## 17.4 Appendix 4. JT Met (2024). Geochemical analysis of tailings

# Rox Resources (ASX: ROX)

## Youanmi Gold Project

## Pre-Feasibility Metallurgy

May 2024

[redacted]

# 1 CONTENTS

**List of Figures**



**List of Tables**

**Appendixes:**

A- Metallurgical Test work Plant Zone Deposits- Goldcrest Mines 2005
B- Youanmi Transition ore Metallurgical Testing: AMMTEC 1992
C- Youanmi Underground Scoping Study- Metallurgical Testwork Report: Orway Mineral Consultants 2021
D- 774-04060-RPT-0001-Testwork Summary_B: MACA Interquip
E- Previous Youanmi Plant PFD
F- Miscellaneous cited Mineralogy Reports
G- Metso BIOX Amenably Testwork 2024
H- ALS Flotation testwork 2024
I- Extended Pre-oxidation Leach testwork 2024

# DISCLAIMER

This Report has been prepared for **Rox Resources** by JT Services Pty Ltd (JTs) based on assumptions as identified throughout the text and upon information and data supplied by others.

The Report is to be read in the context of the methodology, procedures, techniques, assumptions, and the circumstances and constraints under which the Report was written. The Report is to be read as a whole, and sections or parts thereof should therefore not be read or relied upon out of context.

JTs has, in preparing the Report, followed methodology and procedures, and exercised due care consistent with the intended level of accuracy, using its professional judgment and reasonable care. However, no warranty should be implied as to the accuracy of estimates or other values and all estimates and other values are only valid as at the date of the Report and will vary thereafter.

Parts of the Report contain data supplied by third party contributors, as detailed in the document. While the contents of those parts have been generally reviewed by JTs for inclusion into the Report, they have not been fully audited or sought to be verified by JTs. JTs is not in a position to, and does not, verify the accuracy or completeness of, or adopt as its own, the information and data supplied by others and disclaims all liability, damages or loss with respect to such information and data.

In respect of all parts of the Report, whether or not prepared by JTs, no express or implied representation or warranty is made by JTs or by any person acting for and/or on behalf of JTs to any third party that the contents of the Report are verified, accurate, suitably qualified, reasonable or free from errors, omissions or other defects of any kind or nature. Third parties who rely upon the Report do so at their own risk and JTs disclaims all liability, damages or loss with respect to such reliance.

JTs disclaims any liability, damage and loss to **Rox Resources** and to third parties in respect of the publication, reference, quoting or distribution of the Report or any of its contents to and reliance thereon by any third party.

This report, together with all intellectual property contained or embodied therein remains the property of JT Metallurgical Services, subject only to an express written agreement with the Client to the contrary. This report is not to be distributed to other parties. Third parties in possession of this report will be liable for compensation payments to JTs at JTs discretion.

*This disclaimer must accompany every copy of this Report, which is an integral document and must be read in its entirety.*

# 2 EXECUTIVE SUMMARY

JTs completed a thorough review of the pertinent historical metallurgical and mineralogical testwork completed on the Youanmi Project, which was then used as the basis of the Preliminary Feasibility Study testwork which included the following:

- Locked cycle cleaner/re-cleaner flotation testwork, inclusive of mineralogical and tails characterisation
- Metso BIOX® process amenably testwork
- Extended pre-oxygenation leach amenably testwork

The following key findings from the program include:

- A rougher/ cleaner/re-cleaner flowsheet was shown to be an effective method for generating a high-grade gold concentrate from Youanmi ore. The flowsheet showed a marked improvement on historical testwork and plant performance, improving gold to concentrate recoveries.

- Incorporating a regrind stage on rougher concentrate further boosts final concentrate grade without sacrificing gold recovery. The flowsheet was able to generate a flotation concentrate grading 63.8g/t from a feed grade of 8.5g/t representing a gold to concentrate recovery of 91.0% and a mass pull of 11.6%. Low silicate content in the final concentrate is indicative that additional cleaning stages are unlikely to significantly improve the concentrate grade. Testwork and mineralogical results suggest even higher concentrate grades could be achieved at finer regrind sizes. JTs recommends this is assessed in future studies.

- The Youanmi ore was found to be highly amenable to a flotation/BIOX/cyanidation flowsheet, achieving rapid oxidation and high gold cyanide leach extractions. The sighter testwork found that high gold extraction (95.6%) can be achieved with only partial (37%) sulphide/sulphur oxidation. JTs recommends future BIOX studies should assess coarser feed grind sizes, sample variability and alternative cyanidation parameters.

- Extended pre-oxygenation followed by moderate cyanide conditions were found to be ineffective in the oxidation on sulphides hence resulted in similar recoveries to those without pre-oxygenation.

- Variability test work across different ore lodes (Main, Link, Pollard) is recommended for future studies to refine the chosen flowsheet.

- Considering the results of the PFS and past testwork, JTs is of the opinion that Flotation followed by either BIOX or Albion flowsheets present the only economically and environmentally viable on-site processing methods of those assessed. Noting the improvement to flotation grade and recovery achieved in the PFS testwork, offsite sale of concentrate remains a viable option for the project.

- A table outlining the different staged gold recoveries for each unit operation is presented in Table 1. This data is collated from the results of the PFS, historical testwork and plant production records.

*Table 1: Unit Operation Staged Gold Recovery*

| Stage | Staged Recovery (%) | Reference |
|---|---|---|
| Whole of Ore Leach ($P_{80}$ 75µm) | 40-62% | AMMTEC (1992)&(2004), Orway (2021) |
| Flotation | 87.1%<br>91-91.5% | Average Plant Recovery to Concentrate<br>JTs (2024) |
| **Float Con Treatment** | | |
| UFG + Cyanidation | ($P_{80}$ 10µm) 65.3-80.0%<br>$P_{80}$ (6-25µm) 37.7-79.8%<br>$P_{80}$ (8-19µm) 45.1-53.7% | Orway (2021)<br>MACA Interquip (2022)<br>AMMTEC (1992) |
| Roasting+ Cyanidation | 78.8-87.3%<br>89.1-91.6% | AMMTEC (1992)<br>Orway (2021) |
| Bacterial Ox+ Cyanidation | 87.0%<br>95.6% (37.4% SOx) to 97.5% (99.1 SOx) | Average CIL Plant Recovery<br>JTs (2024) |
| Albion+ Cyanidation | (~75% SOx) 88.8-94.4%<br>92.9% (30% SOx) to 99.1% (83% SOx) | Orway (2021)<br>MACA Interquip (2022) |
| POX+ Cyanidation | 98.8 - 99.0% | Orway (2021) |
| Extended Pre-Oxygenation+ Cyanidation | 54-66.8% | JTs (2024) |

# 3 INTRODUCTION

Rox Resources ("Client", "ROX") engaged JT Metallurgical Services ("JTs") to complete a Pre-Feasibility Study (PFS) level metallurgical testwork program on their Youanmi Gold Project located 480km northeast of Perth and 400km inland and to the east of Geraldton. The program encompassed a review of all pertinent historical testwork, mineralogical characterisation and plant operational data. This review served as the foundational framework for the subsequent PFS testwork. The PFS program included the following:

- Locked cycle rougher/cleaner/re-cleaner flotation testwork, inclusive of mineralogical and tails characterisation
- Metso BIOX® process amenably testwork
- Extended pre-oxygenation leach amenably testwork

JTs wishes to thank ROX Resources for the opportunity to conduct this program and wishes the company all the best in the development of the Youanmi Gold Project.

# 4 HISTORICAL DATA REVIEW

JTs was provided with a copy of ROX's historical metallurgical testwork library which contains several reports related to the Youanmi project spanning from the 1940's to present. It is noted that several known testwork campaigns have been completed in the past however there is no record of the testwork in the provided files. Consequently, notable deficiencies are apparent in the documentation of prior testwork, resulting in the absence of potentially valuable metallurgical test data. This historical oversight has at times resulted in redundant metallurgical test programs evaluating nearly identical processing flowsheets.

The Youanmi ore has known semi-refractory characteristics and hence several programs have been undertaken in the past to identify and optimise the most economical processing route for the ore. This section aims to provide a concise overview of the extensive testwork conducted to date, serving as the foundational framework for the subsequent Pre-Feasibility Study (PFS) testwork.

## 4.1 HISTORICAL METALLURGICAL TESTWORK

Historical testwork has centred around testing Youanmi ores amenability to the following processing flowsheets:

- Whole of ore cyanidation with and without gravity pre-concentration
- Flotation (with and without flotation tail cyanidation) and the following unit operations assessed on the flotation concentrate:
    - Direct cyanidation
    - Ultra fine grinding following by cyanidation
    - Roasting following by cyanidation
    - Pressure oxidation (POX) following by cyanidation
    - Neutral Albion Leach (NAL) following by cyanidation
    - Bacterial Oxidation- both Metso BIOX and BacTech BACOX following by cyanidation

### 4.1.1 Whole of ore cyanidation

Whole of ore cyanidation has been assessed at numerous times throughout the project's history. Historically the oxide resource was processed between 1987- 1993 which utilised a conventional CIL flowsheet.

It is noted that the Youanmi non-granite hosted ore (irrespective of the oxidation) has low gravity recoverable gold content. This is due to a low amount of coarse gold speciated either natively, as a telluride (calaverite) or as a gold/silver electrum. Gold speciation of the Youanmi deposit is discussed further in Historical Mineralogical Characterisation Section of this report (Section 0).

Historically most of the testwork has excluded gravity pre-concentration due to the low gold recovery achieved. Some of the 'Plant Zone' oxide testwork completed by Goldcrest Mines in 2005 (Appendix A) did include a gravity pre-concentration stage, achieving an average gravity recovery of 3.05% with a mass pull of 0.72%. JTs understands that granite hosted prospects within the Youanmi such as the Grace prospect host a considerable amount of gravity recoverable gold. Previous testwork completed by JTs achieving ~60-70% gravity gold recovery. Refer to *2021-JT-157 ROX- Grace Assessment of Assay Techniques.* A gravity circuit is therefore recommended if these granite hosted prospects are envisioned to be processed in the future. This could include a bleed stream off the mill discharge hopper to a screen followed by centrifugal concentrator- such as a Knelson or Falcon.

Historical whole of ore cyanidation has been widely tested, with results varying depending on sample oxidation, provenance, grind size and leach conditions. Sulphide ores ground to $P_{80}$ 75µm generally achieve between ~40-62% leach extraction under typical CIL leach conditions in the reports reviewed.

### 4.1.2 Ultra fine grinding

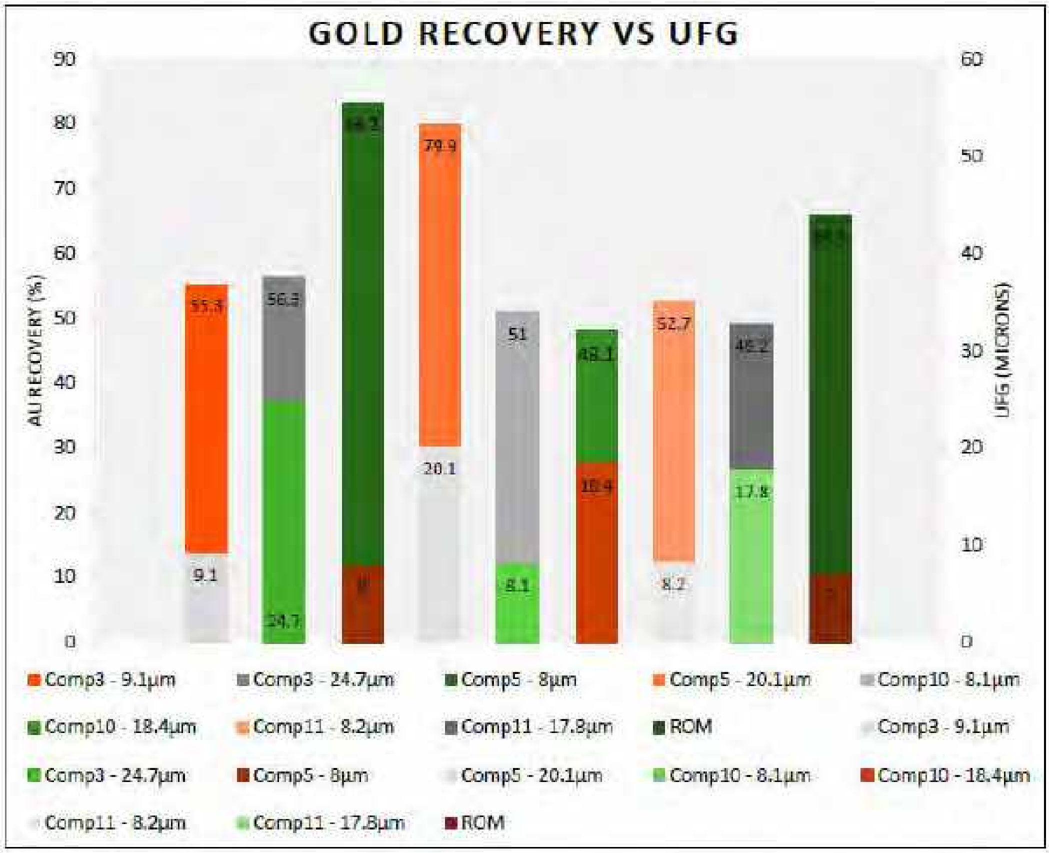
The ultra fine grinding of the sulphide concentrate has been evaluated multiple times over the course of the project's history. This includes in 1992 campaign completed by AMMTEC (Appendix B) and more recently in 2021 completed by Orway Mineral Consultants (Appendix C) and expanded upon in 2022/2023 by work completed by MACA Interquip (appendix D).

The 1992 program concluded that concentrate fine griding "*did not provide any substantial improvement in gold extraction*" when compared to a conventional grind size utilising standardised leach conditions.

The 2021 program found that ultra find grinding to $P_{80}$ 10µm was able to increase the cyanide gold extraction compared to a sample ground to $P_{80}$ 75µm by an average of 14.2%. It is however noted that the ultra-fine ground product was subjected to a significantly more aggressive leach conditions compared to the coarse ground sample. The ultra fine ground sample was also treated with a portion of a lead based oxidative leach accelerant (Leach Well) which is likely to have aided the leach kinetics.

MACA Interquip expanded on the 2021 work by assessing grind sizes down to as low as $P_{80}$ 7µm utilising similar aggressive leach conditions of the earlier Orway work. The results of the testwork were variable, achieving recoveries between 40% to 80% as shown below in Figure 1.

*Figure 1: UFG Results- MACA Interquip 2023 Program*




### 4.1.3 Roasting

The Youanmi ore was processed utilising a float, roast, Merrill Crowe cyanidation flowsheet in the 1940's. A review of the plant records from December 1941 indicate a monthly production of 1126oz from 5,009 net try tons, with a claimed recovery of 78.4%. Ore from this month was sourced from the Youanmi Main and Pollard shafts.

The 1992 AMTEC campaign assessed a two stage calcine roast (550°C) on flotation concentrate followed by standard cyanidation. This testwork achieved gold extractions between 78.8- 87.3% on a flotation concentrate sample grading 15.5g/t. Sighter roasting testwork in the 2021 program achieved comparable results, achieving an average gold extraction of 87.3%.

#### 4.1.4 Pressure Oxidation

JTs understands a POX testwork campaign was completed in the 1990's ahead of the decision to construct the BACOX plant. Results of the testwork are not included in the provided historical metallurgical results, assumed missing.

Basic sighter POX testwork was completed as part of the 2021 program overseen by Orway Mineral Consultants. the testwork is sighter in nature and was designed to provide indicative response to the flowsheet. The POX conditions assessed are presented in Table 2.

*Table 2: 2021 POX Testwork Parameters*

| Stage | Parameter | Value |
|---|---|---|
| POX Conditions | Concentrate grind size ($P_{80}$ µm) | As received (51-71) |
| | Pulp density (% Solids) | 15 |
| | Temperature (°C) | 200 |
| | Residence Time (minutes) | 60 |
| | Pressure (kPa) | 600 |

The testwork indicated that pressure oxidation is effective at oxidation of the sulphide mineralisation present in the ore. Overall, the flowsheet achieved an average gold extraction of 94.7%.

#### 4.1.5 Neutral Albion Leach (NAL)

Neutral Albion Leach (NAL) targeting 60-70% sulphide sulphur oxidation was included in the 2021 Orway testwork campaign. Albion amenability was assessed on flotation concentrates of three Youanmi composites (ROM stockpile, Upper Hanging Wall and Upper Main) ultra fine ground to $P_{80}$ ~10µm. Pertinent parameters of Orway Albion testwork completed in 2021 are presented in Table 3.

*Table 3: 2021 NAL Testwork Parameters*

| Parameter | Unit | ROM Stockpile | Upper Hanging Wall | Upper Main |
|---|---|---|---|---|
| Temperature | Degrees C | 95 | 95 | 95 |
| Residence Time | Hours | 49.0 | 30.3 | 21.0 |
| Slurry Density | % w/w | 3.5 | 3.2 | 2.1 |
| Target pH | | 5.50 | 5.50 | 5.50 |
| Final pH | | 5.52 | 5.68 | 5.57 |
| Final ORP | mV | 158 | 139 | 153 |
| Grind Size P98 | µm | 23.3 | 22.1 | 21.9 |
| Grind Size P80 | µm | 10.3 | 10.2 | 10.0 |
| **Sulphide Oxidation** | **%** | **78** | **77** | **75** |
| Feed mass | g | 362 | 332 | 217 |
| Product mass | g | 567 | 580 | 318 |
| Mass gain | % | 56.6 | 74.7 | 46.5 |
| Acid addition | kg/t feed | 35.2 | 68.0 | 85.7 |
| Limestone addition | g | 199 | 189 | 98 |
| Limestone addition | kg/t feed | 550 | 569 | 452 |
| Limestone addition | t/t SOx | 2.90 | 2.63 | 2.50 |

The Albion oxidised residue was subjected to an intensive cyanide leach. The flotation tail was also subjected to a cyanide leach, reflective of a typical float tail leach CIL circuit. Summary results of the

2021 Albion testwork is presented in Table 4. Albion was shown to be a highly effective flowsheet for oxidising the Youanmi ore.

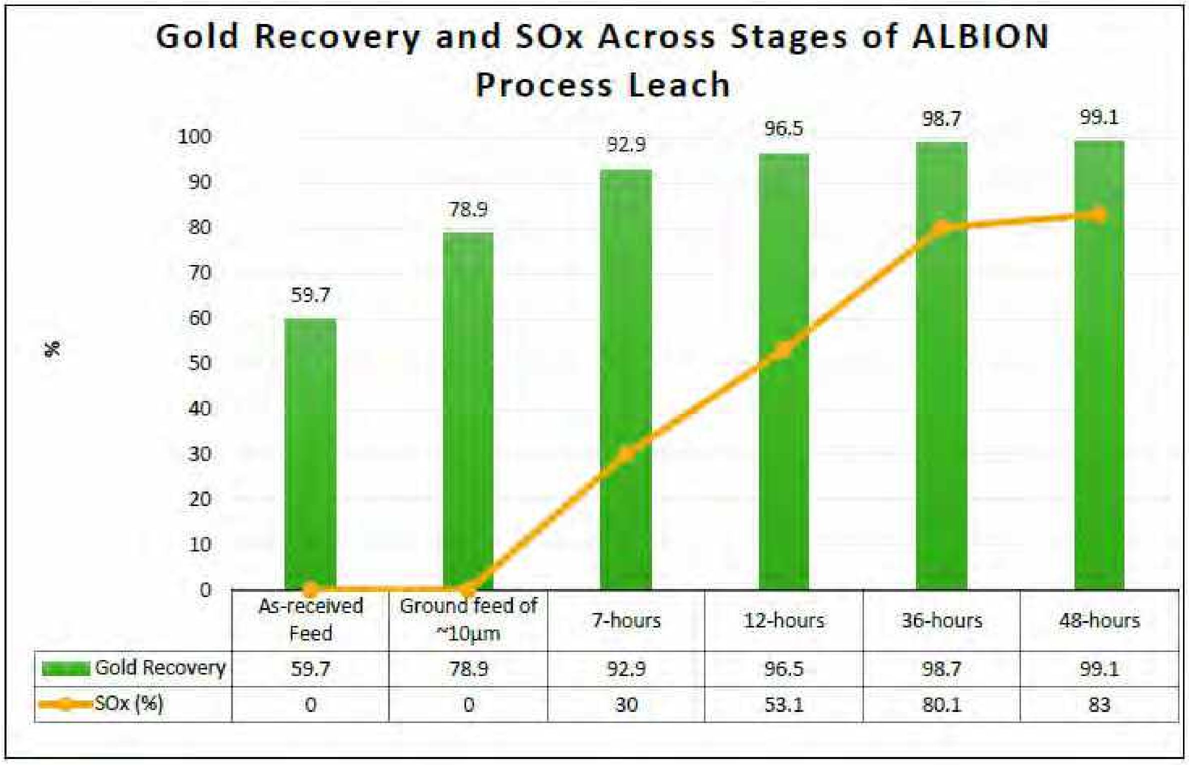
*Table 4: 2021 NAL Testwork results*

| | ROM Stockpile | Upper Hanging Wall | Upper Main |
|---|---|---|---|
| Au Assay head (g/t) | 8.96 | 5.64 | 8.96 |
| Calc. Au head (g/t) | 8.68 | 4.72 | 8.09 |
| Overall leach extraction (%)* | 93.4 | 94.4 | 95.5 |

**Includes NAL residue leach and float tail leach*

MACA Interquip expanded on this work in 2022-23 by assessing NAL targeting ~30% sulphide/sulphur oxidation, which had the aim of reducing both capital and operational plant costs. The exact testwork conditions used in the test were not provided however are expected to comparable to the earlier 2021 testwork. Comparative results based upon the '2022 sulphide ROM composite' is presented below in Figure 2. The testwork showed that 92.9% extraction could be achieve after only 30% of the total sulphide/sulphur is oxidised, taking only 7 hours. Higher gold extractions could be achieved but require a longer oxidation residence time resulting in higher operational cost and the need for larger tanks (higher CAPEX).

*Figure 2: 2022 Program- Oxidation Curve*




| | As-received Feed | Ground feed of ~10µm | 7-hours | 12-hours | 36-hours | 48-hours |
|---|---|---|---|---|---|---|
| Gold Recovery | 59.7 | 78.9 | 92.9 | 96.5 | 98.7 | 99.1 |
| SOx (%) | 0 | 0 | 30 | 53.1 | 80.1 | 83 |

### 4.1.5 Bacterial Oxidation

JT is familiar with numerous past bacterial oxidation testwork programs conducted on the Youanmi project. However, several testwork reports were found to be missing from the metallurgical reports provided. This includes BACOX testwork completed in the early 90's prior to the previous plant's construction. JTs is also aware of two Metso BIOX programs which were completed in 1990 and 1992. Results of these two testwork campaigns was provided by Metso during the 2024 PFS testwork campaign. Results of the recent Metso BIOX work are compared against results of the historical BIOX programs in Section 8 of this report.

The previous metallurgical results of the Youanmi Plant which utilised BACOX technology is presented below in Table 5. From the period between December 1994 to November 1997 the plant achieved an average 87.0% CIL gold recovery utilising a bacterial oxidation flowsheet.

## 4.2 HISTORICAL PROCESSING

JTs understands the Youanmi ore was first prospected in circa 1908 with the first plant flowsheet consisting of flotation, roasting followed by Merrill Crowe cyanidation. JTs understand this plant operated up untill 1942. Oxide ore was processed at Youanmi between 1987- 1993 utilising a conventional Merrill Crowe cyanidation flowsheet. In 1992 Goldcrest mines (Australia) ('GMA'), the then owner of the mine defined the oxide/sulphide 'Youanmi Deeps' resource. GMA undertook several testwork programs on the Youanmi ore to refine a processing flowsheet. Several flowsheets were assessed including roasting, ultra fine grinding, pressure oxidation and importantly biological oxidation.

Despite having an in principal approval to construct a roaster, in 1994 GMA ultimately chose to construct a plant utilising a bacterial oxidation flowsheet citing future environmental and complexity of operation as key reasons for not choosing the roaster option. GMA constructed a plant which employed 'BACOX' technology owned by BacTech Environmental. The plant consisted of a Flotation, BACOX, CIL flowsheet including cyanide leaching of the flotation tail. This plant did not include a gravity circuit. A block flow diagram of the processing plant is presented in Figure 3 below a plant flowsheet is presented in Appendix E of this report.

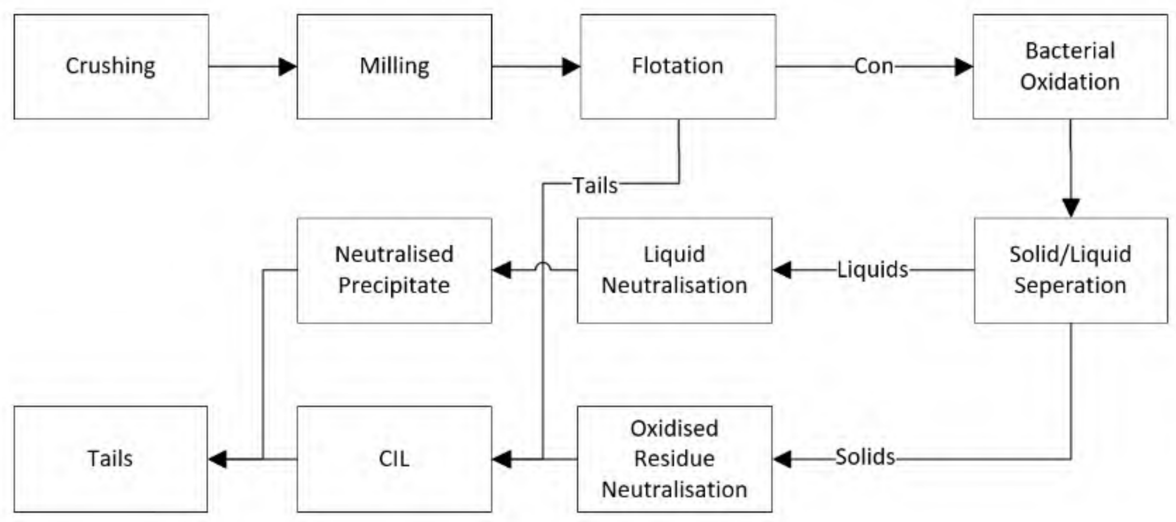



*Figure 3: Historical plant simplified block flow diagram*

JTs was provided with the historical plant data for the period of December 1994 to November 1997. Orway Mineral Consultants as part of their *'Youanmi Underground Scoping Study- Metallurgical Testwork Report'* published in December 2021 completed a comprehensive review of this operational plant dataset. A summary of pertinent metallurgical KPI's derived from this report is presented in below in Table 5.

*Table 5: Historical Youanmi Plant KPI's- Dec 1994 to Nov 1997*

| Parameter | Unit | Average | Min | Max | Std Dev | % Std Dev |
|---|---|---|---|---|---|---|
| **Crushing** | | | | | | |
| Throughput | t/day | 489 | 0 | 1366 | 302 | 62 |
| Operating Time | h | 8 | 0 | 14 | 3 | 45 |
| Grade | g Au/t | 10.7 | 0.0 | 39.5 | 5.7 | 53.7 |
| **Milling** | | | | | | |
| Throughput | t/day | 454 | 0 | 691 | 216 | 48 |
| Grade | g Au/t | 10.57 | 0.00 | 25.66 | 4.92 | 46.50 |
| As | % | 1.16 | 0.00 | 1.82 | 0.33 | 28.36 |
| Fe | % | 7.46 | 0.00 | 19.25 | 3.23 | 43.28 |
| **Flotation Concentrate** | | | | | | |
| Throughput | t/day | 98 | 0 | 220 | 52 | 53 |
| Mass pull | | 21.3 | 7.7 | 57.0 | 5.7 | 26.9 |
| Grade | g Au/t | 44.49 | 0.00 | 117.91 | 20.45 | 45.97 |
| As | % | 2.48 | 0.00 | 6.05 | 1.15 | 46.55 |
| Fe | % | 17.10 | 0.00 | 36.15 | 7.81 | 45.66 |
| **Flotation Tails** | | | | | | |
| Throughput | t/day | 357 | 0 | 553 | 171 | 48 |
| Grade | g Au/t | 1.69 | 0.00 | 4.48 | 0.82 | 48.34 |
| As | % | 0.16 | 0.00 | 0.46 | 0.08 | 53.11 |
| Fe | % | 3.36 | 0.00 | 13.30 | 1.74 | 51.78 |
| Recovery Au | % | 87.1 | 0.0 | 97.0 | 34.5 | 39.6 |
| Recovery As | % | 80.7 | 0.0 | 100.0 | 33.0 | 40.9 |
| **BACOX feed** | | | | | | |
| Throughput | t/day | 75 | 0 | 161 | 39 | 52 |
| Grade | g Au/t | 43.35 | 0.00 | 91.87 | 11.85 | 27.34 |
| As | % | 2.42 | 0.00 | 6.40 | 0.74 | 30.43 |
| Fe | % | 17.28 | 0.00 | 34.80 | 5.06 | 29.28 |
| **CIL tail** | | | | | | |
| Solids Grade | g Au/t | 1.36 | 0.00 | 4.37 | 0.54 | 39.42 |
| Solution Grade | ppm Au | 0.032 | 0.000 | 1.189 | 0.040 | 127.158 |
| CIL Gold recovery | % | 87.0 | 0.0 | 98.2 | 32.8 | 37.7 |

There remains a lot of conjecture around the success of the plant and the problems which arouse around the bacterial oxidation circuit. The operation experienced several issues which contributed it to not meeting production targets ultimately resulting in the mine closure in November 1997. The prevalent poor gold price of ~A$450/oz at the time also was a contributing factor in the closure.

# 5 Historical Mineralogical Characterisation Testwork

The semi-refractory nature of the fresh ore at Youanmi is well known, with many previous owners relying on a variety of oxidative methods to effectively liberate gold from the sulphide mineralisation for downstream cyanidation.

Several mineralogical characterisation programs have been completed on samples from Youanmi in the past to define the ores composition. JTs was provided with a copy of several reports which included mineralogical characterisation by the following methods:

- QEMSCAN mineralogy including XRD and Gold Search on flotation concentrates and tails samples
- Laser Ablation Inductively Coupled Plasma Mass Spectrometry (LA-ICPMS) on selected flotation concentrates
- Petrographic interpretation on polished thin sections collected from selected drill core samples from around the known resource

A copy of these mineralogical reports is presented in Appendix E to this report. This section of the report aims to provide a concise overview of the mineralogical characterisation testwork completed to date. Several reports on the presented data have been written in the past, which contain an expanded amount of information and analysis. Further mineralogical characterisation testwork was completed within the PFS testwork, presented in Section 7.4 below.

## 5.1 QEMSCAN, XRD and Gold Search

Based on the QEMSCAN data reviewed, the fresh ore sulphides are characterised by pyrite (~5-7 %) Arsenopyrite (~0.5-0.85%) on a whole of ore basis. The balance is typically made up of silicates (~80%) consisting of a mixture of quartz, micas, and chlorite. Quartz is the predominate gangue mineral, consisting of 26-31% of the whole of ore mass.

Pyrite, being a primary sulphide mineral, demonstrated a notable presence in assessed flotation concentrates. In the flotation concentrate fractions, pyrite content ranged between 35-55%. Conversely, pyrite levels were markedly lower in the combined rougher tails, constituting less than 0.3% of the mass. Liberation studies revealed that pyrite in the concentrates exhibited varying degrees of liberation, with approximately 60% classified as 'well liberated' and 30% as 'high grade middlings'. In contrast, pyrite in the combined rougher tails showed reduced liberation, with about 50% categorised as 'well liberated' and a minor 3% as 'high grade middlings'. The less liberated pyrite in the tails was predominantly associated with silicates and, to a lesser extent, with other non-sulphide gangue minerals.

Similarly, arsenopyrite, the main arsenic-bearing mineral, displayed preferential distribution in the flotation concentrate fractions, comprising about 4% of the mass. In contrast, arsenopyrite levels in the combined rougher tails were considerably lower, constituting less than 0.2% of the mass. Liberation studies indicated that arsenopyrite in both concentrates and tails was not well liberated, closely associated with silicates within the ore matrix.

*Table 6: 2021 QEMSCAN- Mineral Abundance*

| Mineral group | RDA3249 ROM Stockpile | | | RDA3250 Upper Hanging Wall | | | RDA3251 Upper Main | | |
|---|---|---|---|---|---|---|---|---|---|
| | Float Con | Combined Rougher Tail | Combined | Float Con | Combined Rougher Tail | Combined | Float Con | Combined Rougher Tail | Combined |
| | Mass% in fraction | | | Mass% in fraction | | | Mass% in fraction | | |
| **Native gold** | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| **Au-(Ag)-tellurides** | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| **Pyrite** | 50.9 | 0.28 | 7.11 | 54.0 | 0.29 | 7.75 | 38.9 | 0.19 | 5.18 |
| **Arsenopyrite** | 5.48 | 0.13 | 0.85 | 3.35 | 0.07 | 0.52 | 3.52 | 0.05 | 0.50 |
| **Loellingite and As intergrowths** | 0.73 | 0.42 | 0.47 | 0.04 | 0.00 | 0.01 | 0.07 | 0.00 | 0.01 |
| **Chalcopyrite** | 0.12 | 0.01 | 0.02 | 0.10 | 0.00 | 0.02 | 0.13 | 0.00 | 0.02 |
| **Tetrahedrite** | 0.05 | 0.00 | 0.01 | 0.10 | 0.00 | 0.01 | 0.07 | 0.00 | 0.01 |
| **Stibnite** | 0.03 | 0.00 | 0.00 | 0.95 | 0.02 | 0.15 | 0.00 | 0.00 | 0.00 |
| **Other sulphides** | 0.03 | 0.00 | 0.01 | 0.16 | 0.01 | 0.03 | 0.06 | 0.00 | 0.01 |
| **Quartz** | 12.8 | 34.0 | 31.2 | 9.96 | 28.5 | 25.9 | 13.5 | 28.6 | 26.6 |
| **Micas** | 15.5 | 24.8 | 23.6 | 12.3 | 19.9 | 18.8 | 18.7 | 22.3 | 21.8 |
| **Feldspars** | 0.85 | 4.89 | 4.35 | 1.71 | 8.05 | 7.17 | 1.38 | 5.29 | 4.78 |
| **Chlorite** | 4.60 | 14.3 | 13.0 | 6.56 | 19.4 | 17.6 | 10.1 | 20.4 | 19.1 |
| **Amphibole** | 0.71 | 3.38 | 3.02 | 1.12 | 1.98 | 1.86 | 1.44 | 1.69 | 1.66 |
| **Tourmaline/kaolinite** | 0.23 | 0.46 | 0.43 | 0.23 | 0.42 | 0.39 | 0.34 | 0.44 | 0.42 |
| **Talc** | 0.74 | 0.19 | 0.26 | 0.73 | 0.33 | 0.39 | 1.23 | 0.43 | 0.53 |
| **Epidote** | 0.23 | 0.80 | 0.72 | 0.76 | 2.03 | 1.85 | 0.48 | 2.14 | 1.93 |
| **Other silicates** | 0.30 | 0.27 | 0.27 | 0.35 | 0.46 | 0.45 | 0.54 | 0.42 | 0.44 |
| **Apatite** | 0.47 | 1.06 | 0.98 | 0.45 | 1.03 | 0.95 | 0.40 | 0.65 | 0.62 |
| **Ti minerals** | 1.51 | 2.50 | 2.37 | 1.47 | 2.53 | 2.39 | 1.77 | 2.26 | 2.20 |
| **Magnetite/hematite** | 2.37 | 4.61 | 4.31 | 1.34 | 2.30 | 2.16 | 1.10 | 1.63 | 1.56 |
| **Calcite/ankerite-dolomite** | 2.04 | 7.31 | 6.60 | 4.07 | 12.3 | 11.1 | 5.93 | 13.1 | 12.2 |
| **Steel** | 0.27 | 0.49 | 0.46 | 0.21 | 0.39 | 0.36 | 0.38 | 0.36 | 0.36 |
| **Other minerals** | 0.02 | 0.04 | 0.04 | 0.02 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 |
| **TOTAL** | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |

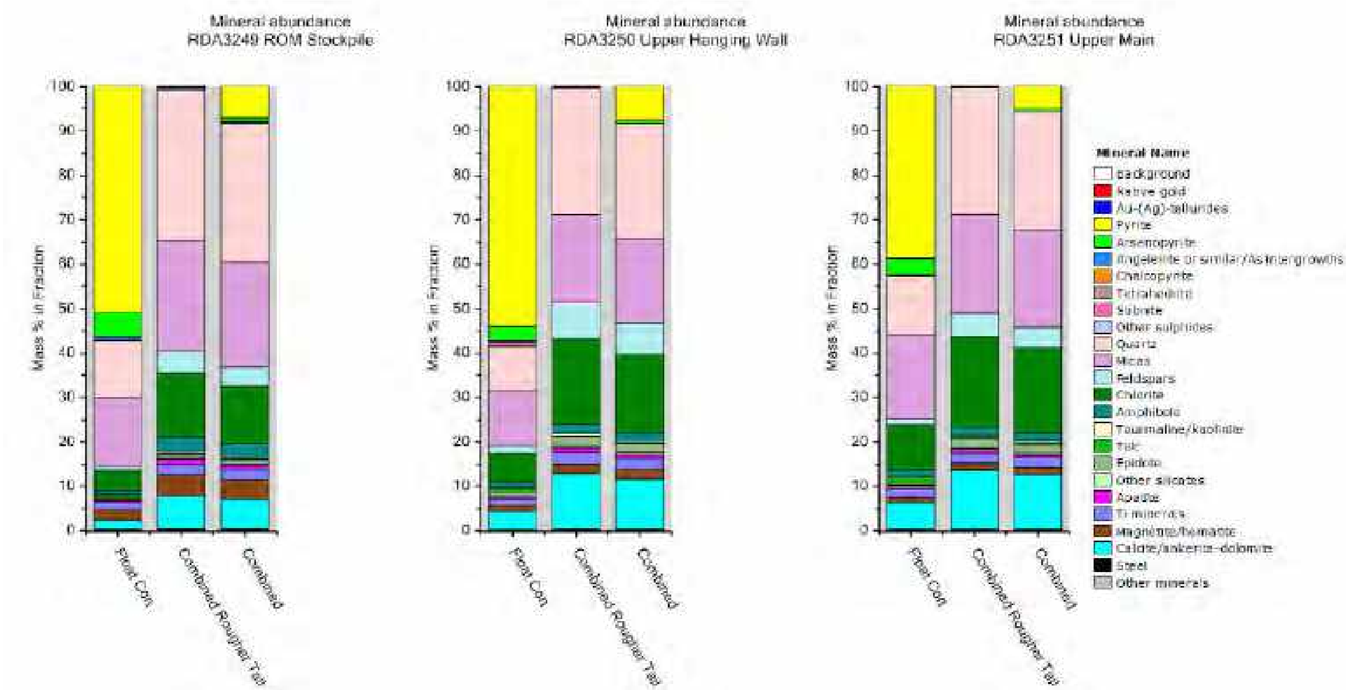



*Figure 4: 2021 QEMSCAN Mineral Abundance*

A gold search of the flotation concentrates fractions found most of the detectable gold was fine grained (<15µm) and speciated either natively or as gold-silver telluride.

Most of the detected gold grains were associated with pyrite, and to a lesser extent with ankerite-dolomite, silicates and arsenopyrite.

## 5.2 LA-ICP MS

It is noted that the above method (QEMSCAN and XRD) is incapable of detecting sub-microscopic gold inclusions and/or gold in solid solution within arsenopyrite. To further characterise the ore a LA-ICP MS (Laser Ablation Inductively Coupled Plasma Mass Spectrometry) program was completed on the flotation concentrate samples. A copy of the report is attached in Appendix E.

The program concluded that refractory gold hosted within arsenopyrite accounts for approximately 13 to 25% of the total gold content in each sample, whereas the contribution of refractory gold hosted by pyrite is minimal as shown below in below in Table 7.

*Table 7: 2021 LA-ICPMS data*

| Sample name | Flotation fractions | Wt. (mass%) | Au (g/t) | Pyrite abundance (Mass% by QEMSCAN) | Gold hosted by pyrite (g/t, calculated) | LA-ICP-MS on pyrite | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Number of grains analysed | Min/Max gold content (ppm) | Average gold content (ppm) | Uncertainty (± 1s, ppm) |
| **RDA3249 ROM Stockpile** | Float Con | 13.5 | 63.2/64.8 | 50.86 | 0.38 | 23 | <0.007 - 7.6 | 0.75 | 0.35 |
| | Combined Rougher Tail | 86.5 | 1.28 | 0.28 | 0 | | | | |
| | Total | 100 | 18.39 | 7.11 | 0.05 | | | | |
| **RDA3250 Upper Hanging Wall** | Float Con | 13.9 | 33.7/33.8 | 53.98 | 1.78 | 24 | <0.007 - 19.0 | 3.3 | 1.1 |
| | Combined Rougher Tail | 86.1 | 0.56 | 0.29 | 0.01 | | | | |
| | Total | 100 | 5.17 | 7.75 | 0.26 | | | | |
| **RDA3251 Upper Main** | Float Con | 12.9 | 65.6/66.9 | 38.86 | 0.39 | 22 | <0.007 - 10.3 | 1 | 0.47 |
| | Combined Rougher Tail | 87.1 | 0.81 | 0.19 | 0 | | | | |
| | Total | 100 | 9.25 | 5.18 | 0.05 | | | | |
| **Sample name** | **Flotation fractions** | **Wt. (mass%)** | **Au (g/t)** | **Arsenopyrite abundance (Mass% by QEMSCAN)** | **Gold hosted by arsenopyrite (g/t, calculated)** | **LA-ICP-MS on arsenopyrite** | | | |
| | | | | | | **Number of grains analysed** | **Min/Max gold content (ppm)** | **Average gold content (ppm)** | **Uncertainty (± 1s, ppm)** |
| **RDA3249 ROM Stockpile** | Float Con | 13.5 | 63.2/64.8 | 5.48 | 15.79 | 23 | 3.2 - 2309 | 288 | 104 |
| | Combined Rougher Tail | 86.5 | 1.28 | 0.13 | 0.38 | | | | |
| | Total | 100 | 18.39 | 0.85 | 2.46 | | | | |
| **RDA3250 Upper Hanging Wall** | Float Con | 13.9 | 33.7/33.8 | 3.35 | 8.11 | 23 | 0.13 - 1611 | 242 | 81 |
| | Combined Rougher Tail | 86.1 | 0.56 | 0.07 | 0.16 | | | | |
| | Total | 100 | 5.17 | 0.52 | 1.27 | | | | |
| **RDA3251 Upper Main** | Float Con | 12.9 | 65.6/66.9 | 3.52 | 15.75 | 23 | 0.75 - 2073 | 447 | 102 |
| | Combined Rougher Tail | 87.1 | 0.81 | 0.05 | 0.23 | | | | |
| | Total | 100 | 9.25 | 0.5 | 2.24 | | | | |

## 5.3 Microprobe Analysis

CSIRO completed a mineralogical characterisation testwork program in 1992 to determine the speciation of the "invisible gold" present in the Youanmi ore. The report titled "*Solid Solution Gold in Pyrite and Arsenopyrite from the Youanmi Goldmine*" by J. Graham (1992) is presented in Appendix E.

Four Youanmi samples were pyrolysed and then analysed by Microprobe. The analysis concluded that gold was present in solid solution within arsenopyrite to "several hundred ppm". No solid solution gold was observed within pyrite however its noted the instrument had a detection limit of 50ppm.

## 5.4 Petrographic Analysis

Roger Townend from Diamantina Laboratories prepared eleven finely polished thin sections (refer to *Report number 24552*, dated 25 August 2021 Appendix E), which underwent petrographic examination with a specific focus on the occurrence and association of gold. Key findings from the report identified that gold was predominately speciated in the following three categories:

**Argentian Gold (silver-rich):** Predominantly refractory, with some semi-refractory grains along micro-fractures, Fine-grained (<10-20µm).

**Aurostibnite (Sb-rich):** Relatively rare, characterised by super-fine grains (<10µm) embedded in a silicate matrix. Considered a refractory mineral.

**Yellow Gold (low silver):** Mainly free-milling on pyrite grain boundaries and with silicates. Some semi-refractory gold in micro-fractures and cavities. Grain sizes ranging from 10-150µm.

Based on grain count, yellow gold emerges as the most prevalent, followed by Argentian gold and aurostibnite. A metallurgical classification derived from the thin sections suggests that approximately half of the detected gold is free-milling, while the remaining half is either refractory or semi-refractory.

Only two instances of non- solid solution gold within arsenopyrite were observed: one involving free-milling gold in an arsenopyrite concentrate, and the other featuring free-milling gold in an arsenopyrite-rich ore (both sourced from beneath Kathleen pit). It's noted that the method does not the ability to detect solid solution gold.

Semi-refractory gold is predominantly found within cavities, along grain boundaries, or within micro-fractures. Despite the term 'semi-refractory' suggesting some susceptibility to cyanidation, it is noted that achieving sufficient liberation for effective leaching requires an extremely fine grind size. This necessity for fine grinding was demonstrated in ultra-fine grinding testwork, where grinding to as low as $P_{80}$ 7µm yielded variable results ranging from 40-80% extraction under intensive cyanidation. The petrographical analysis suggests that cyanide recovery is in part influenced by the structure and composition of these cavities, grain boundaries, and micro-fractures. For a gold particle embedded within a micro-fracture to be liberated, the fracture (or wider conglomerate) must be sheared. Thus, gold recovery is partially contingent upon the selective cleavage of these structures.

An example of a 'Semi refractory' gold grain is presented below in Figure 5. In order for this particle of gold to be extracted via cyanidation, the particle is required to either cleave along the micro-fracture or randomly shear through the pyrite conglomerate to expose a portion of the gold inclusion.

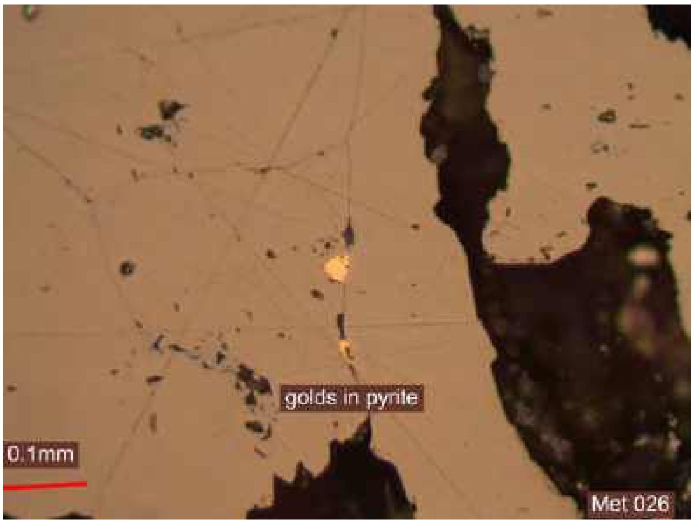



*Figure 5: 'Semi-refractory' gold in pyrite particle*

# 6 2024 PFS Testwork Overview

The PFS Metallurgical Testwork campaign consisted of the following:

- Metso BIOX® process amenably testwork completed through Metso South Africa at SGS Johannesburg
- Cleaner and re-cleaner locked cycle flotation testwork completed at ALS Metallurgy Perth
- Extended Pre-oxidation leach testwork completed at ALS Metallurgy Perth

JT Metallurgical Services acted as the lead manager for all these testwork campaigns on behalf of ROX Resources. The source reports of these testwork campaigns are presented in Appendices G, H, and J of this report. A summation and detailed of analysis of these testwork programs are presented in the following sections.

## 6.1 Sample Provenance & Compositing

### 6.1.1 Downstream Testwork Compositing

Due to the reporting deadline for the broader PFS and the expected timeframes for the testwork programs, several programs opted to utilise concentrate from previous testwork campaigns as their feedstock. Generating new concentrate for downstream testwork was deemed impractical noting the timeline.

JTs understands a Youanmi ROM composite sample was generated by combining handpicked Youanmi ROM samples by geologist on an unknown date. This is referred to as the 'ROM composite' in the Orway Mineral Consultants Report '*Report No. 7471 Youanmi Underground Scoping Study-Metallurgical Testwork*' (Appendix C) published in December 2021.

This composite was then combined with additional ROM samples to generate a composite referred to as the '2022 ROM composite' in the MACA report titled '774-*04060-RPT-0001 – Testwork Summary'* (Appendix D). This material was then used in a bulk flotation program utilising standard roughing flotation conditions (ALS Program IDs: A23155 and A23829) completed in May 2022. The purpose of the bulk flotation program was to generate concentrate for downstream flowsheet development, including Albion and ultrafine grinding testwork.

The Bacterial oxidation and extended pre-oxidation leach testwork were completed on an ultra-fine ground ($P_{80}$ 8µm) sample of the '2022 ROM composite' sample. This sample was retrieved from cold storage at ALS Metallurgy Laboratory Perth and is therefore assumed as un-oxidised. A head assay of the concentrate is presented below in Table 9.

### 6.1.2 Flotation Testwork Compositing

ALS received a total of 67.26kg of selected quartered NQ sized core by ROX Resources. JTs understands the presented core consisted of ore intercepts from the 'Link' mining area inclusive of several different domains, namely:

- Hill End Foot Wall
- Hill End Hanging Wall
- Hill End North Foot Wall
- United North Hanging Wall
- United North Main

All of the selected core is assumed representative of the designed stoping areas of the current Link mine plan. JTs understands the provided core was selected to best represent the un-diluted ore production plan from Link, with high- and low-grade intercepts excluded from the core selection. Figure 6 below shows a long section of the location of the provided core, with the yellow triangles representing a provided ore intercept used in the 2024 PFS testwork.

JTs understands the current mining plan includes ore production from other mining areas, including ‘Main’ and ‘Pollard’. It is noted that no ore intercepts from these two mining areas was provided for inclusion in the PFS testwork program. Past testwork has focused on the Main Lode, so given the significant increase in material from Link in the PFS, Rox considered it appropriate to focus testwork on this area for the PFS. The green triangles shown in Figure 6 represent intercepts form the Main Lode used in the 2021/2022 metallurgical testwork campaign. Planned stopes at time of authorship are presented in purple.  JTs recommends that future metallurgical studies include additional variability testwork samples to assess ore variability.

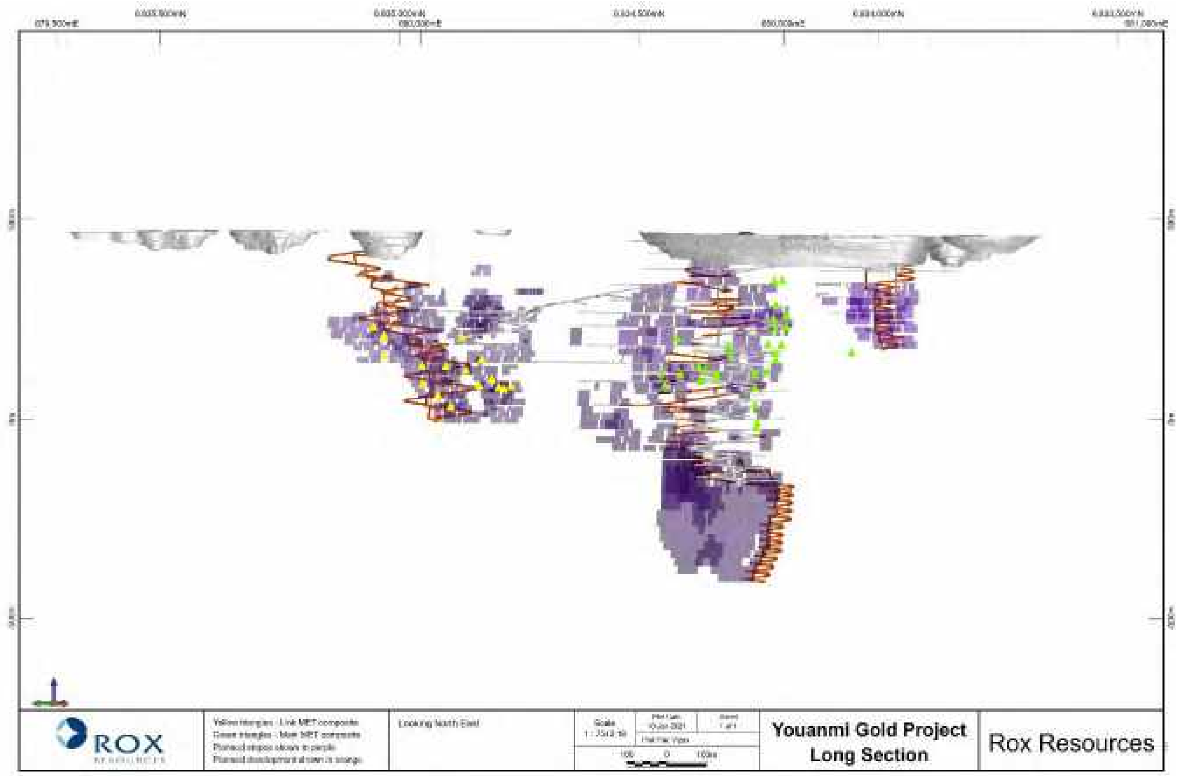


*Figure 6: Long Selection showing selected core*

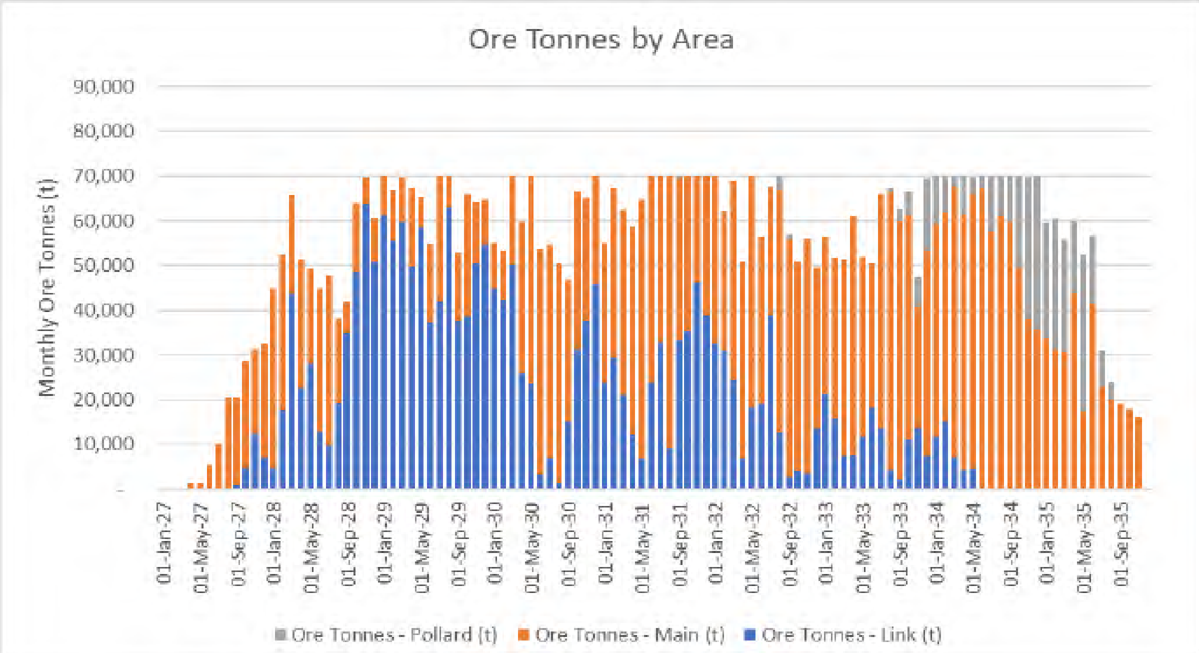



*Figure 7: Current Youanmi Mine Plan by Mining Area*

The provided core was combined into a composite in its entirety. This composite will be henceforth referred to as the 'Youanmi 2024 Master composite'. Details core intercepts which were inputted into this composite are presented in Table 8 below.

*Table 8: Youanmi 2024 Master Composite Makeup*

| Domain | Hole ID | Lode ID | From (m) | To (m) | Length (m) | Au (g/t) | Received mass (kg) |
|---|---|---|---|---|---|---|---|
| Hill End FW | RXDD012 | 40950 | 450.2 | 452.2 | 2.0 | 7.18 | 2.72 |
| Hill End HW | RXDD093 | 41050 | 410.0 | 411.9 | 1.9 | 9.21 | 2.28 |
| Hill End HW | RXDD092 | 41100 | 366.9 | 371.0 | 4.1 | 3.53 | 4.66 |
| Hill End HW | RXDD072 | 41200 | 292.9 | 296.0 | 3.1 | 11.26 | 4.48 |
| Hill End Main | RXDD062 | 41000 | 359.0 | 365.3 | 6.3 | 13.67 | 7.48 |
| Hill End Main | RXDD068 | 41000 | 382.3 | 384.4 | 2.1 | 9.96 | 2.63 |
| Hill End Main | RXDD091 | 41000 | 450.0 | 452.0 | 2.0 | 18.52 | 2.39 |
| United North HW | RXDD058 | 51075 | 339.5 | 343.0 | 3.5 | 15.01 | 4.52 |
| United North HW | RXDD089 | 51200 | 344.3 | 346.6 | 2.3 | 6.79 | 2.83 |
| United North Main | RXDD039 | 51000 | 319.4 | 323.8 | 4.4 | 1.90 | 4.98 |
| United North Main | RXDD076 | 51000 | 285.2 | 287.8 | 2.6 | 7.78 | 3.1 |
| United North Main | RXDD077 | 51000 | 258.0 | 261.0 | 3.0 | 7.35 | 3.52 |
| United North FW | RXDD076 | 50950 | 294.7 | 297.3 | 2.5 | 15.92 | 3.15 |
| Hill End HW | RXDD061 | 41050 | 392.8 | 396.4 | 3.6 | 3.44 | 5.02 |
| Hill End Main | RXDD069 | 41000 | 394.21 | 398.09 | 3.9 | 3.49 | 5.26 |
| United North FW | RXDD096 | 50950 | 412.51 | 416.35 | 3.8 | 9.13 | 4.9 |
| United North Main | RXDD089 | 51000 | 393.77 | 396.46 | 2.7 | 3.67 | 3.34 |
| **Youanmi 2024 MC Total** | | | | | **53.8** | **8.47** | **67.26** |

## 6.2 HEAD ASSAYS

The Youanmi 2022 ROM Composite Flotation Concentrate and Youanmi 2024 Master Composites were submitted for detailed head assay, Results of the head assays are presented in below.

*Table 9: PFS Testwork Feedstock Assay Results*

| Analyte | Units | Youanmi 2022 ROM Composite Flotation Con | Youanmi 2024 Master Composite |
|---|---|---|---|
| Ag | ppm | 4 | <2 |
| Al | % | 4.56 | 6.04 |
| As | ppm | 26,200 | 3940 |
| Au-1 | g/t | 27.3 | 8.35 |
| Au-2 | g/t | 27.4 | 8.7 |
| **Au (average)** | **g/t** | **27.4** | **8.53** |
| Ba | ppm | 300 | 300 |
| Be | ppm | <5 | <5 |
| Bi | ppm | <10 | <10 |
| C-total | % | 0.60 | - |
| C-organic | % | <0.03 | - |
| Ca | % | 2.00 | 2 |
| Cd | ppm | <5 | <5 |
| Co | ppm | 180 | 35 |
| Cr | ppm | 800 | 40 |
| Cu | ppm | 520 | 70 |
| Fe | % | 20.9 | 7.76 |
| Hg | ppm | 0.1 | <0.1 |
| K | % | 1.80 | 2.6 |
| Li | ppm | 65 | 75 |
| Mg | % | 2.40 | 1.16 |
| Mn | ppm | 700 | 700 |
| Mo | ppm | 60 | <5 |
| Na | ppm | 3,140 | 3080 |
| Ni | ppm | 535 | 35 |
| P | ppm | 900 | 2200 |
| Pb | ppm | 25 | <5 |
| S-total | % | 21.2 | - |
| S-sulphide | % | 19.0 | 6.1 |
| Sb | ppm | 342 | 62.3 |
| SiO2 | % | 30.4 | 58.4 |
| Sr | ppm | 50 | 80 |
| Te | ppm | 3.4 | 2.6 |
| Ti | ppm | 4,800 | 1.1 |
| V | ppm | 158 | 246 |
| Y | ppm | <100 | <100 |
| Zn | ppm | 128 | 130 |
| SG | - | 3.58 | 2.99 |

The following is noted from the assay results:

- The ore and flotation concentrate have elevated antimony and arsenic.

- Both samples show low levels of common deleterious elements such as bismuth, tellurium, lead, copper, cadmium and mercury.
- There is a good agreement between repeat gold fire assay results suggesting negligible coarse, free gold is present.

# 7 FLOTATION TESTWORK

As mentioned previously, much of the flotation testwork completed on the Youanmi deposit prior to the PFS consisted of a simple rougher/ scavenger flowsheet. Cleaning testwork was included in the 2022-2023 MACA Interquip work, which was able to generate final concentrates averaging 37.1g/t with a mass pull of 9.12% achieving a gold recovery to concentrate averaging ~72%.

Building upon prior testwork, two additional locked flotation flowsheets were assessed as part of the PFS focused on cleaning testwork with the aim of improving the final concentrate grade and assessing the impact of regrinding the rougher concentrate.

The flotation testwork completed included locked cycle tests, which involves multiple stages of rougher, scavenger, and cleaner and re-cleaner flotation, with the selected product streams from each stage recycled back into the feed of the subsequent stage. The term "locked cycle" refers to the fact that the overall mass balance of the circuit is closed or "locked" at the end of the test.

Locked cycle testwork aims to simulate the continual nature of the flotation circuits, providing a more accurate representation of how the circuit would perform at full scale compared to batch testwork. Two flowsheets were assessed as part of the PFS testwork, including:

**Flowsheet #1- Rougher/Scavenger, Cleaner, Re-cleaner:** flotation feed to rougher/scavenger, rougher/scavenger concentrate cleaned, with the cleaner tail returned to the flotation feed. Cleaner concentrate reports to the re-cleaner with the re-cleaner tail reporting to the cleaner feed. Re-cleaner concentrate reports to final concentrate.

And,

**Flowsheet #2- Rougher/Scavenger, Cleaner, Re-cleaner with Concentrate Regrind:** flotation feed to rougher/scavenger, rougher/scavenger concentrate cleaned, with the cleaner tail returned to the flotation feed. Cleaner concentrate is ground to $P_{100}$ 53µm prior to reporting to the re-cleaner. The re-cleaner tail reports to the cleaner feed. re-cleaner concentrate reports to final concentrate.

