Environmental Monitoring Report

MCARTHUR RIVER MINE

McArthur River Mining Pty Ltd

August 2022

A GLENCORE Company

McArthur River Mining Pty Ltd (MRM) acknowledges the Gudanji and Yanyuwa people of the Gulf Region, the Traditional Owners of the land on which our mine site and Bing Bong Loading Facility operate. We pay our respects to past, present and emerging elders and thank elders for the knowledge and wisdom they share with our people. We also pay our respects to Garrwa and Marra elders and acknowledge their connection to the country on which we operate.

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1 Introduction

1.1 Operator Details

Glencore PLC (Glencore) is one of the world's largest natural resource companies. As a leading integrated producer and marketer of commodities with a well-balanced portfolio of industrial assets, Glencore is strongly positioned to capture value at every stage of the supply chain, from sourcing materials deep underground to delivering products to an international customer base.

Glencore's industrial and marketing activities are supported by a global network of more than 90 offices located in over 50 countries, and its diverse operations comprise over 150 mining and metallurgical sites, offshore oil production assets, farms and agricultural facilities. Glencore employs approximately 158,000 people (including contractors).

McArthur River Mining Pty Ltd (MRM) is a subsidiary of Glencore, and is the operator of the McArthur River Mine (the Mine). MRM operations consist of the open pit mine, a concentrator and processing plant, and the Bing Bong Loading Facility (BBLF) in the Gulf of Carpentaria. MRM is the world's largest producer of zinc in bulk concentrate form, which is used by Imperial Smelting Process smelters in Europe and Asia, and zinc concentrate, which is supplied to electrolytic smelters. The majority of concentrate is transported from the Mine to the BBLF by road. From there, it is loaded onto a barge and transported to waiting ships at sea in the Gulf of Carpentaria. Lead concentrate is transported to the Mt Isa mine by road.

MRM is dedicated to supporting local people and local businesses, and creating strong links between their operations and the Gulf Region. MRM does this through generous contributions to local health, education, cultural and capacity building initiatives, and the funding of vital public services and infrastructure development projects.

Legal Entity:	McArthur River Mining Pty Ltd
ABN:	90 008 167 815
ACN:	008 167 815
Registered Business Address:	Level 44, 1 Macquarie Place, Sydney NSW 2000
Postal Address:	PO Box 36821, Winnellie NT, 0821

1.2 Project Description

1.2.1 Location and Tenements

The Mine is located approximately 45 kilometres (km) south-west of the township of Borroloola (approximately 65 km by road) and 715 km south-east of Darwin (approximately 900 km by road), in the Gulf Region of the Northern Territory (NT) (Figure 1).

The Mine is contained within five contiguous mineral leases (Mineral Lease Northern [MLN] 1121, MLN 1122, MLN 1123, MLN 1124 and MLN 1125), located on the McArthur River Station Pastoral Lease. The McArthur River Station is 100 percent (%) owned by Mount Isa Mines Limited and managed by Colinta Holdings Pty Ltd, a Glencore subsidiary. The BBLF is situated on MLN 1126, located on the Bing Bong Pastoral Lease. Locations and details of MRM tenements are shown in Table 1 and Figures 1, 2 and 3.

TABLE 1: LIST OF MCARTHUR RIVER MINING PTY LTD TENEMENTS

Tenement	Date Granted	Date of Expiry	Area	Holder
MA 366	08 Jun 1992	7 June 2022^	9 blocks	Mount Isa Mines Limited
MA 455	21 Aug 2006	20 Aug 2022^	4 blocks	Mount Isa Mines Limited
MA 456	21 Aug 2006	20 Aug 2022^	1 block	Mount Isa Mines Limited
MLN 582	04 Feb 2020	31 Dec 2040	16.18 ha	Mount Isa Mines Limited
MLN 1121	05 Jan 1993	04 Jan 2043	372.4 ha	Mount Isa Mines Limited
MLN 1122	05 Jan 1993	04 Jan 2043	3348 ha	Mount Isa Mines Limited
MLN 1123	05 Jan 1993	04 Jan 2043	3884 ha	Mount Isa Mines Limited
MLN 1124	05 Jan 1993	04 Jan 2043	3283 ha	Mount Isa Mines Limited
MLN 1125	05 Jan 1993	04 Jan 2043	656.8 ha	Mount Isa Mines Limited
MLN 1126	05 Jan 1993	04 Jan 2043	900 ha	Mount Isa Mines Limited

MA = Mineral Authority; ha = hectares; ^ = renewal has been sought for these tenements.

1.2.2 Project Summary

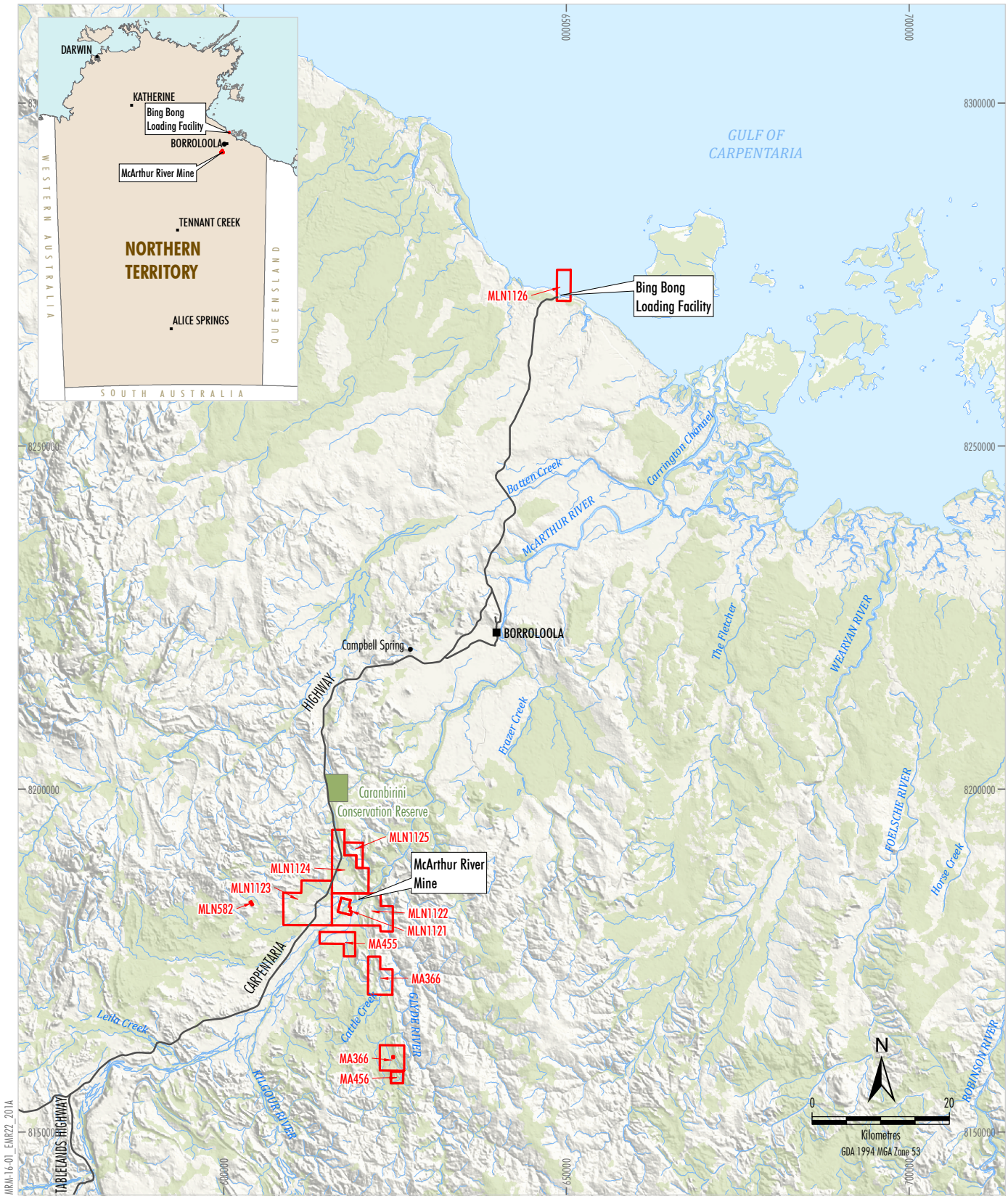
1.2.2.1 History of Development

The Mine is a major open pit operation, developing one of the largest known sedimentary stratiform zinc-lead-silver deposits. The orebodies, making up the deposit known as “Here’s Your Chance”, were discovered in 1955 by Mount Isa Mines Limited geologists. Initial development did not commence until 1975, when a small decline and pilot plant were constructed on-site.

Following the preparation of an Environmental Impact Statement (EIS) in 1992, development of MRM’s underground operation commenced in 1994, with the first shipment of concentrate commencing in mid-1995.

Until 2006, the Mine was an underground operation producing around 333,000 dry metric tonnes per annum (dmtpa) of bulk lead-zinc-silver concentrate for overseas and domestic markets. The Mine was converted to an open pit operation following the completion of the 2005 environmental impact assessment process for the Phase 2 Project (Phase 2). MRM were authorised by the then Minister for the Environment, Heritage and the Arts, Peter Garrett, to construct and operate an open pit lead, zinc and silver mine to replace a closed underground mine on 20 February 2009.

In 2013, the NT Government approved the MRM Phase 3 Development Project (Phase 3). Phase 3 extended the life of the Mine by nine years to 2036, increased ore production from 2.5 million tonnes per annum (Mtpa) to 5.5 Mtpa, improved the ore processing facilities to increase throughput from 360,000 dmtpa to 800,000 dmtpa and involved improvement, expansion and upgrades of existing infrastructure.



LEGEND

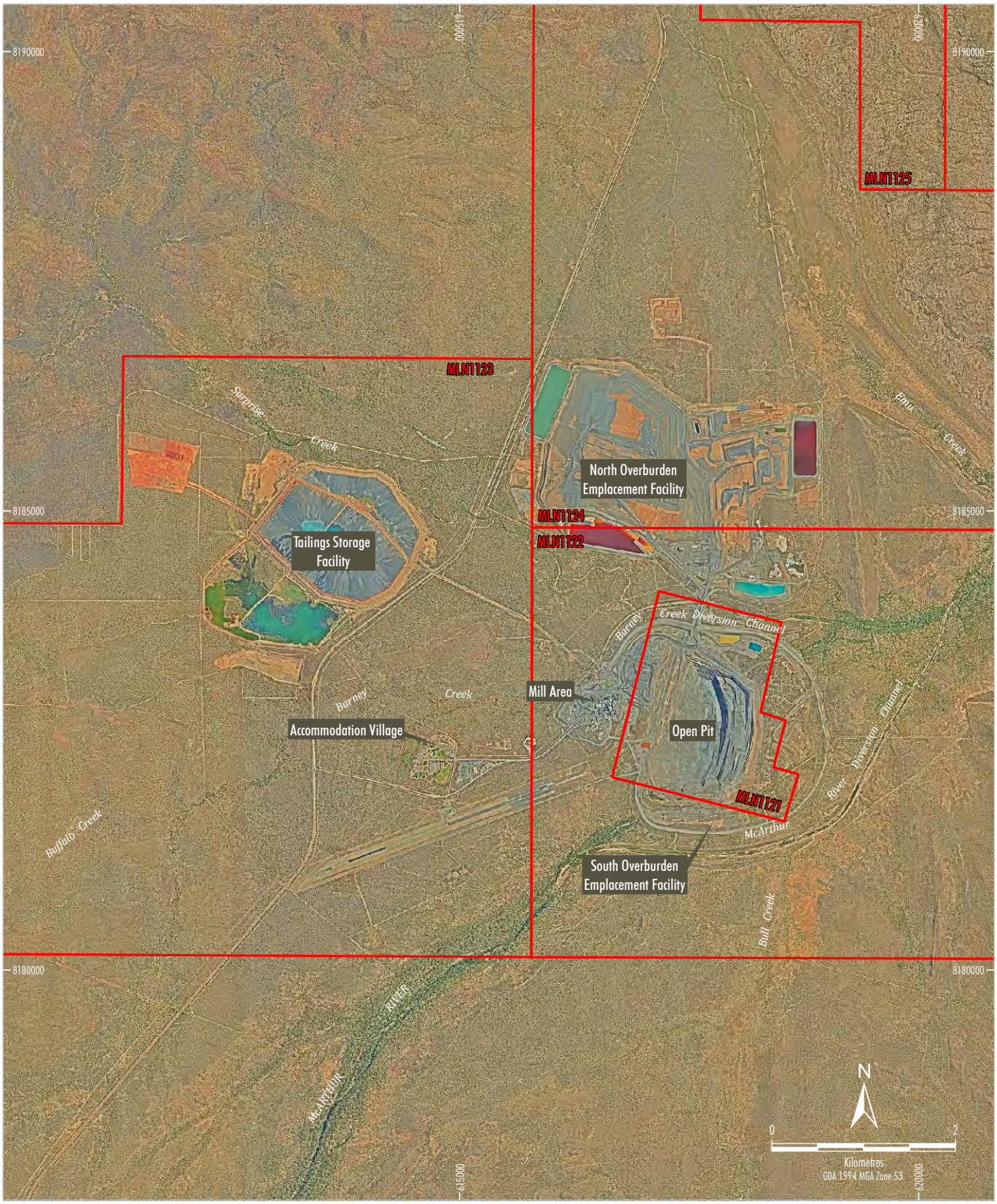
- Mineral Lease/Exploration
- Major Road
- River/Creek

Source: Geoscience Australia - Topography (2006); Department of Environment and Natural Resources (2016)

McARTHUR RIVER MINE

Regional Locality

Figure 1



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LEGEND

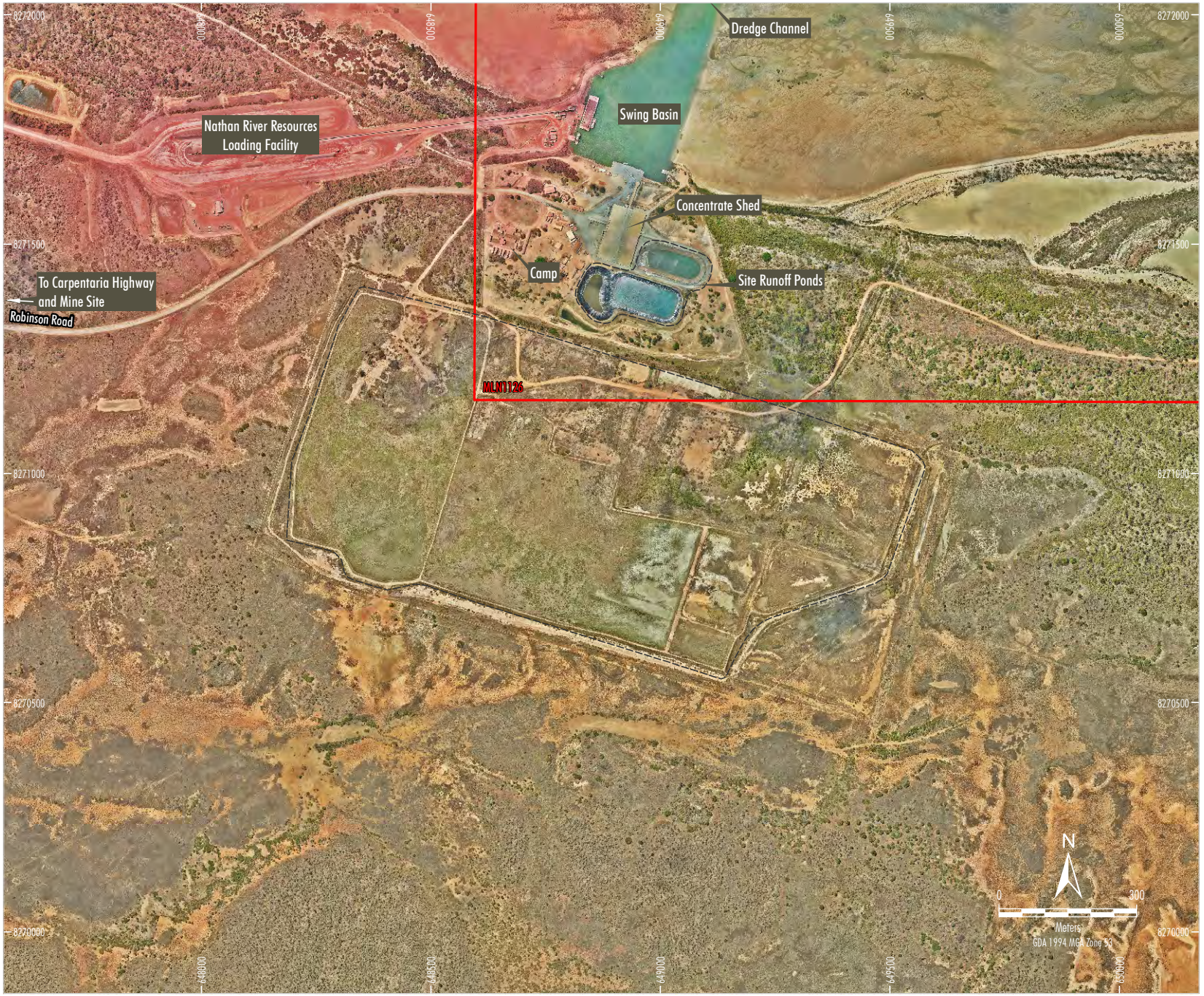
Mineral Lease

Source: Orthophoto MRM (2021); Department of Environment and Natural Resources (2016)

McARTHUR RIVER MINE

Mine Site

Figure 2



LEGEND

Mineral Lease

Source: Orthophoto MRM (2021); Department of Environment and Natural Resources (2016)

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McARTHUR RIVER MINE

Bing Bong Loading Facility

Figure 3

1.2.2.2 Overburden Management Project

In late 2013, MRM lodged the 2013-2015 Mining Management Plan (2013-2015 MMP) with the then NT Department of Mines and Energy (DME) (now the NT Department of Industry, Tourism and Trade [DITT]). The 2013-2015 MMP incorporated amendments to the classification of overburden and resultant modifications to overburden emplacement design, particularly the North Overburden Emplacement Facility (NOEF).

Following initial review, the amendments presented in the 2013-2015 MMP were referred to the NT Environment Protection Authority (NT EPA) in March 2014, for consideration under the NT *Environmental Assessment Act 1982* (Environmental Assessment Act). The NT EPA determined that the amendments to overburden management were significantly different from those presented and approved as part of Phase 3 and assessment under the Environmental Assessment Act was, therefore, necessary. Furthermore, the NT EPA determined that assessment via an EIS was required.

MRM submitted the Overburden Management Project (OMP) EIS in early 2017 and subsequently prepared and submitted a Supplementary OMP EIS.

In July 2018, the NT EPA completed its assessment of the OMP EIS and issued *Assessment Report 86 for the McArthur River Mine Overburden Management Project* (Assessment Report 86), recommending the OMP for approval. Assessment Report 86 is not an environmental approval although it guides the decision for a mining authorisation and the decision for approval under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). The Report also informs approvals under the *Northern Territory Aboriginal Sacred Sites Act 1989*, *Heritage Act 2011* and *Water Act 1992*.

Federal approval of the OMP was received from the then Department of the Environment and Energy on 12 June 2019, with the approval document EPBC 2014/7210 issued. The OMP was formally authorised and commenced on 13 November 2020.

1.3 Scope and Purpose

The purpose of this Environmental Monitoring Report (EMR) is to fulfil the reporting requirements for an 'Environmental Mining Report' under sections 37 (3)I, (4), and (5) of the *Mining Management Act 2001*.

This report has been prepared in accordance with the then Department of Primary Industry and Resources (DPIR) *Mining Management Plan Structure Guide for Mining Operations*, and should be read with reference to the mine management documentation defined in MRM's approved Variation of Authorisation (VOA).

Reporting in this Environmental Monitoring Report (EMR) covers the period of 1 May 2021 to 30 April 2022 (here in referred to as the reporting period). The Mine operated in accordance with VOA 0059 dated 13 November 2020, and subsequent variation dated 18 June 2021 as well as the following approval documents over the reporting period:

- EPBC Act Approval 2014/7210 (dated 12 June 2019), and subsequent variation (dated 29 April 2022).
- EPBC Act Approval 2003/954 (dated 20 February 2009).
- Waste Discharge Licence (WDL) 174-11 (dated 28 April 2019), and subsequent amendments 174-12 (dated 25 May 2021) and 174-13 (dated 10 March 2022).

MRM submitted the *McArthur River Mining Pty Ltd, Mining Management Plan 2020* (January 2020 MMP) on 31 January 2020 to DPIR (now DITT). The January 2020 MMP was approved on 13 November 2020.

Appended to the January 2020 MMP and submitted to DPIR on 31 January 2020 was the MRM Adaptive Management Plan (AMP). Both were approved on 13 November 2020. The Adaptive Management Plan (AMP) was developed to ensure the OMP is implemented in a manner that protects the health of the McArthur River from mine related impacts, consistent with the overarching environmental outcome outlined in Assessment Report 86, reproduced below:

> *Ensure the health of the McArthur River is protected along its whole length at all times from mine related impacts.*

Key environmental objectives have been developed as a result of environmental assessment processes (including EISs), environmental risk assessments, stakeholder engagement and feedback, development of management and monitoring plans, specialist investigations, independent monitoring reviews and regulatory approvals.

The key environmental objectives during mining operations are summarised as follows:

1. Protect the McArthur River beneficial uses and community values from mining impacts.
2. Facilitate development of the ecosystems and their functions along the McArthur River Diversion Channel for terrestrial and aquatic flora and fauna.
3. Minimise air quality related impacts from the Mine's operations with respect to community health and the environment.
4. Protect the beneficial uses and community values adjacent to the BBLF and transhipment corridor from impacts associated with MRM's operations.

The overarching objectives are supplemented by performance indicators and associated environmental triggers detailed in the AMP and sub-management plans. Monitoring data collected under the AMP during the reporting period are analysed by expert specialists to determine the Mine's environmental performance against the aforementioned environmental objectives. Monitoring, management and reporting at the Mine was conducted in accordance with the AMP over the reporting period.

An updated version of the AMP was submitted to DEPWS on 31 March 2021 in accordance with WDL 174-13, and subsequently submitted to DITT.

1.3.1 Environmental Risk, Compliance and Further Actions

Previous environmental assessment processes, including the OMP EIS, identified potential environmental risks associated with the construction and operation of the Mine, Tailings Storage Facility (TSF) and NOEF. A set of mitigation measures were developed specifically to manage the risks identified and have been implemented throughout the reporting period where appropriate.

MRM conducted an environmental risk assessment on 12 May 2022. A risk workshop was coordinated by an independent risk assessment facilitator to review current environmental risks associated with the operations and additional risks associated with operations over the coming EMR reporting period. The risk workshop found that MRM continues to adequately manage its risk and the controls and monitoring programs are fit for purpose.

The overall risk profile for the site was marginally reduced, with a greater portion of risks ranked as 'low' when compared to the January 2020 MMP and OMP EIS. This is primarily based on the successful implementation of controls and identification of additional treatments resulting in some medium risks reducing to low risks.

The analysis of results in this EMR are used to determine environmental performance, compliance with the relevant approval conditions and assess whether the current controls are adequate in managing potential environmental risks. Where management controls are determined to be inadequate, new risks have been identified or performance does not meet relevant approvals, additional controls, monitoring and/or investigations may be required. A summary of any further actions is provided under each environmental aspect in Sections 3 and 4, and summarised in the Discussion section (Section 6).

2 Operational Activities

2.1 Exploration

Exploration and regional drilling works were undertaken within Mining Authority (MA) 366, MA455, MA456 MLN1121, MLN1222 and MLN1123 during the reporting period.

The main findings from the drilling program were that the:

- ore zone intersected within the Lower Fold Zone (LFZ) was consistent with the current geological model;
- further mineralisation was identified within the mining lease;
- strong pyrite alteration within the hanging wall (HW) waste zone and discontinuity of the orebody was observed east of the LFZ; and
- geotechnical drilling investigations have improved the existing structural and rock mass database.

All drilling during the reporting period was undertaken in accordance with the January 2020 MMP.

2.2 Resource Definition and Waste Characterisation

2.2.1 Ore Identification and Mark-up

The January 2020 MMP describes the process for ore identification and mark-up, which includes:

- geological observation to identify lithostratigraphic boundaries of low-grade ore (LGO) and high-grade ore on the pit floor;
- use of fluorescent paint and tape to mark up the lithostratigraphic boundaries;
- excavation of material;
- hauling of excavated material to the appropriate area;
- qualified personnel to direct and supervise operations from the excavator when physically marking the lithostratigraphic boundaries was not possible; and
- physical inspection of the run-of-mine (ROM) ore.

Ore identification and mark-up during the reporting period was undertaken consistent with the process described in the January 2020 MMP.

2.2.2 Waste Characterisation and Identification

2.2.2.1 Waste Classification Criteria

MRM operated in accordance with the January 2020 MMP which describes the MRM waste rock classification criteria.

2.2.2.2 Waste Characterisation and Identification

The January 2020 MMP describes the procedure for in-pit waste characterisation, which includes:

- material classification for each blast block;
- sampling of a representative slice of blast hole cuttings from each drill hole mound;
- analysis of subsamples via on site laboratory inductively coupled plasma mass spectrometry (ICP-MS) analyses;
- data processing concentrating on elements known to be rich in the hanging wall sequence (i.e. antimony (Sb), arsenic (As), bismuth (Bi), cadmium (Cd), chromium (Cr), copper (Cu), iron (Fe), Pb, manganese (Mn), molybdenum (Mo), selenium (Se), sulphur (S) and zinc (Zn);
- verifying on site laboratory performance by use of an external laboratory for elemental analysis of samples; and
- use of block model estimations and geochemical results to determine final material classification and boundaries, then prepare a geology dig guide.

Waste characterisation quality assurance and quality control (QA/QC) activities were undertaken for the reporting period in line with site grade control practices. Blasthole and reverse circulation samples taken during the period were analysed using X-ray fluorescence (XRF) and ICP-MS analysis methods.

The frequency of blasthole sampling verification checks taken as part of grade control practices is summarised in Table 2, and waste dump grab sampling frequencies are summarised in Table 3.

TABLE 2: BLASTHOLE SAMPLING VERIFICATION CHECKS

Total Number of Samples:	**2,551**			
QA/QC	**Standard (ratio)**	**Standard (quantity)**	**Actual (ratio)**	**Actual (quantity)**
Laboratory checks (umpire)	1:20	127	1:19	130
Duplicates	1:20	127	1:18	135

TABLE 3: OVERBURDEN EMPLACEMENT FACILITY WASTE SAMPLING FREQUENCIES

Waste Rock Class	Tonnes (t)	Standard (ratio)	Standard (quantity)	Actual (quantity)
LS-NAF (HC)	1,504,875	1:100,000	15	24
MS-NAF (HC)	3,729,852	1:50,000	75	230
MS-NAF (LC)	8,455,658	1:50,000	169	
PAF (HC)	14,823,354	1:50,000	296	347
PAF (RE)	11,421,155	1:25,000	457	474
Total	39,934,894	-	1,012	1,075

LS-NAF(HC) = Low salinity nori-acid forming rock (high capacity)
MS-NAF(HC) = Metalliferous saline nori-acid forming rock (high capacity)
[MS-NAF(LC)] Metalliferous saline nori-acid forming rock (low capacity)
PAF(HC) = Potentially acid forming rock (high capacity)
PAF(RE) = Potentially acid forming rock (reactive)

2.3 Open Pit Mining

2.3.1 Mine Schedule

Open Pit regions active during the reporting period are shown on Figure 4.

Foot Wall Quarry (FWQ), J Stage, K Stage and L stage progressed as planned during the reporting period. The FWQ was mined to design limits, whilst mining in J Stage progressed down to the 9,816 reference line (RL). During the reporting period, the full extents of K Stage was mined and waste was pre-stripped down to the 9,888 RL.

As planned, the mining fleet remained at the same levels during the reporting period, to accommodate the annual waste tonnes mined.

Table 4 provides the mining quantities for the period of 1 May 2021 to 30 April 2022, along with a breakdown of waste material tonnages according to the MRM waste rock classification criteria.

TABLE 4: 1 MAY 2021 TO 30 APRIL 2022 MINING QUANTITIES

Material	Mined Quantity (Mt)*
Alluvium	1.29
LS-NAF (HC)	1.50
MS-NAF (HC)	3.73
MS-NAF (LC)	8.46
PAF (HC)	14.82
PAF (RE)	11.42
Total Waste	**41.22**

* Mt = million tonnes

2.3.2 Clearing and Soil Stripping

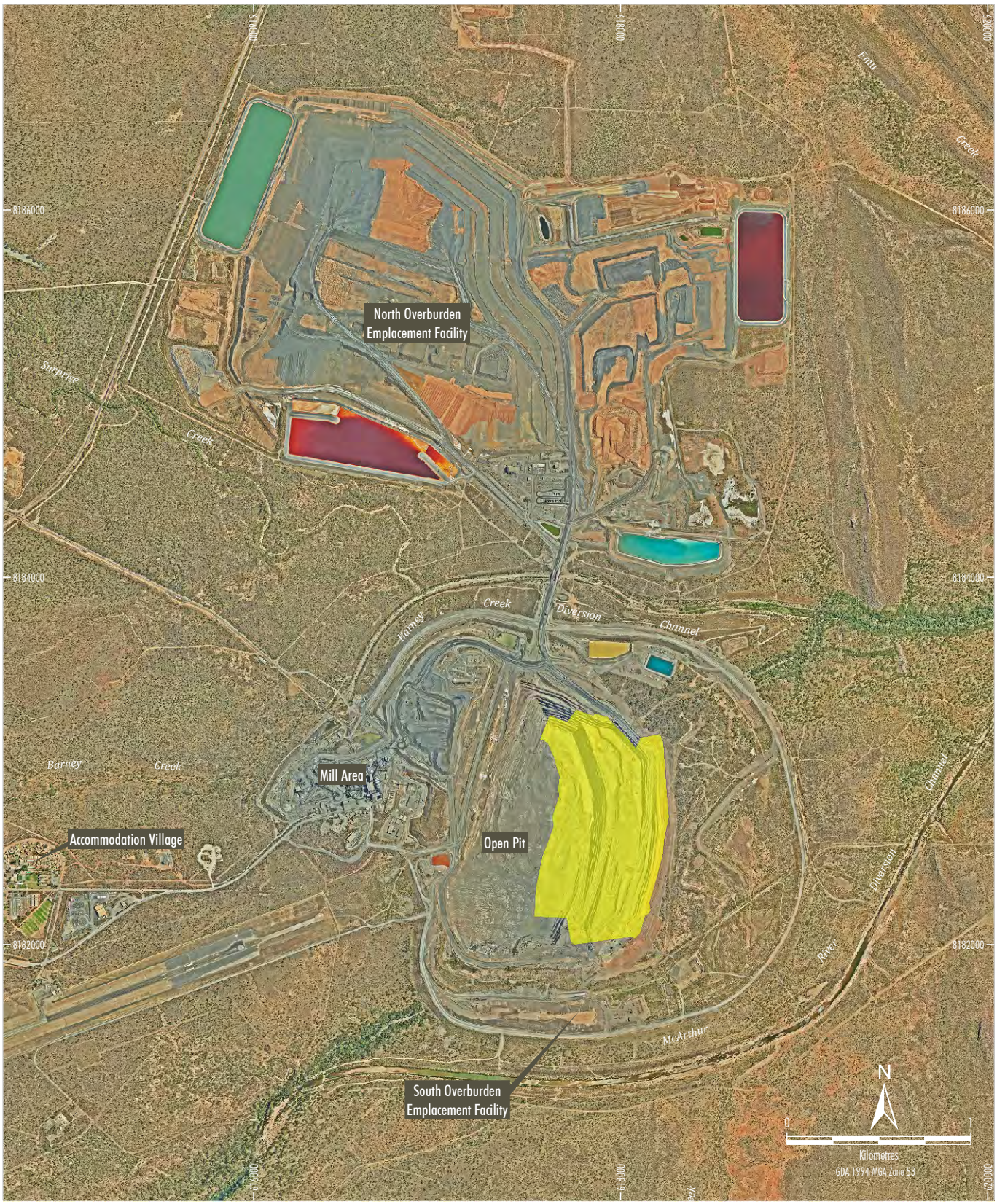
The clearing and soil stripping activities undertaken in accordance with the 2020 MMP during the reporting period are provided in Table 5 and Figure 5.

TABLE 5: CLEARING AND SOIL STRIPPING ACTIVITIES

Location	Destination of Stripped Material
1. Parts of Stage K failure area	Inside the Stage K perimeter
2. Parts of Stage L	Inside the Stage L Perimeter
3. Parts of NOEF NE Alpha Stage	Stockpiled in dedicated stockpile areas inside the NOEF NW Stockpiled cleared area.
4. Parts of NOEF NW Stockpile	Area cleared with no topsoil stripping because only benign material planned to be stockpiled in this area.
5. Parts of NOEF NW Stage	Stockpiled in dedicated stockpile areas inside the NOEF NW Stockpiled cleared area.

2.3.3 Ongoing Operational Activities

Planned activities are outlined in the January 2020 MMP.



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LEGEND

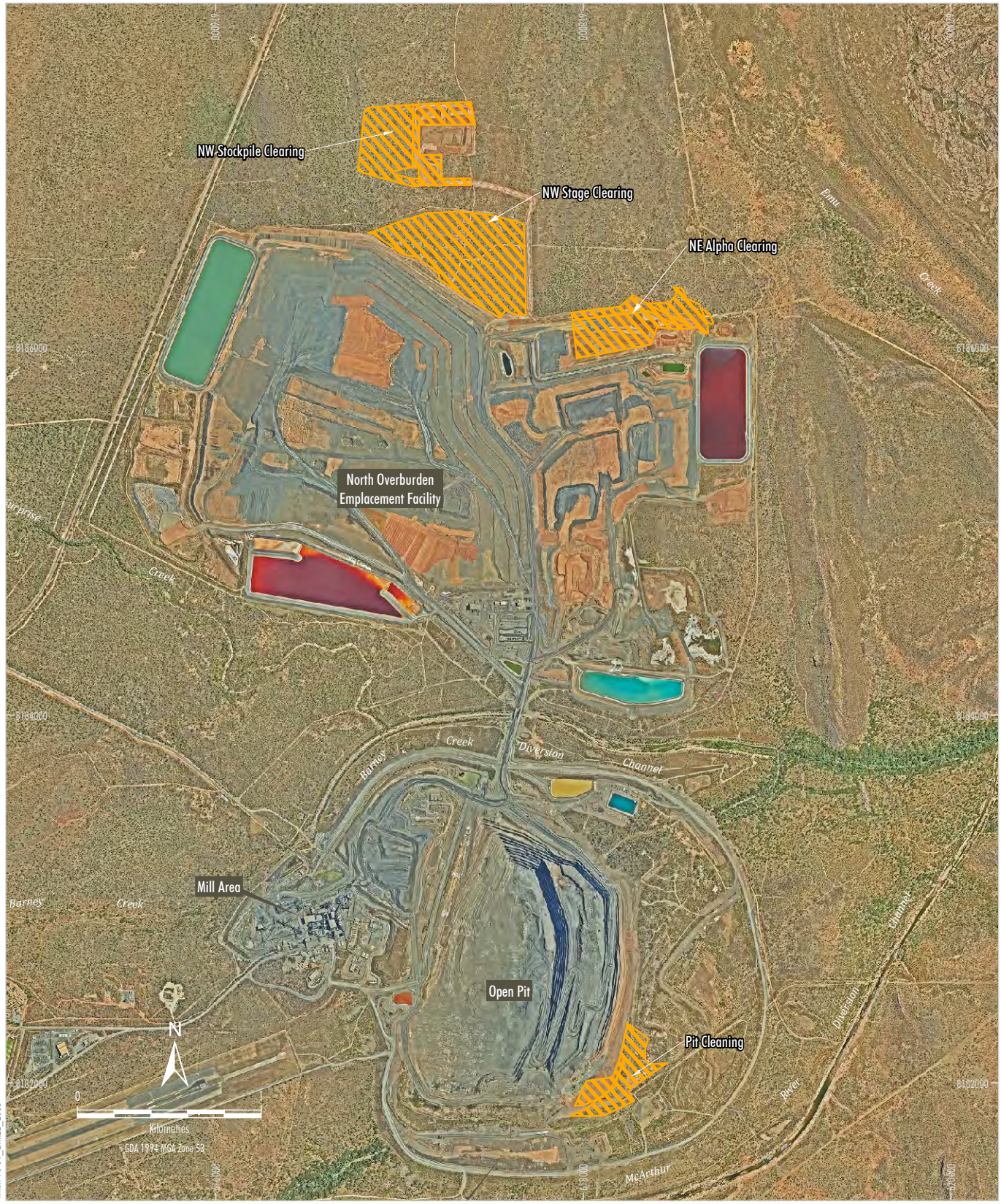
Indicative Mining Activities

McARTHUR RIVER MINE

Mining Activities during the Reporting Period

Source: Orthophoto MRM (2021); Department of Environment and Natural Resources (2016); MRM (2022)

Figure 4



LEGEND

Clearing and Soil Stripping

Source: Orthophoto MRM (2021); Department of Environment and Natural Resources (2016); MRM (2022)

McARTHUR RIVER MINE

Clearing and Soil Stripping Activities during the Reporting Period

Figure 5

2.4 Overburden Emplacement

2.4.1 Emplacement Areas

The following activities were undertaken during the reporting period:

- **NOEF West stage**: Continued construction of the MS-NAF Halo and advection barriers on the top and southwest faces; commenced cover system construction on the southeast batter.
- **NOEF Central West (CW) stage**: Continued construction of the MS-NAF Halo and advection barriers on the top face and stockpiling of materials on CW Alpha and Bravo; continued construction of CW Charlie stage as per OMP EIS methodology.
- **NOEF Central East (CE) stage**: Construction of the Foundation, Base, Core, Halo zones and PAF(RE) Cell as per OMP EIS methodology.
- **NOEF Northeast (NE) stage**: Construction of the Foundation, Base, Core and Halo zones as per OMP EIS methodology .
- **NOEF Southeast (SE) stage**: Stockpiling of benign materials for later use as advection barrier layers in the NOEF construction.
- **NOEF infrastructure**: NOEF Mine Infrastructure Area (NOEF MIA) workshop expansions; powerline and pipeline installations; geotechnical investigation test pits for future SE Alpha stage; lime plant operation; monitoring installations.
- **Flood protection**: The bituminous geomembrane (BGM) liner was installed on the permanent section of the flood protection barrier on the northeast corner of NE Alpha stage.

A breakdown of the quantities of waste emplaced in each of these areas is provided in Table 6, along with classification of the waste as per the MRM waste rock classification criteria.

TABLE 6: WASTE DUMPING DURING THE REPORTING PERIOD

Emplacement Area		Alluvium	LS-NAF (HC)	MS-NAF (HC/LC)	PAF (HC)	PAF (RE)	Total
SOEF (Mt)		0	0	0	0	0	**0**
WOEF (Mt)		0	0	0	0	0	**0**
NOEF (Mt)	West	0	0	0.31	0	0	**0.31**
	Central West	0.34	0	3.51	1.77	0	**5.62**
	Central East	0.55	0.04	4.69	7.82	11.42	**24.52**
	North East	0.11	0.40	3.69	5.22	0	**9.42**
	Stockpiles	0.29	1.06	0	0	0	**1.35**
Total (Mt)		**1.29**	**1.50**	**12.19**	**14.82**	**11.42**	**41.22**

SOEF = South Overburden Emplacement Facility
WOEF = West Overburden Emplacement Facility

During the reporting period, the majority of the overburden was placed in the CW Charlie, Central East and NE Alpha stages of the NOEF (as planned). Smaller amounts of waste were emplaced on West A, B, C and D and CW Alpha/Bravo (as planned) as a cover to protect the PAF cell from erosion and construct the drainage appropriately. No overburden was placed on the SOEF, and a small quantity of waste was used on the West Overburden Emplacement Facility (WOEF) to reshape the surface beneath the ore stockpiles.

2.4.2 North Overburden Emplacement Facility

MRM cleared approximately 61.1 ha within the NOEF area during the reporting period, and constructed approximately 29 ha of Basal Compacted Clay Liners (CCL) (Table 7). These works were carried out in accordance with the January 2020 MMP. Figure 6 shows the cleared area at the NOEF and the constructed CCL in the Central East area.

TABLE 7: NOEF CLEARING AND CCL CONSTRUCTION SUMMARY

Area	Clearing (ha)	CCL Construction (ha)
NOEF NE Alpha Stage	14.2	19.8
NW Stockpile	18.1	0
NOEF NW Stage	28.9	0
NOEF CE Stage	0	9.2
Total	61.1	29.0

2.4.2.1 West A, B, C and D Stage

During the reporting period, MS-NAF was emplaced at the top of the West A, B, C and D stage to provide protection for the advection barrier layer and alluvial material were used to shape the area in preparation for cover system construction.

Alluvium stockpiles were also established on the top of the West stage for later use with advection barriers or cover system construction works.

2.4.2.2 Central West Stage

The CW Charlie stage was constructed as per the OMP EIS methodology, including:

- completion of the Core and Halo zones constructed from non-benign waste in up to 7.5 m lifts, with alluvium advection barriers between each lift to limit oxidation of the PAF material; and
- completion of the temporary MS-NAF Halo on the plateau of the stage.

2.4.2.3 Central East Stage

The CE stage was constructed as per the OMP EIS methodology and consistent with the approved 2020 MMP, including the development of:

- a minimum 0.5 m thick low permeability liner with a maximum saturated hydraulic conductivity of 1×10^{-9} metres per second (m/s), shaped such that water reaching the liner will flow towards dedicated seepage extraction locations;
- an approximate 5 m MS-NAF Base on top of the Basal CCL;
- 'Wedge' geometry on top of the Base zone, constructed from non-benign material in up to 7.5 m lifts, with alluvium advection barriers between each lift, and sloped to assist surface water runoff to NOEF East Perimeter Runoff Dam (EPROD);
- the Core and Halo zones constructed from non-benign waste in up to 7.5 m lifts, with alluvium advection barriers between each lift to limit oxidation of the PAF material; and
- the PAF(RE) Cell, constructed in up to 2 m lifts, with alluvium advection barriers between each lift to limit oxidation of the PAF(RE) waste.

LEGEND

- Geotechnical Test Pits
- Central West Charlie Permanent Flood Proofing
- Central East CCL Construction Area
- NOEF CCL
- NOEF Clearing
- North East Alpha Flood Protection

Source: Orthophoto MRM (2021); Department of Environment and Natural Resources (2016); MRM (2022)

M c A R T H U R R I V E R M I N E

NOEF Works 2020/2021

Figure 6

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The testing frequencies for the CCL completed during the reporting period for the Central East Basal CCL works are summarised in Table 8. The testing showed that 100% of the CCL lots constructed were in conformance with the required permeability specification and zero failures were observed.

TABLE 8: NOEF CENTRAL EAST STAGE COMPACTED CLAY LINER TESTING

Works Area:		Basal CCL	
Volume of CCL Completed (m^3):		64,236	
Test	**Minimum Test Frequency Ratio**	**Minimum Number of Tests Specified**	**Actual Number**
Compaction	1 Test per 500 m^3	129	160
Moisture Content	1 Test per 500 m^3	129	160
Particle Size Distribution	1 Test per 20,000 m^3	3	23
Atterberg Limit	1 Test per 20,000 m^3	3	23
Emerson Class Dispersion	1 Test per 20,000 m^3	3	23
Pinhole Dispersion	1 Test per 20,000 m^3	3	7
Cation Exchange (SAR, ESP)	1 Test per 20,000 m^3	3	6
Permeability (Constant Head @25 kPa)	1 Test per 10,000 m^3	7	16

m^3 = cubic metres; SAR = sodium absorption ratio; ESP = exchangeable sodium percentage.

2.4.2.4 Northeast Alpha (NE Alpha) Stage

The NE Alpha stage was constructed as per the OMP EIS methodology and consistent with the approved MMP, including the development of:

- a minimum 0.5 m thick low permeability liner with a maximum saturated hydraulic conductivity of 1 x 10^{-9} m/s, shaped such that water reaching the liner will flow towards dedicated seepage extraction locations;
- an approximate 5 m MS-NAF Base on top of the Basal CCL;
- 'Wedge' geometry on top of the Base zone, constructed from non-benign material in up to 7.5 m lifts, with alluvium advection barriers between each lift, and sloped to assist surface water runoff to EPROD; and
- the Core and Halo zone constructed from non-benign waste in up to 7.5 m lifts, with alluvium advection barriers between each lift to limit oxidation of the PAF material.

The testing frequencies for the Basal CCL works completed during the reporting period in the NE Alpha Stage are summarised in Table 9. The testing showed that 100% of the CCL lots constructed were in conformance with the required permeability specification and zero failures were observed.

TABLE 9: NOEF NE ALPHA STAGE COMPACTED CLAY LINER TESTING

Works Area:		Basal CCL	
Volume of CCL Completed (m^3):		138,886	
Test	**Minimum Test Frequency Ratio**	**Minimum Number of Tests Specified**	**Actual Number**
Compaction	1 Test per 500 m^3	278	380
Moisture Content	1 Test per 500 m^3	278	380
Particle Size Distribution	1 Test per 20,000 m^3	7	33
Atterberg Limit	1 Test per 20,000 m^3	7	33
Emerson Class Dispersion	1 Test per 20,000 m^3	7	33
Pinhole Dispersion	1 Test per 20,000 m^3	7	11
Cation Exchange (SAR, ESP)	1 Test per 20,000 m^3	7	11
Permeability (Constant Head @25 kPa)	1 Test per 10,000 m^3	14	18

m^3 = cubic metres; SAR = sodium absorption ratio; ESP = exchangeable sodium percentage.

Figure 6 also indicates the extent of the permanent flood barrier on the eastern end of NE Alpha Stage. A geosynthetic liner (GSL) (a 5.6 millimetre [mm] thick elastomeric BGM) has been installed across this area during this reporting period. The BGM has a dual purpose in this location, providing additional flood protection in an extreme flood event, while also forming the barrier layer in the landform's final cover system (Plate 1).

2.4.2.5 Southeast Stage

Crushing activities were conducted on an existing section of SE Alpha Stage of the NOEF, and a geotechnical investigation was conducted within the future SE Alpha stage footprint.

No disturbance has occurred in the area of the MRM4 Cultural Site. The MRM4 Cultural Site has an exclusion fence constructed around it, ranging from approximately 5 - 85m offset from the actual site, with appropriate signage as per Plate 2.

Plate 1: NE Alpha Permanent Flood Proofing

Plate 2: MRM4 Area Fence and Signage

Prior to any disturbance occurring within the fenced off MRM4 area, the following is required:

- An AAPA Certificate obtained for the required disturbance (including undertaking any activities set out as conditions of the AAPA Certificate).
- Approval from DITT in accordance with VOA Condition 31.
- Submission to and approval by the MRM Environment and Community Departments of the required Dig and/or Clearing Permit.

Plates 3 and 4 show recent photos of the undisturbed MRM4 Cultural Site area.

2.4.2.6 Stockpiles

An area of approximately 18.1 ha was cleared in the NW Stockpile complex, to be utilised for stockpiling of topsoil, alluvium, clay and LS-NAF for various future foundation, NOEF and cover system construction activities (Figure 6).

Topsoil, clay, alluvial and LS-NAF (HC) materials were also stockpiled in areas within the NOEF footprint during the reporting period.

2.4.2.7 Ongoing Operational Activities

Planned activities are outlined in the January 2020 MMP.

2.4.3 West Overburden Emplacement Facility

The WOEF forms the base of the ROM pad and is, therefore, in constant use. Small amounts of waste may be used to adjust ramps and drainage as stockpile sizes and shapes evolve over time. The WOEF will continue to be used as the ROM stockpile for crusher feed materials.

A partial expansion of the ROM pad occurred during the reporting period as described in the January 2020 MMP.

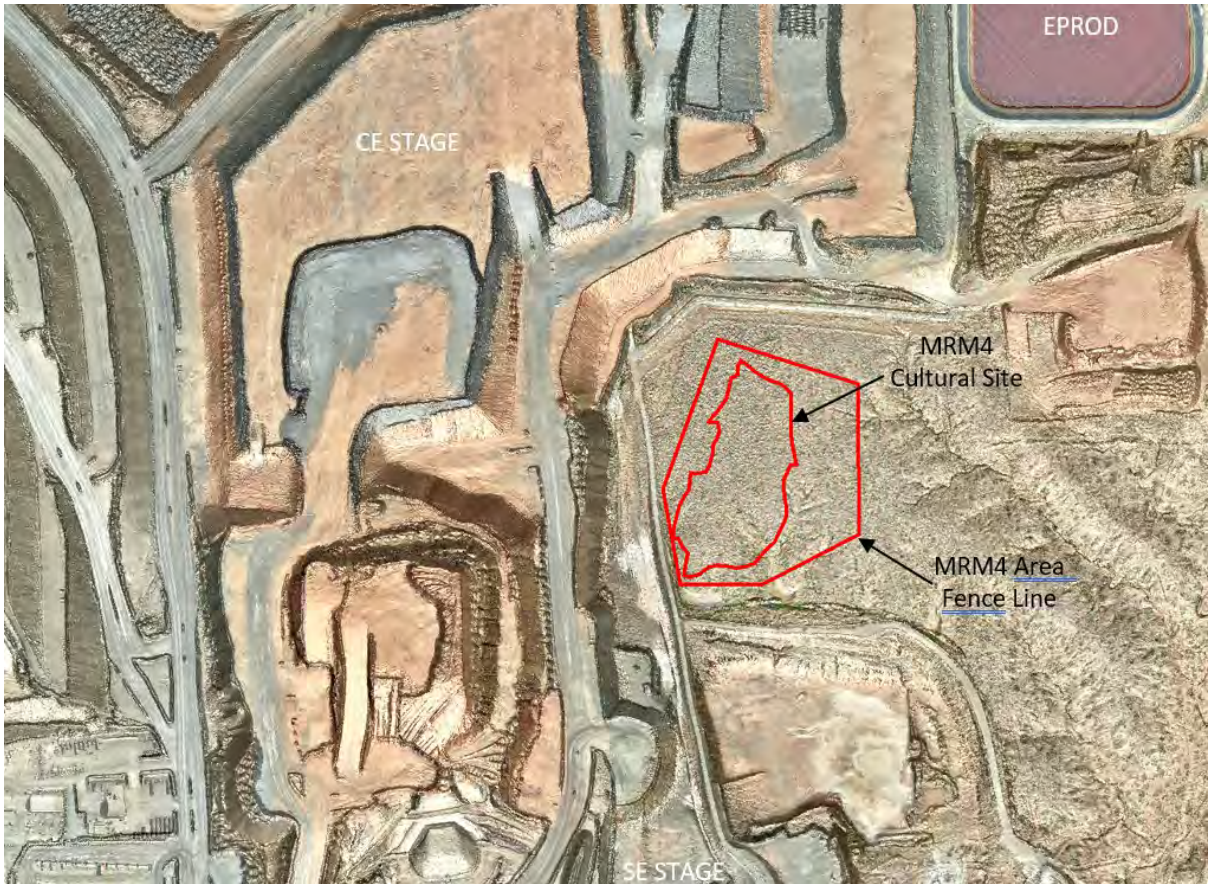


Plate 3: MRM4 Area 2021 Aerial Photo

Plate 4: MRM4 Area Drone Photo – 24 July 2022

2.4.3.1 Geochemical Assessment Drilling

The planned geochemical assessment of the WOEF was not completed due to COVID-19 related interstate restrictions associated with the planned drill program. Works are expected to commence mid-October 2022. The drilling works are expected be finalised by the end of 2022 and the assessment scheduled to carry into 2023.

2.4.4 Rehabilitation

2.4.4.1 Cover System Construction Test Pads Trial

This trial was effectively completed in the 2020/2021 reporting period and the information gained utilised in the NOEF 2021 Rehabilitation Trial. The key outcomes from the Constructability Test Pad Trials included:

- both alluvium and HMR are suitable materials for the under-liner construction, however alluvium is the preferred material;
- due to field observations noting the BGM material softened considerably during daylight hours as a result of the heat, it is recommended that over-liner construction works are conducted during the cooler months of the year and/or at night time;
- alluvium and aggregate products were deemed to be suitable with respect to puncture for use as over-liner materials;
- D6 through to D10 size dozers have potential to place the over-liner without causing significant damage to the liner, however a D6 size dozer with low ground pressure tracks is the preferred machine for spreading of the over-liner material;
- while pushing upslope is the preferred method for over-liner construction to reduce risk of damage to the liner, little difference in liner damage was found through either “bottom up” or “top down” construction methods. If “top down” is to be utilised, the low ground pressure D6 dozer is the preferred spreading machine; and
- with correct machinery selection and operation, 300 mm appears adequate in terms of over-liner thickness to protect the liner from damage.

