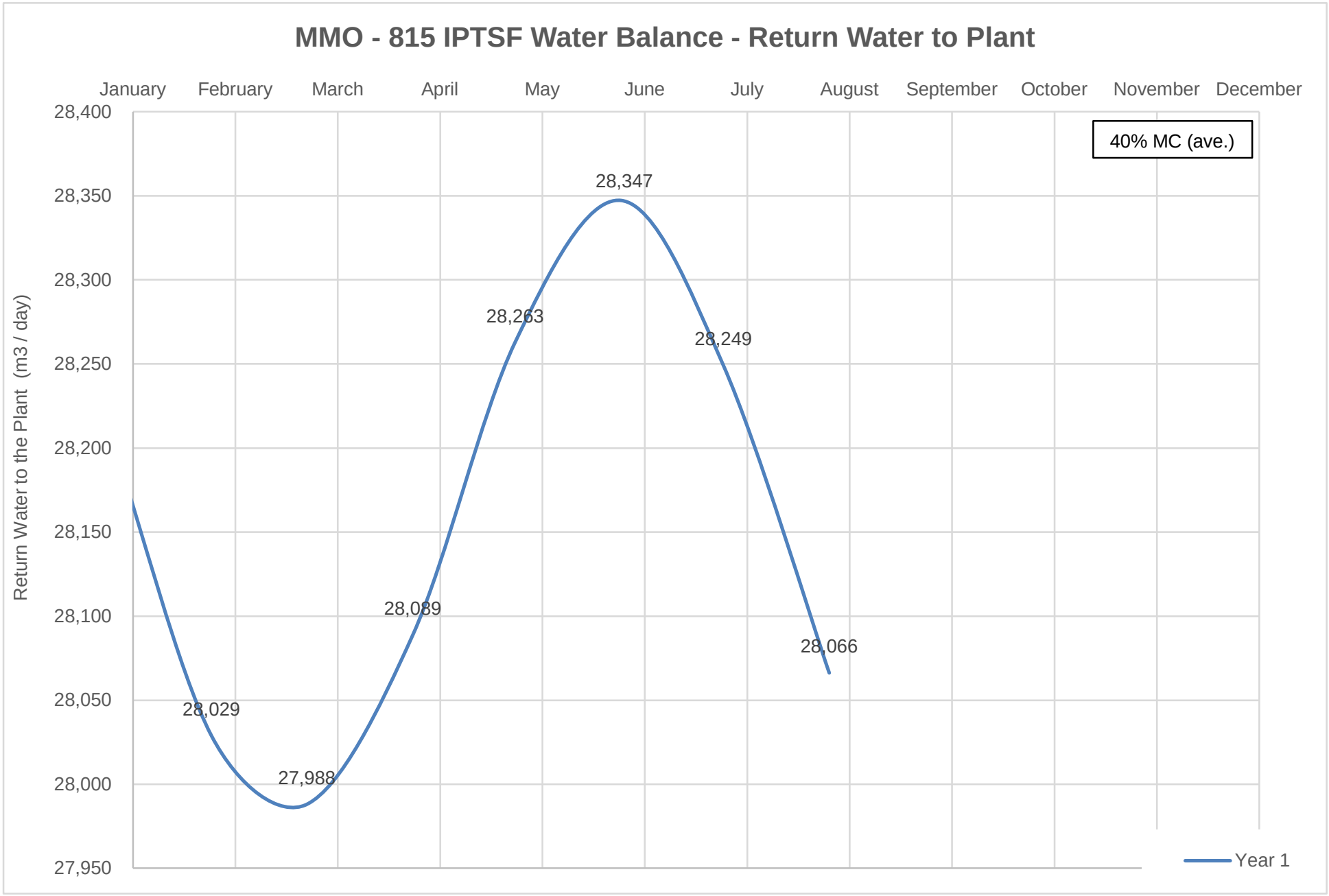
Notes:
1. The above quantities have not been calculated by a Quantity Surveyor. Quantities can be slightly varied and confirmed on site.

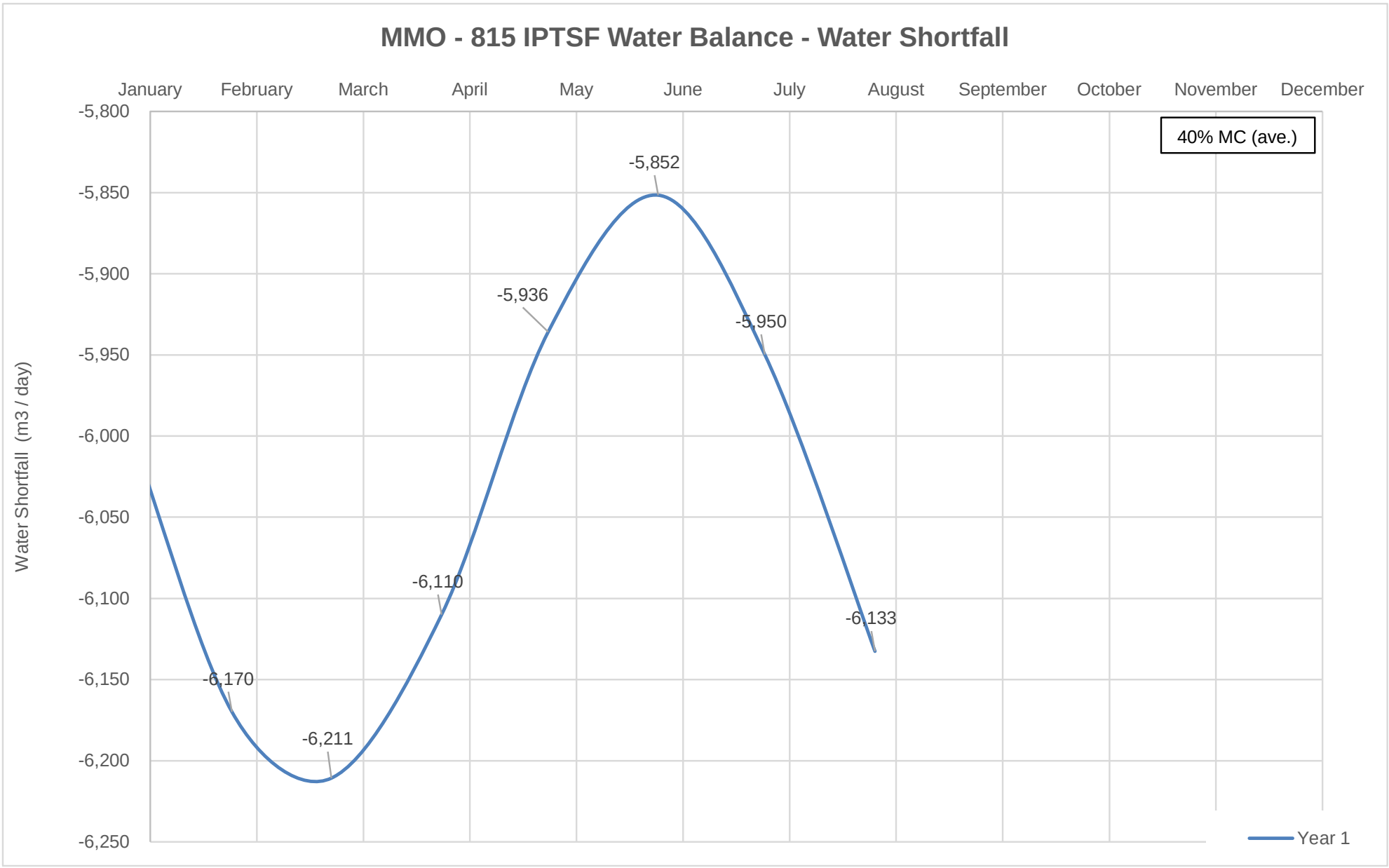
PROJECT	**Murrin Murrin Mine Site**	Date	23/02/2024
		Job No	754-PERGE318544
CLIENT	**Murrin Murrin Operations Pty Ltd**	Revision	A
		Page	1 of 1
LOCATION	**near Leonora, WA**		
SUBJECT	**MMO 8 SERIES IN-PIT TSF EARTHWORKS QUANTITIES**		

Item	Description	Unit	Quantity	Rate	Amount
	ALLOWANCE FOR TAILINGS AND RETURN WATER PIPELINE CONSTRUCTION				
1.0	**Preliminaries & Site Preparation**				
1.1	Site establishment, including all preliminaries, insurances etc, mobilisation, demobilisation, borrow management, maintenance of existing tracks	Item			$ -
1.2	Site clearing including grubbing and stockpiling of vegetation from the pipeline corridor, scour sump and access road (2960m x 6m approx for cooridor and 400m^2 x 6 sumps)	ha	2.2		$ -
2.0	**Earthworks**				
2.1	Strip topsoil (0.1m depth) from the pipeline corridors and scour sump areas and stockpile seperately from vegetation	m^3	2,220		$ -
2.2	Excavate scour sumps (12m x 12m x 2.5 deep)	m^3	4,330		$ -
2.3	Borrow, transport and traffic compact 600mm high earth bund to both sides of pipeline corridor (2no. Bunds)	m^3	2,350		$ -
2.4	Grade and make smooth 5m wide access track to the pipeline corridors	m	2,960		$ -
2.5	Sheet Access Roads width 10mm aggregate sheeting material	m	2,960		$ -
3.0	**Tailings Pipework**				
3.1	Supply and install requisite tailings pipework	m	1,840		$ -
4.0	**Decant Pipework**				
4.1	Supply and install pontoon mounted pump to enable water recovery	No.	1		$ -
4.2	Supply and install requisite decant return pipework	m	1,420		$ -
	SUBTOTAL				**$ -**
5.0	**Ancilliary Items**				
5.1	Airfares for Contractors / Superintendant personnel	No.			$ -
5.2	Accomodation and meals for Contractors	Person days			$ -
5.3	Fuel supplied by Principal	L			$ -
5.4	Construction monitoring costs (Superintendant and vehicle incl misc)	Item			$ -
5.5	QA/QC Geotechnical Testing	Days			$ -
	SUBTOTAL				**$ -**
	Contingency 10%				**$ -**
	TOTAL BUDGET CONSTRUCTION COST				**$ -**

Notes:
1. The above quantities have not been calculated by a Quantity Surveyor. Quantities can be slightly varied and confirmed on site.

APPENDIX G: IPTSF WATER BALANCE ANALYSIS


MMO - 815 IPTSF Water Balance - Return Water to Plant
January
February
March
April
May
June
July
August
September
October
November
December
28,400
28,350
28,300
28,250
28,200
28,150
28,100
28,050
28,000
27,950
Return Water to the Plant (m3 / day)
40% MC (ave.)
28,029
27,988
28,089
28,263
28,347
28,249
28,066
Year 1


MMO - 815 IPTSF Water Balance - Water Shortfall
January
February
March
April
May
June
July
August
September
October
November
December
-5,800
-5,850
-5,900
-5,950
-6,000
-6,050
-6,100
-6,150
-6,200
-6,250
Water Shortfall (m3 / day)
40% MC (ave.)
-6,170
-6,211
-6,110
-5,936
-5,852
-5,950
-6,133
Year 1

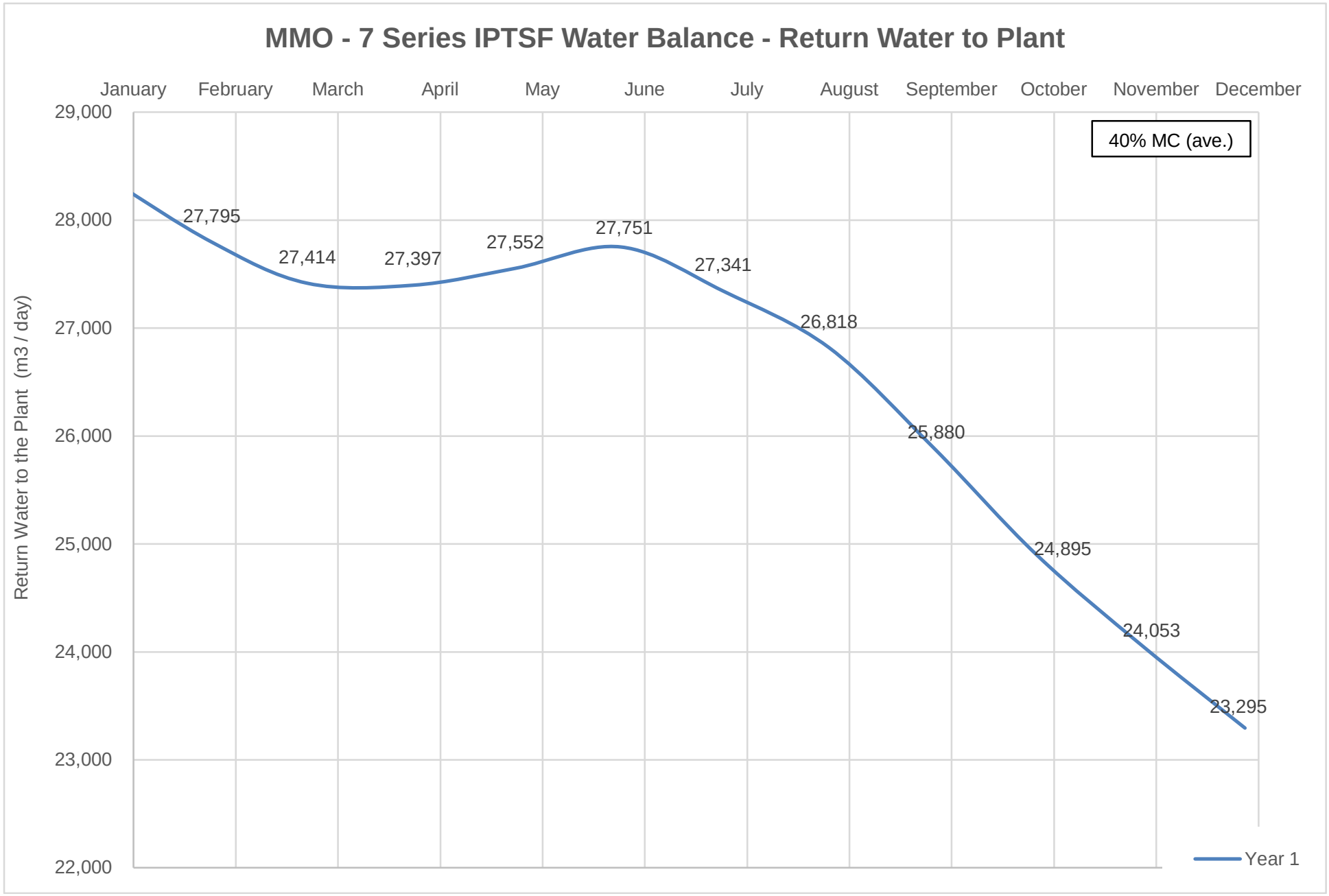
PROJECT	: MURRIN MURRIN OPERATIONS IN-PIT TAILINGS STUDY
CLIENT	: MURRIN MURRIN OPERATIONS PTY LTD
LOCATION	: LEONORA, WA
SUBJECT	: WATER BALANCE - MMO 815 IN-PIT TSF - YEAR 1 — 4.62 Mtpa (dry), 27% Solids

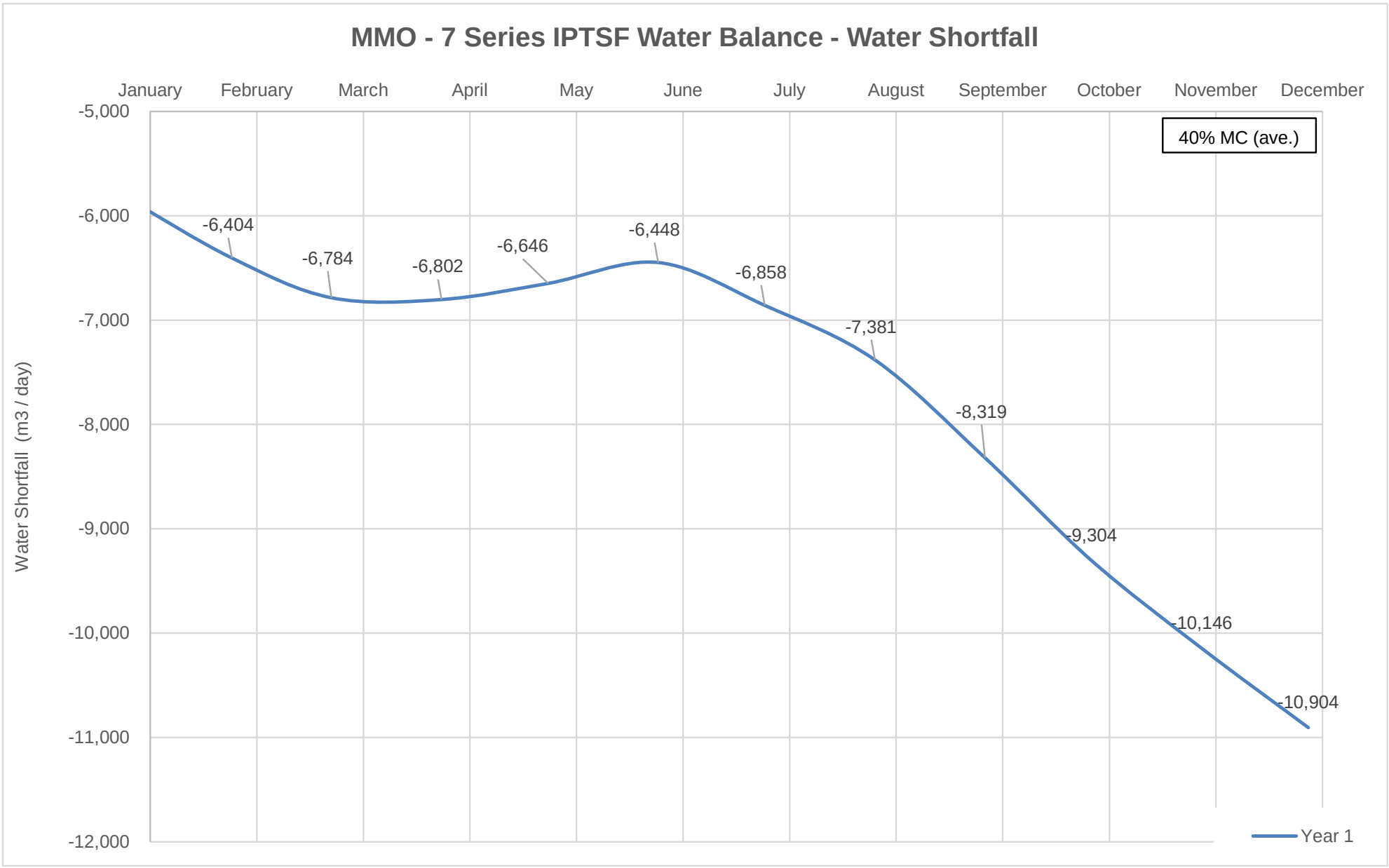
TETRA TECH COFFEY

Date	12-Feb-24
Job No	754-PERGE318544
Rev	A

Month	**JAN**	**FEB**	**MAR**	**APR**	**MAY**	**JUN**	**JUL**	**AUG**	**SEP**	**OCT**	**NOV**	**DEC**	**ANNUAL**
Days per Month	31	28.25	31	30	31	30	31	31	30	31	30	31	365.25
INFLOWS													
RAINFALL													
Rainfall (mm/month)	26.3	30.9	29.0	20.3	23.7	24.8	18.5	15.7					236.40
Average Daily Rainfall (mm)	0.85	1.09	0.94	0.68	0.76	0.83	0.60	0.51					
Pit Surface Area (m2)	381,000	381,000	381,000	381,000	381,000	381,000	381,000	381,000					
Runoff Coefficient	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50					
Pool Area (m²)	20,210	27,606	31,156	33,784	35,822	38,242	39,351	40,995					
Running Beaches (m²)	45,472	62,114	70,102	76,013	80,600	86,044	88,539	92,240					
Rainfall Inflow Total Volume (m³/day)	189	257	226	166	190	209	152	130					46,025
SLURRY WATER													
Tailings Production Rate (t/year)	4,620,000	4,620,000	4,620,000	4,620,000	4,620,000	4,620,000	4,620,000	4,620,000					
Tailings Production Rate (t/day)	12,649	12,649	12,649	12,649	12,649	12,649	12,649	12,649					
% Solids	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27					
Volume of Water (m³/day)	34,199	34,199	34,199	34,199	34,199	34,199	34,199	34,199					8,318,858
TOTAL INFLOW (m³/day)	**34,388**	**34,456**	**34,424**	**34,365**	**34,389**	**34,408**	**34,351**	**34,329**					**8,364,882**
OUTFLOWS													
EVAPORATION (from pond and beaches)													
Pan Evaporation (mm/day)	16.87	14.37	11.90	8.13	5.26	3.60	3.74	5.06					2,086
Evaporation Pan Coefficient	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66					
Average Daily Evaporation Rate (mm/day)	11.13	9.49	7.86	5.37	3.47	2.38	2.47	3.34					
Pool Area & Running Beaches (m²)	65,681	89,721	101,258	109,797	116,422	124,285	127,890	133,235					
Daily Evaporation Loss/Outflow (m³/day)	731	851	795	589	404	295	316	445					134,036
EVAPO-TRANSPIRATION (from drying tailings)													
Average Daily Evapo-transpiration Rate (mm) (Pan/3)	5.62	4.79	3.97	2.71	1.75	1.20	1.25	1.69					695
Drying Tailings Beach Area (m²)	1,516	2,070	2,337	2,534	2,687	2,868	2,951	3,075					
Daily Evaporation Loss (m³/day)	9	10	9	7	5	3	4	5					1,562
SEEPAGE (estimated average value)													
Leakage From Pit Floor (m³/day)	371	507	572	620	658	702	722	753					
Total Seepage Outflow (m³/day)	371	507	572	620	658	702	722	753					149,344
RETENTION													
Assumed Moisture Content of Tailings (average)	40%	40%	40%	40%	40%	40%	40%	40%					
Volume Retained in Tailings (m³/day)	5,060	5,060	5,060	5,060	5,060	5,060	5,060	5,060					1,230,735
TOTAL OUTFLOW/LOSSES (m³/day)	**6,170**	**6,427**	**6,436**	**6,276**	**6,126**	**6,060**	**6,102**	**6,263**					**1,515,677**
BALANCE													
INFLOWS - OUTFLOWS (m³/day)	**28,218**	**28,029**	**27,988**	**28,089**	**28,263**	**28,347**	**28,249**	**28,066**					**6,849,205**
RETURN WATER TO THE PLANT (if available)													
Total Water Return (m³/day)	28,218	28,029	27,988	28,089	28,263	28,347	28,249	28,066					**6,849,205**
Average Water Return	83%	82%	82%	82%	83%	83%	83%	82%					
Annual Water Return Available (m3/year)	**6,849,205**												
Annual Average Water Return (as % of tailings slurry water)	**82%**												

Summary of Water Balance	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG
Water shortfall or excess of requirements (m3/day)	**-5,981**	**-6,170**	**-6,211**	**-6,110**	**-5,936**	**-5,852**	**-5,950**	**-6,133**
Water shortfall or excess of requirements (m3/hr)	**-249**	**-257**	**-259**	**-255**	**-247**	**-244**	**-248**	**-256**
Total water in excess of requirements (m3/month)	**-185,411**	**-174,300**	**-192,534**	**-183,301**	**-184,011**	**-175,547**	**-184,441**	**-190,109**	**-1,469,653**
Total water in excess of requirements (m3/year) =	-1,469,653								


MMO - 7 Series IPTSF Water Balance - Return Water to Plant
January
February
March
April
May
June
July
August
September
October
November
December
29,000
28,000
27,000
26,000
25,000
24,000
23,000
22,000
Return Water to the Plant (m3 / day)
40% MC (ave.)
27,795
27,414
27,397
27,552
27,751
27,341
26,818
25,880
24,895
24,053
23,295
Year 1

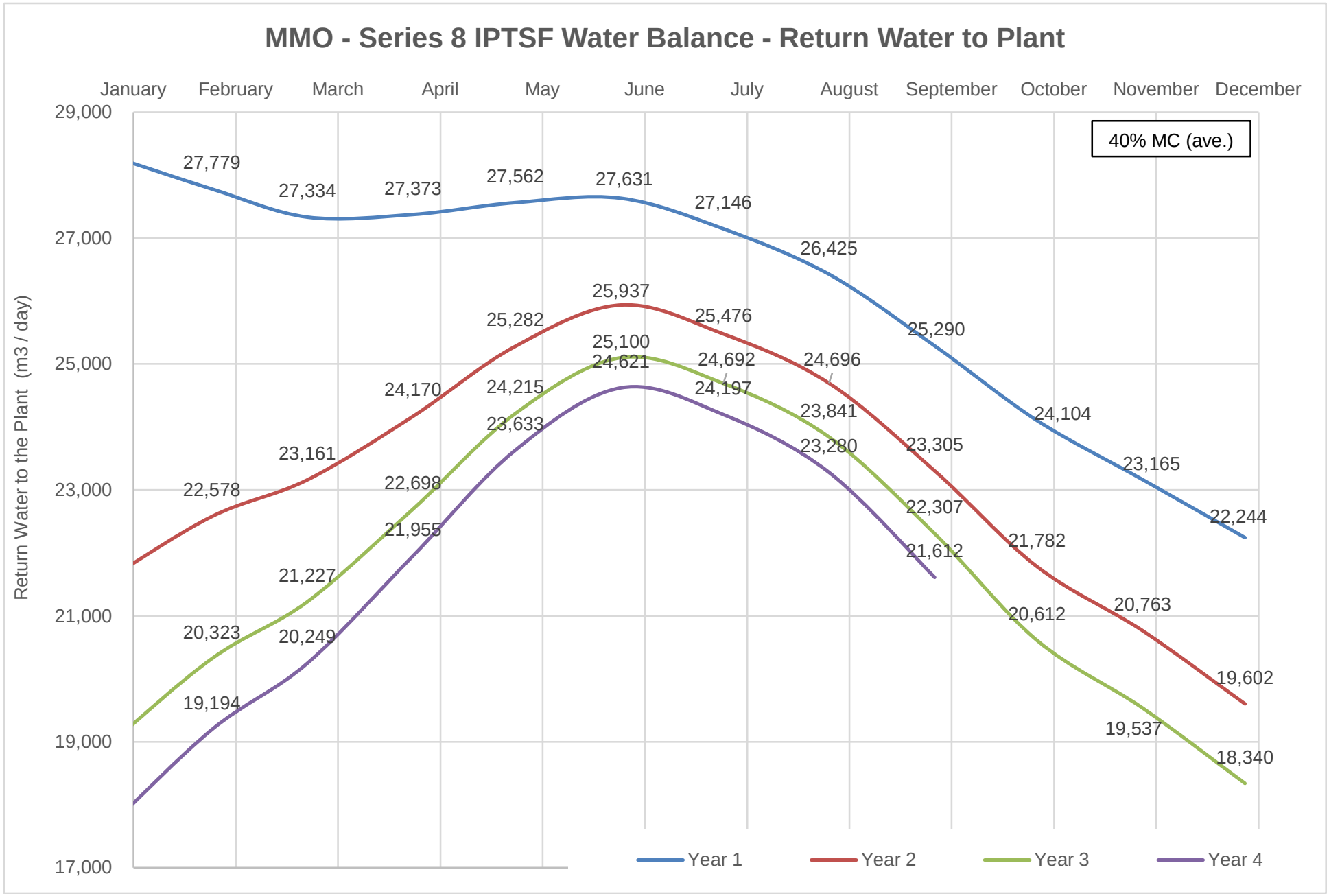

MMO - 7 Series IPTSF Water Balance - Water Shortfall
January
February
March
April
May
June
July
August
September
October
November
December
-5,000
-6,000
-7,000
-8,000
-9,000
-10,000
-11,000
-12,000
Water Shortfall (m3 / day)
40% MC (ave.)
-6,404
-6,784
-6,802
-6,646
-6,448
-6,858
-7,381
-8,319
-9,304
-10,146
-10,904
Year 1

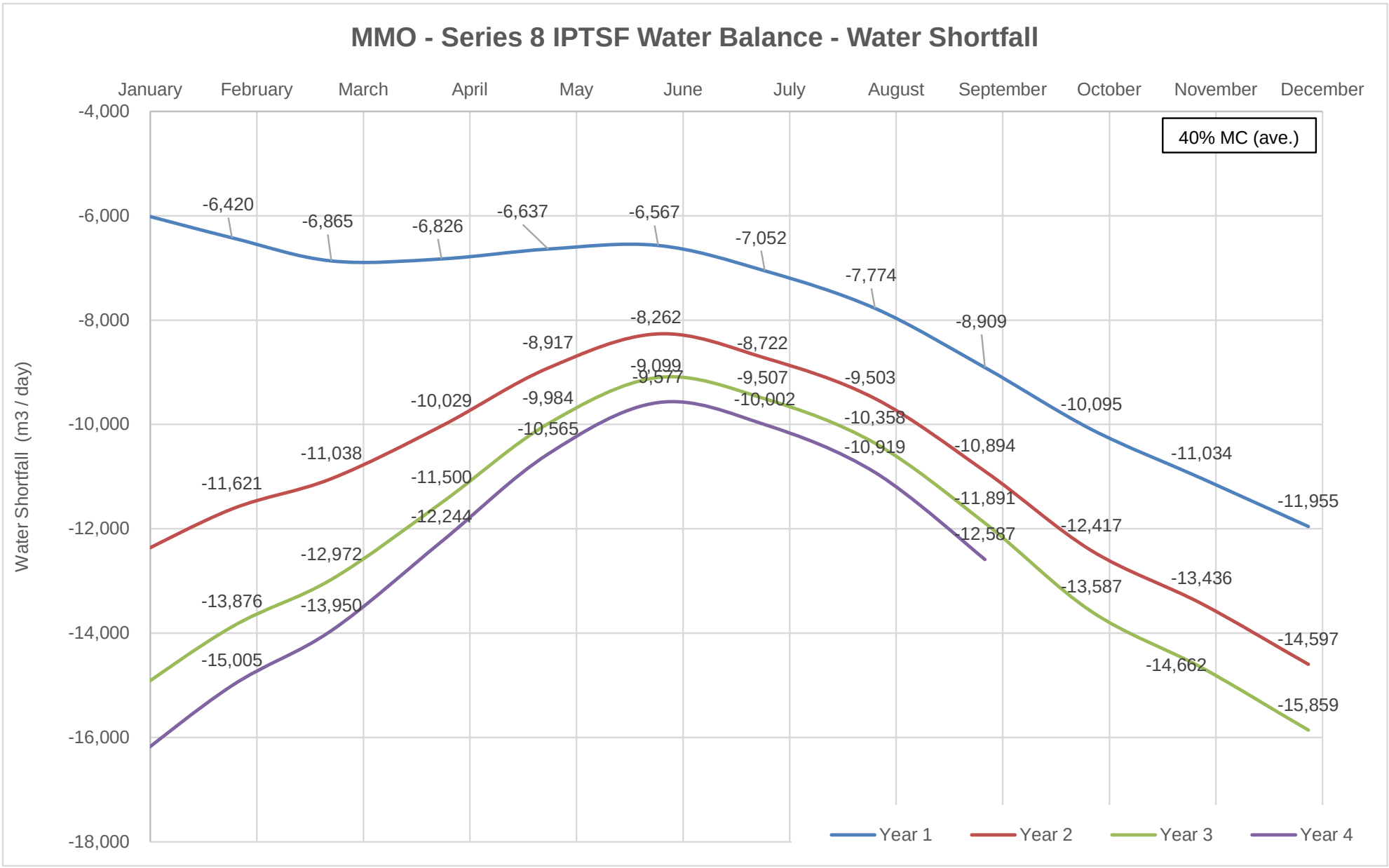
PROJECT	: MURRIN MURRIN OPERATIONS IN-PIT TAILINGS STUDY
CLIENT	: MURRIN MURRIN OPERATIONS PTY LTD
LOCATION	: LEONORA, WA
SUBJECT	: WATER BALANCE - MMO 7 SERIES IN-PIT TSF - YEAR 1 — 4.62 Mtpa (dry), 27% Solids

TETRA TECH COFFEY

Date	12-Feb-24
Job No	754-PERGE318544
Rev	A

Month	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
Days per Month	31	28.25	31	30	31	30	31	31	30	31	30	31	365.25
INFLOWS													
RAINFALL													
Rainfall (mm/month)	26.3	30.9	29.0	20.3	23.7	24.8	18.5	15.7	8.9	9.4	12.3	16.7	236.40
Average Daily Rainfall (mm)	0.85	1.09	0.94	0.68	0.76	0.83	0.60	0.51	0.30	0.30	0.41	0.54	
Pit Surface Area (m²)	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	
Runoff Coefficient	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	
Pool Area (m²)	23,923	44,069	57,990	69,244	83,199	90,221	101,531	108,778	117,494	123,176	131,696	135,547	
Running Beaches (m²)	53,828	99,155	130,478	155,800	187,198	202,996	228,444	244,750	264,361	277,145	296,315	304,981	
Rainfall Inflow Total Volume (m³/day)	457	625	556	414	486	535	397	343	205	212	293	388	149,061
SLURRY WATER													
Tailings Production Rate (t/year)	4,620,000	4,620,000	4,620,000	4,620,000	4,620,000	4,620,000	4,620,000	4,620,000	4,620,000	4,620,000	4,620,000	4,620,000	
Tailings Production Rate (t/day)	12,649	12,649	12,649	12,649	12,649	12,649	12,649	12,649	12,649	12,649	12,649	12,649	
% Solids	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	
Volume of Water (m³/day)	34,199	34,199	34,199	34,199	34,199	34,199	34,199	34,199	34,199	34,199	34,199	34,199	12,491,111
TOTAL INFLOW (m³/day)	**34,656**	**34,824**	**34,755**	**34,613**	**34,684**	**34,733**	**34,596**	**34,542**	**34,404**	**34,411**	**34,492**	**34,587**	**12,640,172**
OUTFLOWS													
EVAPORATION (from pond and beaches)													
Pan Evaporation (mm/day)	16.87	14.37	11.90	8.13	5.26	3.60	3.74	5.06	7.37	10.45	12.60	14.97	3,473
Evaporation Pan Coefficient	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	
Average Daily Evaporation Rate (mm/day)	11.13	9.49	7.86	5.37	3.47	2.38	2.47	3.34	4.86	6.90	8.32	9.88	
Pool Area & Running Beaches (m²)	77,751	143,224	188,469	225,044	270,397	293,217	329,974	353,528	381,855	400,321	428,011	440,528	
Daily Evaporation Loss/Outflow (m³/day)	866	1,359	1,481	1,208	938	697	815	1,182	1,857	2,761	3,559	4,352	642,232
EVAPO-TRANSPIRATION (from drying tailings)													
Average Daily Evapo-transpiration Rate (mm) (Pan/3)	5.62	4.79	3.97	2.71	1.75	1.20	1.25	1.69	2.46	3.48	4.20	4.99	1,158
Drying Tailings Beach Area (m²)	1,794	3,305	4,349	5,193	6,240	6,767	7,615	8,158	8,812	9,238	9,877	10,166	
Daily Evaporation Loss (m³/day)	10	16	17	14	11	8	9	14	22	32	41	51	7,485
SEEPAGE (estimated average value)													
Leakage From Pit Floor (m³/day)	323	595	783	935	1,123	1,218	1,371	1,469	1,586	1,663	1,778	1,830	
Total Seepage Outflow (m³/day)	323	595	783	935	1,123	1,218	1,371	1,469	1,586	1,663	1,778	1,830	447,701
RETENTION													
Assumed Moisture Content of Tailings (average)	40%	40%	40%	40%	40%	40%	40%	40%	40%	40%	40%	40%	
Volume Retained in Tailings (m³/day)	5,060	5,060	5,060	5,060	5,060	5,060	5,060	5,060	5,060	5,060	5,060	5,060	1,848,000
TOTAL OUTFLOW/LOSSES (m³/day)	**6,258**	**7,029**	**7,340**	**7,216**	**7,132**	**6,982**	**7,255**	**7,724**	**8,524**	**9,516**	**10,438**	**11,292**	**2,945,418**
BALANCE													
INFLOWS - OUTFLOWS (m³/day)	**28,398**	**27,795**	**27,414**	**27,397**	**27,552**	**27,751**	**27,341**	**26,818**	**25,880**	**24,895**	**24,053**	**23,295**	**9,694,754**
RETURN WATER TO THE PLANT (if available)													
Total Water Return (m³/day)	28,398	27,795	27,414	27,397	27,552	27,751	27,341	26,818	25,880	24,895	24,053	23,295	**9,694,754**
Average Water Return	83%	81%	80%	80%	81%	81%	80%	78%	76%	73%	70%	68%	
Annual Water Return Available (m3/year)	**9,694,754**												
Annual Average Water Return (as % of tailings slurry water)	**78%**												
Summary of Water Balance	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	
Water shortfall or excess of requirements (m3/day)	**-5,801**	**-6,404**	**-6,784**	**-6,802**	**-6,646**	**-6,448**	**-6,858**	**-7,381**	**-8,319**	**-9,304**	**-10,146**	**-10,904**	
Water shortfall or excess of requirements (m3/hr)	**-242**	**-267**	**-283**	**-283**	**-277**	**-269**	**-286**	**-308**	**-347**	**-388**	**-423**	**-454**	
Total water in excess of requirements (m3/month)	**-179,836**	**-180,902**	**-210,317**	**-204,060**	**-206,039**	**-193,434**	**-212,592**	**-228,804**	**-249,569**	**-288,416**	**-304,366**	**-338,024**	**-2,796,357**
Total water in excess of requirements (m3/year) =	-2,796,357												


MMO - Series 8 IPTSF Water Balance - Return Water to Plant
January
February
March
April
May
June
July
August
September
October
November
December
29,000
27,000
25,000
23,000
21,000
19,000
17,000
Return Water to the Plant (m3 / day)
40% MC (ave.)
27,779
27,334
27,373
27,562
27,631
27,146
26,425
25,290
24,104
23,165
22,244
25,937
25,476
25,282
24,696
24,692
24,621
25,100
24,215
24,197
24,170
23,841
23,633
23,305
23,161
23,280
22,578
22,698
22,307
21,955
21,782
21,612
21,227
20,763
20,612
20,323
20,249
19,602
19,194
19,537
18,340
Year 1
Year 2
Year 3
Year 4


MMO - Series 8 IPTSF Water Balance - Water Shortfall
January
February
March
April
May
June
July
August
September
October
November
December
-4,000
-6,000
-8,000
-10,000
-12,000
-14,000
-16,000
-18,000
Water Shortfall (m3 / day)
40% MC (ave.)
-6,420
-6,865
-6,826
-6,637
-6,567
-7,052
-7,774
-8,909
-10,095
-11,034
-11,955
-8,262
-8,917
-8,722
-9,099
-9,577
-9,507
-9,503
-10,029
-9,984
-10,002
-10,358
-10,894
-11,038
-10,565
-10,919
-11,621
-11,500
-11,891
-12,244
-12,587
-12,417
-12,972
-13,587
-13,436
-13,876
-13,950
-14,597
-15,005
-14,662
-15,859
Year 1
Year 2
Year 3
Year 4

PROJECT	: MURRIN MURRIN OPERATIONS IN-PIT TAILINGS STUDY
CLIENT	: MURRIN MURRIN OPERATIONS PTY LTD
LOCATION	: LEONORA, WA
SUBJECT	: WATER BALANCE - MMO SERIES 8 IN-PIT TSF - YEAR 1 — 4.62 Mtpa (dry), 27% Solids

TETRA TECH COFFEY

Date	12-Feb-24
Job No	754-PERGE318544
Rev	A

Month	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
Days per Month	31	28.25	31	30	31	30	31	31	30	31	30	31	365.25
INFLOWS													
RAINFALL													
Rainfall (mm/month)	26.3	30.9	29.0	20.3	23.7	24.8	18.5	15.7	8.9	9.4	12.3	16.7	236.40
Average Daily Rainfall (mm)	0.85	1.09	0.94	0.68	0.76	0.83	0.60	0.51	0.30	0.30	0.41	0.54	
Pit Surface Area (m2)	1,770,000	1,770,000	1,770,000	1,770,000	1,770,000	1,770,000	1,770,000	1,770,000	1,770,000	1,770,000	1,770,000	1,770,000	
Runoff Coefficient	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	
Pool Area (m²)	32,071	54,256	69,653	78,715	95,218	112,153	122,080	133,641	141,777	148,617	157,746	163,448	
Running Beaches (m²)	72,159	122,076	156,720	177,110	214,240	252,344	274,679	300,692	318,997	334,389	354,929	367,759	
Rainfall Inflow Total Volume (m³/day)	795	1,064	934	685	795	882	647	558	331	342	468	620	246,452
SLURRY WATER													
Tailings Production Rate (t/year)	4,620,000	4,620,000	4,620,000	4,620,000	4,620,000	4,620,000	4,620,000	4,620,000	4,620,000	4,620,000	4,620,000	4,620,000	
Tailings Production Rate (t/day)	12,649	12,649	12,649	12,649	12,649	12,649	12,649	12,649	12,649	12,649	12,649	12,649	
% Solids	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	
Volume of Water (m³/day)	34,199	34,199	34,199	34,199	34,199	34,199	34,199	34,199	34,199	34,199	34,199	34,199	12,491,111
TOTAL INFLOW (m³/day)	**34,994**	**35,263**	**35,133**	**34,884**	**34,994**	**35,081**	**34,845**	**34,757**	**34,530**	**34,540**	**34,667**	**34,819**	**12,737,563**
OUTFLOWS													
EVAPORATION (from pond and beaches)													
Pan Evaporation (mm/day)	16.87	14.37	11.90	8.13	5.26	3.60	3.74	5.06	7.37	10.45	12.60	14.97	3,473
Evaporation Pan Coefficient	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	
Average Daily Evaporation Rate (mm/day)	11.13	9.49	7.86	5.37	3.47	2.38	2.47	3.34	4.86	6.90	8.32	9.88	
Pool Area & Running Beaches (m²)	104,230	176,332	226,373	255,825	309,458	364,497	396,759	434,332	460,774	483,006	512,676	531,207	
Daily Evaporation Loss/Outflow (m³/day)	1,161	1,673	1,778	1,373	1,074	866	980	1,452	2,240	3,332	4,263	5,248	775,285
EVAPO-TRANSPIRATION (from drying tailings)													
Average Daily Evapo-transpiration Rate (mm) (Pan/3)	5.62	4.79	3.97	2.71	1.75	1.20	1.25	1.69	2.46	3.48	4.20	4.99	1,158
Drying Tailings Beach Area (m²)	2,405	4,069	5,224	5,904	7,141	8,411	9,156	10,023	10,633	11,146	11,831	12,259	
Daily Evaporation Loss (m³/day)	14	19	21	16	13	10	11	17	26	39	50	61	9,036
SEEPAGE (estimated average value)													
Leakage From Pit Floor (m³/day)	433	732	940	1,063	1,285	1,514	1,648	1,804	1,914	2,006	2,130	2,207	
Total Seepage Outflow (m³/day)	433	732	940	1,063	1,285	1,514	1,648	1,804	1,914	2,006	2,130	2,207	539,339
RETENTION													
Assumed Moisture Content of Tailings (average)	40%	40%	40%	40%	40%	40%	40%	40%	40%	40%	40%	40%	
Volume Retained in Tailings (m³/day)	5,060	5,060	5,060	5,060	5,060	5,060	5,060	5,060	5,060	5,060	5,060	5,060	1,848,000
TOTAL OUTFLOW/LOSSES (m³/day)	**6,667**	**7,484**	**7,799**	**7,511**	**7,431**	**7,450**	**7,699**	**8,332**	**9,240**	**10,437**	**11,502**	**12,575**	**3,171,660**
BALANCE													
INFLOWS - OUTFLOWS (m³/day)	**28,327**	**27,779**	**27,334**	**27,373**	**27,562**	**27,631**	**27,146**	**26,425**	**25,290**	**24,104**	**23,165**	**22,244**	**9,565,904**
RETURN WATER TO THE PLANT (if available)													
Total Water Return (m³/day)	28,327	27,779	27,334	27,373	27,562	27,631	27,146	26,425	25,290	24,104	23,165	22,244	**9,565,904**
Average Water Return	83%	81%	80%	80%	81%	81%	79%	77%	74%	70%	68%	65%	
Annual Water Return Available (m3/year)	**9,565,904**												
Annual Average Water Return (as % of tailings slurry water)	**77%**												
Summary of Water Balance	**JAN**	**FEB**	**MAR**	**APR**	**MAY**	**JUN**	**JUL**	**AUG**	**SEP**	**OCT**	**NOV**	**DEC**	
Water shortfall or excess of requirements (m3/day)	**-5,872**	**-6,420**	**-6,865**	**-6,826**	**-6,637**	**-6,567**	**-7,052**	**-7,774**	**-8,909**	**-10,095**	**-11,034**	**-11,955**	
Water shortfall or excess of requirements (m3/hr)	**-245**	**-267**	**-286**	**-284**	**-277**	**-274**	**-294**	**-324**	**-371**	**-421**	**-460**	**-498**	
Total water in excess of requirements (m3/month)	**-182,019**	**-181,354**	**-212,822**	**-204,782**	**-205,733**	**-197,025**	**-218,624**	**-241,001**	**-267,271**	**-312,943**	**-331,028**	**-370,607**	**-2,925,208**
Total water in excess of requirements (m3/year) =	**-2,925,208**												

PROJECT	: MURRIN MURRIN OPERATIONS IN-PIT TAILINGS STUDY
CLIENT	: MURRIN MURRIN OPERATIONS PTY LTD
LOCATION	: LEONORA, WA
SUBJECT	: WATER BALANCE - MMO SERIES 8 IN-PIT TSF - YEAR 2 — 4.62 Mtpa (dry), 27% Solids

TETRA TECH COFFEY

Date	12-Feb-24
Job No	754-PERGE318544
Rev	A

Month	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
Days per Month	31	28.25	31	30	31	30	31	31	30	31	30	31	365.25
INFLOWS													
RAINFALL													
Rainfall (mm/month)	26.3	30.9	29.0	20.3	23.7	24.8	18.5	15.7	8.9	9.4	12.3	16.7	**236.40**
Average Daily Rainfall (mm)	0.85	1.09	0.94	0.68	0.76	0.83	0.60	0.51	0.30	0.30	0.41	0.54	
Pit Surface Area (m2)	1,770,000	1,770,000	1,770,000	1,770,000	1,770,000	1,770,000	1,770,000	1,770,000	1,770,000	1,770,000	1,770,000	1,770,000	
Runoff Coefficient	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	
Pool Area (m²)	170,765	175,464	180,008	185,292	191,567	196,992	202,953	206,676	210,220	213,688	217,516	222,020	
Running Beaches (m²)	384,222	394,793	405,019	416,907	431,026	443,231	456,644	465,021	472,994	480,797	489,411	499,545	
Rainfall Inflow Total Volume (m³/day)	986	1,280	1,102	803	915	996	725	618	364	374	508	671	**283,374**
SLURRY WATER													
Tailings Production Rate (t/year)	4,620,000	4,620,000	4,620,000	4,620,000	4,620,000	4,620,000	4,620,000	4,620,000	4,620,000	4,620,000	4,620,000	4,620,000	
Tailings Production Rate (t/day)	12,649	12,649	12,649	12,649	12,649	12,649	12,649	12,649	12,649	12,649	12,649	12,649	
% Solids	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	
Volume of Water (m³/day)	34,199	34,199	34,199	34,199	34,199	34,199	34,199	34,199	34,199	34,199	34,199	34,199	**12,491,111**
TOTAL INFLOW (m³/day)	**35,185**	**35,479**	**35,300**	**35,001**	**35,113**	**35,195**	**34,924**	**34,817**	**34,563**	**34,572**	**34,707**	**34,870**	**12,774,485**
OUTFLOWS													
EVAPORATION (from pond and beaches)													
Pan Evaporation (mm/day)	16.87	14.37	11.90	8.13	5.26	3.60	3.74	5.06	7.37	10.45	12.60	14.97	**3,473**
Evaporation Pan Coefficient	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	
Average Daily Evaporation Rate (mm/day)	11.13	9.49	7.86	5.37	3.47	2.38	2.47	3.34	4.86	6.90	8.32	9.88	
Pool Area & Running Beaches (m²)	554,987	570,257	585,027	602,199	622,593	640,222	659,597	671,697	683,214	694,484	706,927	721,565	
Daily Evaporation Loss/Outflow (m³/day)	6,180	5,409	4,596	3,233	2,161	1,521	1,629	2,245	3,322	4,791	5,879	7,128	**1,462,044**
EVAPO-TRANSPIRATION (from drying tailings)													
Average Daily Evapo-transpiration Rate (mm) (Pan/3)	5.62	4.79	3.97	2.71	1.75	1.20	1.25	1.69	2.46	3.48	4.20	4.99	**1,158**
Drying Tailings Beach Area (m²)	12,807	13,160	13,501	13,897	14,368	14,774	15,221	15,501	15,766	16,027	16,314	16,652	
Daily Evaporation Loss (m³/day)	72	63	54	38	25	18	19	26	39	56	69	83	**17,040**
SEEPAGE (estimated average value)													
Leakage From Pit Floor (m³/day)	2,305	2,369	2,430	2,501	2,586	2,659	2,740	2,790	2,838	2,885	2,936	2,997	
Total Seepage Outflow (m³/day)	2,305	2,369	2,430	2,501	2,586	2,659	2,740	2,790	2,838	2,885	2,936	2,997	**975,718**
RETENTION													
Assumed Moisture Content of Tailings (average)	40%	40%	40%	40%	40%	40%	40%	40%	40%	40%	40%	40%	
Volume Retained in Tailings (m³/day)	5,060	5,060	5,060	5,060	5,060	5,060	5,060	5,060	5,060	5,060	5,060	5,060	**1,848,000**
TOTAL OUTFLOW/LOSSES (m³/day)	**13,617**	**12,900**	**12,139**	**10,831**	**9,831**	**9,258**	**9,447**	**10,121**	**11,258**	**12,791**	**13,943**	**15,268**	**4,302,802**
BALANCE													
INFLOWS - OUTFLOWS (m³/day)	**21,568**	**22,578**	**23,161**	**24,170**	**25,282**	**25,937**	**25,476**	**24,696**	**23,305**	**21,782**	**20,763**	**19,602**	**8,471,683**
RETURN WATER TO THE PLANT (if available)													
Total Water Return (m³/day)	21,568	22,578	23,161	24,170	25,282	25,937	25,476	24,696	23,305	21,782	20,763	19,602	**8,471,683**
Average Water Return	63%	66%	68%	71%	74%	76%	74%	72%	68%	64%	61%	57%	
Annual Water Return Available (m3/year)	**8,471,683**												
Annual Average Water Return (as % of tailings slurry water)	**68%**												
Summary of Water Balance	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	
Water shortfall or excess of requirements (m3/day)	**-12,630**	**-11,621**	**-11,038**	**-10,029**	**-8,917**	**-8,262**	**-8,722**	**-9,503**	**-10,894**	**-12,417**	**-13,436**	**-14,597**	
Water shortfall or excess of requirements (m3/hr)	**-526**	**-484**	**-460**	**-418**	**-372**	**-344**	**-363**	**-396**	**-454**	**-517**	**-560**	**-608**	
Total water in excess of requirements (m3/month)	**-391,541**	**-328,280**	**-342,170**	**-300,860**	**-276,424**	**-247,848**	**-270,395**	**-294,585**	**-326,824**	**-384,931**	**-403,067**	**-452,504**	**-4,019,428**
Total water in excess of requirements (m3/year) =	**-4,019,428**												

