

8/1/2022

WDL 247 Environmental Monitoring Report Version 1

22 June 2021- 21 June 2022

Rustlers Roost Project Area

MLN1083	Waste Discharge Licence No. 247
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Endorsement

Endorsement

	Author	Author	Reviewed by	Approved by
Date	01/08/2022	1/08/2022	01/08/2022	01/08/2022
Name (s)	Sally Horsnell	Jaime Marr	Charles Hastie	Charles Hastie
Signature				

I Charles Hastie, PGL Chief Mining Engineer have reviewed this report and I confirm that to the best of my knowledge and ability, all information provided in the report is true and accurate.


SIGNATURE:

DATE: 01/08/2022.....

Environmental Monitoring Report Checklist

Y/N	Page	Requirement	Department's Comment
Y	0	Title Page -Does it include report name, reporting period, submission date, version number, Licence number, Report author and business details	
Y	ii	Certification	
Y	1	Executive summary	
Y	9	Monitoring Objective	
Y	16	Monitoring Method	
N/A	-	Where there is an approved monitoring plan – details of approved plan title, version number, date of submission)	
Y	16	Where there is no approved monitoring plan – details map, sample locations, site layout, description of receiving environment, description of sampling and analysis methods, factors affecting variability in monitoring results	
Y	28	Monitoring Results	
Y	28/ App A	Has all monitoring data been included?	
N/A	-	Calculations/exceedance of assessment criteria	
Y	45	QAQC	
Y	49	Presentation including graphs against trigger levels/benchmarks.	
Y	49	Discussion analysis and data interpretation against trends included?	
Y	62	Conclusions and proposed actions,	
Y	62	Have non-conformances been identified?	
Y	66	Have changes made to monitoring programs been identified and detailed?	
Y	66	Have corrective actions taken and improvements made been detailed?	
Y	73	Incident Reporting: Have environmental incidents been detailed?	
Y	76	Glossary	
Y	77	References	
Y	78	Appendices	

Table of Contents

Endorsement.....	i
Environmental Monitoring Report Checklist	ii
Executive Summary.....	1
1 Introduction	9
1.1 Monitoring Objectives	9
1.2 Operator Details	10
1.2.1 Organisational Structure and Responsibility.....	11
1.2.2 Workforce	12
1.3 Title Details	12
1.4 Location	13
1.5 Site Activities.....	13
1.5.1 Care and Maintenance.....	13
1.5.2 Waste Discharge Licence	13
2 Monitoring Method	16
2.1 Receiving Environment	16
2.1.1 Catchment	16
2.1.2 Sensitive Receptors.....	18
2.1.3 Rainfall	20
2.2 Sampling and Analysis Method.....	21
2.3 Monitoring Locations.....	23
2.4 Variability of Results	27
3 Monitoring Results.....	28
3.1.1 Field Physical Parameters	31
3.1.2 General Chemistry	34
3.1.3 Dissolved Metals	37
3.1.4 Nutrients	40
3.1.5 Total Loading	42
4 QA/QC Evaluation	45
4.1 Completeness	45

Environmental Monitoring Report Checklist

4.2	Quality Control.....	46
5	Discussion and Interpretation of Results	46
5.1	Monitoring Method Non-Conformances	46
5.2	Statistical Analysis.....	46
5.2.1	Field parameters	46
5.2.2	General Chemistry	47
5.2.3	Dissolved Metals	47
5.2.4	Nutrients	48
5.2.5	Total Loading	48
5.3	Discussion of Spatial and Temporal Trends	49
5.3.1	Field Parameters	49
5.3.2	Dissolved Metals	54
5.3.3	Nutrients	57
5.4	Discussion of Exceedances.....	60
5.5	Discussion of Anomalous	60
5.6	Discussion of Results and Conclusions.....	61
6	Conclusions and Proposed Actions	62
6.1	Compliance with Assessment Criteria	62
6.2	Potential Environmental Harm	64
6.3	Major assumptions or uncertainties	65
6.3.1	Assumptions	65
6.3.2	Uncertainties	66
6.4	Proposed Changes and Actions.....	66
7	Sediment and Macroinvertebrate Monitoring	72
8	Incident Reporting	73
8.1	Incident Response.....	73
8.1.1	Environmental Incident Reporting.....	73
8.2	Incidents Recorded/Reported During the Reporting Period	74
9	Glossary.....	76
10	References	77

11 Appendices.....	78
Appendix A. Water Quality Data.....	78
Appendix B. Regulatory Communication's Register	79
Appendix C. PGL Environmental Incident and Investigation Report Form	82
Appendix D. PGL water monitoring procedure.....	83
Appendix E. Monitoring Performance QA/ QC.....	87
Appendix F. Macroinvertebrate and Sediment Sampling Report (AES, 2022)	92

Tables

Table 1-1 Operator Details	10
Table 1-2 RRPA Monitoring and Management Tasks	12
Table 1-3 RRPA Tenement Information	12
Table 1-4 WDL 247 Authorised Discharge Points and Compliance Points Coordinates	10
Table 2-1 Monitoring Program as per Schedule 1 of the Licence	25
Table 2-2 Monitoring Parameters	26
Table 2-3 Monitoring Frequency Descriptions	26
Table 2-4 Factors that may Affect Variability in Monitoring Results	27
Table 3-1 Summary of Sampling Site Temporal Monitoring Events	30
Table 3-2 Surface Water Field Parameters	31
Table 3-3 Surface Water General Chemistry	34
Table 3-4 Surface Water Dissolved Metals	37
Table 3-5 Mount Bundey Surface Water Nutrients	40
Table 5-1 Summary of Anomalous.....	60
Table 6-1 Compliance Against Assessment Criteria.....	63
Table 6-2 Proposed New Actions for 2022- 23	67
Table 6-3 Proposed Changes to WDL247 Sampling Locations.....	70
Table 8-1 Environment Incident Register	75

Figures

Figure 1-1 RRPA Organisation Structure for Care and Maintenance.....	11
Figure 1-2 Regional Location	9
Figure 1-3 WDL247 Authorised Discharge points and Compliance Points WDL247.....	11
Figure 1-4 Flow kL/sec and Electrical Conductivity from Authorised Discharge Point 2	14
Figure 2-1 Rustlers Roost Project Area Sub Catchments	17
Figure 2-2 Rustlers Roost Sensitive Receptors	19
Figure 2-3 Rustlers Roost Project Area Rainfall (mm)	20
Figure 2-4 WDL247 Surface Water Sampling Site.....	24
Figure 3-1 ADP2 Total Dissolved Loading (2021- 22 wet season).....	42
Figure 3-2 Aluminium Loading (2021- 22 wet season)	43
Figure 3-3 Manganese Loading (2021- 22 wet season)	43
Figure 3-4 Zinc Loading (2021- 22 wet season)	44
Figure 3-5 Total Nitrogen Loading (2021- 22 wet season).....	44
Figure 5-1 Trend Analysis for pH at Compliance Points.....	50
Figure 5-2 Trend Analysis for pH at All Other Sampling Sites	50
Figure 5-3 Trend Analysis for EC at Compliance Points	51
Figure 5-4 Trend Analysis for EC at All Other Sampling Sites.....	51
Figure 5-5 Trend Analysis for DO at Compliance Points	52
Figure 5-6 Trend Analysis for DO at All Other Sites	52
Figure 5-7 Trend Analysis for Turbidity at Compliance Points.....	53
Figure 5-8 Trend Analysis for Turbidity at All Other Sampling Sites	53
Figure 5-9 Trend Analysis for Dissolved Al at Compliance Points.....	55
Figure 5-10 Trend Analysis for Al at All Other Sampling Sites	55
Figure 5-11 Trend Analysis for Fe at Compliance Points	56
Figure 5-12 Trend Analysis for Fe at All Other Sampling Sites.....	56
Figure 5-13 Trend Analysis for Co at RRSW23, Compliance Point	57

Environmental Monitoring Report Checklist

Figure 5-14 Trend Analysis for TN at Compliance Points.....	58
Figure 5-15 Trend Analysis for TN at All Other Sampling Sites	58
Figure 5-16 Trend Analysis for TP at Compliance Points	59
Figure 5-17 Trend Analysis for TP at All Other Sampling Sites	59
Figure 5-18 Proposed Changes to WDL247 Sampling Sites	69

Photos

Photo 1-1 PGL RRPA WDL247 Front Entrance Sign	13
Photo 1-2 Compliance Points Telemetry Stations (RRSW23 and RRSW24) Installation and Rain Gauge.....	12
Photo 1-3 Installation of Discharge Pipeline for Authorised Discharge Point 2	15
Photo 2-1 Authorised Discharge Point 2 Continuous Data Logger	21
Photo 2-2 Field Sampling Method	22
Photo 6-1 Proposed WDL247 Control Site Q29SW9a.....	68

Executive Summary

Primary Gold Pty Limited (PGL) is pleased to submit the first Environmental Monitoring Report (EMR) to the Northern Territory Department of Environment, Parks and Water Security under Waste Discharge Licence WDL 247 pursuant to section 74 of the *NT Water Act, 1992*. Activities under the Licence are for the controlled discharge of water from Rustlers Roost Pit to Mount Bunday and Marrakai Creeks. The Environmental Monitoring Report addresses PGL's performance monitoring and management activities against WDL 247 monitoring objectives from the commencement date period 22 June 2021 to 21 June 2022 reporting year. There were two proposed revisions to Schedule 2 of the Licence presented to and accepted by Department of Environment, Parks and Water Security.

Controlled discharge only occurred at ADP2 to Mount Bunday Creek which commenced at 12:00pm Friday 14th January 2022 and ceased at 9.46am Friday 15th April 2022. A total of 1.3 giga litres was discharged via ADP2 to Mount Bunday during the 2021/22 wet season at a consistent rate of 215 L/sec. This goal is in line with PGL's management targets over a two-year programme. PGL received no formal complaints for the controlled discharge activity under WDL 247. PGL propose to commence controlled water discharge activities at ADP1 and ADP2 in the 2022/23 wet season. For the purposes of this EMR, Marrakai catchment will act as a reference for prevailing conditions.

Water sampling and field data was collected by qualified samplers as per PGL water monitoring procedure with guidance of the AS/NZS 5667 and ANZECC/ARMCANZ, 2000. Continuous loggers were installed at the authorised discharge points and satellite telemetry stations installed both compliance points. All water and sediment sample analysis were performed by a NATA accredited lab. The 95% species protection for Freshwater Ecosystems (ANZG, 2018) was applied to assess water quality health at ADP2 and monitoring sites. Trigger values as per schedule 1 of the Licence was applied to assess compliance points, RRSW23 and RRSW24.

Water monitoring was conducted generally in accordance with Schedule 1 of the Licence with the exception of several sites which were missed during sampling events due to seasonal flooding, poor seasonal access and safety concerns. Sites missed during the reporting period have been included in improvement and proposed actions for the next reporting period.

During the reporting period, there were no exceedance of a trigger value as per section 44.1 and 44.2 as specified in Schedule 2 of WDL 247. There were however elevated analytes recorded in sampling events at Compliance Points RRSW23 and RRSW24 when compared to trigger values. These include pH, dissolved oxygen, electrical conductivity, turbidity, aluminium, iron, cobalt, total nitrogen and total phosphorus. In saying this, results indicate that several of these parameters were evidently elevated prior to commencement of discharge on 14 January 2022 with long term data indicating existing elevated trends.

Executive Summary

There were however improvement in water quality for some parameters found at RRSW23, total phosphorus and total nitrogen in particular. Since the commencement of the 2021- 22 monitoring programme, water quality has seen a decrease in elevated nutrients. It is suspected with the increase in water volumes discharged from Rustlers Roost Pit, could result in water quality dilution beyond natural wet season and pre water discharge activities. The quality of discharged waster was reasonable with no treatment required. Water quality within Rustlers Roost Pit remains within 95% species protection (ANZG, 2018) with the exception of turbidity. However the environmental risks to Mount Bunday Creek was the increased flow disrupting natural flows, risk of bed and bank scouring with the potential to increase suspended loads that would otherwise not mobilise during normal seasonal wet season flows, disrupting macro invertebrate communities.

The Biological monitoring programme conducted in late April 2022 by Aquatic Ecology Services involving sediment and macroinvertebrate sample and analysis. The assessment demonstrated that the macroinvertebrate community of Marrakai Creek and upper Mount Bunday creek catchment are tolerant of pollution and highly influenced by habitat availability. The improvements to sampling design appear to have assisted with compatibility of sites on Marrakai Creek and the addition of an upstream site on Mount Bunday Creek will allow for more robust assessment of potential discharge impacts. Sampler bias and changes to flow in Mount Bunday creek may contribute to slightly poorer macroinvertebrate metrics in 2022 compared to 2021 and recommended ongoing post-wet season monitoring.

1 Introduction

In accordance with sections 47 and 48 of Waste Discharge License 247 (the Licence), this Environmental Monitoring Report (EMR) addresses Primary Gold Pty Ltd (PGL) performance monitoring and management activities at Rustlers Roost Project Area (RRPA) for the 2021/2022 reporting period for the controlled discharge of water from Rustlers Roost Pit to Mount Bunday and Marrakai Creeks.

This is the first EMR to be submitted to the Northern Territory (NT) Department of Environment, Parks and Water Security (DEPWS) under WDL 247 approved on the 22 June 2021 (Dept, Ref: NTEPA2021/0079-002~MR 2020/0297).

Controlled discharge only occurred at Authorised Discharge Point 2 (ADP2) to Mount Bunday Creek commencing at 12:00pm Friday 14th January 2022 and ceased at 9.46am Friday 15th April 2022. Controlled discharge at ADP1 to Marrakai Creek was delayed due to a scheduling of pipeline construction and setup which is scheduled to commence in the 2022/23 wet season.

During the reporting period there were two changes to the Licence, detailed below, which have been discussed and confirmed with DEPWS. Additional communications in relation to the changes and other licence conditions/queries are detailed in the communications register in Appendix B.

The changes to WDL 247 include:

- Removal of the chloride (Cl) trigger value of 3µg/L WDL 247 (The trigger value of 3µg/L for chloride (Cl) is an error, it appears to be the ANZG 2018 95% guideline values for chlorine (Cl), and is not intended to be imposed as a trigger value under WDL247)
- Exceedances of total Nitrogen (TN) above 300µg/L should be reported in accordance with condition 44.1 of WDL247 given the locality of the site based on ANZECC & ARMCANZ 2000. Values below 200 µg/L for TN is not a reportable trigger against condition 44.1 of the WDL 247

1.1 Monitoring Objectives

WDL 247 Conditions 47 and 48, outline the monitoring objectives PGL will address in this EMR during the period from 22 June 2021 to 21 June 2022. The Final EMR will be submitted to DEPWS by 1 August 2022.

As a minimum, the Monitoring Report will:

- Be drafted in accordance with the '*Guideline for Reporting on Environmental Monitoring*';
- Include surface water, sediment, macroinvertebrate monitoring undertaken for WDL 247 as part of the environmental monitoring programme for RRPA;
- Include a tabulation of all monitoring data (provided electronically in Microsoft Excel format);

Introduction

- Include long term trend analysis of monitoring data to demonstrate any environmental impact associated with the discharge of water from Rustler Roost Pit over a minimum of three years (where available). (Provided electronically in Microsoft Excel format);
- Include all exceedances and investigations undertaken for WDL 247;
- Report on the total contaminant load discharged from RRPA annually; and
- Include an assessment of environmental impact from the Rustlers Roost Pit water discharge and if the level of protection has been achieved by PGL

Potential issues associated with the water discharge activity included:

- deterioration of aquatic ecosystem structure and function;
- erosion of natural waterways;
- increased bioavailability of metals due to pH changes; and

toxicity of salinity, sulphate, acid/alkaline solutions and metals/metalloids.

1.2 Operator Details

The Project proponent is PGL, a Company formed through the union of the listed entity Hydrotech International and the privately-owned Primary Minerals PGL acquisition of several gold assets, including the RRPA, from Crocodile Gold in early 2013. The Company was delisted on the Australian Stock Exchange (ASX) in 2018 after HGM Resources Pty Ltd bought 100% of the shares in April 2018. PGL is now a privately-owned company. PGL's assets are focused on the Northern Territory, which in addition to RRPA, include Toms Gully Mine, Q29 Project Area and ~2,000 km² of exploration tenure.

A Summary of operator details is included in Table 1-1.

Table 1-1 Operator Details

Operator Information			
Business Name	Primary Gold Limited (PGL)		
ACN/ABN	ACN: 122 726 283		
Street and Postal Address	Level 26, 140 St Georges Terrace, Perth WA 6000		
Key Contact(s)	Name:	Dr Mark Qiu	Charles Hastie
	Position:	Managing Director	Chief Mining Engineer
	Phone number:	042 4288 016	0419 963 250
	Email:	Mark.Qiu@hanking.com.au	Charles.Hastie@hanking.com.au

1.2.1 Organisational Structure and Responsibility

PGL's overall management/organisational structure is illustrated in Figure 1-1. The organisational structure reflects the relatively new nature of the Company. As operations and development of PGL's assets expand, the organisational structure will develop and be updated to reflect this.

Managing Director and Departmental Managers are responsible for:

- Ensuring compliance with all relevant Statutory Acts and Regulations.
- Ensuring compliance with Safety Management and Emergency Response Plans.
- Ensuring regulatory documents (MMP/EMR) are adhered to; and
- Establishing and maintaining environmental and safety performance monitoring.
- Overall environmental management and compliance at RRPA lies with the Managing Director for PGL, the Chief Mining Engineer and delegated personnel.

Managing Director is responsible for:

- Accountable for the overall environmental management and compliance

Chief Mining Engineer and delegated personnel are responsible for:

- Responsible for resourcing and maintaining environmental management as per the Care and Maintenance MMP
- Responsible for defining and communicating relevant environmental responsibilities and accountabilities to employees, consultants, and contractors within their area of responsibility.
- All contractors/consultants contract obligations outline clear environmental and safety performance standards that are regularly assessed by PGL prior to and during their contract work at RRPA.

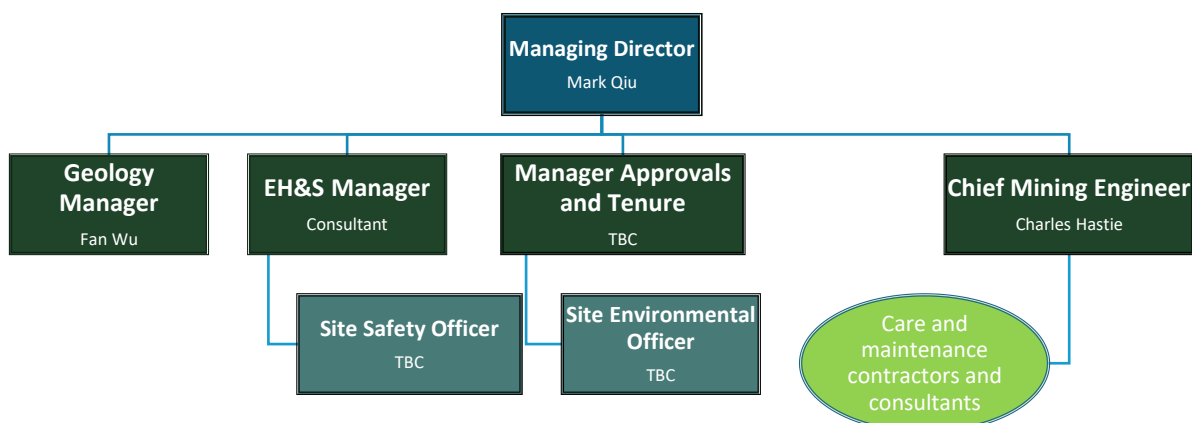


Figure 1-1 RRPA Organisation Structure for Care and Maintenance

1.2.2 Workforce

Table 1-2 RRPA Monitoring and Management Tasks

Monitoring and Maintenance Tasks	
Contractor/Consultant	Task
CDM Smith Consultants	Surface and groundwater sampling
Sally Horsnell/Savannah Roots	MMP, EMR Reporting
	WDL Management and Monitoring WDL Management and Monitoring
	Inspections: Dam/pit water heights
	Surface and groundwater sampling and data analysis and reporting
	Quarterly Inspection (weeds, erosion and sediment controls, security, access, fire mapping and reporting)
Envirolab/ALS (both NATA accredit for analysis category)	Laboratory analysis
Mount Bunday Pastoral Lease Holder	Weed spraying
	Fire mitigation
	Water management/transfer – pipe and pump set-up, maintenance
	Access roads/bund maintenance
	Fencing and gate maintenance
	Tenement access and point of contact for safety and security
Cross Solutions	Survey heights - Pit water levels pick-ups, bore TOC, survey of new crossing (Big Lizard Crossing)

1.3 Title Details

Tenement information has been provided in Table 1-3.

Table 1-3 RRPA Tenement Information

Title Number	Title Holder	%	Grant Date	Area (Ha)	Expiry Date
MLN 1083	Primary Minerals Pty Ltd	100	1st January 2021	755.6	31 December 2045

1.4 Location

RRPA is located approximately 100 kilometres (km) south-east of Darwin in the NT (Figure 1-2) and situated on Old Mount Bunday Station Perpetual Pastoral Lease (PPL 1163). Site access is gained from the Arnhem highway via a 15 km private gravel access road. Access is restricted by locked gates.

1.5 Site Activities

1.5.1 Care and Maintenance

RRPA remained in care and maintenance during 2021-2022 reporting period and has been since PGL's purchase of tenements in 2013. Exploration activities have occurred at site during this reporting period. An EIS is currently in preparation for RRPA and Quest 29 Project Areas (Q29PA) for an open cut goldmine operation. The EIS commenced in mid-2020 and is anticipated to be finalised and submitted by end of December 2022.

1.5.2 Waste Discharge Licence

A two-year Waste Discharge License was issued to PGL on 22 June 2021 (22/06/2021- 21/06/2023) under section 74 of the *Water Act 1992* that authorises for the discharge of pit water from Rustlers Roost Pit to Mount Bunday and Marrakai Creeks as per the conditions of the license. Water discharge from Rustlers Roost Pit is only permitted whilst RRPA is in care and maintenance. PGL obtained the License to access the pit for further exploration activities and as a lead up to operations, once formally approved.

As per Licence Condition 4, a temporary sign was displayed at the entrance to the RRPA which included the license number as issued under the *Water Act* and a 24-hour emergency contact for public viewing (Photo 1-1).



Photo 1-1 PGL RRPA WDL247 Front Entrance Sign

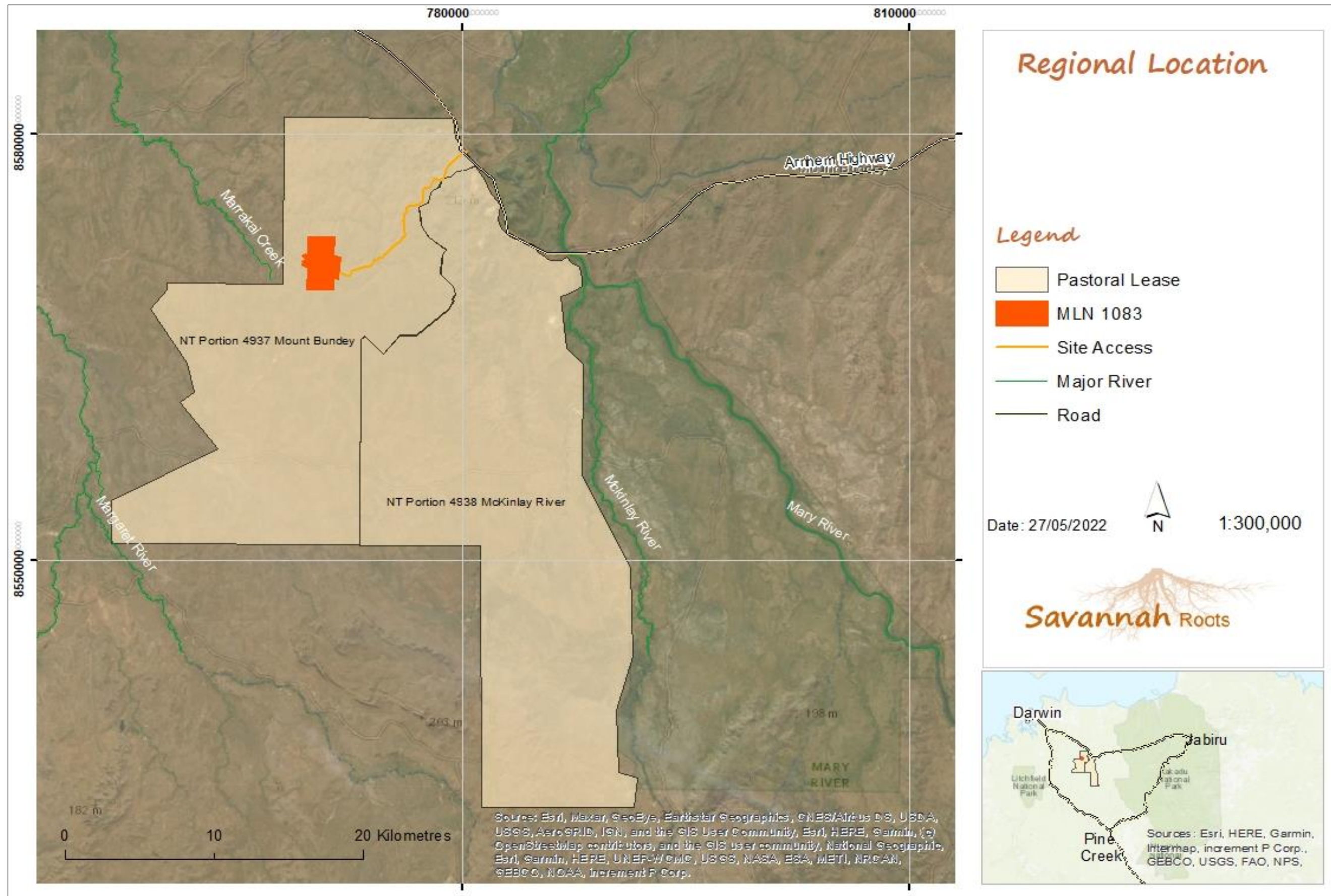


Figure 1-2 Regional Location

Introduction

1.5.2.1 Authorised Discharge Points Compliance Points

As listed in Condition 24 of the Licence, there are two Authorised Discharge Points (ADPs) for Marrakai and Mount Bunday Creek Systems. ADP1 reports from Rustlers Roost Pit via a discharge pipe to a discharge basin located south of Annies Dam and ultimately to the Marrakai Creek. ADP2 reports from Rustlers Roost Pit via a discharge pipe to a discharge basin west of the heap leach ponds and ultimately to the Mount Bunday Creek (Figure 1-3).

Two compliance points are situated downstream of each of the ADPs which continuously monitor discharged water during creek flow. RRSW23 compliance point is downstream of ADP2 and located within the upper reaches of Mt Bunday Creek and Mary River sub catchment. RRSW24 compliance point is downstream of ADP1 and located in the upper reaches of Marrakai Creek and Adelaide River sub catchment (Figure 1-3).

Two telemetry stations were installed at each of the Compliance Points in October 2021 by environmental consultants (Photo 1-2). Xylem Water Solutions Australia Limited supplied two solar powered data logger and satellite units that were installed at RRSW23 and RRSW24. The telemetry stations provide data in real time and collect hourly field parameters that include electro- conductivity, pH units, turbidity, and dissolved oxygen. This data is checked regularly to ensure compliance of water quality during discharge events.

A summary of Compliance Point and ADP locations are included in Table 1-4.

Table 1-4 WDL 247 Authorised Discharge Points and Compliance Points Coordinates

Creek	Site	Type	Easting	Northing
			52L	
Marrakai Creek	RRSW24	Compliance point/ Telemetry Station	7677991	8572070
	ADP1	Authorised Discharge Point	769945	8570110
Mt Bunday Creek	RRSW23	Compliance point/ Telemetry Station	771925	8569180
	ADP2	Authorised Discharge Point	770746	8569880

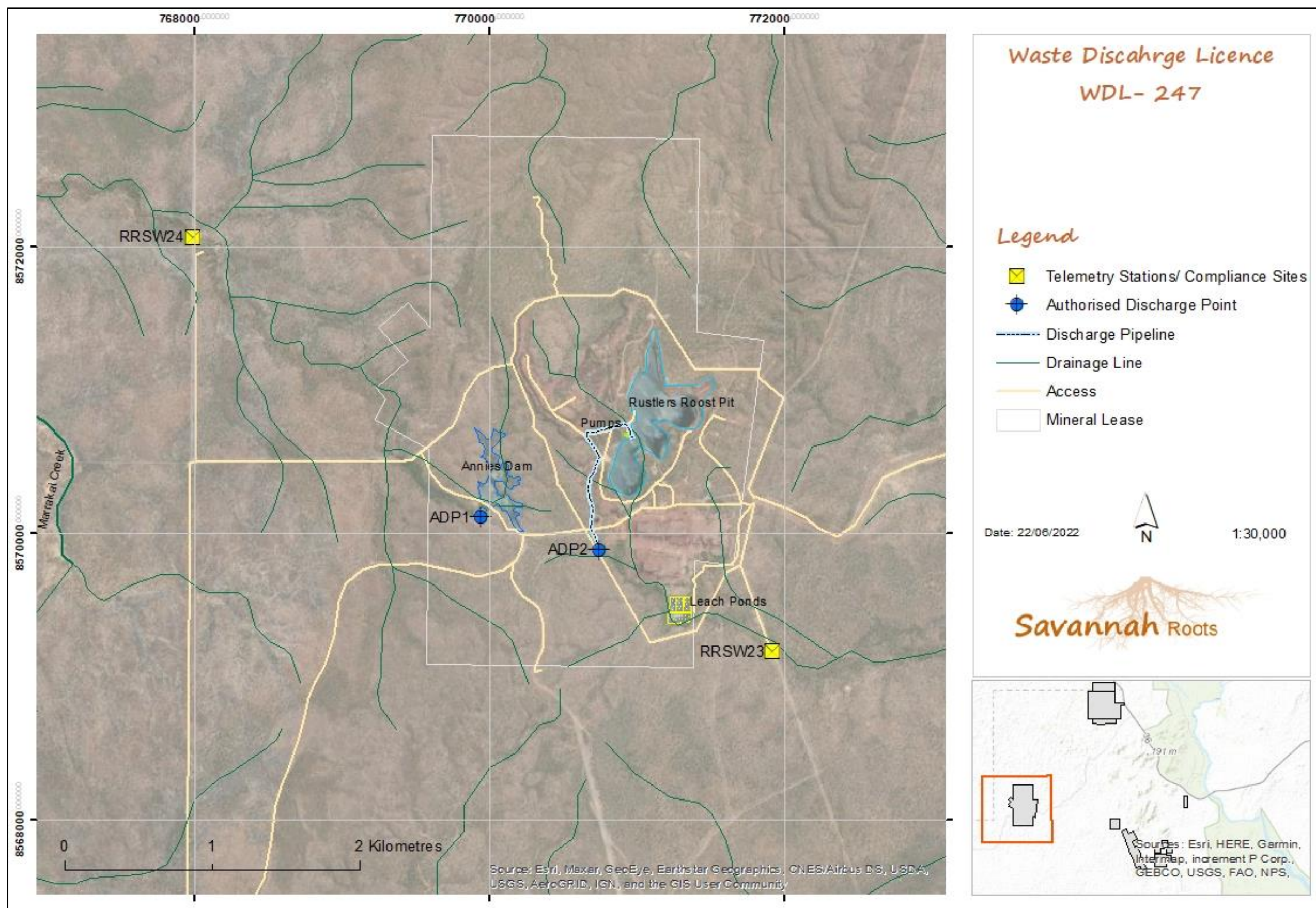


Figure 1-3 WDL247 Authorised Discharge points and Compliance Points WDL247



RRSW24 telemetry station construction installing satellite and solar panel (Nov 2021) Rustlers Roost



RRSW24 telemetry station construction installing steel housing to creek (Nov 2021) Rustlers Roost



RRSW24 telemetry station construction installing access connection pit (Nov 2021) Rustlers Roost



RRSW24 telemetry station construction digging conduit line (Nov 2021) Rustlers Roost



RRSW24 telemetry station construction laying conduit (Nov 2021) Rustlers Roost



RRSW24 telemtry station logger in creek (April 2022), Rustlers Roost



RRSW23 telemetry station logger in creek (March 2022), Rustlers Roost



Rain gauge located at the top of the main WRD, Rustlers Roost

Photo 1-2 Compliance Points Telemetry Stations (RRSW23 and RRSW24) Installation and Rain Gauge

1.5.2.2 Controlled Discharge from Rustlers Roost Pit

Rustlers Roost Pit dewatering is part of the proposal to redevelop an open cut gold mine at Rustlers Roost and Quest 29 Projects Areas. The proposal is currently under formal assessment as an Environmental Impact Assessment and will be assessed by the NT EPA under the *Environment Protection Act 2019*. The decision to obtain a WDL would assist in dewatering Rustlers Roost Pit within a reasonable time frame for exploration and potential operational activities. As noted earlier, the WDL has been granted under Care and Maintenance site activities.

As part of the Licence, PGL was required to notify DEPWS when water is discharged from the Pit (Condition 27) and when discharge ceases (Condition 28). Controlled discharge only occurred at ADP2 to Mount Bunday Creek as delays in scheduling of pipeline construction and set up at ADP1 prevented discharge at this point. PGL anticipate that controlled water discharge will commence from ADP1 during the 2022- 23 wet season.

Prior to the 2021- 22 wet season, a poly pipeline was installed to discharge water from the Rustlers Roost Pit to a tributary to the west of the Heap Leach Pad and ultimately to the headwaters of Mount Bunday Creek (Figure 1-3; Photo 1-3). An Aqua Troll data logger was installed at the end of pipe to record electrical conductivity ($\mu\text{S}/\text{cm}$) and flow (kL/sec) during discharge events to meet Licence requirements.

Condition 25 of WDL 247 requires commencement of controlled water discharge from Rustlers Roost Pit via ADP2 when natural flow is present. During the 2021- 22 reporting period, the decision to commence and cease water discharge required a field indicator site to determine when natural and recessional flows in the upper Mary catchment was occurring. Qualitative judgment and quantitative measure were implemented using indicator creeks to observe when creeks were in natural flow or receding. These measures were established at elected surface water monitoring site(s) observing full flow at a rate of approximately 1 L/ sec at a minimum of 20-50 metres distance up-stream and downstream.

Surface water monitoring sites RRSW23 and Q29SW2 were chosen as indicator creeks for commencement of discharge. These sites were chosen due to their similar locality in the upper Mary River Catchment, proximity to RRPA activities and as active discharge water would report through both sites from ADP2. Conversely, surface water monitoring site Q29SW4 was chosen as indicator creek for cessation of discharge. Q29SW4 was chosen due to its similar locality in the upper Mary River Catchment to site activities, no influence from structures such as weirs, pit overflows or dams that could either be obstructing or controlling natural flow in the catchment.

Discharge from ADP2 commenced at 12:00pm Friday 14th January 2022 and ceased at 9.46am Friday 15th April 2022. The NT EPA were notified by email of commencement and cessation of controlled water discharge. Controlled discharge continued for 13 weeks in which during this time water quality was continuously monitored via telemetry stations located at Compliance Sites and through regular sampling as per Schedule 1 of the Licence. DEPWS issued no directions to PGL for the cessation of discharge at any time during the controlled discharge period. Cease of discharge was due to low flows observed in creeks within the Mary River Catchment, such as Q29SW4.

Introduction

For the 2021-22 wet season, a total 1.3 GL was discharged to the headwaters of the Mt Bunday Creek at a consistent rate of 215 L/ sec via diesel pumps. As of April 2022, the Pits water level was at 52 m AHD with an estimated 2.34 GL remaining.

Figure 1-4 demonstrates daily average flows rates and daily average electrical conductivity recorded from the Aqua Troll at the end of pipe. The Aqua Troll recorded continuous flows and Electrical Conductivity as per Schedule 1 of the Licence.

