

RESPONSE TO FURTHER REQUEST FOR INFORMATION PART 2

GEMCO | EXCESS WATER DISPOSAL (OCEAN OUTFALL) PROJECT

No. Request

Response

1. The additional information response to questions 3c, 5a and 5b refers to the EMRs and MMPs submitted to the Mines Division as part of the conditions of your Mining Licence. The NT EPA does not have access to these documents except where they have been made public. Could you please provide these documents highlighting the relevant information? Alternatively, the relevant information could be provided separately.

A) Statement in Request for Information (RFI) response 3c:

The outcomes of the monitoring program and an assessment of conformance of the bush discharge activities with the relevant environmental criteria are provided annually in the Environmental Mining Report (EMR).

AND

Please refer to the EMR for FY24 for a detailed discussion of the outcomes of the bush discharge monitoring program. The report also includes information on the monthly discharge sources and results from monthly water quality monitoring.

Response regarding 3c:

A summary of the referenced sources is provided in the following table.

Information	Section in source document
<i>Outcomes of the monitoring program</i>	5.1.1.3 Off-Lease Discharge Water Monitoring in EMR FY24 ¹ (Appendix A) Please note the EMR FY24 is referring to the conditions of the MMP FY21-24, which was the MMP current during FY24.
<i>An assessment of conformance of the bush discharge activities with the relevant environmental criteria</i>	5.1.1.3 Off-Lease Discharge Water Monitoring in EMR FY24 (Appendix A)
A description the environmental criteria for bush discharge and monitoring program applicable to FY24	6.4.2 Discharge Monitoring Program in MMP FY21-24 The MMP FY21-24 is available on the South32 website at this link : https://www.south32.net/docs/default-source/operations/gemco/western-leases/mining-management-plan/fy21-24-mmp-(0126-01-jul-2021).pdf

¹ The most recent EMR available is EMR FY24. The EMR for FY25 is currently being prepared and not due for submission to DLPE until 30 September 2025.

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B) References to MMP and EMR in RFI response 5a

- *Potential impacts to hydrology from GEMCO's operations will continue to be monitored using GEMCO's existing water monitoring programs (as described in the EMRs, MMP and this RFI response).*
- *Potential impacts to GDEs and other sensitive vegetation types from GEMCO operations will continue to be monitored using GEMCO's existing water monitoring programs (as described in the MMP, EMRs and this RFI response).*
- *Potential impacts to sensitive vegetation types from GEMCO's operations will continue to be monitored using GEMCO's existing water monitoring programs (as described in the MMP, EMRs and this RFI response).*
- *Potential saline intrusion will be monitored through the existing groundwater monitoring bore network and quarry water quality monitoring programs as described in the MMP, EMRs, and this RFI response.*

GEMCO response relating to statements in RFI response 5a:

The requested information is provided in the following references:

Current monitoring programs	Reference
Surface water monitoring	Section 6.4.1 Surface Water Monitoring in MMP FY21-24 Section 5.1.1.2 in EMR FY24 (Appendix B)
Groundwater monitoring program	Section 6.4.4.1 Mine Groundwater in MMP FY21-24 Section 5.1.1.5 in EMR FY24 (Appendix C)
Vegetation monitoring	RFI response dated 24/07/25, page 5: Vegetation monitoring will continue to include: • drone surveys to assess vegetation change • physical ground-truthing • short-wave infrared (SWIR) remote monitoring • Normalised Difference Vegetation Index (NDVI) assessments of vegetation
Quarry water monitoring program	6.4.2 Discharge Monitoring Program in MMP FY21-24

C) Statement in RFI response 5b:

As reported in the MMP and EMRs, GEMCO conducts sewage effluent and mixing zone monitoring in accordance with the conditions of the former Waste Discharge Licence 163-01 and the more expansive Marine Environmental Monitoring Program (MEMP).

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	GEMCO response relating to the statement in RFI response 5b: The cumulative impact assessment was based on the monitoring program described in the MMP FY21-24 and the historical results presented in EMR FY24. It should be noted that there has been no change to the monitoring program in the MMP FY25-Closure. For a description of the monitoring programs, please refer to the following sections in the MMP FY21-24: - Section 6.4.5 describes the current sewage monitoring program - Sections 6.4.6 and 6.4.7 describe the marine monitoring program
2. The additional information response to question 2 states that there is an operation water balance model and a numerical groundwater model. Could you please provide a visual representation (figure or diagram) of the inflows, outflows and water volumes currently on site and predicted volumes should the excess water disposal project not proceed? Please ensure that the water volumes balance i.e. Inflows = outflows (including processing, dust suppression & evaporation) + storage.	A schematic is provided in Figure 1 (Appendix D) to illustrate GEMCO's current FY26 water management infrastructure and mine plan (red highlighted). The red and purple areas in the schematic illustrates the predicted mine water flows for FY28 including the proposed Excess Water Disposal (Ocean Outfall) Project (the Proposal). The inclusion of the Proposal will prevent mine areas becoming compromised due to large groundwater inflow volumes alongside potentially elevated groundwater salinities being encountered. The water balance information provided demonstrates the scale and environmental complexity of a basin scale mass water balance under tropical weather conditions with unique hydrogeological conditions. GEMCO wishes to emphasise that the water balance predictions are based on a set of model assumptions. It is not possible to predict long term water volumes and groundwater drawdown with certainty as there are many factors which may influence future state (hydrological variability, rainfall fluctuations, etc.).
3. The additional response to question 4 states that current drawdown ranges between 2 and 4 meters for most quarries. It is also predicted that groundwater drawdown cones will develop to 6 – 8 meters. Could you please provide a visual representation (figure/s or diagram/s) of the current and predicted extent of drawdown across the affected area? Ideally this information would show the depth of drawdown and the footprint of the area affected by the drawdown.	Please find contours of the current (2024) and modelled predicted (2028) groundwater drawdown in Figures 2 and 3 respectively (Appendix E). These contours have been created from the numerical groundwater model referred to in GEMCO's RFI response of 24 July 2025. The figures illustrate the depth of drawdown and the extent of the area affected by the drawdown across the GEMCO Western Leases.

Appendix A: Section 5.1.1.3 Off-Lease Discharge Water Monitoring
(extract from EMR FY24)



5.1.1.3. OFF-LEASE DISCHARGE WATER MONITORING

Off-lease dewatering activities are monitored to ensure these activities pose minimal risk to the environment. With the progression of GEMCO's mine plan, additional sites will be brought into the program during the planning process. If approved water quality trigger values are exceeded, water is contained until the data demonstrates that it meets the trigger values.