PROJECT	: MURRIN MURRIN OPERATIONS IN-PIT TAILINGS STUDY
CLIENT	: MURRIN MURRIN OPERATIONS PTY LTD
LOCATION	: LEONORA, WA
SUBJECT	: WATER BALANCE - MMO SERIES 8 IN-PIT TSF - YEAR 3

4.62 Mtpa (dry), 27% Solids

TETRA TECH COFFEY

Date	12-Feb-24
Job No	754-PERGE318544
Rev	A

Month	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
Days per Month	31	28.25	31	30	31	30	31	31	30	31	30	31	365.25
INFLOWS													
RAINFALL													
Rainfall (mm/month)	26.3	30.9	29.0	20.3	23.7	24.8	18.5	15.7	8.9	9.4	12.3	16.7	236.40
Average Daily Rainfall (mm)	0.85	1.09	0.94	0.68	0.76	0.83	0.60	0.51	0.30	0.30	0.41	0.54	
Pit Surface Area (m2)	1,770,000	1,770,000	1,770,000	1,770,000	1,770,000	1,770,000	1,770,000	1,770,000	1,770,000	1,770,000	1,770,000	1,770,000	
Runoff Coefficient	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	
Pool Area (m²)	225,166	228,028	231,161	234,269	236,636	238,908	240,960	242,823	244,604	246,474	248,047	250,000	
Running Beaches (m²)	506,623	513,062	520,113	527,106	532,431	537,544	542,160	546,351	550,359	554,587	558,105	562,500	
Rainfall Inflow Total Volume (m³/day)	1,061	1,373	1,179	856	971	1,053	762	648	380	390	528	696	300,222
SLURRY WATER													
Tailings Production Rate (t/year)	4,620,000	4,620,000	4,620,000	4,620,000	4,620,000	4,620,000	4,620,000	4,620,000	4,620,000	4,620,000	4,620,000	4,620,000	
Tailings Production Rate (t/day)	12,649	12,649	12,649	12,649	12,649	12,649	12,649	12,649	12,649	12,649	12,649	12,649	
% Solids	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	
Volume of Water (m³/day)	34,199	34,199	34,199	34,199	34,199	34,199	34,199	34,199	34,199	34,199	34,199	34,199	12,491,111
TOTAL INFLOW (m³/day)	**35,260**	**35,572**	**35,378**	**35,055**	**35,169**	**35,251**	**34,961**	**34,847**	**34,579**	**34,589**	**34,727**	**34,894**	**12,791,333**
OUTFLOWS													
EVAPORATION (from pond and beaches)													
Pan Evaporation (mm/day)	16.87	14.37	11.90	8.13	5.26	3.60	3.74	5.08	7.37	10.45	12.60	14.97	3,473
Evaporation Pan Coefficient	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	
Average Daily Evaporation Rate (mm/day)	11.13	9.49	7.86	5.37	3.47	2.38	2.47	3.34	4.86	6.90	8.32	9.88	
Pool Area & Running Beaches (m²)	731,789	741,090	751,275	761,376	769,067	776,452	783,120	789,174	794,963	801,041	806,152	812,500	
Daily Evaporation Loss/Outflow (m³/day)	8,148	7,029	5,902	4,087	2,669	1,845	1,934	2,638	3,865	5,526	6,704	8,026	1,773,757
EVAPO-TRANSPIRATION (from drying tailings)													
Average Daily Evapo-transpiration Rate (mm) (Pan/3)	5.62	4.79	3.97	2.71	1.75	1.20	1.25	1.69	2.46	3.48	4.20	4.99	1,158
Drying Tailings Beach Area (m²)	16,887	17,102	17,337	17,570	17,748	17,918	18,072	18,212	18,345	18,486	18,604	18,750	
Daily Evaporation Loss (m³/day)	95	82	69	48	31	22	23	31	45	64	78	94	20,673
SEEPAGE (estimated average value)													
Leakage From Pit Floor (m³/day)	3,040	3,078	3,121	3,163	3,195	3,225	3,253	3,278	3,302	3,327	3,349	3,375	
Total Seepage Outflow (m³/day)	3,040	3,078	3,121	3,163	3,195	3,225	3,253	3,278	3,302	3,327	3,349	3,375	1,178,367
RETENTION													
Assumed Moisture Content of Tailings (average)	40%	40%	40%	40%	40%	40%	40%	40%	40%	40%	40%	40%	
Volume Retained in Tailings (m³/day)	5,060	5,060	5,060	5,060	5,060	5,060	5,060	5,060	5,060	5,060	5,060	5,060	1,848,000
TOTAL OUTFLOW/LOSSES (m³/day)	**16,343**	**15,249**	**14,151**	**12,357**	**10,954**	**10,151**	**10,269**	**11,006**	**12,272**	**13,977**	**15,190**	**16,555**	**4,820,798**
BALANCE													
INFLOWS - OUTFLOWS (m³/day)	**18,917**	**20,323**	**21,227**	**22,698**	**24,215**	**25,100**	**24,692**	**23,841**	**22,307**	**20,612**	**19,537**	**18,340**	**7,970,535**
RETURN WATER TO THE PLANT (if available)													
Total Water Return (m³/day)	18,917	20,323	21,227	22,698	24,215	25,100	24,692	23,841	22,307	20,612	19,537	18,340	**7,970,535**
Average Water Return	55%	59%	62%	66%	71%	73%	72%	70%	65%	60%	57%	54%	
Annual Water Return Available (m3/year)	**7,970,535**												
Annual Average Water Return (as % of tailings slurry water)	**64%**												
Summary of Water Balance	**JAN**	**FEB**	**MAR**	**APR**	**MAY**	**JUN**	**JUL**	**AUG**	**SEP**	**OCT**	**NOV**	**DEC**	
Water shortfall or excess of requirements (m3/day)	**-15,281**	**-13,876**	**-12,972**	**-11,500**	**-9,984**	**-9,099**	**-9,507**	**-10,358**	**-11,891**	**-13,587**	**-14,662**	**-15,859**	
Water shortfall or excess of requirements (m3/hr)	**-637**	**-578**	**-540**	**-479**	**-416**	**-379**	**-396**	**-432**	**-495**	**-566**	**-611**	**-661**	
Total water in excess of requirements (m3/month)	**-473,722**	**-391,997**	**-402,126**	**-345,013**	**-309,491**	**-272,959**	**-294,726**	**-321,105**	**-356,742**	**-421,203**	**-439,865**	**-491,627**	**-4,520,576**
Total water in excess of requirements (m3/year) =	**-4,520,576**												

PROJECT	: MURRIN MURRIN OPERATIONS IN-PIT TAILINGS STUDY
CLIENT	: MURRIN MURRIN OPERATIONS PTY LTD
LOCATION	: LEONORA, WA
SUBJECT	: WATER BALANCE - MMO SERIES 8 IN-PIT TSF - YEAR 4 — 4.62 Mtpa (dry), 27% Solids

TETRA TECH COFFEY

Date	12-Feb-24
Job No	754-PERGE318544
Rev	A

Month	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
Days per Month	31	28.25	31	30	31	30	31	31	30	31	30	31	365.25
INFLOWS													
RAINFALL													
Rainfall (mm/month)	26.3	30.9	29.0	20.3	23.7	24.8	18.5	15.7	8.9				236.40
Average Daily Rainfall (mm)	0.85	1.09	0.94	0.68	0.76	0.83	0.60	0.51	0.30				
Pit Surface Area (m2)	1,770,000	1,770,000	1,770,000	1,770,000	1,770,000	1,770,000	1,770,000	1,770,000	1,770,000				
Runoff Coefficient	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50				
Pool Area (m²)	252,058	254,330	257,036	259,000	261,217	262,882	264,900	266,503	268,595				
Running Beaches (m²)	567,131	572,244	578,331	582,750	587,737	591,484	596,026	599,633	604,340				
Rainfall Inflow Total Volume (m³/day)	1,098	1,420	1,219	884	1,001	1,085	785	668	392				258,820
SLURRY WATER													
Tailings Production Rate (t/year)	4,620,000	4,620,000	4,620,000	4,620,000	4,620,000	4,620,000	4,620,000	4,620,000	4,620,000				
Tailings Production Rate (t/day)	12,649	12,649	12,649	12,649	12,649	12,649	12,649	12,649	12,649				
% Solids	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27				
Volume of Water (m³/day)	34,199	34,199	34,199	34,199	34,199	34,199	34,199	34,199	34,199				9,344,822
TOTAL INFLOW (m³/day)	**35,297**	**35,619**	**35,417**	**35,082**	**35,200**	**35,284**	**34,984**	**34,866**	**34,591**				**9,603,641**
OUTFLOWS													
EVAPORATION (from pond and beaches)													
Pan Evaporation (mm/day)	16.87	14.37	11.90	8.13	5.26	3.60	3.74	5.08	7.37				2,307
Evaporation Pan Coefficient	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66				
Average Daily Evaporation Rate (mm/day)	11.13	9.49	7.86	5.37	3.47	2.38	2.47	3.34	4.86				
Pool Area & Running Beaches (m²)	819,189	826,574	835,367	841,750	848,954	854,366	860,926	866,136	872,935				
Daily Evaporation Loss/Outflow (m³/day)	9,122	7,840	6,563	4,519	2,946	2,030	2,126	2,895	4,244				1,278,475
EVAPO-TRANSPIRATION (from drying tailings)													
Average Daily Evapo-transpiration Rate (mm) (Pan/3)	5.62	4.79	3.97	2.71	1.75	1.20	1.25	1.69	2.46				769
Drying Tailings Beach Area (m²)	18,904	19,075	19,278	19,425	19,591	19,716	19,868	19,988	20,145				
Daily Evaporation Loss (m³/day)	106	91	76	53	34	24	25	34	49				14,901
SEEPAGE (estimated average value)													
Leakage From Pit Floor (m³/day)	3,403	3,433	3,470	3,496	3,526	3,549	3,576	3,598	3,626				
Total Seepage Outflow (m³/day)	3,403	3,433	3,470	3,496	3,526	3,549	3,576	3,598	3,626				961,906
RETENTION													
Assumed Moisture Content of Tailings (average)	40%	40%	40%	40%	40%	40%	40%	40%	40%				
Volume Retained in Tailings (m³/day)	5,060	5,060	5,060	5,060	5,060	5,060	5,060	5,060	5,060				1,382,522
TOTAL OUTFLOW/LOSSES (m³/day)	**17,690**	**16,425**	**15,169**	**13,127**	**11,566**	**10,662**	**10,787**	**11,586**	**12,979**				**3,637,803**
BALANCE													
INFLOWS - OUTFLOWS (m³/day)	**17,607**	**19,194**	**20,249**	**21,955**	**23,633**	**24,621**	**24,197**	**23,280**	**21,612**				**5,965,838**
RETURN WATER TO THE PLANT (if available)													
Total Water Return (m³/day)	17,607	19,194	20,249	21,955	23,633	24,621	24,197	23,280	21,612				**5,965,838**
Average Water Return	51%	56%	59%	64%	69%	72%	71%	68%	63%				
Annual Water Return Available (m3/year)	**5,965,838**												
Annual Average Water Return (as % of tailings slurry water)	**64%**												

Summary of Water Balance	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
Water shortfall or excess of requirements (m3/day)	-16,592	-15,005	-13,950	-12,244	-10,565	-9,577	-10,002	-10,919	-12,587
Water shortfall or excess of requirements (m3/hr)	-691	-625	-581	-510	-440	-399	-417	-455	-524
Total water in excess of requirements (m3/month)	-514,348	-423,881	-432,454	-367,307	-327,525	-287,320	-310,051	-338,479	-377,617
Total water in excess of requirements (m3/year) =	-3,378,983								

APPENDIX H: TSF & IPTSF OPERATIONS MANUAL

Murrin Murrin Operations

TSF & IPTSF Operations Maintenance and Surveillance Manual

Minara Resources Pty Ltd

Reference: 754-PERGE318544 - MMO Updated TSF & IPTSF OMS_Rev0

5 April 2024

MURRIN MURRIN OPERATIONS

TSF & IPTSF Operations Maintenance and Surveillance Manual

Report reference number: 754-PERGE318544 - MMO Updated TSF & IPTSF OMS_Rev0
5 April 2024

PREPARED FOR

Minara Resources Pty Ltd
Murrin Murrin Operations
Level 3, 30 The Esplanade
Perth, WA 6000

PREPARED BY

Tetra Tech Coffey
Level 1, Bishops See, 235 St Georges Terrace
Perth
WA 6000 Australia
p: +61 8 6218 2100
f: +61 8 6218 2222
ABN 55 139 460 521

QUALITY INFORMATION

Revision history

Revision	Description	Date	Author	Reviewer	Approver
A	Issued for client review	23/02/2024	AM / AL	DKN / FvdL	FvdL
0	Issued as final	05/04/2024	AM / AL	DKN / FvdL	FvdL

Distribution

Report Status	No. of copies	Format	Distributed to	Date
Draft	1	PDF	Murrin Murrin Operations	23/02/2024
Final	1	PDF	Murrin Murrin Operations	05/04/2024

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APPENDICES

ACRONYMS/ABBREVIATIONS

Acronyms/Abbreviations	Definition
ANCOLD	Australian National Committee on Large Dams
DMIRS	Department of Mines, Industry Regulation and Safety (formerly, Department of Mines and Petroleum (DMP)
DWER	Department of Water and Environmental Regulation (formerly, Department of Environment Regulation (DER)
EPRP	Emergency Preparedness and Response Plan
EoR	Engineer of Record
MMO	Murrin Murrin Operations
OMS Manual	Operations Maintenance and Surveillance Manual
PAR	Population at Risk
PZ	Piezometer
RTFE / RP	Responsible Tailings Facility Engineer / Responsible Person
TARP	Trigger Action Response Plan
Tetra Tech / Tetra Tech Coffey / TTC	Tetra Tech Coffey Pty Ltd
TSFs / IPTSF	Tailings Storage Facilities / In-Pit Tailings Storage Facilities
VWP	Vibrating Wire Piezometer
WA	Western Australia

1. INTRODUCTION

This Operations Maintenance and Surveillance (OMS) Manual has been prepared as a guide for Process Plant Staff in the operation and management of the active above-ground Tailings Storage Facilities and In-Pit Tailings Storage Facilities (TSFs and IPTSFs) at the Minara Resources Pty Ltd's Murrin Murrin Operations (MMO) mine site, located 60 km east of Leonora, Western Australia (WA). The mine processes laterite ore for the extraction of nickel and cobalt. The process plant is currently generating approximately 3.89 to 4.62 million tonnes of tailings per annum (Mtpa) (Tetra Tech Coffey's Audit Reports, 2022 and 2023).

The TSFs at MMO comprise:

- An existing two-cell Paddock TSF – North Cell and South Cell;
- Nine existing IPTSFs – Pits 2/2-2/4, 2/3, 8/4, 8/5-9/4, 9/2, 9/5, 18/3, 18/6 and 17 Series.
- Three proposed IPTSFs – Pits 815, 7 Series, and 8 Series.

These facilities are located within 5 km of the process plant/refinery area as shown in **Figure 1** (Locality Plan). The evaporation ponds locate to the east of the South Cell, and store decant and seepage water from the TSFs.

The North Cell, Pits 2/3, 8/4, 8/5-9/4, 9/5 and Pit 18/3 have reached capacity. The South Cell and Pit 2/2-2/4 are intermittently used and are reaching full capacity. Considerations for decommissioning, closure and rehabilitation of these TSFs are presented in Section 10. The primary active TSFs are Pits 9/5 and 17 Series.

It is noted that the Paddock TSF is no longer operating and therefore not included in the carbon footprint for the Nickel products from Murrin Murrin. The in-pit tailings disposal is considered in the carbon footprint and the data capture requirements is included in the Murrin Murrin specific Carbon Accounting Appendix, being developed by Glencore Group.

This OMS Manual has been prepared in general accordance with the following standards and guidelines, and is intended for use by Process Plant Management and Staff who operate, undertake regular inspections and maintain the TSFs.

- Glencore Group Standard (2021), *'Tailings Storage Facility and Dam Management Standard';*
- Global Industry Standard on Tailings Management (GISTM, 2020);
- Department of Mines, Industry Regulation and Safety (DMIRS) (formerly DoIR) (2007), *'Guidelines on the Development of an Operating Manual for Tailings Storage'*;
- DMIRS (formerly DMP, 2013),*'Code of practice: tailings storage facilities in Western Australia'*; and
- DMIRS (2015), *'Guide to the preparation of a design report for tailings storage facilities';* and
- ANCOLD (2019), *'Guidelines on Tailings Dams Planning, Design, Construction, Operation and Closure'.*

The provisions of the OMS Manual must be strictly adhered to by the Owner and the TSFs must be operated strictly in accordance with its provisions. Tetra Tech Coffey Pty Ltd (Tetra Tech Coffey) shall not be liable in any respect whatsoever for any damage to or failure in the operation of the TSFs resulting from failure of the Owner, its servants or agents to comply with the provisions of this OMS Manual.

Reference must be made to the relevant reports, regulatory approvals for the TSFs and associated drawings (listed in Section 11 – Bibliography) to ensure that management requirements are fully understood to achieve the operational objectives, which are to:

1. Allow the facilities to function with minimal daily input.
2. Maximise water return from the facilities.
3. Maximise tailings storage capacities of the facilities.
4. Reduce environmental impacts (i.e., seepage losses from the facilities).

Stakeholder Engagement:

MMO undertakes stakeholder engagement in accordance with the Stakeholder Register (0000-80-RE-001-001). The tailings storage solutions for the operations have been developed with stakeholder input through approval processes, including cultural heritage surveys with local indigenous representatives, and updated as changes occur. The operations are remote from local communities with the nearest privately inhabited buildings being approximately 30 kilometers from the operations. The main stakeholders relevant to the TSFs are: Indigenous land owners, regulatory stakeholders including Department of Water and Environmental Regulation (DWER) and DMIRS, Shires of Leonora and Shire of Laverton and our workforce. Regular engagement programs are established to provide updates to stakeholders on the progress of the operations and Tailings management is included in agendas as relevant. The stakeholders relevant to the MMO Paddock TSF EPRP (0000-85-PLN-007-009) are separately identified in that plan and include first responders and Main Roads WA.

2. BACKGROUND

The information presented in this section is made referenced from various Tetra Tech Coffey audit reports (2022 and 2023)

MMO operates the Murrin Murrin Nickel-Cobalt Project, located approximately 60 km east of Leonora, WA. The project area lies within the Mt Morgans district of the Mt. Margaret Mineral field, between the towns of Leonora and Laverton, WA, at latitude 28°50'S and longitude 121°54'E.

Table 1 provides a summary of historical and operational status of each TSF and IPTSF. No additional raises of the Paddock TSF are planned at this stage.

Table 1: Summary of Operational Status of Each TSF and IPTSF

Facility	Type	Designed by	Crest Level (m)	Area (ha)	Total Capacity Remaining (m^3)	Current Status
Paddock TSF (North Cell)	Above ground	Golder	457.5	230	N/A	Decommissioned
Paddock TSF (South Cell)	Above ground	Golder	453.5	230	N/A	Decommissioned
Pit 2/2	In-pit	N/A	N/A	N/A	730,975	Active
Pit 2/3	In-pit	N/A	N/A	N/A	0	Decommissioned
Pit 2/4	In-pit	N/A	N/A	N/A	23,765	Active
Pit 8/4	In-pit	N/A	N/A	N/A	0	Decommissioned
Pits 8/5-9/4	In-pit	N/A	N/A	N/A	0	Decommissioned
Pit 9/2	In-pit	N/A	N/A	N/A	617,186	Active
Pit 9/5	In-pit	N/A	N/A	N/A	289,183	Active
Pit 18/3	In-pit	N/A	N/A	N/A	0	Decommissioned
Pit 18/6	In-pit	N/A	N/A	N/A	303,070	Active
Pit 17 Series	In-pit	Tetra Tech	N/A	N/A	7,278,482	Active
Pit 815	In-pit	Tetra Tech	N/A	38	3,647,040	Proposed
Pit 7 Series	In-pit	Tetra Tech	N/A	100	6,336,361	Proposed
Pit 8 Series	In-pit	Tetra Tech	N/A	177	21,608,122	Proposed

2.1 PADDOCK TSF

The Paddock TSF comprises two cells (North Cell and South Cell) with a combined tailings storage area of approximately 460 ha (2 x 230 ha each cell) and perimeter embankment length of 9 km. The TSF is east of the process plant. The North Cell is full and has remained inactive since 2011, while the South Cell is also inactive although the tailings distribution pipeline for this facility is still in place.

2.2 IPTSF 2/2 – 2/4

Pits 2/2 and 2/4 are located 2 km north of the process plant, and comprise two separate, adjacent pits that were joined by a 'bridge' constructed from mine waste backfill. The pits are orientated north–south, with the total pit length is approximately 1.2 km. The maximum depth of Pit 2/4 is approximately 50 m, with the deepest point occurring centrally within the pit. The maximum depth of Pit 2/2 is approximately 40 m, with low points distributed throughout the pit.

A decant pump was established from an access ramp at the southern end of Pit 2/2, where there was a relatively small pond. Decant water is pumped to Pit 2/3 on an ad hoc basis.

2.3 IPTSF 2/3

Pit 2/3 is oval-shaped, with the principal axis oriented approximately north-south. It is located north of the process plant. Pit 2/3 has not been 'topped up' since 2021, with various pond sizes have been visible on top of the tailings beach at different review audit periods.

2.4 IPTSF 8/4

Pit 8/4 is located 4 km south-west of the process plant. Pit 8/4 is separated from the in-pit facility by a mine waste 'plug' several hundred metres wide. Pit 8/4 is square with approximate dimensions of 500 m x 500 m. The pit depth varies from approximately 30 m at an internal ridge separating northern and southern sections of the pit, to approximately 50 m north and 60 m south of the ridge.

All tailings distribution pipelines at Pit 8/4 have been removed. Pit 8/4 is no longer used for decanting water storage, and has been left to consolidate and dry, with various pond sizes have been visible on top of the tailings beach at different review audit periods. MMO completed investigations in 2022 to enable the commencement of rehabilitation of the facility in 2023.

2.5 IPTSF 8/5 – 9/4

Pits 8/5-9/4 are located southwest of the process plant and oriented north-south. Although identified as two separate pits, Pits 8/5 and 9/4 were mined to form a single void due to the presence of commercial grade between the two. Pit 18/6 to the north and Pit 8/4 to the south are separated from Pits 8/5-9/4 by mine waste backfill embankments. MMO advised the facility is no longer used for decanting water storage.

MMO commenced capping the facility from the north with mine waste during 2020, with some subsidence occurring during capping. MMO completed investigations during 2021 so that capping and rehabilitation of the facility can safely be continued.

2.6 IPTSF 9/2

Pit 9/2 is located approximately 1.5 km west of the process plant. The pit is approximately 1.2 km long, 500 m wide and orientated north-south. The pit depth varies from approximately 30 m at the southern end to 40 m at the northern end. The pit floor is relatively even compared to Pits 2/2-2/4 and 8/4. There are small areas of paddock dumped mine waste backfill in the pit.

Pit 9/2 is nearly full, with a well-developed tailings beach sloping to the north, and suitable for emergency use only. No decant pump was available in the pit. MMO planned to install a decant pump to recover the remaining water from the pit as required.

2.7 IPTSF 9/5

Pit 9/5 is located approximately 4 km east of the process plant, and 1 km southwest of Pit 9/2. The pit floor of Pit 9/5 is relatively uneven compared to Pits 18/3 and 18/6. The pit had approximate dimensions of 800 m x 650 m. The pit depth is approximately 50 m, with the deepest point occurring centrally within the pit.

A decant pump was deployed from the ramp on the west section of the pit to recover water. Access to the pit is via a haul roads east and west of the pit.

MMO will focus on recovering decant water from the pit, which will assist with consolidation and settlement of the tailings, improving working conditions for future capping and rehabilitation.

2.8 IPTSF 18/3

Pit 18/3 is located approximately 4 km east of the process plant, and 500 m northwest of Pit 9/5. A waste dump bounds the northern perimeter of the pit. Pit 18/3 is approximately 800 m long, 450 m wide and orientated northwest to southeast. The pit depth varies from approximately 30 m at the southern end to 40 m at the northern end.

A pump was deployed from the main access ramp near the northeast corner of the pit. MMO will focus on recovering decant water from the pit to reduce the water pond size on top of the tailings beach, which will assist with consolidation and settlement of the tailings, improving trafficability for future capping and rehabilitation.

2.9 IPTSF 18/6

Pit 18/6 is located approximately 4 km east of the process plant, and immediately south of Pit 9/5. Pit 18/6 is approximately 650 m long, 350 m wide and oriented north-south. The pit depth is approximately 60 m, with the deepest point occurring centrally within the pit.

A pump was deployed from the main access ramp at the northern end of the pit. MMO will focus on recovering decant water from the pit to reduce the water pond size on top of the tailings beach, which will assist with consolidation and settlement of the tailings, improving trafficability for future capping and rehabilitation.

2.10 IPTSF 17 SERIES

Pit 17 Series is located immediately southwest of Pit 18/6. The facility was commissioned in 2022. Pit 17 Series is 108.87 ha and oriented north-south. The depth of the Pit 17 series is approximately 36 m, with the deepest point occurring centrally within the pit.

A pump was deployed from the access ramp at the southern end of the pit. MMO will focus on recovering decant water from the pit to reduce the water pond size on top of the tailings beach, which will assist with consolidation and settlement of the tailings, improving trafficability for future capping and rehabilitation.

2.11 IPTSF 815 (PROPOSED)

Pit 815 is located immediately east of Pit 18/6. The pit is currently being mined out since the second half of 2023 and is due for completion in early 2024. Pit 815 is approximately 38 ha and oriented west-east. The depth of the Pit 815 is approximately 42.2 m, with the deepest point occurring at east of the pit.

A dedicated pump will be deployed from the access ramp at the eastern end of the pit. MMO will focus on recovering decant water from the pit to reduce the water pond size on top of the tailings beach, which will assist with consolidation and settlement of the tailings, improving trafficability for future capping and rehabilitation.

2.12 IPTSF 7 SERIES (PROPOSED)

Pit 7 Series is located immediately south of MMO process plant. The pit is proposed to be mined out. Pit 7 Series is approximately 100 ha and oriented west-east. The depth of the Pit 7 Series is approximately 29.0 m, with the deepest point occurring at west of the pit.

A dedicated pump will be deployed from the access ramp at the eastern end of the pit. MMO will focus on recovering decant water from the pit to reduce the water pond size on top of the tailings beach, which will assist with consolidation and settlement of the tailings, improving trafficability for future capping and rehabilitation.

2.13 IPTSF 8 SERIES (PROPOSED)

Pit 8 Series is located immediately southeast of Pit 17 Series. The pit is proposed to be mined out. Pit 8 Series is approximately 177 ha and oriented east-west. The depth of the Pit 8 Series is approximately 45.5 m, with the deepest point occurring at east of the pit.

A dedicated pump will be deployed from the access ramp at the western end of the pit. MMO will focus on recovering decant water from the pit to reduce the water pond size on top of the tailings beach, which will assist with consolidation and settlement of the tailings, improving trafficability for future capping and rehabilitation.

2.14 CONSTRUCTION HISTORY

A construction summary for the TSFs and IPTSFs is in Table 2. Embankment raises on the Paddock TSF were undertaken by upstream construction methods. No additional raises are planned at this stage.

Table 2: Construction History of TSFs and IPTSFs

Year	Stage	Crest Level	Description	Construction Material
1998	Starter	RL450.5m (North) RL445.8m (South)	Initial construction comprising North Cell & South Cell	Clay mine waste (from Pits 2/3 and 9/2)
2002	1A	RL452.0m	North Cell (Lift 1) – 1.5m	Tailings
2002	1B	RL447.8m	South Cell (Lift 1) – 2.0m	Tailings
2003	2A	RL453.5m	North Cell (Lift 2) – 1.5m	Tailings and mine waste (from Pit 2/3)
2004	2B	RL449.3m	South Cell (Lift 2) – 1.5m	Mine waste (from Pit 7/2)
2005	3A	RL455.5m	North Cell (Lift 3) – 2.0m	Mine waste (from Pit 9 stockpiled mine waste and Pit 2/4)
2006	3B	RL451.5m	South Cell (Lift 3) – 2.2m	Mine waste (from Pit 9 stockpiled mine waste and Pit 7/2)
2007	4A	RL457.5m	North Cell (Lift 4) – 2.0m	Mine waste (from Pit 9 stockpiled mine waste)
2008	4B	RL453.5m	South Cell (Lift 4) – 2.0m	Mine waste (from Pit 7)
2009	Pit 2/3	N/A	In-pit TSF	N/A
2010	Pit 8/5-9/4	N/A	In-pit TSFs	N/A
2014	Pit 2/2-2/4 Pit 8/4	N/A	In-pit TSFs	N/A
2015	Pit 9/2	N/A	In-pit TSF	N/A
2016	-	-	-	-
2017	Pit 18/6	N/A	In-pit TSF	N/A
2018	Pits 9/5 and 18/3	N/A	In-pit TSFs	N/A
2022	Pits 17 Series	N/A	In-pit TSF	N/A
TBC	Pit 815	N/A	In-pit TSF	N/A
TBC	Pits 7 Series	N/A	In-pit TSF	N/A
TBC	Pits 8 Series	N/A	In-pit TSF	N/A

3. TAILINGS PROPERTIES

3.1 PSD AND SETTLING TESTING

Previous tailings laboratory testing has been conducted on several occasions throughout operations. No testing was undertaken during the 2022 and 2023 audit periods (Tetra Tech Coffey, 2022 and 2023).

Table 3 compares geotechnical results from testing conducted in 2008 as part of an IPTSF study (for Pits 9/1, 9/2 and 9/7) by Tetra Tech Coffey, and in May 2012 and October 2012 by MMO and Tetra Tech Coffey. The test results indicated that the May 2012 tailings sample was coarser than the 2008 sample and had slightly higher settled densities with slightly more water available. The 2012 results were also compared to the testing results by Golder in 2004 on a tailings sample with 70 to 85% fines (passing the 75-micron sieve), which returned a settled density of 0.64 t/m^3 (dry). The 2012 results returned a lower settled density.

Table 3: Summary of MMO Tailings Properties

Testing Type	2008	May 2012	Oct 2012
Particle Size Distribution (PSD)			
% Passing 80µm	95%	85%	83%
% Passing 25µm	82%	54%	74%
% Passing 5µm	48%	9%	47%
% Passing 2µm	29%	3%	31%
Undrained Settling Test			
Water available for recovery – 10 days after deposition – 20 days after deposition	 20% 30%	 31% 36%	-
Dry Density – 20 days after deposition	0.47 t/m^3	0.55 t/m^3	-
Drained Settling Test			
Water available for recovery – 10 days after deposition	39%	-	-
Dry Density – 10 days after deposition – 23 days after deposition	0.54 t/m^3 0.60 t/m^3	-	-

3.2 CONSOLIDATION TESTING

Rowe Cell testing was performed in 2012 to confirm tailings consolidation characteristics, which are summarised in Table 4.

The results indicated the tailings have poor consolidation characteristics, with C_v values are around an order of magnitude lower than the estimated C_v from CPT testing conducted on the Paddock TSF (C_v ranges 33.5 to 84). This means consolidation from the Rowe Cell testing would likely occur more slowly than from CPT testing.

Table 4: Tailings Consolidation Characteristics from Rowe Cell Testing

Stage	M_v (m^2/KN)	C_v (m^2/yr)	Dry Density (t/m^3)
Initial (20 kPa)	5.0 x 10^{-3}	4.75	0.89
Final (640 kPa)	1.9 x 10^{-4}	4.2	1.20
Note: Initial Stress 10 - 20 kPa, final stress 320 – 640 kPa			

4. TAILINGS PRODUCTION

The ore tonnage treated and approximate tailings tonnage produced since production commenced in February 1999 are summarised in Table 5.

Table 5: Summary of Tailings Production

Year	Total Production (Mt)	Year	Total Production (Mt)
1999	0.56	2011	2.94
2000	1.94	2012	3.44
2001	3.00	2013	3.87
2002	3.62	2014	4.13
2003	3.51	2015	4.11
2004	3.03	2016	4.26
2005	2.97	2017	3.77
2006	3.51	2018	4.27
2007	3.22	2019	4.15
2008	2.99	2020	4.55
2009	2.97	2021	3.89
2010	2.86	2022	4.62

5. HAZARD RATING/ CONSEQUENCE CATEGORY

5.1 PADDOCK TSF

5.1.1 TSF Hazard Rating (DMIRS 2013)

Based on the DMIRS (2013) and the updated TSF dam break assessment (Tetra Tech Coffey, 2024), the hazard rating for the Paddock TSF is deemed to be **'Medium – Category 2'** as shown in Tables 6 and 7. The TSF is classified as Category 1 due to the maximum embankment height of 14.5 m (Northern Cell).

Table 6: Hazard Rating System (MMO Paddock TSF)

Type of Impact or Damage	Hazard Rating		
	High	Medium	Low
	Extent or severity of impact or damage		
Loss of human life or personal injury	Loss of life is possible	Loss of life or injury is possible but not expected	No potential for loss of life or injury
Adverse human death due to physical impact or contamination of the environment (e.g. chemical or radiation denigration of water, soil or air)	Long-term human exposure is possible, and permanent or prolonged adverse health effects are expected	The potential for human exposure is limited, and temporary adverse health effects are possible	No potential for human exposure
	Loss of numerous livestock is possible	Loss of some livestock is possible	Limited or no potential for loss of livestock
Loss of assets due to direct physical impact or contamination of the environment (e.g. chemical or radiation denigration of water, soil or air)	Permanent loss of assets (e.g. commercial, industrial, agricultural and pastoral assets, public utilities and infrastructure, min infrastructure) is possible and no economic repairs can be made	Temporary loss of assets is possible and economic repairs can be made	Limited or no potential for destruction or loss of assets
	Loss of TSF storage capacity is possible and repair is not practicable	Loss of TSF storage capacity is possible and repair is practicable	Insignificant loss of TSF storage capacity is possible
Damage to items of environmental, heritage or historical value due to direct physical impact or contamination of the environment (e.g. chemical or radiation denigration of water, soil or air)	Permanent or prolonged damage to the natural environment (including soil, and surface and ground water resources) is possible	Temporary damage to the natural environment is possible	Limited or no potential for damage to the natural environment
	Permanent or prolonged adverse effects on flora and fauna are possible	Temporary adverse effects on flora and fauna are possible	Limited or no potential for adverse effects on flora or fauna
	Permanent damage or loss of items of heritage or historical value is possible	Temporary damage of items of heritage or historical value is possible	Limited or no potential for damage of items of heritage or historical value

Table 7: Hazard Rating/Height Matrix to Derive TSF Categories (MMO Paddock TSF)

Hazard Rating		High	Medium	Low
Maximum Embankment Height	> 15 m	1	1	1
	5 - 15 m	1	2	2
	< 5 m	1	2	3

5.1.2 TSF Consequence Category (ANCOLD 2019)

Based on the ANCOLD (2019) and updated TSF dam beak assessment (Tetra Tech Coffey, 2024), the Dam Failure Consequence Category (DFCC) for the Paddock TSF is deemed to be **'High C'** due to **Medium** damage and a population at risk (PAR) of < 100 (refer Tables 1 and 2 of ANCOLD, 2019).

Medium damage is characterised by:

- Loss of infrastructure $10M-$100M;
- Significant impacts to business (i.e. the mine);
- Impact area 5 km^2 or less;
- Impact duration less than 5 years; and
- Significant effects on rural land, ephemeral streams, local flora and fauna. Remediation is possible.

The Paddock TSF has a **Low** hazard with respect to Environmental Spill Consequence Category (ESCC) (i.e. spilling of water from the TSF during a 1 in 100-year AEP, 72-hour duration storm event and up to PMP-96 hour duration storm event is unlikely (DSR Report, Coffey 2020)).

5.1.3 TSF Consequence Classification (Glencore 2021/ GISTM 2020)

Based on the Glencore TSF and Dam Management Standard (2021)/ GISTM (2020) and updated TSF dam beak assessment (Tetra Tech Coffey, 2024), the Dam Failure Consequence Classification for the Paddock TSF is deemed to be **'High'** due to the following incremental losses (refer Table 1 of GISTM, 2020):

- PAR: 10 - 100;
- Potential loss of life (PLL): non expected;
- Environment: No significant loss or deterioration of habitat. Potential contamination of livestock/fauna water supply with no health effects. Process water low potential toxicity. Tailings not potentially acid generating and have low neutral leaching potential. Restoration possible within 1 to 5 years;
- Health, Social and Cultural: Significant disruption of business, service or social dislocation. Low likelihood of losing regional heritage, recreation, community, or cultural assets. Low likelihood of health effects; and
- Infrastructure and Economics: High economic losses affecting infrastructure, public transportation, commercial facilities, or employment. Moderate relocation/compensation to communities. <US$100M.

5.2 IN-PIT TSFS (EXISTING PITS 2/2-2/4, 9/5, 18/6 AND 17 SERIES AND PROPOSED PITS 815, 7 SERIES AND 8 SERIES)

5.2.1 IPTSF Hazard Rating (DMIRS 2013)

Based on the DMIRS (2013), the hazard rating for the IPTSFs is considered to be **'Low - Category 3'** as shown in the Tables 8 and 9. The IPTSF is classified as Category 3 due to the maximum embankment height of less than 5 m (regarding IPTSF).

Table 8: Hazard Rating System (MMO IPTSFs)

Type of Impact or Damage	Hazard Rating		
	High	Medium	Low
	Extent or severity of impact or damage		
Loss of human life or personal injury	Loss of life is possible	Loss of life or injury is possible but not expected	No potential for loss of life or injury
Adverse human death due to physical impact or contamination of the environment (e.g. chemical or radiation denigration of water, soil or air)	Long-term human exposure is possible, and permanent or prolonged adverse health effects are expected	The potential for human exposure is limited, and temporary adverse health effects are possible	No potential for human exposure
	Loss of numerous livestock is possible	Loss of some livestock is possible	Limited or no potential for loss of livestock
Loss of assets due to direct physical impact or contamination of the environment (e.g. chemical or radiation denigration of water, soil or air)	Permanent loss of assets (e.g. commercial, industrial, agricultural and pastoral assets, public utilities and infrastructure, min infrastructure) is possible and no economic repairs can be made	Temporary loss of assets is possible and economic repairs can be made	Limited or no potential for destruction or loss of assets
	Loss of TSF storage capacity is possible and repair is not practicable	Loss of TSF storage capacity is possible and repair is practicable	Insignificant loss of TSF storage capacity is possible
Damage to items of environmental, heritage or historical value due to direct physical impact or contamination of the environment (e.g. chemical or radiation denigration of water, soil or air)	Permanent or prolonged damage to the natural environment (including soil, and surface and ground water resources) is possible	Temporary damage to the natural environment is possible	Limited or no potential for damage to the natural environment
	Permanent or prolonged adverse effects on flora and fauna are possible	Temporary adverse effects on flora and fauna are possible	Limited or no potential for adverse effects on flora or fauna
	Permanent damage or loss of items of heritage or historical value is possible	Temporary damage of items of heritage or historical value is possible	Limited or no potential for damage of items of heritage or historical value

Table 9: Hazard Rating/Height Matrix to Derive TSF Categories (MMO IPTSFs)

Hazard Rating		High	Medium	Low
Maximum Embankment Height	> 15 m	1	1	1
	5 - 15 m	1	2	2
	< 5 m	1	2	3

5.2.2 IPTSF Consequence Category (ANCOLD 2019)

Based on the ANCOLD (2019), the DFCC for the IPTSFs is deemed to be **'Very Low'** due to **Minor** damage and a PAR of < 1 (refer Tables 1 and 2 of ANCOLD, 2019).

Based on ANCOLD (2019), the IPTSF has also a **Very Low** hazard with respect to EPCC (i.e. spilling of water from the IPTSF during a 1 in 100-year AEP, 72-hour duration storm event is unlikely).

5.2.3 IPTSF Consequence Classification (Glencore 2021/ GISTM 2020))

Based on the Glencore TSF and Dam Management Standard (2021)/ GISTM (2020), the Dam Failure Consequence Classification for the IPTSFs is deemed to be **'Low'** due to the following incremental losses (refer Table 1 of GISTM, 2020):

- PAR: None;
- PLL: None expected;
- Environment: Minimal short-term loss or deterioration of habitat or rare and endangered species.
- Health, Social and Cultural: Minimal effects and disruption of business and livelihoods. No measurable effect on human health. No disruption of heritage, recreation, community or cultural assets; and
- Infrastructure and Economics: Low economic losses: area contains limited infrastructure or services. <US$1M.

6. ROLES AND RESPONSIBILITIES

6.1 GENERAL

The roles and responsibilities of the various site personnel in relation to the safety, operation, management and monitoring of the TSFs/ IPTSFs are outlined in Table 10.

It is noted that this OMS Manual will be reviewed on an annual basis by site operational personnel. It is also subject to alteration as the MMO organisation structure may have different responsibility matrixes to the responsibilities presented in this document.

Table 10: Organisational Structure and Responsibilities

Key Appointed Position	Roles/ Responsibilities	Reports to	Contact
Accountable Executive	The Industrial Lead - Nickel is the appointed Accountable Executive for the MMO Asset, in relation to TSF as per the requirement of Glencore's TSF & Dam Management Standard (2021). The Accountable Executive is directly answerable to the CEO, communicates with the Board of Directors and is accountable for the TSF safety and minimising the social and environmental consequences of a potential TSF failure. The Accountable Executive may delegate responsibilities, but not accountability.	CEO and Board of Directors	
Dam Owner	The General Manager is the nominated Dam Owner at MMO in relation to TSF as per the requirement of Glencore's TSF & Dam Management Standard (2021). The General Manager or their delegate shall ensure the requirements of the TSF & Dam Management Standard are implemented and allocate associated responsibilities and resources as required.	Appointed Accountable Executive (Industrial Lead - Nickel)	
Responsible Tailings Facility Engineer/ Responsible Person (RTFE/ RP)	The appointed person is responsible for the TSF safety and coordinates with: operations, environment, engineering, projects, Engineer of Record, and Independent Reviews.	Nominated Dam Owner (General Manager)	

Engineer of Record (EoR)	The Professional Engineer is responsible for verifying TSF is designed, constructed and operated in accordance with leading practice and the applicable guidelines, standards and regulations. Tetra Tech Coffey is currently appointed as the EoR at MMO in relation to TSF as per the requirement of Glencore's TSF & Dam Management Standard (2021), and can guide and support the assessment and implementation of response and repair tactics.	Appointed RTFE / RP	
Position	**Roles/ Responsibilities**	**Reports to**	**Contact**
General Manager	Ensure compliance issues, company standards and policies are met in the design, construction, operation and closure of TSF.	Head of Nickel	
Production Manager	Ensure operating, planning, maintenance and risk management aspects of TSF comply with legislation, company policy and standards.	Operations Manager	
Tailings and Water Coordinator	Manage TSF operation, planning, inspections, record keeping, water management, incident prevention, remediation of environmental incidents; ensure compliance with legislation, company standards and policies.	Production Manager	
Shift Supervisor/ Operator	Manage day-to-day TSF operations, including pipeline/ dam inspections, record keeping/ reporting, prevention and control of environmental incidents.	Tailings and Water Coordinator	
Risk, Environmental & Community Manager	Manage licence and permit applications and compliance, groundwater monitoring, flora/fauna surveys, decommissioning/ rehabilitation plans, regulatory reporting, external audits and monitor, compliance with legislation and company policy and standards. Provide emergency responses.	General Manager	
Environmental Advisor	Monitor compliance with legislation, company policies and standards. Conduct groundwater monitoring, assist with rehabilitation programs.	Environmental Superintendent (or Manager)	
Maintenance Superintendent	Manage and assist with planning and maintenance of infrastructure associated with tailing disposal (includes power, pipelines, pumps and tanks etc.).	Maintenance Manager	
Site Emergency Coordinator	Emergency preparedness for tailings associated incident.	Health & Safety Manager	
External Advisers or Consultants	Provide technical support for the construction, operation and auditing of the TSF.	Nominated Site Representative	Tetra Tech Coffey
Legal Personnel	Provide support and guidance on all legal matters.	General Manager	

6.2 ORGANISATION CHART

MMO and all TSFs and IPTSFs have been managed and operated by a team structured and presented in the MMO Operations Management and Production Charts (Appendix A).

6.3 TRAINING

All site personnel in relation to the safety, operation, management and monitoring of the TSFs/ IPTSFs shall complete the appropriate level of Glencore Tailings Management Academy (TMA) training in addition to their nominal training as Site personnel (refer to the 2023 MMO Paddock TSF Emergency Preparedness and Response Plan (EPRP) (0000-85-PLN-007-009) for details), and must be competent in the tasks they are assigned. This means they must have the knowledge and skills necessary to perform the task safely and correctly. Competency is gained through training and experience while being supervised or mentored.

The risk management training provided must be appropriate to the assigned roles and responsibilities. It must provide information on:

- The risk management process; and
- Task-specific safe work methods, including the safe use of tools and equipment and safe systems of work.

All personnel must understand the implications that their activities during construction, operation and decommissioning may have for the eventual closure of the mine and relinquishment of the tenement.

Assessment of competency must be verified before work commences. Competency may be verified by:

- Recognition of prior learning;
- On-site recognition or validation of current competency; and
- Using the operation's training and development program.

Verifications of competency must include a documented assessment.

Whenever systems of work or plant and equipment change, or new systems of work or plant and equipment are introduced, there must be a system to ensure affected personnel are consulted, retrained as necessary and reassessed.

In addition, the key appointed roles/ person will need to undertake the Glencore TMA training requirements:

- Accountable Executive - TMA Level 2;
- Dam Owner - TMA Level 2;
- Responsible Person - TMA Level 3; and
- EoR - TMA Level 3.

7. OPERATING PROCEDURES

7.1 GENERAL

Successful management of the TSFs and IPTSFs to achieve the operational objectives requires a thorough understanding of the major operating components of the facilities.

The components which are influenced by the general day-to-day activities include:

- Tailings deposition;
- Decant operation and supernatant water recovery; and
- Routine inspection and maintenance.

This section outlines the operating and monitoring criteria that will be adopted during the operational life of the TSFs/ IPTSFs.