Visual representation of both flowsheets is presented below in Figure 8 and Figure 9.

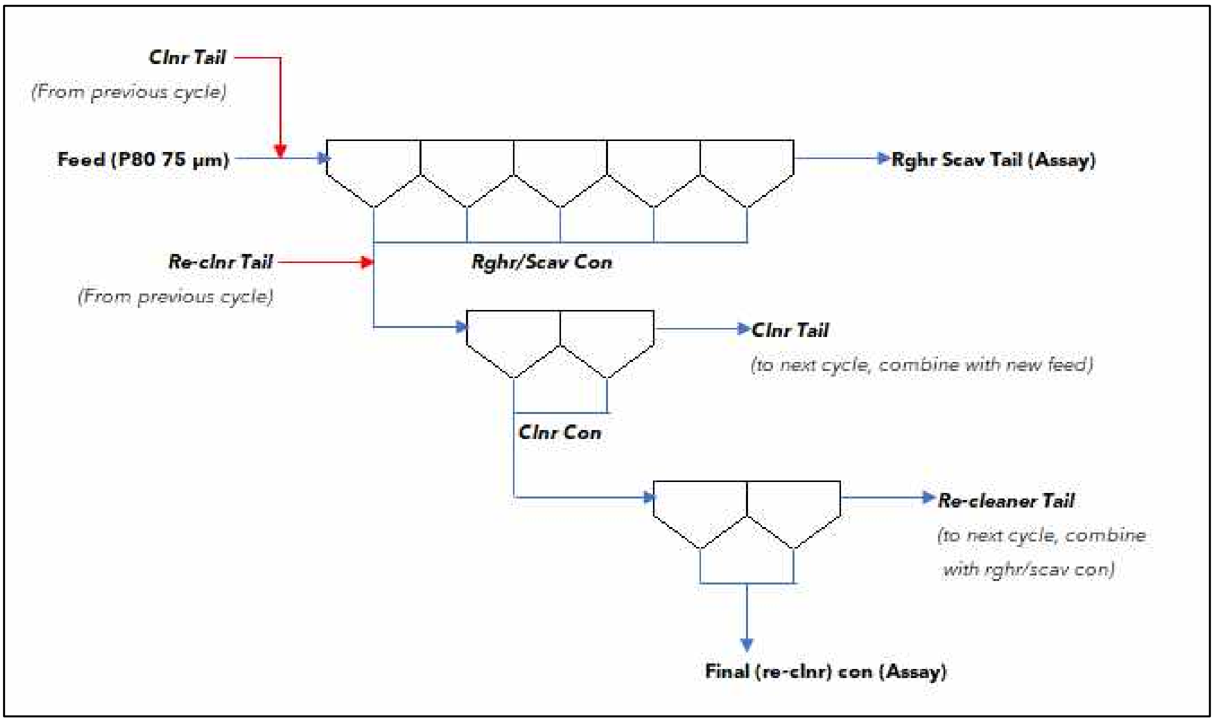



*Figure 8: Flotation Flowsheet 1-No Regrind*

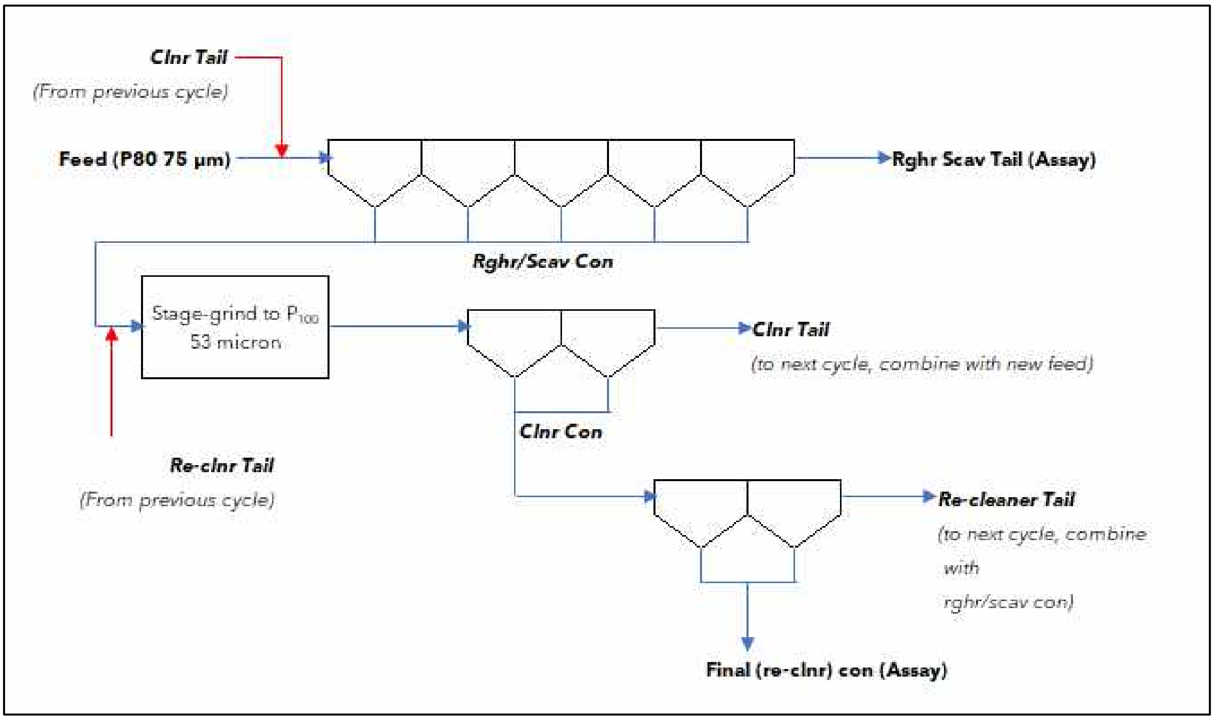



*Figure 9: Flotation Flowsheet 2- Regrind*

The rougher flotation testwork parameters used in the locked cycle tests mirrored the parameters utilised in the earlier programs, namely the bulk flotation testwork program completed by MACA in 2022/2023 (ALS Program ID: A22546). The flotation testwork utilised the following reagents:

- PAX (Potassium Amyl Xanthate)- an industry standard strong sulphide collector
- Copper Sulphate- sulphide mineral activator
- POLYFROTH® W55 Frother- Common frother used extensively in industry

All flotation tests were completed in site water collected from the Kathleen pit which is reflective of ground water available at the Youanmi Project. Pertinent flotation parameters of the tests are presented in Table 10.

Alternative flotation reagents should be assessed in future programs to further improve grade/recovery.

*Table 10: Locked Cycle Test Parameters*

| Parameter | unit | LC1 | LC2 |
|---|---|---|---|
| Charge size (fresh feed) | kg | 1.00 | 1.00 |
| Feed grind size | $P_{80}$ µm | 75 | 75 |
| Rougher Con grind size | $P_{100}$ µm | - | 53 |
| Rougher/Scavenger Cell Size | L | 4 | 4 |
| Cleaner cell size | L | 1 | 1 |
| Re-cleaner cell size | L | 1 | 1 |
| Copper Sulphate dosage | g/t | 50 | 75 |
| PAX dosage | g/t | 100 | 105 |
| W55 dosage | Drops | as req. | as req. |

## 7.1 Locked Cycle 1

A total of six cycles were completed in the Locked cycle 1 test. The cycles were very stable, with only minor variations in concentrate grades and mass pulls. Very little mass reported to the cleaner tails and recleaner tails streams, resulting in only a minimal amount of recirculation into subsequent flotation cycles. This has resulted in only minimal variation in concentrate grades and mass pulls across cycles as shown below in Figure 10 and Figure 11 below. A mass balance of the test is presented in Table 11.

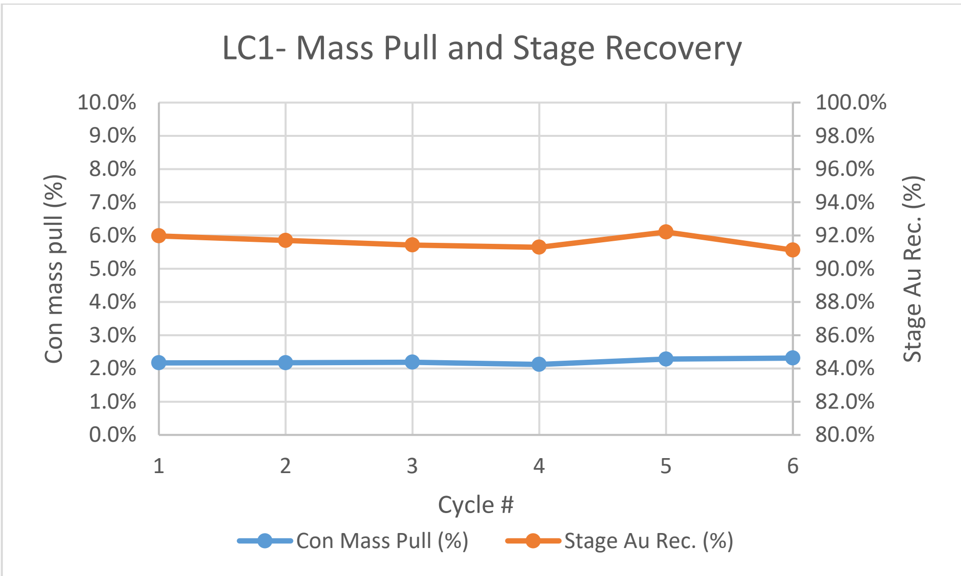



*Figure 10: LC1- Mass Pull and Stage Recovery*

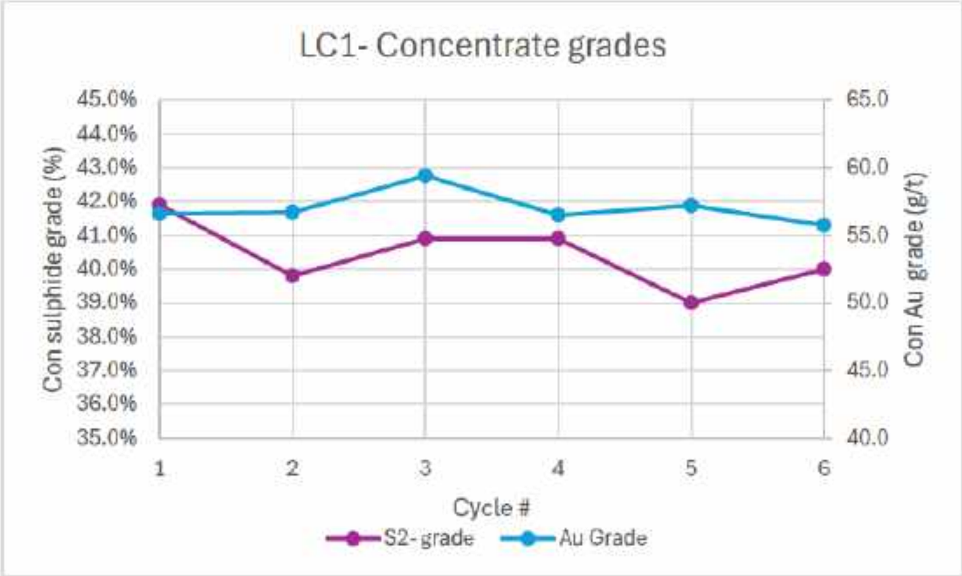



*Figure 11: LC1- Concentrate Grades*

*Table 11: LC1-Mass Balance*

| Product | Mass | | Arsenic | | Gold | | Iron | | Sulphide | |
|---|---|---|---|---|---|---|---|---|---|---|
| | (g) | Dist'n (%) | Grade (%) | Dist'n (%) | Grade (g/t) | Dist'n (%) | Grade (%) | Dist'n (%) | Grade (%) | Dist'n (%) |
| Cycle 1 - Final Concentrate | 260.4 | 2.17 | 2.32 | 13.5 | 56.6 | 14.2 | 39.0 | 11.0 | 41.9 | 16.3 |
| Cycle 1 - Rougher Tail | 1692.2 | 14.1 | 0.036 | 1.37 | 0.76 | 1.24 | 2.82 | 5.16 | 0.06 | 0.15 |
| Cycle 2 - Final Concentrate | 260.7 | 2.17 | 2.46 | 14.4 | 56.7 | 14.2 | 37.4 | 10.5 | 39.8 | 15.5 |
| Cycle 2 - Rougher Tail | 1715 | 14.3 | 0.041 | 1.58 | 0.78 | 1.29 | 2.78 | 5.15 | 0.08 | 0.20 |
| Cycle 3 - Final Concentrate | 262.8 | 2.19 | 2.34 | 13.8 | 59.4 | 15.0 | 38.0 | 10.8 | 40.9 | 16.0 |
| Cycle 3 - Rougher Tail | 1721.5 | 14.3 | 0.041 | 1.58 | 0.85 | 1.41 | 2.84 | 5.28 | 0.08 | 0.21 |
| Cycle 4 - Final Concentrate | 254.8 | 2.12 | 2.12 | 12.1 | 56.5 | 13.8 | 39.1 | 10.8 | 40.9 | 15.6 |
| Cycle 4 - Rougher Tail | 1716.5 | 14.3 | 0.032 | 1.23 | 0.80 | 1.32 | 2.82 | 5.23 | 0.08 | 0.20 |
| Cycle 5 - Final Concentrate | 274.2 | 2.28 | 2.42 | 14.9 | 57.2 | 15.1 | 39.0 | 11.6 | 39.0 | 16.0 |
| Cycle 5 - Rougher Tail | 1720.4 | 14.3 | 0.031 | 1.20 | 0.77 | 1.27 | 2.84 | 5.28 | 0.06 | 0.15 |
| **Cycle 6 - Final Concentrate** | **277.8** | **2.31** | **2.46** | **15.3** | **55.8** | **14.9** | **38.6** | **11.6** | **40.0** | **16.6** |
| Cycle 6 - Re-cleaner Tail | 47.1 | 0.39 | 3.14 | 3.32 | 46.3 | 2.10 | 21.4 | 1.09 | 20.5 | 1.44 |
| Cycle 6 - Cleaner Tail | 86.6 | 0.72 | 2.18 | 4.23 | 32.2 | 2.68 | 13.6 | 1.27 | 11.3 | 1.46 |
| **Cycle 6 - Rougher Tail (Final Tail)** | **1724.3** | **14.4** | **0.038** | **1.47** | **0.88** | **1.45** | **2.86** | **5.33** | **0.10** | **0.26** |
| **Total/calc. Head** | **12014.3** | **100.0** | **0.37** | **100.0** | **8.65** | **100.0** | **7.70** | **100.0** | **5.58** | **100.0** |
| **Assay head** | | | **0.39** | | **8.53** | | **7.76** | | **6.10** | |

## 7.2 Locked Cycle 2 -Regrind

Similar to the LC1 test, the LC2 test was characterised by consistent mass pulls and stable stage recoveries. A total of six cycles were completed in the Locked cycle 2 test. The regrinding of the rougher/scavenger tail was effective in the liberation of locked and conglomerate sulphide mineralisation, resulting in a higher overall gold recovery to concentrate and an overall concentrate mass pull.

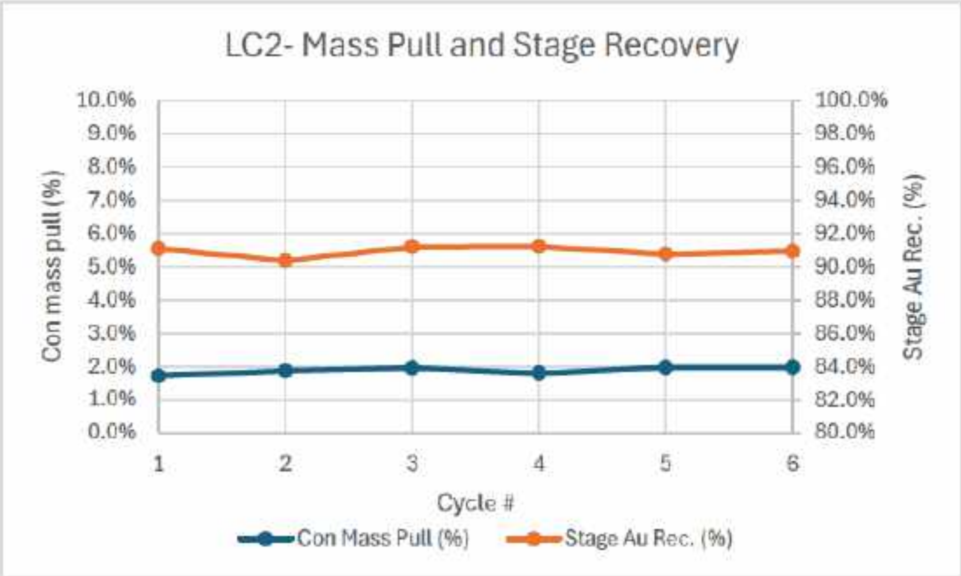



*Figure 12: LC2- Mass Pull and Stage Recovery*

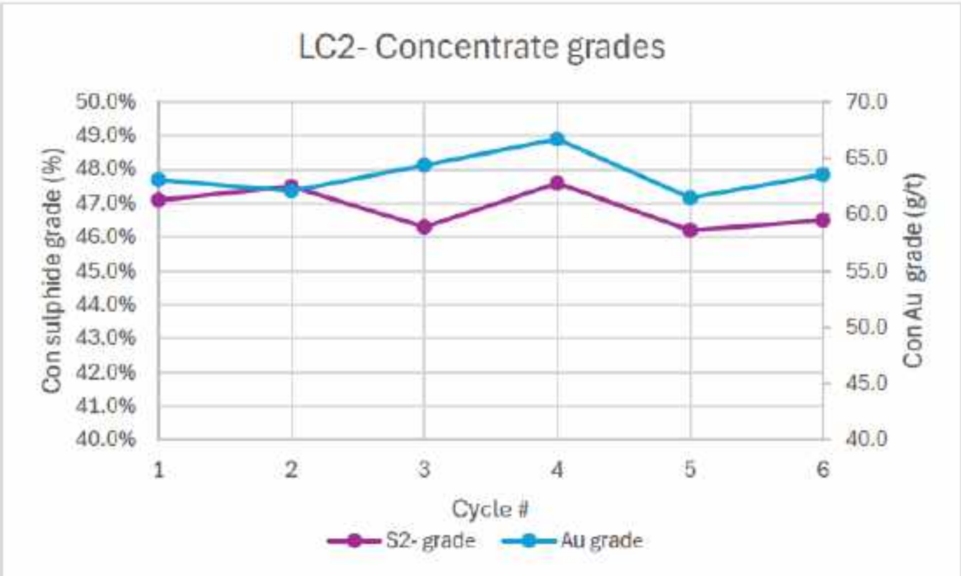



*Figure 13: LC2- Concentrate Grades*

*Table 12: LC2-Mass Balance*

| Product | Mass | | Arsenic | | Gold | | Iron | | $S^{2-}$ | |
|---|---|---|---|---|---|---|---|---|---|---|
| | (g) | Dist'n (%) | Grade (%) | Dist'n (%) | Grade (g/t) | Dist'n (%) | Grade (%) | Dist'n (%) | Grade (%) | Dist'n (%) |
| Cycle 1 - Final Concentrate | 206.9 | 1.72 | 2.46 | 10.9 | 63.1 | 12.8 | 45.3 | 9.80 | 47.1 | 14.2 |
| Cycle 1 - Rougher Tail | 1702.9 | 14.1 | 0.048 | 1.75 | 0.75 | 1.25 | 2.9 | 5.17 | 0.08 | 0.20 |
| Cycle 2 - Final Concentrate | 225 | 1.87 | 2.62 | 12.6 | 62.1 | 13.7 | 44.2 | 10.4 | 47.5 | 15.6 |
| Cycle 2 - Rougher Tail | 1752.3 | 14.6 | 0.042 | 1.58 | 0.85 | 1.46 | 2.92 | 5.35 | 0.08 | 0.20 |
| Cycle 3 - Final Concentrate | 234.5 | 1.95 | 2.70 | 13.6 | 64.4 | 14.8 | 44.2 | 10.8 | 46.3 | 15.8 |
| Cycle 3 - Rougher Tail | 1755.5 | 14.6 | 0.046 | 1.73 | 0.83 | 1.43 | 2.94 | 5.40 | 0.08 | 0.20 |
| Cycle 4 - Final Concentrate | 216.8 | 1.80 | 2.76 | 12.8 | 66.7 | 14.2 | 45.7 | 10.4 | 47.6 | 15.0 |
| Cycle 4 - Rougher Tail | 1761.1 | 14.6 | 0.044 | 1.66 | 0.79 | 1.37 | 2.92 | 5.38 | 0.10 | 0.26 |
| Cycle 5 - Final Concentrate | 236.6 | 1.97 | 2.78 | 14.1 | 61.5 | 14.3 | 43.8 | 10.8 | 46.2 | 15.9 |
| Cycle 5 - Rougher Tail | 1762.1 | 14.6 | 0.044 | 1.66 | 0.84 | 1.45 | 2.94 | 5.42 | 0.08 | 0.21 |
| **Cycle 6 - Final Concentrate** | **237.5** | **1.97** | **2.68** | **13.6** | **63.6** | **14.8** | **43.6** | **10.8** | **46.5** | **16.1** |
| Cycle 6 - Re-cleaner Tail | 53.6 | 0.45 | 4.10 | 4.71 | 53.0 | 2.79 | 33.4 | 1.87 | 31.3 | 2.45 |
| Cycle 6 - Cleaner Tail | 133.7 | 1.11 | 2.62 | 7.50 | 31.1 | 4.08 | 20.9 | 2.92 | 18.4 | 3.59 |
| **Cycle 6 - Rougher Tail (Final Tail)** | **1758** | **14.6** | **0.047** | **1.77** | **0.86** | **1.48** | **2.94** | **5.41** | **0.08** | **0.21** |
| **Total/calc Head** | **12036.5** | **100.0** | **0.39** | **100.0** | **8.46** | **100.0** | **7.94** | **100.0** | **5.70** | **100.0** |
| **Assay head** | | | **0.39** | | **8.53** | | **7.76** | | **6.10** | |

## 7.3 Locked Cycle 1 and 2 Results

The LC1 test achieved a 91.5% gold recovery to concentrate with a mass pull of 13.5%. 98.7% of sulphides reported to the concentrate, suggesting near full concentration of available sulphides.

The generated LC2 concentrate achieved a higher overall gold, sulphide and arsenic grade as shown below in Table 13. The generated concentrate had a measured $P_{80}$ of 45µm. The LC2 achieved a lower overall mass pull compared to LC1 (11.6% to 13.5%) suggesting the regrind resulting in less overall non sulphide gangue entrainment to the final concentrate. Grade recovery curves for the final stage of the locked cycle tests (Cycle 6) are presented below in Figure 14.

Noting the encouraging results achieved through the addition of the regrind to $P_{100}$ 53 µm, JTs recommends that finer regrind sizes be assessed in future study.

It's noted that the results of the locked cycle testwork is a marked improvement from the rougher/ cleaner circuit employed in the historical plant. The reviewed plant records indicate an average flotation recovery of 90.86% to concentrate. The plant achieved an average flotation concentrate grade of 44.6g/t from a 10.7g/t feed grade. Both locked cycle tests achieved a higher concentrate grades and recoveries from a lower grade feed material.

*Table 13: Locked Cycle (Cycle 4-6) Summary Results*

| | Feed | | Cycle 4-6 Concentrates | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Au Assay Head** | **Sulphide Assay Head** | **Mass Pull** | **Float Con Size** | **Au** | | **As** | | **Fe** | | **Sulphides** | |
| | g/t | % | % | $P_{80}$ µm | g/t | % Rec | % | % Rec | % | % Rec | % | % Rec |
| LCT1 | 8.5 | 6.1 | 13.5 | 85 | 56.5 | 91.5 | 2.34 | 91.6 | 38.9 | 68.2 | 39.9 | 98.7 |
| LCT2 | | | 11.6 | 45 | 63.8 | 91.0 | 2.74 | 88.8 | 44.3 | 66.4 | 46.7 | 98.6 |

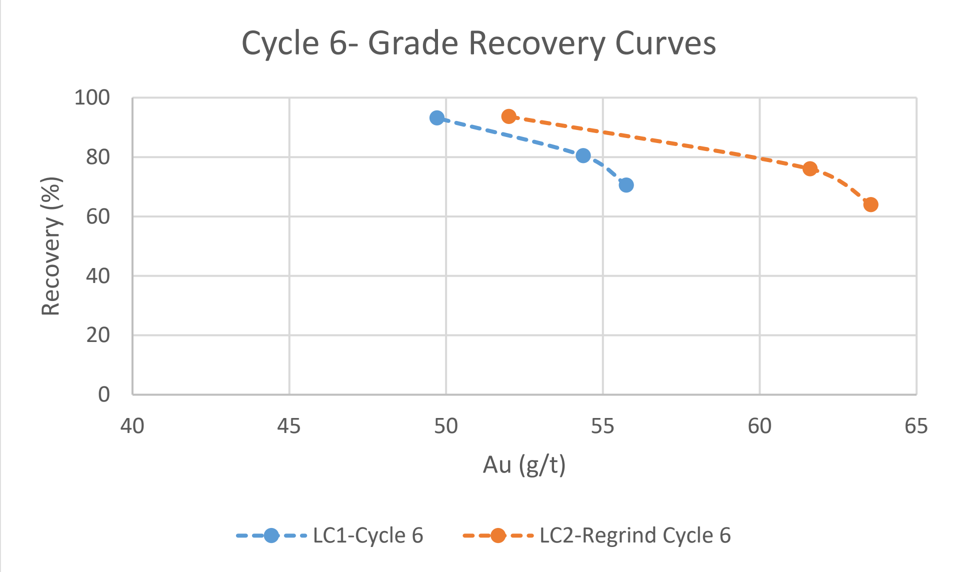



*Figure 14: LC Test Cycle 6 Grade Recovery Curves*

### 7.3.1 Locked Cycle Flotation Tail Leach

Cycle 6 rougher tails from both locked cycle tests were representatively sampled and subjected to a cyanidation leach, reflecting a flowsheet consisting of flotation followed by a CIL on the flotation tail. The leach conditions used in the test are outlined in Table 14. These were chosen to generally reflect the typical conditions of a standard CIL plant in the WA goldfields.

No carbon was added to these tests so that leach kinetics could be observed. The testwork results and extraction curves are presented in below with full results in Appendix H.

*Table 14: Flotation Tail Leach Parameters*

| **Parameters** | | |
|---|---|---|
| pH | Initial | 10 |
| | Maintained | 9.8 |
| NaCN (ppm) | Initial | 300 |
| | Maintained | >250 for 8hrs, 150ppm |
| Pulp Density (%solids) | | 40% |
| Oxygen or Air | | Oxygen |
| Dissolved Oxygen (ppm) | | 10-15ppm |
| Grind Size (µm) | | As received |
| Water | | Kathleen Pit |
| Leach Time | | 48hrs |

*Table 15: Flotation Tail Leach Results*

| Composite ID | Grind Size | Feed Grade (g/t) | | Solid Tails Grade | Au Leach Extraction | Calc. Extraction to Concentrate & CIL |
|---|---|---|---|---|---|---|
| | $P_{80}$ | Fire Assay | Recalc. | g/t | % | % |
| LC1 Cycle 6 Rougher Tail | 75µm | 0.875 | 0.82 | 0.36 | 55.96 | 96.27 |
| LC2 Cycle 6 Rougher Tail | 75µm | 0.86 | 0.87 | 0.32 | 54.42 | 95.70 |

The flotation tail leach achieved an average leach extraction of 55.19% at 48 hours. Factoring in the flotation concentrate, the sample achieved a total extraction (either leached or collected as a flotation concentrate) of 96.27% and 95.70% for LC1 and LC2 respectively. Leach kinetics from the tests suggests moderate leach kinetics as shown below in Figure 15 hence would benefit from more aggressive leach conditions.

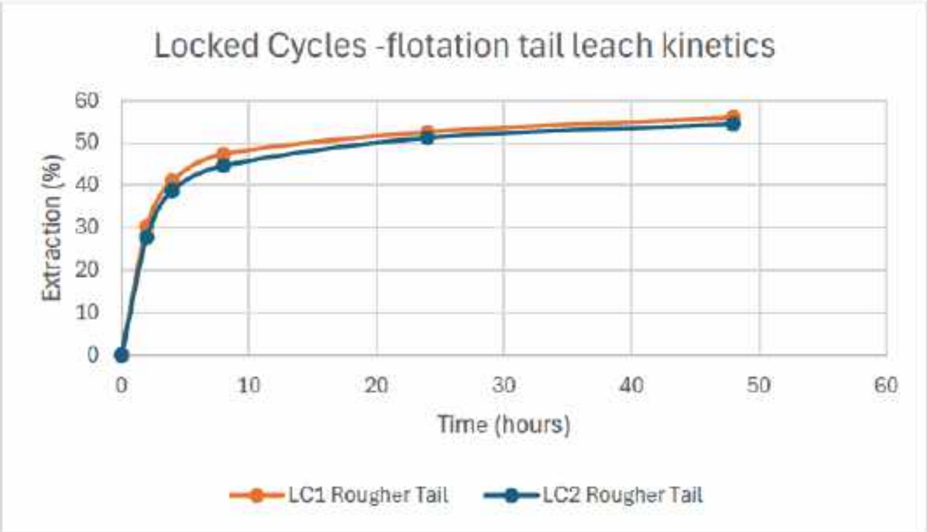



*Figure 15: LC Flotation Tail Leach Kinetics*

Reagent consumptions for each test are provided in Table 16 below. Lime consumptions are considered average by industry standards, averaging 0.83kg/t. Cyanide consumption is considered low averaging 0.16kg/t.

Oxygen uptake testwork was not completed in this program, though no issues maintaining dissolved oxygen content in the leach testwork was noted by the laboratory.

*Table 16: Float Tail leach Reagent Consumptions*

| | Cyanide Consumption (kg/t): | Lime Consumption (kg/t): |
|---|---|---|
| LC1 Flotation tail leach | 0.14 | 0.92 |
| LC2 Flotation tail leach | 0.18 | 0.73 |
| **Average** | **0.16** | **0.83** |

## 7.4 Locked Cycle Final Concentrate & Tailings Analysis- Assays And Mineralogy

Locked cycle final concentrate and Rougher Tailings samples were submitted for comprehensive assay, XRD and QEMScan to better understand performance, optimisation potential and for environmental purposes.

### 7.4.1 Flotation Products Comprehensive Assay Results

An abridged summary of the two final concentrates and tailings are presented in Table 17 with full results in Appendix H.

**The following is noted from the flotation concentrate assay results:**

- Low arsenic concentrations. Concentrations are below the common smelter-imposed penalty threshold of 3%.
- Low silver, likely to be unpayable if sold to a third party.
- Good agreeance between repeat gold fire assay results.
- Low total and organic carbon content.
- Both samples show low levels of common deleterious elements such as bismuth, tellurium, lead, cadmium and mercury. This is in line with historical results.
- Elevated copper and antimony are present in concentrates which can cause downstream cyanidation issues. Copper is likely speciated as chalcopyrite which is only ~5% cyanide soluble.
- Variable silicate concentrations between tests, significant reduction in silicate concentration in LC2 indicates that the regrind was effective in reducing non-sulphide gangue reporting to concentrate.
- 3.00% silicate in LC2 is indicative of good froth drainage and low concentrations of non-sulphide gangue minerals such as clays and other hydrophobic minerals. This is indicative that additional cleaning stages are unlikely to significantly improve the concentrate grade.

**The following is noted from the flotation tails assay results:**

- Good agreeance between repeat gold fire assay results.
- Low sulphur and sulphide content.
- Low arsenic and heavy metal concentrations.

*Table 17: Flotation Products Comprehensive Assays*

| Analyte | Units | LC1 Final Con | LC2 Final Con | LC1 Rghr Tail | LC2 Rghr Tail |
|---|---|---|---|---|---|
| Ag | ppm | 18 | 20 | <2 | <2 |
| Al | % | 1.40 | 0.44 | 7.12 | 6.92 |
| As | % | 2.46 | 2.68 | 0.038 | 0.047 |
| Au-1 | g/t | 54.5 | 63.0 | 0.88 | 0.84 |
| Au-2 | g/t | 57.0 | 64.1 | 0.87 | 0.87 |
| **Au (average)** | **g/t** | **55.8** | **63.6** | **0.88** | **0.86** |
| Ba | ppm | 50 | 10 | 200 | 300 |
| Be | ppm | <5 | <5 | <5 | <5 |
| Bi | ppm | <10 | <10 | <10 | <10 |
| C-total | % | 0.06 | 0.03 | 0.54 | 0.57 |
| C-organic | % | 0.06 | <0.03 | <0.03 | <0.03 |
| Ca | % | 0.30 | 0.30 | 2.40 | 2.40 |
| Cd | ppm | <5 | <5 | <5 | <5 |
| Co | ppm | 220 | 265 | 50 | 50 |
| Cr | ppm | 50 | 200 | 600 | 800 |
| Cu | ppm | 526 | 716 | 28 | 34 |
| Fe | % | 38.6 | 43.6 | 2.86 | 2.94 |
| Hg | ppm | 0.1 | <0.1 | <0.1 | <0.1 |
| K | % | 0.77 | 0.22 | 2.97 | 3.05 |
| Li | ppm | 20 | 10 | 80 | 80 |
| Mg | % | 0.24 | 0.08 | 1.28 | 1.24 |
| Mn | ppm | 100 | 55 | 900 | 800 |
| Mo | ppm | 40 | 65 | 65 | 85 |
| Na | ppm | 560 | 240 | 3420 | 3400 |
| Ni | ppm | 205 | 340 | 345 | 460 |
| P | ppm | 1300 | <100 | 2300 | 2400 |
| Pb | ppm | 100 | 135 | <5 | 10 |
| S-total | % | 40.7 | 52.8 | 0.08 | 0.16 |
| S-sulphide | % | 40.0 | 46.5 | 0.10 | 0.08 |

| | | | | | |
|---|---|---|---|---|---|
| Sb | ppm | 337 | 484 | 12.6 | 12.7 |
| $SiO_2$ | % | 10.2 | 3.00 | 65.4 | 72.0 |
| Sr | ppm | 16 | 4 | 64 | 72 |
| Te | ppm | 15.8 | 19.2 | 0.6 | 0.6 |
| Ti | % | 1.00 | 0.46 | 1.06 | 1.12 |
| V | ppm | 92 | 32 | 250 | 286 |
| Y | ppm | <100 | <100 | <100 | <100 |
| Zn | ppm | 606 | 760 | 54 | 62 |
| SG | | 4.62 | 3.58 | 2.80 | 2.83 |

### 7.4.2 Flotation Concentrates XRD and Mineralogy

Representative subsamples of the final concentrates were submitted for qualitative mineralogy through XRD and QEMSCAN- including gold search. A summary of the mineralogical report is given below with the full mineralogy report presented in Appendix H.

The mineralogical assessment concluded that the flotation concentrates were on average predominately made up of pyrite (83.2%) and arsenopyrite (6.39%) with the balance made up of quartz, micas and Ti minerals amongst other trace minerals. It is noted that the LC2 test (BKF3370) with the regrind resulted in a lower portion of non-sulphide gangue mineralisation in the final concentrate compared to the non-reground locked cycle (BKF3369).

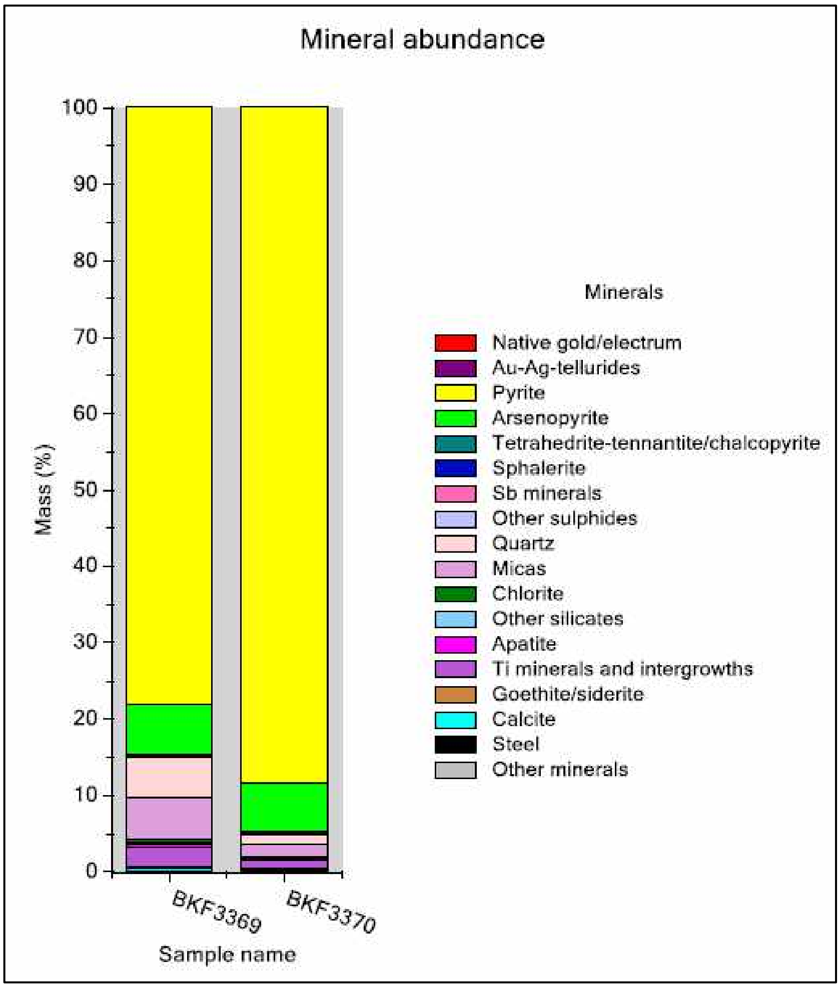



*Figure 16: Final concentrate Mineral Abundance*

Arsenopyrite constitutes approximately 6.5% of the mass in both concentrates, with a calculated $P_{80}$ of 27µm and nearly 80% being well liberated. The arsenopyrite with lower liberation is predominantly linked with silicates and pyrite. Other trace sulphides identified include tetrahedrite-tennantite, chalcopyrite, sphalerite, stibnite, and Sb-Pb-sulphides. Quartz and micas emerge as the primary silicates, trailed by chlorite. Silicates are notably more abundant and coarser in the LC1 test, comprising 11.5% of the total mass with a calculated $P_{80}$ of about 36µm, compared to the LC2 test where they constitute 3.21% of the total mass with a calculated $P_{80}$ of about 18µm. This indicates that more non-sulphide gangue could be rejected from the final concentrate if the regrind is set finer than the assessed $P_{100}$ 53µm.

Approximately half of the silicates are well liberated, while the less liberated silicates are mainly associated with pyrite and, less frequently, with other non-sulphide gangue and arsenopyrite.

A total of 67 gold grains were identified in the two concentrates. It is noted that these gold grains consist of gold speciated natively, as telluride or electrum. The mineralogical assessment method (QEMSCAN and XRD) is incapable of detecting sub-microscopic gold inclusions and/or gold in solid solution with sulphides such as arsenopyrite.

Among them, 51 grains are predominantly native gold (comprising 80-100% Au and 0-20% Ag), while 16 grains are Au-Ag-tellurides, including petzite grains ($Ag_3AuTe_2$) and possibly some fine-grained (Au,Ag)-Pb/Sb-Te-S phases.

Nine of the gold grains are free particles, ranging from 5µm to 30µm in size, and they are primarily gold-silver alloys. These free gold grains are estimated to contain slightly over half of the total gold content in the sample. The remaining gold grains, all smaller than 10µm, are predominantly found within pyrite (46 grains), with fewer occurrences in arsenopyrite (eight grains), tetrahedrite-tennantite (two grains), hessite (one grain), and ilmenite (one grain).

It's worth noting that submicron gold grains and solid solution gold within sulphides, such as pyrite and arsenopyrite, cannot be detected by QEMSCAN. Further investigation, particularly using methods like LA-ICP-MS, is recommended for detailed analysis.

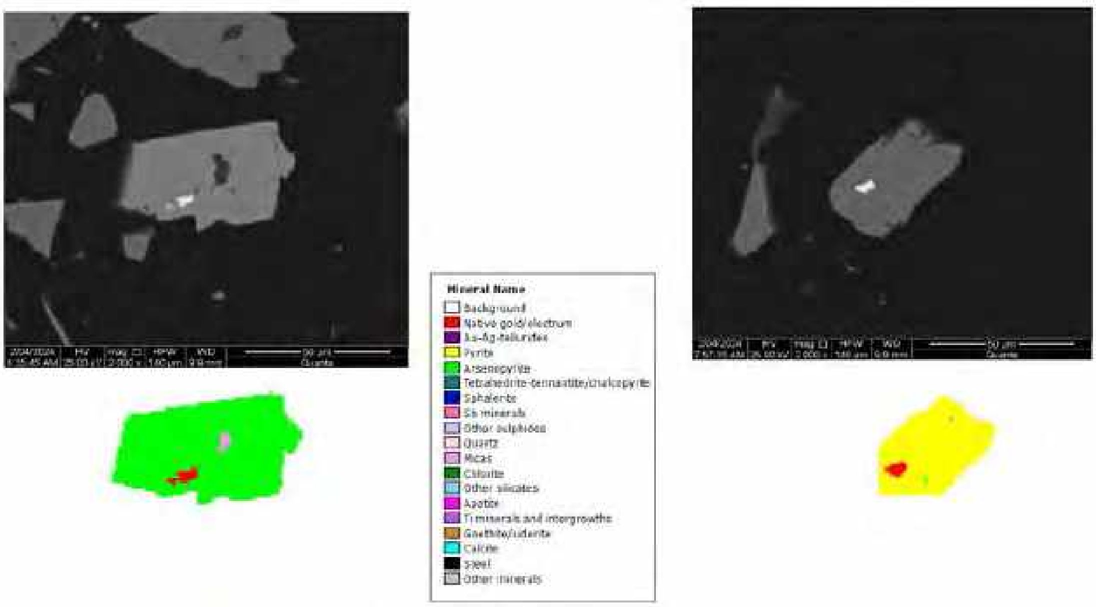



*Figure 17: Native Gold Encapsulated in Arsenopyrite (L) and Pyrite (R)*

### 7.4.3 Flotation Tails Characterisation

Representative subsamples were taken each of the two locked cycle tails streams were submitted for tails characterisation. The testwork can be used to determine the Acid Neutralisation Capacity 'ANC' and Maximum Potential Acidity 'MPA' which are both pertinent metrics for determining the acid mine drainage potential of the treated ore. Results of the tails characterisation are presented in Table 18.

*Table 18: Flotation tails characterisation*

| | Units | LC1 Rougher Tail | LC2 Rougher Tail |
|---|---|---|---|
| Total Sulphur | % | 0.08 | 0.16 |
| ANC | kg/t $H_2SO_4$ | 46 | 57 |
| NAG (pH 4.5) | kg/t $H_2SO_4$ | <2 | <2 |
| NAG (pH 7.0) | kg/t $H_2SO_4$ | <2 | <2 |
| TAPP | kg/t $H_2SO_4$ | 2 | 5 |
| NAPP | kg/t $H_2SO_4$ | -44 | -52 |
| MPA | kg/t $H_2SO_4$ | 2.448 | 4.896 |
| ANC:MPA ratio | kg/t $H_2SO_4$ | 18.79 | 11.64 |
| NAG pH | - | 11.27 | 11.24 |
| Conductivity | ms/cm | 0.644 | 0.622 |

**ANC= Acid Neutralisation Capacity; MPA= Maximum Potential Acidity- A calculated figure based on the total sulphur assay; NAPP= Net Acid Producing Potential (NAPP = MPA- ANC); NAG= Net Acid Generation, TAPP= Total Acid Production Potential.*

According to the AMIRA P387A Acid Rock Drainage (ARD) guidelines, "*an ANC/MPA ratio of greater than 2 signifies there is a high probably that the material will remain circum-neutral in pH.*" Additionally, by referring to the Geochemical Classification plot in Figure 18, a sample can be determined as either Non-Acid Forming (NAF), Potentially Acid Forming (PAF) or Uncertain (UC) through the NAG pH and NAPP. These two metrics indicate that the two tested samples are classified as non-acid forming.

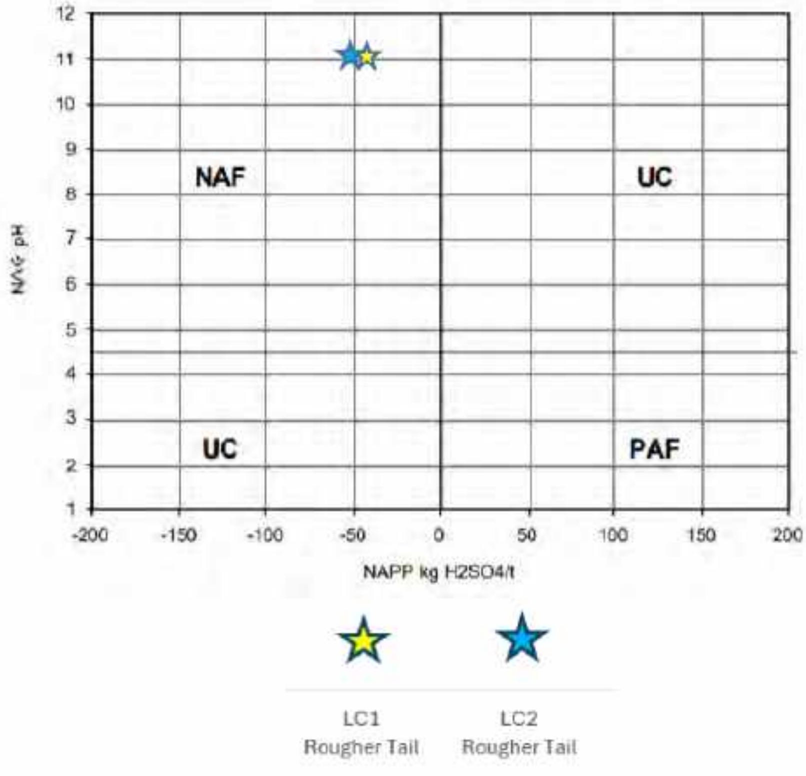



*Figure 18: Geochemical Classification Plot*

# 8 BIOX Amenability Testwork

Metso was engaged to assess the Youanmi ore to their proprietary BIOX® bacterial oxidation technology. JTs understands that Metso have previously tested samples from Youanmi in both 1990 and 1992. The providence of these historical samples is not known and was therefore unable to be assessed in the context of the current mineral resource.

A copy of the Metso testwork report is presented in Appendix G. A summation and analysis of the results are presented below.

## 8.1 BIOX Sample Characterisation

Approximately 4.1kg (dry weight equivalent) of the 2022 ROM Composite Flotation Concentrate was sent over to SGS Johannesburg for BIOX amenability testwork. The provenance of this sample is discussed in Section 6.1.

This sample had previously been ultra fine ground to a claimed $P_{80}$ 8µm. A confirmatory Particle Size Distribution ('PSD') was completed on the sample resulting in a measured $P_{80}$ of approximated 15µm. It is noted that this grind size is deemed fine by bacterial-oxidation standards and is considerably finer than the previous Youanmi samples Metso have assessed. Noting the project deadlines, there was insufficient time to generate new sample with a coarser grind size for the BIOX amenability testwork. If the BIOX flowsheet is selected for further study JTs recommends that coarser grind sizes be assessed.

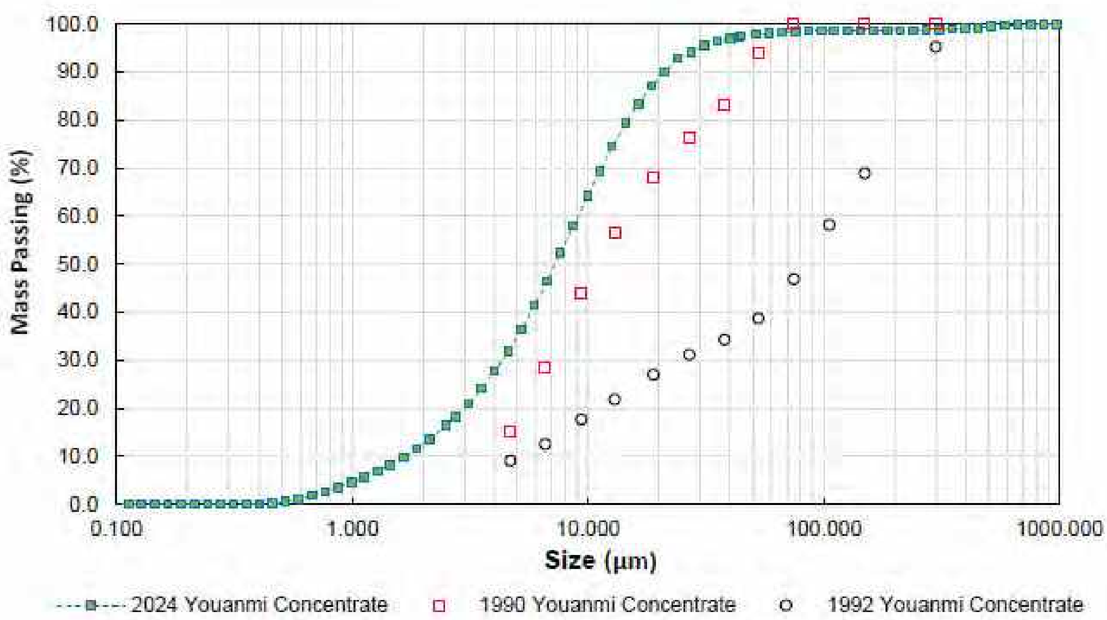



*Figure 19: Assessed BIOX Sample PSDs*

The sample was mineralogically characterised by X-ray diffraction (XRD). The XRD results confirm the sample is predominately made up of Pyrite and Arsenopyrite, with gangue minerals predominately consisting of muscovite, quartz and biotite as shown in Table 19 below.

*Table 19: BIOX Feed XRD Results*

| Mineral name | Chemical Formula | Normalized Mass % |
|---|---|---|
| Pyrite | $FeS_2$ | 33 |
| Arsenopyrite | FeAsS | 5 |
| Dolomite | $CaMg(CO_3)_2$ | 2 |
| Calcite | $CaCO_3$ | 1 |
| Clinochlore (Fe-rich) | $(Mg,Fe)_6(Si,Al)_4O_{10}(OH)_8$ | 5 |
| Muscovite-2M1 | $KAl_2(Si_3Al)O_{10}(OH,F)_2$ | 24 |
| Biotite | $KMg_3(Si_3Al)O_{10}(OH)_2$ | 5 |
| Talc | $Mg_3Si_4O_{10}(OH)_2$ | 2 |
| Quartz | $SiO_2$ | 18 |
| Spinel (Magnetite?) | $Fe_3O_4$ | 2 |
| Gypsum(1) | $CaSO_4\,2H_2O$ | * |
| Bassanite(1) | $Ca_2(SO_4)_2.H_2O$ | * |
| Rutile | $TiO_2$ | 1 |
| TOTAL | | 100 |

**Note**: (1) Possible phase at < 1 % (mass).

## 8.2 BIOX Batch Amenability Tests (BATs)

A total of seven BIOX Batch Amenability Tests (BATs) were completed on the provided 2022 ROM Composite Flotation Concentrate sample. The tests assessed the degree sulphide oxidation across different bacterial oxidation incubation periods namely:

- BAT 1 - 12 Days
- BAT 2 - 15 Days
- BAT 3 - 7 Days
- BAT 4 - 16 Days
- BAT 5 - 13 Days
- BAT 6 - 9 Days
- BAT 7 - 10 Days

All BAT tests were inoculated with an identical quantity of Youanmi adapted culture. All other tests parameters including nutrient additions, initial and total acid additions and temperature were all kept constant across all tests. Bacterial oxidation parameters used in the BAT tests is presented in Table 20.

*Table 20: BIOX Testwork Parameters*

| Parameter | Value |
|---|---|
| Liquid/Solid ratio | 4.25:1 |
| Nutrient Medium | 0 K |
| Slurry Stabilisation | 98% $H_2SO_4$ to pH 1.30 with constant agitation |
| Solids Concentration | 19% |
| Inoculum | ~12% ($V_{INOC}/V_{Total}$) addition |
| pH | pH 1.20 to 1.30 (using acid or lime as required) |
| Temperature | 40°C ±2°C |
| Aeration | Target dissolved $O_2(aq)$ concentration ≥ 2.0 mg/L |
| Agitation | Pitch blade turbine at approximately 460 rpm |
| Monitoring | $Fe^{2+}$ and $Fe^{3+}$ titrations, pH, Redox and $O_2(aq)$ |
| Bio-oxidation period | Various |

Results of the tests are presented in Table 21 and graphically in Figure 20-Figure 22.

*Table 21: BIOX Oxidation Results*

| BAT Test | Period (Days) | Sulphide Oxidation (%) | Arsenic Solubilisation (%) | Iron Solubilisation (%) |
|---|---|---|---|---|
| BAT 3 | 7 | 37.4 | 98.9 | 35.3 |
| BAT 6 | 9 | 92.8 | 99.7 | 78.5 |
| BAT 7 | 10 | 97.8 | 99.7 | 83.2 |
| BAT 1 | 12 | 97.9 | 99.7 | 84.4 |
| BAT 5 | 13 | 98.2 | 99.7 | 83.8 |
| BAT 2 | 15 | 98.6 | 99.7 | 84.7 |
| BAT 4 | 16 | 99.1 | 99.7 | 85.7 |

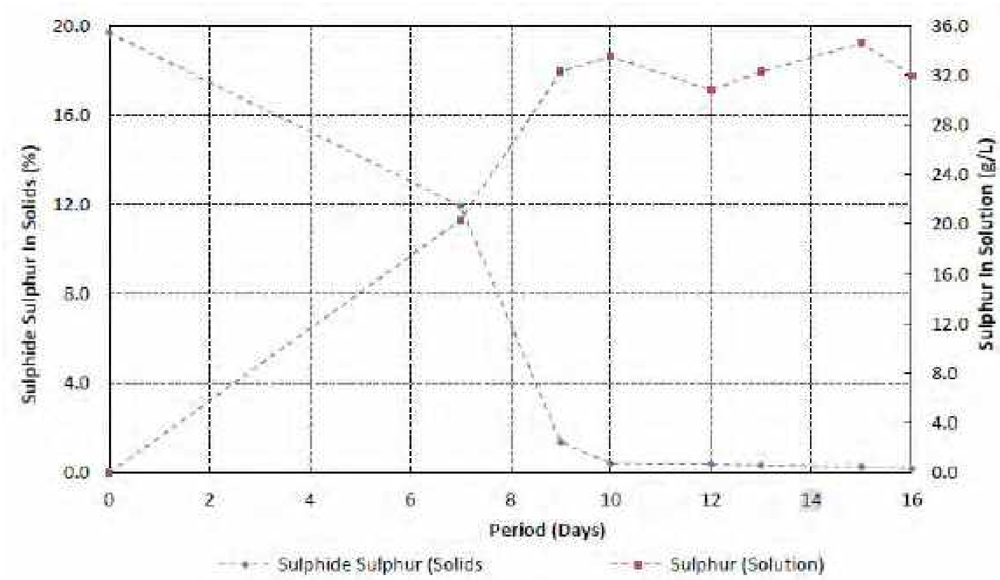



*Figure 20: BIOX Sulphide Solubilisation Results*

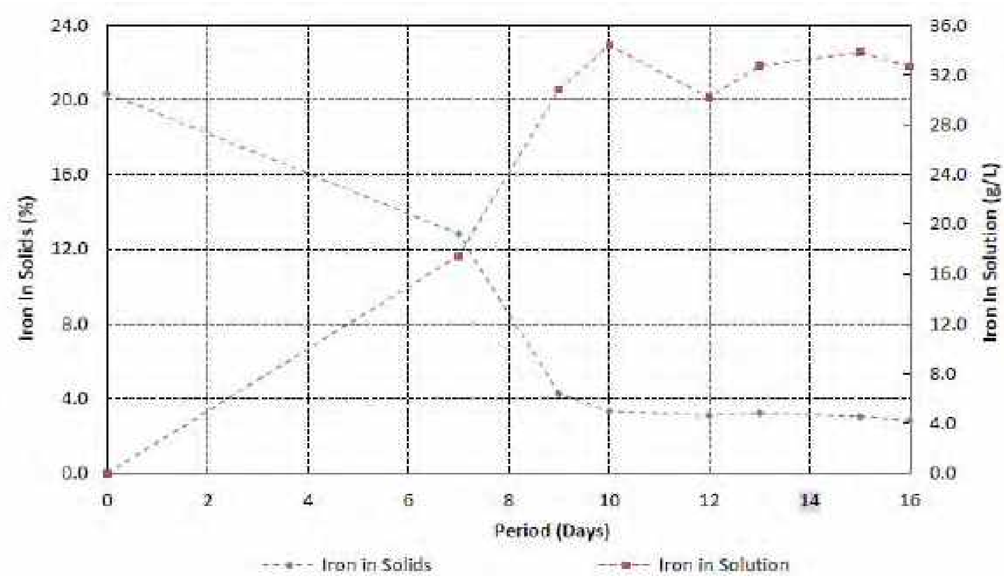



*Figure 21: BIOX Iron Solubilisation Results*

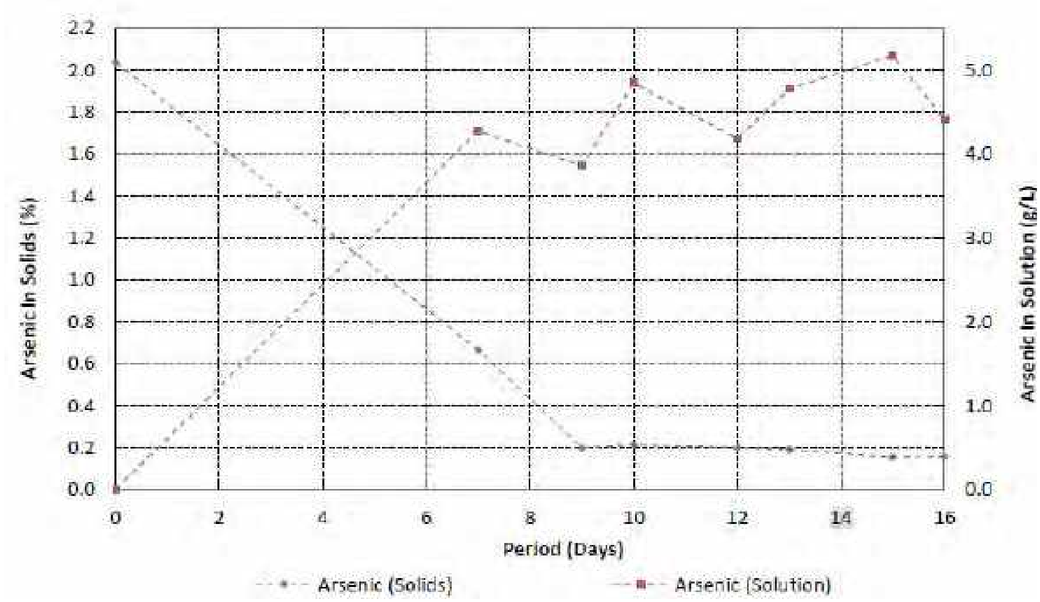



*Figure 22: BIOX Arsenic Solubilisation Results*

The test show that 92.8% of sulphide was oxidised after nine days of bacterial oxidation. Most of the arsenic was near completely solubilised within the first week with iron increasing incrementally throughout the entire tested period concluding at 16 days. Due to the fineness of the provided sample, the sulphide oxidation occurred quicker than other Youanmi concentrates tested previously by Metso in the 90s. It is noted that the oxidation periods noted in batch tests are often considerably slower than those achieved at plant scale, predominately due to economies of scale and the continuous nature of the unit operation. A summary of the degree of sulphide oxidation of the 2022 Youanmi sample compared to the 1990 and 1992 results is presented in Figure 23.

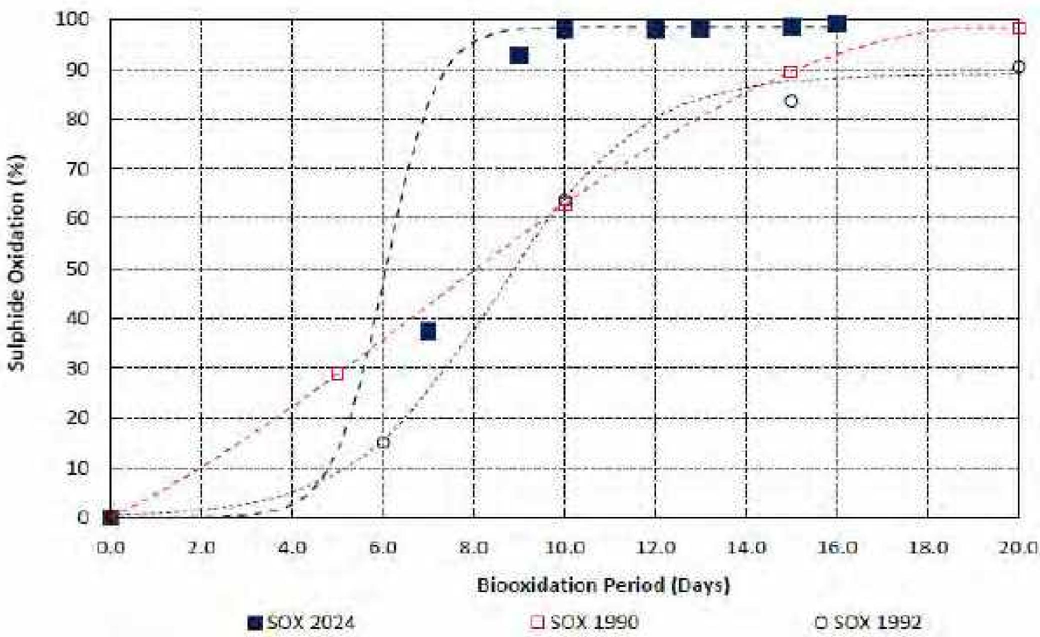



*Figure 23: BIOX Sulphide Oxidation Comparison*

## 8.3 CYANIDATION TEST ON BAT RESIDUES

On completion each BAT test was filtered and the residue washed to remove any residual acid and dried at 50°C. A representative subsample was taken for cyanidation testwork. A cyanidation test was also completed on an un-oxidised sample for comparison. The parameters of the cyanidation tests are presented in Table 22. Results of the cyanidation testwork are presented in Table 23 and graphically in Figure 24.