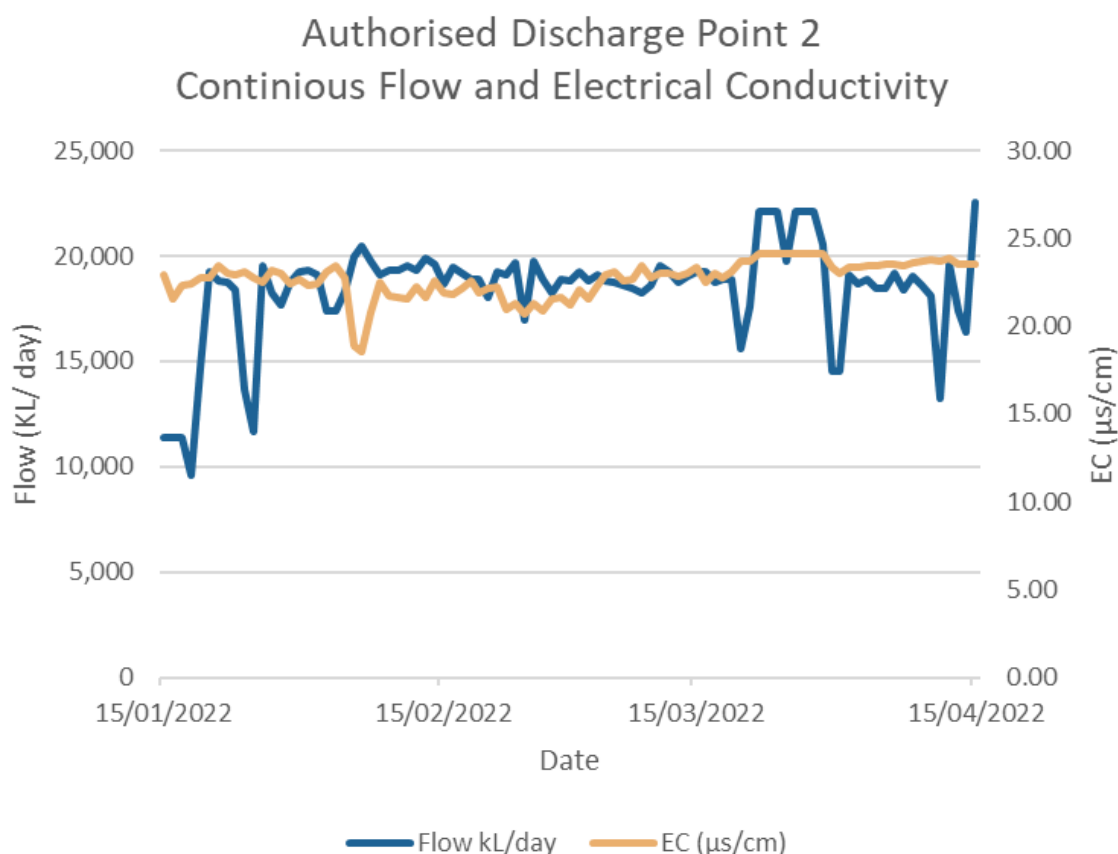


Figure 1-4 Flow kL/sec and Electrical Conductivity from Authorised Discharge Point 2

Figure 1-4 shows EC at the end of pipe is relatively consistent throughout the entire active discharge period. EC ranged from 19 µs/cm- 24 µs/cm with median recording of 23 µs/cm. Flow rate from the pipe however fluctuated from 9,590 kL/ day to 22,550 kL/ day. The commencement (14/01/2022) and towards the end of active pumping (15/04/2022) has seen flow rates fluctuate. This may be due to electrical pump or diesel generator performance variations and when the floats within Rustlers Roost Main Pit were repositioned away from the edge of the Pit to deeper depths.



Rustlers Roost Pit water discharge pipeline construction (Dec 2021) Rusters Roost



Rustlers Roost Pit water discharge pipeline construction (Dec 2021) Rusters Roost



Rustlers Roost Pit water discharge instrumentation and 10,000 litre diesel tank (Dec 2021) Rusters Roost



Rustlers Roost Pit water discharge diesel generator (Dec 2021) Rusters Roost



Rustlers Roost Pit water discharge pipeline into pit (Dec 2021) Rusters Roost



Rustlers Roost Pit water discharge pipeline pipeline floats (Dec 2021) Rusters Roost



ADP2 (WDL 247 monitoring)-Aqua Troll logger placed in pipe, Rustlers Roost



Rustlers Roost pit water discharge (ADP2) – discharge point (Feb 2022)

Photo 1-3 Installation of Discharge Pipeline for Authorised Discharge Point 2

2 Monitoring Method

2.1 Receiving Environment

2.1.1 Catchment

The RRPA is positioned over two sub catchments (eastern and western). The eastern sub catchment is part of the Mary River Basin, covering over 2260 km² and the western sub catchment is part of the Adelaide River Basin, covering over 2,790 km² (Figure 2-1).

The western sub catchment covers approximately a third of MLN 1083 and is relatively undisturbed from mining activities. Annie's dam is situated in this sub catchment and water quality is not known to be influenced by the heap leach pad or leach ponds. The dam freely drains northwest into the headwaters of Marrakai Creek which then flows into Adelaide River (DEPWS, 2022)

The eastern sub catchment covers the remainder of MLN 1083 and contains most of the previously mined features including Rustlers Roost Pit, Run of Mine (ROM) pad, Waste Rock Dump (WRD), heap leach pad and ponds. Surface water runoff from these mined features is largely contained onsite draining to the main pit void which acts like a terminal sink for a large portion of the catchment. (CDM Smith, 2019). The northern side of the WRD and heap leach pad and ponds surface drainage enter at different tributaries at the head waters of Mount Bunday finally reporting to the Mary River (DEPWS, 2022).

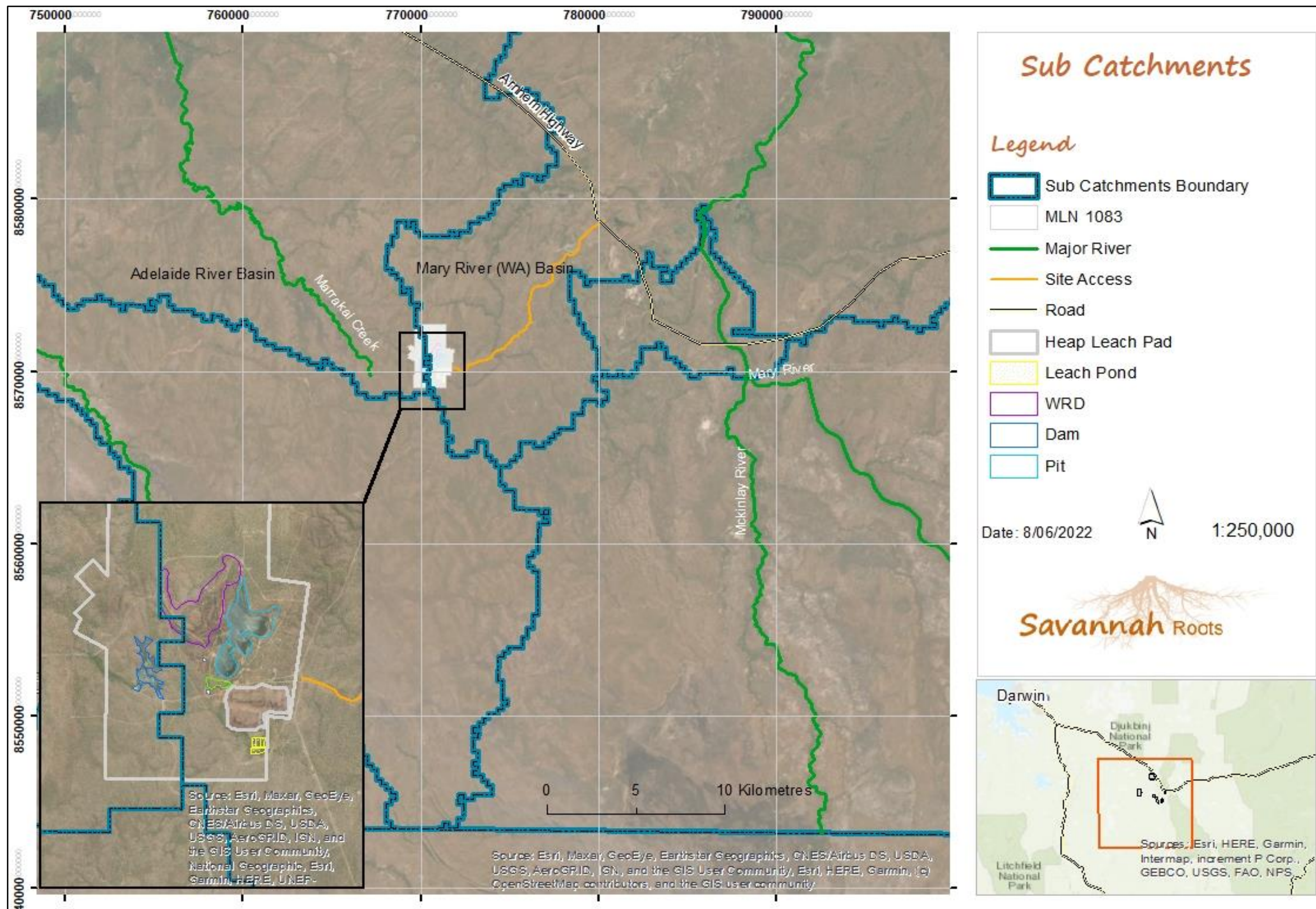


Figure 2-1 Rustlers Roost Project Area Sub Catchments

2.1.2 Sensitive Receptors

RRPA surface water discharge flows into two sub catchments of the Adelaide River Basin and Mary River Basin. The Mary River has beneficial uses for its surface and ground waters. The sub catchment of the Mary River Basin drains through various drains and ephemeral creeks and ultimately enters Mary River system. RRPA is one of many mines situated in Mary River Basin along with quarries, pastoral properties and horticultural activities and recreational areas. Mary River National Park is also situated in its catchment area downstream of RRPA.

The Mary River system includes the Mary River, all its tributaries, lagoons, lakes, swamps, and marshes situated in the catchment of that waterway (Department of Infrastructure, Planning and Environment [DIPE], 2002). The surface waters of the Mary River catchment are declared beneficial use (BUD) for its environmental, riparian, and cultural values. The ground water of the same catchment has environmental, riparian, and agricultural values (DIPE, 2002).

As well as the BUDs, there are several identified conservation areas or national parks in the region or downstream of the site, these include:

- Mary River Floodplain System Directory of Important Wetlands (NR Maps, 2022)
- Mar River Coastal Floodplain Sites of Conservations Significance (SoCS 13) located ~10 km north- east (Department of Natural Resources, Environment, The Arts and Sport [DNRETAS], 2009b; Figure 2-2)
- Mary River National Park located 11 km to the east via McKinlay River and Mount Bunday Creek (NR Maps, 2022; Figure 2-2)
- Adelaide River Coastal Floodplain SoCS site 12 located 28 km to the north- west via Marrakai Creek (DNRETAS, 2009a; Figure 2-2)
- Djukdinj National Park located 15 km to the north (NR Maps, 2022); and
- Adelaide River Foreshore Conservation Area located 24 km to the west (NR Maps, 2022).

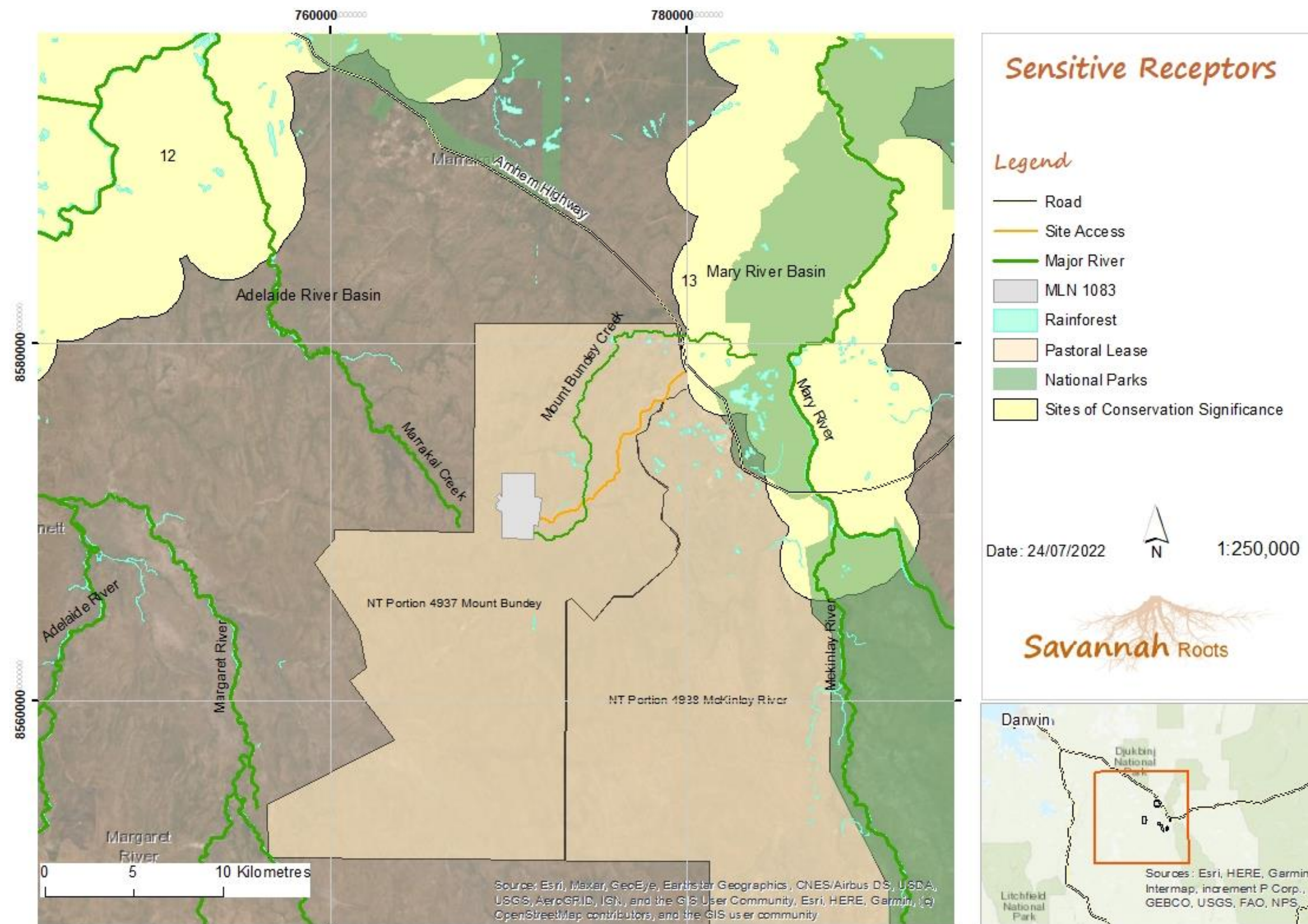


Figure 2-2 Rustlers Roost Sensitive Receptors

2.1.3 Rainfall

A rain gauge installed at the RRPA was monitored throughout the 2021- 22 wet season. The rain gauge located in a cleared areas on top of the main WRD was monitored as often as weekly though monitoring did not commence till December 2021. All rainfall within October and November is included in December rainfall (mm). The rain gauge will assist to fill knowledge gaps and provide accurate detail for inputs to water features. A comparison of rainfall at Rustlers Roost compared to the nearest weather stations and local rain gauge is provided in Figure 2-3. Weather sources include the Cooinda Airstrip weather Station (014256) which is located ~ 60 km southeast and the Quest 29 PA which is located ~5 km from of the RRPA.

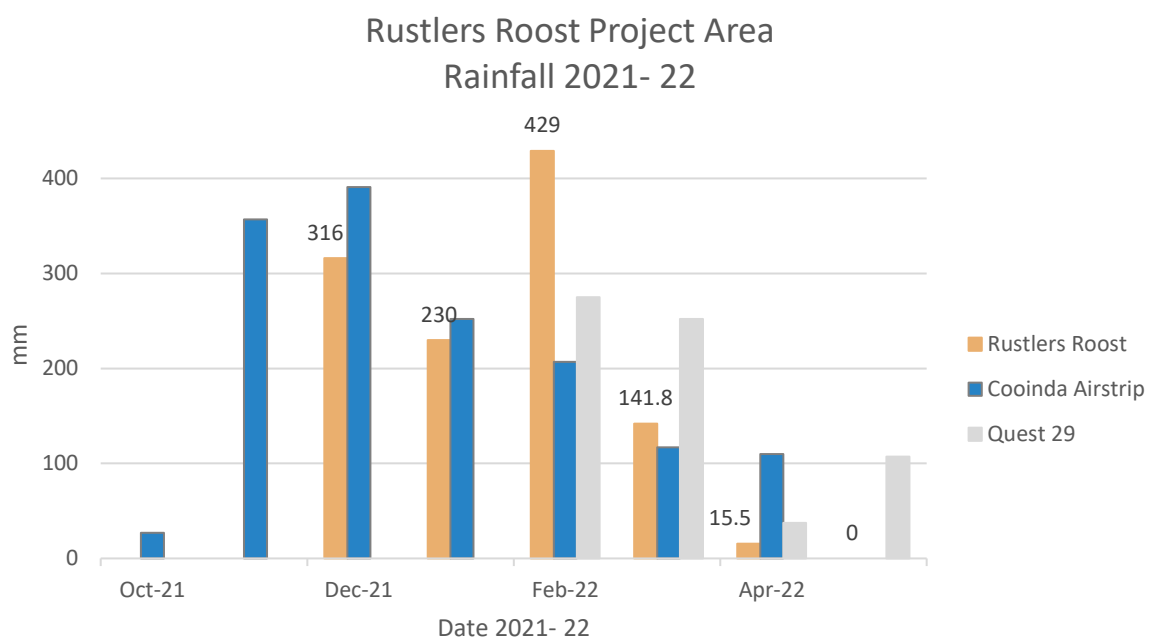


Figure 2-3 Rustlers Roost Project Area Rainfall (mm)

Whilst the beginning of the 2021-22 was missed, the data can be used to compare rainfall for other sites within the Mary River sub- catchment and other Bureau of Meteorology (BoM) weather stations close by. RRPA total rainfall for the entire 2021- 22 wet season was 1132.5 mm whilst Q29PA recorded 647.75 mm from January- May 2022 and Cooinda Airstrip Weather Station (014256) recorded 1359 mm between October- April 2022 (BoM, 2022). A mean year of rainfall at the Cooinda Weather Station is 1382.6 mm. For the period rainfall was monitored at RRPA, it is slightly lower than rainfall within the region.

As shown in Figure 2-3 February 429 mm fall within the month at the RRPA of all three sites. Localised rainfall was recorded in May at Quest 29 with over 100 mm falling whilst Rustlers Roost did not record any rainfall. This graph shows the extent of localised rainfall within the Mary River catchment during the 2021- 22 wet season.

2.2 Sampling and Analysis Method

All field sampling was performed as per PGL's water quality monitoring procedure.

An Aquaread AP-2000 Handheld meter was used at all sites (except ADP2) for field measurements including pH (pH Units), electrical conductivity ($\mu\text{S}/\text{cm}$), dissolved oxygen (% saturation), temperature ($^{\circ}\text{C}$), turbidity (NTU), with all data recorded in a field handbook and then transferred into an excel spreadsheet database. Calibrations using a Quick Cal Solution was performed weekly prior to field activities.

Data collection at ADP2 was performed using the In-Situ Aqua Troll 600 multiparameter sonde installed to continuously gather field data for flow (KL/ sec) and Electrical Conductivity ($\mu\text{S}/\text{cm}$). The probe was installed in a purpose constructed slot in the pipe (situated vertically in the pipe) to ensure the sensors were continuously maintained in pipe flow. Data management involved logged data stored and downloaded weekly via the VuSitu Mobile App in a Universal Data File accessing via blue tooth to the field smart phone. Calibrations using a Quick Cal Solution was performed prior to installation.



In-situ Aqua Troll sonde housing vertical in end of pipe, water discharge from Rustlers Roost Pit, January 2022, Rustlers Roost PA



In-situ Aqua Troll sonde in housing end of pipe, water discharge from Rustlers Roost Pit, February 2022, Rustlers Roost PA

Photo 2-1 Authorised Discharge Point 2 Continuous Data Logger

Monitoring Method

Compliance sites RRSW24 and RRSW23 were installed telemetry stations in late November 20021 with real time solar powered data loggers and satellite. Data management was accessed via the xylem eagle platform to provide in real time pH (pH Units), electrical conductivity ($\mu\text{S}/\text{cm}$), dissolved oxygen (% saturation), temperature ($^{\circ}\text{C}$), turbidity (NTU), water depth (m). The information was invaluable during controlled/no controlled site discharge events to gain a clearer understanding of creek flows and water quality fluctuations particularly when site access was limited.

Water levels at Rustlers Roost pit were measured prior to the commencement and cessation of discharge using a handheld tape measure from the pit water edge to a surveyed marker peg along the western boat access ramp. Water level heights were not recorded at Annie's Dam.

During each site monitoring event, a record of general observations was maintained in the field handbook and included, fauna siting's, tracks, invasive species presence (i.e. weeds, feral animals), fish, bird life, recent fires, other observed disturbances including anthropological activities (vehicles tracks, rubbish):

All metals/metalloids, general chemistry and nutrients were field sampled as per the routine sampling method in pre labelled and acidified bottles provided by the analytical laboratory (Envirolab NATA accredited for the related analysis). Samples were stored in eskies and kept cool using ice or ice bricks. At the end of each day samples were either moved to a fridge/freezer for overnight holding if field sampling finished after 3pm or delivered to the Darwin Envirolab before 3 pm, repacked with new ice bricks and sent by air to Perth Envirolab laboratory for analysis. To ensure samples were delivered to the lab within the respective holding times and temperature, sampling was performed Monday to Wednesday each week and dispatched same day or next day at the latest. A fast turnaround of laboratory analysis was requested for Compliance Point RRSW23.



Field sampling using extension pole at Mine Management Plan
Monitoring Site

Photo 2-2 Field Sampling Method

2.3 Monitoring Locations

PGL has conducted surface water quality monitoring at RRPA since 2016. A water quality database is maintained to store and analyse annual and long-term trends. Monitoring at the site is conducted as per Schedule 1 of the Licence and the Monitoring Program in the RRPA Mine Management Plan (MMP).

Some sites listed in the Licence has been previously monitored under the MMP since 2012. For simplicity, these names have remained throughout this report. Reference to WDL247 site names and existing names have been included in the following table (Table 2-1).

All WDL247 surface water sampling locations have been identified in Figure 2-4 which include six sampling locations, two ADPs and two Compliance Points. The monitoring program as per Schedule 1 of the Licence has been included in Table 2-1. This table provides detail of site name, location (Universal Transverse Mercator [UTM]), description of the site, analytes and frequency. Changes have been proposed for some sampling site locations that do not have all season access or have crocodile safety concerns. This has been discussed further in Section 6 which includes rationale. New control sites have been proposed in Table 2-1 and identified in Figure 6-1 to replace RRSW9 which is inaccessible. This has also been discussed in further detail in Section 6.

Monitoring parameters and analytes have been listed in Table 2-2. Monitoring frequency has been further detailed in Table 2-3.

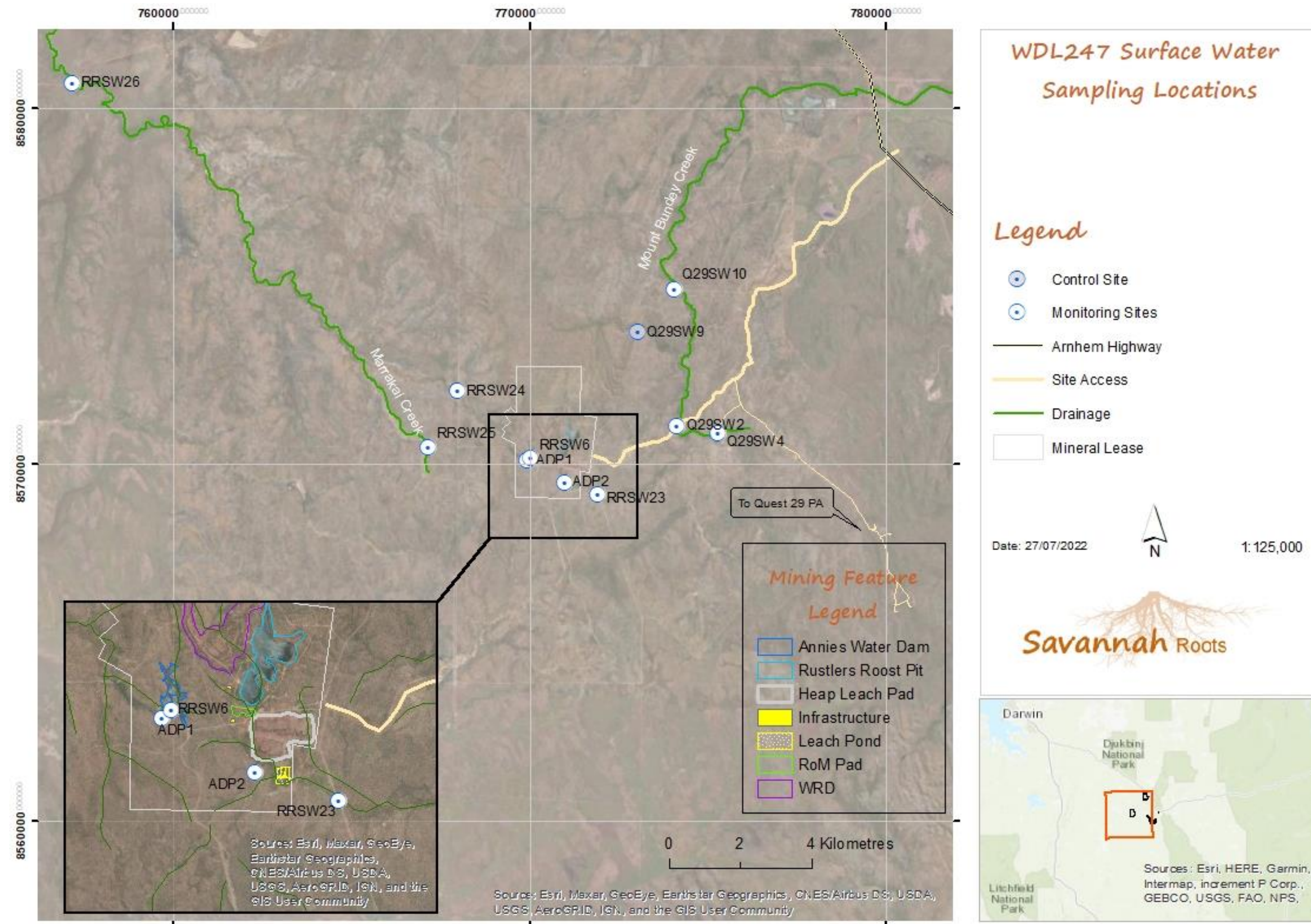


Figure 2-4 WDL247 Surface Water Sampling Site

Table 2-1 Monitoring Program as per Schedule 1 of the Licence

Catchment	WDL247 Sampling Site	Existing Sampling Site	Easting	Northing	Sampling Site Description	Analyte Type					
	Monitoring Sites		Zone 52L								
	0	1	2	3		4	5				
Mount Bunday Creek	ADP2	-	770987	8569505	Authorised Discharge Point 2 located to the west of the heap leach ponds, discharge basin to Mount Bunday Creek	C	-	-	-	-	-
	RRP	RRSW22	771008	8570825	Rustlers Roost Pit	-	W	M	M	M	M
	RRSW23	RRSW23	771925	8569177	Headwaters of Mt Bunday Creek, compliance point (WDL 247)	-	M	M	M	M	M
	Q29SW2	Q29SW2	774154	8571091	On Mt Bunday Creek downstream of Rustlers Roost and Quest Project Areas	-	M	M	M	M	M
	Q29SW10	-	774068	8574906	The most downstream monitoring point on the Mount Bunday Creek, located ~8 km downstream of RRSW23.	-	M	M	M	M	M
	Q29SW4	Q29SW4	775287	8570868	Located to the northeast of the Rustlers Roost Project Area on a tributary of Mt Bunday Creek. The site is downstream of Quest 29 PA and upstream of Rustlers Roost site influences.	-	M	M	M	M	M
	Q29SW9	-	773052	8573733	Control Site located northeast of the RRPA. The site is located on a tributary of Mount Bunday Creek prior to any mining influence.	-	M	M	M	M	M
Marrakai Creek	ADP1	-	769945	8570112	Authorised Discharge Point 1 located to the south of Annies Dam, discharge basin to Marrakai Creek	C	-	-	-	-	-
	AWD	RRSW6	770048	8570198	Sampling location changed to dam wall for safety reasons. The changed location is to the northwest of the spillway. Annie’s Water Dam	-	M	M	M	M	M
	RRSW24	-	767991	8572070	Downstream compliance point for Marrakai Creek. Located to the northwest, ~2.5 km downstream of ADP1.	-	M	M	M	M	M
	RRSW25	-	767162	8570492	Control site for the Marrakai Creek. Located to the west of the tenement boundary ~2 km.	-	M	M	M	M	M
	RRSW26	-	757167	8580717	On the Marrakai Creek, ~16 km downstream of ADP1	-	M	M	M	M	M
Proposed New Sample Locations											
Mount Bunday Creek	Q29SW11	-	-	-	Proposed Control site located east of RRPA, prior to Q29SW4. Site is not influenced by any mining activities and is within the Mary River Catchment	-	M	M	M	M	M
	Q29SW9a	-	-	-	Proposed control site located northeast of RRPA. The monitoring site is located on a tributary of Mount Bunday Creek ~ 400 m upstream of Q29SW10.	-	M	M	M	M	M

Table 2-2 Monitoring Parameters

Type	Analysis	Analysis	Parameter
0	Discharge Monitoring	Data Logger	Flow kilolitres per day, Electrical Conductivity (EC).
1	In field parameters	Field	pH, Electro Conductivity (EC), Dissolved Oxygen (DO), Temperature, Turbidity, Photograph
2	Total and dissolved metals	Total and dissolved	Aluminum (Al), Arsenic (As), Cadmium (Cd), Chromium (Cr), Cobalt (Co), Copper (Cu), Iron (Fe), Lead (Pb), Manganese (Mn), Molybdenum (Mo), Nickel (Ni), Selenium (Se), Tin (Sn), Uranium (U), Zinc (Zn).
3	Dissolved major cations and anions	Dissolved	Calcium (Ca), Manganese (Mg), Potassium (K), Sodium (Na), Sulphate (SO ₄), Chloride (Cl ⁻)
4	Inorganics	Total and dissolved	Hardness (CaCO ₃), Carbonate (CO ₃), Bicarbonate (HCO ₃), Total Suspended Solids (TSS), Total Dissolved Solids (TDS), Cyanide
5	Nutrients	Total	Total nitrogen (TN), total phosphorus (TP)

Table 2-3 Monitoring Frequency Descriptions

Key	Frequency	Description
C	Continuous	Continuous during discharge
W	Weekly	Weekly monitoring
M	Monthly	Monthly monitoring
M	Monthly	Weekly during discharge and at least once per discharge event
M	Monthly	During Discharge event

2.4 Variability of Results

Factors that may affect variability in results are based on site activities and the location of the ML, within a pastoral lease. The following table identifies potential activities that could have influenced the water quality within the RRPA for the 2021- 22 period (Table 2-4).

Table 2-4 Factors that may Affect Variability in Monitoring Results

Site Activities	Activities affecting Monitoring Results
Care and Maintenance activities	Use of tracks and creek crossings eroding land surface and sedimentation to creeks
Exploration activities	Use of tracks and creek crossings and drill pads upstream of sample points eroding land surface and sedimentation of creeks
Track and creek crossing upgrades	Improvements to tracks and creek crossing access for pastoral and PG eroding land surface and sedimentation of creeks
Pastoral activities	Day to day activities, stock movements over land and through creek lines.
Invasive species	Feral animals ie pigs, buffalo wallowing near at sample sites

RRPA remained in care and maintenance during 2021-2022 reporting period and has been since PGL's purchase of tenements in 2013. Exploration activities had occurred at site prior to obtaining the Licence which may influence water quality. Disturbance from exploration activities is yet to be rehabilitated once the sites are no longer required.

The crossing at Mount Bunday creek was replaced with a concrete surface in December 2021 for safety and all-season access for PGL and Mount Bunday pastoral activities. The upgrade was to replace the old crossing which was dilapidated and unsafe and had not been used for the last 10 years. Prior to the upgrade, a dirt track traversed Mount Bunday Creek and has been used daily for pastoral traffic and PGL access to RRPA weekly during the wet season and monthly in the dry season months. The crossing upgrade may influence water quality, sediments and macroinvertebrate results at the downstream RRSW10 for this reporting period. However, the improved crossing has significantly improved safety and removed the continual vehicular movements traversing Mount Bunday creek. Such movements destabilise the creek bed and banks causing soil erosion resulting in sedimentation into the downstream creek system.

The pastoral lease holder conducted access track upgrade earth works with regular communications with PGL's Chief Mining Engineer. Whilst road upgrades will primarily benefit pastoral activities adding value to the Old Mount Bunday pastoral business and activities, the upgrade will indirectly benefit PGL's new proposed open cut operations at Q29 and Rustlers Roost.

3 Monitoring Results

Water quality results for the WDL247 monitoring sites have been included in the following tables. The water quality data has been divided into four sections - field physical parameters (Table 3-2), general chemistry (Table 3-3), dissolved metals (Table 3-4) and nutrients (Table 3-5). All raw water quality data has been presented in Appendix A. Each table includes:

- Current results;
- Unit of measure;
- WDL247 Discharge Trigger Value (TV) for Compliance Points RRSW23 and RRSW24;
- Analysis type;
- Median trends; and
- Limits of Reporting (LoR).

As per Schedule 2 of the Licence, Discharge TVs have only been used for each monitoring event at Compliance Points, RRSW23 and RRSW24. To reiterate RRSW24 Compliance Point for the Marrakai catchment did not receive any discharge water during the reporting period and will act as a reference for prevailing conditions.

Discharge TVs were derived using ANZG (2018) 95 % species level of protection for freshwater ecosystems until the collection of more data allows for the calculation of Site-Specific Trigger Values. Each monitoring event at RRSW23 or RRSW24 was assessed against discharge TV, in which values outside of TV have been highlighted. For all other sampling sites, short term and long term median values were used to determine analyte and water quality trends which have also been compared to the Compliance Points TV in order to clearly identify elevations

Short term and long term median values were used, as opposed to averages, to assess water quality trends against guideline values across RRPA. This statistical method was chosen to avoid data outliers which would otherwise skew average values. Short term (2021- 22 reporting period) and long-term (2015/ 2016- 2022) values were used to compare water quality trends against guideline values. Data was sorted per site and in order of oldest to newest. Median values were calculated using three or more data points. If insufficient data points were available, the median cell was left blank (-). Median values with parameters below LoR have been represented as 'N/A'. Minimum and Maximums were also included for the reporting period to identify anomalies.

Monitoring Results

Total loading has been assessed for TDS, some metals and nutrients. Data sourced for calculations of TDS were from the AquaTROLL data located at ADP2 (Figure 3-1). RRSW22 water quality data was used to determine loading for aluminium, manganese, iron and total nitrogen (Figure 3-2 to Figure 3-5). Data utilised with readings above >LoR. Readings that were below laboratory LoR were taken as 0.5 x LoR.

Graphs have also been included to display long term trends of analytes of concern. Analytes that have triggered the TV at RRSW23 and RRSW24 have been graphed. To graph analytes below LoR, the value has been halved (Department of Environment and Climate Change [DECC], 2008). For instance, a value of <10 has been changed to 5 so it can be identified as a number in Excel and graphed.

Laboratory LoR for total phosphorus ranges from <50 µg/L and <10 µg/L for some sites. Half of <50 µg/L is 25 µg/L and above the RRSW23 and RRSW24 TV. To avoid misleading data, long term data trends were assessed and for sites with more than 50 % of either value are representative of water quality at the site. For instance, sites with both <50 µg/L and <10 µg/L values have been replaced with 5 µg/L if more than 50% of results are <10 µg/L (Figure 5-16 and Figure 5-17).

As discussed in Section 2.3, some sites have been monitored through the RRPA MMP ultimately accumulating long term data, with some sites with data for more than 10 years. New sites introduced with the Licence have been monitored since the commencement of the Licence in 2021 in which only three monitoring events may have been captured for some sites as a result of creek flows and access. Table 3-1 shows the sampling sites that are included in the Licence, their sampling data range and number of samples collected during that time. Sample sites that have not yet been monitored have been marked 'Nil'.

Table 3-1 Summary of Sampling Site Temporal Monitoring Events

Sampling Location	Data Date Range	Sampling events (Field parameters)	Long Term Median
ADP2	2021- 22	Continuous	✗
RRSW22	2012- 22	26	✓
RRSW23	2020- 22	24	✓
Q29SW2	2016- 22	23	✓
Q29SW10	2021- 22	3	✗
Q29SW4	2016- 22	16	✓
Q29SW9	Nil	Nil	✗
ADP1	2021- 22	Continuous	✗
RRSW6	2012- 22	8	✓
RRSW24	2021- 22	3	✗
RRSW25	Nil	Nil	✗
RRSW26	Nil	Nil	✗

3.1.1 Field Physical Parameters

Field parameter results from 2021-22 monitoring period are shown in Table 3-2. Parameters outside of RRSW23 and RRSW24 TV range for each monitoring event at both Compliance Points have been highlighted. Similarly, short term and long term medians for all other sampling sites have also been compared to RRSW23 and RRSW24 TV for analysis.