The focus of operating procedures is on deposition of tailings at a low velocity from a ring main using multiple spigots (Paddock TSF) or discrete single discharge points (IPTSFs), such that sloped tailings beaches are developed. The sloped beaches allow liberated surface water to be concentrated around the decant facility and subsequently returned to the process plant. This is achieved by regular changing of deposition points in a methodical manner around the perimeter embankments (Paddock TSF) or at discrete locations around the pit rims (IPTSFs). The management and operation of the decant pump will address the requirement of keeping the pond as small as practical by maximising water recovery. Under no circumstances water is not allowed to pond against the perimeter embankments (Paddock TSF).

The following considerations relate to the operations of TSFs and IPTSFs:

- Frequent inspections must be made of the tailings and water return pipelines, discharge points, decant water recovery system and the supernatant pond location. All active facilities must be inspected 12-hourly when operating in accordance with the MMO Environmental Operating License.

  Only by regular inspection and appropriate remedial action can the performance of the water return system be optimised and operational problems be avoided.
- Operation, safety and environmental aspects must be periodically reviewed during an inspection by a suitably experienced and qualified TSF/ IPTSF design engineer or the Engineer of Record (EoR). This inspection must be done at least every year.
- The operational design of the facilities is aimed at:
  - Allowing the facilities to function with minimal daily input;
  - Maximising return water from the facilities;
  - Maximising tailings storage capacities of the facilities; and
  - Reducing environmental impacts (i.e., seepage losses from the facilities).

7.2 TAILINGS DEPOSITION COMPONENTS

7.2.1 Deposition Principles

The method of tailings deposition into the TSFs/ IPTSFs is the main controlling factor in achieving:

- Higher in-situ tailings densities;
- Higher water returns, and
- Maintaining embankment stability (Paddock TSF) and pit wall stability (IPTSFs).

To understand the tailings deposition requirements a detailed knowledge of the components of the tailings system is required. These components include and will be discussed in more detail below:

- Tailings pipework;
- Spigotting process; and
- Tailings line flushing.

The following details are provided to enable an efficient tailings disposal system to be operated:

- Multiple spigots/discharge points located around the perimeter embankments of Paddock TSF shall be regularly changed to allow beaching of tailings placed in layers (increments) of approximately 300 mm thickness and to allow sufficient drying time to maximise the in-situ dry density of the deposited tailings. **Figure 2A** shows typical details of spigot offtakes on the embankment crests of existing TSFs.
- Tailings will be deposited sub-aerially (exposed to air) in thin layers at a low velocity from numerous spigot discharge points (Paddock TSF), to form a beach that slopes towards the central decant facility. Deposition will occur for a period of several days from each group of spigots. Information regarding tailings spigotting of Paddock TSF will be recorded on log sheets.
- Discrete single discharge points located at discrete locations around the pit rims of IPTSFs shall be regularly changed to allow beaching of tailings and to allow sufficient drying time to maximise the in-situ dry density of the deposited tailings. The sloped beach allows liberated surface water to be located around the decant pump location. Information regarding tailings spigotting of IPTSFs will be recorded on log sheets. **Figure 2B** shows a typical detail of single discharge point close to the pit rim of existing and proposed IPTSFs.
- The deposited tailings must be allowed to dry for as long as possible before being covered by the next layer of tailings.
- Low velocity discharge is preferred, as this allows the coarser slurry fraction to drop out of suspension at the discharge point, due to sudden change or drop in velocity, with the finer material progressively deposited towards the centre of the facility.
- High discharge velocities result in erosion of previously deposited tailings and formation of channels towards the centre of facility, causing uneven tailings deposition, uneven beach development and turbid water, and as such must be avoided.

7.2.2 Tailings Pipework and Spigotting for TSFs/ IPTSFs

Tailings is transported from the process plant to the active TSFs/ IPTSFs via a large diameter 560 mm OD PE100 PN12.5 pipe. At the Paddock TSF, the tailings delivery pipe is split into 2 tailings distribution lines to discharge tailings around the facility from multiple spigots. At the IPTSF, the tailings delivery pipe extends a minimum distance of 5 m over the crest and at the discrete single discharge point(s), from where the tailings is deposited into the facility.

7.2.2.1 South Cell TSF

The Paddock TSF is currently inactive although the tailings distribution pipeline is currently still in place at the Southern Cell. If tailings deposition was to occur into the Southern Cell, it would be undertaken sub-aerially utilising multiple spigots located on the perimeter embankments. Spigots are located at approximately 20 m intervals. The tailings beach slope based on the previously provided survey data was generally in the order of 1:300 (V:H).

Tailings discharge or spigotting is to be carried out such that the supernatant water pond is maintained around the central decant of the facility. The supernatant pond is to be maintained as small as practical.

7.2.2.2 IPTSF 2/2-2/4

Tailings in the form of slurry is discharged sub-aerially from two single discharge points, one in the northern end of Pit 2/2 and one in the northern end of Pit 2/4. Tailings will be discharged intermittently between these two discharge points.

Tailings discharge is to be carried out such that the supernatant water pond is maintained adjacent to the access ramp in the southern pit end. The supernatant pond is to be maintained as small as practical.

7.2.2.3 IPTSF 9/2

Tailings in the form of slurry is discharged sub-aerially from various single discharge points, located initially in the southern end of the IPTSF 9/2. Depositing the tailings in this manner is enable the water pond to remain adjacent to the access ramp in the north-west pit end. As the tailings surface approaches the pit crest in the northern end, gradually moving the discharge points towards the east along the southern crest to optimise the pit storage capacity.

The discharge points are spaced at 75 m intervals. The tailings has been cascaded over the benches within the pit to the pit floor and gradually flown towards the far end of the pit, forming a beach slope angle of up to 5% near the discharge point location and a beach slope angle of up to 1% at a distance from the discharge point location.

Tailings discharge is to be carried out such that the supernatant water pond is maintained adjacent to the access ramp in the north-west pit end. The supernatant pond is to be maintained as small as practical.

7.2.2.4 IPTSF 18/6

Tailings deposition into the IPTSF 18/6 is undertaken from a single discharge point located on the southern pit rim. Tailings deposition is undertaken to achieve a tailings beach with a slope towards the northern pit end, where a decant pump deployed from an existing access ramp for water recovery. The decant pond was initially form in the lowest part of the facility in the centre, before expanding further north to a point accessible by the decant pump.

Tailings discharge is to be carried out such that the supernatant water pond is maintained adjacent to the access ramp in the northern pit end. The supernatant pond is to be maintained as small as practical.

7.2.2.5 IPTSF 17 Series

Tailings deposition into IPTSF 17 Series takes place from four discharge points on the northern pit rim, resulting in a tailings beach sloping toward the southern pit end, where a decant pump is deployed from an existing access ramp for water recovery. The decant pond will initially form in the lowest part of the facility in the centre, before expanding further south to a point accessible by the decant pump.

Tailings discharge or spigotting is to be carried out such that the supernatant water pond is maintained adjacent to the access ramp in the southern pit end. The supernatant pond is to be maintained as small as practical.

7.2.2.6 IPTSFs 815, 7 Series and 8 Series (Proposed)

Tailings deposition into the IPTSFs 815, 7 Series and 8 Series takes place from discrete single discharge points. Deposition to occurs from one side of the pit, resulting in a tailings beach sloping towards the opposite site, where a decant pump is deployed from an existing access ramp for water recovery. The decant pond will initially form in the lowest part of the facility (potentially in the centre location), before expanding further to a point accessible by the decant pump.

Tailings discharge is to be carried out such that the supernatant water pond is maintained adjacent to the access ramps in the eastern pit end (Pits 815 and 7 Series) and in the western pit end (Pit 8 Series). The supernatant pond is to be maintained as small as practical.

7.2.3 Tailings Line Flushing

At the completion of sequential deposition of tailings, each line to the distribution point will be flushed with water until it is clean. Flushing proceeds in the same sequential manner as tailings spigotting. Flushing shall be undertaken so any discharge is directed away from the perimeter embankment (Paddock TSF)/pit wall (IPTSFs) and monitored to ensure water does not flow back towards the perimeter embankment/pit wall and cause any scour or erosion.

Flushing is not recommended to be undertaken at night shift. If flushing is undertaken on night shift, adequate temporary lighting shall be installed to allow visual monitoring of water flow. The flushing operations will be supervised by the Tailings & Water Coordinator.

7.3 FREEBOARD AND DECANT OPERATION

7.3.1 Freeboard

The DMIRS (2015) sets out freeboard requirements. The DMIRS has defined terminology relating to freeboard for tailings storages and provides minimum freeboard criteria.

For the purposes of TSFs and IPTSFs operations, the following is emphasised in respect to freeboard. Freeboard comprises three distinct elements: operational freeboard, beach freeboard and total freeboard. These elements are graphically illustrated on **Figure 3A** (for TSFs) and **Figure 3B** (for IPTSFs). Each element is defined as follows:

- The operational freeboard is the difference in height between the embankment crest and the adjacent tailings beach. The minimum operational freeboard defined by the DMIRS is 300 mm.
- The beach freeboard is formed by the sloping tailings beaches. The average beach freeboard relates to the average depth of the inverted cone, measured from the tailings beach around the perimeter of the storage, to the water level surrounding the central decant facility less the height required for the 1 in 100 year AEP, 72-hour storm event. The minimum beach freeboard specified by the DMIRs is 200 mm; the allowance for a 1 in 100 year AEP, 72-hour rainfall event above the operating pond level is equivalent to a rainfall depth of approximately 180 mm.
- The minimum required total freeboard as defined by the DMIRs is the addition of the above two components, operational and beach freeboard, and is equal to 500 mm. The minimum freeboard required between the crest and any water pond at the decant facility for the site is thus 680 mm, taking into account the 1 in 100 year AEP, 72-hour rainfall event.

7.3.2 Decant Operation

During operations, each facility will house a manually operated decant pump which removes supernatant water and delivers water to the evaporation ponds.

The location of the supernatant water pond will be controlled by the tailings discharge sequence employed (refer to Section 7.2.2 for supernatant water pond location within each active facility).

The operational pond must be maintained as small as practical to maximise water return to the evaporation ponds, minimise seepage losses and optimise embankment stability.

The operational pond size will be largely governed by the dedicated decant pump efficiency (fixed central decant pump for Paddocks TSFs and floating pontoon-mounted pump for IPTSFs) in removing water from the tailings storage. Other controlling factors will be:

- Evaporation from the surface of the pond;
- Variations to the in-put of tailings water (per cent solids);
- Rainfall events;
- Difference in permeability between the tailings and the underlying rock units; and
- The ratio of horizontal to vertical permeability of the tailings.

7.4 ROUTINE INSPECTION AND MAINTENANCE

Refer to Section 8.1.2.

8. INSPECTIONS, MONITORING AND SURVEILLANCE

8.1 INSPECTIONS AND MAINTENANCE

8.1.1 General

Inspections shall comprise daily inspections by Process Plant Staff (Operator or Shift Supervisor), monthly reviews by Process Plant Management (Production Manager) and Annual Engineering Inspections and Audits by a suitably experienced and qualified TSF/ IPTSF design engineer or the Engineer of Record (EoR).

The inspection and maintenance log sheets/ proformas (Appendix B) included with this OMS Manual are to be completed in full and at the frequencies indicated on the proformas or when required. The inspection log sheets can be reviewed, revised and updated as required by operational personnel.

- Personnel Contact Details (to be provided by MMO) (1 page)
- Assembly Points (to be provided by MMO) (1 page)
- Staff Confirmation Log Sheet (1 page)
- Daily Inspection Log Sheet (1 page)
- Monthly Inspection Log Sheet (1 page)
- Incident Report Forms (3 pages)

The inspection log sheets can be reviewed, revised and updated as required by operational personnel. Hard copies of all inspection records must be filed and retained on site for auditing purposes.

Various inspections covered by the proformas are discussed in the following sections. Any points of concern or unusual occurrences observed during any inspection must be reported to Process Plant Management for their review and consideration and if required a suitably experienced and qualified TSF/ IPTSF design engineer or the EoR must be contacted for assistance or advice with a record kept of any actions planned or taken.

Undertaking regular inspections and monitoring is aimed at identifying any problems prior to them causing a major impact on the operation and/or integrity of the TSFs/ IPTSFs. The inspections may result in the identification of an event that may require reporting to Process Plant Management and in some cases to relevant Government Departments, namely the DMIRS/ and/or Department of Water and Environment Regulation (DWER).

The DMIRS and DWER also have reporting criteria for specific events or occurrences that are specified on mining lease clauses or licence conditions. Typical reporting events include:

- Any fauna death on or near the TSFs/ IPTSFs (not roadkill).
- Any uncontrolled release of tailings slurry or return water and the cause (pipe break, overtopping, pump malfunction, automatic switch malfunction and operator error).
- Impacts from seepage (vegetation distress, soil contamination, water quality changes).
- Defects to the TSFs/ IPTSFs, such as to the embankments/pit walls or return water/decant facilities.
- Changes in water quality that exceed prescribed conditions of licence criteria.
- Increases in production tonnages.

8.1.2 Routine Inspection

Routine inspections and maintenance procedures, as detailed below, are to be undertaken by an Operator or Shift Supervisor 12-hourly, in accordance with the MMO Environmental Operating License. The date and time of each inspection is to be entered into the Shift Supervisor's log book and is to be signed by the person allocated to undertake the inspection on that shift to ensure the requirements have been undertaken. The Shift Inspection Log Sheet is to be filled out on a daily basis.

All personnel involved with the daily inspection of the TSFs/ IPTSFs shall sign the staff confirmation log sheet, to confirm they have received adequate training and understand the safety and induction procedures related to the TSF/ IPTSF operation and maintenance.

Routine inspections must cover the following, as appropriate:

- Pipelines (tailings delivery line and water return line) to and from the TSFs/ IPTSFs.
- Leak detection (pipes).
- Tailings pumps.
- Spigots/discharge points and valves.
- Tailings deposition and spigotting (discharge flow/velocity, beaching characteristics).
- Location and size of the supernatant/decant water pond.
- Condition of decant structure and water pump (Paddock TSF).
- Condition of pontoon-mounted pump (IPTSFs).
- Seepage water.
- Integrity of the perimeter embankments (Paddock TSF - South Cell), i.e. any new erosion, any new cracking, any new seepage (daily), any changes to existing erosion, cracking or seepage.
- Integrity of the pit walls of the IPTSFs i.e. any new cracking, any new seepage (daily).
- Condition of process water pond and return water pumps.
- Conditions of local access road around TSFs/ IPTSFs.
- Fauna and flora deaths.

8.1.2.1 Tailings Pipelines

All tailings lines are to be inspected a minimum of two times per shift, in accordance with the MMO Operating License. The date and time of each inspection is to be entered into the Shift Supervisor's log book.

All tailings lines must be bunded to contain any spill of contaminated liquid. Pipeline corridor spills will be contained in the scour sump.

All tailings lines shall be checked for:

- External damage, potential fractures, stress due to temperature extremes.
- Welds, flange gasket leaks, joint leaks and valve failures.

Any leaks or failures of the tailings pipeline must be immediately reported to the following personnel or project equivalents. Every attempt must be made to minimise the impact of the leak, including shutting down the processing plant until the damaged pipeline can be repaired. An incident report must be completed for any possible Environmental Damage/Loss.

- Shift Supervisor or Tailings & Water Coordinator.

Maintenance

Spigots (for TSFs) and discharge points (for IPTSFs), and tee pieces fitted with residue pipeline, are subject to wearing and breakage. Spigots and discharge points must be thoroughly inspected. If the spigots and discharge points are found to be faulty, a Work Request must be submitted so that maintenance can be conducted.

8.1.2.2 Decant System and Return Water Pipelines

The pond location and size and the decant pump position must be inspected at the same time as the tailings lines. If stormwater extends to the embankment at any time, it will only be a temporary occurrence as continuous water removal will be undertaken. Marker pegs (or similar) could be installed along the decant accessway to facilitate estimation of the water pond extent/ radius (for Paddock TSF).

The return water lines to the evaporation ponds must also be inspected at the same time as the tailings lines. The return water lines run in the same bunded route as the tailings lines. The return water line should be monitored and checked for.

- External damage, potential fractures, stress due to temperature extremes.
- Welds, joint leaks and valve failures.

Any abnormalities, leaks or failures of the tailings pipeline should be immediately reported to the following personnel or project equivalents. If a leak is identified, the decant pump should be stopped immediately to minimise the amount of water that is discharged to the environment. An incident report must be completed for any Environmental Damage/Loss.

- Shift Supervisor or Tailings & Water Coordinator.

The evaporation ponds must also be inspected on a regular basis to ensure that the water from the decant return water pipes is relatively clear and the level of the water in the pond is at or below the design water level (minimum freeboard of 500 mm).

Maintenance

A safe access to the decant return water pump must be maintained at all times to ensure that maintenance can be carried out if required. If the pump is found to be faulty, a Work Request must be submitted so that maintenance can be conducted.

8.1.2.3 TSF Embankment (South Cell)

Part of the general activities of the Operator or Shift Supervisor**,** when visiting the Paddock TSF, shall inspect the perimeter embankments, including crests, berms and batter slopes. Provision should be made for local access roads/tracks to drive along the downstream embankment toe.

The inspection shall note:

- Any embankment cracking, erosion or scour (caused by tailings deposition or rainfall runoff).
- Any water pooling on the embankment crest (caused by operations or rainfall runoff).
- Any new features such as seepage from the embankment. Any seepage at the TSF embankment toe must be monitored regularly to note any changes (especially increases). An increase may indicate a deteriorating embankment condition.
- Any vegetation growth, such that no trees become established while the TSF is active and before any vegetation reaches the sapling stage. Any such vegetation shall be removed.
- Any evidence of burrowing animals and their prevention must be ensured as appropriate.
- Any other obvious changes or problems.

If there is an increase of seepage water at the toe of the embankments, containment trenches (or any other measures) must be put in place to collect water. Any water collected in containment trenches at the toe of the embankments must be monitored regularly to note any changes (especially increases). An increase may indicate a deteriorating condition of the embankment.

No supernatant water pond must be allowed to rest against perimeter walls. During high rainfall events, if personnel safety allows it, the inspection frequency shall be increased. The inspections must ensure that the freeboard of the supernatant pond is within DMIRS guidelines.

Any problems or concerns must be noted on the inspection log sheet and immediately reported to the following personnel or project equivalents:

- Shift Supervisor or Tailings & Water Coordinator (and/or Production Manager).

8.1.2.4 IPTSF Pit Wall

Part of the general activities of the Shift Supervisor, when visiting the IPTSFs, shall be to inspect the pit walls, including the crest. The inspection shall note any cracking or new features, such as seepage, pit wall failures, erosion channels or scour (caused by tailings deposition or rainfall runoff) or any other obvious changes or problems.

During high rainfall events, if personnel safety allows it, the inspection frequency shall be increased. The inspections must ensure that the freeboard of the supernatant pond is within DMIRS guidelines.

Any problems or concerns must be noted on the inspection log sheet and immediately reported to the following personnel or project equivalents:

- Shift Supervisor or Tailings & Water Coordinator (and/or Production Manager).

8.1.3 Monthly Inspection

Monthly inspections of the TSFs/ IPTSFs must be carried out by Process Plant Management, with relevant observations documented in monthly inspection log sheet.

These inspections must assess the following items and note any changes which have occurred since the previous inspection. Items of particular interest are listed on the monthly inspection log sheet:

- Embankments/pit walls.
- Tailings deposition and spigotting.
- Decant system and return water pump.
- Seepage water recovery system.
- Tailings and return water lines.

- Tailings pump (at the plant site).
- Process plant information.
- Water balance.
- Phreatic surface (within perimeter embankment) monitoring.
- Environmental aspects (such as flora and fauna, climatic data and groundwater monitoring).

All the above items must be monitored closely to ensure the TSFs/ IPTSFs are operated and maintained in a satisfactory manner and the embankment/pit wall stability is maintained. If problems are encountered, a suitably experienced and qualified TSF design engineer or the EoR must be contacted, as an investigation may need to be instigated.

8.1.4 Engineering Inspection

An inspection by a qualified geotechnical engineer with experience in the design, operation and auditing of TSFs and IPTSFs is carried out at least once every year, in accordance with DMIRS (2013 and 2015) guidelines. Typical aspects that need to be addressed are discussed in Section 8.2.8.

8.2 MONITORING AND SURVEILLANCE

8.2.1 General

The following section details the monitoring requirements to ensure the TSFs/ IPTSFs perform according to the design parameters.

Water quality and water level information results are recorded on spreadsheets and plotted and graphed as soon as possible. The information must be reviewed after being entered and graphed to allow any changes to be identified and acted upon.

The plotting of recorded information allows trends to be determined. Where newly recorded information deviates (generally significantly) from a previously established trend, the reading must be checked, the general area must be inspected, and the information must be reported to Process Plant Management for consideration and action.

8.2.2 Paddock TSF – Embankment Monitoring

8.2.2.1 General

The embankment stability is crucial to the Paddock TSF's safe operation. Paddock TSF is monitored via visual inspections (Section 7.1.2) and an existing instrumented monitoring system. It is assessed that the existing monitoring system is adequate. Installation of additional instrumentation is not required at this stage.

The existing instrumented monitoring system for Paddock TSF (both Cells) comprises the following:

- Nineteen (19) piezometers (PZs);
- Twelve (12) vibrating wire piezometers (VWPs);
- Eleven (11) settlement pins (high accuracy GPS static survey measurements); and
- Thirty six (36) groundwater monitoring bores (MBs) (including around the evaporation ponds)

The locations of all existing instrumentation installed at and around the Paddock TSF are in Appendix C.

8.2.2.2 Standpipe Piezometers

Nineteen (19) piezometers (PZs) are installed within the paddock TSF embankments to monitor the water level/ phreatic surface within the embankments. Data has been measured since 2014.

Most of the instrumentation targets the South Cell, with only three shallow piezometers in the North Cell. No data was provided for piezometer TDP11 as it was destroyed and thus removed from the monitoring schedule. In addition, TDP17 was damaged in May 2017; therefore, no further data was obtained. Given the status of the facility, replacement of TPD17 is not required.

The North Cell piezometers (TDP14, TDP15 and TDP16) were dry to the installed depths (less than 3 m) throughout the 2022 audit period and therefore did not indicate water levels within the embankments.

8.2.2.3 Vibrating Wire Piezometer

Twelve (12) vibrating wire piezometers (VWPs) (6 x 2 pairs) were installed within the tailing beach in August 2020, to monitor the water level/ phreatic surface within the tailings beach.

The following observation is made regarding the VWP data:

- No data for KCB20-VWP D02 from 22/09/20 onwards. This could be due to the VWP being removed from the data logger, the cable is severed, or the VWP being destroyed. This was confirmed during the site inspection. MMO shall ensure the cable is checked and reconnected.
- KCB20-VWP F02 increased in water level in early December 2020 and started decreasing in mid-March 2021. The increase is still below the alert levels and appears to decrease.
- All the other VWPs appear to be constant or reducing slightly and are below the alert levels.

8.2.2.4 Settlement Pins

Eleven (11) settlement pins are installed along the paddock TSF embankments to monitor the embankment crest settlement. The displacements observed to date have been insignificant, corresponding to total movements generally equal to or less than 100 mm. However, displacement modelling undertaken previously by Golder in 2001 indicated that long-term maximum displacements exceeding 500 mm could be expected (ATC Williams, 2013).

8.2.3 IPTSF – Pit Wall Monitoring

The pit wall stability is crucial to the IPTSF's safe operation. A management system must be implemented to enable the identification of potential instability of the pit wall.

<u>For proposed IPTSF 815:</u>

It was advised that *"in mid-December 2022 twenty-four (24) VWPs were installed in eight (8) vertical boreholes drilled within the inter-pit pillars at Pit 815 (along the northern, western and southern sides of the Pit 815). VWP sensors were installed at the approximate local mid-points of intersected (major) lithological units (three (3) VWP per borehole). The VWP data confirmed the observation from the groundwater monitoring data, that supernatant water from the IPTSFs have infiltrated the adjacent ground to the Pit 815"*. It is assessed that those installed VWPs are adequate for the proposed IPTSF 815 operation.

<u>For proposed IPTSFs 7 Series and 8 Series:</u>

No VWPs are planned to be installed in the proposed IPTSFs 7 Series and 8 Series at this stage.

Monitoring and management requirements for IPTSFs:

- Continue monitoring of VWPs (groundwater levels) and inclinometers (deformation/ displacement) if they are available, and consult the EoR for any unusual reading changes.
- Make general observations regarding crack development and any potential seepage along the exposed pit wall surfaces in order to assess if a pit wall failure is developing.
- Continue daily monitoring for crack and seepage, and consult the EoR if the rate of crack and seepage development changes.
- The visual inspection report must be entered into an inspection log that details the date the inspection was carried out, comments from the inspection, remedial works required, if any, and the date the remedial works are completed.

8.2.4 Environmental Aspects

8.2.4.1 Climatic Data

Rainfall and evaporation data are being collected. The MMO meteorological station collects rainfall data as it occurs, automated data is collated in the online system and transferred via emails to site based user groups. The station also collects solar exposure data on a daily basis and this is used to mathematically estimate evaporation for the month. The daily/ monthly totals of rainfall and evaporation are used in the water balance.

It is noted that the Paddock TSF is no longer operating and therefore not included in the carbon footprint for the Nickel products from Murrin Murrin. The in-pit tailings disposal is considered in the carbon footprint and the data capture requirements is included in the Murrin Murrin specific Carbon Accounting Appendix, being developed by Glencore Group.

Risks of extreme weather events (including relevant to the TSFs in the context of climate change are captured in the Murrin Murrin Climate Change risk assessment, which is updated on an annual basis.

8.2.4.2 Groundwater Monitoring (Level and Quality)

The current MB network established around TSFs/ IPTSFs must be used to monitor groundwater levels and water quality. This information, where applicable, is required to demonstrate compliance with licence reporting conditions.

The water level measurements and quality testing requirements (including analytes to be tested) are conducted at the following locations at frequencies required by the DWER licence conditions:

- Paddock TSF (North and South Cells) and evaporation ponds: 36 monitoring points, quarterly.
- In-pit TSFs:
  - Pits 2/2-2/4: 3 x monitoring points every quarter.
  - Pit 2/3: 4 x monitoring points every quarter.
  - Pit 8/4: 4 x monitoring points every quarter.
  - Pits 8/5-9/4: 6 x monitoring points every quarter.
  - Pit 9/2: 6 x monitoring points every quarter.
  - Pit 9/5: 5 x monitoring points every quarter.
  - Pit 18/3: 3 x monitoring points every quarter.
  - Pit 18/6: 2 x monitoring points every quarter.
  - Pit 17 series: 12 x monitoring points initially every month for six months, then every quarter.
  - Pit 815: proposed 4 x monitoring points initially every month for six months, then every quarter.

  - Pit 7 Series: proposed 10 x monitoring points initially every month for six months, then every quarter.
  - Pit 8 Series: proposed 10 x monitoring points initially every month for six months, then every quarter.
- Water levels in the MBs must be measured quarterly, and water samples must be taken quarterly from MBs to check water quality as per the DWER licence conditions.
- Water samples collected shall be tested by a NATA accreditation laboratory for the specified analyses. Water quality testing must cover at a minimum: pH, TDS, anions and cations for the MBs listed in the DWER licence conditions

Water level and quality information must be recorded on spreadsheets and plotted and graphed as soon as possible. The information must be reviewed after being entered and graphed to allow any changes to be identified. The plotting of recorded data will enable trends to be determined. Where newly recorded information deviates significantly from a previously established trend, the reading must be checked, the general area must be inspected, and the data must be reported to Process Plant Management for consideration and action when/if required.

Response actions will be implemented if the groundwater level approaches the 4 mbgl limit as per the DWER licence conditions. Such actions may involve appropriate studies and mitigation measures to control seepage (i.e., review the decant operation and installation of recovery bores).

Collected information will be provided to the EoR periodically to include in the TSF/ IPTSF Annual Audit Report.

Each time the DMIRS mining lease conditions or DWER licence are renewed or updated, all conditions must be checked for any changes, with appropriate confirmation they have been read and records have been updated and will be acted upon as considered appropriate.

It is noted that the Murrin Murrin Water Management Plan captures the key activities in terms of water balance and monitoring of water quality. Risks for water usage and quality (including relevant to the TSFs in the context of climate change are captured in the Murrin Murrin Climate Change risk assessment, which is updated on an annual basis.

Approval and development of the Murrin Murrin Paddock TSF included collection of detailed ecological baseline, management of impacts, including the collection and re-use of topsoil and vegetative matter and ongoing monitoring of the ecology around and downstream of the TSF. A similar process occurs before and during the development of the Mining open pits, including an update of the environment assessment and management controls to support conversion to an In-Pit TSF.

8.2.4.3 Water Balance

The water discharged to the TSFs/ IPTSFs, and the water withdrawn are totalised each day from data collected from the tailings discharge and pumps that draw water back from the TSFs/ IPTSFs. In each annual review, this data is combined with rainfall and evaporation records to create a water balance specifically for the TSFs/ IPTSFs. The method for maintenance of the site water balance data, which provides the extracted and discharged values is described and in the MMO Water Management plan.

8.2.4.4 Dust Control

Should dust generation during construction due to wind and/or construction activities, the following methods must be considered to mitigate dust spreading over the TSF/ IPTSF sites and adjacent areas that would lead to changed visibility and dust inhalation:

- Construction materials moisture conditioned at borrow locations and/or at the TSF embankment area, little dust generation from fill.
- Haul roads watered (with water carts when required) and dust suppressants used based on scope of work requirements. Operator radio instruction for watering as required.

Should excessive dust from the tailings beach be generated during operation, the following methods must be considered:

- Rotation of spigot points around the facility to maintain damp beaches. This must be adjusted with the aim of reducing drying time cycles between depositions (for example, depositing thinner layers of tailings). However, care must be taken to maintain the intent of the deposition plan.
- Using dust suppressants, silt fences and windbreaks, etc. when required.

8.2.4.5 Noise

The effects of noise during construction and operations of the TSFs/ IPTSFs will be minimal as only vehicular movement is entailed. Due to an absence of human habitation near the TSFs/ IPTSFs, this aspect was considered to not pose a risk during TSF operations.

8.2.5 Process Plant

The following information must be recorded at a minimum monthly, or more frequently if possible, with the information to be used for water balance estimation as part of the TSF/ IPTSF annual audit:

- Ore treatment, measured in dry tonnes.
- Tailings slurry density, measured in % solids or slurry water volume.
- Water return from all sources from the tailings storage to the process plant, measured in cubic metres or tonnes.

8.2.6 Tailings Properties

The following tailings properties must be investigated or measured either independently of or in conjunction with the audit. If there are significant variances in tailings properties and strength, the TSF/ IPTSF design and this OMS shall be reviewed and updated accordingly.

Sampling of the deposited tailings on the ‘dried’ beach including recovery of disturbed bulk samples and undisturbed samples (tubes) must be undertaken to allow laboratory testing, nothing that sampling will only be undertaken if safe access to the tailings beach is possible. Laboratory testing should include:

- Particle size distribution (PSD) and Atterberg limits.
- Moisture content and Standard compaction.
- Emerson class and triaxial shear.

If required, shear vane and/or cone penetration testing (CPT) on the tailings beach along the perimeter embankment alignment will be conducted in order to provide geotechnical parameters for validation of embankment stability assessments.

The requirement for sampling and testing in any subsequent audit will be based on the previous year’s results and any variations in the tailings feed, such that the repetitive testing of similar materials is avoided.

8.2.7 Storage Monitoring

A detailed survey by the mine surveyor of the tailings mudline surface and water pond level surveys shall be carried out at least annually. This will enable the storage volume consumed to be reconciled with the tailings tonnage deposited into the storage to establish an in situ density of the deposited tailings for comparison with the adopted design density. This survey will also allow measurement of the in situ tailings beach slope for comparison with the adopted design value. Based on the results, ongoing predictions of the storage life of the facility can be made

If there are significant variances in tailings density and beach slope, the TSF/ IPTSF design and this OMS shall be reviewed and updated accordingly.

Table 11 summarises storage capacities of various active facilities and estimated remaining capacity in each facility (Tetra Tech Coffey audit report, 2023).

Table 11: Details of Remaining Tailings Storage Volume of Active TSFs/ IPTSFs

Facility	Minimum Crest Level (mAHD)	Tailings Storage Volume Remaining (m^3)	Tailings Storage Capacity Remaining (t)*
Existing Facilities		**(Estimated since July 2023)**	**(Estimated since July 2023)**
Pit 2/2	454.3	730,975	584,780
Pit 2/4	454.3	23,765	19,012
Pit 9/2	458.1	617,186	493,749
Pit 9/5	459.0	289,183	231,346
Pit 18/6	458.1	303,070	242,456
Pit 17 Series	457.6	7,278,482	5,822,786
TSF South Cell	453.5	N/A	N/A
TOTAL		**9,242,661**	**7,394,129**
Proposed Facilities		**(Estimated as part of new IPTSF design, Feb 2024)**	**(Estimated as part of new IPTSF design, Feb 2024)**
Pit 815	462.2	3,647,040	2,917,632
Pit 7 Series	443.0	6,336,361	5,069,089
Pit 8 Series	447.5	21,608,122	17,286,498
TOTAL		**31,591,523**	**25,273,219**

Note: * IPTSFs capacities are estimated based on an expected dry density of 0.8 t/m^3.

Based on the FY22 tailings throughput of 4.62 Mtpa, the remaining storage life of the existing IPTSFs would be approximately 19.2 months (1.6 years) (Tetra Tech Coffey audit report, 2023). The TSF South Cell is excluded from the remaining storage volume and life calculations since MMO only uses in-pit tailings deposition.

8.2.8 Annual Audit and Management Review

In addition to the daily and monthly inspections, an annual audit and management review must be undertaken by a suitably experienced and qualified TSF design engineer or the EoR, in accordance with DMIRS (2013 and 2015) guidelines.

The objective of the annual audit will be to assess the integrity of the TSFs/ IPTSFs against design and regulatory conditions. The audit will be undertaken via a site inspection of the TSFs/ IPTSFs and the collection of relevant site data.

The audit would typically include the following scope of works to satisfy DMIRS auditing requirements:

- Site visit to review and assess all operating TSFs/ IPTSFs.
- Comment on the condition of each operating facility.
- Review and comment on operational aspects (spigotting, freeboard, water return).
- Review and comment on current licence conditions.

- Review any relevant studies or investigation undertaken during the audit period.
- Review monitoring bore water quality and water level information.
- Review survey information (for tailings density reconciliation and remaining storage volume assessment).
- Review environmental aspects.
- Compare any new information against design information. This would typically include an assessment of the filling rate using survey and density; if the information varies from the design, prediction of the storage life of the facility can be made.

9. EMERGENCY PREPAREDNESS AND RESPONSE PLAN

9.1 GENERAL

This section mainly includes the details of the Paddock TSF Emergency Preparedness and Response Plan (EPRP). However, it is also considered applicable to the IPTSF when and if required. The trigger action response plans (TARPs) for both Paddock TSF and IPTSFs are prepared and included in Appendices D and F of this OMS, respectively.

The main purposes of the Paddock TSF EPRP (refer to the 2023 MMO Paddock TSF EPRP (0000-85-PLN-007-009) for details) are to

- Provide details on TSF emergency prevention, mitigation, preparedness, response and recovery;
- Complement the information provided in the MMO Crisis Management Plan and the OMS Manual (this document); and
- Provide specific response measures to various types of emergencies/ credible failures associated with the Paddock TSF, including both a potentially imminent and actual dam failure occurrence.

The plans and procedures described in the MMO Paddock TSF EPRP are informed by the MMO Dam Failure Bowtie Risk Assessment (conducted by MMO in April 2023).

To enable the MMO Paddock TSF EPRP to be implemented and to allow a safe and timely response to be instigated, the attached forms in this OMS Manual (Personnel Contact Details and Assembly Points) outline current information pertaining to personnel contact names and assembly points. The details and information of these forms will be provided by MMO (refer to the 2023 MMO Paddock TSF EPRP (0000-85-PLN-007-009) for details). The forms shall be reviewed at least six monthly or updated as required when new staff become responsible for activities in and around the TSFs.

Contractors shall also be made familiar with the location of the assembly points and be made aware of their reporting responsibilities and to whom they shall report to.

The form must provide a list of relevant contact details of staff associated with the TSFs, senior site responsible staff, safety officers and emergency services (refer to the 2023 MMO Paddock TSF EPRP (0000-85-PLN-007-009) for details).

All personnel associated with the TSFs are also required to sign a form as evidence that they have been inducted and are aware of assembly points and reporting procedures.

A Notification Flowchart for Paddock TSF Emergency has been prepared by MMO and included in Appendix E. An Emergency Procedure Flowchart for Paddock TSF Safety has been also prepared by Tetra Tech Coffey and attached in Appendix E.

9.2 INCIDENT REPORTING

The undertaking of regular inspections and monitoring is aimed at identifying any problems prior to them causing a major impact on the operation or integrity of the structure. The inspections may result in the identification of an event that may require reporting to Process Plant Management. Some cases may require reporting in accordance with the Mine Safety and Inspection Act 1994 to relevant government departments (DMIRS and/or DWER).

If any of the following events or incidents also need to be reported to DMIRS within 7 days or sooner (or as stipulated in the license conditions) of identifying an incident/problem or likely incident/problem. DWER conditions of licence must also be reviewed in respect to the timing and detail required for incident reports.

Each time the DMIRS mining lease conditions or DWER conditions or licence are renewed or updated all conditions must be checked for any changes, with appropriate confirmation they have been read and records have been updated and will be acted upon as considered appropriate.

Typical reporting events include:

1. Any fauna death on or near the TSFs/ IPTSFs (not road kill).
2. Any uncontrolled release of tailings slurry or return water and the cause (pipe break and/or leakage, overtopping, pump malfunction, automatic switch malfunction, operator error, etc.).
3. Impact from seepage (vegetation distress, soil contamination, water quality changes).
4. Defects to the TSFs/ IPTSFs covering such things as the embankments/pit walls, decant return water system, process water pond/tank.
5. Changes in water quality that exceed prescribed conditions of licence criteria.
6. Increases in production tonnages.

Prior to submitting an incident report to DMIRS/DWER, an assessment is undertaken to confirm the nature, type and impact of the incident by either Process Plant Management or an independent organisation. If an incident requires reporting to the DMIRS, as a minimum, the incident report form attached to this document should be used as well as any other regulatory reporting requirements.

9.3 TRIGGER ACTION RESPONSE PLANS (TARPS)

9.3.1 General

Trigger action response plans (TARPs) have been developed for the following items that are critical for safe operations of both Paddock TSF and IPTSFs:

- Maintaining the operational freeboard;
- Controlling the pond elevation and maintaining beach freeboard; and
- Monitoring the piezometer trigger levels (more applicable to the Paddock TSF).

Inspections must be carried out by well-trained staff familiar with the OMS Manual and TSF emergency procedures.

9.3.2 Paddock TSF - Freeboard

Freeboard is required to protect the Paddock TSF dam from overtopping or structural failure during extreme rainfall events.

9.3.2.1 Operational Freeboard

MMO does not operate the Paddock TSF, and therefore no slurry deposition is occurring. However, it is still a requirement from DMIRS that the 300 mm operational freeboard is maintained.

MMO must maintain the operational freeboard by reviewing the survey data and calculate the vertical height below the crest of the embankment. The trigger levels and appropriate responses for the operational freeboard are presented in Table 12.

Table 12: TARP for Operational Freeboard (Paddock TSF)

Trigger	Response Level	Notification	Action required
Tailings at 300mm below embankment crest.	Level 1 (Green)	TSF Supervisor/ Tailings & Water Coordinator to be notified	Continue to monitor the operational freeboard and in accordance with OMS Manual. Daily log sheet must be filled out on a shift basis indicating which areas are in the 300mm freeboard zone.
Tailings at 100mm below embankment crest.	Level 2 (Amber)	Production Manager and Environmental Superintendent to be notified. TSF Design Engineer/ EoR to be notified.	Continue to monitor the operational freeboard and increase the frequency of inspections and in accordance with OMS Manual. Information also needs to be recorded in the daily log sheet on a shift basis. If applicable, stop tailings deposition in the affected area. Corresponding valve must be closed and information tag attached to the spigot valve handle. Prepare a remedial action plan in consultation with the TSF Design Engineer/ EoR.
Tailings less than 100mm below embankment crest.	Level 3 (Red)	Production Manager and Environmental Superintendent to be notified. TSF Design Engineer/ EoR to be notified.	Continue to monitor the operational freeboard and further increase the frequency of inspections (if feasible) and in accordance with OMS Manual. Information also needs to be recorded in the daily log sheet on a shift basis. If applicable, stop all tailings deposition on the TSF immediately. Identify relevant resources required to be applied to rectify the issue and if necessary, follow the procedures for mine personnel (and community if applicable) warnings. Commence remedial works/ corrective action in accordance with the EPRP.

9.3.2.2 Decant Pond Elevation and Total Freeboard

Monitoring of the decant pond and available total freeboard is carried out by reviewing routine surveys and daily inspections. An inspection is also required following a significant rain event.

The trigger levels and appropriate responses for the decant pond and available freeboard are summarised in Table 13.

Table 13: TARP for Decant Pond and Available freeboard (Paddock TSF)

Trigger	Response Level	Notification	Action required
Decant pond within 200m of perimeter embankment; or Freeboard available (top of operating pond to the lowest point on crest) < 3m.	Level 1 (Green)	TSF Supervisor/ Tailings & Water Coordinator to be notified	Continue to monitor the decant pond extent/level and in accordance with OMS Manual. Daily log sheet must be filled out on a shift basis. If applicable, regular tailings discharge to continue, capacity for increased discharge to be confirmed.
Decant pond within 150 m of perimeter embankment; or Freeboard available (top of operating pond to the lowest point on crest) < 2m.	Level 2 (Amber)	Production Manager and Environmental Superintendent to be notified. TSF Design Engineer/ EoR to be notified.	Continue to monitor the decant pond extent/level and increase the frequency of inspections and in accordance with OMS Manual. Information also needs to be recorded in the daily log sheet on a shift basis. If applicable, increased tailings discharge is not recommended.
Decant pond within 100 m of perimeter embankment; or Freeboard available (top of operating pond to the lowest point on crest) < 1m.	Level 3 (Red)	Production Manager and Environmental Superintendent to be notified. TSF Design Engineer/ EoR to be notified.	Continue to monitor the decant pond extent/level and further increase the frequency of inspections (if feasible) and in accordance with OMS Manual. Information also needs to be recorded in the daily log sheet on a shift basis. If applicable, stop all tailings deposition on the TSF immediately, and reduce the pond extent to an acceptable size. Identify relevant resources required to be applied to rectify the issue and if necessary, follow the procedures for community warnings. Commence remedial works/ corrective action in accordance with the EPRP.

9.3.3 Paddock TSF - Piezometers

A total of 19 piezometers (PZs) were installed within the paddock TSF embankments and measuring data since 2014. A total of 12 vibrating wire piezometers (VWPs) were installed within the tailing beach in August 2020.

To reduce the risk of failure, TSFs shall be operated to ensure the phreatic surface within the embankment is as low as practical. This can be achieved by maintaining the water pond around the central decant facility, such that no water ponds against the TSF perimeter embankment.

Individual trigger levels identified for each PZ/VWP currently installed within the Paddock TSF embankments are summarised in Table 14. The piezometer trigger levels and appropriate responses are summarised in Table 15.

Table 14: Piezometer Trigger Levels (Paddock TSF)

Cell	Location	Piezometer ID	Ground level (m RL)	GREEN trigger level (m RL)	AMBER trigger level (m RL)	RED trigger level (m RL)
South Cell Embankment	Starter	TDP1	446.50	< 441.2	441.2 – 442.5	> 442.5
	Starter	TDP2	446.50	< 441.2	441.2 – 442.5	> 442.5
	Starter	TDP3	446.50	< 441.2	441.2 – 442.5	> 442.5
	3B	TDP4	451.50	< 447.7	447.7 – 449.0	> 449.0
	3B	TDP5	451.50	< 447.7	447.7 – 449.0	> 449.0
	3B	TDP6	451.50	< 447.7	447.7 – 449.0	> 449.0
	3B	TDP7	451.50	< 447.7	447.7 – 449.0	> 449.0
	3B	TDP8	451.50	< 447.7	447.7 – 449.0	> 449.0
	3B	TDP9	451.50	< 447.7	447.7 – 449.0	> 449.0
	3B	TDP10	451.50	< 447.7	447.7 – 449.0	> 449.0
	3B	TDP12	451.50	< 447.7	447.7 – 449.0	> 449.0
	3B	TDP13	451.50	< 447.7	447.7 – 449.0	> 449.0
	3B	TDP18	451.50	< 447.7	447.7 – 449.0	> 449.0
	4B	TDP17	453.50	< 447.8	447.8 – 449.1	> 449.1
	4B	TDP19	453.50	< 447.8	447.8 – 449.1	> 449.1
South Cell Tailings beach	H01	S5084	451.74	< 448.0	448.0 – 449.2	> 449.2
	H01	S5089	451.74	< 448.0	448.0 – 449.2	> 449.2
	K01	S5085	450.85	< 448.0	448.0 – 449.2	> 449.2
	K02	S5104	449.30	< 448.7	448.7 – 450.0	> 450.0
	N01	S5091	451.70	< 448.0	448.0 – 449.2	> 449.2
	N02	S5102	450.37	< 448.7	448.7 – 450.0	> 450.0

North Cell Embankment	4A	TDP14	457.50	< 451.9	451.9 – 453.2	> 453.2
	4A	TDP15	457.50	< 451.9	451.9 – 453.2	> 453.2
	4A	TDP16	457.50	< 451.9	451.9 – 453.2	> 453.2
North Cell Tailings Beach	A01	S5086	456.42	< 451.9	451.9 – 453.2	> 453.2
	A02	S5103	454.84	< 453.1	453.1 – 454.2	> 454.2
	D01	S5087	455.70	< 451.9	451.9 – 453.2	> 453.2
	D02	S5088	454.38	< 453.1	453.1 – 454.2	> 454.2
	F01	S5090	456.41	< 451.9	451.9 – 453.2	> 453.2
	F02	S5101	454.35	< 453.1	453.1 – 454.2	> 454.2

Table 15: TARP for Piezometer Monitoring (Paddock TSF)

Trigger	Response Level	Notification	Action required
Readings below the green trigger level	**No Response**	None required	No action necessary. Continue to monitor the piezometer levels and in accordance with OMS Manual.
Readings between the green and amber trigger levels	**Level 1 (Green)**	TSF Supervisor/ Tailings & Water Coordinator to be notified	Continue to monitor the piezometer levels and in accordance with OMS Manual. Carry out weekly visual inspections and look for signs of seepage/ wet spots/ distress/ potential failure.
Readings between the amber and red trigger levels	**Level 2 (Amber)**	Production Manager and Environmental Superintendent to be notified. TSF Design Engineer / EoR to be notified.	Continue to monitor the piezometer levels and in accordance with OMS Manual. Carry out detailed inspections daily and increase monitoring intervals to daily and look for signs of seepage/ wet spots/ potential failure. If applicable, stop tailings deposition in the affected area. Organise an inspection by the TSF Design Engineer/EoR. Prepare a remedial action plan in consultation with the TSF Design Engineer/EoR.
Readings above the red trigger level	**Level 3 (Red)**	Production Manager and Environmental Superintendent to be notified. TSF Design Engineer/ EoR to be notified.	Continue to monitor the piezometer levels and in accordance with OMS Manual. Carry out detailed inspections daily and increase monitoring intervals to daily, and look for signs of seepage/ wet spots/ potential failure (if feasible and safe to do). If applicable, stop all tailings deposition and construction works on the TSF immediately. Identify relevant resources required to be applied to rectify the issue and if necessary, follow the procedures for community warnings. Commence remedial works and increase emergency level to the highest level in accordance with the EPRP.

9.3.4 Paddock TSF - Embankment displacement

Eleven (11) GPS static survey prisms were installed along the Paddock TSF embankments in 2008. The displacements observed to date have been insignificant, corresponding to total movements equal to or less than 100 mm. The trigger levels and appropriate responses for the embankment displacement are summarised in Table 16.

Table 16: TARP for Embankment Displacement (Paddock TSF)

Trigger	Response Level	Notification	Action Required
Max. Displacement ≤ 125mm	Level 1 (Green)	TSF Supervisor/ Tailings & Water Coordinator to be notified	Continue to monitor the embankment displacement and in accordance with OMS Manual. Carry out weekly visual inspections and look for signs of distress / potential failure.
Max. Displacement ≤ 150mm	Level 2 (Amber)	Production Manager and Environmental Superintendent to be notified. TSF Design Engineer/ EoR to be notified.	Continue to monitor the embankment displacement and in accordance with OMS Manual. Carry out detailed inspections daily and increase monitoring intervals to daily and look for signs of distress/ potential failure. If applicable, stop tailings deposition in the affected area. Organise an inspection by the TSF Design Engineer/EoR. Prepare a remedial action plan in consultation with the TSF Design Engineer/EoR.
Max. Displacement ≥ 150mm	Level 3 (Red)	Production Manager and Environmental Superintendent to be notified. TSF Design Engineer/ EoR to be notified.	Continue to monitor the embankment displacement and in accordance with OMS Manual. Carry out detailed inspections daily and increase monitoring intervals to daily, and look for signs of distress/ potential failure (if feasible and safe to do). If applicable, stop all tailings deposition and construction works on the TSF immediately. Identify relevant resources required to be applied to rectify the issue and if necessary, follow the procedures for community warnings. Commence remedial works and increase emergency level to the highest level in accordance with the EPRP.