*Table 22: BIOX Residue Cyanidation Parameters*

| **BIOX cyanidation parameters** | |
|---|---|
| Initial pH | 11 |
| Maintained pH | 10.5-11 |
| NaCN addition (kg/t) | 25.0 |
| Pulp Density (%solids) | 25% |
| Carbon addition (kg/t) | 80 |
| Cyanidation time | 24hrs |

*Table 23: BIOX Testwork Cyanidation Results*

| Sample | $S^{2-}$ Oxdn. (%) | Consumptn. NaCN (kg/t Conc.) | Lime (kg/t Conc.) | Gold Feed (g/t) | Tails (g/t) | Carbon (g/t) | Soln. (ppm) | BCH (g/t) | Dissln.(1) (%) | Accntbly. (%) |
|---|---|---|---|---|---|---|---|---|---|---|
| FEED | - | 10.4 | 2.0 | 26.85 | 10.98 | 189 | 0.003 | 26.12 | 60.4 | 97 |
| BAT 1 | 98 | 5.2 | 2.7 | 29.40 | 1.04 | 316 | 0.016 | 27.15 | 96.7 | 92 |
| BAT 2 | 99 | 5.9 | 2.5 | 29.90 | 0.82 | 332 | 0.015 | 28.36 | 97.4 | 95 |
| BAT 3 | 37 | 6.2 | 2.1 | 28.20 | 1.28 | 346 | 0.006 | 29.87 | 95.6 | 106 |
| BAT 4 | 99 | 5.3 | 2.3 | 29.95 | 0.76 | 370 | 0.013 | 31.31 | 97.5 | 105 |
| BAT 5 | 98 | 5.3 | 2.8 | 29.40 | 0.98 | 322 | 0.016 | 27.57 | 96.9 | 94 |
| BAT 6 | 93 | 6.0 | 3.6 | 28.80 | 1.18 | 306 | 0.009 | 26.16 | 96.2 | 91 |
| BAT 7 | 98 | 6.1 | 3.2 | 29.20 | 1.14 | 320 | 0.010 | 26.69 | 96.4 | 91 |

Note: (1) Dissolution based on residue.

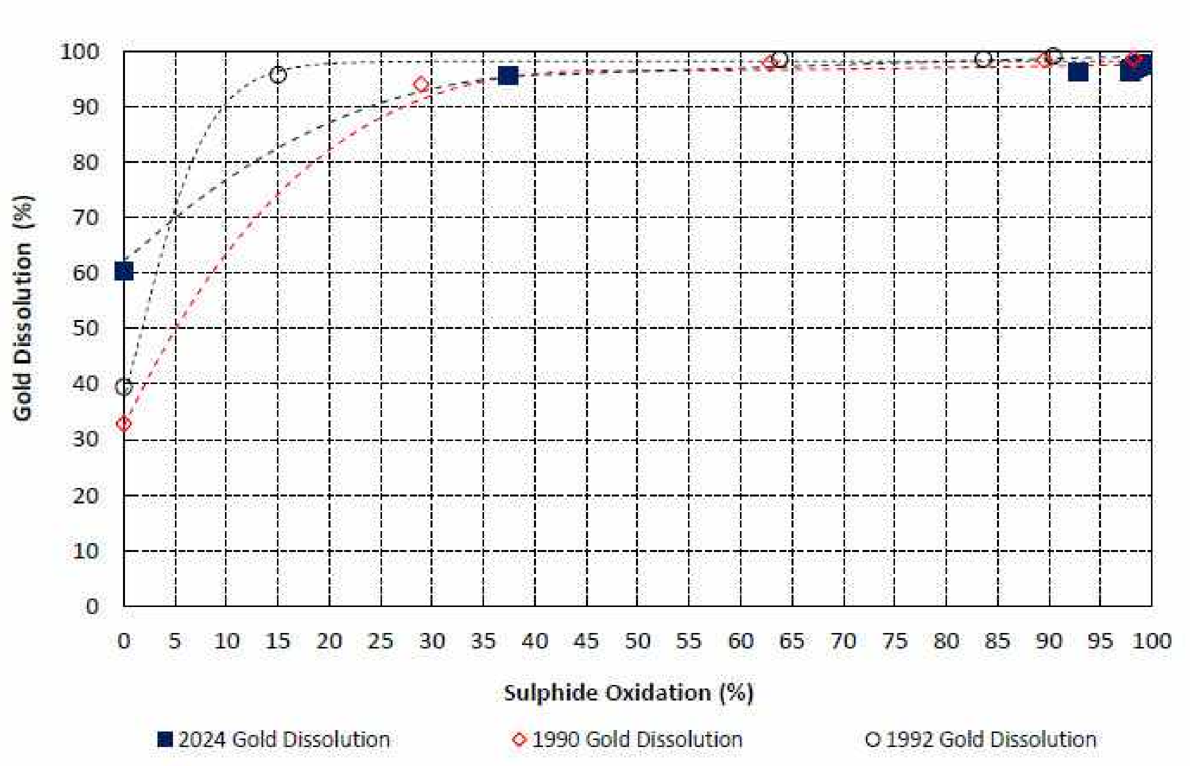



*Figure 24: BIOX Testwork Cyanidation Results*

The tests show that the bacterial oxidation of the sample was effective in increasing the cyanidation leach recovery compared to the unoxidised sample by more than 35.8%. Furthermore, it was shown that partial sulphide oxidation (37%) yielded comparable leach recovery (95.8%) to samples significantly more oxidised. It is hypothesised that biological oxidation preferentially oxidised sulphides minerals containing gold, namely arsenopyrite.

This suggests that only partial oxidation of the Youanmi ore is required to achieve high gold recoveries through cyanidation. This is supported by the results of the 1990 and 1992 programs. It is noted that the 1992 program utilised a flotation concentrate over double the grade compared to the 2024 program- 52.3g/t compared to 24.0g/t respectively. Hence the 1992 concentrate is more reflective of concentrate generated from a Rougher/cleaner/recleaner flowsheet as assessed in the PFS locked cycle testwork.

JTs notes that the cyanidation parameters used in the program are extremely aggressive, with the cyanide dosage (25.0kg/t) an order of magnitude over a typical flotation concentrate leach circuit. JTs recommends that lower cyanide concentrations be assessed in future BIOX studies for potential cost savings.

## 8.4 BIOX PRODUCT NEUTRALISATION AND CHARACTERISATION

Two neutralisation tests were carried out on the Youanmi BAT 4 liquor, which demonstrated the most significant sulphide oxidation. Details of the batch neutralisation tests are outlined in the subsequent table, including the utilisation of AR (analytical) grade limestone and lime, and AR grade lime alone.

The neutralised effluents were classified as "*stable, environmentally compliant and thus acceptable for disposal on a tailings dam*" according to the United States of America's Environmental Protection Agency (USA EPA) regulations.

*Table 24: BIOX Neutralisation Results*

| Description | Units | Test 1<br>Limestone + Lime | Test 2<br>Lime Only |
|---|---|---|---|
| Limestone Consumption | kg/t BIOX Feed | 292 | - |
| Lime Consumption | kg/t BIOX Feed | 18 | 188 |
| $Ca^{2+}$ Content | kg/t BIOX Feed | 129 | 134 |
| Final pH | | 7 | 7 |
| Retention Time | hrs | 6 | 6 |

# 9 OXIDATIVE LEACH TESTWORK

## 9.1 EXTENDED PRE-OXIDATION AMENABILITY TESTWORK

A sighter testwork program was undertaken to represent the oxidation flowsheet of Emerald Resources Okvau Operation in Cambodia. Rox Resources expressed interest in the processing route and hence a small program consisting of two tests was undertaken to assess the Youanmi ores amenability to the flowsheet.

It is noted that there is very little publicly available data available on the parameters of the Okvau processing flowsheet. The testwork parameters were based upon the limited publicly available data released by Emerald Resources and the parameters of other semi-refractory oxidation circuits known to the author. It was JTs understanding based on literature review and discussions with peers that the Okvau flowsheet was simply a UFG followed by an extended pre-oxygenation stage as commonly applied at other gold flotation operations.

A representative split of the 2022 ROM Composite Flotation Concentrate was utilised as the feedstock for this testwork. The sample providence of this composite is explained further in Section 6.1.1. The sample was given a polish grind to $P_{80}$ 8µm to ensure the mineral texture was unoxidised. 100g/t of lead nitrate was added to both the pre-oxidation and cyanide leach stages to assist in kinetics. The cyanide leach conditions are considered extremely aggressive, with an initial cyanide concentration of 8,000ppm.

*Table 25: Extended Pre-oxidation Sighter Testwork Parameters*

| | Parameter | Test 1 | Test 2 |
|---|---|---|---|
| Pre-oxidation | Feed size | $P_{80}$ 8um | |
| | Water | Site water | |
| | % Solids | 20% | |
| | pH initial | 10.0 | 5.5 |
| | pH maintained | 9.8-10.0 | 5.0-5.5 |
| | pH control agents | Sulphuric Acid/Lime | |
| | Lead nitrate addition | 100g/t | |
| | Temperature | Ambient | |
| | Aeration | Constantly sparged oxygen | |
| | Pre-oxidation duration | 24 hours | |
| | Monitoring points | 0,1,2,4,8 and 24 hours | |
| Cyanide Leach | Water | Site water | |
| | Lead nitrate addition | 100g/t | |
| | Initial cyanide concentration | 8,000ppm | |
| | Maintained cyanide concentration | 6,000ppm | |
| | Aeration | Constantly sparged oxygen | |
| | pH maintained | 10.5-10.8 | |
| | pH control agent | Lime | |
| | Leach duration | 48 hours | |
| | Monitoring points | 0,1,2,4,8, 24 and 48 hours | |

Results of the testwork are presented in Table 26. The results suggest the assessed flowsheets were not aggressive enough to achieve the required degree of oxidation necessary for effective gold cyanidation. Test 1 and Test 2 achieved 66.83% and 54.05% Au leach extraction respectively with sulphur extractions of 6.8% and 5.7% respectively. The results are in line with the unoxidised (T=0, Feed) BIOX cyanidation test which achieved 60.4% leach extraction. It is noted that these two tests share a common feedstock and hence the results are directly comparable.

*Table 26: Extended Pre-oxidation Sighter Testwork Results*

| | Assayed Au head grade (g/t) | Calc. Au head grade (g/t) | Au Leach extraction (%) | Fe Leach extraction (%) | S Leach extraction (%) | As Leach extraction (%) |
|---|---|---|---|---|---|---|
| Test 1- pH 10.0 | 27.4 | 26.3 | 66.83 | 2.19 | 6.78 | 0.37 |
| Test 2- pH 5.0 | 27.4 | 26.1 | 54.05 | 2.71 | 5.70 | 1.36 |

Leach kinetic curves for the two tests are presented below. The gold leach kinetics are considered slow, with very little gold leaching occurring after 4-hour mark. This is likely due to majority of the gold containing mineralisation remaining un-oxidised prior to cyanidation. It is hypothesised that the more reactive sulphides such as pyrite were only partially oxidised during this test accounting for the marginal ~6% sulphur extraction. The more stable arsenopyrite which is known to contain solid solution gold was only marginally oxidised.

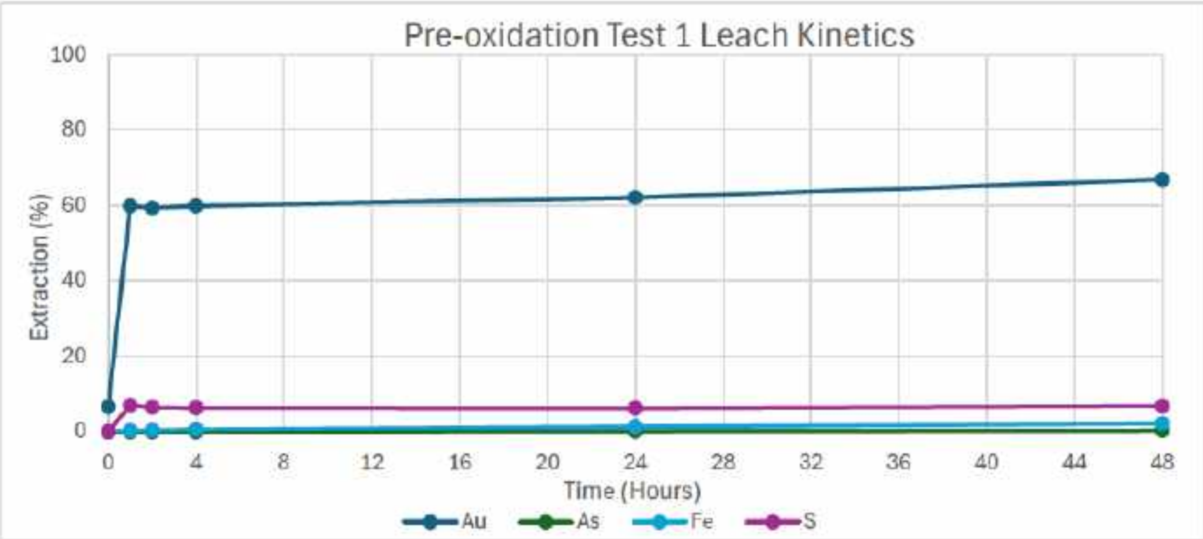



*Figure 25: Pre-oxidation Test 1 Leach Kinetics*

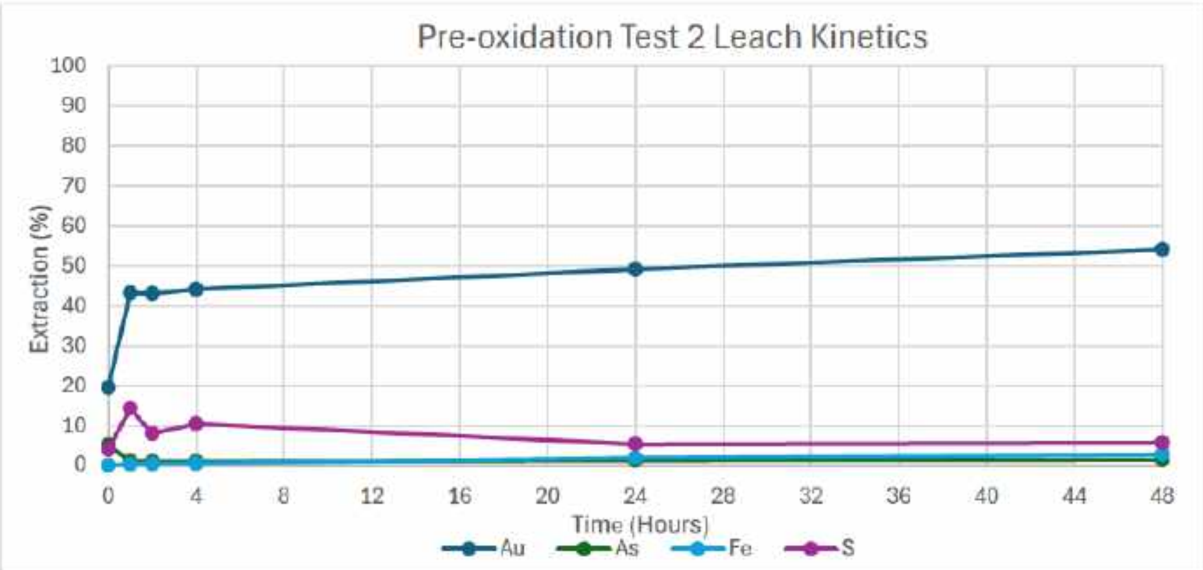



*Figure 26: Pre-oxidation Test 2 Leach Kinetics*

Considering the 19.0% concentration of sulphide in the feed sample and the exothermic nature of sulphide oxidation, certain testwork mimicking a full-scale plant operation may involve heating the sample. This approach is occasionally adopted to best simulate a continuous process within a batch configuration. It's important to mention that these tests were conducted at ambient temperature without additional heating representative of the Okvau flowsheet.

Test two involved maintaining the pH between 5.0-5.5 utilising sulphuric acid and sodium hydroxide. During the test at the monitoring points the pH continued to be higher than the control range, requiring the constant addition to sulphuric acid to bring the pH down to within the desired range. It is noted that the oxidation of arsenopyrite (minor sulphide species) is acid consuming, while the oxidation of pyrite (major sulphide species) is acid generating. Noting the continual need to add acid in the pre-oxidation stage and the poor gold cyanide leach extraction, its likely pyrite only marginally oxidised during the testwork.  Reagent consumptions for the two tests are presented in Table 27.

*Table 27: Pre-oxidation Sighter Testwork Reagent Consumptions*

| | **Sulphuric acid consumption (kg/t)** | **Lime consumption (kg/t)** | **Cyanide consumption (kg/t)** |
|---|---|---|---|
| Pre-oxidation Test 1- pH 10.0 | - | 22.7 | 36.3 |
| Pre-oxidation Test 2- pH 5.0 | 21.5 | 12.1 | 42.5 |

The results suggest that the Youanmi ore is not amenable to pre-oxygenation then cyanidation such as the Okvau flowsheet and more aggressive oxidative conditions which target gold locked in solid solution sulphides are required to achieve better cyanide leach extraction.

# 10 SUMMARY & RECOMMENDATIONS

JTs provides the following summary and recommendations based upon the learnings of the PFS:

- A Rougher/ Cleaner/Recleaner flowsheet was shown to be an effective method for generating a high-grade gold concentrate from Youanmi ore. The flowsheet showed a marked improvement on historical testwork and plant results, improving concentrate grade and recovery.

- Incorporating a regrind stage on rougher concentrate further boosts final concentrate grade without sacrificing gold recovery. The flowsheet was able to generate a flotation concentrate grading 63.8g/t from a feed grade of 8.5g/t representing a gold to concentrate recovery of 91.0% and a mass pull of 11.6%. Testwork and mineralogical results suggest even higher concentrate grades could be achieved at finer regrind sizes. JTs recommends this is assessed in future study. The low silicate content in the LC2 concentrate suggests relatively low concentrations of non-sulphide gangue mineralisation. This is indicative that additional cleaning stages are unlikely to significantly improve the concentrate grade.

- The Youanmi ore was found to be highly amenable to a flotation/BIOX/cyanidation flowsheet, achieving rapid oxidation and high gold cyanide leach extractions. The sighter testwork found that high gold extraction (95.6%) can be achieved with only partial (37%) sulphide/sulphur oxidation indicating the targeted oxidation of gold ladened sulphide mineral(s). JTs recommends that future BIOX study include the following:

    - Coarser feed grind sizes, inclusive of BIOX testing on unground flotation concentrate.
    - Alternate cyanidation parameters, including a reduction in cyanide concentration in the cyanide leach.

- Extended pre-oxygenation followed by moderate cyanide conditions were found to be ineffective in the oxidation on sulphides hence resulted in similar recoveries to those without pre-oxygenation.

- The ore contains elevated antimony content, likely in the form of stibnite. Stibnite can cause passivation issues in cyanidation when the pH is elevated. To mitigate this, cyanidation should be performed at a carefully controlled, lower pH than typical (9-9.5). JTs recommends this is assessed in future study.

The ore's semi-refractory characteristics and gold speciation necessitates intensive oxidation for effective cyanidation. Fine grinding alone is considered insufficient due to the proven presence of solid solution gold in arsenopyrite. Historically, Pressure oxidation was found to be an effective processing route however is likely cost prohibitive for the project. Citing the results of both the Preliminary Feasibility Study (PFS) and past metallurgical and mineralogical test work, JTs is of the opinion that Flotation followed by either BIOX or Albion flowsheets present the only economically and environmentally viable on-site processing methods of those assessed.

Noting the improvement to flotation grade and recovery achieved in the PFS testwork, offsite sale of concentrate remains a viable option for the project. The generated flotation concentrates had low quantities of common deleterious elements such as arsenic (<3%), cadmium and mercury. This would likely make the concentrate an attractive option for third parties and is unlikely to attract element exceedance penalties.

JTs reiterates the need for variability testwork in future study. Discrete testing of the different ore domains representing the known resources of Main, Link and Pollard needs to undertaken on the chosen flowsheet.

A table outlining the different staged gold recoveries for each unit operation is presented in Table 28. This data is collated from the results of the PFS, historical testwork and plant production records.

*Table 28: Unit Operation Staged Gold Recovery*

| Stage | Staged Recovery (%) | Reference |
|---|---|---|
| Whole of Ore Leach ($P_{80}$ 75µm) | 40-62% | AMMTEC (1992)&(2004), Orway (2021) |
| Flotation | 87.1%<br>91-91.5% | Average Plant Recovery to Concentrate<br>JTs (2024) |
| **Float Con Treatment** | | |
| UFG + Cyanidation | ($P_{80}$ 10µm) 65.3-80.0%<br>$P_{80}$ (6-25µm) 37.7-79.8%<br>$P_{80}$ (8-19µm) 45.1-53.7% | Orway (2021)<br>MACA Interquip (2022)<br>AMMTEC (1992) |
| Roasting+ Cyanidation | 78.8-87.3%<br>89.1-91.6% | AMMTEC (1992)<br>Orway (2021) |
| Bacterial Ox+ Cyanidation | 87.0%<br>95.6% (37.4% SOx) to 97.5% (99.1 SOx) | Average CIL Plant Recovery<br>JTs (2024) |
| Albion+ Cyanidation | (~75% SOx) 88.8-94.4%<br>92.9% (30% SOx) to 99.1% (83% SOx) | Orway (2021)<br>MACA Interquip (2022) |
| POX+ Cyanidation | 98.8 - 99.0% | Orway (2021) |
| Extended Pre-Oxygenation+ Cyanidation | 54-66.8% | JTs (2024) |

**END OF REPORT**

# Appendices

## 17.5 Appendix 5. EGI (2026). Youanmi Tailings Geochemical Assessment

## 17.6 Appendix 6. Gas & Diesel Engine Emissions Data References

# G3520K

## GAS ENGINE SITE SPECIFIC TECHNICAL DATA
## Youanmi G3520K

GENSET - WITHOUT RADIATOR

| | | | |
|---|---|---|---|
| ENGINE SPEED (rpm): | 1500 | RATING STRATEGY: | HIGH RESPONSE |
| COMPRESSION RATIO: | 10.5 | FUEL SYSTEM: | CAT LOW PRESSURE WITH AIR FUEL RATIO CONTROL |
| AFTERCOOLER TYPE: | SCAC | | |
| AFTERCOOLER - STAGE 1/STAGE 2 INLET (°C): | 86 / 57 | **SITE CONDITIONS:** | |
| JACKET WATER OUTLET (°C): | 99 | FUEL: | Gas Analysis |
| ASPIRATION: | TA | FUEL PRESSURE RANGE(kPag): (See note 1) | 4-35 |
| COOLING SYSTEM: | JW+OC+1AC, 2AC | FUEL METHANE NUMBER: | 74.2 |
| CONTROL SYSTEM: | ADEM6 | FUEL LHV (MJ/Nm3): | 39.60 |
| EXHAUST MANIFOLD: | DRY | ALTITUDE(m): | 470 |
| COMBUSTION: | LOW EMISSION | STANDARD RATED POWER: | 2636 bkW@1500rpm |
| NOx EMISSION LEVEL (mg/Nm3 NOx): | 500 | GENERATOR / VOLTAGE / POWER FACTOR: | 5699888 / 11000V / 0.8 |

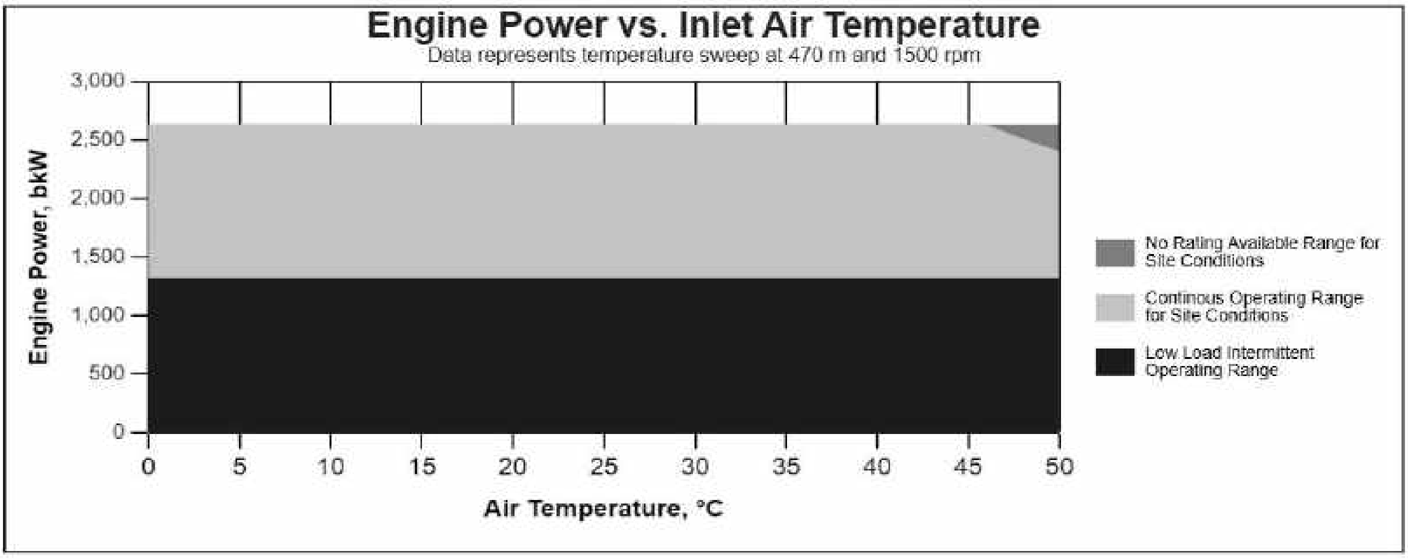
| | | | | MAX RATING | SITE RATING AT MAX INLET AIR TEMP | | |
|---|---|---|---|---|---|---|---|
| **RATING** | | **NOTES** | **LOAD** | **100%** | **100%** | **75%** | **54%** |
| GENSET POWER | (WITHOUT FAN) | (2)(3) | ekW | 2549 | 2323 | 1743 | 1262 |
| GENSET POWER | (WITHOUT FAN) | (2)(3) | kVA | 3186 | 2904 | 2179 | 1578 |
| ENGINE POWER | (WITHOUT FAN) | (3) | bkW | 2636 | 2404 | 1809 | 1318 |
| INLET AIR TEMPERATURE | | | °C | 46 | 50 | 50 | 50 |
| GENERATOR EFFICIENCY | | (2) | % | 96.7 | 96.6 | 96.3 | 95.8 |
| GENSET EFFICIENCY | (ISO 3046/1) | (4)(5) | % | 45.5 | 45.3 | 44.1 | 42.3 |
| THERMAL EFFICIENCY | | (4)(6) | % | 43.2 | 43.5 | 44.5 | 46.5 |
| TOTAL EFFICIENCY | | (4)(7) | % | 88.7 | 88.8 | 88.6 | 88.8 |
| **ENGINE DATA** | | | | | | | |
| GENSET FUEL CONSUMPTION | (ISO 3046/1) | (8) | MJ/ekW-hr | 7.90 | 7.95 | 8.16 | 8.52 |
| GENSET FUEL CONSUMPTION | (NOMINAL) | (8) | MJ/ekW-hr | 8.17 | 8.22 | 8.44 | 8.81 |
| ENGINE FUEL CONSUMPTION | (NOMINAL) | (8) | MJ/bkW-hr | 7.90 | 7.95 | 8.13 | 8.44 |
| AIR FLOW (@inlet air temp, 101.3 kPa) | (WET) | (9) | Nm3/bkW-hr | 4.38 | 4.44 | 4.45 | 4.41 |
| AIR FLOW | (WET) | (9) | kg/bkW-hr | 4.84 | 4.85 | 4.86 | 4.82 |
| FUEL FLOW (0°C, 101.3 kPa) | | | Nm3/hr | 526 | 483 | 371 | 281 |
| INLET MANIFOLD PRESSURE | | (10) | kPa(abs) | 476 | 434 | 328 | 241 |
| EXHAUST TEMPERATURE - ENGINE OUTLET | | (11) | °C | 401 | 410 | 440 | 475 |
| EXHAUST GAS FLOW (0°C, 101.3 kPa) | (WET) | (12) | Nm3/bkW-hr | 3.97 | 3.97 | 3.98 | 3.96 |
| EXHAUST GAS MASS FLOW | (WET) | (12) | kg/bkW-hr | 5.00 | 5.01 | 5.02 | 4.98 |
| MAX INLET RESTRICTION | | (13) | kPa | 3.60 | 2.90 | 1.35 | 0.60 |
| MAX EXHAUST RESTRICTION | | (13) | kPa | 5.00 | 4.19 | 2.32 | 1.20 |
| **EMISSIONS DATA - EXHAUST OUT** | | | | | | | |
| NOx (as NO2) | (NOMINAL) | (14)(15) | g/bkW-hr | 1.24 | 1.25 | 1.28 | 1.31 |
| CO | | (14)(15) | g/bkW-hr | 1.52 | 1.52 | 1.52 | 1.49 |
| NMHC (mol. wt. of 15.84) | | (14)(15) | g/bkW-hr | 0.40 | 0.43 | 0.46 | 0.43 |
| NMNEHC (VOCs) (mol. wt. of 15.84) | | (14)(15)(16) | g/bkW-hr | 0.21 | 0.22 | 0.24 | 0.22 |
| HCHO (Formaldehyde) | | (14)(15) | g/bkW-hr | 0.23 | 0.23 | 0.24 | 0.24 |
| CH4 (mol. wt. of 16.04) | (NOMINAL) | (14)(17) | g/bkW-hr | 1.46 | 1.54 | 1.65 | 1.54 |
| CO2 | (NOMINAL) | (14)(17) | g/bkW-hr | 440 | 443 | 453 | 464 |
| EXHAUST OXYGEN | (NOMINAL) | (14)(18) | % DRY | 9.7 | 9.7 | 9.4 | 8.9 |
| **HEAT REJECTION** | | | | | | | |
| LHV INPUT | | (19) | kW | 5790 | 5310 | 4088 | 3090 |
| HEAT REJ. TO JACKET WATER (JW) | | (20) | kW | 570 | 546 | 469 | 418 |
| HEAT REJ. TO ATMOSPHERE | (INCLUDES GENERATOR) | (20) | kW | 170 | 157 | 136 | 110 |
| HEAT REJ. TO LUBE OIL (OC) | | (20) | kW | 226 | 218 | 196 | 173 |
| HEAT REJECTION TO EXHAUST (LHV TO 120°C) | | (20) | kW | 1143 | 1081 | 902 | 730 |
| HEAT REJ. TO A/C - STAGE 1 (1AC) | | (20)(21) | kW | 587 | 485 | 266 | 128 |
| HEAT REJ. TO A/C - STAGE 2 (2AC) | | (20)(21) | kW | 120 | 108 | 78 | 55 |
| **COOLING SYSTEM SIZING CRITERIA** | | | | | | | |
| TOTAL JACKET WATER CIRCUIT (JW+OC+1AC) | | (22) | kW | 1686 | 1571 | | |
| TOTAL AFTERCOOLER CIRCUIT (2AC) | | (22) | kW | 131 | 119 | | |
| HEAT REJECTION TO EXHAUST (LHV TO 120°C) | | (22) | kW | 1258 | 1189 | | |
| A cooling system safety factor of 0% has been added to the cooling system sizing criteria. | | | | | | | |
| **MINIMUM HEAT RECOVERY** | | | | | | | |
| TOTAL JACKET WATER CIRCUIT (JW+OC+1AC) | | (23) | kW | 1251 | 1127 | | |
| TOTAL AFTERCOOLER CIRCUIT (2AC) | | (23) | kW | 114 | 102 | | |
| HEAT REJECTION TO EXHAUST (LHV TO 120°C) | | (23) | kW | 871 | 818 | | |

**CONDITIONS AND DEFINITIONS**

Engine rating obtained and presented in accordance with ISO 3046/1, adjusted for fuel, site altitude and site inlet air temperature. 100% rating at maximum inlet air temperature is the maximum engine capability for the specified fuel at site altitude and maximum site inlet air temperature. Maximum rating is the maximum capability at the specified aftercooler inlet temperature for the specified fuel at site altitude and reduced inlet air temperature. Refer to product O&M manual for details on additional lower load capability. No overload permitted at rating shown.

For notes information consult page three.
***WARNINGS ISSUED FOR THIS RATING CONSULT PAGE 3***

PREPARED BY: James Body, EPSA
Data generated by: GERP Web, GAPI 2.23.0.7
Ref. Dta Set EM7194-07-001, 24Oct2025


Engine Power vs. Inlet Air Temperature
Data represents temperature sweep at 470 m and 1500 rpm
Engine Power, bkW
3,000
2,500
2,000
1,500
1,000
500
0
0
5
10
15
20
25
30
35
40
45
50
Air Temperature, °C
No Rating Available Range for Site Conditions
Continous Operating Range for Site Conditions
Low Load Intermittent Operating Range

**NOTES:**

1. Fuel pressure range specified is to the engine fuel control valve. Additional fuel train components should be considered in pressure and flow calculations.

2. Generator efficiencies, power factor, and voltage are based on specified generator. [Genset Power (ekW) is calculated as: Engine Power (bkW) x Generator Efficiency], [Genset Power (kVA) is calculated as: Engine Power (bkW) x Generator Efficiency / Power Factor]

3. Rating is without engine driven water pumps. Tolerance is (+)3, (-)0% of full load. Engine is equipped with a Humidity Management Strategy that will optimize SCAC inlet water temperature and limit available power during periods of high ambient humidity to protect the engine. When operating in high humidity conditions, please contact dealer / A&I team for details.

4. Efficiency represents a Closed Crankcase Ventilation (CCV) system installed on the engine.

5. Genset Effieciency published in accordance with ISO 3046/1.

6. Thermal Efficiency is calculated based on energy recovery from the jacket water, lube oil, 1st stage aftercooler, and exhaust to 120°C with engine operation at ISO 3046/1 Genset Efficiency, and assumes unburned fuel is converted in an oxidation catalyst.

7. Total efficiency is calculated as: Genset Efficiency + Thermal Efficiency. Tolerance is ±10% of full load data.

8. ISO 3046/1 Genset fuel consumption tolerance is (+)5, (-)0% at the specified power factor. Nominal genset and engine fuel consumption tolerance is ± 1.5% of full load data at the specified power factor.

9. Air flow value is on a 'wet' basis. Flow is a nominal value with a tolerance of ± 5 %.

10. Inlet manifold pressure is a nominal value with a tolerance of ± 5 %.

11. Exhaust temperature is a nominal value with a tolerance of (+)35°C, (-)30°C.

12. Exhaust flow value is on a "wet" basis. Flow is a nominal value with a tolerance of ± 6 %.

13. Inlet and Exhaust Restrictions are maximum allowed values at the corresponding loads. Increasing restrictions beyond what is specified will result in a significant engine derate.

14. Emissions data is at engine exhaust flange prior to any after treatment.

15. NOx tolerances are ± 18% of specified value. CO, NMHC, NMNEHC, and HCHO emission values listed are higher than nominal levels to allow for instrumentation, measurement, and engine-to-engine variations. They indicate the maximum values expected under steady state conditions. Fuel methane number cannot vary more than ± 3. NMHC, and NMNEHC do not include aldehydes.

16. VOCs - Volatile organic compounds as defined in US EPA 40 CFR 60, subpart JJJJ

17. $CO_2$ tolerance is ± 1.5%. $CH_4$ tolerance is ± 26.0%. Fuel methane number cannot vary more than ± 3.

18. Exhaust Oxygen level is the result of adjusting the engine to operate at the specified NOx level. Tolerance is ± 0.5.

19. LHV rate tolerance is ± 1.5%.

20. Heat rejection values are representative of site conditions. Tolerances, based on treated water, are ± 10% for jacket water circuit, ± 50% for atmosphere, ± 20% for lube oil circuit, ± 10% for exhaust, and ± 5% for aftercooler circuit.

21. Aftercooler heat rejection is nominal for site conditions and does not include an aftercooler heat rejection factor. Aftercooler heat rejection values at part load are for reference only.

22. Cooling system sizing criteria represent the expected maximum circuit heat rejection for the ratings at site, with applied plus tolerances. Total circuit heat rejection is calculated using formulas referenced in the notes on the standard tech data sheet with the following qualifications. Aftercooler heat rejection data (1AC & 2AC) is based on the standard rating. Jacket Water (JW) and Oil Cooler (OC) heat rejection values are based on the respective site or maximum column. Aftercooler heat rejection factors (ACHRF) are specific for the site elevation and inlet air temperature specified in the site or maximum column, referenced from the table on the standard data sheet.

23. Minimum heat recovery values represent the expected minimum heat recovery for the site, with applied minus tolerances. Do not use these values for cooling system sizing.

**WARNING:**

1. Continuous operation at rated power above 40C(104F) ambient air temperatures may contribute to faster degradation of generator insulation. Consult TMI for degradation curves.

| Constituent | Abbrev | Mole % | Norm |
|---|---|---|---|
| Water Vapor | H2O | 0.0000 | 0.0000 |
| Methane | CH4 | 90.0000 | 91.8367 |
| Ethane | C2H6 | 5.0000 | 5.1020 |
| Propane | C3H8 | 1.5000 | 1.5306 |
| Isobutane | iso-C4H10 | 1.0000 | 1.0204 |
| Norbutane | nor-C4H10 | 0.0000 | 0.0000 |
| Isopentane | iso-C5H12 | 0.5000 | 0.5102 |
| Norpentane | nor-C5H12 | 0.0000 | 0.0000 |
| Hexane | C6H14 | 0.0000 | 0.0000 |
| Heptane | C7H16 | 0.0000 | 0.0000 |
| Nitrogen | N2 | 0.0000 | 0.0000 |
| Carbon Dioxide | CO2 | 0.0000 | 0.0000 |
| Hydrogen Sulfide | H2S | 0.0000 | 0.0000 |
| Carbon Monoxide | CO | 0.0000 | 0.0000 |
| Hydrogen | H2 | 0.0000 | 0.0000 |
| Oxygen | O2 | 0.0000 | 0.0000 |
| Helium | HE | 0.0000 | 0.0000 |
| Neopentane | neo-C5H12 | 0.0000 | 0.0000 |
| Octane | C8H18 | 0.0000 | 0.0000 |
| Nonane | C9H20 | 0.0000 | 0.0000 |
| Ethylene | C2H4 | 0.0000 | 0.0000 |
| Propylene | C3H6 | 0.0000 | 0.0000 |
| TOTAL (Volume %) | | 98.0000 | 100.0000 |

| | |
|---|---|
| Fuel Makeup: | Gas Analysis |
| Unit of Measure: | Metric |

**Calculated Fuel Properties:**

| | |
|---|---|
| Caterpillar Methane Number: | 74.2 |
| Lower Heating Value (MJ/Nm3): | 39.60 |
| Higher Heating Value (MJ/Nm3): | 43.82 |
| WOBBE Index (MJ/Nm3): | 50.37 |
| THC: Free Inert Ratio: | Not Applicable |
| Total % Inerts (% N2,CO2,He): | 0.00% |
| RPC (%) (To 35.64 MJ/Nm3 Fuel): | 100% |
| Compressibility Factor: | 0.997 |
| Stoich A/F Ratio (Vol/Vol): | 10.48 |
| Stoich A/F Ratio (Mass/Mass): | 16.95 |
| Specific Gravity (Relative to Air): | 0.618 |
| Fuel Specific Heat Ratio (K): | 1.302 |

**CONDITIONS AND DEFINITIONS**

Caterpillar Methane Number represents the knock resistance of a gaseous fuel. It should be used with the Fuel Usage Guide for the engine and rating to determine the rating for the fuel specified. A Fuel Usage Guide for each rating is included on page 2 of its standard technical data sheet.

RPC always applies to naturally aspirated (NA) engines, and turbocharged (TA or LE) engines only when they are derated for altitude and ambient site conditions.

Project specific technical data sheets take the Caterpillar Methane Number and RPC into account when generating a site rating.

Fuel properties for MJ/Nm3 calculations are at 0C and 101 kPa.

Caterpillar shall have no liability in law or equity, for damages, consequently or otherwise, arising from use of program and related material or any part thereof.

**FUEL LIQUIDS**

Field gases, well head gases, and associated gases typically contain liquid water and heavy hydrocarbons entrained in the gas. To prevent detonation and severe damage to the engine, hydrocarbon liquids must not be allowed to enter the engine fuel system. To remove liquids, a liquid separator and coalescing filter are recommended, with an automatic drain and collection tank to prevent contamination of the ground in accordance with local codes and standards.

To avoid water condensation in the engine or fuel lines, limit the relative humidity of water in the fuel to 80% at the minimum fuel operating temperature.

**WARNING:**

1. Continuous operation at rated power above 40C(104F) ambient air temperatures may contribute to faster degradation of generator insulation. Consult TMI for degradation curves.

| Cummins Inc. | Basic Engine Model: QSK78-G9 | Curve Number: FR60115 | G-DRIVE QSK 1 |
|---|---|---|---|
| Columbus, Indiana 47202-3005 | Engine Critical Parts List: CPL : 4444 | Date: 21 AUG 13 | |
| EXHAUST EMISSIONS DATA SHEET | | | |

| | |
|---|---|
| Compression Ratio : **15.3 : 1** | Displacement : **4735** in³ (**77.6** L) |
| Fuel System : **HPI-PT** | Aspiration : **Turbocharged and Low Temp Aftercooled (2P/2L)** |
| Emission Certification : **Non-Certified** | |

| Engine Speed | Standby Power | | Prime Power | | Continuous Power | |
|---|---|---|---|---|---|---|
| rpm | kWm | hp | kWm | hp | kWm | hp |
| **1500** | 2539 | 3404 | 2304 | 3088 | 2072 | 2777 |

## Exhaust Emissions Data @ 1500 RPM

| | | Standby Power | | | Prime Power | | | Continuous Power | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Component | | g/BHP-h | mg/m$^3$ | PPM | g/BHP-h | mg/m$^3$ | PPM | g/BHP-h | mg/m$^3$ | PPM |
| **HC** | **(Total Unburned Hydrocarbons)** | 0.16 | 78 | 109 | 0.14 | 70 | 96 | 0.14 | 68 | 98 |
| **NOx** | **(Oxides of Nitrogen as $NO_2$)** | 9.9 | 4890 | 2382 | 7.6 | 3721 | 1813 | 7.4 | 3559 | 1734 |
| **CO** | **(Carbon Monoxide)** | 0.39 | 195 | 147 | 0.23 | 114 | 84 | 0.25 | 119 | 94 |
| **PM** | **(Particulate Matter)** | 0.01 | 6 | N/A | 0.02 | 9 | N/A | 0.01 | 6 | N/A |
| **$SO_2$** | **(Sulfer Dioxide)** | 0.10 | 42 | 17 | 0.10 | 42 | 17 | 0.10 | 42 | 14 |

Note: mg/m$^3$ and PPM numbers are measured dry and corrected to 5% $O_2$ content.

Test Methods and Conditions:
Steady-State emissions recorded per ISO8178-1 during operation at rated engine speed (+/- 2%) and stated constant load (+/-2%) with engine temperatures, pressures, and emission rates stabilized.

Fuel Specifications:
46.5 Cetane Number, 0.035 Wt. % Sulfur; Reference ISO8178-5, 40CFR86.1313-98 Type 2-D and ASTM D975 No. 2-D.

Reference:
25°C (77°F) Air Inlet Temperature, 40°C (104°F) Fuel Inlet Temperature, 100 kPa (29.53 in Hg) Barometric Pressure; 10.7 g/kg (75 grains $H_2O$/lb) of dry air Humidity (required for NOx correction): Intake Restriction set to maximum allowable limit for clean filter; Exhaust Back Pressure set to maximum allowable limit.

Data was taken from a single engine test according to the test methods, fuel specification, and reference conditions stated above and is subject to engine-to-engine variability. Tests conducted with alternate test methods, instrumentation, fuel, or reference conditions can yield different results.

Data subject to change without notice.

## 17.7 Appendix 7. TailCon (2025b). Evaporation Pond Extension Design Report

# Technical Memorandum

Date: 21-Nov-2025

Ref: 160-01-3144C-TM001_03

[redacted]

Subject: Evaporation Pond Extension Design

## 1 Introduction

This technical memorandum presents the development of the design for the Youanmi Gold Project (YGP) Evaporation Pond Extension (EPE). YGP is located approximately 480 km northeast of Perth, Western Australia, within the Youanmi Greenstone Belt of the Southern Cross Province in the Archaean Yilgarn Craton. Rox Resources Limited (ROX) holds a 100% interest in the project, encompassing 11 granted mining leases and extensive regional exploration tenures (ROX, 2025).

## 2 Background

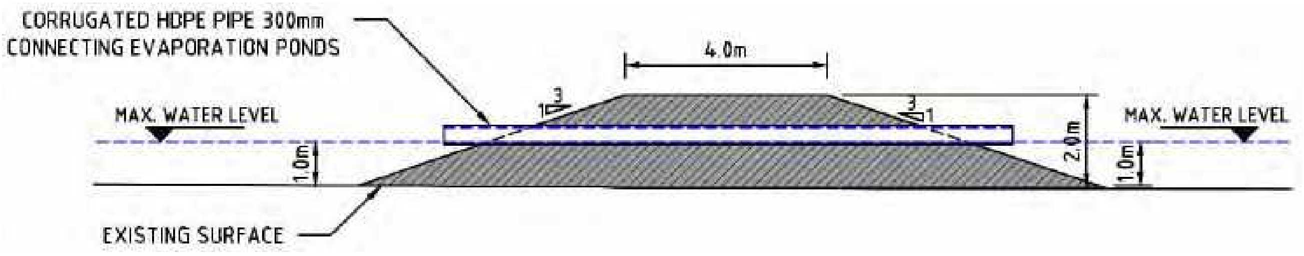
Historically, the Youanmi Gold Project (YGP) produced gold through both open pit (1987–1993) and underground mining operations. During this period, excess water on site was managed using evaporation ponds.

Currently, a network of evaporation ponds—divided into multiple cells—is in operation. These cells are managed to a maximum water depth of 1.0 metre to optimise evaporation. Interconnected by a series of pipes, the system allows water to overflow from one cell to the next once the 1.0 m capacity is reached.

Since acquiring the project, ROX Resources has focused on resource expansion and development. In July 2024, ROX completed a Pre-Feasibility Study (PFS) for the Youanmi Gold Project, which included a 750,000 tonnes per annum (t/a) processing plant, mining infrastructure, and a Tailings Storage Facility (TSF).

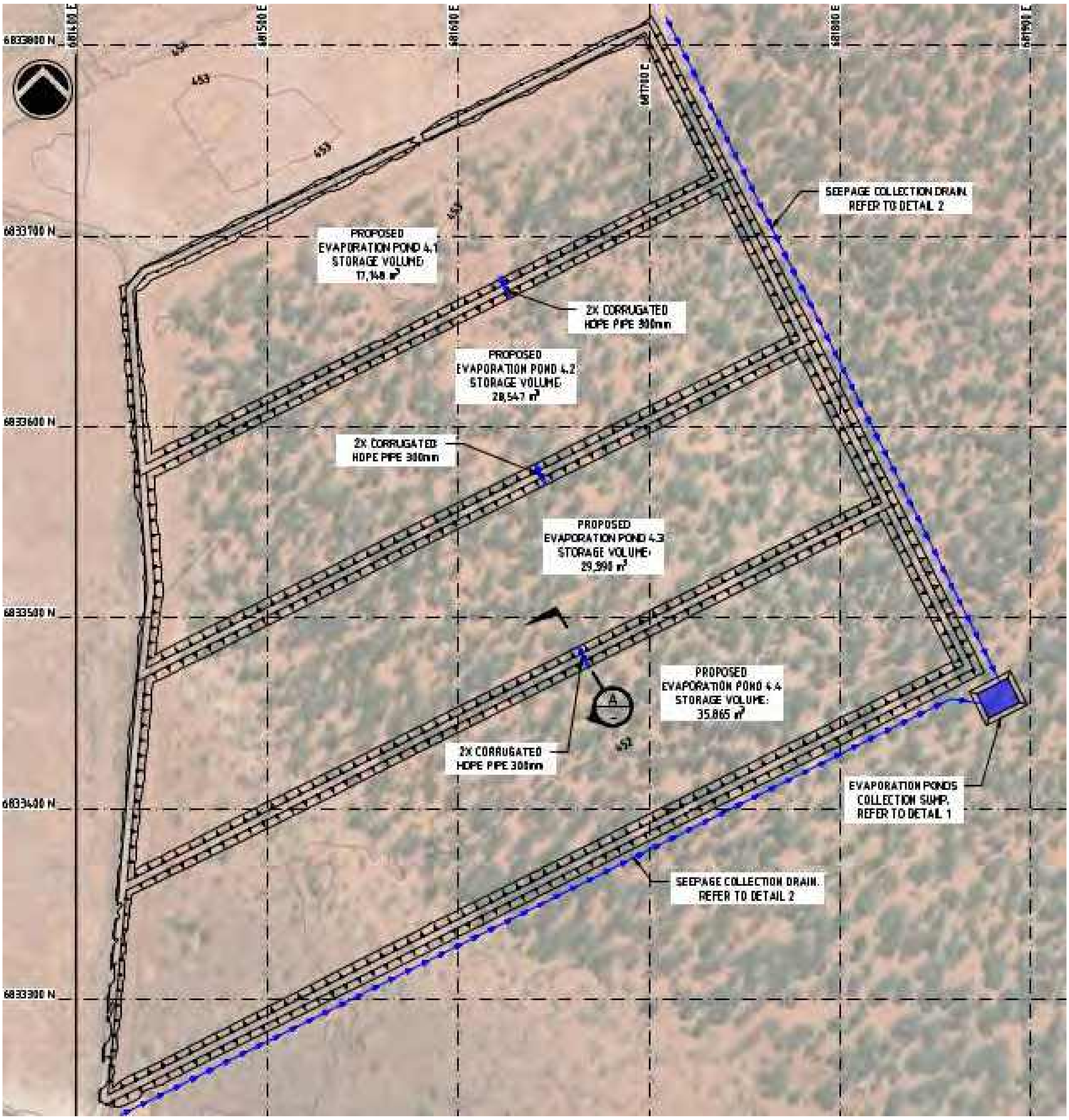
To support this expansion and enable remining activities, excess water from the pit must be removed. As part of its dewatering strategy, ROX has engaged TailCon to design additional evaporation ponds adjacent to and southeast of the existing pond network. A typical section view and plan view of the proposed EPE facility is presented in Figure 2-1 and Figure 2-2, respectively.

**Figure 2-1: Proposed YGP Evaporation Pond Extension – Typical Section View**




The EPE comprises four (4) additional interconnected cells designed to enhance site water management. Water from the existing cells will first enter Cell 4.1, then sequentially flow into Cells 4.2, 4.3, and 4.4. The flow between these cells will be facilitated by double-corrugated HDPE pipes installed approximately 1.0 m above ground level to promote gravity-driven transfer and operational flexibility.

**Figure 2-2: Proposed YGP Evaporation Pond Extension – Plan View**




# 3 Design

## 3.1 Introduction

The conceptual design for the Evaporation Pond Extension utilises the details discussed below in Section 4 and the guiding principles in the following documents:

- Government of Western Australia Department of Mines and Petroleum (DMP): “Guide to Departmental requirements for the management and closure of tailings storage facilities (TSFs)”, 2015;
- Government of Western Australia Department of Mines and Petroleum (DMP) Code of Practice (CoP): “Tailings Storage Facilities in Western Australia”, 2013;
- Australian National Committee on Large Dams (ANCOLD): “Guidelines on Tailings Dams Planning, Design, Construction, Operation and Closure”, 2019.

## 3.2 Design Basis

The evaporation pond has been designed to temporarily contain shallow volumes of water generated from pit dewatering activities, with the primary objective of facilitating natural evaporation as the key water removal mechanism. The design considers local climatic conditions, including high evaporation rates and minimal rainfall infiltration, to ensure effective water volume reduction over time.

The collected water is primarily derived from groundwater and surface water ingress into the pit. While it is generally not expected to contain process reagents or elevated concentrations of heavy metals, the water can be hypersaline, which poses a potential environmental risk if released. Although hypersalinity does not typically constitute a hazardous substance classification, uncontrolled discharge could adversely impact surrounding soils, vegetation, and surface-water ecosystems. Therefore, the ponds require appropriate containment and seepage control measures to prevent off-site impacts, even though no specialised treatment systems are anticipated to be necessary. The pond geometry, embankment height, and storage capacity have been developed to accommodate anticipated inflow volumes while maintaining sufficient freeboard under conservative design storm events, consistent with a medium risk classification. Design considerations include:

- Pond depth and surface area optimized for promoting evaporation through maximum exposed surface area.
- Embankment height sufficient to contain inflows and maintain a minimum of 0.5 m freeboard.
- Seepage controls such as clay lining or low-permeability base materials to limit infiltration where required.
- Access provisions for inspection and maintenance during operations.

## 3.3 Storage Capacity

The storage capacity for each cell of the proposed EPE is summarized in  below.

**Table 3-1: Proposed EPE Storage Capacity**

| EPE Cell No. | Capacity ($m^3$) |
|---|---|
| 4.1 | 17,148 |
| 4.2 | 28,547 |
| 4.3 | 29,390 |
| 4.4 | 35,865 |

## 3.4 Population at Risk

The Population at Risk (PAR) is defined as all people who would be directly exposed to floodwaters assuming they took no action to evacuate. Downstream of the proposed Evaporation Pond Extension (EPE) there is no active mining or infrastructure, and any release of water is unlikely to impact any individual. Based on this assumption, the PAR is <1.

## 3.5 DMPE Classification

EPE has been assessed in accordance with the DMP CoP (DMP 2013, Table 1). The assessment concluded that a 'Medium' hazard rating be assigned to the facility, as demonstrated in  (highlighted grey).

In accordance with the DMP Code of Practice (DMP 2013, Table 2), the proposed EPE is classified as a "Category 2" facility as the facility has a hazard rating of 'Medium' and the embankment will be <5.0 m in height (2.0 m), as demonstrated in (highlighted grey).

**Table 3-2: DMP CoP Hazard Rating System**

| 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 or injury is possible | Loss of life or injury is possible although not expected | No potential for loss of life or injury |
| **Adverse human health due to direct physical impact or contamination of the environment** | 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 assets due to direct physical impact or contamination of the environment** | Loss of numerous livestock is possible | Loss of some livestock is possible | Limited or no potential for loss of livestock |
| | Permanent loss of assets (e.g. commercial, industrial, agricultural and pastoral assets, public utilities and infrastructure, mine 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 |
| **Damage to items of environmental, heritage or historical value due to direct physical impact or contamination of the environment** | 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 and 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 3-3: DMP CoP Category Rating System**

| Maximum Embankment or Structure Height (m) | Hazard Rating | | |
|---|---|---|---|
| | High | Medium | Low |
| **> 15.0** | Category 1 | Category 1 | Category 1 |
| **5.0 - 15.0** | Category 1 | Category 2 | Category 2 |
| **< 5.0** | Category 1 | Category 2 | Category 3 |

## 3.6 ANCOLD Consequence Category

### 3.6.1 General

The ANCOLD consequence category is used to establish various design criteria, including seismic loading for embankment stability and design rainfall events for freeboard and spillway design. According to the criteria outlined in the ANCOLD Guidelines on Assessment of the Consequences of Dam Failure (ANCOLD, 2012), the factors that influence the consequence category of the Dam complex are the population at risk (PAR), as well as the 'severity level', which is established from potential damages and losses to the community, environment, and the operation.

### 3.6.2 Dam Failure Severity Level

In accordance with ANCOLD (2019) Guidelines, there are seven damage type categories that need to be assessed to determine the severity level/impact (Minor, Medium, Major and Catastrophic) of a potential facility failure or spill.

In accordance with the Dam Severity Level impact assessment (ANCOLD 2012), the proposed facility can be classified as a 'Medium' severity. summarizes the dam failure severity level, with the assessed rating highlighted in grey.

**Table 3-4: ANCOLD Dam Severity level Rating System**

| Damage Type | Minor | Medium | Major | Catastrophic |
|---|---|---|---|---|
| **Infrastructure (dam, houses, commerce, farms, community)** | <$10M | $10M-$100M | $100M-$1B | >$1B |
| **Business importance** | Some restrictions | Significant impacts | Severe to crippling | Business dissolution, bankruptcy |
| **Public health** | <100 people affected | 100-1000 people affected | <1000 people affected for more than one month | >10,000 people affected for over one year |
| **Social dislocation** | <100 person or <20 business months | 100-1000 person months or 20-2000 business months | >1000 person months or >200 business months | >10,000 person months or numerous business failures |
| **Impact Area** | <1 km2 | < 5 km2 | < 20 km2 | > 20 km2 |
| **Impact Duration** | < 1 (wet) year | < 5 years | < 20 years | > 20 years |
| **Impact on natural environment** | Damage limited to items of low conservation value (e.g. degraded or cleared land, ephemeral streams, non-endangered flora and fauna).<br>Remediation possible. | Significant effects on rural land and local flora & fauna.<br>Limited effects on:<br>Item(s) of local & state natural heritage.<br>Native flora and fauna within forestry, aquatic and conservation reserves, or recognised habitat corridors, wetlands or fish breeding areas | Extensive rural effects.<br>Significant effects on river system and areas A & B.<br>Limited effects on:<br>Item(s) of National or World natural heritage.<br>Native flora and fauna within national parks, recognised wilderness areas, RAMSAR wetlands and nationally protected aquatic reserves.<br>Remediation difficult. | Extensively affects areas A & B.<br>Significantly affects areas C & D.<br>Remediation involves significantly altered ecosystems. |

### 3.6.3 Dam Failure Consequence Category

The dam failure consequence category (DFCC) is adapted from the severity level assessment of damage and loss, combined with the Population at Risk (PAR).

Based on a dam failure severity level of 'Medium' and a PAR < 1, the ANCOLD guidelines recommend the adoption of a 'Low' Dam Failure Consequence Category rating for EPE as demonstrated in (grey).

**Table 3-5: ANCOLD Recommended Consequence Category**

| Population at Risk (PAR) | Severity of Damage or Loss | | | |
|---|---|---|---|---|
| | Minor | Medium | Major | Catastrophic |
| <1 | Very Low | Low | Significant | High C |
| >1 to 10 | Significant (Note 2) | Significant (Note 2) | High C | High B |
| >10 to 100 | High C | High C | High B | High A |
| >100 to 1000 | Note 1 | High B | High A | Extreme |
| >1000 | | Note 1 | Extreme | Extreme |

Notes:

1 – With a PAR in excess of 100, it is unlikely Damage will be minor. Similarly, with a PAR more than 1,000 it is unlikely Damage will be classified as Medium.

2 – Change to "High C" where there is the potential of one or more lives being lost. The potential for loss of life is determined by the characteristics of the flood area, particularly the depth and velocity of flow.

### 3.6.4 Environmental Spill Consequence Category

The Environmental Spill Consequence Category is assessed by considering the effect of spilling dam water to the downstream environment (typically through the dam spillway during a flood event). The effect of spilling water to the environment from the EPE is primarily driven by the geochemistry of the stored water.

Water spilled from EPE under extreme weather events will be significantly diluted and further diluted again given the downstream environment of the dam is also likely to be flooded. Therefore, the severity of impact on the natural environmental from environmental spills from EPE would be 'Minor'.

The PAR assigned to a dam spill from EPE is < 1. Therefore, the combined Dam Spill Consequence Category is assessed as 'Very Low' for EPE.

### 3.6.5 ANCOLD Design Criteria

The recommended design criteria for a 'Low' consequence category facility have been adopted for the design of EPE as presented in below.

**Table 3-6: ANCOLD Design Criteria**

| Parameter | Value |
|---|---|
| Design Storm Event | Determine by risk assessment |
| Operating Basis Earthquake (OBE) | 1:475-year |
| Safety Evaluation Earthquake (SEE) | 1:1,000-year AEP |

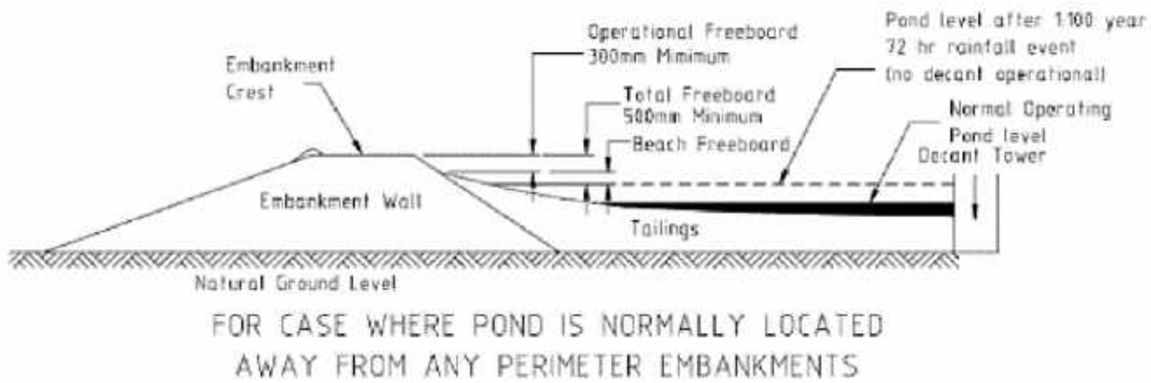
## 3.7 Minimum Freeboard

The hydraulic performance design criteria are applied to assess the freeboard requirements for EPE in general according to the DMPE (Formerly DEMIRS) TSF/Dam design report guide Figure A1 (DMP, 2015.08) as shown in .

Freeboard requirements for a dam comprise three distinct elements, namely:

- Total freeboard – The vertical distance between the Maximum Operating (Pond) Level and the dam crest level and represents the capacity of the dam to pass an extreme storm by combination of extreme storm storage, spillway discharge path, wave freeboard and contingency freeboard to prevent overtopping of the dam.
- Operational Freeboard - This is the vertical distance between the top of the tailings (tailings beach head) and the embankment crest / spillway level. A minimum operational freeboard is normally specified to allowance for embankment deformation or tailings backflow and mounding.
- Beach Freeboard - Vertical distance between the tailings beach head and the tailings pond level after an appropriate extreme storm event. Beach freeboard is definite to control the phreatic surface level against the upstream face and thus maximize stability. This is achieved by maximizing the distance between the decant pond and the embankment.

**Figure 3-1: DMPE TSF Freeboard Guidance (DMP, 2015)**




The facility is rated as 'Low' consequence category as per ANCOLD guidelines and as a result no additional or contingency freeboard is required. No storm storage is required for the EPE either given the facility is rated 'Low'. The required freeboard for EPE is as follows:

- Operational Freeboard of 300mm; and
- Beach Freeboard of 200mm.