2.4.4.2 PAF (RE) Cell and Cover System Performance Trials

The PAF (RE) Cell field trial is a macroscale multi-lift cell of PAF(RE) encapsulated in a halo of MS-NAF material and a GSL cover system to assess the overall effectiveness of the proposed waste rock placement strategies and cover system in managing both spontaneous combustion and acid mine drainage (AMD). The GSL component of the cover system is a BGM.

The trial is being constructed as a two-phase approach to observe the behaviour of the landform during wet season conditions, prior to the installation of the GSL cover. Phase 1 involves construction of the subgrade and basal liner, seepage collection system, PAF(RE) core and a wet season cap. The purpose of the wet season cap is to manage the impacts of wet season rainfall, prior to the construction of Phase 2, and comprises a layer of finer-textured alluvium material underlying a layer of coarse-textured MS-NAF.

Phase 2 will involve the construction of a Halo and GSL Cover System to encapsulate the PAF(RE) Cell, and expansion of the field performance monitoring systems to assess performance of the cover system. The field trial will be monitored for a period of approximately seven years, before being encapsulated in the final stage of the NOEF.

Sensors are installed to measure suction, temperature, volumetric water content, differential pressure, pore-water pressure, oxygen (O_2), carbon dioxide plus gas tubes to take manual pore gas samples for measurement.

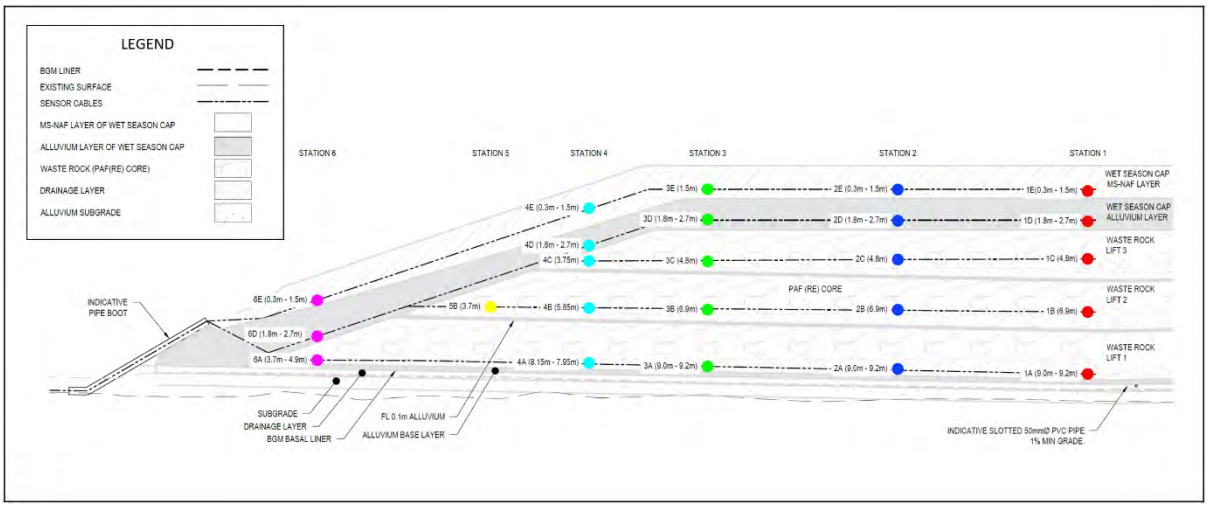


Plate 5: Field Trial Stations and Sensor Nests

The preliminary findings of the PAF(RE) Trial Cell indicate:

- in general, the Field Trial performance suggests that reductions in AMD risk and spontaneous combustion are occurring as a result of the waste placement methodology;
- trends in data collected through the monitoring period indicate the waste placement method employed within the Field Trial is reducing oxygen ingress to the majority of the PAF(RE) material; and
- temperature differentials develop between ambient air and within the Field Trial, with internal temperatures remaining higher than atmospheric except for very brief periods within the wet season cover. Differences in air temperature between the Field Trial and ambient is a major controlling factor for the ingress of oxygen by advection. Construction strategies employed at the Field Trial (i.e. low tip heads, compacted alluvium layers, wet season cap) aim to mitigate against this mechanism and appear to be effective at limiting oxygen ingress deep into the PAF(RE) Cell.

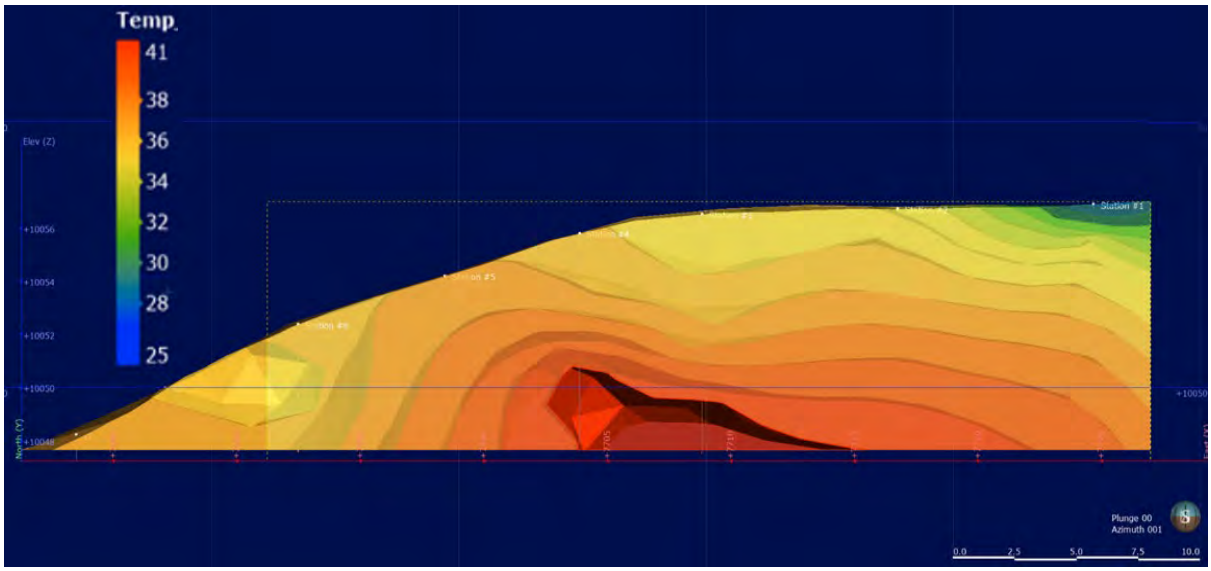


Plate 6: Temperature Profile along Sensor Array Section

Phase 2 of the Trial (i.e. the cover system construction), which was originally planned to be installed in the 2021 dry season, was delayed until 2022 to allow the cover system to be subject to another wet season and increase data obtained from the Trial.

2.4.4.3 NOEF Large-Scale West AB Rehabilitation Trial

Key aims of the large-scale cover trials on the southern face of the West AB Stage include the following:

- Underliner trials:
  - Assessment of the suitability of the MS-NAF Halo surface to receive alluvium and development of treatment measures to fill open rockfill voids at the surface such as compaction and blending of heavy metal rejects (HMR) or alluvial soils.
- BGM installation:
  - Development of optimised installation methods to achieve the design objectives with particular attention paid to temperature effects on the BGM, construction details such as anchor trenches gas vents etc.
- Overliner trials:
  - Overliner construction trials using alternative materials such as alluvium and crushed/screened aggregate options to assess key constructability aspects and feasibility of construction on a range of slopes.
- Growth medium trials:
  - Development of optimal methods for placement and spreading of the Breccia growth medium with a particular focus on developing controls for avoid loose boulders rolling down the slope and avoiding puncture and damage to the BGM liner.
- Performance Monitoring:
  - Temperatures developing at the base the cover system, at the base of the advection barrier and through the cover system.
  - Strain on the BGM during and following constructions of the over-liner and growth medium layers.
  - Pore pressures, moisture content and matric suction within the cover.
  - Oxygen and evolved gas concentrations beneath the cover.
  - Revegetation trials including assessing root depth for different cover arrangements, with and without capillary break drainage layer.
  - Erosion and sediment loading off the slope.
  - Microbial sampling on BGM.

Ten hectares of BGM were installed during 2021 on the West AB southern face, as indicated in Plate 7 and Plate 8. Delays in the delivery of the BGM in 2021 meant that no over-liner, growth medium or topsoil was constructed during the reporting period. Two separate monitoring systems are being trialled under/over the BGM, including a wireless system and a fibre optic system, however no monitoring data is available as yet.

The over-liner, growth medium and topsoil layers will be constructed during the 2022 dry season, after which monitoring data will also start to become available.

Plate 7: NOEF Rehabilitation Trial Area – Drone Shot

Plate 8: NOEF Rehabilitation Trial Area

2.5 Tailings Storage Facility

2.5.1 Tailings Operation

Tailings were placed using the installed spigot discharge system around the Cell 1 and Cell 2 perimeters, as per the designs and TSF operational guidelines. A total of 2,639,180 t of tailings were deposited into the TSF during the reporting period.

The 2021 annual TSF safety inspection was completed prior to the onset of the wet season by GHD Pty Ltd (GHD). The inspection was undertaken in accordance with the Australian National Committee on Large Dams Incorporated (ANCOLD) *Guidelines on Dam Safety Management* (2003) and the *Guidelines on Tailings Dams* (ANCOLD, 2019), as well as Glencore's *Tailings Storage Facility and Dam Management Standard.*

Quarterly TSF operations reports continued to be submitted to the DITT during the reporting period. The reports cover a range of monitoring data including water inflows and outflows, seepage collection records, pond and beach levels, deposition schedule, piezometer levels, climate conditions, photographic records, water quality assays and relevant construction and earthworks recorded during the quarter.

Water reclaim from the TSF continued with water primarily returned to the Concentrator Runoff Pond (CRP) for use in the processing plant.

The design philosophy of the TSF, as outlined in the January 2020 MMP, is as follows:

- Reduce seepage from the TSF by maintaining a small decant pond, and through optimised tailings management to remove surface water (by evaporation). This also assists in controlling pore water pressures in the tailings adjacent to the perimeter embankments.
- Achieving and maintaining consistent target tailings density by managing tailings deposition, ponded water and tailings drainage.
- Maintain a uniform beach profile around the TSF to consistently provide the design stormwater storage capacity.
- Maintain beach freeboard (and therefore reduce piping risk). This is achieved by progressively raising the spillway to match the tailings rate of rise. Therefore, at all times, the spillway level will remain below the minimum tailings beach level.

The design philosophy was achieved through operational controls throughout the reporting period.

2.5.2 Construction Works

In line with the January 2020 MMP, the following construction activities occurred over the reporting period:

- Completion of Cell 2 Stage 7 – 2 m upstream raise to RL 10,063 m.

Construction works were completed consistent with the approved designs, the General Specification for Design and Construction (Appendix I of the January 2020 MMP), and the overall Life of Mine philosophy.

2.5.3 Management of Tailings Pipeline

During the reporting period, management of the tailings line was undertaken as described in Section 4.4.6 of the January 2020 MMP, which includes:

- inspection of the tailings system on a daily basis by two persons dedicated to the operation of the line and associated flowmeters;
- non-destructive testing of the pipeline quarterly (minimum annually per the MMP) to monitor pipe wear; and
- checking and resetting of expansion joints as required.

2.6 Product Handling and Transport

Section 4.2.3 of the 2013-2015 MMP describes the procedure for bulk and zinc concentrate handling and transport, which includes:

- Transporting of the filtered concentrate from the filter building to the Mine concentrate storage shed via a covered conveying system.
- Loading of concentrate into covered, side-tipping road train trailers with a front-end loader.
- Transporting of bulk and zinc concentrate from the Mine to the BBLF by road trains with a payload of approximately 120 t.

Section 4.2.3 of the 2013-2015 MMP also describes the procedure for lead concentrate handling and transport, which includes:

- Loading lead concentrate into double-lined bulk bags using specially designed equipment and excavator. Subsequent loading of these bags into sealed containers for road transport to Mt Isa Mine or Darwin for export.

Product handling and transport activities during the reporting period were conducted in accordance with the 2013-2015 MMP.

It is anticipated that additional road haulage movements of lead concentrate to Mt Isa Mine may be required in the coming EMR reporting period as a result of the improvements of the PBOX process as described in Section 4.3.2 of the January 2020 MMP.

2.7 Bing Bong Loading Facility

The loading procedure at the BBLF includes:

- The receipt and unloading of product from road transport into the concentrate storage shed.
- Holding of product in a concentrate storage shed.
- Controlling and maintaining the stockpile using front-end loaders to move the concentrate away from the truck discharging area to the rear of the shed compartments.
- Self-loading of the load-out and bulk carrier (Aburri) via a single shore-mounted loading chute.
- Disengaging of Aburri from its moorings, and shuttling of Aburri through a dredged channel to an ocean-going vessel waiting in the designated offshore transfer zone.
- Securing of Aburri to the ocean-going vessel and positioning of the loading boom discharge point in the centre of the nominated hatch with the chute below the hatch coaming.
- Unloading to an off-shore, ocean-going vessel.
- Maintenance (dredging) of the swing basin as required.

During the reporting period, the Aburri was in full service. Dredging of the swing basin or navigation channel did not occur during the reporting period. Maintenance dredging is expected to occur in the next EMR period under MRM's existing approvals.

The adjacent loading facility at Bing Bong, Nathan River Resources, went into care and maintenance in October 2021.

2.8 Reconciliation of Operational Commitments and Actions

A reconciliation of the operational management commitments and actions is provided in Appendix B.

3 Environmental Management

MRM's AMP and Bing Bong Loading Facility Environment Management Plan (BB EMP) were approved on 13 November 2020 and the implementation of the Trigger Action Response Plans (TARPs) commenced. The TARPs detailed in the AMP link the key environmental objectives to performance indicators. The AMP also details the actions that will take place if specified criteria are not achieved (such as undertaking an investigation into the source of an elevated analyte concentration).

TARPs are assessed on the basis of their level during the reporting period, which is determined by comparing monitoring results to specific trigger levels or criteria. Each TARP consists of three distinct Trigger Levels (Levels 1 to 3). Each level of the TARP sets out specific actions that are proportional to the environmental risk. No individual Trigger Level is directly indicative of an environmental impact, or an environmental objective not being met.

Typically, when a TARP is at Level 1, there is no additional action required in order to achieve the environmental objectives, and the controls being implemented appear to be adequate. At Level 2, monitoring results are still within expected boundaries, but may be trending towards away from expectations. As such, relevant data should be reviewed to determine whether additional pre-emptive controls should be implemented, or if the TARP is likely to return to Level 1 without interference.

A TARP of Level 3 indicates that monitoring results are outside of expected boundaries, and that an investigation report should be developed to determine if any impact has occurred, if the exceedance is mine-derived, and if further additional controls are necessary. Part of the investigation process is also to review the TARPs, and ensure that the trigger levels are appropriate for the protection of the environment. As the AMP and the TARPs have only recently been approved and implemented, it is early in the ongoing review process, and some TARPs may require adjustment.

3.1 Ambient Air Quality

TARP Level 1

3.1.1 Monitoring Program

The *Ambient Air Monitoring Report* (TAS, 2021b) (Appendix E) provides a review of MRM's air quality management and performance between May 2021 and April 2022, in accordance with the Air Quality Management Plan (AQMP). The objective of the air quality monitoring program is to measure concentrations of dust, sulphur dioxide (SO_2) and contaminates in the ambient air near the operational areas of the Mine and the BBLF to determine the effectiveness of the air quality controls.

Results from the monitoring program are also used to assess MRM's performance against the key Environmental Objective to minimise air quality related impacts with respect to community health and the Environment.

Monitoring Methodology

The air quality monitoring network at the Mine and the BBLF during the reporting period consisted of multiple methods (locations presented in Figures 7 and 8), including:

- Thirty depositional dust gauges (24 near the Mine [including two control sites] and three near the BBLF [including one control site]). The dust gauge sampling period is approximately one month (30 days ±2) with the analytical laboratory conducting analysis of the material collected in the gauges to determine the ash content, combustible matter, total insoluble matter and metals.

- Two Ecotech Serinus 50 SO_2 analysers, used to continuously monitor SO_2 concentrations. The monitor uses ultra-violet fluorescent radiation to detect SO_2 in the range of 0-20 parts per million (ppm). The SO_2 monitors are calibrated remotely by the equipment supplier on a monthly basis, and MRM staff have been trained to perform routine monthly maintenance.

- One High Volume Air Sampler (HVAS), used to measure total suspended particulate concentrations in the ambient air for a 24-hour period, on a one day in six cycle (i.e. measures concentrations every six days).

- One Tapered Element Oscillating Microbalances (TEOMs), used to continuously measure concentrations of particulates, at approximately 5-minute intervals. The BBLF TEOM monitor was decommissioned in November 2021 in accordance with the revised AQMP.

3.1.2 Monitoring Results and Trends

The Mine

Deposited Dust Gauge Monitoring

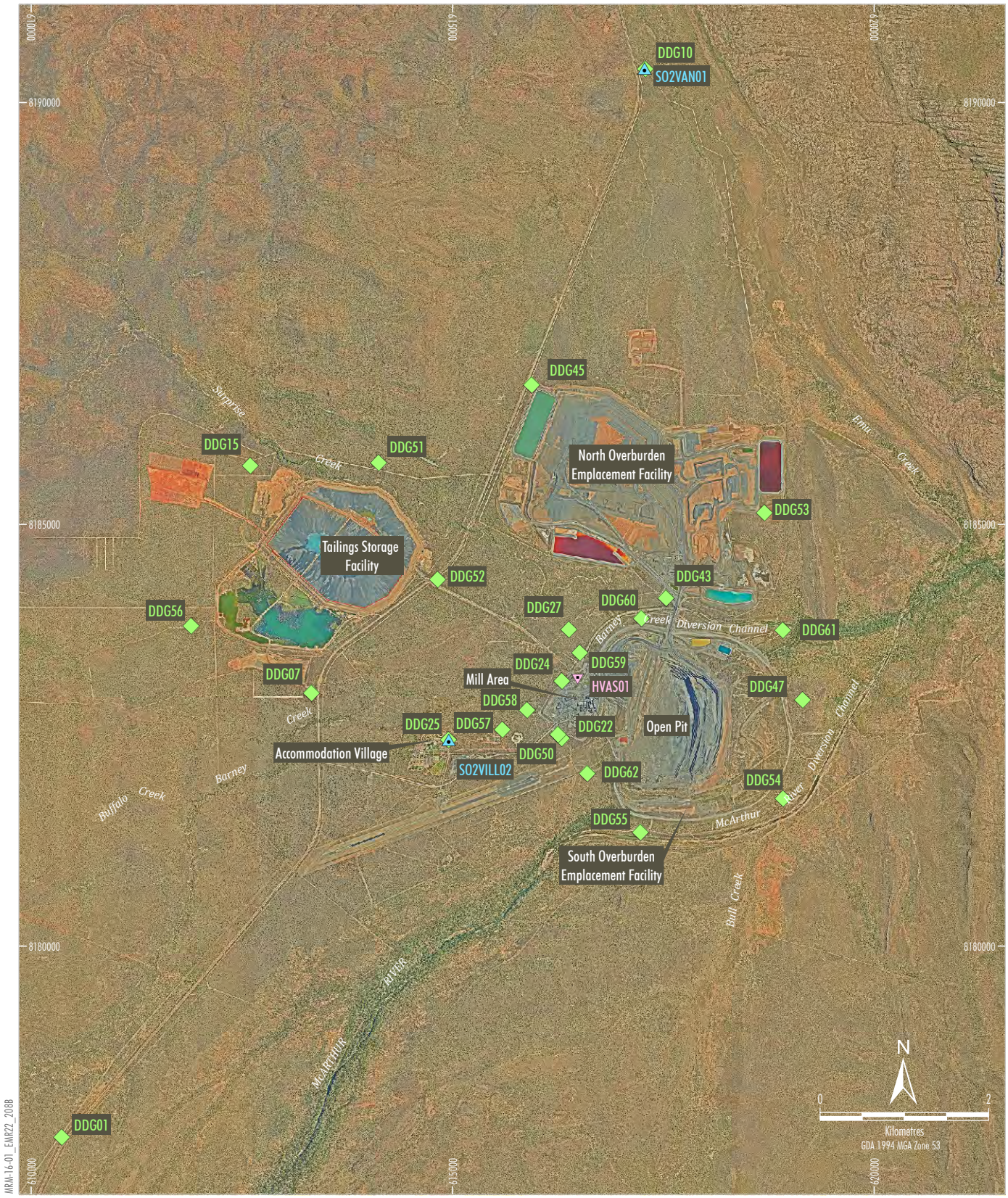
The annual average Total Insoluble Matter of all monitoring locations were approximately within the range of historical values.

There were insufficient data in the 2021-2022 reporting period (i.e. less than 75% data availability per calendar quarter) to calculate an annual average at deposited dust gauge (DDG) 22, DDG24, DDG53, DDG58, DDG60, DG61 and DDG62. Insufficient data was due to decommissioning of DDG22, limited access over the wet season to DDG24 and DDG58, and damage to equipment at the remaining sites. For the purpose of this report, an average for the available data during the period is presented.

Figures 9 and 10 present an interpolated grid of the annual average results for total insoluble matter and Pb at the Mine for the May 2021 to April 2022 monitoring period.

The highest concentrations of total insoluble solids and metals were generally recorded at the processing areas and Barney Creek haul bridge, as would be expected.

Chart 1 gives a comparison between the total insoluble matter deposited at key dust monitoring sites for the current reporting period and previous reporting periods.



LEGEND

- Depositional Dust Gauge
- High Volume Air Sampler
- SO_2 Monitor

Source: Orthophoto MRM (2021); Department of Environment and Natural Resources (2016); MRM (2022)

McARTHUR RIVER MINE

Mine Ambient Air Quality Monitoring Sites

Figure 7

LEGEND

- Depositional Dust Gauge
- TEOM

Source: Orthophoto MRM (2021); Department of Environment and Natural Resources (2016); Todoroski Air Sciences (2018); MRM (2022)

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McARTHUR RIVER MINE

Bing Bong Loading Facility
Ambient Air Quality Monitoring Sites

Figure 8

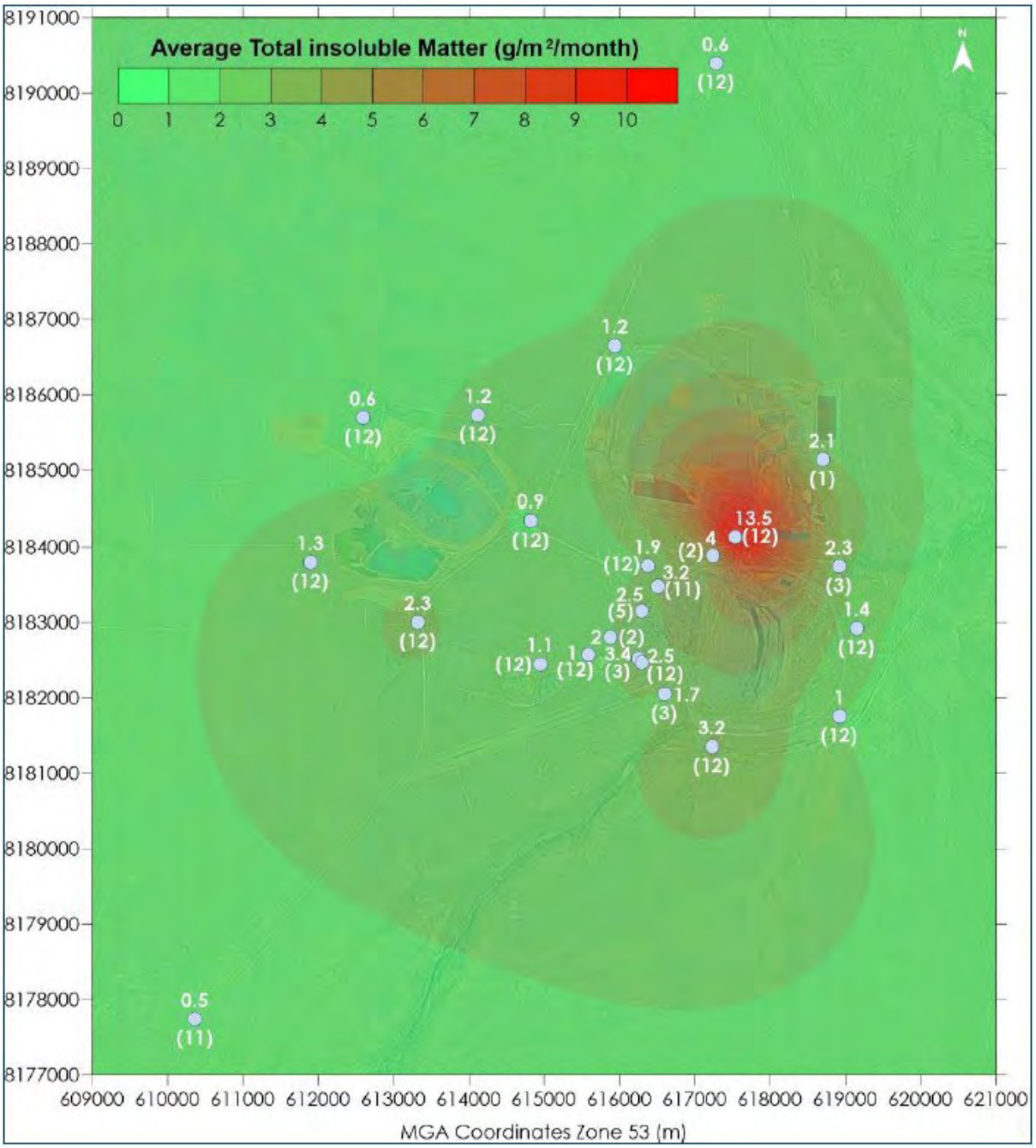


Figure 9: Interpolation of May 2021 to April 2022 Mine Annual Average Total Insoluble Matter Results

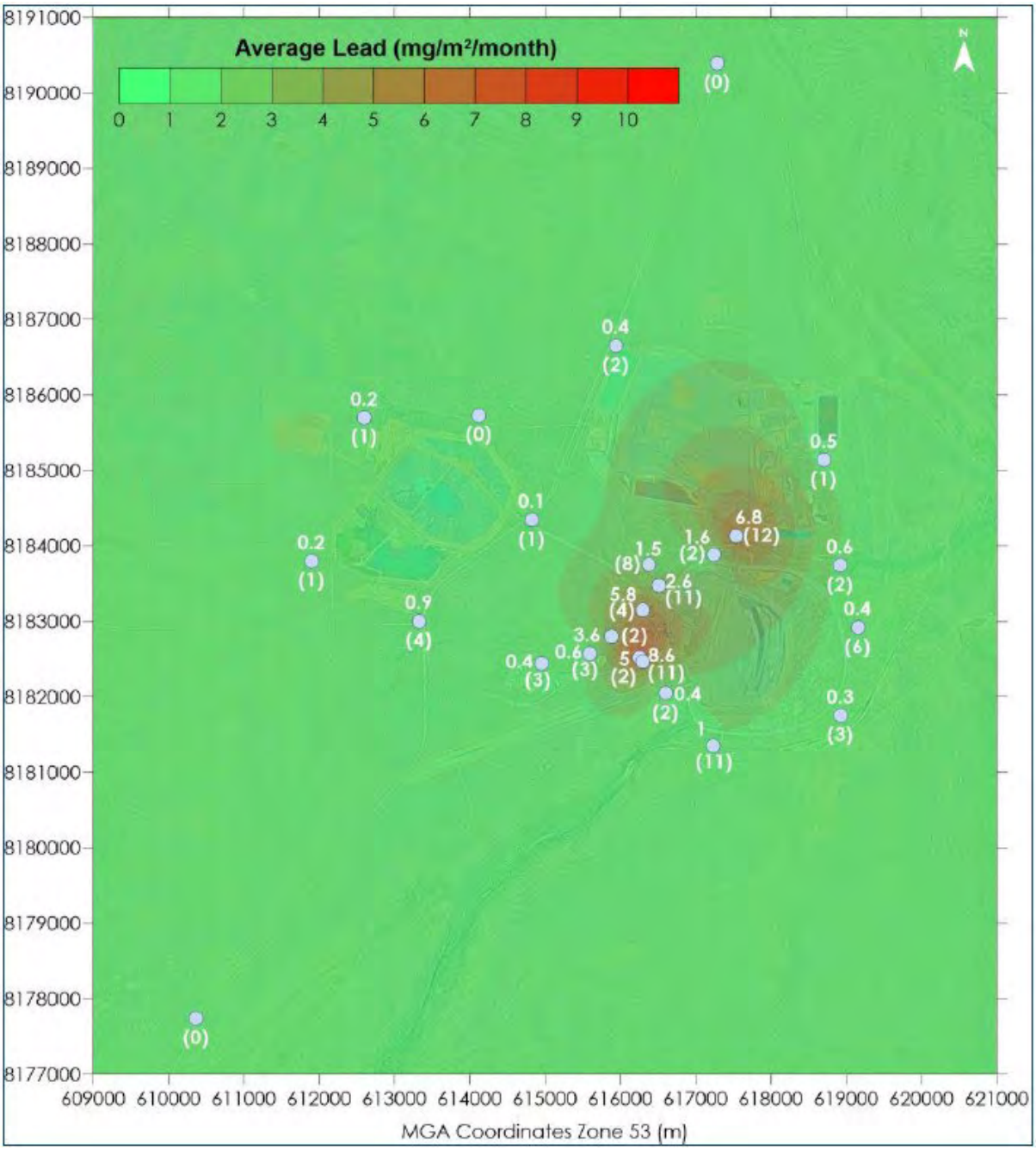


Figure 10: Interpolation of May 2020 to April 2021 Mine Annual Average Lead Load Results

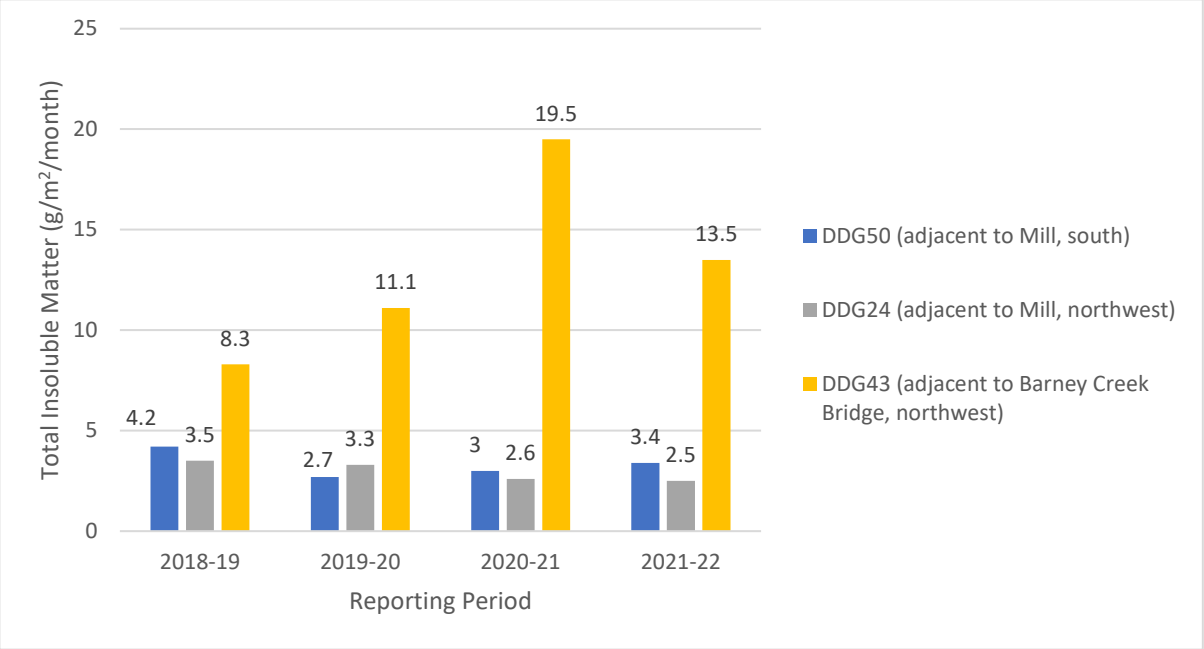


Chart 1: Average Deposited Total Insoluble Matter at Key Depositional Dust Monitoring Sites

Chart 2 shows that for sites DDG50 and DDG24 (near the Mill), total insoluble matter is either similar or slightly lower than the previous years. Total insoluble matter measured at DDG43 (adjacent to Barney Creek Haul Road Bridge) was elevated during this reporting period when compared to previous years, except 2020-2021. It is considered likely that the elevated dust loads at DDG43 are as a result of ongoing increase in truck movements across the bridge (due to increased total haulage).

Chart 2 gives a comparison of the annual average lead loads at the same sites for the same reporting periods.

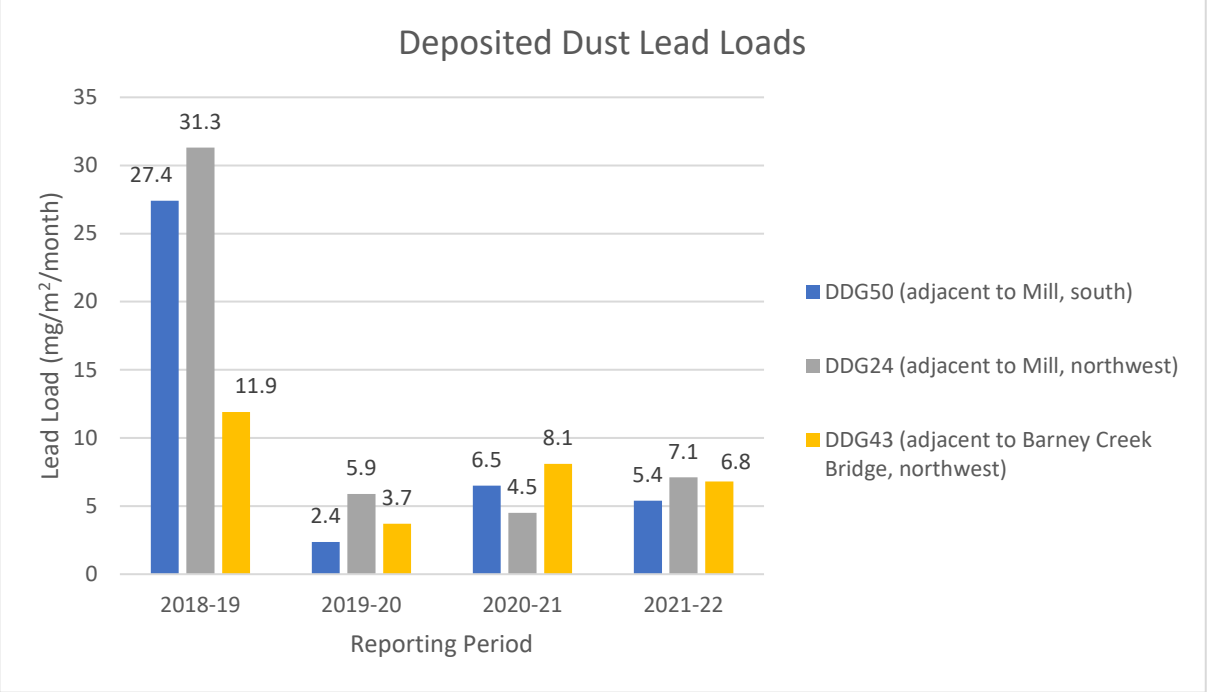


Chart 2: Average Deposited Lead Loads at Key Depositional Dust Monitoring Sites

The lead results presented in Chart 2 show that despite some elevated levels compared to the previous reporting period at key monitoring sites, the lead results are considerably lower than measured in the 2018-19 reporting period.

The interpolation of the particulate monitoring data (including lead and zinc) shows that the elevated results were confined to areas near to the Mine's processing and mining areas. This is to be expected given that the monitoring sites are positioned in close proximity to the processing area and mining activities. The Mine's monitoring locations further from these areas generally recorded low pollutant concentrations, considered to be at or near to the likely background pollutant concentrations for the area. This indicates that these pollutants only travel a short distance before they are dispersed and/ or deposited. As such, it can be inferred that dust concentrations due to the mining activities at Borroloola and Goolminyini (44 km and 28 km away, respectively) would likely not be discernible from background concentrations.

SO_2 Monitoring

The data indicates that there was one exceedance of the National Environmental Protection Measure (NEPM) guideline for hourly SO_2 concentrations at the SO2VAN01 monitoring site during the reporting period and no exceedances at the SO2 Village monitoring site (Chart 3 and 4).

In summary, the Mine was at TARP Level 1 for the majority of the reporting period. The TARP was raised to Level 2 on one occasion during the reporting period in response to elevated concentrations of SO_2 at the SO2VAN01 monitoring site but returned to Level 1 at the next measurement.

Further discussion of monitoring results is available in Appendix E.

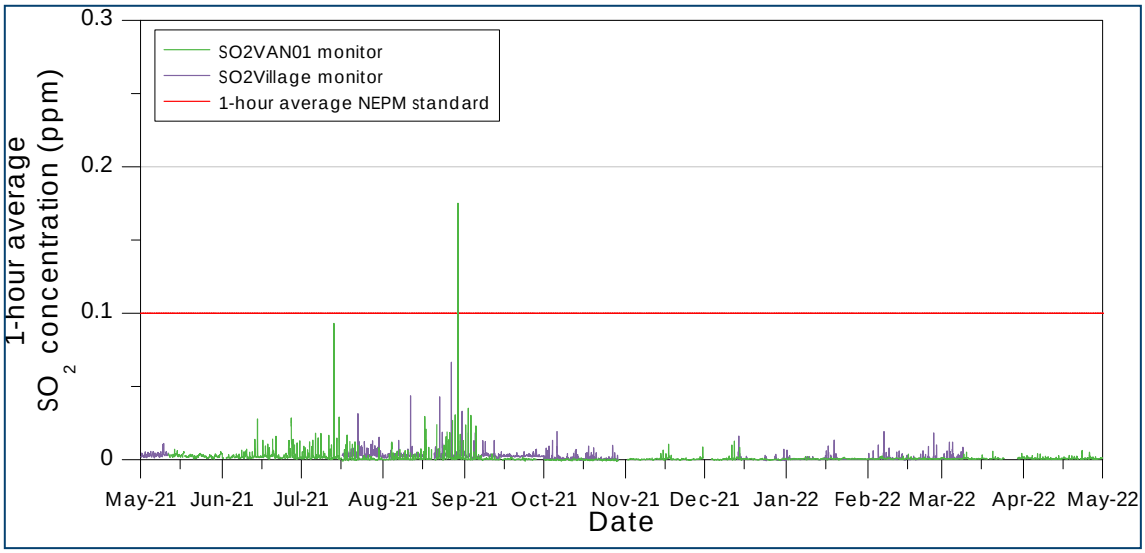


Chart 3: SO2VAN01 and SO2VILL02 1-hour average SO_2 monitoring data

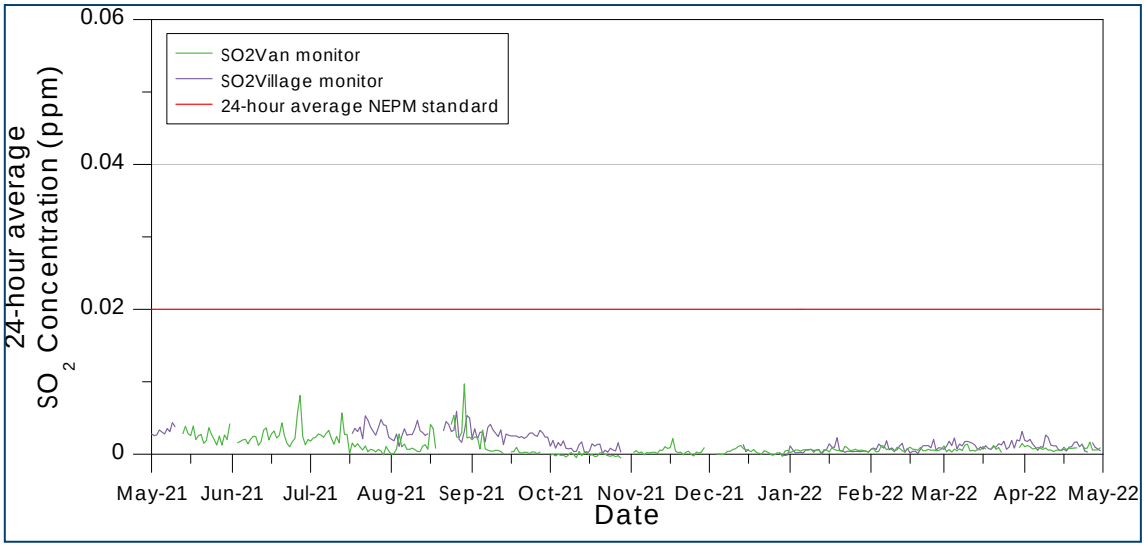


Chart 4: SO2VAN01 and SO2VILL02 24-hour average SO_2 monitoring data

Bing Bong Loading Facility

Deposited Dust Gauge Monitoring

The annual average Total Insoluble Matter of all monitoring locations were approximately within the range of historical values, with the exception of site BBDDG02. The loads at monitoring site BBDDG02 decreased when compared to the 2020-2021 reporting period.

3.1.3 Controls

The Mine has implemented dust mitigation measures during the reporting period, including:

- Dust suppression involving water carts which operate on a daily continuous schedule throughout operational areas and the open pit. Approximately 690 megalitres (ML) of water was utilised in dust suppression activities during the reporting period.
- When continuous SO_2 concentration monitoring is interrupted by power outages or cellular service faults, immediate investigations are conducted to ensure no data is lost and the issue is rectified. The equipment supplier also performs daily checks of the equipment to ensure maximum data capture rates are maintained and provides monthly validated data reports.
- Application of alluvial covers on all exposed PAF including the placement of a reduced air permeability barrier and wet season cap on the existing NOEF to manage spontaneous combustion of reactive rock and generation of SO_2.
- A scope of works has been developed for the trial of dust suppression binders trials on haul roads as a mitigation measure for dust impacts associated with mine haulage. Three DustTrak Aerosol Monitors will collect baseline data to enable an assessment of the effectiveness of the dust suppression agent against traditional haul road watering methods.

3.1.4 Performance Summary and Recommendations

The exceedance of the NEPM guideline at SO2VAN01 triggered TARP Level 2 during the reporting period. Todoroski Air Sciences undertook an investigation for this exceedance event (Todoroski Air Sciences, 2021). The investigation estimated that the maximum SO_2 concentrations at Goolminyini and Borroloola (based on previous modelling and the maximum recorded SO_2 level at the SO2VAN01 monitor) would have been significantly lower than the NEPM air quality standard of 0.1 ppm at this time. The TARP Level 2 was therefore downgraded to Level 1 of the TARP and no additional management was required.

As such, the key environmental objective to minimise air quality related impacts with respect to community health and the Environment continues to be met.

TAS recommends recommencement of the 3-month long sampling periods trial at key monitoring sites. The 3-month sampling period dust gauge monitors should be co-located alongside the existing routine dust gauge monitors. MRM will recommence the 3-month long dust sampling period trials at key monitoring sites during the dry season of 2023. A longer sampling period is unsuitable over the wet season as gauges often overflow due to the high rainfall. MRM will also incorporate secondary sign-off on the sample jar, field sheet and lab forms to ensure the correct sample lengths are accurately recorded.

3.2 Diversion Channel Revegetation

TARP Level 3

3.2.1 Monitoring Program

The *McArthur River and Barney Creek Revegetation Monitoring 2021* (IPE, 2020a) (Appendix F) assessment aimed to monitor the growth and health of rehabilitation along the McArthur River and Barney Creek Diversion Channels in order to evaluate the effectiveness of revegetation works and provide feedback for adaptive management. The methodology and site selection used in 2021 generally followed the methodology outlined in the Revegetation Monitoring Procedure (Eco Logical, 2017) and Rehabilitation Management Plan (MRM, 2021).

Revegetation monitoring is conducted annually by Indo-Pacific Environmental (IPE) at mid-stage and early-stage revegetation assessment plots on the slopes and batters of the McArthur River and Barney Creek Diversion Channels, and at associated reference sites (Figure 11). For the current reporting period, 111 mid-stage plots and 18 early-stage plots were surveyed.

Results from the monitoring program are used to assess the Mine's performance against the Environmental Objective to "*facilitate development of the ecosystems and their functions along the McArthur River Diversion Channel for terrestrial and aquatic flora and fauna*".

3.2.2 Monitoring Results and Trends

The study found that revegetation along the Barney Creek and McArthur River Diversion Channels has positively progressed. A total of three revegetation sites met completion criteria and do not require further rehabilitation works or monitoring, which is an increase on the number of sites reported in 2020. An additional four sites were also considered to be tracking towards completion and only require further monitoring. The remaining 16 sites require additional revegetation works or earthworks to reduce erosion and flood damage.

Overall, results indicated that revegetation efforts have been particularly successful at establishing vegetation within the lower reaches of both the Barney Creek and McArthur River diversion channels and the upper reaches of the McArthur River Diversion Channel. However, vegetation appeared to be comparatively sparse within the middle reaches of the McArthur River and Barney Creek diversion channels and the upper reaches of the Barney Creek Diversion Channel. This difference was considered largely due to issues associated with erosion, shallow soils, low retention and storage of soil moisture and the presence of existing rocky banks that make the establishment of vegetation difficult.

Mortality rates of planted tree tube stock remained high. While a low survival rate in the long term should be expected, the sheer number of trees still present combined with increases in height and shrub cover suggest that early-stage revegetation plots are on a positive trajectory.

In 2021, no Class A weed species were recorded within or near control or revegetation plots.

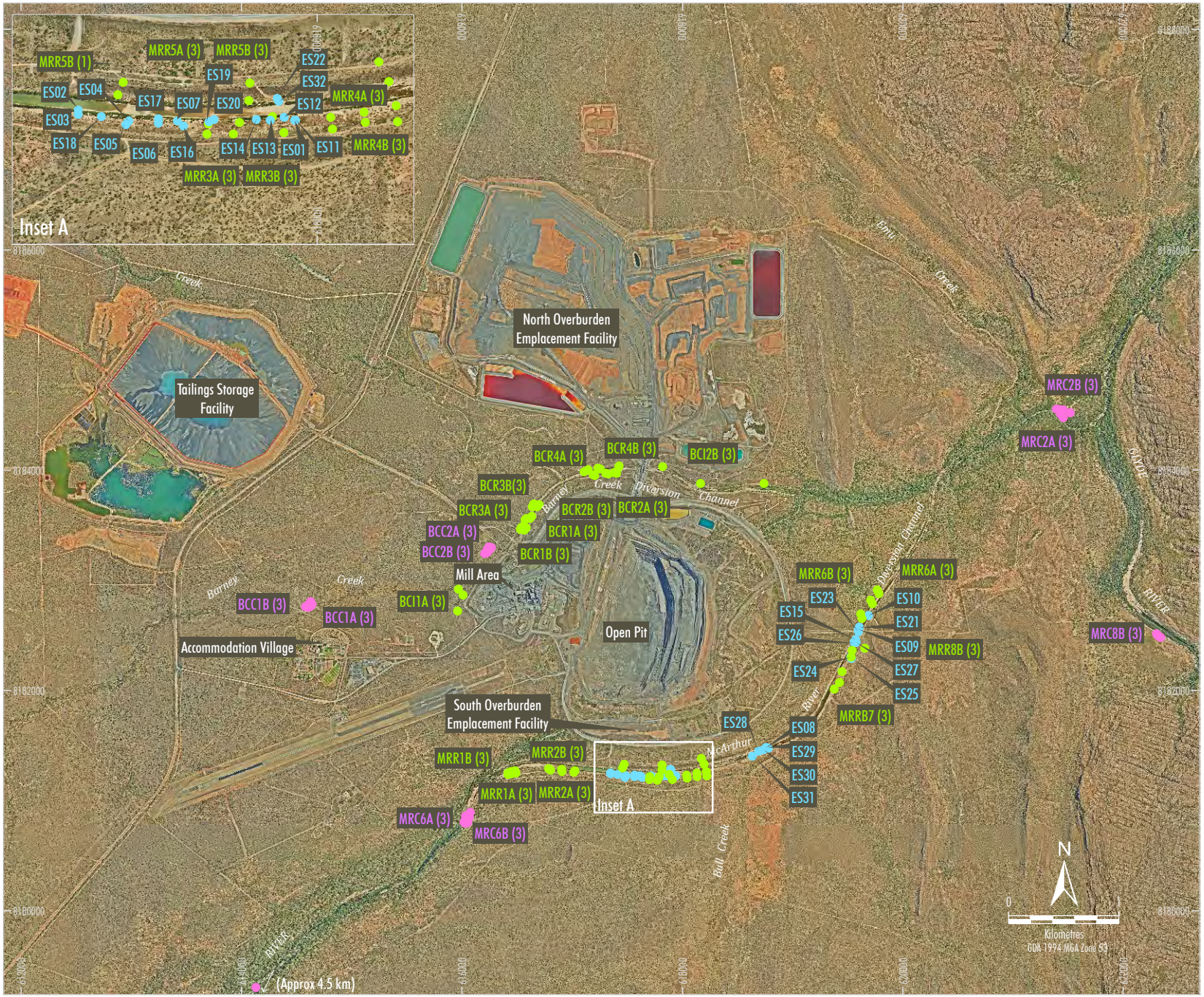
Further discussion of monitoring results is available in Appendix F.

3.2.3 Performance Summary and Recommendations

Monitoring data for the reporting period indicates that a number of revegetation sites have triggered TARP Level 2 and Level 3.

Revegetation monitoring results for sites BCR1A, MRR4A, MRR7B and MRR8B triggered the Level 3 TARP listed in the AMP.

An investigation conducted on 23 March 2022 resulted in determining that the Level 3 TARP exceedances were attributed to flood damage as a result of an average to high magnitude 2020-2021 wet season and high erosion potential.



LEGEND

- Control Site
- Revegetation Site
- Early Stage Monitoring Site

Source: Orthophoto MRM (2021); Department of Environment and Natural Resources (2016); MRM (2022)

McARTHUR RIVER MINE

Mine Revegetation Monitoring and Control Sites

Figure 11

MRM-16-01_EMR22_210D

Flood events can cause erosion and loss of sediment/soil as well as vegetation damage and mortality due to high water velocity and extended inundation. Other monitoring sites were less effected by flooding and had higher resistance to erosion due to the establishment of thick stands of woody vegetation which appear to have reduced water velocities and increased sedimentation.

It should be noted that the Level 3 TARP rating for site BCR1A was a result of a single sapling, within a single plot containing a few trees, succumbing to the previous wet season. As such, it is expected that even without remediation, this site will no longer be considered Level 3 in subsequent years and the damage resulting from the 2020-2021 wet season was an isolated event.

A further 11 revegetation monitoring sites have been assigned a Level 2 trigger. Level 2 TARP exceedances were attributed to a range of factors across the sites including the following:

- high percentage of bare ground/rock cover at nine sites;
- low percentage of grass and herb cover at nine sites;
- number of key species below the criterion range at nine sites;
- number of trees below the criterion range at four sites;
- high percentage of declared weed cover at one site; and
- high impact of fauna disturbance at one site.

MRM is currently working with specialists to investigate and implement remediation actions during the 2022-2023 reporting period.

An options assessment for erosion mitigation at MRR4A, MRR7B and MRR8B will be undertaken and engineering designs for mitigation works developed. Potential options to be considered include reshaping of the steep eroded upper clay slopes, treatment with gypsum, hydromulching and application of jute matting and rock. Reshaping will follow the natural flow paths. There may also be potential for installation of groynes, riprap, gabion walls or similar to reduce stream velocity and encourage deposition in the rocky sections.

MRM will also continue the revegetation program across all Level 2 and Level 3 TARP sites with a successional approach focusing on the initial planting of tufted and tussock grasses to establish stability of the ground prior to the planting of trees and shrub tube stock. Intensive planting of *Chrysopogon elongates* and *Acacia* sp. may also be implemented at some sites to provide protection from erosion, ground cover habitat and a more protective micro-climate environment for the germination and survival of planted trees and shrubs. *Acacia* sp. have a relatively low mortality rate, widespread distribution, relative abundance, growth rate and general hardiness which means they can assist in early ground stabilisation and establishment of thick stands of vegetation. Targeted weed and pest control will also be undertaken at BCI1A and MRR5B.