Table 3-2 Surface Water Field Parameters

Site	Date	SWL	pH	EC	DO	Temp	Turbidity	TDS
		mRL	Units	µS/cm	%	°C	NTU	mg/L
RR WDL247 TV for RRSW23 and RRSW24		-	6.0- 8.0	20- 250	85- 120	-	2.0- 15	-
WDL247 Compliance Sites								
RRSW23	05/01/2022	-	6.7	73	100.6	30.1	63.4	38
RRSW23	18/01/2022	-	6.3	31	87.6	30.7	13	58
RRSW23	25/01/2022	-	6.1	26	86.3	29.5	36.1	14
RRSW23	02/02/2022	-	6.0	29	87.6	28.45	21.1	22
RRSW23	09/02/2022	-	6.2	32	90.4	29.4	10.9	13
RRSW23	15/02/2022	-	6.2	31	89.7	29.9	19.3	44
RRSW23	15/02/2022	-	6.2	31	89.7	29.9	19.3	44
RRSW23	21/02/2022	-	6.3	34	90.2	30.7	10.2	46
RRSW23	28/02/2022	-	6.2	34.5	91.1	29.3	11.2	47
RRSW23	09/03/2022	-	6.4	32	91.3	31.4	7.0	43
RRSW23	16/03/2022	-	6.3	30	90.9	31.4	8.1	53
RRSW23	21/03/2022	-	6.3	43	84.8	31.6	17.6	92
RRSW23	29/03/2022	-	6.9	105.5	78.4	30.2	30.6	162
RRSW23	08/04/2022	-	6.4	26	91.8	31.5	6.6	74
RRSW23	12/04/2022	-	6.3	29.5	86.9	31	8.3	71
RRSW23	22/04/2022	-	6.7	81.5	63.8	29.7	23.8	-
Minimum (2021- 22)			6	26	63.8	28.45	6.6	13
Maximum (2021- 22)			6.9	105.5	100.6	31.6	63.4	162
Median (2021- 22)			6.3	31.5	89.95	30.15	12.1	46
Long term median (2020- 22)			6.3	33	90.3	30.15	18.45	46
RRSW24	05/01/2022	-	6.96	35	104.8	33.33	21	22
RRSW24	02/02/2022	-	8.11	14	107.6	28.83	38	-
RRSW24	21/03/2022	-	7.59	94	106.6	35.43	9.4	61
Median (2021- 22)		7.59	7.59	35	106.6	33.33	21	41.5
All Other Sampling Locations								
Q29SW9a (Proposed Control Site)	06/01/2022		6.69	43	103.5	28	21.7	27
Q29SW9a (Proposed Control Site)	09/02/2022		8.24	15	105	26.5	-	9
Q29SW9a (Proposed Control Site)	16/03/2022		7.44	38	112.4	32.5	24.9	26
Median (2021- 22)			7.44	38	105	28	-	26

Site	Date	SWL	pH	EC	DO	Temp	Turbidity	TDS
		mRL	Units	µS/cm	%	°C	NTU	mg/L
RR WDL247 TV for RRSW23 and RRSW24		-	6.0- 8.0	20- 250	85- 120	-	2.0- 15	-
RRSW6	27/09/2021	-	8.05	20	113.9	33.65	-	13
RRSW6	06/12/2021	-	6.38	47	77.6	32.5	2.5	31
RRSW6	16/03/2022	-	7.77	22	92	32	10	12
RRSW6	16/05/2022	-	8.16	54	89.1	34.7	0	35
Minimum (2021- 22)			6.38	20	77.6	32	0	12
Maximum (2021- 22)			8.16	54	113.9	34.7	10	35
Median (2021- 22)			7.91	34.5	90.6	33.1	2.5	22
Long term median (2012- 22)			6.19	21	89.1	32.5	10	13
RRSW22	27/09/2021	-	7.33	18	113.4	30.6	0	11
RRSW22	06/12/2021	-	6.81	48	112.6	31.2	0	30
RRSW22	05/01/2022	-	7.92	41	111.7	33.65	1.2	26
RRSW22	05/01/2022	-	7.92	41	111.7	33.65	1.2	26
RRSW22	18/01/2022	-	7.23	47	113	30.13	0	29
RRSW22	25/01/2022	-	7.79	27	110	30.3	0	16
RRSW22	02/02/2022	-	7.77	24	107	34	0	-
RRSW22	15/02/2022	-	7.72	50	115.6	31.3	11.5	33
RRSW22	21/02/2022	-	7.54	49	118.94	33.8	-	31
RRSW22	28/02/2022	-	7.32	45	105.9	31.6	0.5	27
RRSW22	28/02/2022	-	7.32	45	105.9	31.6	0.5	27
RRSW22	09/03/2022	-	7.34	58	111	36.65	1.5	35
RRSW22	14/03/2022	-	7.97	58	114	35	0	37
RRSW22	21/03/2022	-	7.94	71	111.5	35	0	46
RRSW22	29/03/2022	-	7.59	94	106.6	35.43	9.4	61
RRSW22	08/04/2022	-	8.13	24	108.7	34	0	15
RRSW22	12/04/2022	-	8.72	95	111.2	34.2	0	63
Minimum (2021- 22)			6.81	18	11.2	30.13	0	11
Maximum (2021- 22)			8.72	95	118.94	36.65	11.5	63
Median (2021- 22)			7.72	47	111	33.65	0	29.5
Long term median (2012- 22)			7.34	34.2	109.35	33.18	0.95	27
Q29SW2	06/01/2022	-	7.06	41	103	28	80	27
Q29SW2	18/01/2022	35.8	6.78	31	100.3	29.98	21.8	20
Q29SW2	08/02/2022	36.4	7	14	101.8	31.75	19	9
Q29SW2	08/02/2022	36.4	7	14	101.8	31.75	19	9
Q29SW2	14/03/2022	35.8	6.87	65	107	31.3	13.1	41
Minimum (2021- 22)			6.78	14	100.3	28	13.1	9
Maximum (2021- 22)			7.06	65	107	31.75	80	41
Median (2021- 22)			7	31	101.8	31.3	19	20
Long term median (2016- 22)			6.7	33.5	90.7	28.5	42	20.1

Site	Date	SWL	pH	EC	DO	Temp	Turbidity	TDS
		mRL	Units	µS/cm	%	°C	NTU	mg/L
RR WDL247 TV for RRSW23 and RRSW24		-	6.0- 8.0	20- 250	85- 120	-	2.0- 15	-
Q29SW10	06/01/2022	-	7.85	68	105.2	26.65	87.5	43
Q29SW10	09/02/2022	-	7.56	34	100	29	17.18	21
Q29SW10	16/03/2022	-	6.99	49	101	31.75	38.2	32
Median (2021- 22)			7.56	49	101	29	38.2	32
Q29SW4	06/01/2022	-	7.17	59	105	30	38	38
Q29SW4	08/02/2022	-	7.11	22	103.1	34.05	-	14
Long term median (2016- 22)			6.6	34.7	97.7	31.15	46.5	19.5

3.1.2 General Chemistry

General chemistry results from 2021-22 monitoring period are shown in Table 3-3. Cyanide outside of RRSW23 and RRSW24 TV range for each monitoring event at both Compliance Points have been highlighted, if applicable. Similarly, short term and long term medians for all other sampling sites have also been compared to RRSW23 and RRSW24 TV for analysis.

Table 3-3 Surface Water General Chemistry

Site	Date	Total							Filtered					
		Lab Inorganics		Alkalinity as CaCO3			Total Hardness	Cyanide	Cations Dissolved				Anions Dissolved	
		TSS	TDS	Bicarbonate	Carbonate	Total			Calcium	Potassium	Magnesium	Sodium	Chloride	Sulphate
		mg/L							µg/L	mg/L				
Laboratory PQL		5	5	5	5	5	3	4	0.5	0.5	0.5	0.5	1	1
RR WDL247 TV for RRSW23 and RRSW24		-	-	-	-	-	/Sample	7	-	-	-	-	-	-
WDL 247 Compliance Sites														
RRSW23	05/01/2022	38	-	23	<5	23	11	<4	2.8	1	0.9	8.6	3	4
RRSW23	18/01/2022	<5	-	9	<5	9	5	<4	1	1.1	0.6	2.9	2	1
RRSW23	25/01/2022	16	-	8	<5	8	4	<4	0.9	0.8	0.5	2.4	2	<1
RRSW23	02/02/2022	<5	-	10	<5	10	5	<4	1.1	0.6	0.6	3.4	3	1
RRSW23	09/02/2022	5	-	10	<5	10	5	<4	1.2	0.9	0.6	3.1	2	<1
RRSW23	09/02/2022	7	-	10	<5	10	5	<4	1.2	1	0.6	3.2	3	1
RRSW23	15/02/2022	10	-	10	<5	10	5	<4	1.2	0.7	0.6	3.1	2	1
RRSW23	15/02/2022	8	-	10	<5	10	5	<4	1.2	0.9	0.6	3.1	2	1
RRSW23	21/02/2022	<5	-	12	<5	12	6	<4	1.4	1	0.6	3.8	2	1
RRSW23	28/02/2022	11	-	13	<5	13	6	<4	1.4	0.8	0.6	3.6	<1	<1
RRSW23	09/03/2022	12	-	10	<5	10	5	<4	1.1	1	0.5	2.9	2	1
RRSW23	16/03/2022	10	-	9	<5	9	5	<4	0.9	1	0.5	2.6	2	1
RRSW23	16/03/2022	<5	-	9	<5	9	5	-	1	1.2	0.6	2.8	2	1
RRSW23	21/03/2022	<5	-	14	<5	14	6	<4	1.3	0.9	0.8	6.3	<5	<5
RRSW23	29/03/2022	20	-	34	<5	34	13	<4	3.5	0.6	1.1	15	3	7
RRSW23	08/04/2022	5	15	8	<5	8	4	<4	0.7	1.1	0.6	2.2	2	1
RRSW23	12/04/2022	6	19	13	<5	13	6	<4	1.5	1.1	0.7	3.5	2	2
RRSW23	22/04/2022	10	43	24	<5	24	7	<4	1.3	0.9	1	12	3	5
Minimum (2021- 22)		5	15	8	N/A	8	4	N/A	0.7	0.6	0.5	2.2	2	1
Maximum (2021- 22)		38	43	34	N/A	34	13	N/A	3.5	1.2	1.1	15	3	7
Median (2021- 22)		10	19	10	N/A	10	5	N/A	1.2	0.95	0.6	3.15	2	1
Long term median (2020- 22)		10	19	11	N/A	11	5	N/A	1.3	1	0.6	3.45	2.5	1
RRSW24	05/01/2022	6	-	8	<5	8	5	<4	0.6	0.9	0.9	2.6	3	<1
RRSW24	02/02/2022	12	-	<5	<5	<5	<3	<4	<0.5	<0.5	<0.5	1.8	2	<1

Site	Date	Total							Filtered					
		Lab Inorganics		Alkalinity as CaCO3			Total Hardness	Cyanide	Cations Dissolved				Anions Dissolved	
		TSS	TDS	Bicarbonate	Carbonate	Total			Calcium	Potassium	Magnesium	Sodium	Chloride	Sulphate
		mg/L							µg/L	mg/L				
Laboratory PQL		5	5	5	5	5	3	4	0.5	0.5	0.5	0.5	1	1
RR WDL247 TV for RRSW23 and RRSW24		-	-	-	-	-	/Sample	7	-	-	-	-	-	-
RRSW24	21/03/2022	9	-	26	<5	26	5	<4	0.6	<0.5	0.9	2.2	2	<1
Median (2021- 22)		9	-	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	2.2	2	N/A
All other Sampling Locations														
Q29SW9a (Proposed Control Site)	06/01/2022	7	17	6	<5	6	<3	<4	<0.5	1.4	0.6	1.8	2	<1
Q29SW9a (Proposed Control Site)	09/02/2022	22	-	10	<5	10	3	<4	<0.5	1	0.8	2.1	<1	<1
Q29SW9a (Proposed Control Site)	16/03/2022	<5	-	9	<5	9	<3	<4	<0.5	1	<0.5	1.8	1	<1
Median (2021- 22)		-	-	9	N/A	9	N/A	N/A	N/A	1	-	1.8	-	N/A
RRSW6	27/09/2021	20	-	5	<5	5	<3	-	<0.5	0.7	<0.5	1.6	2	1
RRSW6	06/12/2021	19	-	<5	<5	<5	<3	<4	<0.5	0.7	<0.5	1.5	2	<1
RRSW6	09/02/2022	<5	-	<5	<5	<5	<3	<4	<0.5	<0.5	<0.5	0.9	<1	<1
RRSW6	16/03/2022	<5	-	<5	<5	<5	<3	<4	<0.5	<0.5	<0.5	0.97	1	<1
RRSW6	16/05/2022	<5	6	<5	<5	<5	<3	<4	<0.5	<0.5	<0.5	0.96	2	<1
Minimum (2021- 22)		19	-	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.9	1	N/A
Maximum (2021- 22)		20	6	5	N/A	5	N/A	N/A	N/A	0.7	N/A	1.6	2	1
Median (2021- 22)		19.5	-	5	N/A	N/A	N/A	N/A	N/A	0.7	N/A	0.97	2	N/A
Long term median (2012- 22)		19.5	-	5	N/A	5	N/A	N/A	N/A	0.7	N/A	0.97	2	N/A
RRSW22	27/09/2021	<5	-	7	<5	7	<3	-	<0.5	1.1	0.7	1.9	3	2
RRSW22	06/12/2021	<5	-	5	<5	5	<3	<4	<0.5	1.2	0.7	2	2	<1
RRSW22	05/01/2022	<5	-	9	<5	9	<3	<4	<0.5	1.2	0.6	1.9	2	<1
RRSW22	05/01/2022	<5	-	9	<5	9	<3	<4	<0.5	1.1	0.6	1.6	2	<1
RRSW22	15/02/2022	<5	-	7	<5	7	6	<4	1	1.1	0.9	3.8	3	<1
RRSW22	14/03/2022	<5	-	8	<5	8	4	<4	0.6	1.2	0.6	1.8	2	<1
RRSW22	12/04/2022	<5	18	5	6	12	<3	<4	<0.5	0.9	<0.5	1.4	3	<1
RRSW22	16/05/2022	<5	14	7	<5	7	<3	<4	<0.5	1.2	0.6	1.8	3	<1
Minimum (2021- 22)		N/A	14	5	N/A	5	4	N/A	0.6	0.9	0.6	1.4	2	N/A
Maximum (2021- 22)		N/A	18	9	N/A	12	6	N/A	1	1.2	0.9	3.8	3	2
Median (2021- 22)		N/A	16	7	N/A	7.5	N/A	N/A	N/A	1.15	0.6	1.85	2.5	N/A
Long term median (2012- 22)		11	16	7	N/A	7	5	N/A	0.6	1.2	0.7	1.9	2	2
Q29SW2	06/01/2022	57	-	7	<5	7	4	<4	0.5	1.2	0.7	2.7	3	<1
Q29SW2	08/02/2022	16	-	9	<5	9	5	<4	0.7	0.6	0.7	2.5	1	<1
Q29SW2	14/03/2022	9	-	12	<5	12	6	<4	1.1	1.4	0.9	3.8	2	2

Site	Date	Total							Filtered					
		Lab Inorganics		Alkalinity as CaCO3			Total Hardness	Cyanide	Cations Dissolved				Anions Dissolved	
		TSS	TDS	Bicarbonate	Carbonate	Total			Calcium	Potassium	Magnesium	Sodium	Chloride	Sulphate
		mg/L							µg/L	mg/L				
Laboratory PQL		5	5	5	5	5	3	4	0.5	0.5	0.5	0.5	1	1
RR WDL247 TV for RRSW23 and RRSW24		-	-	-	-	-	/Sample	7	-	-	-	-	-	-
Q29SW2	22/04/2022	5	22	14	<5	14	6	<4	0.9	1.3	0.9	4	2	2
Minimum (2021- 22)		5	-	7	N/A	7	4	N/A	0.5	0.6	0.7	2.5	1	N/A
Maximum (2021- 22)		57	22	14	N/A	14	6	N/A	1.1	1.4	0.9	4	3	2
Median (2021- 22)		16	-	9	N/A	9	5	N/A	0.7	1.2	0.7	2.7	2	2
Long term median (2016- 22)		27	-	11	N/A	10	5	N/A	0.7	1.25	0.8	3	2	2
Q29SW10	06/01/2022	68	-	7	<5	7	4	<4	0.5	1.2	0.6	2.2	2	<1
Q29SW10	09/02/2022	26	-	9	<5	9	5	<4	0.7	0.6	0.7	2.3	2	<1
Q29SW10	16/03/2022	27	-	10	<5	10	5	<4	0.8	1.2	0.6	2.6	2	<1
Median (2021- 22)		27	-	9	N/A	9	5	N/A	0.7	1.2	0.6	2.3	2	2
Q29SW4	06/01/2022	21	-	9	<5	9	4	<4	0.6	1.3	0.7	2.6	2	<1
Q29SW4	08/02/2022	9	-	10	<5	10	5	<4	0.6	1	0.8	3.1	<1	<1
Q29SW4	12/04/2022	<5	16	12	<5	12	<3	<4	<0.5	1.3	0.5	3.7	2	<1
Median (2021- 22)		-	-	10	N/A	10	N/A	N/A	0.6	1.3	0.7	3.1	N/A	N/A
Long term median (2016- 22)		24	-	10	N/A	10	5	N/A	0.7	1.1	0.8	3.7	2	2

3.1.3 Dissolved Metals

Dissolved metal results from 2021-22 monitoring period are shown in Table 3-4. Dissolved metals outside of RRSW23 and RRSW24 TV range for each monitoring event at both Compliance Points have been highlighted. Similarly, short term and long term medians for all other sampling sites have also been compared to RRSW23 and RRSW24 TV for analysis.

Table 3-4 Surface Water Dissolved Metals

Site	Date	Al	As	Cd	Cr	Co	Cu	Fe	Pb	Mn	Mo	Ni	Se	Sn (Tin)	U	Zn
		µg/L														
Laboratory PQL		10	1	0.1	1	1	1	10	1	5	1	1	1	1	0.5	1
RR WDL247 TV for RRSW23 and RRSW24		55	13	0.2	1	1.4	1.4	300	3.4	1900	34	11	11	3	0.5	8
WDL247 Compliance Site																
RRSW23	05/01/2022	49	4.6	<0.1	<1	2.1	<1	140	<1	37	2.6	<1	<1	<1	<0.5	<1
RRSW23	18/01/2022	20	4	<0.1	<1	<1	<1	80	<1	15	<1	<1	<1	<1	<0.5	<1
RRSW23	25/01/2022	70	3	<0.1	<1	<1	<1	180	<1	39	<1	<1	<1	<1	<0.5	<1
RRSW23	02/02/2022	28	3.3	<0.1	<1	<1	1.3	130	<1	25	<1	1.3	<1	<1	<0.5	1.8
RRSW23	09/02/2022	23	5	<0.1	<1	<1	<1	100	<1	18	<1	<1	<1	<1	<0.5	1
RRSW23	09/02/2022	27	5	<0.1	<1	<1	<1	99	<1	20	<1	<1	<1	<1	<0.5	<1
RRSW23	15/02/2022	21	4.7	<0.1	<1	<1	<1	120	<1	25	<1	<1	<1	<1	<0.5	<1
RRSW23	15/02/2022	20	4.7	<0.1	<1	<1	<1	110	<1	27	<1	<1	<1	<1	<0.5	<1
RRSW23	21/02/2022	<10	7.7	<0.1	<1	<1	<1	65	<1	19	1.1	<1	<1	<1	<0.5	<1
RRSW23	28/02/2022	15	7.5	<0.1	<1	<1	<1	94	<1	23	<1	<1	<1	<1	<0.5	1.6
RRSW23	09/03/2022	<10	8.5	<0.1	<1	<1	<1	53	<1	16	1	<1	<1	<1	<0.5	<1
RRSW23	16/03/2022	25	6.9	<0.1	<1	<1	<1	55	<1	17	<1	<1	<1	<1	<0.5	1.2
RRSW23	16/03/2022	<10	6.9	<0.1	<1	<1	<1	65	<1	16	<1	<1	<1	<1	<0.5	1.4
RRSW23	21/03/2022	21	3.7	<0.1	<1	<1	<1	96	<1	68	<1	<1	<1	<1	<0.5	<1
RRSW23	29/03/2022	17	7.4	<0.1	<1	3.5	<1	93	<1	57	4.1	<1	<1	<1	<0.5	<1
RRSW23	08/04/2022	10	3.2	<0.1	<1	<1	<1	41	<1	10	<1	<1	<1	<1	<0.5	<1
RRSW23	12/04/2022	17	3.1	<0.1	<1	<1	<1	77	<1	41	<1	<1	<1	<1	<0.5	1.3
RRSW23	22/04/2022	180	9.1	<0.1	<1	2	<1	1400	<1	92	-	<1	-	-	<0.5	3.3
Minimum (2021- 22)		10	3	N/A	N/A	2	N/A	41	N/A	10	1	N/A	N/A	N/A	N/A	1
Maximum (2021- 22)		180	9.1	N/A	N/A	3.5	1.3	1400	N/A	92	4.1	1.3	N/A	N/A	N/A	3.3
Median (2021- 22)		21	4.85	N/A	N/A	2.1	N/A	95	N/A	24	1.85	N/A	N/A	N/A	N/A	1.4
Long term median (2020- 22)		27	5	N/A	N/A	3.75	N/A	105	N/A	20.5	1.85	N/A	N/A	N/A	N/A	1.4
RRSW24	05/01/2022	76	<1	<0.1	<1	<1	<1	240	<1	20	<1	<1	<1	<1	<0.5	<1
RRSW24	02/02/2022	69	<1	<0.1	<1	<1	<1	150	<1	14	<1	<1	<1	<1	<0.5	<1
RRSW24	21/03/2022	37	<1	<0.1	<1	<1	<1	440	<1	37	<1	<1	<1	<1	<0.5	<1
Median (2021- 22)		69	N/A	N/A	N/A	N/A	N/A	240	N/A	20	N/A	N/A	N/A	N/A	N/A	N/A
All Other Sampling Locations																

Site	Date	Al	As	Cd	Cr	Co	Cu	Fe	Pb	Mn	Mo	Ni	Se	Sn (Tin)	U	Zn
		µg/L														
Laboratory PQL		10	1	0.1	1	1	1	10	1	5	1	1	1	1	0.5	1
RR WDL247 TV for RRSW23 and RRSW24		55	13	0.2	1	1.4	1.4	300	3.4	1900	34	11	11	3	0.5	8
Q29SW9a (Proposed Control Site)	06/01/2022	120	<1	<0.1	<1	<1	<1	140	<1	22	<1	<1	<1	<1	<0.5	<1
Q29SW9a (Proposed Control Site)	09/02/2022	34	<1	<0.1	<1	<1	<1	140	<1	13	<1	<1	<1	<1	<0.5	1.2
Q29SW9a (Proposed Control Site)	16/03/2022	120	<1	<0.1	<1	<1	<1	170	<1	15	<1	<1	<1	<1	<0.5	1.1
Median (2021- 22)		120	N/A	N/A	N/A	N/A	N/A	140	N/A	15	N/A	N/A	N/A	N/A	N/A	-
RRSW6	27/09/2021	<10	1	<0.1	<1	<1	<1	740	<1	9	<1	<1	<1	<1	<0.5	2
RRSW6	06/12/2021	<10	1	<0.1	<1	<1	<1	230	<1	39	<1	<1	<1	<1	<0.5	2
RRSW6	09/02/2022	12	<1	<0.1	<1	<1	<1	290	<1	14	<1	<1	<1	<1	<0.5	<1
RRSW6	16/03/2022	<10	<1	<0.1	<1	<1	<1	360	<1	17	<1	<1	<1	<1	<0.5	<1
RRSW6	16/05/2022	<10	<1	<0.1	<1	<1	<1	220	<1	23	<1	<1	<1	<1	<0.5	1.2
Minimum (2021- 22)		N/A	N/A	N/A	N/A	N/A	N/A	220	N/A	9	N/A	N/A	N/A	N/A	N/A	1.2
Maximum (2021- 22)		12	1	N/A	N/A	N/A	N/A	740	N/A	39	N/A	N/A	N/A	N/A	N/A	2
Median (2021- 22)		N/A	1	N/A	N/A	N/A	N/A	290	N/A	17	N/A	N/A	N/A	N/A	N/A	2
Long term median (2012- 22)		12	1	N/A	N/A	N/A	N/A	290	N/A	17	N/A	N/A	N/A	N/A	N/A	2
RRSW22	27/09/2021	<10	<1	<0.1	<1	<1	<1	<10	<1	<5	<1	<1	<1	<1	<0.5	5
RRSW22	06/12/2021	<10	<1	<0.1	<1	<1	<1	<10	<1	<5	<1	<1	<1	<1	<0.5	<1
RRSW22	05/01/2022	<10	<1	<0.1	<1	<1	<1	<10	<1	5.9	<1	<1	<1	<1	<0.5	<1
RRSW22	05/01/2022	<10	<1	<0.1	<1	<1	<1	<10	<1	5.6	<1	<1	<1	<1	<0.5	<1
RRSW22	15/02/2022	<10	<1	<0.1	<1	<1	<1	<10	<1	6.2	<1	<1	<1	<1	<0.5	<1
RRSW22	14/03/2022	<10	<1	<0.1	<1	<1	<1	<10	<1	8.6	<1	<1	<1	<1	<0.5	1.2
RRSW22	12/04/2022	<10	<1	<0.1	<1	<1	<1	<10	<1	5.9	<1	<1	<1	<1	<0.5	<1
RRSW22	16/05/2022	<10	1	<0.1	<1	<1	<1	<10	<1	<5	<1	<1	<1	<1	<0.5	<1
Minimum (2021- 22)		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	5.6	N/A	N/A	N/A	N/A	N/A	1.2
Maximum (2021- 22)		N/A	1	N/A	N/A	N/A	N/A	N/A	N/A	8.6	N/A	N/A	N/A	N/A	N/A	5
Median (2021- 22)		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	5.9	N/A	N/A	N/A	N/A	N/A	3.1
Long term median (2012- 22)		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	5.9	N/A	N/A	N/A	N/A	N/A	5
Q29SW2	06/01/2022	200	<1	<0.1	<1	<1	1.3	390	<1	14	<1	<1	<1	<1	<0.5	<1
Q29SW2	08/02/2022	75	<1	<0.1	<1	<1	<1	230	<1	12	<1	<1	<1	<1	<0.5	<1
Q29SW2	08/02/2022	87	<1	<0.1	<1	<1	<1	260	<1	12	<1	<1	<1	<1	<0.5	<1
Q29SW2	14/03/2022	46	2.4	<0.1	<1	<1	<1	220	<1	9.4	<1	<1	<1	<1	<0.5	<1
Q29SW2	22/04/2022	220	1.5	<0.1	<1	<1	<1	1000	<1	42	-	<1	-	-	<0.5	2.1
Minimum (2021- 22)		46	1.5	N/A	N/A	N/A	N/A	220	N/A	9.4	N/A	N/A	N/A	N/A	N/A	N/A
Maximum (2021- 22)		220	2.4	N/A	N/A	N/A	1.3	1000	N/A	42	N/A	N/A	N/A	N/A	N/A	2.1
Median (2021- 22)		87	N/A	N/A	N/A	N/A	N/A	260	N/A	12	N/A	N/A	N/A	N/A	N/A	2.1
Long term median (2016- 22)		110	1	N/A	N/A	N/A	1	300	N/A	13	N/A	N/A	N/A	N/A	N/A	3.55
Q29SW10	06/01/2022	140	<1	<0.1	<1	<1	1	400	<1	18	<1	<1	<1	<1	<0.5	<1
Q29SW10	09/02/2022	61	<1	<0.1	<1	<1	<1	260	<1	18	<1	<1	<1	<1	<0.5	1.1

Site	Date	Al	As	Cd	Cr	Co	Cu	Fe	Pb	Mn	Mo	Ni	Se	Sn (Tin)	U	Zn
		µg/L														
Laboratory PQL		10	1	0.1	1	1	1	10	1	5	1	1	1	1	0.5	1
RR WDL247 TV for RRSW23 and RRSW24		55	13	0.2	1	1.4	1.4	300	3.4	1900	34	11	11	3	0.5	8
Q29SW10	16/03/2022	120	1.2	<0.1	<1	<1	<1	330	<1	10	<1	<1	<1	<1	<0.5	1.7
Median (2021- 22)		120	1.2	N/A	N/A	N/A	N/A	330	N/A	18	N/A	N/A	N/A	N/A	N/A	1.4
Q29SW4	06/01/2022	97	<1	<0.1	<1	<1	1.1	320	<1	17	<1	<1	<1	<1	<0.5	3.7
Q29SW4	08/02/2022	93	<1	<0.1	<1	<1	<1	230	<1	12	<1	<1	<1	<1	<0.5	1.3
Q29SW4	12/04/2022	73	1.9	1.2	1.5	1.5	1.9	420	1.6	27	-	1.6	-	-	1.2	2.3
Median (2021- 22)		93	N/A	N/A	N/A	N/A	N/A	320	N/A	17	N/A	N/A	N/A	N/A	N/A	2.3
Long term median (2016- 22)		93	1.9	N/A	N/A	N/A	1.05	250	1.6	18	N/A	N/A	N/A	N/A	N/A	3

3.1.4 Nutrients

Total nutrient results from 2021-22 monitoring period are shown in Table 3-5. Dissolved metals outside of RRSW23 and RRSW24 TV range for each monitoring event at both Compliance Points have been highlighted. Similarly, short term and long term medians for all other sampling sites have also been compared to RRSW23 and RRSW24 TV for analysis.

Table 3-5 Mount Bunday Surface Water Nutrients

Site	Date	TN	TP
		µg/L	µg/L
Laboratory PQL		100	10/ 50
RR WDL247 TV for RRSW23 and RRSW24		300	10
WDL247 Compliance Site			
RRSW23	05/01/2022	600	<10
RRSW23	18/01/2022	200	<10
RRSW23	25/01/2022	300	10
RRSW23	02/02/2022	200	<10
RRSW23	09/02/2022	180	<10
RRSW23	09/02/2022	200	<10
RRSW23	15/02/2022	220	<10
RRSW23	15/02/2022	190	<10
RRSW23	21/02/2022	<100	<10
RRSW23	28/02/2022	<100	<10
RRSW23	09/03/2022	<100	<10
RRSW23	16/03/2022	<100	<10
RRSW23	16/03/2022	<100	<10
RRSW23	21/03/2022	400	<10
RRSW23	29/03/2022	310	<10
RRSW23	08/04/2022	<100	<10
RRSW23	12/04/2022	160	<10
RRSW23	22/04/2022	280	12
Minimum (2021- 22)		160	10
Maximum (2021- 22)		600	12
Median (2021- 22)		210	N/A
Long term median (2020- 22)		290	20
RRSW24	05/01/2022	400	<50
RRSW24	02/02/2022	200	<10
RRSW24	21/03/2022	280	<10
Median (2021- 22)		280	N/A

Monitoring Results

Site	Date	TN	TP
		µg/L	µg/L
Laboratory PQL		100	10/ 50
RR WDL247 TV for RRSW23 and RRSW24		300	10
All Other Sampling Locations			
Q29SW9a (Proposed Control Site)	06/01/2022	600	<50
Q29SW9a (Proposed Control Site)	09/02/2022	340	<10
Q29SW9a (Proposed Control Site)	16/03/2022	500	<10
Median (2021- 22)	06/01/2022	500	N/A
RRSW6	27/09/2021	700	<50
RRSW6	06/12/2021	700	<50
RRSW6	09/02/2022	-	<10
RRSW6	16/03/2022	<100	<10
RRSW6	16/05/2022	390	<10
Minimum (2021- 22)		390	N/A
Maximum (2021- 22)		700	N/A
Median (2021- 22)		700	N/A
Long term median (2012- 22)		700	N/A
RRSW22	27/09/2021	200	<50
RRSW22	06/12/2021	200	<50
RRSW22	05/01/2022	100	<50
RRSW22	05/01/2022	100	<50
RRSW22	15/02/2022	110	<10
RRSW22	14/03/2022	<100	<10
RRSW22	12/04/2022	140	<10
RRSW22	16/05/2022	210	<10
Minimum (2021- 22)		100	N/A
Maximum (2021- 22)		210	N/A
Median (2021- 22)		140	N/A
Long term median (2012- 22)		140	N/A
Q29SW2	06/01/2022	700	<50
Q29SW2	08/02/2022	1800	<10
Q29SW2	08/02/2022	400	<10
Q29SW2	14/03/2022	400	<10
Q29SW2	22/04/2022	280	<10
Minimum (2021- 22)		280	N/A
Maximum (2021- 22)		1800	N/A
Median (2021- 22)		400	N/A
Long term median (2016- 22)		400	30
Q29SW10	06/01/2022	500	<50

Site	Date	TN	TP
		µg/L	µg/L
Laboratory PQL		100	10/ 50
RR WDL247 TV for RRSW23 and RRSW24		300	10
Q29SW10	09/02/2022	390	<10
Q29SW10	16/03/2022	600	<10
Median (2021- 22)		500	N/A
Q29SW4	06/01/2022	500	<50
Q29SW4	08/02/2022	360	<10
Q29SW4	12/04/2022	180	<10
Median (2021- 22)		360	N/A
Long term median (2016- 22)		300	40

3.1.5 Total Loading

A summary of loading from ADP2 for TDS has been provided in Figure 3-1, for aluminium has been provided in Figure 3-2, for manganese loading has been provided in Figure 3-3, for zinc has been provided in Figure 3-4 and total nitrogen has been provided in Figure 3-5.