Therefore, the total required freeboard for EPE is 0.5m.

### 3.8 Recommended Freeboard

As presented in , the design storm event for the EPE cells—consistent with ANCOLD guidelines—is to be determined via a risk-based assessment approach.

The EPE cells are designed to store a maximum water depth of 1.0 m, with embankments constructed to approximately 2.0 m above the natural ground level. This provides a nominal freeboard of 1.0 m, which is adequate to contain the 1-in-100-year, 72-hour rainfall event under medium climate change impact (220 mm x 1.097=225 mm) while still maintaining the minimum required total freeboard of 0.5 m. The factor 1.097 is derived in accordance with ARR v4.2 (Chapter 6.4.1), using a rate of change of 8 %/°C and a projected global mean surface temperature increase of +1.2 °C for the 2021-2040 period.

Given that the facility is classified as having a 'Low' consequence category, the available freeboard is considered appropriate for the expected design storm event. Therefore, no additional assessments for stormwater contingency storage or further freeboard allowances are considered necessary at this stage.

## 4 Modelling and Design Studies

### 4.1 Foundation Conditions

A geotechnical site investigation consisting of three (3) test pits was completed in July 2025 across the proposed EPE footprint. All three test pits were excavated to refusal to depths of approximately 1.0 m below natural ground. Based on the investigation, the foundation is as follows:

- 0 to 0.3m: Topsoil material (Unsuitable, to be cleared)
- 0.3 to 1.0m: Clay/Silt, sandy & gravelly
- > 1.0m: Wiluna Hardpan followed by Basalt bedrock

The foundation of the EPE is similar to the southern sections of TSF3 and is considered geotechnically strong with low foundation permeability. The subsurface materials—cemented colluvium, ferricrete, silcrete hardpan, weathered granite, and rock—provide high resistance to shear under static and dynamic loads. The absence of loose, saturated granular soils means liquefaction is unlikely, and therefore, the foundation is not expected to pose a risk to the stability or performance of the TSF3 embankment under seismic conditions.

### 4.2 Retaining Structure

As shown in , the retaining structure consists of a homogeneous embankment (Zone A) constructed from a single material type. The Zone A material must meet the permeability requirements specified in and may be sourced locally from the facility basin or from a designated material stockpile (Bunker Dump).

The embankment is designed with a crest width of 4.0 m and side slopes of 1V:2H. Compaction will be achieved either through traffic-based methods or by roller compaction to a minimum of 95% SMDD, with particular attention given to thorough compaction around the corrugated HDPE pipe to minimise the risk of internal erosion or piping.

To reduce the potential for surface erosion, placement of a thin layer of mine waste rock is recommended, although this measure is not essential for structural stability.

### 4.3 Material Parameters

Based on preliminary findings from the GSI and experience on similar projects, the estimated material strength properties are summarised in . For the post seismic slope stability assessment, a conservative strength reduction factor of 20% has been applied, as presented in .

**Table 4-1: Geotechnical design parameters – Operating conditions**

| Material | Bulk unit weight (kN/m3) | Drained shear strength properties | | Undrained shear strength properties | | Hydraulic conductivity coefficient, k (m/s) |
|---|---|---|---|---|---|---|
| | | ϕ' (°) | c' (kPa) | $S_u$min (kPa) | Su/σv' | |
| Zone A (Compacted Clay) | 20 | 32 | 10 | - | - | $1x10^{-8}$ |
| Wiluna Hardpan (Ferricrete) | 20 | 35 | 50 | - | - | $1x10^{-10}$ |
| Basalt Bedrock (XW/HW) | 22 | 38 | 100 | - | - | $1x10^{-9}$ |

**Table 4-2: Geotechnical design parameters – Post Seismic**

| Material | Bulk unit weight (kN/m3) | Drained shear strength properties | | Undrained shear strength properties | |
|---|---|---|---|---|---|
| | | ϕ' (°) | c' (kPa) | Su/σv' | $S_u$min (kPa) |
| Zone A (Compacted Clay) | 20 | 26.6 | 8 | - | - |
| Wiluna Hardpan (Ferricrete) | 20 | 29.3 | 40 | - | - |
| Basalt Bedrock (XW/HW) | 22 | 32.0 | 80 | - | - |

## 4.4 Seepage Assessment

### 4.4.1 Assessment Methodology

The seepage assessment was done using the 2D slope stability software Slide2, the analysis is based on the following assumptions.

- The pond is 1.0m above natural ground level.
- The natural ground water elevation approximately 30 m below natural ground.
- Material hydraulic parameters as per .

### 4.4.2 Seepage Results

Seepage modelling indicates that a phreatic surface is expected to develop through the embankment and extend into the natural foundation, terminating prior to reaching the downstream toe. However, the seepage rate into the foundation is anticipated to be low due to the low permeability of the underlying foundation materials. Detailed seepage analysis results are provided in Appendix B.

## 4.5 Slope Stability Assessment

### 4.5.1 Assessment methodology

Geotechnical slope stability assessments have been undertaken to assess the Factor of Safety (FoS) of the proposed embankment configuration for EPE. The approach adopted to assess slope stability as part of this report comprised of the following:

- The FoS of the perimeter embankment were estimated through limit-equilibrium calculations, using effective strength parameters and/or undrained strength parameters, depending on the embankment and foundation characteristics. The Morgenstern-Price calculation method was adopted for circular and non-circular failure modes.
- The stability of the perimeter slopes was checked under drained, undrained and post-seismic loading conditions.
- Slope stability was completed for the critical cross-section located southeast section of the EPE, as presented in  above.

### 4.5.2 Seismic Conditions

Peak ground accelerations were interpolated from the updated seismic hazard maps published by Geoscience Australia, 2018. The interpolation indicates peak ground acceleration (PGA) values for a range of return periods, summarized in .

**Table 4-3: Peak Ground acceleration Values for YGP (Geoscience Australia, 2018)**

| Return Period | PGA Value |
|---|---|
| 1:475 AEP | 0.0147 g |
| 1:1,000 AEP | 0.0246 g |
| 1:2,475 AEP | 0.0457 g |
| 1:10,000 AEP | 0.12 g |

### 4.5.3 Stability Results

Slope stability results for the critical cross-section based on the estimated strength parameters and assumptions are summarized in  below. Results indicate that stability is achieved under both static and seismic conditions. Stability results are presented in Appendix B.

**Table 4-4: TSF3 Slope Stability Results**

| Loading Condition | Required FoS | Achieved FoS |
|---|---|---|
| **Long-term Drained** | 1.50 | 5.3 |
| **Post-Seismic (20% Strength Reduction)** | 1.1-1.2 | 4.3 |

# 5 Water and Seepage Management

## 5.1 General

The EPE cells are intended to be operated in general accordance with the existing evaporation pond practices. It is recommended that Cells 4.1 to 4.4 be incorporated into the current Evaporation Pond Operational Manual. If no such manual exists, it is recommended that a comprehensive operational manual be developed to cover all existing and new evaporation pond cells to ensure consistent and effective water management practices.

## 5.2 Surface Water Management

Cells 4.1, 4.2, and 4.3 are designed to self-regulate their maximum pond level at 1.0 m using corrugated HDPE pipes installed through the interconnecting embankments. In addition, water level markers will be installed—consistent with the existing ponds—to allow for visual monitoring and to ensure that water levels do not exceed the maximum design depth of 1.0 m. This approach is intended to optimise evaporation and maintain the required freeboard for stormwater management.

## 5.3 Seepage Management

Minimal seepage is expected through the embankments due to the low permeability of the embankment fill material. To manage any potential seepage that may occur, a seepage interception drain has been incorporated along the southern and eastern embankment of Cell 4.4 This drain directs seepage into a designated sump, allowing for collection and recycling of water back into the facility, thereby supporting water conservation, intercepting seepage to minimise damage to downstream environment and maintaining embankment integrity. Refer to and Appendix A for details.

# 6 Construction

## 6.1 BoQ

Based on the modelling and design geometry, a summary of the approximate bill of quantities is summarised in below. Topsoil is to be cleared beneath the embankments prior to construction.

**Table 6-1: Estimated BoQ**

| EPE Cell No. | Bill of Quantities ($m^3$) |
|---|---|
| 4.1 | 7,176 |
| 4.2 | 8,921 |
| 4.3 | 9,263 |
| 4.4 | 10,137 |

## 6.2 Quality Assurance

Embankment construction will be carried out using traffic or roller compaction in maximum 300 mm lifts to 95% SMDD. Following substantial completion of the EPE construction, a Construction Completion Report will be prepared by a Competent Person—typically the design engineer—in accordance with the requirements of the DMPE Code of Practice (DMP, Sep 2013).

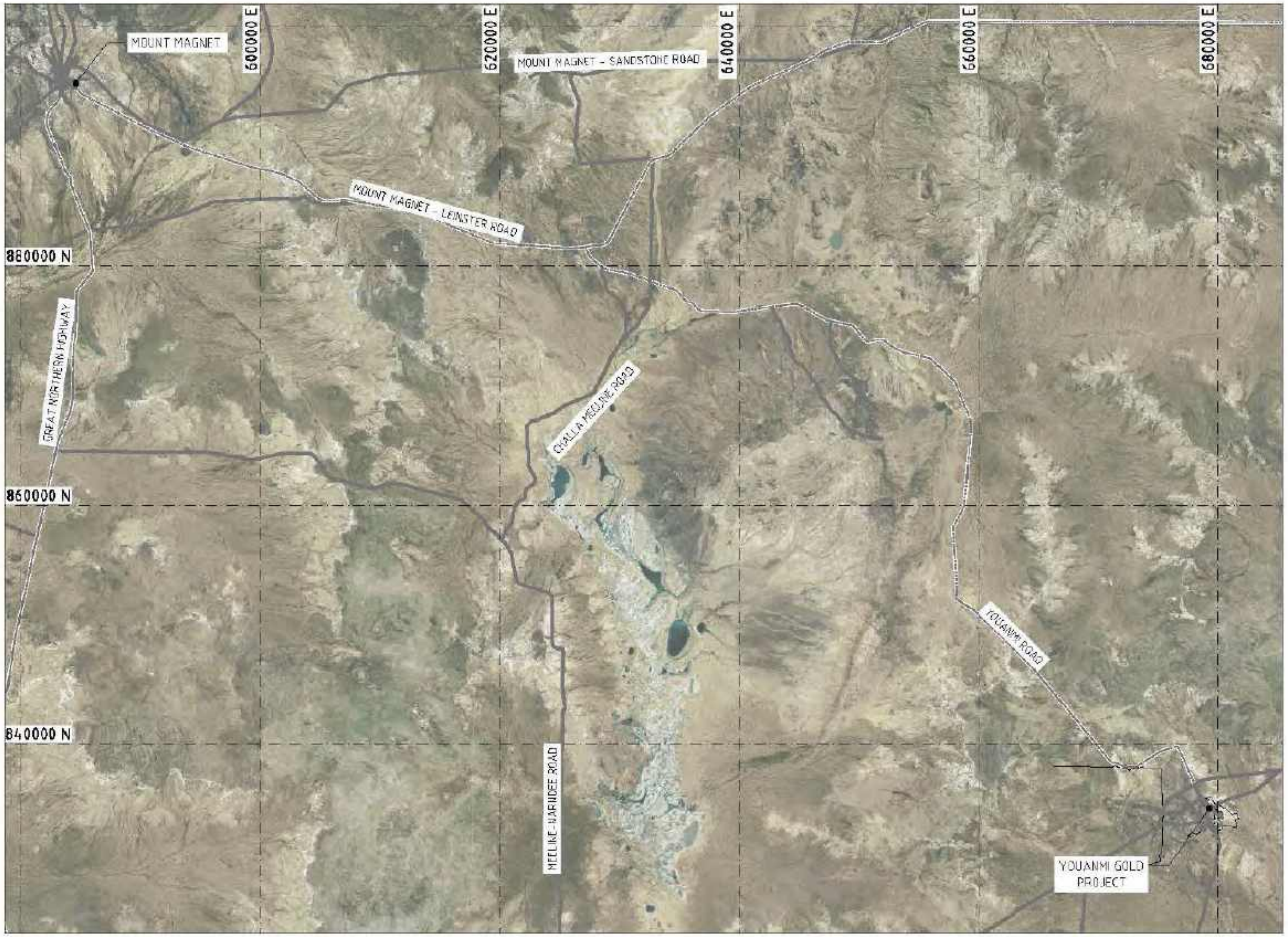
# 7 Closure

TailCon trusts that this technical memorandum provides a clear overview of the Evaporation Pond Extension design at YGP. Please feel free to contact us with any queries and comments.

[redacted]

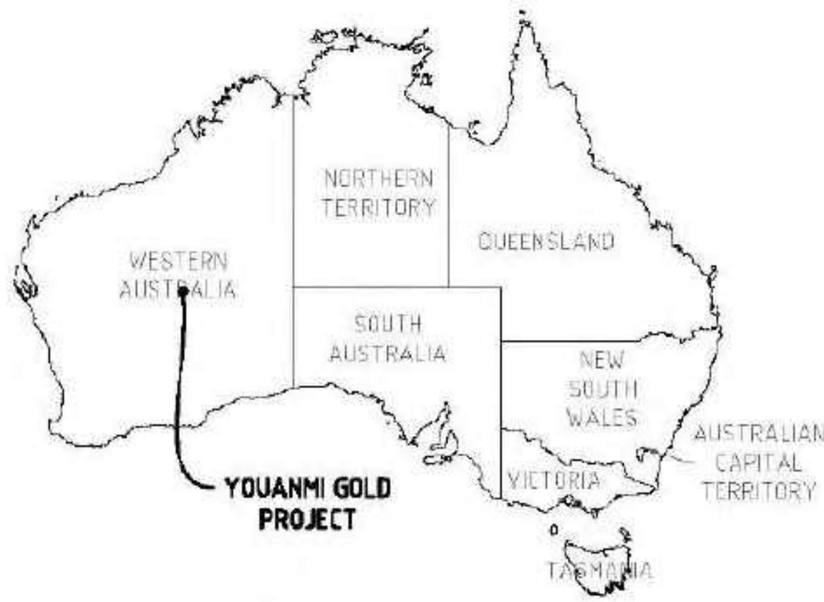
# Appendix A Design Drawings

# YOUANMI GOLD PROJECT
## EVAPORATION PONDS




SITE LOCATION
SCALE: 1:400,000

| DRAWING NO. | DRAWING TITLE |
|---|---|
| 160-01-3139C-DG001 | SITE LOCATION AND DRAWING INDEX |
| 160-01-3139C-DG002 | GENERAL ARRANGEMENT LAYOUT PLAN |
| 160-01-3139C-DG101 | EVAPORATION POND - LAYOUT PLAN AND TYPICAL DETAILS |




PROJECT LOCATION
N.T.S.

1:400,000 0 4,000 8,000m

| REV | REVISION | DATE | DWN | CHK | APP |
|---|---|---|---|---|---|
| A | ISSUED FOR REVIEW | 2025.07.25 | AX | MS | MS |

ORIGINAL SIZE A3

DRAWN: AX
DESIGNED: AS
CHECKED: MS
ENGINEER: MS
APPROVED:
RPEQ:
DATE:

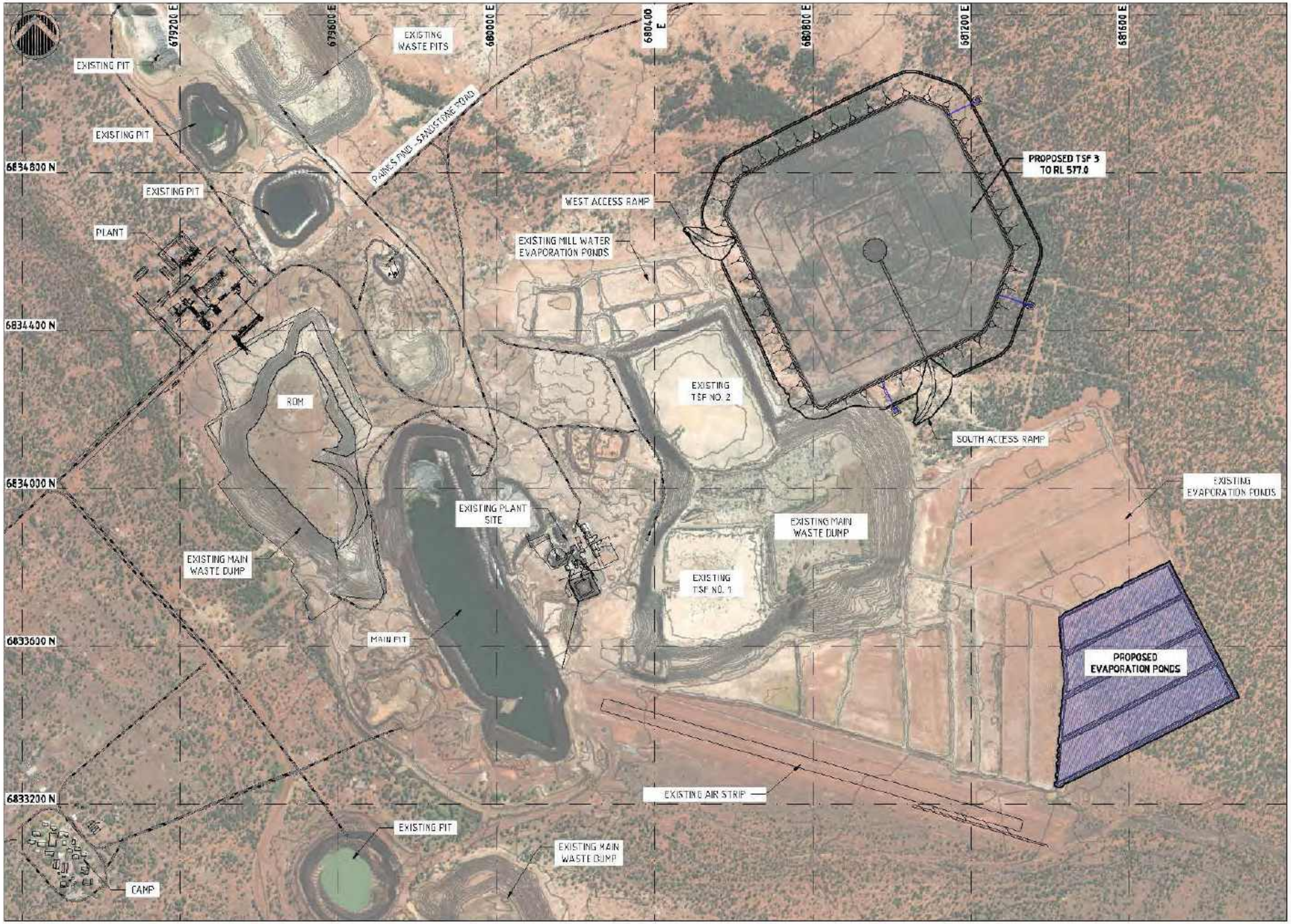
GDA94/MGA ZONE 50
HORIZONTAL DATUM
AHD
VERTICAL DATUM

TailCon Projects

CLIENT: ROX RESOURCES

PROJECT: YOUANMI GOLD PROJECT EVAPORATION PONDS
DRAWING TITLE: EVAPORATION PONDS
SITE LOCATION AND DRAWING INDEX

ISSUE: ISSUED FOR REVIEW
CLIENT DRAWING NO.
DRAWING NO. 160-01-3144C-DG001
REV A




SITE LAYOUT
SCALE: 1: 10,000

1:10,000 — 0 — 100 — 200m

| ORIGINAL SIZE A3 | | | | | |
|---|---|---|---|---|---|
| A | ISSUED FOR REVIEW | 2025.07.25 | AX | MS | MS |
| | REVISIONS | DATE | DWN | CHC | APP |

| | | | |
|---|---|---|---|
| DRAWN | AX | APPROVED | |
| DESIGNED | AS | RPEQ | |
| CHECKED | MS | | |
| ENGINEER | MS | DATE | |

GDA94 / MGA ZONE 50
HORIZONTAL DATUM
AHD
VERTICAL DATUM

TailCon Projects

CLIENT: ROX RESOURCES

PROJECT: YOUANMI GOLD PROJECT
EVAPORATION PONDS

DRAWING TITLE: EVAPORATION PONDS
GENERAL ARRANGEMENT LAYOUT PLAN

ISSUE: **ISSUED FOR REVIEW**

CLIENT DRAWING NO.

DRAWING NO. 160-01-3144C-DG002 REV A

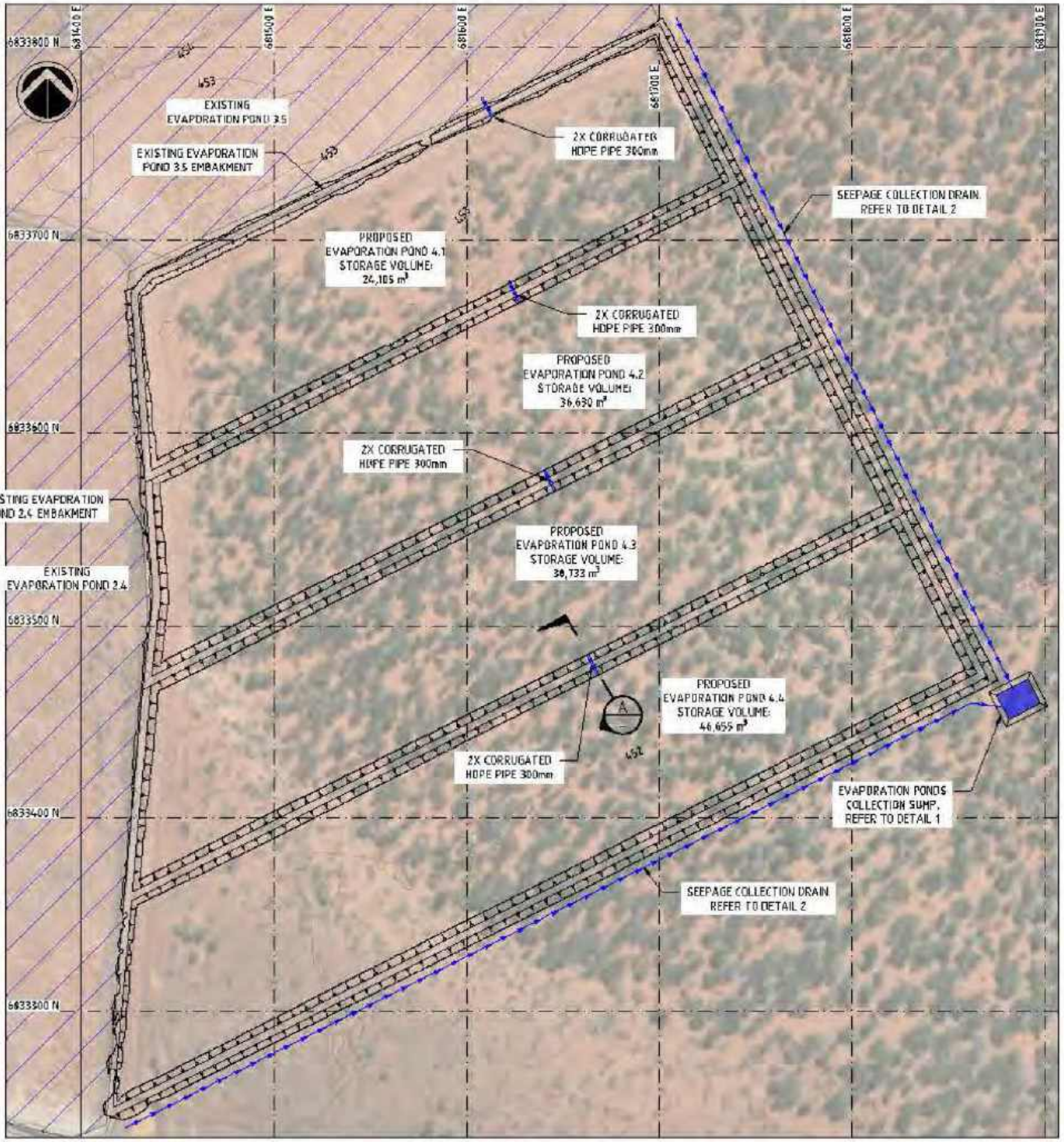
QR CODE

NOTES:

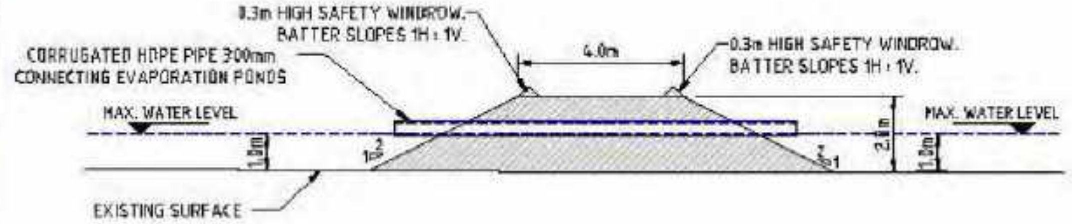
1. ALL DIMENSIONS ARE IN METRES (m) UNLESS OTHERWISE NOTED.

LEGEND:

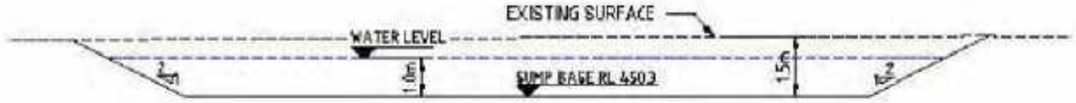
TRAFFIC COMPACTED MATERIAL



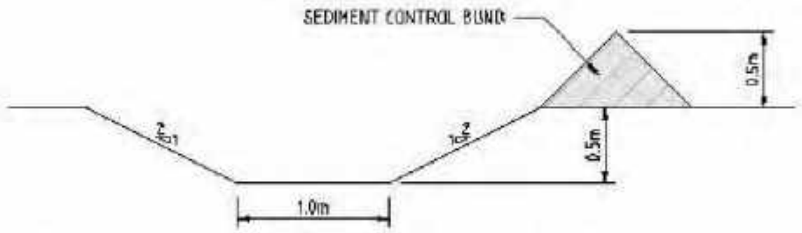

SITE LAYOUT
SCALE: 1:2,500




A EVAPORATION POND WALL - TYPICAL SECTION
SCALE 1: 200




1 COLLECTION SUMP - TYPICAL SECTION
SCALE 1 : 200




2 SEEPAGE COLLECTION DRAIN - TYPICAL SECTION
SCALE 1 : 50

| REV | REVISIONS | DATE | DWN | CHK | APP |
|---|---|---|---|---|---|
| B | REISSUED FOR REVIEW | 2025.09.11 | AX | MS | MS |
| A | ISSUED FOR REVIEW | 2025.07.25 | AX | MS | MS |

DRAWN: AX
DESIGNED: AS
CHECKED: MS
APPROVED: MS

GDA94/MGA ZONE 50
AHD

TailCon Projects

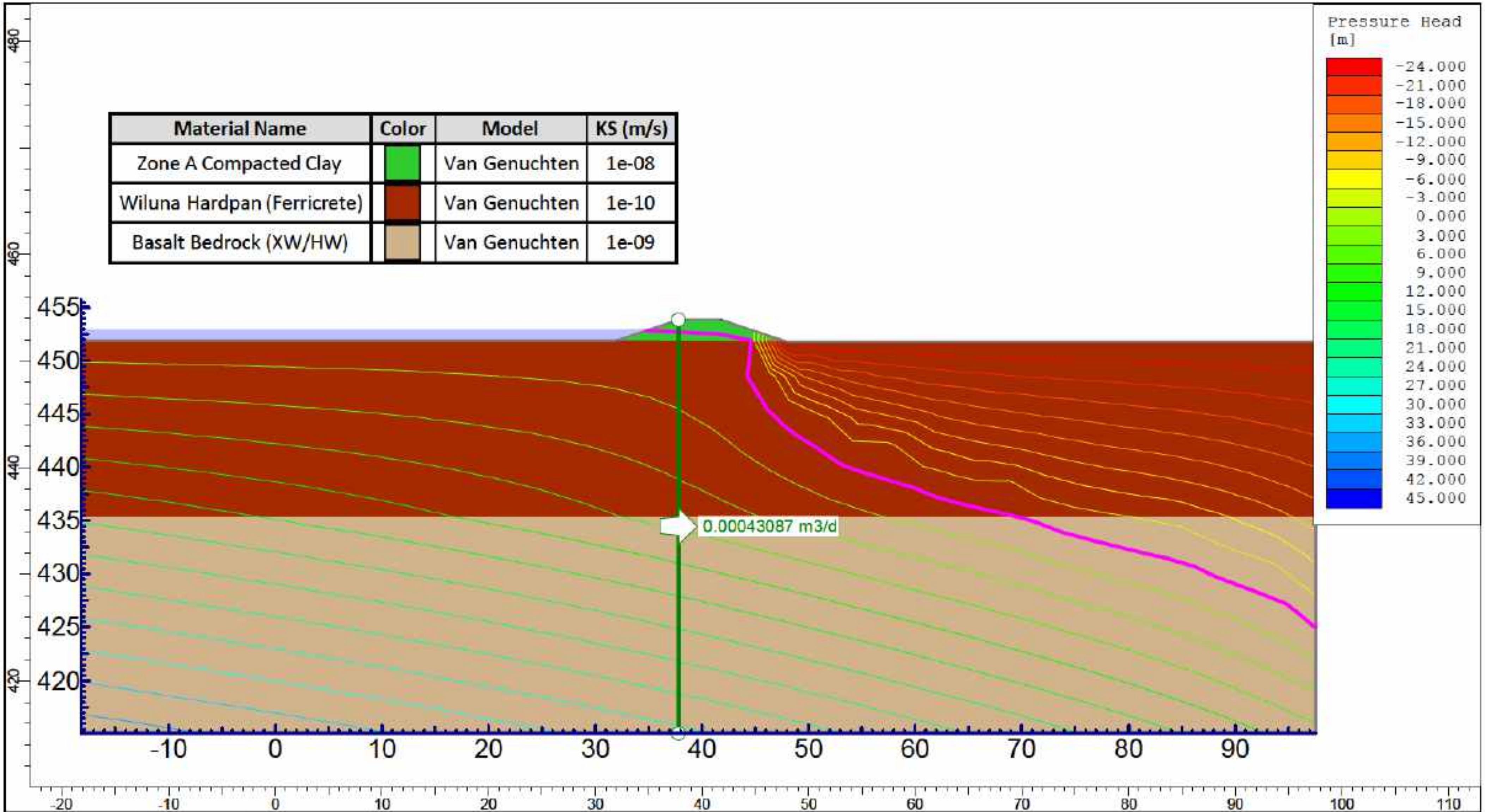
ROX RESOURCES

PROJECT: YOUANMI GOLD PROJECT EVAPORATION PONDS
DRAWING TITLE: EVAPORATION PONDS LAYOUT PLAN AND TYPICAL DETAILS

ISSUED FOR REVIEW

DRAWING NO. 160-01-3144C-DG0101 REV B

# Appendix B Seepage and Stability Results



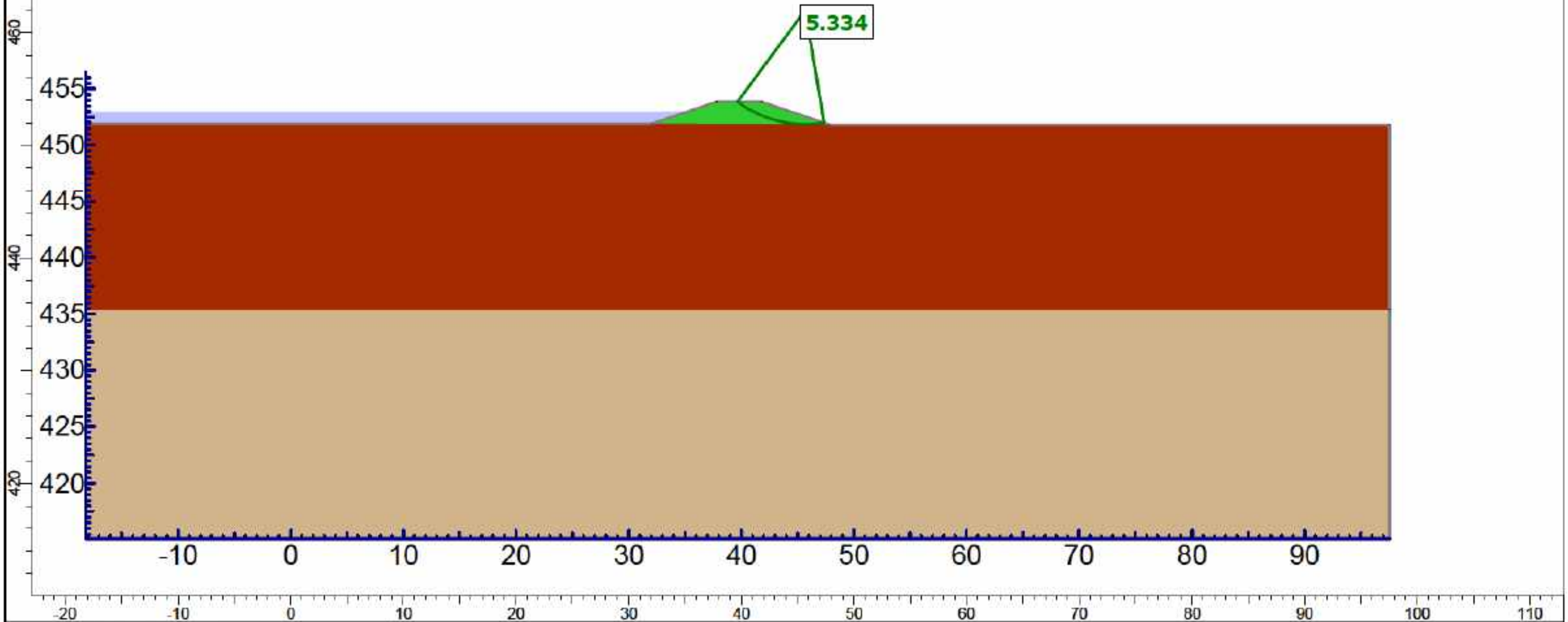

| Material Name | Color | Model | KS (m/s) |
|---|---|---|---|
| Zone A Compacted Clay | | Van Genuchten | 1e-08 |
| Wiluna Hardpan (Ferricrete) | | Van Genuchten | 1e-10 |
| Basalt Bedrock (XW/HW) | | Van Genuchten | 1e-09 |

**TailCon Projects**
Consulting

SLIDEINTERPRET 9.030

| | | | | | |
|---|---|---|---|---|---|
| *Project* | YOUANME Evaporation Pond Extension (EPE) | | | | |
| *Analysis Description* | EPE-Slope Stability Assessment | | | | |
| *Drawn By* SW | *Scale* 1:500 | *Paper Size* A4 | *Scenario Name* Seepage Results | | |
| *Date* 25/07/2025 | | | *File Name* EPE Slope stability Analysis.SW.slmd | | |

| Material Name | Color | Unit Weight (kN/m3) | Strength Type | Cohesion (kPa) | Phi (°) |
|---|---|---|---|---|---|
| Zone A Compacted Clay | | 20 | Mohr-Coulomb | 10 | 32 |
| Wiluna Hardpan (Ferricrete) | | 20 | Mohr-Coulomb | 50 | 35 |
| Basalt Bedrock (XW/HW) | | 22 | Mohr-Coulomb | 100 | 38 |

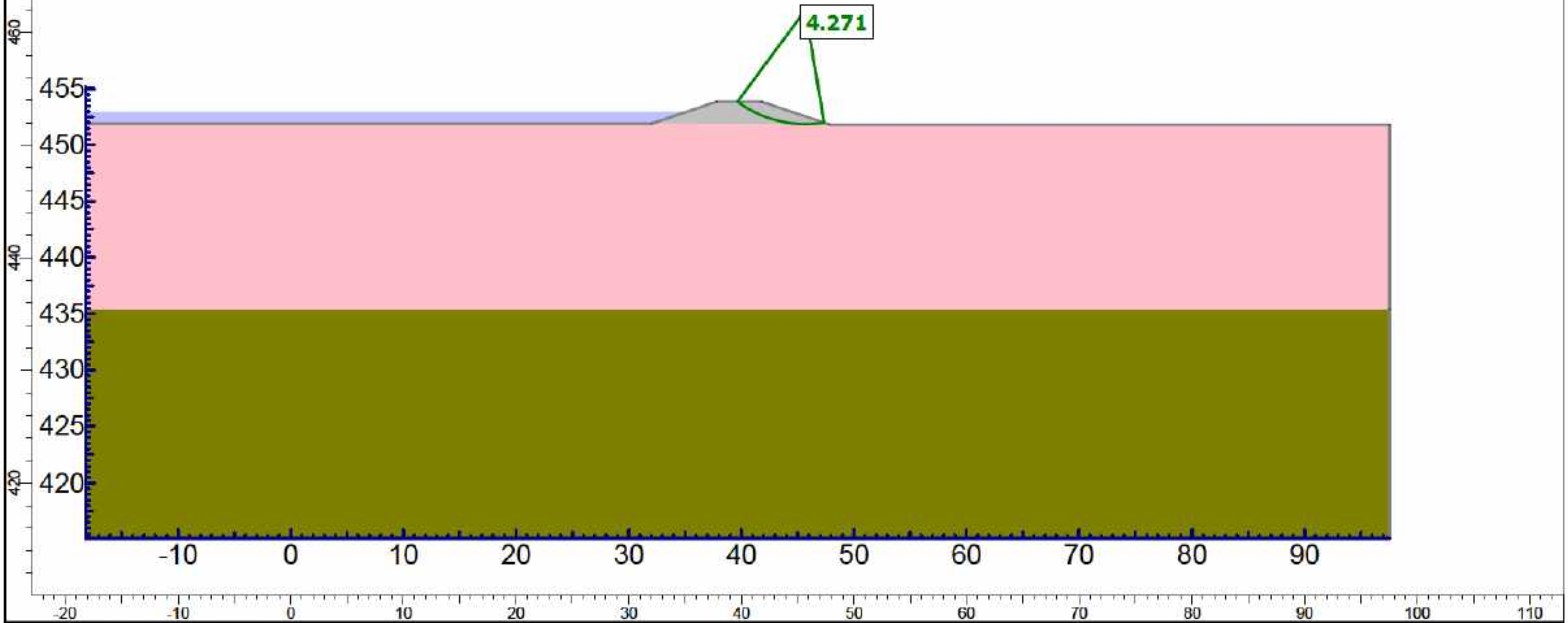



TailCon Projects Consulting

| | | | | | |
|---|---|---|---|---|---|
| *Project* | YOUANME Evaporation Pond Extension (EPE) | | | | |
| *Analysis Description* | EPE-Slope Stability Assessment | | | | |
| *Drawn By* SW | *Scale* 1:500 | *Paper Size* A4 | *Scenario Name* | Long-term static | |
| *Date* 25/07/2025 | | | *File Name* | EPE Slope stability Analysis.SW.slmd | |

SLIDEINTERPRET 9.030

| Material Name | Color | Unit Weight (kN/m3) | Strength Type | Cohesion (kPa) | Phi (°) |
|---|---|---|---|---|---|
| Zone A Compacted Clay (Post seismic) | | 20 | Mohr-Coulomb | 8 | 26.6 |
| Wiluna Hardpan (Ferricrete)-Post seismic | | 20 | Mohr-Coulomb | 40 | 29.3 |
| Basalt Bedrock (XW/HW)-Post Seismic | | 22 | Mohr-Coulomb | 80 | 32 |




TailCon Projects Consulting

SLIDEINTERPRET 9.038

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| *Project* | YOUANME Evaporation Pond Extension (EPE) | | | | | | |
| *Analysis Description* | EPE-Slope Stability Assessment | | | | | | |
| *Drawn By* | SW | *Scale* | 1:500 | *Paper Size* | A4 | *Scenario Name* | Post Seismic |
| *Date* | 25/07/2025 | | | | | *File Name* | EPE Slope stability Analysis.SW.slmd |

## 17.8 Appendix 8. AQ2 (2025b). Evaporation Pond Expansion Hydrological Impact Assessment

AQ2 Pty Ltd
ABN 38 164 858 075

Ground Floor
1 Howard Street
Perth WA 6000
Tel +61 8 9322 9733

www.aq2.com.au

# Memo

| | | | |
|---|---|---|---|
| [redacted] | | Company | Rox Resources |
| | | Job No. | 581D |
| Date | 11/12/2025 | Doc No. | 581D_013a |
| Subject | Youanmi Project - Evaporation Pond Expansion: Hydrological Impact Assessment | | |

Dan,

The following technical memo report presents the outcomes of our surface water and groundwater assessments related to the proposed expansion of the evaporation ponds at the Youanmi mine site.

## 1. BACKGROUND

Rox Resources (Rox) is planning to restart mining at the Youanmi Project (the Project) by significantly extending the existing underground workings to form three separate underground mining areas, comprising Main Lode, Pollard and Link.

A series of unlined evaporation ponds were constructed as part of past mining campaigns to assist with managing the surplus dewatering generated. Rox Resources proposes adding additional cells to the existing evaporation ponds in the south-eastern corner of the site, as shown in Figure 1.1. These additional cells are proposed to assist in managing the expected dewatering volumes generated as part of a proposed underground mining campaign. As part this campaign, the water within some of the pit lakes which have formed in the existing open cut pits needs to be removed to recommence mining, plus the requirement for ongoing dewatering.

The intent of the following report is to support environmental approval submissions by Rox for the proposed Evaporation Pond Expansion (EPE). to the report documents assessments completed on the potential impacts of the proposed EPE on the local surface water and groundwater systems, including considerations for water management and monitoring.

The EPE is proposed to be constructed on the southeast corner of the existing evaporation ponds (as shown in Figure 1.1), with a total footprint area of 152,488 $m^2$. A layout of the evaporation ponds is provided in Figure 1.2. The EPE comprises four interconnected evaporation cells.


Figure 1.1 Youanmi Existing Mine Layout and Proposed Evaporation Pond Extension in Purple (TailCon, 2025)

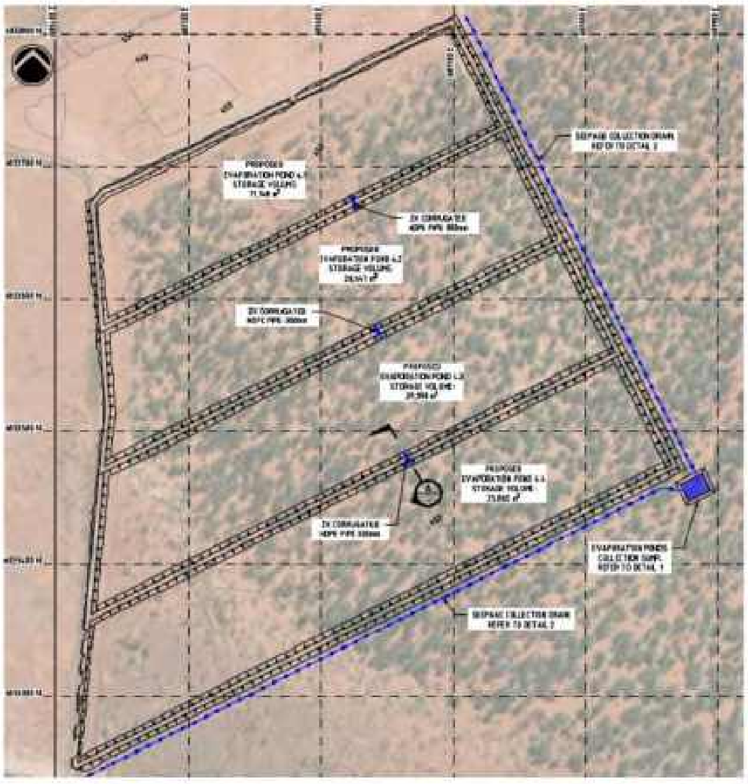


Figure 1.2 Proposed Evaporation Pond Expansion Design (TailCon, 2025)

# 2. BASELINE ENVIRONMENTAL DATA

## 2.1 Climate

### 2.1.1 General

The Youanmi site is in a region with a Köppen climate classification of hot (summer drought) grassland with hot dry summers and cold winters (BOM 2025a). The closest weather station to the site is Sandstone (012072); details of this weather station are shown in Table 2.1.

The average annual daily maximum temperature at Sandstone is 27.3°C, with the highest average daily maximum temperatures in January of 35.8°C and lowest average minimum temperatures in July of 5.1°C. Individual daily maximum temperatures can exceed 40°C during the summer and minimum temperatures close to 0°C can occur during winter.

Average monthly rainfall is low across all months of the year with the highest monthly average rainfall depths occurring from January to March. The average rainfall in these months is likely to be driven by the occurrence of rare, large rainfall events, which result in the monthly rainfall totals for January to March being highly variable. Average monthly evaporation rates exceed the average monthly rainfall throughout every month of the year, with runoff events generated by short-duration intense rainfall events.

Table 2.1 Sandstone Weather Station Details

| Site Name | BOM Site Number | Rainfall Data Period | Distance From Site (km) |
|---|---|---|---|
| Sandstone | 012072 | 1904 -2025 | 80 |

Table 2.2 Sandstone Monthly Climate Statistics (source BOM 2025b)

| Statistic | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Annual |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mean Max Temp (°C) | 35.8 | 35.5 | 32.4 | 27.7 | 22.1 | 18.2 | 17.5 | 19.6 | 24.1 | 27.6 | 32.4 | 35.3 | 27.3 |
| Mean Min Temp (°C) | 21.3 | 20.9 | 18.4 | 14.1 | 9.3 | 6.3 | 5.1 | 8.8 | 8.8 | 11.8 | 16.6 | 19.8 | 13.2 |
| Mean Rainfall (mm) | 30.8 | 33.3 | 29.3 | 19.3 | 26.0 | 26.2 | 22.4 | 18.0 | 7.7 | 8.5 | 11.3 | 16.7 | 249.7 |
| Mean Pan Evaporation (mm)* | 411 | 331 | 292 | 186 | 120 | 81 | 83 | 109 | 170 | 257 | 320 | 389 | 2750 |

* Pan evaporation taken from BOM maps of average pan evaporation for the Youanmi site location

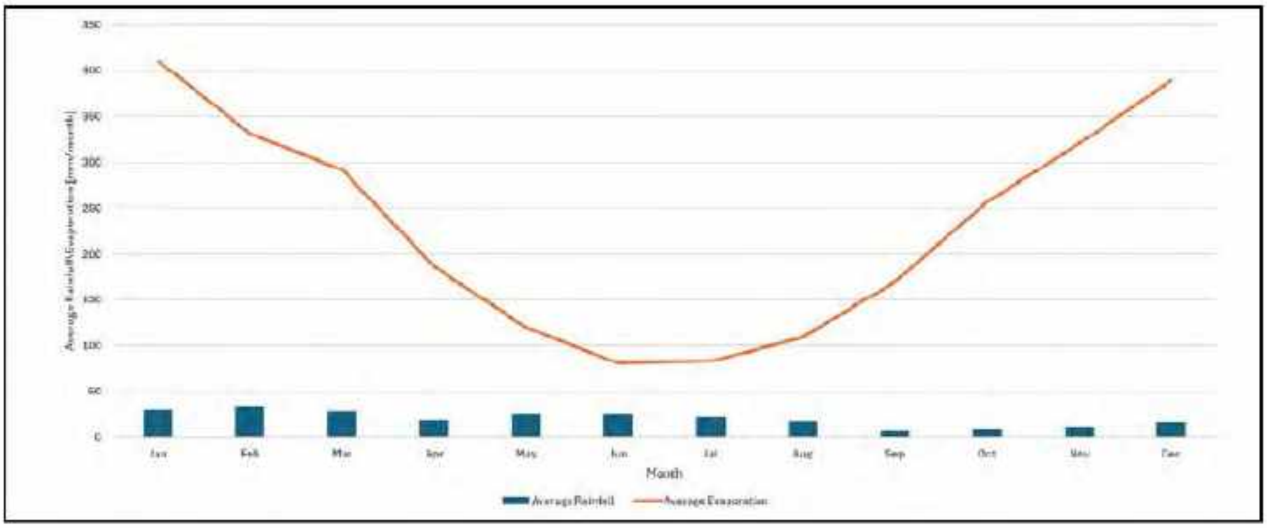



Figure 2.1 Sandstone Monthly Average Rainfall vs Evaporation

### 2.1.2 Rainfall

Rainfall data is available from the Sandstone Station from 19104 to 2024, noting the station is still open. The average annual rainfall is highly variable and rainfall patterns are typically associated with cold fronts in winter. Thunderstorms and larger rainfall events typically result from rain bearing ex-tropical depressions in summer.

The daily rainfall record is shown in Figure 2.2 and over the recorded rainfall period there have been about 7 daily rainfall events which were in the order of 100 mm or higher (average recurrence interval of ~20 years). The highest daily rainfall total recorded at Sandstone was 144 mm on 24 February 1975 and associated with the passing of Cyclone Trixie through the region. Note that this rainfall total was actually recorded over a 2-day period (with no recording on 23 February). The event resulted in a total of 281 mm over four days. Another significant rainfall event occurred on 13 January 1939 (127 mm) following a cyclone which struck the Pilbara.

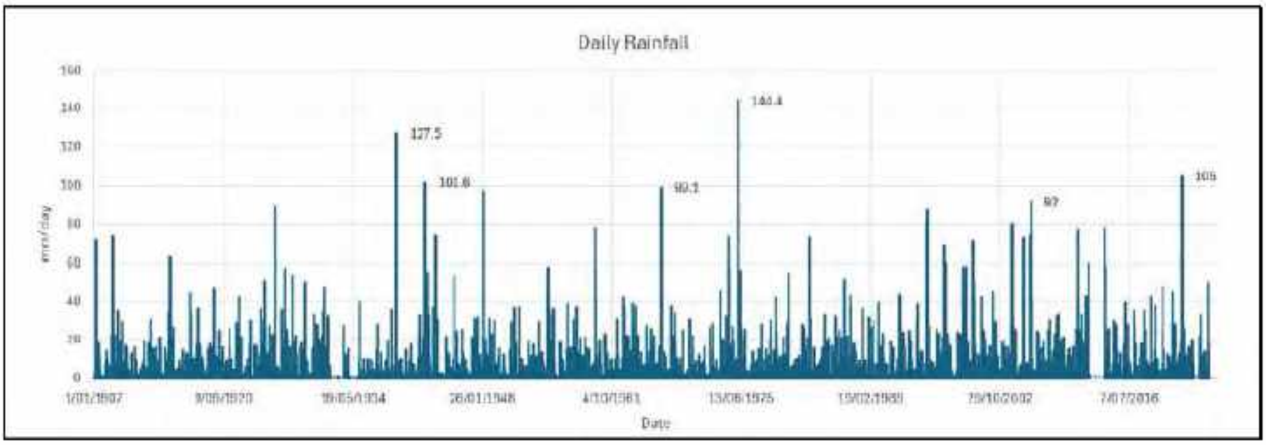



Figure 2.2 Daily Rainfall from the Sandstone Station (012072)

Rainfall IFD data was sourced from BOM for the Project location. The IFD data is shown in Table 2.3.

Table 2.3 IFD Rainfall Depth

| Duration | 63.20% | 50% | 20% | 10% | 5% | 2% | 1% | 1 in 200 | 1 in 500 | 1 in 1000 | 1 in 2000 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 min | 1.11 | 1.34 | 2.14 | 2.76 | 3.43 | 4.4 | 5.24 | 5.97 | 7.2 | 8.25 | 9.38 |
| 2 min | 1.86 | 2.25 | 3.62 | 4.68 | 5.78 | 7.47 | 8.92 | 10.3 | 12.6 | 14.5 | 16.6 |
| 3 min | 2.55 | 3.09 | 4.96 | 6.4 | 7.92 | 10.2 | 12.2 | 14 | 17 | 19.6 | 22.4 |
| 4 min | 3.16 | 3.83 | 6.14 | 7.91 | 9.79 | 12.6 | 15 | 17.2 | 20.9 | 24 | 27.4 |
| 5 min | 3.7 | 4.48 | 7.17 | 9.24 | 11.4 | 14.7 | 17.5 | 20 | 24.2 | 27.8 | 31.7 |
| 10 min | 5.67 | 6.86 | 11 | 14.1 | 17.5 | 22.5 | 26.8 | 30.4 | 36.6 | 41.9 | 47.6 |
| 15 min | 6.97 | 8.43 | 13.5 | 17.4 | 21.6 | 27.7 | 32.9 | 37.4 | 45.1 | 51.5 | 58.6 |
| 20 min | 7.93 | 9.59 | 15.3 | 19.8 | 24.6 | 31.6 | 37.5 | 42.7 | 51.5 | 58.9 | 67 |
| 25 min | 8.7 | 10.5 | 16.8 | 21.7 | 26.9 | 34.6 | 41.2 | 46.9 | 56.7 | 64.8 | 73.8 |
| 30 min | 9.33 | 11.3 | 18.1 | 23.3 | 28.9 | 37.2 | 44.3 | 50.5 | 61 | 69.8 | 79.5 |
| 45 min | 10.8 | 13.1 | 20.9 | 26.9 | 33.4 | 43.1 | 51.3 | 58.7 | 71 | 81.3 | 92.7 |
| 1 hour | 11.9 | 14.4 | 23 | 29.7 | 36.8 | 47.5 | 56.6 | 64.7 | 78.3 | 89.8 | 102 |
| 1.5 hour | 13.6 | 16.4 | 26.2 | 33.8 | 41.9 | 54 | 64.5 | 73.7 | 89.2 | 102 | 117 |
| 2 hour | 14.9 | 18 | 28.7 | 36.9 | 45.8 | 59.1 | 70.5 | 80.6 | 97.5 | 112 | 127 |
| 3 hour | 17 | 20.4 | 32.6 | 41.9 | 52 | 67.1 | 80 | 91.2 | 110 | 126 | 144 |

| Duration | 63.20% | 50% | 20% | 10% | 5% | 2% | 1% | 1 in 200 | 1 in 500 | 1 in 1000 | 1 in 2000 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 4.5 hour | 19.4 | 23.3 | 37.1 | 47.7 | 59.2 | 76.3 | 91 | 103 | 124 | 142 | 162 |
| 6 hour | 21.3 | 25.6 | 40.6 | 52.3 | 65 | 83.8 | 99.8 | 113 | 136 | 155 | 176 |
| 9 hour | 24.3 | 29.2 | 46.3 | 59.7 | 74.4 | 95.7 | 114 | 129 | 155 | 176 | 200 |
| 12 hour | 26.7 | 32 | 50.7 | 65.5 | 81.8 | 105 | 125 | 141 | 170 | 194 | 220 |
| 18 hour | 30.2 | 36.2 | 57.4 | 74.3 | 93.2 | 120 | 143 | 162 | 195 | 223 | 252 |
| 24 hour | 32.7 | 39.2 | 62.3 | 80.9 | 102 | 131 | 156 | 178 | 215 | 246 | 280 |
| 30 hour | 34.6 | 41.4 | 66 | 86 | 108 | 140 | 167 | 193 | 234 | 268 | 305 |
| 36 hour | 36.1 | 43.2 | 69 | 90.1 | 114 | 147 | 175 | 204 | 249 | 286 | 327 |
| 48 hour | 38.2 | 45.7 | 73.4 | 96.2 | 122 | 158 | 188 | 222 | 272 | 315 | 362 |
| 72 hour | 40.7 | 48.7 | 78.5 | 103 | 132 | 171 | 205 | 243 | 301 | 352 | 409 |
| 96 hour | 42 | 50.3 | 81.2 | 107 | 137 | 178 | 214 | 255 | 317 | 373 | 435 |
| 120 hour | 42.9 | 51.3 | 82.6 | 109 | 139 | 182 | 218 | 261 | 325 | 385 | 450 |
| 144 hour | 43.4 | 52 | 83.4 | 109 | 141 | 183 | 220 | 264 | 329 | 390 | 456 |
| 168 hour | 43.9 | 52.5 | 83.9 | 109 | 141 | 184 | 221 | 265 | 331 | 391 | 458 |

### 2.1.3 Probable Maximum Precipitation (PMP)

The BoM has developed several methods for estimating the PMP rainfall depth depending on storm duration for the Project region. To determine the appropriate PMP rainfall intensity for the site, two methods were used to estimate the design rainfall depth: the GTSMR (Generalised Tropical Storm Method) and the GSAM (Generalised Southeast Australian Method). The PMP rainfall depths generated by the GTSMR method were adopted for this assessment, as they were significantly larger and more consistent with the rainfall depths for rare rainfall events estimated by the IFD curves.

A summary of the GTSMR-generated PMP rainfall depths for a point location and the for the whole catchment's wide application (considering a reduction in average rainfall depth over a large catchment) are summarised in Table 2.4. The PMP adopted for this assessment is the 72-hour duration event, in accordance with the evaporation pond crest levee design criteria (TailCon 2025) for freeboard.

Table 2.4 Probable Maximum Precipitation

| PMP Calculation | 72hr Rainfall (mm) |
|---|---|
| Point Location | 1370 |

## 2.2 Topography

Since the Project's inception in 1987, mining landforms have been developed, altering the groundsurface elevation. The existing topography at the proposed EPE site varies from elevations of 470 mAHD to 490 mAHD, with the ground generally sloping downwards from the northwest to the southeast. The existing site topography is shown in Figure 2.3.


Figure 2.3 Youanmi Mine Site Topography

## 2.3 Hydrology

### 2.3.1 Regional Hydrology

The Youanmi mine site is located within the broader Reaside-Ponton catchment (DWER 2025), which forms part of an extensive regional drainage system. The mine site is situated at the upper end of the Lake Noondie catchment, with drainage from the site flowing into a tributary of one of the main Lake Noondie tributary drainage lines. The drainage path from the mine site to Lake Noondie is approximately 28 km.

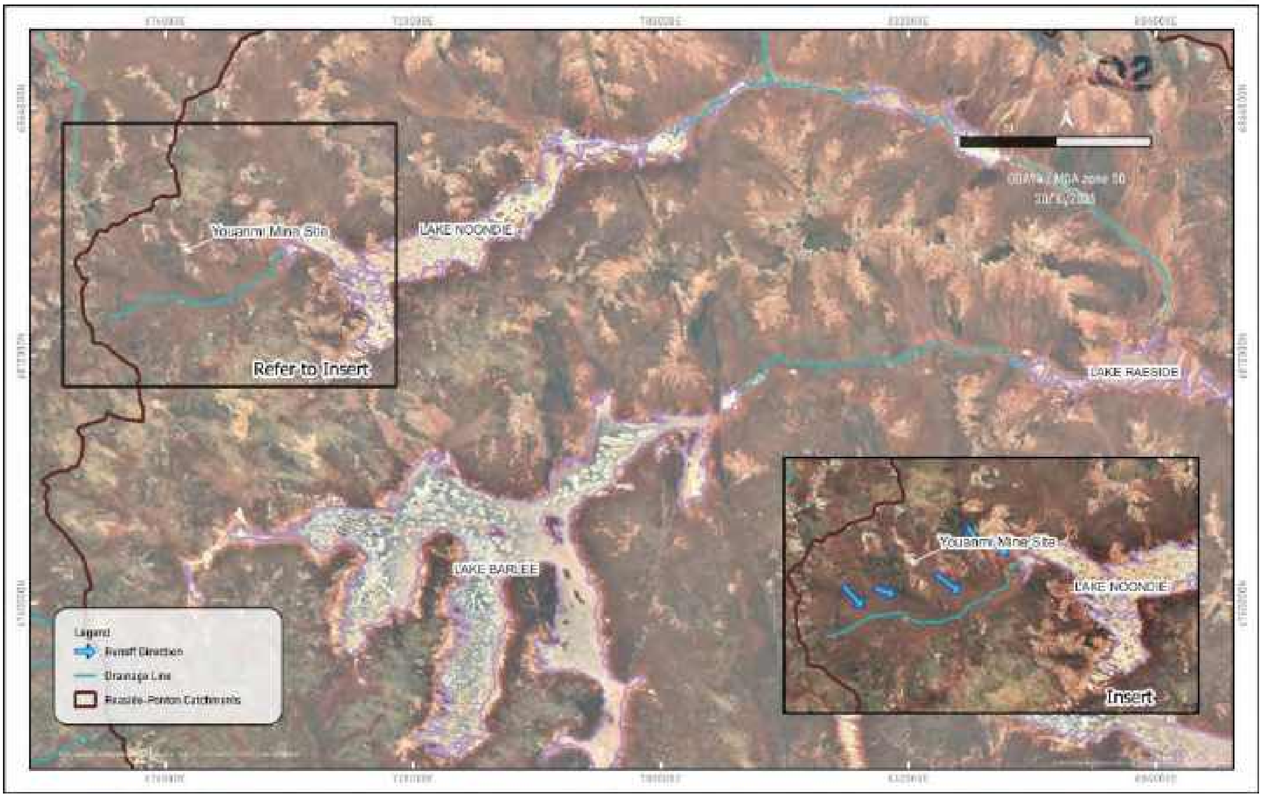



Figure 2.4 Regional Hydrology

### 2.3.2 Project Hydrology

The existing mine disturbance area spans across a localised ridge line, with runoff from the ridge line flowing to the east or west. The ridge line acts as a catchment divide to two localised surface water catchments (A and B), which convey water through the mine disturbance area. Catchments A and B converge immediately downstream of the mining area, with any drainage flow continuing from the convergence point to Lake Noondie.

Catchment A, located to the west of the ridge, commands a catchment area of 37 $km^2$ to the point where it converges with Catchment B. Catchment A contains a defined creek line (named Western Creek for this report) with a sandy/gravelly base and hosts the historic water supply bores for the Youanmi townsite.

The EPE is located within Catchment B, which commands a catchment area of 70 $km^2$ and is located on the eastern side of the ridge. Although defined creek channels are apparent in the upper parts of the catchment, the main drainage path within this catchment adjacent to the EPE (Eastern Creek) is poorly defined, with flow likely to be characterised by a broad area of concentrated shallow sheet flow.