9.3.5 Paddock TSF - Embankment Crack

The trigger levels and appropriate responses for the cracks in the embankment face and/or along the embankment crest are summarised in Table 17.

Table 17: TARP for Embankment Crack (Paddock TSF)

Trigger	Response Level	Notification	Action Required
Max. Longitudinal Crack Width < 10 mm	Level 1 (Green)	TSF Supervisor/ Tailings & Water Coordinator to be notified	Continue to monitor the embankment crack and in accordance with OMS Manual. Carry out weekly visual inspections, and look for signs of distress/ potential failure.
Max. Longitudinal Crack Width >10 to < 80 mm	Level 2 (Amber)	Production Manager and Environmental Superintendent to be notified. TSF Design Engineer/ EoR to be notified.	Continue to monitor the embankment crack and in accordance with OMS Manual. Carry out detailed inspections daily and increase monitoring intervals to daily, and look for signs of distress/ potential failure. If applicable, stop tailings deposition in the affected area. Organise an inspection by the TSF Design Engineer/EoR. Prepare a remedial action plan in consultation with the TSF Design Engineer/EoR.
Max. Longitudinal Crack Width > 80 mm	Level 3 (Red)	Production Manager and Environmental Superintendent to be notified. TSF Design Engineer/ EoR to be notified.	Continue to monitor the embankment crack and in accordance with OMS Manual. Carry out detailed inspections daily and increase monitoring intervals to daily, and look for signs of distress/ potential failure (if feasible and safe to do). If applicable, stop all tailings deposition and construction works on the TSF immediately. Identify relevant resources required to be applied to rectify the issue and if necessary, follow the procedures for community warnings. Commence remedial works and increase emergency level to the highest level in accordance with the EPRP.

9.3.6 Paddock TSF - TARPs (Credible Dam-Related Emergency) by MMO

The following information is taken from the 2023 MMO Paddock TSF EPRP (0000-85-PLN-007-009).

TSF Emergencies are identified through in-place routine monitoring, surveillance and early warning systems such monthly VWP monitoring and monthly survey pick-up of the TSF walls to determine any stability concerns, with the data obtained subsequently analysed by the EoR, and as outlined in the OMS Manual and TARPs. TSF Emergencies may also be identified through non-routine observations by various personnel.

Once an emergency has been triggered, and standard notifications are issued, the process for determining the type and classification, along with the required level of the response to implement, is described in the MMO Crisis Management Plan (0000-85-PLN-007-007), along with the Emergency Management Structure that is in place.

A general description of each credible dam-related emergency is provided below, and is detailed in the TARPs in Appendix D. A Notification Flowchart for Paddock TSF Emergency has been prepared by MMO and included in Appendix E.

Instability

Instability can occur due to a number of mechanisms including seepage damaging the footing of the wall. Earthquakes can destabilise the wall.

Seismic Event

Earthquakes have the potential to cause damage to a dam wall weakening it to the point that it fails and then allows a breach could continue to escalate. Earthquakes can cause liquefaction in dam walls.

Internal Erosion

This could be through seepage of material out taking part of the wall with it. It could be through liquefaction which makes the stable wall thinner and thus more likely to breach.

Overtopping

Water build up on the top of the dam can rise to a level that it runs over the top of the wall of the dam. This is particularly prevalent in areas that have high rainfall events.

Abnormal conditions, that are not emergencies - but could become such if not addressed with adequate maintenance or operational actions, are addressed in more detail in the OMS Manual.

9.3.7 IPTSFs - TARPs

IPTSF Emergencies are identified through in-place daily routine monitoring/inspection, surveillance and early warning systems to determine any pit wall stability concerns, with the data obtained subsequently analysed by the EoR, and as outlined in the OMS Manual and TARPs. IPTSF Emergencies may also be identified through non-routine observations by various personnel.

Once an emergency has been triggered, and standard notifications are issued, the process for determining the type and classification, along with the required level of the response to implement, is described in the TARPs for IPTSFs (Appendix F).

9.4 OPERATIONAL RISK ASSESSMENT

9.4.1 Risk Identification and Register

The risk matrix in Table 18 was used to assess the risks and provide a rating.

Table 18: Risk Matrix

Probability		Consequence				
		Slight	**Minor**	**Moderate**	**Major**	**Extreme**
	Rare	Low	Low	Low	Medium	Medium
	Unlikely	Low	Low	Medium	Medium	Medium
	Moderate	Low	Medium	Medium	Medium	High
	Likely	Medium	Medium	Medium	High	High
	Very Likely	Medium	Medium	High	High	High

The risks and resulting hazards for the TSF/ IPTSF operational stages have been identified and presented in Table 19, along with the potential mitigation measures that reduce the consequence. The final column presents the risk rating after the implementation of proposed mitigation.

Table 19: Hazard Register with Preventative and Mitigation Measures and Revised Rating *

Risk	Hazards	Rating	Preventative Controls	Mitigation Measures (Referenced from Bowtie Risk Analysis)	Rating*
TSF Embankment Failure - Small Scale	• Personnel injury • Further collapse of subsidence • Damage to equipment and plant • Chemical contamination	Medium	• Routine inspections including additional monitoring in the event of instability • Acceptable outer slope geometry validated by construction compliance reports. • Stability to be validated during annual audits • Adequate construction compaction for raising	• Appropriate EPRP • Adequate Insurance Policy • Identify, Register and Log Coordinates of Sites	Low
TSF Embankment Failure - Large Scale	• Personnel injury, drowning or other fatality • Further collapse of subsidence • Damage to equipment and plant • Buried Personnel, plant or equipment • Chemical contamination	High	• Routine inspections including additional monitoring in the event of instability. • Acceptable outer slope geometry validated by construction compliance reports. • Stability to be validated during annual audits • Adequate construction compaction for raising	• Appropriate EPRP • Adequate Insurance Policy • Identify, Register and Log Coordinates of Sites	Medium
TSF Embankment / IPTSF Pit Wall Erosion	• Development of embankment/pit wall failure • Localised soil transport • Subsidence and/ or damage to distribution pipeline • Damage to pedestrian or vehicular traffic on access way	Medium	• Routine inspections • Groundwater monitoring. • Maintain relatively small water pond. • A resultant low phreatic surface. • Adequate decant operation.	• Appropriate EPRP • Adequate Insurance Policy • Identify, Register and Log Coordinates of Sites	Low
TSF Embankment Settlement or Lateral Movement	• Development of embankment failure • Reduction of freeboard which could lead to over topping • Subsidence and/ or damage to distribution pipeline • Damage to pedestrian or vehicular traffic	High	• Routine inspections. • Acceptable slope geometry validated by construction compliance reports. • Adequate construction compaction for raising.	• Appropriate EPRP • Adequate Insurance Policy • Identify, Register and Log Coordinates of Sites	Medium

Risk	Hazards	Rating	Preventative Controls	Mitigation Measures (Referenced from Bowtie Risk Analysis)	Rating*
Seepage from TSF/ IPTSF	• Damage to Flora • Development of embankment failure	Medium	• Routine inspections • Maintain drainage recovery bore operation • Groundwater monitoring.	• Appropriate EPRP	Low
Burst or Leakage of Tailings Delivery Pipeline	• Injury to personnel • Damage to flora • Damage to fauna • Surface Erosion	Medium	• Routine inspections • Periodic rotation of pipelines. • Pipe wall thickness checking. • Preventive maintenance with a replacement policy. • Automatic shut-off valves on the pipelines	• Appropriate EPRP	Low
Burst of Leakage of Return Water Pipeline	• Injury to personnel • Damage to flora • Damage to fauna • Surface Erosion • Groundwater contamination	Medium	• Routine inspections • Periodic rotation of pipelines. • Pipe wall thickness checking. • Preventive maintenance through replacement policy. • Automatic shut-off valves linked to pressure transducers located on the pipelines	• Appropriate EPRP	Low

9.4.2 Preventative Controls

The following sections provide preventative controls to potentially reduce the risk ratings (or probability) provided in the hazard register (Table 19).

It is noted that the critical controls to prevent a potential major embankment failure (Paddock TSF) is similar to the preventative controls as outlined below:

- Routine inspections as per Section 8.1.2;
- Embankment monitoring as per Sections 8.2.2 and 9.4.2.1;
- Freeboard and decant pond control as per Section 9.4.2.3; and
- Seepage monitoring as per Section 9.4.2.4.

9.4.2.1 TSF Embankment

The embankments of the Paddock TSF have been designed with an adequate factor of safety (FoS) against failure under normal operating conditions and seismic load conditions appropriate for the project location. However the following measures must be taken into consideration during the TSF operations:

- Routine inspections as per Section 8.1.2.
- Acceptable outer slope geometry validated by construction compliance reports and stability analyses.
- Stability to be validated during annual audits against an adequate FoS determined from assessments in the design report.
- Adequate construction compaction (QA/QC).

9.4.2.2 IPTSF Pit Walls

The pit voids from the mining process constitute the pit walls. Although the pit voids are considered stable (experience from stable adjacent pit voids and IPTSFs), routine inspections and pit wall monitoring must still be undertaken during the IPTSFs operations as per Sections 8.1.2 and 8.2.3, respectively.

9.4.2.3 TSF - Freeboard and Decant Pond Control

To reduce the risk of an embankment failure (Paddock TSF) due to high phreatic surface, the following measures must be taken into consideration the following measures:

- Routine inspections and groundwater monitoring as per Sections 8.1.2 and 8.2.4.2.
- Maintain relatively small water pond with no free water ponding against the perimeter embankments, this will result a low phreatic surface within the embankment.
- Adequate decant operation.

9.4.2.4 Seepage

To ensure drainage flow through the tailings contained in a storage facility does not compromise the stability of the embankment (Paddock TSF) the following measure must be considered:

- Routine inspections and groundwater monitoring as per Sections 8.1.2.
- Following operational aspects in this manual to achieve a desirable beach slope to keep pond away from perimeter embankment.
- Maintain drainage recovery bore operation.

9.4.2.5 Pipelines

Appropriate management of delivery, distribution and return water pipelines will reduce the risks of downtime and/or environmental damage associated with pipe blockages, leaks and bursts. The pipelines must be managed and taken into consideration the following measures:

- Routine inspections as per Section 8.1.2.
- Periodic rotation of pipelines (flanges to be date stamped for reference).
- Pipe wall thickness checking.
- Preventive maintenance through a periodic replacement policy.
- Automatic shut-off valves linked to pressure transducers located on the pipelines.
- Periodic clearing of vegetation under and around the pipelines to prevent damage from bush fires.

9.4.3 Response Actions

9.4.3.1 TSF Embankment/ IPTSF Pit Wall Failure

Under normal operating conditions the perimeter embankments (Paddock TSF) and pit walls (IPTSFs) are not expected to become unstable.

Given the adoption of the tailings deposition philosophy, adequate pontoon mounted pump operation, routine inspections and maintenance practices set out in the OMS Manual the probability of an embankment/pit wall failure during normal operations is low.

In the unlikely event of a major embankment/pit wall failure, the tailings within the facility will most likely remain within the facility or be confined within one of the adjacent pits.

No personnel shall enter the base of any operating pits (i.e. start-up). Access must be confined to ramps associated with decants.

Action to control a **small-scale** failure and limit environmental damage would include:

- Assess the requirement to direct deposition to alternative facilities, or reduce process plant throughput.
- Movement of tailings deposition to areas not affected by the small scale embankment failure.
- Contact a suitably qualified geotechnical specialist for technical assistance.
- Prior to the commencement of any repairs undertake a thorough inspection of the area.
- Undertake remedial and repair work of the damaged embankment or affected area.
- Clean up of tailings as soon as practical after repairs have been completed and the storage is considered in a safe condition.
- An incident report is to be completed, as discussed in Section 9.2.

Action to control a **large-scale failure** and limit environmental damage would include:

- Assess the requirement to shut down of the process plant.
- Direct deposition to alternative facilities.
- Contact a suitably qualified geotechnical organisation for technical assistance.
- Advise relevant government departments particularly DMIRS and DWER.
- Prior to the commencement of any repairs undertake a thorough inspection of the area with the assistance of a geotechnical specialist.
- Repair the damaged embankment in accordance with the specialist's instructions.
- Clean up of tailings as soon as practical after the repairs have been completed.

- An incident report is to be completed, as discussed in Section 9.2.

It must be stressed, however, that the safe operation of the in-pit facilities relies upon the implementation of operational procedures which comprise tailings deposition, decant operation; and routine inspections and maintenance, as set out in the OMS Manual to minimise the potential for a catastrophic event such as a failed embankment.

9.4.3.2 TSF Embankment/ IPTSF Pit Wall Erosion

- If erosion has developed to a point where collapse may be imminent, proceed as per Section 9.4.3.1.
- Otherwise install bunds or drains to divert water flow away from the area of erosion and install any necessary protective barriers to protect personnel or vehicles.
- Report circumstances to Tailings and Water Management Supervisor/ Coordinator.
- The Tailings and Water Management Supervisor/ Coordinator is to inspect the site and either; arrange appropriate rectification measures; or contact the EoR for specific advice.
- An incident report is to be completed, as discussed in Section 9.2.

9.4.3.3 TSF Embankment Settlement or Lateral Movement

- If movement has developed to a point where collapse may be imminent, proceed as per Section 9.4.3.1.
- Otherwise install bunding or drains to limit flow of water into depression cracks and install any necessary protective barriers to prevent personnel and vehicles entering the area and to limit additional loading of the surface at the area of movement.
- Placement of rockfill (consider use of filters as appropriate) against the toe of the embankment if there is evidence of lateral movement outwards.
- Report circumstances to the Tailings and Water Management Supervisor/ Coordinator/ Superintendent.
- The Tailings and Water Management Supervisor/ Coordinator/ Superintendent is to inspect the site and arrange any additional emergency measures and contact the EoR for specific advice.
- An incident report is to be completed, as discussed in Section 9.2.

9.4.3.4 Seepage

- If during any inspection of the Paddock TSF, wet surface areas or areas in the vicinity of the TSFs, the Tailings and Water Management Supervisor/ Coordinator is to be notified.
- The Tailings and Water Management Supervisor/ Coordinator is to inspect and photograph the site, ascertain details of location and extent of seepage and proceed as outlined in Section 9.4.3.2.
- The EoR is to be advised of details as soon as possible.
- An incident report is to be completed, as discussed in Section 9.2.

9.4.3.5 Power Outage and Decant Pump Failure

The decant pump(s) is operated to recover water from the TSFs/ IPTSFs when available. The decant pump(s) is operated manually and run at all times. The pumps are only switched off during:

- Shutdowns;
- When dirty water is pumped into the evaporation pond; and
- When it is necessary during periods of rainfall to ensure minimal water on the storage.

Action to control:

- If power outages and/or TSFs/ IPTSFs decant pumps failures that could lead to an increase in the decant pond size during a storm event, hence impact to seepage and embankment stability, the TSF Operator could deploy and use a diesel generator and the standby pump(s).
- Report circumstances to Tailings and Water Management Supervisor/ Coordinator.
- The Tailings and Water Management Supervisor/ Coordinator is to inspect the site and either arrange appropriate rectification measures or contact the EoR for specific advice.
- An incident report is to be completed, as discussed in Section 9.2.

9.4.3.6 Burst or Leakage of Tailings Delivery Pipeline

The tailings lines from the process plant to the tailings storages and the return water lines from the fixed decant pump (Paddock TSF) and floating pontoon mounted pumps (IPTSFs) to the evaporation ponds are to be located inside bunded open trenches to contain any spillage of materials resulting from lines which develop leaks or burst during operation.

- If alert to hazard arises from control room instrumentation (drop in pressure in delivery lines), immediate inspection of the line is required to locate and assess the leakage.
- If automatic shutdown/diversion of tailings flow has not occurred, Tailings and Water Management Supervisor/ Coordinator shall arrange appropriate shut down or diversion.
- If alert to the hazard alert arises from inspection, the Tailings and Water Management Supervisor/ Coordinator is to be advised immediately who shall arrange appropriate shut down or diversion.
- At the location of the leakage, the Tailings and Water Management Supervisor/ Coordinator is to inspect the site and arrange appropriate additional containment and/or clean up in association with the Environmental Advisor.
- The Tailings and Water Management Supervisor/ Coordinator is to ascertain the causes of the leakage/burst and institute procedures or measures to minimise risk of recurrence.
- An incident report is to be completed, as discussed in Section 9.2.

9.4.3.7 Burst or Leakage of Return Water Pipeline

- If alert to hazard arises from control room instrumentation (drop in pressure in delivery lines), inspection of the line is required to locate and assess the leakage.
- If automatic shutdown of the return water pump has not occurred, pump is to be shut down immediately.
- If the hazard alert arises from inspection, the Tailings and Water Management Supervisor/ Coordinator is to be advised immediately who shall arrange appropriate shut down.
- At the location of the leakage, the Tailings and Water Management Supervisor/ Coordinator is to inspect the site and arrange appropriate additional containment and/or clean up in association with the Environmental Advisor.
- The Tailings and Water Management Supervisor/ Coordinator is to ascertain the causes of the leakage/burst and institute procedures or measures to minimise risk of recurrence.
- An incident report is to be completed, as discussed in Section 9.2.

10. CLOSURE AND REHABILITATION PLAN

This OMS Manual contain copies of pro forma log sheets and lists of information to be inspected and recorded on a daily and monthly basis. When TSFs/ IPTSFs are close to full capacity, closure/rehabilitation plans preparations will need to be implemented. Upon completion of tailings placement within each facility, the surface will undergo appropriate capping material and local flora species to revegetate the surface of each facility.

Prior to the commencement of the rehabilitation program, each facility will undergo a topping up process. The topping up process maximises the storage capacity of the facility and reduces the impact of the final settlement of the tailings surface. Based on consolidation estimates, previously calculated, it is expected that rehabilitation work will not be able to commence for a period of up to four (4) years post completion of filling due to the expected low strength of the deposited tailings.

The Paddock TSF (South Cell) and IPTSFs 2/2-2/4, 9/2, 18/3 and 18/6 are nearing full capacity and closure is likely to happen in the near future. Due to the North Cell TSF and IPTSFs 2/3, 8/4 and 8/5-9/4 being full, these facilities may be closed earlier. These facilities should be closed and rehabilitated whilst continuing operations of the existing IPTSFs 9/5 and 17 Series and proposed IPTSFs 815, 7 Series and 8 Series.

It is noted that risks of climate change on closure plans (including relevant to the TSFs) are captured in the Murrin Murrin Climate Change risk assessment, which is updated on an annual basis.

10.1 STRATEGY

The preliminary rehabilitation and closure design for the TSFs/ IPTSFs should be based on the following guiding principles, which in order of priority are:

- Protect public health, safety and property;
- Ensure long-term physical and chemical stability of disturbed area;
- Design for a sustainable ecosystem and land use;
- Employ rehabilitation methods that are technically effective and cost efficient; and
- Standard and proven engineering practices to minimise ongoing maintenance.

As part of decommissioning:

- All the delivery and discharge pipes and valves should be removed from the closed TSFs/ IPTSFs;
- Power cable and pipe to the decant pump and the pump should be removed; and
- The stand pipes of the piezometers and ground water monitoring boreholes should be replaced with ground level covers, so that they are less obtrusive, but still available for monitoring.

In view of the potentially soft tailings it is desirable to create a firm surface by inducing consolidation of the tailings and capping the tailings with waste rock.

10.2 TOPSOILING

Rehabilitation of the TSF/ IPTSF areas would be designed to re-create, as far as possible, the vegetation cover that originally existed.

For this purpose the topsoil removed from the TSF (or other facilities) prior to construction will be redeployed on the final downstream slopes of the final batters of the TSF to assist with rehabilitation. The downstream slopes will be covered with topsoil, contour ripped, seeded with native species and fertilised as appropriate. Any remaining topsoil will be stockpiled in an adjacent location for use in later rehabilitation.

10.3 REHABILITATION TRIALS

Rehabilitation of TSFs/ IPTSFs must be researched and reviewed during the life of the project under the direction of personnel from the MMO environmental team. A detailed closure/ decommissioning plan must be prepared prior to decommissioning to confirm the feasibility of the preliminary rehabilitation and closure plan, including:

- Confirming water balance and final closure design;
- Review cover quantities, sources and cost of soil and rock materials available;
- Contact seed suppliers and identify any issues;
- Review re-vegetation opportunities;
- Carry out nutrient tests of local stockpiles soils; and
- Reassess closure plan, incorporating changes based on annual reviews.

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FIGURES

385000 390000 395000

6820000 6815000 6810000

204 203 202 North Tailings Cell South Tailings Cell 907 906 901 1801 1803 902 905 1806 805 804 1301 1308 1302 1303 1309 1304 803 807 806 1001 701 702 707 1954 703 705 105 108 104 102E 460 410 403 403 403 412 411 455 455 405 414 402 402

Current Fill Levels

Murrin Road System
- Haul Road
- Parking / Laydown
- Arterial Haul Road
- Light Vehicle Track
- Bitumen

Pit Boundaries
- Backfill
- Completed Mining
- Current Mining
- Water Harvesting

Stockpiles
- Blue Stockpile
- Green Stockpile
- Laterite
- Pink
- ROM
- Red Stockpile
- Skyway
- Waste Dump

Plant

385000 390000 395000

MINARA

Murrin Murrin Operations

Figure 1 - Site Layout
Murrin Murrin North

N

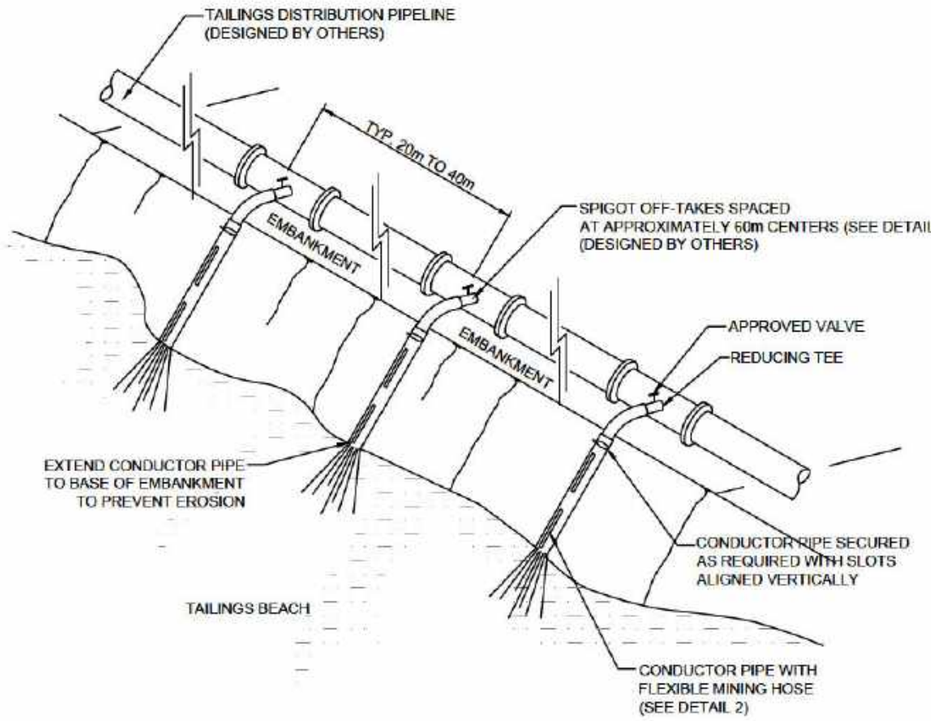
1:50,000

Projection : GDA 1994 MGA Zone 51
Datum : GDA 1994

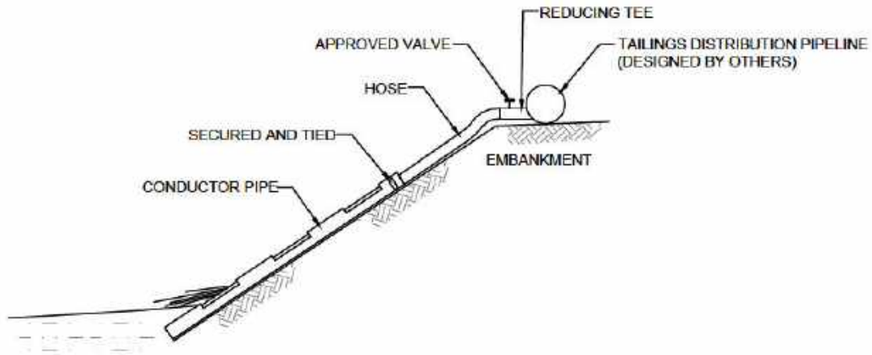
500 250 0 500 1000 1500 Meters

Originator :	
Company : Tetra Tech	Date : 27/05/2022
Drawn By : [redacted]	Revision : 0
File : O:\GIS\Maps\In Pit Tailings\TSF Audits\TSF Audits.aprx Map : Site Layout MMO	A3

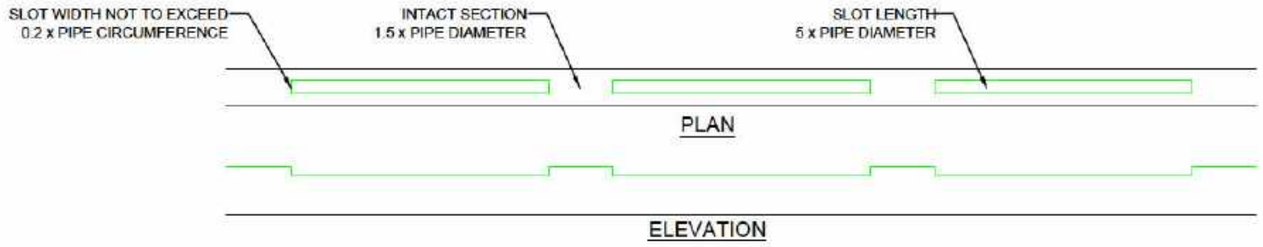
Minara Resources Pty Ltd ACN 000 370 785



SPIGOTTING ARRANGMENT
NOT TO SCALE



TYPICAL DETAIL 1 - SPIGOT OFF-TAKES
NOT TO SCALE



TYPICAL DETAIL 2 - CONDUCTOR PIPE
NOT TO SCALE

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Approved:	[redacted]
Date:	20-06-2023
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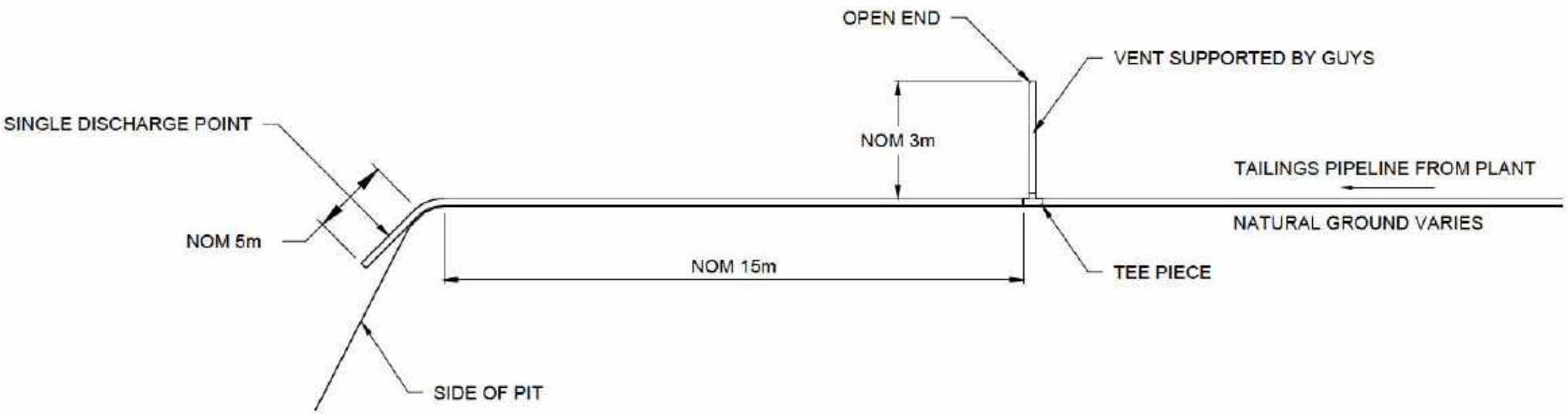
Original size:	A3

TETRA TECH COFFEY

Client:	MURRIN MURRIN OPERATIONS
Project:	OPERATIONS MANUAL TAILINGS STORAGE FACILITY
Title:	SKETCH OF SPIGOT DETAIL
Project no: 754-PERGE312759	Dwg no: FIGURE 2 — Rev:

DWG: C:_Coffey Job_from Oct 2016\754-PERGE312759 - MMO TSF EoR 2023\8. Reports\Text\Ops Manual\App & Figures\Figures\Figure 2 - Spigot Detail.dwg



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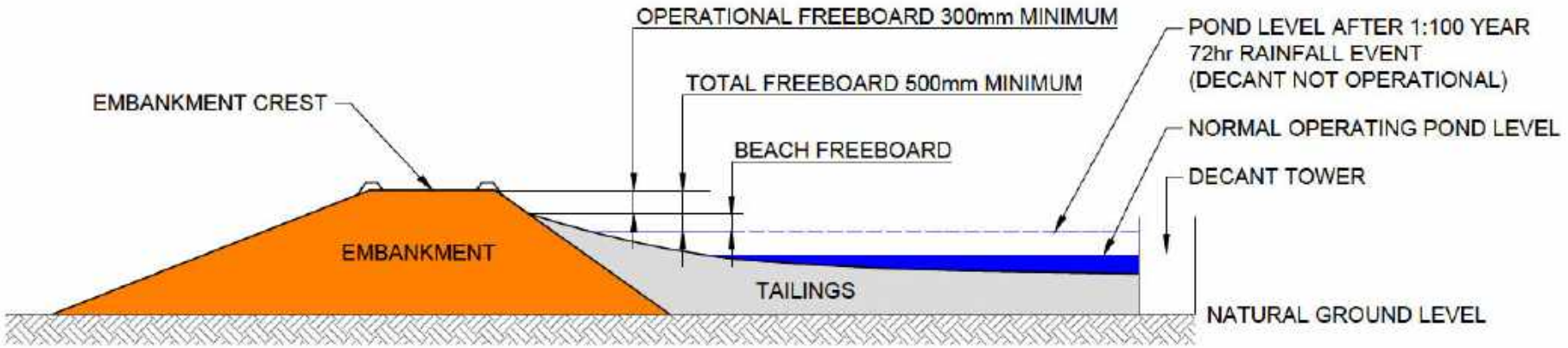
Project:	OPERATIONS MANUAL TAILINGS STORAGE FACILITY		
Title:	SKETCH OF DISCHARGE POINT (FOR IPTSF)		
Project no: 754-PERGE312759		Dwg no: FIGURE 2B	Rev:

DWG: C:__Coffey Job_from Oct 2016\MMO\754-PERGE312759 - MMO TSF EoR 2023\8. Reports\Ops Manual\App & Figures\Figures\Figure 2B - Discharge Point Detail_IPTSF.dwg



NOTE: FOR CASE WHERE POND IS NORMALLY LOCATED AWAY FROM ANY PERIMETER EMBANKMENTS

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Approved:	[redacted]
Date:	20-06-2023
Scale:	AS SHOWN
Original size:	A4

TETRA TECH COFFEY

Client:	MURRIN MURRIN OPERATIONS		
Project:	OPERATIONS MANUAL TAILINGS STORAGE FACILITY		
Title:	FREEBOARD NOMENCLATURE (DMP / DMIRS)		
Project no: 754-PERGE312759		Dwg no: FIGURE 3	Rev:

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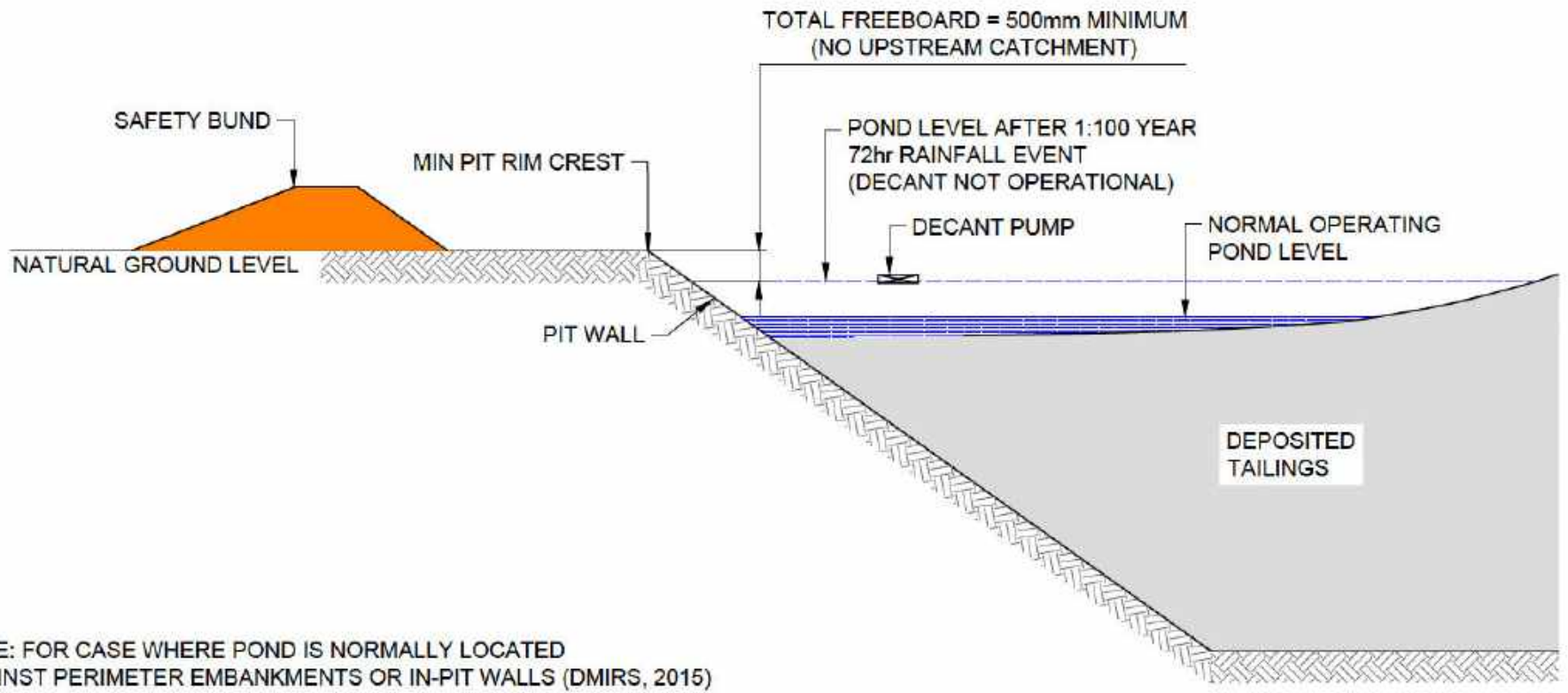

NOTE: FOR CASE WHERE POND IS NORMALLY LOCATED
AGAINST PERIMETER EMBANKMENTS OR IN-PIT WALLS (DMIRS, 2015)

Drawn:	[redacted]
Approved:	[redacted]
Date:	16-02-2024
Scale:	AS SHOWN
Original size:	A4

TETRA TECH COFFEY

Client: MURRIN MURRIN OPERATIONS

Project: OPERATIONS MANUAL
TAILINGS STORAGE FACILITY

Title: FREEBOARD NOMENCLATURE (DMP / DMIRS) (FOR IPTSF)

Project no: 754-PERGE312759 | Dwg no: FIGURE 3B | Rev:

DWG: C:__Coffey Job_from Oct 2016\MMO\754-PERGE312759 - MMO TSF EoR 2023\8. Reports\Ops Manual\App & Figures\Figures\Figure 3B - Freeboard_IPTSF.dwg

Location

Label: Murrin Murrin Operations
Easting: 390000
Northing: 6820000
Zone: 51
Latitude: Nearest grid cell: 28.7375 (S)
Longitude: Nearest grid cell: 121.8625 (E)

IFD Design Rainfall Depth (mm)

Issued: 23 June 2023

Rainfall depth for Durations, Exceedance per Year (EY), and Annual Exceedance Probabilities (AEP).
FAQ for New ARR probability terminology

Table | Chart

Unit: mm

	Annual Exceedance Probability (AEP)						
Duration	**63.2%**	**50%#**	**20%***	**10%**	**5%**	**2%**	**1%**
1 min	1.09	1.31	2.10	2.71	3.36	4.33	5.15
2 min	1.84	2.21	3.52	4.56	5.70	7.47	9.04
3 min	2.52	3.03	4.83	6.24	7.78	10.2	12.2
4 min	3.11	3.75	5.97	7.71	9.60	12.5	15.0
5 min	3.63	4.37	6.98	9.00	11.2	14.5	17.3
10 min	5.50	6.65	10.6	13.7	17.0	21.8	25.9
15 min	6.72	8.13	13.0	16.8	20.8	26.7	31.6
20 min	7.62	9.22	14.7	19.0	23.5	30.2	35.9
25 min	8.34	10.1	16.1	20.7	25.7	33.1	39.4
30 min	8.94	10.8	17.2	22.2	27.5	35.5	42.3
45 min	10.3	12.4	19.8	25.5	31.6	40.9	48.8
1 hour	11.4	13.6	21.6	27.9	34.6	44.8	53.7
1.5 hour	13.0	15.5	24.5	31.5	39.2	50.7	60.8
2 hour	14.2	17.0	26.7	34.3	42.7	55.3	66.2
3 hour	16.3	19.4	30.3	38.9	48.2	62.3	74.5
4.5 hour	18.7	22.2	34.5	44.2	54.7	70.4	83.9
6 hour	20.6	24.5	38.0	48.6	60.0	77.0	91.5
9 hour	23.7	28.2	43.7	55.7	68.7	87.7	104
12 hour	26.2	31.1	48.4	61.6	75.8	96.5	114
18 hour	29.9	35.7	55.6	70.7	86.9	111	131
24 hour	32.6	39.0	61.0	77.7	95.6	122	144
30 hour	34.8	41.7	65.4	83.3	103	131	155
36 hour	36.4	43.8	68.9	87.9	108	139	165
48 hour	38.9	46.9	74.2	95.0	117	151	181
72 hour	41.9	50.6	80.7	104	129	168	202
96 hour	43.6	52.7	84.3	109	135	178	215
120 hour	44.6	53.8	86.3	112	139	183	223
144 hour	45.2	54.5	87.3	113	141	186	226
168 hour	45.7	55.0	87.8	114	142	187	227

Note:
The 50% AEP IFD **does not** correspond to the 2 year Average Recurrence Interval (ARI) IFD. Rather it corresponds to the 1.44 ARI.
* The 20% AEP IFD **does not** correspond to the 5 year Average Recurrence Interval (ARI) IFD. Rather it corresponds to the 4.48 ARI.

Drawn:	[redacted]	TETRA TECH COFFEY	Client:	MURRIN MURRIN OPERATIONS	
Approved:	[redacted]		Project:	OPERATIONS MANUAL TAILINGS STORAGE FACILITY	
Date:	20-06-2023		Title:	RAINFALL INTENSITY TABLE	
Scale:	AS SHOWN		Project no: 754-PERGE312759	Dwg no: FIGURE 4A	Rev:
Original size:	A4				

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Label:Murrin Murrin Operations

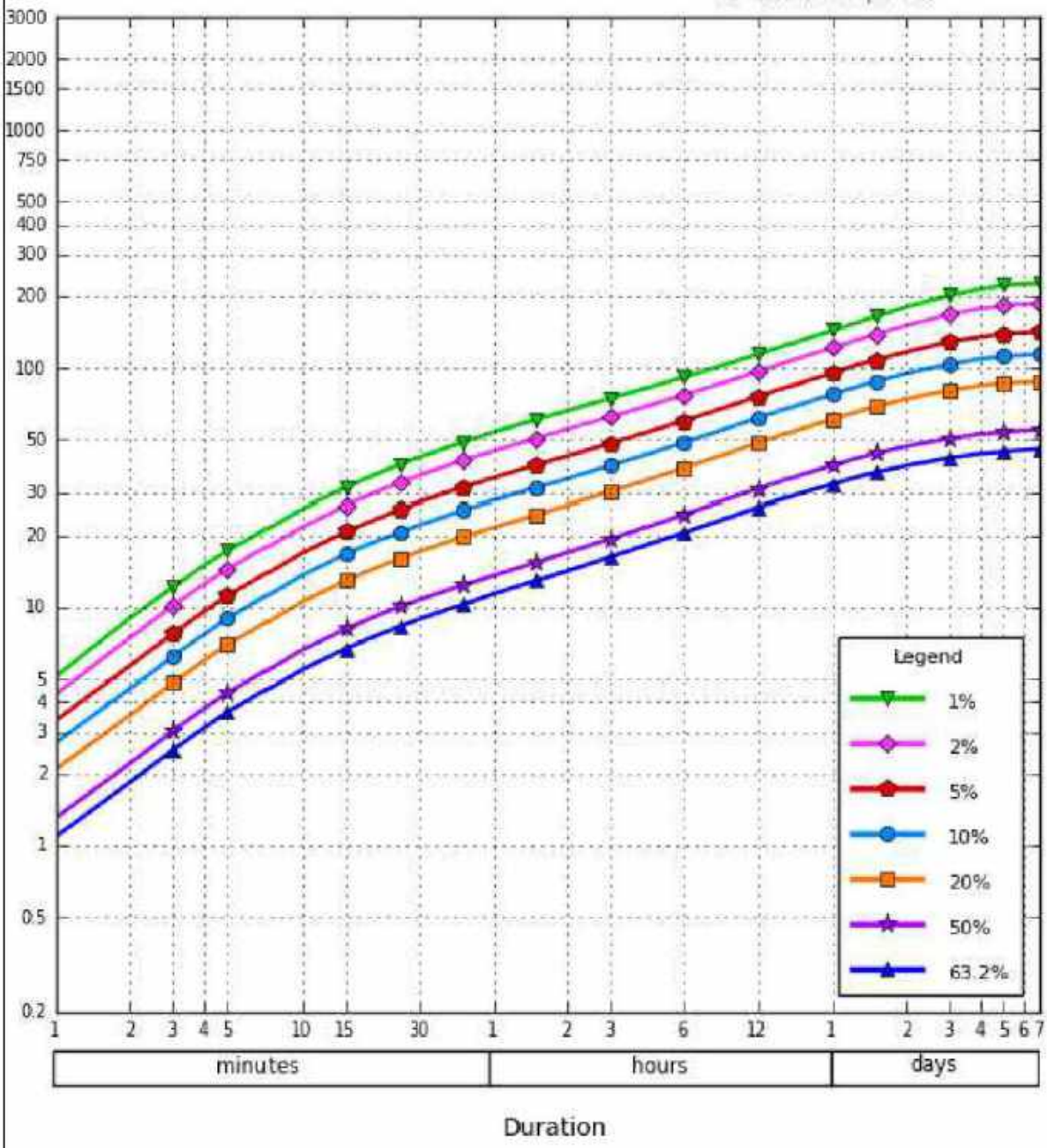
Requested coordinate Easting: 390000.0000 Northing: 6820000.0000 Zone: 51

Nearest grid cell Latitude: 28.7375 (S) Longitude: 121.8625 (E)

IFD Design Rainfall Depth (mm)

Issued: 23 June 2023

Rainfall depth in millimetres for Durations, Exceedance per Year (EY), and Annual Exceedance Probabilities (AEP).



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Date:	20-06-2023		Title:	RAINFALL INTENSITY CHART
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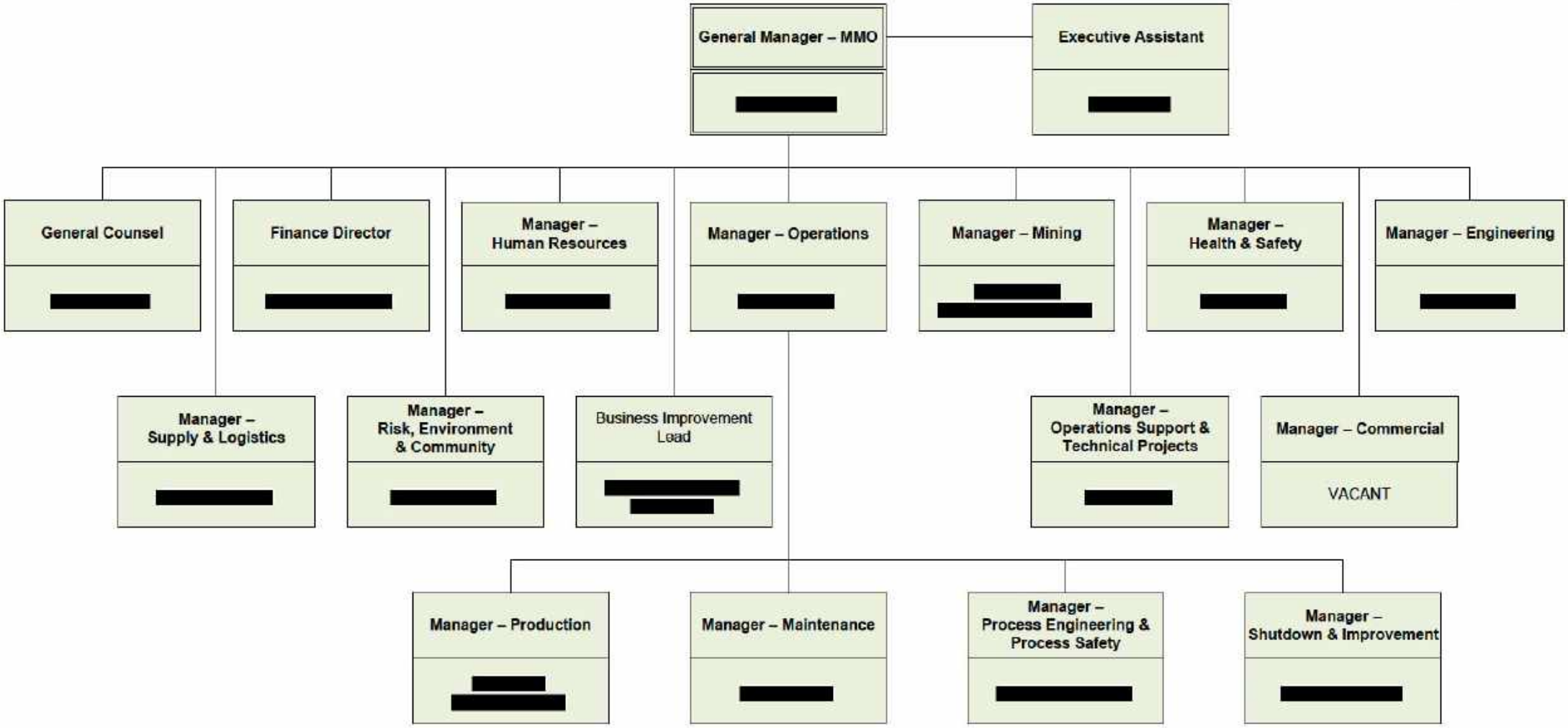
APPENDIX A: MMO OPERATIONS MANAGEMENT AND PRODUCTION CHARTS

OPERATIONS MANAGEMENT ( )

Operations Management

MINARA RESOURCES

A GLENCORE COMPANY



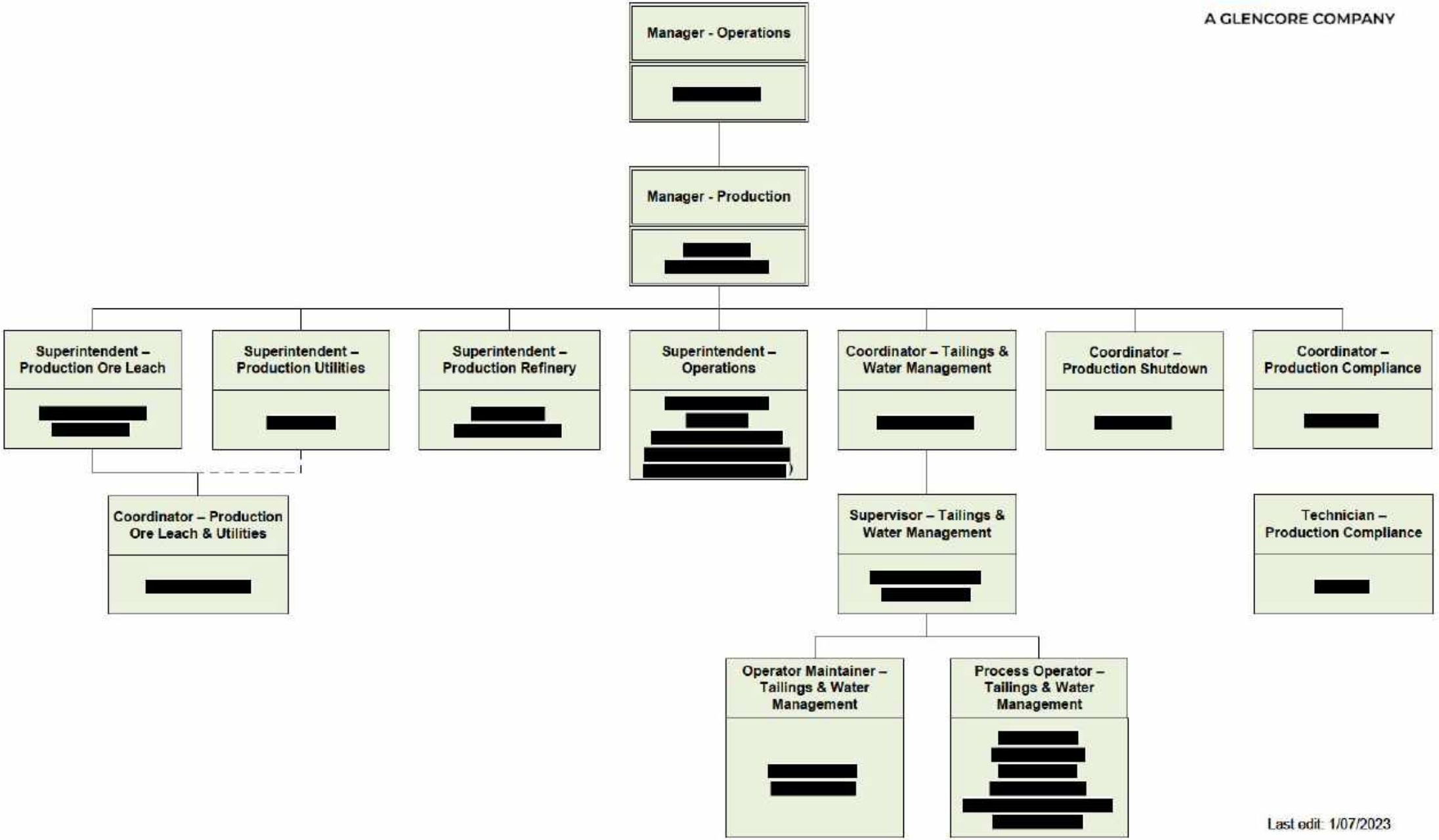
Last edit: 30/06/2023

PRODUCTION (208)

Production

MINARA RESOURCES

A GLENCORE COMPANY



Last edit: 1/07/2023

APPENDIX B: INSPECTION LOG SHEETS / PROFORMAS

PROJECT	**: TAILINGS STORAGE FACILITY**	Date	June 2023
		Job No	754-PERGE312759
CLIENT	**: MINARA RESOURCES PTY LTD**	File	OMS Forms
		Subject	Inspections
LOCATION	**: MURRIN MURRIN OPERATIONS**	Rev	
SUBJECT	**: PERSONNEL CONTACT DETAILS**	**TSF Form 1**	

Name	Company	Responsibility	Contact Details

PROJECT	**: TAILINGS STORAGE FACILITY**	Date	June 2023
		Job No	754-PERGE312759
CLIENT	**: MINARA RESOURCES PTY LTD**	File	OMS Forms
		Subject	Inspections
LOCATION	**: MURRIN MURRIN OPERATIONS**	Rev	
SUBJECT	**: ASSEMBLY POINTS**	**TSF Form 2**	

TO BE PROVIDED BY PROCESSING PLANT MANAGEMENT

PROJECT	**: TAILINGS STORAGE FACILITY**	Date	June 2023
		Job No	754-PERGE312759
CLIENT	**: MINARA RESOURCES PTY LTD**	File	OMS Forms
		Subject	Inspections
LOCATION	**: MURRIN MURRIN OPERATIONS**	Rev	
SUBJECT	**: STAFF CONFIRMATION LOG SHEET**	**TSF Form 3**	

As part of the requirements for the safe operation of the tailings storage facility (TSF), personnel involved with the daily or regular operation and inspection of the TSFs as well as those who are responsible for the TSFs, are required to sign this form as confirmation that you have attended and understood safety and induction procedures. In particular that you are familiar with the existing or any newly prepared operations manual that have been prepared in general accordance with DMIRS guidelines.