As the mining footprint expands closer to the coast, which may result in potential saltwater/brackish water intrusion within GEMCO quarries, GEMCO has voluntarily adopted an interim default trigger value of 250 $\mu\text{S}/\text{cm}$ for Electrical Conductivity (EC). While studies are being undertaken by the University of Queensland to determine a GEMCO site-specific trigger value, an EC Trigger Action Response Plan (TARP) will be implemented. The TARP involves monitoring and alternative use for water that exceeds 250 $\mu\text{S}/\text{cm}$. Where discharge water EC exceeds 250 $\mu\text{S}/\text{cm}$, the following decision hierarchy / response will be applied:

- Preferentially use the water in plant and dust suppression. If excess water that is $>250 \mu\text{S}/\text{cm}$ EC still remains, then:
- Discharge to bush, but only during periods of natural rain events where salinity is naturally attenuated (diluted). If excess water that is $>250 \mu\text{S}/\text{cm}$ EC is still requiring release and it is outside of natural rainfall events, then:
- Discharge to bush, but conduct vegetation monitoring that includes i) monitoring of Normalised Difference Vegetation Index (NDVI), and consideration of potential impacts to soil, ii) monitoring of the dry season 0.8 metres below ground level (mbgl) groundwater level nominated by the ALC.

Dewatering activities have been endorsed by the ALC based on conditions including notification of ALC and Traditional Owners in advance of discharge, in-situ water quality of the discharge, laboratory testing of the water quality. In 2022, the ALC endorsed extended off-lease dewatering year-round with conditions involving free draining requirements, additional monitoring bores, and vegetation health monitoring, specifically:

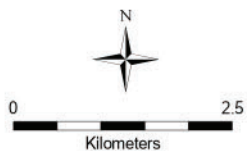
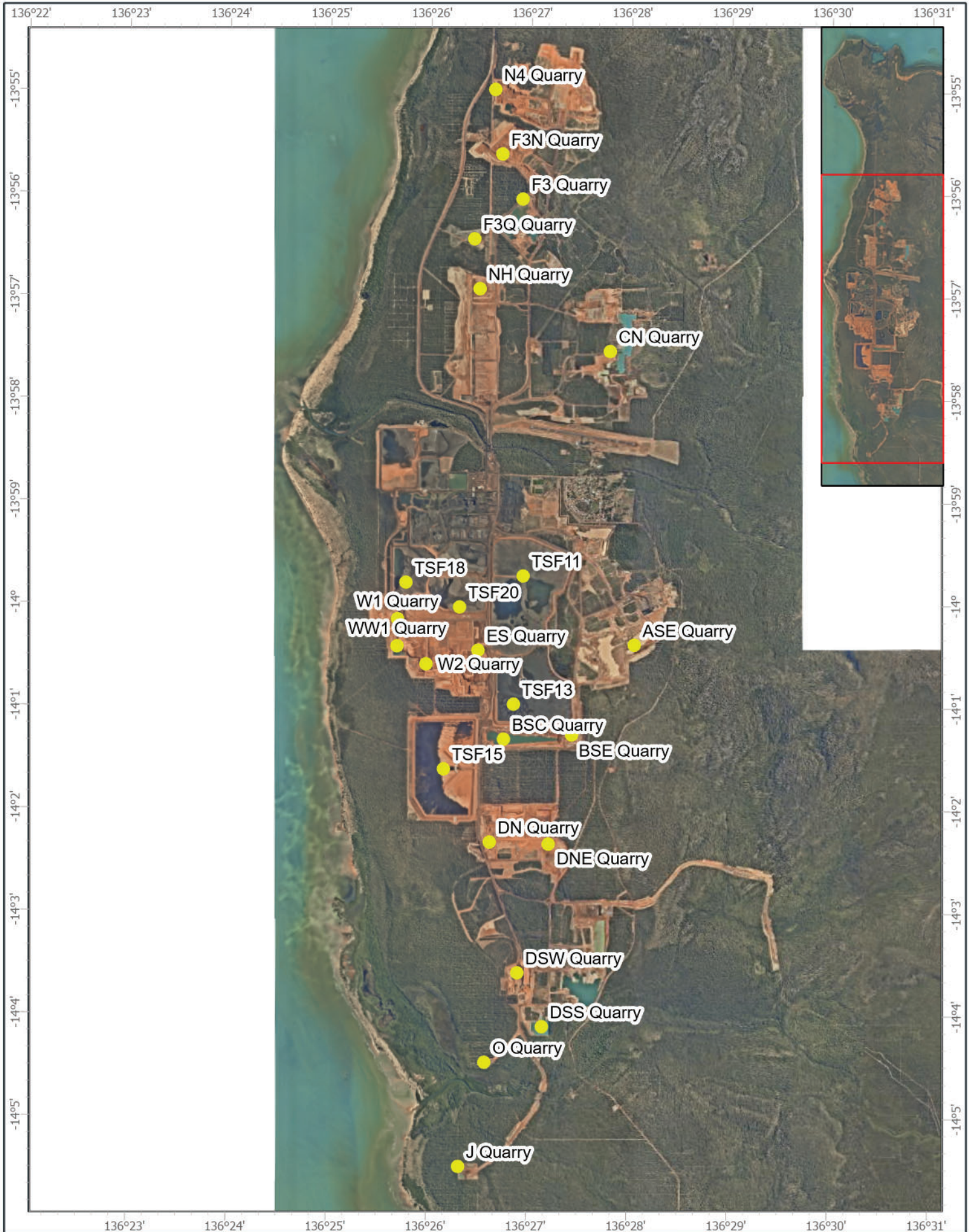
- At least 0.8 m free drainage is maintained in woodlands in disposal areas between July and October (inclusive).
- Observation wells are continuously monitored, and hydrographs reported to the ALC each month as control charts using the above reference condition until notified otherwise.
- The operation will cease to use land application area or discharge point once the free drainage condition is exceeded, or vegetation monitoring identifies tree mortality induced by waterlogging.
- Monitoring of vegetation health in disposal areas undertaken by GEMCO contractors will be used to review the free drainage condition after operation for one season.
- ALC reserves the right to suspend water disposal to woodland in the dry season if these conditions are not met and to review the draft vegetation management strategy before it is finalised.

Trigger values and monitoring locations for the reporting period are presented in Table 5-6 and Figure 5-3 respectively.

TABLE 5-6 DISCHARGE WATER MONITORING PROGRAM TRIGGER VALUES – WESTERN LEASES

Monitoring Parameters	Trigger Value	Frequency
Dissolved Aluminium	630 µg/L	Prior to discharge off-lease to confirm conformance to trigger value and then monthly while pumping
Dissolved Barium	135 µg/L	
Dissolved Manganese	1,900 µg/L	
Dissolved Iron	1,550 µg/L	
Dissolved Zinc	51 µg/L	
Dissolved Nickel	11 µg/L	
Total Recoverable Hydrocarbons [TRH (Sum of >C10 - C40 Fraction)]	0 µg/L [not detected]	
Electrical Conductivity	250 µS/cm [interim value]	

Data from this monitoring program, including the interpretation of results against the defined trigger values are presented annually through GEMCO's annual EMR and MMP.



Legend

- Dams and Quarries Sampling

Coordinate System: GDA94 Zone 53

SOUTH32

GEMCO

**Figure 5-3
Dams and Quarries
Sampling Locations**

Date: 1 August 2024

Author: gales2

Scale: 1:86,352

Figure No:

Vegetation Health Assessment

To monitor and manage potential vegetation impacts from off-lease dewatering, GEMCO has developed a vegetation monitoring plan. This program has been implemented and will be undertaken on an ongoing basis. The monitoring program currently incorporates the following key components:

- Geographical Information System (GIS) mapping identifying catchments where dewatering is occurring.
- Monitoring of groundwater bores within each catchment to ensure 0.8 m of free drainage (unsaturated zone) is maintained.
- In-field monitoring of vegetation health within dewatering catchments.
- Use of satellite imagery (NDVI) to undertake broad-scale monitoring of changes to vegetation within dewatering catchments.
- Daily inspections of pumping points by dewatering personnel to ensure water quality is being maintained (e.g. pumps are not pumping fines/sediment from the quarry sump).