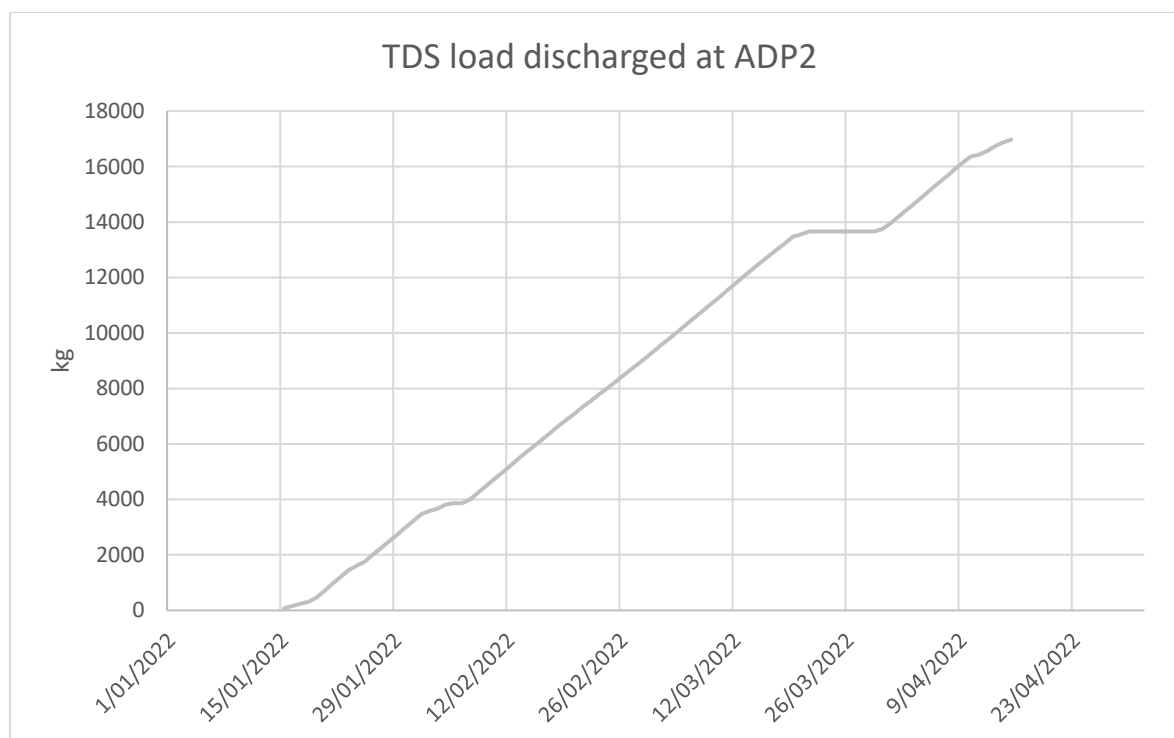


Figure 3-1 ADP2 Total Dissolved Loading (2021- 22 wet season)

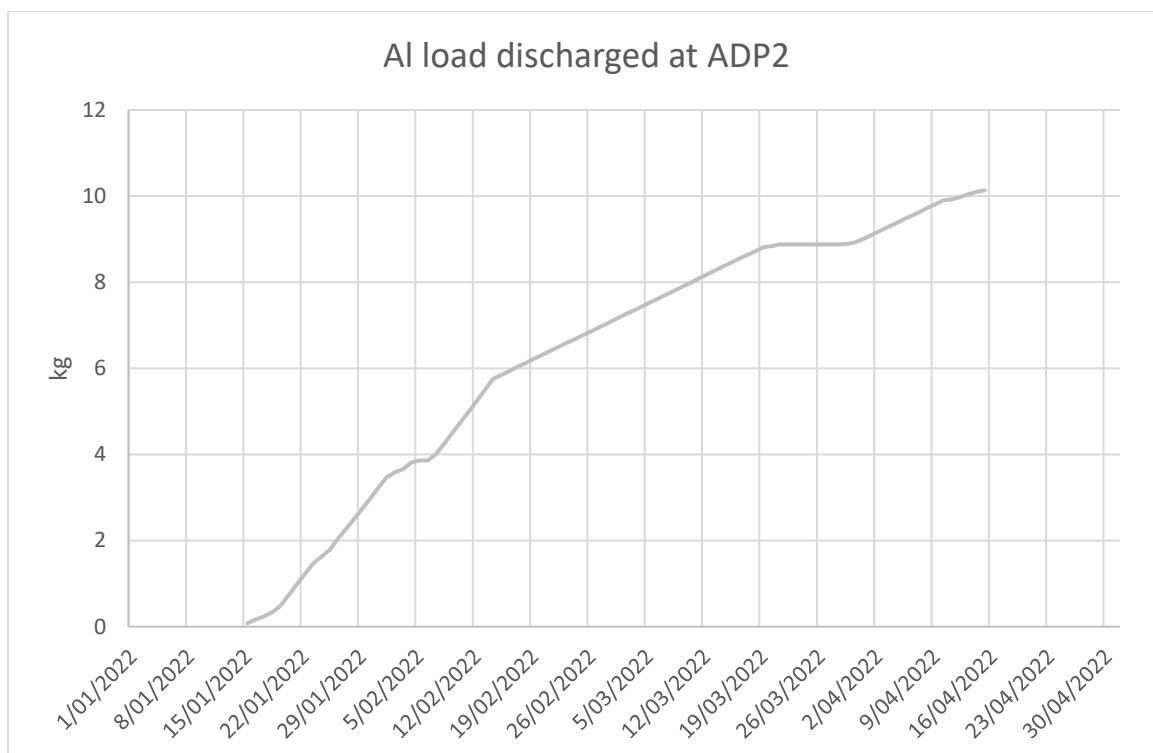


Figure 3-2 Aluminium Loading (2021- 22 wet season)

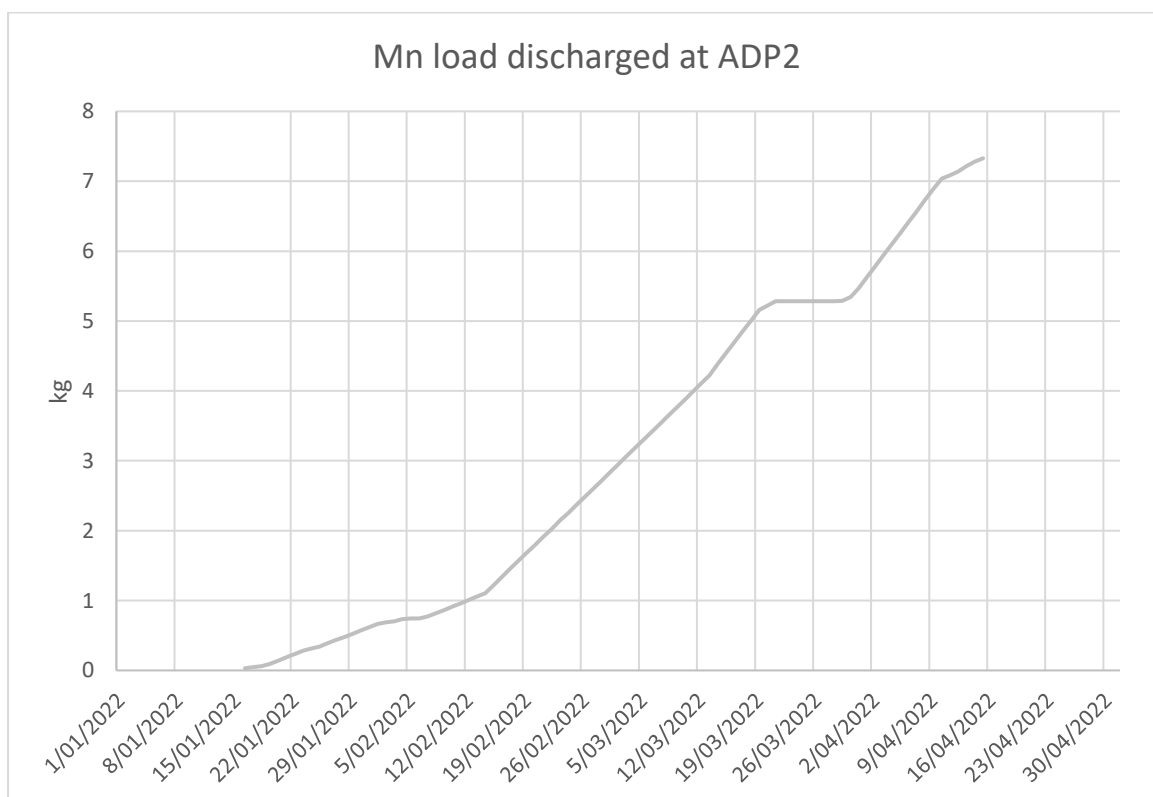


Figure 3-3 Manganese Loading (2021- 22 wet season)

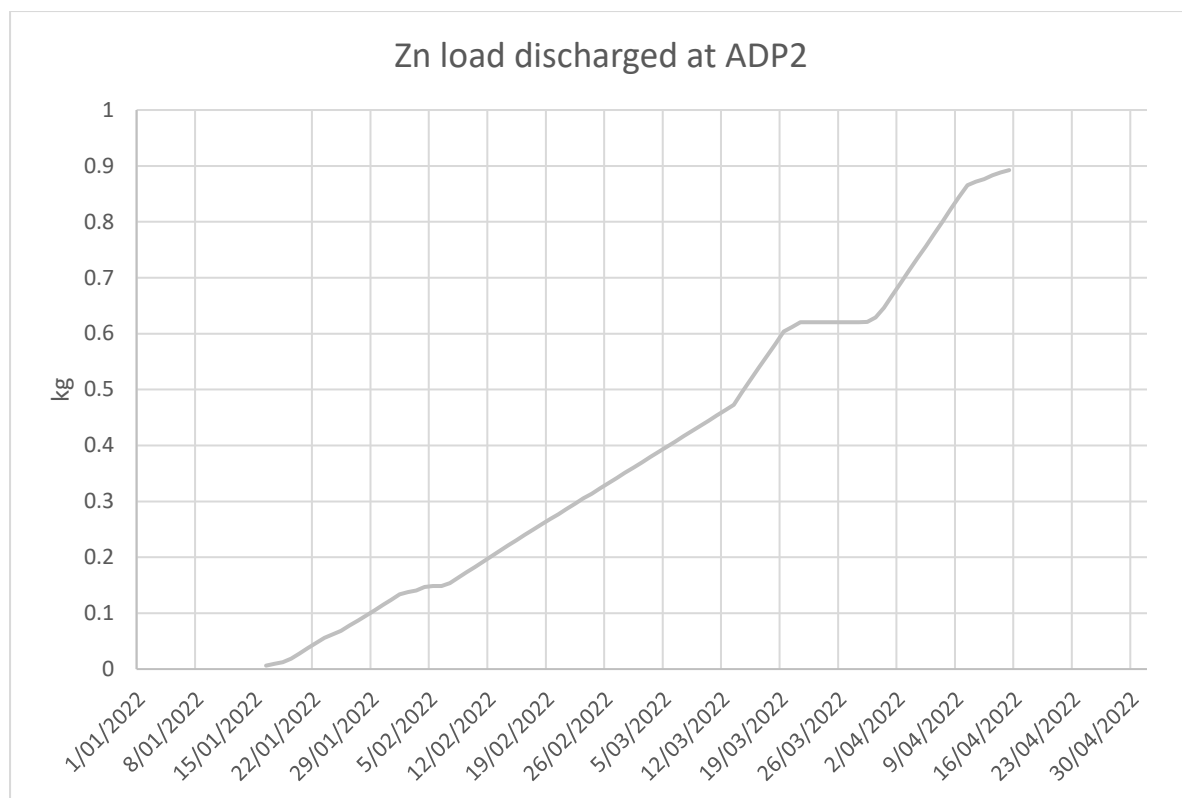


Figure 3-4 Zinc Loading (2021- 22 wet season)

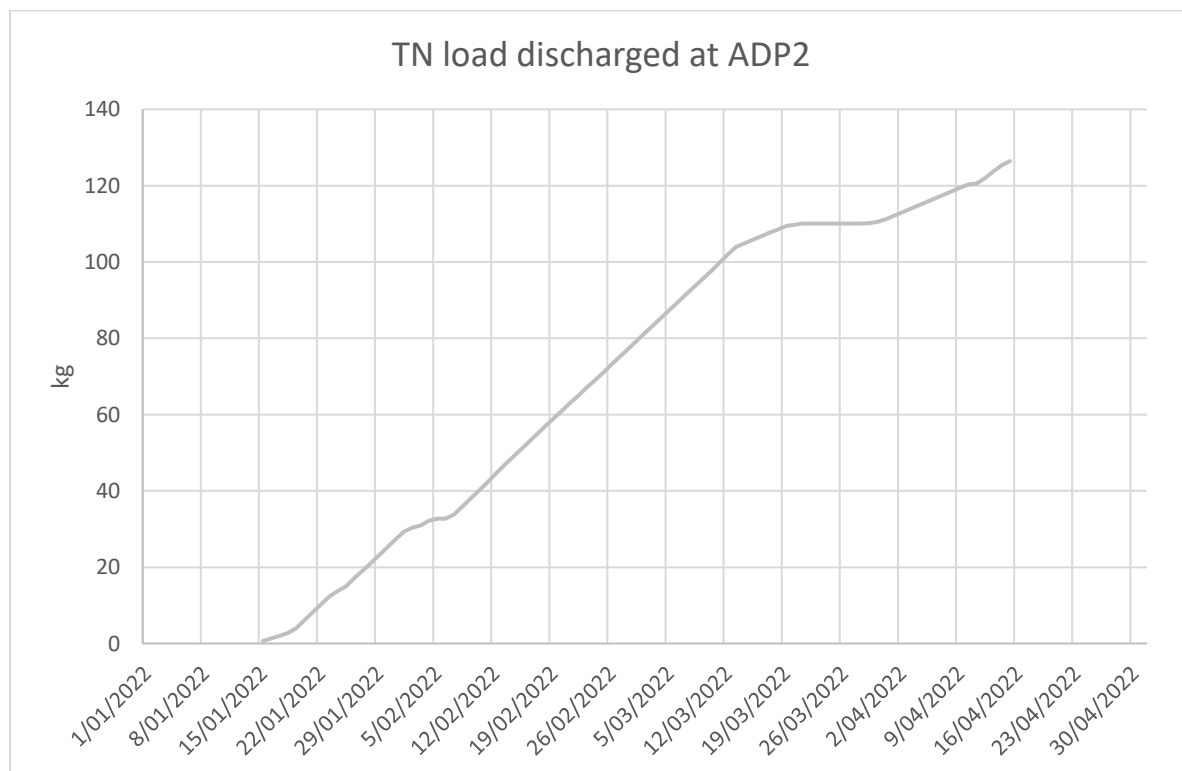


Figure 3-5 Total Nitrogen Loading (2021- 22 wet season)

4 QA/QC Evaluation

4.1 Completeness

Monitoring frequency performance was assessed and tabulated in Appendix E. The assessment lists every monitoring event in accordance with Schedule 1 of the Licence. The table identifies in colour, whether the sampling events were met, frequency of events, analytes and field notes. In summary, of the 184 sampling events, 142 were met which equates to 77.2% completeness.

ADP1 and Marrakai Creek monitoring sites, RRSW25 and RRSW26, were not sampled as there was no authorised discharge to this catchment. RRSW24 compliance site was monitored as the telemetry station and infrastructure had already been installed and operational by December 2021. Q29SW9 (Control) was not sampled due to restricted access from seasonal flooding and track access. Q29SW9a was chosen as a replacement to Q29SW9 for its suitable proximity within Mount Bundey Creek sub catchment, the same stream order (1 minor and non-perennial) to Q29SW9, upstream of mining activities, creek system has consistent flow throughout the wet season, and accessible for all sample events. Section 6.4 provides further detail of site changes and justification.

RRSW22 (Rustler Roost Pit) frequency of monitoring met 18 of the 37 sampling events. Missed events included weekly field monitoring during dry season months (June- December 2021) and then from April to June 2022. Monthly water sample events were generally maintained. During discharge all field and sampled events were collected. RRSW22 is an existing monitoring site under the RRPA MMP with data captured since 2012 with 30 monitoring events captured during this time.

PGL propose to change RRSW22 field monitoring frequency to weekly during discharge events only and monthly throughout the remainder of the reporting period. Further detail of proposed changes are provided 6.4.

RRSW6 (Annies Water Dam) frequency of monitoring were met for four of the 13 sampling events. Majority of dry season months (May- October) were missed in 2021 and 2022. September, December, February and March were all sampled. RRSW6 is also an existing site with data captured since 2012 with 12 monitoring events occurring during this time.

RRSW22 and RRSW6 are generally accessible all season and therefore on approval of the proposed frequency changes to RRSW22 PGL will ensure all attempts to sample as per Schedule 1 of WDL 247 unless unsafe to do so will be met for the 2022/23 period. All proposed changes have been highlighted in Section 6.4 which includes rationale for improvement.

4.2 Quality Control

Sampling method was consistent for all water sampling events in accordance with the sampling method detailed in Section 2.2. Qualified and experienced environmental consultants undertook the field monitoring since the commencement of the Licence.

All metals/metalloids, general chemistry and nutrients were field sampled as per the routine sampling method in pre labelled and acidified bottles provided by the analytical laboratory (Envirolab NATA accredited for the related analysis).

Calibration of field equipment was undertaken as per the manufacturer's recommendations for telemetry and data loggers. Field handheld equipment was calibrated prior to each weekly sampling event for pH and EC using buffer and quick Cal solutions. DO was also undertaken frequently.

5 Discussion and Interpretation of Results

5.1 Monitoring Method Non-Conformances

Refer to Section 0 for actions to address monitoring non-conformances.

5.2 Statistical Analysis

5.2.1 Field parameters

There were no exceedances of a trigger value for field parameters at RRSW23 or RRSW24 (Table 3-2) as specified in Condition 44.1 and 44.2 of WDL 247 during the reporting period.

- RRSW23 recorded elevated levels of turbidity and low levels of DO on several separate occasions.
- Of the 15 monitoring occasions, 7 monitoring events recorded turbidity (NTU) greater than 15 NTU.
- Of the 15 monitoring occasions, 2 monitoring events recorded low DO (% Saturation) <85%.
- RRSW24 recorded three sampling events with elevated levels of pH and turbidity and low levels of DO on several occasions.
- Majority of sampling events captured elevated turbidity above 15 NTU.
Most downstream sites of RRSW23 recorded short term or long term median levels of elevated turbidity >15 NTU with Q29SW4 with the greatest long term median.
- Two of the monitoring occasions at, Q29SW9a, recorded levels greater than 15 NTU.
- RRSW22 recorded all field parameters within TV with the exception of turbidity which recorded below the low-level TV.

5.2.2 General Chemistry

There were no exceedances of a trigger value for general chemistry at RRSW23 or RRSW24 (Table 3-3) as specified in Condition 44.1 and 44.2 of WDL247.

- General chemistry values were consistent at creeks compliance sites, downstream monitoring sites and control site Q29SW9a.
- Total alkalinity median and long term median values tended to be low at RRSW6 and RRSW22 compared all creeks sample sites.
- Sodium ion median and long term median values were the dominant cations at all monitoring sites with >3 mg/L recorded at RRSW23, RRSW2, Q29SW4.
- Chloride ion median and long term median values were 2- 2.5 mg/L consistently at all monitoring sites.
- Sulphate ions median and long term median values were 1- 2 mg/L at the Mount Bunday Creek monitoring sites including RRP; and <1 mg/L at the Marrakai Creek monitoring sites including Annies Dam.
- Cyanide compound was below laboratory PQL of <4 µg/L on all sampling occasion and at all monitoring sites..

5.2.3 Dissolved Metals

There were no exceedances of a trigger values for dissolved metals at RRSW23 or RRSW24 (Table 3-4) as specified in Condition 44.1 and 44.2 of WDL247 during the reporting period.

- RRSW23 compliance site recorded cobalt concentrations above TV's on three separate monitoring events .
- Cobalt and molybdenum median trends were recorded only at RRSW23.
- RRSW23 recorded aluminium and iron concentrations above trigger value on the 22/04/2022.
- aluminium and iron concentrations and median and long term median trends were above TV on several occasions were elevated at all creek monitoring sites (control and impact) except for RRSW6 and RRSW22.
- Aluminium and iron concentrations were above TV on several occasions.
- Aluminium median is above TV at RRSW24.
- RRSW22 recorded all dissolved metals and metalloids below laboratory LoR with the exception of arsenic, manganese and zinc. These metals recorded low concentrations when compared to RRSW23 and RRSW24 TV.
- Cadmium, chromium, nickel, selenium, tin and uranium were all below laboratory LoR at all monitoring sites for median trends.

5.2.4 Nutrients

There were no exceedances of a trigger values for nutrients at RRSW23 or RRSW24 (Table 3-5) as specified in Condition 44.1 and 44.2 of the WDL.

- Three separate monitoring events captured total nitrogen values above the TV.
- Long term trends were below TV for total nitrogen at RRSW23.
- RRSW24 recorded elevated total nitrogen above the TV on one monitoring event.
- Total nitrogen long term median values were elevated at all downstream monitoring sites including the control site RRSW9a when compared to TV.
- The highest long term median of total nitrogen was recorded at Q29SW2.
- RRSW23 recorded 2 separate monitoring events above TV for total phosphorus however long term medians showed a greater increase when compared to each monitoring point in the 2021- 22 period.
- Total Phosphorus long term median trends are elevated at Q29SW2 and Q29SW4 with all other sites remaining below TV.

5.2.5 Total Loading

Contaminant loading was calculated using the NSW EPA '*Load Calculation Protocol*' (2008) to measure the mass load of a specified analyte from controlled discharge activities. TDS was used from ADP2 as the site is the only site that requires flow to be recorded as per Schedule 1 of the Licence. Continuous flow and EC readings allowed for an accurate load calculation. Data used for the metal and nutrient loading was sourced from the RRSW22 given the parameters monitored at ADP2. Water quality monitored at RRSW22 is best representative of Pit and discharge water quality.

The following analysis has been made:

- As indicated in the Figure 3-1 there is a cumulative trend of TDS mass between commencement of discharge (15 January 2022- 14 April 2022). Daily loading ranged from 49 kg/ day to 257 kg/ day with a total of 16, 971 kg of TDS being discharged from ADP2 for the discharge period. Several assumptions have been made when considering calculations of TDS loading, these have been addressed in Section 6.3.1
- Aluminium total loading for the discharge period totalled 10.13 kg (Figure 3-2)
- Manganese total loading for the discharge period totalled 7.32 kg (Figure 3-3)
- Zinc total loading for the discharge period totalled 0.89 kg (Figure 3-4)
- Total nitrogen loading for the discharge period totalled 126.4 kg (Figure 3-5).

Considering the dilute nature of the water discharged from ADP2, it is unlikely that the contaminant loads detailed in Table xx would have resulted in any adverse impact to aquatic flora or fauna, or contaminant accumulation in the sediments of the Mount Bunday Creek.

5.3 Discussion of Spatial and Temporal Trends

As indicated in Table 3-1, several sites across the RRPA have been introduced since the commencement of the Licence and do not have long term data. Compliance Point RRSW24 is a new site in which no trends of data can be drawn upon. RRSW23 however has been monitored since 2020 with 24 monitoring events captured.

Several analytes were recorded elevated at RRSW23 and RRSW24 throughout the 2021- 22 reporting period. Analytes in elevation of TV have been included in the following graphs (Figure 5-1- Figure 5-17) to indicate trends at the Compliance Points where available, trends spatially throughout the Mount Bunday or whether trends relate to temporal variations. Analytes found in elevation to TV include pH, electrical conductivity, dissolved oxygen, turbidity, aluminium, iron, cobalt, total nitrogen and total phosphorus.

5.3.1 Field Parameters

Although pH was recorded in elevation against TV at RRSW24 on one monitoring occasion, both other monitoring events remained within the TV range (Figure 5-1). RRSW23 which has been monitored since 2020 has recorded consistent pH levels during this time. Other sites within the Mount Bunday Creek also recorded pH levels above 8.0 pH Units towards the end of the 2021- 22 wet season including proposed site Q29SW9a (Figure 5-2).

Although EC was recorded in elevation against TV at RRSW24 on one monitoring occasion, both other monitoring events remained within the TV range (Figure 5-3). RRSW23 which has been monitored since 2020 has recorded consistent EC levels during this time. Other sites within the Mount Bunday Creek also recorded EC levels below 20 $\mu\text{S}/\text{cm}$ during the 2021- 22 wet season, including control site Q29SW9a (Figure 5-4). RRSW22, source of discharge has seen a slight increase of EC since 2015 with levels ranging between this time from 21 $\mu\text{S}/\text{cm}$ to 95 $\mu\text{S}/\text{cm}$. An exponential trendline has been included in Figure 5-4 to show slow increase trend in the six years of monitoring.

DO Saturation was recorded lower than TV at RRSW23 on four monitoring occasions (Figure 5-5). Analysis of long term trends shows consistency in DO concentrations for the 2021- 22 wet season whilst monitoring prior to this shows variation in results. RRSW24 remained within TV range. Q29SW4 and Q29SW2 located downstream and upstream of discharge water influence recorded low DO concentrations on several locations during 2020- 22 wet season however remained between 85- 120 saturation for the 2021- 22 reporting period (Figure 5-6).

Turbidity was recorded in elevation against TV at both Compliance Points, RRSW23 and RRSW24, on several monitoring occasions (Figure 5-7). Most monitoring occasions at RRSW23 recorded elevated turbidity since 2020 with some monitoring occasions within TV from 2022. RRSW23 recorded several anomalies at the commencement of sampling at the site in 2020. The 2022 monitoring events recorded turbidity at the site between 8.1 NTU and 63.4 NTU. RRSW24 recorded elevated turbidity above TV for two of the three sampling occasions.

Discussion and Interpretation of Results

Long term trends for downstream sites within the Mount Bunday Creek have maintained turbidity levels above 15 NTU since 2016 (Figure 5-8). Proposed control site showed similar trends to other sites within the same catchment, remaining above 15 NTU. RRSW22 has remained below 11.5 NTU since 2016.