As recommended by IPE (2021i), MRM will continue to implement the revegetation monitoring program with a successional approach and undertake intensive erosion control works in highly unstable areas to reduce water velocities and encourage sedimentation.

3.3 Riparian Birds

No TARP

3.3.1 Monitoring Program

The objective of the riparian bird monitoring program is to monitor riparian birds in the vicinity of the Mine and determine the success of rehabilitation works along the Barney Creek Diversion Channel and McArthur River Diversion Channel as habitat for vertebrate fauna. Additionally, the monitoring is used to confirm if the McArthur River Diversion Channel is functioning as a riparian corridor that can provide for the dispersal and movement of riparian birds between habitats upstream and downstream of the McArthur River Diversion Channel. The methodology and site selection used in 2021 is outlined in *McArthur River Riparian Bird Monitoring Early Dry Season June 2021* (Appendix G) and *McArthur River Riparian Bird Monitoring Late Dry Season November 2021* (Appendix H).

Riparian bird monitoring is conducted twice a year by Ecological Management Services (EMS) at sites along the McArthur River Diversion Channel, Barney Creek Diversion Channel and additional reference sites upstream and downstream of the Mine (Figure 12). A total of 162 two-hectare/20-minute bird counts were conducted for both the early dry season and late dry season surveys

Results from the monitoring program are used to assess the Mine's performance against the key Environmental Objective "*Facilitate development of the ecosystems and their functions along the McArthur River Diversion Channel for terrestrial and aquatic flora and fauna*".

3.3.2 Monitoring Results and Trends

The study found that the riparian bird assemblage at the upper and lower ends of the McArthur River Diversion Channel has increased in similarity to reference riparian forest. Bird communities at sites on the mid-section of the McArthur River Diversion Channel, which are yet to be actively revegetated, support lower numbers of bird species. Impediments to revegetation in the mid-section of the McArthur River Diversion Channel include the narrow gauge, steep banks, areas of erosion and exposed bedrock.

Ongoing development of revegetation on Barney Creek Diversion Channel has resulted in all sites in this area supporting a bird assemblage that is increasingly similar to open woodland and riparian reference sites.

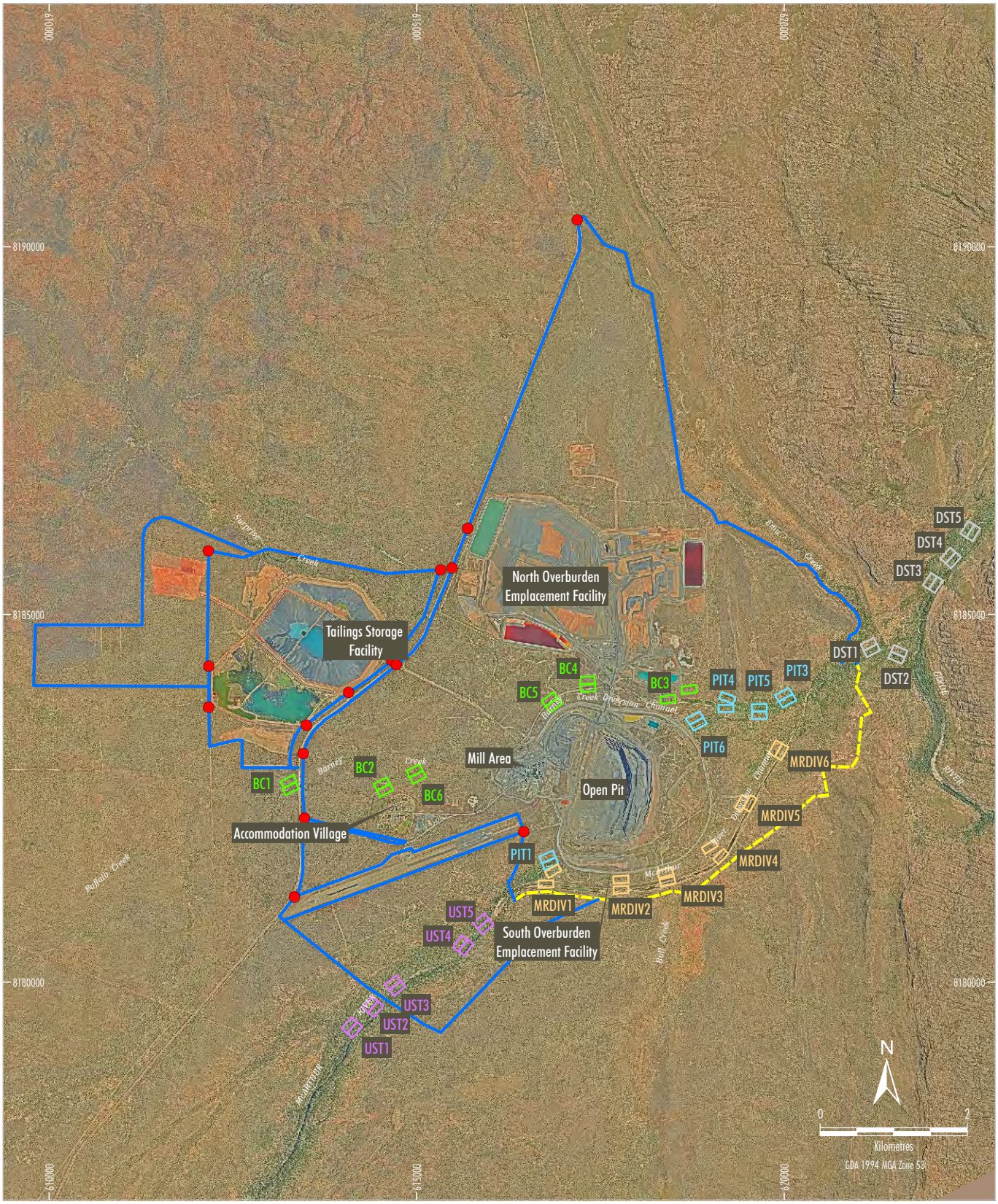
Further discussion of monitoring results is available in Appendix G and H.

3.3.3 Performance Summary and Recommendations

Monitoring data for the reporting period supports the conclusion that ecosystems and their functions along the McArthur River Diversion Channel continue to be developed.

EMS (2021a and 2022a) made the following recommendations for 2022:

- continue weed control measures, particularly within diversion channel revegetation areas;
- continue removal of cattle and feral animals from the Cattle Exclusion Zone and the diversion channel revegetation areas; and
- continue to investigate alternative measures for establishing cane grass (*Chionachne cyathopoda*) and other riparian ground cover species (e.g. *Flueggea virosa*) at revegetation sites, including cluster plantings of key species at middle and upper bank locations.



MRM-16-01_EMR22_211B

LEGEND

Riparian Bird Monitoring Site
- Barney Creek
- McArthur River Diversion
- McArthur River Downstream
- McArthur River Upstream
- Old McArthur River Channel

- Cattle Fence
- Electric Fence
- Gate

McARTHUR RIVER MINE

Mine Riparian Bird Monitoring Sites

Source: Orthophoto MRM (2021); Department of Environment and Natural Resources (2016); EMS (2019); MRM (2022)

Figure 12

3.4 Diversity and Abundance of Freshwater Macroinvertebrates

TARP Level 1

3.4.1 Monitoring Program

The *McArthur River Freshwater Aquatic Macroinvertebrate Assessment 2021* (Appendix I) aimed to identify whether significant changes in macroinvertebrate communities near mine operations were occurring, and to monitor the development of macroinvertebrate assemblages at instream habitats in the McArthur River and Barney Creek Diversion Channels. The methodology and site selection used in 2021 generally followed the methodology outlined in the McArthur River Freshwater Aquatic Macroinvertebrate Monitoring 2018 Program Review.

Macroinvertebrate monitoring is conducted annually by IPE at edge habitats and, where present, riffle habitats at reference sites and sites that may be potentially impacted by MRM operations (Figures 13 and 14). For the current reporting period, 30 sites located within the McArthur catchment were surveyed.

Results from the monitoring program are used to assess the Mine's performance against the key Environmental Objective "*Protect the McArthur River beneficial uses and community values from mining impacts*".

3.4.2 Monitoring Results and Trends

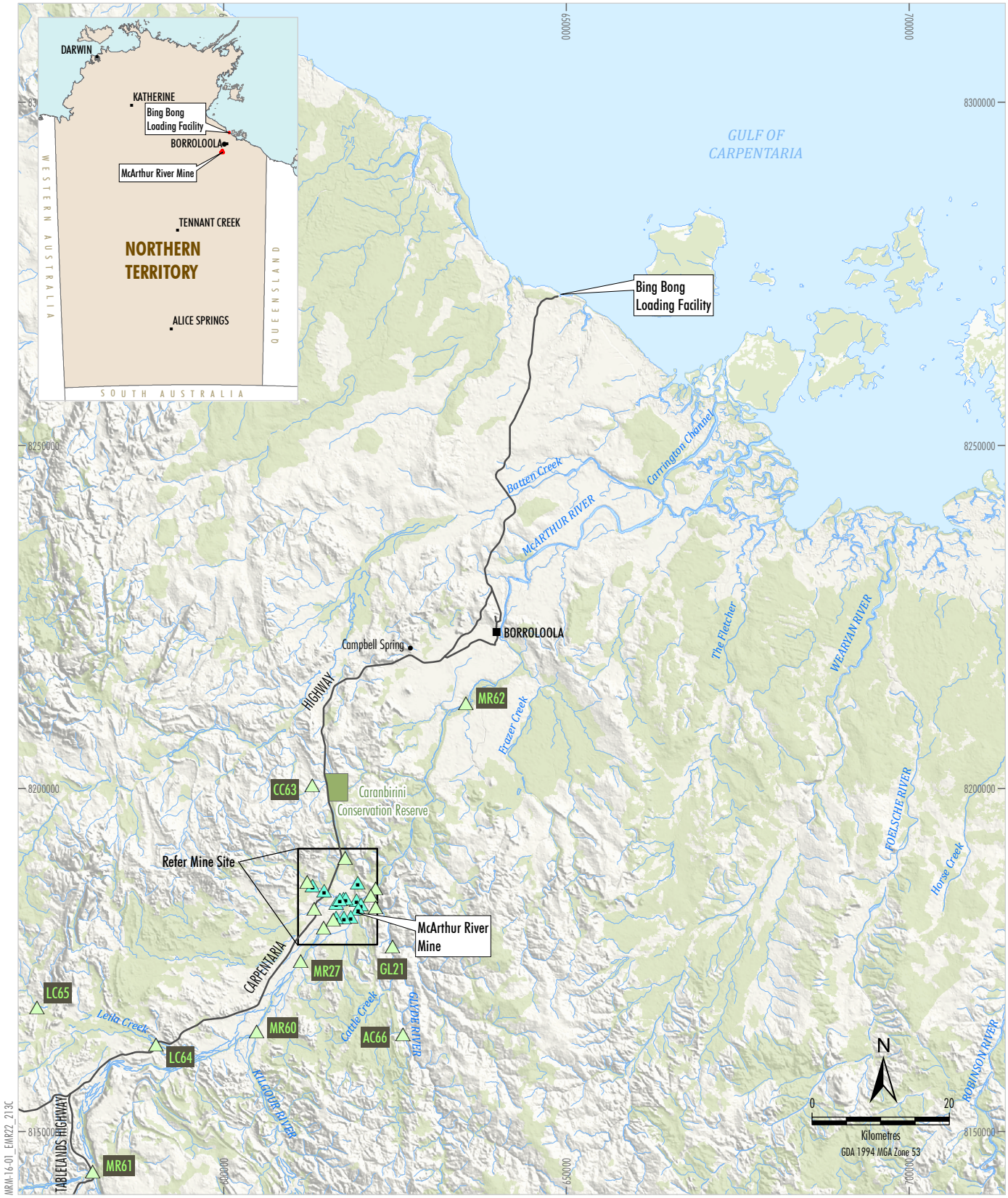
The study found that macroinvertebrate diversity and abundances were generally comparable within the Barney Creek Diversion Chanel (BCH18, BCH19U, BCH19D) and McArthur River Diversion Channel (MCH13-17) sites when compared to reference sites. Statistical analyses indicated that edge and riffle microhabitat macroinvertebrate assemblages at minor drainage line impact (MR06, BC3, SC1, SC2, EC26) sites were not significantly different from those at reference sites.

While the same was also true for riffle microhabitat macroinvertebrate assemblages at Barney Creek Diversion Channel sites, however those within edge microhabitat were significantly different. Further analysis indicated this difference resulted from the higher number of more mobile taxa present at Barney Creek Diversion Channel sites. It was suspected that, as water levels rose rapidly within Barney Creek immediately prior to these sites being sampled, comparable taxa had not yet had time to colonise the recently inundated accessible edge microhabitat. As such, this significant difference should be treated with caution.

Whilst elevated soluble salts and several metals of concern or those associated with mining activities (i.e. lead, zinc, thallium, copper, arsenic and cadmium) have historically been significant in explaining the variation of riffle and edge macroinvertebrate communities between minor drainage line sites, this was not the case during the current study. This is likely due to the concentrations of those parameters at sites on Barney and Surprise Creeks, which have typically contained elevated concentrations, being notably lower during the current study as a result of ongoing management and elevated water levels at the time of the survey diluting concentrations. As such, current results indicated that macroinvertebrate assemblages at minor drainage line impact sites, and Barney Creek Diversion Channel sites, to be increasing in resemblance or remaining comparable to those at reference sites.

Within the McArthur River Diversion Channel, results conform to those obtained between 2008 and 2020 which indicated that within two years of operation, macroinvertebrate assemblages at riffle microhabitats within the McArthur River Diversion Channel resembled, and continue to resemble, those at McArthur River reference sites.

Furthermore, in 2021, for edge microhabitat, results generally conform to historic results whereby edge macroinvertebrate assemblages appear to be improving and increasing in resemblance to those at McArthur River reference sites. Additionally, analysis of assemblages of upstream McArthur River reference sites and performance identification sites downstream of MRM operations indicated no significant difference during the 2021 sampling period. Further discussion of monitoring results is available in Appendix I.



LEGEND

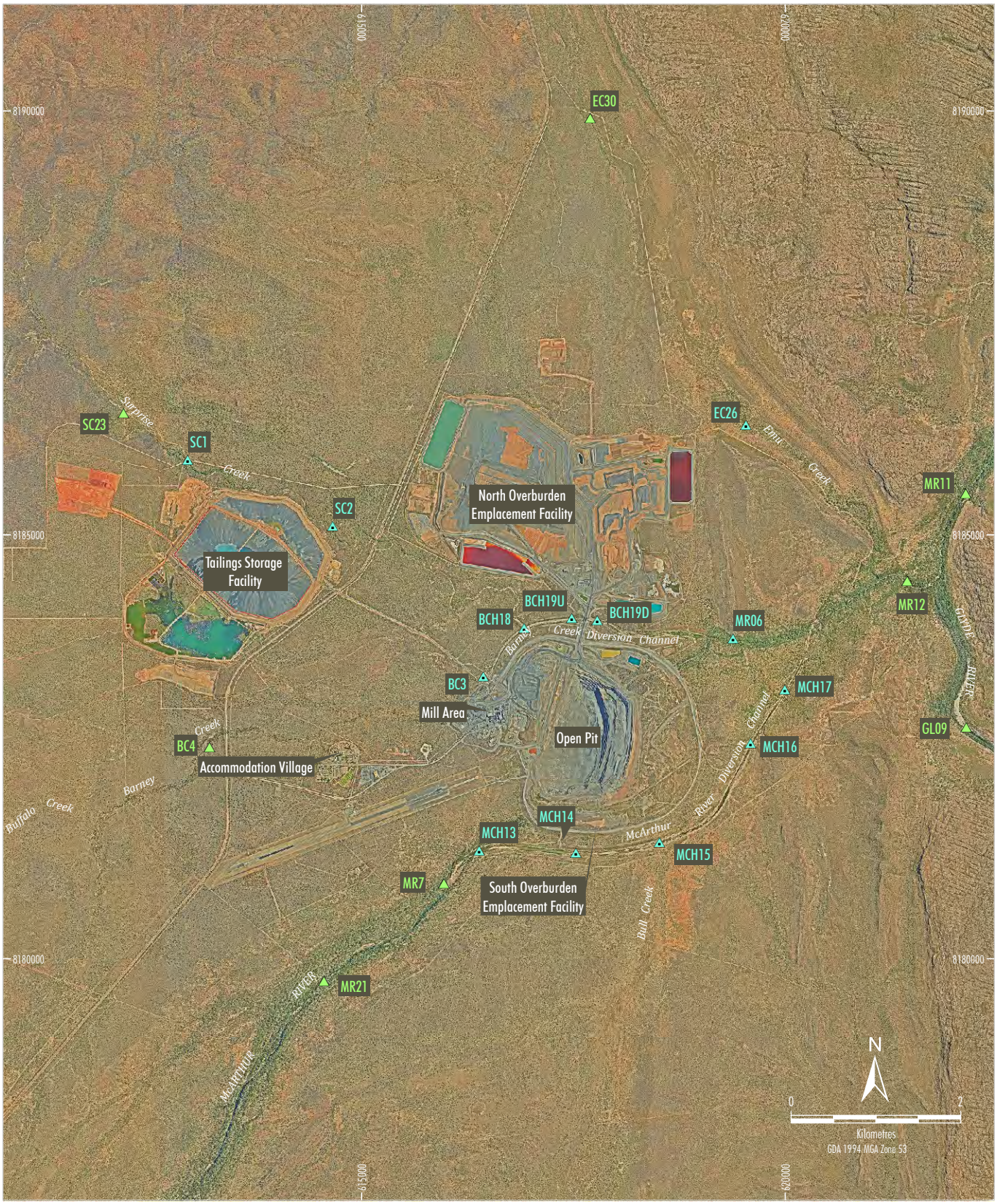
- Major Road
- River/Creek
- Potential Impact
- Reference Site

McARTHUR RIVER MINE

Regional Macroinvertebrate Monitoring Sites

Source: Geoscience Australia - Topography (2006); Department of Environment and Natural Resources (2016); EMS (2019); MRM (2022)

Figure 13



LEGEND

- Potential Impact
- Reference Site

Source: Orthophoto MRM (2021); Department of Environment and Natural Resources (2016); EMS (2019); MRM (2022)

McARTHUR RIVER MINE

Mine Macroinvertebrate Monitoring Sites

Figure 14

3.4.3 Performance Summary and Recommendations

Monitoring data for the reporting period indicates that performance meets TARP Level 1 and supports the conclusion that the key Environmental Objective "*Protect the McArthur River beneficial uses and community values from mining impacts*" continues to be met.

No additional actions or monitoring are recommended.

3.5 Metals in Aquatic Fauna and Fluvial Sediment

TARP Level 1 | TARP Level 2

3.5.1 Monitoring Program

The *Monitoring of Select Analytes and Lead Isotope Ratios in Fluvial Sediments, Fish, Crustations and Molluscs of the McArthur River 2021* (IPE, 2021b) (Appendix J) program aimed to detect whether metals associated with MRM mining activities are entering the aquatic food chain and to assess the risk in relation to human consumption of commonly consumed species. The methodology and site selection used in 2021 generally followed the methodology outlined in *Monitoring of Metal Concentrations within Fluvial Sediments, Freshwater Fish, Crustaceans and Molluscs of the McArthur River* (IPE, 2020).

Monitoring is conducted annually across the McArthur, Limmen, Wearyan and Robinson River catchments (Figures 15 and 16). During the 2021 survey, the site located at the Robinson River community was not visited as a precaution due to COVID-19 restrictions in Darwin and Perth. A site upstream of the Wollogorang road crossing at the Wearyan River was used in replacement.

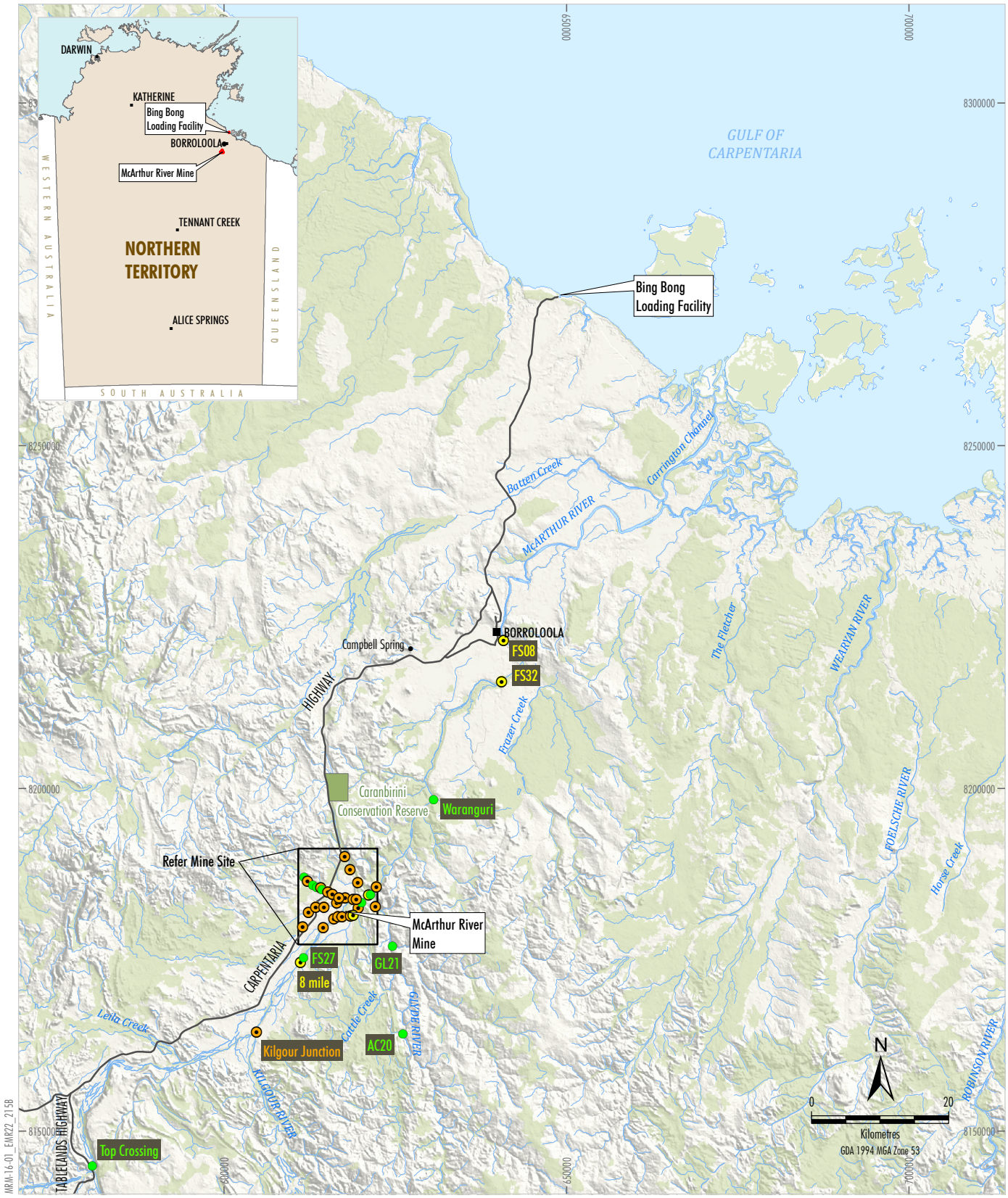
In total, fluvial sediment samples were collected from 41 sample sites and more than 400 fauna tissue samples were analysed during the 2021 reporting period.

Results from the monitoring program are used to assess the Mine's performance against the key Environmental Objective "*Protect the McArthur River beneficial uses and community values from mining impacts*".

3.5.2 Monitoring Results and Trends

Data collected over the 2021 monitoring program demonstrated that all Barramundi (*Lates calcarifer*) and Sooty Grunter (*Hephaestus fuliginosus*) caught throughout the McArthur River catchment, including Mineral Lease areas, were safe to consume. The concentrations of lead in these commonly consumed finfish were well below the applicable maximum permitted concentration (MPC), with calculated safe consumption amounts being vastly greater than the current Food Standards Australia New Zealand (FSANZ) recommendation of 2-3 servings of fish per week (FSANZ, 2011). Furthermore, the vast majority of consumption amounts calculated using the FSANZ methodology were considered high consumption levels and it is unlikely that one person could physically consume the amount per week. The current data did, however, indicate that the intake of Freshwater Mussel (*Velesunio angasi*) should be limited irrespective of the collection site which is consistent with the findings of previous surveys.

In regard to environmental indicator species, analysis of tissue samples collected in 2021 found one sample collected at FS03 to record a lead concentration above the MPC. However, the mean lead concentration for that species at that site was below the MPC. No other individual samples or site mean concentrations were found to exceed any relevant MPC amongst the three environmental indicator species. Overall, the analysis of environmental indicator species sampled during 2021 showed that MRM operations continue to have little measurable effect on the main channel of the McArthur River.



LEGEND

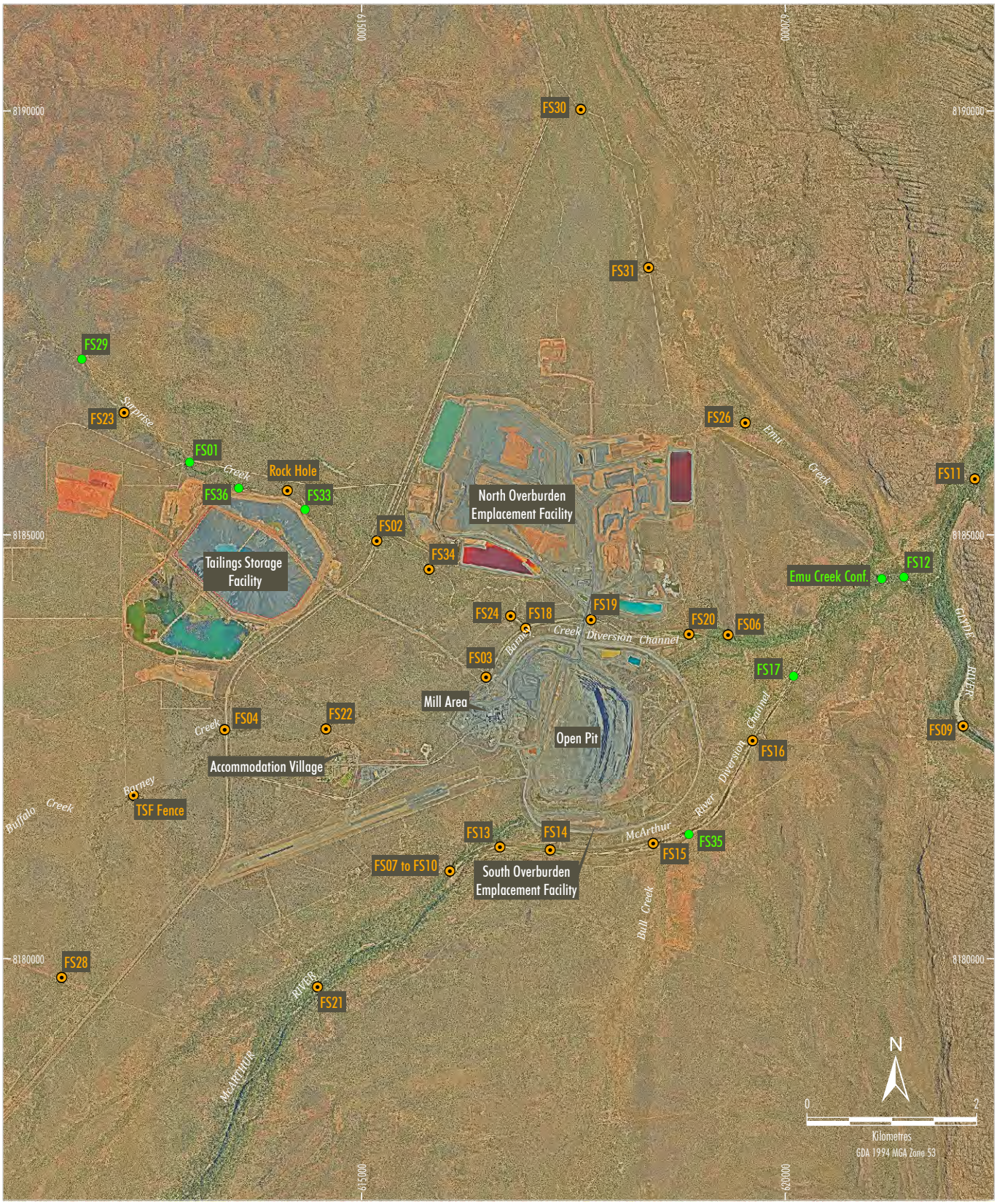
- Major Road
- River/Creek
- Monitoring Site (Fluvial Sediment)
- Monitoring Site (Aquatic Fauna Metals and Fluvial Sediment)
- Restricted Due to COVID-19

McARTHUR RIVER MINE

Regional Aquatic Fauna Metals and Fluvial Sediment Monitoring Sites

Source: Geoscience Australia - Topography (2006); Department of Environment and Natural Resources (2016); IPE (2019); MRM (2022)

Figure 15



LEGEND

- Monitoring Site (Fluvial Sediment)
- Monitoring Site (Aquatic Fauna Metals and Fluvial Sediment)

Source: Orthophoto MRM (2021); Department of Environment and Natural Resources (2016); IPE (2019); MRM (2022)

McARTHUR RIVER MINE

Mine Aquatic Fauna Metals and Fluvial Sediment Monitoring Sites

Figure 16

In relation to fluvial sediment, the following exceedances were recorded:

- Lead – The bioavailable concentration of lead at four sites within Barney Creek, five sites within Surprise Creek and one site within the McArthur River Diversion Channel exceeded the Sediment Quality Guideline Value (SQGV). Of these sites, two also exceeded the SQGV-high concentration. Consistent with previous findings, it is likely that the lead is derived from either mining operations and/or surface mineralisation which is known to occur within the area.

- Zinc – In 2021, the bioavailable concentration of zinc exceeded the SQGV at four sites, three of which are located within the lower section of Barney Creek and one of which was located in Surprise Creek. Of these sites, the SQGV-high was exceeded at two sites. Therefore, the concentration of zinc within fluvial sediments were found to follow a very similar geographical pattern to that described for lead.

- Arsenic – One exceedance of the SQGV was recorded in Barney Creek. While it is likely that the arsenic concentration at this site is related to the activities of MRM, the concentrations of bioavailable arsenic at the sites directly upstream and directly downstream were well below the SQGV, indicating elevated arsenic is not widespread within this reach of Barney Creek.

- Cadmium – One exceedance of the SQGV for cadmium was recorded in Barney Creek. Bioavailable cadmium recorded at all other sites surveyed was very low and considered comparable with data attained since 2016.

Overall, the current concentrations of analytes associated with MRM activities were considered similar to those of 2018 but increased in comparison to concentrations reported in 2019 and 2020. The exception was site FS03, which was found to have lead and zinc levels greater than those recorded since 2014. All sites that exceeded the SQGV, apart from FS16, were within or directly adjacent operational areas and had previously been defined as potentially or likely to be impacted.

Sites immediately downstream of FS16 (i.e. FS17) recorded fluvial sediment concentrations well below the SQGV for bioavailable lead. An analysis of the PbIR of FS16 found there was a sufficient distinction between the PbIR of FS16 and the PbIR of MRM concentrate to suggest some influence from the surface mineral expression directly upstream of FS16, and that the lead at FS16 does not necessarily originate from mining activities.

3.5.3 Performance Summary and Recommendations

Monitoring data in relation to metal concentrations in aquatic fauna indicates that performance meets TARP Level 1 and supports the conclusion that the key environmental objective *"Protect the McArthur River beneficial uses and community values from mining impacts"* continues to be met.

In relation to fluvial sediment, as a result of exceedances during the reporting period, TARP Level 2a has been triggered at eight monitoring sites. Furthermore, fluvial sediment results at two sites have triggered TARP Level 2b.

Current mitigation measures employed by MRM, including the physical removal of sediment and the construction of silt traps to capture runoff, have significantly reduced analyte concentrations within fluvial sediment. Noting the impractically of completely remediating the sections of Surprise and Barney Creeks within operational areas during the processing life of the Mine, the lower reach of Barney Creek (i.e. the reach that includes FS19 and FS20) requires annual targeted sediment removal, in addition to the existing capturing of haul road run off water. Upstream of this reach, bed rock is likely to make sediment removal problematic at some sites for which biota show increased analyte concentrations.

MRM will consider IPE's recommendation of investigating the viability of extending mitigation measures currently implemented to reduce the likelihood of sediment from this area reaching the main McArthur River.

Notwithstanding the above, the key environmental objective continues to be met.

3.6 Diversity and Abundance of Aquatic Fauna

TARP Level 1

3.6.1 Monitoring Program

The objective of the aquatic fauna abundance and diversity assessments completed in 2021 (Appendix K and L) was to establish whether the Mine is impacting aquatic fauna within the wider McArthur River catchment area and whether the McArthur River Diversion Channel is providing suitable habitat for aquatic fauna. The methodology and site selection generally followed the methodology outlined in the *Aquatic Fauna Abundance and Diversity Monitoring Program* (IPE, 2021c, IPE 2021d) and *Freshwater Sawfish Monitoring Program* (IPE, 2021e).

Annual monitoring is conducted in the early dry season and late dry season, across the McArthur River catchment (Figures 17 and 18). A total of 31 sites early dry season and 19 late dry season sites were surveyed.

Acoustic tagging and tracking of *Pristis pristis* (Freshwater Sawfish) and *Lates calcarifer* (Barramundi) was also undertaken during the reporting period. A total of 14 acoustic receivers are currently installed throughout the McArthur River catchment (Figures 19 and 20).

Results from the monitoring program are used to assess the Mine's performance against the key environmental objectives to "*Protect the McArthur River beneficial uses and community values from mining impacts*" and to "*Facilitate development of the ecosystems and their functions along the McArthur River Diversion Channel for terrestrial and aquatic flora and fauna*".

3.6.2 Monitoring Results and Trends

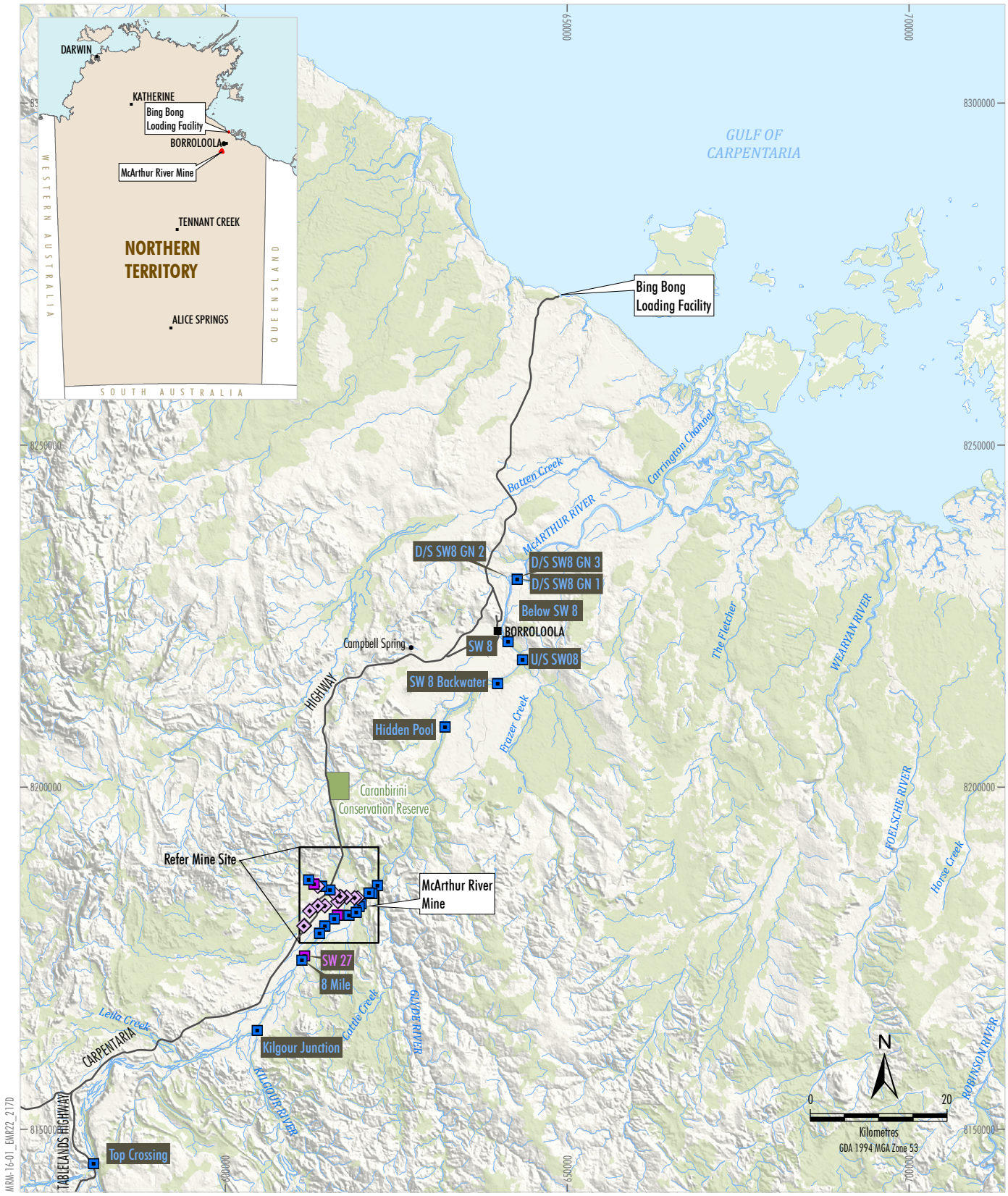
Consistent with previous studies, the 2021 results concluded that there has been no observable decline in species diversity and abundances in waters upstream and downstream of the Mineral Lease; outside of which would be considered natural variation or as a result of variable seasonal flows or changes in river bed morphology. This suggests that the McArthur River catchment is not being adversely influenced by current mining operations. Furthermore, these results suggest that the recovery of the McArthur River Diversion Channel is on a positive trajectory towards that of natural sections of the McArthur River.

Consistent with data collected since 2006, the results of the current survey indicated aquatic fauna abundance and diversity within the McArthur River catchment was most strongly influenced by wet season rainfall patterns and the subsequent duration of river inundation.

The capture of eight *P. pristis* juveniles throughout the survey area, including sites within and upstream of the McArthur River Diversion Channel, provided ongoing confirmation that this vulnerable species remains able to navigate from the McArthur River upstream to prey-rich and relatively predator-free environments.

Within the McArthur River Diversion Channel mean fish density at sites classified as diversion bare bank remained consistently lower than sites classified as diversion complex woody habitat. Furthermore, recorded fish densities and diversity within complex woody habitat were statistically similar to that recorded at upstream natural habitat. This confirmed previous conclusions that the addition of complex habitat, either through the addition of woody debris or planted vegetation, has increased both species richness and abundance within the McArthur River Diversion Channel.

Further discussion of monitoring results is available in Appendix K and L.



LEGEND

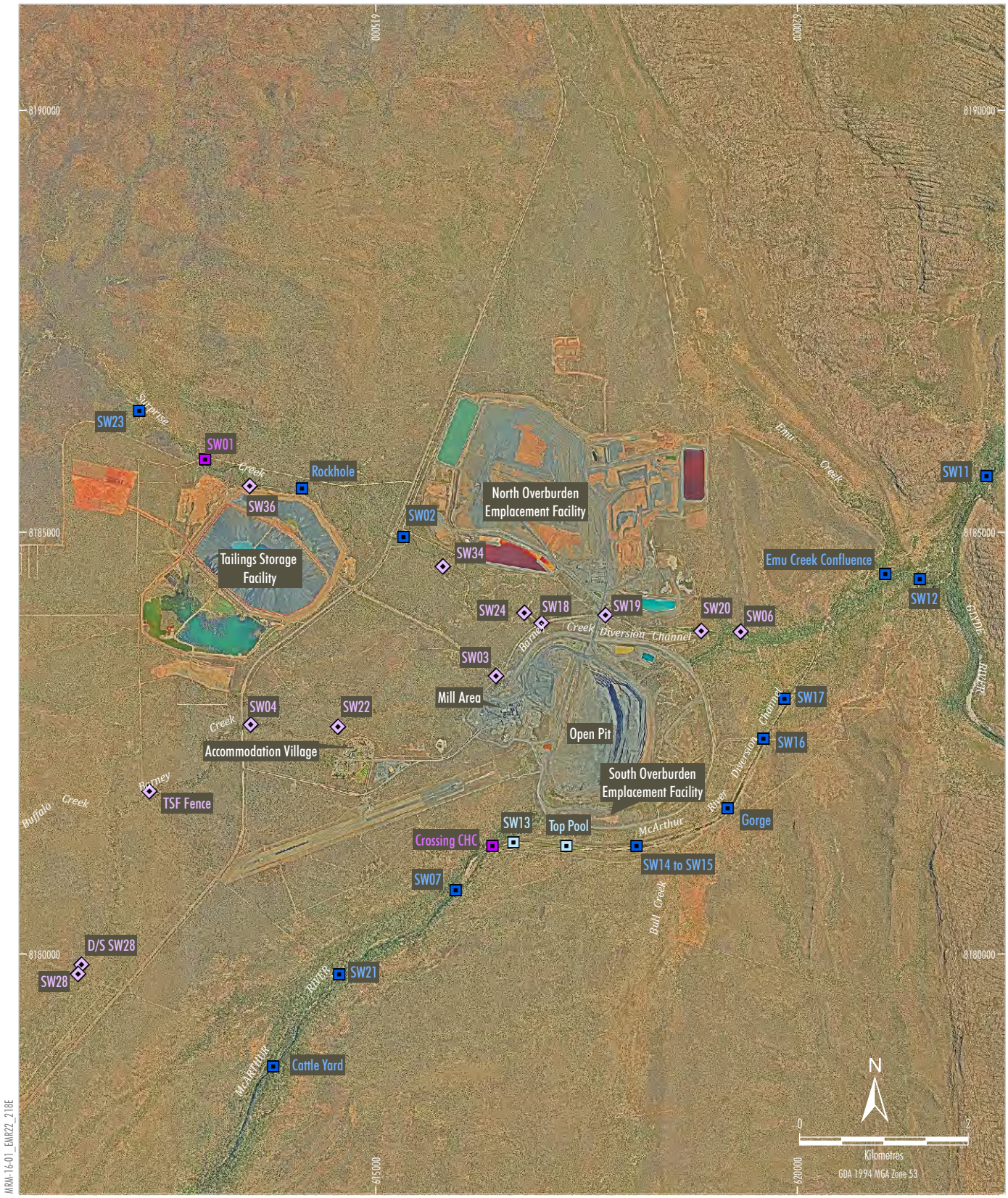
- Major Road
- River/Creek
- Early Dry Season Site
- Early and Late Dry Season Site
- Late Dry Season Site
- Attempted Survey Site – Dry Conditions Present

Source: Geoscience Australia - Topography (2006); Department of Environment and Natural Resources (2016); IPE (2019); MRM (2022)

McARTHUR RIVER MINE

Regional Aquatic Fauna Monitoring Sites

Figure 17



LEGEND

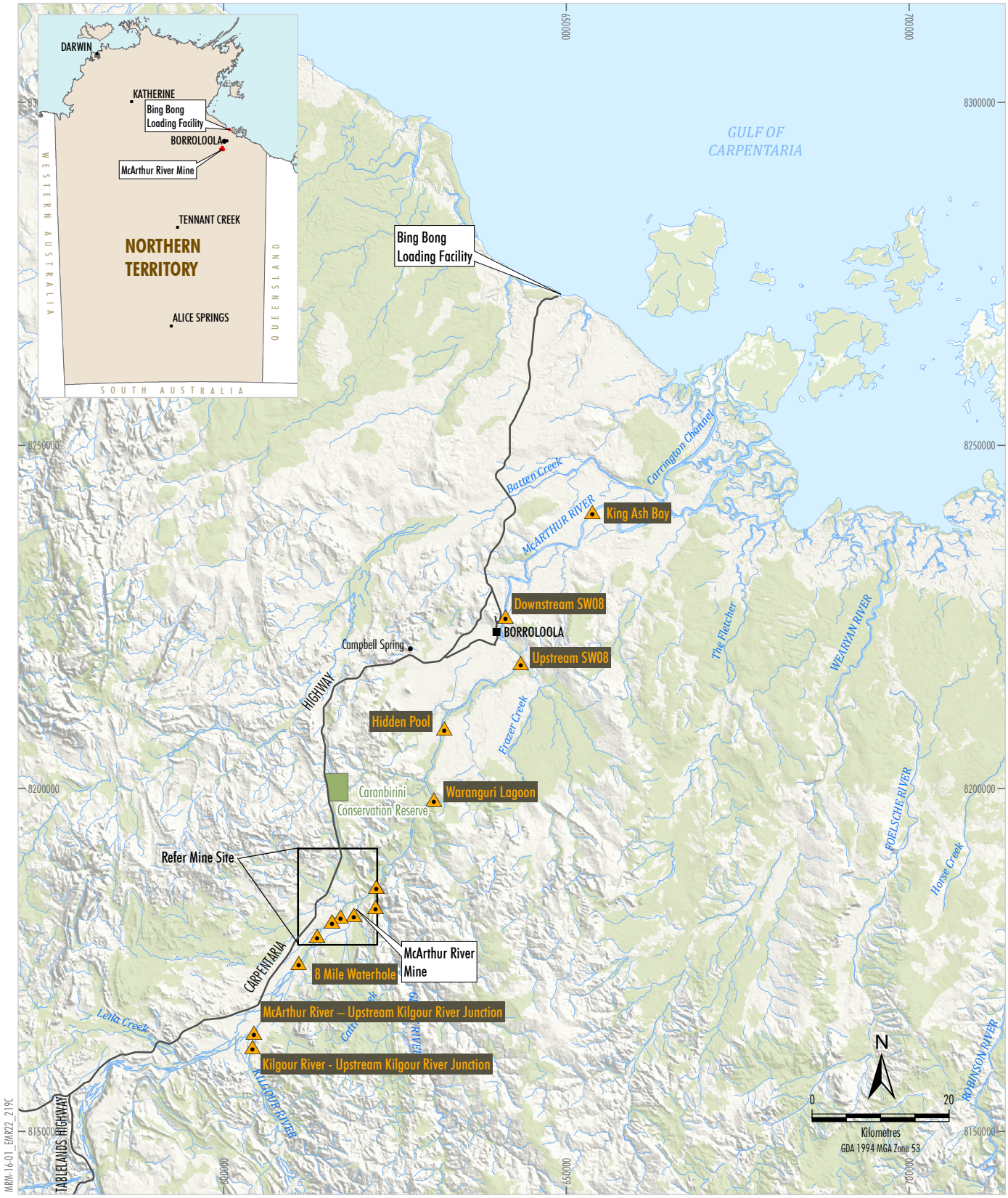
- Early Dry Season Site
- Early and Late Dry Season Site
- Late Dry Season Site
- Attempted Survey Site – Dry Conditions Present

Source: Orthophoto MRM (2021); Department of Environment and Natural Resources (2016); IPE (2019); MRM (2022)

McARTHUR RIVER MINE

Mine Aquatic Fauna Monitoring Sites

Figure 18



LEGEND

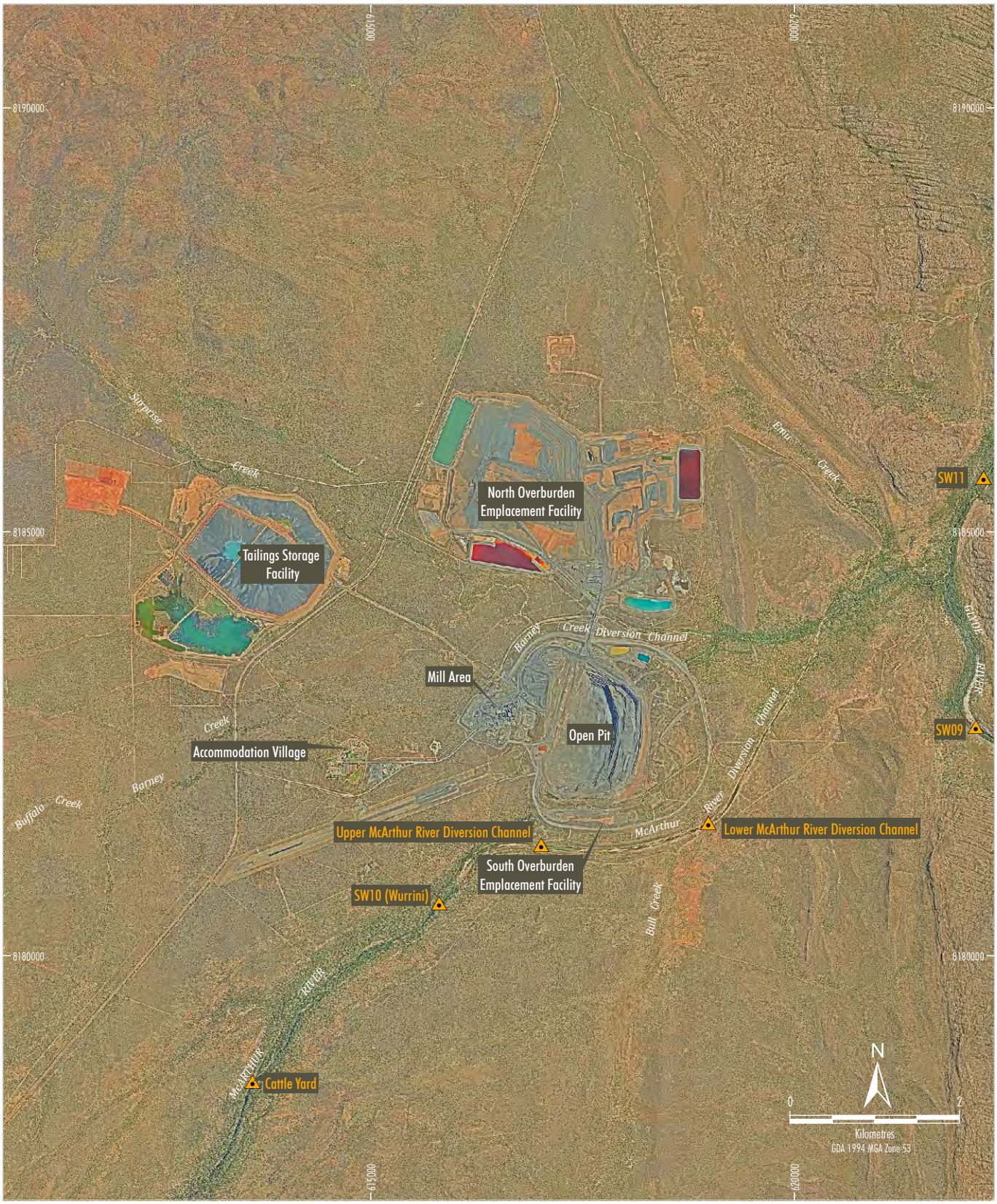
- Major Road
- River/Creek
- Acoustic Receiver Site

Source: Geoscience Australia - Topography (2006); Department of Environment and Natural Resources (2016); Australian Institute of Marine Science (2019); MRM (2021)

McARTHUR RIVER MINE

Regional Acoustic Receiver Monitoring Sites

Figure 19



LEGEND

▲ Acoustic Receiver Site

Source: *Orthophoto MRM (2021); Department of Environment and Natural Resources (2016); MRM (2022)*

McARTHUR RIVER MINE

Mine Acoustic Receiver Monitoring Sites

Figure 20

3.6.3 Performance Summary and Recommendations

Monitoring data for the reporting period indicates that performance meets TARP Level 1 and supports the conclusion that the key environmental objectives to "*Protect the McArthur River beneficial uses and community values from mining impacts*" and to "*Facilitate development of the ecosystems and their functions along the McArthur River Diversion Channel for terrestrial and aquatic flora and fauna*", continue to be met.

3.7 Seagrass Diversity and Abundance

TARP Level 1

3.7.1 Monitoring Program

The annual seagrass survey of the BBLF 2021 (IPE, 2021f) (Appendix N) aimed to determine if any changes in seagrass distribution or composition have occurred in waters adjacent to the BBLF, and if any change identified was likely to be naturally occurring or potentially influenced by the BBLF operations. The methodology and site selection used in 2021 was consistent with previous surveys conducted from 2017 to 2020.

Seagrass monitoring is conducted annually by IPE within waters directly adjacent to the BBLF and at reference sectors (see Figure 21). In total, 201 sites were surveyed for seagrass in 2021.