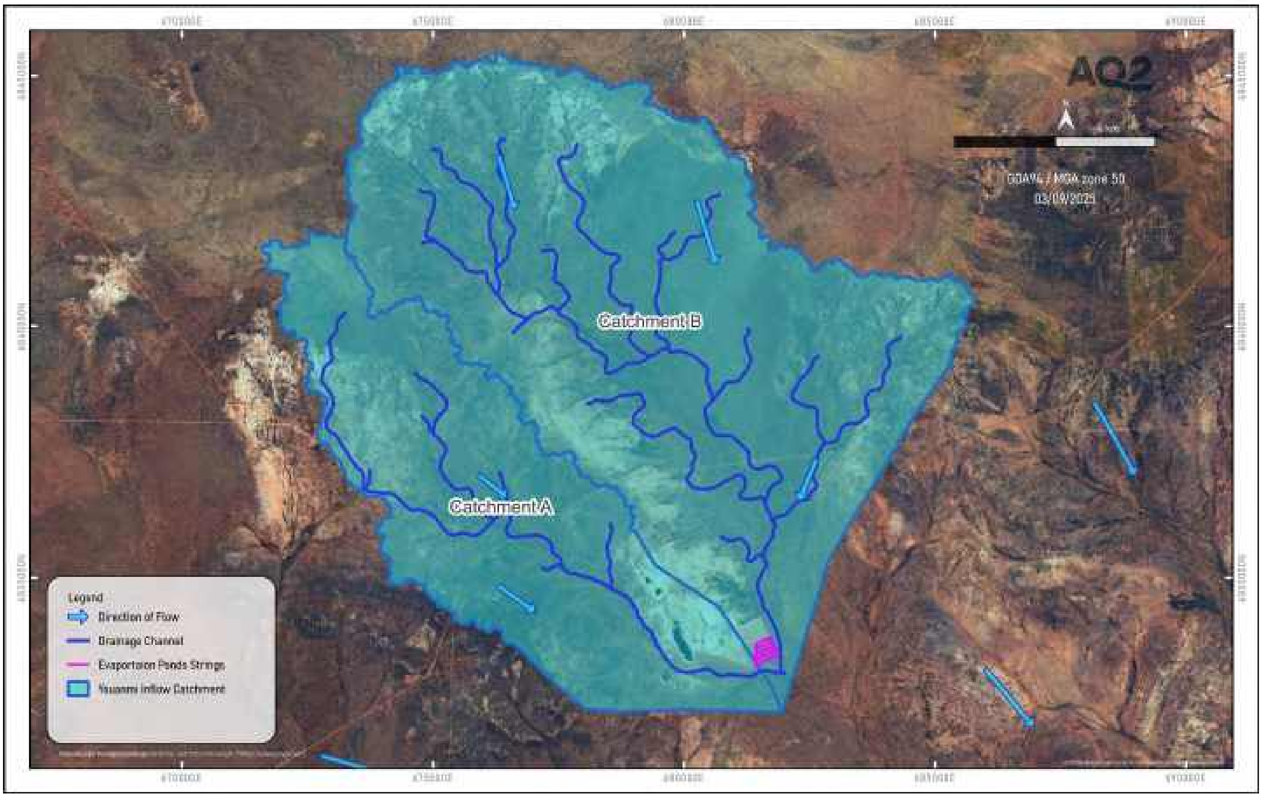



Figure 2.5 Local Hydrology


Figure 2.6 Drainage Lines and EPE Footprint Area

## 2.4 Hydrogeology

The geology and hydrogeology of the Project area have been documented in the recent Water Assessment report (AQ2, 2025), with the local geology and hydrogeology in the proposed EPE area being summarised below.

### 2.4.1 Local Geology

A geotechnical site investigation consisting of test pits across the proposed EPE footprint was completed in July 2025 (TailCon, 2025). The geotechnical results indicate the following subsurface profile:

- Topsoil - 0.1 to 0.3 m –top layer comprising brown, slightly moist, sandy and gravelly silt/clay with roots. The topsoil is typically firm to stiff and of low plasticity.
- Colluvium - 0.3 to 1 m –consisting of sandy, gravelly silt/clay.
- Ferricrete (Wiluna Hardpan) followed by weathered basalt bedrock – more than 1 m.

The foundation of the EPE is similar to the southern sections of the proposed TSF3 and is considered geotechnically strong and with low foundation permeability. The subsurface materials, comprising cemented colluvium, ferricrete, silcrete hardpan, weathered granite, and rock, provide high resistance to shear under static and dynamic loads.

### 2.4.2 Local Aquifers

The local and regional underlying bedrock has little to no primary aquifer permeability and its aquifer potential is associated with fracture and weathering induced secondary permeability and porosity. In the Project area, five local aquifers (or aquitards) have been identified:

- Surficial sediments (valley-fill deposits)– associated with recent cover material (transported sediments i.e., sand, silt and clay).
- Fault/Fractured/shear zones – a fractured rock aquifer system associated with the northwest trending mineralised shear zones that host the Youanmi orebodies.
- Saprock - associated with slightly weathered material in the transition zone from decomposed/highly weathered (clay rich saprolite) to fresh bedrock.
- Saprolite – associated with shallow weathered horizons (clay rich).
- Fresh basement rock - associated with fresh and weakly fractured basement rocks at depth.

It should be noted that there is no evidence of the Raeside basal palaeochannel aquifer, (i.e. high yielding, hypersaline aquifer associated with alluvial sands and gravels deposited within the base of the paleovalleys), within the footprint of the mining area.

### 2.4.3 Groundwater Levels and Flow Directions

There are three monitoring bores comprising SMB1, SMB2 and SMB3, located in the vicinity of the proposed EPE (as shown in Figure 2.7). Depth to water in the EPE area currently ranges from 23.5 to 24 metres below ground level (mbgl). This equates to a groundwater elevation of around 429.7 to 430.8 mAHD (Figure 2.6). Current groundwater levels have been influenced by the presence of mined out pits, which are all groundwater sinks. As a result, there is groundwater flow towards all pits and this flow has influenced the general groundwater flow patterns and local groundwater levels (Figure 2.7). The data shows that the groundwater flow direction in the vicinity of the proposed EPE is to the south-southwest towards the Main Pit.


Figure 2.7 Existing Bores Nearby Proposed Evaporation Pond Expansion

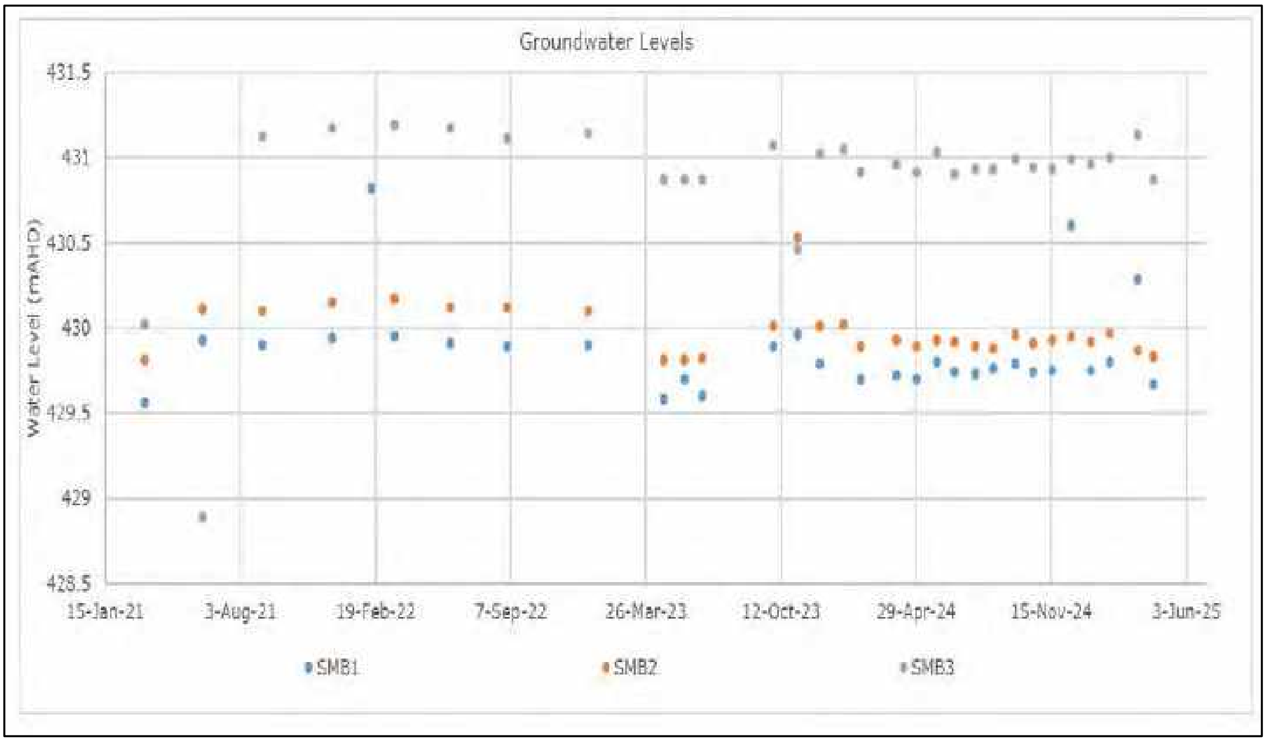



Figure 2.8 Current Monitoring Bore Groundwater Level Elevations

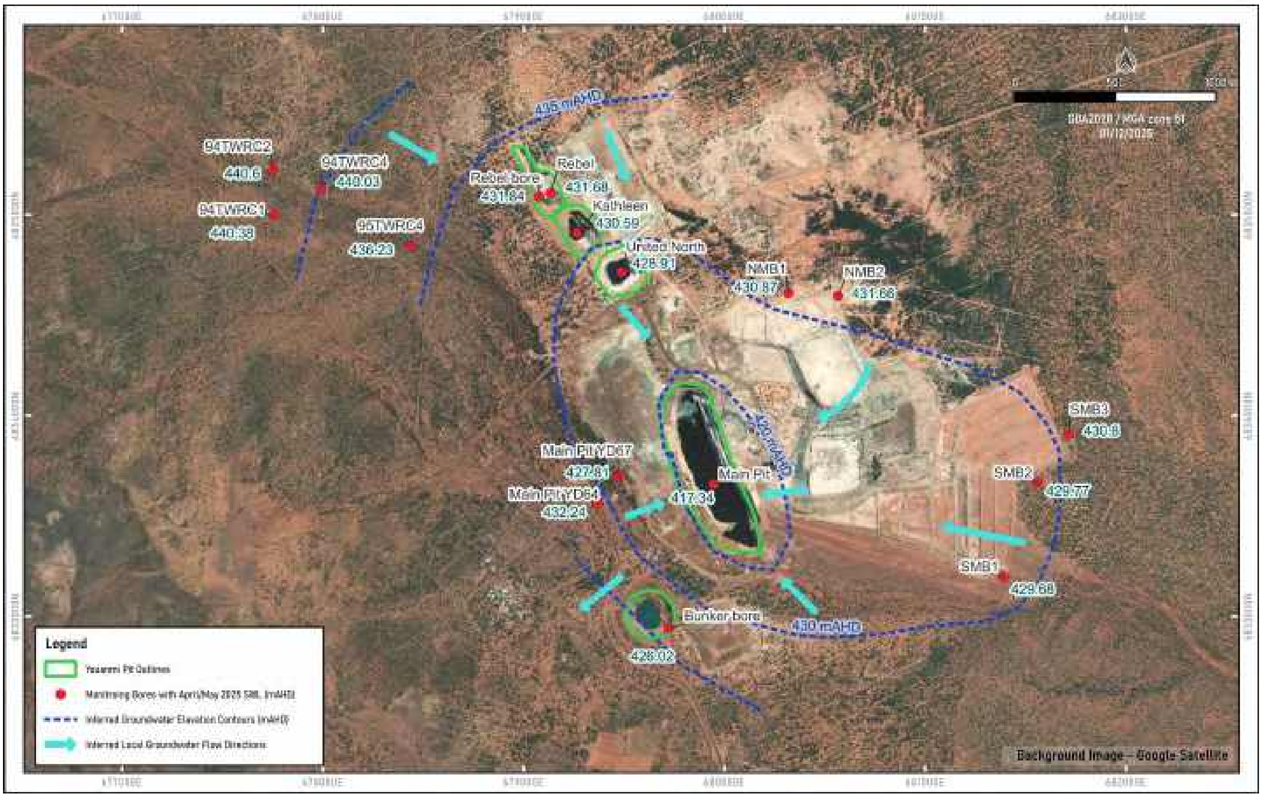



Figure 2.9 Current Monitoring Bore and Pit Lake Water Levels

### 2.4.4 Groundwater Quality

The recent water quality monitoring records from monitoring bores SMB1-SMB3 are shown in Figure 2.8. The results indicate that the groundwater is characterised as slightly alkaline (pH range of 7.1 to 8.1). The salinity ranges from 2,000 to 4,000 mg/L Total Dissolved Solids (TDS) in bores SMB2 and SMB3 and from 18,000 to 41,500 mg/L TDS in SMB1, indicating groundwater being brackish to hypersaline. The elevated salinities in SMB1 are likely related to a historical over-topping event of the evaporation ponds during cyclonic-related rainfall. Groundwater is generally slightly alkaline and of sodium chloride type, with low calcium and bicarbonate concentrations (indicating limited rainfall recharge).

### 2.4.5 Foundation Permeability

There has been no test work undertaken within the proposed EPE footprint to estimate the permeabilities of the in-situ soils. TailCon (2025) adopted the following permeabilities of the foundation material based on the results from geotechnical investigation and experience on similar projects:

- Colluvium / Ferricrete (Wiluna Hardpan) – $1x10^{-2}$ m/d to $1x10^{-3}$ m/d (i.e. $1x1\ 10^{-7}$ m/s $1x1\ 10^{-8}$ m/s).
- Weathered Bedrock (granite & basalt)- $1x10^{-3}$ m/d (i.e. $1x1\ 10^{-8}$ m/s).

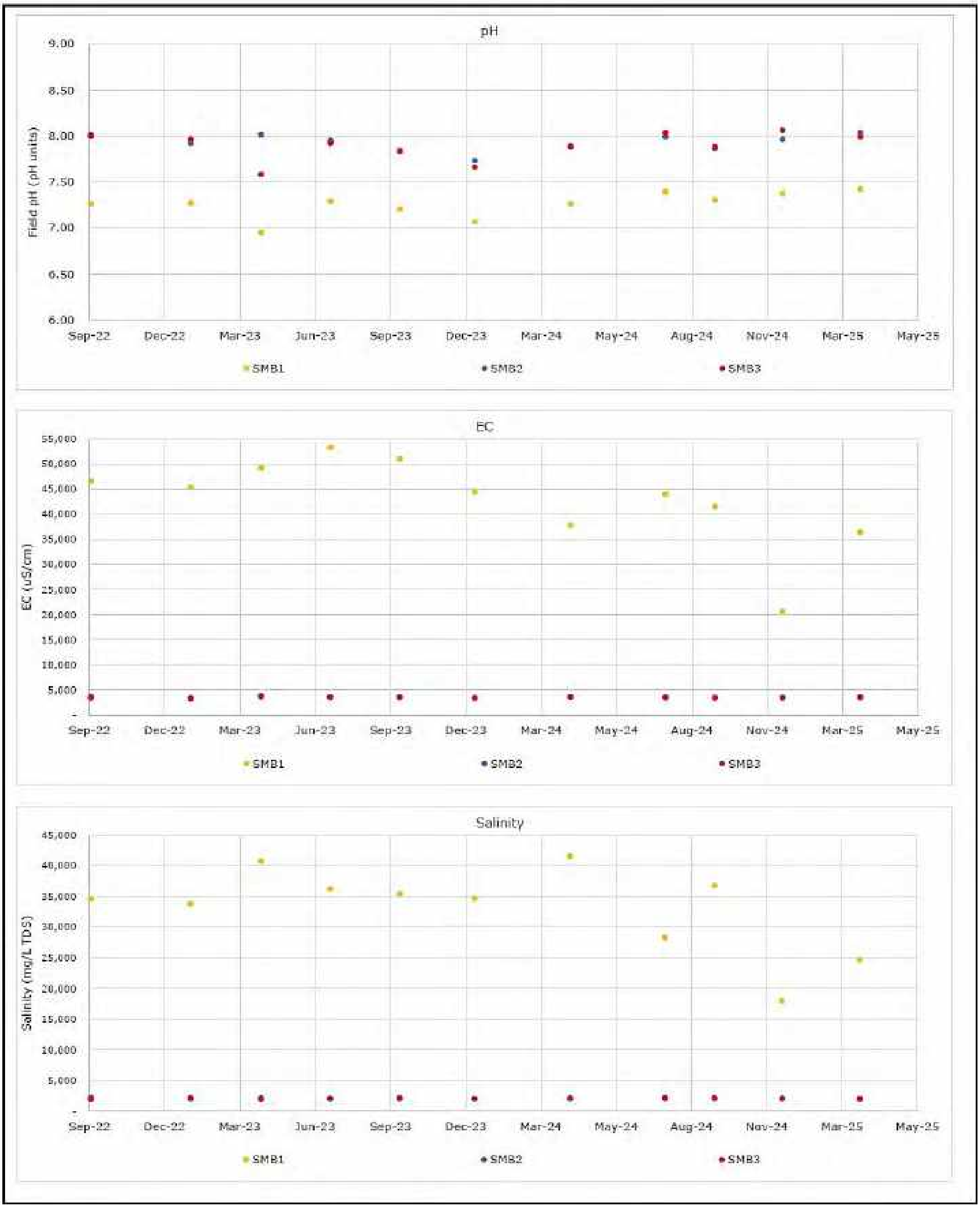



Figure 2.10 Monitoring Bores Water Quality (pH, EC, TDS)

## 3. KEY EPE DESIGN FEATURES

The EPE has been designed to temporarily contain shallow volumes of water generated from pit dewatering activities, with the primary objective of facilitating natural evaporation as the key water removal mechanism.

The proposed EPE design is documented in TailCon (2025), and key features are as follows:

- The EPE comprises four additional interconnected cells designed to enhance site water management (Figure 1.2). Water from the existing cells will first enter Cell 4.1, then sequentially flow into Cells 4.2, 4.3, and 4.4. The flow between these cells will be facilitated by double-corrugated HDPE pipes installed approximately 1.0 m above ground level to promote gravity-driven transfer and operational flexibility.
- The pond geometry, embankment height, and storage capacity have been developed to accommodate anticipated inflow volumes, while maintaining sufficient freeboard under conservative design storm events, consistent with a low-risk, non-hazardous classification. Design considerations include:
  - Pond depth and surface area optimised for promoting evaporation through maximum exposed surface area.
  - Embankment height sufficient to contain inflows and maintain a minimum of 0.5 m freeboard.
  - Seepage controls such as clay or low-permeability materials within the embankment wall to limit infiltration where required.
  - Access provisions for inspection and maintenance during operations
- The proposed EPE design assumes that the EPE basin is not lined. The proposed EPE embankment structure comprises a distinct material (Zone A), comprising compacted clay with a permeability of $1x10^{-3}$ m/d (i.e., $1x1\ 10^{-8}$ m/s).
- The EPE design features have been incorporated to minimise seepage losses through the embankment wall. A quantitative seepage analysis through the embankment has been undertaken by TailCon (2025) and the seepage modelling indicated the following:
  - A phreatic surface is expected to develop through the embankment and extend into the natural foundation, terminating prior to reaching the downstream toe.
  - The modelled seepage through the embankments is minimal, at approximately 0.0004 $m^3$/d.
  - To manage any potential seepage that may occur, a seepage interception drain has been incorporated along the southern and eastern embankment of Cell 4.4 (Figure 1.2). This drain directs seepage into a designated sump, allowing for collection and recycling of water back into the facility.
  - It should be noted that a quantitative seepage analysis through the base of the EPE into the formation has not been undertaken by TailCon (2025). However, TailCon (2025) anticipated that the seepage to be minimal due to the low permeability of the underlying foundation materials.
- The collected water is classified as benign, originating from groundwater or surface water ingress into the pit and is not anticipated to contain harmful contaminants, process reagents, or elevated concentrations of heavy metals. However, the collected water is hypersaline, which, does pose a risk to the environment or human health. Although hypersaline water does not typically constitute a hazardous substance classification, uncontrolled discharge could adversely impact surrounding soils, vegetation, and surface-water ecosystems. Therefore, the ponds require appropriate containment and seepage control measures to prevent off-site impacts, even though no specialised treatment systems are anticipated to be necessary.,

# 4. HYDROLOGICAL IMPACT AND RISK ASSESSMENT

## 4.1 Identification of Potential Impacts

The potential impacts of the EPE on the hydrological environment and of the hydrological environment to the EPE have been assessed. The potential risks are:

- Modification of the existing hydrological regime, by increasing or decreasing water availability and flood levels within the environment.
- Increased risk of erosion and subsequent sedimentation in downstream areas.

- Release of poor-quality water to the environment (via groundwater or surface water).
- Impact of flooding on the EPE structure integrity.

## 4.2 Surface Water Impacts

### 4.2.1 Modification of Hydrological Regime

The construction of the EPE may result in changes to the existing hydrological regime, as it encroaches within the flood extent of Catchment B.

### 4.2.2 Increased Risk of Erosion

The encroachment of the EPE into the Catchment B floodplain may reduce the available flow area and increase the flow velocities through the drainage line. This increased velocity could increase the risk of erosion in the drainage line and subsequent sedimentation in downstream areas.

### 4.2.3 Impacts to Water Quality

The EPE is proposed to manage water with a high salinity. Large rainfall events could cause the cells to overtop and release high-salinity water to the environment.

### 4.2.4 Hydrological Impacts on the Project

During a 1% AEP event, flood levels may rise sufficiently to overtop the EPE embankments. If this occurs, saline pond water could be released into the downstream system, posing a risk to environmental values and potentially altering local hydrological conditions.

## 4.3 Groundwater Impacts

As outlined in Section 3, predicted maximum EPE seepage losses through the embankments have been estimated by TailCon to be very low, approximately 0.0004 kL/d over a 1 m section (i.e. a total of 0.2 kL/d). A seepage collection trench is proposed around the perimeter of the EPE to collect this seepage and divert it to a collection sump.

There may also be some minor seepage through the EPE foundation, which will eventually make its way to the water table in the main aquifer (at ~24 mbgl). Seepage losses from the EPE are dependent on the nature of the EPE foundations (pre and post construction), underdrainage systems and walls.

The fate (flow paths) of foundation seepage once it has exited the EPE will depend upon the nature of the subsurface and local aquifers and regional groundwater flow gradients. The main seepage mechanisms and pathways away from the base of the EPE are as follows:

- Infiltration through unsaturated zone – seepage will initially move vertically under the influence of gravity until it reaches the water table (in the main aquifer – weathered bedrock). There may be some minor shedding of seepage along the top of the saprolite (base of cover material) and any such flow will follow the topography of this surface. However, specific shallow seepage interception and recovery design features incorporated into the design of the EPE should minimise this. Some minor seepage may make its way vertically to the water table.
- Flow within the main aquifer – once seepage reaches the water table in the main aquifer, the water table will rise forming a “mound”. Seepage will mix with groundwater and then flow following the groundwater hydraulic gradient. Initially, flow will be radial (or semi-radial) away from the mound at rates determined by the hydraulic gradient and aquifer permeability. However, at some distance from the EPE the regional hydraulic gradients will be the dominant influence and groundwater flow will be to the west to northwest towards the Main Pit.

The water table mound will continue to rise until such time as either the discharge water into the EPE ceases or the hydraulic gradients are sufficient to drive enough water away from the mound to balance all seepage.

The following potential receptors have been identified based on the expected seepage processes and pathways:

- Topographic low points on-lease, including minor creeks.
- Main Pit mine void.

It should be noted that as outlined in the Water Assessment report (AQ2, 2025), no groundwater dependent ecosystems (including stygofauna or groundwater-dependent vegetation) or existing other groundwater users identified in close proximity to the Project. However, down-topographic gradient vegetation may be affected by seepage.

The potential environmental consequences of seepage on groundwater are largely related to:

- The water table rising to ground level (i.e., surface expression of groundwater) as a result of "hydraulic push" from the water table mound that will develop beneath the EPE and consequent impacts on local vegetation.
- If the above occurs, the potential development of surface water flow (from the immediate area of the EPE) of any surface expression water that is not evaporated or retained as soil moisture. The quality of the surface expression of water will be affected by seepage, with a general salinity rise in surface waters.

It is noted that the water table mound, (as measured by rising water levels in bores), can expand far more quickly than physical seepage (i.e., seepage that has originated in the EPE). The rising water levels reflect a moving "hydraulic pressure wave" induced by leakage to the water table beneath the EPE. Seepage particle flow rates are controlled by a range of aquifer hydraulic properties and move relatively slowly. The "front" of elevated solutes is also controlled by geochemical attenuation properties and results in the front moving even more slowly. The presence (and first arrival) of seepage can only be confirmed by water quality changes but will significantly lag behind rises in water levels.

The potential for water table mounding and seepage away from the EPE is assessed in Section 7. The potential impacts and seepage management are addressed in Section 8.

## 5. SURFACE WATER ASSESSMENT

The EPE is proposed to be constructed at the southeast corner of the existing evaporation ponds, within the extent of Catchment B, and could potentially be impacted by flooding of Eastern Creek.

A surface water assessment has been completed to identify hydrological impacts and the risk that the EPE may have on the surface water environment. As part of the assessment, a 2D hydraulic flood model was developed in HEC-RAS to assess the surface water risk to the EPE, and to determine what surface water management measures are required. The flood model simulated rainfall-runoff processes to simulate flooding in the vicinity of the EPE.

Design runoff hydrographs (runoff rates over time) were prepared for Catchments A and B using a hydrological model (RORB) for different exceedance probability events. These hydrographs were applied as inflow boundaries to the HEC-RAS 2D flood model.

## 5.1 Design Flow Rates

As part of the assessment a hydrological (flow rates) model was prepared for the project in RORB to estimate design flow hydrographs for Western Creek and Eastern Creek (Catchment A and B respectively). The layout for each of the RORB models is shown in Figure 5.1 and Figure 5.2 The models were used to develop flow hydrographs for the 1% AEP flow event.

The RORB model setup is summarised as follows:

- RORB model was run for the 1% AEP storm event.
- The IFD rainfall depths sourced from BOM were increased to account for climate change as per ARR guidelines. The rainfall depths were increased by 22% consistent with predictions from SPP2-4.5 climate change projections to 2070.
- A runoff coefficient (ROC) value was used to simulate rainfall losses within the RORB simulations. For the 1% AEP event a ROC value of 32% was used. This ROC value includes an allowance for a 10% increase in rainfall losses consistent with predictions from SPP2-4.5 climate change projections to 2070.
- The model's key parameters, Kc and m, are inputs that represent the catchment's hydrological response. Published regional relationships for determining Kc have been established for Australia, as outlined in ARR (Ball et al., 2019), including specific recommendations for the arid and northwest regions of Western Australia. The following relationship has been adopted for this study:

$$K_c = 1.06L^{0.87} \qquad S_e^{-0.46}$$

- The Kc values for each catchment were calculated separately for Catchment A (6.8) and Catchment B (5.7).
- The exponent "m" is the RORB parameter that describes the non-linearity of a catchment's storage routing. A value of 0.8 was adopted for the exponent "m" for ungauged catchments (Laurenson et al. 2010) without any streamflow calibration data available.
- 1% AEP ensemble rainfall simulations were completed for each of the catchments to generate a range of catchment discharge rates. The selected design discharge rates were selected using the following procedure:
  - For each ensemble rainfall simulation, a series of ARR 2016-defined temporal pattern rainfall hyetographs was used for storm durations ranging from 10 minutes to 168 hours.
  - The ensemble hyetographs consist of 10 different synthetic temporal rainfall patterns for each storm duration.
  - RORB produces a flood hydrograph and maximum discharge rate for each of the ensemble hyetographs.
  - The critical storm duration for the catchment was selected as the storm duration producing the highest peak discharge.
  - For that critical storm duration, the hydrograph closest to the mean value of the peak flows was adopted as the design flood hydrograph.

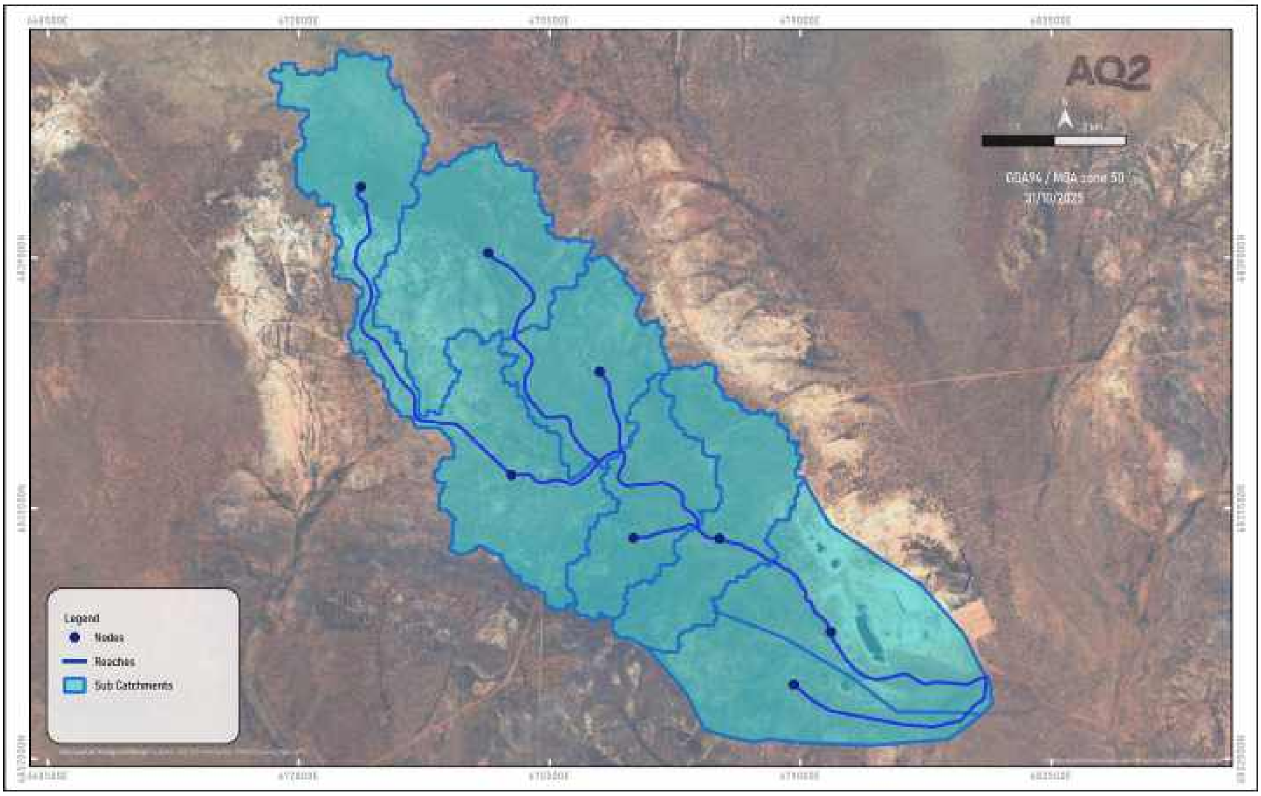



Figure 5.1 Catchment A (Western Creek) RORB Model Set Up

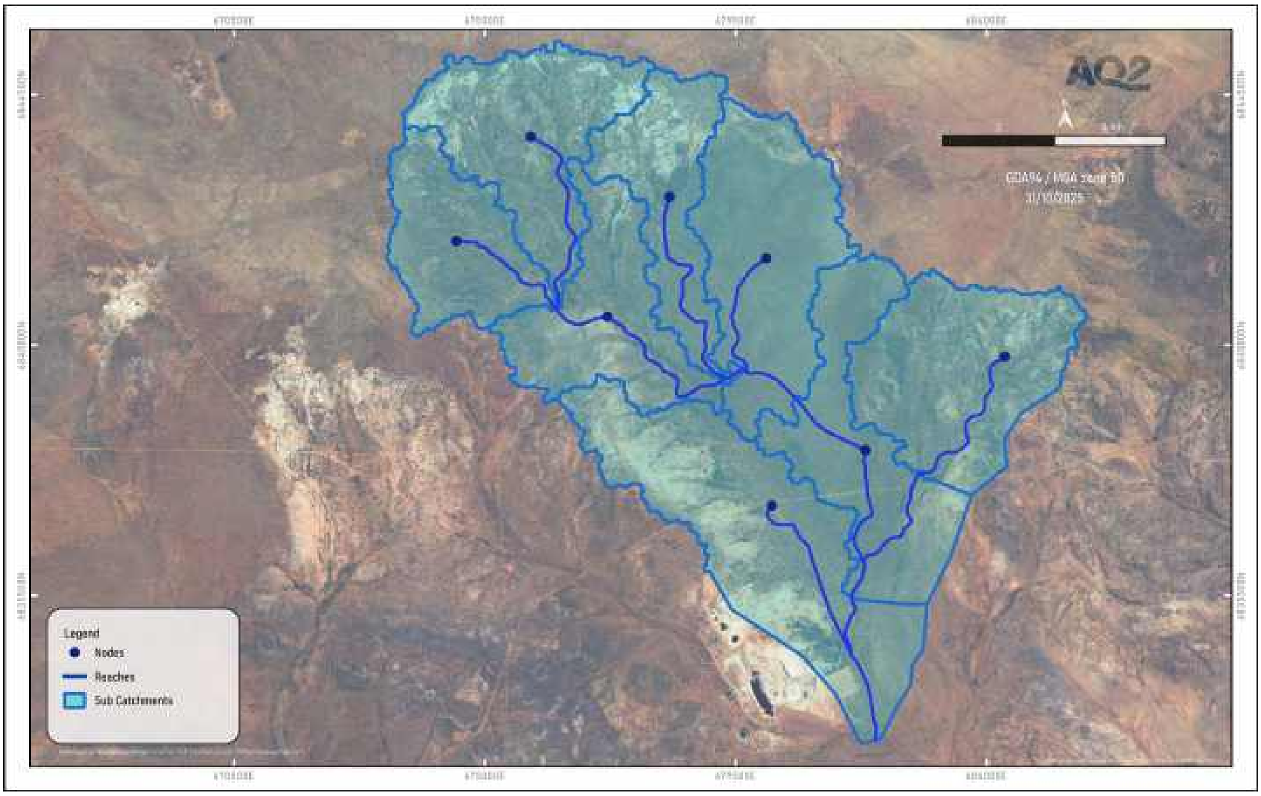



Figure 5.2 Catchment B (Eastern Creek) RORB Model Set Up

The resulting peak flows from the RORB model are shown in Table 5.1. The results were compared against estimates from ARR's RFFE to validate of the RORB model. A comparison between the peak flow rates from the RORB model and the RFFE estimates (Figure 5.3), indicates the RORB peak flows are within the range of likely flow rates generated from RFFE and close to the likely design flow rate.

Table 5.1 Project Catchment Peak Flow Rates

| Catchment ID | Area ($km^2$) | RORB 1% AEP Peak Flow ($m^3/s$) |
|---|---|---|
| Catchment A | 37 | 51. |
| Catchment B | 70 | 113 |

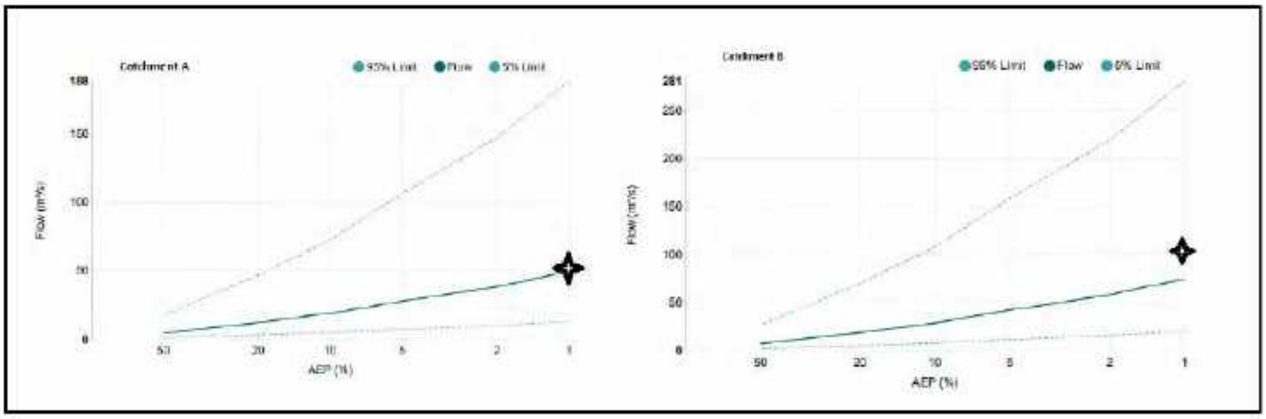



Figure 5.3 Comparison of 1%AEP RORB Peak Flow Estimates and RFFE Flow Range

## 5.2 Flood Modelling Setup

The flood characteristics of the EPE area were mapped by creating a 2D flood model using HEC-RAS, version 6.7 beta 4 software. The flood model was run for the 1% AEP and included the EPE landform within the model terrain. The resulting flood map was used to identify where surface water management measures may need to be considered.

The general model build details for the pre-development model are as follows (and summarised in Figure 5.5):

- A computational mesh spacing of 50 m x 50 m was applied to the 2D flow area.
- Breaklines were added along the perimeter of the EPE with a grid size of 5 m along the perimeter.
- The landform design of the EPE was overlaid on the LiDAR data to create a terrain model for the 2d model (refer Figure 5.4).
- Different manning 'n' values were applied across the extent of the model. A Manning 'n' value of 0.045 was applied to the defined flow channel of the Western Creek, and 0.1 for the rest of the model extent ( to simulate roughness in sheet /flood plan flow).
- An adaptive timestep was assigned using a maximum Courant Number of 1.0.
- Inflow hydrographs were then applied for each inflow catchment (Catchment A and Catchment B).
- The model simulation time of 48 hours was applied to allow all peak flows to recede before the end of the simulation.
- Outflow model boundary conditions were set on the eastern side and the south-east corner of the model domain, using normal depth energy gradients.
- A rain-on-grid routine was applied over the model extents to simulate local runoff. A 1-hour nested frequency storm using the 1% rainfall depths was applied.

Note that the extents of the available terrain data for the flood model mean that the extent of flooding within Eastern Creek is constrained by the model boundary, which may lead to inaccuracies in the model results. The resulting flood depths are influenced by the outflow boundary conditions (which use normal depth energy gradients) and outflow locations.

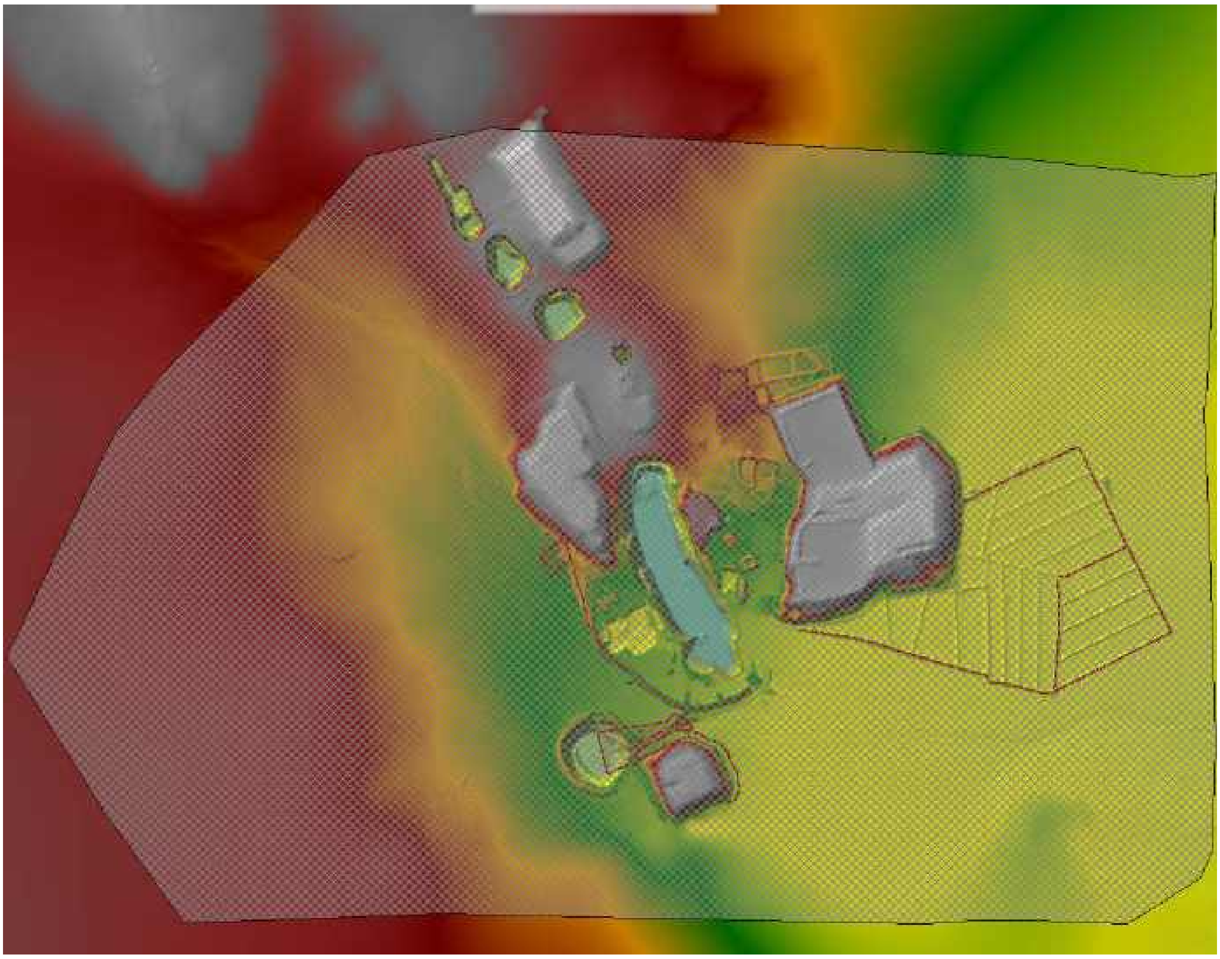


Figure 5.4 Model Terrain Data


Figure 5.5 2D Model Setup

## 5.3 Flood Model Results

Maps of the predicted 1% AEP, flood depth, flood velocities and WSE around the EPE are shown in Figures 5.6 to Figure 5.8:

- The EPE footprint encroaches into the Eastern Creek floodplain which is constrained (in the model) between the boundary of the model and the EPE embankment. The model allows some surface water outflow along the eastern edge of the boundary, but potentially flow could spread out further to the east across the flood plain and result in lower flood depths.
- The maximum surface water elevation for the 1% AEP event around the boundary of the EPE is predicted to be approximately 453.7 mRL (Figure 5.8).
- The maximum predicted flood velocity is in the order of 0.7 m/s around the southeast corner of the EPE footprint (Figure 5.7).

The predicted 1% AEP water surface elevation around the EPE is compared to the natural ground surface elevation and the TailCon-designed EPE crest elevation in Figure 5.9. The comparison shows the predicted flood level remaining below the crest elevation.

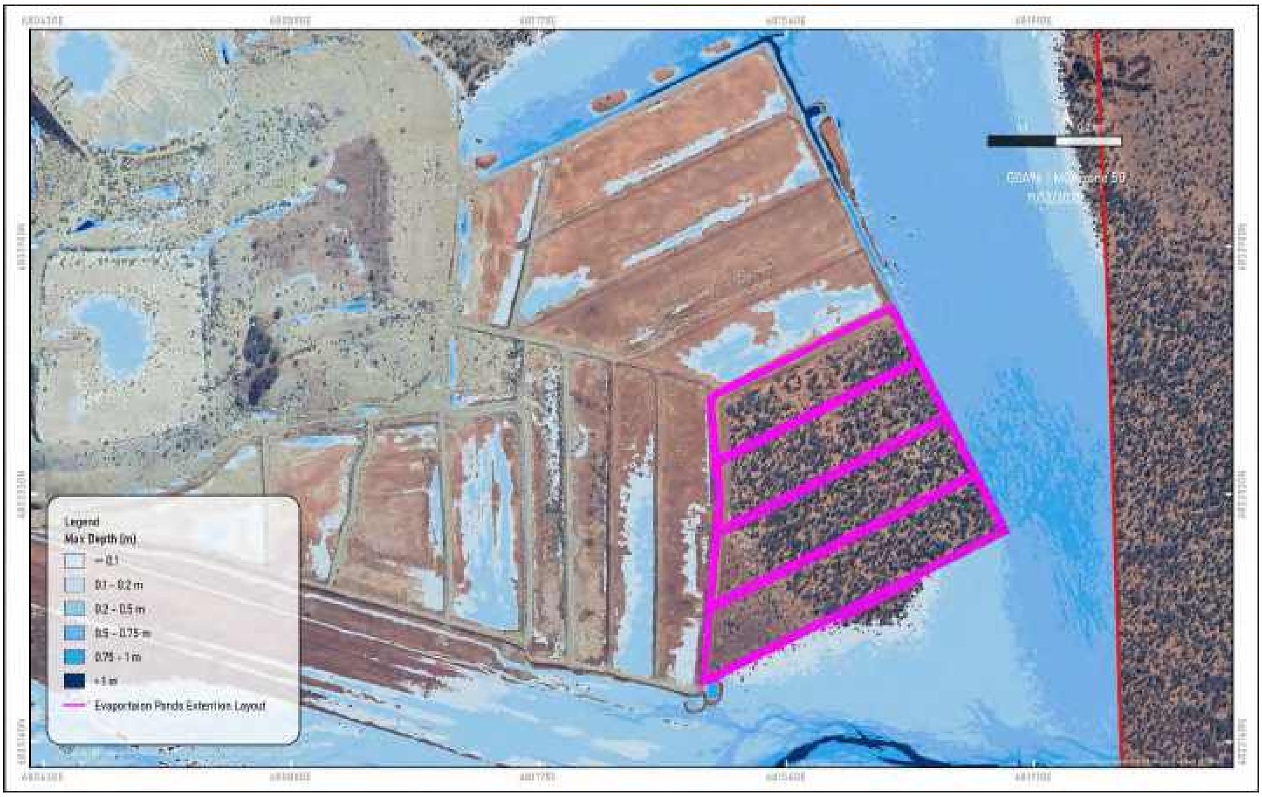



Figure 5.6 1% AEP Flood Depth

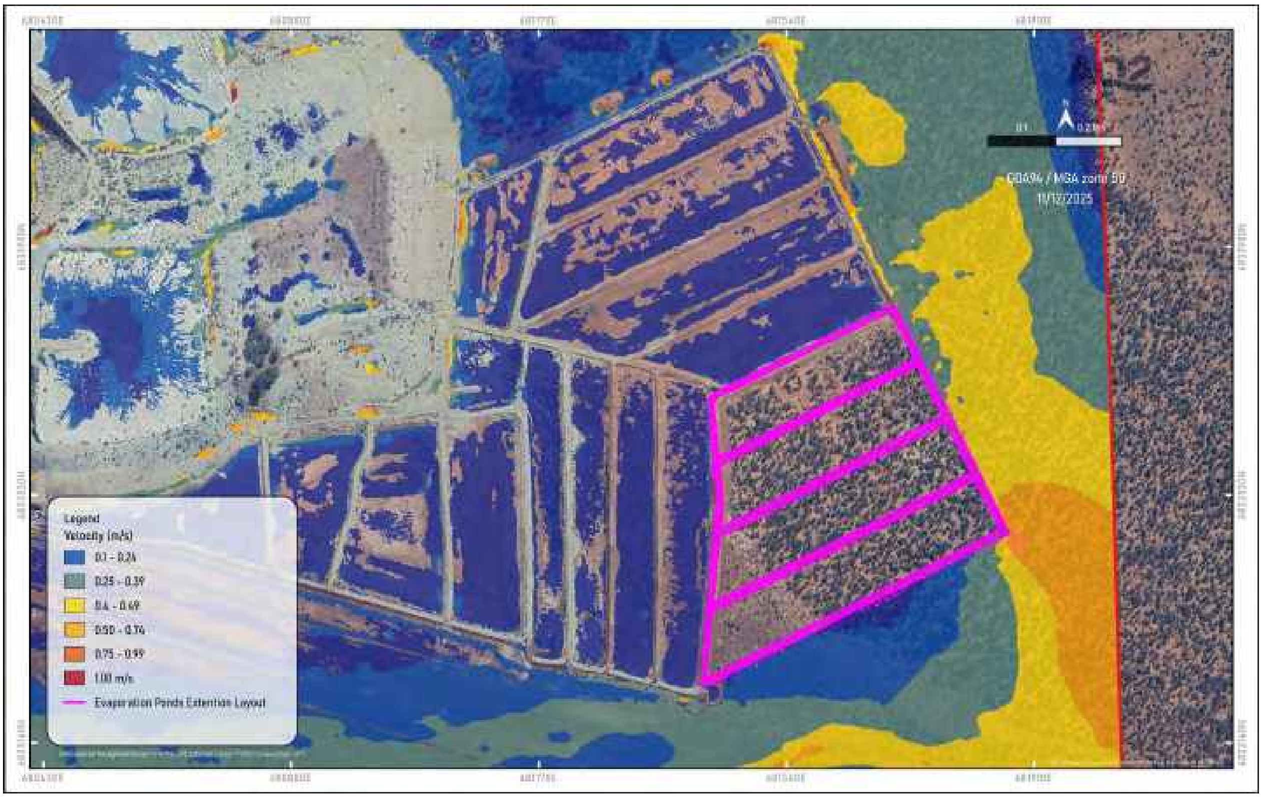



Figure 5.7 1% AEP Flood Velocity

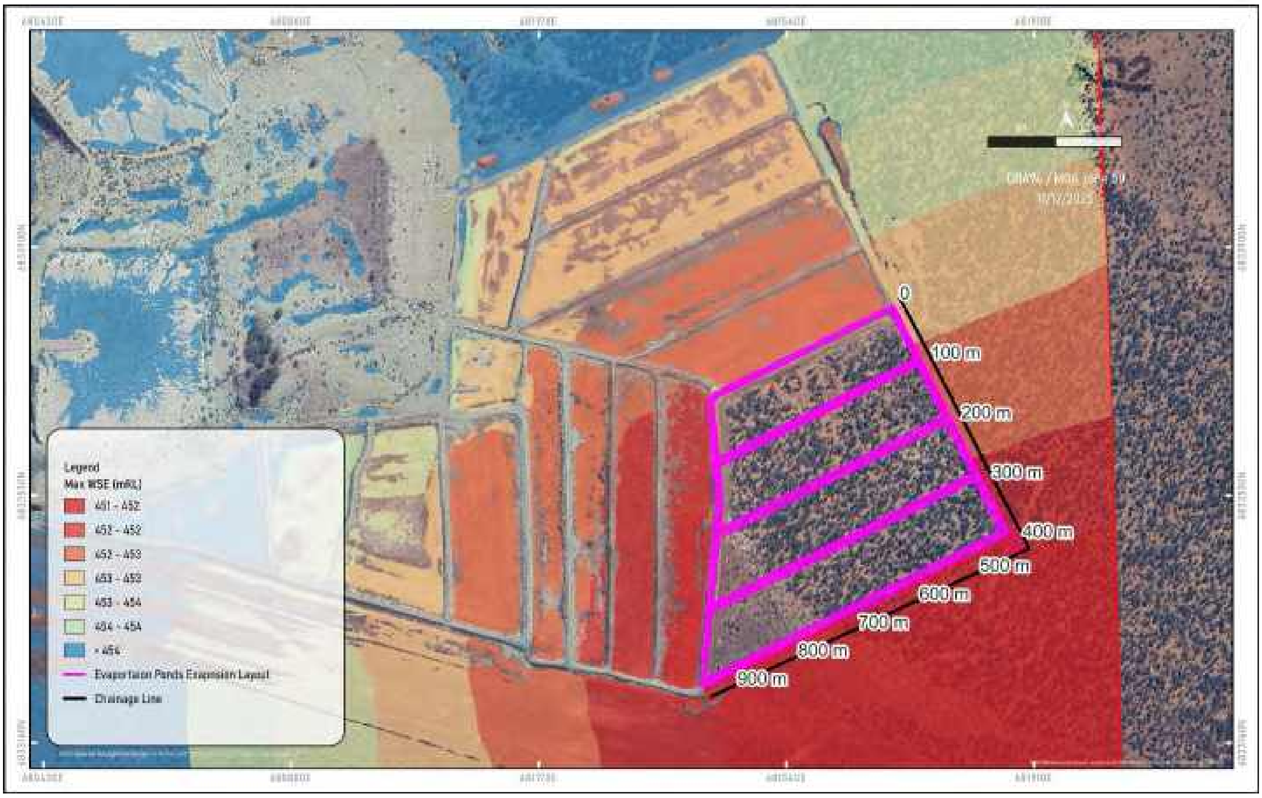



Figure 5.8 WSE and Profile Chainage

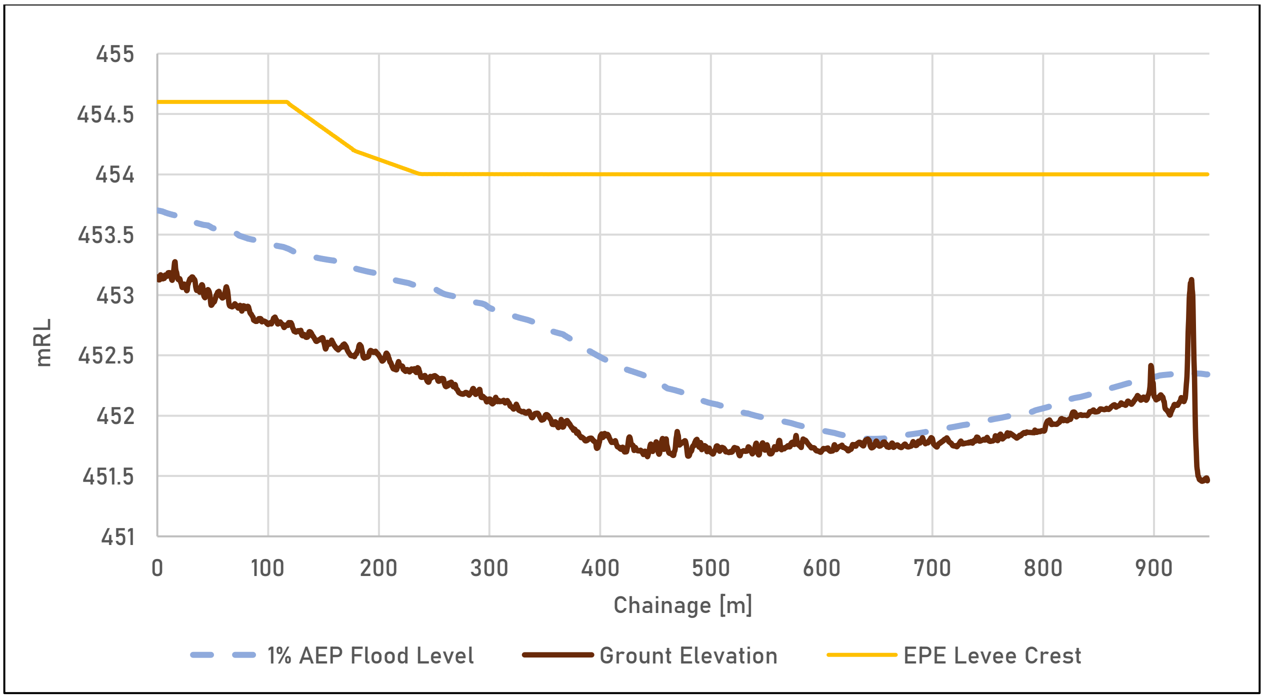



Figure 5.9 1% AEP Flood Profile around the EPE

# 6. EVAPORATION POND FLOW CAPACITY ASSESSMENT

The evaporation pond extensions are proposed to operate at a maximum operating water depth of 1.0 m through the use of HDPE pipes installed within the interconnecting embankments (TaliCon 2025).

To determine the capacity of the EPE to manage surplus dewatering, a monthly water balance was developed.

## 6.1 Methodology

A simple water balance calculation was completed using a monthly calculation time-step to account for seasonal variations in evaporation rates and the resulting changes to pond water storage. The water balance assumes the only inflows to the EPE are the dewatering discharge and the only losses are evaporation and seepage from the floor of EPE.

## 6.2 Water Balance Calculation Assumptions

The following assumptions were made when completing the assessment of the evaporative potential of the proposed EPE area:

- The Morton's shallow lake evaporation rates from SILO were used to estimate evaporation losses from the evaporation ponds' surface area. A nominal reduction to the evaporation rates was applied to reflect likely reduced evaporation rates due to the high salinity of the dewatering discharge. A multiplier of 0.9 was applied to reduce the evaporation rates.
- The pond surface is assumed to be constant regardless of the pond depth, and water is assumed to cover the base of the EPE at all times.
- Four different seepage rates were modelled: 0mm/day, 1 mm/day, 10 mm/day, and 50 mm/day.
- For each monthly timestep, the water balance calculated the change in pond storage volume by adding inflows (dewatering discharge) and subtracting outflows (evaporative and seepage losses), enabling the progression of storage level to be reached throughout the simulation period.
- The volume in the EPE changes with time as the evaporation rates vary seasonally. The maximum possible discharge rate to the EPE is the rate at which the predicted EPE water level did not increase above the operating design operating depth (1 m).

Table 6.1 EPE Capacity to Manage Surplus Water

| Assumed Seepage Rate | 0 mm/d | 1 mm/day | 10 mm/day | 50 mm/day |
|---|---|---|---|---|
| Discharge Rate | 12 L/s | 14 L/s | 29 L/s | 95 L/s |

Based on the assessment completed, it is estimated that the EPE could be used to evaporate discharge rates in the range of 12-95 L/s depending on the seepage rate through the floor of the EPE. Note that the assessment is dependent on the evaporation rate adopted in the calculation and there is a large degree of uncertainty as to what evaporation rate may be achieved from a shallow evaporation pond storing hypersaline water.

## 6.3 Evaporation Ponds Freeboard

The evaporation ponds are required to be operated to maintain a sufficient freeboard depth such that the ponds will not overtop if a large rainfall were to occur. The design rainfall depths predicted for the site in the 1 in 100, 1 in 1000 and PMP 72-hour rainfall events are as follows:

- 1 in 100: 240 mm
- 1 in 1000: 410 mm
- PMP: 1,370 mm.

# 7. GROUNDWATER ASSESSMENT

## 7.1 Predicted Water Table Mound

A seepage model was developed to predict likely maximum water table mounding for the EPE. The model is an analytical model based on the Hantush (1967) equation for calculating a groundwater mound under a rectangular recharge area. The model, which is now available as an "on-line calculator" (GroundwaterSoftware.com) predicts the maximum rise in the water table (i.e. the mound) recharge area for given values for:

- Aquifer thickness (m).
- Aquifer permeability (m/d).
- Specific yield of the aquifer (dimensionless).
- Time (days).
- Base area of the rectangular recharge area (m).
- Recharge or percolation rate ($m^3$/d).

Key parameters adopted were as follows:

- Aquifer thickness – 16 m (the initial height of the water table above the base of the aquifer based on the average depth to the base of weathered bedrock of 40 m and the average inferred depth to groundwater of 24 m).
- Aquifer permeability - 0.01 m/d (adopted upper range).
- Specific yield - 0.015.
- Base area of EPE – 160,000 $m^2$.
- Recharge rate– 0.00025 m/d (based on the assumed total seepage rate of around 40 $m^3$/d over the base area of the EPE).
- Time - 10 years.

As outlined in Section 3, a quantitative seepage analysis through the base of the EPE into the formation has not been undertaken by TailCon (2025). However, the seepage rate into the foundation is anticipated to be low due to the low permeability of the underlying foundation materials. For the purpose of this assessment, a infiltration rate of 0.15 $m^3$/d was estimated by TailCon for the Youanmi TSF3 (refer to AQ2, 2025), was used for the planned EPE, as it overlies the same ferricrete (Wiluna Hardpan). This equates to around 40 $m^3$/d total seepage over the base area of the EPE, which is consistent with the EPE design assumptions of the seepage being low.

The predicted water table mound around the EPE is shown (as a model output) in Figure 7.1. This shows a water table rise of 10 m and 5 m extending around 100 m and 200 m, respectively from the inside toe of the EPE at the end of the 10 year active life of the EPE (i.e. water being discharged into the pond). Based on inferred water levels in the EPE footprint (24 m below ground), this means that the water table at the margins of the EPE area will be mounded to about 14 m below surface. The water table mound rapidly decreases in magnitude with distance from the EPE and the predicted water table rise is less than 1 m at 400 m distance from the inside toe of the EPE.

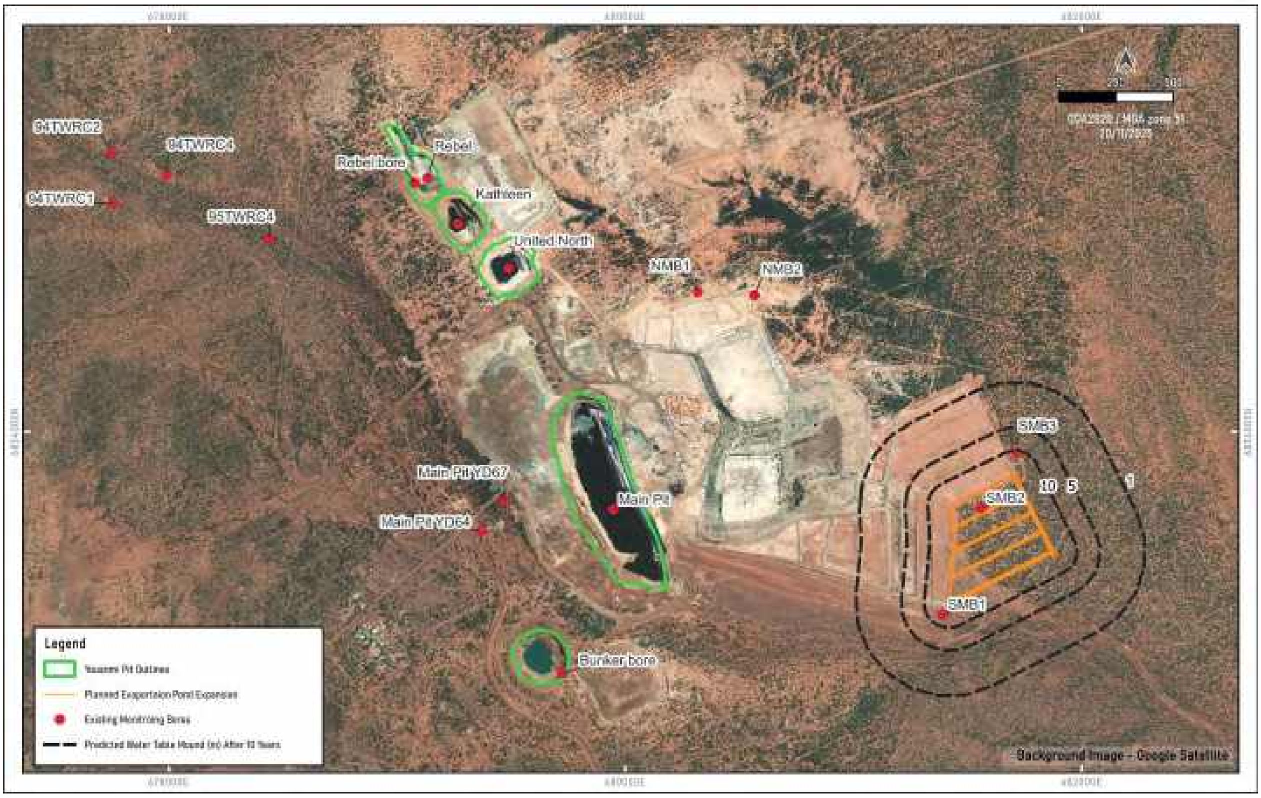



Figure 7.1 Predicted EPE Groundwater Level Mounding After 10 Years

## 7.2 Seepage Flow Directions

As outlined in Section 7.1, seepage flows will initially be semi-radially away from the EPE under the influence of the water table mound, but will eventually come under the influence of regional hydraulic gradients and flow to the south south-east towards the Main Pit.