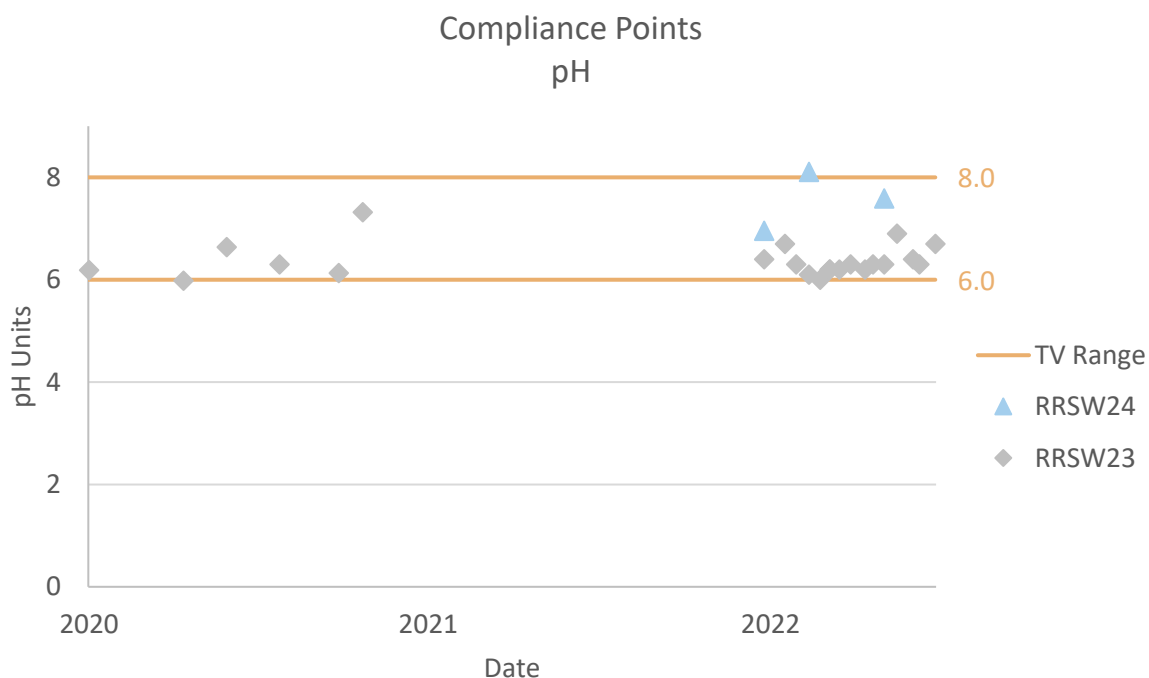


Figure 5-1 Trend Analysis for pH at Compliance Points

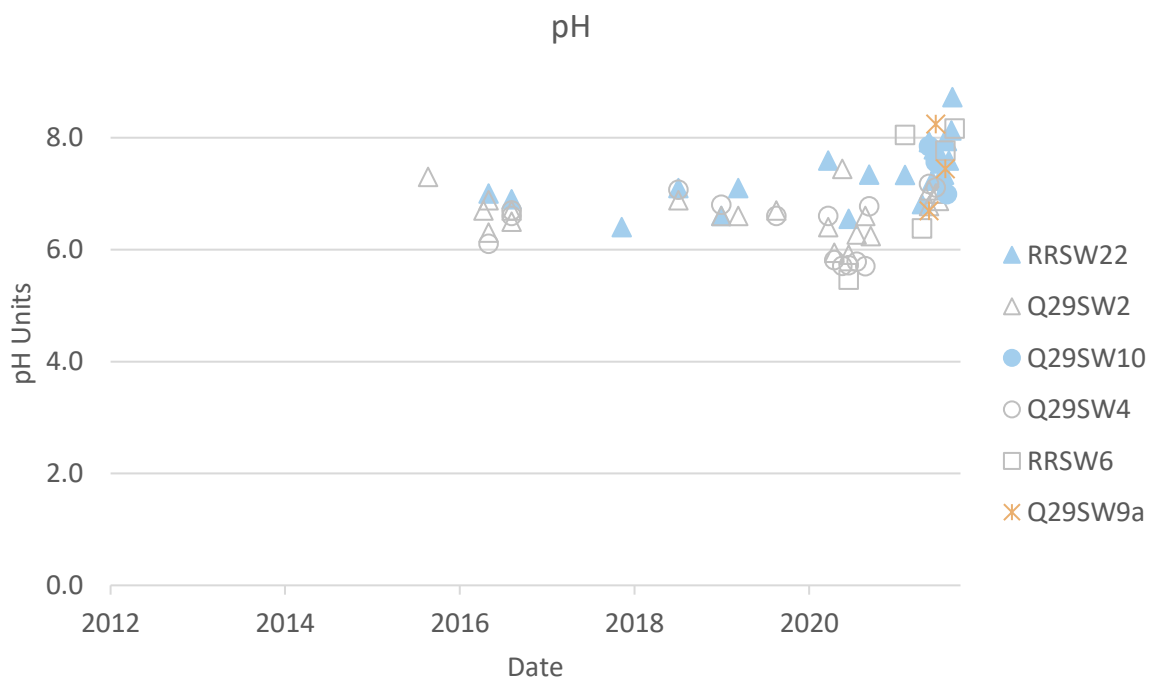


Figure 5-2 Trend Analysis for pH at All Other Sampling Sites

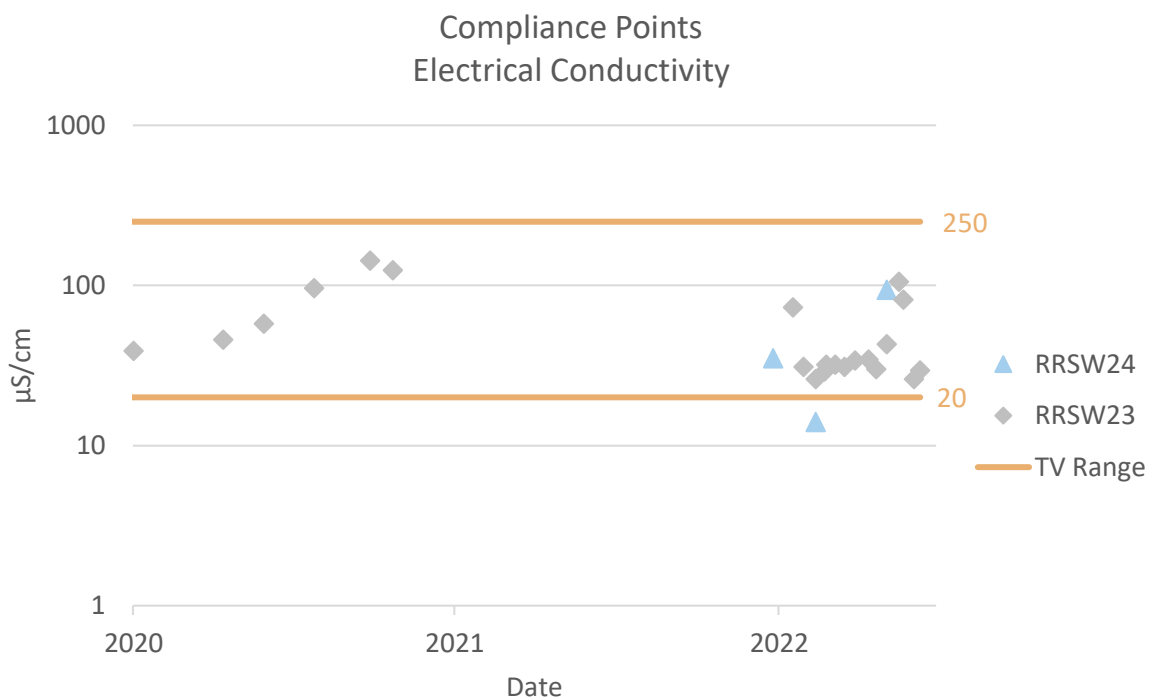


Figure 5-3 Trend Analysis for EC at Compliance Points

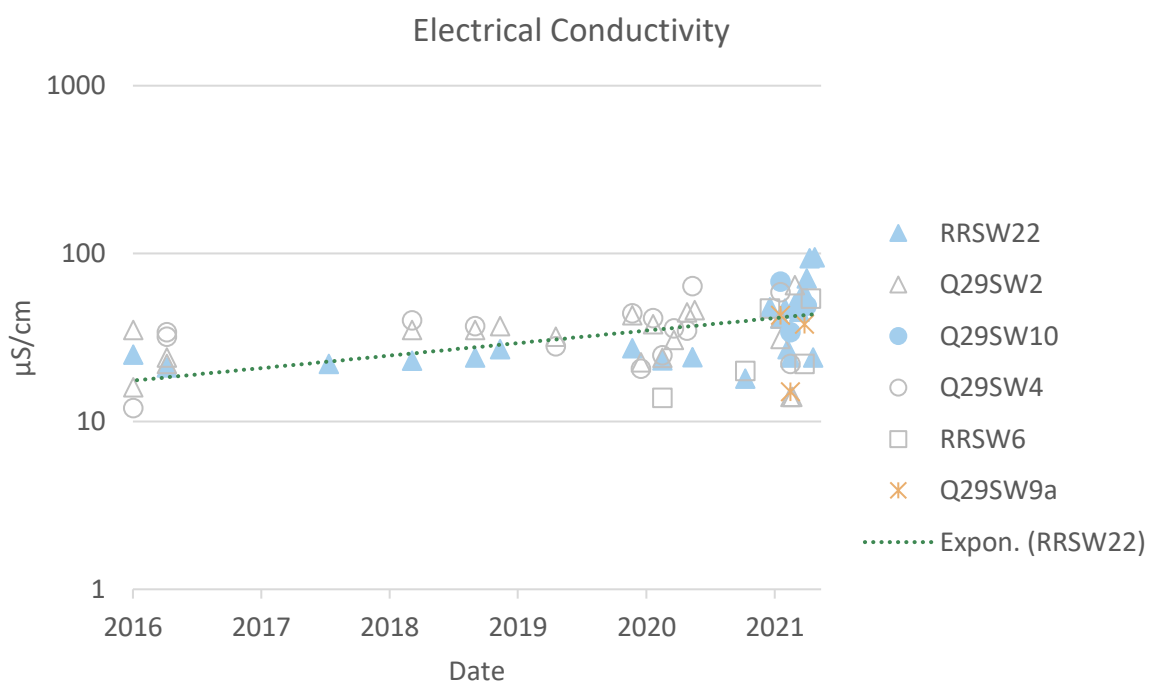


Figure 5-4 Trend Analysis for EC at All Other Sampling Sites

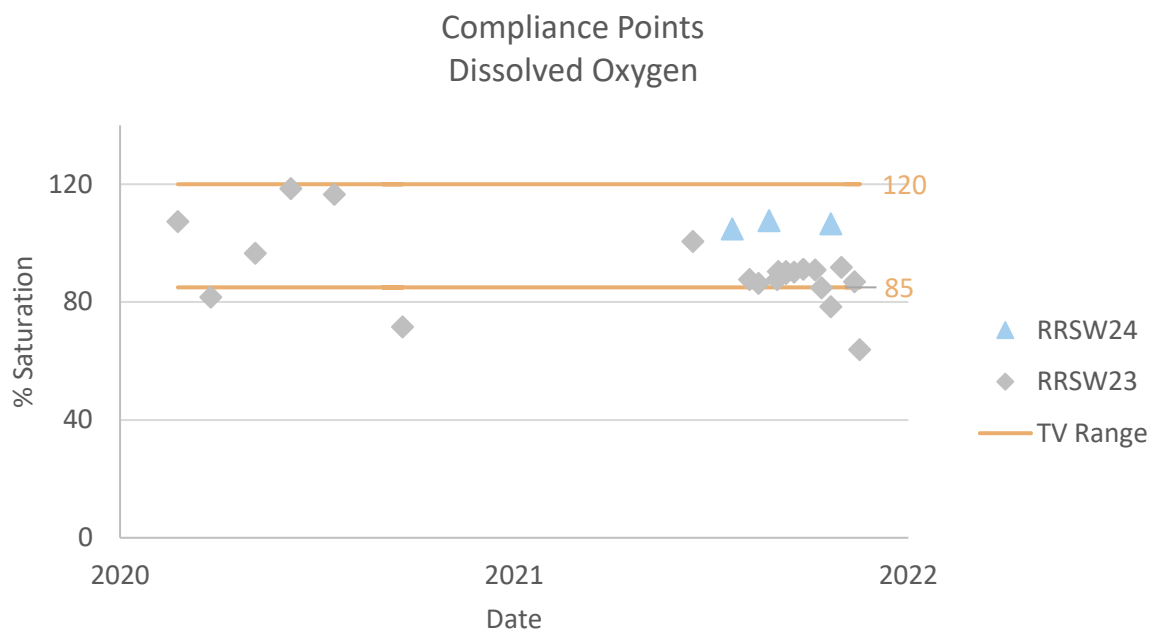


Figure 5-5 Trend Analysis for DO at Compliance Points

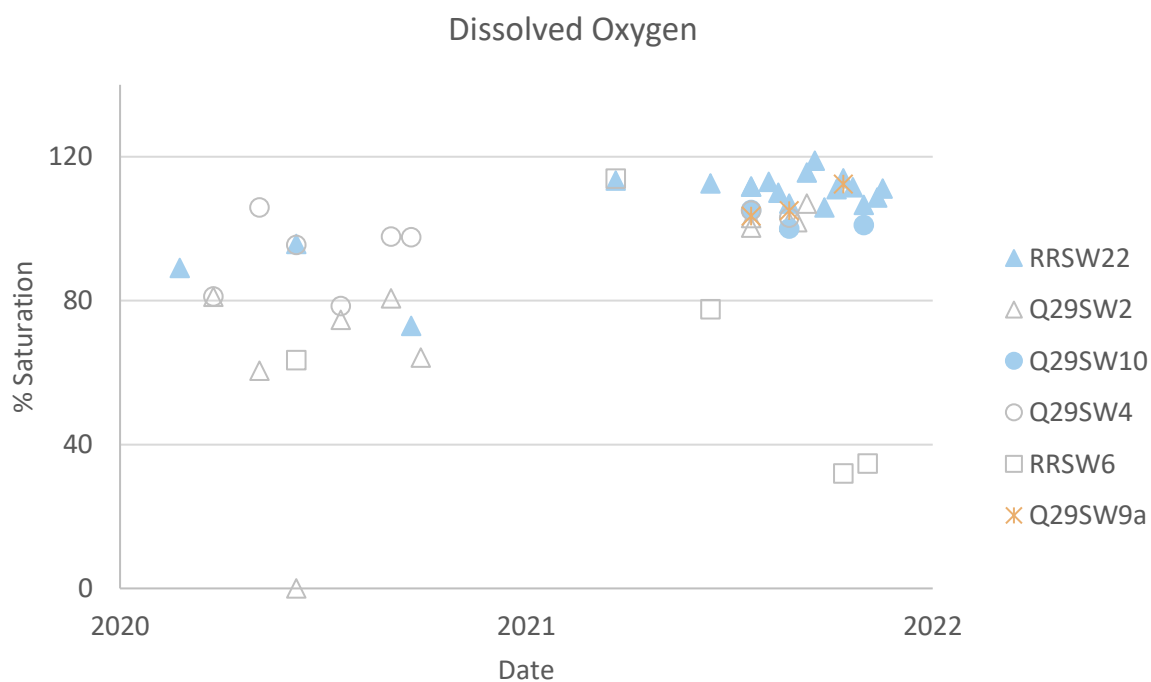


Figure 5-6 Trend Analysis for DO at All Other Sites

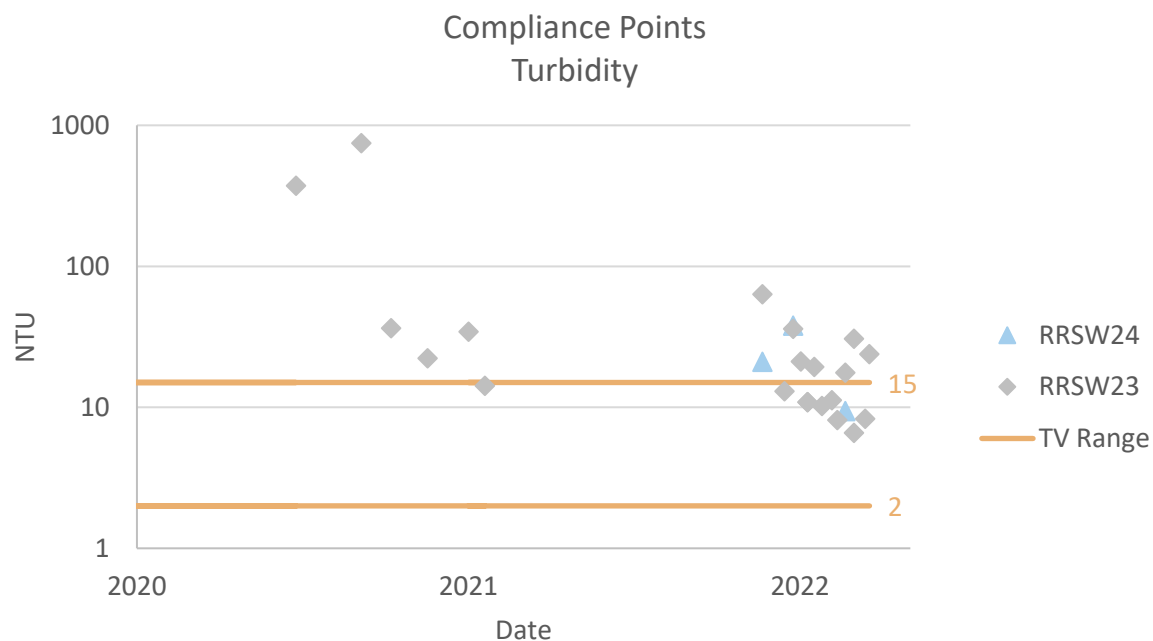


Figure 5-7 Trend Analysis for Turbidity at Compliance Points

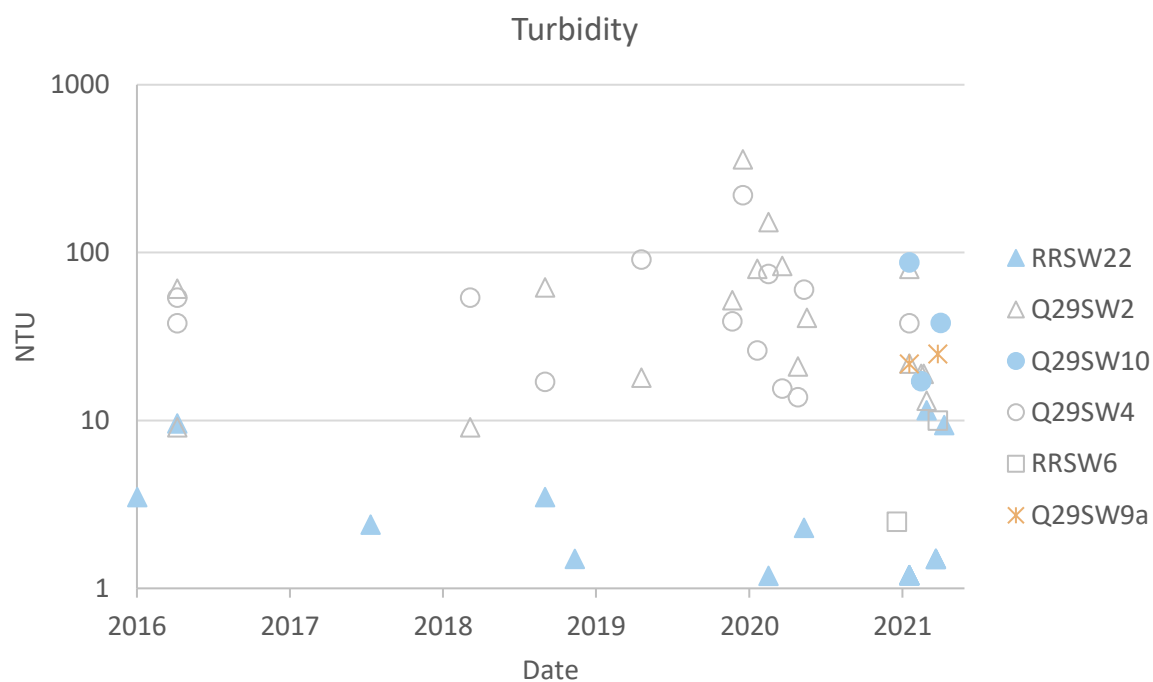


Figure 5-8 Trend Analysis for Turbidity at All Other Sampling Sites

5.3.2 Dissolved Metals

Aluminium was recorded in elevation against TV at both Compliance Points, RRSW23 and RRSW24, on several monitoring occasions (Figure 5-9). RRSW23 recorded two monitoring occasions above the TV of 55 µg/L during 2021- 22 however all monitoring occasions in 2020- 21 remained above the TV. RRSW24 was also above the TV on two of the three monitoring occasions. Downstream sites Q29SW2 and Q29SW10 recorded long term elevated concentrations of aluminium including prior to any discharge events (Figure 5-10). Upstream sites of discharge influence, Q29SW4 and the proposed control site Q29SW9a, recorded elevated trends of aluminium. RRSW22 recorded long term trends below laboratory LoR since 2012, with the exception of one monitoring event which recorded 20 µg/L.

Iron was recorded in elevation against TV at both Compliance Points, RRSW23 and RRSW24, on several monitoring occasions (Figure 5-11). RRSW23 recorded one monitoring occasion above 300 during the 2022 monitoring period however most monitoring occasions in 2020- 21 remained above the TV. RRSW24 also recorded one monitoring event above the TV. Downstream sites Q29SW2 and Q29SW10 recorded long term elevated concentrations of iron including prior to any discharge events (Figure 5-12). Upstream site of discharge influence, Q29SW4, also recorded long term trends of elevated iron. The proposed control site Q29SW9a recorded levels below 300 µg/L. RRSW22 recorded long term trends below laboratory LoR with the exception of two monitoring event which recorded 12 µg/L and 20 µg/L.

Cobalt was recorded in elevation against TV at RRSW23 on several monitoring occasions. RRSW23 is the only site that has been graphed for cobalt as it is the only site with elevated cobalt. Figure 5-13 shows elevated trends in cobalt at RRSW23 since the commencement of monitoring at the site in 2020. The graph shows six elevated concentrations of cobalt since 2020 whilst the remainder of the monitoring events were recorded below laboratory LoR. Trends in water quality prior to discharge show cobalt as elevated as 5 µg/L. For the 2021- 22 reporting period, three monitoring events recorded elevated levels of cobalt which include the first and last monitoring event for the season. It should be noted that immediately downstream monitoring site, Q29SW2, has recorded cobalt levels below laboratory LoR since the commencement of monitoring at the site.

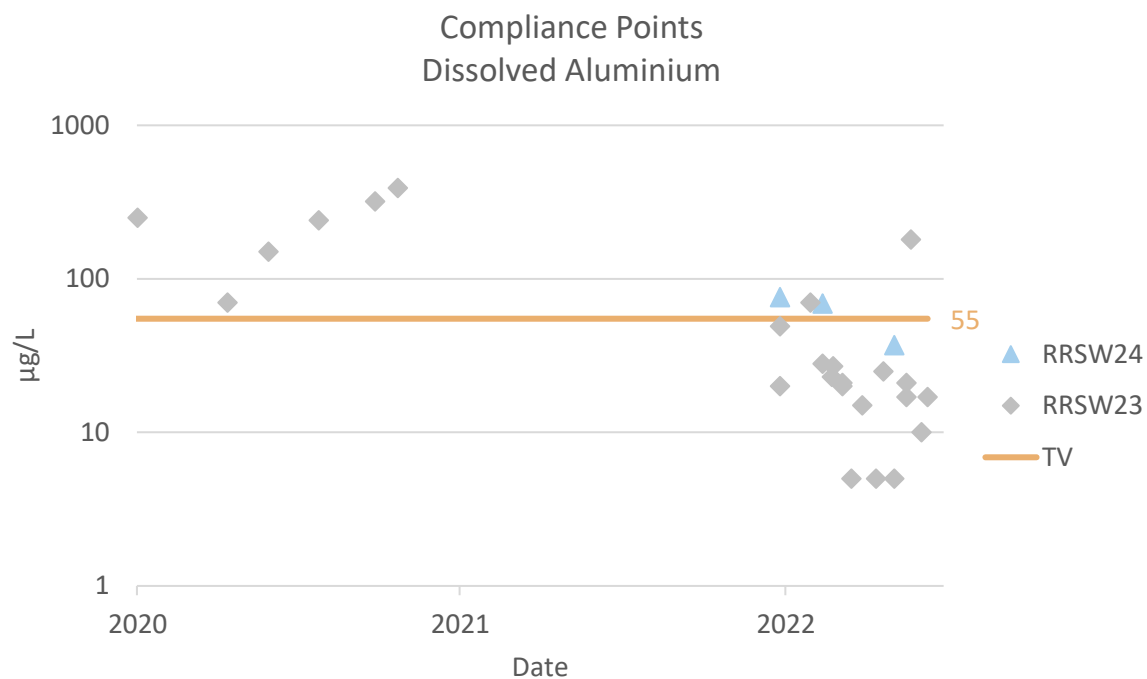


Figure 5-9 Trend Analysis for Dissolved Al at Compliance Points

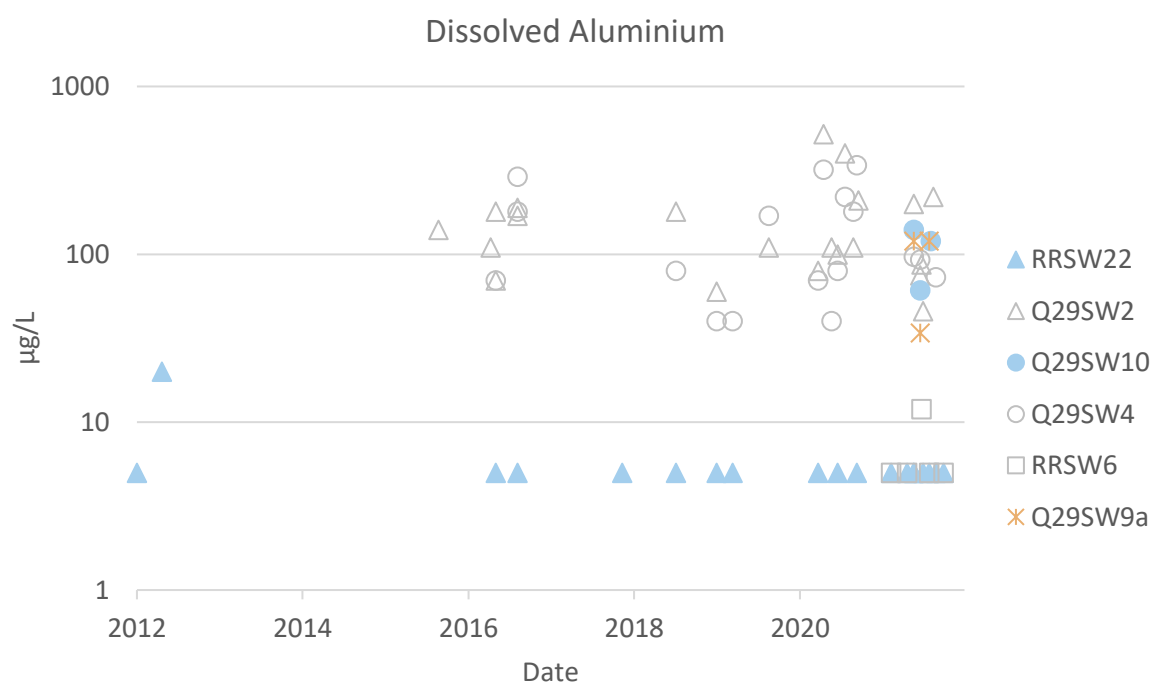


Figure 5-10 Trend Analysis for Al at All Other Sampling Sites

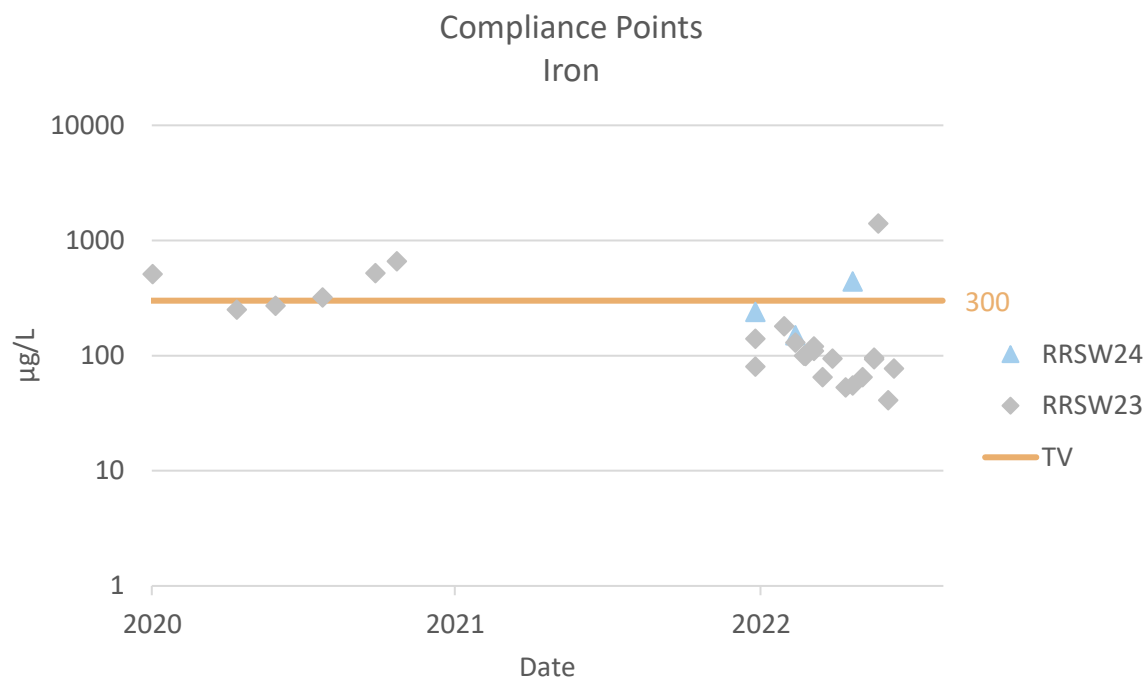


Figure 5-11 Trend Analysis for Fe at Compliance Points

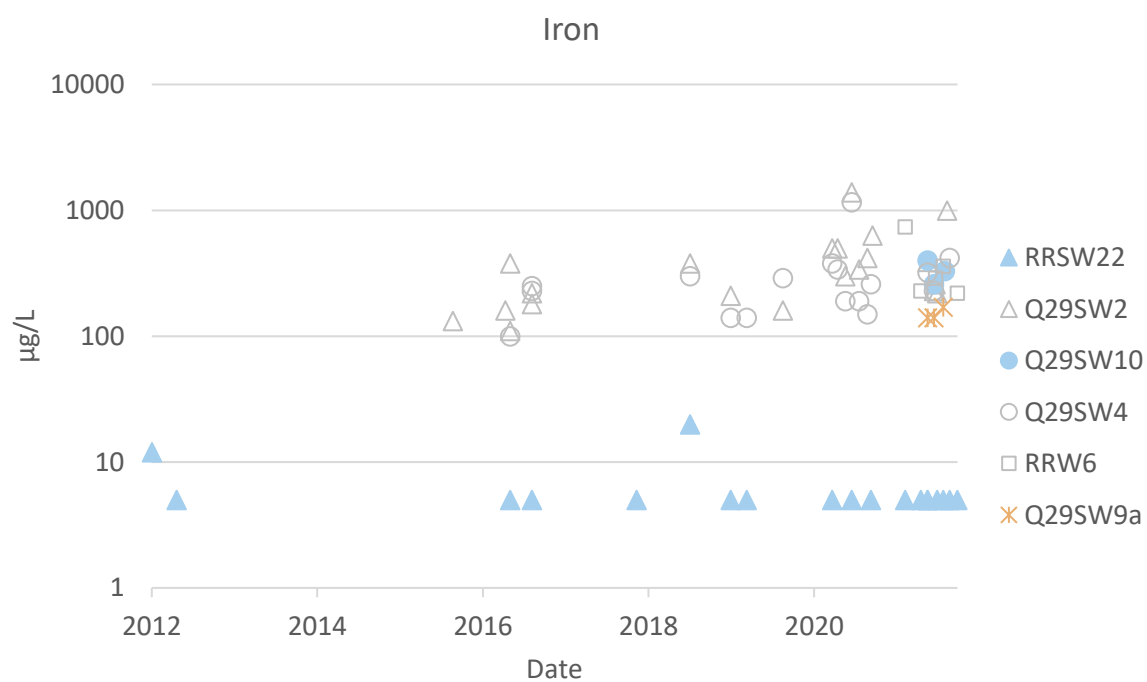


Figure 5-12 Trend Analysis for Fe at All Other Sampling Sites

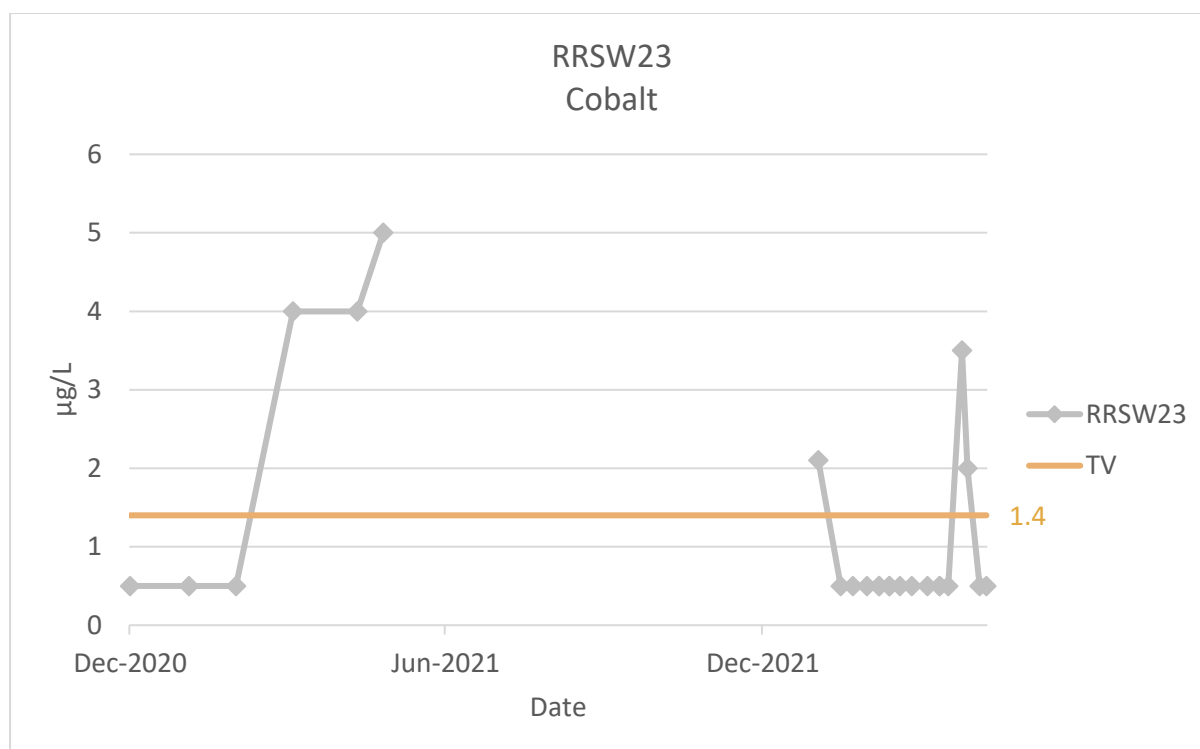


Figure 5-13 Trend Analysis for Co at RRSW23, Compliance Point

5.3.3 Nutrients

Total nitrogen was recorded in elevation against TV at both Compliance Points, RRSW23 and RRSW24, on several monitoring occasions (Figure 5-14). RRSW23 recorded greater elevation of total nitrogen during the previous wet season (2020- 21) than the reporting period, recording as high as 2,500 µg/L. The first monitoring event prior to discharge on the 5 January 2022, was elevated recording 600 µg/L before reducing below 300 µg/L until March. March and April recorded varying results above and below TV. RRSW24 also recorded elevated total nitrogen on the 5 January 2022 before remaining below TV for the other two sampling occasions. All other monitoring sites within Rustlers Roost PA also showed elevation above 300 µg/L on several monitoring occasions since monitoring of nutrients commenced in December 2020. Q29SW2, Q29SW10, Q29SW4, Q29SW9a and RRSW6 all recorded total nitrogen levels above 300 µg/L during the 2021- 22 period.

Total phosphorus was recorded in elevation against TV at Compliance Point RRSW23 on several monitoring occasions (Figure 5-16). RRSW23 recorded greater elevations of total phosphorus during the previous wet season (2020- 21) than the reporting period, recording as high as 290 µg/L. The highest recording during the reporting period was at RRSW23 of 12 µg/L and 10 µg/L, the remaining monitoring events remained within laboratory LoR. Similarly, greater elevations were recorded at monitoring sites Q29SW2 and Q29SW4 during the previous wet season than the reporting period which recorded all monitoring events at all monitoring sites below laboratory LoR.

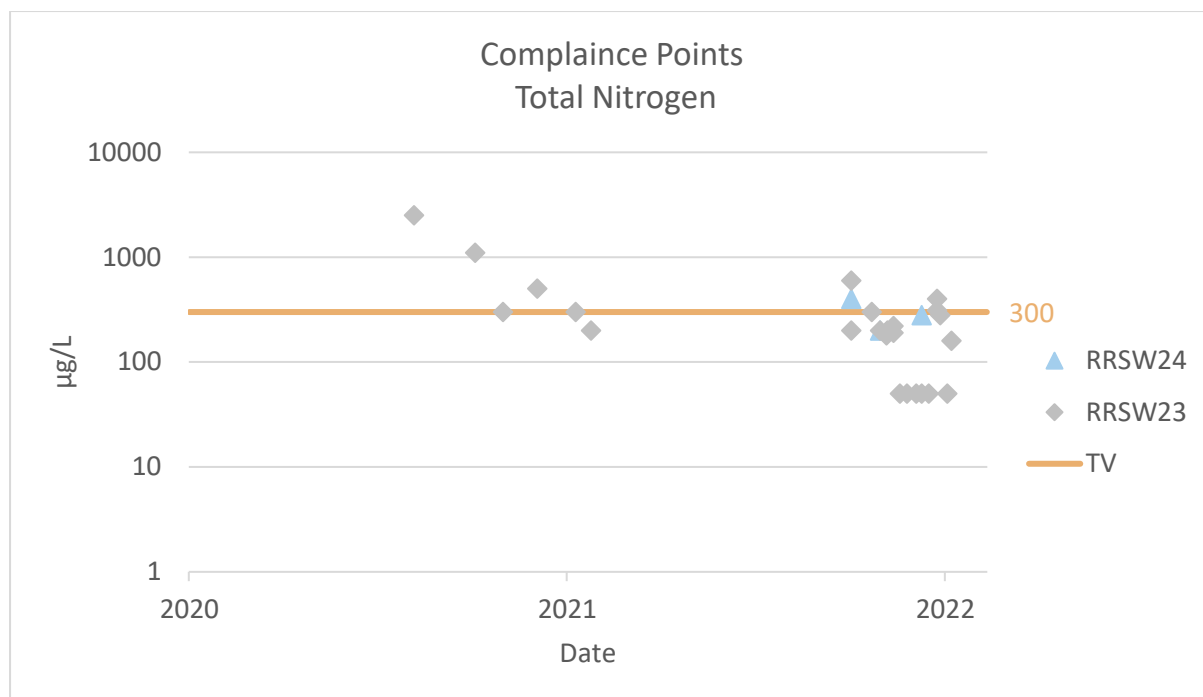


Figure 5-14 Trend Analysis for TN at Compliance Points

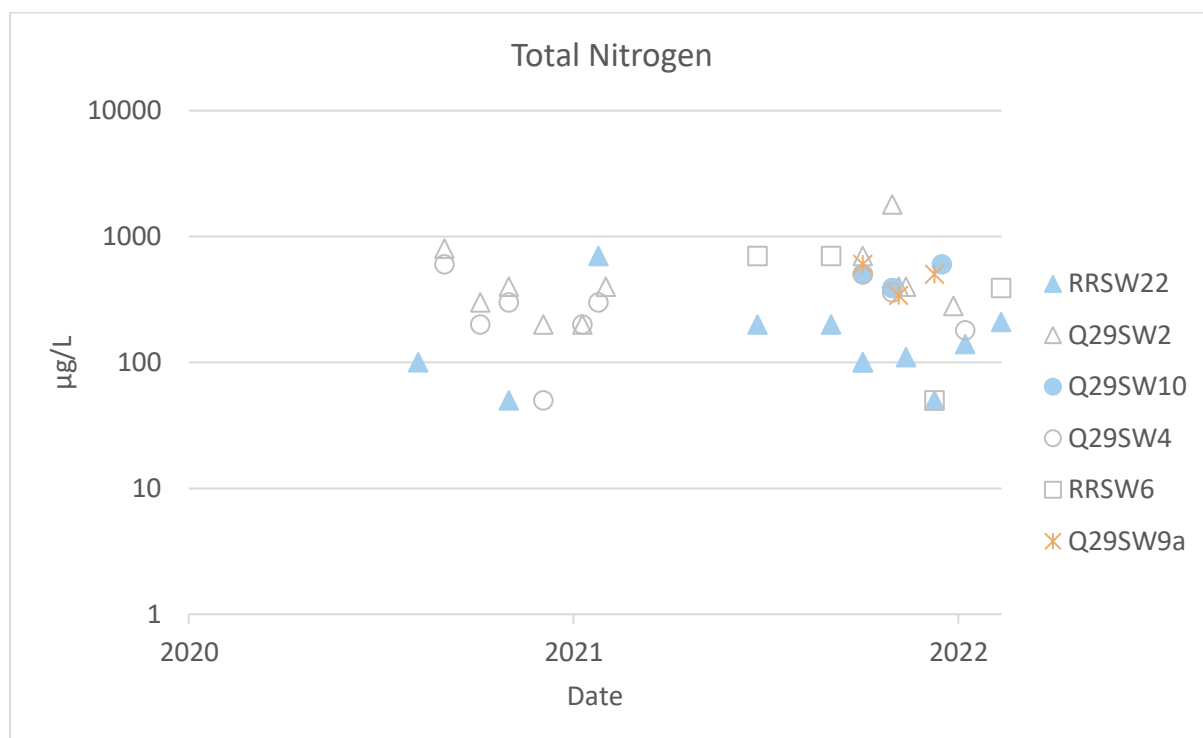


Figure 5-15 Trend Analysis for TN at All Other Sampling Sites

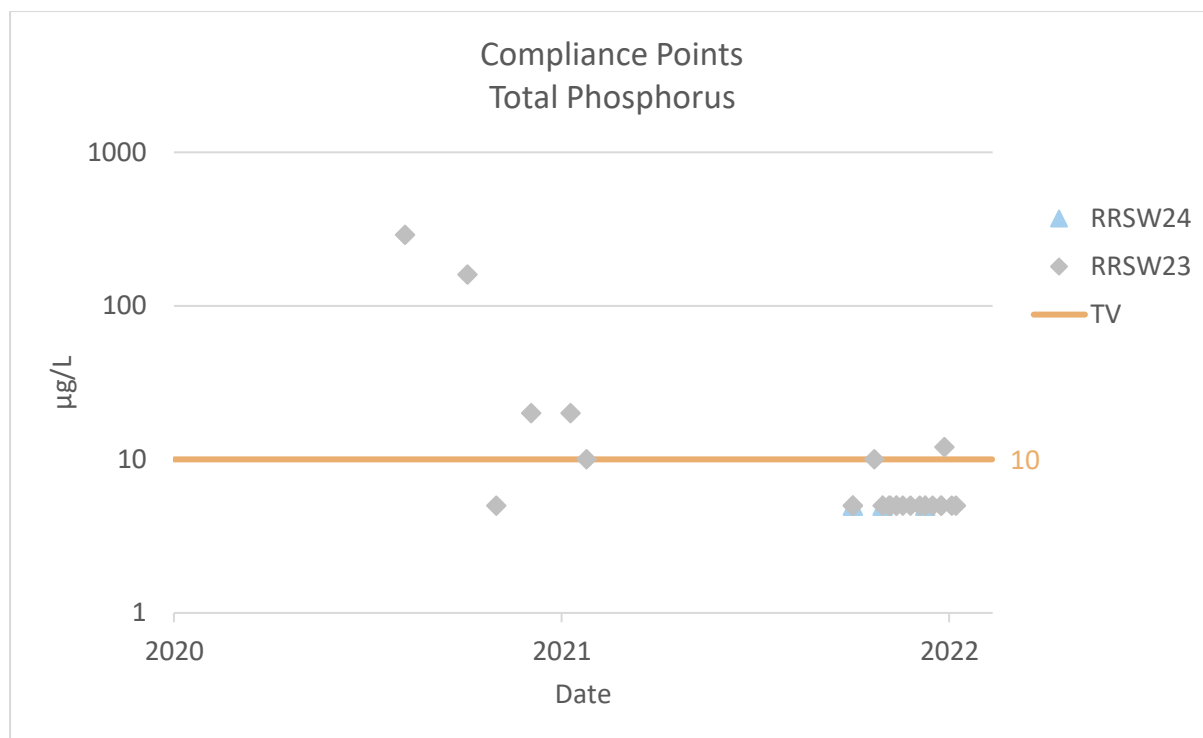


Figure 5-16 Trend Analysis for TP at Compliance Points

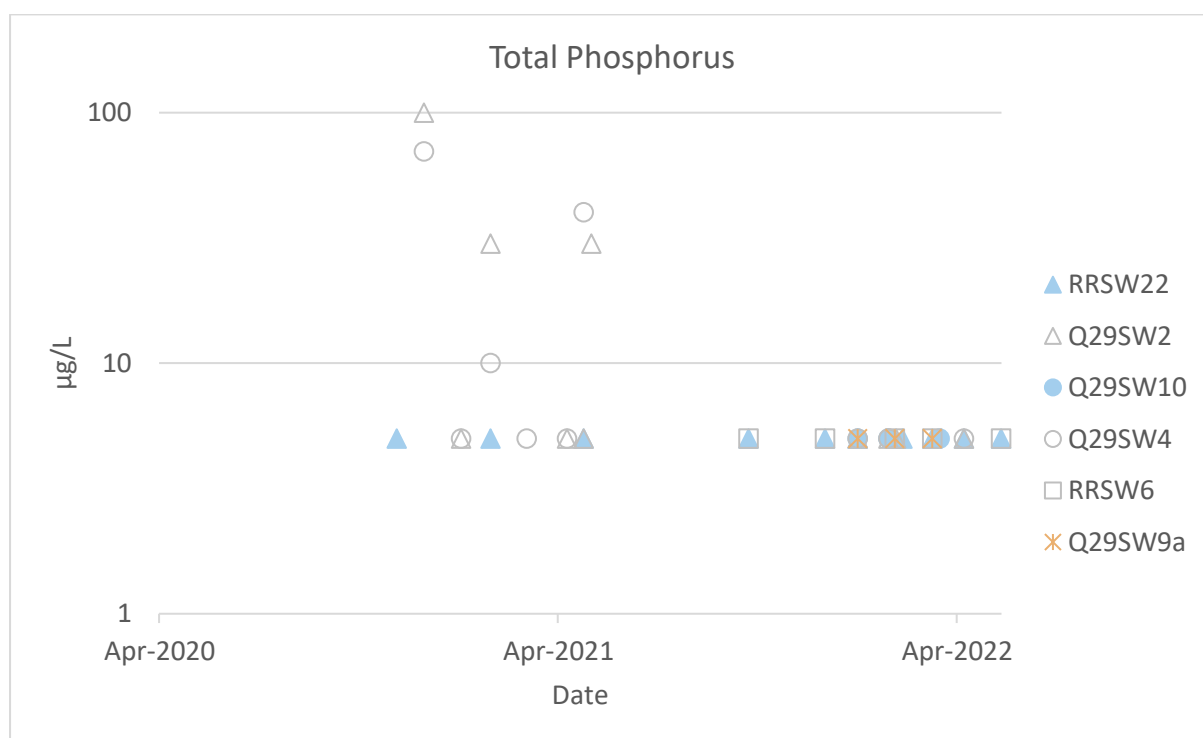


Figure 5-17 Trend Analysis for TP at All Other Sampling Sites

5.4 Discussion of Exceedances

There were no exceedances recorded for Compliance Points RRSW23 and RRSW24 for the 2021- 22 reporting period as per Condition 44.1 and 44.2 of the Licence. Since water monitoring and sampling commenced at the creek sites on 5 January 2022 to 16 May 2022 there were no exceedances recorded when compared to TVs. The likelihood of exceedances as a result of discharge activities is considered low. Water quality from the Rustlers Roost Pit is of reasonable quality as discussed in results in Section 5 and in trends analysis in Section 5.3)

5.5 Discussion of Anomalous

Anomalous have been detected in data results at RRSW23 for the 2021- 2022 period (Table 5-1). Anomalous could not be detected for RRSW24 as the sites was monitored three times during the 2021- 22 period and thus difficult to determine if data points are natural variations or outliers.

Table 5-1 Summary of Anomalous

Site	Date	Parameter	Anomaly	Long Term Median	Potential Cause
RRW23	05/01/2022	DO	0	88.65	A fault in compliance point telemetry station data logger was detected early in the season and prior to discharge. The DO probe was replaced and calibrated.
RRSW23	22/04/2022	FE	1400	105	Increased elevated iron is suspected to be a result of laboratory analytical error or as a result from sampling pooled water. Macro invertebrate and sediment monitoring was undertaken at RRSW23 on 22 April 2022 in which generally sites are to have low flow or are pooled to ensure safe access ultimately increasing concentrations of analytes.

5.6 Discussion of Results and Conclusions

In Conclusion, there were no exceedances of water quality parameters at RRSW23 and RRSW24 during the 2021- 22 reporting period as per Condition 44.1 and 44.2 of the Licence. There were however elevated levels of some field parameters, dissolved metals and nutrients at RRSW23 and RRSW24 outside of TVs. It should be highlighted, the water quality from the source of discharge, Rustlers Roost Pit (RRSW22) is of reasonable quality with all analytes short term and long term trends remaining within 95% species protection for freshwater ecosystems with the exception of turbidity which recorded below the TVs. Rustlers Roost Pit is of discharge quality and did not require water treatment or ameliorants prior to controlled discharge, in particular dissolved metals (EcOz Environmental Consultants, 2020).