The first round of the vegetation monitoring program using NDVI was completed in 2022 (AECOM, 2023) and the results from this program indicated that overall, there is insufficient evidence to determine that the extended dewatering program is resulting in an impact, though observable impacts due to insect attack were present. GEMCO engaged AECOM to complete the end of dry season (2023) Vegetation Health Assessment and the report from this was finalised in February 2024. This report found two potential areas (one area on site and one area off site) that seemed to demonstrate links between dewatering and reduced vegetation health. These areas are adjacent to the W quarries and north of TSF15. GEMCO have ceased dewatering into these areas and are looking at further mitigation measures for the program.

Results

In accordance with the conditions for the FY24 reporting period, GEMCO discharged off-lease from several quarries between July 2023 and June 2024. The active discharge sources for each month of FY24 are summarised in Table 5-7. The results from water quality monitoring for quarries being discharged off-lease is presented in Table 5-8.

Additional data is collected from other quarries and TSFs, however, this has not been presented in this EMR as it is not relevant to current discharge compliance. This data is collected to obtain longer term data sets on quarry water quality and to assist with water management decisions (e.g., determining whether particular quarries meet the water quality criteria if there is a need to dewater them to bushland).

TABLE 5-7 OFF-LEASE WATER DISCHARGE SOURCES (JULY 2023 – JUNE 2024) – WESTERN LEASES

Month	Off-Lease Discharge Source
July 2023	DN Quarry, ES Quarry, F3 Quarry SW, NH Quarry, W1 Quarry, W4 Quarry, WW1 Quarry
August 2023	DN Quarry, DNE Quarry, ES Quarry, F3 Quarry SW, NH Quarry, W2 Quarry, W4 Quarry, WW1 Quarry
September 2023	DN Quarry, ES Quarry, F3 Quarry SW, NH Quarry, W2 Quarry, WW1 Quarry
October 2023	DN Quarry, DSW Quarry, ES Quarry, F3 Quarry SW, W2 Quarry, WW1 Quarry
November 2023	DN Quarry, DSW Quarry, ES Quarry, F3 Quarry SW, W2 Quarry, WW1 Quarry
December 2023	DN Quarry, DSS Quarry, DSW Quarry, ES Quarry, F3 Quarry SW, NH Quarry, W2 Quarry, WW1 Quarry
January 2024	BSC Quarry, DN Quarry, DSS Quarry, DSW Quarry, F3 Quarry SW, W1 Quarry, W2 Quarry, WW1 Quarry
February 2024	BSC Quarry, DN Quarry, DSS Quarry, ES Quarry, F3 Quarry SW, W1 Quarry, W1 Quarry, W2 Quarry, WW1 Quarry
March 2024	BSC Quarry, F3 Quarry SW, W1 Quarry, WW1 Quarry, DN Quarry, DSS Quarry, ES Quarry, W2 Quarry, DSS Quarry, DN Quarry, W1 Quarry, WW1 Quarry, W2 Quarry, BSC Quarry
April 2024	ES Quarry, NH Quarry, DN Quarry, DNE Quarry, DSS Quarry, DSW Quarry, BSC Quarry, ES Quarry, W2 Quarry, WW1 Quarry
May 2024	BSC Quarry, DN Quarry, DNE Quarry, F3Q Quarry, F3N Quarry, NH Quarry, DSS Quarry, ES Quarry, W2 Quarry (incl. W1 quarry), WW1 Quarry
June 2024	BSC Quarry, DNE Quarry, ES Quarry, DSS Quarry, F3N Quarry, F3Q Quarry, NH Quarry, W2 Quarry, WW1 Quarry

Sampling throughout FY24 indicated that hydrocarbons were detected on three occasions and that the interim EC trigger value was exceeded on several occasions across a number of quarries (Table 5-8). All other analytes were below their respective trigger values for the twelve-month reporting period.

Upon the detection of the hydrocarbons, operational personnel were informed and pumping off-lease was ceased until re-sampling confirmed concentrations of hydrocarbons below laboratory detection limits. The hydrocarbon contamination was attributed to diesel from dewatering generator sets. During FY24, GEMCO have therefore changed out a number of older open, bunded tanks to closed, self-contained tanks to better manage this risk. In addition to this, the importance of minimising diesel spillage and cleaning up any spills immediately, has also been reinforced with operation personnel (i.e. sumps and pumps crews, service truck operators).

While the interim trigger value for EC was exceeded on a number of occasions, the trigger value is based on the default Australian and New Zealand Guideline (ANZG) (2018) guideline value for slightly disturbed ecosystems in tropical Australia. GEMCO believe that this trigger value is likely to be conservative for the application in GEMCO's dewatering program given the proximity of the receiving environments to the coast and prevalence of more saline conditions. For any exceedance of the interim EC trigger value, GEMCO applied the decision hierarchy detailed in Section 5.1.1.3, until derivation of a site-specific trigger value is complete.

TABLE 5-8 OFF-LEASE WATER DISCHARGE RESULTS – WESTERN LEASES

Location	Date	Dissolved Metals (µg/L)						TRH (µg/L)	EC (µS/cm)
		Al	Ba	Fe	Mn	Ni	Zn	>C10 - C40 Fraction (sum)	-
Trigger Values		630	135	1,550	1,900	11	51	0 [no detect]	250 [interim]
DN Quarry	27/07/2023	< 10	< 1	< 50	12	< 1	< 5	< 100	73
ES Quarry	27/07/2023	< 10	< 1	< 50	14	< 1	< 5	< 100	93
F3 Quarry SW	27/07/2023	130	20	< 50	138	< 1	< 5	< 100	1700
NH Quarry	27/07/2023	20	4	< 50	52	< 1	< 5	< 100	73
W1 Quarry	27/07/2023	< 10	< 1	< 50	73	2	< 5	< 100	224
W4 Quarry	27/07/2023	10	5	< 50	42	< 1	9	< 100	143
WW1 Quarry	27/07/2023	10	1	< 50	24	< 1	< 5	< 100	1060
DN Quarry	17/08/2023	10	< 1	< 50	12	< 1	< 5	< 100	134
DNE Quarry	17/08/2023	< 10	2	< 50	6	< 1	6	< 100	46
ES Quarry	17/08/2023	10	< 1	< 50	19	< 1	< 5	< 100	122
F3 Quarry SW	17/08/2023	190	20	< 50	131	1	< 5	< 100	1870
NH Quarry	17/08/2023	< 10	< 1	< 50	8	< 1	< 5	< 100	53
W2 Quarry	17/08/2023	< 10	< 1	< 50	5	< 1	< 5	< 100	48
W4 Quarry	17/08/2023	10	5	< 50	27	< 1	< 5	< 100	148
WW1 Quarry	17/08/2023	< 10	2	< 50	152	2	< 5	< 100	501
DN Quarry	14/09/2023	< 10	< 1	< 50	17	< 1	< 5	< 100	183
ES Quarry	14/09/2023	< 10	< 1	< 50	13	< 1	< 5	< 100	71
F3 Quarry SW	14/09/2023	300	18	< 50	139	< 1	< 5	< 100	1623
NH Quarry	14/09/2023	< 10	1	< 50	11	< 1	< 5	< 100	34
W2 Quarry	14/09/2023	< 10	< 1	< 50	7	< 1	< 5	< 100	38
WW1 Quarry	14/09/2023	< 10	2	< 50	144	2	< 5	< 100	554
DN Quarry	10/10/2023	< 10	< 1	< 50	18	< 1	< 5	< 100	136
DSW Quarry	10/10/2023	< 10	4	< 50	8	< 1	< 5	< 100	79
ES Quarry	10/10/2023	< 10	< 1	< 50	20	< 1	< 5	< 100	98
F3 Quarry SW	10/10/2023	330	18	< 50	156	1	< 5	< 100	2430
W2 Quarry	10/10/2023	< 10	< 1	< 50	7	< 1	< 5	< 100	50
WW1 Quarry	10/10/2023	< 10	< 1	< 50	32	< 1	< 5	< 100	426
DN Quarry	2/11/2023	< 10	< 1	< 50	14	< 1	< 5	< 100	90