It should be noted that the Main Pit is a long-term groundwater sink during (due to dewatering) and after mining (post-closure).

Figure 7.2 shows the interpreted seepage flow pathways from the EPE. Please note that, based on available topographic data, the minimal predicted water table mound rise and the fact that the Main Pit will be a long-term groundwater sink during and after mining, all seepage flow is predicted to flow to the west and eventually into the Main Pit (i.e., seepage flows will be "captured" by the Main Pit).

It is not expected that there will be any seepage flow away from the Project site.

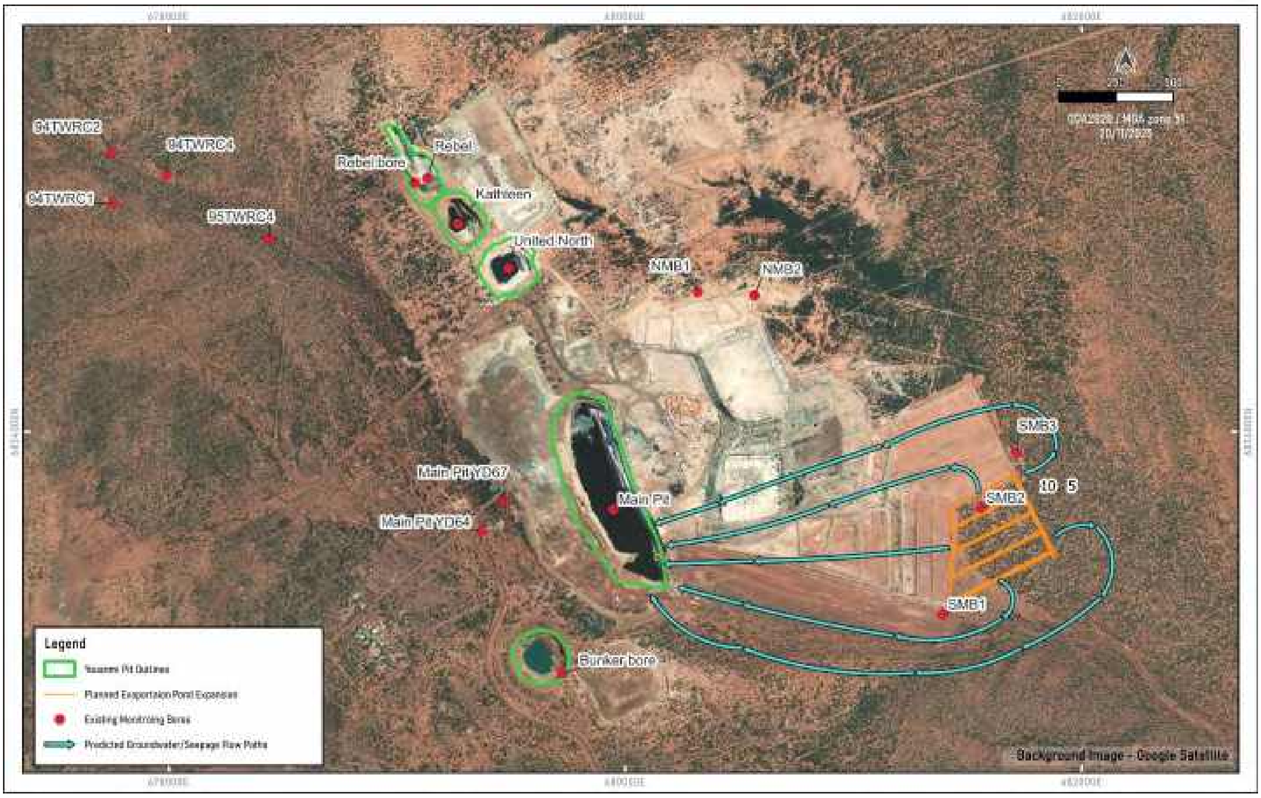



Figure 7.2 Predicted Groundwater Flow Paths After 10 Years

### 7.2.1 Seepage Velocities and Travel Times

Seepage velocity is the migration velocity of a conservative (i.e., non-reactive) solute carried by groundwater through the local aquifers and can be estimated using the following Darcy equation:

$$v = Ki/n$$

Where: v is the pore velocity (seepage velocity) (m/d)

K is the permeability (m/d)

i is the hydraulic gradient (m/m)

n is the effective porosity (similar to specific yield for velocity calculations)

For the purposes of these predictions, an average permeability of 0.01 m/d and an effective porosity of 0.015 have been adopted. Hydraulic gradients were measured on Figure 7.1 (predicted water table mound) and the following average seepage velocities were derived:

- From the toe of the TSF to the 5 m water table mound contour – around 8 m/year.
- From the 5 m to the 1 m contour – around 6 m/year.
- Beyond the 1 m contour - <3 m/year.

Please note however, that these seepage velocity estimates only refer to the velocities and travel times of water particles. The concentrations of solutes within the seepage from EPE will be reduced as a result of blending with unaffected groundwater and geochemical attenuation reactions within the aquifer matrix. As such, the “front” of elevated solutes will advance much more slowly that the actual seepage water particles.

# 8. RISKS AND PROPOSED MANAGEMENT

## 8.1 Surface Water

Based on the results outlined in the surface water assessment in Section 5, the following surface water risks have been identified:

- The EPE footprint encroaches into the Eastern Creek floodplain, partially constraining natural flow paths and creating the potential for localised changes to flood distributions, with increased flood depths around the EPE. A comparison of the modelling results to the pre-development conditions (refer AQ2 2025) indicates that the maximum flood depth increase in the 1% AEP event is predicted to be 0.2 m. Note that the predicted changes to flood levels are likely to be over-estimated due to the model boundary constraints adjacent to the EPE. Flow is likely to spread out further east over the flood plain compared to what has been simulated in the model.
- The constrained flood plain may also increase the flow velocities through the drainage lines around the EPE, which may increase the erosion potential of the natural drainage lines. Compared to the pre-development flow velocities (presented in AQ2 2025), the velocity is predicted to increase by approximately 0.1 m/s (to typical flow velocities of 0.6 m/s). Note that the predicted changes to flow velocities are likely to be over-estimated due to the model boundary constraints adjacent to the EPE.
- Large rainfall events may cause the EPE cells to overtop and release saline water to the environment. The EPE has been designed to be operated to maintain a freeboard of 0.5 m between the maximum pond water level and the EPE crest. This is greater than the 72-hour 1:1000 AEP rainfall depth (0.41 m).
- Flood waters may overtop the embankments of the EPE and wash out saline water stored in the EPE. A comparison of the maximum flood level predictions to the proposed embankment design indicates the EPE crest elevations to be more than 0.75 m above the predicted flood levels in the 1% AEP flood event.
- Flood flows around the perimeter of the EPE may cause erosion which could compromise the integrity of the embankments. The maximum flood velocity around the perimeter of the EPE is predicted to be 0.7 m/s. The embankment toe should be constructed with sufficient erosion protection to withstand flow velocities of 0.7 m/s.

## 8.2 Groundwater

As outlined in Section 7, the predicted water table mound outside of the area cleared for EPE construction is less than 10 m, which means the water table will likely be well below the ground surface (i.e. 14 mbgl).

It has long been recognised that local Goldfields vegetation largely relies on fresh soil moisture above brackish and saline water tables and that water tables less than 6 m deep can negatively impact vegetation. In recent years DWER have adopted the following trigger levels for managing the impacts of seepage, (from pits, evaporation ponds and tailings storage facilities (TSFs)), to local aquifers:

- Water table reaches 6 m depth below surface – trigger for investigation.
- Water table 4 m depth below surface – trigger for immediate remedial action.

The predicted rise in the local water table around the EPE is below trigger levels commonly adopted in DWER licensing conditions. As such, there are expected to be minimal impacts on local vegetation (due to inundation of tree roots) and surface soils due to water table mounding.

Seepage will move away from the EPE at rates determined by the hydraulic gradient and aquifer permeability. Seepage flow will initially be semi-radially away from EPE, but will become dominated by existing regional hydraulic gradients a short distance away from the EPE. Seepage flows will then largely be in an easterly direction towards the Main Pit. The ultimate fate of any seepage will be flow towards and into the Main Pit (i.e., seepage flows will be "captured" by the pit).

The predicted water table rise and rates of seepage migration are not expected to result in any impacts on groundwater dependent ecosystems (GDEs) or the beneficial use of local groundwater. There are no known GDEs or other groundwater users within the predicted water table mounding area.

In summary, the water discharge to the proposed EPE will have no long-term impact on the local hydrogeological environment.

However, there will always remain a risk (even if a very low risk) that unexpected/unknown site conditions might result in the water table mound rising higher than predicted or the seepage advancing more quickly than predicted.

Management strategies are presented below which cover:

- Groundwater Monitoring – to measure actual impacts.
- Mitigation – in case unacceptable impacts appear to be likely based on monitoring results.

### 8.2.1 Groundwater Monitoring

It is recommended that a flexible and adaptive groundwater monitoring approach and network be established. That is, monitoring would include:

- Indicator parameter monitoring:
  - Key parameters that clearly define first arrival of "impact" (water quality or water level)
  - Water level indicators as per DWER guidelines (i.e. 6 mbgl/4 mbgl depths to water)
- Investigation monitoring:
  - Triggered by a spike in indicator parameters
  - Repeat/confirmatory monitoring, including other parameters (determined by the nature of the trigger event)
  - Continues until issue/uncertainty resolved
- Synoptic (snapshot) monitoring:
  - More complete set of parameters, determined by nature of seepage
  - Periodic monitoring – with frequency determined by seepage velocity
  - To provide a clear picture of the distribution of groundwater levels and quality
- Compliance Monitoring:
  - Based on company standards and permitting/licensing requirements

There are currently three monitoring bores SMB1, SMB2 and SMB3 located in the vicinity of the proposed EPE (as shown on Figure 2.7). It is recommended to drill additional monitoring bores at the EPE to assist in monitoring of potential impacts, with the EPE monitoring network comprising a pair of shallow and deep monitoring bores (adjacent to each other) at each bore location. There should be a proper annular seal above the slotted section in the deep monitoring bore to prevent flow up or down the bore annulus between the shallow and deep aquifer zones. To effectively evaluate data collected during the monitoring programme, monitoring bores should be installed and sampled prior to EPE construction/usage in order to provide baseline data for comparison. Figure 8.1 shows provisional locations of the proposed EPE monitoring bores.

In addition to groundwater monitoring, non-invasive (visual) seepage observations along the toe of the EPE are recommended together with monitoring of the condition of vegetation fringing the EPE area.

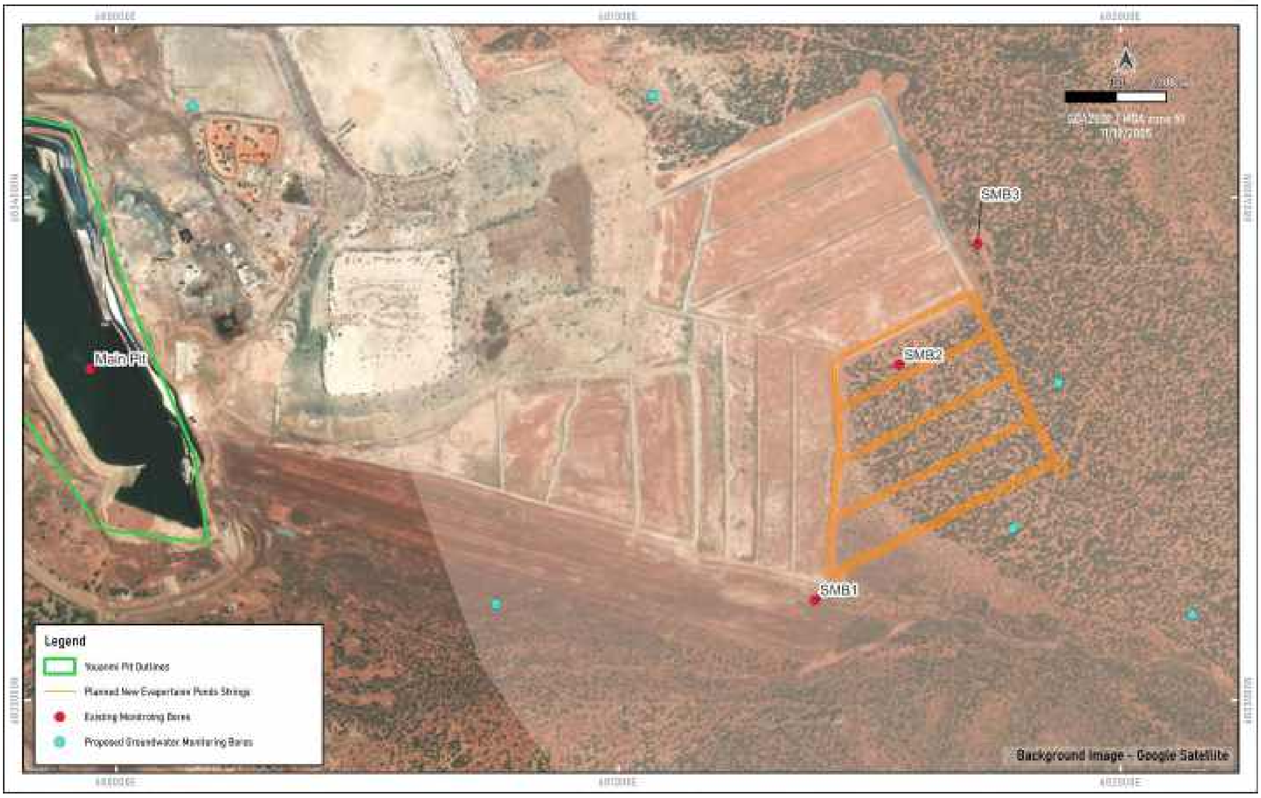



Figure 8.1 Proposed EPE Groundwater Monitoring Bores

### 8.2.2 Mitigation

Should any unacceptable impacts on local vegetation or groundwater be observed due to the EPE then the following impact mitigation strategies can be adopted to lower the water table mound around the EPE:

- Low-rate pumping from existing (or new) bores.
- Excavations and pumping from a seepage recovery trench.

## 9. CONCLUSION

The key outcomes of the surface water assessment are as follows:

- 2D flood modelling indicates that the proposed EPE embankments are not predicted to be overtopped during the 1% AEP flood event.
- The hydrological impacts associated with the EPE are predicted to be low, with only minor changes to local flow conditions.
- The EPE embankment construction needs to have suitable erosion protection for flow velocities of up to 0.7 m/s.
- The proposed operational freeboard within the EPE of 0.5 m should be sufficient to contain a 72-hour 1:1000-year AEP rainfall event.
- The EPE is estimated to have capacity of managing an inflow rate of 12 L/s to 95 L/s depending on the rate of seepage loss through the floor of the EPE.

The key outcomes of the EPE seepage assessment are as follows:

- The design and proposed construction methodology of the proposed EPE are such that there is predicted to be minimal seepage losses to the local environment.

- Any seepage will infiltrate vertically to the local water table which has developed in low permeability transported cover sediments (colluvium / ferricrete) and underlying weathered basement rock. The predicted hydraulic impacts of such seepage are as follows:
  - A negligible water table mound will develop beneath the EPE. The predicted maximum rise in the water table from the toe of the EPE is around 10 m.
  - Based on current groundwater levels (i.e., approximately 24 mbgl), the resulting water table will remain 14 m below the surface.
- Seepage will move away from the EPE at rates determined by the hydraulic gradient and aquifer permeability. Seepage flow will initially be semi-radially away from EPE, but will become dominated by existing regional hydraulic gradients a short distance away from the EPE.
- Seepage flows will then largely be in a westerly direction towards the Main Pit. The ultimate fate of any seepage will be flow towards and into the Main Pit (i.e., seepage flows will be "captured" by the pit).
- The predicted water table rise and rates of seepage migration are not expected to result in any impacts on GDEs or the beneficial use of local groundwater. Nevertheless, an impact management strategy is proposed to identify any unexpected impacts and to mitigate these if/when they arise. These include groundwater monitoring to confirm the hydraulic response of the aquifer system to seepage and to monitor the migration of seepage through the aquifer system. Mitigation measures are proposed to lower the water table mound around the EPE, including low rate pumping from bores and/or excavations and pumping from a seepage recovery trench, depending upon the rise (if any) in the water table.

## 10. REFERENCES

Australian Rainfall and Runoff (ARR) 2019, Book 7: Design Rainfall Estimation, Chapter 6.2.1.

AQ2, 2025. Youanmi DFS, Water Assessments. Unpublished report prepared for Rox Resources. AQ2 document reference 581C_016a, issued on 9 December 2025.

Bureau of Meteorology (BOM) 2016. Design Rainfall Data System [Online Resource: http://www.bom.gov.au/water/designRainfalls/revised-ifd

Hantush, M.S., 1967. Growth and decay of ground-water mounds in response to uniform percolation.

TalisCon 2025, – Evaporation Pond Extension Design, issued 21 November 2025. Doc No160-01-3144C-TM001_03

Regards,

[redacted]

## 17.9 Appendix 9. RWTS (2025a). WWTP Design Drawings

# LEGEND OF TYPICAL PWTP P&ID
# ABBREVIATIONS, SYMBOLS & ICONS

## SERVICE FLUID

| | |
|---|---|
| AIR | AIR/BLEED AIR |
| EFF | EFFLUENT |
| FIG | FILTERED GAS |
| SEW | RAW SEWAGE |
| SLG | WASTE SLUDGE |
| SRW | (POTABLE) SERVICE WATER |
| TEFF | TREATED EFFLUENT |
| WAS | WASTE ACTIVATED SLUDGE |
| WW | WASTE WATER |

## CHEMICALS

| | |
|---|---|
| ALK | ALKALINITY CHEMICAL |
| ATS | ANTISCALANT |
| CB | CARBON CHEMICAL |
| CLG | CHLORINE GAS |
| NUT | NUTRIENT CHEMICAL |
| POS | POLYMER SOLUTION |
| SDG | SULPHUR DIOXIDE GAS |
| SH | SODIUM HYPOCHLORITE (12.5%) |
| SUA | SULPHURIC ACID (30%) |

## MATERIALS

| | |
|---|---|
| HDPE | HIGH DENSITY POLYETHYLENE |
| LDPE | LOW DENSITY POLYETHYLENE |
| PVC | POLYVINYL CHLORIDE |
| SS | STAINLESS STEEL (316) |

## EQUIPMENT

| | |
|---|---|
| A | ANCILLIARY EQUIP |
| F | FILTRATION EQUIP |
| P | PUMPS |
| PV | PRESSURE VESSELS |
| TK | TANKS |

## VALVES

| | | |
|---|---|---|
| VC | CHEMICAL INJECTION VALVE | |
| VI | AIR INJECTION VALVE | |
| VM | MANUAL VALVE (BUTTERFLY, GATE, BALL) | |
| VMO | ELECTRIC ACTUATED BALL VALVE (ON/OFF) | |
| VMOD | ELECTRIC ACTUATED BALL VALVE (MODULATING) | |
| VNR | NON-RETURN VALVE (CHECK, RPZ) | |
| VS | SAMPLE POINT | |

## INSTRUMENTS

| | | |
|---|---|---|
| DIT | DISSOLVED OXYGEN TRANSMITTER | DIT 201 |
| FIT | FLOW METER | FM |
| LIT | LEVEL TRANSMITTER | LIT 101A 0...0.4 bar |
| PIT | PRESSURE TRANSMITTER | PIT 101 -1...+6 bar |
| - | BELLOWS | |

REMOTE WATER WESTERN AUSTRALIA
WWW.REMOTEWTS.COM.AU
225 KELVIN ROAD, ORANGE GROVE, WA, 6109
P: (08) 9493 8200 | E: SALES@REMOTEWTS.COM.AU

SHEET SIZE A1

REFERENCES

REVISIONS

| REV | BY | DATE | DESCRIPTION | CHECKED | APP |
|---|---|---|---|---|---|
| A | RM | 21.10.25 | ISSUED FOR REVIEW | SL | - |

NOT FOR CONSTRUCTION
PRELIMINARY

RWWA
ROX RESOURCES VILLAGE
PWTP
P&ID - SHEET 1



SCALE: N.T.S
DRAWING NUMBER: RWTS-2025032-QP-DWG-0565
REV: A
PROJECT/JOB NUMBER: 2025032


RWWA — REMOTE WATER WESTERN AUSTRALIA
ecoFarmer


REMOTE WATER WESTERN AUSTRALIA
WWW.REMOTEWTS.COM.AU
225 KELVIN ROAD, ORANGE GROVE, WA, 6109
P: (08) 9493 0300 | E: SALES@REMOTEWTS.COM.AU


SHEET SIZE A1

REFERENCES

REVISIONS

| REV | BY | DATE | DESCRIPTION | CHECKED | APP |
|---|---|---|---|---|---|
| A | RM | 21.10.25 | ISSUED FOR REVIEW | SL | - |

NOT FOR CONSTRUCTION

PRELIMINARY

RWWA

ROX RESOURCES VILLAGE

PWTP

P&ID - SHEET 2



SCALE: N.T.S

DRAWING NUMBER: RWTS-2025032-QP-DWG-0566

REV: A

PROJECT/JOB NUMBER: 2025032


RWWA — REMOTE WATER WESTERN AUSTRALIA | ecoFarmer

REMOTE WATER WESTERN AUSTRALIA
WWW.REMOTEWTS.COM.AU
225 KELVIN ROAD, ORANGE GROVE, WA, 6109
P: (08) 9493 0300 | E: SALES@REMOTEWTS.COM.AU

SHEET SIZE A1
REFERENCES

REVISIONS

| REV | BY | DATE | DESCRIPTION | CHECKED | APP |
|---|---|---|---|---|---|
| A | RM | 21.10.25 | ISSUED FOR REVIEW | SL | - |

NOT FOR CONSTRUCTION
**PRELIMINARY**

RWWA
ROX RESOURCES VILLAGE
PWTP
P&ID - SHEET 3



SCALE: N.T.S
DRAWING NUMBER: RWTS-2025032-QP-DWG-0567
REV: A
PROJECT/JOB NUMBER: 2025032



RWWA
ecoFarmer
REMOTE WATER WESTERN AUSTRALIA
WWW.REMOTEWTS.COM.AU
225 KELVIN ROAD, ORANGE GROVE, WA, 6109
P: (08) 9453 6300 | E: SALES@REMOTEWTS.COM.AU


SHEET SIZE A1

REFERENCES

REVISIONS

| REV | BY | DATE | DESCRIPTION | CHECKED | APP |
|---|---|---|---|---|---|
| A | RM | 21.10.25 | ISSUED FOR REVIEW | SL | - |

NOT FOR CONSTRUCTION

PRELIMINARY

RWWA

ROX RESOURCES VILLAGE

PWTP

P&ID - SHEET 4



SCALE: N.T.S

DRAWING NUMBER: RWTS-2025032-QP-DWG-0568

REV: A

PROJECT/JOB NUMBER: 2025032


RWWA — REMOTE WATER WESTERN AUSTRALIA

ecoFarmer — WASTEWATER TREATMENT SOLUTIONS

REMOTE WATER WESTERN AUSTRALIA
WWW.REMOTEWTS.COM.AU
225 KELVIN ROAD, ORANGE GROVE, WA, 6109
P: (08) 9493 6300 | E: SALES@REMOTEWTS.COM.AU

SHEET SIZE A1

REFERENCES

REVISIONS

| REV | BY | DATE | DESCRIPTION | CHECKED | APP |
|---|---|---|---|---|---|
| A | RM | 21.10.25 | ISSUED FOR REVIEW | SL | - |

NOT FOR CONSTRUCTION

PRELIMINARY

RWWA

ROX RESOURCES VILLAGE

PWTP

P&ID - SHEET 5



SCALE: N.T.S

DRAWING NUMBER: RWTS-2025032-QP-DWG-0569

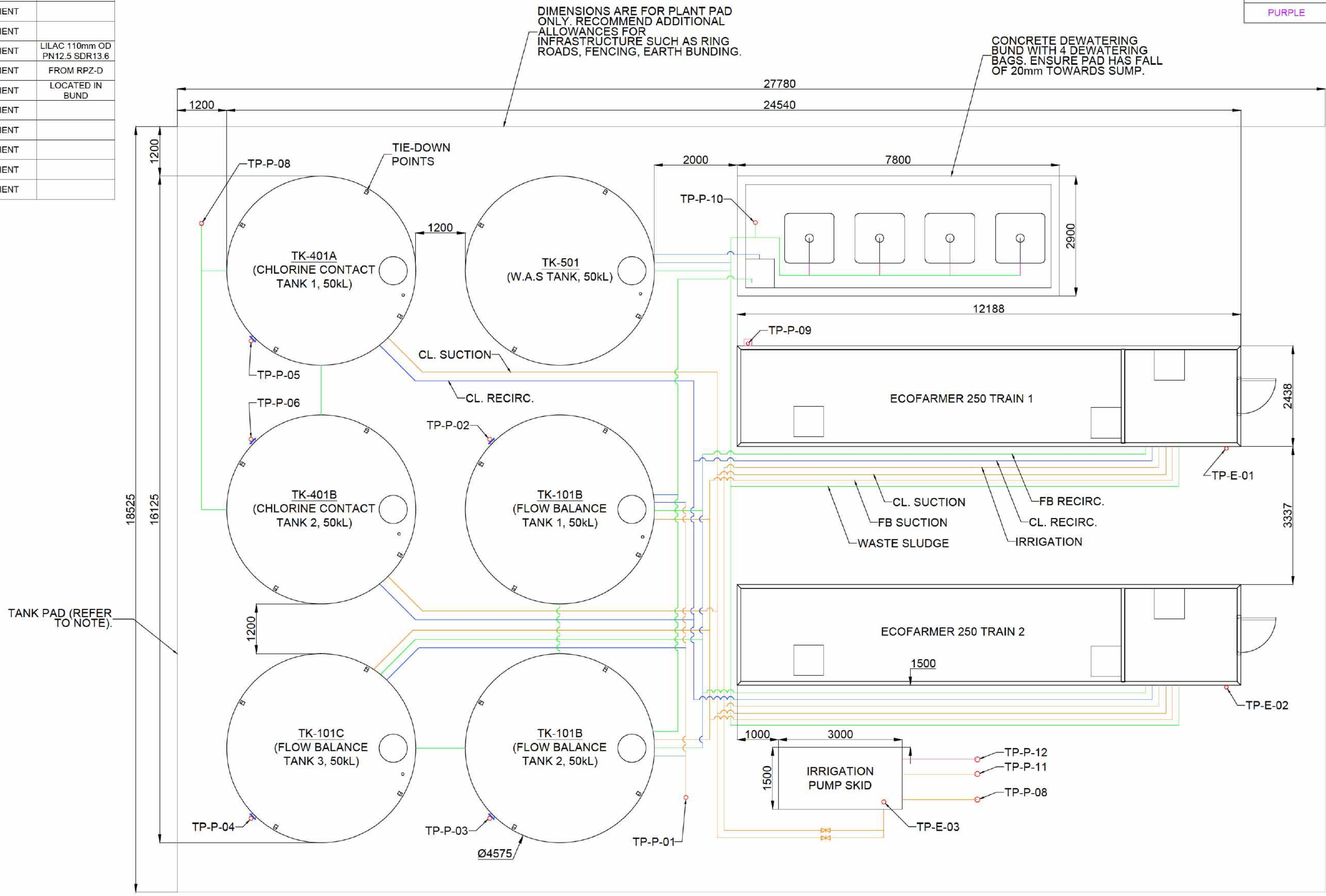
REV: A

PROJECT/JOB NUMBER: 2025032

| TERMINATION POINT SCHEDULE | | | | | | | |
|---|---|---|---|---|---|---|---|
| TP | DISCIPLINE | DESCRIPTION | TYPE | SIZE | MATERIAL | RESPONSIBLE PARTY | NOTES |
| TP-P-01 | PLUMBING | RAW SEWAGE (RISING MAIN INLET) | TABLE D/E FLANGE | DN150 | PVC | CLIENT | |
| TP-P-02 | PLUMBING | TRUCK SUCTION POINT | TABLE D/E FLANGE | DN80 | PVC | CLIENT | |
| TP-P-03 | PLUMBING | TRUCK SUCTION POINT | TABLE D/E FLANGE | DN80 | PVC | CLIENT | |
| TP-P-04 | PLUMBING | TRUCK SUCTION POINT | TABLE D/E FLANGE | DN80 | PVC | CLIENT | |
| TP-P-05 | PLUMBING | TRUCK SUCTION POINT | TABLE D/E FLANGE | DN80 | PVC | CLIENT | |
| TP-P-06 | PLUMBING | TRUCK SUCTION POINT | TABLE D/E FLANGE | DN80 | PVC | CLIENT | |
| TP-P-07 | PLUMBING | TRUCK SUCTION POINT | TABLE D/E FLANGE | DN80 | PVC | CLIENT | |
| TP-P-08 | PLUMBING | IRRIGATION FIELD HYDRAULICS | TABLE D/E FLANGE | DN100 | PVC | CLIENT | LILAC 110mm OD PN12.5 SDR13.6 |
| TP-P-09 | PLUMBING | SERVICE WATER (POTABLE) HOSE REEL | TABLE D/E FLANGE | DN25 | PVC | CLIENT | FROM RPZ-D |
| TP-P-10 | PLUMBING | TRUCK SUCTION POINT (W/ CAMLOCK) | TABLE D/E FLANGE | DN80 | PVC | CLIENT | LOCATED IN BUND |
| TP-P-11 | PLUMBING | TRUCK SUCTION POINT | TABLE D/E FLANGE | DN100 | PVC | CLIENT | |
| TP-P-12 | PLUMBING | SERVICE WATER TO IRRIGATION FIELD | TABLE D/E FLANGE | DN25 | PVC | CLIENT | |
| TP-E-01 | ELECTRICAL | 3-PHASE NEUTRAL + EARTH | - | 29.7A | - | CLIENT | |
| TP-E-02 | ELECTRICAL | 3-PHASE NEUTRAL + EARTH | - | 29.7A | - | CLIENT | |
| TP-E-03 | ELECTRICAL | 3-PHASE NEUTRAL + EARTH | - | TBC | - | CLIENT | |

| PIPE SIZES | |
|---|---|
| PIPE COLOUR | SIZE |
| PINK | DN25 |
| GREEN | DN50 |
| BLUE | DN80 |
| ORANGE | DN100 |
| PURPLE | DN150 |

| EQUIPMENT MASSES (kg) | | | |
|---|---|---|---|
| ITEM | DRY WEIGHT | MIN. OPERATING | MAX. OPERATING |
| 50kL POLY TANK | 1,200 | 11,200 | 51,200 |
| ECOFARMER | 11,500 | 51,500 | 61,500 |
| IRR SKID | 700 | - | - |




**NOTES:**
1. POLY TANKS ARE TO BE INSTALLED ON A WELL COMPACTED, LEVELLED SANDY LOAM PAD, (MIN. 100mm DEPTH) FREE FROM SHARP OR LOCALISED HARD STONES/OBJECTS THAT COULD DAMAGE THE TANK BASE.
2. BASE OF ALL TANKS AND PLANT EQUIPMENT (REACTORS, SKIDS, ETC.) TO BE ON THE SAME RL.
3. ELECTRICAL SUPPLY TO MEET RWTS MAX. DEMAND SHEETS.
4. BACKFLOW PREVENTION TO BE INSTALLED ON THE POTABLE WATER LINE INTO THE COMPOUND. INSTALLATION TO ONLY BE CARRIED OUT BY PLUMBER WITH RELEVANT TERRITORY LICENSE.
5. WHEN PROVIDED, SAFETY SHOWER AND/OR EYE WASH STATIONS SHALL COMPLY WITH AS4775 AND SITE REQUIREMENTS.


RWWA | ecoFarmer
REMOTE WATER WESTERN AUSTRALIA
WWW.REMOTEWTS.COM.AU
225 KELVIN ROAD, ORANGE GROVE, WA, 6109
P: (08) 9453 8200 | E: SALES@REMOTEWTS.COM.AU


SHEET SIZE A1
REFERENCES

| REV | BY | DATE | DESCRIPTION | CHECKED | APP |
|---|---|---|---|---|---|
| B | RM | 04.12.25 | DEWATERING BUND INCORPORATED | SL | - |
| A | RM | 16.10.25 | ISSUED FOR REVIEW | SL | - |

REVISIONS

NOT FOR CONSTRUCTION
**PRELIMINARY**

RWWA
ROX RESOURCES VILLAGE
WWTP
GA - SHEET 1



SCALE: N.T.S
DRAWING NUMBER: RWTS-2025032-QP-DWG-0570
REV: B
PROJECT/JOB NUMBER: 2025032

# LEGEND OF TYPICAL WWTP P&ID ABBREVIATIONS, SYMBOLS & ICONS

## SERVICE FLUID

| | |
|---|---|
| AIR | AIR/BLEED AIR |
| CEB | CHEMICAL ENHANCED BACKWASH |
| EFF | EFFLUENT |
| FIG | FILTERED GAS |
| SEW | RAW SEWAGE |
| SLG | WASTE SLUDGE |
| SRW | (POTABLE) SERVICE WATER |
| TEFF | TREATED EFFLUENT |
| WAS | WASTE ACTIVATED SLUDGE |
| WW | WASTE WATER |

## CHEMICALS

| | |
|---|---|
| ALK | ALKALINITY CHEMICAL |
| ATS | ANTISCALANT |
| CB | CARBON CHEMICAL |
| CLG | CHLORINE GAS |
| NUT | NUTRIENT CHEMICAL |
| POS | POLYMER SOLUTION |
| SDG | SULPHUR DIOXIDE GAS |
| SH | SODIUM HYPOCHLORITE (12.5%) |
| SHO | SODIUM HYDROXIDE (CAUSTIC) |
| SUA | SULPHURIC ACID (30%) |

## MATERIALS

| | |
|---|---|
| HDPE | HIGH DENSITY POLYETHYLENE |
| LDPE | LOW DENSITY POLYETHYLENE |
| PVC | POLYVINYL CHLORIDE |
| SS | STAINLESS STEEL (316) |

## EQUIPMENT

| | |
|---|---|
| A | ANCILLIARY EQUIP |
| F | FILTRATION EQUIP |
| P | PUMPS |
| PV | PRESSURE VESSELS |
| TK | TANKS |

## VALVES

| | | |
|---|---|---|
| VC | CHEMICAL INJECTION VALVE | |
| VI | AIR INJECTION VALVE | |
| VM | MANUAL VALVE (BUTTERFLY, GATE, BALL) | |
| VMO | ELECTRIC ACTUATED BALL VALVE (ON/OFF) | |
| VMOD | ELECTRIC ACTUATED BALL VALVE (MODULATING) | |
| VNR | NON-RETURN VALVE (CHECK, RPZ) | |
| VS | SAMPLE POINT | |

## INSTRUMENTS

| | | |
|---|---|---|
| DIT | DISSOLVED OXYGEN TRANSMITTER | DIT 201 |
| FIT | FLOW METER | FM |
| LIT | LEVEL TRANSMITTER | LIT 101A 0...0.4 bar |
| PIT | PRESSURE TRANSMITTER | PIT 101 -1...+6 bar |
| OIT | OXIDATION-REDUCTION POTENTIAL TRANSMITTER | ORP 101 |
| AIT | ANALYTICAL TRANSMITTER | AIT 101 pH |
| TIT | TEMPERATURE TRANSMITTER | TIT 101 |
| - | BELLOWS | |

RWWA REMOTE WATER WESTERN AUSTRALIA
ecoFarmer

REMOTE WATER WESTERN AUSTRALIA
WWW.REMOTEWTS.COM.AU
225 KELVIN ROAD, ORANGE GROVE, WA, 6109
P: (08) 9493 8200 | E: SALES@REMOTEWTS.COM.AU

SHEET SIZE A1
REFERENCES

REVISIONS

| REV | BY | DATE | DESCRIPTION | CHECKED | APP |
|---|---|---|---|---|---|
| A | RM | 21.10.25 | ISSUED FOR REVIEW | SL | - |

NOT FOR CONSTRUCTION
PRELIMINARY

RWWA
ROX RESOURCES VILLAGE
WWTP
P&ID - SHEET 1



SCALE: N.T.S
DRAWING NUMBER: RWTS-2025032-QP-DWG-0571
REV: A
PROJECT/JOB NUMBER: 2025032


RWWA ecoFarmer

REMOTE WATER WESTERN AUSTRALIA
WWW.REMOTEWTS.COM.AU
225 KELVIN ROAD, ORANGE GROVE, WA, 6109
P: (08) 9493 6200 | E: SALES@REMOTEWTS.COM.AU

SHEET SIZE A1

REFERENCES

REVISIONS

| REV | BY | DATE | DESCRIPTION | CHECKED | APP |
|---|---|---|---|---|---|
| A | RM | 21.10.25 | ISSUED FOR REVIEW | SL | - |

NOT FOR CONSTRUCTION

PRELIMINARY

RWWA

ROX RESOURCES VILLAGE

WWTP

P&ID - SHEET 2



SCALE: N.T.S

DRAWING NUMBER: RWTS-2025032-QP-DWG-0572

REV: A

PROJECT/JOB NUMBER: 2025032


RWWA REMOTE WATER WESTERN AUSTRALIA

ecoFarmer

REMOTE WATER WESTERN AUSTRALIA
WWW.REMOTEWTS.COM.AU
225 KELVIN ROAD, ORANGE GROVE, WA, 6109
P: (08) 9493 6300 | E: SALES@REMOTEWTS.COM.AU

SHEET SIZE A1

REFERENCES

REVISIONS

| REV | BY | DATE | DESCRIPTION | CHECKED | APP |
|---|---|---|---|---|---|
| A | RM | 21.10.25 | ISSUED FOR REVIEW | SL | - |

NOT FOR CONSTRUCTION

PRELIMINARY

RWWA

ROX RESOURCES VILLAGE

WWTP

P&ID - SHEET 3



SCALE: N.T.S

DRAWING NUMBER: RWTS-2025032-QP-DWG-0573

REV: A

PROJECT/JOB NUMBER: 2025032


RWWA — REMOTE WATER WESTERN AUSTRALIA
ecoFarmer

REMOTE WATER WESTERN AUSTRALIA
WWW.REMOTEWTS.COM.AU
225 KELVIN ROAD, ORANGE GROVE, WA, 6109
P: (08) 9453 6300 | E: SALES@REMOTEWTS.COM.AU

SHEET SIZE A1

REFERENCES

REVISIONS

| REV | BY | DATE | DESCRIPTION | CHECKED | APP |
|---|---|---|---|---|---|
| A | RM | 21.10.25 | ISSUED FOR REVIEW | SL | - |

NOT FOR CONSTRUCTION

PRELIMINARY

RWWA
ROX RESOURCES VILLAGE
WWTP
P&ID - SHEET 4



SCALE: N.T.S

DRAWING NUMBER: RWTS-2025032-QP-DWG-0574

REV: A

PROJECT/JOB NUMBER: 2025032


RWWA — REMOTE WATER WESTERN AUSTRALIA
ecoFarmer

REMOTE WATER WESTERN AUSTRALIA
WWW.REMOTEWTS.COM.AU
225 KELVIN ROAD, ORANGE GROVE, WA, 6109
P: (08) 9453 8200 | E: SALES@REMOTEWTS.COM.AU

SHEET SIZE A1
REFERENCES
REVISIONS

| REV | BY | DATE | DESCRIPTION | CHECKED | APP |
|---|---|---|---|---|---|
| A | RM | 21.10.25 | ISSUED FOR REVIEW | SL | - |

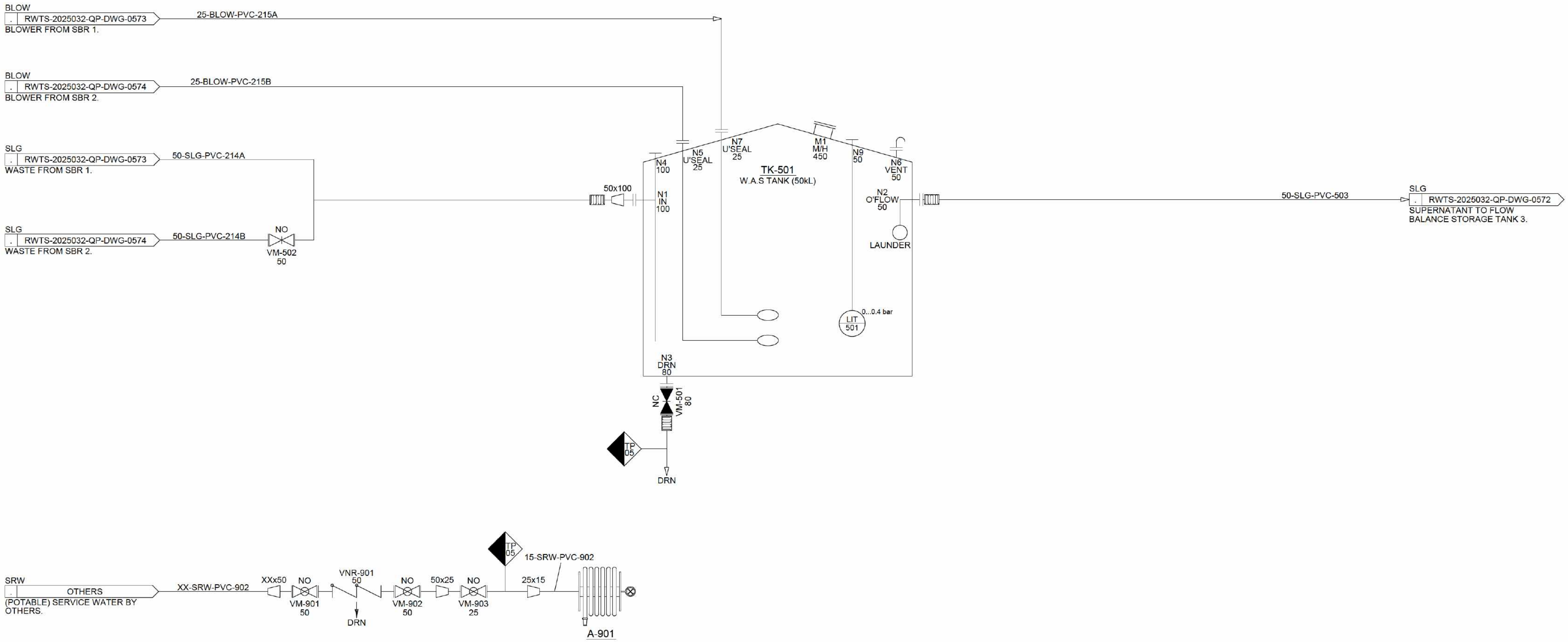
NOT FOR CONSTRUCTION
**PRELIMINARY**

RWWA
ROX RESOURCES VILLAGE
WWTP
P&ID - SHEET 5



SCALE: N.T.S
DRAWING NUMBER: RWTS-2025032-QP-DWG-0575
REV: A
PROJECT/JOB NUMBER: 2025032

UNCONTROLLED WHEN PRINTED




RWWA ecoFarmer

REMOTE WATER WESTERN AUSTRALIA
WWW.REMOTEWTS.COM.AU
225 KELVIN ROAD, ORANGE GROVE, WA, 6109
P: (08) 9493 8300 | E: SALES@REMOTEWTS.COM.AU

SHEET SIZE A1

REFERENCES

REVISIONS

| REV | BY | DATE | DESCRIPTION | CHECKED | APP |
|---|---|---|---|---|---|
| A | RM | 21.10.25 | ISSUED FOR REVIEW | SL | - |

NOT FOR CONSTRUCTION

PRELIMINARY

RWWA

ROX RESOURCES VILLAGE

WWTP

P&ID - SHEET 6

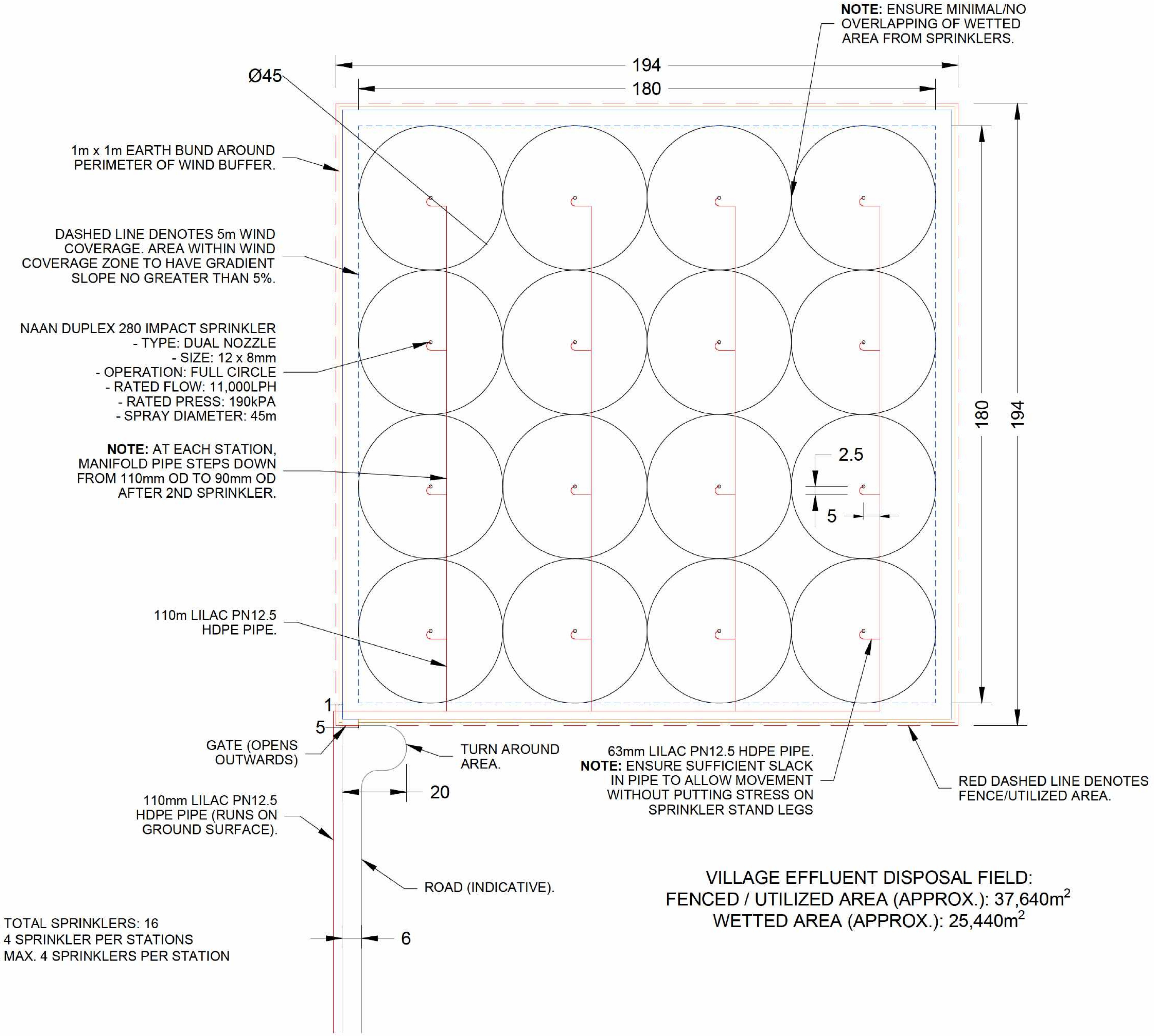


SCALE: N.T.S

DRAWING NUMBER: RWTS-2025032-QP-DWG-0576

REV: A

PROJECT/JOB NUMBER: 2025032




VILLAGE EFFLUENT DISPOSAL FIELD:
FENCED / UTILIZED AREA (APPROX.): 37,640m$^2$
WETTED AREA (APPROX.): 25,440m$^2$

- TOTAL SPRINKLERS: 16
- 4 SPRINKLER PER STATIONS
- MAX. 4 SPRINKLERS PER STATION


REMOTE WATER WESTERN AUSTRALIA
WWW.REMOTEWTS.COM.AU
225 KELVIN ROAD, ORANGE GROVE, WA, 6109
P: (08) 9493 8200 | E: SALES@REMOTEWTS.COM.AU


SHEET SIZE A1

REFERENCES

REVISIONS

| REV | BY | DATE | DESCRIPTION | CHECKED | APP |
|---|---|---|---|---|---|
| A | RM | 04.12.25 | ISSUED FOR REVIEW | SL | - |

NOT FOR CONSTRUCTION

PRELIMINARY

RWWA ROX RESOURCES VILLAGE
EFFLUENT DISPOSAL FIELD
WWTP
GA - SHEET 1



SCALE: N.T.S

DRAWING NUMBER: RWTS-2025032-QP-DWG-0711 | REV: A

PROJECT/JOB NUMBER: 2025032

## 17.10 Appendix 10. RWTS (2025b). Youanmi Village Sewage Treatment System Design Information

# ROX Resources Limited Youanmi Gold Mine Accommodation Village Project Sewage Treatment Plant Design Overview, Process Certification

| Rev | Date | Author | Description | Checked | Approved |
|---|---|---|---|---|---|
| 0 | 01/12/2025 | [redacted] | | [redacted] | |
| | | | | | |
| | | | | | |
| | | | | | |

ISO 9001 certified Equal Assurance
AS 4801 certified Equal Assurance
ISO 14001 certified Equal Assurance

ecoFarmer | RWTS REMOTE WATER TREATMENT SERVICES

# PROJECT INFORMATION

| CLIENT INFORMATION | |
|---|---|
| **Name** | [redacted] |
| **Company** | ROX Resources Limited |
| **Date** | 01/12/2025 |
| **Position** | [redacted] |
| **Phone** | [redacted] |
| **Email** | [redacted] |

| PROJECT INFORMATION | |
|---|---|
| **Project Name** | 300-person Accommodation Village Sewage Treatment System |
| **Document #** | TBA |
| **Project ID number** | TBA |
| **Location** | The ROX Resources Youanmi Gold Mine Accommodation Village Site will be located at L8275 – GDA 1994 MGA ZONE 50 |
| **RWTS Internal Job No.** | TBA |
| **Contract No.** | TBA |
| **Production Volume** | 80 Kl per day of Raw Sewage – plus Reverse Osmosis Brine - @ up to 27KL PER DAY |
| **Assembly** | Biological Wastewater Treatment System Multiple Train SBR Ecofarmer 500 SNR STD |

# DESIGN CERTIFICATION INFORMATION

**CLIENT:** ROX Resources Youanmi Gold Mine Accommodation Village

**PRINCIPAL:** ROX Resources Limited

**CONTRACT No:** 2025 - 019

**SCOPE OF WORK:** 300 Person Sewage Treatment System

1 x Fabricated sewage treatment plant including poly storage tanks for Balance, Treated Effluent and Chlorine Contact including effluent disposal field.

The packaged sewage treatment has been designed and will be constructed by Remote Water Treatment Services Pty Ltd, 52 Industry Place Wynnum, QLD 4178, ABN: 72 143 206 820.

Remote Water Treatment Service Pty Ltd (RWTS) hereby certify that the Biological Waste Water Treatment System Ecofarmer 250 Multiple Train Sewage treatment system has been designed for site specific operating conditions for the Fortescue Bonny Downs Accommodation Village 550 person Sewage Treatment System Project – and hereby certify that the system has been designed to provide the quality of effluent as set out further in this documentation. This certificate certifies that all items listed below comply with the equipment and workmanship requirements of the RWTS engagement order including standard specification.

- AS1547:2012 - On-site domestic Wastewater Management – Accepted by RWTS
- AS1546.3:2017 - On-site domestic Wastewater Treatment Plants – Accepted by RWTS
- AS1170 - Structural Design for steel fabricated reactors
- AS4020:2002 & AS2070 - Poly tank material for food contact
- AS4766:2006 - Tank manufacturing guidelines
- AS3500.2:2015 Plumbing – Sanitary signed off on by WA contracted plumber
- AS1657:2013 – Ladders and Platforms
- AS3990 – Mechanical Equipment – Steel work

# GENERAL PROJECT OVERVIEW

ROX Resources requires an Accommodation Facility for construction workforce to meet project targets for the Youanmi Gold Mine.

The intent is to install a new facility – allowing for 300 persons – with a waste treatment Capacity of 80 kl per day to be treated, and up to a total of 27 kl per day of reverse osmosis reject to be discharged/blended with the treated wastewater to the irrigation area. Total irrigated volume of up to 107 m3 day.

The new STP is to be designed to provide ongoing reliable service and to minimise maintenance requirements and ensure ease of operation whilst maintaining reliable effluent quality and daily production.

The table below **outlines the New Additional Wastewater Treatment Facility Characteristics Summary**

| | |
|---|---|
| Location | Facility located at Youanmi Gold Mine, Mt Magnet Region within the Archaean Yilgarn Craton, 125 klms south of Mt Magnet. |
| Maximum Throughput | Maximum sewage throughput capacity of the new combined facility – 100,000 L/day |
| Storage Tanks | 2 x 50,000 litre poly chlorine contact/Irrigation storage tanks – 3 x 50,000 litre Raw Sewage Storage Tanks – 1 x 50,000 Waste Activated Sludge Storage Tank. |
| Irrigation Area | 4.948 Hectares or 49,480 square metres with an average DIR of 2.89 mm (maximum DIR 4.45 mm) |
| Key Nutrient Outputs | BOD < 20 mg/l<br>Total N < 20 mg/l<br>Total P < 7.5 mg/l<br>Suspended Solids < 30 mg/l<br>E-Coli/Coliform < 1000 cfu/100 ml<br>TDS < 2800 mg/l |
| Existing Soil Type | Fractured Rock and sandy gravel throughout |

The absolute peak daily inflow the system is capable of is 100,000 ltrs, as a result – the system has a maximum design EP of 500 persons @ 200 litres per person per day, or 300 ep @ 333 litres per person. Hydraulically, the system design is capable of a nominal 100,000 litres per day – and has the biological capacity to treat up to 500 persons.

| | Raw Influent | Treated Effluent Required |
|---|---|---|
| ADWF ($m^3$/day) | 80 $m^3$ | 80 $m^3$ Max Flow - |
| BOD (mg/L) | 300 | <20 |
| SS (mg/L) | 300 | <30 |
| Total N (mg/L) | 80 | <20 |
| NH3 – N (mg/L) | 60 | < 1 |
| Total P (mg/L) | 20 | <7.5 |
| Coliforms (units/100 mL) - | - | <1000 |
| Dissolved Oxygen (mg/L) | - | > 2 |
| Free Chlorine residual (mg/L) | < 0.2 - | 0.2-2.0 |
| Ph | 6.5 – 8.5 | 6.5 – 8.5 |

As a result, the following design loads are to be used for the site for **the Ecofarmer 500 SBR Hybrid WWTP – (Minimum 2 x Operating Trains Ecofarmer 250)** :

Site input basis of design for long term process stability is as follows:

- Peak load - 500 persons – at 200 litres per person per day peak = 100,000 litres per day maximum total hydraulic load.
- Realistic load - @ 70% of the above Peak Load figures as an average once the site is established over the next few years = 70,000 litres per day.
- Initial Average Load on start-up will be @ 50% of the above realistic load at 35,000 litres to 50,000 litres per day.
-

We use the following data for equivalent persons – which are industry standard figures and realistic as seen in the field:
Per EP – BOD = 60 grams per person per day
Per EP – TN = 16 grams per person per day
Per EP – TP = 5 grams per person per day
Average Realistic Hydraulic Load per EP – 200 ltrs day
Peak Hydraulic Load per EP – 250 ltrs day

**Daily – Final Realistic load BOD = 18.00 KGS**
**Daily - Final Realistic Load TN = 4.80 kgs**
**Daily - Final Realistic Load TP = 1.50 kgs**
**Daily - Final Hydraulic Realistic Load = 60 kl**
EP *Equivalent* Total = **300 Persons**

**The systems maximum peak load capacity is as follows:**

**Daily – Peak load BOD = 30.00 KGS**
**Daily - Peak Load TN = 8.00 kgs**
**Daily - Peak Realistic Load TP = 2.50 kgs**
**Daily - Final Hydraulic Peak Load = 100 kl maximum capacity**
EP *Equivalent* Total = **500 Persons**

Final design range is therefore:
**Nominal Biological Range of 300 EP (Peak capacity of the system is 500 ep)**
**Nominal Hydraulic Range of 60,000 litres per day to 80,000 litres per day (Peak capacity of the system is 100,000 litres per day)**
Peak **biological reserve** – 40% = **200 persons additional capacity**
Peak **hydraulic reserve** – 20% = **20,000 ltrs day additional capacity**.

As a result, the following design loads are to be used for the site for **this Ecofarmer Train** – with the new combined system using Three Ecofarmer 250 Trains:

| | |
|---|---|
| BOD | = 18.00 kgs/day BOD |
| Total Ammonia Nitrogen | = 4.80 kgs |
| Total Phosphorous | = 1.50 kgs |
| Suspended Solids | = 18.0 kgs |

Daily Hydraulic Load Max Expected = 80,000 litres

It is noted that the target environmental design output for nutrients and effluent quality is as follows:

- SS < 30 mg/l
- BOD < 20 mg/l
- TN < 20 mg/l
- TP < 7.5 mg/l
- Total Coliform < 1000 cfu/100 ml
- **TDS <2800 mg/l**

This effluent quality requirement is typical for Low Risk.

**Individual Ecofarmer 250 Train Design Details**
**Influent Criteria Specified as follows:**

- 50,000 litres per day per train
- 15.0 kgs per day BOD per train
- 15.0 kgs per day Suspended Solids per train
- 4.0 kgs per day Ammonia Nitrogen per train
- 1.25 kgs per day Phosphorous per train

**Bioreactor Sizing**

A hydraulic retention time (H.R.T) of 24 hours under maximum operating conditions (50kL/day per train).
Carbon dosing (Sucrose) may not be required in high loading periods as the F:M ratio should be sufficient, however may be required in low loading periods to meet the Nitrogen release limit of 20mg/L. Carbon Dosing support is provided as standard equipment with the system.

**Process Design Workings SBR 250**

Target operating MLSS is to be 3000mg/L at bottom water level (i.e. decant level) which will result in a correction of Active Biomass as follows: -
Total system biomass = 3000mg/L x Vol @ BWL (41.60kL) = 124.8kg

**Maximum Loading**
System design loading (Max including design reserve.) = 17.5 kg/day
Food: Mass Ratio (average) = 0.13
Carbon addition (sucrose dosing) not required.

**Average Loading**
System design loading (average) = 10.0 kg/day
Food: Mass Ratio (average) = 0.08
Carbon addition may be required.

**Low Loading (100 EP)**
System design loading (min) = 6.0 kg/day
Food: Mass Ratio (min) = 0.048
Carbon addition will be required.

**Ratios and Equations**

**Target operating MLSS for DO demand Calcs**: 3500 mg/l – working range of 1200mg/l to 4500 mg/l

**SBR Biological Process Area – Cycling Height**: 50,837 litres

**SBR Biological Process Area – Decant Height**: 38,437 litres

**Active Biomass**: at 3500 mg/l = 3500 x 38,437 = 135000000 / 1000000 = 134.52 kg

**Design Load**: **250 EP @ 70 grams BOD/ep/day** and a maximum of 200 litres per ep/day
Design load is therefore 17,500 grams per day or 17.5 kg per day and a maximum hydraulic load of 50,000 litres per day with 10% redundancy.

**The basis of design is 250 persons at a maximum daily hydraulic throughput of 50,000 litres.**

**Food/Mixed liquor (FM) Ratio**: 17.5/134.52 = 0.130 with a working range of 0.050 to 0.150

**Available Cycles per day**: 6 x 4-hour cycles – minimum available aeration time of 130 minutes per 4 hour cycle

**Oxygen delivery available per cycle**: 130 minutes or 2.17 hours @ 5.46 kg per hour = 11.83 kg per cycle

AOTR Testing has been completed and checked inhouse at RWTS to determine aeration transfer efficiency of the aeration package designed for the system. Our system design uses a reflected/rebound flow path from the outlet of the venturi units – reflecting and recycling off an internal wall of the system creating additional mixing and air retention – which has resulted in improved oxygen transfer rates at the system working depth.

The following figures reflect the as tested values:

At an air delivery rate of 2600 litres per minute, @ an AOTR of **35 grams of o2 /m3/hr air delivered** this equates to an AOTR of **5.46 kgs/hr**. 2600 litres per minute air delivery **is the expected minimum available**, 2 x Mazzei 4091 Venturi @ 1011 ltrs per minute motive liquid flow ea @ 1.41 Bar feed pressure at the venturi inlet.

The feed pressure, air delivery rate and aeration timing is all fully adjustable – allowing flexibility and the ability to optimise aeration control.

**Actual Demand Calculations are as follows:**

50,000 litres per day / 6 cycles = 8,333 litres per cycle / plus Purge allowance of 300 litres

8,633 x 300 mg/l BOD = 2916 grams BOD per cycle x 1.2 (O2 Take up requirement) = 3500 grams

8,633 x 80 mg/l NH3 = 690.64 grams Ammonia Nitrogen Per Cycle x 4.6 (O2 Take up requirement) = 3176.94 grams

Actual Total Base Demand per cycle = 6676.95 grams or 6.68 kgs / 2.50 hrs = 2970 grams per hour actual demand, or **3.0 kgs/hr.**

**Aeration Oxygen Requirements**
Aeration calculations for the SOTR/hr and based on the Peak Load Operation (4.00-hour cycle), the required Oxygen Transfer Rate is approximately 3.5kg/hour. Based on 2hr 10mins aeration, the oxygen transfer rate per cycle is a minimum of 11.83 kg/O2/cycle.