Most field parameters were in elevation of TV at either or both Compliance Points, RRSW23 and RRSW24 though did not trigger a non- conformance. Turbidity was a common field parameter in elevation at all sampling sites within Mount Bunday Creek with the exception of Q29SW9a. The proposed control site recorded insufficient data to calculate short term turbidity trends. For sampling sites with long term data, RRSW23, Q29SW2 and Q29SW4, shows existing trends of elevated turbidity prior to discharge on 14 January 2022. Long term trends since 2016 for downstream of RRSW23 (Q29SW2) and upstream of RRPA influences (Q29SW4) indicates long term natural variations in turbidity levels.

Contributors of elevated turbidity across the site may be from pastoral activities with downstream sites part of an active cattle station, including RRSW23 and RRSW24. There is evidence of creek bed and bank scouring as a result of either vehicular movement near creek areas, cattle movements across the pastoral lease or as a result of high flows. It should be noted that the discharge rate averaged to 215 L/sec for the 13 weeks during discharge. It is suggested that a rate of 200 L/ sec to the Mount Bunday Creek was considered acceptable to minimise the impact of additional flows in the creek system (EcOz Environmental Consultants, 2020).

Aluminium, iron and cobalt were the only dissolved metals in elevation to TV at Compliance Points RRSW23 and/ or RRSW24. Aluminum and iron showed similar trends in the Mount Bunday Creek system. Sites with long term data indicated long term trends in elevated aluminium and iron throughout the creek systems including prior to discharge events. Q29SW2 and Q29SW4, which have been monitored since 2016 shows consistent elevations on several monitoring occasion above TV. Given the long term trends for iron and aluminium, it is suspected to be a result of natural variation within the Mount Bunday Catchment.

Cobalt was only found in elevation at RRSW23 with downstream site, Q29SW2, recording long term trends below laboratory LoR. Cobalt could potentially be influenced by onsite mining domains, such as the heap leach pad or ponds which are located upstream of RRSW23.

Cobalt was only found elevated on several monitoring occasions at RRSW23 which is consistent with long term monitoring trends. Q29SW2 cobalt levels have been below laboratory LoR since the commencement of monitoring at the site (2016-22). It should be noted the quality of discharged water short term and long term

Conclusions and Proposed Actions

dissolved metal concentrations remained below laboratory LoR with the exception of manganese and zinc which remained within Compliance Point TVs.

Monitoring of nutrients commenced in December 2020, resulting in two years worth of nutrient data. During this time trends have become evident with the prominent elevation and occurrence of total nitrogen in all monitoring sites within the Mount Bundey Creek system. Compliance points RRSW23 and RRSW24 also recorded elevated levels. For total phosphorus however, the previous monitoring period (2020- 21) seen greater elevations than the reporting period. RRSW23, Q29SW2 and Q29SW4 recorded greater elevations of total phosphorus during the previous wet season. All monitoring sites remained below laboratory LoR for this reporting period.

Several parameters reduced in concentrations during the 2021- 22 monitoring period when compared to previous monitoring events. Aluminium, cobalt and total phosphorus recorded greater concentrations prior to commencement of discharge, indicating dilution.

Outcomes of the surface water monitoring programme conclude that with the increased water volumes discharged from Rustlers Roost Pit would result in water quality dilution beyond natural wet season fluctuations to Mount Bundey Creek. As shown in this Section, discharge water quality had a negligible change in water chemical and physical properties and even improved water quality by diluting identified dissolved metal and nutrients.

6 Conclusions and Proposed Actions

6.1 Compliance with Assessment Criteria

Compliance with WDL237 assessment criteria has been included in Table 6-1. Yellow coloured dots indicate the specified Condition of the Licence has been met. Yellow coloured dots mean the Condition has not yet been met but is in progress. Red coloured dots mean the Condition has not been met. Improvements are proposed in Section 6.4.

ADP1 and Marrakai Creek monitoring sites, RRSW25 and RRSW26, were not sampled as there was no authorised discharge to this catchment. RRSW24 compliance site was monitored as the telemetry station and infrastructure had already been installed and operational by December 2021.

Table 6-1 Compliance Against Assessment Criteria

WDL 247 Monitoring Conditions												
Sample Locations			C31	C32	C33	C34	C35	C36	C37	C38	C39	C40 (40.1-40.7)
Marrakai Creek	ADP1	Authorized discharge point	NA	NA	NA	NA	NA	●	NA	NA	NA	NA
	RRSW24	Compliance Point	●	●	●	●	●	●	●	●	●	●
	RRSW25	Monitoring Control Point	NA	NA	NA	NA	NA	●	NA	NA	NA	NA
	RRSW26	Monitoring Downstream Point	NA	NA	NA	NA	NA	●	NA	NA	NA	NA
Mount Bunday Creek	ADP2	Authorized discharge point	●	●	●	●	●	●	●	●	●	●
	RRSW23	Compliance Point	●	●	●	●	●	●	●	●	●	●
	Q29SW2	Monitoring Downstream Point	●	●	●	●	●	●	●	●	●	●
	Q29SW4	Monitoring Upstream Point	●	●	●	●	● no safe access	●	●	●	●	●
	Q29SW9	Monitoring Control Point	NA	●	NA	NA	No safe access	NA	NA	NA	NA	NA
	Q29SW9a	Substitute Monitoring Control Point	●	●	●	●	●	●	●	●	●	●
	Q29SW10	Monitoring Downstream Point	●	●	●	●	●	●	●	●	●	●
Rustlers Roost Pit	RRP (RRSW22)	Monitoring Point	●	●	●	●	●	●	●	●	●	●
Annies Water Dam	AWD (RRSW6)	Monitoring Point	●	●	●	●	●	●	●	●	●	●

6.2 Potential Environmental Harm

Environmental harm as defined in the *Water Act 1992* as:

‘Any harm to or adverse effect on, or potential harm to or adverse effect on, the environment’.

During the Licence reporting period 22 June 2021 to 21 June 2022 for the controlled discharge of water from Rustlers Roost Pit to Mount Bunday Creek and associated field monitoring activities, it is determined no environmental harm was caused to or adverse effect on the Mount Bunday creek water quality, sediments and macroinvertebrates. The reasoning for this decision is based on the following points:

- During the reporting period, there were no exceedances of trigger values at RRSW23 as per Conditions 44.1 and 44.2 of WDL 247.
- Water quality at all monitoring sites were generally with the 95% species protection.
- Minimal missed monitoring events, and therefore data gaps, as per schedules 1 and 2.
- Dissolved aluminium and iron median concentrations were elevated across the control and impact creek monitoring sites indicating natural elevations in the catchment soil and mineralogy profiles.
- Elevated turbidity values were consistent across all monitoring sites (control and impact sites) and lowest at RRSW23 compliance indicating no relationship between sites receiving and not receiving discharge water.
- Rustlers Roost pit water meets 95% species level of protection and therefore the mobility of contaminants in the environment is likely a result of increased flows rather than discharge water quality. During controlled discharge, compliance sites RRSW24 and RRSW23 telemetry stations continuously logged for pH, electrical conductivity, dissolved oxygen, temperature, turbidity, water depth and showed rainfall patterns and creek height and physical parameter concentrations proportional. Discharge water occurred only through RRSW23, however there were similar trends with periods of high rainfall and creek flows recorded low physical parameter values and no rainfall and low flows recorded elevated physical parameters.

Conclusions from the macroinvertebrate and sediment monitoring programme include:

- Water quality and sediment results from sites on Mount Bunday Creek do not suggest any risk to aquatic ecosystems.
- Sampler bias and changes to flow in Mount Bunday creek may contribute to slightly poorer macroinvertebrate metrics in 2022 compared to 2021 and recommended ongoing post-wet season

6.3 Major assumptions or uncertainties

6.3.1 Assumptions

In order to meet the WDL 247 monitoring objectives the following set of assumptions were followed:

- Sampling programme as defined in WDL 247 is assumed to meet the requirements for the monitoring objectives except for:
- ADP1 and Marrakai Creek monitoring sites (RRSW25, RRSW26), were not sampled as there was no authorised discharge to this catchment. RRSW24 compliance site was monitored as the telemetry station and infrastructure had already been set-up in December 2021 and operational.
- Sample method bias was minimised by having the same consultants conducting the field programme throughout the entire season.
- Field meters and other equipment maintained and calibrated to PGL water sampling programme procedure.
- Field instrumentation (including handheld meters, telemetry equipment and in situ probes) maintained in accordance with retailers' instrumentation specification and maintenance documents.
- Sampling techniques, as per PGL water sampling programme and guidance with the AS/NZS 5667 and ANZECC/ARMCANZ).
- Sample containers, preservation techniques, holding times compliant with lab specifications.
- The statistical analysis method applied was median values for short- and long-term trend analysis.
- To obtain a representative surface water sample to compare against guideline values and avoid high variability, creek sampling occurred only when creeks at the first flush, in full and recessional flows (not pooled areas), during daylight hours and in the same location where safe to do so.
- For the loading calculations the following assumption were made:
 - For TDS, AquaTroll data (conversion factor of 0.65 - is slightly higher than actual based on the lab data, which makes the assumption conservative)' and
 - For metals and TN analytes which had >LoR readings during the period were only considered, and assumed the concentrations applied to all days after the sample (and before for the 9/2 sample). <LoR readings taken as 0.5 x LoR.

6.3.2 Uncertainties

There are uncertainties around whether Q29SW9a and Q29SW11 are suitable control sites. Q29SW9a was chosen to replace Q29SW9 because of unsafe site access. Significant track upgrades with culvert construction in washouts is required before safe access is achieved. Q29W9a site location was chosen because it is situated in the Mount Bunday creek system/sub catchment, upstream of mining influence, same stream order to Q29SW9 (1 minor and non-perennial) creek system with consistent flow throughout wet season months, and accessible for all sample events. Q29SW11 was also chosen for the same reasons except that it is a stream order 3 minor and non-perennial. Ongoing water quality monitoring, macro invertebrate and sediment sampling will assist in understanding. Whether both control sites are suitable.

Uncertainties of the level of direct and indirect impact pastoral activities have on water quality is difficult to measure particularly when all sites have no pre-disturbance data available to understand the natural ecological condition including water quality when compared to 95% species level of protection for compliance. Pastoral activities cover the entire area of the Mount Bunday creek sub catchment and more broadly the Mary River Basin. Therefore, for this project it would be difficult to determine a surface water monitoring site not affected by pastoral activities.

Uncertainty using the 95% species protection only as a measure of ecological protection should be avoided as there are too many uncertainties to be applied on the pastoral impacted areas of the Mount Bunday Creek system. Instead, utilising water quality indicators i.e. EC, turbidity/TSS values, and dissolved aluminium concentrations to compare for similar responses in the control and disturbed monitoring sites prior to waste water discharge is recommended. Fortunately, control sites (Q29SW9a and Q29SW11) are both located in pastoral areas that have similar levels of pastoral activity i.e., cattle, feral animals, vehicular activities. This would mean that the level of protection of the receiving environment where minimal change in water/sediment chemical and physical properties beyond natural variation is assessed against control sites and 95% species protection. It is recommended SSTV's to be developed for future mining activities interacting with the Mount Bunday creek system environmental compliance monitoring.

6.4 Proposed Changes and Actions

As per Condition 32 of the Licence, there are several monitoring sites that require updates to either locations, frequency or parameters. The following section addresses these and have been put forward by PGL for the 2022- 23 monitoring period.

During the reporting period there were two changes to the Licence, detailed below, which have been discussed and confirmed with DEPWS. Additional communications in relation to the changes and other licence conditions/queries are detailed in the communications register in Appendix B. The changes to WDL 247 include:

Conclusions and Proposed Actions

- Removal of the chloride (Cl) trigger value of 3µg/L WDL 247 (The trigger value of 3µg/L for chloride (Cl) is an error, it appears to be the ANZG 2018 95% guideline values for chlorine (Cl), and is not intended to be imposed as a trigger value under WDL247)
- Exceedances of total Nitrogen (TN) above 300µg/L should be reported in accordance with condition 44.1 of WDL247 given the locality of the site based on ANZECC & ARMICANZ 2000. Values below 200 µg/L for TN is not a reportable trigger against condition 44.1 of the WDL 247

Changes for sampling sites include improved access to allow for wet season sampling and to improve safety when sampling and accessing water. Changes have been included in Table 6-2. A figure indicating changed locations has been provided in Figure 6-1 and coordinates has been provided in Table 6-3.

Table 6-2 Proposed New Actions for 2022- 23

Proposed New Actions 2022- 23	Rationale	Timeline
Propose alternative site locations for Q29SW4	RRSW4 monitoring site is inaccessible and safety issues with wandering stock and buffalo observed during wet season months (February-April) Propose an alternative RRSW4 with safer access. This is yet to be determined, assessment on site will determine safe access.	Subject to DEPWS approval
New control monitoring site RRSW9a to substitute existing RRSW9	A substitute monitoring site RRSW9a (Photo 6-1) to replace RRSW9. RRSW9 site access is unsafe and requires significant track upgrades and culvert construction to enable vehicular use. RRSW9a was chosen as its location is in the same catchment as RRSW9, same stream order, has consistent all-season flows (based on site observations during the 2021/22 wet season), water quality is not influenced by mining activities and has all season access.	Subject to DEPWS approval (ideally approved prior to 2022/23 wet season flows)
Continuous logger installed at RRSW26	RRSW26 monitoring site is inaccessible during wet season months and the Marrakai Track is closed to public use in this area due to flooding. Installation of a continuous logger will maintain physical parameters collection and when access is permissible and safe, samples will be collected.	Subject to DEPWS approval (Ideally before January 2023)
Propose alternative site locations for RRSW25	RRSW25 monitoring site is inaccessible and safety issues with wandering stock and buffalo observed during wet season months (February-April) Propose an alternative RRSW25 with safer access (Figure 6-1).	Subject to DEPWS approval
RRWSW22	RRSW22 existing monitoring frequency is weekly for fields and monthly for samples. PGL propose to change all water monitoring to monthly.	Subject to DEPWS approval



Q29SW9a proposed control site upstream, photo taken January 2022.



Q29SW9a proposed control site downstream, photo taken January 2022.

Photo 6-1 Proposed WDL247 Control Site Q29SW9a

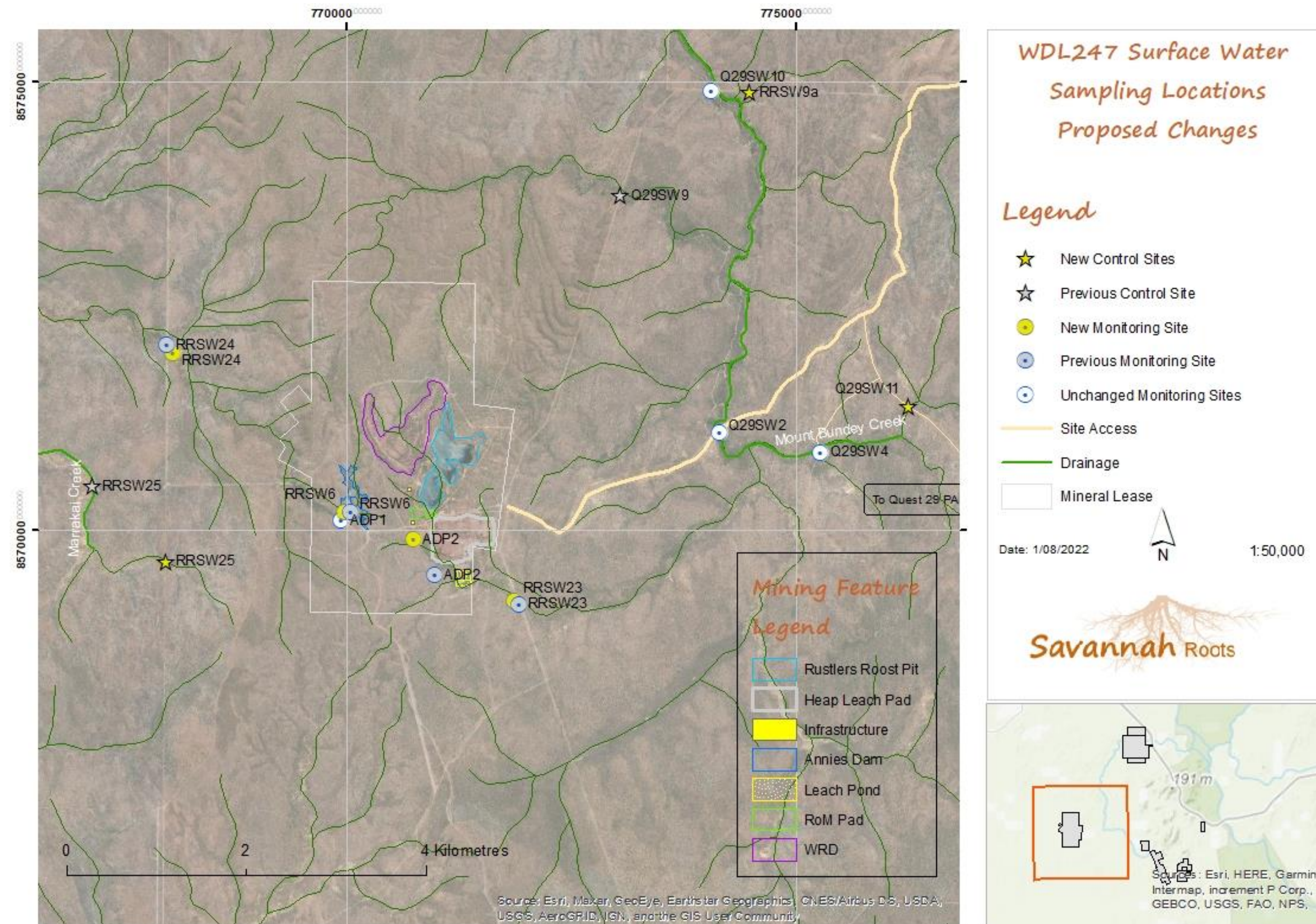


Figure 6-1 Proposed Changes to WDL247 Sampling Sites

Table 6-3 Proposed Changes to WDL247 Sampling Locations

Catchment	Sampling Site	New Monitoring Site		WDL247/ Previous Monitoring Site		Monitoring Site Description
		Easting	Northing	Easting	Northing	
		Zone 52L				
Surface Water						
Mount Bunday Creek	ADP2	770745	856990	770987	8569505	Authorised Discharge Point 2 located to the west of the heap leach ponds, discharge basin to Mount Bunday Creek
	RRSW22	770967	8570660	771008	8570825	Rustlers Roost Main Pit
	RRSW23	771876	8569210	771925	8569177	Headwaters of Mt Bunday Creek, compliance point (WDL 247)
	Q29SW2	774153	8571100	774154	8571091	On Mt Bunday Creek downstream of Rustlers Roost and Quest Project Areas
	Q29SW10	-	-	774068	8574906	RoM drainage (before influence of heap leach)
	Q29SW4	-	-	775287	8570868	Located to the northeast of the Rustlers Roost Project Area, located at a tributary of Mt Bunday Creek
	-	-	-	773052	8573733	Control Site located northeast of the RRPA. The site is located on a tributary of Mount Bunday Creek prior to any mining influence.
Marrakai Creek	-	-	-	769945	8570112	Authorised Discharge Point 1 located to the south of Annies Dam, discharge basin to Marrakai Creek

Conclusions and Proposed Actions

Catchment	Sampling Site	New Monitoring Site		WDL247/ Previous Monitoring Site		Monitoring Site Description
		Easting	Northing	Easting	Northing	
		Zone 52L				
	RRSW6	769977	8570210	770048	8570198	Sampling location changed to dam wall for safety reasons. The changed location is to the northwest of the spillway. Annie’s Water Dam
	RRSW24	768062	8571970	767991	8572070	Downstream compliance point for Marrakai Creek. Located to the northwest, ~2.5 km downstream of ADP1.
	RRSW25	767986	8569653	767162	8570492	Control site for the Marrakai Creek. Located to the west of the tenement boundary ~2 km.
	RRSW26	-	-	757167	8580717	On the Marrakai Creek, ~16 km downstream of ADP1
Proposed New Sample Location						
Mount Bunday Creek	Q29SW11	776266	8571380	-	-	Proposed Control site located east of RRPA, prior to Q29SW4. Site is not influenced by any mining activities and is within the Mary River Catchment
Mount Bunday	Q29SW9a	774487	8574883	-	-	Proposed control site located northeast of RRPA. The monitoring site is located on a tributary of Mount Bunday Creek ~ 400 m upstream of Q29SW10.

7 Sediment and Macroinvertebrate Monitoring

The Biological monitoring programme conducted in late April 2022 by Aquatic Ecology Services involving sediment and macroinvertebrate sample and analysis. The assessment demonstrated that the macroinvertebrate community of Marrakai Creek and upper Mount Bunday creek catchment are tolerant of pollution and highly influenced by habitat availability. The improvements to sampling design appear to have assisted with compatibility of sites on Marrakai Creek and the addition of an upstream site on Mount Bunday Creek will allow for more robust assessment of potential discharge impacts. Sampler bias and changes to flow in Mount Bunday creek may contribute to slightly poorer macroinvertebrate metrics in 2022 compared to 2021 and recommended ongoing post-wet season monitoring (Appendix F).

2022 samples show similarity providing assurance results and analysis are robust for future comparison of historical data. Water quality and sediments from Mount Bunday Creek do not suggest any risks to aquatic ecosystems. Dissolved oxygen results from the April 2022 sampling were below guideline value up and downstream of RRPA indicating natural processes influenced by reduced stream flow in the early dry season (AES, 2022) rather than mine influences. In line with adaptive management, it is recommended that ongoing annual macroinvertebrate and sediment monitoring and water monitoring to continue post wet-season of 2023 and include longer periods between from cease of discharge and sampling and a stepped reduced flow process to allow for gradual changes in water levels. (AES, 2022).

8 Incident Reporting

8.1 Incident Response

Under a care and maintenance regime, typical environmental incidents that may occur at RRPA include:

- hydrocarbon spills and leaks from vehicles/machinery/pumps/generators;
- disturbance/destruction to or contravene the AAPA Certificate, heritage site;
- destruction to Pastoral Lease holder property (i.e., cattle, fencing, gates, designated access tracks);
- unauthorised access;
- wildfires destroying assets (property, pumps, fencing, cattle);
- breach of leach pond water; and
- noise and dust complaints.

8.1.1 Environmental Incident Reporting

All notifiable incidents are to be reported to the respective regulator immediately after becoming aware it has happened for all mining related environmental incidents occurring on and off tenement

- Contact NT DITT and complete a Section 29 Environmental Incident form (in accordance with section 29 Mining Management Act 2001): <https://nt.gov.au/industry/mining-and-petroleum/mining-activities/mining-forms-and-guidelines/environmental-incident-form> and e-mail to mineralinfo.itt@nt.gov.au
- Call the NT EPA Pollution Hotline in addition to providing the written notice, if a person becomes aware of an event which has caused or threatens serious or material environmental harm, the person should immediately (within 24 hours of first becoming aware) call the Pollution Hotline on 1800 064 567 and report the event. And fill out a Section 14 Incident report Forms: <https://ntepa.nt.gov.au/your-business/compliance-and-regulation/notification-of-an-incident> <https://ntepa.nt.gov.au/make-a-report/pollution-report-form>
- urgent incidents (significant illegal dumping, inland/marine water oil spills, fish kills): 1800 064 567.
- Non urgent incidents (noise, odours, algal blooms, unreasonable dust, inadequate storage/handling of wastes, visible sheens/dischour of waterways, contaminated sites) pollution@nr.gov.au :1800 064 567, GPO Box 3675, Darwin NT 0801
- For all mining work- related injury, illness or dangerous incident occurring on and off tenement

Incident Reporting

- Contact NT Work Safe (in accordance the Work Health and Safety (National Uniform Legislation) Act 2011) of a 'notifiable incident' <https://worksafe.nt.gov.au/forms-and-resources/bulletins/work-health-and-safety-incident-notification>: 1800 019 115, ntworksafe@nt.gov.au
- Contact NT police, fire, and emergency services for life-threatening situation on 000.

8.2 Incidents Recorded/Reported During the Reporting Period

One non-notifiable environmental incident related to activities under WDL 247 occurred at the RRPA during 2021/2022 reporting period. The incident was assessed using PGL's incident report risk assessment framework and it was determined the incident would not cause an environmental nuisance or material or serious environmental harm and therefore was assessed as a low risk to the environment and would not require external notification to DITT or the NT EPA. The incident was recorded on PGL's environmental incident register in Table 9 and full report is included in Appendix C.

Incident Reporting

Table 8-1 Environment Incident Register

Incident Date	ID	Is this a <u>notifiable</u> incident to DITT/ NTEPA	Location	All material facts and circumstances	Impact area (L, M ³ , M ²)	Performance objective(s) and /or standards breached	Immediate Action taken	Corrective Action taken to prevent recurrence
29/03/2022	RRPA01	No – minor spill incident and contained	RRPA - near RR Pit ramp western edge	Refer to incident report in Appendix Appendix C	1m2	Equipment failure Note: The 10,000-litre fuel cell is equipped with an anti-syphon value to prevent the entire contents of the tank from leaking out in the case of a broken hose.	As soon as leak observed contact made with pump contractor (NPE) and PGL Chief Engineer	Contacted NPE Pumps at 2 pm on the 29th of March 2022. NPE responded immediately and travelled to site on the 29th of March, wrapped joiner to prevent further leaks. To prevent re occurrence The full-length fuel pipeline will be installed to eliminate the risk of future leaks from joiners. This will be done by mid-April 2022.

9 Glossary

Abbreviations	Definitions
ADP	Authorised Discharge Point
ANZECC/ ARMCANZ	Australia New Zealand Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand
DEPWS	Department of Environment, Parks, and Water Security
DITT	Department of Industry, Tourism and Trade
EA Act	<i>Environmental Assessment Act 1982 (NT)</i> Please note - This instrument has been Repealed by the ENVIRONMENT PROTECTION ACT 2019, NO. 31 which commenced on the 28/06/2020.
EP Act	<i>Environment Protection Act 2019 (NT)</i> In force as of 29/06/2020
EMP	Environmental Management Plan
EMR	Environmental Monitoring Report
GV	Guideline Value
KL	Kilolitre
Km	Kilometre
LoR	Limits of Reporting
ML	Megalitre
mm	Millimetre
N/A	Not Applicable
NATA	National Association of Testing Authorities
NT EPA	Northern Territory Environment Protection Authority
PL	Pastoral Lease
PGL	Primary Gold Limited
PPL	Perpetual Pastoral Lease
Q29PA	Quest 29 Project Area
RoM	Run of Mine
RRPA	Rustlers Roost Project Area
SoCs	Sites of Conservations Significance
TV	Trigger Values
WA	<i>Water Act 1999</i>
WRD	Waste Rock Dump

10 References

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11 Appendices

Appendix A. Water Quality Data

Appendix B. Regulatory Communication's Register

Communication Type/Date/ref	Source	Feedback	Action/response and reference in EMR
Email: from Sallyhorsnell@outlook.com 14/01/2022 8.38 pm	PGL	-Notification of commencement of wastewater discharge from Rustlers Roost Pit as 12:00pm Friday 14th January 2022 from authorised discharge point ADP1. No wastewater discharge is occurring at ADP2 and will not occur throughout the 2022 wet season.	Email: from Todd.Jenkins@nt.gov.au 24/01/2022 4.59 pm (read below)
Email: from Sallyhorsnell@outlook.com 20/01/2022 8.12 am	PGL	-Active discharge commenced at 3pm on the 14th January 2022. For the depth data for RRSW23 compliance data sheet, please add 0.1 to all depth data points which is for an offset. WDL 247 data sheet includes dissolved metals. Attachments RRSW 23 compliance data, ADP2 and WDL water quality data to date	Email: from Todd.Jenkins@nt.gov.au 24/01/2022 4.59 pm (read below)
Email: from Todd.Jenkins@nt.gov.au 24/01/2022 4.59 pm	DEPWS	-Request for additional information: Clarify and provide rationale for discharge notification commencing from ADP2 and not ADP1. -Provide lab results of samples taken from 18 January round.	PGL email response via sallyhorsnell@outlook.com on 27/01/2022 5.06pm and full results in included in this EMR. - Active discharge commenced at ADP2 on the 14 January 2022 - ADP1 discharge point pipework setup was Stage 1 of a staged program of pipe construction. Primary Gold intends to set up pipework and pumps, to be ready for the 2022/23 wet season active discharge via ADP1 and ADP2. - Unfortunately, the 18 January 2022 lab results had not been issued within the timeframe for responding to your requests. An updated spreadsheet is attached for viewing. (WDL247 spreadsheet is the lab analysis water quality data for WDL sample points, RRSW23 is the compliance point continuous data, pump flow rate data is flow rate (m3) from Roosters Roost Pit)
Email: from Sallyhorsnell@outlook.com 11/02/2022 12:27am	PGL	Clarification and confirmation requests on 27/01/2022 regarding: -Chloride units and trigger values in WDL -mixing zone not considered in determination of trigger values - to provide ADP2 data over a 7 day rolling average (Friday to Friday)-	DEPWS email response 11/02/2022 12.27pm. - The trigger value of 3µg/L for chloride (Cl-) is an error, it appears to be the ANZG2018 95% guideline values for chlorine (Cl) and is not intended to be imposed as a trigger value under WDL247. To resolve this, an officer driven amendment will be undertaken to remove the trigger value requirements for chloride from WDL247. In the interim any non-compliances for the exceedance of the chloride 3µg/L trigger value are not required to be reported to the department. - The WDL application and supporting documentation provided did not specify the requirement of a dilution/mixing zone for the discharge water from Rustlers Roost Pit to achieve ANZG2018 95%

Communication Type/Date/ref	Source	Feedback	Action/response and reference in EMR
			guideline values. The presence of elevated metals within Mount Bunday Creek at the compliance point in years prior to active discharge are the result of discharge from the heap leach ponds and erosion from the heap leach pads. Condition 24 of WDL247 specifies that the only discharge sources authorised under this licence is Rustlers Roost Pit, as such it is Primary Golds responsibility to maintain the landforms within the mining lease to prevent to release of contaminated water off site. The continuous information is only to assist officers in understanding site water quality and should be provided in the event of a non-compliance or when requested. There are no trigger values associated with the continuous monitoring of flowrate and electrical conductivity at ADP2 as such the requirement to assess the continuous data over a 7 day rolling average is not required.
Email(s): from Todd.Jenkins@nt.gov.au 12:27 pm, 07/03/2022 3:40pm; waste.NTEPA@Nt.gov.au	DEPWS	Rustlers Roost WDL 247 site visit request	PGL email response via sallyhorsnell@outlook.com on 11/02/2022 1:01pm <i>Hi Todd, thanks for your response. I am away at a funeral next week but am more than happy to organise a site visit the following week starting 21st February. Access with a 4wd should be fine to RRSW23 and pit and end of pipe discharge. However I do have an ATV to access if necessary. Please let me know if the week of the 21st suits as I need to let the Pastoral Lease Holder aware of our visit for safety and pastoral logistics.</i>
Email: from Sallyhorsnell@outlook.com 07/03/2022 3:08pm	PGL	Confirm values below 200 ug/L for TN is not a reportable trigger against condition 44.1 of the WDL 247.	DEPWS email response 07/03/2022 3:40pm Error within licence only exceedances of TN above 300µg/L should be reported in accordance with condition 44.1 of WDL247 given the locality of the site based on ANZECC & ARMCANZ 2000
Email: from Sallyhorsnell@outlook.com 20/04/2022 2.43 pm	PGL	Notification of cease of waste water discharge from Rustlers Roost Pit to ADP2 9.46am Friday 15th April No wastewater discharge occurred at ADP1 throughout the 21-2022 wet season.	No comments

Communication Type/Date/ref	Source	Feedback	Action/response and reference in EMR
Email: from waste.NTEPA@nt.gov.au 22/04/2022 4:06pm	DEPWS	Response to PGL query on RR pit water level and total water pumped as of yesterday 12/04/22 and PGL request to dewater for a following 2 weeks further to uncover a flat area needed for drilling	DEPWS email response 22/04/2022 4:06pm <i>I appreciate the call to discuss the current situation. As I mentioned during our conversation, condition 25 of WDL247 stipulates that discharge must only occur from the authorised discharge points when natural flow is present within the system.</i> <i>I note that discharge ceased at 9.46am on 15 April 2022 from authorised discharge point ADP2, presumably due to insufficient natural flow to enable discharge. Should Primary Gold wish to recommence discharge of wastewater via ADP2, detailed information regarding the current status of the catchment and system flows must be provided to the Department in support of the recommencement.</i>

Appendix C. PGL Environmental Incident and Investigation
Report Form

Primary Gold Limited - Environmental Incident and Investigation Report Form

(This Report is for internal use only. For external reporting requirements to DITT and/or NT EPA refer to Site MMP for details)

Incident Form (Section A)

Incident details						
1A Category	Environment	☒	Community	☐	Quality (including Damage)	☐
	Pollution (air, noise, water, ground)	☒	Complaint	☐	Damage	☐
	Conservation breach	☐	Promotion	☐	Production Loss	☐
	Heritage breach	☐	Compliance breach	☐		
	Compliance breach	☐				
2A Subcategory	Air	☐	Blasting	☐	Light Vehicle	☐
	Surface and ground water	☐	Noise	☐	Mobile Equipment	☐
	Ground (inc erosion/sedimentation)	☐	Odour	☐	Fixed Plant	☐
	Threatened Flora/Fauna	☐	Lighting	☐	Tools	☐
	Cultural/Heritage	☐	Dust	☐	Other.....	☐
	Fire	☐	Property damage	☐		
	Invasive Species	☐	Other.....	☐		
	Land Clearing	☐				
	Waste/contaminated material	☒				
	Pollution/Spill	☐				
	Other.....					
	3A. Incident Number: RRPA01			4A. Project Site: Rustlers Roost		
	5A. Date/Time of Incident: 29/03/2022; 2pm			6A. Date Reported: 29/03/2022; 2pm		
	7A. Reporter Name: Sally Horsnell			Reporter position/title: Environmental Consultant		
	Contact details: 0455669600; sallyhorsnell@outlook.com					
Employment type: Permanent ☐ Casual ☐ Labour Hire ☐ Contractor: Yes ☒ No ☐ Other ☐						
8A. Reported To (Supervisor Level): Charles Hastie			Position/Title: PGL Chief Mining Engineer			
Employment type: Permanent ☒ Casual ☐ Labour Hire ☐ Contractor: Yes ☒ No ☐ Other ☐						
9A. PGL Responsible Manager: Charles Hastie			Position/Title: PGL Chief Mining Engineer			
10A. Site contact	Sally Horsnell					
11A. Contact details	Mobile	0455669600				
	Email	sallyhorsnell@outlook.com				

Primary Gold Limited - Environmental Incident and Investigation Report Form

12A. Incident location Use GPS co-ordinates, attach map as necessary	Rustlers Roost main pit area near ramp on western side of pit Lat -12.917329° Long 131.496854°			
13A. Incident/event description <i>Attach photographs, maps (step by step description including immediate actions undertaken and existing controls at site. Note if there are SOP's, approvals, etc)</i>	During water pumping from RR pit under WDL 247, a hydrocarbon leak noticed during a routine weekly environmental monitoring round on the 29 th of March 2022. On inspection of the generator and diesel tank area, an area beneath the pipeline which transfers diesel fuel from the diesel tank(10,000 litre) to the generator observed a hydrocarbon stain approximately of 1m2 on the open ground beneath the pipeline joiner. The fuel line running from the fuel cell to generator had a joiner, which had a slow intermittent drip (leak) causing the spill to ground . There was no observed overland flow or spread from the 1m2 .			
14A. Equipment/Materials Involved	diesel tank(10,000 litre) to the generator			
15A. Nature of actual / potential impact Volume of material (litres, m3), area impacted (m2), flora and fauna affected, erosion, duration of incident, etc, as relevant	Approximately 5-10 litres of diesel fuel lost to open ground	Volume	-	m ³
			5-10	litres
		Area (m2)	1 m2	
		Duration (hrs)	March 15 -March 29, 2022	
16A. Immediate action taken i.e., spill contained / stopped / location of disposal	During a routine inspection of the water pump and generator area at RRPA, Sally messaged David and Ben from NPE Pumps and Charles Hastie from Primary Gold at approximately 2 pm on the 29 th of March 2022 near Corrobboree Tavern to inform the pump operation and notify of a minor leak to open ground from a leaking fuel hose leading from the diesel fuel tank to the generator.			
Environmental details (may require input from Site Environmental Officer delegate)				
17A. Emergency and remedial action taken	Contacted NPE Pumps at 2 pm on the 29 th of March 2022. NPE had already departed to site to investigate the pump operation. The joiner has been wrapped to prevent further leaks.			
18A. Current situation Potential / ongoing / ceased etc. Include current location of contaminated material	Contaminated material is left insitu and a minimal risk of leak impacting RR pit water due to the limited quantity of hydrocarbon lost to open ground. Locally won soil will cover the leak surface area approx. 100mm depth.			