NAME :

SIGNATURE :

DATE :

NAME :

SIGNATURE :

DATE :

NAME :

SIGNATURE :

DATE :

PROJECT	**: TAILINGS STORAGE FACILITY**	Date	June 2023
		Job No	754-PERGE312759
CLIENT	**: MINARA RESOURCES PTY LTD**	File	OMS Forms
		Subject	Inspections
LOCATION	**: MURRIN MURRIN OPERATIONS**	Revision	
SUBJECT	**: DAILY INSPECTION LOG SHEET**	**TSF Form 4**	

Date:	**Time:**	**Shift Day/Night:**
Shift Supervisor:	**Inspection by:**	**Verified by:**

Item	Criteria	YES/NO		Comments
		N/S	D/S	
TSF Access Roads	Good condition?			Maintenance required:
Embankment/ Pit crest area	Any distress or any cracking present since previous inspection?			
Within embankments/ pit walls	Any staining (darker coloured patches) of soil?			
	Are the recovery bores running?			
	Any tailings spillages?			
Seepage	Any new seepage. If so, where?			
	Existing seepage : any change in flow?			
Tailings discharge	Is the number of spigots operating and the location of the spigots as planned?			**Number open :**
	Is the tailings deposition on the beaches in 300 mm layers?			
	Is the tailings level closer than 300 mm from the crest of the pit wall?			
Pipelines	Leaks?			
Return water	Decant pump operating? If pump is working is discharge clear?			
Maintenance	Outline any maintenance requirements and nominate responsible person.			
Decant Facility	Integrity. Any cracks in the decant access embankments?			
	Is the water in the decant pond clear?			
	Is the water pond positioned around the decant and approximately 300m away from the perimeter of the wall?			
	Is the water pond against or near the pit wall? If so arrange for it repositioning			
Fauna	Any deaths			
Flora	Any new distress Any vegetation requiring removal due to potential growth size			

NOTES :
Please provide any comments or notes relating to the tailings storage facility

PROJECT	**: TAILINGS STORAGE FACILITY**	Date	June 2023
		Job No	754-PERGE312759
CLIENT	**: MINARA RESOURCES PTY LTD**	File	OMS Forms
		Subject	Inspections
LOCATION	**: MURRIN MURRIN OPERATIONS**	Rev	
SUBJECT	**: MONTHLY INSPECTION AND MONITORING LOG SHEET- BY MANAGEMENT**	**TSF Form 5**	

Date:		**Time:**	**Shift Number:**
Shift Supervisor:		**Inspection by:**	**Verified by:**

Item	**Description of Inspection Activity**	**Comments**	**Remedial Works**	
			Start	**Finish**
1.0	**Embankment Crest/Pit Crest / Walls**			
	Is cracking present on the crest/walls of the facility? If yes, is it new cracking or existing cracking.	Photograph No.		
	If existing has the cracking got larger?			
	Is staining or discolouration present outside the extent of the facility?	Photograph No.		
	Is there water flow from any part of the facility?	Photograph No.		
	Is the freeboard adjacent to the pit wall above the designated level? (DMIRS criteria: 0.2m beach freeboard + 0.3m operational freeboard = 0.5m total freeboard)			
	Have the water levels in the monitoring bores been measured and the data entered and graphed to the appropriate sheet?			
	Is there supernatant water against the pit walls? If so arrange for its repositioning			
2.0	**Spigotting**			
	Is the distribution of the tailings on the beaches as required by the operations manual?			
	Do any of the spigots leak or need repair?			
	Is the spigotting effective in keeping the water around the water recovery point?			
3.0	**Water Recovery System (Decant)**			
	Is the supernatant water positioned around the decant facility?	Photograph No.		
	Is the supernatant water as planned, or is there excess water on the storage?	Diameter of supernatant water against wall: m		
	Can the decant system handle storm runoff in addition to the supernatant water efficiently?			
4.0	**Process Plant Information**			
	Ore processed for the month (tonnes)			
	Average tailings slurry density, measured in percentage solids			
	Water return from the tailings storage to the process plant (in tonnes and m³)			
5.0	**Water Balance**			
	Record volume of water discharged into TSF for this month			
	Record volume of water recovered from the TSF			
	Record any other inflows			
	Record any other outflows			
	Calculate the % water return			
6.0	**Monitoring**			
	Has the water depth from the monitoring bores been measured, checked and the data entered and graphed into the appropriate spreadsheet?			
	Has the water quality data from the monitoring bores been checked and data entered into the appropriate spreadsheet?			
7.0	**Climatic Data**			
	Any significant rainfall events? Record as required			
8.0	**Maintenance**			
	Check on the status of any nominated maintenance or repair issues. Escalate repairs if required			
9.0	**Other Aspects**			
	Comments			

PROJECT	**: TAILINGS STORAGE FACILITY**		Date	June 2023
			Job No	754-PERGE312759
CLIENT	**: MINARA RESOURCES PTY LTD**		File	OMS Forms
			Subject	Inspections
LOCATION	**: MURRIN MURRIN OPERATIONS**		Rev	
SUBJECT	**: INCIDENT REPORT FORM**	**TSF Form 6** sheet 1 of 3		

INSPECTORATE	**COLLIE** ☐ **KALGOORLIE** ☐ **GERALDTON** ☐ **PERTH** ☐			
STORAGE DATA	Name of Mine :			
	Phone number :			
	Name of person completing report :			
	Name of Facility :			
	Storage Area :			(m^2)
	Date and time of incident :			
	Incident location (draw sketch on next page) :			
	Facility type :	Tailings Storage	☐	
		Evaporation Pond	☐	
		Other	☐	
	Status :	Operational	☐	
		Decommissioned	☐	
		Date decommissioned	☐	
	Layout :	Ring dyke (paddock)	☐	
		Single spigot	☐	
		Multi-spigot	☐	
		Other	☐	
	Water recovery :	Gravity decant	☐	
		Pumped decant	☐	
		Pump on pontoon	☐	
		Other	☐	
	Type of tailings stored :	Gold	☐	
		Nickel	☐	
		Lead/Zinc/Copper	☐	
		Iron Ore	☐	
		Alumina	☐	
		Mineral Sand	☐	
		Other	☐	
	Annual production rate			(Mtpa)
	Water Quality :	pH		(mg/l)
		TDS		
	Known hazardous chemicals :			
WALL FAILURE INCIDENTS	Wall failure dimensions (L measured along top of pit wall)			LxWxH (m)
	Failure Mode :	Wall sliding	☐	
		Sliding through foundation	☐	
		Wall erosion	☐	
		Piping	☐	
		Overtopping	☐	
		Other	☐	
	Describe failure event (e.g.. Initiation point, sequence of events etc) :			

PROJECT	**: TAILINGS STORAGE FACILITY**		Date	June 2023
			Job No	754-PERGE312759
CLIENT	**: MINARA RESOURCES PTY LTD**		File	OMS Forms
			Subject	Inspections
LOCATION	**: MURRIN MURRIN OPERATIONS**		Rev	0
SUBJECT	**: INCIDENT REPORT FORM**		**TSF Form 6** sheet 2 of 3	
Water issues in the vicinity before wall failure occurring	Seepage/leakage through :	Pit Wall	☐	
		Foundation	☐	
		Buried pipes	☐	
		Other	☐	
	Estimated quantity of seepage :			litres/sec
		Moist/damp	☐	
		Wet only	☐	
	Control methods (describe) :			
	Rainfall in the previous 72 hours :			(mm)
	Downstream ponding adjacent to failure?:	Yes	☐	
		No	☐	
	Upstream pond located :	Against failure wall	☐	
		Away from failure wall	☐	
		Distance		(m)
		Other	☐	
	Freeboard behind crest :	To top of tailings		(m)
		To top of water		(m)
Foundation, soil/rock types, weathering etc.	Describe foundation geology in immediate failure area :			
Construction details of wall that failed	Construction completion date :			
	Overall pit height :			(m)
	Slope angle in failure area :			(degrees)
	Wall designed by :	Experience	☐	
		Geotechnical Methods	☐	
	Construction materials and methods (describe) :			
	Date of most recent geotechnical review : By :			
OTHER INCIDENTS	Pipe failure		☐	
	Return water pond overflow		☐	
	Overtopping with no wall failure		☐	
	Other (describe)		☐	
RESULTS OF THE INCIDENT	Type of material released :	Tailings	☐	
		Saline water	☐	
		Other (describe)	☐	
	Duration of release	< 1 hour	☐	
		1 to 2 hours	☐	
		2 to 6 hours	☐	
		6 to 24 hours	☐	
		>24 hours	☐	
	Amount or volume of material released :			(t/m^3/bcm)
	Released material contained :	Yes	☐	
		No	☐	
	Maximum distance travelled by :	Tailings		(km)
		Water		(km)
ENVIRONMENTAL DAMAGE	Describe environmental impact and downstream facilities that are affected			
MONITORING DETAILS	Signs of failure observed or monitored prior to failure : Monitoring methods used : Summarise observations or monitoring results :			

PROJECT	**: TAILINGS STORAGE FACILITY**	Date	June 2023
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LOCATION	**: MURRIN MURRIN OPERATIONS**	Revision	0
SUBJECT	**: INCIDENT REPORT FORM**	**TSF form 6**	sheet 3 of 3

SKETCH PLAN OF FACILITY SHOWING EXTENT OF FAILURE AREA

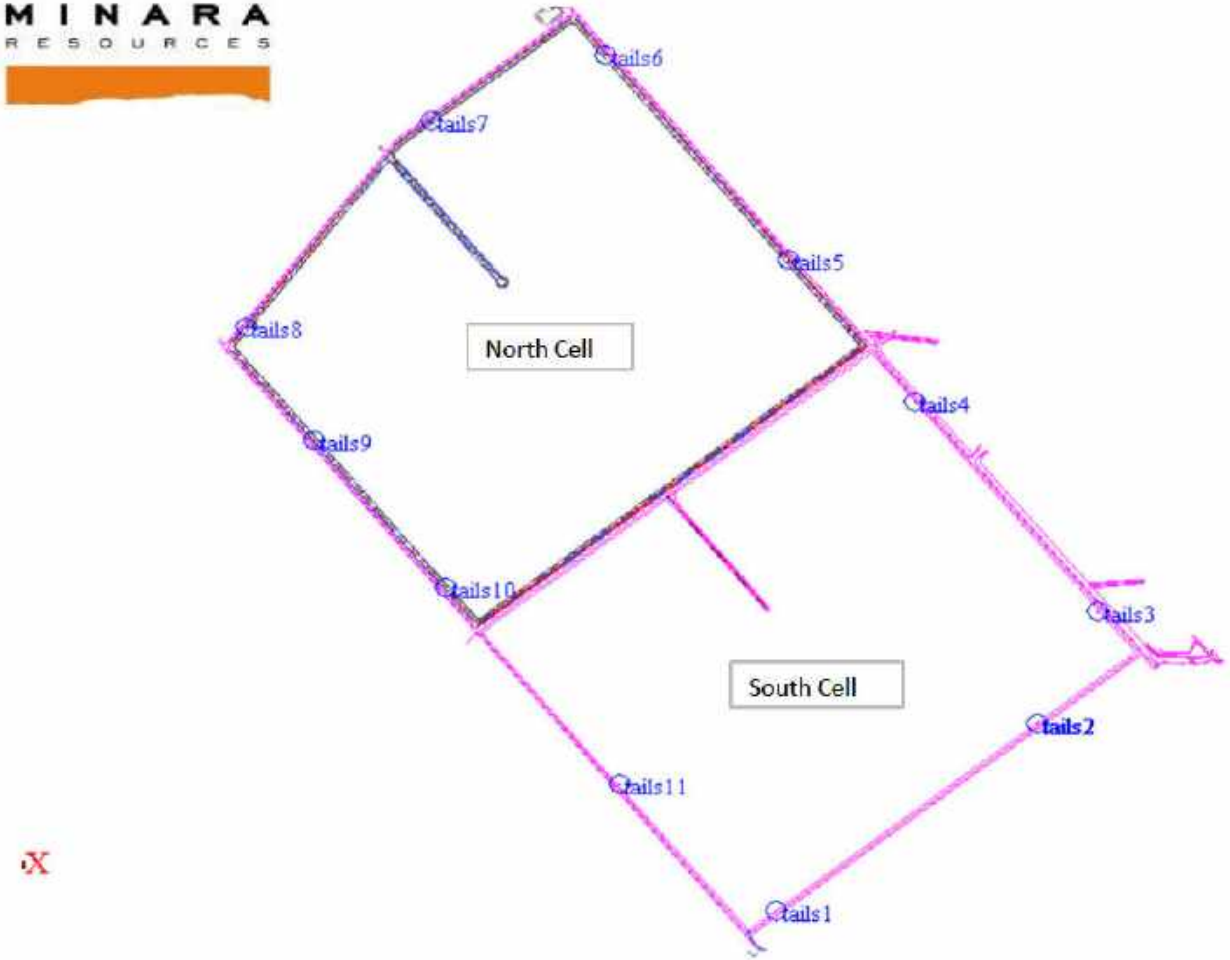
Show the following on the above sketch plan : as appropriate

Extent of pit wall and tailings material failure as appropriate
All access ways into underground mines (shafts, declines, sink holes, intake and exhaust rises, etc)
All tailings storage facilities
Evaporation ponds, water storage facilities (including thickeners)
Open pits, waste dumps
Offices, accommodation, etc
Roads, airfields
Buildings (eg. Mill, concentrator, workshops, etc) and fuel storage areas
Direction of surface drainage flow
Indicate True North direction and approximate scale

Additional Comments :

APPENDIX C: PADDOCK TSF - INSTRUMENTED MONITORING LOCATION PLAN

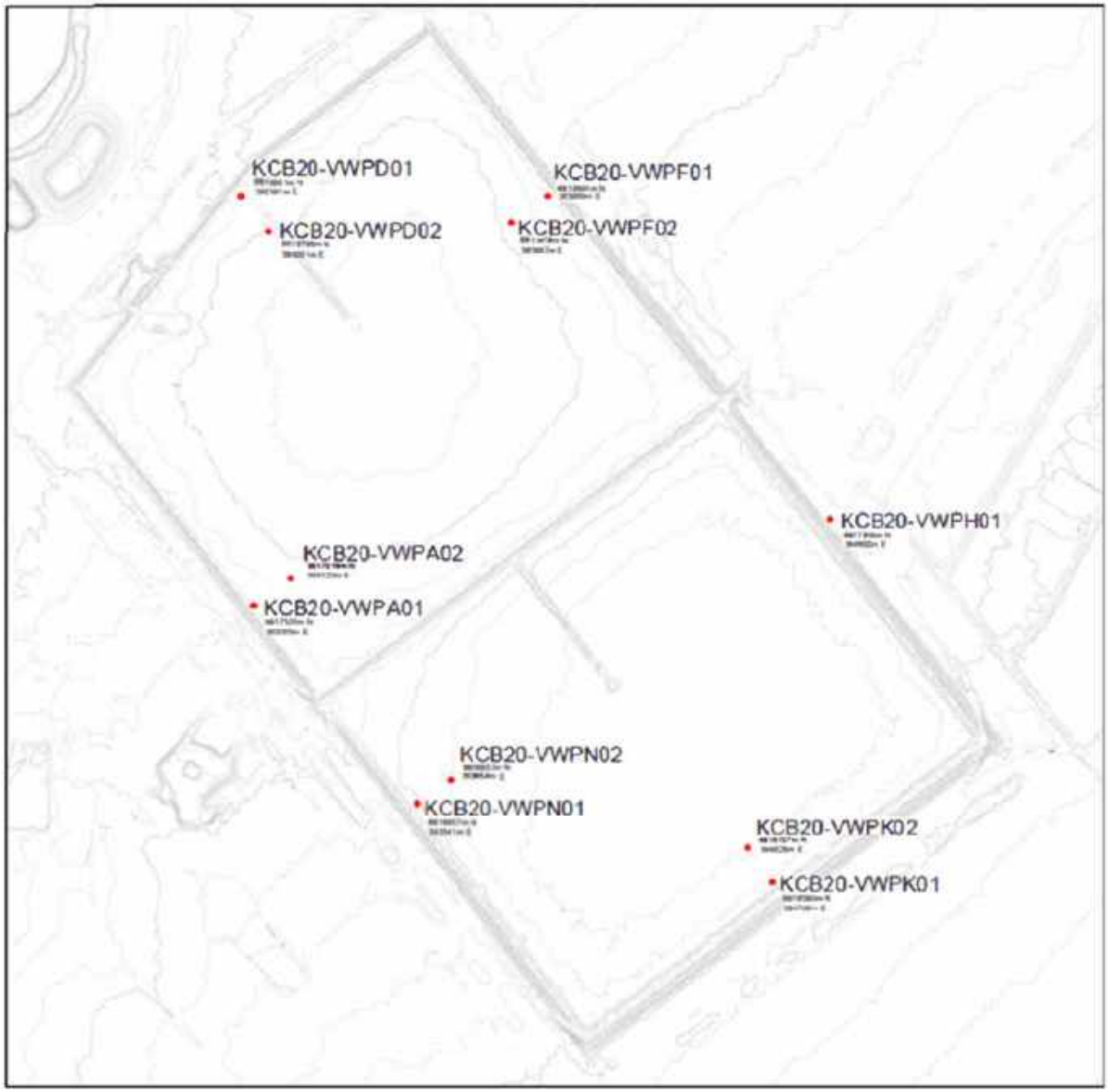
TAILS DAM WALL MONITORING PROGRAM

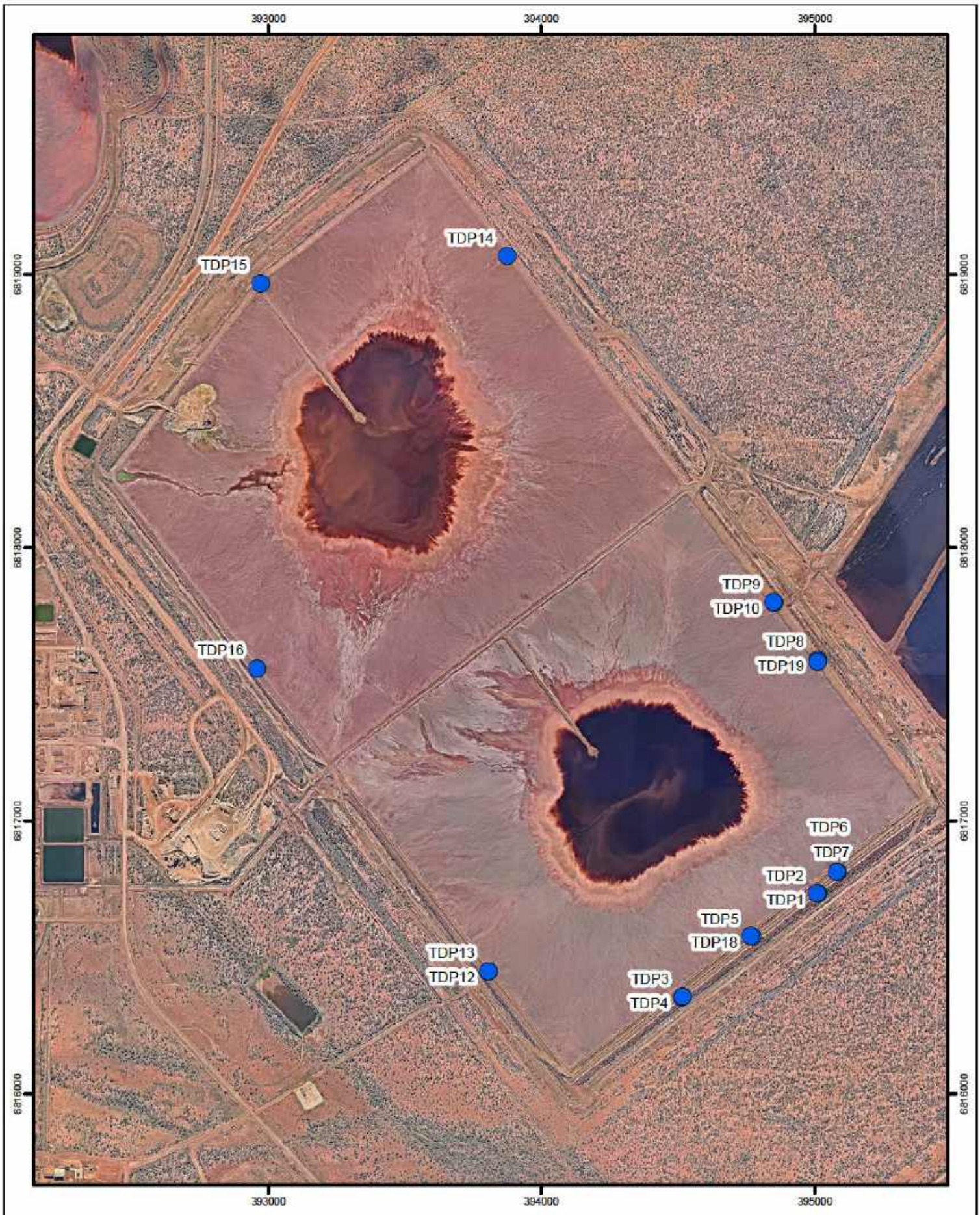


All stations were established using high accuracy GPS static survey measurements. This involved logging satellite data at each control location, building the data into a geodetic network and performing an adjustment analysis using least squares techniques. All control stations are subsequently surveyed each month to monitor movement on the tailsdam walls.

MURRIN MURRIN OPERATIONS
PADDOCK TSF - VWP LOCATION PLAN

TETRA TECH COFFEY





MINARA

Murrin Murrin Operations

TSF Wall Piezometers
Map 12

DATUM: GDA 1994
PROJECTION : GDA 1994 MGA Zone 51

Legend

● Water Infrastructure selection selection

N

1:18000

0 500 1000 Meters

Originator :	
Department : Environment	Date : 17/07/2019
Drawn By: [redacted]	Revision:

File : J:\EAP\Environment\GIS\MXDprojects\Water Monitoring Maps - Wall B

Minara Resources Pty Ltd ACN 000 370 783

391000 392000 393000 394000 395000 396000 397000 398000

6819000 6818000 6817000 6816000

TDMB28D
TDMB25D
TDMB1D
TDMB14D
TDMB4D
TDMB13D
TDMB12D
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TDMB11D
TDMB26D
TDMB19D
TDMB15D
TDMB10D
TDMB29D
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TDMB30D
TDMB27D
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TDMB7D
TDMB24D
TDMB31D
TDMB8D
TDMB22D
TDMB3D
TDMB32D
TDMB36D
TDMB23D
TDMB33D
TDMB6D
TDMB35D
TDMB34D
TDMB20D
TDMB5D
TDMB21D

GALCRETE ROAD
Forrest Grein
MURRIN ROAD
LAVERTON LEONORA HIGHWAY
RED OCTOBER ROAD

391000 392000 393000 394000 395000 396000 397000 398000

MINARA

Murrin Murrin Operations

Map 16
Tailings Dam Monitoring Bores (Deep)

TSFs
Tailings Dam (Deep)
Tailings Dam

Principal Road
Drilling Line
Haul Road
Minor Road
Track

N

DATUM: GDA 1994
PROJECTION : GDA 1994 MGA Zone 51

Scale 1:20549

0 250 500 1,000 Metres

Originator :	
Department :	Date : 21/01/2015
Drawn By: [redacted]	Revision:
File : J:\EAP\Environment\GIS\MXDprojects\Water Monitoring Maps\TDMB.m	A3

Minara Resources Pty Ltd ACN 000 370 783

APPENDIX D: PADDOCK TSF - TARPS (CREDIBLE DAM-RELATED EMERGENCY)

Appendix 3: Trigger Action Response Plans (TARPs)

FHP Protocol	Aspect	Trigger	Level	Finding	Primary Actions	Time Line	Increasing	Time Line	Emergency Management Team Actions	Time Line	Crisis Management Team Actions	Time Line
Tailings Storage Facility & Dam Management Standard	MMO TSF	Instability	Normal	* All monitoring indicators, including routine inspections and instrumentation monitoring indicate normal conditions.	* Regular monitoring and documentation of process.	As required	* Tracking and review of monitoring indicators.	As required	No Action Required	N/A	No Action Required	N/A
			Level 1	* Cracking visible on the top of the north, east or south wall with or withoutt vertical displacement (<25mm) across crack; or. * Noticeably recent or changing depression or bulging observed on dam; or * Recent displacement of material on the face of the dam slope; or * Noticeable ground heaving in vicinity of dam toe (may be signalled by newly tilted trees).	1. Notify Supervisor. Send photos if possible to ?? To allow initial validation of abnormal conditions; 2. If finding concerns the south wall of the south cell then assessment to be carried out to determine if it is an active situation; 3. Engineer of Records to initiate summary inspection of affected wall for signs of active conditions; and 4. Engineer of Record to determine whether this is a Phase 1 or Phase 2 item or if it can be downgraded to normal.	Immediately	Phase 1 - Investigate and Assess 1. Engineer of Record performs detailed inspection assess affected area. 2. Record findings and iddencify areas for further inspection and/or recommend non-urgent maintenance actions; 3. Schedule and document increased inspections. 4. Update Production Manager on findings. Phase 2 - Implement Contingency Measures 1. Administrative contingencies (water management, material topping of TSF, carsul dumping); or 2. Maintenance contingencies (i.e. temporary repairs)	Immediately	No Action Required	N/A	No Action Required	N/A
			Level 2	* Cracking visible on the top of the west wall that show visible vertical displacement across crack; or * Fresh or active sliding of material down the face with cracks on or near the crest; or * Significant bulging, sloughing or settlement of any portion of the dam; or * Active ground heaving in vicinity of toe of dam. May be indicated by observation of trees actively tilting.	1. Mobilise to safe adjacent location, on egress route, to monitor condition until asked to leave the area; 2. Notify supervisor to confirm an emergency; 3. Production Manager to assume role as Incident Controller; a) Notify Engineer of Recording; b) Notify Emergency Services through MMO Gatehouse; 4. Assess all areas of the dam if safe to do so; and 5. Document and report all findings.	Immediately	1. Production Manager with the aid of Engineer of Record to verify condition and confirm emergency level; 2. Production Manager to develop action plan with Engineer of Records; 3. Notify WAPOL if there will be a flow towards the Leonora/Laverton Highway; 4. Barricade area and restrict entry to areas threatened by the location of the possible breach; and 5. Monitor site roadways.	Immediately	1. Activate MMO Emergency Management Plan; and 2. Notify Emergency Management Team Controller.	Immediately	1. Notify General Manager if not on Site; 2. Reassess emergency level and escala	Immediately
			Level 3	* Personnel reports observing active displacement of structure; or * Failure of dam has been confirmed or is occuring. LIKELY EXTERNAL ENVIRONMENTAL AND/OR INFRASTRUCTURE EFFECTS	1. Evacuate to safe adjacent location, on egress route and away from dam and potential ainundationzone, to monitor condition until asked to leave area; 2. Contact Control Room to notify of occuring loss of containment and activate Production Manager to assume Incident Controller; 3. Call emergency services through the Gatehouse; 4. Evacuate personnel in the path of inundation to muster points at the ROM and 5. If it is a south cell breach then arrange road blocks on the Leonora/Laverton Highway to protect community traffic.	Immediately	1. Confirm mobilisation of Emergency Response Team; and 2. Confirm mobilisation of Emergency Management Team. FLOW COVERING THE HIGHWAY TO BE CONSIDERED AND APPROPRIATELY CONTROLLED REPORTING OF ENVIRONMENTAL SPILL REQUIRED	Immediately	1. Follow MMO Emergency Management Plan	Immediately	1. Ensure notification of Glencore Nickel Crisis Management Team; 2. Confirm notification of WAPOL for highway closure and diversions; 3. Develop incident action plans; and 4. Address conditions as they develop to lessen impact.	Immediately

FHP Protocol	Aspect	Trigger	Level	Finding	Primary Actions	Time Line	Increasing	Time Line	Emergency Management Team Actions	Time Line	Crisis Management Team Actions	Time Line
Tailings Storage Facility & Dam Management Standard	MMO TSF	Seismic Event	Normal	No seismic activity or seismic events detected or reported by media.	*Regular monitoring and documentation of process.	As required	*Tracking and review of monitoring indicators.	As required	No Action Required	N/A	No Action Required	N/A
			Level 1	*Notification of indication of local seismic activity; or *Media report of regional minor seismic event; *Review of piezometric data resulting from detection of seismic event indicates a surge in pore pressures that is unlikely to trigger liquefaction.	1. Notify Supervisor and on to Production Manager; 2. Contact Environmental Dept for data from piezometric sesnors; 3. Engineer of Records to initiate inspection of dams; 4. Engineer of Record to determine whether this is a Phase 1 or Phase 2 item or if it can be downgraded to normal.	Immediately	Phase 1 - Investigate and Assess 1. Engineer of Record performs detailed inspection assess affected area. 2. Record findings and iddentify areas for further inspection and/or recommend non-urgent maintenance actions; 3. Schedule and document increased inspections. 4. Update Production Manager on findings. Phase 2 - Implement Contingency Measures 1. Administrative contingencies (water management; material topping of TSF, carsul dumping); or 2. Maintenance contingencies (i.e. temporary repairs)	Within 24 hours	No Action Required	N/A	No Action Required	N/A
			Level 2	*Personnel reporting obvious damage to dam with visible bulging or cracking following an earthquake. *Review of piezometric data resulting from detection of seismic event indicates a surge in pore pressures that is likely to trigger liquefaction.	1. Mobilise to safe adjacent location, on egress route, to monitor condition until asked to leave the area; 2. Notify supervisor to confirm an emergency; 3. Production Manager to assume role as Incident Controller; a) Notify Engineer of Recording; b) Notify Emergency Services through MMO Gatehouse; 4. Assess all areas of the dam if safe to do so; and 5. Document and report all findings.	Immediately	1. Production Manager with the aid of Engineer of Record to verify condition and confirm emergency level; 2. Production Manager to develop action plan with Engineer of Records; 3. Notify WAPOL if there will be a flow towards the Leonora/Laverton Highway; 4. Barricade area and restrict entry to areas threatened by the location of the possible breach; and 5. Monitor site roadways.	Immediately	1. Activate MMO Emergency Management Plan; and 2. Notify Emergency Management Team Controller.	ASAP	1. Notify General Manager if not on Site; 2. Reassess emergency level and escala	ASAP
			Level 3	*Personnel reports observing active displacement of structure; or *Failure of dam has been confirmed or is occuring. LIKELY EXTERNAL ENVIRONMENTAL AND/OR INFRASTRUCTURE EFFECTS	1. Evacuate to safe adjacent location, on egress route and away from dam and potential inundationzone, to monitor condition until asked to leave area; 2. Contact Control Room to notify of occuring loss of containment and activate Production Manager to assume Incident Controller; 3. Call emergency services through the Gatehouse; 4. Evacuate personnel in the path of inundation to muster points at the ROM and 5. If it is a south cell breach then arrange road blocks on the Leonora/Laverton Highway to protect community traffic.	Immediately	1. Confirm mobilisation of Emergency Response Team; and 2. Confirm mobilisation of Emergency Management Team. FLOW COVERING THE HIGHWAY TO BE CONSIDERED AND APPROPRIATELY CONTROLLED REPORTING OF ENVIRONMENTAL SPILL REQUIRED	Immediately	1. Follow MMO Emergency Management Plan	Immediately	1. Ensure notification of Glencore Nickel Crisis Management Team; 2. Confirm notification of WAPOL for highway closure and diversions; 3. Develop incident action plans; and 4. Address conditions as they develop to lessen impact.	Immediately

FHP Prococol	Aspect	Trigger	Level	Finding	Primary Actions	Time Line	Increasing	Time Line	Emergency Management Team Actions	Time Line	Crisis Management Team Actions	Time Line
Tailings Storage Facility & Dam Management Standard	MMO TSF	Internal Erosion	Normal	All monitoring indicators suggest normal levels	Regular monitoring and documentation of process.	As required	Tracking and review of indicator monitoring.	As required	No Action Required	N/A	No Action Required	N/A
			Level 1	* Appearance of seepage; or * Significant increase in seepage (e.g. from trickle to stream); or * Appearance of fresh sinkholes on dam crest or slopes.	1. Notify Supervisor and on to Production Manager; 2. Contact Environmental Dept for data from piezometric sesnors; 3. Engineer of Records to initiate inspection of dams; 4. Engineer of Record to determine whether this is a Phase 1 or Phase 2 item or if it can be downgraded to normal.	Immediately	Phase 1 - Investigate and Assess 1. Engineer of Record performs detailed inspection assess affected area. 2. Record findings and iddentify areas for further inspection and/or recommend non-urgent maintenance actions; 3. Schedule and document increased inspections. 4. Update Production Manager on findings. Phase 2 - Implement Contingency Measures 1. Administrative contingencies (water management, material topping of TSF, carsul dumpings or	Immediately	No Action Required	N/A	No Action Required	N/A
			Level 2	* New or significantly higher concentrated seepage flow emerging from dam or beyond toe that is visually estimated at about 50 l/min; or * Sinkholes or very localised depressions appearing as fresh or developing, sometimes with audible flow of water, with or without downstream outlet;	1. Mobilise to safe adjacent location, on egress route, to monitor condition until asked to leave the area; 2. Notify supervisor to confirm an emergency; 3. Production Manager to assume role as Incident Controller; a) Notify Engineer of Recording; b) Notify Emergency Services through MMO Gatehouse; 4. Assess all areas of the dam if safe to do so; and 5. Document and report all findings.	Immediately	1. Production Manager with the aid of Engineer of Record to verify condition and confirm emergency level; 2. Production Manager to develop action plan with Engineer of Records; 3. Notify WAPOL if there will be a flow towards the Leonora/Laverton Highway; 4. Barricade area and restrict entry to areas threatened by the location of the possible breach; and 5. Monitor site roadways.	Immediately	1. Activate MMO Emergency Management Plan; and 2. Notify Emergency Management Team Controller.	ASAP	1. Notify General Manager if not on Site; 2. Reassess emergency level and escala	ASAP
			Level 3	* Personnel reports observing active displacement of structure; or * Failure of dam has been confirmed or is occuring. LIKELY EXTERNAL ENVIRONMENTAL AND/OR INFRASTRUCTURE EFFECTS	1. Evacuate to safe adjacent location, on egress route and away from dam and potential uinundationzone, to monitor condition until asked to leave area; 2. Contact Control Room to notify of occuring loss of containment and activate Production Manager to assume Incident Controller; 3. Call emergency services through the Gatehouse; 4. Evacuate personnel in the path of inundation to muster points at the ROM and 5. If it is a south cell breach then arrange road blocks on the Leonora/Laverton Highway to protect community traffic.	Immediately	1. Confirm mobilisation of Emergency Response Team; and 2. Confirm mobilisation of Emergency Management Team. FLOW COVERING THE HIGHWAY TO BE CONSIDERED AND APPROPRIATELY CONTROLLED REPORTING OF ENVIRONMENTAL SPILL REQUIRED	Immediately	1. Follow MMO Emergency Management Plan	Immediately	1. Ensure notification of Glencore Nickel Crisis Management Team; 2. Confirm nocification of WAPOL for highway closure and diversions; 3. Develop incident action plans; and 4. Address conditions as they develop to lessen impact.	Immediately

FHP Protocol	Aspect	Trigger	Level	Finding	Primary Actions	Time Line	Increasing	Time Line	Emergency Management Team Actions	Time Line	Crisis Management Team Actions	Time Line
Tailings Storage Facility & Dam Management Standard	MMO TSF	Overtopping	Normal	All monitoring indicators suggest normal levels	Regular monitoring and documentation of process.	As required	Tracking and review of indicator monitoring.	As required	No Action Required	N/A	No Action Required	N/A
			Level 1	* Buildup of debris in spillway or flow control structure noted that is preventing evacuation of excess water; * Notification or indication of high water levels above operating parameters; or * Reduced dam freeboard (could be due to settlement)	1. Notify Supervisor and on to Production Manager; 2. Contact Environmental Dept for data from piezometric sesnors; 3. Engineer of Records to initiate inspection of dams; 4. Engineer of Record to determine whether this is a Phase 1 or Phase 2 item or if it can be downgraded to normal.	Immediately	Phase 1 - Investigate and Assess 1. Engineer of Record performs detailed inspection assess effected area. 2. Record findings and iddentify areas for further inspection and/or recommend non-urgent maintenance actions; 3. Schedule and document increased inspections. 4. Update Production Manager on findings. Phase 2 - Implement Contingency Measures 1. Administrative contingencies (water management, material topping of TSF, carsul dumping); or 2. Maintenance contingencies (i.e. temporary repairs)	Immediately	No Action Required	N/A	No Action Required	N/A
			Level 2	* Implemnted water management contingencies are inadequate and overtopping of the dam is imminent; or * Downstream slope appears wet with slight bulging or sloughing and settlement of dam crest is apparent;	1. Mobilise to safe adjacent location, on egress route, to monitor condition until asked to leave the area; 2. Notify supervisor to confirm an emergency; 3. Production Manager to assume role as Incident Controller; a) Notify Engineer of Recording; b) Notify Emergency Services through MMO Gatehouse; 4. Assess all areas of the dam if safe to do so; and 5. Document and report all findings.	Immediately	1. Production Manager with the aid of Engineer of Record to verify condition and confirm emergency level; 2. Production Manager to develop action plan with Engineer of Records; 3. Notify WAPOL if there will be a flow towards the Leonora/Laverton Highway; 4. Barricade area and restrict entry to areas threatened by the location of the possible breach; and 5. Monitor site roadways.	Immediately	1. Activate MMO Emergency Management Plan; and 2. Notify Emergency Management Team Controller.	ASAP	1. Notify General Manager if not on Site; 2. Reassess emergency level and escala	ASAP
			Level 3	* Personnel reports observing active displacement of structure; or * Failure of dam has been confirmed or is occuring. **LIKELY EXTERNAL ENVIRONMENTAL AND/OR INFRASTRUCTURE EFFECTS**	1. Evacuate to safe adjacent location, on egress route and away from dam and potential uinundationzone, to monitor condition until asked to leave area; 2. Contact Control Room to notify of occuring loss of containment and activate Production Manager to assume Incident Controller; 3. Call emergency services through the Gatehouse; 4. Evacuate personnel in the path of inundation to muster points at the ROM and . 5. If it is a south cell breach then arrange road blocks on the Leonora/Laverton Highway to protect community traffic.	Immediately	1. Confirm mobilisation of Emergency Response Team; and 2. Confirm mobilisation of Emergency Management Team. FLOW COVERING THE HIGHWAY TO BE CONSIDERED AND APPROPRIATELY CONTROLLED REPORTING OF ENVIRONMENTAL SPILL REQUIRED	Immediately	1. Follow MMO Emergency Management Plan	Immediately	1. Ensure notification of Glencore Nickel Crisis Management Team; 2. Confirm notification of WAPOL for highway closure and diversions; 3. Develop incident action plans; and 4. Address conditions as they develop to lessen impact.	Immediately

APPENDIX E: PADDOCK TSF - EMERGENCY PROCEDURE FLOWCHART

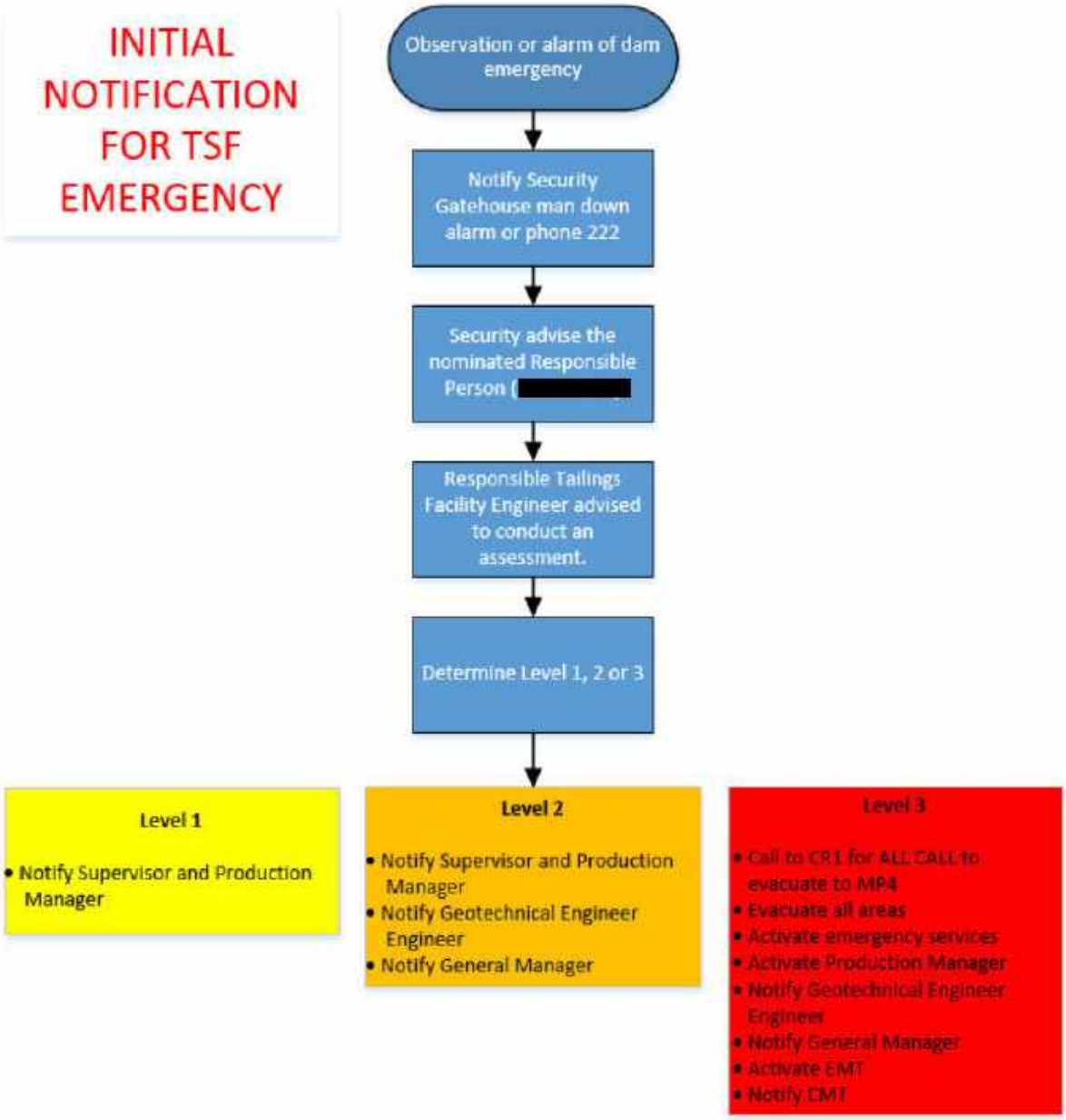
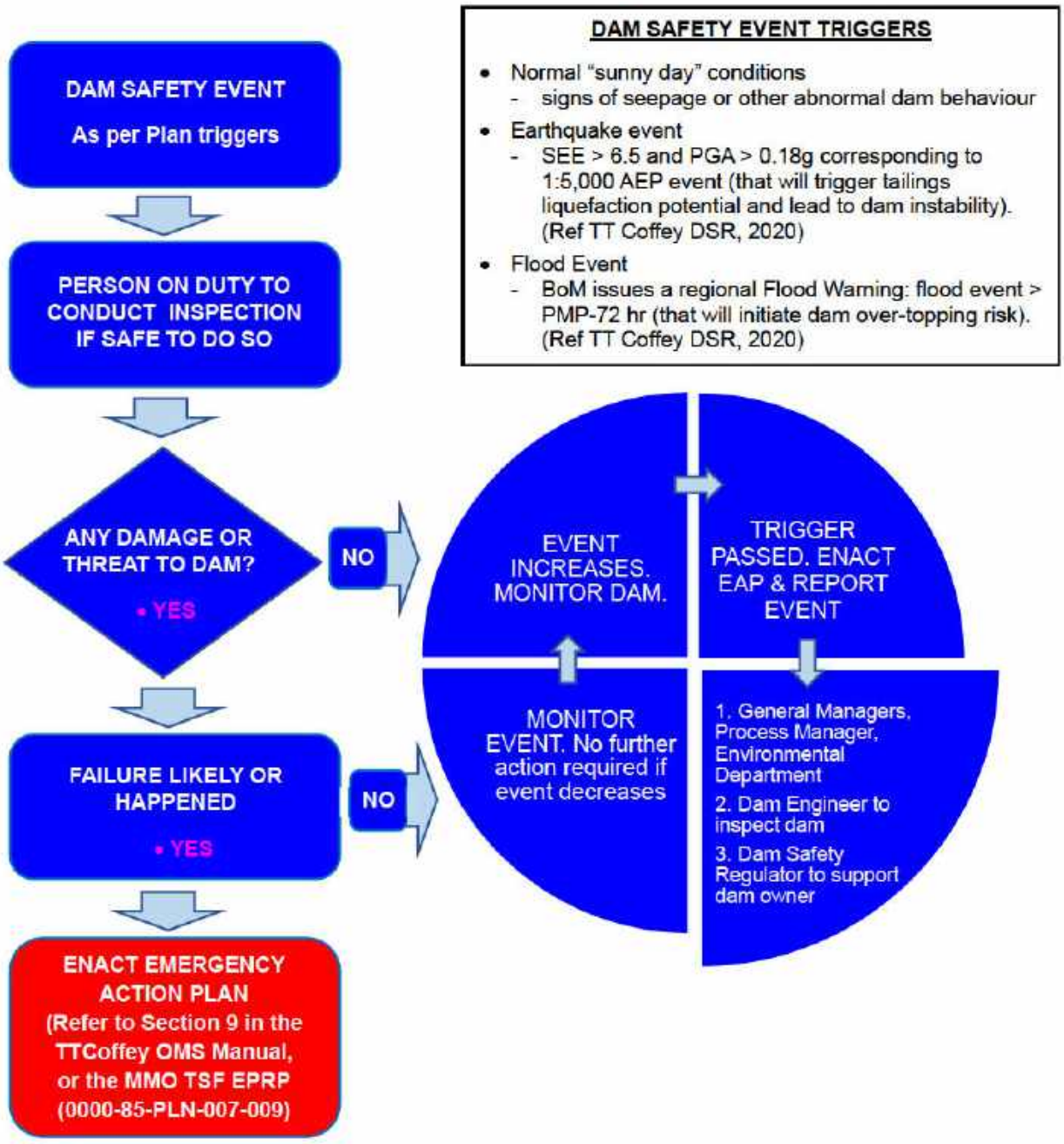


Figure 1: Process Map for TSF Emergency Notification

Murrin Murrin Operations

Emergency Procedure Flowchart for MMO Paddock TSF Safety



APPENDIX F: IPTSF - TARPS

Trigger Action Response Plan **Operational Freeboard (or Tailings Level)**	**Normal**	**Level 1 Trigger**	**Level 2 Trigger**	**Level 3 Triggers**
TRIGGER	➢ Operational freeboard (or tailings level) > 400 mm below the minimum pit rim crest level	➢ Operational freeboard (or tailings level) = 400 mm below the minimum pit rim crest level	➢ Operational freeboard (or tailings level) = 300 mm below the minimum pit rim crest level	➢ Operational freeboard (or tailings level) < 300 mm below the minimum pit rim crest level
ACTION	➢ No action necessary ➢ If applicable, regular tailings discharge to continue, capacity for increased discharge to be confirmed	➢ If applicable, increased tailings discharge is not recommended ➢ If applicable, stop tailings deposition in the affected area. Corresponding valve must be closed and information tag attached to the spigot valve handle	➢ Stop tailings deposition in the affected area immediately. Corresponding valve must be closed and information tag attached to the spigot valve handle ➢ Conduct survey for the tailings beach and water pond levels to verify the operational freeboard issue ➢ Prepare a remedial action plan in consultation with the TSF Design Engineer / EoR (such as reduce the supernatant water pond size and level by increasing water pumping capacity – this will increase the beach, operational and total freeboard; or deposit into other active pits in line with MMO operating strategy etc)	➢ Stop all tailings deposition in the IPTSF immediately. Corresponding valve must be closed and information tag attached to the spigot valve handle ➢ Conduct survey for the tailings beach and water pond levels to verify the operational freeboard issue ➢ Identify relevant resources required to be applied to rectify the issue and if necessary, follow the procedures for mine personnel warnings ➢ Commence remedial works / corrective action in accordance with the remedial action plan.
MONITORING	➢ Continue to monitor the operational freeboard and in accordance with OMS Manual ➢ Daily log sheet must be filled out on a shift basis	➢ Continue to monitor the operational freeboard and in accordance with OMS Manual ➢ Daily log sheet must be filled out on a shift basis indicating which areas are in the 300 mm freeboard zone	➢ Continue to monitor the operational freeboard and increase the frequency of inspections and in accordance with OMS Manual ➢ Information also needs to be recorded in the daily log sheet on a shift basis	➢ Continue to monitor the operational freeboard and further increase the frequency of inspections and in accordance with OMS Manual ➢ Information also needs to be recorded in the daily log sheet on a shift basis
NOTIFICATION	➢ TSF Supervisor / Tailings & Water Coordinator	➢ TSF Supervisor / Tailings & Water Coordinator	➢ Production Manager and Environmental Superintendent ➢ TSF Design Engineer / EoR	➢ Production Manager and Environmental Superintendent ➢ TSF Design Engineer / EoR
CRITERIA FOR DOWNGRADING	➢ N/A	➢ No alarms triggered	➢ Alarm downgraded to "Yellow" alarm	➢ Alarm downgraded to "Orange" alarm

Notes & Reference
Refer to the MMO TSF OMS Manual for further details and information of freeboard requirements (including operational, beach and total freeboard as per DMIRS (2015)), operating procedures and inspections, monitoring and surveillance for all IPTSFs at MMO.