Location	Date	Dissolved Metals (µg/L)						TRH (µg/L)	EC (µS/cm)
		Al	Ba	Fe	Mn	Ni	Zn	>C10 - C40 Fraction (sum)	-
Trigger Values		630	135	1,550	1,900	11	51	0 [no detect]	250 [interim]
DSW Quarry	2/11/2023	20	4	< 50	6	< 1	< 5	< 100	74
ES Quarry	2/11/2023	< 10	< 1	< 50	20	< 1	< 5	< 100	102
F3 Quarry SW	2/11/2023	320	20	< 50	158	1	< 5	< 100	2370
W2 Quarry	2/11/2023	< 10	< 1	< 50	4	< 1	< 5	< 100	48
WW1 Quarry	2/11/2023	20	4	< 50	180	3	< 5	< 100	1260
DN Quarry	7/12/2023	< 10	< 1	< 50	31	< 1	< 5	< 100	116
DSS Quarry	7/12/2023	< 10	3	< 50	24	< 1	< 5	< 100	38
DSW Quarry	7/12/2023	< 10	4	< 50	53	< 1	< 5	< 100	56
ES Quarry	7/12/2023	< 10	2	< 50	76	< 1	< 5	< 100	63
F3 Quarry SW	11/12/2023	60	14	< 50	214	< 1	< 5	< 100	1590
NH Quarry	7/12/2023	< 10	6	< 50	111	< 1	< 5	< 100	74
W2 Quarry	7/12/2023	< 10	2	< 50	70	< 1	< 5	< 100	137
WW1 Quarry	7/12/2023	< 10	< 1	< 50	52	< 1	< 5	< 100	67
BSC Quarry	3/01/2024	< 10	6	< 50	672	4	< 5	< 100	623
DN Quarry	3/01/2024	< 10	< 1	< 50	14	< 1	< 5	< 100	85
DSS Quarry	3/01/2024	< 10	3	< 50	41	< 1	< 5	< 100	39
DSW Quarry	3/01/2024	< 10	4	< 50	34	< 1	< 5	< 100	61
F3 Quarry SW	4/01/2024	< 10	10	< 50	182	< 1	< 5	< 100	1060
W1 Quarry	3/01/2024	< 10	2	< 50	160	2	< 5	130	673
W2 Quarry	3/01/2024	< 10	< 1	< 50	18	< 1	< 5	< 100	96
WW1 Quarry	3/01/2024	< 10	< 1	< 50	8	< 1	< 5	< 100	92
BSC Quarry	7/02/2024	< 10	7	< 50	981	5	< 5	< 100	732
DN Quarry	7/02/2024	< 10	2	< 50	47	< 1	< 5	< 100	152
DSS Quarry	7/02/2024	< 10	4	< 50	92	< 1	< 5	< 100	40
ES Quarry	7/02/2024	< 10	< 1	< 50	35	< 1	< 5	< 100	110
F3 Quarry SW	8/02/2024	< 10	5	< 50	141	< 1	< 5	< 100	372
W1 Quarry	5/02/2024	< 10	1	< 50	67	2	< 5	< 100	270
W1 Quarry	7/02/2024	10	2	< 50	227	2	< 5	< 100	356
W2 Quarry	7/02/2024	< 10	< 1	< 50	22	< 1	< 5	< 100	44

Location	Date	Dissolved Metals (µg/L)						TRH (µg/L)	EC (µS/cm)
		Al	Ba	Fe	Mn	Ni	Zn	>C10 - C40 Fraction (sum)	-
Trigger Values		630	135	1,550	1,900	11	51	0 [no detect]	250 [interim]
WW1 Quarry	7/02/2024	< 10	< 1	< 50	10	< 1	< 5	< 100	90
BSC Quarry	5/03/2024	10	5	< 50	851	4	6	< 100	593
F3 Quarry SW	6/03/2024	< 10	5	< 50	138	< 1	< 5	< 100	343
W1 Quarry	6/03/2024	< 10	2	< 50	113	2	< 5	< 100	318
WW1 Quarry	6/03/2024	< 10	3	< 50	34	< 1	< 5	< 100	1740
DN Quarry	7/03/2024	< 10	< 1	< 50	17	< 1	< 5	< 100	119
DSS Quarry	7/03/2024	< 10	5	< 50	163	< 1	< 5	< 100	42
ES Quarry	11/03/2024	< 10	< 1	< 50	29	< 1	< 5	< 100	55
W2 Quarry	11/03/2024	< 10	6	< 50	88	< 1	< 5	< 100	1470
DSS Quarry	21/03/2024	< 10	3	< 50	137	< 1	17	<100	35
DN Quarry	21/03/2024	< 10	1	< 50	26	< 1	< 5	<100	32
W1 Quarry	21/03/2024	< 10	4	< 50	91	< 1	< 5	<100	468
WW1 Quarry	21/03/2024	< 10	4	< 50	88	< 1	< 5	<100	474
W2 Quarry	21/03/2024	< 10	8	< 50	133	< 1	< 5	<100	914
BSC Quarry	21/03/2024	< 10	7	< 50	483	2	< 5	<100	380
ES Quarry	4/04/2024	< 10	1	< 50	36	< 1	< 5	< 100	54
NH Quarry	4/04/2024	10	4	< 50	92	7	23	< 100	60
DN Quarry	22/04/2024	< 10	1	< 50	24	< 1	< 5	< 100	60
DNE Quarry	22/04/2024	< 10	2	< 50	20	< 1	< 5	< 100	37
DSS Quarry	22/04/2024	< 10	5	< 50	139	< 1	< 5	< 100	42
DSW Quarry	22/04/2024	< 10	6	< 50	63	< 1	< 5	< 100	56
BSC Quarry	23/04/2024	< 10	3	< 50	193	< 1	< 5	< 100	274
ES Quarry	23/04/2024	< 10	1	< 50	33	< 1	< 5	< 100	59
W2 Quarry	23/04/2024	< 10	4	< 50	72	< 1	< 5	< 100	445
WW1 Quarry	23/04/2024	< 10	6	< 50	99	1	< 5	< 100	1210
BSC Quarry	20/05/2024	< 10	3	< 50	131	< 1	< 5	< 100	394
DN Quarry	20/05/2024	< 10	2	70	32	< 1	< 5	< 100	110
DNE Quarry	20/05/2024	< 10	1	< 50	10	< 1	< 5	< 100	54
F3Q Quarry	20/05/2024	< 10	18	< 50	221	< 1	< 5	< 100	430