Primary Gold Limited - Environmental Incident and Investigation Report Form

19A. Details of any samples taken When / where / type / number / time for availability of results etc. Include plans of sampling locations where possible	No samples were required as it is known of the leak source and cause from a split pipe joiner leading from the diesel fuel tank.				
Follow-up and Prevention					
20A. Future actions (if any) including timeframe	The full-length fuel pipeline will be installed to eliminate the risk of future leaks from joiners. This will be done by mid-April 2022. The 10,000-litre fuel cell is equipped with an anti-syphon valve to prevent the entire contents of the tank from leaking out in the case of a broken hose.				
21A. Will this incident require further investigation/follow-up and required date	Yes ☐ Refer to Incident Investigation Form Section B attached below No ☒ Date to follow-up by: ____/____/____ Time: _____				
22A. Actual Consequence <i>(See Table 1)</i>	Insignificant (1) ☒	Minor (2) ☐	Moderate (3) ☐	Major (4) ☐	Catastrophic (5) ☐
23A. Potential Likelihood <i>(See Table 2)</i>	Rare (E) ☐	Unlikely (D) ☒	Possible (C) ☐	Likely (B) ☐	Almost Certain (A) ☐

24A. Overall Risk Rating <i>(See Table 3)</i>																								
L 1	L 2	L 3	L 4	L 5	L 6	M 7	M 8	M 9	M 10	M 11	M 12	M 13	H 14	H 15	H 16	H 17	H 18	H 19	H 20	H 21	C 22	C 23	C 24	C 25
☐	☒	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Regulatory Notification Requirement			
25A. Is this a notifiable incident to a Regulatory body?			Yes ☐ No ☒
26A. Justification for decision: <i>(i.e. overall risk rating was rated as Low and did not require external notification)</i>			
27A. Regulatory Body (s):	NT DITT MMA Act 2001 ☐	NT EPA WMPC Act 1998 ☐	NT Work Safe WHS(NUL) Act 2011 ☐

28A. Date Reported: ____/____/____ **Time:** _____ **Reported by:** _____

29A. Regulatory person reported to: _____

30A. Information Provided: _____



Diesel fuel leak -generator and diesel tank area near main pit, Rustlers Roost



10,000 litre diesel fuel tank and line to generator with leak, Rustlers Roost

Primary Gold Limited - Environmental Incident and Investigation Report Form

31A. Information Requested: _____

32A. Instructions given by Regulator (if any): _____

33A.	Incident review and sign off		
Role:	Name:	Signature	Date
Person/s involved			
Immediate Supervisor			
Site Manager			
Environmental Representative			
Health and Safety Representative <i>(if required)</i>			
Company Senior Executive (incidents greater than a moderate)			

Primary Gold Limited - Environmental Incident and Investigation Report Form

Table 1: Qualitative Measures of Consequence

Level	Rank	Reputation & Trust (Political, Stakeholders and Community)	Business Operations	Environmental	Indigenous/European Heritage	Legal & Compliance
1	INSIGNIFICANT	- Isolated local community or individual's issue-based concerns. - Low profile media attention	- Some insignificant delays to business activities. - Up to 5% variation in KPI or objective	- Low impact to isolated area. - Simple or no treatment required. - No lasting effect or significance <i>i.e.: Contained oil spill in non-sensitive environment.</i>	No measurable change in existing natural or human processes impacting on heritage/indigenous sites across Project Area.	- Guidance required for legal/compliance issues managed through routine procedures. - Legal action unlikely.
2	MINOR	- Local community impacts and concerns. - Occasional once off negative media attention. - Trust issues raised.	- Minor delays to business activities. 5% to 10% variation in KPI or objective.	- Contained low impact. - Standard treatment. - Minor local short-term residual effect. <i>i.e.: Contained oil spills in sensitive environment; Unauthorised clearing (<10ha) of area with low environmental values.</i>	- Partial removal of one or more Indigenous archaeological sites on a specific landform within a single Project Area. - Detectable impact to NT/Commonwealth significant site with heritage values remaining largely intact, or partial reduction in heritage value intrinsic to non- NT/Commonwealth significant site.	- Complex legal/ non-compliance issue to be addressed. - Legal action and /or public liability claim possible. - Potential Material Environmental Harm, Environmental Nuisance (MMA Act 2001)
3	MODERATE	- Sectional community impacts and concerns publicly expressed. - Increased negative media attention. - Loss of confidence and trust by community and stakeholders in Agency processes and capability. - Ministerial concern.	- Some moderate delays to business activities. 10% - 25% variation in KPI or objective. - One or more projects is significantly impaired.	- Uncontained impact, able to be rectified in short-medium term. - Significant medium term residual effect. <i>i.e.: Uncontained spills causing minor pollution. Unauthorised clearing of area containing moderate environmental values; minor unauthorised impacts to population of threatened flora or fauna.</i>	- Complete removal of one or more Indigenous archaeological sites on a specific landform within a single Project Area. - Partial reduction in heritage value intrinsic to non- NT/Commonwealth significant site, or substantial reduction in heritage value intrinsic to non- NT/Commonwealth significant site.	- Non-compliance/s with regulation and/ or probity infringements, which may result in some processes repeated. - Legal action probable - Material Environmental Harm (MMA Act 2001)
4	MAJOR	- Considerable and prolonged community impact and dissatisfaction publicly expressed. - Consistent negative media attention.	- Major delays to activities 25% to 50% variation in KPI or objective.	- Extensive hazardous impact requiring long-term rectification. - Major medium-term residual effect. <i>i.e.: Unauthorised clearing of area containing significant environmental values; Extensive unauthorised impacts to population of</i>	- Complete or partial removal of multiple Indigenous archaeological sites on different landforms within more than one Project Area. - Substantial reduction in heritage value intrinsic to non- NT/Commonwealth	- Major non-compliance with regulation which may result in termination of a process or imposed penalties. - Legal action taken against agency and/ or major public

Primary Gold Limited - Environmental Incident and Investigation Report Form

Table 1: Qualitative Measures of Consequence

Level	Rank	Reputation & Trust (Political, Stakeholders and Community)	Business Operations	Environmental	Indigenous/European Heritage	Legal & Compliance
		• Criticism and loss of confidence/ trust by community and stakeholders in Agency processes and capability. • Ministerial intervention	• One or more critical programs or projects cannot be delivered.	<i>threatened flora or fauna, Major pollution of waterways at local scale.</i>	significant site, or complete loss of heritage value intrinsic to non-NT/Commonwealth significant site.	liability claim or potential class action. • Serious Environmental Harm (MMA Act 2001)
5	CATASTROPHIC	• Significant adverse community impacts and condemnation. • Extreme negative media attention. • Consistent ongoing community loss of confidence and trust in Agency capabilities and intentions. • Government intervention	• Activities ceased. • More than 50% variation in KPI or objective. • Multiple critical programs or projects cannot be delivered.	• Uncontained hazardous impact requiring major long-term treatment and monitoring. • Major long-term residual effect. <i>i.e.: Unauthorised clearing of area containing significant environmental values where the impacts were understood, and the impacts were deliberate; Unauthorised eradication of local population of threatened flora or fauna; Extensive pollution of waterways at regional scale.</i>	• Complete or partial removal of multiple Indigenous archaeological sites on all landforms across site. • Complete loss of heritage value intrinsic to NT/Commonwealth significant site.	• Major non-compliance with legislation and/ or regulation which may result in criminal charges and/ or loss of required accreditation. • Significant legal consequences/ class action against Agency. • Serious Environmental Harm (MMA Act 2001)

Primary Gold Limited - Environmental Incident and Investigation Report Form

Table 2: Potential Likelihood Description and Frequency Ratings

Descriptor	Description	Suggested Frequency
Almost certain	The event is expected to occur	Recurring event during the lifetime of a project / operation e.g. More than once per month
Likely	The event will probably occur	Event that may occur frequently during the lifetime of a project / operation e.g. At least once per year
Possible	The event should occur	Event that may occur during the lifetime of a project / operation e.g. Once in 3 years
Unlikely	The event could occur	Event that is unlikely to occur during the lifetime of a project / operation e.g. Once in 10 years
Rare	The event may occur only in exceptional circumstances	Event that is very unlikely to occur during the lifetime of a project / operation e.g. Once in 15 + years

Table 3: Overall Potential Risk Rating

Consequence Likelihood	Insignificant (1)	Minor (2)	Moderate (3)	Major (4)	Catastrophic (5)
Almost certain (A)	Moderate (11)	High (16)	High (20)	Critical (23)	Critical (25)
Likely (B)	Moderate (7)	Moderate (12)	High (17)	High (21)	Critical (24)
Possible (C)	Low (4)	Moderate (8)	Moderate (13)	High (18)	Critical (22)
Unlikely (D)	Low (2)	Low (5)	Moderate (9)	High (14)	High (19)
Rare (E)	Low (1)	Low (3)	Low (6)	Moderate (10)	High (15)

Primary Gold Limited - Environmental Incident and Investigation Report Form

(This Report is for internal use only. For external reporting requirements to DITT and/or NT EPA refer to Site MMP for details)

Incident Investigation Form (Section B)

1B. Incident Reference Number <i>(same as recorded on incident form)</i>	
Reference Number:	RRPA01

2B. Investigation Details (only required if incident requires follow-up)		
Investigation Team Members (if required)		
Name:	Role:	Signature:

3B. Incident Investigation Analysis		
System Factor	In Place	Absent / Failed / Inadequate
Environment (Check surroundings, access, egress, hostile environment, workspace, housekeeping, noise, dust, confined areas, weather, poor visibility, task unfamiliarity, uneven ground, wildlife)		
Equipment and Materials (Check chemicals, tooling, and equipment) (Check suitability, fit for purpose, approved for site use, design, modifications, suitability, condition, guarding, maintenance records)		
Methods of Work (Check procedures, permits, training, instructions, Take 5, Job Hazard Analysis, risk assessments, licences)		

Primary Gold Limited - Environmental Incident and Investigation Report Form

3B.	Incident Investigation Analysis		
System Factor	In Place	Absent / Failed / Inadequate	
Organisation (Check systems of work, training provided, supervision, communications, instructions given, personal protective equipment provided, culture, pressures)			

4B.	Failures	Why?
1.		
2.		

Add more lines as required

5B.	Recommendations to prevent recurrence			
No.	Action Description	By Whom	By When	Hierarchy of Control (Elimination, Substitution, Engineering, Isolation, Administration, Personal Protective Equipment)
1.				
2.				

Add more lines as required

6B.	Investigation review and sign off			
Role:	Name:	Signature	Date	
Person/s involved				
Immediate Supervisor				
Site Manager				
Environmental Representative				
Health and Safety Representative				
Company Senior Executive (incidents greater than a moderate)				

Primary Gold Limited - Environmental Incident and Investigation Report Form

7B.	Evaluation	Comment	Conducted by	Date
(To be conducted 3 months after incident occurrence)				
	Have all corrective actions been implemented?			
	Has the incident and corrective actions been communicated to personnel and key stakeholders?			
	Have any similar incidents or near misses occurred?			
	Do the implemented controls appear to be effective?			

PRIMARY GOLD PROJECTS WATER QUALITY PRIMARY GOLD PROJECTS WATER MONITORING PROCEDURE

1.1 Purpose

To ensure all surface water sampling is consistent, representative, undertaken in a safe manner and follows best-practice procedures in accordance with relevant standards.

1.2 Scope

This procedure applies to all surface water sampling undertaken at the Primary Gold mining leases located on the Arnhem Highway, approximately 100 km south-east of Darwin. Primary Gold undertake routine water monitoring of surface water bodies upstream, within and downstream of their mining leases. This procedure applies to all water monitoring including the measurement of water quality parameters in the field, and the collection of water samples for subsequent laboratory analysis.

1.3 Standards and other requirements

To ensure the quality and accuracy of the measurements, sampling procedures have been developed in accordance with the following standards and guidelines:

1. Australian Standard on Water Quality Sampling - *Part 1: Guidance on the design of sampling programs, sampling techniques and the preservation and handling of samples* (AS/NZS 5667.1:1998);
2. Australian Standard on Water Quality Sampling - *Part 4: Guidance on sampling from lakes, natural and man-made* (AS/NZS 5667.4:1998);
3. Australian Standard on Water Quality Sampling – *Part 6: Guidance on sampling of rivers and streams* (AS/NZS 5667.6:1998);
4. Australian Standard on Water Quality Sampling – *Part 10: Guidance on sampling of waste waters* (AN/NZS 5667.10:1998)
5. ANZECC & ARMCANZ 2000, *Australian Guidelines for Water Quality Monitoring and Reporting*, National Water Quality Management Strategy Paper No 7, Australian and New Zealand Environment and Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand, Canberra.
6. ANZECC & ARMCANZ 2000, *Australian and New Zealand Guidelines for Fresh and Marine Water Quality*, National Water Quality Management Strategy Paper No 4, Australian and New Zealand Environment and Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand, Canberra.

1.4 Equipment

The following equipment is required when undertaking surface water sampling at all Primary Gold mine leases:

- **Map** showing monitoring sites
- **GPS** with coordinates uploaded for locating sites
- **Folder/clipboard** and waterproof notebook
- **Stationary:** Pens / pencils, permanent markers for completing sample bottle labelling

- **Sample bottles** obtained from Envirolab, ensuring that specific bottles are obtained for each parameter to be tested and appropriate pre-treatment is undertaken (e.g. preservatives). Remember also to prepare a full set of sample bottles for duplicate samples. Also take some spares, especially the glass bottle types.
- **Eskies** with ice or frozen ice bricks
- **Field meters** (pH, temperature, EC, DO, ORP); calibrated on the day of sampling
- **Calibration solutions** in case of issue with field meters (refer to manufacturers calibration instructions)
- **Camera**
- **Sample pole and Jug**
- **Deionised water** to clean equipment between sample sites
- **Syringes and filters** (for dissolved metals)
- **Powder-free gloves**
- **Spare batteries** for camera, GPS and field test meters
- **Chain of Custody (COC) forms** for Envirolab
- **Plastic sleeves** (snap-lock bags) to protect COC forms inside the eskies
- **Consignment (Con) Notes** for freighting samples to Envirolab
- **Tape and security seal** for eskies; also stickers such as address label, fragile, keep chilled etc.
- **Communications equipment** (e.g. mobile/satellite phone, radio, EPIRB)
- **Personal Protective Equipment (PPE)**
- **Garbage bag** for used filters, syringes, gloves and any other waste generated during sampling.

1.5 Procedure

Preparation

1. Gather all equipment listed in Section 0.
2. Bottles may need to be ordered from Envirolab. Contact the laboratory for advice on what bottles are required (certain analytes require particular bottles and preservatives).
3. Put together a package of sample bottles for each site (i.e. in a large snap-lock bag), including bottles for duplicates.
4. Label each bottle with the site name (or duplicate).
5. For metals, tick the box on the bottle label for either filtered or total, depending on whether samples for metals analysis will be filtered in the field.
6. Calibrate the field test meters (e.g. pH, EC, DO, ORP) according to the manufacturer's instructions.
7. Ensure camera and GPS (if required) are fully charged and have sufficient memory.
8. Depending on the number of sites being sampled, prepare a sufficient volume de-ionised water to use for cleaning sampling equipment in the field.
9. Print out required number of blank Field Data Sheets, COC forms and maps.
10. Ensure that ice bricks have been put in the freezer, or sufficient ice is available to chill samples as they are collected.

Field observations and in-situ parameters

1. Record on field sheets the date, time, site name/number, sampler's name, and field observations such as weather conditions, water colour, clarity, water depth, flow rate, any obvious pollution (e.g. rubbish, odours, surface films etc.), flora/fauna, and any other issues that may affect the samples.
2. Put on gloves.

3. Ideally, in-situ readings (e.g. pH, EC, DO, temperature and ORP) are collected directly from the water body being sampled by immersing the meters in the area to be sampled. However, if safety and/or logistical issues preclude this, field readings may need to be taken from the sampling jug.
4. Record the in-situ parameters just below the water surface (between 0.2 and 0.5 m depth), depending on water depth. Alternatively, if collecting samples from various depths (e.g. depth profiling), ensure the field meter is lowered to the desired depth.
5. If collecting field readings from the sampling jug, collect a representative water sample using the jug mounted on a sampling pole. Ensure that the jug/sampler is fully immersed and rinsed at least three times, tipping the rinse water away from (e.g. on the bank), or downstream of, where the sample is to be collected.
6. If sampling flowing waters, ensure that you are standing downstream of where you are sampling so as not to contaminate the sample.
7. Record all the readings on the Field Data Sheet; one sheet to be filled out per site.

Laboratory sample collection

1. Ensure gloves are on.
2. Take out the snap-lock bag full of sample bottles for the site and fill in any remaining information on the labels with the permanent marker (e.g. time, date, and name of sampler.)
3. Unscrew the cap, making sure not to touch the opening of the bottle with your fingers to avoid contaminating the sample. Put the cap upside-down on a clean surface where it won't pick up any contaminants.
4. If safe to do so (i.e. crocodiles), fill the bottles directly from the water body being sampled; otherwise use the jug on the end of the pole to collect a water sample representative of the site.
5. Fully immerse the sample bottle or jug in the water and rinse at least three times before filling. For sample bottles containing preservatives (e.g. nutrients), do not rinse before filling, use the jug to fill these sample bottles. Bottles should be filled from below the water surface (10-20 cm depending on water depth).
6. Make sure that you are standing downstream of where you are sampling so as not to contaminate the sample.
7. If using the jug, pour the water into each sample bottle.
8. Fill each bottle to the top leaving no headspace and screw on the cap.
9. For samples requiring field filtering (e.g. dissolved metals), draw some water into a syringe, put a filter on the end of the syringe, rinse the filter by pushing a few drops of the sample through onto the ground, then fill the bottle leaving no headspace. Depending on the size of the syringe, it may be necessary to draw several syringes-full of water to fill the sample bottle.
10. Put all the sample bottles back in the snap-lock bag and immediately place them in the esky on ice.

Collection of duplicates

1. For duplicate samples, repeat all the above steps outlined above at the site(s) chosen for these samples (generally at least 1 in 10 sample sites, or one per monitoring event). Label the bottles 'Duplicate' as appropriate. Ensure to note which site these samples were collected at on the Field Data Sheet.

Cleaning of field equipment

1. After sampling each site, rinse all sampling equipment (e.g. jugs) with the deionised water.

2. Dispose of used filters, syringes, and gloves appropriately. Consumables are one use only and fresh gloves, syringes and filters are required at each site.

Sample dispatch

1. Once sampling is completed, pack the samples securely in an esky with ice bricks – note that freight companies generally will not allow ice. Ensure that samples have sufficient contact with the ice bricks to stay as cool as possible.
2. Fill out the COC, put in a plastic sleeve (snap-lock bag) and place inside the esky.
3. Tape up the esky and put on address label and stickers as appropriate (e.g. fragile, keep chilled).
4. Fill out consignment note and stick on esky.
5. Deliver samples direct to freight company or organise pick-up, ensuring that samples will be dispatched in time to meet laboratory holding times (usually by 16:00 on day of sampling for overnight priority service).
6. Note that sample dispatch on Friday and Saturday is not acceptable as samples will not be delivered to labs until Monday morning. Therefore, samples with short holding times (i.e. nutrients) cannot be collected on Friday or Saturday. Other parameters with longer holding times can be kept in fridge until dispatch on Sunday or Monday.

Data management

7. All field sheets should be scanned and saved for future reference, and all photographs are to be saved and labelled according to the relevant site name.
1. Field data and site observations are to be recorded in the Water Quality Database immediately following monitoring.
2. Upon receipt of laboratory results, enter data into the Water Quality Database. All laboratory documents (e.g. results, sample receipt notices, certificate of analysis and QA/QC information) should be grouped and saved in the same folder as the database.
3. Data should be compared to guideline values in the database. Any exceedances of guideline values are to be highlighted in red.
4. Data is analysed annually for reporting in the MMP.

1.6 Monitoring program

All Primary Gold mining leases use the following key for water quality analysis.

Appendix E. Monitoring Performance QA/ QC

Site	Date	Field Comments	Indicator	Discharge	Frequency	Parameter
RRSW22	23/06/2021	No sample taken		No Discharge	W, M	1,2,3,4,5
RRSW22	30/06/2021	No Fields taken		No Discharge	W	1
RRSW22	07/07/2021	No Fields taken		No Discharge	W	1
RRSW22	14/07/2021	No Fields taken		No Discharge	W	1
RRSW22	21/07/2021	No Fields taken		No Discharge	W	1
RRSW22	28/07/2021	No sample taken		No Discharge	W, M	1,2,3,4,5
RRSW22	04/08/2021	No Fields taken		No Discharge	W	1
RRSW22	11/08/2021	No Fields taken		No Discharge	W	1
RRSW22	18/08/2021	No Fields taken		No Discharge	W	1
RRSW22	25/08/2021	No sample taken		No Discharge	W, M	1,2,3,4,5
RRSW22	01/09/2021	No Fields taken		No Discharge	W	1
RRSW22	08/09/2021	No Fields taken		No Discharge	W	1
RRSW22	15/09/2021	No Fields taken		No Discharge	W	1
RRSW22	22/09/2021	No Fields taken		No Discharge	W	1
RRSW22	27/09/2021	Sample taken		No Discharge	W, M	1,2,3,4,5
RRSW22	04/10/2021	No Fields taken		No Discharge	W	1
RRSW22	11/10/2021	No Fields taken		No Discharge	W	1
RRSW22	18/10/2021	No Fields taken		No Discharge	W	1
RRSW22	27/10/2021	No sample taken		No Discharge	W, M	1,2,3,4,5
RRSW22	01/11/2021	No Fields taken		No Discharge	W	1
RRSW22	08/11/2021	No Fields taken		No Discharge	W	1
RRSW22	15/11/2021	No Fields taken		No Discharge	W	1
RRSW22	22/11/2021	No Fields taken		No Discharge	W	1
RRSW22	25/11/2021	No sample taken		No Discharge	W, M	1,2,3,4,5
RRSW22	06/12/2021	Sample taken		No Discharge	W, M	1,2,3,4,5
RRSW22	13/12/2021	No Fields taken		No Discharge	W	1
RRSW22	20/12/2021	No Fields taken		No Discharge	W	1
RRSW22	27/12/2021	No Fields taken		No Discharge	W	1
RRSW22	05/01/2022	Sample taken		No Discharge	W, M	1,2,3,4,5
RRSW22	12/01/2022	No Fields taken		Discharge	W	1
RRSW22	18/01/2022	Fields Taken		Discharge	W	1
RRSW22	25/01/2022	Fields Taken		Discharge	W	1
RRSW22	02/02/2022	Fields Taken		Discharge	W	1
RRSW22	09/02/2022	Sample taken		Discharge	W, M	1,2,3,4,5
RRSW22	15/02/2022	Fields Taken		Discharge	W	1
RRSW22	21/02/2022	Fields Taken		Discharge	W	1
RRSW22	28/02/2022	Fields Taken		Discharge	W	1
RRSW22	28/02/2022	Fields Taken		Discharge	W	1

Site	Date	Field Comments	Indicator	Discharge	Frequency	Parameter
RRSW22	09/03/2022	Sample taken		Discharge	W, M	1,2,3,4,5
RRSW22	14/03/2022	Fields Taken		Discharge	W	1
RRSW22	21/03/2022	Fields Taken		Discharge	W	1
RRSW22	29/03/2022	Fields Taken		Discharge	W	1
RRSW22	08/04/2022	Fields Taken		Discharge	W	1
RRSW22	12/04/2022	Sample taken		Discharge	W, M	1,2,3,4,5
RRSW22	19/04/2022	No Fields taken		No Discharge	W	1
RRSW22	22/04/2022	No Fields taken		No Discharge	W	1
RRSW22	04/05/2022	No Fields taken		No Discharge	W	1
RRSW22	11/05/2022	No Fields taken		No Discharge	W	1
RRSW22	16/05/2022	Sample taken		No Discharge	W, M	1,2,3,4,5
RRSW22	16/06/2022	No sample taken		No Discharge	W, M	1,2,3,4,5
RRSW23	23/06/2021	Dry		No Discharge	M	1,2,3,4,5
RRSW23	21/07/2021	Dry		No Discharge	M	1,2,3,4,5
RRSW23	25/08/2021	Dry		No Discharge	M	1,2,3,4,5
RRSW23	27/09/2021	Dry		No Discharge	M	1,2,3,4,5
RRSW23	27/10/2021	Dry		No Discharge	M	1,2,3,4,5
RRSW23	25/11/2021	Dry		No Discharge	M	1,2,3,4,5
RRSW23	06/12/2021	Dry		No Discharge	M	1,2,3,4,5
RRSW23	05/01/2022	Sample taken		No Discharge	M	1,2,3,4,5
RRSW23	18/01/2022	Sample taken		Discharge	W	1,2,3,4,5
RRSW23	25/01/2022	Sample taken		Discharge	W	1,2,3,4,5
RRSW23	02/02/2022	Sample taken		Discharge	W	1,2,3,4,5
RRSW23	09/02/2022	Sample taken		Discharge	W	1,2,3,4,5
RRSW23	09/02/2022	Sample taken		Discharge	W	1,2,3,4,5
RRSW23	15/02/2022	Sample taken		Discharge	W	1,2,3,4,5
RRSW23	15/02/2022	Sample taken		Discharge	W	1,2,3,4,5
RRSW23	21/02/2022	Sample taken		Discharge	W	1,2,3,4,5
RRSW23	28/02/2022	Sample taken		Discharge	W	1,2,3,4,5
RRSW23	09/03/2022	Sample taken		Discharge	W	1,2,3,4,5
RRSW23	16/03/2022	Sample taken		Discharge	W	1,2,3,4,5
RRSW23	16/03/2022	Sample taken		Discharge	W	1,2,3,4,5
RRSW23	21/03/2022	Sample taken		Discharge	W	1,2,3,4,5
RRSW23	29/03/2022	Sample taken		Discharge	W	1,2,3,4,5
RRSW23	08/04/2022	Sample taken		Discharge	W	1,2,3,4,5
RRSW23	12/04/2022	Sample taken		Discharge	W	1,2,3,4,5
RRSW23	22/04/2022	Sample taken		No Discharge	W	1,2,3,4,5
RRSW23	16/05/2022	Pooled		No Discharge	M	1,2,3,4,5
RRSW23	16/06/2022	Dry		No Discharge	M	1,2,3,4,5
Q29SW2	23/06/2021	Dry		No Discharge	M	1,2,3,4,5
Q29SW2	21/07/2021	Dry		No Discharge	M	1,2,3,4,5
Q29SW2	25/08/2021	Dry		No Discharge	M	1,2,3,4,5

Site	Date	Field Comments	Indicator	Discharge	Frequency	Parameter
Q29SW2	27/09/2021	Dry		No Discharge	M	1,2,3,4,5
Q29SW2	27/10/2021	Dry		No Discharge	M	1,2,3,4,5
Q29SW2	27/11/2021	Dry		No Discharge	M	1,2,3,4,5
Q29SW2	07/12/2021	Pooled		No Discharge	M	1,2,3,4,5
Q29SW2	06/01/2022	Sample taken		No Discharge	M	1,2,3,4,5
Q29SW2	18/01/2022	Fields only		Discharge	M	1,2,3,4,5
Q29SW2	08/02/2022	Sample taken		Discharge	M	1,2,3,4,5
Q29SW2	08/02/2022	Sample taken		Discharge	M	1,2,3,4,5
Q29SW2	14/03/2022	Sample taken		Discharge	M	1,2,3,4,5
Q29SW2	22/04/2022	Pooled		No Discharge	M	1,2,3,4,5
Q29SW2	16/05/2022	Pooled		No Discharge	M	1,2,3,4,5
Q29SW2	16/06/2022	Dry		No Discharge	M	1,2,3,4,5
Q29SW10	23/06/2021	Dry		No Discharge	M	1,2,3,4,5
Q29SW10	21/07/2021	Dry		No Discharge	M	1,2,3,4,5
Q29SW10	25/08/2021	Dry		No Discharge	M	1,2,3,4,5
Q29SW10	27/09/2021	Dry		No Discharge	M	1,2,3,4,5
Q29SW10	27/10/2021	Dry		No Discharge	M	1,2,3,4,5
Q29SW10	27/11/2021	Dry		No Discharge	M	1,2,3,4,5
Q29SW10	07/12/2021	Pooled		No Discharge	M	1,2,3,4,5
Q29SW10	06/01/2022	Sample taken		No Discharge	M	1,2,3,4,5
Q29SW10	09/02/2022	Sample taken		Discharge	M	1,2,3,4,5
Q29SW10	16/03/2022	Sample taken		Discharge	M	1,2,3,4,5
Q29SW10	12/04/2022	Pooled		Discharge	M	1,2,3,4,5
Q29SW10	16/05/2022	Pooled		No Discharge	M	1,2,3,4,5
Q29SW10	16/06/2022	Dry		No Discharge	M	1,2,3,4,5
Q29SW4	23/06/2021	Dry		No Discharge	M	1,2,3,4,5
Q29SW4	21/07/2021	Dry		No Discharge	M	1,2,3,4,5
Q29SW4	25/08/2021	Dry		No Discharge	M	1,2,3,4,5
Q29SW4	27/09/2021	Dry		No Discharge	M	1,2,3,4,5
Q29SW4	27/10/2021	Dry		No Discharge	M	1,2,3,4,5
Q29SW4	27/11/2021	Dry		No Discharge	M	1,2,3,4,5
Q29SW4	07/12/2021	Pooled		No Discharge	M	1,2,3,4,5
Q29SW4	06/01/2022	Sample taken		No Discharge	M	1,2,3,4,5
Q29SW4	08/02/2022	Sample taken		Discharge	M	1,2,3,4,5
Q29SW4	14/03/2022	No Safe Access		Discharge	M	1,2,3,4,5
Q29SW4	12/04/2022	Sample taken		Discharge	M	1,2,3,4,5
Q29SW4	16/05/2022	Pooled		No Discharge	M	1,2,3,4,5
Q29SW4	16/06/2022	Dry		No Discharge	M	1,2,3,4,5
RRSW6	23/06/2021	No sample taken		No Discharge	M	1,2,3,4,5
RRSW6	21/07/2021	No sample taken		No Discharge	M	1,2,3,4,5
RRSW6	25/08/2021	No sample taken		No Discharge	M	1,2,3,4,5
RRSW6	27/09/2021	Sample taken		No Discharge	M	1,2,3,4,5

Site	Date	Field Comments	Indicator	Discharge	Frequency	Parameter
RRSW6	27/10/2021	No sample taken		No Discharge	M	1,2,3,4,5
RRSW6	27/11/2021	No sample taken		No Discharge	M	1,2,3,4,5
RRSW6	06/12/2021	Sample taken		No Discharge	M	1,2,3,4,5
RRSW6	06/01/2022	No sample taken		No Discharge	M	1,2,3,4,5
RRSW6	09/02/2022	Sample taken		Discharge	M	1,2,3,4,5
RRSW6	16/03/2022	Sample taken		Discharge	M	1,2,3,4,5
RRSW6	25/04/2022	No sample taken		No Discharge	M	1,2,3,4,5
RRSW6	16/05/2022	No sample taken		No Discharge	M	1,2,3,4,5
RRSW6	16/06/2022	No sample taken		No Discharge	M	1,2,3,4,5
RRSW24	23/06/2021	Dry		No Discharge	M	1,2,3,4,5
RRSW24	21/07/2021	Dry		No Discharge	M	1,2,3,4,5
RRSW24	25/08/2021	Dry		No Discharge	M	1,2,3,4,5
RRSW24	27/09/2021	Dry		No Discharge	M	1,2,3,4,5
RRSW24	27/10/2021	Dry		No Discharge	M	1,2,3,4,5
RRSW24	27/11/2021	Dry		No Discharge	M	1,2,3,4,5
RRSW24	06/12/2021	Dry		No Discharge	M	1,2,3,4,5
RRSW24	05/01/2022	Sample taken		No Discharge	M	1,2,3,4,5
RRSW24	02/02/2022	Sample taken		No Discharge	M	1,2,3,4,5
RRSW24	21/03/2022	Sample taken		No Discharge	M	1,2,3,4,5
RRSW24	12/04/2022	Pooled		No Discharge	M	1,2,3,4,5
RRSW24	16/05/2022	Pooled		No Discharge	M	1,2,3,4,5
RRSW24	16/06/2022	Dry		No Discharge	M	1,2,3,4,5
RRSW25	23/06/2021	Dry		No Discharge	M	1,2,3,4,5
RRSW25	21/07/2021	Dry		No Discharge	M	1,2,3,4,5
RRSW25	25/08/2021	Dry		No Discharge	M	1,2,3,4,5
RRSW25	27/09/2021	Dry		No Discharge	M	1,2,3,4,5
RRSW25	27/10/2021	Dry		No Discharge	M	1,2,3,4,5
RRSW25	27/11/2021	Dry		No Discharge	M	1,2,3,4,5
RRSW25	06/12/2021	Dry		No Discharge	M	1,2,3,4,5
RRSW25	05/01/2022	No vehicle access		No Discharge	M	1,2,3,4,5
RRSW25	02/02/2022	No vehicle access		No Discharge	M	1,2,3,4,5
RRSW25	16/03/2022	No vehicle access		No Discharge	M	1,2,3,4,5
RRSW25	12/04/2022	No vehicle access		No Discharge	M	1,2,3,4,5
RRSW25	16/05/2022	No vehicle access		No Discharge	M	1,2,3,4,5
RRSW25	16/06/2022	Dry		No Discharge	M	1,2,3,4,5
RRSW26	23/06/2021	Dry		No Discharge	M	1,2,3,4,5
RRSW26	21/07/2021	Dry		No Discharge	M	1,2,3,4,5
RRSW26	25/08/2021	Dry		No Discharge	M	1,2,3,4,5
RRSW26	27/09/2021	Dry		No Discharge	M	1,2,3,4,5
RRSW26	27/10/2021	Dry		No Discharge	M	1,2,3,4,5
RRSW26	27/11/2021	Dry		No Discharge	M	1,2,3,4,5
RRSW26	06/12/2021	Dry		No Discharge	M	1,2,3,4,5

Site	Date	Field Comments	Indicator	Discharge	Frequency	Parameter
RRSW26	05/01/2022	No vehicle access		No Discharge	M	1,2,3,4,5
RRSW26	02/02/2022	No vehicle access		No Discharge	M	1,2,3,4,5
RRSW26	16/03/2022	No vehicle access		No Discharge	M	1,2,3,4,5
RRSW26	12/04/2022	No vehicle access		No Discharge	M	1,2,3,4,5
RRSW26	16/05/2022	No vehicle access		No Discharge	M	1,2,3,4,5
RRSW26	16/06/2022	Dry		No Discharge	M	1,2,3,4,5
Q29SW9	23/06/2021	No vehicle access		No Discharge	M	1,2,3,4,5
Q29SW9	21/07/2021	No vehicle access		No Discharge	M	1,2,3,4,5
Q29SW9	25/08/2021	No vehicle access		No Discharge	M	1,2,3,4,5
Q29SW9	27/09/2021	No vehicle access		No Discharge	M	1,2,3,4,5
Q29SW9	27/10/2021	No vehicle access		No Discharge	M	1,2,3,4,5
Q29SW9	27/11/2021	No vehicle access		No Discharge	M	1,2,3,4,5
Q29SW9	07/12/2021	No vehicle access		No Discharge	M	1,2,3,4,5
Q29SW9	06/01/2022	No vehicle access		No Discharge	M	1,2,3,4,5
Q29SW9	08/02/2022	No vehicle access		Discharge	M	1,2,3,4,5
Q29SW9	14/03/2022	No vehicle access		Discharge	M	1,2,3,4,5
Q29SW9	12/04/2022	No vehicle access		Discharge	M	1,2,3,4,5
Q29SW9	16/05/2022	No vehicle access		No Discharge	M	1,2,3,4,5
Q29SW9	16/06/2022	No vehicle access		No Discharge	M	1,2,3,4,5

Appendix F. Macroinvertebrate and Sediment Sampling Report
(AES, 2022)

Rustlers Roost Mine

Biological and Sediment Monitoring 2022

Final Report



This report has been prepared for Hanking as a technical document. The opinions, conclusions and any recommendations in this report are based on information obtained from, and testing undertaken at or in connection with, specific sample points. As a result, not all relevant site features and conditions may have been identified in this report.

Meteorological and flow data have been obtained from external sources. Aquatic Ecology Services has made the assumption that all data has been validated and is correct.