Trigger Action Response Plan **Operating Supernatant Water Pond Level and Total Freeboard**	**Normal**	**Level 1 Trigger**	**Level 2 Trigger**	**Level 3 Triggers**
TRIGGER	➢ Operating supernatant water pond level: For Existing IPTSF 9/5, < RL 455.4m For Existing IPTSF 18/6, < RL 457.9m For Existing IPTSF 17 Series, < RL 449.4m For Proposed IPTSF 815, < RL 460.9m For Proposed IPTSF 7 Series, < RL 440.7m For Proposed IPTSF 8 Series, < RL 445.6m ➢ Minimum total freeboard available (vertical height between the minimum pit rim crest level and the pond level after 1:100-yr 72-hr ARI) > 600 mm	➢ Operating supernatant water pond level: For Existing IPTSF 9/5, = RL 455.4m For Existing IPTSF 18/6, = RL 457.9m For Existing IPTSF 17 Series, = RL 449.4m For Proposed IPTSF 815, = RL 460.9m For Proposed IPTSF 7 Series, = RL 440.7m For Proposed IPTSF 8 Series, = RL 445.6m ➢ Minimum total freeboard available (vertical height between the minimum pit rim crest level and the pond level after 1:100-yr 72-hr ARI) = 600 mm	➢ Operating supernatant water pond level: For Existing IPTSF 9/5, = RL 455.5m For Existing IPTSF 18/6, = RL 458.0m For Existing IPTSF 17 Series, = RL 449.5m For Proposed IPTSF 815, = RL 461.0m For Proposed IPTSF 7 Series, = RL 440.8m For Proposed IPTSF 8 Series, = RL 445.7m ➢ Minimum total freeboard available (vertical height between the minimum pit rim crest level and the pond level after 1:100-yr 72-hr ARI) = 500 mm	➢ Operating supernatant water pond level: For Existing IPTSF 9/5, > RL 455.5m For Existing IPTSF 18/6, > RL 458.0m For Existing IPTSF 17 Series, > RL 449.5m For IPTSF 815, > RL 461.0m For IPTSF 7 Series, > RL 440.8m For IPTSF 8 Series, > RL 445.7m ➢ Minimum total freeboard available (vertical height between the minimum pit rim crest level and the pond level after 1:100-yr 72-hr ARI) < 500 mm
ACTION	➢ No action necessary ➢ If applicable, regular tailings discharge to continue, capacity for increased discharge to be confirmed	➢ If applicable, increased tailings discharge is not recommended ➢ If applicable, stop tailings deposition in the affected area. Corresponding valve must be closed and information tag attached to the spigot valve handle	➢ Stop tailings deposition in the affected area immediately. Corresponding valve must be closed and information tag attached to the spigot valve handle ➢ Conduct survey for the tailings beach and water pond levels to verify the operating supernatant water pond level and total freeboard issue ➢ Prepare a remedial action plan in consultation with the TSF Design Engineer / EoR (such as reduce the supernatant water pond size and level by increasing water pumping capacity – this will increase the beach, operational and total freeboard; or deposit into other active pits in line with MMO operating strategy etc)	➢ Stop all tailings deposition in the IPTSF immediately. Corresponding valve must be closed and information tag attached to the spigot valve handle ➢ Conduct survey for the tailings beach and water pond levels to verify the operating supernatant water pond level and total freeboard issue ➢ Identify relevant resources required to be applied to rectify the issue and if necessary, follow the procedures for mine personnel warnings ➢ Commence remedial works / corrective action in accordance with the remedial action plan.
MONITORING	➢ Continue to monitor the operating supernatant water pond level and total freeboard and in accordance with OMS Manual. A digital gizmo (or physical marker) can be installed to help with monitoring the pond level. ➢ Daily log sheet must be filled out on a shift basis	➢ Continue to monitor the operating supernatant water pond level and total freeboard and in accordance with OMS Manual. A digital gizmo (or physical marker) can be installed to help with monitoring the pond level. ➢ Daily log sheet must be filled out on a shift basis indicating which areas are in the 300 mm freeboard zone	➢ Continue to monitor the operating supernatant water pond level and total freeboard and increase the frequency of inspections and in accordance with OMS Manual. A digital gizmo (or physical marker) can be installed to help with monitoring the pond level. ➢ Information also needs to be recorded in the daily log sheet on a shift basis	➢ Continue to monitor the operating supernatant water pond level and total freeboard and further increase the frequency of inspections and in accordance with OMS Manual. A digital gizmo (or physical marker) can be installed to help with monitoring the pond level. ➢ Information also needs to be recorded in the daily log sheet on a shift basis
NOTIFICATION	➢ TSF Supervisor / Tailings & Water Coordinator	➢ TSF Supervisor / Tailings & Water Coordinator	➢ Production Manager and Environmental Superintendent ➢ TSF Design Engineer / EoR	➢ Production Manager and Environmental Superintendent ➢ TSF Design Engineer / EoR
CRITERIA FOR DOWNGRADING	➢ N/A	➢ No alarms triggered	➢ Alarm downgraded to "Yellow" alarm	➢ Alarm downgraded to "Orange" alarm

Notes & Reference
Refer to the MMO TSF OMS Manual for further details and information of freeboard requirements (including operational, beach and total freeboard as per DMIRS (2015)), operating procedures and inspections, monitoring and surveillance for all IPTSFs at MMO.

Attachment 8C: Hydrogeological Assessment

MURRIN MURRIN NORTH MINING AREA PROPOSED INPIT TAILINGS DISPOSAL INTO 7 SERIES PITS, 8 SERIES PITS & PIT 8/15 HYDROGEOLOGICAL ASSESSMENT

Murrin Murrin Nickel Cobalt Project

REPORT NUMBER: **L0113-12-01 – Ver B**

Prepared For

Murrin Murrin Operations Pty Ltd
Murrin Murrin Nickel Cobalt Project

March 2024

SAPROLITE PTY LTD (ACN 135 590 724)
PO Box 2234 Ellenbrook WA 6069
52B Mornington Parkway Ellenbrook WA 6069
Ph: +61 8 6296 7760 www.saprolite.com.au
Fax: +61 8 6296 7762 admin@saprolite.com.au

Copies of Final Reports to:
MMO Environment (e-copy)
Saprolite Environmental (e-copy)

15 March 2024
Project No: L0113-12-01

Murrin Murrin Operations Pty Ltd
Murrin Murrin Mine Site
Locked Bag 4
Welshpool Delivery Centre
Pilbara Street
WELSHPOOL WA 6106

Attention: [redacted] – Senior Environmental Adviser

Dear [redacted]:

Subject: Murrin Murrin Operations Pty Ltd
Hydrogeological Assessment - Proposed In-pit Tailings Disposal into 7 Series Pits, 8 Series Pits & Pit 8/15

We are pleased to provide Murrin Murrin Operations with an e-copy of the above final report, as per the distribution list on the cover.

We thank you for the opportunity in working on this project and look forward to being of assistance in the future.

Should you have any queries about the report or any other matter please do not hesitate to contact the undersigned

Yours faithfully

SAPROLITE ENVIRONMENTAL

[redacted]
Senior Environmental Hydrogeologist

[redacted]
Senior Principal Consultant
Managing Director

Saprolite Pty Ltd
ABN 43 135 590 724
PO Box 2234, Ellenbrook WA 6069
52B Mornington Parkway Ellenbrook WA 6069
Ph: (+61 8) 6296 7760 I Fax: (+61 8) 6296 7762 I Email: [redacted]

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DOCUMENT REVISION HISTORY

Revision Number	Status	Revision Date	Revision Comments	Primary Author	Reviewer	Approved
A	Draft	07/02/2024	Issued for internal review	[redacted]	[redacted]	[redacted]
A	Draft	07/02/2024	Draft report for client review			
B	Draft	14/03/2024	Address client comments			
B	Final	15/03/2024	Report issued as final		-	

STATEMENT OF LIMITATIONS

Aquifer materials and groundwater flow systems are a product of continuing natural and man- made processes and thus exhibit a variety of characteristics and properties that vary from place to place and can change with time. Geology/hydrogeology involves gathering and assimilating limited facts about these characteristics and properties in order to understand and predict the behaviour of the ground on a particular site under certain conditions. This report may contain such facts obtained by inspection, drilling, excavation, probing, sampling, testing or other means of investigation, particularly pumping and drawdown data. If so, they are directly relevant only to the groundwater system at the place where, and the time when the investigation was carried out. Any groundwater modelling predictions presented should not be regarded as matters of fact.

This report and other reports referred to contain comments on works being carried out by others. Saprolite Environmental cannot and will not take responsibility for works carried out by others on site to date. We do not guarantee the performance of the project in any respect, only that our work and judgement meet the standard of care of our profession at this time.

Any interpretation or recommendation given in this report shall be understood to be based on judgement and experience, not on greater knowledge of facts other than those reported. The interpretation and recommendations are therefore opinions provided for the Client's sole use in accordance with a specific brief. As such they do not necessarily address all aspects of the groundwater system on the subject site.

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Additional copies and or enquiries about this document should be addressed to The Principal, Saprolite Environmental, PO Box 2234 Ellenbrook, WA, 6069 [redacted]

1. INTRODUCTION

The Murrin Murrin Nickel Cobalt Project (Murrin Murrin) is located approximately 60km east of Leonora in the north-eastern Goldfields of Western Australia, Figure 1. Murrin Murrin is operated by Murrin Murrin Operations Pty Ltd (MMO), a wholly owned subsidiary of Minara Resources Pty Ltd. Minara Resources Pty Ltd is a 100% subsidiary of Glencore PLC.

MMO are proposing to utilise additional mined-out pits (pit voids) in the Murrin Murrin North (MMN) mining area to supplement the existing tailings storage capacity. Saprolite Environmental (Saprolite) was engaged by MMO to undertake a desktop hydrogeological assessment for the proposed inpit Tailings Storage Facilities (TSFs). This hydrogeological assessment focuses on three separate resource zones proposed for tailings disposal:

1. The proposed 7 Series inpit TSF includes a continuous sequence of pits in Resource Zone 07 (rz07), located near the Laverton-Leonora Road mine site entrance, Figure 2. The rz07 Series includes areas of completed mining (7/1, 7/2, 7/3, 7/5, 7/7 and 19/54) and future mining (7/4, 7/8, and 7/11), Figure 2. Mining is scheduled for completion in the first half of 2027.

2. The proposed 8 Series inpit TSF includes a continuous sequence of pits in Resource Zone 08w (rz08w). The rz08w Series is located to the immediate south of existing inpit TSFs, namely the 17 Series inpit TSF and inpit TSF 8/4, and includes areas of completed mining (8/3), current mining (8/6, 8/7, 8/9, and 8/10) and future mining (8/8 and 8/12), Figure 2. Mining is scheduled for completion in the first half of 2024.

3. The proposed inpit TSF at pit 8/15 is located in the centre of the MMN mining area, between existing inpit TSFs 9/4 and 9/5 and just east of inpit TSF 18/6, Figure 2. Mining of pit 8/15 commenced in the second half of 2023 and is due for completion in early 2024.

As the resource zones are only partially developed, geological characterisation is limited in some areas. This assessment is based on best available information at the time of writing.

1.1 In-Pit Tailings Disposal

The primary function of a TSF is the safe and economical storage of tailings in an erosion-resistant, non-polluting structure that minimises environmental impacts (DMP, 2013). Compared to conventional paddock-style tailings disposal, in-pit tailings disposal offers numerous benefits, including:

- Reduced environmental footprint: In-pit tailings disposal minimises the need for additional land and reduces the overall land disturbance associated with constructing and maintaining separate containment facilities.
- Stability: Rehabilitated paddock style facilities create an elevated landform, making them highly visible and providing higher potential for erosion. The degradation of these landforms can be unpredictable and may have subsequent impacts on the surrounding environment.

- Progressive reclamation: The deposition of tailing into existing pit voids provides an opportunity for progressive reclamation, reducing the overall environmental impact and facilitating ecosystem rehabilitation. Abandoned open pits offer limited biodiversity and no potential for improvement if left untouched.
- Seepage migration: Seepage migration from paddock-style facilities may occur near the ground surface, where there are potential negative implications for native flora and fauna. Potential seepage migration from pit voids is more likely to occur at depths beyond the root zone.
- Safety: A properly consolidated in-pit TSF is superior to an open pit or above ground TSF from the perspective of public safety. In-pit tailings disposal enhances safety by reducing the risk of catastrophic tailings dam failures, ensuring improved stability and containment of tailings.
- Stakeholder preference: Traditional owners may find in-pit tailings disposal favourable as it allows for backfilling of pits, resulting in a decrease in the number of noticeable elevated landforms. In addition, regulators have demonstrated that they are willing to permit appropriately designed and managed in-pit TSFs.

In-pit tailings storage, despite its advantages, introduces a number of distinct challenges. These include water management complexities, risks of groundwater contamination and the requirement for long-term monitoring and maintenance. The suitability and effectiveness of in-pit tailings storage depends on site specific factors, including the geological and hydrogeological conditions and specific characteristics of the tailings.

To obtain approval for additional in-pit TSFs, MMO is required to submit a mining proposal for the TSFs to the Department of Energy, Mines, Industry Regulation and Safety (DEMIRS) and a Works Approval Application to the Department of Water and Environmental Regulation (DWER).

A glossary of terms and units is presented as Appendix A.

2. OBJECTIVES AND SCOPE OF WORK

The primary objective of this hydrogeological assessment is to evaluate the potential impacts on the groundwater environment from tailings disposal into the proposed pit voids.

The scope of work includes the following:

- Assessment and discussion of the groundwater environment at the 7 Series pits, 8 Series pits & pit 8/15 (based on best available information).
- Comparison with findings from previous hydrogeological investigations and performance of existing inpit facilities.
- Seepage Analysis: given the complex nature of the hydrogeology in the MMN project area it is anticipated that case study results from existing inpit TSFs will provide the most suitable indications of potential groundwater mounding and seepage migration from future in-pit TSFs.
- Discussion of potential implications of tailings disposal into the 7 Series pits, 8 Series pits & pit 8/15 (based on best available information).
- Nominal locations for monitoring bores will be provided, including technical specifications to allow Wallis Drilling to subsequently quote. This includes liaison with MMO to discuss accessible locations during the course of the hydrogeological assessment.

3. CLIMATE/ RAINFALL

The climate of the Laverton-Leonora area is warm and semi-arid, with irregular rainfall. Meteorological data has been collected at the Murrin Murrin Meteorological Station since 1999. Monthly rainfall totals for a ten year period between 2013 and 2022 are presented in Table 3.1. Monthly averages are also presented for comparison purposes and include data from 1999 (when records began) to June 2023.

Table 3.1 Murrin Murrin Rainfall (mm)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
2013	32.8	15.6	58.4	8.6	38.0	13.8	12.2	0.2	27.0	0.0	11.6	17.2	235.4
2014	137.0	44.0	6.6	33.8	33.8	3.4	6.4	3.2	1.6	52.4	18.6	4.2	345.0
2015	0.0	43.8	90.8	2.6	15.6	11.6	26.4	7.6	0.0	1.2	11.6	39.8	251.0
2016	57.4	13.4	91.2	16.8	7.6	29.8	37.2	16.6	4.0	0.0	3.6	39.4	317.0
2017	39.2	79.8	138.8	24.0	6.6	0.0	0.6	29.0	5.0	4.4	1.0	13.2	341.6
2018	91.6	37.6	4.0	6.8	0.4	15.8	3.0	11.6	6.2	22.0	6.2	28.2	233.4
2019	3.4	6.6	19.2	20.4	0.2	13.4	1.4	4.6	0.0	0.2	0.6	8.4	78.4
2020	41.6	14.6	11.2	0.4	0.6	3.8	0.8	11.2	0.0	7.0	2.0	16.2	109.4
2021	20.6	15.8	15.0	1.2	25.4	1.6	19.6	4.4	3.4	7.6	16.4	6.0	137.0
2022	6.6	10.6	4.2	9.6	2.0	19.0	12.0	9.6	28.6	8.6	0.6	13.8	125.2
Average	42.4	36.2	40.0	17.3	14.7	9.8	11.8	7.9	5.5	11.4	14.7	20.0	231.7

High rainfall events occur periodically in the summer months as a result of rain-bearing depressions that move inland from the north-west. Rainfall during the winter months is usually the result of low-pressure systems. Annual rainfall totals show significant variation year to year which is attributable to the variable nature of the cyclonic depressions.

From Bureau of Meteorology mapping, average annual pan evaporation for the Murrin Murrin Area is approximately 2,800mm (Bureau of Meteorology, 2006), which is more than 10 times annual rainfall. This factor has significant impact on surface water storage and soil moisture conditions.

Groundwater recharge in the Northern Goldfields region constitutes a very small proportion of rainfall (less than 1%) (Johnson et al, 1999), with recharge limited to specific geological/ topographic sites following high intensity rainfall events. The main geological/ topographic sites for recharge include: outcropping permeable calcrete, high-level laterite, and exposed weathered and fractured rock along catchment divides.

4. GEOLOGY AND HYDROGEOLOGY

The following sections present a summary of the geological and hydrogeological setting of the Murrin Murrin North mining area. Information has been sourced from published papers and from geological architecture reports.

4.1 Regional Geology

The Ni-Co ore deposits of the MMN project area are positioned over serpentinised peridotite komatiitic lava flows (Hill et al, 1990) which occur low in the stratigraphy within a sequence of felsic volcaniclastics, clastic sediments, mafic volcanics and related intrusives in the upper parts of the stratigraphic sequence (Monti and Fazakerley, 1996). The serpentinised peridotite protolith has been folded and faulted around the Kilkenny Syncline (Markwell, 1999). The sequence forms a corridor constrained by major NNE trending, westerly dipping faults. These faults are splays off the major NW trending Keith-Kilkenny tectonic zone to the SW (Monti and Fazakerley, 1996). Gradual oxidation and leaching of the ultramafic protolith has produced a regolith with sub-horizontal layers which hosts the ore deposits (Camuti and Riel, 1996).

4.2 Lithological Overview – Murrin Murrin North

The generalised geological and lateritic weathering profile at Murrin Murrin can be broadly divided into five major units. The lithology was described in the 2009 Geological Architecture Report for Murrin Murrin North (Douglas, 2009) and is reproduced below:

1. The ultramafic basal unit is a slightly weathered locally silicified unit (Fazakerley and Monti, 1998). It is a serpentinised medium to coarse grained olivine cumulate which originated as extruded komatiite flows (Markwell, 1999).
2. The saprolite zone has retained the primary rock texture of the ultramafic bedrock beneath. Its composition is largely serpentine with accessory chlorite, magnesite, silica and smectite (Wells, 2003; Fazakerley and Monti, 1998).
3. The Smectite Zone (SZ) is the dominate nickel bearing zone (Gaudin et al, 2005). It varies in colour and texture from waxy apple green to black/dark brown to a granular yellow brown composition depending on the content of Fe and Mn oxides. There is a gradational boundary between the SZ and Ferruginous zones (FZ), known as the Ferruginous Smectite Zone.
4. Ferruginous Zone (FZ) is fine to coarse grained and iron rich. Typically, red/brown in colour with hard brown/black nodules within. The majority of nodules are goethite with hematite and maghemite increasing in proportion towards the surface (Anand, 1998).
5. The upper most units of colluvium/plastic clays are distinctive by its mottled white/pink/red texture. It is often up to 20m thick and commonly shares a sharp lithological boundary with the FZ underneath.

4.3 Hydrology – Murrin Murrin North

The Murrin Murrin operations area is situated in a region of low relief, a consequence of extensive alluvial and colluvial materials which have blanketed areas to the north-west, south-west and east-southeast of the Murrin Murrin Ni laterite deposits (Wells, 2003).

The MMN mining area is bisected by a major drainage divide between the Katata Creek and Cement Creek Catchments. The Katata Creek Catchment drains to the south-west via an extensive dendritic drainage system towards Lake Raeside, while the Cement Creek Catchment drains in a south-easterly direction towards Lake Carey.

The 8 Series Pits and pit 8/15 are located to the west of the divide in the Katata Creek Catchment, the 7 Series Pits are located to the east of the drainage divide in the Cement Creek Catchment, Figure 2.

4.4 Hydrogeology - Murrin Murrin North

The laterite profile above the Archean greenstone belt is typically the derivation of preferential weathering with respect to the resistant nature of their parent host rock. Rocks that weather preferentially (i.e., ultramafic rocks compared to mafics and felsics) and faster are more susceptible to hosting groundwater, which then promotes weathering compared to rocks that are resistant and with shallower profiles. The deep weathering in the greenstones is further enhanced by near vertical bedding, intense shearing, and variation in competence of contiguous rock units (Johnson et al, 1999). Granitoids typically have greater mineralogical and structural homogeneity resulting in shallower depths of weathering (Johnson et al, 1999). Mining across the study area is primarily contained within the weathered profile of the ultramafic protolith; it is expected that the weathering front exists slightly beyond the mined depth.

In the weathering profile, complex chemical processes have led to the removal of large quantities of soluble material, some of which, such as silica, iron, calcium carbonate and calcium sulphate have been re-deposited elsewhere. These processes have produced layers of widely differing permeability and storage within the weathering profile, so that the groundwater to some degree has shaped the nature and thickness of the ‘aquifer’ in which it occurs (Johnson et al, 1999).

The ultramafic basal unit is interpreted to have relatively low hydraulic conductivity at depth. However, there is a gradational contact with the overlying saprolite unit that could have enhanced permeability where jointing and shearing is prevalent. This slightly weathered transition zone is typically beyond the depth of mining, which is largely constrained to the weathering profile of the ultramafic protolith.

In the MMN project area, the saprolite zone retains much of the structure of the underlying and unweathered ultramafic bedrock, including significant areas of shearing and jointing. Structural features are likely to act as permeability pathways; however, significant alteration during the formation of the saprolite zone has resulted in the abundance of magnesite and smectite clays, which, in combination with remobilised silica, are anticipated to suture these migratory zones to some degree.

The overlying smectite zone is comprised of dense clay in which most rock structures and textures have been obliterated. This zone is interpreted to lower hydraulic conductivity compared to the saprolite zone.

The lateritic profiles of ultramafic rocks tend to be very ferruginous towards the surface (Brand et al, 1998), which is a product of laterisation under high water tables (during a more humid period in the Miocene-Pliocene) and leaching under progressively lower water tables (during a post-Miocene change to an increasingly arid climate). The lateritic zone is coarse grained with clay horizons and dispersed hematite nodules and has developed deep in the profile in some areas due to fluid migration along shear zones during the formation of the profile. The ferruginous zone has the potential to be comparatively transmissive, especially where it has developed deep in the profile due to existing structural features.

The hydraulic properties of the various lithological units were approximated in 2004 (Golder Associates, 2004). Results were derived from progressive constant head and falling head tests undertaken at monitoring bores near pit MM2/3 and are reproduced in Table 4.1 below.

Table 4.1 Estimated Hydraulic Properties of the Weathering Profile

Geological Horizon	Vertical Hydraulic Conductivity (m/s)	Horizontal Hydraulic Conductivity (m/d)	Porosity (%)
Ferruginous	1×10^{-6}	8.64×10^{-2}	5
Smectite	1×10^{-8}	8.64×10^{-4}	40
Saprolite	2×10^{-8}	1.73×10^{-3}	20
Fractured Ultramafic	1×10^{-6}	8.64×10^{-2}	5
Bedrock	1×10^{-9}	8.64×10^{-5}	1

The results indicate relatively high hydraulic conductivity in the laterite and fractured ultramafic units, compared to the saprolite and smectite units.

4.5 7 Series Pits - Geological Architecture

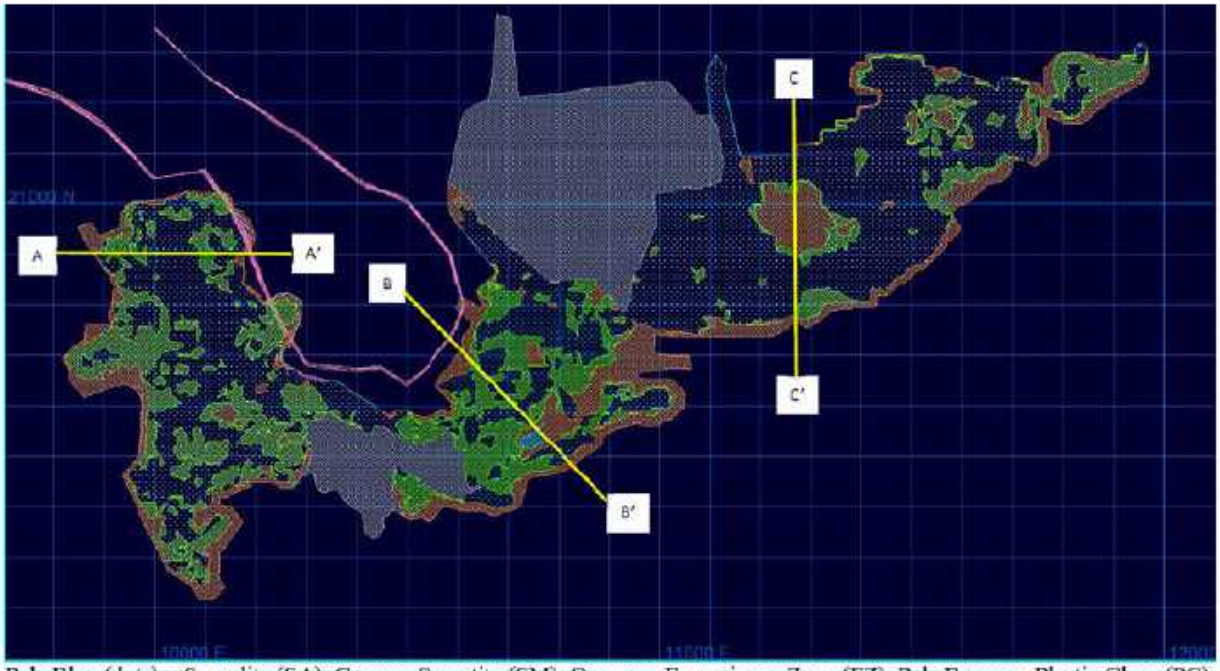
The proposed 7 Series inpit TSF includes a continuous sequence of pits in Resource Zone 07 (rz07), located near the Laverton-Leonora Road mine site entrance, Figure 2. The rz07 Series includes areas of completed mining (7/1, 7/2, 7/3, 7/5, 7/7 and 19/54) and future mining (7/4, 7/8, and 7/11), Figure 2. The completion of mining is scheduled for the first half of 2027.

The following section provides a summary of information from the Geological Architecture Report for rz07 (Kemp, 2023). As rz07 is only partially developed, the interpretations are derived predominantly from the resource model.

4.5.1 Lithological Overview

The distribution of regolith types in the designed pit walls and floor is illustrated in Plate 1 below; reproduced from the Geological Architecture Report for rz07 (Kemp, 2023).

Plate 1 Distribution of Regolith Rock Types – rz07



Pale Blue (dots) = Saprolite (SA), Green = Smectite (SM), Orange = Ferruginous Zone (FZ), Pale Brown = Plastic Clays (PC), Bright blue = Transported Zone (TZ), Pink = Mafic (MAF), Grey = Backfill.

The weathering profile of rz07 generally conforms to the basic laterite sequence for the MMN mining area (detailed in Section 4.2.). A summary of the local lithology, outlined in the geological architecture report, is presented below.

- The modelled fresh and semi-weathered ultramafic units are anticipated to be beyond the depth of mining, with no exposure likely at the completion of the pits.
- Saprolite is expected to comprise more than 50% of the pit walls and floor based on the current pit design. The saprolite is high in magnesium and silica, averaging 13.1% magnesium and 19.5% silicon.
- The main ore zone, comprising smectite clays and ferruginous smectite material, overlies the saprolite and makes up approximately 15% of the pit walls and floor.
- The ferruginous zone overlies the ore zone and is generally exposed in the upper 20m of the pit walls, although is up to 30m deep in some areas. The ferruginous zone comprises less than 20% of the pit surface.
- The upper most units include mottled plastic clays, which can be up to 15m thick, and a thin cap of semi-consolidated transported materials, generally less than 5m thick.

4.5.2 Structural Features

As mining at MMN is restricted to the weathering profile, structural features can most readily be identified from the distribution of certain elements or lithology domains in the regolith profile.

The geological architecture report inferred one main structural feature, a zone of deep weathering on the eastern margin of the pit complex. The zone could represent a weathered fault, which has acted as a conduit for fluid flow resulting in the development of deeper weathering. This zone of deeper weathering is interpreted to be located outside the eastern edge of the proposed pit void and therefore is unlikely to be a primary point of seepage migration.

4.6 8 Series Pits Geological Architecture

The proposed 8 Series inpit TSF includes a continuous sequence of pits in Resource Zone 08w (rz08w). The rz08w Series is located to the immediate south of existing inpit TSFs, namely the 17 Series inpit TSF and TSF 8/4 inpit, and includes areas of completed mining (8/3), current mining (8/6, 8/7, 8/9, and 8/10) and future mining (8/8 and 8/12), Figure 2. The mining of resource rz08w is scheduled for completion in the first half of 2024.

The following section provides a summary of information from the Geological Architecture Report for rz08w (King, 2023a). As rz08w is only partially developed, the interpretations are derived predominantly from the resource model.

4.6.1 Lithological Overview

The distribution of regolith types in the designed pit wall and floor is illustrated in Plate 2 below; reproduced from the Geological Architecture Report for rz08w (King, 2023a).

Plate 2 Distribution of Regolith Rock Types – rz08w

Pale Blue (dots) = Saprolite (SA)/ High Silica Saprolite (SSA), Green = Smectite (SM), Orange = Ferruginous Zone (FZ), Pale Brown = Plastic Clays (PC), White = Magnesite (MAG), Magenta = Foliated Ultramafic (FUM), Purple = Mafic (MAF), Yellow = Felsic (FEL).

The weathering profile of rz08w generally conforms to the basic laterite sequence for the MMN mining area (detailed in Section 4.2.). A summary of the local lithology, outlined in the geological architecture report, is presented below.

- As per rz07, the modelled fresh and semi-weathered ultramafic units at rz08W are anticipated to be beyond the depth of mining, with no exposure likely at the completion of the pits.

- Saprolite is expected to comprise more than 50% of the pit walls and floor based on the current pit design. The saprolite is relatively high in magnesium (averaging 9.7%) and high in silicon (averaging 23.0%).

- The main ore zone, comprising smectite clays and ferruginous smectite material, overlies the saprolite and comprises a high proportion (>40%) of the pit walls and floor. This proportion is high compared to rz07, where smectite makes up less than 15% of the pit surface. Smectite is modelled to depths of up to 55m near foliated ultramafic (FUM).

- The ferruginous zone overlies the ore zone and is generally exposed in the upper 20m of the pit walls, although can be over 40m deep in areas where structural features are prevalent, such as shear zones or FUM.

- As per rz07, the upper most units include mottled plastic clays, which can be up to 15m thick, and a thin cap of semi-consolidated transported materials, generally less than 5m thick.

4.6.2 Structural Features

The geological architecture report for rz08w identified several distinct structural features, with interpretations primarily based on the distribution of certain elements in the regolith profile.

- Foliated ultramafic units (FUM) were identified in pits 8/9 and 8/10 and are characterised by elevated Al/Mg and moderate Fe. The FUM in pit 8/9 trends south and south-west with a westward dip towards pit 8/7. This unit coincides with a zone of deep weathering through the centre of the final pit void.

- In the MMN project area the ultramafic regolith profiles are commonly bound by weathered felsic and/or mafic volcanic and intrusive rock. An E-W to N-S trending felsic volcanic unit has been defined by resource definition and grade control drilling to the north of the rz08w pit complex and is characterised by elevated Al and low Mg and Fe. The felsic unit intersects the top of pit 8/7 and extends northwards to the western boundary of existing inpit TSF 8/4, and north westwards to the eastern boundary of the 17 Series inpit TSF.

- A mafic intrusive intersects the top of the proposed pit void between pits 8/6 and 8/7 and is identified by elevated Al, low Mg, and moderate Fe.

- Additional structural zones were identified in the south-eastern corner of the pit series. Little detail is presented in the geological architecture report for these features.

4.7 Pit 8/15 Geological Architecture

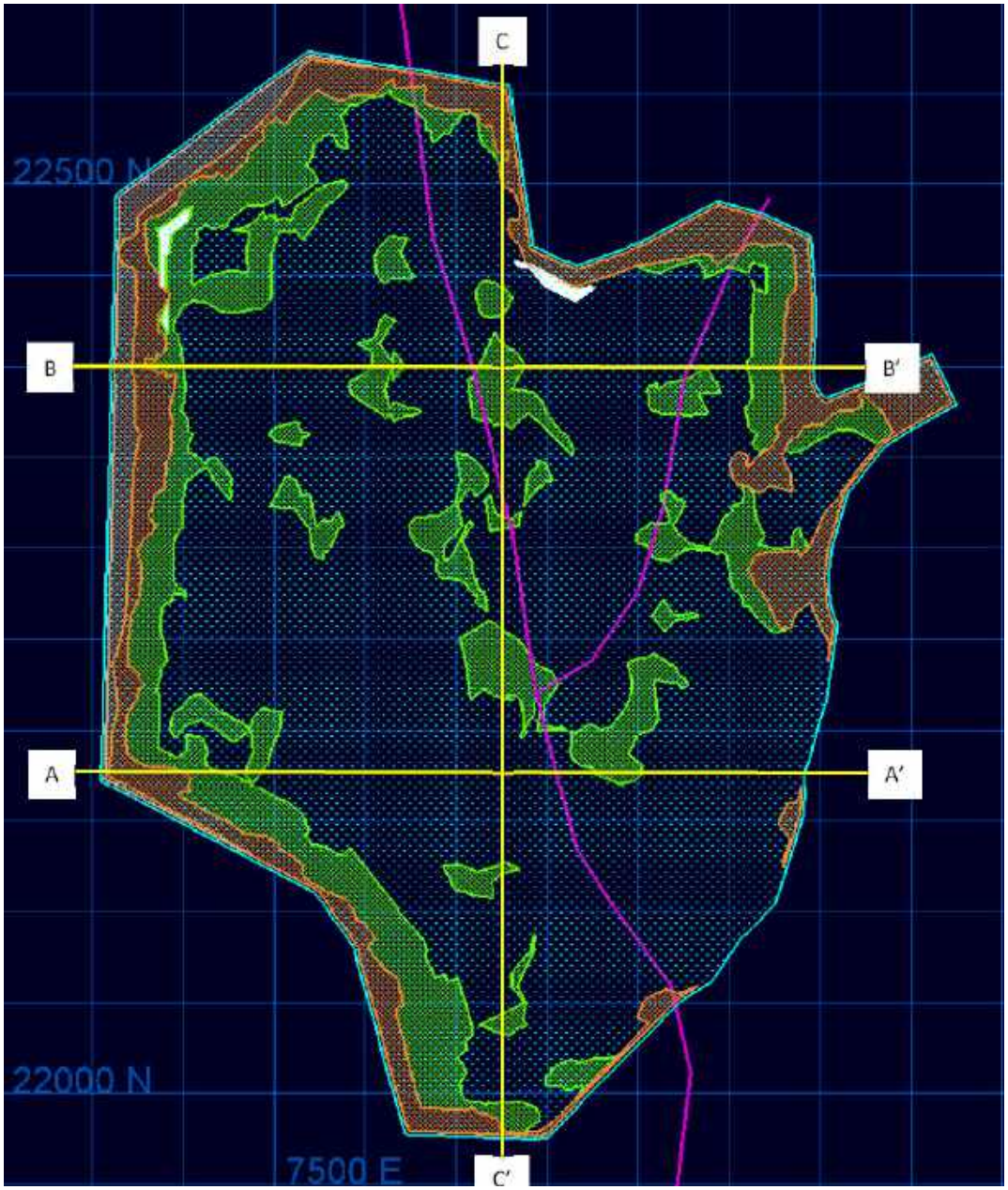
The proposed inpit TSF at pit 8/15 is located in the centre of the MMN mining area, between existing inpit TSFs 9/4 and 9/5 and just east of inpit TSF 18/6, Figure 2. Mining of pit 8/15 commenced in the second half of 2023 and is due for completion in early 2024.

The following section provides a summary of information from the Geological Architecture Report for pit 8/15 (King, 2023b). As the pit is only partly developed, the interpretations are derived predominantly from the resource model.

4.7.1 Lithological Overview

The distribution of regolith types in the designed pit wall and floor is illustrated in Plate 3 below; reproduced from the Geological Architecture Report for pit 8/15 (King, 2023b).

Plate 3 Distribution of Regolith Rock Types – Pit 8/15



Pale Blue (dots) = Saprolite (SA)/ High Silica Saprolite (SSA), Green = Smectite (SM), Orange = Ferruginous Zone (FZ), Pale Brown = Plastic Clays (PC), White = Magnesite (MAG), Pink = Foliated Ultramafic (FUM) (Structure).

The weathering profile of pit 8/15 generally conforms to the basic laterite sequence for the MMN mining area (detailed in Section 4.2.). A summary of the local lithology, outlined in the geological architecture report, is presented below.

- The modelled fresh and semi-weathered ultramafic units at pit 8/15 are anticipated to be beyond the depth of mining, with no exposure likely at the completion of the pit.

- Saprolite (SA) or siliceous saprolite (SSA) is expected to comprise >70% of the pit walls and floor by surface areas exposure. The saprolite zones are relatively high in magnesium, averaging 9.2% across the pit, and are high in silica, averaging 22.5% and 29.9% silicon for SA and SSA respectively.

- The main ore zone, comprising smectite clays and ferruginous smectite material, overlies the saprolite and comprises <20% of the pit walls and floor. Smectite is modelled to depths of up to 55m near foliated ultramafic (FUM).

- The ferruginous zone overlies the ore zone and is generally exposed in the upper 20m of the pit walls, although can be over 40m deep in areas where structural features are prevalent, such as shear zones or FUM. The ferruginous zone makes up less than 10% of the pit surface area.

- The upper most units include mottled plastic clays, which can be up to 15m thick, and a thin cap of semi-consolidated transported materials, generally less than 5m thick.

4.7.2 Structural Features

As pit 8/15 is only partially developed, geological interpretations must be relied upon for delineation of structural features which could represent pathways for seepage migration.

The geological architecture report for pit 8/15 identified one major structural feature; a foliated ultramafic unit (FUM) cuts across the pit, following a south-east trend with a westward dip. The FUM coincides with a zone of deep weathering through the centre of the pit, which is interpreted to represent a weathered fault or shear. The fault or shear has acted as a conduit for fluid flow, resulting in the development of deeper weathering.

5. GROUNDWATER MONITORING

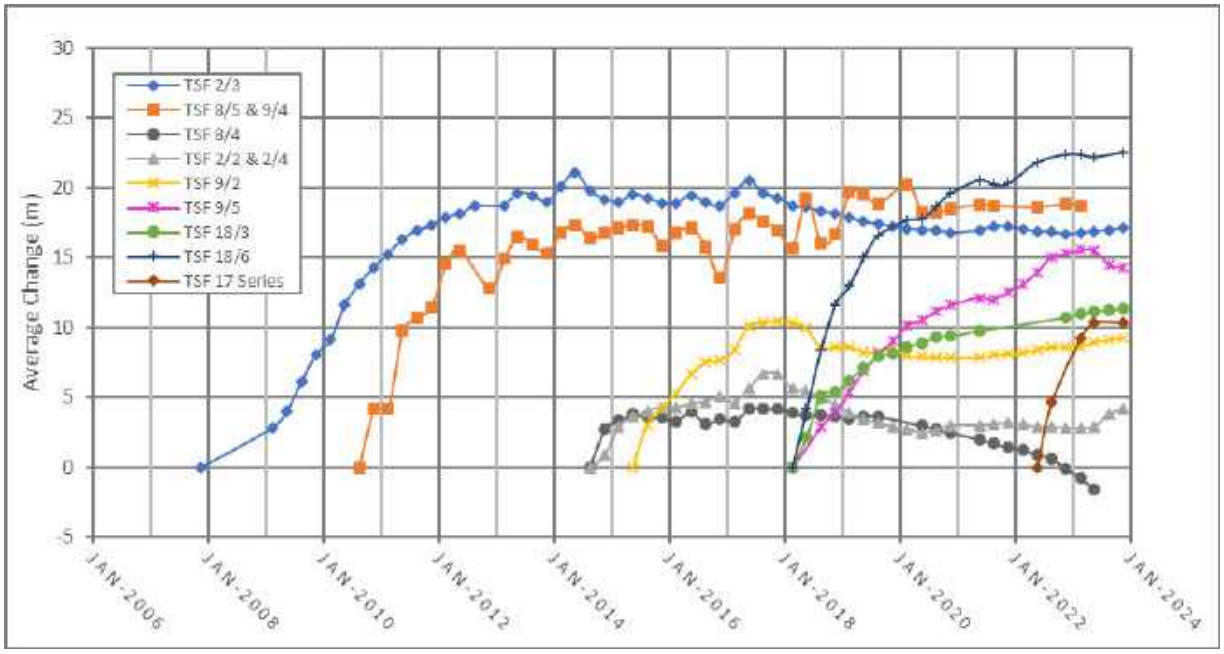
Considerable monitoring data has been collected from monitoring bores adjacent to existing inpit TSFs, including quarterly water chemistry laboratory analysis and water level measurements. The performance of existing facilities is considered to be fundamental to this hydrogeological assessment, especially considering proximity of the 8 series pits and pit 8/15 and similarities in lithology and geological structure.

5.1 Water Levels

Water level measurements have been recorded on a quarterly basis at seepage indication bores. The dataset includes water level measurements collected pre and post TSF commissioning.

Chart 1 displays relative changes in groundwater levels at each inpit TSF since its commissioning. The chart consists of multiple series, with each series representing the average water level change for all seepage indication bores within a specific inpit TSF area. To ensure comparability of the presented averages in each series, any data points where one or more water level measurement was not recorded that quarter have been excluded.

Chart 1 Seepage Indication Bores – Average Water Level Change



The chart shows relatively rapid water level rises during the early stages of tailings deposition at most inpit TSFs. However, the magnitude of water level rise recorded at seepage indication bores adjacent to each facility differs widely; from less than 5m for inpit TSF 8/4, to well in excess of 20m for inpit TSF 18/6.

The overall extent of water level rise at each facility is governed largely by the local hydrogeological conditions and site-specific operational factors. Sites with less mounding and where mounding dissipates quickly (for instance TSF 8/4 compared to TSF 18/6) might indicate higher bulk hydraulic conductivity, with seepage flowing more readily through the subsurface. The wide variation in groundwater mounding supports previous interpretations that the weathering profile is highly heterogeneous and anisotropic.