This monitoring program is not included within the AMP however, it is a requirement under WDL-174.

3.7.2 Monitoring Results and Trends

A total of five seagrass species were identified during the current survey. All species of seagrass were recorded from all survey sectors, with the exception of the BBLF sector, where one species was recorded in very low densities.

The study found a reduction in seagrass density and percentage cover throughout the survey area. Changes detected within the BBLF sector were considered comparable to those within reference sectors, suggesting changes to be more likely the result of naturogenic causes rather than operations conducted at the BBLF.

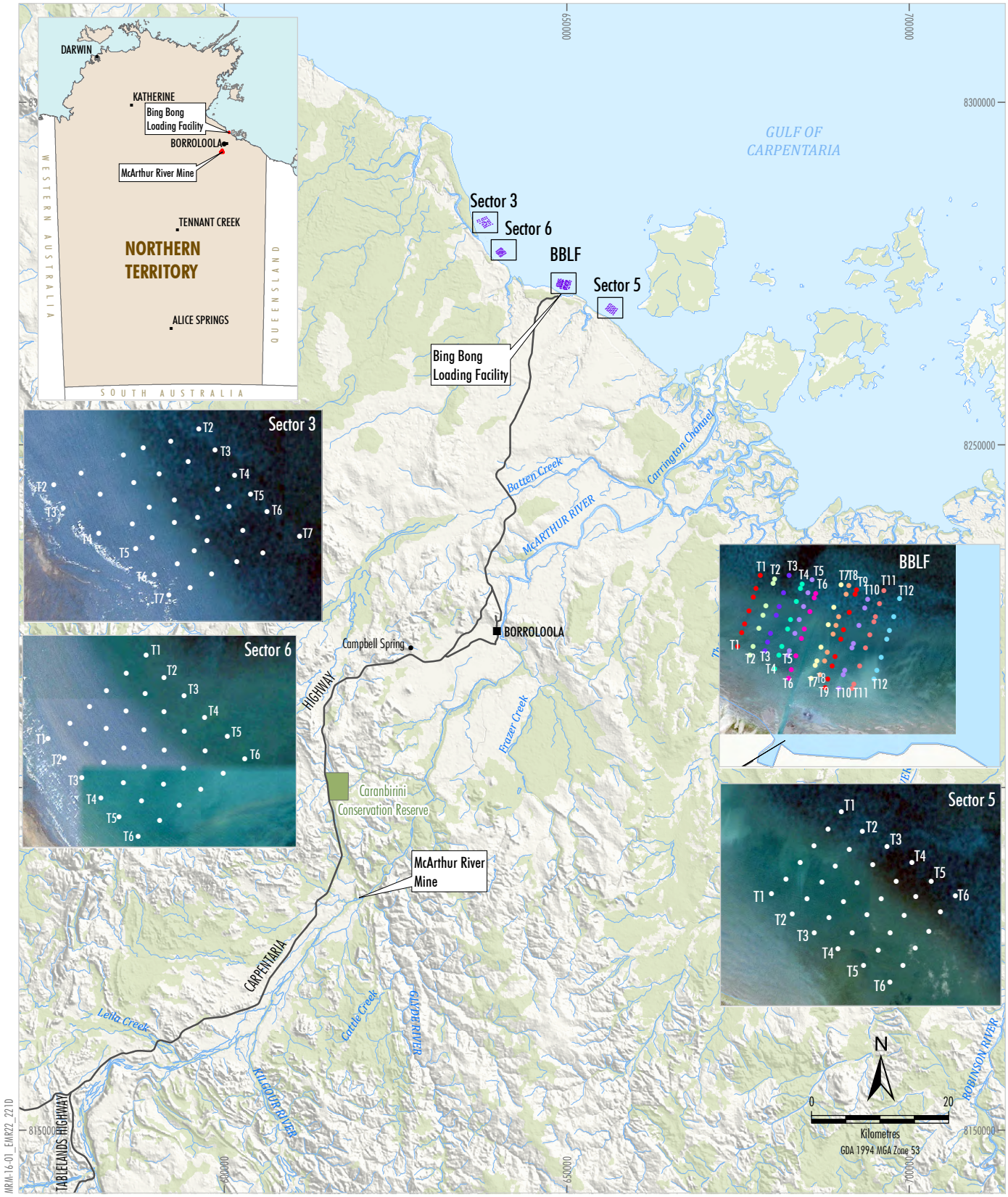
Consistent with previous surveys, increases in macroalgae densities were considered naturogenic, representing natural succession from epiphytic macroalgae as seagrass assemblages mature and stabilise the surrounding benthic environment. Thus, creating greater habitable benthic environment for aquatic flora.

Further discussion of monitoring results is available in Appendix N.

3.7.3 Performance Summary and Recommendations

Monitoring data for the reporting period indicated a reduction in seagrass density and percentage cover in waters adjacent to the BBLF. It was determined that the change was likely to be naturally occurring, rather than influenced by operations conducted at the BBLF.

No additional actions or monitoring are recommended.



LEGEND

- Major Road
- River/Creek
- Seagrass Survey Site

Source: Geoscience Australia - Topography (2006); Department of Environment and Natural Resources (2016); IPE (2019); MRM (2021)

McARTHUR RIVER MINE

Areas Surveyed for Seagrass in 2021

Figure 21

3.8 Marine Sediment Quality, Water Quality and Metals in Marine Biota

TARP Level 2

3.8.1 Monitoring Program

The *Annual Marine Monitoring Program of the Bing Bong Loading Facility 2021* (IPE, 2021g) (Appendix O) aimed to detect if operations at the BBLF are introducing mine-derived contamination into the marine ecosystem and subsequently impacting the immediate surrounds and broader marine environment. The methodology and site selection used in 2021 was consistent with previous surveys conducted since 2017 (IPE, 2017a and 2017b).

Marine monitoring is conducted annually by IPE at the BBLF and along the surrounding coastline in accordance with the BBLF Environment Management Plan (Figures 22 and 23). For the current reporting period, water, sediment and biota samples were collected from 20 sites. Marine sediment was also collected from an additional 10 sites within the BBLF swing basin and dredged shipping channel.

3.8.2 Monitoring Results and Trends

Evidence compiled through analysis of water, sediment and biota samples collected during the 2021 survey indicated that influence from operations at the BBLF on the marine environment to be confined to the swing basin, and a small section of tidal flat on the western side of the facility.

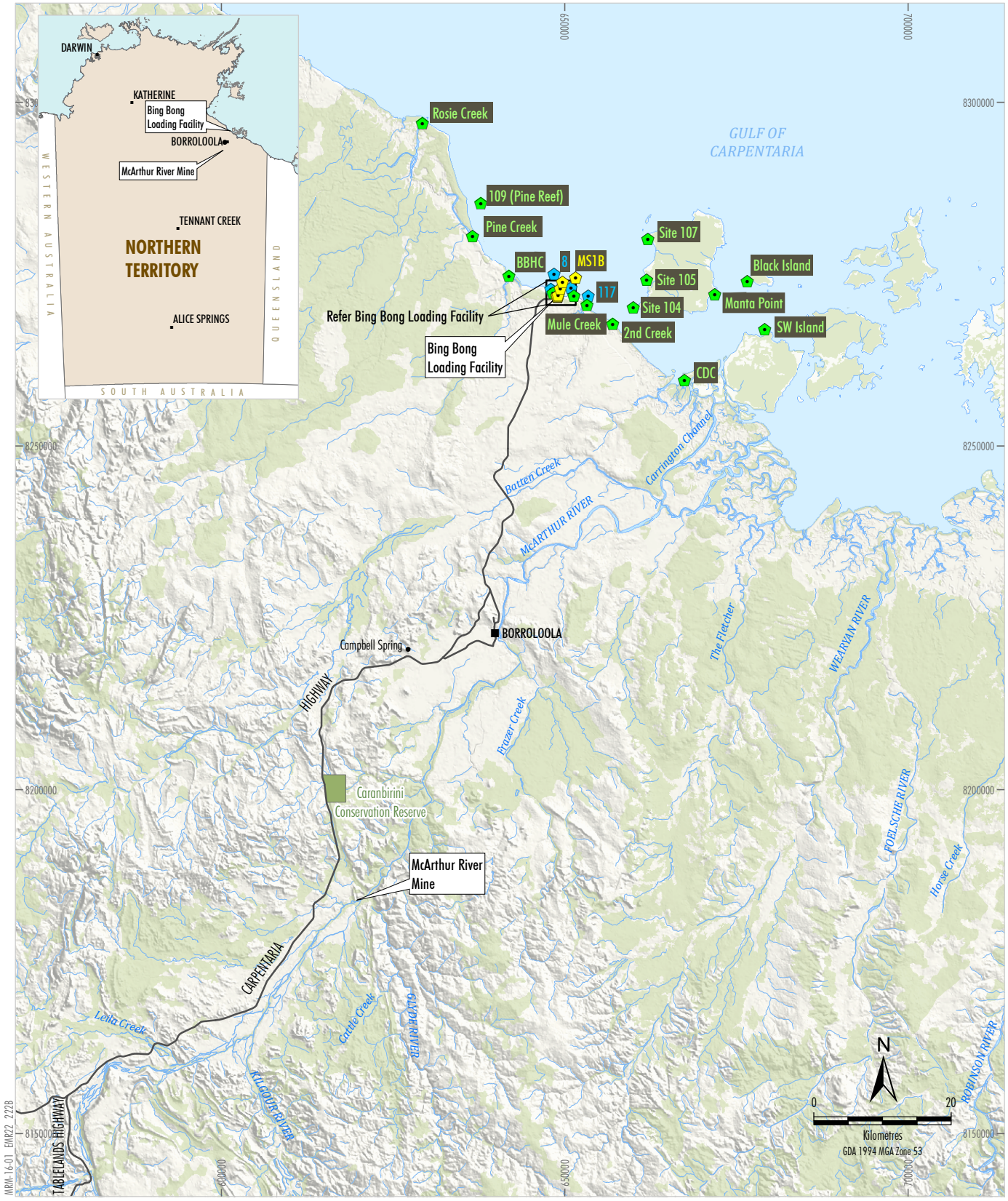
The concentrations of analytes within the <63 micrometre (µm) sediment fraction, including several SQGV exceedances of analytes associated with the MRM shipping product, in combination with lead isotope ratios (PbIR), indicated operations at the BBLF have had a measurable impact on marine sediments within the immediate vicinity of the facility. Consistent with the conclusions of previous surveys conducted since 2014, the current results indicated measurable effects are restricted to the swing basin, with analyte concentrations declining rapidly to background levels seaward of these locations. There was evidence to suggest dredging conducted by Nathan River Resources (NRR) had reduced lead and zinc concentrations in sections of the swing basin and immediate surrounds.

The impact on fauna is essentially restricted to sessile species, species of low mobility and individuals of species which have extended residency times in the swing basin itself. Sessile and less mobile biota collected from the BBLF were found to have consistently higher lead levels (and in some instances also zinc) than individuals collected from other sites. The PbIR of these species collected from the BBLF showed greatest similarity to that of the MRM shipping product, while those collected on the adjacent western site also generally recorded PbIR which approached the signature of the MRM shipping product and were distinctly higher than those of individuals collected away from the BBLF. Whilst concentrations of lead and zinc within biota collected at the BBLF were, on occasion, higher in comparison to biota collected from reference sites, the risk to human health through consumption of biota collected in the vicinity of the BBLF was considered to be low. Furthermore, consideration of the concentrations of other metals naturally present within the wider environment, such as cadmium, showed that zinc and lead may not be the analyte upon which consumption limit should be based.

Further discussion of monitoring results is available in Appendix O.

3.8.3 Performance Summary and Recommendations

Consistent with the conclusions since 2014, the current results indicate measurable effects are restricted to the swing basin and to a far less degree MS4 and BBW1, with analyte concentrations declining rapidly to background levels seaward of these locations.



LEGEND

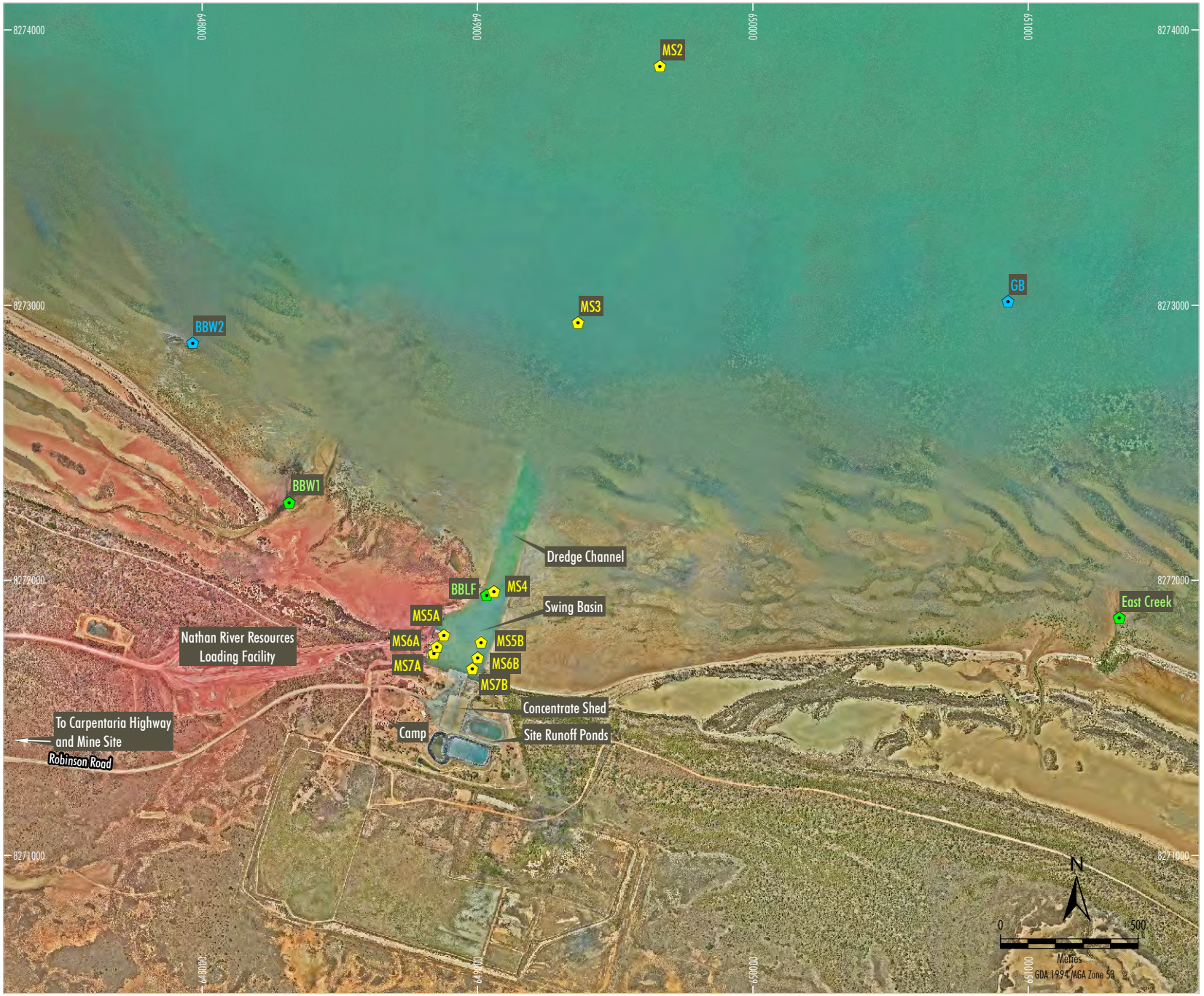
- Major Road
- River/Creek
- Fauna, Sediment and Water Monitoring Site
- Sediment Monitoring Site
- Sediment and Water Monitoring Site

Source: Geoscience Australia - Topography (2006); Department of Environment and Natural Resources (2016); IPE (2019); MRM (2021)

McARTHUR RIVER MINE

Regional Marine Monitoring Sites

Figure 22



LEGEND

- Fauna, Sediment and Water Monitoring Site
- Sediment Monitoring Site
- Sediment and Water Monitoring Site

Source: Orthophoto MRM (2021); Department of Environment and Natural Resources (2016); IPE (2019); MRM (2022)

MRM-16-01_EMR22_223A

McARTHUR RIVER MINE

Bing Bong Loading Facility
Marine Monitoring Sites

Figure 23

The sites within the swing basin have a greater percentage contribution of the <63 µm fraction to the total sediment sample in comparison to other sites examined. The severity and underlying implications of analytes within the biological fraction are reduced however, the concentrations are still significantly greater than sites outside the swing basin. The TARP rose in response to the current results indicating measurable effects restricted to the swing basin and to a far less degree sites MS4 and BBW1, with analyte concentrations declining rapidly to background levels seaward of these locations and resulting in a Level 2 TARP trigger. Exceedance of the guideline value for Cd was also recorded at Mule Creek triggering TARP Level 2.

IPE 2021 undertook actions during the monitoring programme that investigated the performance trigger and associated causes. The Level 2 results will continue to be reported annually with MRM inquiring into potential improvements that could be made to the BBLF EMP TARPS during the next reporting period.

MRM will continue investigate options to undertake dredging activities and specifically target the removal of impacted sediments. No additional actions or monitoring are recommended.

3.9 Rehabilitation

The key objective of rehabilitation at the Mine, within the McArthur River and Barney Creek Diversion Channels, is to establish primary drainage paths with functioning riverine ecosystems comparable to the original water courses prior to diversion with potential for custodian use. The key objective in all other domains is to establish suitable vegetation for the agreed end land uses.

A number of activities were undertaken during the reporting period to support rehabilitation onsite and achieve these key objectives. These activities are listed in Table 10.

3.10 NOEF Temperatures

A summary of NOEF temperature monitoring program and resulting during the reporting period are provided in Appendix D.

The NOEF temperature monitoring program was initiated in 2016 as part of the spontaneous combustion remediation works undertaken from 2014 to 2018 on the NOEF PAF cell.

Results obtained over the reporting period show that the progressive decrease in temperatures observed in the NOEF from 2017 to 2021 has been maintained with all bores approaching or maintaining an average background temperature of 65 degrees Celsius (°C). Of the original eight temperature wells which had elevated temperatures in 2017, five have cooled down to essentially background temperatures. Only three wells (20A, 21A and 25A) still had elevated temperatures in June 2019, although all had been progressively cooling over time. The background temperature of the original NOEF PAF cell remains around 65 °C, which is about 35 °C warmer than ambient air temperatures. The progressive failures of thermocouples in the original bores no longer enables the ongoing measurement of the slow cooling trend even though it is expected to continue over time. The planned additional four bores will enable MRM to extend the monitoring of this trend.

Initial results from the first 18 months of operation of the Central West Charlie horizontal instrumental array are overall positive:

- Temperatures in the outer 10 m of the NOEF (MS-NAF halo) are stable at 35 to 40 °C and are consistent with diurnal air temperatures at the site. The temperatures are also consistent with the oxygen concentration measurements (19 to 17%) suggesting a small amount of oxygen consumption due to the comparatively low sulphide content of the material.

- Variations in the oxygen concentration in the halo are influenced by atmospheric pressure indicating that barometric pumping is a likely important mechanism of oxygen ingress into the batters.

- The fine-grained alluvial barrier 10 m into the NOEF appears to act as an effective moisture barrier. Sensors in the advection barrier show increased moisture content during wet events, but this does not appear to be the case in the PAF cell located below it.

- Oxygen concentrations in the advection barrier and the first few meters of the PAF cell do show some indications of barometric pumping which indicates that at least minor advective transport is occurring. However, the results from March 2022 onwards suggest that the advection barrier is starting to be effective at limiting advective transport of O_2 deeper int the NOEF, a trend that needs to be confirmed in the next reporting period.

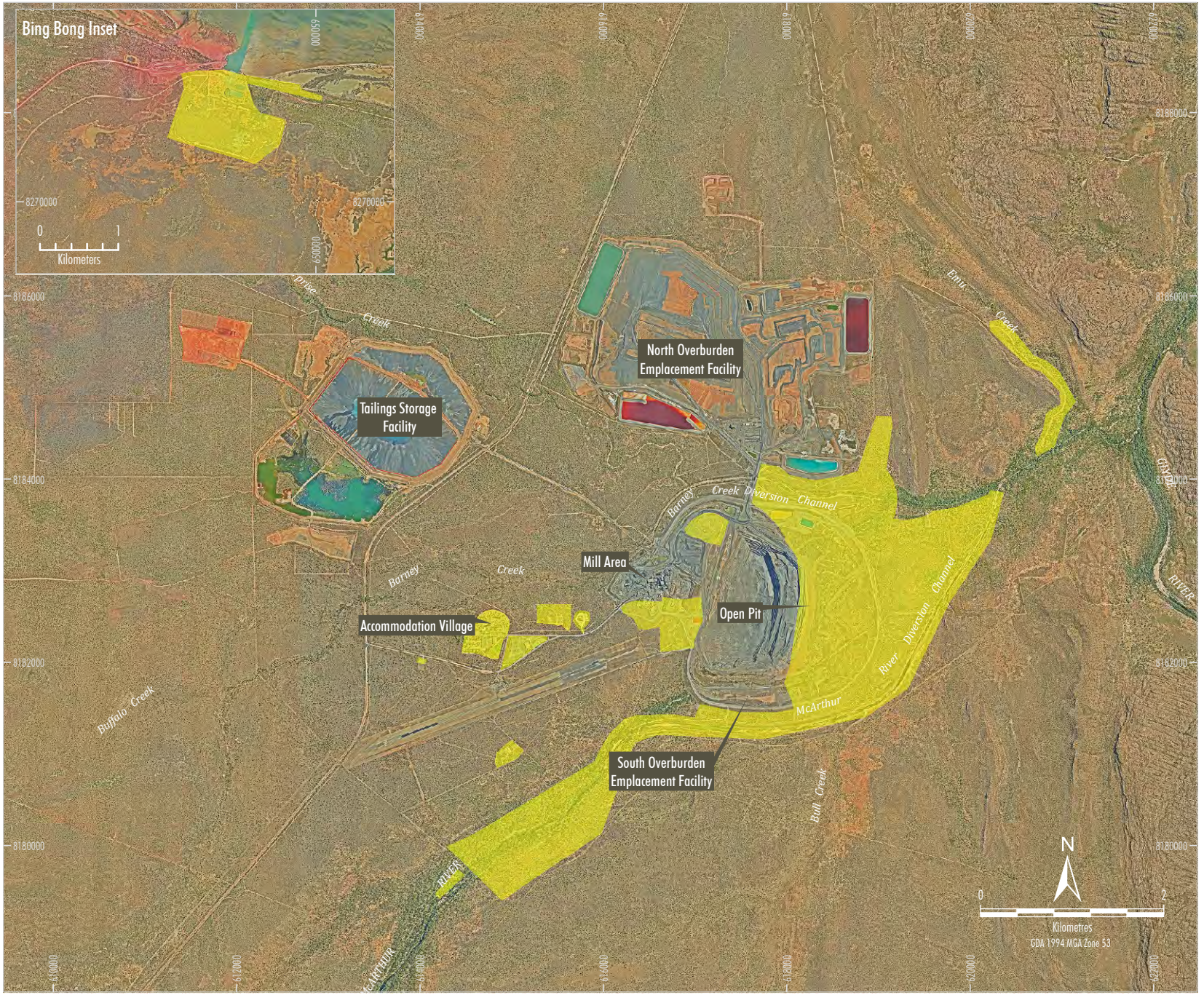
- The progressive increase in temperatures with depth is consistent with the gradual equilibration of the rock mass with the background temperature of the NOEF with the deeper sensor reaching 77 °C. Most importantly, this temperature is well below the lowest temperature to initiate spontaneous combustion so the NAF halo plus advection barrier layer appears effective at limiting temperatures in the batter.

The MS-NAF halo appears to provide an effective thermal barrier between the PAF cell core and the future low permeability cover system.

TABLE 10: KEY REHABILITATION ACTIVITIES COMPLETED DURING THE REPORTING PERIOD

Activity	Objective	Work completed during the reporting period
Diversion Channel Revegetation	The purpose of the McArthur River Diversion Channel revegetation program is to facilitate the development of an ecosystem and its functions, minimise impacts on the surrounding environments, reduce erosion, improve stability, and improve visual amenity. Further detail is outlined in the Rehabilitation Management Plan (RMP).	A total of 112,819 tubestock were planted, all of which were sourced from MRM's onsite nursery. Planting, including infill planting, took place between SW13 and SW16 along the waterline, mid bank and upper bank.
NOEF Revegetation	The purpose of the NOEF revegetation program is to facilitate the development of an ecosystem and its functions, minimise impacts on the surrounding environments, reduce erosion, improve stability, and improve visual amenity. Further detail is outlined in the RMP.	Revegetation trials are scheduled to begin Q3 2022. The performance indicators and completion criteria will be developed in future versions of the RMP and based on trial results and the final landform present.
Seed Collection	The purpose of the native seed collection program is to increase the current stock of riparian species used in the McArthur River Diversion Channel revegetation program. Further detail is outlined in the RMP.	During the reporting period, approximately 74 kilograms (kg) of native seed was collected onsite. Seed harvesting and processing equipment has been ordered in order to improve the efficiency and capacity of the seed collection program for future years.
McArthur River Diversion Channel Erosion Mitigation	The purpose of erosion works within the McArthur River Diversion Channel are to reduce erosion and improve rehabilitation success. Further detail is outlined in the RMP.	Rock armouring was installed along the McArthur River Diversion Channel fence line in problem areas to improve fence line integrity, reduce potential for cattle access and to allow access to the diversion during the wet season.
Cattle Management	Cattle management is undertaken to reduce the potential exposure of cattle onsite and to reduce disturbances cause by cattle in areas of revegetation. Further detail is outlined in the Cattle Management Plan.	In total, 11 cattle musters were undertaken during the reporting period. As per the Cattle Management Plan, weekly inspections of the cattle exclusion zone fence were also undertaken throughout the dry season, and repairs completed as required.
Weed Management	Introduced plants are of concern as they have the potential to out-compete native species, to alter habitat and affect land use. Failure of rehabilitation due to inadequate control of such weeds is considered a high risk if not controlled. The purpose of weed management onsite is to prevent the introduction and spread of weeds, and where possible, eradicate weed species. Further detail is outlined in the Weed Management Plan.	During the reporting period, approximately 784 ha of land at the Mine and 128 ha surrounding BBLF was inspected for weeds, and identified weeds were either sprayed or removed (refer to Figure 24). Weed control activities focused on the control and eradication of Class A and Class B weeds listed under the *NT Weeds Management Act 2013*.
Pest Management	The purpose of pest management is to minimise disturbance from pest species of fauna on existing habitat and revegetation areas at the Mine. Further detail is outlined in the RMP.	Feral animals including donkeys, buffalo and pigs were targeted and culled during aerial cattle musters. A total of 22 feral animals were culled during the reporting period.

Activity	Objective	Work completed during the reporting period
Bushfire Management	The objectives of bushfire management are to reduce unplanned fire ignition potential, prevent the spread of fire, protect flora and fauna from unplanned fire events and utilise fire as a management tool to maintain and enhance native ecosystems. Further detail is outlined in the Fire Management Plan.	No bushfire management activities were undertaken during the reporting period.
Access Management	Access management is used to reduce the impact of vehicle traffic in rehabilitation areas onsite. Vehicle traffic can result in the compaction of soil (which can reduce the infiltration of water into the soil and restrict root growth, and consequently reduce natural regeneration), and result in the spread of weeds and disturbance to vegetation.	To reduce the degree of disturbance to the rehabilitation areas, access to these areas has been limited to authorised personnel only. Furthermore, vehicle access is restricted to existing access tracks only.
Large Woody Debris Installation	The purpose of the large woody debris program is to facilitate the development of aquatic fauna habitat, and subsequently increase aquatic fauna biodiversity within the McArthur River Diversion Channel. Further detail is outlined in the RMP.	No large woody debris was installed within the McArthur River Diversion Channel during the reporting period due to equipment breakdowns and early rainfall preventing heavy vehicle access. Large woody debris installations are scheduled to recommence September 2022.



LEGEND

Areas Targeted for Weed Control

Source: Orthophoto MRM (2021); Department of Environment and Natural Resources (2016); MRM (2022)

MRM-16-01_EMR22_224C

McARTHUR RIVER MINE

BBLF and Mine Weed Control
2021-2022 Reporting Period

Figure 24

3.11 Other

3.11.1 Waste Management

Quantities of waste produced onsite during the reporting period are provided in Table 11.

TABLE 11: SUMMARY OF WASTE QUANTITIES

Waste Type	Unit	Q2 2021	Q3 2021	Q4 2021	Q1 2022	TOTAL
General waste (Non-hazardous)	t	0.90	4.60	3.55	0.00	9.05
Garden/green waste (Non-hazardous)	t	0.00	1.60	0.00	0.80	2.40
Food (Non-hazardous)	t	136.60	117.60	121.10	127.50	502.80
Contaminated to landfill	t	492.90	399.05	547.00	366.11	1805.06
Scrap metal recycled	t	137	1.80	0.00	0.00	138.80
Batteries recycled	t	5.96	4.20	0.99	1.33	12.48
Waste oil recycled	t	215	189	217	259	880
Aluminium (Al) cans recycled	t	0.37	0.57	0.60	0.87	2.41

3.11.2 Diesel Spill Remediation

On 19 May 2011, MRM discovered an open valve leaking diesel onto the ground in the vicinity of the Mine power plant. The volume of diesel lost was estimated at approximately 27,678 litres (L).

MRM immediately notified the then DME of the leak and commenced the initial remediation response. A Detailed Site Investigation and Remediation Action Plan were prepared in consultation with the DME and finalised in 2012. Since that time, remedial activities have been undertaken in accordance with these plans.

The *2011 Diesel Spill Incident - 2022 Annual Report* (MRM, 2021a) is provided in Appendix P.

Performance during the Reporting Period

The recovery system was not operational over the 2021 dry season. Regular isolation of power in the impacted area due to construction, along with limited resources with COVID-19 restrictions resulted in no product being recovered in the reporting period. Over the life of the project, approximately 4,898 litres have been recovered to date, which is approximately 17.7% of the original spill.

Results for the reporting period have remained consistent with previous results. Evidence to date suggests that free phase Light Non-Aqueous Phase Liquid (LNAPL) is not mobile or migrating and thickness has decreased since the spill as a result of remedial actions.

The results indicate that the impacts of the 2011 diesel spill have stabilised and that the plume is not expanding. Any migration of the plume is likely to be toward the underground workings and will experience dilution of several orders of magnitude before emerging in the pit or being pumped to the Mine's water management circuit.

Attenuation parameter results indicate that conditions are favourable for the biodegradation of hydrocarbons, with aerobic degradation the most effective and thus dominant mechanism of natural attenuation contributing to the attenuation of the contaminants of concern. Rates of attenuation are controlled more by the solubility of the LNAPL than the rate of chemical reactions and as such accurate rates of degradation are not able to be readily deduced.

Data collected in the reporting period found no evidence of exceeding the WDL trigger value for surface water monitoring site SW18 over the reporting period.

The investigation to date has indicated that there is negligible risk to Barney Creek or the McArthur River as groundwater from the impacted area is likely to discharge into the underground workings during both wet and dry seasons. Any diesel impacted groundwater that is drawn into the underground workings, will experience continued attenuation and dilution by several orders of magnitude before possibly emerging in the pit or being pumped to the Mines water management circuit. As such, any contaminants that travel beyond the immediate spill investigation area are not expected to be detectable or pose a significant risk to the environment or human health.

Non-conformances, Corrective Actions and Improvements

No non-conformances, corrective actions or improvement opportunities were identified over the reporting period.

4 Site Water Management

4.1 Site Water

4.1.1 MRM Site Water Inventory

Total rainfall recorded at the Mine Airport (Station No. 14704) for the reporting period was 537 mm, which is 189 mm less than the annual rainfall average of 715 mm. The highest daily rainfall (74.0 mm) during the period was recorded on 20 December 2021. The highest monthly rainfall was recorded in January 2021 (159.0 mm). Table 12 provides a summary of the site inventory for key existing water storages at the end of the reporting period.

Time series of inventories in the underground voids (UG), NOEF South Perimeter Runoff Dam (SPROD), NOEF Southeast Perimeter Runoff Dam (SEPROD), NOEF West Perimeter Run-Off Dam (WPROD), NOEF East Perimeter Runoff Dam (EPROD) and the TSF Water Management Dam (WMD) over the reporting period are presented in Charts 5 to 10, respectively. The following is of note with respect to water management in the major site storages:

- The Open Pit was not used to store any water over the reporting period (Chart 5). The underground voids were steadily dewatered from 1 May to 11 December 2021, using the Mine Underground Dewatering System (MUDS), at which point the water RL reached the reserve level used as a contingency for a potentially late wet season (220 ML). The extraction rate was reduced to match operational water requirements until 21 April 2022, when the MUDS were switched off due to lower-than-expected rainfall and reduced recharge of the underground inventory. The strategy changed to conserve the underground water and prioritise use of existing surface water inventory for the impending dry season. The Pit RL level remained well below the geotechnical water exclusion zone, which extends 17 m below the pit floor and aims at keeping water away from the base of the pit walls to supplement its geotechnical stability. The water was at its maximum on the first reporting day 1 May 2021, approximatively 4 m below the geotechnical limit and 24 m below the Open Pit floor.

- NOEF SPROD was used to store excess water from the PbOx leach circuit and NOEF run-off water over the full reporting period with an additional 237 ML of PbOx water transferred from EPROD to SPROD between 25 August and 8 September 2021 (Chart 6). The water was subsequently lime treated in situ using a total of 556 t of lime, and the treated water blended in with WPROD water to supplement the operational water supply.

- NOEF WPROD (Chart 7) was used to store and manage underground dewatering water, NOEF surface runoff and excess TSF water over the full reporting period. In addition, 656 ML of WMD water were transferred into WPROD from 10 April to 12 May 2021 to supplement the operational water supply.

- NOEF SEPROD was periodically filled with various sources of water for lime treatment (Chart 8). From 1 May 2021 to 11 March 2022, 1,594 ML of treated water was dewatered to OP P2 and then stored in the TSF WMD. A further 392 ML were treated and used as operational water supply. A total of 629 t of hydrated lime was used to treat approximately 1,978 ML of mine water over the reporting period.

- NOEF EPROD (Chart 9) has been exclusively operated as a turkey's nest (no reporting catchment) to store and manage PbOx impacted water over the whole reporting period. The volume in NOEF EPROD at the start of the reporting period was 1,247 ML, and 237 ML were dewatered to SPROD at the end of August 2021. The final volume of EPROD was 1,194 ML at the end of the reporting period.

- TSF WMD (Chart 10) began the reporting period with an inventory of 934 ML of treated water from NOEF SEPROD, reaching a maximum of 1,025 ML on 6 June 2021. The Maximum Operating Level (MOL) of the TSF WMD has been reduced to 1,300 ML following a dam review by GHD and will remain at this volume until further works to stabilise the walls are completed. A total of 656 ML was dewatered from the WMD to WPROD in April 2022 to supplement the operational water supply. Managed releases from the TSF WMD to the McArthur River occurred over the reporting period. Further details are provided in Section 4.1.3.

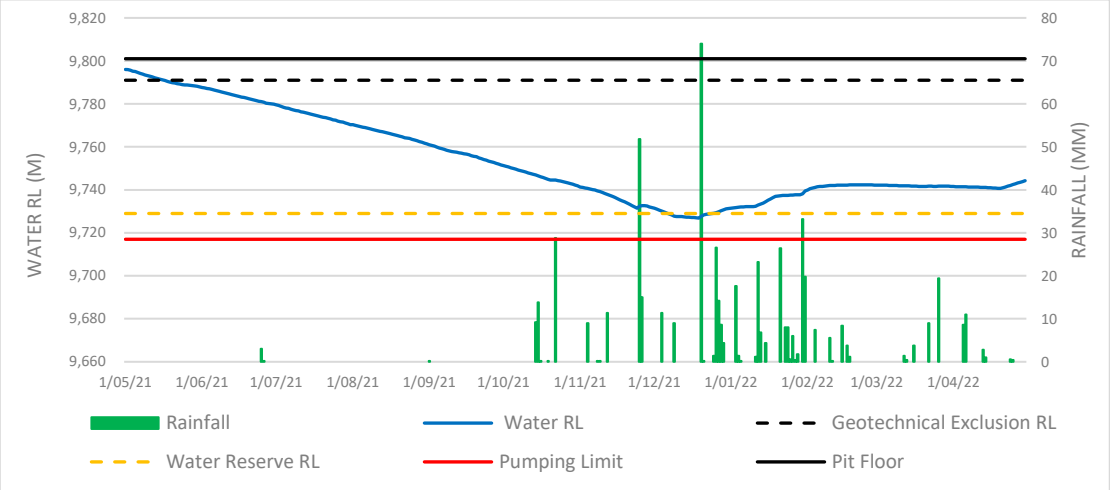


Chart 5: Recorded UG Stored Water Level, May 2021 – April 2022

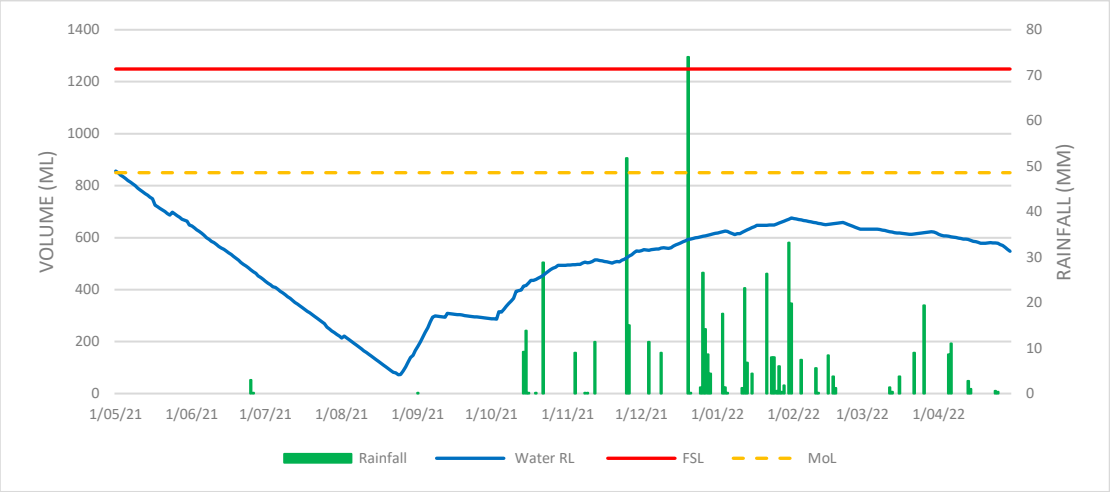


Chart 6: SPROD Stored Volume and Water Treatment Lime Consumption, May 2021 – April 2022

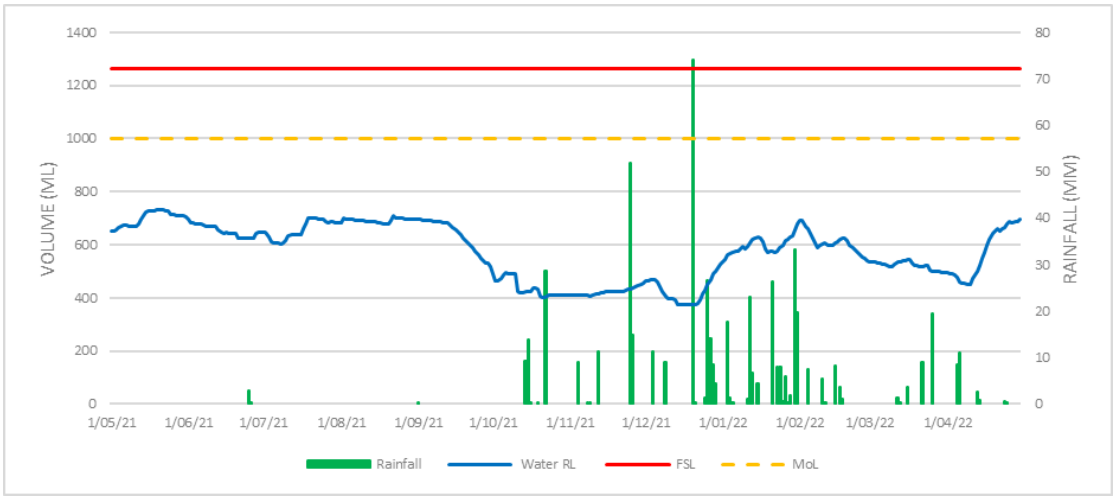


Chart 7: WPROD Stored Volume, May 2021 – April 2022

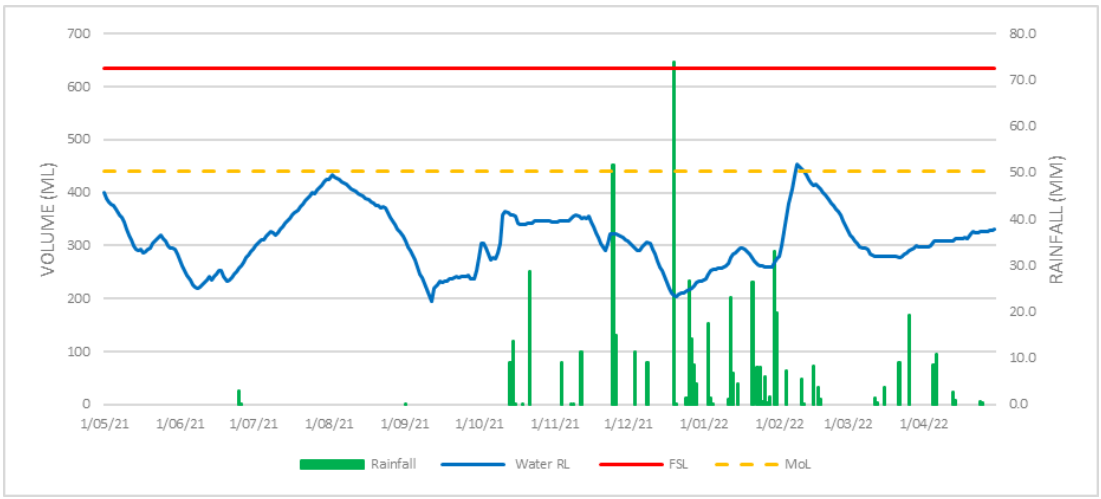


Chart 8: SEPROD Stored Volume, May 2021 – April 2022

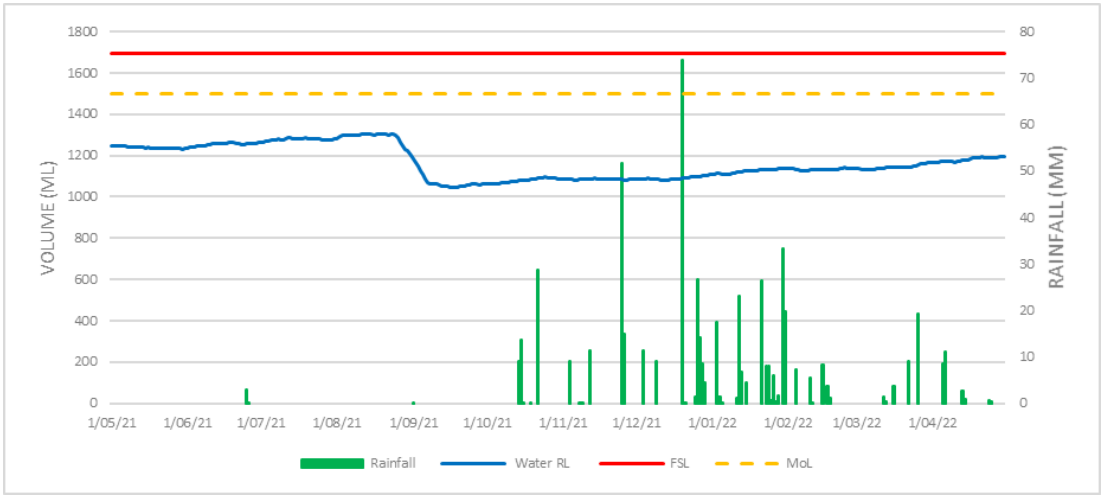


Chart 9: EPROD Stored Volume, May 2021 – April 2022

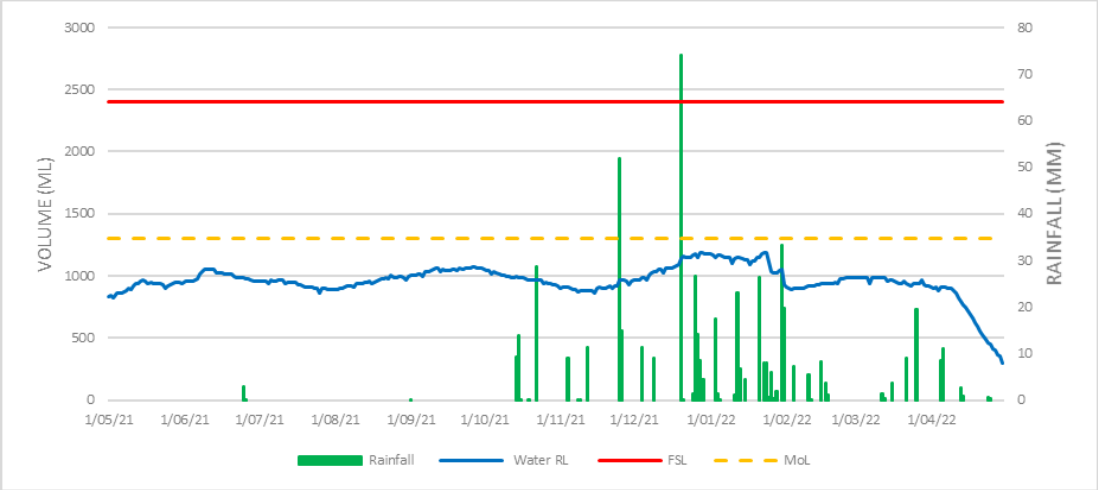


Chart 10: WMD Stored Volume, May 2021 – April 2022

TABLE 12: SITE WATER INVENTORY AT 30 APRIL 2022

Storage Name	Full Supply Level Volume (ML)	Stored Volume on 30 April 2022 (ML)
Open Pit and Mill		
Mill Anti-Pollution Pond	23	2
Mill CRP	27	26
Open Pit Van-Duncan's Dam (VDD)	26	14
Open Pit Pete's Pond	115	87
Open Pit Lake Archer	25	12
Underground Void and Open Pit (UG&OP)	3,080	1,995
Open Pit Pond 2 (OP P2)	65	44
North Overburden Emplacement Facility		
NOEF South Perimeter Runoff Dam (SPROD)	1,310	604
NOEF SEPROD	634	347
NOEF WPROD	1,263	714
NOEF SEL1	343	0
NOEF CW Alpha Sump (CWAS)	26	0
NOEF CW Charlie Sediment Trap (CWCST)	9	0
NOEF East Sediment Trap (NOEF EST)	76	50
NOEF EPROD	1,695	1,275
NOEF South West Silt Trap (SWST)	8	<1
NOEF West D Sump (WDS)	38	<1
NOEF East Drain Sump (EDS)	97	<1
Tailings Storage Facility		
TSF Cell 1	250 – 300	50
TSF Cell 2	– 1,200 – 1,400	50
TSF Mini Dam	94	0
TSF WMD	2,400	301

4.1.2 Water Treatment

4.1.2.1 Hydrated Lime

Following the previous successful mine water treatment practices using hydrated lime, pH circumneutral water from the underground void was transferred to the SEPROD facility for water treatment over the reporting period. Treatment occurred via the application of a hydrated lime slurry using a lime mixing plant. The general treatment methodology involves the continuous input of mine-affected water in conjunction with a lime slurry with an ongoing extraction of treated water from the dam. During the operational period, 1,978 ML of mine water was treated in SEPROD and a total of 629.7 t of hydrated lime was used.

Water being transferred from SEPROD is monitored to ensure that adequate treatment has occurred and that the water quality and class are suitable for offsite managed release.

Water treatment aims to improve the water quality to a Class 4 status for storage in the WMD or other suitable structures for subsequent release in accordance with the WDL. Filtered zinc is typically the limiting analyte of concern in the Mine-affected waters. A pH of 8.7 is targeted during treatment with hydrated lime, which effectively precipitates the majority of zinc from solution. The target zinc concentration is <1,000 micrograms per litre (µg/L), as this allows discharge using existing infrastructure at typical McArthur River wet season flows. The Class 4 maximum allowable zinc concentration is 3,134 µg/L.

In addition to SEPROD, hydrated lime was also used in the SPROD to treat the PbOx water inflows. In the reporting period, approximately 512 ML of PbOx water was directed to SPROD, and 556.4 t of lime were used for treatment. SPROD water was not dewatered to another storage or released offsite following lime treatment.

4.1.2.2 Water Treatment Plant

The reverse osmosis water treatment plan was not operated over the reporting period. Operation of the facility is contingent on repairs to the ultrafiltration and membrane system and is not expected to occur prior to March 2023.

4.1.2.3 Artificial Water Quality

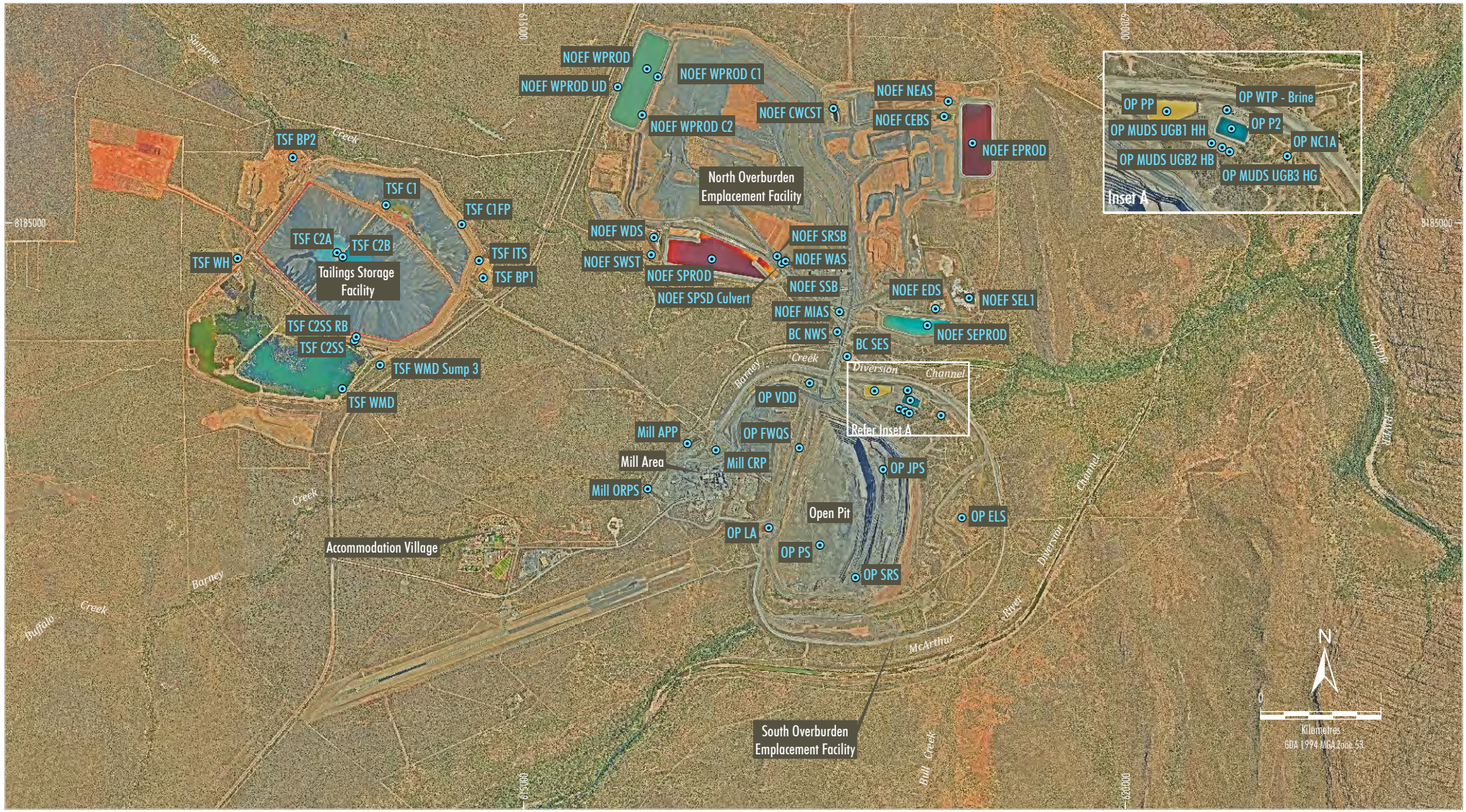
Monitoring results for the artificial surface water sites at the Mine were reviewed by WRM (2022). A summary of water quality of artificial waters at the NOEF, Open Pit and Metallurgy domains over the reporting period is presented in Appendix Q.