Location	Date	Dissolved Metals (µg/L)						TRH (µg/L)	EC (µS/cm)
		Al	Ba	Fe	Mn	Ni	Zn	>C10 - C40 Fraction (sum)	-
Trigger Values		630	135	1,550	1,900	11	51	0 [no detect]	250 [interim]
F3N Quarry	20/05/2024	10	21	< 50	184	< 1	< 5	< 100	503
NH Quarry	20/05/2024	<10	9	< 50	113	< 1	< 5	< 100	160
DSS Quarry	21/05/2024	< 10	5	< 50	124	< 1	< 5	< 100	49
ES Quarry	21/05/2024	< 10	2	< 50	33	< 1	< 5	1150	64
W2 Quarry (incl. W1 quarry)	21/05/2024	< 10	2	< 50	38	< 1	< 5	< 100	222
WW1 Quarry	21/05/2024	< 10	6	< 50	107	2	< 5	< 100	2560
BSC Quarry	17/06/2024	< 10	2	< 50	72	< 1	< 5	< 100	366
DNE Quarry	17/06/2024	< 10	3	< 50	18	< 1	< 5	< 100	40
DSS Quarry	17/06/2024	< 10	5	< 50	123	< 1	< 5	< 100	65
ES Quarry	6/06/2024	< 10	1	< 50	26	< 1	< 5	< 100	81
ES Quarry	17/06/2024	< 10	2	< 50	42	< 1	< 5	< 100	86
F3N Quarry	19/06/2024	< 10	21	< 50	198	< 1	< 5	< 100	540
F3Q Quarry	19/06/2024	< 10	15	< 50	187	2	< 5	120	1600
NH Quarry	19/06/2024	< 10	6	< 50	70	< 1	< 5	< 100	86
W2 Quarry	17/06/2024	< 10	< 1	< 50	18	< 1	< 5	< 100	132
WW1 Quarry	17/06/2024	30	8	< 50	110	2	< 5	< 100	3510

Grey highlighting = exceedance of approved trigger value.

Italics = exceedance of interim trigger value.

Appendix B: Section 5.1.1.2 Surface Water Monitoring (extract from EMR FY24)



5.1.1.2. SURFACE WATER MONITORING

The natural surface water monitoring program involves the collection of both in-situ field readings and water samples at numerous locations along the Angurugu and Emerald Rivers (Figure 5-2). The program consists of monitoring sites situated both upstream (reference monitoring sites) and downstream (impact monitoring sites) of mining activities. Data collected from the downstream monitoring sites are analysed for various parameters against ANZG (2018) default guideline values (where available) using a 95% level of protection for aquatic ecosystems. The monitoring program is summarised in Table 5-3. The relevant analyte default guideline values for surface water are detailed in Table 5-4.

Abstraction from the Angurugu River is recorded as part of the monthly water accounting and water levels are measured weekly. GEMCO monitors abstraction volumes against abstraction limits detailed in their abstraction licence (Licence No. 9291005) issued by the NT Department of Environment, Parks and Water Security (DEPWS). The water abstraction licence is relevant to the period from 23 October 2020 to 22 October 2025. In accordance with the licence, a report of abstraction volumes and river gaugings undertaken on the Angurugu River has been provided to DEPWS Water Resources Division for FY24.

TABLE 5-3 SURFACE WATER MONITORING PROGRAM – WESTERN LEASES

Location	Monitoring Parameters	Frequency
Angurugu River: AMP1, AMP2, AMP3, AMP4, AMP5, AMP6, AMP7	Temperature, pH, Dissolved Oxygen (DO), EC, Oxidation Reduction Potential (ORP), Turbidity, Total Suspended Solids (TSS)	1 Monthly
Emerald River: EMP1, EMP2, EMP3	Total and dissolved metals / metalloids: Aluminium (Al), Barium (Ba), Manganese (Mn), Zinc (Zn), Iron (Fe) Major Anions: Chlorine (Cl), Sulphate (SO ₄) Alkalinity Major Cations: Calcium (Ca), Magnesium (Mg), Sodium (Na), Potassium (K)	
Pumping station	Flow meter reading	1 Monthly
Gauging station	River level reading	1 Weekly

TABLE 5-4 SURFACE WATER MONITORING PROGRAM TRIGGER VALUES – WESTERN LEASES

Location	Trigger Value (Dissolved Fraction - µg/L) ¹		
	Al	Mn	Zn
Estuarine Environment: AMP1, AMP2, AMP3, EMP3	N/A ²	390 ³	15 ⁴
Freshwater Environment: AMP4, AMP5, AMP6, AMP7, EMP1, EMP2	55	1,900	8

(1) Triggers values are only applicable to monitoring sites downstream of mining activities (impact monitoring sites). These are AMP1, AMP2 and AMP3. As of FY24, EMP3 is also considered downstream of mining activities. (2) Previous reporting by GEMCO used a trigger value of 0.5 µg/L for Aluminium (based on the "low reliability" marine trigger value stated by ANZG (2018) however no trigger value will be applied for the FY21-FY24 MMP term as there is currently no toxicant default guideline values for Aluminium in estuarine environments. (3) A trigger value of 390 µg/L is applied to estuarine reaches of the Angurugu and Emerald Rivers as advised by the NT Environment Protection Authority (EPA). The Australian and New Zealand Environment Conservation Council (ANZECC) Steering Committee have approved revised/unpublished, moderate to high reliability trigger values for manganese in marine waters. (4) Trigger value based on a study undertaken by Indo-Pacific Environment (2023), and is derived from the second highest Zn concentration recorded at a reference site in the Angurugu River.



Appendix C: Section 5.1.1.5 Groundwater Monitoring (extract from EMR FY24)



5.1.1.5. GROUNDWATER MONITORING

GEMCO undertakes groundwater monitoring at locations up and down hydraulic gradient from the mine site, wet tip (landfill), dry tip (landfill), TSFs and the port. The objectives of the groundwater monitoring program are to:

- Monitor groundwater levels around the mine site to support dewatering and seepage studies.
- Monitor for potential hydrocarbons in groundwater from bulk fuel storage facilities.
- Monitor for potential seepage issues at the TSFs.
- Detect potential contaminated leachate from the landfills.
- Continually review the environmental risk associated with the legacy hydrocarbon contamination at the Milner Bay port facility by:
 - monitoring for phase-separated hydrocarbons (PSH) to ensure the integrity of the poly membrane is intact;
 - monitoring dissolved petroleum hydrocarbons (DPH) concentrations to determine any increasing trends in the concentrations of DPH in bores historically effected by DPH;
 - monitoring the number of bores effected by DPH to ensure there is not an increase in the number of bores affected by DPH; and
 - ensuring the protection of the marine environment by applying a trigger value at the most seaward monitoring wells (PF0600A, PF0600B, PF0600C and PF0600D).