5.2 Water Chemistry

Nickel, cobalt, and TDS concentrations are considered to be key indicators for seepage migration from the TSFs. The historical concentrations of these analytes, recorded at seepage indication bores for all existing inpit TSFs, are presented on bore hydrographs in Appendix B, and are summarised below:

Inpit TSF (Figure No.)	**Summary of Trends**
2/3 (B1)	Deposition commenced in early-2009 and ceased in June 2014. Concentrations of TDS, Co and Ni were consistent during this period and near ambient levels. Gradual increases in TDS were recorded at IP203-1 during 2017 and 2018, with similar increases in TDS recorded at IP203-4 since mid-2021. The slight increases in TDS are likely to be related to more recent discharge of decant water from inpit TSF 2/2-2/4. Concentrations of Co and Ni remain at ambient levels.
7/2 (B2)	All concentrations remain at ambient levels. Pit 7/2 has only been used for the disposal of scats from the heap leach facility.
8/5 & 9/4 (B3)	Deposition was undertaken between late-2010 and May 2014. Historical results show elevated concentrations of Ni, Co, and TDS at IP805-2 and IP805-3. Higher concentrations have typically been recorded post-deposition at these seepage indication bores. However, the facility was used as a decant disposal location from adjacent inpit TSFs until 2019/2020, which likely contributed to these increases. Historical TDS concentrations were also elevated at IP805-1 and IP904-2. However, TDS concentrations have fallen considerably at IP904-2, with analysis in February 2023 (before the bore was destroyed) indicating a return to near ambient conditions.
2/2 & 2/4 (B4)	The facility was commissioned in September 2014, and has not yet been decommissioned, although there is limited remaining storage capacity. Concentrations of TDS, Co, and Ni have generally remained stable at ambient levels. Occasional spikes in TDS have been recorded at IP202-2; however, TDS concentrations have remained near baseline levels since mid-2021.
9/2 (B5)	Inpit TSF 9/2 was commissioned in August 2015, and was used for primary tailings discharge between August 2015 and June 2018. Since June 2018 the facility has been in a top up phase, but has also received decant water from the other inpit TSFs when decant cannot be sent to the evaporation ponds. Historical results indicate fluctuating TDS, with concentrations at IP902-1, IP902-2, and IP902-6 often exceeding 5,000mg/L. TDS concentrations peaked between 2019 and 2020, after the facility entered the top up phase. Since February 2022, TDS concentrations at all sites (except IP902-6) have remained below 5,000mg/L. As of November 2023, concentrations of Co and Ni were mostly near ambient levels.
8/4 (B6)	Deposition was undertaken between September 2014 and July 2017. TDS increases were recorded at IP804-2 in 2012, prior to commissioning, likely due to seepage influence from inpit TSF 8/5 to the north. Increases in TDS were recorded at IP804-1 and IP804-3 during the operating period, although Co and Ni increases appear to have occurred primarily after deposition ceased. The chart illustrates intermittently elevated concentrations of TDS, Co, and Ni at IP804-3, with fluctuating results possibly indicative of rainfall influence. Significant increases in TDS, Co and Ni were recorded at IP804-1 in May 2023.
9/5 (B7)	Deposition commenced in September 2018; the facility remains active as of November 2023, although there is limited remaining storage capacity. Gradual increases in TDS have been recorded at some sites between 2021 and 2023, with concentrations rising slightly above 5,000mg/L at IP905-1, IP905-2, and IP905-3. Concentrations of Co and Ni have typically remained near ambient levels.
18/3 (B8)	The facility was commissioned in July 2018 and remains active as of November 2023, although there is limited remaining storage capacity. Historical results indicate highly elevated TDS, Co, and Ni at IP1803-3. Analyte concentrations at IP1803-1 and IP1803-2 remain near ambient levels indicating that the seepage is somewhat discrete at IP1803-3.
18/6 (B9)	The facility was commissioned in March 2018 and has been in a top up phase since July 2022. Concentrations of Ni, Co, and TDS remain near ambient levels. Baseline TDS concentrations at IP1806-1 appear to be slightly elevated, which may be due to pre-existing influence from established inpit TSFs north (9/5) or south (9/4).
17 Series (B10 & B11)	The 17 series inpit was commissioned in May 2022 and remains active, with significant remaining storage capacity. Concentrations at the 17 Series seepage bores are typically near ambient levels. The exceptions are TDS concentrations at IP17-02 and IP17-09, which have increased consistently, with concentrations now above 5,000mg/L.

The charts show notable increases in concentrations at certain locations, while others show minimal or no changes. These variations are, in part, attributable to the heterogenous nature of the fractured and weathered aquifers in the MMN area. Understanding these aquifer complexities is essential for accurate assessment and effective management of groundwater quality in the inpit TSF areas.

5.3 Seepage Migration

Many of the established seepage indication bores have been sited to target potential pathways for seepage migration, including structural features (e.g., faults, shears, and contact zones) and areas of deeper/enhanced weathering. Lithological logging and hydraulic testing of the seepage indication bores has identified layers of widely differing permeability and storage across the MMN project area.

An examination of the hydrogeological characteristics of seepage indication bores with notable concentration increases is merited to enhance the understanding of the primary drivers behind seepage migration in the MMN area. Seepage indication bores with the largest increases in concentrations of Ni, Co, and TDS (as discussed in Section 5.2) include: IP1803-3, IP805-2, IP805-3, IP804-1, and IP804-3. The main lithological/hydrogeological characteristics of these sites are detailed below:

IP1803-3	Lithology: Heavily weathered siliceous ultramafic saprolite, overlain by units of undifferentiated saprolite and magnesite. The profile was capped with a mottled ferruginous/clay zone and ferruginous duricrust, with fill materials near the surface (which inhibited bore development due to lost air). Hydrogeology: First groundwater was intersected at 45mbgl in heavily weathered siliceous ultramafic saprolite, with a standing water level of 39.33mbgl. Subsequent testing indicated relatively high hydraulic conductivity of **$3.77x10^{-1}$m/d** (applicable for tested units below approximately 35mbgl).
IP805-2	Lithology: Drilling terminated in massive mafic rock with slight weathering. A clay rich weathering profile was intersected above approximately 33mbgl, which was capped by ferruginous laterite near the surface. Hydrogeology: No groundwater flow was observed during drilling and the initial standing water level was near the base of the bore at 57.45mbgl. Hydraulic testing indicated relatively low hydraulic conductivity of **$1.17x10^{-2}$m/d** (applicable for tested units below approximately 36mbgl). Hydraulic testing did not include shallower unsaturated weathered units (above approximately 36mbgl) although these units are reportedly clay rich.
IP805-3	Lithology: Drilling terminated in massive fine grained mafic, which was overlain by massive ultramafic with little to no recorded weathering. The profile was capped by <5m of clay at the surface. Hydrogeology: No groundwater flow was observed during drilling and the initial standing water level was deep at 54.25mbgl. Subsequent testing indicated very low hydraulic conductivity of **$4.41x10^{-3}$m/d**, which reflects the competent and massive profile.
IP804-1	Lithology: The drillhole terminated in massive ultramafic rock, which was overlain by a clay rich weathering profile and a thin cap of alluvium at the surface. Massive ultramafic rock was intersected from 28mbgl, which is shallow compared to the depth of weathering in the pits. Hydrogeology: No hydrogeological information was collected during drilling and hydraulic testing was not undertaken at IP804-1.
IP804-3	Lithology: Drilling terminated in fresh dolerite, which graded into weathered ultramafic saprock and heavily weathered saprolite. Secondary siliceous material was recorded in saprolite at 31-38mbgl. The upper saprolite profile was clay rich, grading into ferruginous saprolite and laterite at the surface. Hydrogeology: A drilling yield of approximately 0.5L/s was recorded, with first water intersected in saprock at 48mbgl. The initial standing water level was 40.23mbgl. Hydraulic testing results could not be analysed as there was insufficient extra head imposed for falling head test analysis. This is indicative of relatively high hydraulic conductivity, either through aquifer units (i.e., the saprock) or unsaturated units (saprock/saprolite) slightly above the standing water level.

Hydraulic testing indicated comparatively high hydraulic conductivity at seepage indication bores IP1803-3 and IP804-3, which could be a major factor enabling seepage migration to these sites. In contrast, low hydraulic conductivity was recorded at IP805-2 and IP805-3, with more competent and massive lithologies intersected during drilling.

It should be noted that falling head tests, from which hydraulic conductivity values are derived, have a very localised “reach” into the aquifer due to the small volume of water displaced. Historical hydraulic conductivity results are therefore only indicative of the localised conditions at each bore. In the case of IP805-2 and IP805-3 (where low hydraulic conductivity was interpreted), there are likely to be more permeable lithologies (seepage pathways), between the bore and the inpit TSF. Conversely, there are a number of monitoring bores with comparatively high local hydraulic conductivity, but with unaffected water quality. These sites are likely to have less permeable sediments between the bore location and the inpit TSF, thus constraining seepage migration on a broader scale.

While historical hydraulic conductivity results provide valuable information about localised aquifer conditions at specific bore locations, they should be interpreted with caution, recognising that they may not capture the full complexity of aquifer behaviour extending beyond the influence of the bore sites. Additionally, shallower seepage pathways, which at the time of bore construction may be unsaturated (and therefore untested), may undergo saturation over time due to continuous tailings deposition and subsequent groundwater mounding.

6. DISCUSSION

6.1 Existing Inpit TSFs – Past Performance

Extensive monitoring data has been collected from a network of some 44 seepage indication bores situated on the perimeter of existing inpit TSFs, including quarterly water level measurements and water chemistry laboratory analysis. The water chemistry data, examined in Section 5.2 of this report, highlights five bores within the monitoring network which exhibit notable seepage, characterised by elevated concentrations of nickel, cobalt, and TDS.

To enhance the understanding of potential drivers behind seepage migration, available lithological and hydrogeological information for the five contaminated bores was examined (see Section 5.3). Upon evaluation of all five sites, no significant correlation was observed between specific lithology or hydraulic conductivity thresholds. Surprisingly, two of the bores exhibited mostly competent and massive lithologies, coupled with low hydraulic conductivity. This highlights that the localised hydrogeological conditions at the bores are not necessarily reflective of the conditions prevailing between the bores and the TSF, reinforcing previous interpretations that the aquifers at MMN are highly heterogeneous.

6.2 Proposed Inpit TSFs – Seepage Migration Potential

A thorough examination of available data was conducted for the proposed tailings disposal into the 7 Series Pits, 8 Series Pits and Pit 8/15. Drawing on previous experience with the weathering profiles and the hydrogeology in the MMN mining area, information has been synthesised from geological architecture reports, and case-study evidence and other supportive work undertaken at existing in-pit TSFs. The analysis yields the following general findings regarding seepage potential:

- The weathering profile comprises layers of widely differing permeability and storage. Complex chemical processes have led to the removal of large quantities of soluble material, some of which, such as silica, iron, magnesium carbonate and calcium carbonate have been re-deposited elsewhere.

- Water levels may be rapidly affected at proposed in-pit TSF monitoring sites, particularly during early stages of deposition. Highly variable water level mounding at existing facilities indicates the likelihood of a heterogenous and anisotropic groundwater environment.

- Structural features (e.g., faults, shears, and contact zones) can most readily be identified from the distribution of certain elements or lithology domains in the regolith profile. These features may act as preferential pathways for seepage migration.

- Structural features within the saprolite have been variably filled by remobilised silica, which is likely to suture migratory/leaching zones to some degree. The structural features are likely to continue into the underlying semi-weathered ultramafic protolith, however these units are modelled below the depth of mining and are unlikely to represent seepage pathways.

- Saprolite comprises the majority of the walls and floor of the pits of interest, and is typically high in magnesium. It is expected that the saprolite will have neutralising properties when exposed to potentially acidic tailings, providing some degree of mitigation for falls in pH.

- There is potential for shallower flow paths to be established should water levels return to or rise above their pre-mining elevation as a result of natural groundwater inflow or from tailings deposition within the pits. This could include flow paths within the ferruginous zone.

- Interpreted structural features, which could represent potential seepage pathways, were outlined in geological architecture reports for rz07, rz08w and pit 8/15 and have been summarised below. These features may be appropriate targets for the positioning of seepage indication bores.

    - 7 Series Pits - the geological architecture report for rz07 identified a single structural feature near the pit complex. A zone of deeper weathering is located outside the eastern edge of the proposed pit void, but does not intersect the pit and is unlikely to be a primary point of seepage migration.

    - 8 Series Pits - the geological architecture report for rz08w identified several distinct structural features of potential concern:

        - two foliated ultramafic units which intersect the proposed pit void and coincide with zones of deeper weathering.

        - An E-W to N-S trending felsic volcanic unit intersects the northern pit wall and extends northwards to the western boundary of existing inpit TSF 8/4, and north westwards to the eastern boundary of the 17 Series inpit TSF.

        - A mafic intrusive intersects the top of the proposed pit void between pits 8/6 and 8/7.

        - Additional structural zones were identified in the south-eastern corner of the pit series. Little detail is presented in the geological architecture report for these features.

    - Pit 8/15 - the geological architecture report for pit 8/15 identified one major structural feature; a foliated ultramafic unit cuts across the pit. The unit coincides with a zone of deep weathering through the centre of the pit, which is interpreted to represent a weathered fault or shear.

7. RECOMMENDATIONS

7.1 Pre-construction of the Inpit TSFs

Seepage Indication Bore Installation

Seepage indication bores should be installed on the perimeter of the proposed inpit TSFs. Previous installations (at existing inpit TSFs) have been 100mm in diameter to enable the bores to be equipped for seepage recovery. However, recent advice from DWER relating to the 17 Series inpit TSF is that *"monitoring bores should be kept separate from seepage recovery to ensure continuity and reliability of monitoring data. Conversion of monitoring bores into seepage recovery bores will therefore not be accepted."* As such, consideration should be given to the installation of 50mm monitoring bores if this suits MMO's proposed sampling methodology and preference.

The seepage indication bores should be constructed at a distance where they will not be unreasonably impacted by seepage due to proximity. This is especially important if more rigorous licence limits are included, such as the 1mg/L limit for nickel at the 17 Series inpit TSF. This spacing also allows for the establishment of a purpose-built seepage recovery bore between the seepage indication bore and inpit TSF, if required.

The bores should be strategically located to ensure comprehensive spatial coverage while also targeting the main structural features identified in the geological architecture reports, which may serve as primary pathways for seepage migration. To maximise the likelihood of intersecting structural targets, the final drilling sites should be confirmed by the Geology Department using their expertise in managing the geological block model and drilling data.

Baseline Testing

Baseline testing should be conducted at the seepage indication bores prior to the commencement of tailings deposition into the proposed inpit TSFs. Nominally, the baseline testing should include:

- Electrical Conductivity (EC) profiling of completed monitoring bores.
- Groundwater sampling and water chemistry laboratory analysis.
- Falling head and rising head permeability testing (slug testing).

Ongoing Monitoring

Ongoing quarterly groundwater monitoring should be undertaken in accordance with the monitoring requirements specified in L7276/1996/12. The groundwater sampling should be conducted in accordance with AS/NZS 5667.1, with groundwater samples sent to a NATA accredited laboratory for analysis.

A minimum of two quarterly monitoring events should be completed prior to the commencement of tailings deposition. The analyses should include all analytes tabulated under "monitoring of ambient groundwater quality" in the Part V Licence (L7276/1996/12).

Data collected from existing seepage indication bores is reviewed on a quarterly basis to highlight where seepage is indicated, and identify monitoring locations exceeding or at risk of exceeding licence limits and/or MMO TARP triggers. Any new seepage indication bores should be included in the quarterly seepage review.

8. REFERENCES

Douglas, R., 2009, Potential Tailings Storage Facility (TSF), Geological Architecture Report for Murrin Murrin North, July 2009, unpublished internal report by Minara Resources Ltd.

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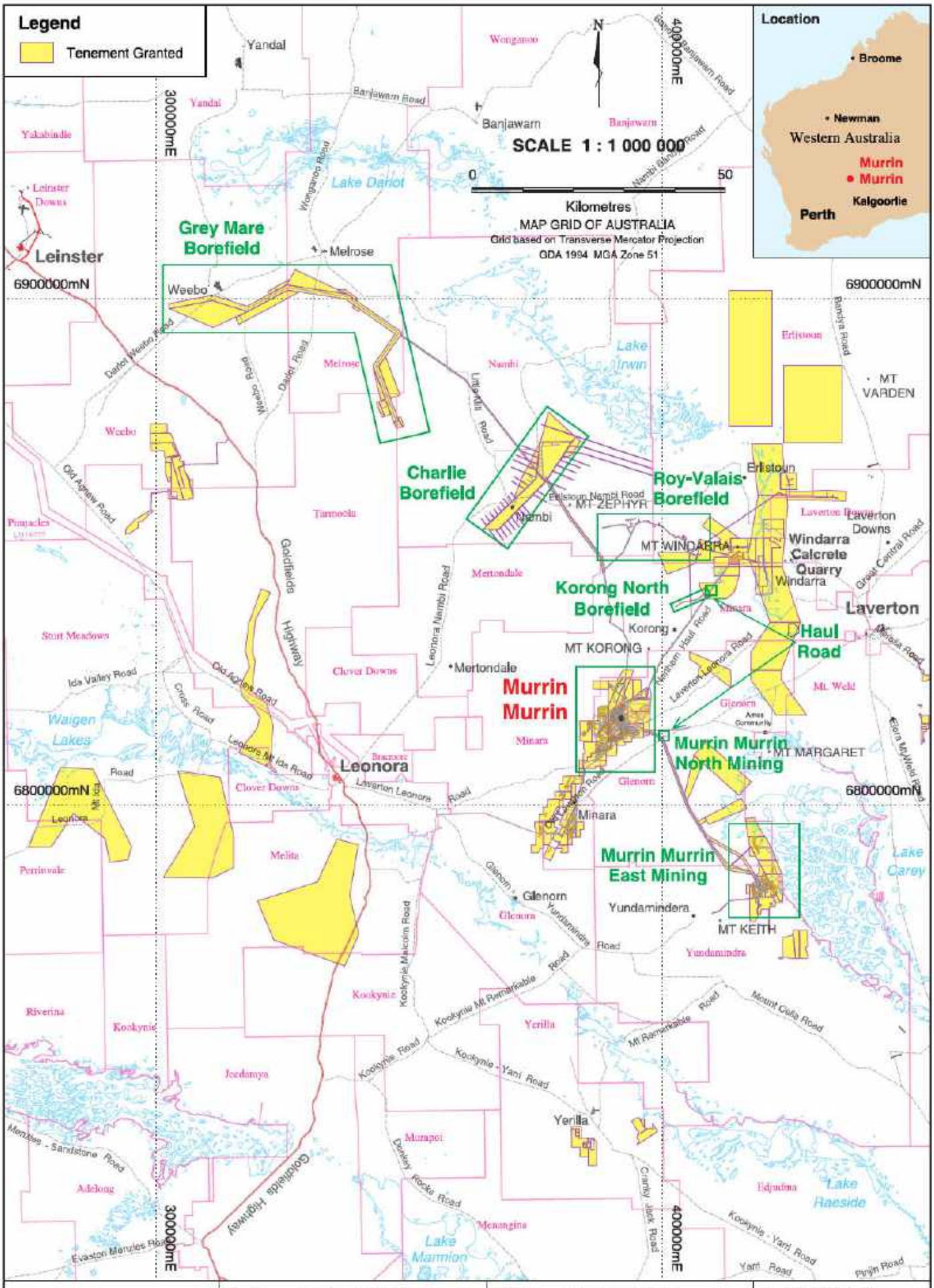
Morgan, K.H., 1999, Rainfall recharge to arid-semi arid phreatic aquifers, Yilgarn Carton, Western Australia. Water 99, Joint Congress, Brisbane, Australia, 6 to 8 July 1999, pp1204-1211.

Department of Mines and Petroleum, 2013, Tailings storage facilities in Western Australia – code of practice: Resources Safety and Environment Divisions, Department of Mines and Petroleum, Western Australia, 13 pp.

FIGURES



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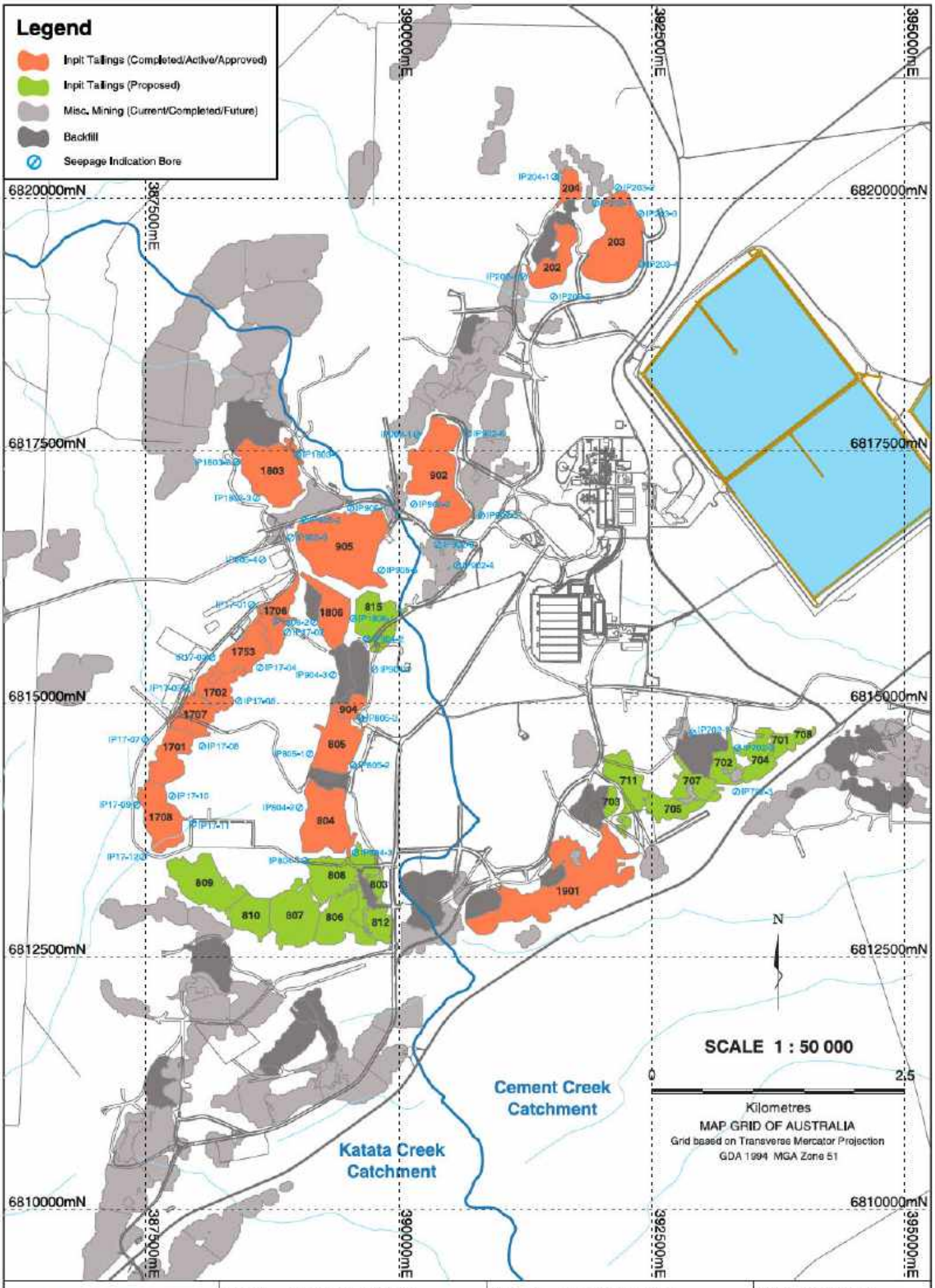
			Scale: 1:1 Million
			Author: [redacted]
Checked: [redacted]	**REGIONAL LOCATION**		Figure No. 1
Approved: [redacted]		A4	Plan No. L0100-1110



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		A4	Author: [redacted]
Checked: [redacted]	PROPOSED INPIT TAILINGS STORAGE FACILITIES		Figure No. 2
Approved: [redacted]			Plan No. L0100-1213

APPENDIX A

GLOSSARY - Units & Terms

GLOSSARY

Units

Km	Kilometre	
Ha	Hectare	= 10,000m^2
kL	Kilolitre	= 1m^3
ML	Megalitre	= 1,000m^3
GL	Gigalitre	= 1,000,000m^3
MTPA	Million Tonnes Per Annum	
mg/L	Milligrams per litre	

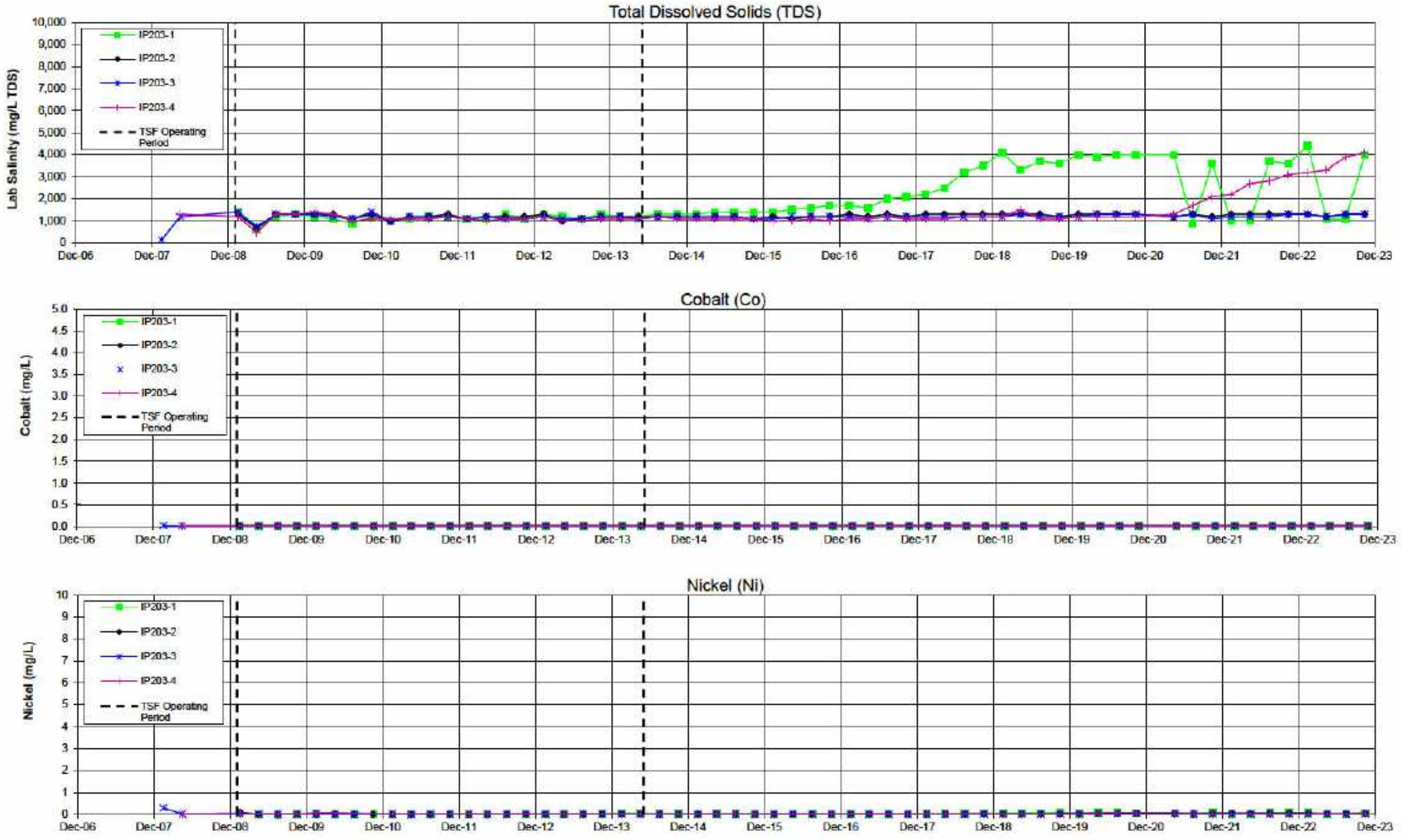
Terms

Abstraction	Pumping groundwater from an aquifer
Alluvium (alluvial)	Detrital material transported by streams and rivers
Aquifer	A geological formation or group of formations able to receive, store and transmit significant quantities of water
Basin	A discrete Phanerozoic age (less than 545Ma) geological structure containing sedimentary and sometimes volcanic rocks and groundwater resources with porous, permeable formations
Bedrock	General term for solid rock underlying unconsolidated materials
Bore	Drilled small diameter well, usually lined with steel or plastic casing for the purpose of obtaining or monitoring groundwater
Brackish	Water containing between 1,500 and 3,000 mg/L total dissolved solids (TDS), tasting slightly salty
Cavitation	A phenomena of cavity formation, or formation and collapse, especially in regard to pumps, when the absolute pressure within the water reaches the vapour pressure causing the formation of vapour pockets
Colluvium (colluvial)	Detrital material transported by gravity down slopes
Confined aquifer	An aquifer located between upper and lower layers of low permeability
Dewatering	Removal of free-draining water resulting in lowering the watertable and reduction of groundwater in storage
Drawdown	The distance between the static water level and the surface of the cone of depression
Formation	A lithological distinctive stratum or sequence of rocks deposited during a finite period and constituting a mappable unit
Fractured rock aquifer	Crystalline rocks that yield economic supplies of groundwater from fractures or weathering profiles
Fresh	Water containing less than 500mg/L TDS, and generally suitable for drinking
Groundwater	Water occurring below the land surface in the saturated zone in pores and fissures, generally in motion and part of the hydrologic cycle
Hydraulic conductivity	A measure of the rate at which water moves through a porous medium
Hydrogeology	Science concerned with the study of groundwater occurrence and movement and its relation to the geological environment

Inferred	A geological boundary or resource estimate that is based on experience, comparisons to geological relationships, and has not necessarily been ground truthed or verified from field investigations or drilling.
Karst	A type of topography produced by solution and collapse of limestone formations
Leakage	Vertical (and or horizontal) flow of groundwater from one aquifer to another, generally through a less permeable layer
Marginal quality	Water containing between 500 and 1,500mg/L TDS, in the upper range of acceptability for drinking
Outcrop	Portion of land surface occupied by a particular geological formation
Permeability	A measure of the rate at which fluid or gas can move through a porous medium
Potentiometric surface	The level to which water from a confined aquifer will rise
Recharge	The water that infiltrates the watertable originating from rainfall and streamflow
Renewable resources	The amount of groundwater that accrues each year from recharge
Saline	Water containing more than 3,000mg/L TDS
Salinity	A measure of the concentration of total dissolved solids (TDS)
Specific capacity	The rate of discharge of a water well per unit of drawdown, commonly expressed in m^3/day/m. It varies with duration of discharge
Specific yield	The volume of water that an unconfined aquifer releases from storage per unit surface area of the aquifer per unit decline in the watertable
Storage coefficient	The volume of water that a confined aquifer releases from storage per unit surface area of aquifer per unit decline in the potentiometric surface
Sustainable yield	The amount of groundwater that may be abstracted from an aquifer in perpetuity without adverse impact
Transmissivity	The rate at which water is transmitted through a unit width of an aquifer under a unit hydraulic gradient; in the International System, transmissivity is given in m^3/day through a vertical section of an aquifer one meter wide and extending the full saturated height of an aquifer under a hydraulic gradient of 1.
Throughflow	The process or amount of groundwater flowing through an aquifer
Unconfined aquifer	An aquifer overlying a relatively impermeable layer which is saturated from the watertable (at atmospheric pressure) downwards and generally with free vertical infiltration of recharge from the surface
Weathering	Process whereby surface rock materials are broken down and chemically altered by exposure and biological agents
Well	A hole or dug excavation designed to facilitate the abstraction of groundwater (term also applied to drilled bores)
Wellfield (borefield)	A group of wells or bores used together to provide a groundwater supply
Yield	The amount of water that can practically be pumped from a well/bore or aquifer

APPENDIX B

SEEPAGE INDICATION BORE HYDROGRAPHS



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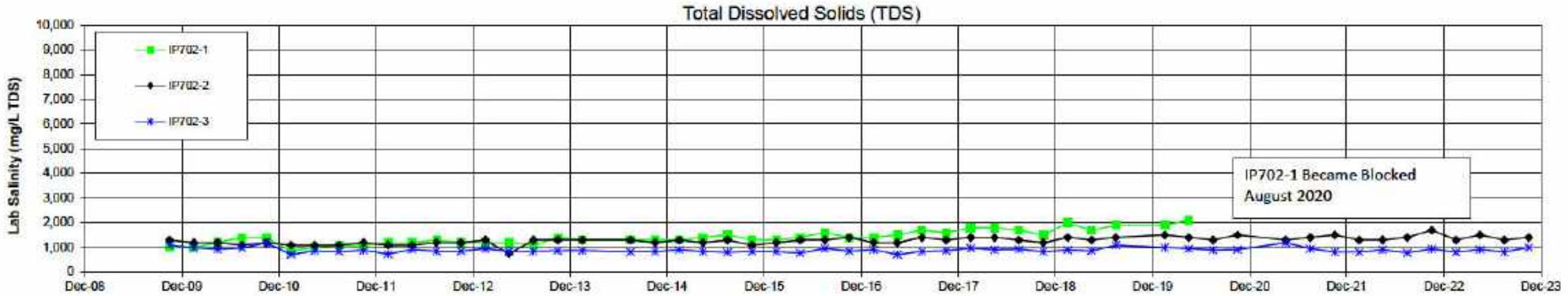

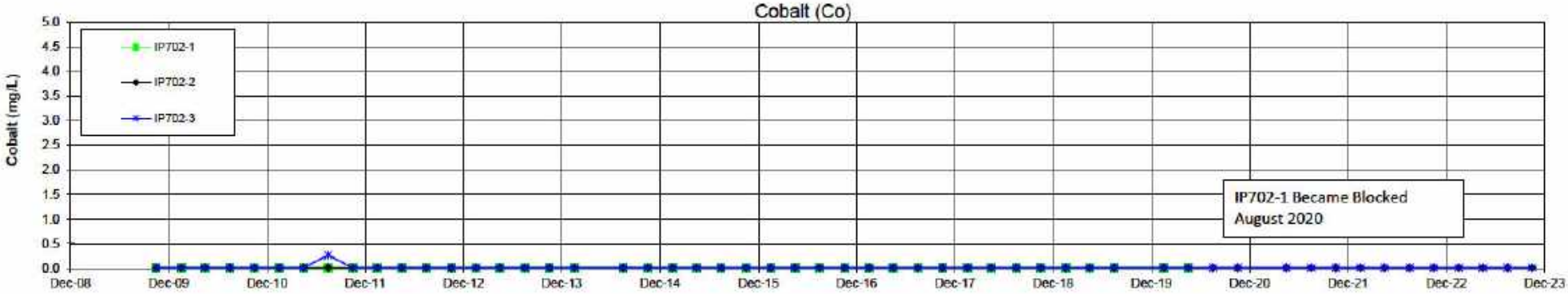

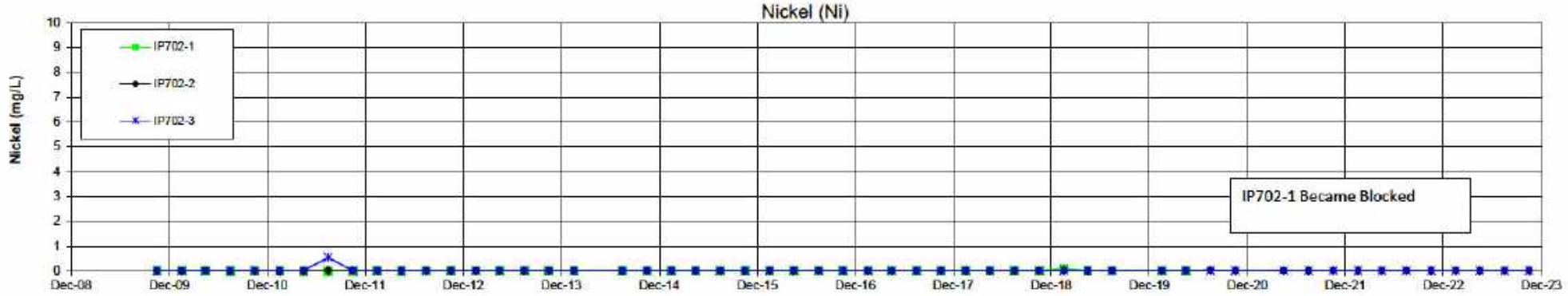

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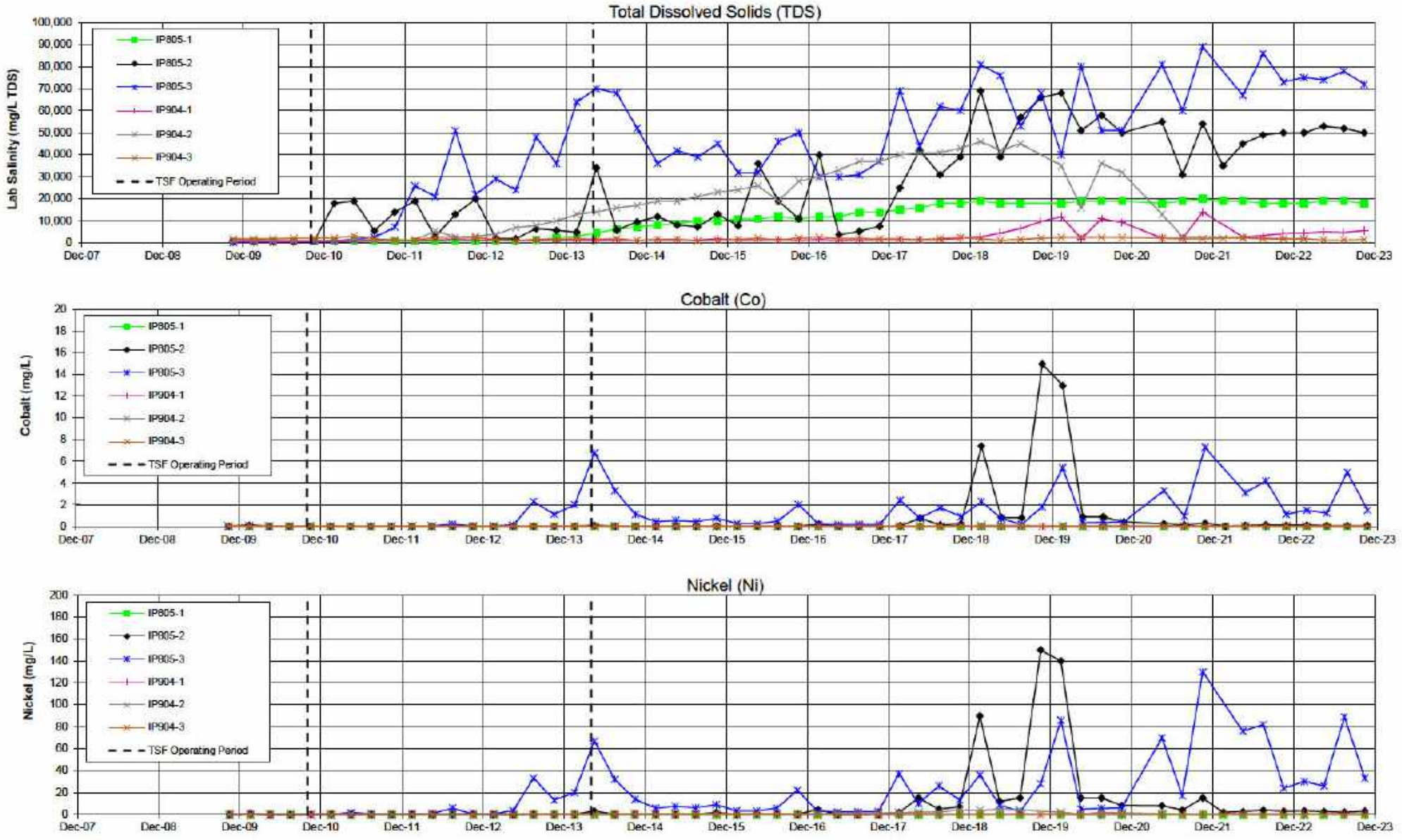

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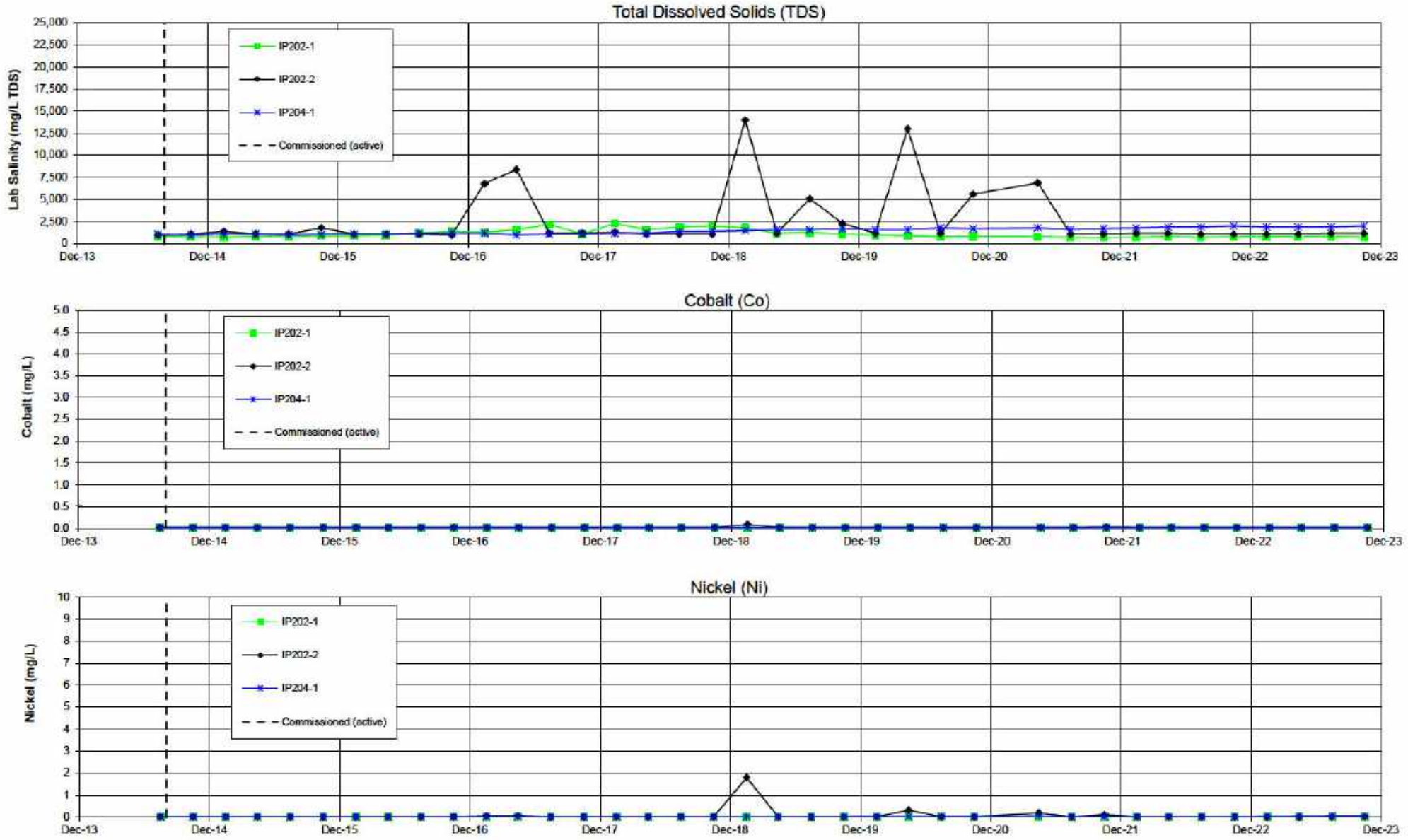

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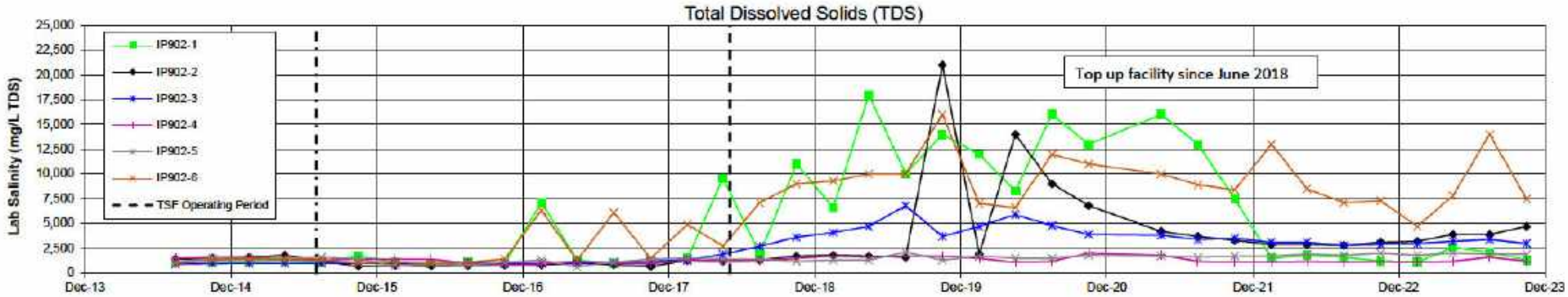

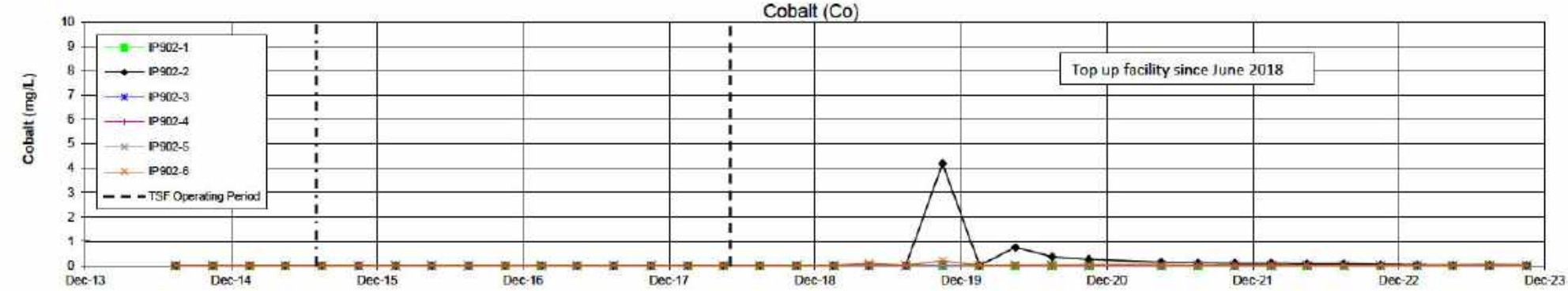

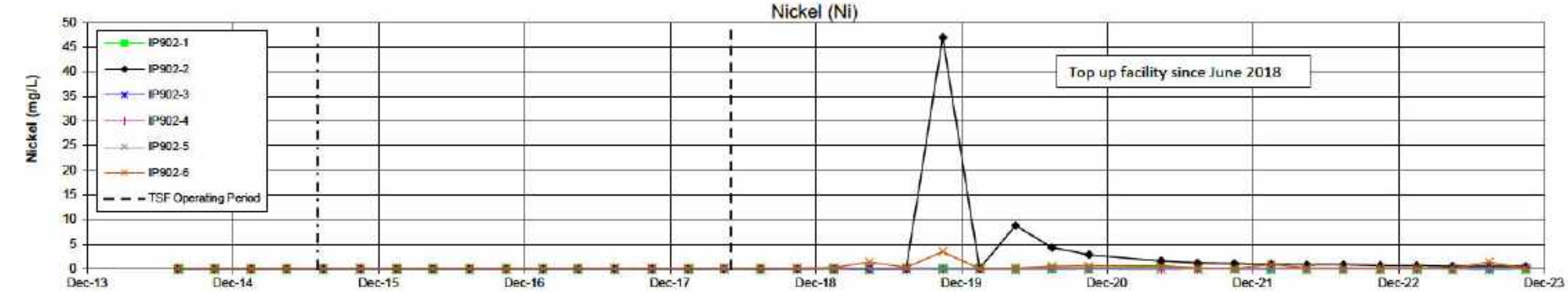

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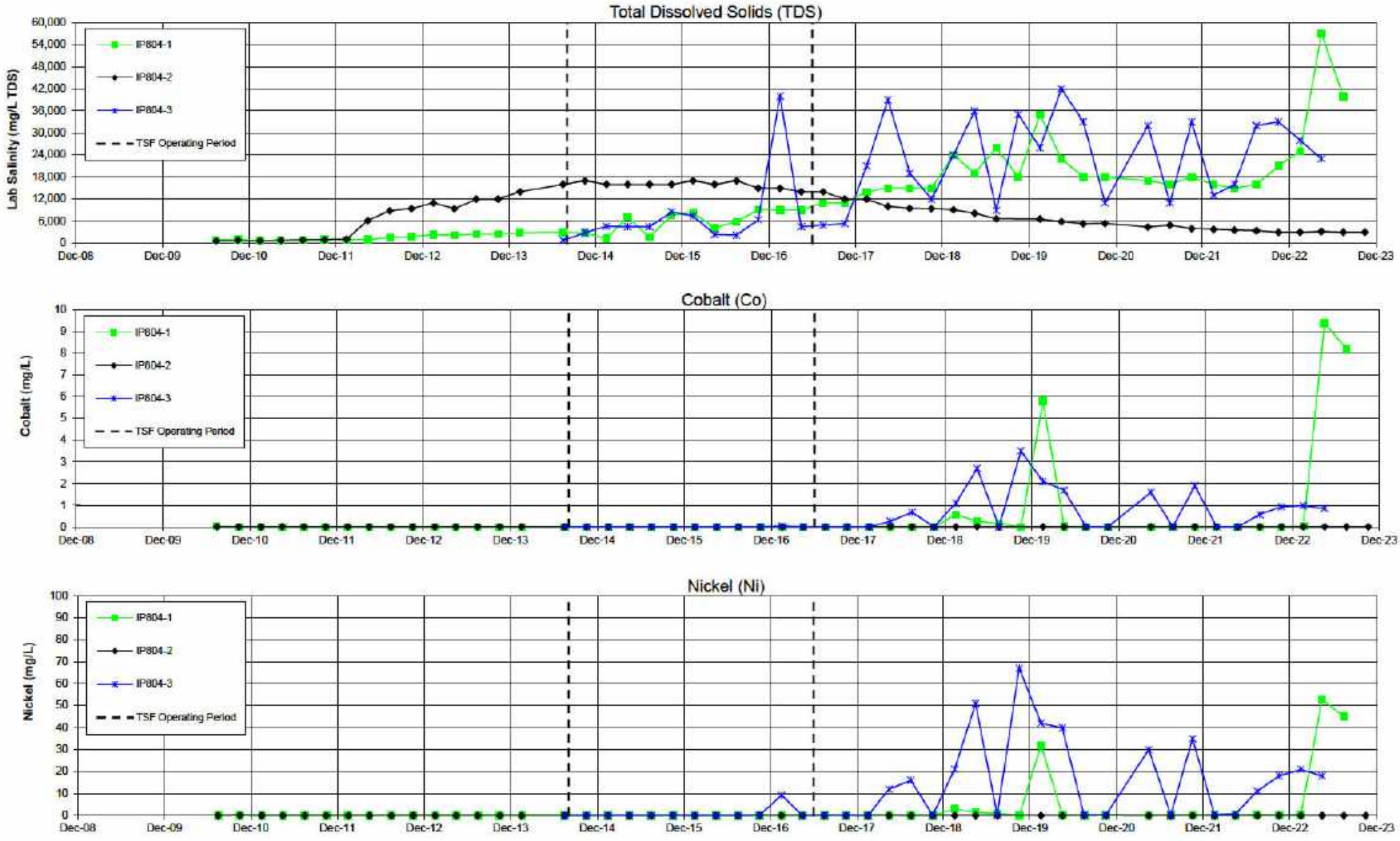