In relation to the acidic water inventory, the majority of ASW sites had a neutral pH during the reporting period except for seven sites where median water pH levels were less than 5. These storages were:

- NOEF SPROD – median pH of 3.0;
- NOEF EPROD – median pH of 2.4;
- NOEF WAS – median pH of 3.7;
- NOEF WDS – median pH 3.0;
- OP East Levee Storage – median pH of 4.9; and
- OP Lake Archer – median pH of 3.2.

Except for the Open Pit East Levee Storage (OP ELS), low pH water in the above storages was likely attributed to PbOx water inflows and NOEF seepage. The OP ELS median pH was only represented by a single sample and may have been anomalous.

Over the reporting period, there was no spillway overflow to the receiving environment reported from any of the major water storages at the Mine, including from the seven low pH storages listed above.



MRM-16-01_EMR22_229C

LEGEND

- Artificial Surface Water Site

Source: *Orthophoto MRM (2021); Department of Environment and Natural Resources (2016); MRM (2022)*

McARTHUR RIVER MINE

Artificial Surface Water Monitoring Sites

Figure 25

4.1.3 Managed Water Release

Table 13 presents the releases from the Mine Levee Discharge Point(s) (MLDP) and the Water Management Dam Release Point (WMD RP) to the McArthur River between 1 May 2021 and 30 April 2022. A total of approximately 307 ML was released from the authorised discharge and release points during the reporting period. This included approximately:

- 107 ML via the MLDP (from WMD); and
- 200 ML via the WMD RP (from the WMD siphons).

Managed releases from the MLDP were undertaken in accordance with conditions of WDL 174. Managed releases from the WMD RP were undertaken in accordance with conditions of MRM's VOA 0059.

TABLE 13: MANAGED RELEASE VOLUMES FOR THE 2021-22 REPORTING PERIOD

Discharge event ID	Managed Release Point	Location Site ID	Release Start Date / Time	Release Finish Date / Time	Average Release flow rate (L/s)	Duration (hr)	Total Release (ML)
1	MLDP	WMD	25/01/2022 13:30	27/01/2022 17:00	220	51.50	40.79
2	WMD RP	WMD	25/01/2022 17:30	27/01/2022 6:30	850	37.00	113.22
3	MLDP	WMD	30/01/2022 10:30	02/02/2022 17:49	230	79.32	65.87
4	WMD RP	WMD	30/01/2022 13:00	31/01/2022 17:30	850	28.50	87.21

During the period of managed release, three potential non-compliance events were recorded for filtered aluminium at the SW11 compliance point. However, the potential non-compliances were investigated by MRM and communicated to the NT Department of Environment, Parks and Water Security (DEPWS), and none were found to be related to the Mine's operations, including any managed release activities.

WRM (2022) concluded the following in regard to water quality exceedances recorded during periods of managed release:

> "*Based on a review of monitoring data for the reporting period, WRM supports the conclusions presented within each of the associated investigation reports including that the potential non-compliances were unrelated to managed release activities.*"

Additionally, there was one site-specific trigger value (SSTV) exceedance of filtered iron and three exceedances of dissolved oxygen (DO) at SW11 during managed releases. These exceedances did not trigger the requirement to undertake an investigation in accordance with Conditions 39 and 40 of the WDL.

4.1.3.1 Managed Release Loads

Analyte loads related to managed release from the Mine have been estimated for the period between 1 May 2021 and 30 April, 2022 (Table 14). The relative contribution of loads from managed release compared to loads estimated in the McArthur River at the SW21 upstream control site and in the Glyde River at SW09 control site, are also presented in Table 14. The data shows that increases in estimated analyte loads due to managed releases from the Mine were generally less than 10% except for sulphate, total dissolved solids (TDS), manganese (filtered) and thallium (total and filtered). The notable increases in these analytes were mainly due to managed releases via the MLDP and WMD RP.

Based on the estimated managed release loads (WRM, 2022), the total zinc and lead loads released during the 2021/22 reporting period were less than 90% of the annual defined limit (the 2017/18 managed release loads). Hence, the analyte loads TARP remained in Level 1 for the duration of the 2021/22 reporting period. MRM has met the Level 1 monitoring and reporting requirements of the analyte loads TARP.

TABLE 14: MANAGED RELEASE LOADS AND CONTRIBUTION RELATIVE TO MCARTHUR RIVER BACKGROUND LOADS FOR THE 2021-22 REPORTING PERIOD

Parameters	Pre-mine (SW21+SW09)	Managed releases from the Mine	Percentage increase
Total Flow (ML)	125,211	307	0.25%
Aluminium_F (kg)	23,667	1.9	0.01%
Aluminium_T (kg)	1,930,462	61	0.00%
Arsenic_F (kg)	91	1.41	1.54%
Arsenic_T (kg)	423	1.89	0.45%
Boron_F (kg)	2,018	132	6.54%
Boron_T (kg)	2,826	169	5.97%
Cadmium_F (kg)	25	0.06	0.25%
Cadmium_T (kg)	25	0.07	0.27%
Cobalt_F (kg)	125	0.31	0.25%
Cobalt_T (kg)	588	0.48	0.08%
Copper_F (kg)	125	0.31	0.25%
Copper_T (kg)	1,093	0.31	0.03%
Iron_F (kg)	29,328	6	0.02%
Iron_T (kg)	1,674,084	92	0.01%
Lead_F (kg)	63	0.15	0.24%
Lead_T (kg)	890	1.01	0.11%
Manganese_F (kg)	468	225	48.12%
Manganese_T (kg)	21,903	305	1.39%
Mercury_F (kg)	1	0.00	0.23%
Mercury_T (kg)	6	0.02	0.24%
Nickel_F (kg)	125	0.61	0.49%
Nickel_T (kg)	1,213	0.79	0.06%
Thallium_F (kg)	13	7.1	52.91%
Thallium_T (kg)	29	7.7	27.13%
Zinc_F (kg)	260	1.8	0.70%
Zinc_T (kg)	3,359	6.4	0.19%
Sulphate_F (tonnes)	185	2,798	1508.95%
Nitrate (kg)	52,341	86	0.16%
Total Dissolved Solids (tonnes)	14,292	4,491	31.42%
Total Suspended Solids (tonnes)	40,782	9	0.02%

The managed release loads estimated for the 2021-22, 2020-21, 2019-20 and 2018-19 periods for total zinc and total lead were compared to the managed release loads estimated for the baseline 2017-18 period (Chart 11). It should be noted that the 2021-22, 2020-21, 2019-20 and 2018-19 reporting periods were from May to April, whereas the 2017-18 reporting period was from July to June.

The 2021-22 reporting period managed release loads for total zinc and total lead were 6.4 kg and 1.01 kg respectively. The loads were considerably less than those released over the baseline period of 2017-18 (Chart 11).

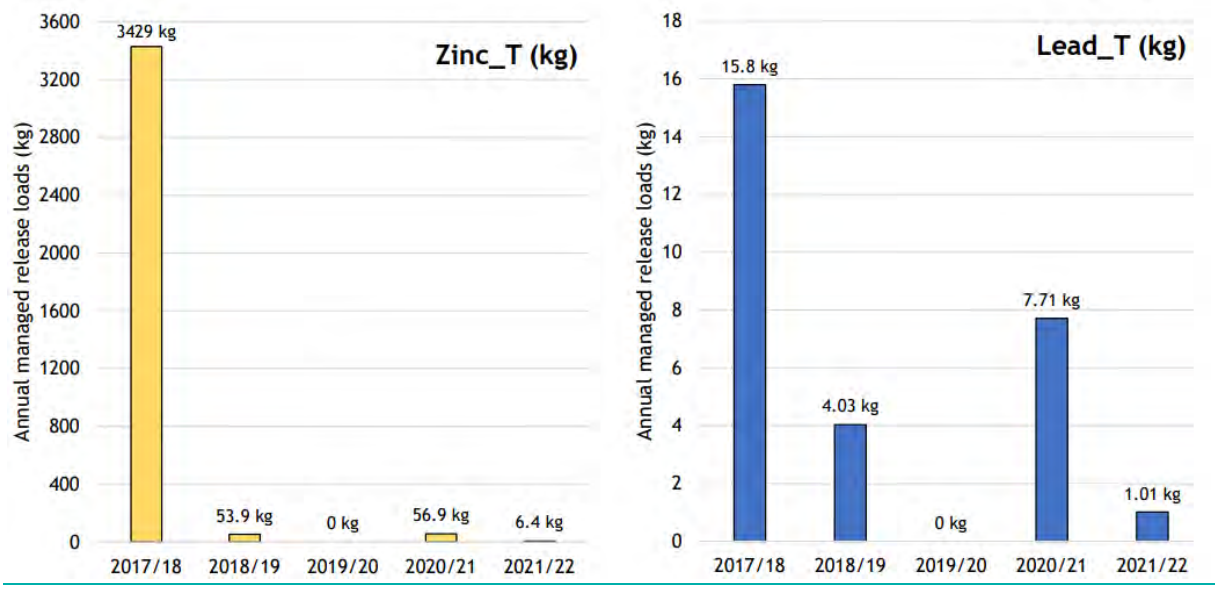


Chart 11: Managed Release Loads of total Zinc and Lead for the Reporting Period

4.1.4 BBLF Site Water Inventory and Artificial Surface Water

The SILO data drill rainfall dataset for the BBLF (132 years) indicates that the long-term average annual rainfall is approximately 892 mm. Approximately 580 mm of rainfall was recorded at the BBLF gauge (14729) over the reporting period which is lower than the long-term annual average.

Table 15 provides a summary of the BBLF site inventory for key existing water storages as at 30 April 2022. The Water Management Infrastructure for BBLF is shown on Plate 9.

TABLE 15: BBLF SITE WATER INVENTORY AT 30 APRIL 2022

Storage Name	Storage Capacity (ML)	Stored Volume on 30 April 2022 (ML)
SRP1	28	7.9
SRP2	31	9.0
SRP3	18	1.5

Artificial surface water quality data was collected at three locations at BBLF (SRP1, SRP2 and SRP3) over the reporting period. The monitoring data was provided to DITT on an ongoing quarterly basis.

4.2 Surface Water Quality

TARP Level 1 | TARP Level 2

MRM operates an extensive surface water monitoring program at the Mine and BBLF. A summary of the surface water monitoring data for the reporting period, and comparison against historic data for the period 2008 to 2022, has been undertaken by WRM (2022). All surface water quality data collected by MRM is also provided to DITT on an ongoing quarterly basis.

The *Groundwater Monitoring Annual Report 2021-22* and *Surface Water Monitoring Report* (WRM, 2022) are provided in Appendices R (KCB, 2022) and Q (WRM. 2021), respectively.

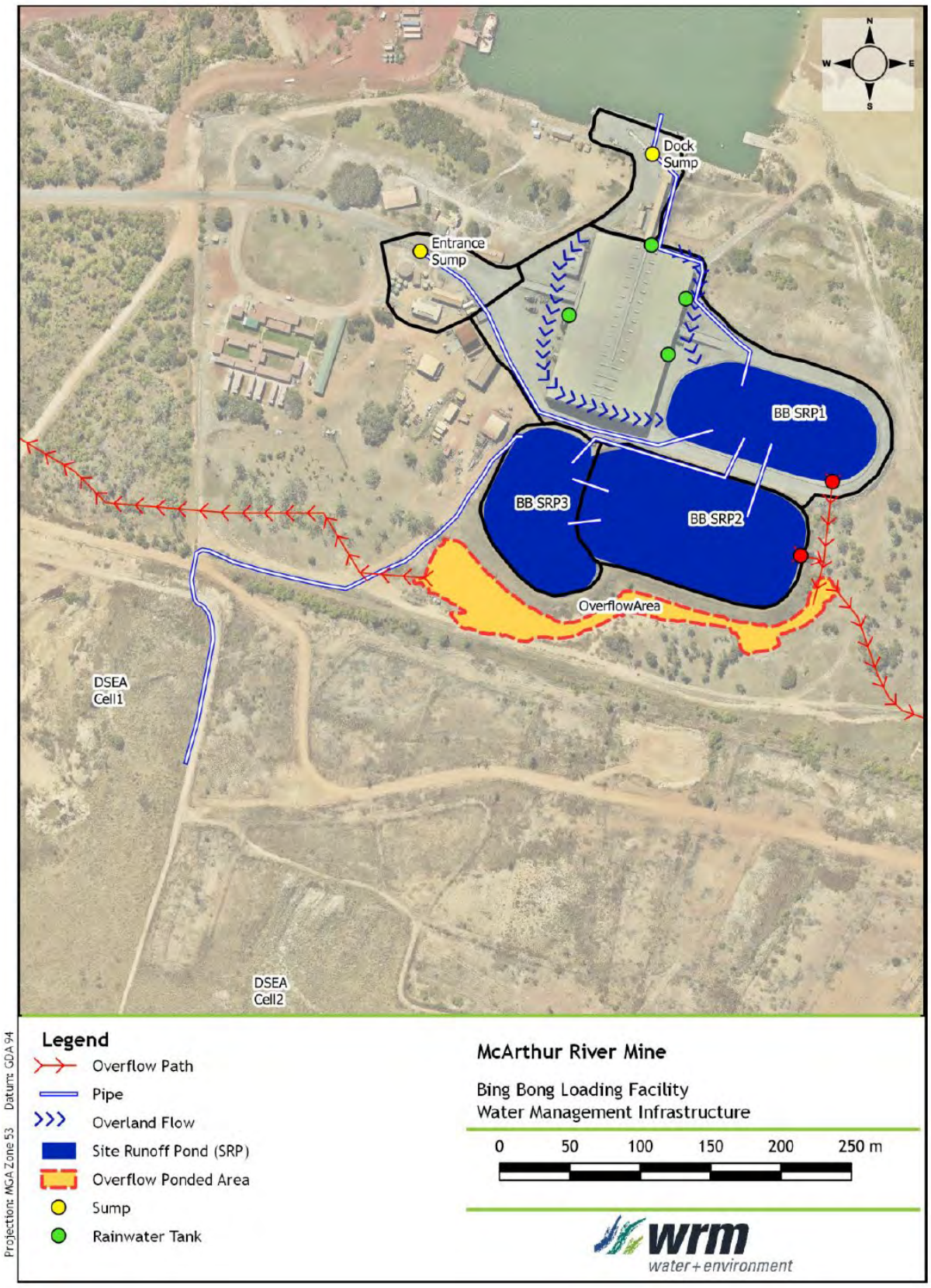


Plate 9: 2021-22 BBLF Water Management Infrastructure

4.2.1 Monitoring Program Overview

The objectives of the surface water monitoring program are to:

- characterise water quality at monitoring sites upstream and downstream of mine operations;
- assess the potential impacts on the receiving waters from mine operations;
- assess the measured surface water quality against SSTVs to verify compliance;
- identify the potential sources of contamination measured at water monitoring sites; and
- assess the efficacy of controls implemented by MRM.

4.2.1.1 Monitoring Sites

The surface water monitoring network consists of 33 monitoring locations (Table 16) along the McArthur River, Barney Creek, Surprise Creek, Emu Creek and Glyde River, as well as one monitoring location at the BBLF (Figures 26 and 27). The methodology and site selection are outlined further in the Mine's Water Management Plan (MRM 2022).

Upstream control/reference sites (i.e. sites that monitor background concentrations) and downstream sites are located along local creeks around the Mine and the McArthur River, as well as a control/reference site located on the Glyde River (tributary of the McArthur River removed from potential mine influence). The monitoring site at the BBLF is located at the authorised discharge point (BBDDP) where the BBLF perimeter drain discharges to the Gulf of Carpentaria marine waters.

4.2.1.2 Data Collection

Over the reporting period, water quality data from the monitoring points at the Mine were generally collected on a weekly basis, with some additional monitoring undertaken during discharge events. Continuous monitoring is also undertaken for select field parameters at some sites.

4.2.1.3 Site Conditions over the Reporting Period

Climatic conditions are known to significantly influence the natural environment in the vicinity of the Mine and the BBLF, in particular the McArthur River and its tributaries.

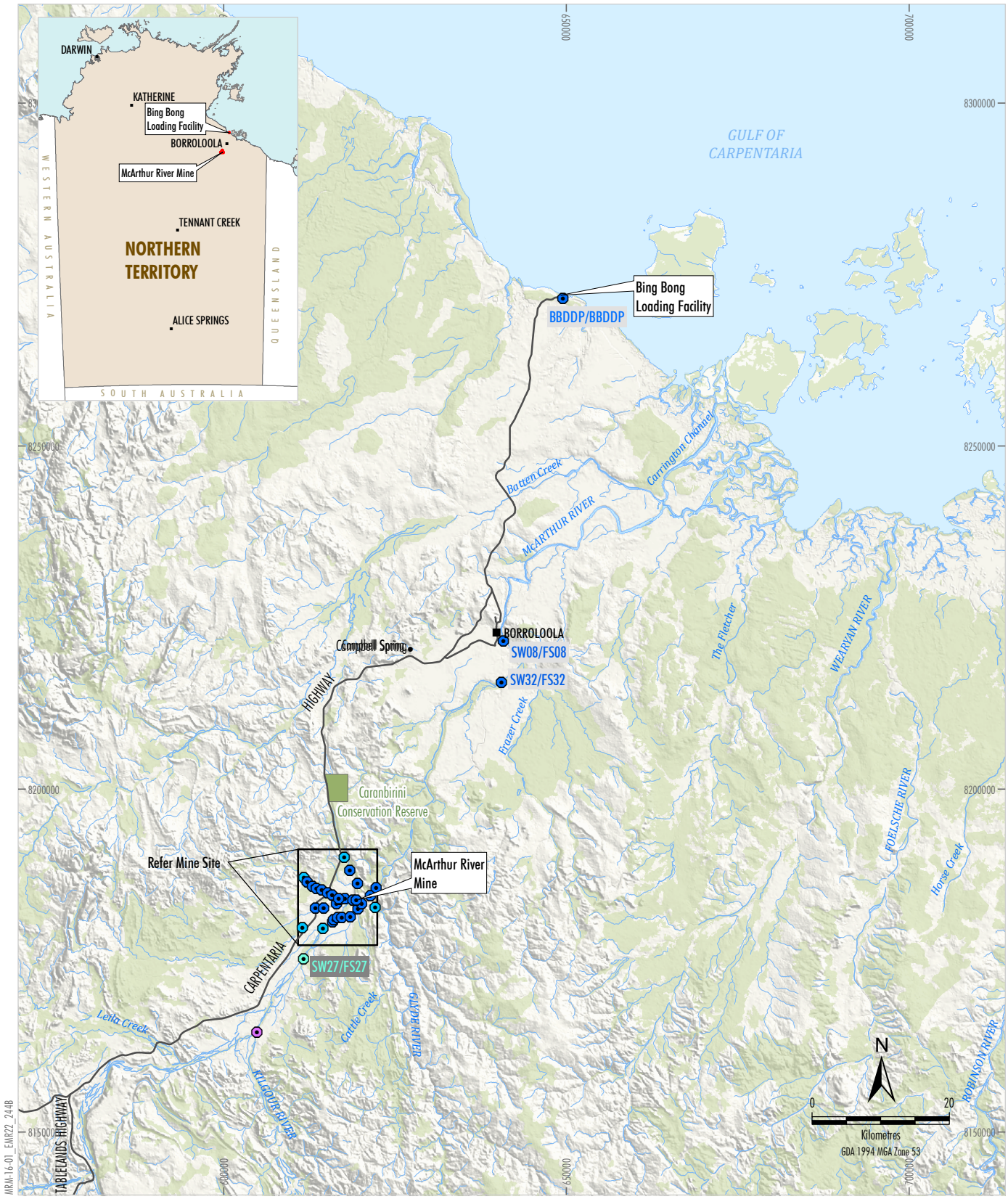
Rainfall at the Mine was approximately 537 mm for the reporting period, which was notably lower than the long-term average of 715 mm. Most of the rainfall occurred over the wet season months between November and April, with the McArthur River ceasing to flow at the SW11 compliance point between September and November 2021, as well as for two weeks in December 2021, and in April 2022 at the early commencement of the 2022 dry season.

During the 2021/22 reporting period, weekly monitoring was attempted at each of the upstream control locations and the most downstream monitoring locations on Surprise, Barney and Emu creeks, on a combined total of 314 occasions. However, due to the low rainfall experienced at the Mine during the reporting period, most of these monitoring sites were under cease-to-flow conditions for the majority of these occasions. This resulted in a combined total of only 10 flow samples being taken at these locations during the 2021/22 reporting period.

Rainfall at the BBLF was approximately 580 mm for the reporting period, which is much lower than the long-term average of 892 mm. As a result of the dry conditions, no flow or passive discharge was observed at the BBDDP monitoring location over the 2021-22 reporting period.

TABLE 16: SURFACE WATER MONITORING PROGRAM OVERVIEW

Catchment	Monitoring Location	Site Type	Location Description
McArthur River	SW27	Upstream	McArthur River, crossing to Merlin Diamond Mine
	SW21	Control	McArthur River, between Merlin crossing and Wurrini Waterhole
	SW10	Potential Impact	McArthur River, Wurrini Waterhole
	SW07	Potential Impact	McArthur River, Djirrinmini Waterhole
	SW13	Potential Impact	McArthur River Diversion Channel, upstream of the crossing
	SW14	Potential Impact	McArthur River Diversion Channel, adjacent viewing platform
	SW15	Potential Impact	McArthur River Diversion Channel, upstream of Bull Creek
	SW16	Potential Impact	McArthur River Diversion Channel, adjacent power line crossing
	SW17	Potential Impact	McArthur River Diversion Channel, upstream of the confluence with Barney Creek
	SW12	Potential Impact	McArthur River, downstream of Barney Creek and Emu Creek and upstream of the Glyde River
	SW11	Potential Impact	McArthur River, 900 m north of the boundary of MLN1122
	SW32	Potential Impact	McArthur River, 6 km upstream of the Burketown causeway
	SW08	Potential Impact	McArthur River, Burketown causeway at Borroloola, 60 km downstream from mine site
Barney Creek	SW28	Control	Barney Creek, south-west of site, adjacent to the Carpentaria Highway
	SW04	Potential Impact	Barney Creek, upstream of the Carpentaria Highway bridge
	SW22	Potential Impact	Barney Creek, adjacent MRM camp
	SW03	Potential Impact	Barney Creek, upstream of causeway
	SW18	Potential Impact	Barney Creek Diversion Channel, downstream of Surprise Creek
	SW19	Potential Impact	Barney Creek Diversion Channel, downstream of Haul Road bridge
	SW20	Potential Impact	Barney Creek Diversion Channel, lower reach
	SW06	Potential Impact	Barney Creek, south of Barramundi Dreaming, in the old McArthur River
Surprise Creek	SW29	Control	Surprise Creek, upstream of Tailings Storage Facility
	SW23	Potential Impact	Surprise Creek, upstream of Tailings Storage Facility
	SW01	Potential Impact	Surprise Creek, upstream of crossing
	SW36	Potential Impact	Surprise Creek, adjacent northwest side of Cell 1
	SW33	Potential Impact	Surprise Creek, adjacent Cell 1, at old Surprise Creek pump station
	SW02	Potential Impact	Surprise Creek, downstream of Carpentaria Highway bridge
	SW34	Potential Impact	Surprise Creek, south of the NOEF
	SW24	Potential Impact	Surprise Creek, upstream of confluence with Barney Creek Diversion Channel
Emu Creek	SW30	Control	Emu Creek, north of site, adjacent the Carpentaria Highway
	SW31	Potential Impact	Emu Creek, along cattle exclusion boundary fence.
	SW26	Potential Impact	Emu Creek, upstream of crossing
Glyde River	SW09	Control	Glyde River, upstream of confluence with the McArthur River
Bing Bong	BBDDP	Potential Impact	Bing Bong dredge discharge point



LEGEND

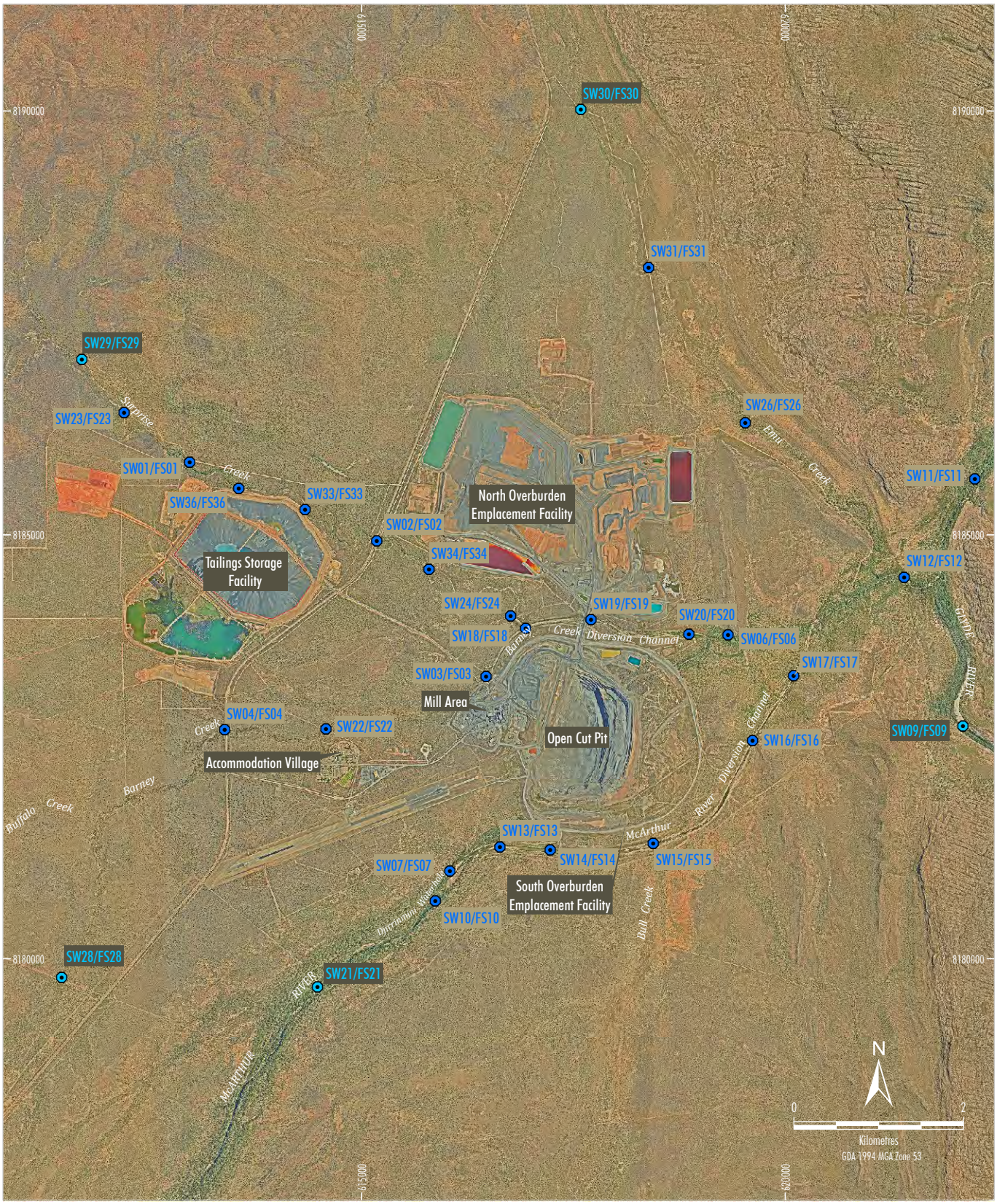
- Major Road
- River/Creek
- Control
- Early Warning Flood Station
- Potential Impact
- Upstream

Source: Geoscience Australia - Topography (2006); Department of Environment and Natural Resources (2016)

McARTHUR RIVER MINE

Regional Surface Water and Fluvial Sediment Monitoring Sites

Figure 26



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LEGEND

- Control
- Potential Impact

Source: Orthophoto MRM (2021); Department of Environment and Natural Resources (2016); MRM (2022)

McARTHUR RIVER MINE

Local Surface Water and Fluvial Sediment Monitoring Sites

Figure 27

4.2.1.4 WDL Site-specific Trigger Values

MRM operated under WDL 174-12 from 25 May 2021 to 9 March 2022. Following a requested amendment of the WDL conditions, MRM operated under WDL 174-13 from 10 March 2022 until the end of the reporting period (30 April 2022). The SSTVs for the compliance monitoring points at the Mine (SW11) and BBLF (BBDDP) as outlined in WDL 174-12 and 174-13, are provided in Table 17.

The SSTV sources are referenced in WDL 174-13, which is available from the public register at:

> https://ntepa.nt.gov.au/your-business/public-registers/licences-and-approvals-register/waste-discharge-licences

Data collected at other natural surface water monitoring sites is generally consistent with the parameters for which there are SSTVs at SW11, so that background and mine-influenced concentrations can be considered, and trends identified. Additional parameters are also monitored as conditioned in the WDL and VOA.

TABLE 17: WDL 174-12 AND WDL 174-13 SITE-SPECIFIC TRIGGER VALUES FOR SW11 AND BBDDP

Parameter	Abbreviation	Units	Analysis	SW11 SSTVs 174-12	SW11 SSTVs 174-13	BBDDP 174-12/3
Field Measurements						
pH	pH	pH Units	In situ	6.0-8.5	6.0-8.5	8.0-8.4
Electrical Conductivity	EC	µS/cm		1,000	1,000	-
Dissolved Oxygen	DO	% saturation		85-120	85-120	-
Metals and Metalloids						
Aluminium	Al	µg/L	Filtered (0.45 µg/L)	55	269	0.5
Arsenic	As			24	24	2.3
Cadmium	Cd			1.73	1.73	5.5
Cobalt	Co			-	1.4	-
Copper	Cu			10.97	9	1.3
Iron	Fe			300	347	
Lead	Pb			16.6	17	4.4
Manganese	Mn			1,900	1,900	80
Mercury	Hg			0.6	-	0.4
Nickel	Ni			11	11	70
Thallium	Tl			-	58	-
Zinc	Zn			62.68	32	15
Total Petroleum Hydrocarbons (TPH)						
TPH Fraction $C_6 – C_9$	N/A	µg/L		-	-	-
Benzene	N/A			950	10	500
TPH Fraction $C_{10} – C_{36}$	N/A			600	600	600
Other						
Sulphate	SO_4	mg/L	-	341	1,000	-
Nitrate	NO_3	µg/L	-	700	10,600	-

mg/L = milligrams per litre

4.2.2 Changes Made to the Monitoring Program or Techniques during the Reporting Period

Other than updates to the SW11 SSTVs, there were no significant changes made to the surface water monitoring program during the reporting period.

4.2.3 Performance during the Reporting Period

Based on the findings of WRM (2022), comparison of the monitoring results against the objectives of the monitoring program is provided below.

4.2.3.1 Comparison to Site-specific Trigger Values

Over the reporting period, a neutral pH was reported across all the natural surface water monitoring locations, including those located in the onsite tributaries. Sulphate (SO_4) levels were low and recorded less than 200 mg/L across all the McArthur River monitoring locations, including the SW11 compliance point.

Filtered metal concentrations were below the SSTVs at the SW11 compliance point, with the only exceptions found to be derived from natural catchment sources located upstream of the Mine.

No SSTV exceedances at the SW11 compliance point, which triggered investigation, were found to be related to the Mine's operations. Based on a review of the monitoring data for the reporting period, WRM (2022) supported the conclusions presented within each of the associated investigation reports completed by MRM.

4.2.3.2 McArthur River – Monitoring Results

A summary of the performance at the SW11 compliance point against the WDL SSTVs is provided below, with reference to select upstream monitoring sites (including the Glyde River) and historical context where relevant.

4.2.3.2.1 McArthur River – pH

Field pH results from 1 January 2008 to 30 April 2022 are presented in Chart 12. Field pH results from the reporting period are presented in Chart 13.

The plot shows that pH levels have remained fairly consistent over time in the McArthur River and Glyde River. However, it does appear that dry season fluctuations have reduced in recent years, from around the 2015 dry season.

During the reporting period, pH levels were generally consistent with the range of historical values, between 7.0 and 8.5 (pH units), with exception to a measurement taken on 27 March 2022 at SW11. Decreases in pH were observed during the wet season, coinciding with periods of rainfall runoff events.

There was one recorded SSTV exceedance at SW11 during the reporting period of 8.84 (pH units), which occurred in the final sample prior to SW11 ceasing to flow for the reporting period. Monitoring locations on the McArthur River Diversion Channel, such as SW15 and SW16 (8.79 and 8.76 pH units, respectively), and on the main McArthur River channel also recorded elevated pH levels on 27 March 2022. This includes SW27 (8.58 pH units), which is upstream of the influence of the Mine. This suggests that the elevated pH level may have been derived from naturally occurring groundwater baseflow into the surface water system.

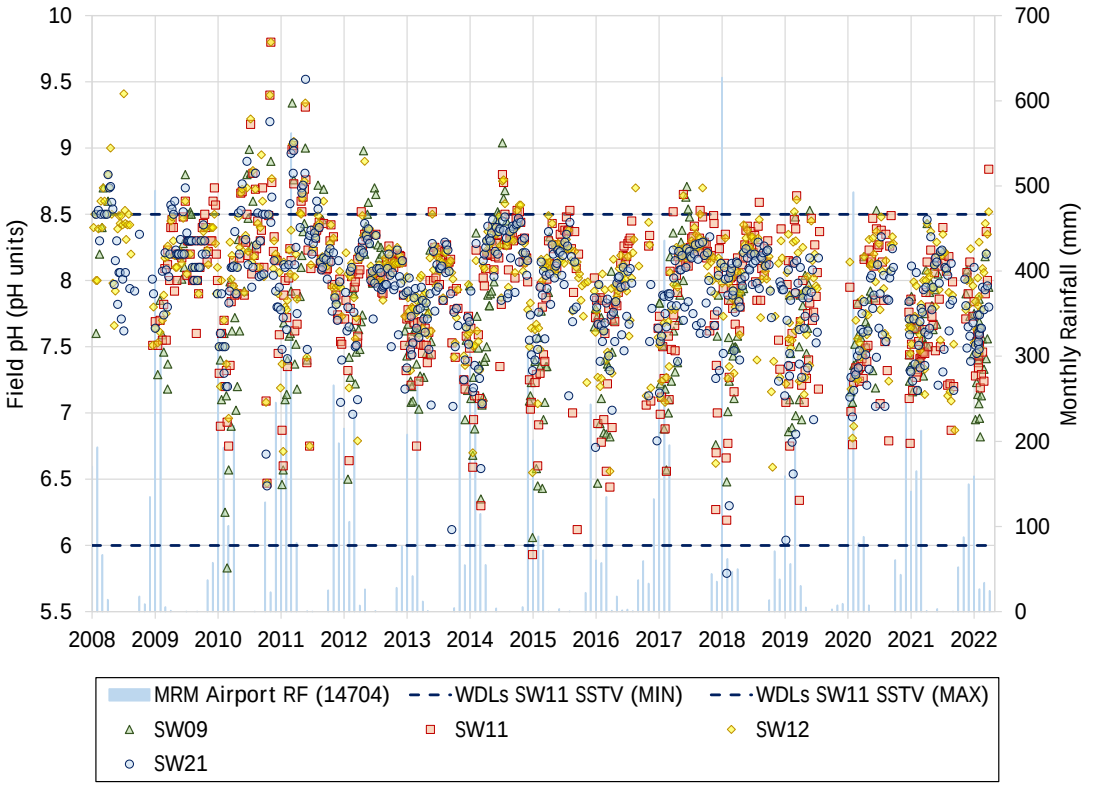


Chart 12: Long Term pH and Monthly Rainfall – McArthur River and Glyde River Monitoring Sites

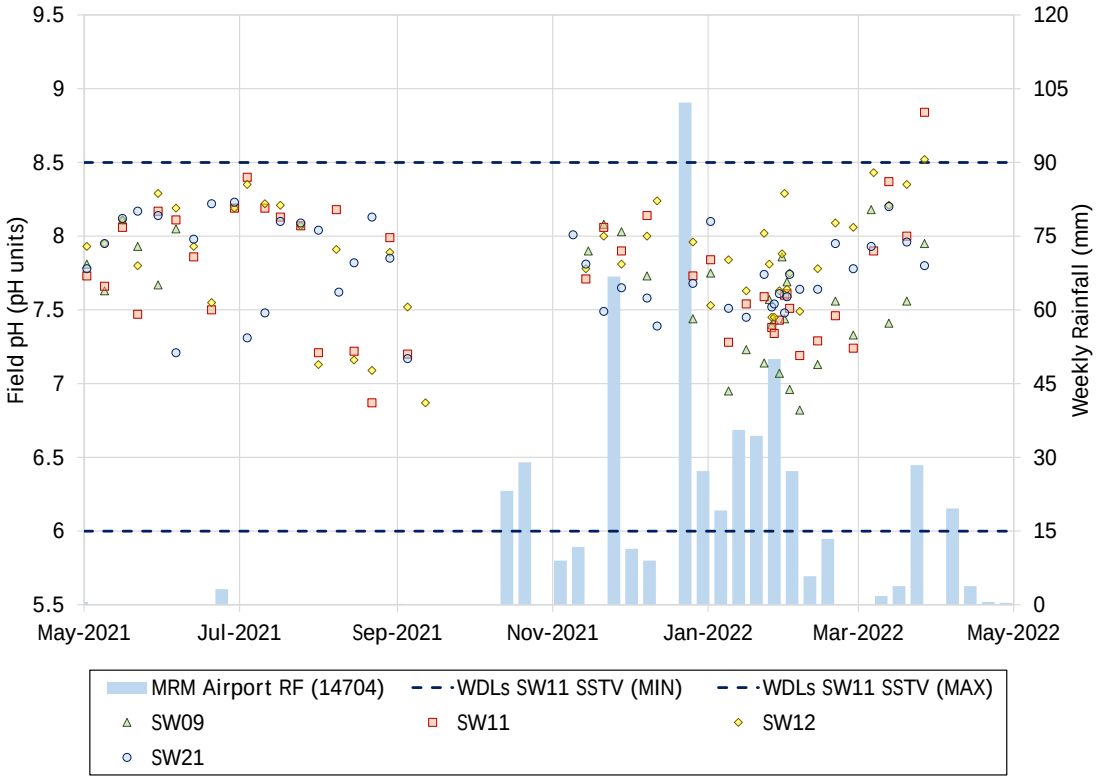


Chart 13: Short Term pH and Weekly Rainfall – McArthur River and Glyde River Monitoring Sites

4.2.3.2.2 McArthur River – Electrical Conductivity

Electrical Conductivity (EC) (laboratory-measured) results from 1 January 2008 to 30 April 2022 are presented in Chart 14. EC results from the reporting period are presented in Chart 15.

Historically, EC levels in McArthur River and Glyde River follow a cyclic trend. That is, EC levels sharply increase during the dry season due to increased evaporation, reduced flow volumes and a higher contribution from groundwater expressing as surface water baseflow. This is followed by rapid decreases in EC during the wet season due to the dilution provided by rainfall events. It should also be noted that the EC in the Glyde River is notably lower than the McArthur River. The EC levels in the in the McArthur River, upstream of the Mine (SW21) are generally similar to the EC downstream of the Mine (SW12 and SW11), with the exception of the 2013, 2014 and 2015 dry seasons.

During the reporting period, EC levels were generally consistent with the range of historical values. During the 2021 dry season, the EC levels at the upstream control location SW21 did not exceed the SSTV as they had during the previous reporting period.

There were no recorded SSTV exceedances for EC at SW11 during the reporting period.

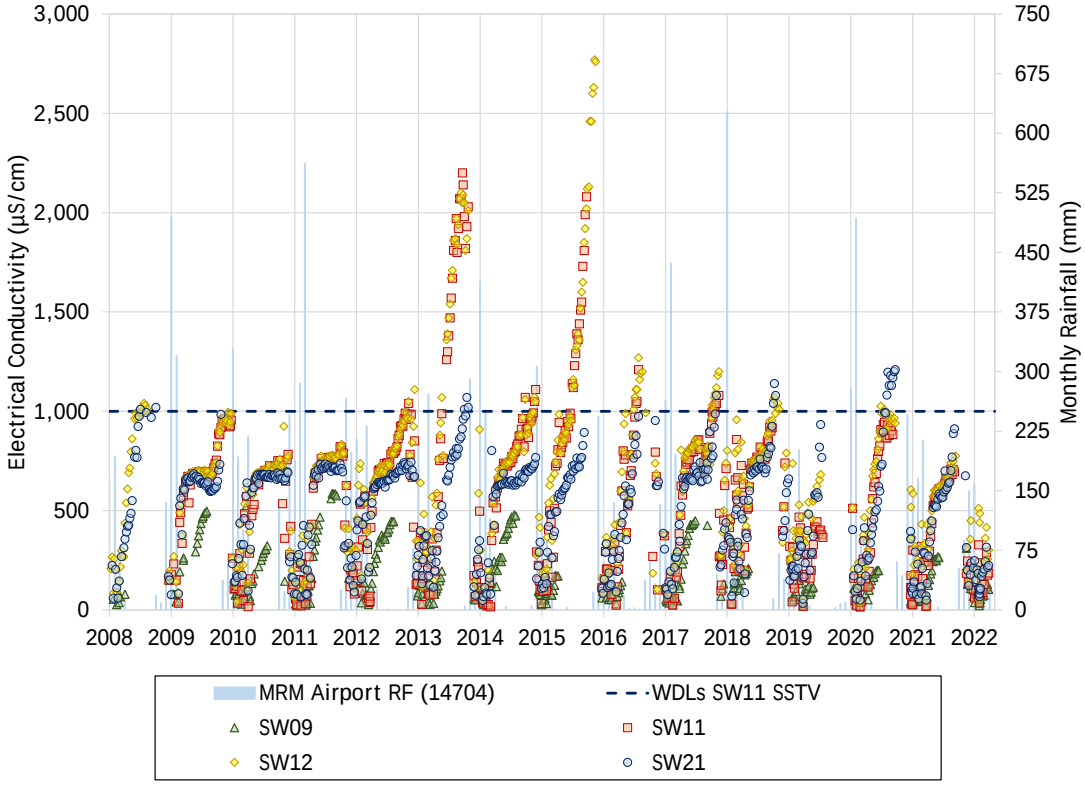


Chart 14: Long Term Electrical Conductivity and Monthly Rainfall – McArthur River and Glyde River Monitoring Sites

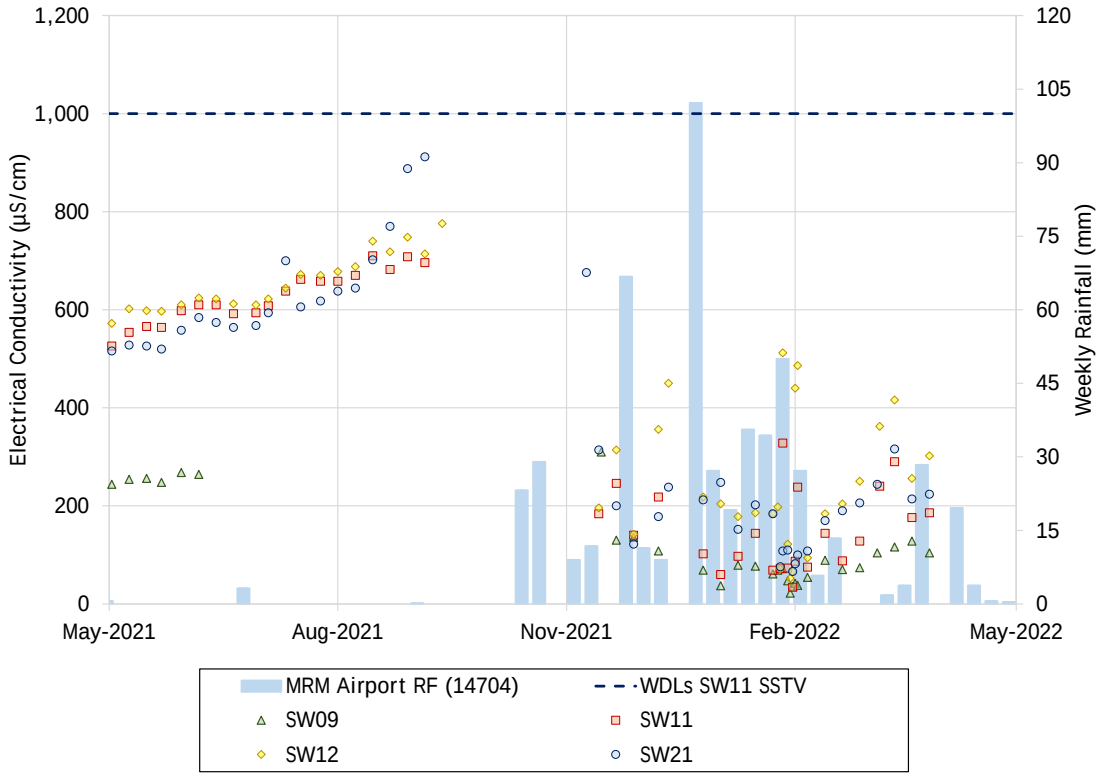


Chart 15: Short Term Electrical Conductivity and Weekly Rainfall – McArthur River and Glyde River Monitoring Sites

4.2.3.2.3 McArthur River – Filtered Lead

Filtered lead measurements from 1 January 2008 to 30 April 2022 are presented in Chart 16. Filtered lead measurements from the reporting period are presented in Chart 17. There were two SSTVs operated under during the reporting period:

- 16.6 µg/L under WDL 174-12 (until 10 March 2022); and
- 17 µg/L under WDL 174-13 (from 10 March 2022).

The long-term data suggests that filtered lead levels are consistently low.

During the reporting period, all measured filtered lead levels were below 1.0 µg/L which is consistent with the historical concentrations.

There were no exceedances of the SSTV for filtered lead at SW11 during the reporting period.

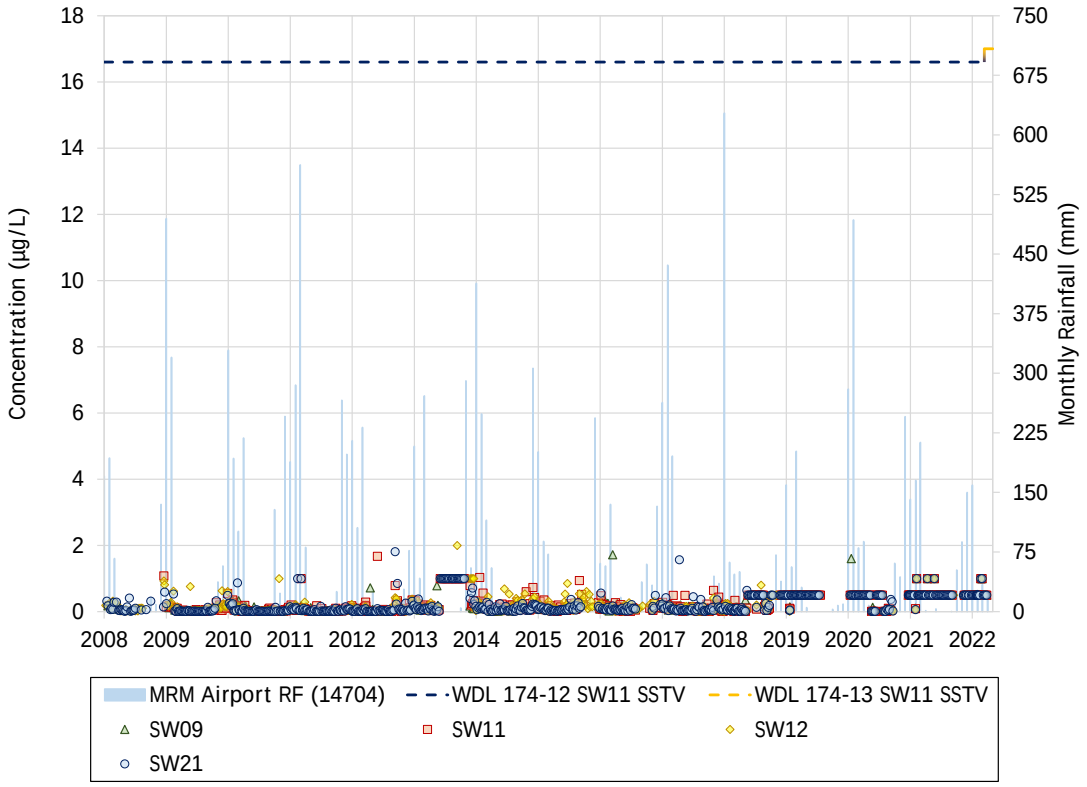


Chart 16: Long Term Filtered Lead and Monthly Rainfall – McArthur River and Glyde River Monitoring Sites

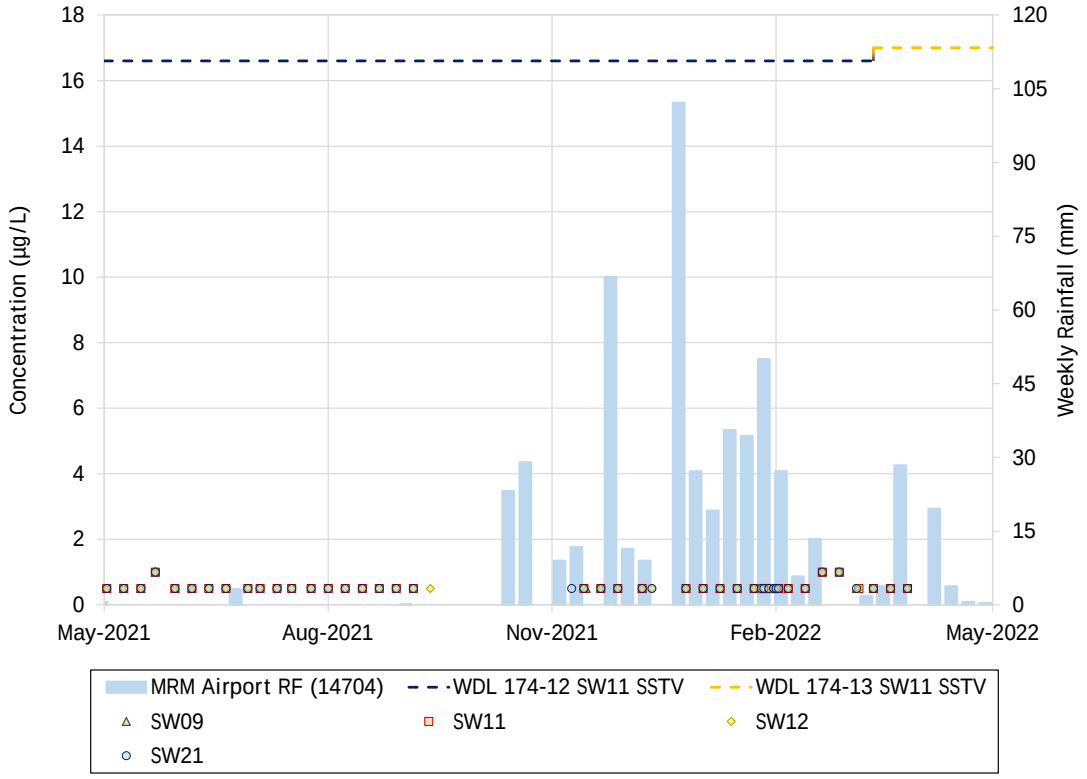


Chart 17: Short Term Filtered Lead and Weekly Rainfall – McArthur River and Glyde River Monitoring Sites

4.2.3.2.4 McArthur River – Filtered Thallium

Filtered thallium measurements from 1 January 2008 to 30 April 2022 are presented in Chart 18. Filtered thallium measurements from the reporting period are presented in Chart 19. Prior to the WDL 174-13, there was no SW11 SSTV for filtered thallium. Beginning on 10 March 2022, an SSTV of 58 µg/L has been implemented for filtered thallium.

The long-term data suggests that filtered thallium levels were consistently low, with the exception of one period in 2017/18 wet season at SW11 and SW12 coinciding with periods of managed releases from the Mine.

During the reporting period, all filtered thallium levels were below 1.0 µg/L, which is consistent with the historical concentrations.

There were no exceedances of the SSTV for filtered thallium at SW11 during the reporting period.