**Air Supply**
The air supply consists of a dry mounted Grundfos SE1.80.100.75 centrifugal pump and two (2) Mazzei 4091 Venturi Injectors which supply a combined air flow rate of 156 m3/hr (1300 litres per minute each, 2600 litres per minute combined), with a delivered O2 per m3/air of 35 grams as tested in our facility.

The liquid flow rate required to drive the two venturis is 36.2 l/sec or 2,172 ltrs/min - @ 1.41 bar at the venturi inlet (the pump provides the duty at 15 mtrs delivery head).

The Latest Generation 6 series of Ecofarmer 250 systems operates with Variable speed drive control – and Dissolved oxygen target setpoints available to the operator.

Each of the 2 operating trains are 100% redundant and independent – but communicate via Ethernet comms and allow a network ID and subsequent sequence ID to ensure the systems operate evenly and in synchronization. If one system fails or shuts down due to lower loads – the system ID can be changed to ensure the balance of Trains are operating in a sequenced format.

This arrangement provides a huge amount of redundancy, operational flexibility and site security – resulting in a robust design that is easier to manage.

# WASTE WATER SYSTEM OVERVIEW

From the standpoint of sources of generation, wastewater may be defined as a combination of the liquid or water-carried wastes removed from residences, institutions, and other establishments.

If untreated waste is allowed to accumulate, the decomposition of the organic materials it contains can lead to the production of large quantities of foul-smelling gases. In addition, untreated wastewater usually contains numerous pathogenic or disease-causing organisms, micro-organisms that dwell in the human intestinal tract. Wastewater also contains nutrients, which can stimulate the growth of aquatic plants and it may contain toxic compounds. For these reasons, the immediate and nuisance-free removal of wastewater from its sources of generation, followed by treatment and disposal is not only desirable but also necessary in any society.

## WASTE WATER CHARACTERISTICS

The important contaminants of concern in wastewater treatment are listed in **Table 1.1**.

Table 1.1 - Important contaminants of concern in wastewater treatment

| Contaminants | Reason for Importance |
|---|---|
| **Suspended Solids** | Suspended solids can lead to the development of sludge deposits and anaerobic conditions when untreated wastewater is discharged into the aquatic and land-based environment. Example: faeces, dirt, and grit. |

| | |
|---|---|
| **Biodegradable organics** | If discharged untreated to the environment, their biological stabilisation can lead to the depletion of natural oxygen resources (which can kill animal life) and to the development of septic (unsanitary and noxious) conditions. Biodegradable organics are measured most commonly in terms of BOD (Biochemical Oxygen Demand). Example: carbohydrates, proteins, fats. |
| **Pathogens** | Communicable diseases can be transmitted by the pathogenic organisms in wastewater. Example: Hepatitis A, Giardia, and Cryptosporidium. |
| **Nutrients** | Both nitrogen and phosphorous, along with carbon and alkalinity, are essential nutrients for growth. When discharged to the aquatic environment, these nutrients can lead to the growth of undesirable aquatic life resulting in ecological changes. When discharged in excessive amounts on land, they can also lead to the pollution of groundwater. |

The composition and quantity of wastewater produced will vary depending on the nature of the facilities, number of persons using the facilities, upstream management and the local environmental conditions. Typical compositions of domestic wastewater are presented in **Table 1.2.**

Table 1.2 Typical domestic untreated wastewater composition

| Contaminants | Concentration | | |
|---|---|---|---|
| | Weak | Medium | Strong |
| **Suspended Solids (mg/L)** | 100 | 200 | 400 |
| **Chemical Oxygen Demand (mg/L)** | 250 | 500 | 900 |
| **Biochemical Oxygen Demand (mg/L)** | 110 | 250 | 450 |
| **Nitrogen (Total as N) (mg/L)** | 20 | 60 | 100 |
| **Organic N (mg/L)** | 8 | 15 | 20 |
| **Free Ammonia (mg/L)** | 20 | 50 | 80 |
| **Nitrites (mg/L) & Nitrates (mg/L)** | 0 | 0 | 0 |
| **Phosphorous (Total) (mg/L)** | 5 | 10 | 25 |
| **Chlorides (mg/L)** | 30 | 100 | 400 |
| **Sulphate (mg/L)** | 20 | 30 | 50 |
| **Alkalinity as $CaCO_3$ (mg/L)** | 50 | 200 | 300 |
| **Fats, Oil & Grease or FOG (mg/L)** | 2 | 5 | 15 |
| **Total Coliform (orgs/100mL)** | $10^6$-$10^7$ | $10^7$-$10^8$ | $10^7$-$10^9$ |

# PLANT DESIGN PERFORMANCE SPECIFICATIONS FOR ECOFARMER 750 SBR HYBRID WWTP

## BASIS FOR DESIGN

When designing a wastewater treatment system, hydraulic and organic loadings must be fixed as a basis for design. The wastewater treatment system is then sized according to this basis and the effluent standard requirements. This Sewage Treatment Plant has been designed in this manner. Failure to observe the hydraulic and organic loadings may result in the discharge of effluent that does not meet the required standards. If the loadings are not exceeded (and upstream management and servicing procedures are adequate) the treatment plant will produce a high quality secondary treated effluent.

**Table 2.1** presents the effluent quality that can be expected from the Sewage Treatment Plant if the influent loadings are not exceeded. The treatment plant is designed for specific influent concentrations. The influent concentrations relative to the hydraulic load for design are proportional, meaning the influent concentrations can be higher, if the hydraulic load is lower. The system will need to be tuned to the site concentrations experienced. These influent characteristics are detailed in the table below.

| Characteristic | Average Influent | Desired Effluent Quality |
|---|---|---|
| **PDWF[1] ($m^3$/day)** | 10 m3 Min Flow | 100 m3 Max Flow |
| **BOD (mg/L)** | 360 | <20 |
| **SS (mg/L)** | 360 | <30 |
| **Total N (mg/L)** | 100 | <20 |
| **$NH_3$ – N (mg/L)** | 80 | - |
| **Total P (mg/L)** | 20 | <7.5 |
| **Faecal Coliforms (units/100 mL)** | - | <1000 |

# TANKS & SIZING

| Tank Description | Function | Capacity<br>L x W x H |
|---|---|---|
| **Balance Tanks** | Receives Raw sewage From the Site. | D: COERCO 50KL IND<br>Capacity: 3 x 50,000 L |
| **Waste Activated Sludge Tank** | Waste Solids Storage Tank to assist in managing MLSS levels and system biological sludge age | D: COERCO 50KL IND<br>Capacity: 1 x 50,000 L |
| **2 x Sequential Batch Reactor (SBR) and Plant Room** | Aeration, mixing, settling, decant. Treats effluent with a combination of air and mixing schedules controlled via the PLC an air induction pump adds the oxygen and then mixes the chamber for nitrogen conversion | **Each Train - Overall D:**<br>12000 L x 3000 H x 2400 W<br>**Each Train - Nominal Usable SBR Process Area**<br>Capacity: 50,000 L |
| **Final Effluent/Chlorine Contact and blended RO brine storage Tanks** | Treated effluent collection. Upon the decant phase of the SBR treated effluent is decanted and disinfected with Sodium Hypochlorite via chlorine dosing system and stored within the chlorine contact tank/ brine/ wet weather storage tanks before discharged to irrigation. | D: COERCO 50KL IND<br>Capacity: 2 x 50,000 L |

# TREATMENT PROCESS OVERVIEW

The treatment process is arranged in an SBR (sequential batch reacting) configuration consisting of a primary tank, screen and balance tank front end. The SBR Process features a combined anoxic/aerobic biological suspended growth treatment process. This relies on bacterial action to achieve the following:

- Coagulate and remove the non-settleable colloidal solids and carbonaceous organic matter
- Convert the colloidal and dissolved carbonaceous organic matter into various gases and cell mass
- Reduce the nutrients such as nitrogen and phosphorus and other trace organic compounds

## Anoxic degradation

The anoxic phase is designed to provide:

- Combined unheated but mixed Anoxic degradation / digestion
- Sludge storage in suspension
- De-Nitrification

## Degradation Mechanism

Anoxic digestion is the process whereby anoxic organisms use oxidised inorganic compounds such as nitrate and nitrite as electron acceptors instead of oxygen in the respiratory metabolism to convert the colloidal and carbonaceous organic matter into gases and cell tissue.

The equation provides a simplified representation of the decomposition process.

**Complex Organic and Inorganic Compounds = > Energy + Waste Products**

Energy is derived from the biochemical decomposition of complex organic and inorganic molecules in processes similar to the way animals obtain energy from food. The energy is used for cell growth, maintenance and reproduction.

The waste products of these processes may be either gases (e.g. $CO_2$ or $CH_4$) or metabolic end products (e.g. alcohol and organic acids). The gases escape from the system and the soluble waste products are further degraded in subsequent treatment units.

The nitrate used in respiration will be reduced to nitrite and then to nitrogen gaseous forms, including $N_2$ or $N_2O$: this anaerobic respiration process is referred to as denitrification.

Denitrification is performed by denitrifying bacteria, which are facultative aerobes (i.e. aerobic bacteria also capable of utilising oxidised nitrogen compounds e.g. nitrate in place of oxygen as electron acceptor in the respiration).

The bacteria use the carbon contained in organic matter and the oxygen available from the nitrate to decompose organic matter.  Under normal aerobic conditions, these bacteria will respire by aerobic respiration using oxygen. When the oxygen source is depleted, they will respire by anoxic respiration using nitrate as the electron acceptor.

BOD reduction is essential to maintain the efficiency of the subsequent nitrification process; Nitrate conversion to gaseous compounds (nitric oxide, nitrous oxide and N2) in the overall nutrient removal process.

Via the internal recycling of the process, nitrate produced by nitrification in the aerobic phase is recycled to the anoxic phase to result in denitrification. Prior to being converted to nitrogen gas (N2), nitrate undergoes a series of transformations shown under the following chemically simplified equation:

$$NO_3^- \Rightarrow NO_2^- \Rightarrow NO \Rightarrow N_2O \Rightarrow N_2$$

The denitrification process is governed by a number of factors such as the amount of dissolved oxygen, available carbon, available alkalinity/pH and temperature. The gaseous nitrogen products escape the atmosphere and are therefore removed from the treated wastewater (final effluent).

The efficiency of the denitrification process is further governed by the supply of a good carbon source, which originates primarily from the incoming raw sewage supplied to the anoxic reactor, and to some extent also contained in the sludge recycled back from the aerobic phase through to the anoxic phase.

## Mixed liquor suspended solids

Even though the volume of solid material being deposited is being reduced continually by anoxic or aerobic respiration (decomposition), a net increase of solids in suspension will always occur in an activated sludge system that is fed raw sewage due to the accumulation of non-biodegradable solids originating from the sewage as well as the net production of biomass originating from bacterial growth processes. If sludge is wasted from the system (as waste activated sludge), at steady state the inventory (concentration) of mixed liquor solids in suspension in the system will be constant. The mass of sludge wasted will be equal to the production due to processes of bacterial growth or accumulation of non-biodegradable organic matter. The system operator will need to tune the WAS system to achieve steady state inventory, based on the influent quality and system performance.

## Aerobic processes

Aerobic growth and digestion takes place in the Aerobic stage and consists of the conversion of organic matter by aerobic microorganisms to new cell mass (biomass), followed by a series of death and cell regeneration processes sometimes called aerobic digestion.

The bacteria oxidize only a portion of the original waste stream (maximum net amount of 80%) introduced into the reactor into low-energy compounds such as nitrate, sulphate, carbon dioxide and water and through this will release energy to synthesize the remainder of the organic matter into new cellular material (biomass).

The cells produced (along with accumulated non-biodegradable organic material, collectively named the ‘biomass’) is settled out during the settle/decant phase of the system operation - and is recycled back through the bioreactor upon restart of the next batch treatment to reseed the process with active organisms and to maintain a desired mixed liquor solids concentration. The mixture of old and new synthesized cellular material must be managed by the system operator in order to allow stable and efficient settling of this material based on a suitable sludge age and biomass performance.

The bacterial re-seeding of the process allows the continuous degradation of organic compounds (carbonaceous organic matter) fed to the process as raw sewage.

Simultaneously with the aerobic degradation of organic compounds, specific bacteria named "nitrifying bacteria" will convert ammonia into nitrate (or sometimes small amounts of nitrite - that forms nitrogen as part of the overall nitrogen removal process). This conversion process is referred to as nitrification.

Nitrification consists of converting the ammonia present in the incoming sewage to nitrate. This conversion is represented by the following:

$$NH_3 \Rightarrow NO_2^- \Rightarrow NO_3^-$$

The conversion of nitrite to nitrate occurs so rapidly that nitrite is usually non-detectable in the overall process. Low concentrations may be detected when part of the nitrification pathway is blocked (typically under conditions of low dissolved oxygen or low pH/ low wastewater alkalinity).

Degradation occurs under aerobic conditions (presence of oxygen). The efficiency of the process is highly dependent upon the BOD load, available amount of dissolved oxygen and ph. A high or low BOD load will reduce the nitrification efficiency since the nitrifying bacteria are slower growing and cannot easily compete for available oxygen supply conditions with bacteria oxidising carbonaceous (organic or BOD) compounds.

Optimum aerobic conditions required for successful aerobic digestion and nitrification are maintained by the use of dissolved air introduction in the aerobic tank, this air introduction system also provides the minimum mixing intensity required to keep the bacterial culture and all other compounds contained within the reactor in suspension.

## Clarification

Settling is the main process occurring in the SBR for clarification of fluid. The solid material (biomass) that settles out in the SBR includes cellular material (old and new) and non-biodegradable / inert compounds, which were not used as energy by bacteria in the synthesis of organic matter. These combined create a biological floc, which combines and settles leaving behind clarified/clear fluid for decanting and disinfection.

These compounds will form a sludge layer at the bottom of the reactor which will be returned/re-mixed as "activated sludge" to re-seed the incoming effluent and continue the biological process ("Return Activated Sludge" or RAS). A portion of the RAS will be wasted and is then termed Waste Activated Sludge (WAS). The RAS, which includes the active microbial population, will undergo further cycles of growth and death/ regeneration in the Anoxic and Aerobic Reactors to maintain the biological process.

The clarified liquid stream leaves the SBR via the decant system as Secondary Effluent. The more efficient the clarification (settling) operation is, the higher the clarity (lower turbidity and suspended solids content) of the Secondary Effluent.

## Disinfection and Instrumentation System

ACH also provides a final chemical polish/removal of remaining phosphorous and typically results in TP levels of less than 2.5 mg/l consistently when combined with the RWTS Hybrid SBR Process.

Historically – and when managed correctly – this process produces Turbidity values of less than 5 ntu. High Level warning limits and High High Level alarm limits will also be employed to notify the system operator that the system is performing outside recommended guidelines.

Chlorine is used to disinfect the final polished effluent from the SBR. The method used to deliver chlorine to the treated effluent is by way of chlorine dosing via a dosing system delivering a set amount of chlorine to the effluent flow during the decant process, with the system design allowing enough time to disinfect the body of water fit for final irrigation. Irrigation is inhibited for a minimum CCT or chlorine contact time in mg/min to ensure complete disinfection has occurred.

A secondary disinfection function is employed using a top up function built into the control system, providing a secondary – delayed delivery of chlorine that is fully adjustable by the system operator. This is a very reliable and robust disinfection platform that typically provides low detectable E-Coli and Coliform levels when operated and maintained correctly.

## RWTS Proprietary Nitrogen and Phosphorous Removal System

Nitrogen, in the form of Ammonia predominantly in the raw sewage collected form the site, as well as phosphorous are the two key nutrients that require considerable reduction before the treated effluent can be discharged to the receiving environment.

A number of keys steps are employed with our Hybrid SBR design to reduce these nutrients to as low as practical and below expected compliance targets.

**Removal Process Number One** – RWTS Proprietary Chemical Nitrogen and Phosphorous Removal

RWTS employs smart chemistry and process design techniques to chemically bind Ammonia, Phosphorous and Magnesium within the process area of the system. Supplementary sources of chemical are delivered accurately during processing of sewage, using smart control techniques and software to produce an effective and efficient reduction of Ammonia/Nitrogen and Phosphorous, with some cases allowing up to 40% reduction of TN and TP with this step alone. In a standard operating environment such as this situation – the expected reduction should result in 30% removal with this step alone.

**Removal Process Number Two** – RWTS Proprietary Biological Nitrogen and Phosphorous Removal

A smart Anoxic operating phase controlled accurately by proprietary RWTS software and control methodology using advanced Dissolved Oxygen Monitoring and Control, combined with balanced Carbon to Ammonia operating ratios allow Phosphorous accumulating Organisms to Biologically take up more than they require for metabolism and multiplication, resulting in retained biological phosphorous removal occurring during treatment. Phosphorous ultimately ends up in the WAS tank and waste sludge and is maintained in an aerobic state in this tank to eliminate the chance of re-release back to the process area of the system.

De-nitrification occurs biologically when Nitrate is sacrificed during respiration requirements due to the oxygen molecule being extracted by capable denitrifying bacteria within the process area. Ideal de-nitrification conditions are controlled and maintained by design using RWTS's hybrid platform and proprietary techniques.

## Summary

Each cycle is a sequence of multiple aeration & anoxic cycles followed by settling, decanting and re-filling. Each sequence is fully adjustable for optimum treatment and nutrient removal based on site conditions through the HMI screen.

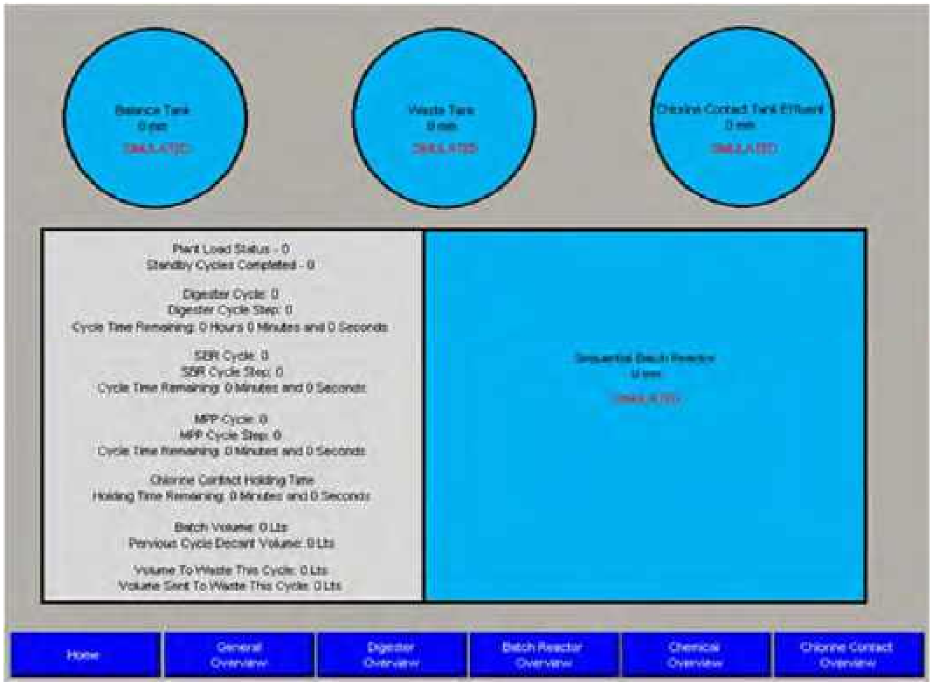
Smart dosing is provided for balancing of Carbon to Ammonia Ratio, as well as Ammonia/Nitrogen and Phosphorous

- Sludge age will average 8 - 21 days depending on hydraulic/organic loads
- Each cycle will decant approximately 9500 litres /treat approximately 8,400 litres of fluid – 3 trains provide a total maximum of 18 cycles per day.
- **WAS tank** provides storage for waste activated sludge, and foreign material removal – with a capacity of 50,000 litres usable storage. Waste sludge is then dewatered via Geobags and polymer dosing – with supernatant recovery using a Geobag slab/bund and dewatering via dehydration. Geobags will be disposed of via regulatory allowable disposal – either using brown hazardous material waste bins supplied by a suitable licensed waste contractor – or via licensed/approved waste land fill on the site.
- **Flow Balance tank** is 150,000 litres usable in size. This will cater for 100 % of the daily peak load over 24 hours.
- **Chlorine contact/ Brine Storage** is 400,000 litres, Chlorine delivery can be adjusted to ensure adequate initial dose is provided for minimum PPM hours needed for effective disinfection – based on final effluent quality – with a target residual of 0.70 ppm after 3 hours of disinfection prior to release to irrigation/environment.

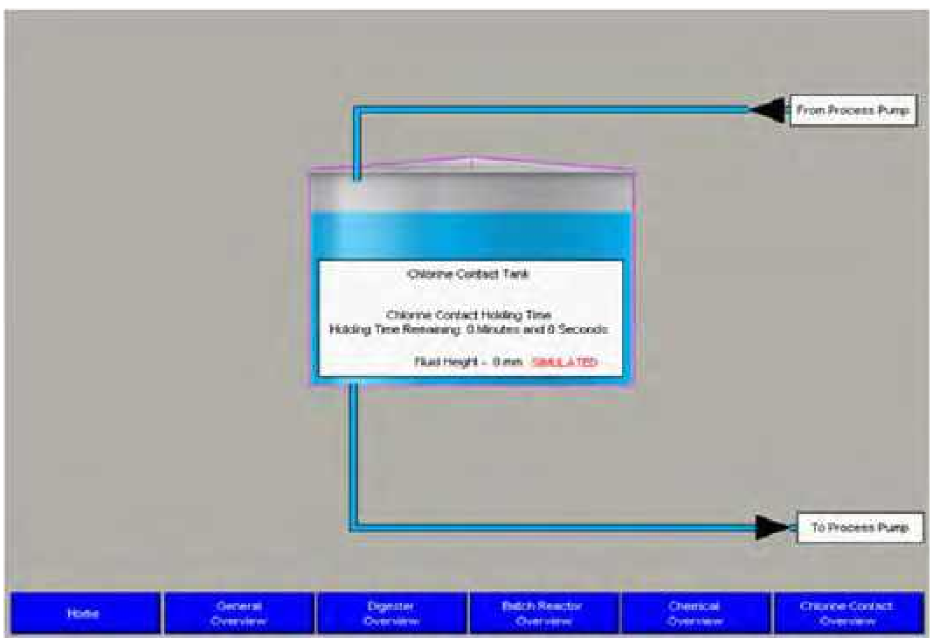
**Example HMI screens are as per the below screen shots for the system – from left to right as you access them via the HMI:**

## HMI Screens

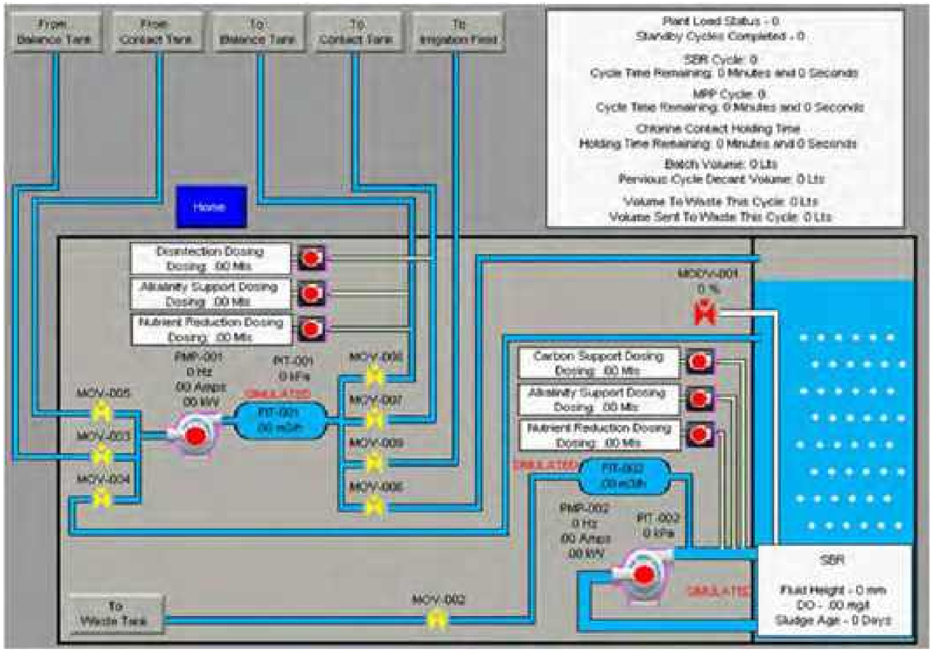
## General overview



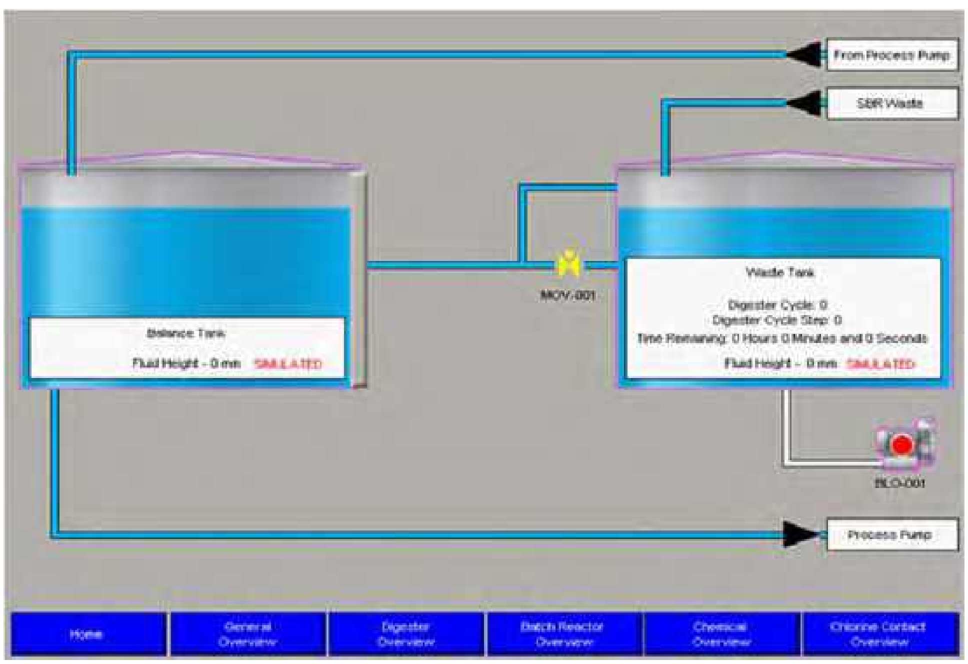

## Chlorine Contact



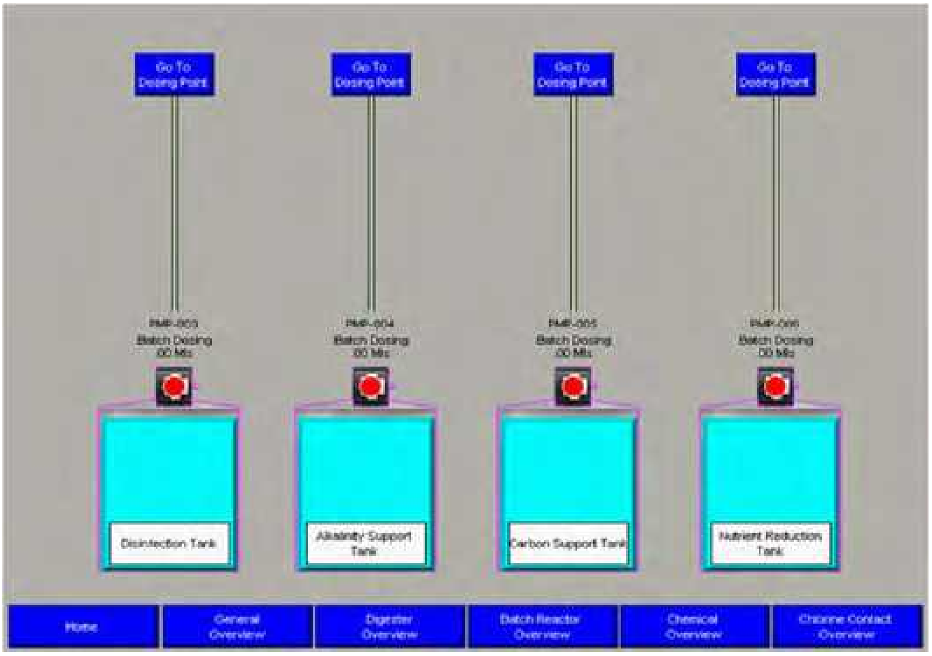
## SBR OVERVIEW




## DIGESTER OVERVIEW



## CHEMICAL OVERVIEW




## PUMPS AUTO OFF MANUAL

| EQUIPMENT | DESCRIPTION | AUTO | OFF | MANUAL | MANUAL VALUE |
|---|---|---|---|---|---|
| PMP-001 | Process Pump | AUTO | OFF | MANUAL | % |
| PMP-002 | Aeration Pump | AUTO | OFF | MANUAL | % |
| PMP-003 | Disinfection Pump | AUTO | OFF | MANUAL | |
| PMP-004 | Alkalinity Support Pump | AUTO | OFF | MANUAL | |
| PMP-005 | Carbon Support Tank | AUTO | OFF | MANUAL | |
| PMP-006 | Nutrient Reduction Pump | AUTO | OFF | MANUAL | |
| BLO-001 | Digester Blower | AUTO | OFF | MANUAL | |

## VALVES AUTO OFF MANUAL

| EQUIPMENT | DESCRIPTION | AUTO | OFF | MANUAL | MANUAL VALUE |
|---|---|---|---|---|---|
| MOV-001 | Digester Decant Valve | AUTO | OFF | MANUAL | |
| MOV-002 | Waste Valve 2 | AUTO | OFF | MANUAL | |
| MOV-003 | Balance Tank Suction Valve | AUTO | OFF | MANUAL | |
| MOV-004 | SBR Decant Suction Valve | AUTO | OFF | MANUAL | |
| MOV-005 | Chlorine Contact Tank Suction Valve | AUTO | OFF | MANUAL | |
| MOV-006 | SBR Fill Valve | AUTO | OFF | MANUAL | |
| MOV-007 | Chlorine Contact Recirculation Valve | AUTO | OFF | MANUAL | |
| MOV-008 | Balance Tank Recirc / Purge Valve | AUTO | OFF | MANUAL | |
| MOV-009 | Irrigation Discharge Valve | AUTO | OFF | MANUAL | |
| MODV-001 | Oxygen Inlet Modulating Valve | AUTO | OFF | MANUAL | % |



## TRANSMITTER SIMULATION VALUES

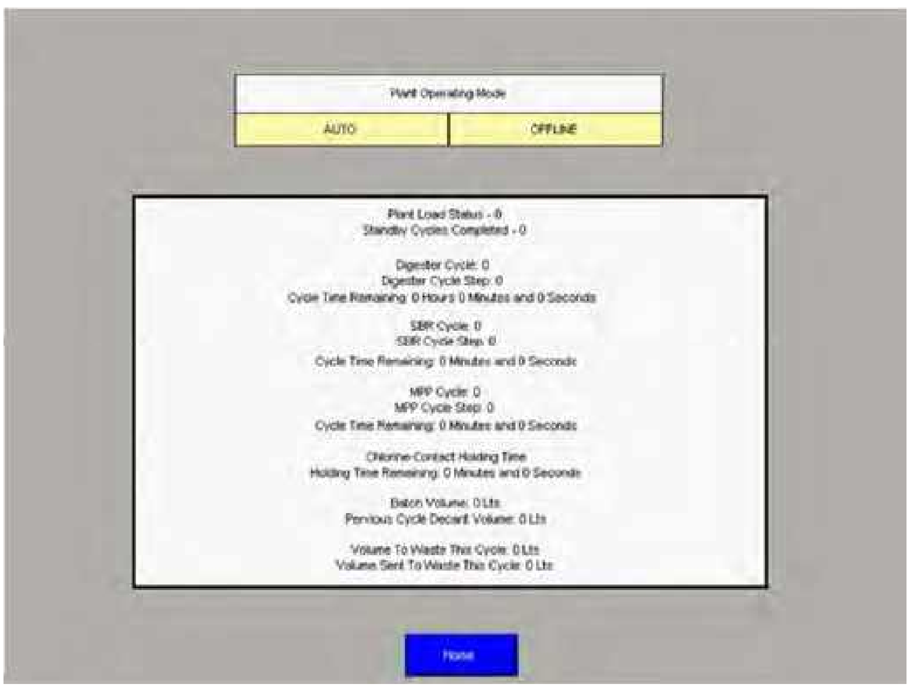
| SENSORS | DESCRIPTION | SIMULATED VALUE | ON/OFF | SCALED VALUE |
|---|---|---|---|---|
| LIT-001 | Waste Tank Level | mm | Simulate | mm |
| LIT-002 | SBR Tank Level | mm | Simulate | mm |
| LIT-003 | Balance Tank Level | mm | Simulate | mm |
| LIT-004 | Chlorine Contact Tank Level | mm | Simulate | mm |
| PIT-001 | Mixer / Aerator Pump Discharge Pressure | kPa | Simulate | kPa |
| PIT-002 | Chlorine Contact Recirculation Pump Discharge Pressure | kPa | Simulate | kPa |
| FIT-001 | Multi Purpose Flow Meter | m3/h | Simulate | m3/h |
| FIT-002 | SBR Waste Flow Meter | m3/h | Simulate | m3/h |

## ANALOG SCALING

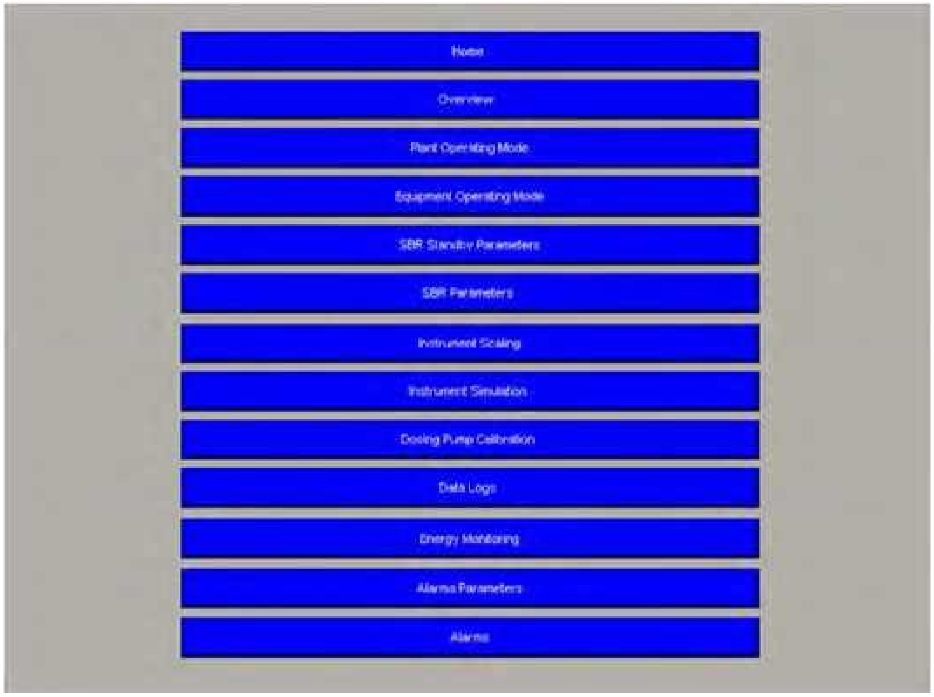
| SENSORS | DESCRIPTION | RAW mA VALUE | RANGE MINIMUM | RANGE MAXIMUM | SCALED VALUE |
|---|---|---|---|---|---|
| LIT-001 | Waste Tank Level | mA | mm | mm | mm |
| LIT-002 | SBR Tank Level | mA | mm | mm | mm |
| LIT-003 | Balance Tank Level | mA | mm | mm | mm |
| LIT-004 | Chlorine Contact Tank Level | mA | mm | mm | mm |
| PIT-001 | Mixer / Aerator Pump Pressure | mA | kPa | kPa | kPa |
| PIT-002 | Chlorine Contact Pump Pressure | mA | kPa | kPa | kPa |
| FIT-001 | Process Pump Flow Meter | mA | m3/h | m3/h | m3/h |
| FIT-002 | Waste Flow Meter | mA | m3/h | m3/h | m3/h |

Home

## PLANT OPERATING MODE



## MAIN NAVIGATION




## SBR STANDBY

| SBR PARAMETERS | PARAMETER DESCRIPTION | SETTING |
|---|---|---|
| Standby Aeration Time | Aeration cycle runtime in standby. | Minutes |
| Standby Mixing Time | Mixing cycle runtime in standby. | Minutes |
| Extended Standby Aeration Time | Aeration cycle runtime in extended standby. | Minutes |
| Extended Standby Mixing Time | Mixing cycle runtime in extended standby. | Minutes |
| Standby Cycles | Standby cycles to complete before entering extended standby. | Cycles |
| Carbon Supplement Delay | A carbon supplement dose will be dosed into the SBR if the system is in standby for greater then. | Minutes |
| Carbon Supplement Dose | Carbon dose in litres to be dosed into SBR. | Litres |
| Disinfection Top Up Delay | A disinfection top up dose will be dosed into the irrigation tank if the system is in standby for greater then. | Minutes |
| Disinfection Top Up Dose | Disinfection top up dose. Dosed in PPM, relevant to last decant volume | PPM |

Home

## SBR PARAMETERS

| SBR PARAMETERS | PARAMETER DESCRIPTION | SETTING |
|---|---|---|
| Balance Tank Holding Capacity (TNK-001) | Total Capacity Of Balance Tanks in Litres | Litres |
| Balance Tank Head At Capacity (TNK-001) | Static Pressure Difference Between Level Transmitter and Overflow. | mm |
| Balance Tank Minimum Height (TNK-001) | Minimum Height Required to be Maintained in the Balance Tank | mm |
| Balance Tank Start Refill Height | Calculated Balance Tank Level Required To Start A Cycle | 0 mm |
| Reactor Transfer Volume | Minimum Volume Of Fluid Required in Balance Tank to Start a Fill Cycle | Litres |
| Balance Tank Mixing (TNK-001) | Balance Tank Mixing Time. | Minutes |
| Pipework Purge Time | Pipework Purge Time | Seconds |
| Normal Demand Level | When the balance tank level rises above this setpoint, Normal demand parameters are used. | mm |
| Peak Demand Level | When the balance tank level rises above this setpoint, Peak demand parameters are used. | mm |
| Pump Parameters | Pump Speed and Current Limiting Settings | Pump Parameters |
| Low Demand Parameters | Settings runtime parameters for SBR Cycles | Low Demand Parameters |
| Normal Demand Parameters | Settings runtime parameters for SBR Cycles | Normal Demand Parameters |
| Peak Demand Parameters | Settings runtime parameters for SBR Cycles | Peak Demand Parameters |
| Sludge Wasting | Sludge Wasting Parameters | Waste Parameters |
| Chemical Dosing | Plant Chemical Dosing Parameters | Dosing Parameters |
| Dissolved Oxygen Control | Dissolved Oxygen Control Valve Positioning | DO Parameters |
| Irrigation Parameters | Irrigation Parameters | Irrigation Parameters |

Home

## LOW DEMAND PARAMETERS

| LOW DEMAND PARAMETERS | PARAMETER DESCRIPTION | SETTING |
|---|---|---|
| Low Demand Refill Height | Height to refill SBR tank to in low demand. | mm |
| Low Demand Aeration 1 Time | Aeration cycle one runtime in low demand. | Minutes |
| Low Demand Mixing 1 Time | Mixing cycle one runtime in low demand. | Minutes |
| Low Demand Aeration 2 Time | Aeration cycle two runtime in low demand. | Minutes |
| Low Demand Mixing 2 Time | Mixing cycle two runtime in low demand. | Minutes |
| Low Demand Aeration 3 Time | Aeration cycle three runtime in low demand. | Minutes |
| Low Demand Mixing 3 Time | Mixing cycle three runtime in low demand. | Minutes |
| Low Demand Aeration 4 Time | Aeration cycle four runtime in Low Demand | Minutes |
| Low Demand Settling Time | SBR settling time in low demand. | Minutes |
| Low Demand Purge Time | Purges decant line to balance tank for set time. | Seconds |
| Low Demand Decant Level | Decant cycle will run until SBR level is below setpoint. | mm |
| Low Demand Decant Maximum Time | Maximum time the decant cycle is able to run in the event the SBR tank does not reach level setpoint. | Minutes |

Back

## NORMAL DEMAND PARAMETERS

| NORMAL DEMAND PARAMETERS | PARAMETER DESCRIPTION | SETTING |
|---|---|---|
| Normal Demand Refill Height | Height to refill SBR tank to in normal demand. | mm |
| Normal Demand Aeration 1 Time | Aeration cycle one runtime in normal demand. | Minutes |
| Normal Demand Mixing 1 Time | Mixing cycle one runtime in normal demand. | Minutes |
| Normal Demand Aeration 2 Time | Aeration cycle two runtime in normal demand. | Minutes |
| Normal Demand Mixing 2 Time | Mixing cycle two runtime in normal demand. | Minutes |
| Normal Demand Aeration 3 Time | Aeration cycle three runtime in normal demand. | Minutes |
| Normal Demand Setting Time | SBR setting time in normal demand. | Minutes |
| Normal Demand Purge Time | Purges decant line to balance tank for set time. | Seconds |
| Normal Demand Decant Level | Decant cycle will run until SBR level is below setpoint. | mm |
| Normal Demand Decant Maximum Time | Maximum time the decant cycle is able to run in the event the SBR tank does not reach level setpoint. | Minutes |

Back

## PEAK DEMAND PARAMETERS

| PEAK DEMAND PARAMETERS | PARAMETER DESCRIPTION | SETTING |
|---|---|---|
| Peak Demand Refill Height | Height to refill SBR tank to in peak demand. | mm |
| Peak Demand Aeration 1 Time | Aeration cycle one runtime in peak demand. | Minutes |
| Peak Demand Mixing 1 Time | Mixing cycle one runtime in peak demand. | Minutes |
| Peak Demand Aeration 2 Time | Aeration cycle two runtime in peak demand. | Minutes |
| Peak Demand Mixing 2 Time | Mixing cycle two runtime in peak demand. | Minutes |
| Peak Demand Aeration 3 Time | Aeration cycle three runtime in peak demand. | Minutes |
| Peak Demand Setting Time | SBR setting time in peak demand. | Minutes |
| Peak Demand Purge Time | Purges decant line to balance tank for set time. | Seconds |
| Peak Demand Decant Level | Decant cycle will run until SBR level is below setpoint. | mm |
| Peak Demand Decant Maximum Time | Maximum time the decant cycle is able to run in the event the SBR tank does not reach level setpoint. | Minutes |

Back

## WASTE PARAMETERS

| PARAMETER | PARAMETER DESCRIPTION | SETTING | |
|---|---|---|---|
| Sludge Wasting Method | Select To Waste By Percentage Or Volume. | Percentage | Volume |
| Volume to Waste | Volume of Fluid To Waste From SBR Each Cycle. | Lts | |
| Waste Maximum Runtime | Maximum Time Waste Valve Will Open In A Cycle. | Minutes | |
| Settling Start Time | Time the the day the sludge digester will start settling. | O'clock | |
| Settling Time | Time during the sludge digester will settle before decanting. | Minutes | |
| Decant Runtime | Time during the sludge digester decant valve will open after settling. | Minutes | |

Back

## DOSING PARAMETERS

| CHEMICAL PARAMETERS | PARAMETER DESCRIPTION | SETTING | |
|---|---|---|---|
| Disinfection Dosing (PMP-003) | Disinfection PPM Dose During Decant Cycle. | PPM | |
| Disinfection Top Up Dose (PMP-003) | Disinfection PPM Dose Top Up Dose In Standby. | PPM | |
| Alkalinity Support Dosing (PMP-004) | Alkalinity Support Dosing Point | Balance Tank | SBR |
| Alkalinity Support Dosing (PMP-004) | Alkalinity Support PPM Dose Per Cycle | PPM | |
| Carbon Support (PMP-005) | Carbon Support PPM Dose During Second Anoxic Cycle | PPM | |
| Carbon Support (PMP-005) | Carbon Supplement Dose In Litres After Delay In Standby Mode. | Litres | |
| Nutrient Reduction Dosing (PMP-006) | Nutrient Reduction Dosing Point | Balance Tank | SBR |
| Nutrient Reduction Dosing (PMP-006) | Nutrient Reduction PPM Dose Per Cycle | PPM | |

Back

## DO PARAMETERS

| CYCLE | AERATION START SETPOINT | DERATE AT % OF CYCLE | DERATING STARTING POINT | DERATING END POINT |
|---|---|---|---|---|
| Low Load Aeration 1 Setting | DO | % | DO | DO |
| Low Load Aeration 2 Setting | DO | % | DO | DO |
| Low Load Aeration 3 Setting | DO | % | DO | DO |
| Low Load Aeration 4 Setting | DO | % | DO | DO |
| Normal Load Aeration 1 Setting | DO | % | DO | DO |
| Normal Load Aeration 2 Setting | DO | % | DO | DO |
| Normal Load Aeration 3 Setting | DO | % | DO | DO |
| Peak Load Aeration 1 Setting | DO | % | DO | DO |
| Peak Load Aeration 2 Setting | DO | % | DO | DO |
| Peak Load Aeration 3 Setting | DO | % | DO | DO |
| Standby Aeration Setting | DO | % | DO | DO |
| Extended Standby Aeration Setting | DO | % | DO | DO |

| | |
|---|---|
| Air Valve Max Clamp | % |
| Air Valve Min Clamp | % |

| | |
|---|---|
| Air Valve PID Gains - Kc | |
| Air Valve PID Gains - Ti | |
| Air Valve PID Gains - TD | |
| Air Valve PID Gains - FC | |

No DO Probe | DO Probe Installed

Back | DO Calibration

## DOSING PUMP CALIBRATION

| Disinfection Pump - PMP-003 | SETTINGS |
|---|---|
| Pump Flow Calibration | Abort Calibration |
| Measured Calibrated Volume | Mls |
| Chemical Strength (%) | % |

| Alkalinity Support Pump - PMP-004 | SETTINGS |
|---|---|
| Pump Flow Calibration | Abort Calibration |
| Measured Calibrated Volume | Mls |
| Chemical Strength (%) | % |

| Carbon Support Pump - PMP-005 | SETTINGS |
|---|---|
| Pump Flow Calibration | Abort Calibration |
| Measured Calibrated Volume | Mls |
| Chemical Strength (%) | % |

| Nutrient Reduction - PMP-006 | SETTINGS |
|---|---|
| Pump Flow Calibration | Abort Calibration |
| Measured Calibrated Volume | Mls |
| Chemical Strength (%) | % |

Back

ALARM NAVIGATION PAGE


LEVEL ALARMS - ALARMS PAGE 1

| SENSORS | DESCRIPTION | ALARM VALUE | DELAY |
|---|---|---|---|
| LIT-001 | Waste Tank Low Level Alarm | mm | Secs |
| | Waste Tank Low Level Warning | mm | Secs |
| | Waste Tank High Level Warning | mm | Secs |
| | Waste Tank High Level Alarm | mm | Secs |
| LIT-002 | Sequential Batch Reactor Low Level Alarm | mm | Secs |
| | Sequential Batch Reactor Low Level Warning | mm | Secs |
| | Sequential Batch Reactor High Level Warning | mm | Secs |
| | Sequential Batch Reactor High Level Alarm | mm | Secs |
| LIT-003 | Balance Tank Low Level Alarm | mm | Secs |
| | Balance Tank Low Level Warning | mm | Secs |
| | Balance Tank High Level Warning | mm | Secs |
| | Balance Tank High Level Alarm | mm | Secs |
| LIT-004 | Chlorine Contact Low Level Alarm | mm | Secs |
| | Chlorine Contact Low Level Warning | mm | Secs |
| | Chlorine Contact High Level Warning | mm | Secs |
| | Chlorine Contact High Level Alarm | mm | Secs |

Home

PRESSURE ALARMS - ALARMS PAGE 2

| SENSORS | DESCRIPTION | ALARM VALUE | DELAY |
|---|---|---|---|
| PIT-002 | Mixer / Aerator Low Pressure Alarm | kPa | Secs |
| | Mixer / Aerator Low Pressure Warning | kPa | Secs |
| | Mixer / Aerator High Pressure Warning | kPa | Secs |
| | Mixer / Aerator High Pressure Alarm | kPa | Secs |
| PIT-001 | Balance Mixing Low Pressure Alarm | kPa | Secs |
| | Balance Mixing Low Pressure Warning | kPa | Secs |
| | Balance Mixing High Pressure Warning | kPa | Secs |
| | Balance Mixing High Pressure Alarm | kPa | Secs |
| PIT-001 | Reactor Refill Low Pressure Alarm | kPa | Secs |
| | Reactor Refill Low Pressure Warning | kPa | Secs |
| | Reactor Refill High Pressure Warning | kPa | Secs |
| | Reactor Refill High Pressure Alarm | kPa | Secs |
| PIT-001 | Pipework Purge Low Pressure Alarm | kPa | Secs |
| | Pipework Purge Low Pressure Warning | kPa | Secs |
| | Pipework Purge High Pressure Warning | kPa | Secs |
| | Pipework Purge High Pressure Alarm | kPa | Secs |
| PIT-001 | Decant Purge Low Pressure Alarm | kPa | Secs |
| | Decant Purge Low Pressure Warning | kPa | Secs |
| | Decant Purge High Pressure Warning | kPa | Secs |
| | Decant Purge High Pressure Alarm | kPa | Secs |

Home Next

PRESSURE ALARMS - ALARMS PAGE 3

| SENSORS | DESCRIPTION | ALARM VALUE | DELAY |
|---|---|---|---|
| PIT-001 | Decant Low Pressure Alarm | kPa | Secs |
| | Decant Low Pressure Warning | kPa | Secs |
| | Decant High Pressure Warning | kPa | Secs |
| | Decant High Pressure Alarm | kPa | Secs |
| PIT-001 | Treated Effluent Recirculation Low Pressure Alarm | kPa | Secs |
| | Treated Effluent Recirculation Low Pressure Warning | kPa | Secs |
| | Treated Effluent Recirculation High Pressure Warning | kPa | Secs |
| | Treated Effluent Recirculation High Pressure Alarm | kPa | Secs |
| PIT-001 | Irrigation Discharge Low Pressure Alarm | kPa | Secs |
| | Irrigation Discharge Low Pressure Warning | kPa | Secs |
| | Irrigation Discharge High Pressure Warning | kPa | Secs |
| | Irrigation Discharge High Pressure Alarm | kPa | Secs |

Back Home

## FLOW ALARMS - ALARMS PAGE 4

| SENSORS | DESCRIPTION | ALARM VALUE | DELAY |
|---|---|---|---|
| FIT-002 | SBR Waste Low Flow Alarm | m3/h | Secs |
| | SBR Waste Low Flow Warning | m3/h | Secs |
| | SBR Waste High Flow Warning | m3/h | Secs |
| | SBR Waste High Flow Alarm | m3/h | Secs |
| FIT-001 | Balance Mixing Low Flow Alarm | m3/h | Secs |
| | Balance Mixing Low Flow Warning | m3/h | Secs |
| | Balance Mixing High Flow Warning | m3/h | Secs |
| | Balance Mixing High Flow Alarm | m3/h | Secs |
| FIT-001 | Reactor Refill Low Flow Alarm | m3/h | Secs |
| | Reactor Refill Low Flow Warning | m3/h | Secs |
| | Reactor Refill High Flow Warning | m3/h | Secs |
| | Reactor Refill High Flow Alarm | m3/h | Secs |
| FIT-001 | Pipework Purge Low Flow Alarm | m3/h | Secs |
| | Pipework Purge Low Flow Warning | m3/h | Secs |
| | Pipework Purge High Flow Warning | m3/h | Secs |
| | Pipework Purge High Flow Alarm | m3/h | Secs |
| FIT-001 | Decant Purge Low Flow Alarm | m3/h | Secs |
| | Decant Purge Low Flow Warning | m3/h | Secs |
| | Decant Purge High Flow Warning | m3/h | Secs |
| | Decant Purge High Flow Alarm | m3/h | Secs |

Home Next

## FLOW ALARMS – ALARMS PAGE 5

| SENSORS | DESCRIPTION | ALARM VALUE | DELAY |
|---|---|---|---|
| FIT-001 | Decant Low Flow Alarm | m3/h | Secs |
| | Decant Low Flow Warning | m3/h | Secs |
| | Decant High Flow Warning | m3/h | Secs |
| | Decant High Flow Alarm | m3/h | Secs |
| FIT-001 | Treated Effluent Recirculation Low Flow Alarm | m3/h | Secs |
| | Treated Effluent Recirculation Low Flow Warning | m3/h | Secs |
| | Treated Effluent Recirculation High Flow Warning | m3/h | Secs |
| | Treated Effluent Recirculation High Flow Alarm | m3/h | Secs |
| FIT-001 | Irrigation Discharge Low Flow Alarm | m3/h | Secs |
| | Irrigation Discharge Low Flow Warning | m3/h | Secs |
| | Irrigation Discharge High Flow Warning | m3/h | Secs |
| | Irrigation Discharge High Flow Alarm | m3/h | Secs |

Back Home

## ACTUATOR VALVE ALARMS – ALARMS PAGE 6

| SENSORS | DESCRIPTION | DELAY | DISABLE |
| --- | --- | --- | --- |
| MOV-001 | MOV-001 Alarm delay if correct feedback signal is not received. | Secs | Disabled |
| MOV-002 | MOV-002 Alarm delay if correct feedback signal is not received. | Secs | Disabled |
| MOV-003 | MOV-003 Alarm delay if correct feedback signal is not received. | Secs | Disabled |
| MOV-004 | MOV-004 Alarm delay if correct feedback signal is not received. | Secs | Disabled |
| MOV-005 | MOV-005 Alarm delay if correct feedback signal is not received. | Secs | Disabled |
| MOV-006 | MOV-006 Alarm delay if correct feedback signal is not received. | Secs | Disabled |
| MOV-007 | MOV-007 Alarm delay if correct feedback signal is not received. | Secs | Disabled |
| MOV-008 | MOV-008 Alarm delay if correct feedback signal is not received. | Secs | Disabled |
| MOV-009 | MOV-009 Alarm delay if correct feedback signal is not received. | Secs | Disabled |
| MODV-001 | MODV-001 Alarm delay if correct feedback signal is not received | Secs | Disabled |

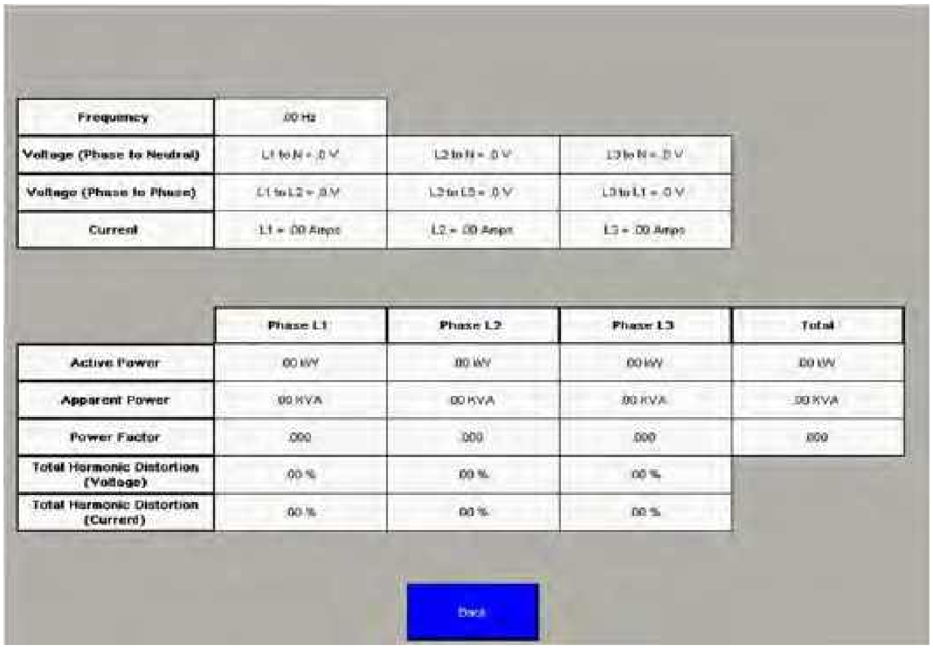
Home

## IRRIGATION PARAMETERS

| SBR PARAMETERS | PARAMETER DESCRIPTION | SETTING |
| --- | --- | --- |
| Chlorine Contact Tank Recirc Stop Level | Chlorine Contact Recirculation Stop Level | mm |
| Chlorine Contact Tank Recirc Start Level | Chlorine Contact Recirculation Start Level | mm |
| Irrigation Stop Level | Irrigation Stop Level | mm |
| Irrigation Start Level | Irrigation Start Level | mm |
| Chlorine Contact Holding Time | Chlorine Contact Holding Time After Decant | Minutes |

Home

## ENERGY MONITORING



| | | | | |
|---|---|---|---|---|
| Frequency | .00 Hz | | | |
| Voltage (Phase to Neutral) | L1 to N = .0 V | L2 to N = .0 V | L3 to N = .0 V | |
| Voltage (Phase to Phase) | L1 to L2 = .0 V | L2 to L3 = .0 V | L3 to L1 = .0 V | |
| Current | L1 = .00 Amps | L2 = .00 Amps | L3 = .00 Amps | |
| | Phase L1 | Phase L2 | Phase L3 | Total |
| Active Power | .00 kW | .00 kW | .00 kW | .00 kW |
| Apparent Power | .00 KVA | .00 KVA | .00 KVA | .00 KVA |
| Power Factor | .000 | .000 | .000 | .000 |
| Total Harmonic Distortion (Voltage) | .00 % | .00 % | .00 % | |
| Total Harmonic Distortion (Current) | .00 % | .00 % | .00 % | |

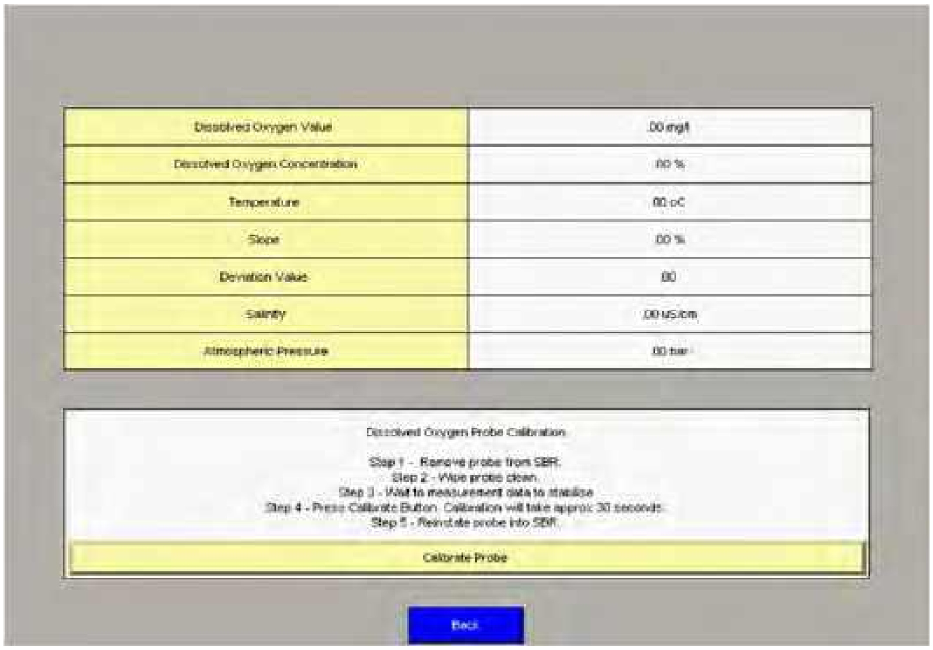


## HMI RESET

ALARM PAGE


PUMP PARAMETERS

## DISSOLVED OXYGEN CALIBRATION



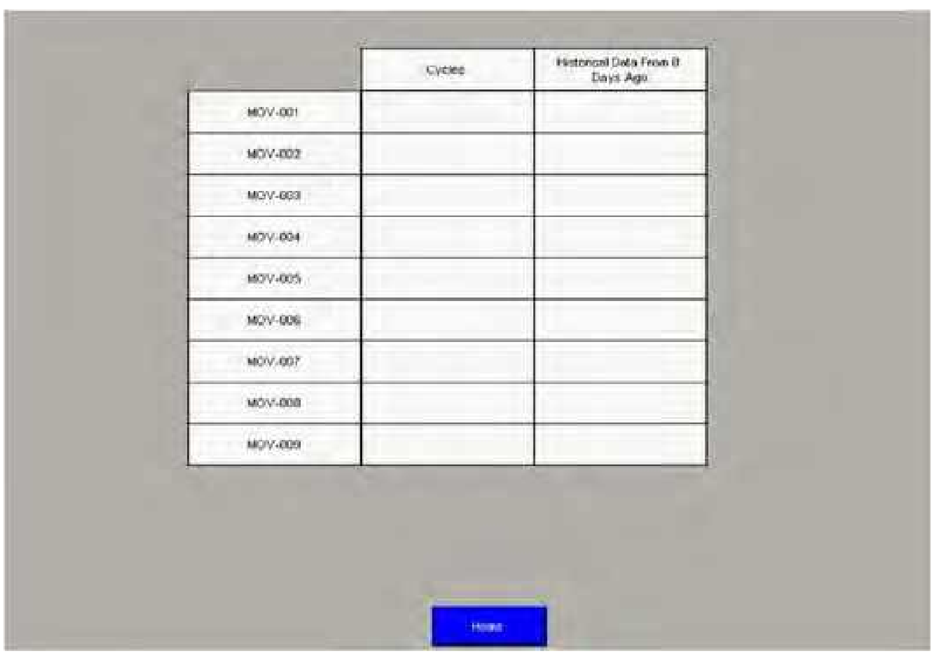

## DATA LOGS PAGE 1 – FLOW LOGS

## DATA LOGS PAGE 2 - PUMP LOGS

| | Run Hours Total | Historical Data From 0 Days Ago | Flow Today | Historical Data From 0 Days Ago |
|---|---|---|---|---|
| PMP-001 | 0 Hours | 0 Hours | | |
| PMP-002 | 0 Hours | 0 Hours | | |
| PMP-003 | 0 Hours | | 0 ml | 0 ml |
| PMP-004 | 0 Hours | | 0 ml | 0 ml |
| PMP-005 | 0 Hours | | 0 ml | 0 ml |
| PMP-006 | 0Hours | | 0 ml | 0 ml |



## DATA LOGS PAGE 3 - VALVE LOGS



| | Cycles | Historical Data From 0 Days Ago |
|---|---|---|
| MOV-001 | | |
| MOV-002 | | |
| MOV-003 | | |
| MOV-004 | | |
| MOV-005 | | |
| MOV-006 | | |
| MOV-007 | | |
| MOV-008 | | |
| MOV-009 | | |

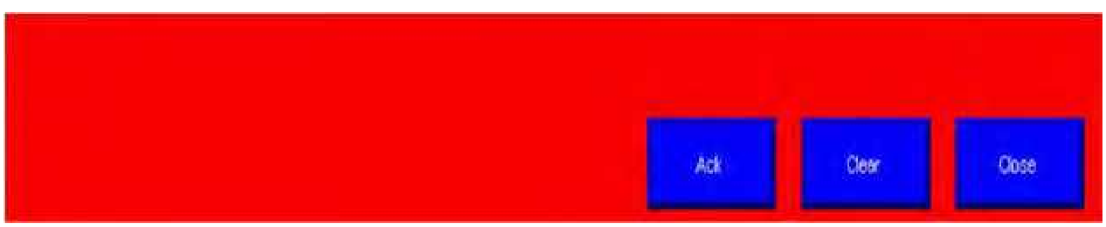
## DATA LOGS PAGE 4 - CYCLE LOGS

| | Cycles | Historical Data From 0 Days Ago |
|---|---|---|
| Standby Aeration | 0 | 0 |
| Standby Mixing | 0 | 0 |
| Extended Standby Aeration | 0 | 0 |
| Extended Standby Mixing | 0 | 0 |
| Reactor Refill | 0 | 0 |
| SBR Cycles | 0 | 0 |
| Balance Mixing | 0 | 0 |
| SBR Waste | 0 | 0 |
| Pipework Purge | 0 | 0 |
| Irrigation Recirculation | 0 | 0 |
| Irrigation Discharge | 0 | 0 |
| Critical Fault - Cat 1 | 0 | 0 |
| Critical Fault - Cat 2 | 0 | 0 |

Home

## DAIGNOSTICS


## ALARM BANNERS




***Note: Only trained persons to operate the engineering pages of the HMI all changes must be reported back to RWTS engineering team for verification of process change. Failure to do so may result in poor effluent quality and risk of plant failure.***

# SYSTEM SOFTWARE PLATFORM AND PROGRAM

The platform basis is as follows:

**Waste activated sludge management**

One option provided – percentage (%) of daily inflow

Range = 0.00 to 10.00% with a default setting of 5.00% (two decimal places available)

The system measures the Batch volumes based on the flow meter log value for the previous days total throughput – and automatically calculates the volume eg: previous daily total volume of 1,400 litres and then multiplies it by the percentage target (using default for the example of 5 %) = 70 litres to waste per batch

The system will then allow one WAS function per day – on the first sequence after the Operator Nominated time of day – which is adjustable.