The groundwater network can be divided into smaller networks, which target auxiliary activities associated with GEMCO's operations. The data and discussion within this section has therefore been separated so that it is focussed and relevant on each of these networks, specifically:

- Mine site groundwater monitoring:
 - mine site;
 - refuelling stations;
 - mobile workshop drain; and
 - sewage pond.
- Disposal facilities (landfill) groundwater monitoring.
- Tailings dam groundwater monitoring.
- Port facility and Milner Bay monitoring.

Where relevant, water quality data are compared against the Australian and New Zealand Guidelines (formerly ANZECC, 2000) for slightly to moderately disturbed (95% species protection) freshwater and marine water ecosystems (ANZG, 2018).

Groundwater monitoring is also undertaken at a series of control (reference) sites, which are used as a comparison to locations potentially impacted by the mining operations, such as the TSFs.

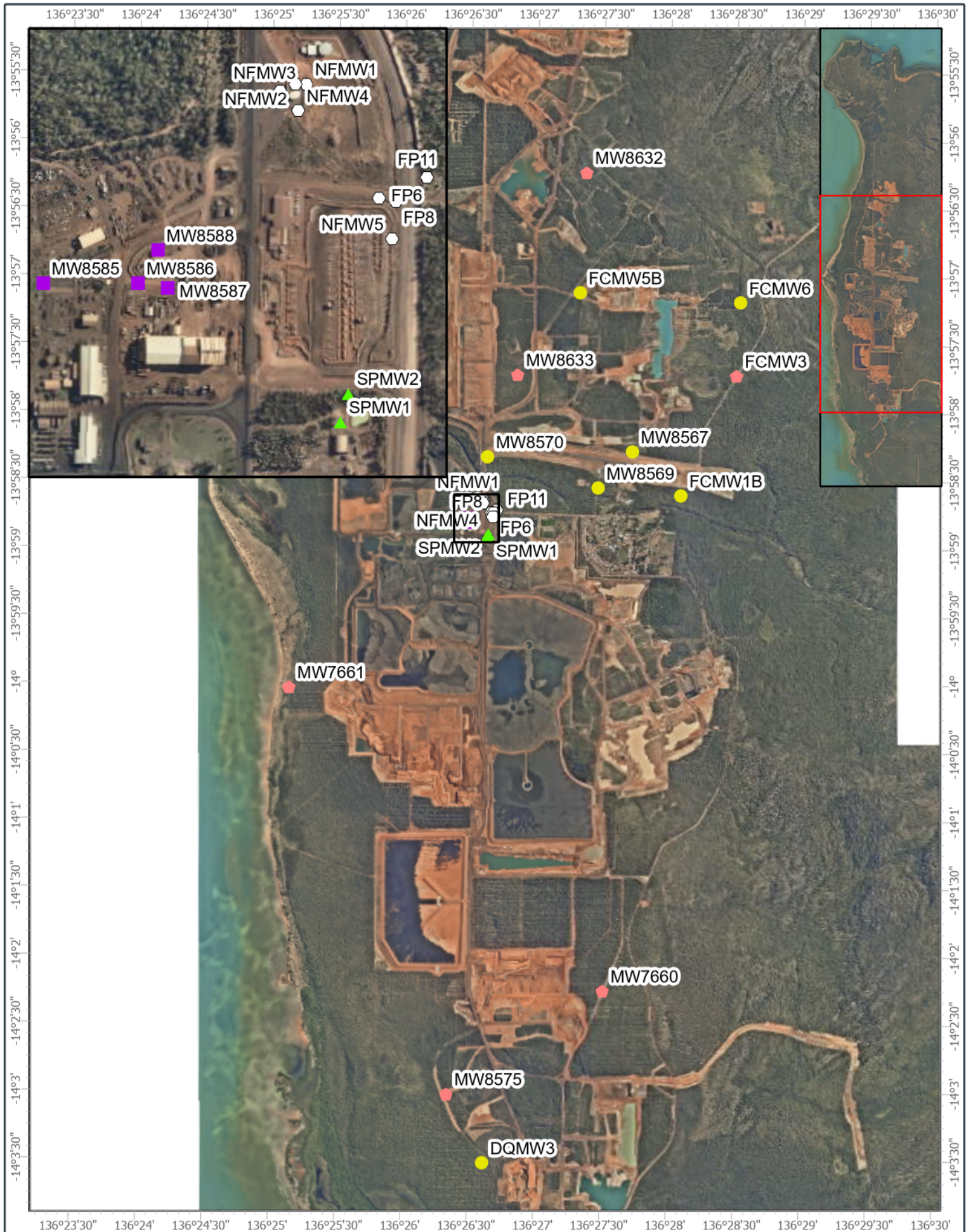
The network of groundwater monitoring bores is strategically located around the mine footprint (Figure 5-5) to monitor changes in groundwater levels and quality. Monitoring is undertaken on a quarterly to annual basis with details of the respective monitoring programs provided in Table 5-12.

TABLE 5-12 MINE GROUNDWATER MONITORING PROGRAM – WESTERN LEASES

Location	Monitoring Parameters	Trigger Values (µg/L)	Frequency
Mining Area			
MW7660, MW7661, MW8575, MW8632, MW8633, FCMW3	Depth to water	-	Biannual
FCMW5B, FCMW6, FCMW1B, MW8567, MW8569, MW8570, DQMW3	Depth to water	-	Biannual
	Total and dissolved Al	55 (dissolved, pH>6.5)	
	Total and dissolved Ba, Total and dissolved Fe	-	
	Total and dissolved Mn	1,900 (dissolved)	
	Total and dissolved Zn	8 (dissolved)	
	Major Anions: Cl, SO4 Alkalinity, Major Cations: Ca, Mg, Na, K, Total hardness	-	
Refueling Stations			
NFMW1, NFMW2, NFMW3, NFMW4, NFMW5, FP6, FP8, FP11	TPH (C6 – C36) ¹	600 ¹	Quarterly
	Benzene	950	
	Toluene	180	
	Ethylbenzene	80	
	Total Xylenes	300	
Mobile Workshop Drain ²			
MW8585, MW8586, MW8587, MW8588	Total and dissolved Al	55 (dissolved, pH>6.5)	Annually
	Total and dissolved Ba, Total and dissolved Fe	-	
	Total and dissolved Mn	1,900 (dissolved)	
	Total and dissolved Zn	8 (dissolved)	
	TPH (C6 – C36)	600	
	Benzene	950	
	Toluene	180	
	Ethylbenzene	80	
	o-Xylene	350	
	m-Xylene and p-Xylene	75 ³	
Sewage Ponds			
SPMW1, SPMW2	Depth to water Total and dissolved metals / metalloids: Al, Ba, Mn, Zn, Fe; Major Anions: Cl, SO4; Alkalinity; Major Cations: Ca, Mg, Na, K; Total hardness; Ammonia as N; nitrate as N; reactive phosphorus; methane; E. coli	-	Biannual

(1) ANZG (2018) criteria for lethal concentration 50 (LC50) in molluscs. (2) GEMCO monitored the mobile workshop bores in 2021 following elevated TPH concentrations recorded at RMS35 in 2020. GEMCO has continued this program annually to determine whether there is migration of hydrocarbons to groundwater. (3) Para- and meta-Xylene are combined within lab analysis. The lower trigger value (i.e. para-Xylene) has been applied

Note: bores which have been removed during the FY21-24 MMP term have been noted in previous EMR submissions.