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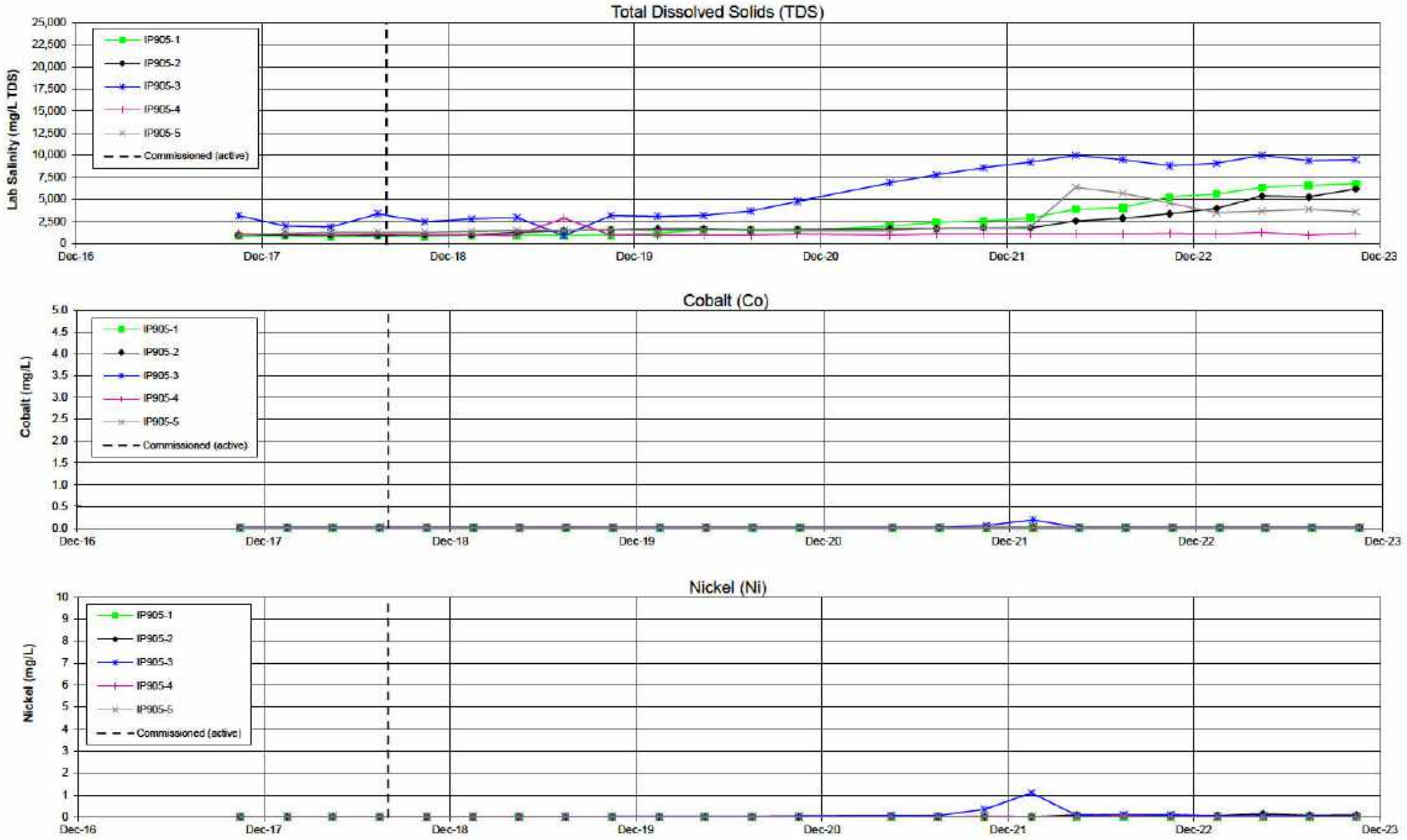

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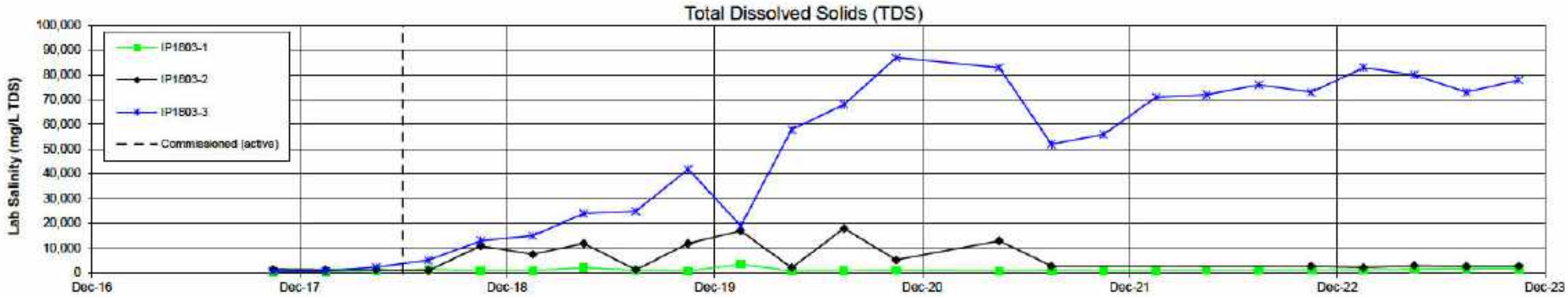

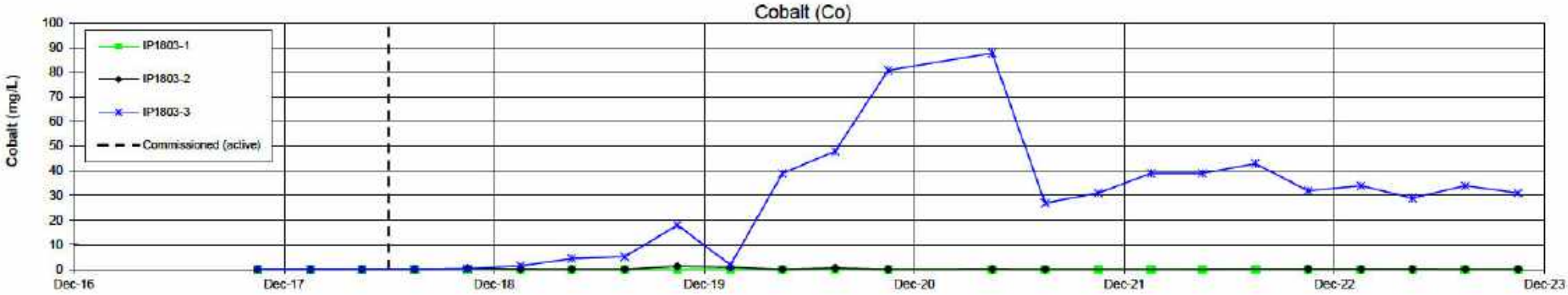

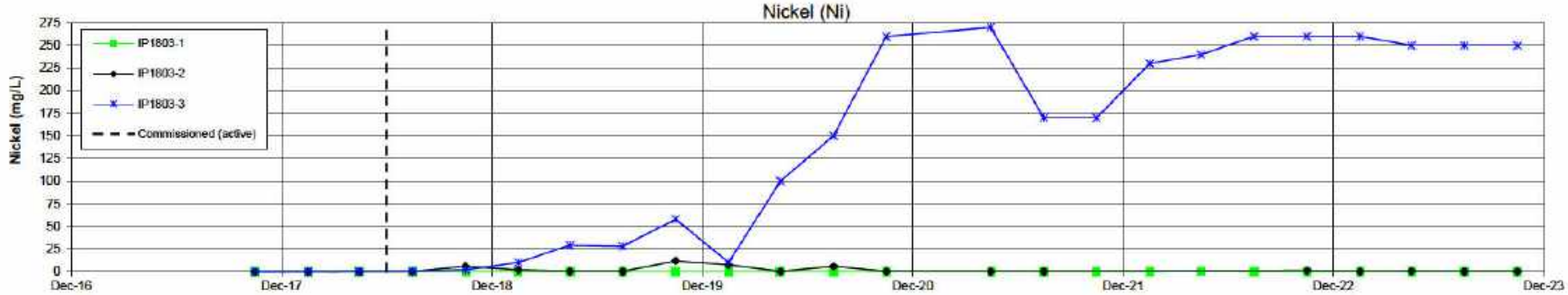

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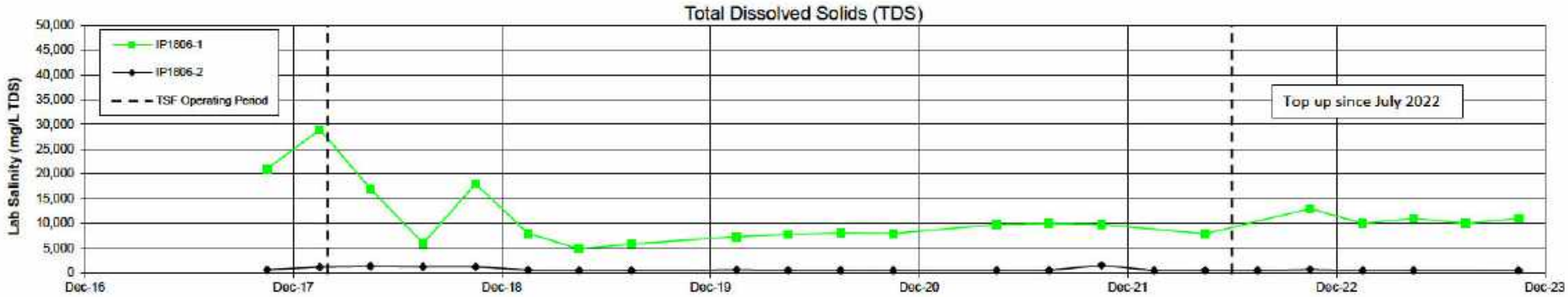

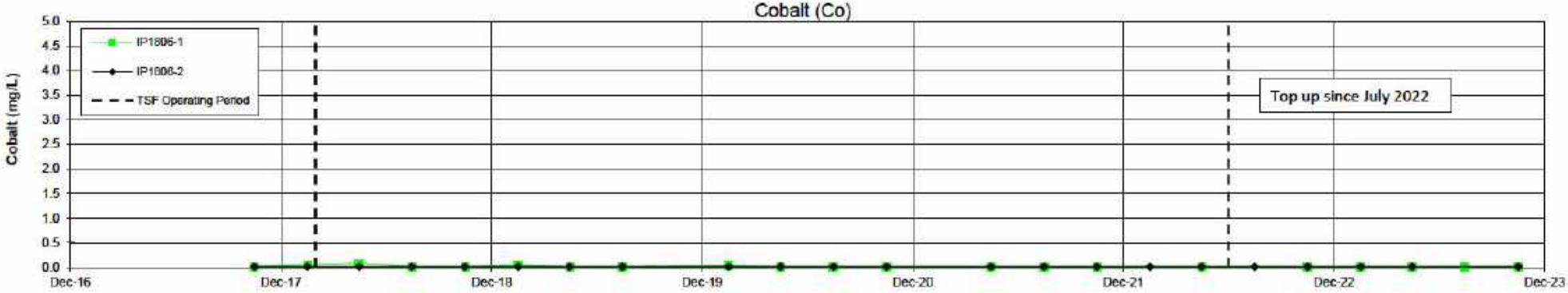

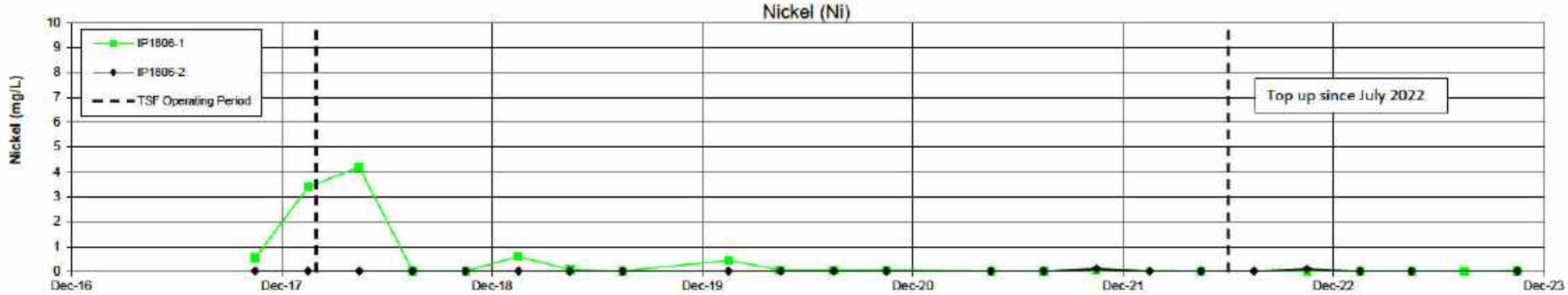

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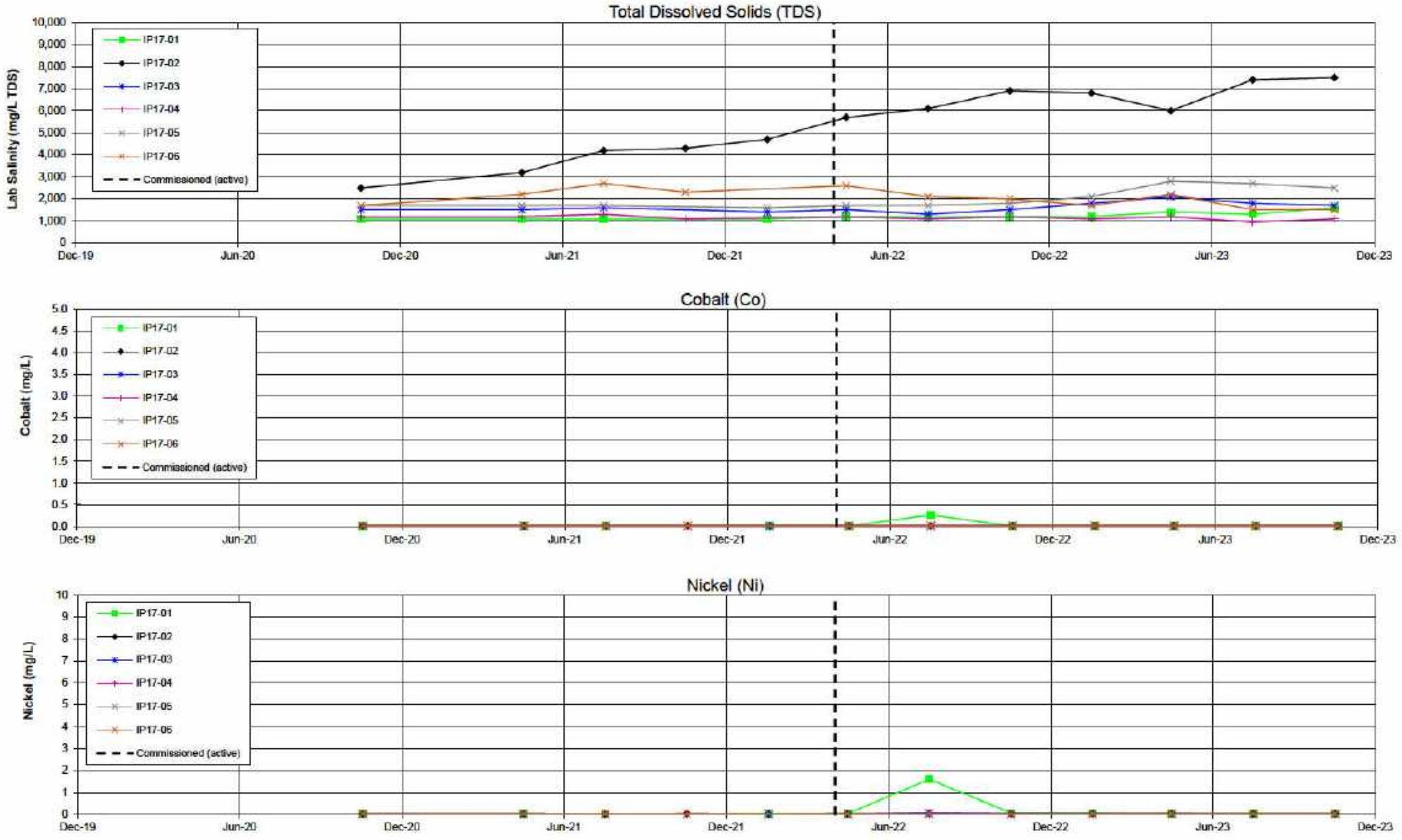

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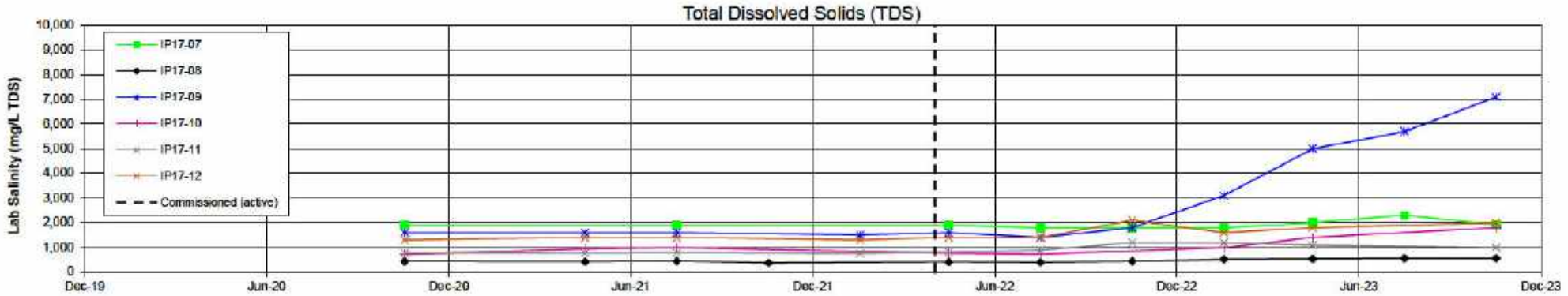

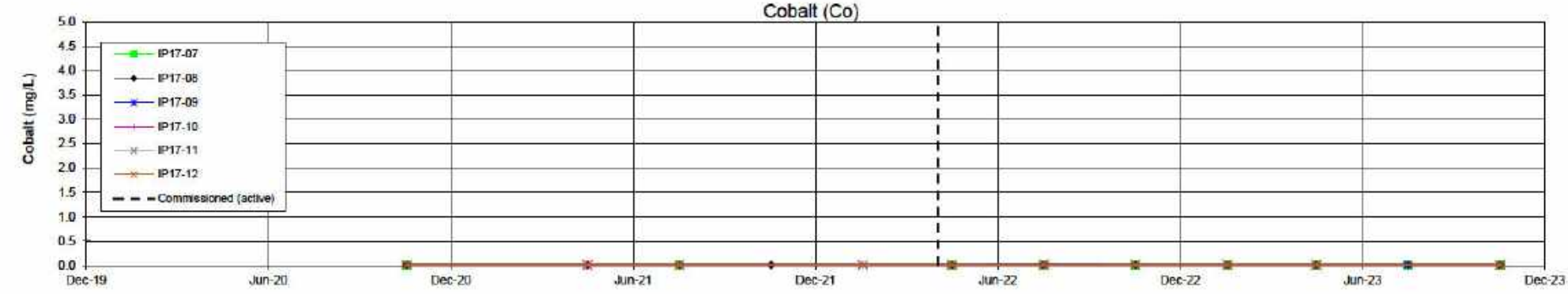

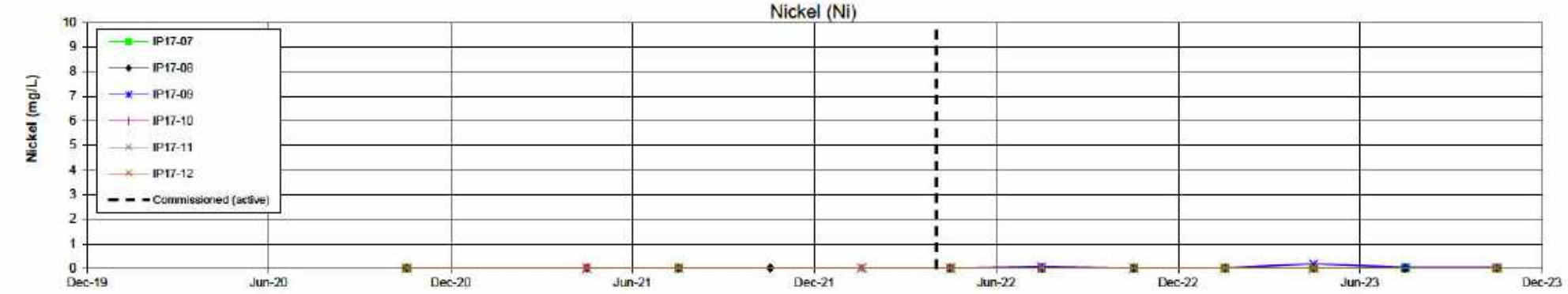

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Attachment 9: Category checklists

Government of **Western Australia**
Department of **Water and Environmental Regulation**

Region Application form annex: Category checklist (tailings storage facilities)

Part V Division 3, *Environmental Protection Act 1986,*
Environmental Protection Regulations 1987

INSTRUCTIONS:

- This checklist outlines additional information requirements for applications under Part V Division 3 of the *Environmental Protection Act 1986* (EP Act) to:
  - construct and operate Tailing Storage Facilities (TSF), or
  - amend an instrument to change the conditions or characteristics related to an existing TSF (e.g. new TSFs or wall rises or lifts, or changes to delivery process or material characteristics).
- References to 'TSF' in this form include containment cells or dams and the retaining embankment, delivery system, water return system and ancillary structures required to support operations, including spillways and decant facilities.
- This checklist must be completed and submitted as an attachment to the main 'works approval, licence or amendment application form' (see Part 12 of that form). Notes included throughout this checklist must be read in conjunction with the instructions and requirements of the main application form.
- The application checklist must be completed with all relevant Application Supporting Information (ASI) attached. The 'ASI reference' column must clearly identify where in the supporting attachment(s) the relevant information has been provided or the relevant requirements have been met. Attachments containing ASI can be combined and submitted as one or more consolidated documents if desired, provided it is clear which section of the checklist the content relates to.
- If a checklist has been submitted and is incomplete the Chief Executive Officer (CEO) of the Department of Water and Environmental Regulation (the department) will decline or return the application (as applicable).
- The information requirements outlined in this checklist are not exhaustive. Applicants are advised to provide the ASI and environmental investigations as required to support the application and assessment process.

Completion matrix

The matrix below explains what sections are required to be completed for different types of TSF applications, as described in Schedule 1 Part 1 of the Environmental Protection Regulations 1987 (EP Regulations):

Category 5(c) – "Processing or beneficiation of metallic or non-metallic ore: premises on which - (c) tailings or residue from metallic or non-metallic ore are discharged into a containment cell or dam."

Key: • Form section must be completed and relevant supporting information provided. Δ To the extent required or (if amendment) changed. N/A Not applicable (information not required with application). Form section	Scenario 1 New[1] above-ground or in-pit TSF (including valley TSF)	Scenario 2 Wall raise/lift to existing TSF (in-pit or above-ground, including valley TSF)	Scenario 3 Significant change to tailings delivery process (i.e. cyclone, thickener, etc) which will change the physical characteristics of tailings	Scenario 4 Change to the tailings material characteristics (e.g. change in geochemical character, ore body, ore type, ore material character, etc) or the reprocessing of tailings
Part 1: Other approvals	Δ	Δ	Δ	Δ
Part 2: Conceptual Site Model	•	•	•	•
Part 3: Design overview	•	•	Δ	Δ
3.1 Design overview	•	•	Δ	Δ
3.2 Staging and storage capacity	•	•	Δ	N/A
3.3 Starter embankments and raises	•	N/A	N/A	N/A
Part 4: Construction overview	•	•	Δ	N/A
Part 5: Materials characterisation	•	N/A	Δ	•
Part 6: Seepage and water management	•	Δ	Δ	Δ
6.1 Hydrogeology	•	Δ	Δ	Δ
6.2 Stormwater management	•	Δ	Δ	Δ
6.3 TSF seepage and water management	•	•	Δ	Δ (if increase in risk)

Part 7: Other operational and management requirements	•	Δ	Δ	Δ
7.1 Dust	•	Δ	Δ	Δ
7.2 Tailings delivery and return water pipelines	•	•	Δ	N/A
Part 8: Monitoring and inspections	•	Δ (if change to layout)	Δ	Δ
8.1 Groundwater, surface water and seepage monitoring	•	Δ (if change to layout)	Δ	Δ
8.2 Dust monitoring	•	Δ	Δ	Δ
8.3 TSF inspections	•	Δ	Δ	N/A
Attachments	•	•	•	•
Att. 1 Drawings and figures (locality maps)	•	•	•	•
Att. 2 CSM table	•	•	•	•
Att. 3 Premises map and site layout	•	•	•	•
Att. 4 Design figures	•	•	•	•
Att. 5 Topography, geology and hydrogeological plans/maps	•	•	Δ	Δ
Att. 6 Layout of seepage management system	•	•	Δ	Δ
Att. 7 Stormwater or surface water management infrastructure	•	•	Δ	Δ
Att. 8 Layout of tailings delivery and return water pipelines	•	•	Δ	N/A
Att. 9 Monitoring locations map	•	Δ	Δ	Δ

Note 1: for Scenario 1, 'new' means:

- a new above-ground or in-pit TSF (i.e. whole facility)
- a new above-ground or in-pit storage cell to an existing licensed above-ground or in-pit TSF
- a change to the location, a change in the proposed liner or a change in the type of construction and staging of an approved TSF.

Part 1: Other approvals			
	Yes	**N/A**	**ASI reference**
1.1 State Agreement Act Is the premises subject to a State Agreement Act? If yes, provide a description of: • title of State Agreement Act. • relevant considerations within that State Agreement Act pertaining to the TSF and associated activities or infrastructure. • any consultation with the Department of Jobs, Tourism, Science and Innovation (DJTSI) about the TSF. • if the proposed/existing TSF is not on *Mining Act 1978* tenure, provide details of the proposed closure and rehabilitation aspects pertaining to the TSF (i.e. research, investigations, trials, progressive rehabilitation, early closure, closure outcomes and completion criteria). Refer to the Department of Mines, Industry Regulation and Safety (DMIRS) guidance on mine closure plans, particularly *How to prepare in accordance with the Statutory Guidelines*.	☐	☒	
1.2 *Mining Act 1978* approvals Provide a description of: • any consultation with DMIRS about the TSF. • status of the associated mining proposal (include registration ID if available) and mine closure plan.	☒	☐	Attachment 5 – Mining Act 1978
1.3 Part IV Environmental Protection Act 1986 (EP Act) Provide a description of: • what has been referred and assessed in a Part IV referral. • all changes made to the TSF since Part IV referral or approval. • Part IV EP Act ministerial statement conditions pertaining to the existing TSF or proposed changes to the TSF.	☒	☐	Attachment 5 – Environmental Protection Act 1986 – Part IV
1.4 *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) Provide: • any consultation with the Department of Climate Change, Energy, Environment and Water about the TSF. • a description of any changes made to the TSF since submission or approval. • the EPBC approval number and copy of the TSF-related approval conditions.	☐	☒	

Part 2: Conceptual Site Model			
	Yes	N/A	ASI reference
2.1 Conceptual Site Model (CSM) table Provide a site-specific conceptual site model (CSM)[2] that clearly identifies all potential Source-Pathway-Receptor (SPR) linkages for related environmental and public health receptors (refer to Section 2.3; Attachment 2 below). If this is for an existing facility that was previously approved under Part V Division 3 of the EP Act, only identify the changes to the model resulting from the proposed modification(s). The complexity of the CSM corresponds to the scale and complexity of the TSF activities and should be devised to assist in the TSF design process to identify appropriate design and operational measures as well as environmental monitoring requirements. A site-specific SPR assessment[3] for seepage must be undertaken as part of the CSM. Refer to Section 6.3 for seepage requirements. Note 2: Guidance on developing CSMs is provided in the department's Assessment and management of contaminated sites guidelines. Note 3: Assessment should be conducted as part of and be consistent with the requirements outlined in Part 9 of the main application form (potential emissions and discharges).	☒	☐	Attachment 8A – Conceptual Site Model
Attachments			
2.2 Attachment 1: Locality map(s) An aerial photograph, map, and/or site plan of sufficient scale showing the proposed prescribed premises boundary and locality of the TSF and supporting infrastructure in respect to: • nearby sensitive receptors and surrounding land uses. • multiple maps at different scales can be provided.	☒	☐	Attachment 2 – Premises Maps
2.3 Attachment 2: CSM table In accordance with Part 2.1 above, provide a site-specific CSM in table format. The CSM table should clearly summarise the identified SPR linkages for construction and operation. An example CSM table is provided in Appendix 1 to this form.	☒	☐	Attachment 8A – Conceptual Site Model

Part 3: Other approvals

INSTRUCTIONS:

- This section requires applicants to provide a detailed overview of the design concept including all related infrastructure, such as seepage collection and management infrastructure.
- The proposed design should consider and acknowledge the interactions between all elements and take into consideration the environmental setting, adjacent current and future land uses, available materials and infrastructure, and materials characteristics of the tailings to be received.

	Yes	N/A	ASI reference
3.1 Design overview Provide details on the design overview (e.g. TSF footprint, cells and division embankments etc.). Specified design detail must be provided for each proposed cell of the TSF. If a change is being applied for a facility previously approved under Part V Division 3 of the EP Act (i.e. not a new facility) clearly define: • changes proposed • how they alter from the existing design and facility management measures.	☒	☐	Attachment 8B – Geotechnical Assessment/ Design Report
3.2 Staging and storage capacity Provide details on proposed staging and storage capacity. As a minimum, include the: • expected crest elevation/pit depth, • tailings storage area (m^2), • tailings storage volume (m^3), • cumulative storage volume (m^3) for the starter embankment(s) and raise(s).	☒	☐	Attachment 8B – Geotechnical Assessment/ Design Report, Section 8.4.
3.3 Starter embankments and raises Provide details on the proposed starter embankments and raises including: • general approach (upstream, centreline, downstream) • maximum height • materials properties, and availability.	☒	☐	Attachment 8B – Geotechnical Assessment/ Design Report, Section 7.
Attachments			
3.4 Attachment 3: Premises map and site layout plan(s) A premises map and site layout plan(s) must be provided and include: • premises boundary and relevant tenure • TSF cell(s), proposed staged build (if required) and final landform • construction borrow source • seepage and groundwater monitoring bores • dewatering bores • roads (including haulage) and access tracks • topsoil stockpiles	☒	☐	Attachment 2 – Premises Maps

Part 3: Other approvals			
• pipelines, including connectivity (e.g. processing plant to the TSF) and scour pits if relevant • key environmental aspects or features (e.g. watercourses) • other key site infrastructure (i.e. pits, plant, accommodation village, administration offices, etc.) • topographical contours on and around the TSF • scale, north arrow, GPS coordinates and legend.			
3.5 Attachment 4: Design figures A series of design figures must be provided that include the following: • TSF layout depicting all TSF-related infrastructure (existing and proposed) including, but not limited to: - TSF cell(s) - embankments - supernatant pond(s) - stormwater infrastructure - tailings and water pipelines, including decant lines and pump locations, and related tanks and/or ponds - tailings discharge location(s) - seepage management and/or underdrainage design • clear highlighting/identifying of the proposed changes (if applicable) • schematic cross-sections of the TSF cell(s) and or embankments, including related geology.	☒	☐	Attachment 8B – Geotechnical Assessment/ Design Report, Appendix E.

Part 4: Construction overview			
INSTRUCTIONS: • This section requires applicants to provide a detailed overview of the proposed construction works including all related infrastructure that are proposed under this application to clarify the scope of assessment.			
	Yes	**N/A**	**ASI reference**
4.1 Scope of construction works Provide details of construction works including, but not limited to: • general site preparation works • infrastructure to be constructed • construction phases • timing of works – including all lifts being applied for, if applicable, (including all lifts proposed for within the next five years) • summary of management measures and controls to be adopted for key environmental factors including, but not limited to: - noise - dust - stormwater/surface water - erosion and sediment - hydrocarbon management (fuel, spills)	☒	☐	Attachment 3B – Construction Activities

Information must be consistent with the requirements outlined in Part 9 of the main application form (potential emissions and discharges).			

Part 5: Materials characterisation

INSTRUCTIONS:

- This section requires applicants to provide a detailed overview of the physical and geochemical characteristics of the tailings and embankment materials.
- Geochemical characteristics of representative material (i.e. tailings or other) should been defined, such that the geochemical risks are understood at least to a high level.
- A sampling program that sufficiently addresses the different type(s) of materials, such that their variability/heterogeneity is represented, should be conducted.
- Altered weathering zone(s) should be considered in the sampling program where applicable.
- Representative samples of tailings/process residues should be obtained from metallurgical test work conducted during the feasibility and development stages of the project.
- For existing sites, sampling should cover the full lateral and vertical extent from existing facilities/stockpiles, where possible.

	Yes	N/A	ASI reference
5.1 Materials characterisation Provide details on materials characterisation including, but not limited to: • where is each tailings type coming from? • any blending and ratios • number of samples taken relative to the volume/throughput • process chemicals used • water used, additional inputs to the system (any wastewater, decant recycled) • deposition methodology • physical details of each tailings type (i.e. material characterisation, wet/dry material, moisture content, dispersion characteristics, attenuation properties, modelled/actual consolidation) • geochemical performance of each tailings type (i.e. composition, contaminants of concern) • where a new tailings material (including new pits) is proposed, a comparison against existing tailings should be provided • acidic and/or metalliferous drainage (AMD), inclusive of: - potential risk of AMD, neutral mine drainage (NMD), saline drainage, and acidic drainage of the tailings - metalliferous drainage (encompassing all metals and metalloids, regardless of whether the conditions are acidic) - naturally occurring radioactive material (NORM) and technologically enhanced naturally occurring radioactive materials (TENORM). • erosive, sodic and/or dispersive materials • fibrous minerals • leachability of contaminants with environmental significance from the tailings • water quality of tailings decant and seepage • continuity and variability of the geochemical characteristics of tailings • characteristics of embankment material.	☒	☐	Attachment 8B – Geotechnical Assessment/ Design Report, Section 5.

Part 6: Seepage and water management

INSTRUCTIONS:

- This section requires applicants to provide a detailed overview of seepage and water management.
- Information must be provided on the proposed seepage management system including seepage recovery requirements.
- The premises must be designed and constructed to ensure that stormwater is diverted away from the TSF (including individual cells). This may be achieved through the use of surface grade changes, bunding, interceptor drains, piping and other drainage systems.
- Stormwater that has come into contact with the surface of the TSF (including embankments) must be collected and managed as decant in the decant management system.

	Yes	N/A	ASI reference
6.1 Hydrogeology Provide a detailed overview on the following in relation to the TSF: • local geology • topography • geotechnical characteristics • hydrogeology including waterways and drainage plains • for in-pit TSFs, include known preferential and fracture pathways. Aerial overview and geological cross-section drawings must be provided.	☒	☐	Attachment 8C – Hydrogeological Assessment
6.2 Stormwater management Provide details on the proposed stormwater management and controls for the TSF including, but not limited to: • diversion of stormwater away from the TSF using drainage features, bunds, interceptor drains or other drainage systems • details on clean stormwater holding ponds to be constructed (if required). Design specifications and an overview of construction works should also be provided. • details of any proposed controlled releases of clean stormwater into the environment and/or proposed reuse options on site • erosion and sediment control along drainage lines and discharge points. This includes stormwater flow control, vegetation, detention ponds, minimising land disturbance and other temporary and permanent erosion protection measures. Guidance on stormwater management can be found in the department's *Stormwater Management Manual for Western Australia*.	☒	☐	Attachment 8B – Geotechnical Assessment/ Design Report, Section 6.5 & 8.5.
6.3 TSF water and seepage management Provide details on seepage including, but not limited to: • where seepage is expected to occur (include a figure or map of plume modelling or estimated groundwater flow rates over time) • seepage rate and flow direction – including in-pit walls if applicable • estimated seepage migration timeframes in relation to receptors • seepage water quality and known contaminants of concern • consideration of existing seepage (including adjacent TSFs if applicable) as cumulative emissions in water balance calculations	☒	☐	Attachment 8B – Geotechnical Assessment/ Design Report. Attachment 8C - Hydrogeological Assessment.

Part 6: Seepage and water management			
• seepage management measures. **Has a seepage assessment been conducted for the works proposed under this application?** A site-specific self-assessment[4] based on the SPR model and risk-rating matrix outlined in the department's *Guideline: Risk assessments* must be undertaken for seepage as part of the CSM: • The self-assessment should be conducted as part of and be consistent with the requirements outlined in Part 9 of the main application form (potential emissions and discharges). • The CSM must be completed as outlined in Part 2 of this form. • Proposed mitigation measures, triggers and timeframes, along with any residual risks must be clearly identified. • Self-assessment should include any SPR linkage of seepage to near-surface (i.e. land or soils), surface water and/or groundwater receptors. If the department's risk assessment (conducted as part of the assessment of this application) results in a residual risk the following further information may be required: - a time-dependent model including sensitivity of key parameters - relevant cross-sections of the pore pressure conditions for key time steps in the TSF's life. At a minimum this should include pre-mining conditions, year 1, mid-life, final year and post-operational drain-down - seepage management measures, including plan location, depth and expected efficiency. It is recommended that the above information is provided with the application up-front if the self-assessment identifies a 'high' or 'extreme' risk to avoid delays in the application process[5]. Note 4: The risk assessment must be undertaken in accordance with the department's *Guideline: Risk assessments*. Note 5: Risk ratings are to be in accordance with the risk rating matrix outlined in the department's *Guideline: Risk assessments*. **Provide details on the proposed TSF water management and controls including, but not limited to details of the:** • proposed tailings delivery and decant/reclaim system • proposed cut-off trenches/toes and underdrainage system • operational water balance assessment, including approach, assumptions and estimates • operational freeboard assessment of storm storage capacity of the TSF (for each cell) at the proposed final height, relevant to its consequence category • proposed decant/reclaim system, including: - inlet/outlet locations - pumps and contingencies for failures - incidental rainfall collection on the TSF - pipelines, including location and specifications - access causeway construction - emergency spillway(s) - decant ponds (i.e. size, capacity, freeboard requirements, elevations, locations, etc).			

Part 6: Seepage and water management			
For existing sites previously approved under Part V Division 3 of the EP Act, provide information on existing water and seepage management. Include details such as updated water modelling. Data should be provided in Excel format to demonstrate trends over time.			
Attachments			
6.4 Attachment 5: Topography, geology and hydrogeological plan(s) An aerial overview and cross-section drawings of topographical, geological, and hydrogeological features related to the TSF, including existing monitoring bores and other monitoring instrumentation.	☒	☐	Attachment 2 - Premises Maps. Attachment 8C – Hydrogeological Assessment, Section 4.7.
6.5 Attachment 6: Layout of seepage management system Provide a layout plan of the proposed seepage management system that clearly depicts all associated infrastructure and equipment. Multiple plans can be provided.	☒	☐	Attachment 2 - Premises Maps. Attachment 8B – Geotechnical Assessment/ Design Report, Section 9. Attachment 8C - Hydrogeological Assessment, Section 5.

Part 7: Seepage and water management			
INSTRUCTIONS: • This section outlines the operational management aspects of the TSF that must be addressed as part of an application. Focus should be given to the day-to-day activities undertaken at the TSF and the practices to be implemented to minimise environmental impacts.			
	Yes	**N/A**	**ASI reference**
7.1 Dust Provide details on the proposed dust mitigation measures to control dust emissions from the TSF. Where saline water is used for dust suppression, all reasonable measures must be taken to avoid detrimental impacts to surrounding environmental receptors. These measures must be documented in the application. 'Dust' includes dried tailings lift-off from the surface of the TSF.	☒	☐	Attachment 6A - Dust.
7.2 Tailings delivery and return water pipelines	☒	☐	Attachment 3B – Proposed

Part 7: Seepage and water management			
Provide details on the proposed tailings delivery and return water pipelines including, but not limited to: • locations • design specifications • connectivity (i.e. processing plant to TSF) • decant and reclaim system • supernatant ponds (location, size, etc). Provide details of the proposed management measures for tailings delivery and return water pipelines including, but not limited to: • trenches and diversion bunds • monitoring devices • flow meters • telemetry • leak detection/monitoring system • shut-off valves • inspections • deposition strategy • contingency measures in event of pipeline spills or ruptures.			Activities. Attachment 8B – Geotechnical Assessment/ Design Report, Section 8.
Attachments			
7.3 Attachment 8: Layout of tailings delivery and return water pipelines Design drawings and layout figure(s) of the proposed tailings delivery and return water pipeline infrastructure must be provided.	☒	☐	Attachment 2 – Premises Maps

Part 8: TSF monitoring and inspections			
INSTRUCTIONS: • This section requires applicants to provide an overview of the proposed monitoring and inspection components of the TSF. • A comprehensive monitoring program should be developed to support the ongoing operation of the TSF. Aspects that should be included in the monitoring program (as a minimum) include seepage, surface water and groundwater, relevant to the risks identified. • The operator must continually review the quality of data obtained and the positioning of monitoring points during the regular review of monitoring data. • Typical monitoring aspects are outlined further below. Where an operator elects not to commit to certain monitoring programs, they must provide clear justification and rationale for this decision.			
	Yes	**N/A**	**ASI reference**
8.1 Groundwater, surface water and seepage monitoring Provide details on the proposed groundwater and surface water monitoring program including, but not limited to: • groundwater, surface water, and seepage sampling/monitoring locations (including monitoring and recovery bores) • nearest stock bore(s)	☒	☐	Attachment 8C - Hydrogeological Assessment, Section 5. Attachment 3B, Proposed

Part 8: TSF monitoring and inspections			
• nearest supply bore(s) • well construction specifications • sampling methodology • analysis suite • sampling frequency. For a new TSF, the operator should seek to demonstrate baseline groundwater and surface water conditions before construction works and to feed the results of this monitoring into the initial CSM development. The monitoring program should as a minimum seek to establish: • background groundwater quality, levels (in mAHD and mBGL), flow rates and flow directions • background surface water quality, levels, flow rates and flow directions • local aquifers, and groundwater flow direction and rates of each aquifer (if available) • a monitoring network that acts as an early indicator of seepage contamination in groundwater or surface water prior to offsite migration. For established TSFs, the operator should seek to demonstrate no changes from baseline conditions; and that any models/assumptions provided in original approval applications are sound. A Sampling and Analysis Quality Plan (SAQP) should be prepared to ensure that the data collected are representative and sufficient to address critical gaps and uncertainties identified in the CSM so that the information obtained provides a reliable basis for continually reviewing site operations and meeting compliance requirements of the operating licence. For established TSFs please provide a summary/trend of the results of the data from the past five years and identify if there are any issues. Further guidance on developing a groundwater and surface water monitoring program, including the development of a SAQP, can be sourced from the department's Assessment and management of contaminated sites guideline and from Schedule B2 of the *National Environment Protection (Assessment of Site Contamination) Measure 1999* (ASC NEPM).			Activies. Attachment 6A - Tailings.
8.2 Dust monitoring Provide details on the proposed TSF dust monitoring including, but not limited to: • monitoring locations • monitoring methodology (i.e. visual, monitoring stations, DustTrak etc.) • monitoring frequency and duration • contingency measures.	☒	☐	Attachment 6A, Dust
8.3 TSF Inspections Provide details on the proposed TSF inspections including, but not limited to: • timing and frequency • erosion and sediment monitoring (including locations, methodology, frequency)	☒	☐	Attachment 8B – Geotechnical Assessment/ Design Report, Appendix H, Section 8.

Part 8: TSF monitoring and inspections			
• inspection locations and TSF components (i.e. drainage, freeboard, pipelines, vegetation etc).			
Attachments			
8.4 Attachment 9: Monitoring locations Provide layout figure(s) of the proposed monitoring locations (with GPS coordinates) including, but not limited to: • monitoring bore locations (including groundwater, seepage and recovery bores) • surface water monitoring locations • dust monitoring locations • vegetation monitoring locations.	☒	☐	Attachment 2 - Premises Maps.

APPENDIX 1: Example Conceptual Site Model (CSM) table:

Source / Activities	Potential emissions, pollutants, or contaminants of concern	Potential pathway	Potential receptors	Potential impacts	Proposed controls and contingencies
TSF-Cell 1 (deposition of tailings)	TSF-Cell 1 supernatant potentially containing concentrations of elements with environmental significance such as cyanide	Seepage/ infiltration	Underlying groundwater (20 mBGL)	Reduced groundwater quality	Groundwater monitoring, recovery bores, triggers and actions
			Groundwater and/or surface water users located at Green Town, 15 km	Health and amenity impacts	
		Groundwater mounding, seepage expression)	Surface water (specifically Blue Creek located 200 m south of the southern embankment of the TSF-Cell 1	Reduced surface water quality, and ecosystem disturbance	
Decant pipeline and/or tailings delivery pipeline failure	Decant water potentially containing concentrations of elements with environmental significance such as cyanide	Direct discharge Infiltration into soil or groundwater	Surface water (specifically Blue Creek located 200 m south of the southern embankment of the TSF-Cell 1	Reduced surface water quality and ecosystem disturbance	Telemetry, auto cut-offs, visual monitoring; clean-up response, reporting, spill containment measures
			General native vegetation. No Threatened Ecological Communities (TECs), Priority Ecological Communities (PECs) or threatened or priority flora were recorded within or near the proposed works area of the TSF	Reduced vegetation health, and potential loss of vegetation in some areas	Vegetation monitoring, siting of infrastructure
Stormwater	Sediment laden runoff. Potentially contaminated stormwater	Overland runoff	Surface water (specifically Blue Creek located 200 m south of the southern embankment of the TSF-Cell 1	Reduced surface water quality and ecosystem disturbance	Stormwater infrastructure, diversion drains, trenches, monitoring
			Native vegetation. No TECs, PECs or threatened or priority flora were recorded within or near the proposed works area of the TSF	Reduced vegetation health	Vegetation monitoring, flora surveys
Overtopping of TSF-Cell 1 due to insufficient freeboard capacity	Tailings potentially containing concentrations of cyanide	Unplanned direct discharge of tailings into the environment	Underlying groundwater (20 mBGL)	Reduced groundwater quality and impacts to downgradient groundwater users	Freeboard, water balance, water recovery measures
			Surface water (specifically Blue Creek located 200 m south of the southern embankment of the TSF-Cell 1	Reduced surface water quality, and ecosystem disturbance	
			Native vegetation. No TECs, PECs or threatened or priority flora were recorded within or near the proposed works area of the TSF	Reduced vegetation health, and potential loss of vegetation in some areas	
Dust (dried tailings) lift-off from the surface of the TSF-Cell 1, or embankments	Dust (dried tailings) potentially containing contaminants	Windblown dust transport through air then deposition	General native vegetation. No TECs, PECs or threatened or priority flora were recorded within or near the proposed works area of the TSF	Health/amenity impacts	Monitoring, triggers, dust suppression measures; modelling
		Air/wind dispersion	Residents located in proximity		

Attachment 10: Fee Calculation

Cost of Works

Details regarding the projected cost of works associated with the construction of 8 Series Inpit TSF are included in Table 2. This includes all estimated costs (inclusive of GST) associated with the construction and establishment of the premises infrastructure.

TABLE 2: PROJECTED COST OF WORKS

Activity	Estimated Cost
Engineering	[redacted]
Valves	
E&IC Materials	
HDPE Piping	
Piping Transport	
Fasteners and Gaskets	
Labour - Mechanical	
Labour - Electrical	
Fuel	
Equipment Hire and Consumables	
Earthworks	
Culverts and Transport	
TOTAL	

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