The WAS function will operate and measure the wasted volume of water in ltrs – which, once achieved, will stop the WAS function and allow the system to continue with the Refill Phase – which is the next step in the operating sequence.

The operator is then given a sludge age display – based on reactor volume with a range of 0 days up to 150 days – with a given calculated displayed value based on the following calculation:

Combined addition of wasted volume over the past Variable number of days is completed until it reaches or exceeds the nominated process volume in the system reactor – which is calculated as follows:

Liquid height (variable operator selection in Flow Balance Settings – default of 2.1 mtrs)

Reactor length – fixed at 9.5 mtrs
Reactor Width – fixed at 2.38 mtrs

Equation is a follows: (Variable H) x 9.5 x 2.38 =
2.1 x 9.5 x 2.38= 47,481 ltrs reactor capacity

The system continues to subtract days - 1,2 3, and so on until it equals or exceeds the capacity calculated – and then displays based on the number of days it took to complete the equation – with the display showing as

System Sludge Age in Days = "Result"

Waste sludge will be sent to Geobags held within a bund /recovery sump for supernatant – and dosed with polymer automatically during the wasting sequence. Geobags will be rotated once full to allow them to dehydrate, allowing them to reinstated and topped up on rotation until they are full and ready for disposal and replacement with new Geobags. The bags are a purpose designed 1 m3 holding volume fabricated bag using quality material – with lifting straps to allow removal and changeover with a small Telehandler of forklift. Waste Solids will be disposed of via regulated waste landfill disposal compliant with WA regulatory requirements.

# OPERATING PLATFORM SETTINGS

## Standby Operation

Aeration Standby = ? minutes 0-60 mins adjustable- default 30 minutes

Mixing Standby = ? minutes 0-60 mins adjustable- default 30 minutes

As soon as standby is started – a counter starts counting with the following outcome:

After min number of standby operation FOR (v) – default setting of **4** complete cycles (Aeration and Mixing = 1 cycle) the system enters Extended Standby Operation.

## Extended Standby Operation

Extended Aeration Standby = ? minutes 0-60 mins adjustable - default 30 minutes

Extended Mixing Standby = ? minutes 0-60 mins adjustable- default 45 minutes

## Flow Balance Settings

Min Flow Balance Height pump stop level = (V) 0.65 mtrs default adjustable
Flow Balance Pump Run Level = (V) 0.80 mtrs default adjustable
Flow balance tank Level system changes to normal operation mode from low load level = (V) 1.0 mtrs default adjustable (below this level the system operates under the low load settings, above it operates in normal settings)
Flow balance tank Level system changes to Peak operation mode from normal load level = (V) 1.5 mtrs default adjustable (below this level the system operates under the normal load settings, above it operates in Peak load settings)
Reactor Fill Height = (V) 2.15 mtrs default adjustable

## Low Load Operation

Aeration Phase One Run Time = 0-120 minutes adjustable (default of 30 minutes)
Anoxic Phase One Run Time = 0-120 minutes adjustable (default of 60 minutes)
Aeration Phase Two Run Time = 0-120 minutes adjustable (default of 30 minutes)
Anoxic Phase Two Run Time = 0-120 minutes adjustable (default of 60 minutes)
Aeration Phase Three Run Time = 0-120 minutes adjustable (default of 30 minutes)
Anoxic Phase Three Run Time = 0-120 minutes adjustable (default of 60 minutes)
Aeration Phase Four Run Time = 0-120 minutes adjustable (default of 30 minutes)
Settle Time = 0- 90 minutes adjustable (default of 60 minutes)
Decanter Purge Time = 0 – 300 seconds adjustable (default of 60 seconds)
Decant Time Out setting if level not reached = = 0-60 minutes adjustable (default of 30 minutes)
Decant Height Setting = (V) 1.90 mtrs default adjustable

## Normal Load Operation

Aeration Phase One Run Time = 0-120 minutes adjustable (default of 60 minutes)
Anoxic Phase One Run Time = 0-120 minutes adjustable (default of 45 minutes)
Aeration Phase Two Run Time = 0-120 minutes adjustable (default of 60 minutes)
Anoxic Phase Two Run Time = 0-120 minutes adjustable (default of 45 minutes)
Aeration Phase Three Run Time = 0-120 minutes adjustable (default of 30 minutes)
Settle Time = 0- 90 minutes adjustable (default of 60 minutes)
Decanter Purge Time = 0 – 300 seconds adjustable (default of 150 seconds)
Decant Time Out setting if level not reached = = 0-60 minutes adjustable (default of 30 minutes)
Decant Height Setting = (V) 1.80 mtrs default adjustable

## Peak Load Operation

Aeration Phase One Run Time = 0-120 minutes adjustable (default of 60 minutes)
Anoxic Phase One Run Time = 0-120 minutes adjustable (default of 30 minutes)
Aeration Phase Two Run Time = 0-120 minutes adjustable (default of 45 minutes)
Anoxic Phase Two Run Time = 0-120 minutes adjustable (default of 30 minutes)
Aeration Phase Three Run Time = 0-120 minutes adjustable (default of 30 minutes)
Settle Time = 0- 90 minutes adjustable (default of 60 minutes)
Decanter Purge Time = 0 – 300 seconds adjustable (default of 150 seconds)
Decant Time Out setting if level not reached = = 0-60 minutes adjustable (default of 30 minutes)
Decant Height Setting = (V) 1.70 mtrs default adjustable

## Decanter and SBR Fill Height Settings

Decant stop height setting – **All Load Operations** = 1.70 mtrs default (adjustable) (absolute minimum of 1.65)
SBR refill height setting - **All Load Operations** = 2.15 mtrs default (adjustable) (absolute maximum of 2.25) (0.45 mtrs operating range equates to 10,175 litres decant volume in total each cycle – and a realised net processed fluid volume of approximately 9,000 litres after purge and backwashing.

## Chemical Dosing Settings

Chemical dosing requires a setup with the following:

Dosing Pump Setup Page: - **Operator to input the strength of each chemical and the size of the dosing pump used to dose that chemical based on the dosing pump nameplate!**

Chemical strength % = ??
Dosing Pump Size = ?? ltrs/hr

Alkalinity Support = **Operator Adjustable Dosing Target in mg/l of delivered Chemical**

Carbon Support = **Operator Adjustable Dosing Target in mg/l of delivered Chemical**

Nutrient Removal = **Operator Adjustable Dosing Target in mg/l of delivered Chemical**

**Mathematics for the dosing equation is as follows:**

Fluid Batch Volume **(eg: 10,500 ltrs)** x Dose rate in mg/l **(eg: 15mg/l) /1,000,000/ Strength of chemical as a decimal point (eg: 47% strength would be 0.45) = ltrs chemical x 1000 = mls chemical.**

The example equation would be as follows: 10,500 x 15/1,000,000/0.47 = 0.335106383 ltrs x 1000 = 335.106383 mls chemical required

**Dosing is then calculated based on the following:**

Dosing pump size in ltrs hr@ 100% speed setting **= (eg: 6.0)** ltrs/hr **= (6000)** mls/hr

mls/hr/3600 = mls second

mls chemical required / mls/sec = ?? seconds of dosing pump run time

The example equation would be as follows using our chemical required answer from the example above: 6000/3600 = 1.6666 mls per second (This is the dosing pumps delivery rate)

335.106383 (mls chemical required) / 1.6666 (mls of chemical delivered per second) = 201.0718726749 seconds – round up = **202 seconds of dosing pump runtime**. This runtime is adjusted automatically in the PLC software based on the volume of fluid processed each time – and takes into account the strength of chemical and size of dosing pump settings the operator has selected in the setup page – as well as the required dosing rate target in mg/l for the chemical that the operator has placed into the chemical dosing target setting for each chemical.

Chlorine Dosing = **Operator Adjustable Dosing Target in mg/l of delivered Chemical**

**The chemicals are dosed based on the Volume of fluid decanted to Chlorine Contact from the reactor ( Taking into account the reduction in fill volume due to losses from the Decant Purge Sequence) – directly proportional and taking into account the strength of the chemical as a %.**

Chlorine Dosing – boost/Top Up Dose of chlorine = **Operator Adjustable Dosing Target in mg/l of Residual Chemical** to allow a maintenance dose of chlorine to be added to the chlorine contact tank and maintained at that level at all times.

## Irrigation

**Daily Discharge Volume and Active time control system**

Maximum Hydraulic Discharge Volume per 24 hour day setpoint -  a Supervisor Adjustable Volume to be set in Litres/24 hours allowable to Irrigation system – for example: 19,000 litres.

When the daily volume is reached – the system inhibits irrigation until the following day.

The start and stop times each day are adjustable by the site operator – eg: 6.30 am start and 6.00 pm stop – only irrigating during daylight hours.

## Data Logging

30-day visual data log on HMI - System provides the following logged information:

- Total WAS Flow Daily
- Total Purge Flow Daily
- Sludge Age Daily
- Total Decanted Effluent
- Total Number of decant cycles
- 7 day average values for all of the above
- Total Treated Effluent Irrigated (discharged to irrigation)
- Hours in each operating mode
- Run Hour Meters for Dosing Pumps and main pumps.
- 7 day average values for all of the above

# GENERAL TIPS ON GOOD SYSTEM OPERATIONAL PRACTICES

The following information is intended for an audience that already has previous experience and is qualified in Water and Waste Water Operations to a minimum level of Certificate 111 ( WP 30215 or equivalent).
Please note: RWTS cannot provide the equivalent orientation/training skills needed to meet the Certificate 111 level of experience – this is a formal qualification via the National Training Platform in Australia.
RWTS can provide basic training and orientation for the intended system operator – and provide support through onsite visits, via phone and e-mail.
It is recommended that the system operator be already qualified to Certificate 111 **Water and** Waste Water Operations ( NWP30222), or immediately be enrolled in the course.

# Remote On-Site Sewage Treatment Systems - Upstream Management Requirements

## Upstream Management Overview

Any location that requires an on-site stand-alone sewage treatment system will need to consider the overall site conditions and the requirements of the sewage treatment system to ensure the biological process operates as designed – and final treated effluent quality meets the site environmental license conditions and requirements.

Locations that don't have accommodation, laundry, kitchen and meals preparation occurring on site should consider the overall raw water quality characteristics and ensure the Sewage Treatment System is balanced chemically – providing the Biomass and individual Bacteria the correct balance of Nutrients, Food and Trace Elements for optimum operation. A qualified site operator with the correct tools and instruments will be able to make the required assessment and ensure the system is balanced – adding individual products to the system to ensure it is balanced and operating correctly.

For all "Traditional Remote Sites" that have on site accommodation, laundry, kitchen and in some cases potable water treatment waste water and would be considered a small city where all wastewater generated has to be treated and disposed of on-site – the following considerations should be given to the management of the site and how waste streams are controlled – ensuring optimum conditions are provided for the sewage treatment facility – allowing environmental compliance and stable system operation.

## Cleaning and Bleaching Liquids

Harsh cleaning chemicals have the "potential" to impact greatly on sewage treatment systems – but if used correctly will not impact the systems operation.

Bleaches/Oxidising Agents – are used for disinfection, whitening, removal of moulds and scum and are a common product used in traditional domestic and commercial living environments. Conservative use of these products will provide the required cleaning outcome – with little to no impact on your sewage treatment facility.

The key to ensuring the impact is minimal is to avoid large left over volumes of liquid solutions (such as mop buckets full of bleach) being dumped down the drain – which end up in the sewage treatment system – the dumping of "left over cleaning chemicals" to sewer should be avoided at all times. It is best to spread the left over products over a suitable paved (concrete or bitumen) area and allow them to evaporate.

The same principal is applied when cleaning commercial kitchens – with cooking equipment usually cleaned with a spray on foam product – however larger material is generally cleaned by physical removal first and the overall strategy should not involve large amounts of cleaning products being wasted – ending up down the drain and on their way to the sewage treatment facility.

## Caustic and Acidic Cleaners

Typically used in the kitchen environment – these cleaners, if used correctly are safe and will not impact on the sewage treatment facility.

Your cleaning product supplier should be consulted and notified about the site operation and management requirements (Running an on-site Sewage Treatment System) – with most major suppliers now providing products that are more suited to this type of operation.

Again – care should be taken to avoid large amounts of additional unused chemical entering the sewer network – as these "shock doses" in one large hit can provide unbalanced conditions and result in a failure of the sewage treatment system biomass – in some cases the system will take weeks to recover in the event the biomass suffers "die back" as a result of the shock dose received.

## FATS OILS AND GREASE (FOG) and Grease Trap Management

One of the largest problems in any sewage treatment system is FOG carry over – resulting in compliance failure most of the time, and at a minimum – expensive repairs and system recovery costs.

Typically – THREE key contributors lead to FOG breakthrough into the sewage treatment network – and are outlined below:

**Grease Trap Sizing is Inadequate –** in a least 60% of all cases tested – grease trap sizing is a major contributor to FOG breakthrough. A Grease Trap that is too small will result in the waste water temperature remaining too high all the way through the unit – and as a result the fats oil and grease stay in a dissolved state due to the water still being too hot.

Grease traps rely on "cooling" of the waste stream through a labyrinth path – and as the water cools below 40 degrees Celsius through the trap – the fats oil and grease "congeal" back into a solid form and float on the surface of the retention chamber in each compartment of the unit. It is quite easy to determine if a grease trap is being overloaded – as they usually have three compartments – with the first compartment designed to complete most of the removal of FOG, the second compartment to catch the remainder – and the third is an insurance only and should catch minimal material. During inspection of a grease trap the depth of material in each compartment can be checked to determine how the unit is performing.

In addition – temperature testing of the fluid in each compartment during kitchen peak periods (cooking and dishwashers active) will also provide live data as to how well the unit is performing.

If the Grease Trap is undersized – the FOG will continually break through and impact the sewage treatment system – causing huge issues with the system operation, high costs continually due to pump outs and unplanned maintenance and make the system painful in all aspects to own and manage.

This is a regular problem that is almost always overlooked or considered "trivial" when the site planning stages are considered.

**Grease Trap is Inadequately Maintained**

Even if the grease trap is sized correctly – poor management of the unit will result in the same conditions as having a unit that is undersized.

The reason for this is that as material is removed and floated off into the top of each chamber – the available room for water is reduced – effectively the system removes material and stores it from the top down. As the unit continues to get full of removed material – the available water for temperature reduction is reduced.

If allowed to get too full of material – eventually the unit will foul all three compartments and allow FOG breakthrough to occur – and carry over into the sewage treatment system.

Regular inspection of the grease trap should be completed – usually every two days on a new site to gain an understanding of how rapidly the unit fills up with material – and then once a baseline is established every four to five days – usually completed by the site waste water treatment plant operator and recorded on the daily log sheet for the site records.

On average – a correctly sized grease trap will require pump out once every four weeks – however this can also be as low as every 7 days depending on site kitchen staff behaviour – type of food being cooked and the clean-up methodology used in day to day kitchen practices.

## Kitchen Waste Management

It has been noted that in a lot of cases when inspecting site systems and problems with FOG carry over that although the grease trap is adequately sized – the site cannot obtain more than 7 days between pump outs – and the question is regularly asked – "why?"

The contributor – in most cases that have been investigated is poor kitchen management practices.

Poor training of kitchen staff – lacking procedures on how to manage clean up and waste oil recovery, grittle clean-up resulting in scraping of all waste being dropped into floor wastes and generally poor ongoing behaviour/thinking of staff due to lack of time or a "lazy" approach. Once its down the drain the evidence is gone has been the mentality found in a lot cases.

This however is very untrue – as the above editorial has explained.

It is recommended that the nominated facility manager and the kitchen supervisors have a solid management system in place – with clear requirements that are "best industry practice" to ensure that all recoverable fats, oil and grease are recovered and placed into recovery storage drums for collection and removal from site – therefore reducing the pump out requirements for the grease trap and the high costs involved in doing this more regularly than should be normally required.

Ultimately – it everyone's responsibility to ensure the upstream management is completed in a manner that protects the downstream system from operating problems, damage and unplanned maintenance.

The final determination on effectiveness of upstream management should be provided by weekly feedback during team meetings via the nominated Qualified Water and Waste Water Treatment Plant Operator (Minimum Certificate Three Qualification). Investigations can be completed by means of independent site Auditing – completed by a representative of the waste water system manufacturer. Documented findings with photographic evidence and a written report provided, outlining the site operating conditions. It is advisable to complete at least one independent audit every six months – or quarterly, in the event that the site is experiencing ongoing operational challenges – each audit is also an opportunity to provide additional training to the system operator.

In addition – General housekeeping and maintenance should be completed to **minimise water leaks on site** – as these cost money to manage due to increased hydraulic load on wastewater systems not to mention the cost of the water in the first place.

# Non-Dissolvable Wet Wipes – Packaged as "Biodegradable"

The number one contributor to Sewage Treatment system and sewage network pump station failures is the use of non-dissolvable wet wipes. Currently – the use of these items presents the number one cause of STP failures nationally – across all brands of systems produced for wastewater treatment.

Wet Wipe manufacturers – although comment on packaging as "biodegradable" – may not necessary be dissolvable – and are designed to **breakdown in landfill over time** rather than be dissolvable and suitable for flushing into sewer networks.

It is recommended that this will be the number one highlighted issue with accommodated persons within the village – and that steps are taken to remind accommodated persons that Foreign objects, sanitary items and non Dissolvable, non flushable wet wipes cannot be flushed down the toilet under any circumstances.

Packing on Flushable wet wipes may be accurate – but can also be misleading – and a simple test can determine of the wet wipes are dissolvable and suitable for flushing. Take a wet wipe intended for use, place it in a glass of clean water and stir gently with a spoon for 20 seconds – if the wet wipe is dissolvable – it should begin to break apart and separate within 6 minutes of entering the glass of water.

## Good Practice System Management Tips

- Ensure pump station inspections are completed – and debris periodically removed via pump truck – this will ensure pump reliability is maintained and reactive maintenance is minimized.
- It is noted in the above specifications that the MLSS level is designed to operate at 3000 mg/l at bottom decant level (system in standby). This equates to a full operational system that is running a designated batch sequence (full operating height) as an MLSS of 2500 mg/l – which is the likely state the system will be in when testing of settle ability and MLSS samples are being taken from the sample points.
- Settle ability testing using a "settle-ometer" should be completed multiple times per week to establish biomass behavior and system stability. A system that is running at optimum efficiency and has healthy biomass behavior will provide the following results as a rule of thumb:

A settleability test should be completed over a 30 minute period – recording the value of the sludge settling rate at the 5 minute, 10 minute, 20 minute and 30 minute intervals.
The majority of the biomass in the sample taken should coagulate and settle within 5 minutes of the sample being taken and gently mixed for 10 seconds.
The following 25 minutes will see only a minor increase in sludge compression (possibly another 5 % compression) with the final result recorded at 30 minutes.
If being managed correctly, with a healthy biomass – the settled sludge volume should be approximately 30% of the total cylinder height – and the fluid above the sludge should be extremely clean and clear – we refer to this clear fluid as the supernatant.

- If the system has a biomass behavior that would typically be deemed in the lazy or in the poor category – the individual results will see a much slower selling rate, and may also see less compression in the final result.
- A note of warning – if the settling rate is still fast – with visible compression nice and tight (not fluffy flocs floating around) – and the final result provides a settled result that is considerably higher than 30 % - we suggest that the MLSS WAS settings may need to be increased and that the actual operating MLSS is higher than it should be.
- If in doubt, or if in need of establishing a baseline value for MLSS – take a sample and send it to a suitable laboratory for MLSS testing via the bake out method – and complete a settle ability test at exactly the same time as the lab sample are taken from the system – thus allowing a settleability result as a reference to the MLSS result from the LAB once received.

Nutrient results – although possibly not required for the site Environmental compliance requirements – are necessary to trend the system biomass performance and overall system health. The following individual items should be tested regularly each week to ensure the system behavior is stable and within design:
Ammonia mg/l
Nitrate mg/l
Phosphorous mg/l
Alkalinity mg/l
Ph (Ph units)
Free chlorine mg/l
Turbidity (FNU)
The above results will allow a system performance trend to be developed, showing nitrification, denitrification, clarification and biomass performance.
In the event that the system is difficult to manage biologically, the above results should be tested on the raw influent, along with BOD and FOG (Total Fats Oil and Grease) - to determine the quality of fluid the system is treating is within the design requirements.

- Complete regular inspections of the bioreactor to ensure that elevated levels of crusting and debris are not forming on the surface of the fluid in the reactor. In the levels are deemed too high, it is advised to use a vacuum truck to remove the scum and crust only from the system. High levels of crust build up typically occur when higher than normal levels of FOG (Fats Oils and Grease) are entering the system – or the MLSS operating Level is higher than normal – which will require manual wasting of MLSS to the WAS tank to correct it.
- Sucrose dosing is a carbon based BOD supplement/ additive used to balance the AMMONIA:BOD ratio on the system and enable better complete Nitrification/Denitrification performance by the system. In addition, the Sucrose will support the system in lower inflow periods of operation by providing some supportive carbon as food for the biomass – noting that this will only support the system to a point where the nutrient imbalance will become problematic and result in a hard to manage biomass – RWTS can provide support and advice on this if the situation arises.
- Ensure the chemicals for the system are topped up regularly and do not “run out” as this will likely result in non-compliant final effluent quality and a hard to manage system. Keep a record of chemical usage to enable trending – and make sure the system is using consistent amounts in relation to the volume of fluid being treated.
- Ensure the daily log sheet for the system is being completed to maintain a record of system operation – this is important as the information will be needed by the State regulatory body (DWER) for ongoing reporting .

# EFFLUENT DISPOSAL CALCULATION DETAILS AND DESIGN METHODOLOGY

The total treated wastewater volume will be 80,000 litres per day.

A total volume of Reverse Osmosis Reject at 27,000 litres per day will be blended with the treated wastewater for the sewage treatment system.

Total Irrigated Volume will be a maximum of 107,000 litres per day.

**Irrigating Treated Effluent Plus Reverse Osmosis Reject as a Blended Effluent Stream**

The proposed Total Irrigation Area for this stage of the project development is 40,000 square metres – **achieving a total wetted effluent disposal area of 26,021 m2**.

**EcoFarmer 500 Sewage Treatment System Only Data**

**The effluent quality characteristics of the standard system are secondary effluent with the following characteristics:**

- BOD < 20 mg/l
- SS < 30 mg/l
- TN < 20 mg/l
- TP < 7.5 mg/l
- Faecal Coliform < 1000 cfu/100ml
- Total Coliform < 1000 cfu/100ml
- E/Coli < 1000 cfu/100ml
- TDS < 2800 mg/l

Using average numbers – the site will be processing 29,200 m3 per annum or 80.0 kl/day)

TN @ 20 mg/l – annually totals 584 kgs
TP @ 7.5 mg/l – annually totals 219 kgs

## Normal Average Load Design Methodology

The following detail is the systems **normal/average site load expected due to the site accommodation capacity and nominated occupancy potential:**

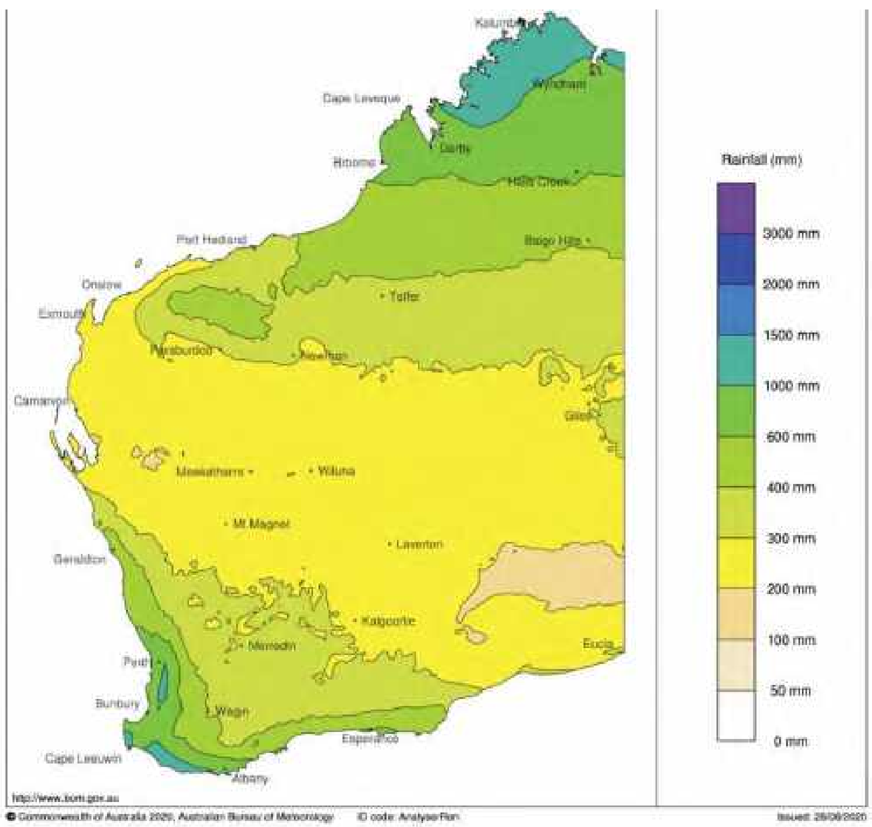
Number of persons on site Average (EP 300 @ 266 l/pp/pd average usage

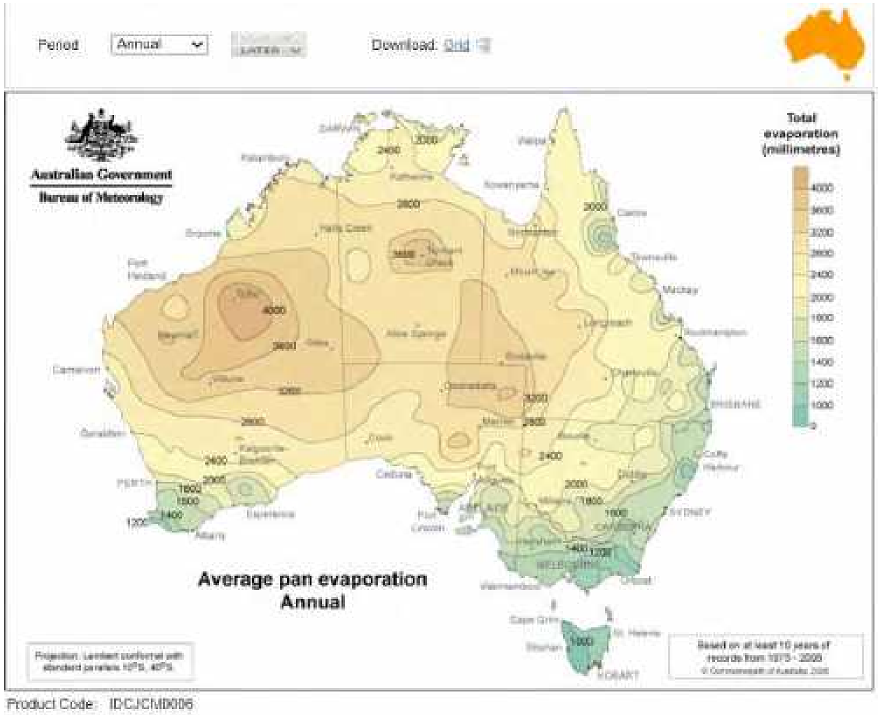
System hydraulic flow rate = 80,000 litres per day – plus RO Reject (@ 75% recovery for normal design) = Total of **107,000 litres per day – and a Wetted Irrigation area of 2.6021 HA or 26,021 m2.**

**Average Actual Hydraulic Loading Rate per m2 per Day – 4.11 mm**

**Average Actual Phosphorous application rate per HA = 84.16 kg year**
**Average Actual Nitrogen Loading Rate per HA = 224.45 kg year**
**Average TDS of Treated Effluent > 1200 mg/l & < 2800 mg/l**

The Point Potential for Evapotranspiration at the nominated site is approximately 3200 mm per annum, similarly – Evaporation rates for the region are also 3200 mm per annum with the maximum irrigation rate at 4.11 mm per day or 1600.00 mm per annum it is clear that the actual migration of effluent water into the sub soil structure will be minimal and provide limited benefit to the vegetation growing in the nominated effluent disposal application area of 26,021 square metres.




Period
Annual
Download: Grid
Australian Government
Bureau of Meteorology
Total evaporation (millimetres)
Average pan evaporation
Annual
Based on at least 10 years of records from 1975 - 2005
Product Code: IDCJCM0006


Climate
Seasonal outlooks
Reports & summaries
Weather & climate data
Data services
Maps – recent conditions
Maps – average conditions
Evaporation
Evapotranspiration
Climate change
Extremes of climate
About Australian climate
Contents
References & Guides
Additional climate products
Climate Data Online
Climate data FAQ
Climate education
At a glance
These evapotranspiration maps show the average annual and average monthly evapotranspiration distributed across Australia.
View the maps
Product
Areal actual
Areal potential
Point potential
Period
Annual
Download: Grid
Australian Government
Bureau of Meteorology
Millimetres
Average point potential evapotranspiration
Annual
Product Code: IDCJCM0006
What do the maps show?

| Statistics | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Annual | Years | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Temperature** | | | | | | | | | | | | | | | |
| Mean maximum temperature (°C) | 39.0 | 37.2 | 35.8 | 31.6 | 26.0 | 22.4 | 22.3 | 24.8 | 29.2 | 33.6 | 36.6 | 36.3 | 31.4 | 31 | 1965 1997 |
| Mean minimum temperature (°C) | 25.3 | 24.4 | 22.4 | 18.4 | 13.0 | 9.6 | 8.1 | 10.1 | 13.7 | 17.9 | 21.4 | 23.9 | 17.3 | 31 | 1965 1997 |
| **Rainfall** | | | | | | | | | | | | | | | |
| Mean rainfall (mm) | 51.4 | 80.1 | 38.6 | 25.3 | 23.2 | 26.0 | 12.6 | 10.5 | 4.1 | 3.9 | 9.8 | 27.0 | 317.8 | 32 | 1965 2003 |
| Decile 5 (median) rainfall (mm) | 35.8 | 57.5 | 23.9 | 12.0 | 12.5 | 9.8 | 4.1 | 2.6 | 0.0 | 0.7 | 5.0 | 16.1 | 307.8 | 37 | 1965 2003 |
| Mean number of days of rain ≥ 1 mm | 4.5 | 5.0 | 3.3 | 2.6 | 2.6 | 2.3 | 1.7 | 1.4 | 0.6 | 0.8 | 1.5 | 3.2 | 29.5 | 34 | 1965 2002 |
| **Other daily elements** | | | | | | | | | | | | | | | |
| Mean daily sunshine (hours) | | | | | | | | | | | | | | | |
| Mean number of clear days | 9.2 | 7.8 | 11.5 | 11.6 | 14.4 | 14.6 | 21.0 | 21.7 | 22.4 | 19.6 | 15.4 | 11.5 | 180.7 | 31 | 1965 1996 |
| Mean number of cloudy days | 6.5 | 7.8 | 8.0 | 6.9 | 7.1 | 7.3 | 4.4 | 3.0 | 1.0 | 1.5 | 2.7 | 4.0 | 59.4 | 31 | 1965 1996 |
| **9 am conditions** | | | | | | | | | | | | | | | |
| Mean 9am temperature (°C) | 31.7 | 29.7 | 28.3 | 24.4 | 18.9 | 15.2 | 14.2 | 16.6 | 21.2 | 25.6 | 29.0 | 31.1 | 23.8 | 29 | 1965 1997 |
| Mean 9am relative humidity (%) | 36 | 42 | 37 | 41 | 49 | 55 | 49 | 42 | 31 | 25 | 24 | 31 | 39 | 20 | 1973 1997 |
| Mean 9am wind speed (km/h) | 10.5 | 10.4 | 9.1 | 7.7 | 6.8 | 6.9 | 7.5 | 8.2 | 10.4 | 11.2 | 10.5 | 10.5 | 9.1 | 30 | 1965 1996 |
| 9am wind speed vs direction plot | PDF | PDF | PDF | PDF | PDF | PDF | PDF | PDF | PDF | PDF | PDF | PDF | PDF | | |
| **3 pm conditions** | | | | | | | | | | | | | | | |
| Mean 3pm temperature (°C) | 37.8 | 35.9 | 34.6 | 30.7 | 25.3 | 21.6 | 21.5 | 24.0 | 28.4 | 32.5 | 35.3 | 36.9 | 30.4 | 29 | 1965 1997 |
| Mean 3pm relative humidity (%) | 23 | 27 | 23 | 26 | 31 | 34 | 27 | 24 | 17 | 14 | 14 | 19 | 23 | 20 | 1973 1997 |
| Mean 3pm wind speed (km/h) | 10.1 | 10.7 | 8.8 | 7.7 | 7.9 | 8.3 | 8.3 | 9.2 | 10.2 | 11.0 | 10.2 | 9.6 | 9.4 | 30 | 1965 1996 |
| 3pm wind speed vs direction plot | PDF | PDF | PDF | PDF | PDF | PDF | PDF | PDF | PDF | PDF | PDF | PDF | PDF | | |

The irrigation system will ensure even distribution is applied across the 26,021 square metre application area.

## Final summary of Rainfall, Evaporation Potential and effluent application

- The number of average rain days with rainfall greater than 1.0 mm/day is 29.5 days
- The total average rainfall per annum is 317.80 mm
- The **Short-term Maximum design** for application rate of Effluent is 4.11 mm/day at Maximum Average loading
- The Annual Average application rate of effluent is potentially – 1500.00 mm per year, operating at average load 365 days per annum.
- The evaporation rate potential for the location is 3200.00 mm per annum – or effectively over double the expected application rate for the location.
- The maximum humidity level for the area averages at no more than 34% - resulting on consistently high evaporation potential for 90% of the year.
- The Average Combined Effluent and rainfall application is 1870 mm per annum – resulting in an evaporation deficit of over 1200.00 mm per annum for the site.

The system has an operator adjustable start and stop time for irrigation available (7.00 am to 6.00 pm for example) as well as an adjustable run time and delay off time to enable the operator to correctly cycle the system to improve evaporation loss and reduce load on the nominated area. This provides system flexibility and allows the operator to tune the system to site conditions.

In summary – the Effluent Disposal System provides the following outcomes:

- Efficient Application with good distribution uniformity
- Automatic Station Changeover valving and automation control to eliminate surface ponding and over application in one area of the site
- Capitalises on evaporation every day – minimising the impact on the receiving environment
- Easy to operate and maintain – low operator input needed
- Low application rates based on utilising evaporation assistance
- Fit for purpose design that is robust and reliable.

### Project Manning Schedule

There is no current fixed manning schedule for the project moving forward – however a peak occupation period of months is expected to occur during the rise and reduction of workforce flow for the project.

The overall nominal average per annum for site occupancy is expected to be 70%, or 225 persons – which will further reduce the average output to the nominated irrigation area.

## SERVICING

# Daily Checklist

### STP & WTP Daily Checklist

| | Item | Yes | No |
|---|---|---|---|
| **1** | Record System Data Log readings | | |
| **2** | Visually inspect surrounding area for leaks & valving position, report on findings | | |
| **3** | Inspect plants for visual alarms report & comment on such events | | |
| **4** | Record tank levels | | |
| | EXAMPLE: balance tanks ½ full at time of inspection. This will allow for habitual timing, if the tank levels stray form this point dramatically, we may possibly avoid a crisis through the peak periods of the day. | | |
| **5** | Inspect the process Aeration for its correct operation | | |
| **6** | Record the PLC display For example: At time of inspection the PLC stated the plant was in settling | | |

| | | | |
|---|---|---|---|
| 7 | Inspect the Soda Ash dosing tank fill as required | | |
| 7 | Inspect the Sucrose dosing tank fill as required | | |
| 8 | Inspect the Alum dosing tank fill as required | | |
| 9 | Inspect the chlorine dosing tank fill as required | | |
| 10 | Inspect the levels within the final effluent tanks and record | | |
| 11 | Inspect irrigation pump set for leaks and valving position | | |
| 12 | Walk irrigation field and isolate and reinstate areas as needed | | |
| 13 | Record chemical consumption on site and re order as required | | |
| 14 | Record usage of chemical stocks on site remaining | | |
| 15 | Record pressures on Recirculation/ Irrigation Pump | | |
| 16 | Sample effluent and test for free chlorine level and nutrients | | |

## WEEKLY STP SERVICING CHECKLIST

*In addition to Daily Checklist*

| | Item | Yes | No | Comment |
|---|---|---|---|---|
| **System monitoring and recording** | | | | |
| 1 | Record and sample MLSS within aeration sequence of SBR chamber | | | |
| 2 | Record DO value on aeration sequence adjust times if necessary | | | |
| 3 | Record DO value on mixing sequence adjust times if necessary | | | |
| 4 | Record pH value within SBR chamber | | | |
| 5 | Record pH value in final treated water | | | |
| 6 | Record DO value in final treated water | | | |
| 7 | Record residual chlorine in final treated water | | | |
| 8 | Complete final effluent samples as per EA conditions, pack and send to lab for further testing | | | |
| **System mechanical checks** | | | | |

| | | | | |
|---|---|---|---|---|
| **WAS tank** | | | | |
| 9 | Check operation – arrange removal of waste activated sludge if required | | | |
| 10 | Measure and record sludge and crust levels advise client of pump out | | | |
| 11 | Check all tanks and external connections for leaks | | | |
| **Balance tank** | | | | |
| 12 | Activate balance pump and view pump operation | | | |
| 13 | Check pump operation and flow value through flow meter | | | |
| 14 | Record and analyse meter data | | | |
| 15 | Open and clear control valves of debris | | | |
| 16 | Check operation of the non-return valves | | | |
| 17 | Activate high level switch and view alarm | | | |
| **SBR and Plant Room** | | | | |
| 19 | Check operation of aeration and mixing pump | | | |
| 20 | Check operation of Waste activation sludge valve and advance or retard timing of sludge wasting pending on MLSS test | | | |
| 21 | Check automatic valves for sequencing and operation | | | |
| 22 | Check decant sequencing and operation | | | |
| 23 | Check decant line for debris and fouling | | | |
| 24 | Check all external connections are free of leaks to and from container | | | |
| 25 | Check HMI for alarms page and record if available | | | |
| 26 | Check timers in HMI for sequencing timing adjust if necessary | | | |
| 27 | Check manual and automated operation of the chlorine disinfection unit, test flow and clean if required | | | |
| 28 | Check manual and automated operation of the Alum coagulation unit, test flow and clean if required | | | |

| | | | | |
|---|---|---|---|---|
| 29 | Check manual and automated operation of the sucrose solution unit, test flow and clean if required | | | |
| 30 | Check manual and automated operation of the Soda Ash solution unit, test flow and clean if required | | | |
| 31 | Check all chemical tank levels and fill as required | | | |
| 32 | Spray hatch hinges with lubricating spray | | | |
| 33 | Clean chemical bund in control room container | | | |
| 34 | Inspect ladder and hand rail system if installed | | | |
| 35 | Complete site written report and communicate findings with site representative | | | |
| **Final effluent** | | | | |
| 36 | Check all equipment relating to Final treated effluent storage and disposal | | | |
| **Pump stations** | | | | |
| 37 | Skim off all fats and grease that may have accumulated via pump truck if required | | | |
| 38 | Inspect control board for integrity | | | |
| 39 | Clean and test for automation the level activation switches | | | |
| 40 | Check non-return valve operation | | | |
| 41 | Open and flush all valving to remove debris | | | |
| 42 | Manually run pumps and test loading by qualified electrician | | | |
| 43 | Reseal cast lid with white grease | | | |
| 44 | Inspect inlet pipe from camp and seal around well | | | |
| **Irrigation field** | | | | |
| 45 | Test irrigation pump operation | | | |
| 46 | Walk irrigation field and check for ponding | | | |
| 47 | Walk irrigation field and check for broken sprinkler heads and pipework repair as required | | | |
| 48 | Check all timers through control system and adjust if required | | | |

| | | | | |
|---|---|---|---|---|
| 49 | Check storage tanks for integrity and report | | | |
| 50 | Check irrigation rate to land on an extended run period and ensure no ponding occurs on the run times set in the control system | | | |
| 51 | Check filters/ strainers and clean if required | | | |

\

# DESIGN LIFE AND BIOLOGICAL PROCESS/TREATED EFFLUENT QUALITY CERTIFICATION

Remote Water Treatment Services – engaged by ROX Resources on behalf of the Youanmi Accommodation Village Project to provide wastewater equipment, installation and ongoing operational support and maintenance hereby provide the following statements:

RWTS have completed a full design review of the Ecofarmer 250 Twin Train sewage Treatment System being installed at the Youanmi Accommodation Village Project – in WA and hereby confirm the system will easily perform to the design calculations stated in the supporting documentation provided above.

The system has been designed and fabricated in a transportable/ semi-permanent or permanent installation arrangement to provide continuous service with the required maintenance for a 25-year life expectancy. The system is independently structurally certified by a Registered Practicing engineer in Australia. The biological Process for the Ecofarmer WWTP has also been independently engineering certified by Ganden Consulting who provide registered engineering services throughout Australia.

As the entire system core structure is- at its thinnest point, 6mm thickness carbon steel, protected by a corrosion inhibitor coating designed specifically for water and wastewater treatment applications – it is crucial that the integrity of this corrosion inhibitor coating be maintained.

Although the system design has an allowance for corrosion to occur, whilst maintaining structural integrity – any coating damage will result in accelerated deterioration of the steel structure – and premature failure of the core system structure.

Remote Water Treatment Services recommends the following be carried out: Routine general inspection of the overall system structure is to be carried out (daily, weekly, monthly subject to the system owner's schedule) with the structural condition of the system core to be inspected. This would typically be done by the responsible person operating the system process and ensuring the system is compliant with environmental conditions for effluent quality and overall operation.

In addition – it is recommended **the system have a Bi-annual "Major Inspection" completed** – where the core structure and process area are inspected for coating integrity and any potential corrosion spots that have taken hold within the system core. Any coating damage or corrosion should be repaired as soon as possible to reduce the damage potential to the system core. Although this is not considered mandatory for the ongoing reliability of the system, this procedure will help extend the life of the system and minimise potential failure points due to poor corrosion management.

In order to complete the major inspection on the system – the process area will need to be emptied, and all of the biomass removed from the system to expose the internal system coating. The inspection should cover 100% of the internal and external core of the system to ensure the coating integrity is maintained.

Any corrosion areas that are left unmanaged will result in a life expectancy reduction on the system core structure.
With correct maintenance and coating management the system core structure service life will exceed 25 years.

For any queries or assistance required in managing the Ecofarmer 250 Sewage Treatment System please contact the Remote Water Treatment office in Wynnum Qld.

[redacted]

## EXECUTION

Signed signatory on behalf of the company Remote Water Treatment Services Pty Ltd.

[redacted]

[redacted]

## 17.11 Appendix 11. Risk Assessment Table

**Appendix 11: Prescribed Premises - Risk Assessment Table**

**Prescribed Premises - Risk Assessment**

| Source / Activities | Potential Emissions / Contaminants | Potential Pathway | Potential Receptors | Potential Impacts | Proposed controls & Contingencies | Consequence | Likelihood | Risk Level | Reasoning |
|---|---|---|---|---|---|---|---|---|---|
| Construction:<br>-Veg. clearing & Topsoil stripping;<br>-Vehicle movement on unsealed roads;<br>Earthmoving activities.<br>Operations<br>-Vehicle movement on unsealed roads;<br>-Ore and waste handling;<br>-Crushing and conveying;<br>-Earthmoving activities;<br>-Dry tailings lift-off. | **Dust**<br>Emission to Air | Windblown (fugitive dust) then deposition. | Native vegetation in vicinity of Processing Plant and TSF3 infrastructure;<br>Sensitive Residential Receptors. | Death or decline of vegetation health due to dust deposition and / or toxic material deposited on leaves or soil.<br>Nearest residence 17km away – no dust impacts anticipated. | Dust suppression using water carts on roads, hardstand areas, ROM and all construction and operational areas;<br>No nearby residential areas or pastoral homesteads<br>Complaints from stakeholders regarding dust emissions will be acted on immediately and management measures reviewed accordingly.<br>Stripping and movement of topsoil and other dust-generating works not undertaken in windy conditions where practical;<br>Vehicle speeds and movements managed via a Traffic Management Plan - which addresses dust management requirements;<br>Vehicle movement vehicles restricted to established roads and speed limits imposed;<br>Water-cannons or sprinklers used on stockpiles or other areas not accessible to water carts;<br>Dust suppression sprays on ore transfer points, chutes and conveyors on the crusher, processing plant and materials handling areas;<br>Progressive rehabilitation of disturbed areas;<br>Moisture conditioning of construction materials prevents dust generation. | Slight | Unlikely | Low | Sufficient controls are in place to minimise dust emissions and potential impacts. |
| Construction<br>-Vehicles, machinery, construction tools & equipment.<br>Operations<br>-Vehicles, machinery; tools and equipment;<br>-Process Plant;<br>-Power Station. | **Noise** | Direct emissions (air/wind) | Sensitive Residential & Fauna | No specific noise-sensitive or conservation significant fauna identified in proximity;<br>Nearest residence 17km away – no dust impacts anticipated. | No nearby residential areas or pastoral homesteads<br>Regular maintenance of vehicles and plant equipment;<br>Noise emissions will be managed in accordance with the Work Health and Safety (Mines) Regulations 2022 and the Environmental Protection (Noise) Regulations 1997<br>Complaints from stakeholders regarding noise emissions will be acted on immediately and management measures reviewed accordingly. | Slight | Rare | Low | No specific noise-sensitive or conservation significant fauna identified in proximity;<br>Nearest residence 17km away – no dust impacts anticipated. |
| Construction:<br>Internal combustion engines in vehicles;<br>Operations<br>Power Station gas and diesel turbines;<br>Carbon regeneration kiln & Gold melting furnaces;<br>Internal combustion engines in mobile and other fixed plant | **Gas and particulates:**<br>$CO^2$ (and $CO^2$ equivalent);<br>Oxides of Nitrogen as $NO_2$, CO, $SO_2$ and volatile organic compounds (VOCs). | Direct emissions (air/wind) | Conservation significant flora and fauna, staff and residential receptors. | Decline in vegetation or fauna health;<br>Reduced air quality for employees (amenity) in Project area<br>Reduced air quality for Community. | Minimise use of gas and diesel turbines at Power Station via preferential use of PV power, then gas and diesel only as backup;<br>Generators will be housed in a newly fabricated high air-flow steel engine hall including exhaust stacks, air intake and cooling systems;<br>Operate the generators at optimal load to promote cleaner and more efficient operation<br>Undertake regular maintenance of the generators in accordance with the manufacturer specifications.<br>Monitoring of fuel use, power outputs and emissions;<br>Reporting in accordance with NPI, NGERS and licence requirements.<br>No nearby residential areas or pastoral homesteads. | Moderate | Unlikely | Medium | Limited potential impacts to site. |

| Source / Activities | Potential Emissions / Contaminants | Potential Pathway | Potential Receptors | Potential Impacts | Proposed controls & Contingencies | Consequence | Likelihood | Risk Level | Reasoning |
|---|---|---|---|---|---|---|---|---|---|
| Construction & Operations:<br>Leaks and spills from storage containment, or during operating, servicing or refuelling of fixed or mobile plant. | Hydrocarbons and Chemicals | Leaks & spills direct to soil, infiltration to groundwater or transported with surface water. | Soils and vegetation; Surface water and / or groundwater. | Contamination of soil, groundwater and / or surface water;<br>Vegetation death or decline. | Hydrocarbons and chemicals stored in appropriate bunded areas or containment;<br>Hazardous chemicals, fuel and other hydrocarbons will be stored in accordance with Australian Standards;<br>Waste oils stored in bunded containment, and oily rags, filters, hoses and other contaminated material stored in dedicated bins. Hydrocarbon waste removed from site by a licensed contractor;<br>Generators at the power station contained within bunded, compounds, and portable generators 'self bunded';<br>Plant, vehicles, machinery and equipment regularly serviced and maintained, within designated workshop areas where possible;<br>Washdown water from hardstand areas directed to an oil water separator for treatment, and sludge from the washdown pad removed to bioremediation area;<br>Ore Processing activities conducted within bunded hardstand areas within the plant footprint, with spills directed to collection sumps;<br>All chemical reagents stored within tanks in appropriately bunded facilities, whereby 110% of the largest vessel is contained and 25& of the total volume is contained (according to AS1940 and AS 1692);<br>Personnel handling hazardous materials made aware of MSDS guidance and trained in spill response of that material prior to commencing work.<br>Spill management equipment appropriate to the volume and type of material stored will be available at the storage location, clearing labelled and highly visible at all times;<br>All spills are contained, controlled and cleaned up immediately;<br>Contaminated soil resulting from spills and / or runoff will be removed for treatment at bioremediation pads constructed on site, treated in situ if appropriate, or removed from site and disposed to a licensed facility;<br>Bunding and surface water management structures in place to contain potentially contaminated runoff;<br>All staff and contractors adhere to Hydrocarbon and Chemical Procedures;<br>Regular inspections of workshops and fuel / chemical storage area are completed by contractors and Rox staff. | Slight | Possible | Low | Sufficient controls are in place to prevent and minimise potential impacts of hydrocarbon and chemical spills. |
| Operations<br>-TSF3 tailings delivery or decant return pipeline failure. | Tailings<br>Solids, process water & chemicals with potentially contaminated levels of salinity, cyanide, heavy metals or acid. | Leaks & spills direct to soil, infiltration to groundwater or transported with surface water. | Soils, surface or groundwater and native vegetation in the vicinity of TSF3 and pipeline infrastructure. | Potential impacts on other groundwater users;<br>Reduced quality of surface water runoff;<br>Reduced vegetation health or death. | All tailings, process water and decant return pipelines are bunded to contain spills, with scour pits or sumps along their length to ensure leaks or spills are contained;<br>Pipelines installed with electromagnetic flow meters and pressure sensors downstream of pump station and upstream of TSF discharge, to provide constant monitoring of the tailings and decant pipelines, and shutdown in the event of pipeline failure;<br>Operate the TSF in accordance the Operations Manual;<br>Undertake routine inspections (twice daily when operational) of the TSF, water storage dams and ponds, and tailings and return water pipelines | Moderate | Unlikely | Medium | Robust controls and management measures in place to minimise tailings and decant water impacts.<br>Saline water used in processing unpalatable to fauna, so does not attract them to source. |

| Source / Activities | Potential Emissions / Contaminants | Potential Pathway | Potential Receptors | Potential Impacts | Proposed controls & Contingencies | Consequence | Likelihood | Risk Level | Reasoning |
|---|---|---|---|---|---|---|---|---|---|
| <u>Operations</u><br>-Tailings deposition to TSF3 | **Tailings & Decant Water**<br>Process water & chemicals with potentially contaminated levels of salinity, cyanide, heavy metals or acid. | Seepage / Infiltration to groundwater or transported with surface water;<br>Overtopping of the TSF 3 after excessive rainfall. | Groundwater, topographic low points within or outside the prescribed premise, including minor creeks and Main Pit mine void; | Reduced quality or contamination of groundwater;<br>Raised groundwater levels with negative impacts to local vegetation;<br>Surface expression of groundwater and consequent impacts on local vegetation and surface water quality;<br>Contaminated mine water beyond the margins of the TSF, with potential impacts on GDE's and other groundwater users | TSF3 design conforms to appropriate Codes of Practice and ANCOLD Guidelines on Tailings Dams;<br>TSF3 constructed in accordance with design specifications by competent, qualified professionals using appropriate equipment with material of correct specifications;<br>TSF3 construction supervised and signed off by competent, qualified professionals;<br>Supernatant water collected from TSF surface via a central rock-ring decant system, to minimise tailings water percolating through the TSF, maximise settled density and manage supernatant water for re-use in the plant;<br>Seepage interception cut-off trench and collection drain installed beneath TSF3, to captures seepage water and direct to external collection sumps and back to process-water ponds for re-use;<br>Undertake routine inspections (twice daily when operational) of the TSF, water storage dams and ponds, and tailings and return water pipelines<br>Supernatant pond size minimised and maintained >100m from embankment;<br>TSF operated with designed freeboard of 0.5m with continuous, in situ telemetry monitoring of pond level.<br>Operate the TSF in accordance the Operations Manual; prepared prior operation of TSF3, in accordance with DMPE guideline. The OMPS covers essential duties and tasks, including deposition methodology, decant operation, Routine daily inspections of tailings lines, decant systems and water return, freeboard, process water pond, embankments;<br>Regular monitoring pf WAD cyanide in process water and tailings decant water;<br>Instrumentation and monitoring program to track phreatic surface, groundwater levels and quality, to identify issues and apply timely remedial actions as required; and<br>Annual geotechnical audit of TSF3 throughout operations. | Slight | Rare | Medium | Robust controls and management measures in place to minimise tailings and decant water impacts.<br>Saline water used in processing unpalatable to fauna, so does not attract them to source. |
| | **Tailings & Decant Water**<br>Process water & chemicals with potentially contaminated levels of salinity, cyanide, heavy metals or acid;<br>Tailings physical properties (fine grained & sticky). | Direct ingestion;<br>Entrapment. | Native fauna | Direct mortality of native fauna, in particular bird species. | | | | | |
| <u>Operations:</u><br>-Dewater, tailings & process water transfer (pipelines);<br>-Dewater, tailings & process water storage or containment. | **Saline Water** | Leaks or spills direct to soil, infiltration to groundwater or transported with surface water.<br>Overflow of containment. | Soil and vegetation in vicinity or downstream of TSF3, dewater containment or pipelines;<br>Groundwater & surface water. | Vegetation death or decline;<br>Contamination of soils, surface water or groundwater. | Containment infrastructure designed by suitably qualified engineers and constructed to approved designs;<br>Suitable qualifications of pipeline construction crews, and quality control of construction (weld inspections / records);<br>Process water dam constructed with an HDPE liner of permeability <1x10$^{8}$m/s;<br>Water level sensors installed on process water pond, to monitor water level, with high level alarms and alerts to management to ensure safe operating freeboard levels;<br>Evaporation ponds fitted with visual level markers, telemetric system to automatically turn off the pump if leak is detected.;<br>Seepage interception trench / drain and collection sumps downstream of evaporation ponds and TSF3, to capture seepage water and return to ponds or plant;<br>Dewatering and water supply pipelines located on disturbed areas surrounded by existing mine disturbance (as far as possible) to reduce impact of leaks or spills; | Minor | Rare | Medium | Robust controls and management measures in place to minimise saline water impacts. |

| Source / Activities | Potential Emissions / Contaminants | Potential Pathway | Potential Receptors | Potential Impacts | Proposed controls & Contingencies | Consequence | Likelihood | Risk Level | Reasoning |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Pipelines installed with electromagnetic flow meters and pressure sensors and / or telemetric systems for constant monitoring and shutdown in the event of pipeline failure;<br>All pipelines containing saline fully bunded to contain spills, with scour pits or sumps along their length to ensure leaks or spills are contained;<br>Secondary containment sumps sized to contain the maximum water volume pumped between a leak occurring, detection and pump cut-out (redundancy time);<br>Leaks or spills to be controlled and contained immediately on detection, followed by clean up and remediation of impacted area as soon as possible;<br>Pipelines inspected daily during operation to identify leaks or spills and reported immediately (internally) and to DWER as-per licence conditions and S72 of EP Act;<br>Inductions and training of all staff and contractors involved in dewatering, tailings & process water operations, storage and management;<br>Monitor and manage freeboard levels in evaporation ponds to prevent overtopping;<br>Inspection schedule (documented) – daily, plus weekly & monthly by management, with remedial or emergency actions taken as required;<br>Groundwater, surface water and vegetation monitoring. | | | | |
| <u>Operations</u><br>-Dust Suppression. | **Saline Water** | Direct to soil & vegetation via over-spray;<br>Infiltration to groundwater; or transported by surface water. | Soil and vegetation in vicinity of roads and hardstand areas or downstream;<br>Groundwater or surface water contamination. | Vegetation death or decline;<br>Contamination of soils, surface water or groundwater. | Inductions and appropriate training of all staff and contractors involved in dust suppression & management;<br>Inspection schedule (documented) – daily, plus weekly & monthly by management, with remedial or emergency actions taken as required;<br>Dust suppression preferentially using dribble-bars to prevent overspray, and managed to minimise over-watering and salt build-up on roads and hardstand areas;<br>Groundwater, surface water and vegetation monitoring programs. | Minor | Rare | Low | Sufficient controls are place to minimize potential impacts of dust suppression using saline water |
| <u>Construction & Operations:</u><br>Erosion of infrastructure;<br>Leaks or spills from pipelines or storage containment;<br>Leaks or spills during operation, servicing or refuelling of fixed or mobile plant. | **Contaminated Stormwater**<br>Sediment, salt, hydrocarbons or chemicals. | Surface water flows. | Surrounding / downstream soils, & drainage lines | Containation of soils and ephemeral drainage lines. | Flood modelling completed to understand site drainage flow paths<br>Install a sump and pump in the Processing Plant reagent area to remove any collected material (including rainwater). The area will be routinely inspected to confirm the bunding integrity and containment volume is not compromised<br>Collect surface water runoff from the Processing Plant via vee drains and culverts and direct into the containment sump.<br>Regular inspection of containment infrastructure<br>Building designed so that hydrocarbon spills and contaminated stormwater are contained directed to spill containment sump | Minor | Rare | Low | |
| <u>Operation of Landfill:</u> | Windblown waste,<br>Leachate;<br>Contaminated surface water; | Entrapment;<br>Ingestion of waste;<br>Windblown;<br>Infiltration to soils aquifer;<br>Transported by | Native or feral fauna;<br>Adjacent vegetation areas;<br>Groundwater or surface water; | Increased feral fauna;<br>Direct mortality of native fauna;<br>Contamination of surface water or groundwater. | Existing conditions of L8275/2008/2, and management including:<br>Inert and putrescible waste disposed into trenches, excavated within the United North WRD footprint;<br>United North WRD is located >100m from any surface water feature and>3m above the groundwater table;<br>Putrescible waste disposed is kept separate from the inert waste streams as far as possible; | Slight | Unlikely | Low | Existing licence conditions and controls sufficient to minimise impacts of landfill. |

| Source / Activities | Potential Emissions / Contaminants | Potential Pathway | Potential Receptors | Potential Impacts | Proposed controls & Contingencies | Consequence | Likelihood | Risk Level | Reasoning |
|---|---|---|---|---|---|---|---|---|---|
| | | surface water; | | | The tipping area of the landfill not greater than 30 m width and 3m in depth;<br>The landfill is covered monthly with inert material readily available with the waste rock dump footprint;<br>Existing fencing surrounds the landfill facility which is designed to capture windblown waste (should it occur) and to prevent scavenging animals from entering;<br>Stormwater is diverted from the landfill trenches to prevent contact with waste;<br>Regular inspections of landfill, including collection of windblown waste if observed;<br>Records kept of the type and volume of waste disposed in the landfill, to track cumulative waste volume for compliance reporting; and<br>No unauthorised waste is disposed of in the land fill. | | | | |
| Operation of WWTP:<br>Spills, pipeline leak or rupture;<br>Uncontrolled or over-discharge;<br>Treated waste water exceeds quality limits. | Raw sewage, partially treated or Treated wastewater | Discharge to land or via surface water | Contamination of surface water, ephemeral creek lines, or local aquifers | Reduced quality or contamination of soil, sediment, surface water, groundwater or reduced vegetation health. | Effluent discharge will be managed to ensure there is no surface water ponding or runoff from the irrigation area. Irrigation area will be fenced to restrict access.<br>Irrigation area located away from drainage lines<br>Regular inspections of WWTP facilities and pipeline.<br>Minor spills to be reported and cleaned immediately and reported through incident reporting procedure.<br>The WWTP will include alarms for aerobic treatment air blown and discharge pump.<br>Secondary containment sufficient to contain spills for a period equal to the time between routine inspections<br>Effluent discharge quality will meet DWER criteria;<br>Quarterly sampling of treated waste water;<br>Schedule inspections. | Possible | Minor | Low | |