Legend

- ▲ Bi-Annual Sewage Pond Groundwater Sampling
- ◆ Bi-Annual Groundwater Gauging
- Bi-Annual Groundwater Sampling
- Quarterly Groundwater Sampling
- Annual Mobile Workshop Groundwater Sampling

SOUTH32

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Figure 5-5
Mine Groundwater Gauging
and Sampling Locations

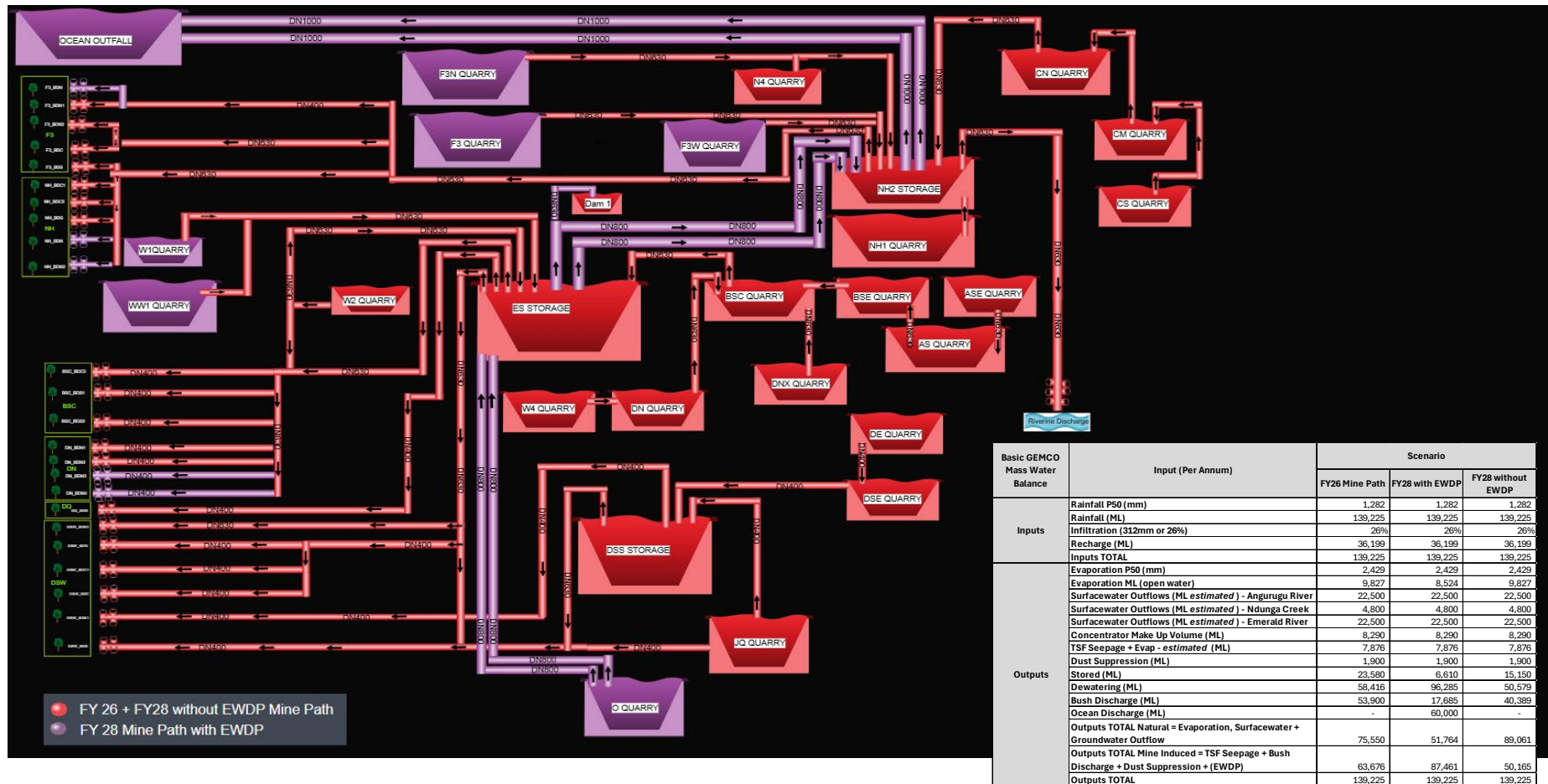
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Author: gales2
Figure No:

Coordinate System: GDA94 Zone 53

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Appendix D: GEMCO Western Leases mine water balance schematic (Figure 1)



Appendix E: Groundwater drawdown contours (current and predicted)
(Figures 2 and 3)