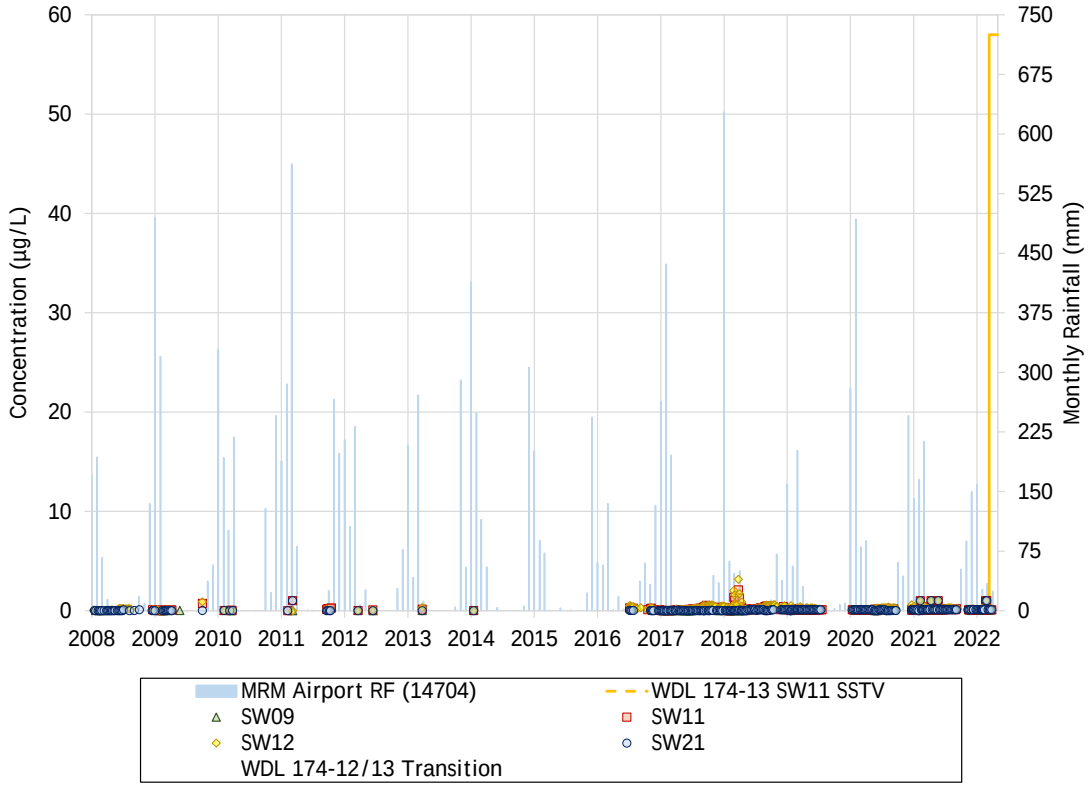


Chart 18: Long Term Filtered Thallium and Monthly Rainfall – McArthur River and Glyde River Monitoring Sites

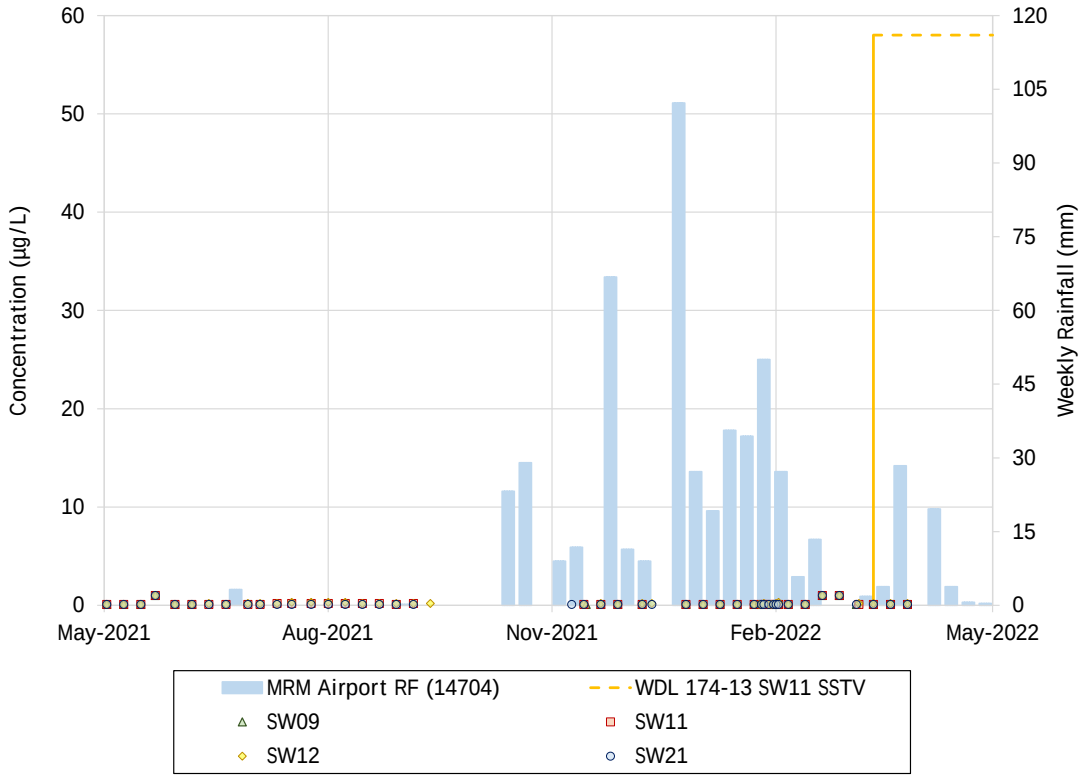


Chart 19: Short Term Filtered Thallium and Weekly Rainfall – McArthur River and Glyde River Monitoring Sites

4.2.3.2.5 McArthur River – Filtered Zinc

Filtered zinc measurements from 1 January 2008 to 30 April 2022 are presented in Chart 20. Filtered zinc measurements from the reporting period are presented in Chart 21. There were two SSTVs operated under during the reporting period:

- 62.68 µg/L under WDL 174-12 (until 10 March 2022); and
- 32 µg/L under WDL 174-13 (from 10 March 2022).

The long-term data suggests that filtered zinc levels were consistently low, with an isolated number of elevated historical values (up to 50 µg/L) downstream of the Mine in the McArthur River (SW11 and SW12).

During the reporting period, filtered zinc levels were at or below 5.0 µg/L, with the exception of a measurement taken on 20 February 2022 (14 µg/L) at SW21 upstream of the Mine. The filtered zinc levels during the reporting period are consistent with the historical trends.

There were no exceedances of the SSTV for filtered zinc at SW11 during the reporting period.

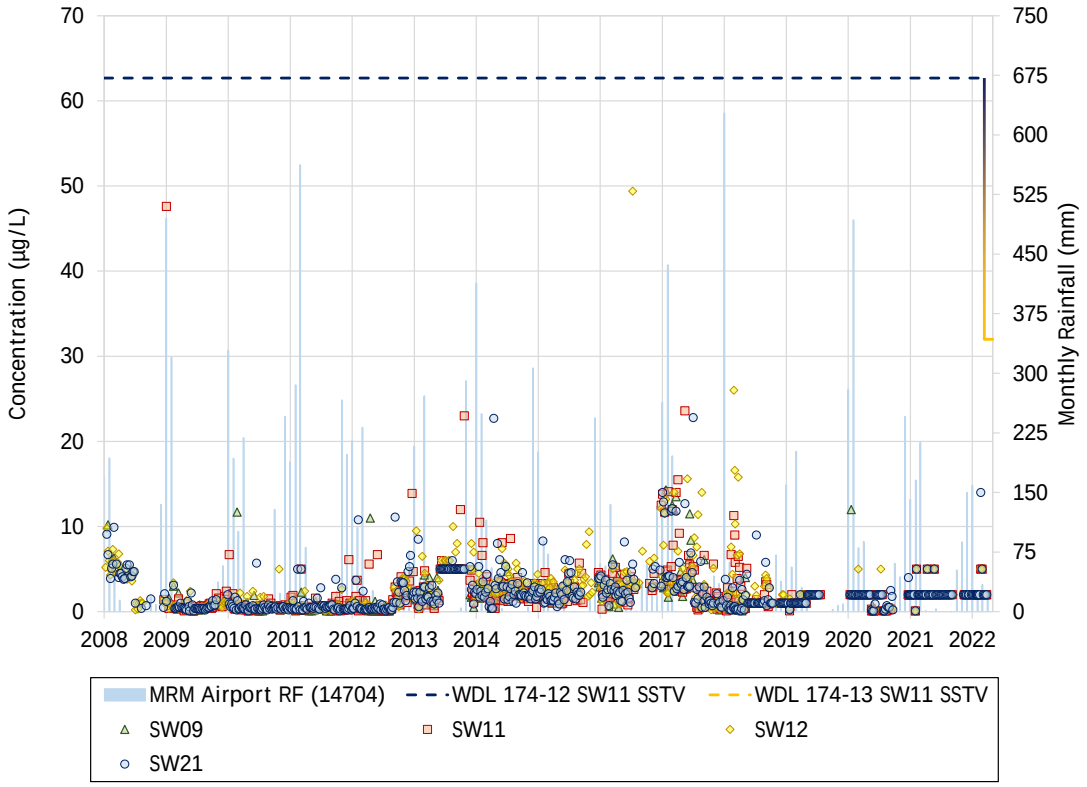


Chart 20: Long Term Filtered Zinc and Monthly Rainfall – McArthur River and Glyde River Monitoring Sites

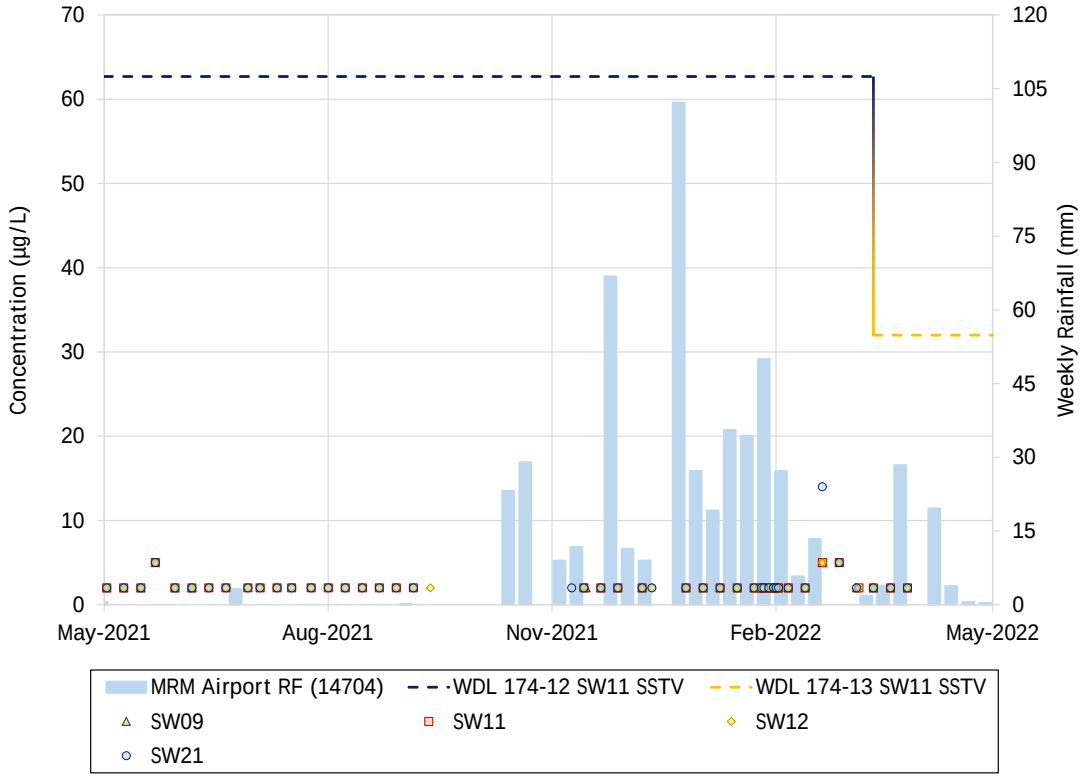


Chart 21: Short Term Filtered Zinc and Weekly Rainfall – McArthur River and Glyde River Monitoring Sites

4.2.3.2.6 McArthur River – Sulphate

Sulphate (SO_4) results from 1 January 2008 to 30 April 2022 are presented in Chart 22. SO_4 results from the reporting period are presented in Chart 23. There were two SSTVs operated under during the reporting period:

- 341 mg/L under WDL 174-12 (until 10 March 2022); and
- 1,000 mg/L under WDL 174-13 (from 10 March 2022).

SO_4 levels show a similar trend to EC levels where values are highest during the dry season and lowest during the wet season.

During the reporting period, SO_4 levels were generally consistent with historical levels. The highest levels during the reporting period were recorded from late January to early February 2022 at SW12 and SW11, coinciding with periods of managed releases from the Mine.

There were no exceedances of the SSTV for SO_4 at SW11 during the reporting period.

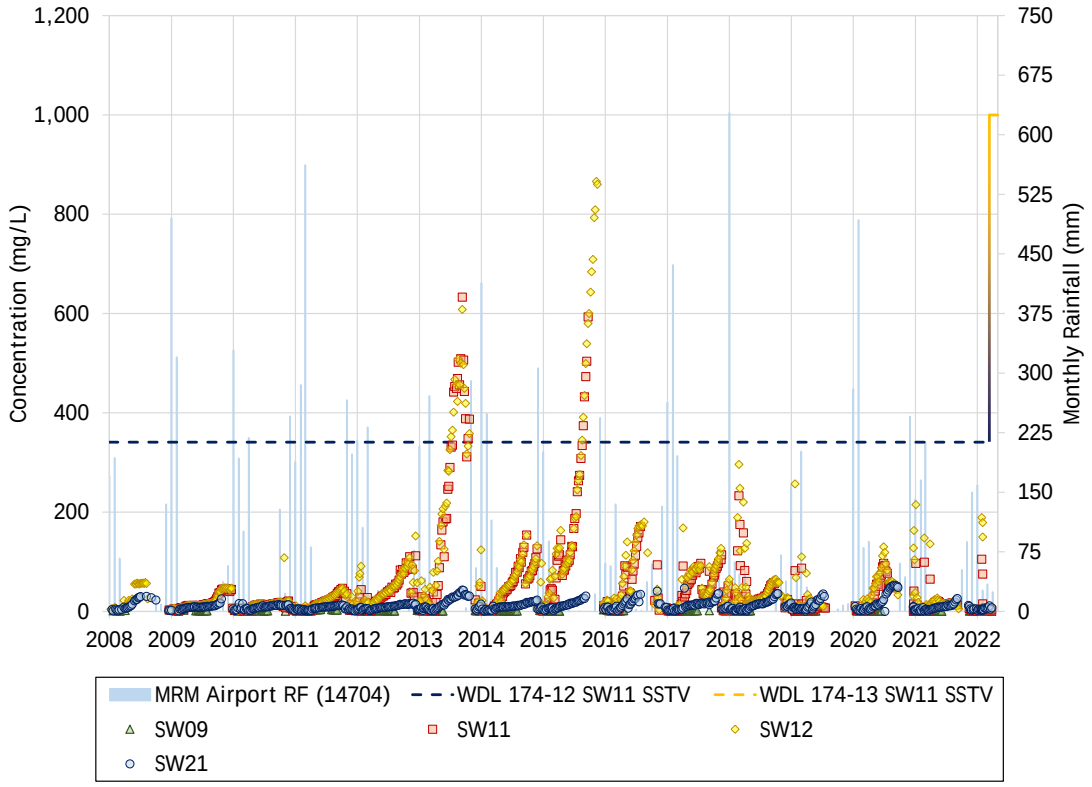


Chart 22: Long Term Sulphate and Monthly Rainfall – McArthur River and Glyde River Monitoring Sites

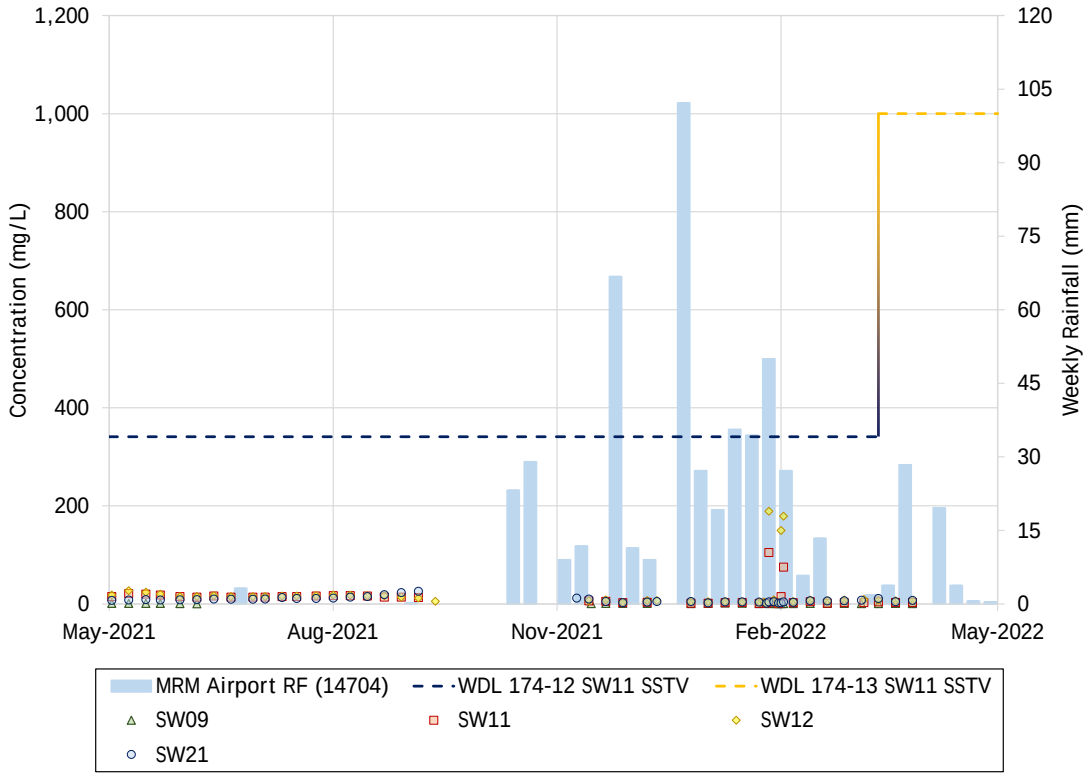


Chart 23: Short Term Sulphate and Weekly Rainfall – McArthur River and Glyde River Monitoring Sites

4.2.3.3 Bing Bong Loading Facility Observations

The BBDDP receives water that is passively discharged via the dredge spoil drain (DSD). The DSD receives overflow from the final dredge spoil emplacement area cell when in operation and saline water from the perimeter drain which surrounds the dredge spoil emplacement area.

Sampling at BBDDP occurs when flow is present (regardless of whether rainfall has occurred). Historically, BBDDP has also been influenced by spring tide waters. No dredging or dredge spoil emplacement has been undertaken by MRM at the BBLF since 2013.

No active dredging occurred at the BBLF during the reporting period and, therefore weekly sampling of BBDDP was not required. BBDDP was inspected on a monthly basis for flow and tidal connection in accordance with the WDL; however, no flow or connection was observed, and no samples were taken. Accordingly, there are no data for BBDDP in this report.

4.2.3.4 Performance against the Compliance Point Triggers

Over the reporting period there were 30 individual exceedances of the SSTVs at SW11 (Table 18). The exceedances were related to pH, dissolved oxygen, filtered aluminium, filtered iron, nitrate and TPH C10-C36 Fraction. Of these exceedances, only filtered aluminium triggered potential non-compliance under the conditions of the WDLs and required further investigation.

There was a total of eleven exceedances of the filtered aluminium SSTV at SW11 during the reporting period, with six potential non-compliances. MRM produced four investigation reports covering the potential non-compliances for submission to DEPWS. None of the potential non-compliances investigated by MRM were found to be related to the Mine's operations. The elevated filtered aluminium at SW11 was instead attributed to natural catchment sources from the McArthur River and Glyde River located upstream of the Mine. Based on a review of the monitoring data for the reporting period, WRM (2022) agreed with the conclusions presented by MRM within each of the investigation reports submitted to DEPWS.

No SSTV exceedances were recorded for the BBDDP over the reporting period as no flow or tidal connection was observed (i.e. no samples were collected).

TABLE 18: SUMMARY OF SSTV EXCEEDANCES AT SW11

Site	Analyte Result at SW11						Elevated Result Related to Active Discharge?	Investigation Triggered?	Investigation Report Confirms Elevated Result is from MRM Operations?
Quality Parameter	DO	NO_3	Fe*	Al*	TPH C15-C36 Fraction	pH			
	% sat	µg/L	µg/L	µg/L	µg/L	pH units			
SSTV	85 – 120	700	300	55	600	6.0-8.5			
1 August 2021					850		No	No	NA
15 August 2021							No	No	NA
5 September 2021	60						No	No	NA
14 November 2021			397	115			No	No	NA
2 January 2022	81	839					No	No	NA
9 January 2022		1,867		106			No	No	NA
23 January 2022				113			No	No	No
26 January 2022	70		391	469			No	Yes (filtered Al greater than three times the SSTV)	No
27 January 2022	64			78			No	Yes (filtered Al beyond SSTV on third consecutive result)	No
29 January 2022			354	237			No	Yes (filtered Al greater than three times the SSTV)	No
31 January 2022				147			No	No	No
1 February 2022	84			70			No	Yes (filtered Al beyond SSTV on third consecutive result)	No
6 February 2022			349	200			No	Yes (filtered Al greater than three times the SSTV)	No
13 February 2022	82						No	No	NA
20 February 2022			560	340			No	Yes (filtered Al greater than three times the SSTV)	No
27 February 2022	82						No	No	NA
27 February 2022			410	90			No	No	NA
Amended SSTVs (WDL 174-13)	85 – 120	10,600	347	269	600	6.0-8.5			
13 March 2022	168						No	No	NA
20 March 2022			442				No	No	NA
27 March 2022						8.84	No	No	NA

4.2.4 Non-conformances, Corrective Actions and Improvements

None of the potential non-compliances investigated by MRM over the 2021-22 reporting period were found to be related to the Mine's operations. Based on a review of the monitoring data for the reporting period, WRM (2022) agreed with the conclusions presented by MRM within each of the associated investigation reports.

4.2.5 Performance Summary

4.2.5.1 Adaptive Management Plan TARPs

Based on the review by WRM (2022), performance was at TARP Level 1 for the majority of the 2021/22 reporting period. MRM reviewed each Level 2 trigger to determine if the triggering analyte was likely resultant of the Mine or managed release. In each case, it was determined that the triggering analyte was likely caused by natural catchment processes and therefore no further action was necessary. In relation to the SSTV exceedances that could have potentially elevated the TARP to Level 3 during the reporting period, formal investigations were undertaken and concluded that the exceedances were not due to the Mine. The events were therefore reported as Level 2 in accordance with the TARP.

4.2.5.2 General Performance

Based on the WRM (2022) review of surface water quality monitoring data between over the reporting period, MRM continued to implement effective controls to minimise the risk of environmental harm of downstream receiving waters due to Mine operations. The review concluded that the beneficial uses and community values of the McArthur River continue to be protected from potential mine derived impacts.

4.2.6 Changes for the Next Reporting Period

Surface water quality monitoring will continue to be undertaken in accordance with the currently approved Water Management Plan (MRM, 2022). A review of the natural surface water monitoring sites will be completed over the coming reporting period with any changes from the review communicated in the 2022-23 EMR.

4.3 Groundwater Quality and Levels

TARP Level 1

MRM undertakes an extensive groundwater monitoring program targeting the major hydrostratigraphic units surrounding sources of potential contamination, along the identified pathways and within the vicinity of surface water (Appendix S).

Groundwater monitoring data for the reporting period has been analysed by Klohn Crippen Berger (KCB) (2022) and is presented in the *McArthur River Mine Annual Groundwater Monitoring Report 2021/2022* (Appendix R).

4.3.1 Monitoring Program Overview

The objectives of the groundwater monitoring program are to:

- characterise water quality at monitoring sites upstream of Mine operations and in zones of natural mineralisation;
- identify adverse or unexpected trends in groundwater quality that may harm the receiving environment and community values;
- assess measured groundwater quality against groundwater flowpaths and predicted groundwater impacts;
- validate the source – pathway – receptor model; and
- assess the efficacy of controls implemented.

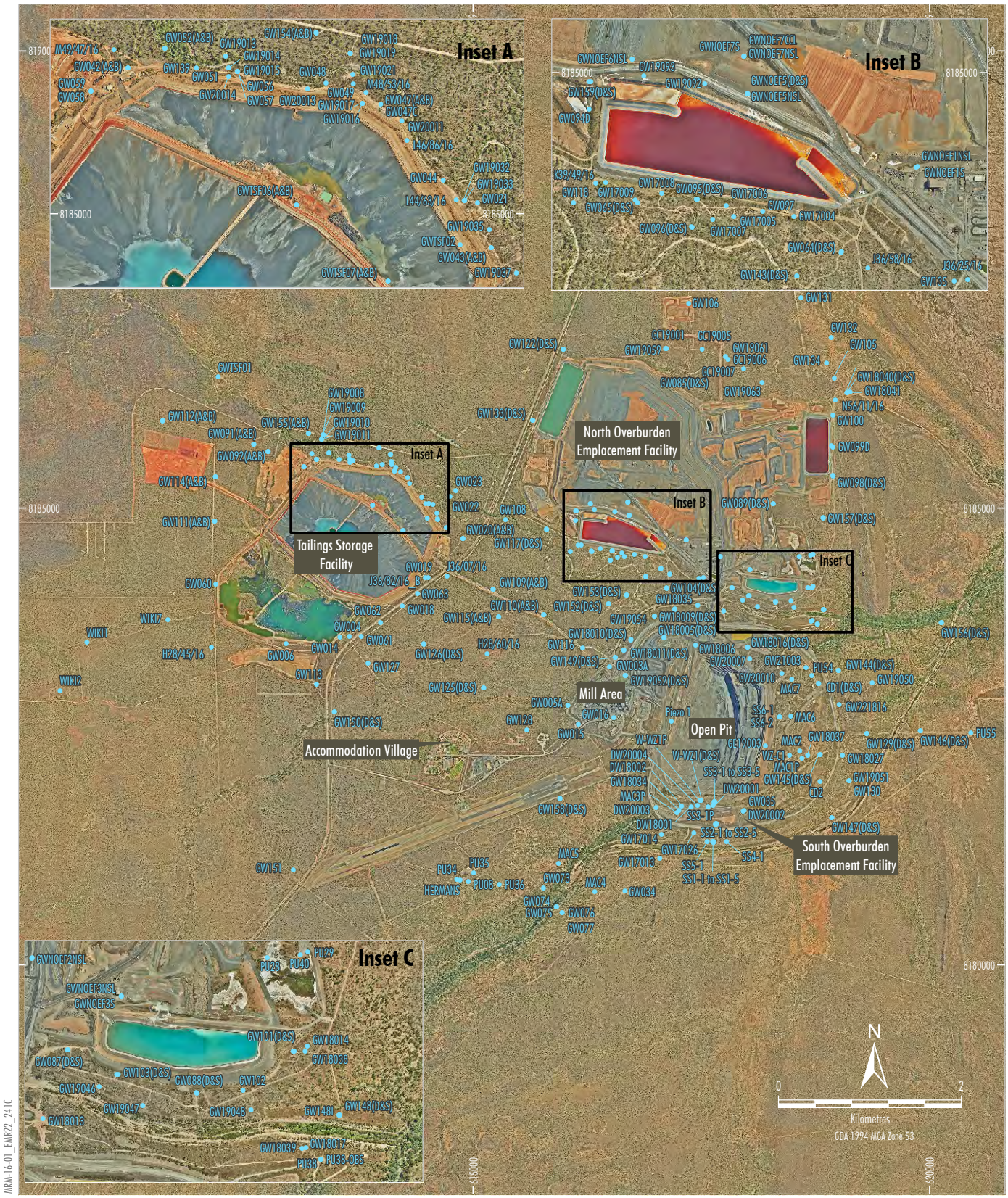
4.3.1.1 Monitoring Sites

The current groundwater monitoring network consists of around 300 groundwater monitoring bores across MRM and BBLF as shown in Figures 28 and 29.

4.3.1.2 Data Collection

Groundwater sampling is typically undertaken quarterly. The analytical suite monitored at the groundwater monitoring sites at the Mine and BBLF over the reporting period is listed in Table 19.

Groundwater level data is collected manually at each bore using a water level meter prior to commencing groundwater sampling. Continuous groundwater levels are recorded with data loggers deployed in approximately 150 monitoring bores across the site. Groundwater pressure levels are also recorded at over 50 VWPs, predominantly within and close to the open pit and water dam embankments.



LEGEND

Groundwater Monitoring Site

McARTHUR RIVER MINE

Mine Groundwater Monitoring Sites

Source: Orthophoto MRM (2021); Department of Environment and Natural Resources (2016); MRM (2022)

Figure 28

LEGEND

- Groundwater Monitoring Site

Source: Orthophoto MRM (2021); Department of Environment and Natural Resources (2016); MRM (2022)

MRM-16-01_EMR22_242B

McARTHUR RIVER MINE

Bing Bong Loading Facility
Groundwater Monitoring Sites

Figure 29

TABLE 19: GROUNDWATER QUALITY ANALYTE SUITE

Category	Analytes		
Physico-chemical Parameters	pH EC Dissolved oxygen Temperature Oxidation reduction potential Turbidity Total dissolved solids	Sulphate (SO_4) Calcium (Ca) Magnesium (Mg) Sodium (Na) Potassium (K) Fluoride (F) Chloride (Cl)	Bromide (Br) Nitrate (NO_3), Ammonia (NH_3) Total nitrogen (N) Total phosphorous (P) Hardness Alkalinity
Metals and Metalloids	Aluminium (Al) Antimony (Sb) Arsenic (As) Barium (Ba) Beryllium (Be) Boron (B) Bismuth (Bi) Cadmium (Cd)	Chromium (Cr) Cobalt (Co) Copper (Cu) Nickel (Ni) Iron (Fe) Lead (Pb) Manganese (Mn) Mercury (Hg)	Molybdenum (Mo) Selenium (Se) Silver (Ag) Thallium (Tl) Uranium (U) Vanadium (V) Zinc (Zn)
Hydrocarbons[1]	Benzene	Total petroleum hydrocarbons (TPH) (C_6-C_{36})	

[1] Monitored at select sites.

4.3.1.3 Wurrini Waterhole

The only body of water which is considered a true dry season refuge pool within the Mineral Lease is Wurrini Waterhole – referred to in previous reports as Djirrinmini (IPE, 2021). During dry season conditions, the approximate dimensions of Wurrini Waterhole are 800 m in length, 30 m average width, 2.37 m average depth, maximum depth of 4.77 m, and a total storage volume of 32,600 m^3 (WRM, 2021). Wurrini Waterhole includes the water quality monitoring site SW10, and the Upstream Gauging Station (also known as G9070132 – McArthur River – MIM pump). Wurrini Waterhole is known to provide refuge to Freshwater Sawfish during the dry season.

4.3.1.4 Djirrinmini Waterhole

Immediately downstream of Wurrini Waterhole is Djirrinmini Waterhole, a much smaller pool in comparison. During dry season conditions, the approximate dimensions of Djirrinmini Waterhole are 600 m in length, 15 m average width, 1.13 m average depth, maximum depth of 2.25 m, and a total storage volume of 3,060 m^3 (WRM 2021). Based on total storage volume, Wurrini Waterhole is approximately 10 times larger than Djirrinmini Waterhole. Since the commencement of aquatic fauna monitoring in 2006, no single Freshwater Sawfish has been recorded within Djirrinmini Waterhole.

Due to the smaller size in comparison to Wurrini Waterhole, and the lack of record of Freshwater Sawfish within the pool, Djirrinmini is not considered a true 'refuge pool' (IPE, 2021). Djirrinmini does however have significant cultural value and is a registered sacred site by the Aboriginal Areas Protection Authority (AAPA).

4.3.1.5 Other Receptors

There are no environmental values for aquaculture, public water supply, agricultural supply, domestic use or industrial use relevant to groundwater in the mineral leases. There is stock watering in the wider region; however, there are no registered bores that are used for stock watering purposes in the vicinity of the Mine.

Water supply bores surrounding the Mine are owned and operated by MRM.

4.3.2 Changes Made to the Monitoring Program or Techniques during the Reporting Period

No monitoring bores were decommissioned across the Mine during the reporting period.

4.3.3 Performance during the Reporting Period – Groundwater Levels

4.3.3.1 Groundwater Level Trend Analysis

Groundwater levels were analysed by KCB (2022) for temporal trends during the review period and for comparison against historical trends.

Groundwater levels during the review period continued to follow the climatic trend for most bores. KCB (2022) noted that dry season groundwater levels (end of 2021) were similar or lower than the previous dry season and attributed this to the below average total rainfall over the 2021/22 wet season.

4.3.3.2 Djirrinmini-Wurrini Waterhole Groundwater Levels

Under the current AMP, MRM has established TARP's to assess performance against the key environmental objectives. A TARP has been developed to assess potential drawdown impacts on groundwater levels in bores near the Djirrinmini-Wurrini waterhole, which is sustained through dry season periods by groundwater baseflow.

Five groundwater bores either side of Djirrinmini-Wurrini waterhole (GW073 to GW077) have been used to establish normal conditions. If the water levels drop to below these normal conditions, then investigations are commenced and potentially mitigation measures implemented. Plate 10 shows groundwater levels in these five 'performance indicator' bores since 2010. Groundwater levels in all five bores throughout the reporting period decreased in response to the below average rainfall, but remained above the performance indicator level.

4.3.3.3 Groundwater Flow Directions

Groundwater elevation contour maps are provided in Appendix R for the end of the latest dry season (October 2021) and wet season (April 2022). These contours indicate a regional groundwater flow direction from west to east, consistent with previous years. Groundwater levels show some localised operational influences around the Open Pit, TSF, WMD and NOEF. However, the majority of groundwater level monitoring data indicates the expected behaviour (climate-driven trends), with limited influence from operational activities.

4.3.4 Performance during the Reporting Period – Groundwater Quality

4.3.4.1 Sample Collection

Over the reporting period (1 May 2021 – 30 April 2022), 423 groundwater samples were collected from the bores scheduled for regular monitoring. The number of samples collected represents 50% of the planned number of samples (992). The reduced amount of sample collection was related to restricted access due to wet weather or unsafe conditions and, bores becoming dry or insufficient groundwater to obtain a representative sample.

Groundwater sampling and laboratory analyses of water quality during the review period was subject to a comprehensive QA/QC procedure as described in KCB (2022a). A total of 35 laboratory blanks and rinsate samples were analysed, as well 23 field duplicate samples. Only a few low-level exceedances were recorded within the blank and rinsate suite, most notably filtered Boron exceeded the limit of detection 18 times. The field duplicate results were within the range of typical variability and analytical reproducibility for groundwater monitoring (DPIR, 2016).

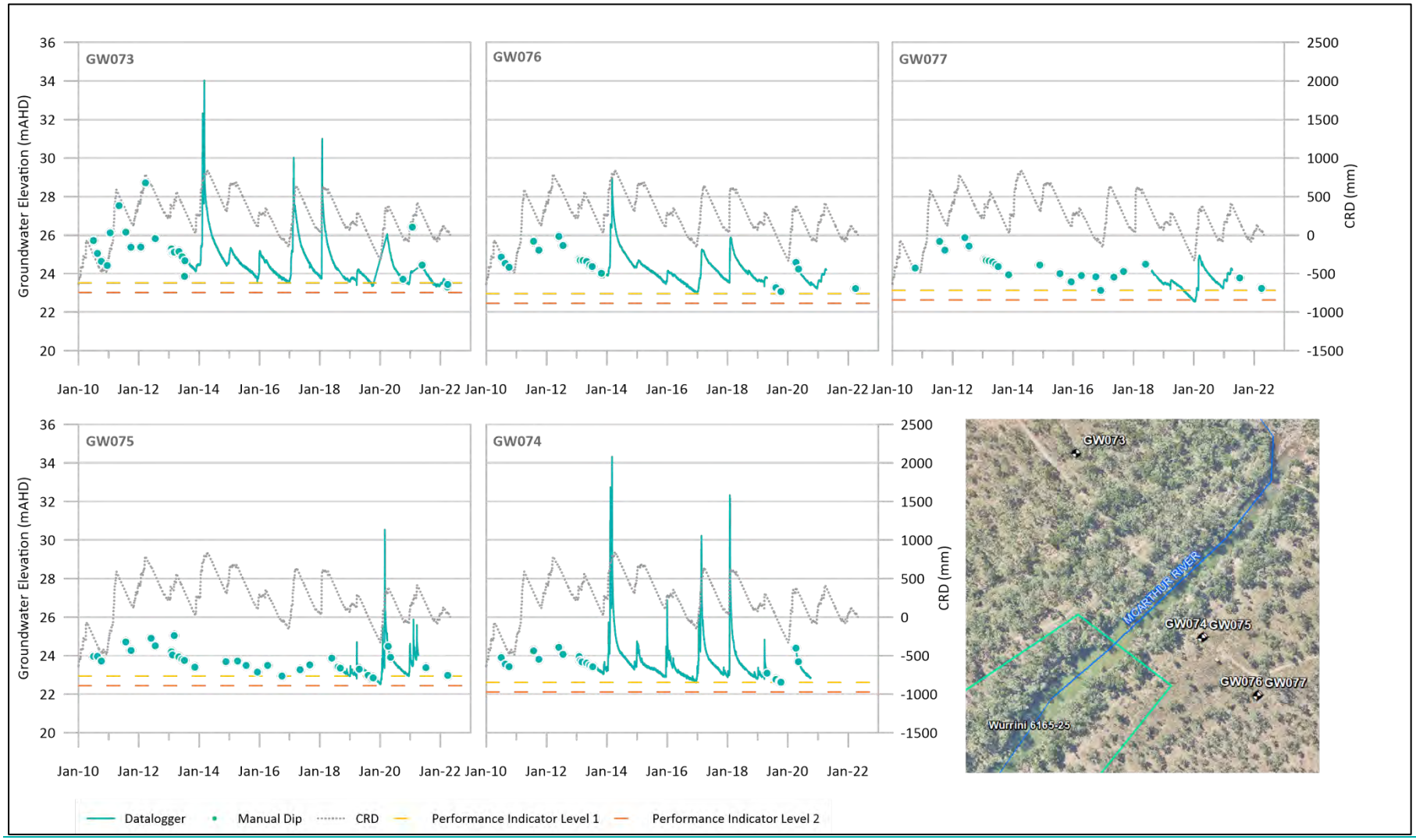


Plate 10: Groundwater Level Data from Performance Indicator Bores Surrounding the Djirrinmini-Wurrini Waterhole (after KCB, 2022a)

4.3.4.2 Groundwater Quality Trend Assessment

Groundwater quality trends were assessed by KCB (2022) throughout each site domain using the analytes of field pH, sulphate, lead, zinc, arsenic, nitrate. These assessments were augmented by considering:

- The spatial pattern of sulphate and zinc levels in groundwater within alluvial and weathered bedrock aquifer zones at the end of the current dry and wet seasons.
- Comparison of observed sulphate levels against model-predictions from the 2017 EIS-S studies.

Groundwater quality during the reporting period at the majority of bore sites has been consistent with previous trends and expected levels. Trends of significance at individual bores within each site domain are described below.

4.3.4.3 Groundwater Quality Spatial Patterns

Groundwater sulphate and zinc contour maps for the reporting period are provided in Plate 11 and Plate 12 for the end of the dry season. Note that a source concentration has been added to the TSF and NOEF as limited monitoring is available underneath the facilities. The maps show broad trends similar to previous interpolations and highlight the majority of elevated sulphate and zinc concentrations in groundwater occurs in relative proximity to the TSF, NOEF, WOEF and Mill infrastructure. As noted by KCB (2022), the highest zinc concentrations generally occur in similar areas to sulphate.

The area between the TSF and Mine contains elevated sulphate and zinc concentrations over a relatively broad area, which coincides with significant occurrences of weathered background sulphide mineralisation in the Barney Creek Formation lithologies.

Sulphate concentrations in areas of predicted impact are showing that monitoring data compares well with the predicted concentrations from the numerical models as detailed in KCB (2022). In summary (Appendix R):

<u>NOEF domain:</u>

- Sulphate at GW101D and GW103S (located south of SEPROD) is increasing a slower rate than predicted. This may relate to improved water management practices around SEPROD.
- Decreasing concentrations are observed at GW064D, GW143S, GW143D, which are located southeast of SPROD. This may be related to the re-lining of SPROD, which occurred earlier than simulated in the numerical model (built in 2017).
- As described earlier in this report, GW159S and GW159D showed a significant increase in concentration in early 2020, which continued through the reporting period.

<u>TSF domain:</u>

- As noted in last year's annual report (KCB, 2021), an increasing trend, prior to the predicted increase, has been recorded at GW061, which is located east of the WMD. This is attributed to seepage of water from the WMD as further discussed below.
- An increasing trend was emerging at GW043A and GW043B in the 2020/21 reporting period. These bores are located north-east of the TSF. The TSF Cell 1 was reactivated during the previous reporting period, and the operation of the TSF trench had commenced. The concentration at GW043A in 2022 in now showing a decrease.

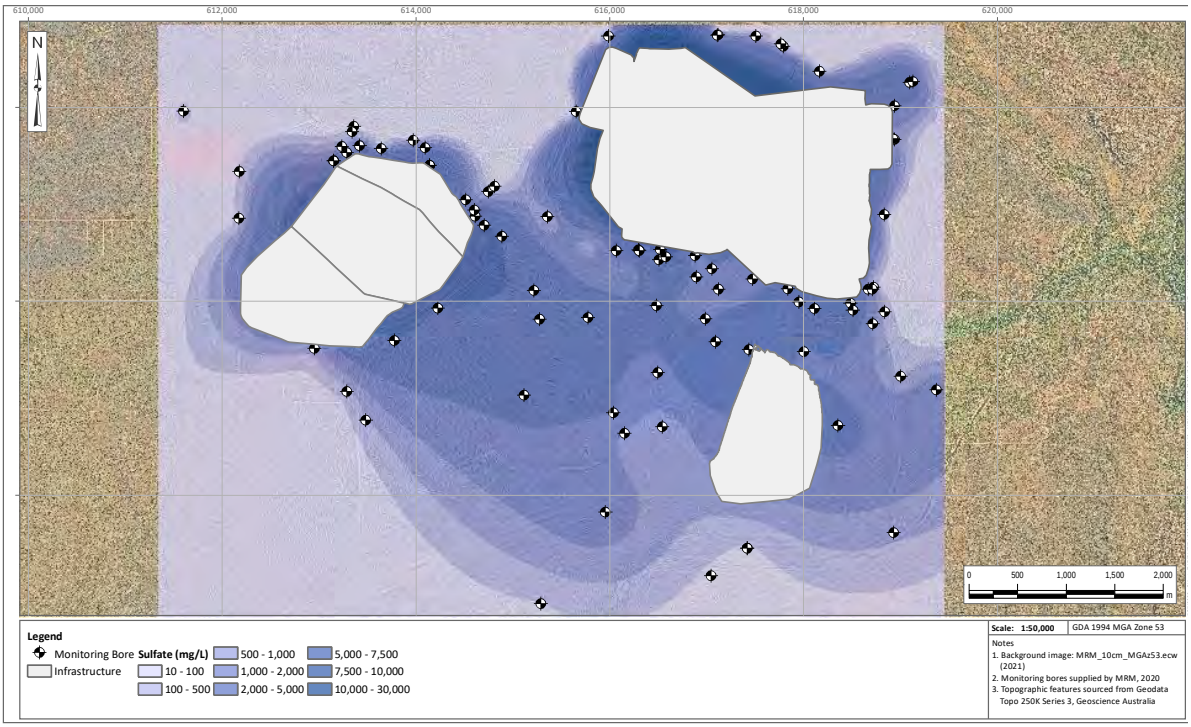


Plate 11: Sulphate Concentration Contours in the Weathered Bedrock and Alluvial Aquifers for October – December 2021

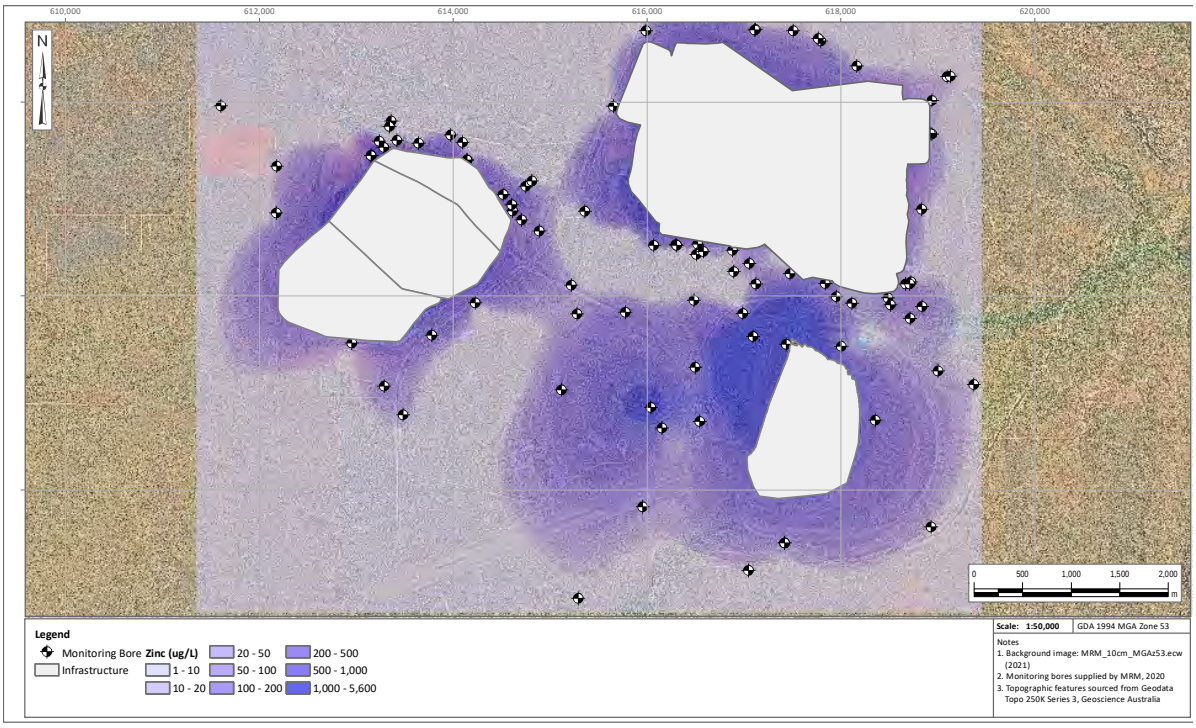


Plate 12: Zinc Concentration Contours in the Weathered Bedrock and Alluvial Aquifers for October – December 2021

4.3.4.4 Open Pit Domain

Groundwater quality in the Open Pit domain is generally consistent with historical data. The groundwater quality is variable, ranging from fresh alkaline groundwater in the paleochannel aquifer in proximity of the McArthur River, to slightly saline higher sulphate groundwater around the WOEF and the Eastern Levee Storage (ELS). Major ion composition in the open pit domain is mixed, with a Ca-Mg-HCO_3 water signature in monitoring bores in the south and southwest of the Open Pit and a Ca-Mg- SO_4 water signature in monitoring bores in the remainder of the domain.

Several monitoring bores located to the east of the Open Pit (i.e., GW129D, GW145D, GW18027) have shown a general decreasing TDS trend historically since mid-2016 and through the reporting period. The decreasing trends are also observed in sulphate concentrations and EC measurements. It is considered likely that the decreasing concentrations are related to the change in water management in this area of the domain. The ELS is no longer used to store water, and this may have contributed to improving groundwater quality in this area.

Groundwater sampled at GW19052D has measured elevated sulphate, EC, lead, and zinc concentrations during the reporting period in comparison to other bores in this area. The bore is located within the Mill area of the Mine domain and adjacent to the WOEF and CRP, an area underlain by very thin or no alluvial cover over dolomitic bedrock. The bore is screened within weathered bedrock. Persistent elevated concentrations from five samples collected from this monitoring bore to date indicates a potential impact associated with the Mill CRP (which contains mine-affected water elevated in sulphate, zinc, and lead) and possibly the WOEF.

Elevated sulphate, zinc, lead, and nitrate were measured at GW18005S during the reporting period, as well as historically as noted in KCB (2021). The bore is located in the vicinity of the WOEF to the northwest of the Open Pit. In 2020, MRM reviewed the bore construction at GW18005S and identified the bore construction may be across both the WOEF and underlying weathered bedrock and therefore identified GW18005S for decommissioning or replacement.

Arsenic concentration at GW19050, located to the east of the pit, has been increasing since September 2020 and was measured at a dataset peak of 127 µg/L in January 2022, possibly in response to a decreasing trend in pH observed during this period. Arsenic in other bores in this area are generally below 30 µg/L. It is most likely this is a natural source, rather than mine-influenced concentrations, due to the distance of the bore from mining activities.

4.3.4.5 NOEF Domain

Groundwater quality in the NOEF domain during the review period remained generally consistent with historical data. Groundwater to the north of the NOEF typically has Ca-Mg-HCO_3 signature, whilst bores to the south of the NOEF tend to have a Ca-Mg-SO_4 water type, partly reflecting their location down-gradient of the NOEF and water storage dams SPROD and SEPROD. Bores grouped in the NOEF footprint also show a different chemical signature, which is related to their location within the NOEF footprint and the Mine-affected nature of the groundwater in this location (KCB, 2022).

During the reporting period, increasing concentrations of sulphate and zinc were recorded at GWNOEF1NSL GWNOEF2NSL and GWNOEF5S are located within the NOEF footprint and screened within the fill / waste material of the NOEF. These increasing concentrations are expected, as predicted in the EIS and EIS-S (KCB, 2017a; 2017b). Neutral pH conditions are being maintained in these locations.

East of the NOEF, increasing sulphate (as well as TDS and EC) trends were observed at GW089D/S and GW100. Low pH (~6.3 pH units) was recorded in both bores during 2020 and remained at this level in GW100. Low pH, high sulphate water is being stored in the Eastern Perimeter Run-off Dam (EPROD), which is located near these monitoring bores. It is possible these monitoring bores have been impacted by the EPROD water.

The most significant water quality observation in the NOEF domain remains to be at GW159S/D (located to the northwest of SPROD), which have recorded changed water quality conditions since 2020. A general decreasing trend in pH is seen at GW159S since March 2020, which recorded a dataset low of 4.05 pH units in November 2021 before recovering slightly towards the end of the monitoring period (5.38 pH units in February 2022). Elevated sulphate concentrations remain to be measured at GW159S and GW159D (at 32,157 mg/L and 13,938 mg/L respectively). Zinc and arsenic also increased at GW159S in response to the decreasing pH trend. The downgradient monitoring does not show any changes in water quality. MRM has completed additional investigations into this during the reporting period and identified that it is likely that GW159S provides a preferential flow path for poor quality water deriving from above one of the clay liners in the NOEF.

A general decreasing trend in sulphate, EC and TDS is also observed since 2018 in most monitoring bores to the southeast of SPROD (with the exception of GW135).

South of the SEPROD, sulphate concentrations have historically been increasing in this group of bores since 2014. Several bores now show a stabilisation of concentrations, or a decrease. The bores include GW087D, GW102, GW103S/D, GW101S, GW19048. Bores that continued to show an increasing sulphate trend during the reporting period include: GW19046, GW088D, GW101D, GW18038, GW19046 and, PU38. EC and TDS show the same trends as sulphate.

4.3.4.6 TSF Domain

Groundwater quality data in the TSF domain was similar to previous years. Trends of potential significance are summarised below and explained in more detail in KCB 2022.

As described in the 2020/21 annual groundwater report (KCB, 2021), increasing EC, TDS, sulphate, and zinc concentrations have been monitored at GW061. This continued to occur during this reporting period, with sulphate concentrations rising since 2018. pH is also slowly declining at this bore. The monitoring bore is located southeast of the WMD and is screened within weathered / fresh bedrock. The change in water quality at this location is attributed to seepage of water from the WMD, which has sulphate concentrations ranging between 2,500 and 6,000 mg/L.

Sulphate, EC, and TDS have been increasing at GW020A and (more steeply) at GW020B since 2015. Continued increases at this location likely reflects temporal migration of the contaminant plume associated with the TSF.