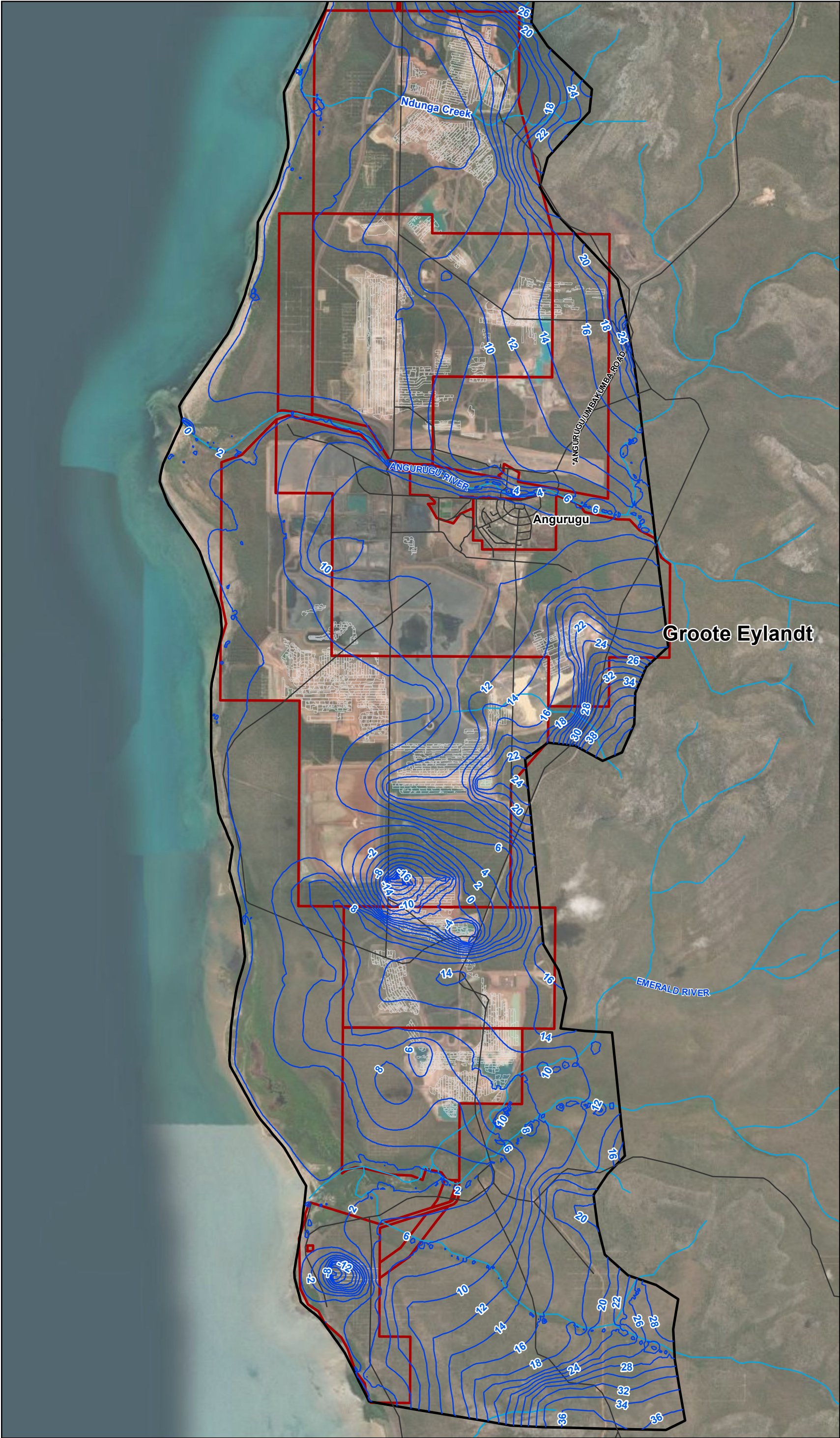
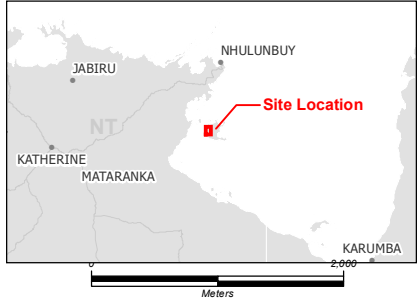


Figure 2
Model predicted drawdown
August 2024

Legend

- Model layer 1 head contours 2m (1 August 2024)
- Roads
- Watercourse
- Model domain
- Western Lease
- Historical mining



Coordinate system: GDA2020 MGA Zone 53
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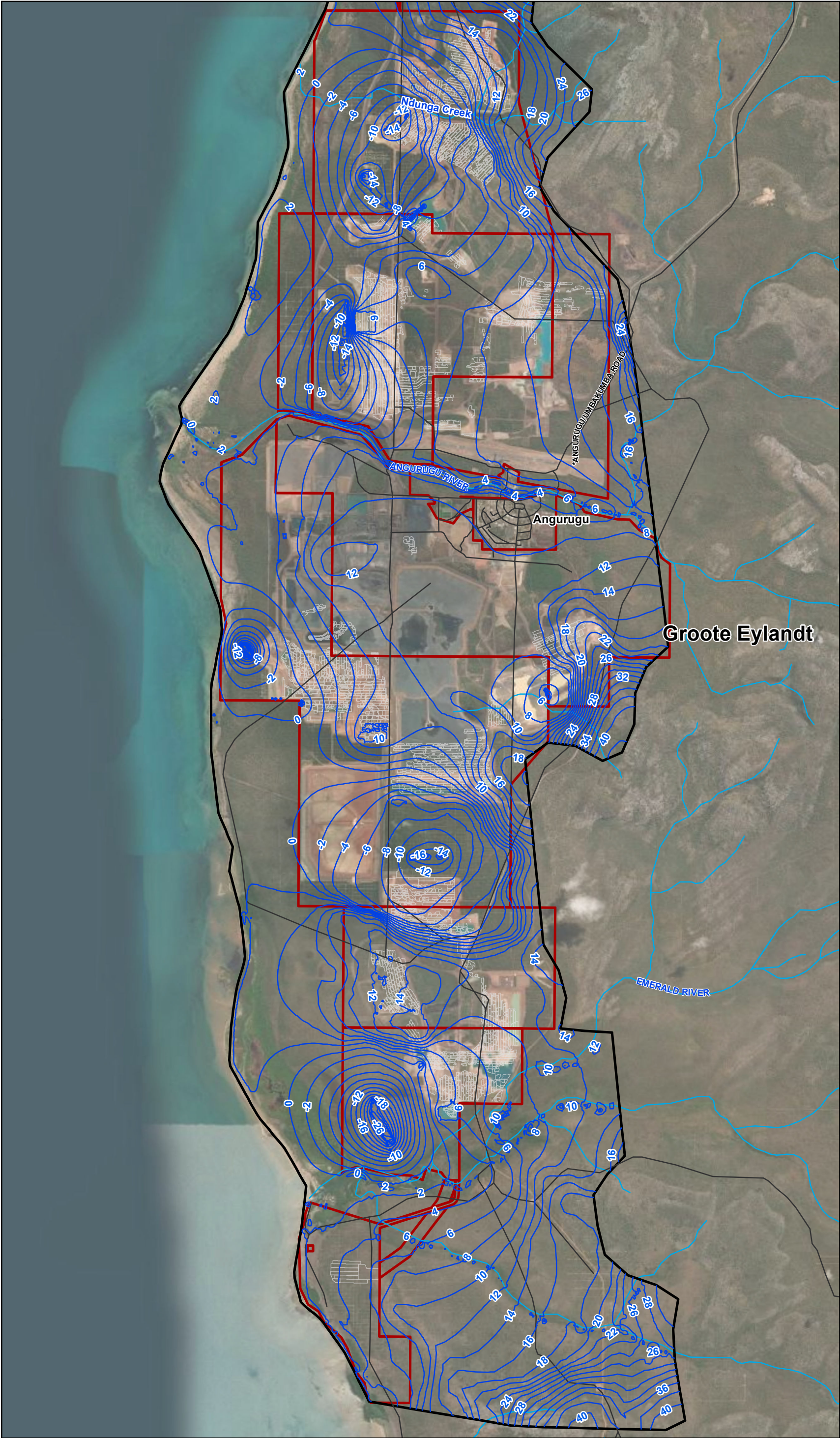
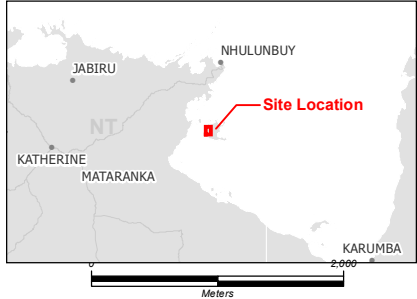


Figure 3
Model predicted drawdown
December 2028

- Legend**
- Model layer 1 head contours 2m (December 2028)
 - Roads
 - Watercourse
 - Model domain
 - Western Lease
 - Historical mining



Coordinate system: GDA2020 MGA Zone 53
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