Several parameters (zinc, sulphate, nitrate, EC, and TDS) continued to be elevated at GW058 during the reporting period, as well as recording a lower pH from January 2021 as described in the 2020/21 annual groundwater report (KCB,2021). GW058 is located north-west of the TSF Cell 1 in close proximity to the TSF. An investigation was completed in 2021, which concluded that the source of the decreasing water quality is TSF seepage as a result of increased deposition on Cell 1. It was assessed that the TSF trench would ultimately capture this seepage prior to any impacts to Surprise Creek.

Groundwater sampled at GW043 (located adjacent to the north-eastern corner of the TSF between the TSF and the TSF interception trench) during the previous reporting period showed an increasing concentration of sulphate, which was attributed to TSF Cell 1, which was raised in December 2019. Since July 2021, groundwater sampled from GW043B has shown a decrease in sulphate, which may be related to the operation of the TSF trench, which was installed in 2019 to mitigate against seepage from the TSF.

4.3.5 Sacred Sites Groundwater Impacts Assessment

Seven sacred sites at the Mine site have been flagged by the AAPA as being potentially groundwater dependant (Plate 13) and consequently MRM has recently commenced regular reviews of groundwater data relevant to these sites. Full details of the assessment are included within the annual groundwater review report (KCB, 2022a), whilst a summary of the findings are provided below:

- The sites Jirinmini 6165-5, Coolibah 2 6165-7, Coolibah Tree 6165-8 and Wurrini 6165-25 occur in close proximity to each other near the McArthur River southwest of the Mine. Groundwater levels at and near these sites have a strong correlation to seasonal rainfall recharge from wet season rainfall events and flood events. No mine-influenced drawdown from open pit dewatering or operation of the Mimex water supply borefield are evident in groundwater bores at these locations in the current review period or historical record.

- Garbula (site 6165-65) involves groundwater drawdown concerns for a mature gum tree located near the south-western mine levee wall. No observable drawdown impact was recorded during the reporting period.

- Nanbindi (site 6165-64) is a waterhole located approximately 600 m to the northeast of the TSF that is known to historically dry up most years. Concerns regarding water quality have been flagged. There is no water quality monitoring done at this site to make direct observations, but adverse impacts to water quality from operation of the TSF are highly unlikely given the known groundwater levels and flow directions in the nearest monitoring bores (i.e away from the sacred site). Installation and operation of the new TSF Interception will create flow gradients back towards the trench and further limit the possibility for groundwater from near the trench to reach Nanbindi.

Donagans Lagoon (site 6165-101) occurs on the northern side of the McArthur River approximately 3 km downstream of the Mine levee wall. The nearest monitoring bore is GW156 and being located 1,800 m from the site precludes it from being representative of water levels in the lagoon. The site is geologically disconnected from the mining operations and too remote to be affected by mining operations

4.3.6 BBLF Performance during the Reporting Period

Twenty-two groundwater quality samples were collected at BBLF over the reporting period.

Groundwater monitoring data at BBLF highlighted consistent (with historical data) and stable trends. No dredging occurred at BBLF during the monitoring period.

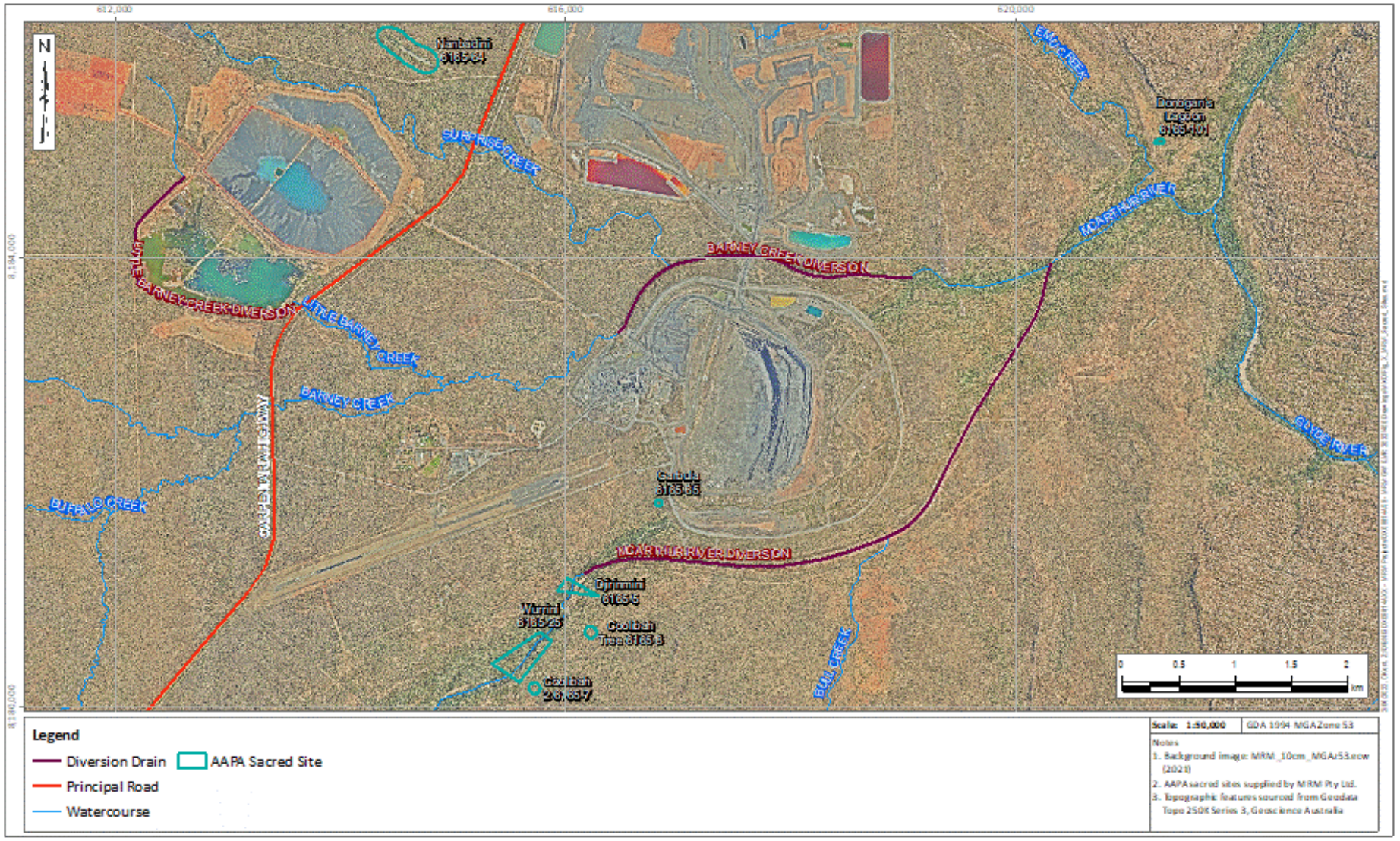


Plate 13: AAPA Sacred Sites Requiring Groundwater Reviews

4.3.7 Non-conformances, Corrective Actions and Improvements

Several improvements were commenced or concluded during the reporting period that will have longer term benefits to the groundwater monitoring system and contribute to overall water management improvements. These included:

- Ongoing refinement of the groundwater database using the *Equis* database software platform. Work commenced in 2021 using external consultants (ERM) to migrate historical data into the database and develop queries and reports that will provide MRM with the ability to rapidly collate and visualise groundwater-related data during investigations and regular reporting. The database will house and connect various datasets not previously captured within databases, such as groundwater abstraction, bore logs and VWP data.

- The annual groundwater monitoring review report has been modified to include direct comparison of modelled sulphate levels (from 2017 EIS-S) and observed sulphate levels at numerous bore sites (KCB, 2022a). As noted in the discussions above, this work has shown a high degree of correlation at most sites, which provides confidence in the veracity of the 2017 groundwater modelling work.

- MRM has been implementing the performance indicators and control limits developed with the assistance of KCB at select groundwater monitoring sites. The quarterly reviews of the data using this system have enhanced the management of water resources and assisted in the context of developing TARPs for specific source-pathway-receptor (SPR) occurrences within the project site.

4.3.8 Changes for the Next Reporting Period

The current groundwater monitoring network consists of nearly 350 groundwater bores as shown in Figures 28 and 29. MRM continues to review and refine the groundwater monitoring program as part of the development of the Adaptive Management Plan. Under the latest revisions of the Adaptive Management Plan, the subset of ‘performance indicator’ bores were identified to be analysed to assess the environmental risk associated with major infrastructure and facilities.

4.4 Surface Water and Groundwater Interactions

The groundwater and surface water systems surrounding the Mine are highly connected, with one system often influencing the other.

In general, groundwater provides base flow to the watercourses and diversions across the Mine during dry periods, when surface water levels are low or absent, as groundwater levels typically recede slower than surface water levels. During the wet season, when significant flows and flooding occurs, the watercourses and diversions across the Mine act as losing streams, becoming a source of water to surrounding aquifers.

These temporal changes from gaining to losing streams result in the cyclic water quality trends observed in surface waters upstream and downstream of the Mine as evident in recent and past surface water monitoring reports (e.g. WRM, 2022). EC levels of surface water clearly highlight these cyclic trends. The EC sharply increases during the dry season due to increased evaporation, reduced flow volumes and a higher contribution from groundwater expressing as surface water base flow. This is followed by rapid decreases in EC during the wet season due to the dilution provided by rainfall events. The EC levels in the McArthur River, upstream of the Mine (SW21) are generally similar to the EC downstream of the Mine (SW12 and SW11), with the exception of the 2013, 2014 and 2015 dry seasons.

Natural mineralisation is present in a number of areas outside of the main ore body, which can result in elevated analyte concentrations (e.g. sulphate, metals) within the groundwater. Groundwater that flows through a mineralized zones and reports to surface water can impact surface water quality (e.g. in the McArthur River Diversion Channel in the proximity of the Cooley prospects).

Geological structures, and the properties of materials between them, impact the location, quantity and quality of base flow contributions to surface waters. This results in spatial variations in base flow quality in addition to the temporal variations discussed above. Due to the below average rainfall season, flow in the rivers was very limited this reporting period, therefore no low-flow water quality sampling was completed along the creeks on site.

The relatively low rainfall experienced at the site during the reporting period resulted in below average flows in the McArthur and Glyde Rivers and little to no flows in Barney Creek, Surprise Creek and Emu Creek. Fewer natural flow samples were collected during the reporting period when compared with the long-term average due to the below average rainfall. The results of the natural surface water quality data collected during the reporting period indicated that the water quality at SW11 generally remained within the compliance limits defined by the WDLs (WRM, 2022).

As in past seasons, Mine derived base flow caused elevated EC and sulphate levels at SW06 (WRM, 2022). Groundwater levels are predicted to decrease to below the invert of the Barney Creek Diversion Channel once the pit will intersect the more permeable Cooley Dolomite. This will result in reduced groundwater base flow to the Barney Creek Diversion Channel during life of mine.

Improved water management around SPROD, including the installation of the HDPE liner, are showing an improvement in water quality around this water storage facility. SPROD's influence on groundwater loads reporting to Surprise Creek will continue to decline (KCB, 2022b).

The TSF interception trench that was constructed to the north of TSF Cell 1 in 2019 to intercept groundwater impacted by TSF basal seepage before it entered Surprise Creek as base flow was operational throughout the reporting year. Monitoring bores located on the northern side of Surprise Creek do not show a response to the TSF interception trench operation. Analysis of natural surface water quality data, including in the Surprise Creek upstream and downstream of the TSF, showed neutral pH and low sulphate levels over the reporting. Note that relatively low rainfall experienced at the site during the reporting period resulted in very few days when Surprise Creek recorded flow.

4.5 Marine Metal Concentration

TARP Level 1

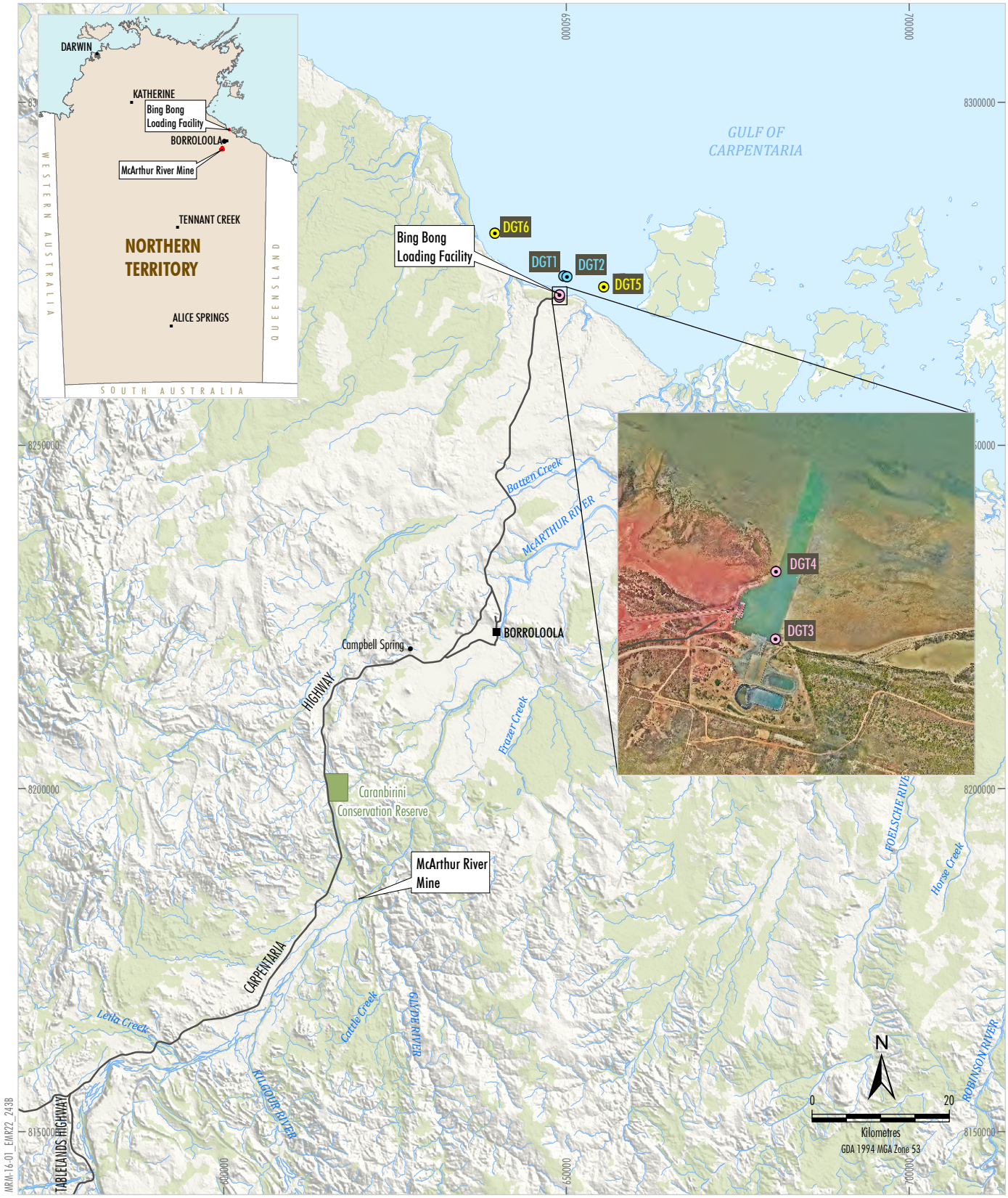
4.5.1 Monitoring Program

The report '*Concentrations of Select Bioavailable Metals and Lead Isotope Ratios within Ocean Water in the Vicinity of the Bing Bong Loading Facility as Monitored by Diffusive Gradients in Thin Films (DGTs): 2021-2022*' (IPE, 2021h) (Appendix T) outlines the marine water quality monitoring program undertaken during the reporting period.

The aim of the monitoring program is to provide an ongoing data set that assists in identifying if analytes that occur within the MRM shipping product are being introduced into the marine waters surrounding the BBLF to a level that may cause harm to the environment. The methodology and site selection used during the current program were developed with assistance from specialists at the Australian Institute of Marine Science (AIMS) Darwin branch and Charles Darwin University (CDU) generally followed the methodology outlined in the BBLF Environment Management Plan 2021.

DGT-labile metals in seawater around BBLF were monitored from July 2021 to April 2022 by MRM at reference sites and sites that have the potential to be impacted by BBLF operations (Figure 30). For the current reporting period, six locations within the BBLF swing basin and Gulf of Carpentaria were sampled.

Results were compared to the relevant *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* ANZG (2018) default guideline values (DGVs) for marine water, and were used to assess the Mine's performance against the key Environmental Objective "*Protect the beneficial uses and community values adjacent to the BBLF and transhipment corridor from impacts associated with MRM's operations*".



LEGEND

- Major Road
- River/Creek
- Channel Site
- Coastal Site
- Swing Basin Site

McARTHUR RIVER MINE

DGT Monitoring Sites

Source: Geoscience Australia - Topography (2006); Department of Environment and Natural Resources (2016); Australian Institute of Marine Science (2019); MRM (2022)

Figure 30

4.5.2 Monitoring Results and Trends

The study found that DGT-labile metals were generally comparable within the BBLF swing basin sites when compared to reference sites, with the exception of DGT-3 which exceeded the DGVs for lead and zinc on one occasion, during the February deployment (Charts 24 and 25). It is important to note that:

- the concentration of lead recorded in February at DGT-4, which is also located within the swing basin, was the lowest for all deployment periods and zinc was less than the detectable limit;
- for other deployment periods, the mean concentrations of DGT-labile metals at DGT-3 and DGT-4 were well below the applicable DGVs;
- the concentrations of DGT-labile metals recorded at monitoring locations outside of the BBLF swing basin were below the applicable DGV, and in many cases below detectable concentrations; and
- DGTs for which all replicates returned non-detectable zinc are denoted by chequered column, and represent half the zinc reporting limit for that particular deployment period.

Previous reports have attributed occasional increased analyte concentrations at DGT-3 to vessel movements, particularly ug movements, creating sediment resuspension within the swing basin. However, considering the magnitude of the lead concentration recorded at DGT-3 during February (and other analyte concentrates discussed), it is likely that either DGT-3 was contaminated during the sampling process, or a small amount of MRM shipping product entered the swing basin near DGT-3.

DGT-3 Lead isotope ratios PbIR were consistently most similar to that of the MRM shipping concentrate PbIR, while other deployment locations were generally less similar as geographical distance from the swing basin increased. However, if compared to the Present Day Average Crustal (PDAC), all DGT PbIR were relatively similar to that of the shipping concentrate. This is likely a reflection of the DGT technique, which only monitors the labile fraction of total lead, thereby excluding the majority of the naturally occurring, possibly non-bioavailable lead.

Further discussion of monitoring results is available in Appendix T.

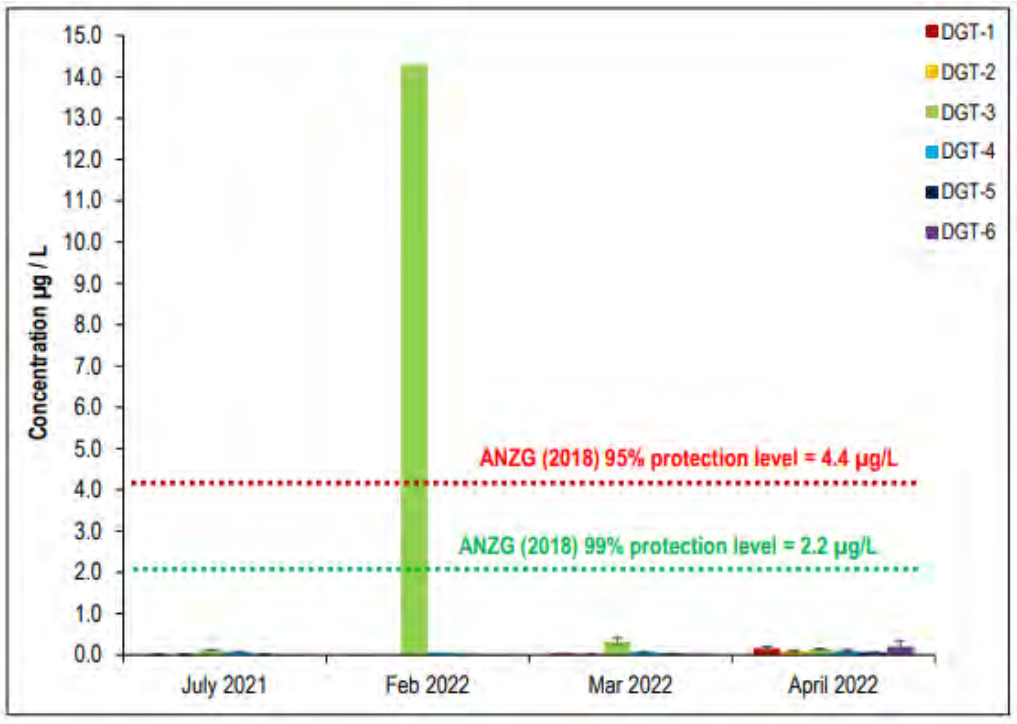


Chart 24: Mean concentrations of DGT-labile lead recorded via quarterly DGT deployments between July 2021 and April 2022.

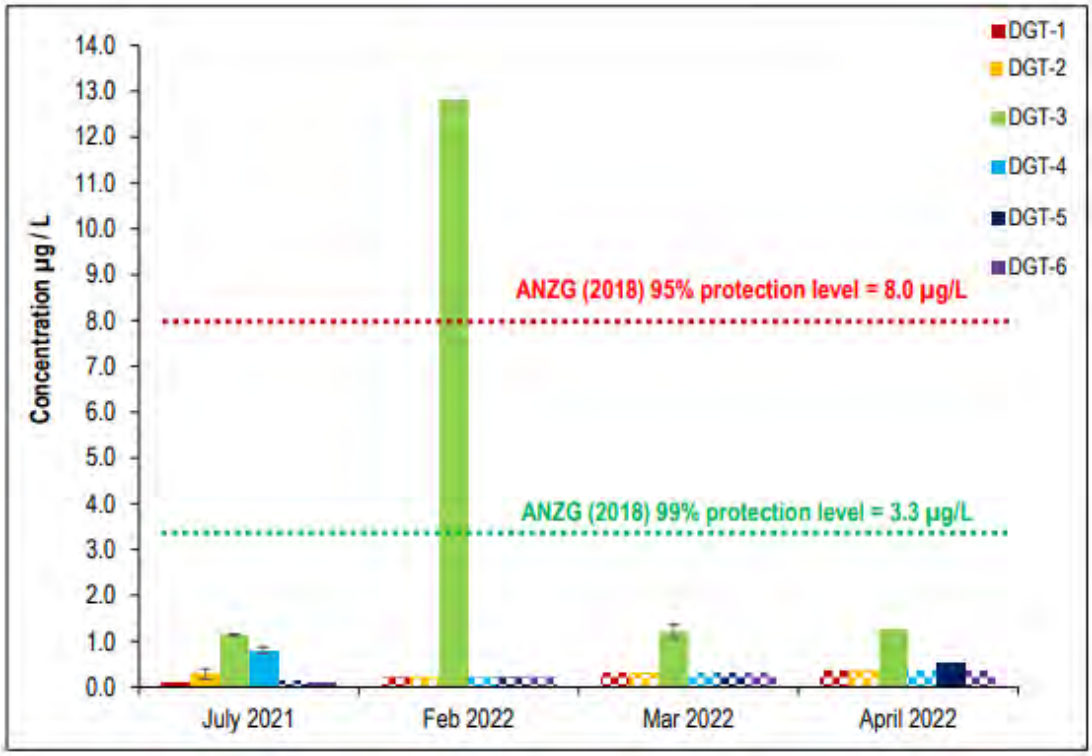


Chart 25: Mean concentrations of DGT-labile zinc recorded via quarterly DGT deployments between July 2021 and April 2022.

4.5.3 Performance Summary and Recommendations

The exceedance of the performance criteria for lead and zinc at DGT-3 during the February deployment triggered TARP Level 2 under the BBLF Environment Management Plan 2021 (BBLF EMP) and an internal investigation occurred July 2022. The investigation involved actioning the BBLF EMP TARP items and concluded that the environmental objectives continues to be met. Results of the subsequent deployments in March and April 2022 met all performance criteria and as such the TARP level was returned to Level 1.

For future monitoring, IPE have recommended that sampling should be conducted as close as practically possible to quarterly periods to allow for a broad comparison of monitoring for the program and that DGTs be deployed in triplicate as a minimum. These recommendations will be implemented during the 2022-23 monitoring period.

4.6 Metal and Metalloid Concentrations in Near Shore Sediment

TARP Level 2

4.6.1 Monitoring Program

The *McArthur River Metal and Metalloid Concentrations of Near Shore Sediments of Bing Bong Loading Facility 2021* (IPE, 2021i, Appendix U) aimed to identify whether metals or metalloids are being introduced into the near shore sediments as a result of mining operations. The methodology and site selection used in 2021 followed the methodology outlined in the McArthur River BBLF EMP 2020 (Section 6.4.2. Metal and Metalloid Concentrations in Near Shore Sediment) and in accordance with MRM's former WDL 174-12.

The annual monitoring program consists of seven sampling zones which are presented in Figure 31. Three of these zones are considered to be potential impact zones at which contaminants may be directly introduced. These zones being to the immediate west (Zone 2) and east (Zone 3) of the swing basin and adjacent the DSD outfall (Zone 4). Two sampling zones to the immediate west (Zone 1) and east (Zone 5) of the Mine lease boundaries are also sampled, these are considered to be reference sites from which background metal concentrations could be determined. Two additional reference sites (the Western Control and Eastern Control zones) located ~3 km west and east of the swing basin, respectively, are sampled to provide additional background data.

Sediment samples are collected from 10 randomly selected sites within each sampling zone, resulting in a total of 70 near shore sediment samples being collected and analysed. Additional sediment samples are collected from the BBDDP and from four sites within the DSD.

Results from the monitoring program are used to assess MRM's performance against the key Environmental Objective "*Protect the beneficial uses and community values adjacent to the BBLF and transhipment corridor from impacts associated with MRM's operations*".

4.6.2 Monitoring Results and Trends

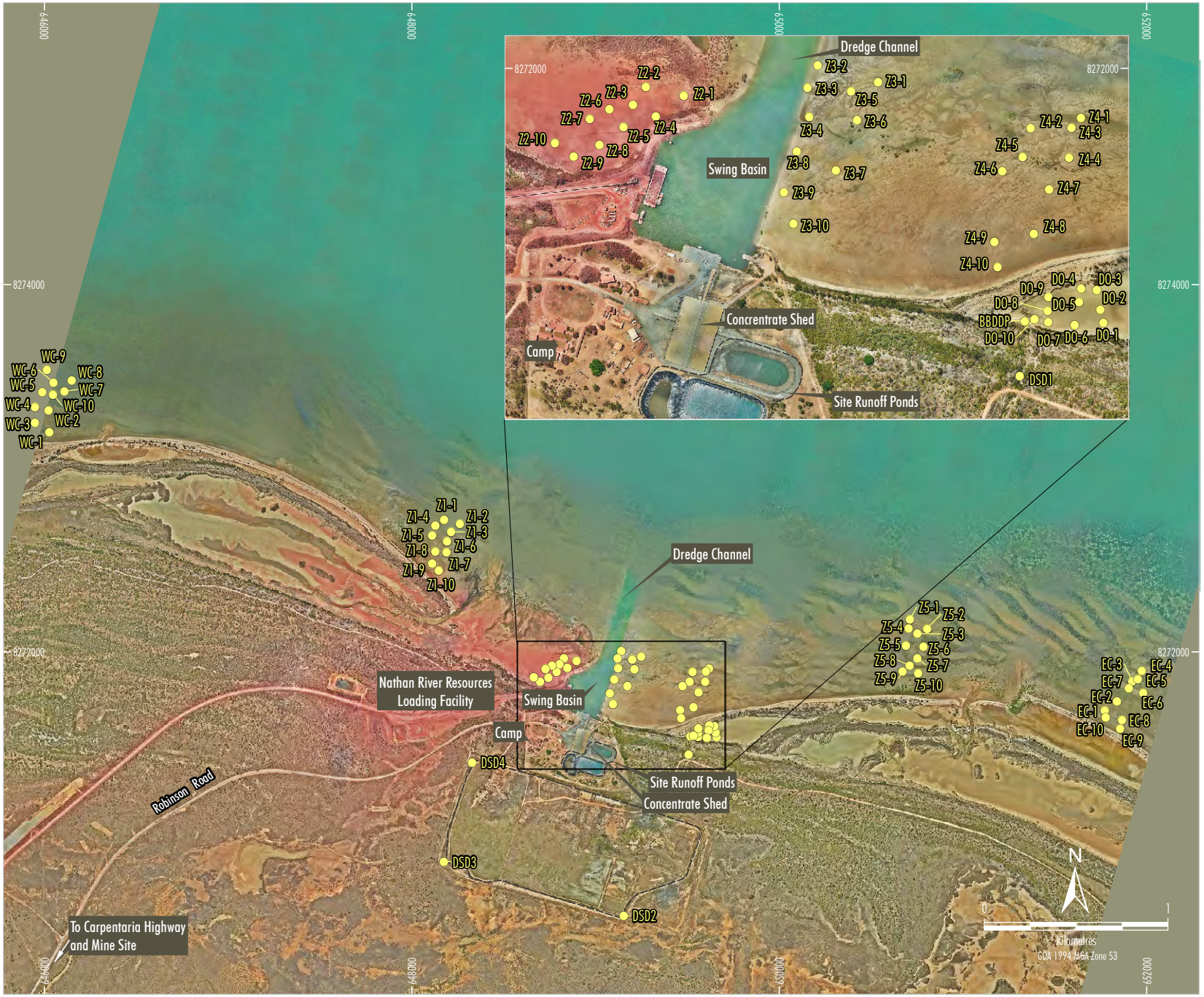
The study found that analyte concentrations of near shore sediments were often variable between and within sampling zones which is consistent with previous surveys. Comparison of mean zone As, Cd, Cu, Pb and Zn concentrations to relevant SQGVs found no exceedances for the seven sampling zones during the 2021 sampling period. The mean concentrations of As, Cd and Cu were generally comparable between potentially impacted and sites well out of the mining lease (reference zones), and well below the applicable SQGV. The mean concentrations of Pb and Zn within Zone 2, and to a lesser extent Zone 3, were considered elevated in comparison to the other zones.

The results attained during the current study indicated that mean Pb and Zn concentrations from each zone were largely comparable to corresponding mean recorded between 2017 and 2020 and, in general, well below associated SQGV. The exception to this was Zone 2, which recorded increased mean concentrations of Pb and Zn, and Zone 3 which recorded an increased mean Pb concentration in comparison to previous data.

As discussed by IPE (2018a, 2018b, 2020 and 2021), within Zone 2 there appears to have been a gradual increase in the concentration of Pb and Zn since 2015, and within Zone 3, a gradual increase of in the concentration of Pb over the same time period. Mean Pb and Zn concentrations of Zone 4 (a potential impact zone) have generally remained stable, and well below respective SQGVs since 2015, and concentrations at sites within Zone 2 and Zone 3, that are frequently inundated by the tide, were well below SQGVs. Therefore, it has historically been considered unlikely that swing basin sediments are dispersing onto the tidal flats adjacent the swing basin to any large degree as a result of BBLF operations or natural processes. This is still considered to be the case, and wind dispersed dust is considered the most likely cause of increased Pb and Zn on the tidal area adjacent the BBLF.

Regarding the BBDDP, DSD and Drain Outlet (DO) sites, the survey found no exceedance of any applicable SQVG, aside from one sample collected at DSD-4 which recorded a Pb concentration of 53 milligrams per kilogram (mg/kg). Due to the location of DSD-4 and its level of Zn (180 mg/kg), it is likely that shipping concentrate rich dust has accumulated within the site. Overall, the concentrations of analytes associated with the shipping product at BBDDP, DSD and DO sites were found to be comparable to the wider survey area, or at least no greater than those recorded within Zone 3, particularly if concentration data from DSD-4 is removed from the analysis. Continued monitoring of these zones will provide an 'early warning system' should changes to coastal morphology or environmental processes occur.

Further discussion of monitoring results is available in Appendix U.



LEGEND

Near Shore Sediment Monitoring Site

Source: Orthophoto MRM (2021); Department of Environment and Natural Resources (2016); IPE (2019); MRM (2022)

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McARTHUR RIVER MINE

Bing Bong Loading Facility
Near Shore Sediment Monitoring Sites

Figure 31

4.6.3 Performance Summary and Recommendations

In light of the analyte concentrations recorded during the current study and following the tiered framework outlined in ANZG (2018) and Simpson and Batley (2016), whilst considering the amount of <63 µm fraction within the whole sediment fraction, sediments present within the immediate vicinity of the BBLF (Zone 2, Zone 3 and Zone 4) are still considered to be of low environmental risk. Monitoring data for the reporting period indicates that performance meets the BBLF EMP TARP Level 2 and supports the conclusion that the key Environmental Objective "*Protect the beneficial uses and community values adjacent to the BBLF and transhipment corridor from impacts associated with MRM's operations*".

As recommended by IPE (2022i), MRM will continue to implement the *McArthur River Metal and Metalloid Concentrations of Near Shore Sediments of Bing Bong Loading Facility* monitoring program throughout the nearshore BBLF environment.

MRM and IPE have identified potential improvements that could be made to the BBLF EMP TARPs so that they can more effectively detect potential impacts resulting from the Mine's operations. MRM proposes to revise TARPs to align with those in the AMP during the next reporting period.

No additional actions or monitoring are recommended.

4.7 Metal and Metalloid Concentrations in Transhipment Seafloor Sediment

TARP Level 1

4.7.1 Monitoring Program

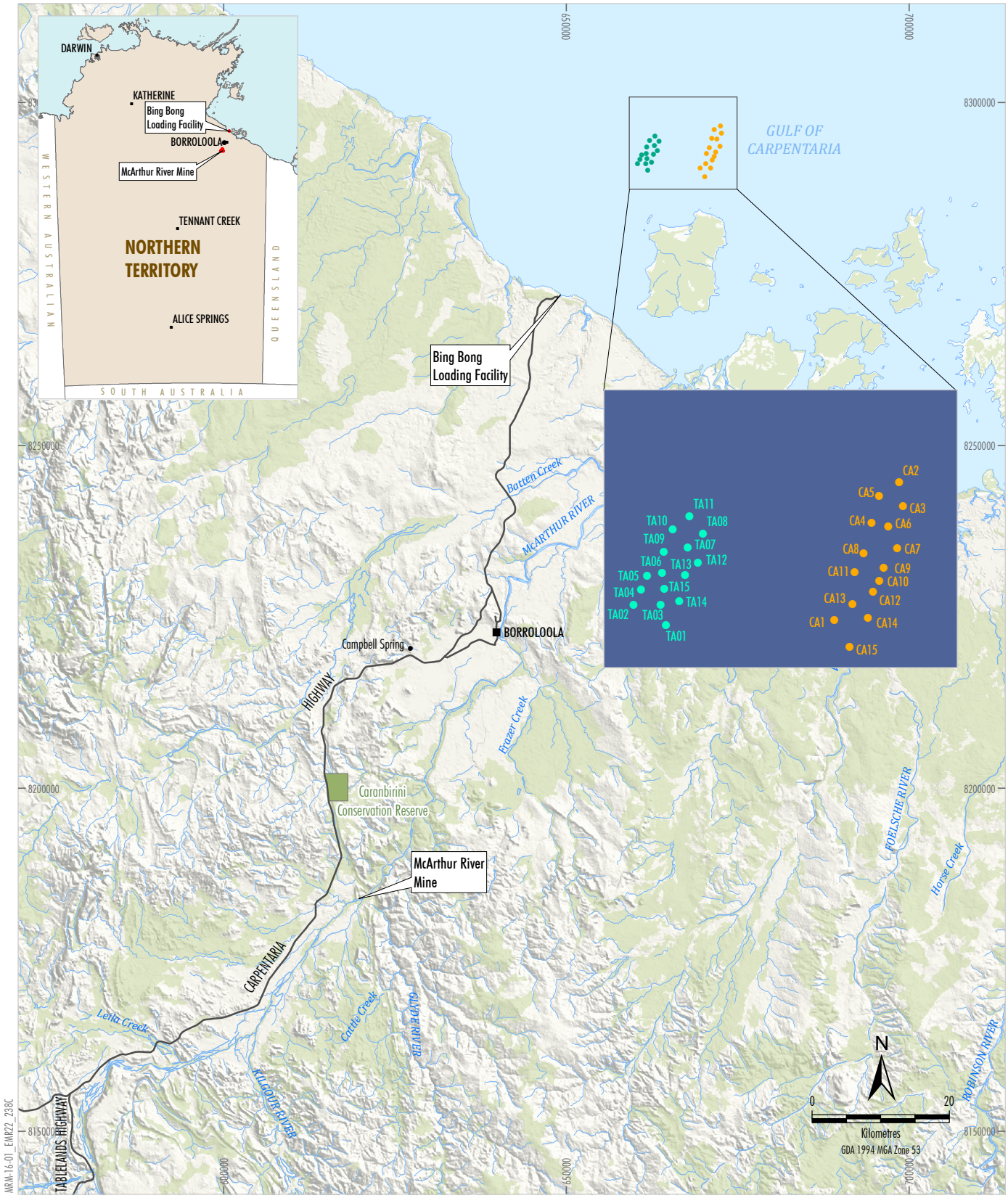
The *McArthur River Assessment of Bioavailable Metal Concentrations and Lead Isotope Ratios of Seafloor Sediments in the BBLF Transhipment Area 2021* (IPE, 2021j, Appendix V) aimed to determine whether seafloor sediment concentrations of analytes associated with the export of concentrate are being affected to the extent that they may be approaching levels biologically harmful to marine flora and fauna.

The annual study's methodology and site selection used in the current study followed the methodology outlined in the McArthur River BBLF EMP 2020 (Section 6.4.3. Metal and Metalloid Concentrations in Transhipment Seafloor Sediment) and in accordance with MRM's former WDL 174-12. This involved random collection of 15 seafloor sediment samples from both the Transhipment Area and the Control Area with a stainless steel Van-Veen grab (see Figure 32).

Results from the monitoring program are used to assess MRM's performance against the key Environmental Objective "*Protect the beneficial uses and community values adjacent to the BBLF and transhipment corridor from impacts associated with MRM's operations*".

4.7.2 Monitoring Results and Trends

The study found that concentrations of all analytes within the <63 micrometre (µm) fraction of the 15 samples collected from the Transhipment Area and Control Area were below the SQGV. Despite the current study showing an increase in the concentrations of analytes associated with the shipping concentrate, the magnitude of fluctuations recorded was considered small when the tonnage of product shipped, the fact that transfers have occurred in the same small geographical area since the late 1990s, and the percentage change relative to the SQGV was taken into account. It is considered unlikely that activities associated with the transfer of shipping concentrate have resulted in measurable detrimental impacts to the benthic community and the surrounding environment.



LEGEND

- Major Road
- River/Creek
- Transhipment Monitoring Site
- Control Monitoring Site

Source: Geoscience Australia - Topography (2006); Department of Environment and Natural Resources (2016); IPE (2019); MRM (2022)

McARTHUR RIVER MINE

Transhipment Seafloor Sediment Monitoring Sites

Figure 32

The analysis of the sediment samples PbIR 207Pb/206Pb and 208Pb/206Pb found the PbIR of Control Area samples were comparable, and akin to those of the Present Day Average Crustal (PDAC), which is consistent with that reported by IPE (2018; 2019; 2020; and 2021). Also consistent with previous reports, PbIR of samples collected from the TA were variable, with a number being closer to that of the MRM concentrate than that of the PDAC and distinctively different from Control Area PbIR. Furthermore, Transhipment Area samples with a PbIR most similar to that of MRM concentrate also had the highest concentrations of lead and zinc, and are located geographically close to the BB1 anchorage.

When compared with recent year's data the current data indicated a slow time-based increase in the concentration of lead and cadmium within the Transhipment Area, while zinc appears to have increased at a greater rate in the last two years in comparison to the slow rise recorded prior to 2019. However, investigation of individual sample concentrations showed that the mean concentration of these analytes, particular zinc, was increased by four samples collected near the BB1 anchorage, which was also the case in 2020. When the percentage contribution of the <63 µm fraction within the whole sediment habitable fraction is taken into account, the variation in mean analyte concentrations between Transhipment Area and Control Area are minimal.

Further discussion of monitoring results is available in Appendix V.

4.7.3 Performance Summary and Recommendations

Monitoring data for the reporting period indicates that performance meets the BBLF EMP TARP Level 1 and supports the conclusion that the key Environmental Objective "*Protect the beneficial uses and community values adjacent to the BBLF and transhipment corridor from impacts associated with MRM's operations*".

As recommended by IPE (2022), MRM will continue to implement the *McArthur River Metal and Metalloid Concentrations in Transhipment Seafloor Sediment* monitoring program.

No additional actions or monitoring are recommended.

5 Community

5.1 Community Engagement Overview

MRM has a comprehensive community engagement program that extends to Borroloola, other communities in the Gulf region and the wider Territory community. Underpinned by open, honest and transparent engagement, we work hard to form genuine and meaningful relationships with our stakeholders and give back to the communities where we operate.

5.1.1 Borroloola Community Office

The opening of the MRM Borroloola Community Office in November 2020 has seen a significant shift in engagement with residents of Borroloola and surrounding areas. Originally opening two days a week, it is now a permanent presence, opening weekdays and staffed by a team of three, including two local resident employees.

The office gives residents the opportunity to meet with our community engagement team at any time and with our senior leaders on a regular basis.

It features a permanent display area, office and boardroom, which can be used for community meetings. The MRM Community Benefits Trust (CBT) now holds all its board meetings in Borroloola at the office, giving the Board the opportunity to meet with funding applicants.

During the reporting period, there were 1,113 visits to the office (Chart 26), despite some closures due to COVID-19 lockdowns. In the coming period, it is planned to host weekly meet and greet sessions in the office every Tuesday.

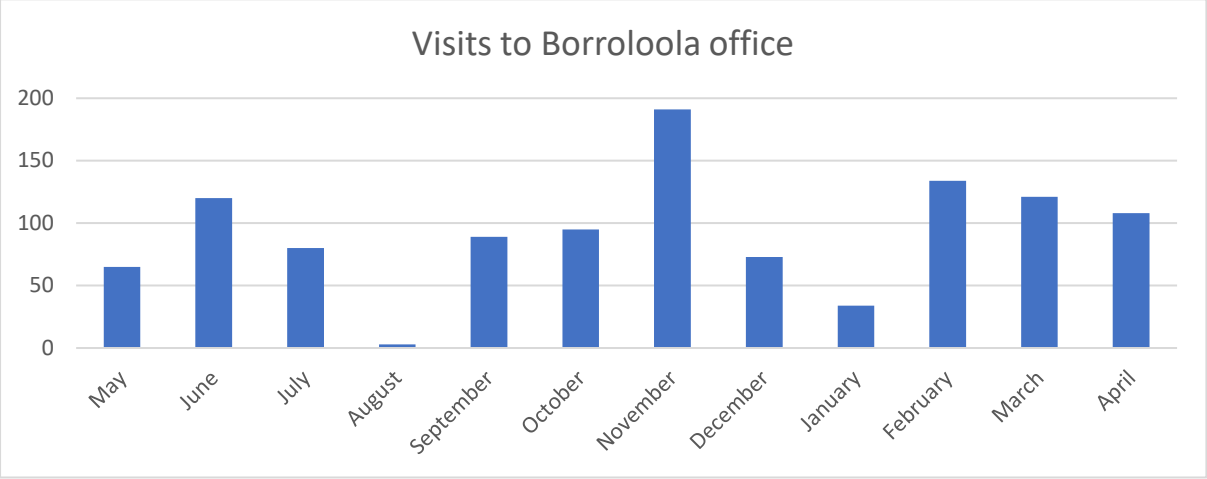


Chart 26: Visits to Borroloola Office

5.1.2 Participation in Local Events, Activities and Committees

MRM is embedded in the local community and a member of a number of boards and committees. Communities and Social Performance Department team members and senior leaders from across MRM are active participants in local events and activities that give them the opportunity to support and connect with local people.

A team member sits on the Roper Gulf Local Authority Board and we participate on the committees of the Borroloola Amateur Race Club, Borroloola Show Committee and Counter Disaster Regional Committee. Our team runs the sideshow alley at the annual Borroloola Show and our Women in Mining Group collects toiletries and sanitary products for donation to the Women's Safe House.

We attend most public events and are invited to many private events and activities in the local community and often provide catering or other support to these events.

5.1.3 MRM Facebook Page

Facebook is the most popular social media channel used in Borroloola and the surrounding region, providing an additional way to engage with local residents. MRM launched its local Facebook page in February 2021 and a large proportion of our followers are resident in the Gulf region.

5.2 Cultural Respect

Our Cultural Respect Strategy demonstrates our commitment to engage with our Aboriginal and Torres Strait Islander employees, our local community stakeholders and the Traditional Owners and Custodians of the country on which we operate in a culturally appropriate manner. The initiatives within the strategy aim to ensure a culturally safe and equitable workplace at the Mine. The Strategy was reviewed during the reporting period and updated to reflect additional commitments of the business.

5.2.1 Indigenous Land Use Agreement

Our Cultural Respect Strategy provides a pathway to have more meaningful and respectful relationships with Indigenous people in community and in our workforce. With these goals in mind, we have started discussions with Traditional Owners about establishing an Indigenous Land Use Agreement which sets out how we will respect culture and share the benefits of mining with Traditional Owners.

The first negotiation meeting with Traditional Owners was held in Borroloola on 22 May 2022.

5.2.2 Cultural Heritage Management

MRM has now fully implemented its Aboriginal Cultural Heritage Management Plan, which is based on world best practice in protecting and respecting sacred sites. The Plan details how sites are protected and monitored for physical or environmental impacts as well as how MRM consults with Traditional Owners and custodians about their ongoing management and protection. An education program is well advanced across the business to ensure leaders, planners and the broader workforce are aware of their responsibilities under the Plan.

We have begun talking with Traditional Owners and custodians about access to sacred sites so they can visit them at any time for ceremony and to make sure they are being looked after. We have also commenced discussions on how we can facilitate Traditional Owners documenting the stories of sacred sites and songlines to pass their knowledge on to future generations.

5.2.3 Cultural Advisors

To support our Cultural Respect Strategy, two local men are employed as Cultural Advisors. Chris Pluto, a Gudanji man, and Alan Baker, a Garrwa Gudanji man, provide advice across the Mine site on cultural matters. They are supported by a number of Elders in community as well as an expert cross-cultural consultant.

5.2.4 Cultural Workshops

Cultural Workshops were developed as part of the Cultural Respect Strategy to provide MRM employees and contractors with face-to-face cultural learning experience about the local people, environment and traditional land the Mine operates on. Workshops are held after hours in a voluntary capacity with attendance on average 30-40 participants. The sessions are facilitated on a regular basis by local Elders with engagement and conversation being as important as the activity being conducted.

To facilitate this initiative, a culturally safe space was created in the Mine village with native bush medicine plants, campfire and other facilities. The outcomes have been:

- Broadened cultural competency and understanding across MRM workforce of Gudanji land and culture.
- Greater respect and willingness to learn about local culture.
- Large participation from local Indigenous employees who voluntarily attend and assist with informal learning conversations.
- Sense of reconnection with family for local Indigenous employees who are currently on site working roster away from community.

5.2.5 Cultural Celebrations

National Aborigines and Islanders Day Observance Committee (NAIDOC) and Reconciliation Weeks are a time of celebration at MRM as workers from across the business come together to share stories and show their respect for Aboriginal and Torres Strait Islander culture. Activities during NAIDOC Week and Reconciliation Week included a Welcome to Country and dance display, opening ceremonies, spear throwing competition, fire making lessons, cultural workshops and special dinner.

5.3 Indigenous Employment

5.3.1 Indigenous Employment Program

Our dedicated Indigenous Employment Program continues to be successful, with 25.2% of our employees identifying as Aboriginal or Torres Strait Islander as at 30 April 2022. Our aim is to reach 28% Indigenous employment, which will mirror the Indigenous make-up of the Territory's working age population, which is currently 27.5%.

The recruitment focus to date has been on entry level positions, with a total of 52 new trainees welcomed into the business throughout 2021 and 56 during the reporting period. 2 trainees from the 2021 intake have since moved into apprenticeships, 9 into other permanent positions and 28 are still completing their traineeship. Unfortunately, 17 have since exited the business for a variety of reasons, including family commitments or taking up roles in other businesses. The turnover rate of 30.3% remains below the turnover rate across the wider business.

While the trainee program continues to provide opportunities for Indigenous people, particularly in the Gulf region, a greater focus will be placed on attracting skilled Indigenous employees and providing leadership development opportunities for existing employees. These programs are currently being implemented across the business.

Key to the long-term success of the Indigenous Employment Program at MRM is the implementation of support mechanisms for all employees, not just trainees or new recruits. These include:

- The establishment of a dedicated Indigenous Employment team in the Communities and Social Performance Department, which includes two full-time cultural advisors from the local community
- A mentoring and buddy network drawn from Indigenous employees across the business, with dedicated mentors available for both women and men
- Cross-cultural mentor training for supervisors and mentors
- A cross-cultural support hotline operated by a Cross Cultural expert consultant to support supervisors in dealing with cultural issues
- All employees and contractors must complete mandatory cultural awareness training as part of their induction and more advanced cross-cultural training is available to all personnel on site
- The establishment of regular bus route between the Mine site and Borroloola to assist employees get to and from work.

5.3.2 Youth Mentoring Network

MRM has a dedicated program to attract local employees from the Gulf Region, and our partnership with Borroloola School aims to generate interest among school students to participate in the mining industry and develop career pathway plans. The MRM Youth Mentoring Network involves a series of four workplace mentoring sessions held over the school year, covering the mining lifestyle and workplace environment, workplace health and safety and career pathway planning.

A number of culturally-appropriate educational resources and interactive materials have been developed in partnership with Borroloola School to deliver the program.

5.4 Community Support Programs

5.4.1 Community Benefits Trust

The McArthur River Mine CBT is a unique partnership between Glencore's McArthur River Mine, the NT Government and the local community. The Trust was established in 2007 for the life of mine.

MRM contributes $1.3 million every year in funding to the CBT and the Trust has invested more than $20 million into about 130 programs in areas that include health, education, job creation and culture.

Some of the larger projects funded in the region include $1 million for the construction of a crèche, $1.2 million towards the funding of a new bridge over Rocky Creek, $1.5 million to build a sporting facility and $30,000 a year for the school breakfast program.

Projects approved for funding during the reporting period include:

- $320,000 for archaeological studies on Mara country;
- $120,000 to support the Malandarri Festival in Borroloola;
- $156,000 for a vet program looking after the health of dogs in the region;
- $153,000 in bursaries to help senior students purchase school supplies; and
- $26,000 for training for Waralungku Arts.

The CBT has an independent Board and local community form the majority of its Directors, including a representative from each clan or language group. In addition to the annual grant to the CBT, MRM funds project management and secretariat services valued at around $350,000 per year.

5.4.2 Local Sponsorships and Donations

MRM is one of the largest sponsors of events, programs and activities in the local region. In addition to our partnership with Borroloola School – valued at $260,000 over three years – we have sponsored the following activities in the Gulf region during the reporting period:

- Borroloola Show;
- Borroloola Rodeo;
- International Women's Day;
- King Ash Bay Fishing Competition;
- Mabunji Christmas Concert;
- Waralungku Arts; and
- Robinson River Fishing Competition.

5.4.3 Territory Partnerships

MRM sponsors events and programs elsewhere in the NT that align with our values and support Territorians. We have a focus on young Territorians, activities that align with our business activities and causes important to our employees. Examples include:

- NT Young Achiever Awards;
- NT Training Awards;
- Women in Resources Awards;
- NT Automotive Apprentice Awards;
- Run with Dad in support of prostate cancer; and
- Mother's Day Classic in support of breast cancer.

5.4.4 Community Grants Program

In April 2021, MRM launched a Territory Community Grants Program to support small projects in the NT. Two funding rounds will be offered each year, with successful projects winning grants of up to $10,000.

Ten programs gave been funded under this program to date as follows:

- $2,500 for the Arafura Wind Ensemble to purchase new musical equipment;
- $10,000 for the Nightcliff Lions Annual Film Festival for children with special needs (two grants);
- $4,000 for the Rotary Club of Litchfield and Palmerston Books for Children initiative;
- $10,000 for the Saltbush Practical Learning Space program;
- $2,500 for the Lions Special Children's Christmas Party;
- $10,000 for the Darwin Surf Life Saving Club's Fannie Bay Classic;
- $3,000 sponsorship of the Salvation Army Red Shield Appeal;
- $5,000 for the Fred's Pass Show; and
- $6,000 for Skipping NT to host the National championships in Darwin.

5.4.5 Annual Charity Golf Days

The MRM Charity Golf Days are held annually to raise money for local charities. After a break in 2020 due to COVID-19 restrictions, in 2021 we partnered with the Humpty Dumpty Foundation to raise money for life-saving medical equipment for babies and children in NT hospitals and health centres. The events are widely supported by our local contractors and suppliers raised more than $250,000 for the Humpty Dumpty Foundation.

The money purchased 100 Ezio drills for 48 hospitals and health centres across the NT to help take blood samples from babies and toddlers and specialised monitoring equipment for Royal Darwin Hospital.

6 Discussion

This section provides a holistic review of the environmental performance at the Mine site over the reporting period. A weight-of-evidence assessment has been undertaken by considering results of key monitoring programs to determine whether there are any areas of environmental risk that require further actions for the protection of the McArthur River beneficial uses and community values from mining impacts.

6.1 Source Pathway Receptor Conceptual Site Model

A SPR conceptual site model has been developed by MRM to determine environmental risks from potential contaminant sources (e.g. areas of the Mine management of non-benign waste) to a receptor (e.g. McArthur River). This is summarised in Figure 33.

The SPR model is a tool that allows undesirable conditions to be identified at all stages through monitoring of the source, the pathway and the receptor. A comprehensive understanding of the SPR model allows for effective and targeted mitigation strategies. Key elements of the model include:

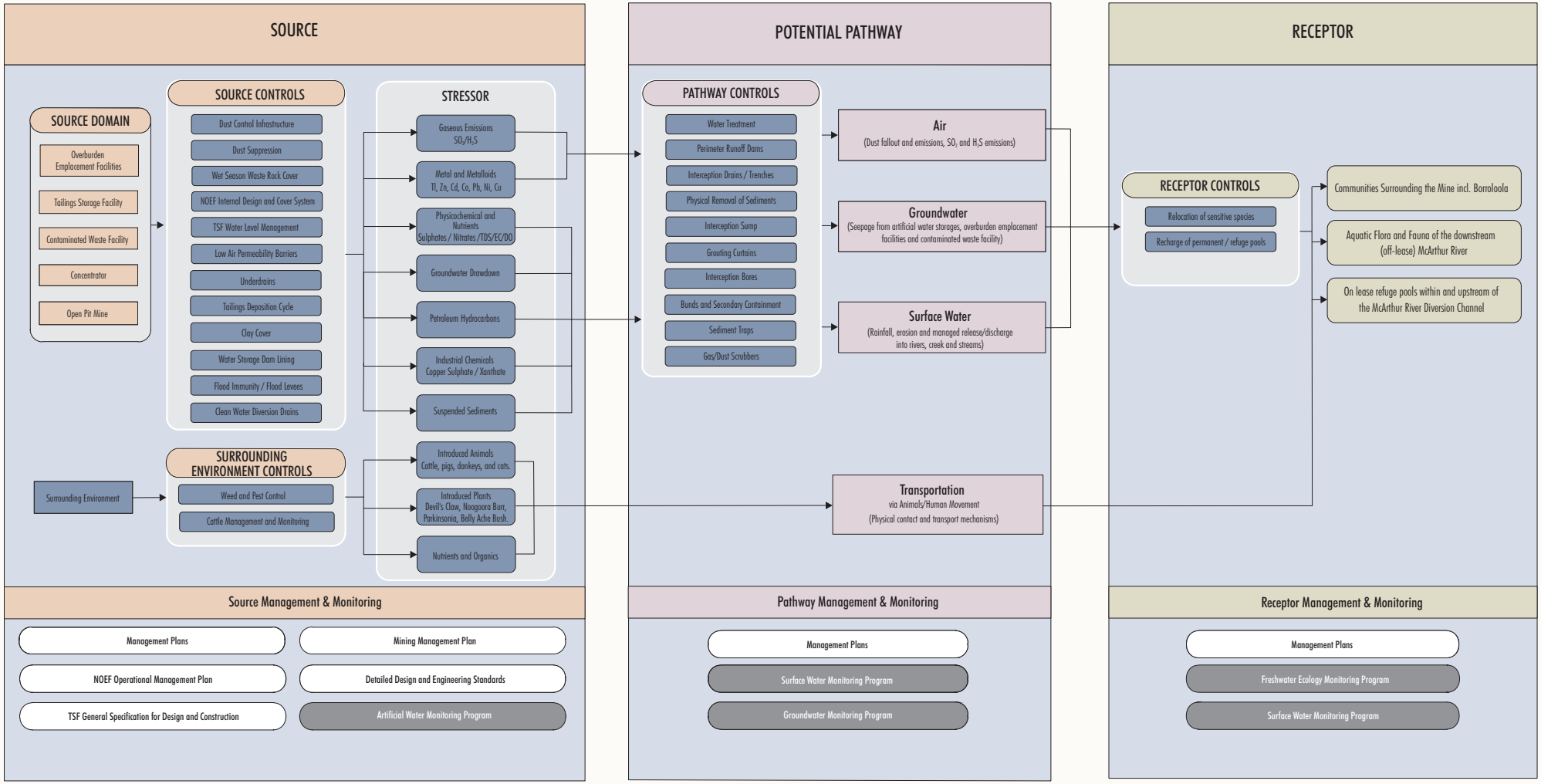
- prioritising the management of potential contamination at sources - preventing and minimising contamination at the source is the most effective strategy in SPR risk management;
- utilising pathway controls to limit the transmission of contaminants of potential concern from the source to the receiving environment;
- monitoring of on-lease surface water, groundwater, fluvial sediment and aquatic fauna for early identification of adverse or unexpected trends prior to potential off-lease impacts; and
- monitoring of off-lease and sensitive receptors including surface water, fluvial sediments and aquatic fauna to confirm environmental objectives are being met.

Principal **sources** of environmental risk at the Mine include the release of acid and metalliferous drainage and the transport of potential contaminants associated with mining and processing activities. Practices that avoid, prevent or limit these sources are the most effective controls for minimising potential risk to the receiving environment.

Airborne (i.e. dust and gas) and waterborne (i.e. surface water or groundwater) transport are the two dominant **pathways** for the transport of contaminants from sources to receptors in natural systems at the Mine.

The potential **receptors** of the contaminants of potential concern at the Mine are the aquatic flora and fauna of the downstream (off-lease) McArthur River and communities surrounding the Mine. Consistent with the previous reporting period, air quality and metals in aquatic fauna monitoring results for the reporting period indicate that there was very low risk of impacts to community health from the Mine. Therefore, discussion in this section focuses on potential ecological impacts to the McArthur River.

A holistic analysis of dust, surface water, fluvial sediment, macroinvertebrate and biota monitoring data has been completed for sites along, and proximal to, Surprise Creek, Barney Creek and the McArthur River. Emu Creek was excluded from the holistic assessment as monitoring data indicates that there are no environmental risks of concern for Emu Creek. Using the SPR model, and based on the findings of the specialists' monitoring reports, the key sources, stressors and pathways have been identified as those listed in Table 20.



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McARTHUR RIVER MINE

Source - Pathway - Receptor
Conceptual Site Model

Figure 33

TABLE 20: SUMMARY OF KEY SOURCES, STRESSORS AND PATHWAYS

Domain	Source	Stressor	Pathway
NOEF	Waste rock	Metals and metalloids Physicochemical and nutrients Suspended sediment Gaseous emissions	Rainfall run-off Rainfall infiltration and seepage Surface Waters: • Barney Creek Diversion Channel • Surprise Creek • Emu Creek
	PRODs		Groundwater (basal seepage)
			Air (dust and gas)
Concentrator	Mill and processing plant	Metals and metalloids Petroleum hydrocarbons Industrial chemicals (e.g. copper sulphate) Gaseous emissions	Rainfall run-off Rainfall infiltration and seepage Surface Waters: • Barney Creek • Barney Creek Diversion Channel
			Groundwater (basal seepage)
			Air (dust and gas)
TSF	Tailings active cell process water	Metals and metalloids Physicochemical and nutrients Suspended sediment Industrial chemicals Petroleum hydrocarbons	Rainfall run-off Rainfall infiltration and seepage Surface Waters: • Surprise Creek • Little Barney Creek
	Water management dam		Groundwater (basal seepage)
	Contaminated waste facility		
Open Pit	Open Pit	Metals and metalloids Physicochemical and nutrients Suspended sediment Industrial chemicals Gaseous emissions Petroleum hydrocarbons Groundwater drawdown	Rainfall run-off Rainfall infiltration and seepage Surface Waters: • Barney Creek Diversion Channel • McArthur River Diversion Channel
	Dams and sumps		
	OEFs waste rock		Groundwater (basal seepage)
	ROM pad		Air (dust and gas)

6.2 Climatic Conditions

The McArthur River catchment experiences a monsoonal climate regime, which is strongly seasonal with distinct wet and dry seasons. Climatic conditions are known to significantly influence the natural environment in the vicinity of the Mine, in particular the McArthur River and its tributaries. The total rainfall over the 12-month reporting period was 537 mm (Chart 27), which is notably lower than the average rainfall over the reporting period (715 mm). The highest daily rainfall (74 mm) during the period was recorded on 20 December 2021. Rainfall throughout the reporting period exhibited distinct wet (November to April) and dry (May to October) seasons, with a dry season low of 0.4 mm for the month of August 2021 to a wet season high of 192 mm in for the month of January 2022.

Barney, Surprise and Emu Creeks are ephemeral (fleeting) waterways, only flowing during the wet season following large episodic rainfall. Surface water flow in these creeks typically ceases annually early in the dry season. The cease to flow conditions and eventual drying of the waterways influence water quality through the evapo-concentration of major solutes. Additionally, as the waterways near cease to flow conditions, the influence of baseflow from mine derived sources or zones of natural mineralisation becomes more pronounced.

Notably, during the reporting period, even the compliance monitoring point SW11 (on the McArthur River) experienced cease to flow conditions during the 2021 dry season between September 2021 and November 2021, during the 2021/2022 wet season in December 2021, and again in the 2022 dry season from April 2022 to the end of the reporting period.

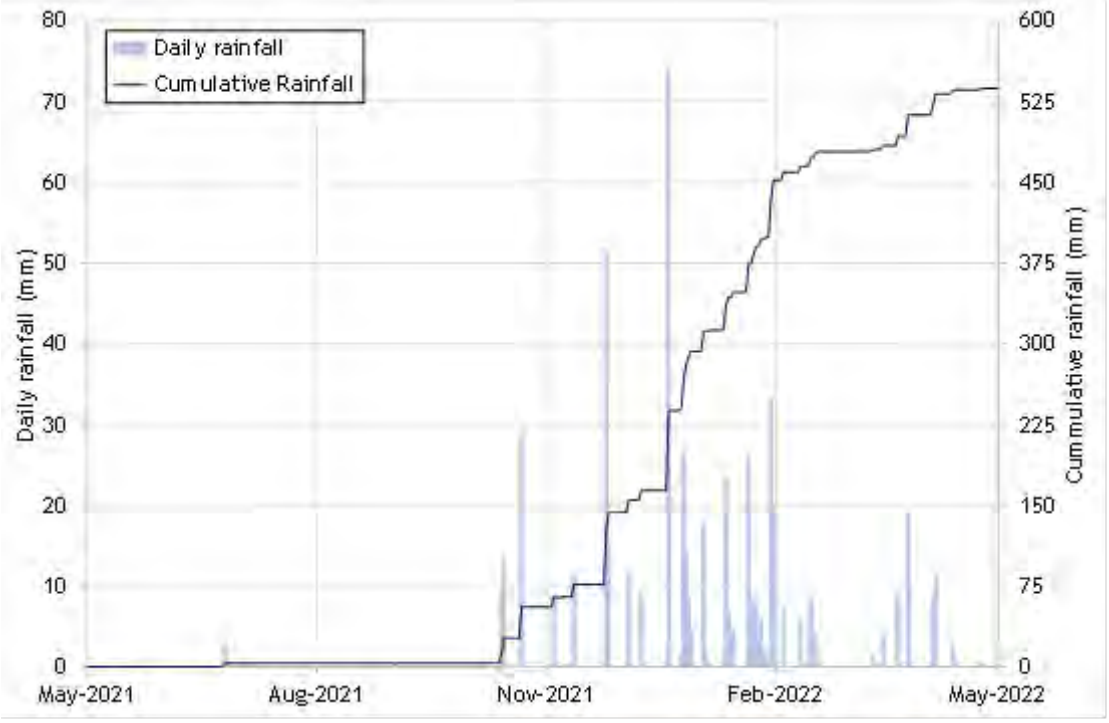


Chart 27: McArthur River Airport Daily and Cumulative Rainfall over the Reporting Period

6.3 Managed Releases

Managed releases from the MLDP were undertaken in accordance with conditions of WDL 174, totalling 106.7 ML released. Managed releases totalling 200.4 ML from the WMD RP were undertaken in accordance with conditions of MRM's VOA 0059. There were no managed releases at SEL1 DP during the reporting period. The total lead and zinc loads discharged to the McArthur River during the reporting period were 1.01 kg and 6.4 kg, respectively. These discharged loads were well under the annual loads limits of 15.8 kg and 3,429 kg, respectively.

6.4 Surprise Creek

Surprise Creek is an ephemeral creek originating from the west of the Mine that flows north of the TSF and south of the NOEF into the Barney Creek Diversion Channel. No flow was reported at Surprise Creek Gauging Station (SCGS) between May 2021 and mid-late December 2021. Surprise Creek flow at SCGS ceased again in mid-February 2022.

The main sources of mining-related contaminants of potential concern reporting to Surprise Creek have been identified as:

- groundwater seepage from the TSF; and
- groundwater seepage from SPROD and the NOEF.

While there is limited available monitoring data during periods of flow for the reporting period, water quality results along Surprise Creek were similar to the previous reporting period, with pH values showing similar results to historical observation.

In October 2020, the TSF Interception Trench was completed, leading to a notable reduction in sulphate and zinc concentrations, as well as electrical conductivity in the surface water, adjacent to the TSF (i.e. at sites SW01, SW02 and SW33). Otherwise, groundwater quality at sites near to the TSF were generally consistent with historical observations and no adverse trends of concern were observed. Since October 2020, monitoring bores located north of the TSF and downstream of Surprise Creek (e.g. GW19033, GW19035) have shown a positive response to the operation of the TSF Interception Trench. Improvements to monitoring bores north of surprise creek (i.e. GW022 and GW023) are expected as a result of the TSF Interception Trench during future reporting periods.

With the exception of a single bore GW159S (considered to be impacted by nearby temporarily stored acidic water and not SPROD seepage), measured pH, zinc and sulphate concentrations around SPROD were generally stable relative to historical data during this monitoring period. The overall improving trend at monitoring bores down hydraulic gradient of SPROD (e.g. GW064D, GW143S and GW143D) has been further increased since the HDPE-lining of SPROD prior to the 2019-2020 wet season.

Metal concentrations in surface water were generally consistent with historical observations, with the majority of samples recorded at the limit of reporting when consistent flows were observed (including thallium and zinc).

Along Surprise Creek, concentrations of bioavailable metals in fluvial sediments were generally either consistent with historical concentrations, or observed to be improving. The only data contrary to this is for the site known as “Rock Hole”, as it was added to the fluvial sediment monitoring program during the previous reporting period and therefore has minimal historical data to compare. During the reporting period, Rock Hole exceeded the SQGV for both bioavailable zinc and bioavailable lead, while sites FS02, FS33, FS34 and FS36 only exceeded the SQGV for bioavailable lead. There were no SQGV-High exceedances at monitoring sites along Surprise Creek during the reporting period. The bioavailable concentrations of arsenic, cadmium and copper in fluvial sediments from all sample sites were found to be below the relative SQGV.

While some elevation of analyte concentrations was observed downstream of operational areas, no adverse trends in surface water or fluvial sediment were identified at sites along Surprise Creek. Importantly, there were no exceedances of the MPCs for lead recorded at biota monitoring sites along Surprise Creek, and the relevant sites noted above showed no adverse trends in biota. The contribution of lower quality baseflow on Surprise Creek water quality has already been shown to have improved following the commissioning of the TSF Interception Trench, and is expected to improve further.

6.5 Barney Creek

Barney Creek is an ephemeral creek originating from the southwest of the Mine that flows through the Barney Creek Diversion Channel around the western and northern perimeter of the mine levee wall and into the McArthur River. No flow was reported at any sites along Barney Creek between May 2021 and late November 2021.

The main potential sources of mining-related contaminants of potential concern reporting to Barney Creek have been identified as the following:

- Dust from the Mill and associated handling and transportation of raw and product materials in this area.
- Dust associated with haulage of waste rock over the Barney Creek Haul Road Bridge.
- Groundwater seepage from the SEPROD and the NOEF in the lower reach of the Barney Creek Diversion Channel.

Groundwater impacts along Barney Creek Diversion Channel are predicted to occur over the life of mine, with the more conservative elements (such as sulphate) reporting to the diversion channel in the short to medium-term and dissolved metals predicted to report to the diversion channel in the long-term as the natural attenuation in the aquifer is limiting the rate of migration of dissolved metals. In terms of potential impacts to the receiving environment, other contamination pathways (e.g. dust fallout landing within the catchment) are considered to be more relevant to water and sediment quality in the Barney Creek Diversion Channel over the short-term. Notwithstanding, the concentrations of contaminants of potential concern have been considered to identify any potential unexpected trends or risks associated with groundwater.

Similar to the previous reporting period, groundwater concentrations for sulphate, pH and zinc in the area between the Mill and Barney Creek Diversion Channel remain stable and no adverse trends have been identified at the monitoring bores (i.e. GW003A, GW005A, GW015, GW149D, GW149S). One newly installed bore directly adjacent to the CRP (i.e. GW19052D) showed elevated EC, sulphate, lead and zinc concentrations, indicating potential impacts associated with the CRP or WOEF. However, groundwater level data shows that the Open Pit is drawing the water table down in this area creating an eastward flow away from the Barney Creek Diversion Channel. Consistent with modelling predictions from the OMP EIS, groundwater bores in the vicinity of SEPROD continued to record relatively higher sulphate concentrations, however, several bores during the reportion now show a stabilisation of concentrations, or a decrease. Groundwater at this location is likely affected by SEPROD seepage, and is showing a generally improving trend in both pH and zinc concentration.

Metals and other key analyte concentrations in surface water were generally consistent with historical observations. Sulphate, EC and zinc were observed to be within historical ranges at sites along Barney Creek compared to previous years, with some elevated levels associated with managed releases. No adverse surface water quality trends have been identified at sites along Barney Creek.

Similar to those on Surprise Creek, four sites (FS03, FS18, FS19 and FS20) along Barney Creek exceeded the fluvial sediment SQGV for bioavailable lead, while two sites (FS03 and FS19) exceeded the SQGV-High. Three of these sites (FS03, FS19 and FS20) also exceeded the fluvial sediment SQGV for bioavailable zinc, and FS03 and FS19 exceeded the SQGV-High. Additionally, the SQGV for bioavailable cadmium and bioavailable arsenic was exceeded by FS03 and FS20, respectively. As in the previous reporting period, all sites that exceeded the SQGV for lead were within or directly adjacent operational areas – FS03 near the Mill, and FS18, FS19 and FS20 nearby or downstream of the Barney Creek Haul Road Bridge, between the NOEF and the Open Pit.

Though elevated concentrations of lead in fluvial sediment were recorded along the Barney Creek sites downstream of the Mill, there were no exceedances of the current MPC for lead in fish of 0.5 mg/kg at all sites along Barney Creek during the reporting period.

Based on the monitoring data, the primary sources contributing to the metals in the Barney Creek Diversion Channel fluvial sediment are dust associated with the Mill area and haulage of waste rock across Barney Creek Haul Road Bridge. Deposited dust landing within the Barney Creek catchment can be transported to Barney Creek via surface water runoff in the catchment.

Consistent with the previous three reporting periods, total dust deposition measured as total insoluble matter was highest adjacent to the Barney Creek Haul Road Bridge. However, the highest lead and zinc dust loads have been identified at sites in close proximity to the Mill (due to the processing and handling of materials with high concentrations in this area), which recorded the next highest level of total deposited dust. These two dust sources are considered to be the primary contributors to the elevated metal concentrations in fluvial sediment and biota at sites along the Barney Creek Diversion Channel.

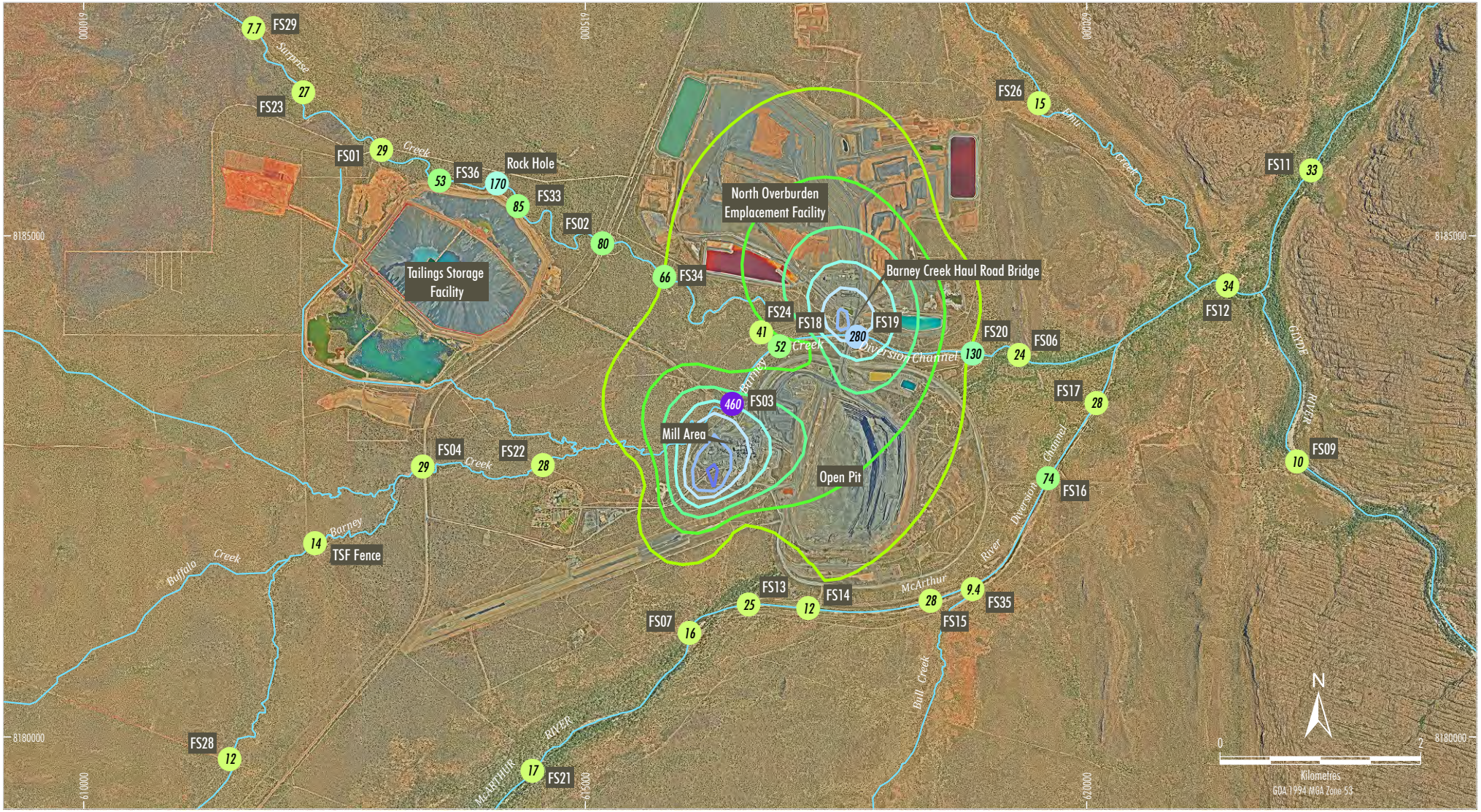
Data attained during the reporting period identified increases in the concentrations of analytes associated with the Mine within dust, fluvial sediment and biota similar to the previous reporting period. It is likely that the increased haulage of waste rock across the Barney Creek Haul Road Bridge to the NOEF over the past two reporting periods contributed to this increase, due to the associated increased number of truck movements leading to settled dust becoming disturbed and resuspended. Notably, at monitoring sites near the Mill, while identified analytes were measured to have increased, total insoluble matter levels have remained similar to the previous reporting period. This data can be used to identify that an increasing contribution is likely resulting from operational aspects related to concentrate (e.g. concentrate stockpiles, road train loading, etc), as opposed to operations related to ore.

The correlation between the dust lead loads and fluvial sediment lead concentrations is depicted on Figure 34, and between dust lead loads and biota lead concentrations on Figure 35. Similarly, the correlation between the dust zinc loads and fluvial sediment zinc concentrations is depicted on Figure 36, and between dust zinc loads and biota zinc concentrations on Figure 37.

IPE has previously recommended investigating the viability of extending the fluvial sediment removal remediation program (Plate 14) to include the lower reach of Barney Creek in the vicinity of FS20 to further reduce the likelihood of this sediment reaching the McArthur River.

Overall, the contribution of loads from dust to the local surface water system is considered to be the main driver of fluvial sediment quality and concentrations of metals in biota.

Plate 14: Sediment Removal from Barney Creek and Barney Creek Haul Road Bridge Sump



MRM-16-01_EMR22_232D

LEGEND

Major Drainage

Annual Average Lead Load in Deposited Dust (mg/m²/month)

1
2
3
4
5
6
7
8
9

March/May 2021 Bioavailable Lead in Fluvial Sediment Results

36 March/May 2021 Bioavailable Lead in Fluvial Sediment Results (mg/kg)

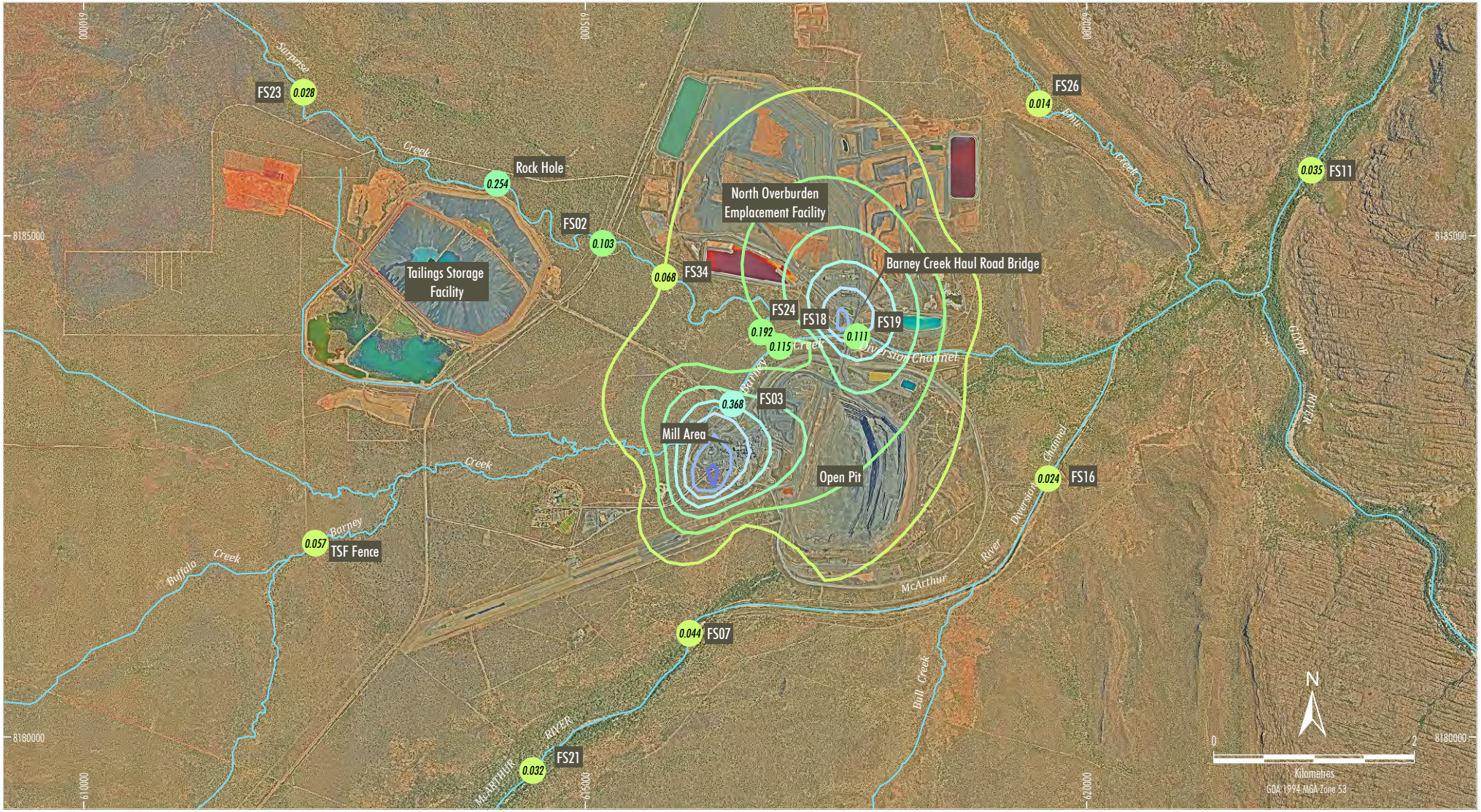
500
220 (SQGV - High)
50 (SQGV)
0

Source: Orthophoto MRM (2021); Department of Environment and Natural Resources (2016); MRM (2022)

McARTHUR RIVER MINE

Annual Average Lead in Deposited Dust and March/May 2021 Fluvial Sediment Results for 2021/2022

Figure 34



MRM-16-01_EMR22_234E

LEGEND

Major Drainage

Annual Average Lead Load in Deposited Dust (mg/m²/month)

1
2
3
4
5
6
7
8
9

Annual Average Lead in Aquatic Fauna

0.227 Annual Average Bioavailable Lead in *M.splendida* Trunk Average (mg/kg)

Note: *M.splendida* is only one of three environmental indicator species collected.

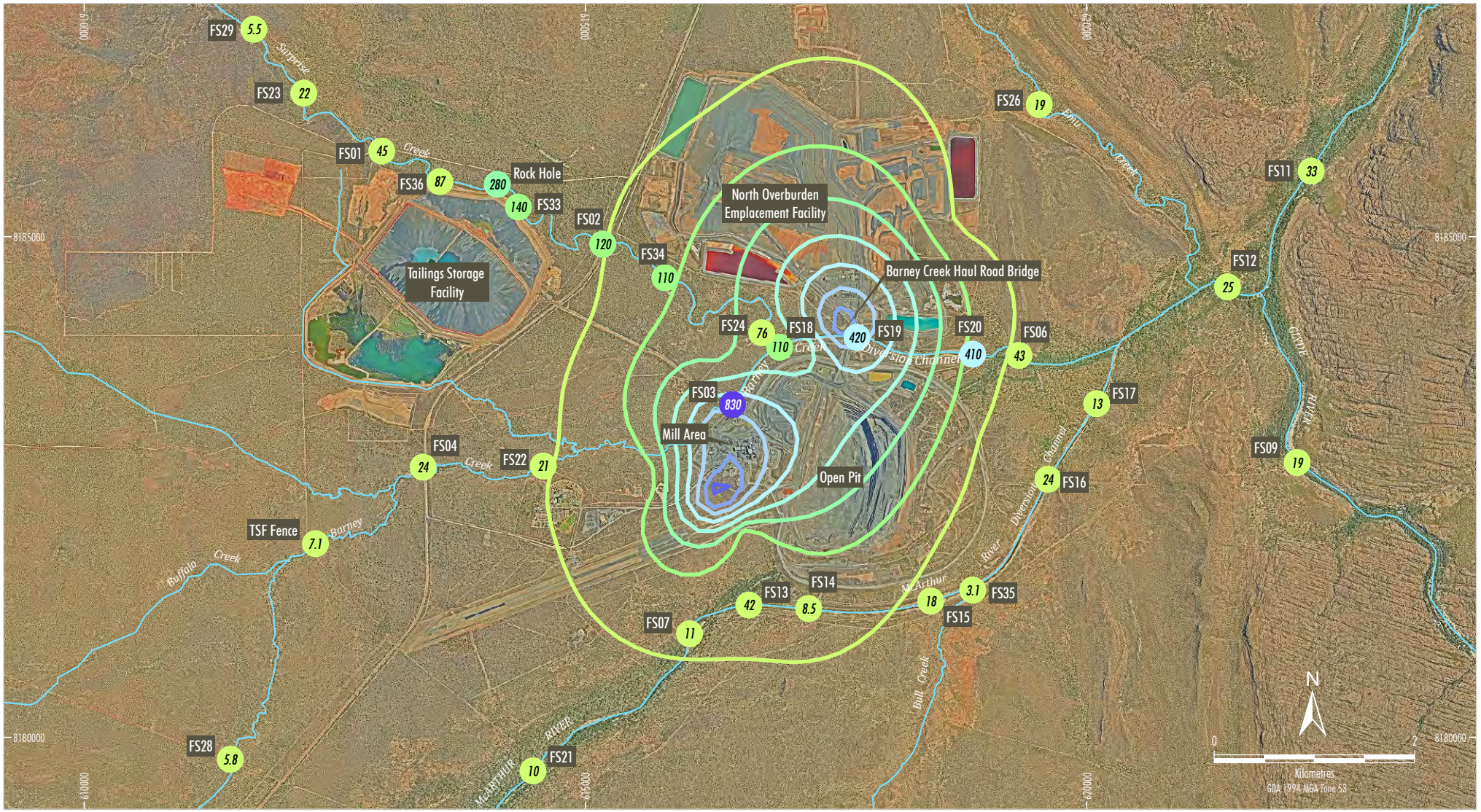
1.0
0.5 (MPC)
0

Source: Orthophoto MRM (2021); Department of Environment and Natural Resources (2016); MRM (2022)

McARTHUR RIVER MINE

Annual Average Lead in Deposited Dust and Aquatic Fauna for 2021/2022

Figure 35



MRM-16-01_EMR22_235E

LEGEND

Major Drainage

Annual Average Zinc Load in Deposited Dust (mg/m²/month)

10	60
20	70
30	80
40	90
50	100

March/May 2021 Bioavailable Zinc in Fluvial Sediment Results

22 March/May 2021 Bioavailable Zinc in Fluvial Sediment Results (mg/kg)

1000

410 (SQGV High)

200 (SQGV)

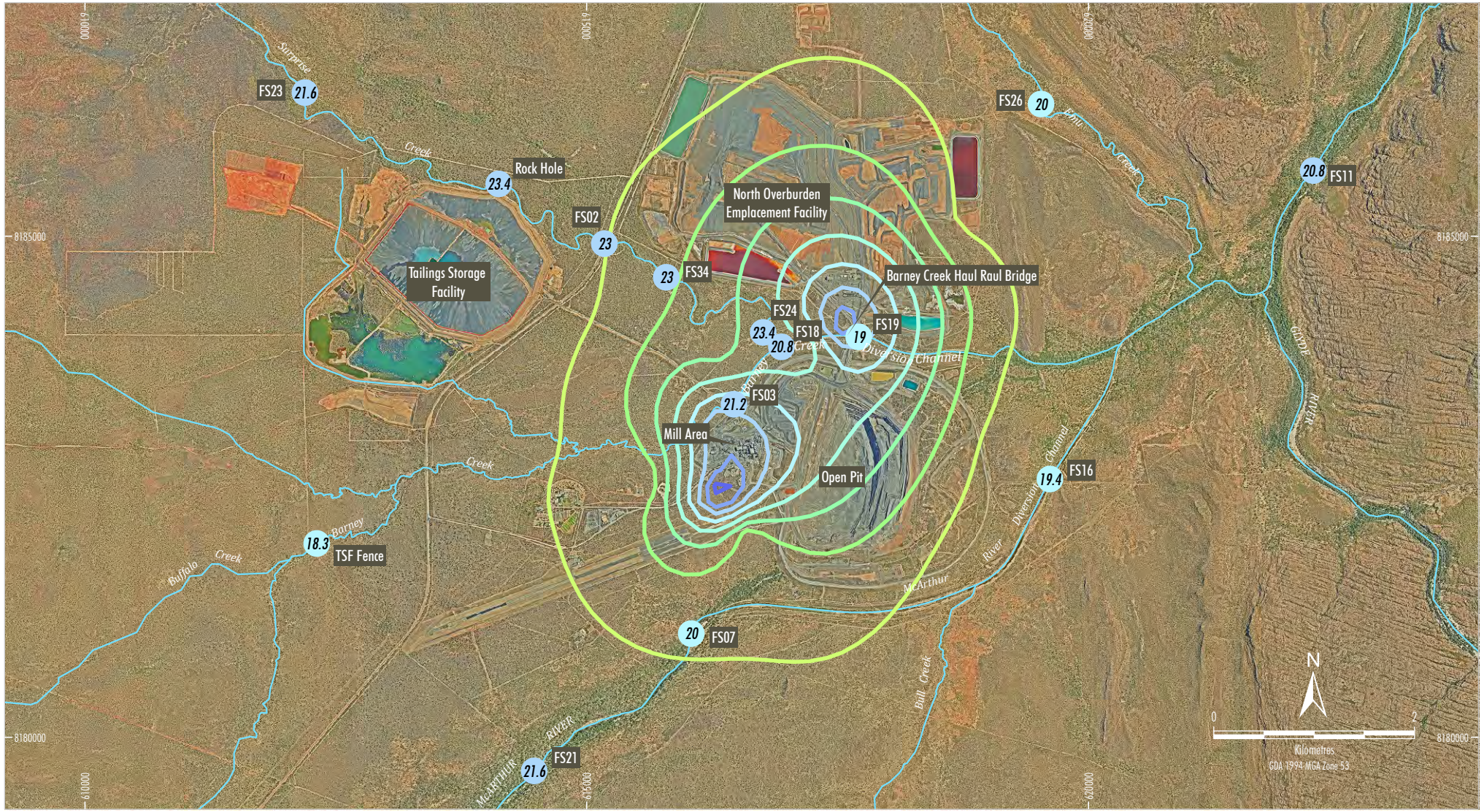
0

Source: Orthophoto MRM (2021); Department of Environment and Natural Resources (2016); MRM (2022)

McARTHUR RIVER MINE

Annual Average Zinc in Deposited Dust and March/May 2021 Fluvial Sediment Results for 2021/2022

Figure 36



MRM-16-01_EMR22_233E

LEGEND

Major Drainage

Annual Average Zinc Load in Deposited Dust (mg/m²/month)

10	60
20	70
30	80
40	90
50	100

Annual Average Zinc in Aquatic Fauna

19.6 Annual Average Bioavailable Zinc in *M.splendida* Trunk Average (mg/kg)

Note: *M.splendida* is only one of three environmental indicator species collected.

40
20
0

Source: *Orthophoto MRM (2021); Department of Environment and Natural Resources (2016); MRM (2022)*

McARTHUR RIVER MINE

Annual Average Zinc in Deposited Dust and Aquatic Fauna for 2021/2022

Figure 37

6.6 McArthur River Health

No elevated results beyond the SSTVs for key metals of concern (zinc, lead, cadmium, copper, arsenic, manganese and thallium) have been identified at SW11 over the reporting period. Historically, sulphate concentrations (and similarly electrical conductivity) were occasionally elevated beyond the SSTV, but for a number of years the records have shown an improvement in performance, with no results exceeding the sulphate SSTV since 2015.

The results exceeding the SSTVs at SW11 identified in the reporting period were restricted to pH, filtered aluminium, filtered iron, nitrate, dissolved oxygen and TPH C10-36 Fraction. No elevated results exceeding SSTVs were found to be related to Mine activities and were considered to be as a result of natural river processes and contributions from areas upstream of the Mine or in the neighbouring Glyde River catchment.

During the reporting period, one site located in the McArthur River Diversion Channel (i.e. FS16) exceeded the fluvial sediment SQGV for bioavailable lead. There were no SQGV-High exceedances at monitoring sites along the McArthur River during the reporting period. FS16 has historically been considered to be upstream, and upwind, of obvious anthropogenic lead influences (aside from pit dust). Sites immediately downstream of FS16 (i.e. FS17) recorded fluvial sediment concentrations well below the SQGV for bioavailable lead. An analysis of the PbIR of FS16 found there was a sufficient distinction between the PbIR of FS16 and the PbIR of MRM concentrate to suggest some influence from the surface mineral expression directly upstream of FS16, and that the lead at FS16 does not necessarily originate from mining activities.

A similar exceedance at fluvial sediment monitoring site FS16 occurred during the 2018/2019 EMR reporting period.

The bioavailable concentrations of arsenic, cadmium, copper and zinc in fluvial sediments from all sample sites along the McArthur River were found to be below the relative SQGV.

Overall, the fluvial sediment and biota monitoring continue to show that the Mine's operations continue to have little measurable effect on the McArthur River, and that elevated tissue metal concentrations are limited to Barney and Surprise Creek sites within operational areas.

In addition, the current data continues to support past conclusions that there has been no observable decline in species diversity or abundances in waters upstream and downstream of the mineral lease, outside of that which would be considered to be natural variation as a result of variable seasonal flows or changes in river bed morphology (Plate 15).

Plate 15: Two Sampling Methods Utilised to Capture Aquatic Fauna during the Reporting Period

6.7 Conclusions and Recommended Actions

The holistic assessment using the SPR model previously identified that deposited dust from the Mill and haulage of materials across the Barney Creek Haul Road Bridge are the main contributors to elevated metals in fluvial sediment and biota along Barney Creek. A number of measures and investigations were identified in the previous reporting period to be implemented to reduce the potential risk to biota associated with dust. During the reporting period, the following measures were undertaken:

- sediment removal from the lower reach of Barney Creek; and
- three DustTrak Aerosol Monitors will collect baseline data to enable an assessment of the effectiveness of the dust suppression agent against traditional haul road watering methods. The dust suppression trial results will be available in the next reporting period. If successful, it is anticipated that the dust suppression agent would continue to be used on haul roads.

As a result of the increased understanding of the system and mitigation measures likely to be effective in reducing potential risk to biota, Table 21 outlines the measures to be carried out in the following reporting period.

TABLE 21: DUST MITIGATION MEASURES TO BE UNDERTAKEN DURING THE NEXT REPORTING PERIOD

Identified Contaminant Source	Further Measures to be Undertaken in next Reporting Period	Timing
Dust associated with haulage across Barney Creek Haul Road Bridge	Trial of dust suppression for watering of haul roads to reduce wheel-generated dust.	Commenced – Results provided next reporting period.
	Investigation into the viability of sediment removal from the lower reach of Barney Creek.	2022
Dust associated with Mill operations and handling/storage of materials (particularly product materials)	If the above trial is successful the product will be expanded to include the Mill area during normal operations.	Pending Above
	An investigation into the Wiki Borefield (west of the TSF) is currently underway to determine suitability for extraction of clean water to allow for improved operation of recently installed dust suppression system.	Ongoing

Table 22 provides a summary of the proposed changes to MRM's monitoring programs that have been identified by expert specialists and MRM in consideration of the environmental performance over this EMR reporting period.

TABLE 22 SUMMARY OF CHANGES FOR EACH MONITORING PROGRAM FOR THE NEXT REPORTING PERIOD

Monitoring Program	Change for the Next Reporting Period
Ambient Air	• Commence 3-month long dust gauge sampling periods at key monitoring sites, co-located alongside the existing routine dust gauge monitors. • Incorporate secondary sign-off on the sample jar, field sheet and lab forms to ensure the correct sample lengths are accurately recorded
Revegetation	• Implement the revegetation monitoring program with a successional approach and undertake intensive erosion control works in highly unstable areas to reduce water velocities and encourage sedimentation.
Riparian Birds	• Investigate alternative measures for establishing cane grass and other riparian ground cover species at revegetation sites, including cluster plantings of key species at middle and upper bank locations.
Fluvial Sediment	• Investigating the viability of extending mitigation measures currently implemented to reduce the likelihood of sediment from this area reaching the main McArthur River.
NOEF Temperatures	• Quarterly measurements of temperatures from the existing temperature bores will be discontinued during the next reporting period. • The temperature monitoring program will focus on: - new vertical temperature bores; - increased use of thermal imaging to monitor NOEF temperatures; and - horizontal instrument arrays.

In consideration of all monitoring results for the reporting period, the performance required to protect the downstream beneficial uses and community values of the McArthur River continues to be achieved (Plate 16), and the current monitoring and management measures being implemented are appropriate, with the recommended additional measures to further reduce the risk associated with lead fallout. Groundwater trends continue to remain generally stable and within the predictions of the OMP EIS.

Plate 16: McArthur River Diversion Channel

6.8 Mining Management Plan Review

In consideration of the results presented in this EMR, the Mining Management Plan has been reviewed and it was determined that no updates are currently required in order for MRM's key environmental management objectives to continue to be met.

7 Incident Reporting

A reconciliation of all environmental incidents at the Mine externally reported from 1 May 2021 to 30 April 2022 is provided in Appendix W.

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9 Abbreviations

Abbreviation	Definition
°C	degrees Celsius
%	percent
2013-2015 MMP	2013-2015 Mining Management Plan
AAPA	Aboriginal Areas Protection Authority
ACL	added contaminant limits
Ag	silver
AIMS	Australian Institute of Marine Science
Al	aluminium
AMD	Acid Mine Drainage
AMMP	annual marine monitoring program
AMP	Adaptive Management Plan
ANCOLD	Australian National Committee on Large Dams Incorporated
ANZG	Australian and New Zealand Governments
AQMP	Air Quality Management Plan
As	arsenic
Assessment Report 86	Assessment Report 86 for the McArthur River Mine Overburden Management Project
B	boron
BB	Bing Bong
BBDDP	Bing Bong Dredge Spoil Discharge Point
BBDS	Bing Bong Dredge Spoil
BB EMP	Bing Bong Loading Facility Environment Management Plan
BBLF	Bing Bong Loading Facility
BCD	Barney Creek Diversion Chanel
BGM	Bituminous Geomembrane
Bi	bismuth
CA	Control Area
CBT	Community Benefits Trust
CCL	compacted clay liner
Cd	cadmium
CDU	Charles Darwin University
CE	Central East
cm	centimetres
Co	cobalt
Cr	Chromium
CRP	Concentrator Runoff Pond
Cu	copper
CW	Central West
CWAS	CW Alpha Sump
CWCST	CW Charlie Sediment Trap
DAWE	Commonwealth Department of Agriculture, Water and the Environment
DBH	Diameter at Breast Height
DEPWS	Department of Environment, Parks and Water Security

Abbreviation	Definition
DGT	diffusive gradients in thin films
DGV	default guideline value
DDG	Deposited Dust Gauge
DITT	NT Department of Industry, Tourism and Trade
DME	NT Department of Mines and Energy
dmtpa	dry metric tonnes per annum
DO	Drain Outlet
DoH	Department of Health
DPIR	NT Department of Primary Industry and Resources
DSD	Dredge Spoil Drain
EC	electrical conductivity
EIS	Environmental Impact Statement
EMP	Environment Management Plan
EMR	Environmental Monitoring Report
EMS	Ecological Management Services Pty Ltd
Environmental Assessment Act	NT *Environmental Assessment Act 1982*
EPBC Act	Commonwealth Environment Protection and Biodiversity Conservation Act 1999
EPROD	Eastern Perimeter Runoff Dam
ESP	exchangeable sodium percentage
EST	East Sediment Trap
F	fluoride
Fe	iron
FSANZ	Food Standards Australia and New Zealand
FWQ	Foot Wall Quarry
g/m^2/month	grams per square metre per month
GHD	GHD Pty Ltd
Glencore	Glencore PLC
GSL	Geosynthetic Liner
GW	Groundwater
ha	hectares
HC	High Capacity
HDPE	high density polyethylene
Hg	mercury
HIL	health-based investigation levels
HMP	Heavy Medium Plant
HMTV	Hardness Modified Tigger Value
HW	Hangingwall
HVAS	High Volume Air Sampler
ICP-AES	Cold Vapour Generation Inductively Coupled Atomic Emission Spectrometry
ICP-MS	inductively coupled plasma mass spectrometry
IM	Independent Monitor
IPE	Indo-Pacific Environmental
ISQG	interim sediment quality guideline
January 2020 MMP	*McArthur River Mining Pty Ltd, Mining Management Plan 2020*
KBA	Key Biodiversity Area
KCB	Klohn Crippen Berger

Abbreviation	Definition
Kg	kilograms
km	kilometres
kt	kilotonnes
L	litres
LC	Low Capacity
L/s	litres per second
LDPE	low-density polyethylene
LFZ	Lower Fold Zone
LGO	low-grade ore
LNAPL	Light Non-Aqueous Phase Liquid
LOM	Life of Mine
LS-NAF(HC)	Low salinity nori-acid forming rock (high capacity)
LWD	large woody debris
m	metres
m^3	cubic metres
MA	Mineral Authority
mAHD	metres Australian Height Datum
MCH	McArthur River Diversion Channel
Mg	manganese
mg/kg	milligrams per kilogram
mg/L	milligrams per litre
Mining Zone	mining activity throughout the lease
ML	megalitres
ML/day	megalitres per day
MLDP	Mine Levee Discharge Point(s)
MLN	Mineral Lease Northern
mm	millimetre
Mo	molybdenum
MOL	Maximum Operating Level
MPC	Maximum Permitted Concentration
MRM	McArthur River Mining Pty Ltd
MS-NAF(HC)	Metalliferous saline nori-acid forming rock (high capacity)
MS-NAF(LC)	Metalliferous saline nori-acid forming rock (low capacity)
Mt	million tonnes
MTL	Maximum Tolerable Level
Mtpa	million tonnes per annum
MUDS	Mine Underground Dewatering System
NAF	non-acid forming
NATA	National Association of Testing Authorities
NE	Northeast
NEPM	National Environment Protection Measures
Ni	nickel
NO_3	nitrate
NOEF	North Overburden Emplacement Facility
NRR	Nathan River Resources

Abbreviation	Definition
NSW EPA	New South Wales Environment Protection Authority
NT	Northern Territory
NT EPA	NT Environment Protection Authority
O_2	Oxygen
OMP	Overburden Management Project
OP ELS	Open Pit East Levee Storage
OP P2	Open Pit Pond 2
ORPS	Old ROM Pad Sump
PAF	potentially acid forming
PAF(HC)	Potentially acid forming rock (high capacity)
PAF(RE)	Potentially acid forming rock (reactive)
Pb	lead
PbIR	Pb isotope ratios
PDAC	Present Day Average Crustal
PER	Public Environmental Report
Phase 2	Phase 2 Project
Phase 3	MRM Phase 3 Development Project
ppm	parts per million
PROD	Perimeter Runoff Dam
QA/QC	quality assurance and quality control
RE	Reactive
Reference Zones	sites well out of the mining lease
RL	Reference Line
RMP	Rehabilitation Management Plan
ROM	run-of-mine
RP	Release Point
RPD	relative percent difference
S	sulphur
SAR	sodium absorption ratio
Sb	antimony
Se	selenium
SE	Southeast
SO_2	sulphur dioxide
SO_4	sulphate
SOEF	South Overburden Emplacement Facility
SPROD	South Perimeter Runoff Dam
SQGVs	sediment quality guideline values
SRP1	Site Runoff Pond 1
SRP2	Site Runoff Pond 2
SRP3	Site Runoff Pond 3
SSTV	site-specific trigger value
SW	Surface Water
SWST	South West Silt Trap
t	tonne
TA	Transhipment Area
TARP	Trigger Action Response Plan

Abbreviation	Definition
TBA	Total Basal Area
TDS	total dissolved solids
TEOM	Tapered Element Oscillating Microbalance
the Mine	McArthur River Mine
TAS	Todoroski Air Sciences Pty Ltd
Tl	thallium
TPH	Total Petroleum Hydrocarbons
TSF	Tailings Storage Facility
UG&OP	underground void and open pit
USEPA	United States Environmental Protection Authority
U	uranium
VDD	Van-Duncan's Dam
VOA	Variation of Authorisation
VWP	Vibrating Wire Piezometers
WC	Western Control [zone]
WDL	Waste Discharge Licence
WDS	West D Sump
WMD	Water Management Dam
WOEF	West Overburden Emplacement Facility
WPROD	Western PAF Run-Off Dam
WRM	WRM Water & Environment Pty Ltd
WTP	Water Treatment Plant
XRF	X-Ray Fluorescence
Zn	zinc
µg/L	micrograms per litre
µg/m³	micrograms per cubic metre
µm	micrometre

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