Version	Prepared by	Reviewed by	Review Date
Draft 1.0	T Steele	C. Hastie	31/07/2022
Final 2.0	T Steele		



Table of Contents

1. Background.....	4
1.1 Catchment	4
1.2 Monitoring Program.....	4
1.3 Scope	4
2. Study Design.....	5
2.1 Sampling sites.....	5
2.2 Timing.....	5
3. Methods.....	7
3.1 Habitat assessment	7
3.2 Water quality	7
3.3 Macroinvertebrates.....	8
3.3.1 Field sampling.....	8
3.3.2 Laboratory processing	8
3.4 Data analysis	9
4. Results and Discussion	11
4.1 Site conditions.....	11
4.1.1 Rainfall	11
4.1.2 Habitat characteristics.....	12
4.2 Water quality	15
4.3 Macroinvertebrates.....	16
4.3.1 Relative abundance.....	17
4.3.2 Taxa richness	18
4.3.3 PET richness	18
4.3.4 SIGNAL-2	19
4.3.5 Community composition	21
4.4 Discussion	24
5. References.....	26
Appendix A. Raw Macroinvertebrate Data.....	27
Appendix B. Macroinvertebrate QA.....	29

Figures

Figure 1 – Macroinvertebrate sampling site locations (Ecoz 2021).....	6
Figure 2 – Monthly Rainfall recorded at Middle Point July 2020-June 2021 (BOM 2021)	11
Figure 3 – Relative abundance of samples collected in 2021.....	17
Figure 4 -Family taxa richness from sites at the RRPA sampled in 2021	18
Figure 5 – PET richness from sites at the RRPA sampled in 2021	19
Figure 6 – SIGNAL-2 scores for samples collected at the RRPA in 2021.....	21
Figure 7 - Percentage of tolerant taxa found at each site	20
Figure 8 – Proportional abundance of macroinvertebrate orders collected in 2021	21

Figure 9 - NMDS plot showing variation in community composition between sites 22

Tables

Table 1 – Sampling sites at the RRPA..... 5

Table 2 – BMP site descriptions, April 2021..... 13

Table 3 – In situ water quality results from sites visited in April 2021 15

1. Background

1.1 Catchment

Rustlers Roost Mine is located at the headwaters of two catchments. To the west, Marrakai Creek flows to the Adelaide River, approximately 35km downstream. To the east, Mount Bunday Creek flows into Hardies Creek, a tributary of the Mary River Floodplain. The catchment to the east of Rustlers Roost is located within the Mary River Surface Water Beneficial Use and Objectives Area, which identifies all tributaries that enter the Mary River as having environmental, riparian and cultural beneficial uses. The Rustlers Roost Project Area (RRPA) is located on Old Mount Bundy Station, and the surrounding land use is predominantly cattle grazing.

1.2 Monitoring Program

Primary Gold Limited received approval to discharge water under a Waste Discharge Licence (WDL-247). In early 2021, a Sediment and Macroinvertebrate Monitoring Program (Ecoz 2021) was developed for the RRPA. Although the WDL application does not include details on ecosystem monitoring to validate environmental harm, a biological and sediment monitoring program has been implemented to gather data before and during pit dewatering in the receiving environment of the RRPA. Baseline data was collected in 2021.

The 2022 monitoring round signifies the first year of aquatic ecology monitoring after start of discharge of water from Rustlers Roost Mine to Mount Bunday Creek, which commenced in January 2022, and ceased in April 2022. There was no active discharge to Marrakai Creek in the 2021/2022 wet season.

1.3 Scope

Aquatic Ecology Services was engaged by Hanking to complete sample processing, data analysis and reporting for the biological monitoring component of the macroinvertebrate monitoring program. This report details the outcome of macroinvertebrate sampling completed in the early dry season, 2022.

2. Study Design

2.1 Sampling sites

Five sites were visited during macroinvertebrate sampling in 2022 (Table 1). This included one upstream and one downstream site on Marrakai Creek, and two downstream sites on Upper Mount Bunday Creek. The previously sampled site upstream on Marrakai Creek (RRMCUS) was not deemed suitable in 2022, and so a new upstream site was sought. The chosen site is on a creek with similar habitat features to the Marrakai Creek downstream site. After sampling in 2021, it was recommended that an upstream site in the Mount Bunday Creek catchment would be beneficial for robust analysis of any impacts on a catchment-specific basis (AES 2021). An additional site (MBCUS) was sampled in 2022, located upstream of Rustlers Roost in the Mount Bunday Creek Catchment. The site is located outside of the influence of both Quest 29 and Rustlers Roost and represents an upstream location for comparison of results from each catchment individually.

As there has been no active discharge to Marrakai Creek, sites sampled on the watercourse can act as a reference for prevailing conditions.

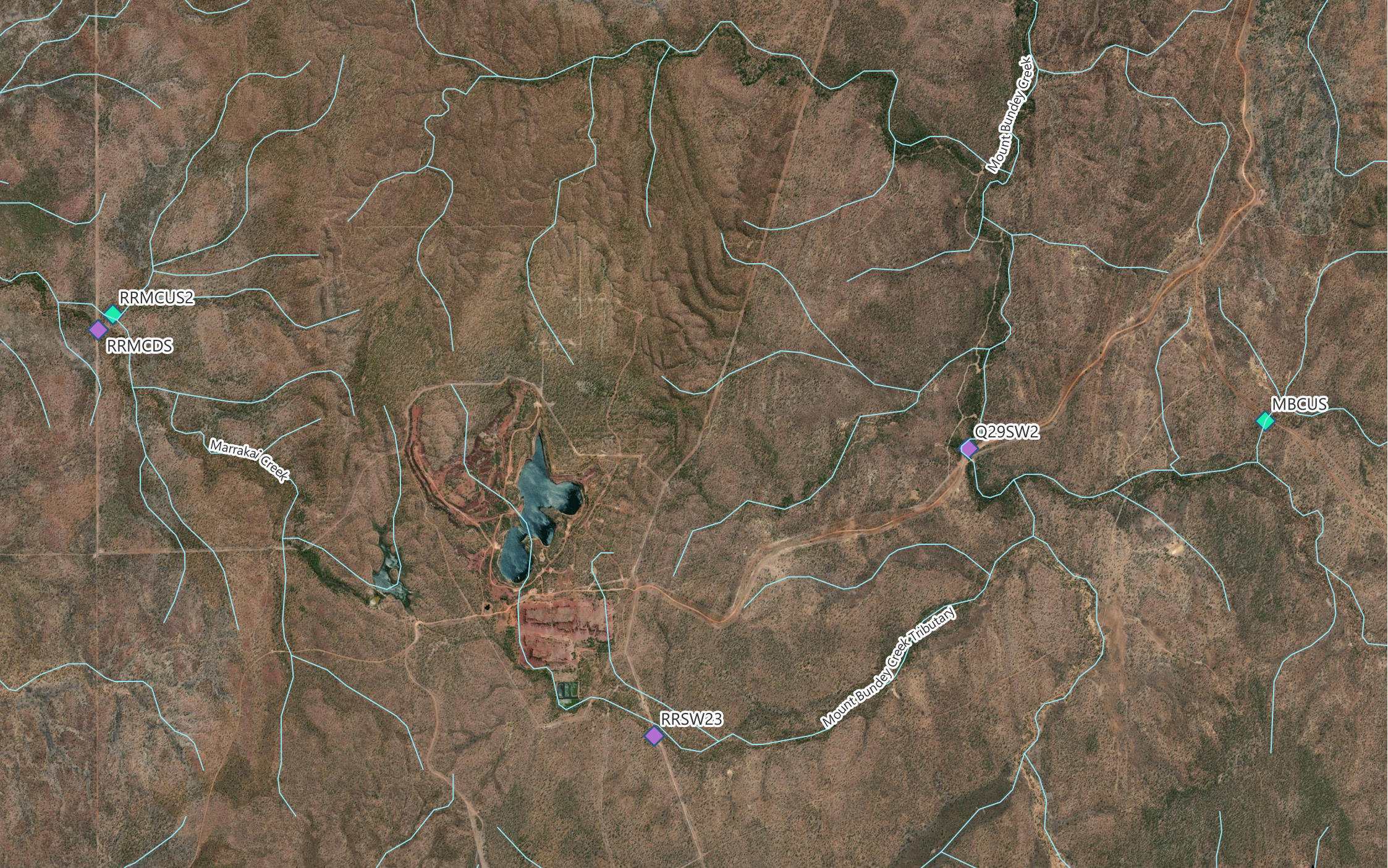
Sampling locations are pictured in Figure 1.

Table 1 – Sampling sites at the RRPA in 2022

Site Code	Site type	Description	Easting	Northing
RRMCUS2	Upstream	Unnamed Creek – reference for Marrakai Creek	768087	8572197
RRMCDS	Downstream	Marrakai Creek downstream of inflows from the RRPA	767981	8572085
RRMBCUS	Upstream	Mount Bunday Creek Upstream of Rustlers Roost	776247	8571338
RRSW23	Downstream	Upper Mount Bunday Creek tributary downstream of proposed authorised discharge point	771900	8569190
Q29SW2	Downstream	Mount Bunday Creek tributary crossing on RRPA access road	774154	8571092

2.2 Timing

To meet the protocols outlined in the Darwin-Daly AUSRIVAS sampling manual (Lamche 2007), sampling was conducted in the post-wet season during the recessional flow period. Sampling was undertaken in late April to target adequate water availability at all sites.



3. Methods

3.1 Habitat assessment

At each site, descriptions of habitat characteristics were recorded following the criteria listed in the Northern Territory AUSRIVAS "Darwin-Daly Region Model" field sheets (Lamche, 2007). Habitat assessments were undertaken in consideration of the whole reach sampled, including:

- Site description
- Water quality
- Instream physical characteristics (flow velocity and depth, instream habitat characteristics, bank height, riparian zone width)
- Riparian vegetation characteristics (types, %cover, exotic species, erosion, land use)
- Water quality observations (clarity, odour, oils, foam/scum, plumes etc.)
- Sketches of the site, including a cross - section of the reach

The information recorded was used to assist interpretation of biological data. Data recorded is also used in conjunction with the biological community information as the basis of the overall health assessment.

Photos were taken of upstream and downstream portions of the reach sampled, as well as bank habitat and other key habitat features. This further characterises the habitat conditions at each site, serving as a pictorial record of site conditions that can be tracked over time using photos taken from the same photo points.

3.2 Water quality

The physico-chemical parameters of the water at each site were measured using a calibrated multi-parameter water quality meter. The following parameters were recorded:

- Water temperature (°C)
- Dissolved oxygen (DO) concentrations (mg/L and % saturation)
- pH
- Electrical conductivity (EC) (µS/cm)
- Turbidity

The results were compared to guideline values (ANZECC 2000).

3.3 Macroinvertebrates

3.3.1 *Field sampling*

Macroinvertebrate sampling and field processing was completed by Ecoz, and followed procedures outlined in the Northern Territory AUSRIVAS Manual for the Darwin-Daly Region (Lamche, 2007). Sampling involved one field team member scraping submerged root matter associated with the lower bank to agitate and remove macroinvertebrates into the water column, while the other field team member swept a dip net through the water column downstream of the edge habitat, to collect the dislodged animals. Areas of riffle or fast flowing habitat, Pandanus roots and severe bank undercuts were avoided when collecting edge habitat samples.

Once collected, the samples were washed through 10mm and 250µm mesh sieves. The coarse mesh sieve was examined for large, conspicuous taxa, and these were placed in the labelled sample container. The sample collected in the fine mesh sieve was also placed in the labelled sample container and filled with 70% ethanol. All samples were sent to the macroinvertebrate laboratory for further processing and identification.

3.3.2 *Laboratory processing*

Samples were washed through a series of sieves (10mm, 500µm and 250µm mesh sizes). Any large, conspicuous taxa identified in the 10 mm mesh sieve were added to the contents of the large mesh fraction retained in the field. The contents of the 500µm mesh sieve were retained for macroinvertebrate identification and enumeration, while the 250µm fraction was retained as sample residue for quality assurance purposes. The contents of the 500µm mesh fraction was poured into a Marchant sub-sampler (Marchant, 1989) and extractions made randomly from cells (aliquots) in this apparatus. These extractions were placed under a microscope and the taxa identified and counted. This process continued until either all aliquots were examined, or a total of 200 individuals had been counted and identified. The number of aliquots required to be processed to obtain a minimum 200 individual sub-sample was recorded in order to be able to calculate abundance. A Leica stereo-dissection microscope was used to examine specimens.

Taxa were identified to genus level where possible, with the exception of key taxa identified in Lamche (2007), requiring identification to order level (e.g., Conchostraca). Quality assurance processes were followed as per Lamche (2007). Five percent of samples were sent to an external laboratory and checked for correct identification by an AUSRIVAS accredited Senior Taxonomist.

3.4 Data analysis

A number of indices can be used to assess and/or quantify the influence of anthropogenic activities on macroinvertebrate communities. Responses to contaminants or changes in flow can result in anything from changes in abundance and diversity, through to changes in community composition through the loss or reduction of sensitive taxa. Macroinvertebrate community indices were calculated for each sample at each site. A summary of the univariate macroinvertebrate indices assessed as part of this study are provided below:

- Relative abundance – Total number of individual taxa collected at a site. This information is calculated based on processing requirements in the laboratory (% of sample processed).
- Taxa richness (Family) – Total number of taxa present at the site used as a measure of diversity of families (used for long-term data analysis).
- Taxa Richness (Genus) - Total number of taxa present at the site used as a measure of diversity of genera.
- PET richness – total number of families from orders Plecoptera, Ephemeroptera and Trichoptera. PET taxa are generally more sensitive to disturbance.
- SIGNAL-2 – a biotic index that allocates a value to each macroinvertebrate family based on their sensitivity to pollution. The metric is calculated by averaging the index of all families collected. Lamche (2007) cautions against the use of the SIGNAL-2 index for assessing the status of Northern Territory macroinvertebrate communities. This measure is however, considered appropriate for this study as the number of pollution-sensitive versus pollution-tolerant families does provide some insight to the level of stress that the macroinvertebrate community is experiencing. In order to further understand this metric, the tolerant taxa index was calculated from SIGNAL grade numbers. Taxa with SIGNAL grade numbers of 3 or less are designated as tolerant (Marshall et al. 2001), and the number of these tolerant taxa are compared to the overall taxa count and expressed as a percentage. This approach allows for a more nuanced assessment of any impacts associated with active discharge from the RRPA in the future, and provides background data on the overall tolerance of taxa in the catchments.

Prior to 2021, biological monitoring programs commonly utilised the NT AUSRIVAS Darwin-Daly Early (dry season) Family level Edge habitat model. New guidance on the use of these models in the NT to understand impacts of point source pollution have been published (ANZG 2021). The updated guidance states that the models are not useful in understanding aquatic ecosystem health outside of the large rivers where macroinvertebrates have been collected, and therefore the use of AUSRIVAS modelling has not been undertaken on the data collected for this project.

In addition to univariate analysis of metrics, an assessment of differences in the macroinvertebrate community composition was undertaken. NMDS Ordination provides a representation of the relative similarity of entities (i.e., samples) based on their attributes (i.e., macroinvertebrate community composition) within a reduced dimensional space. The more similar sites are to each other, the closer they

are located in the NMDS ordination space. In this study, NMDS plots were used to display the similarity between site types (Upstream and Downstream) and catchments (Marrakai and Mt Bunday). A similarity matrix for all pairs of samples based on the Bray-Curtis similarity coefficient was calculated. Stress, which is a measure of the distortion produced by compressing multi-dimensional data into a reduced set of dimensions, was used to gauge how reliable the patterns presented in two-dimensional NMDS plots are. Stress levels above 0.20 indicate a poor representation of inter-sample similarity and, as such, the NMDS results with stress values of this order require interpretation with caution (Clarke *et al* 2014).

Sample data was fourth-root transformed prior to multivariate analysis.

4. Results and Discussion

4.1 Site conditions

4.1.1 Rainfall

Rainfall recorded at the closest available weather station (Cooinda Airstrip, Station no. 14256) is presented in Figure 2. Rainfall data was recorded approximately 60km from the Rustlers Roost site and is indicative of rainfall at the RRP. A total of 1439.5mm of rain was recorded in 2021/2022, which was greater than the long-term average for the station (1382.5mm) and rainfall was above average in the months of November and December, and below average for the following three months, before a slightly above average rainfall record for April.

It is acknowledged that rainfall in the NT can be patchy, and rainfall recorded at Cooinda Airstrip is indicative of climate, but may not accurately represent conditions on site at the RRP. A rain gauge was installed at Quest 29 in January 2022, which will assist with future wet season rainfall records that are more geographically accurate.

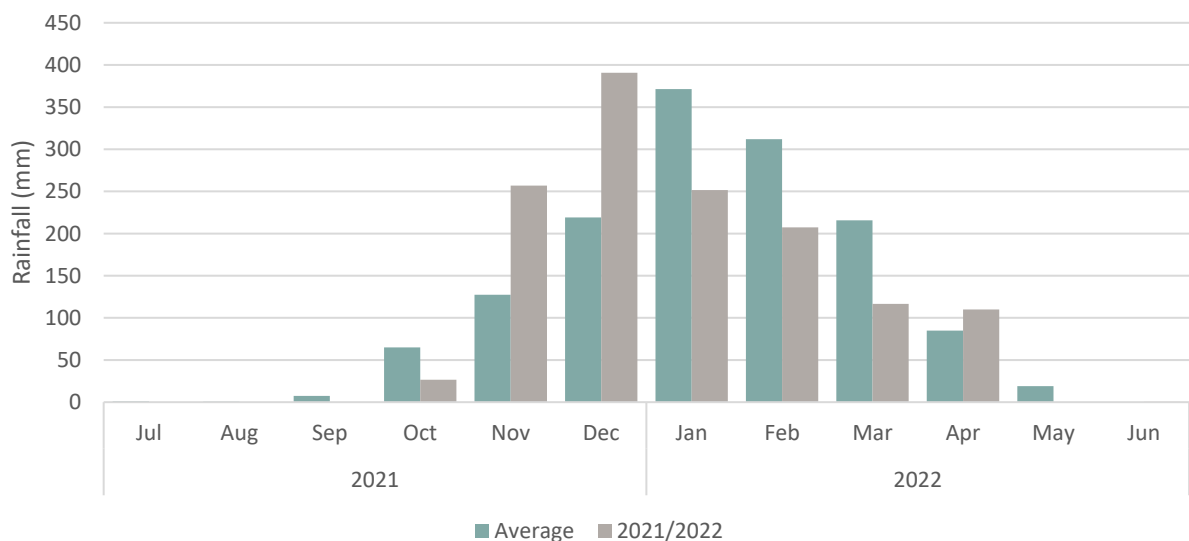


Figure 2 – Monthly Rainfall recorded at Cooinda Airstrip July 2021-June 2022 (BOM 2022)

4.1.2 Mount Bunday Catchment Flow

Creek flows recorded in the Mount Bunday Creek Tributary at the RRSW23 telemetry station are presented as creek heights in Figure 3. The highest flows were consistent with the highest rainfall recorded at Cooinda Airstrip, with quite stable flows recorded towards the end of the wet season. The last drop in flow was related to the cease of discharge into the Mount Bunday Creek tributary.

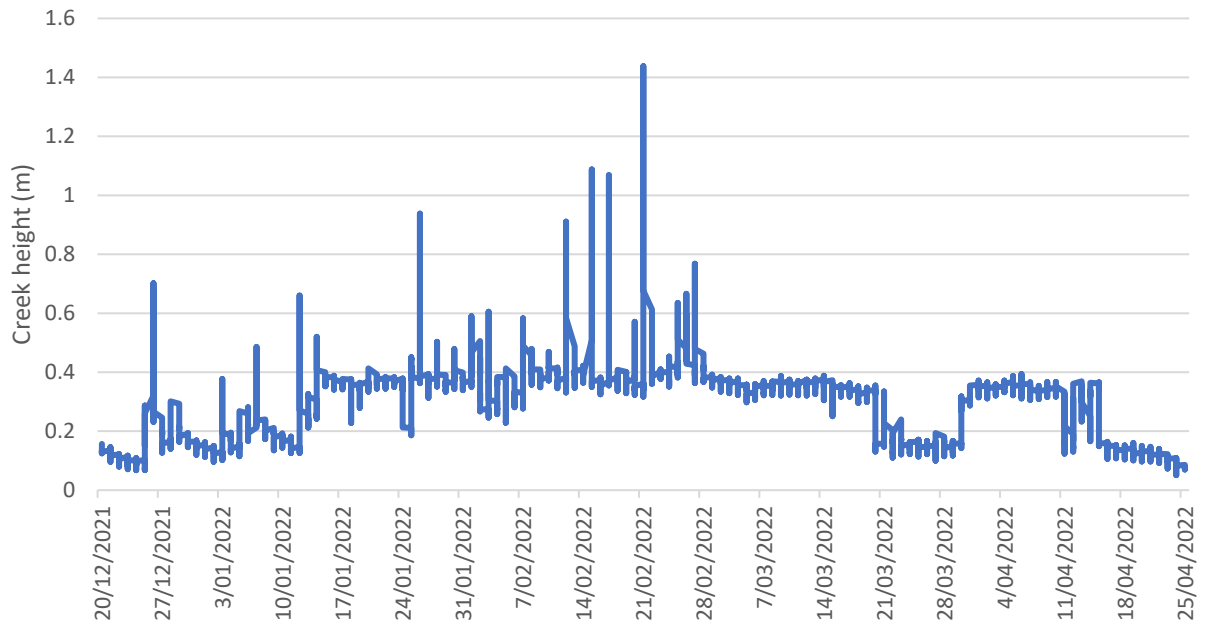


Figure 3 – Creek heights recorded at RRSW23 December 2021 to April 2022

4.1.3 Habitat characteristics

Habitat characteristics of each site are detailed below in Table 2. All sites were flowing at the time of sampling. Sufficient water was present for sampling to take place at each site, and sample timing was considered appropriate. Evidence of cattle access at all sites was observed.

Table 2 – BMP site descriptions, April 2021

Site description	Site photo
RRMCUS – Upstream The site was located in a tributary of Marrakai Creek. The site is characterised by a narrow, meandering creek line through Paperbark and Pandanus which lined the banks. the creek was flowing at the time of sampling and contained several pools connected by shallow runs.	
RRMCDS – Downstream The site is located downstream of a large dam constructed across Marrakai Creek. The site is characterised by a narrow, meandering creek line through Paperbark trees and an understorey of grass. Habitat was very similar to the upstream site, containing pools and runs	
MBCUS – Upstream The site is located upstream of influences from Rustlers Roost and Quest 29. The site was characterised by sandy substrate in pools connected by shallow runs. There was an indication of nutrient enrichment, as filamentous algae was present in the water column. Riparian vegetation provided moderate shade.	
RRSW23 -Downstream The site is located on a tributary of Mount Bunday Creek and consisted of a large, deep pool between riffles and runs. Substrate in shallow habitats was a mixture of sand and pebbles, and the pool contained sand with bedrock covered by detritus. Riparian vegetation was made up of shrubs, with some trailing into the water. There was very little shade at the site.	

Site description	Site photo
Q29SW2 – Downstream The site is located on a tributary of Mount Bunday Creek and was relocated downstream of the road crossing due to safety concerns. A bridge had been constructed across Mount Bunday Creek prior to the 2021/2022 wet season. The site consisted of shallow pools between riffles and runs. Substrate in shallow habitats was a mixture of sand and pebbles with a layer of fine silt. Riparian vegetation was made up of shrubs and provided good and continuous shade.	

4.2 Water quality

In situ water quality data collected at sampling sites is presented below in Table 3. The following observations can be made about water parameters at sites associated with the RRPA:

- Water temperatures were similar at all sites.
- Dissolved oxygen was recorded outside of the guideline value range at several sites, which is likely to be related to shading and turbidity, limiting light penetration and primary productivity. Lower dissolved oxygen readings did not appear to have any relationship to the position of the site in the catchment.
- Conductivity was lowest at sites on Marrakai Creek, with very little difference between sites upstream and downstream. The highest conductivity was recorded at the site closest to the RRPA in the Mt Bunday Creek catchment (RRSW23), but was well within the guideline range for the site.
- pH was similar at all sites. Waters at all sites were circumneutral.
- Turbidity was low at most sites, with decreased water clarity recorded at Q29SW2. Earthworks upstream of the site related to road crossing construction is the likely reason for the higher turbidity at this site.

Table 3 – *In situ* water quality results from sites visited in April 2022

Site Code	Date	Time	Temp (°C)	DO (%)	EC (µS/cm)	pH	Turbidity (NTU)
Guideline Value			-	85-110	20-250	6-8	15
RRMCUS2	15/04/2021	10:30	27.3	87.6	21.8	6.19	7.51
RRMCDS	23/04/2022	9:20	25.2	37.8	29.0	6.86	8.29
RRMBCUS	22/04/2022	11:40	31.5	62.4	32.5	6.84	6.80
RRSW23	22/04/2022	15:20	32.1	52.1	67.5	6.80	12.70
Q29SW2	22/04/2022	14:20	31.2	90.4	37.0	6.60	26.60

4.3 Sediment quality

The results of laboratory analysis of sediments are presented in Table 4. There were no exceedances of the SQGVs at any site. Proportions of total organic carbon (TOC) in samples were variable. Overall, the proportion of TOC in each sample was low (It is unlikely that these quantities of TOC would ameliorate the bioavailability of metals in sediments of Marrakai and Mount Bunday Creeks (ANZG 2018)).

Several acid-extractable metal concentrations were higher downstream of the RRPA on Mount Bunday Creek. Both sites downstream of the RRPA had concentrations of Aluminium, Iron, Chromium, Cobalt and Manganese that were greater than the upstream site. This indicates that accumulation above what is occurring due to natural mineralisation of the catchment.

The circumneutral pH for surface waters in the catchment denote there is a low likelihood of bioavailability of any accumulated metals in sediments in the catchment.

Table 4 - Analysis results of sediment parameters from 2022, compared with default guideline values. All values are presented in mg/kg

Catchment position	Site		Upstream	Downstream	Upstream	Downstream	Downstream
DGV	Low	High	RRMCUS2	RRMCDS	RRMCBUS	RRSW23	Q29SW2
TOC			8000	4000	3000	8000	3000
Aluminium			660	460	79	430	240
Arsenic	20	70	<4	<4	<4	<4	<4
Cadmium	1.5	10	<0.5	<0.5	<0.5	<0.5	<0.5
Chromium	80	370	2	<1	<1	2	1
Cobalt			2.6	<1	<1	1.5	1.9
Copper	65	270	<1	<1	<1	1	<1
Iron			1700	580	460	2800	1300
Lead	50	220	4	2	4	3	6
Manganese			120	74	33	75	140
Nickel	21	52	<1	<1	<1	<1	<1
Zinc	200	410	<1	<1	<1	<1	2

4.4 Macroinvertebrates

The following sections summarise the findings of results from 2022, which represents the first year that sampling was completed. Raw data is attached in Appendix A and QA results in Appendix B.

4.4.1 Relative abundance

The relative abundance of macroinvertebrates collected at the RRPA in 2022 is presented in Figure 4. A greater number of individuals were collected at the upstream site on Marrakai Creek. The relative abundance of samples collected at the upstream site were lower at the upstream site compared with both downstream sites on Mt Bunday Creek.

Relative abundance results from pre and post discharge are compared in Figure 5. Only sites for which there is data from 2021 are presented. Samples from downstream sites on Mount Bunday Creek contained a higher abundance of macroinvertebrates in 2022, compared with 2021, whereas samples from Marrakai creek were similar.

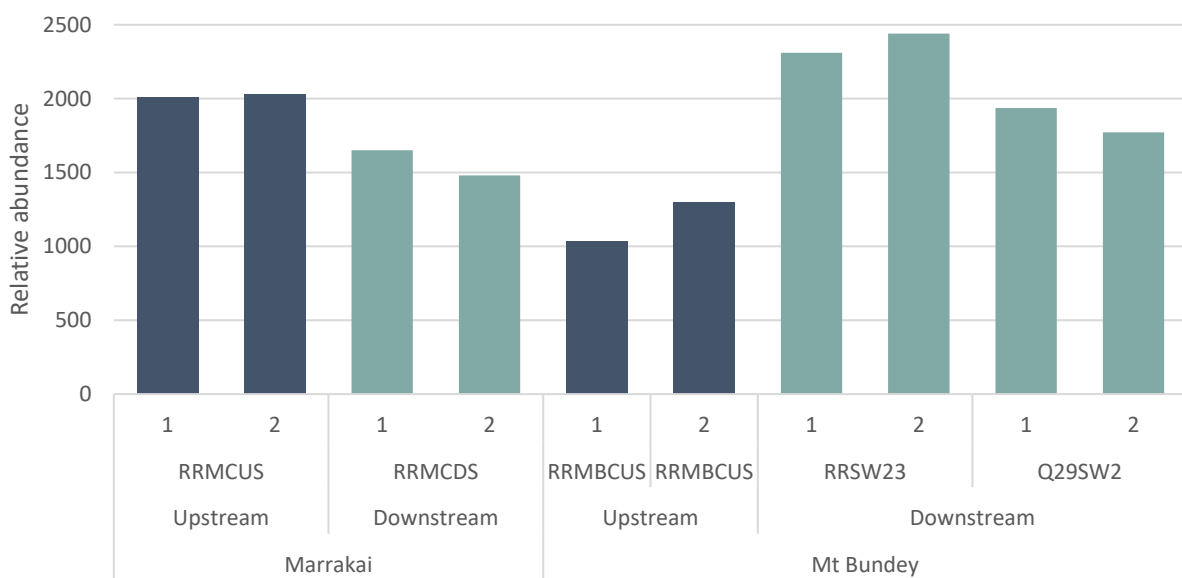


Figure 4 – Relative abundance of samples collected in 2022



Figure 5 – Relative abundance of samples from 2021 and 2022

4.4.2 Taxa richness

Taxa richness of samples collected in 2022 are presented in Figure 6. Results were similar at sites on Marrakai Creek, whereas there was an increase in taxa richness downstream of Rustlers Roost Mine, with a slight increase with distance downstream of the mine.

Results from 2021 and 2021 were similar at all sites that had been sampled in both years from both catchments (Figure 7)

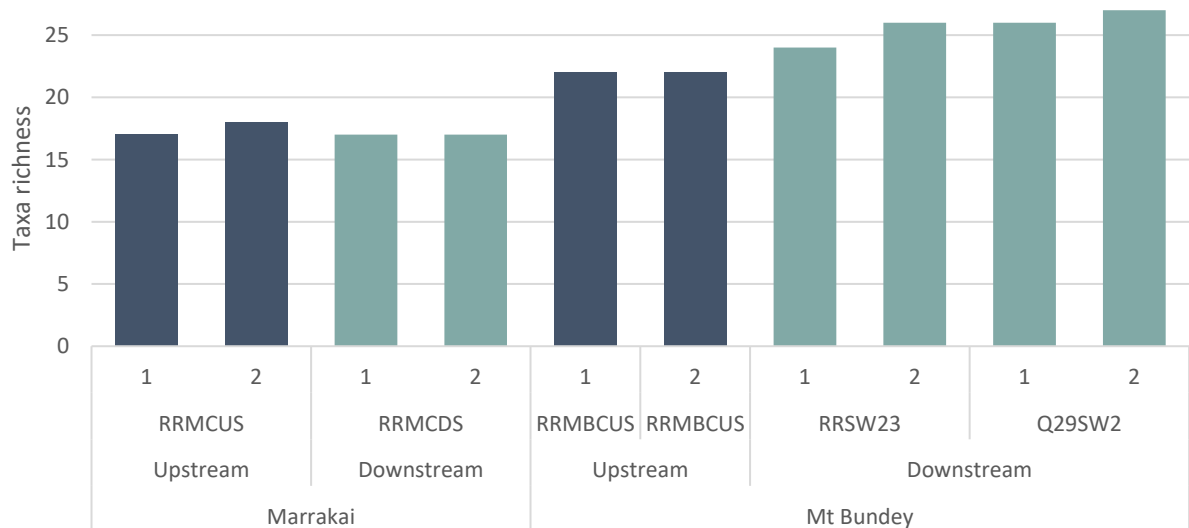


Figure 6 -Taxa richness from sites at the RRPA sampled in 2022

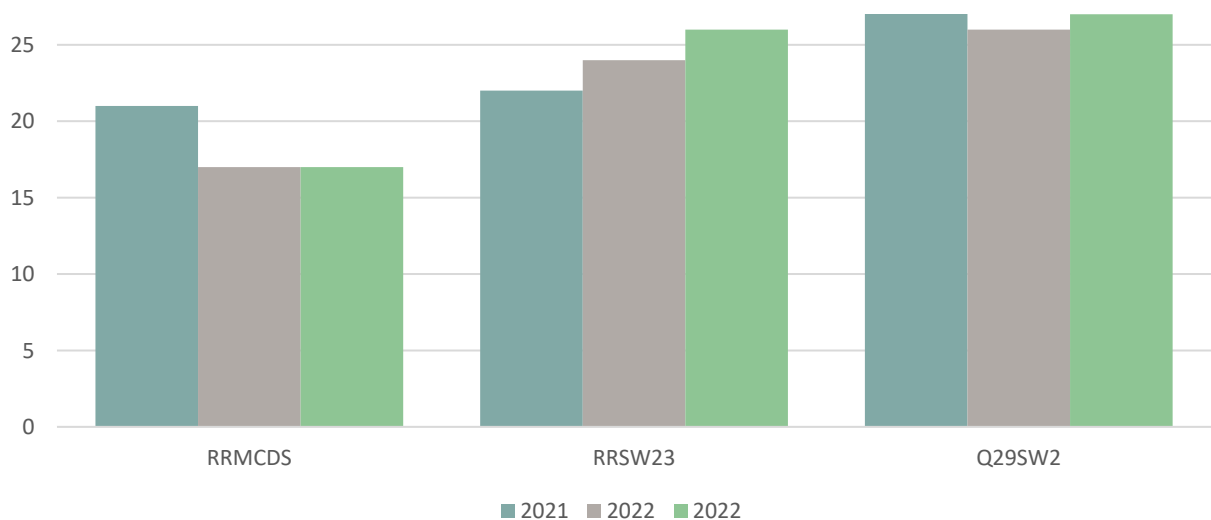


Figure 7 – Taxa richness of samples from 2021 and 2022

4.4.3 PET richness

PET richness results for samples collected in 2022 are presented in Figure 8. There was very little difference between results on Marrakai Creek, and PET results were higher in all samples collected downstream on Mount Bunday Creek.

PET richness was lower in all samples collected in 2022 compared with those collected in 2021 (Figure 9).

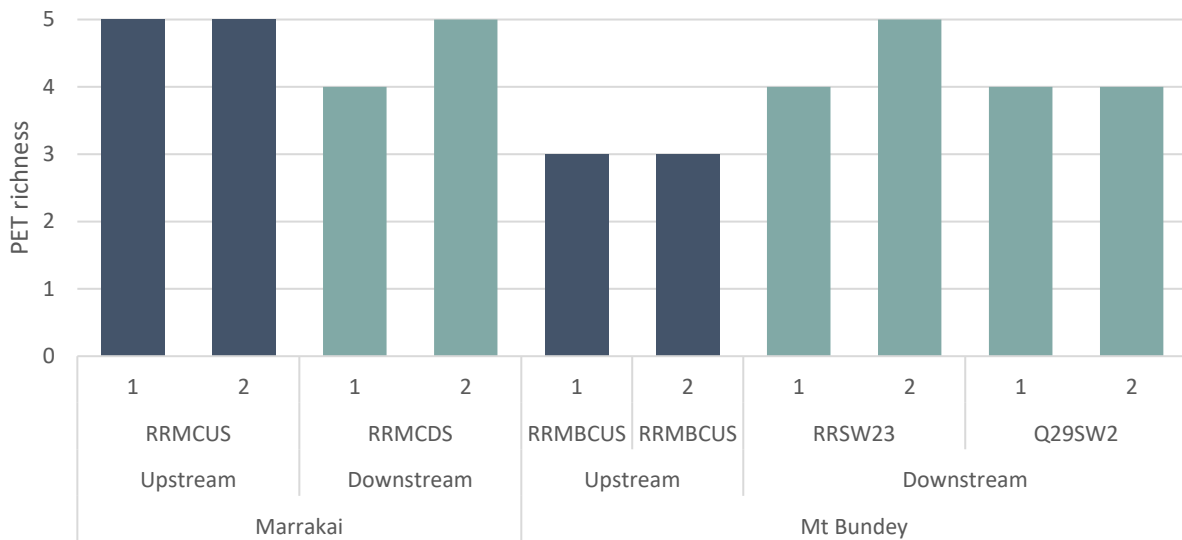


Figure 8 – PET richness from sites at the RRPA sampled in 2022

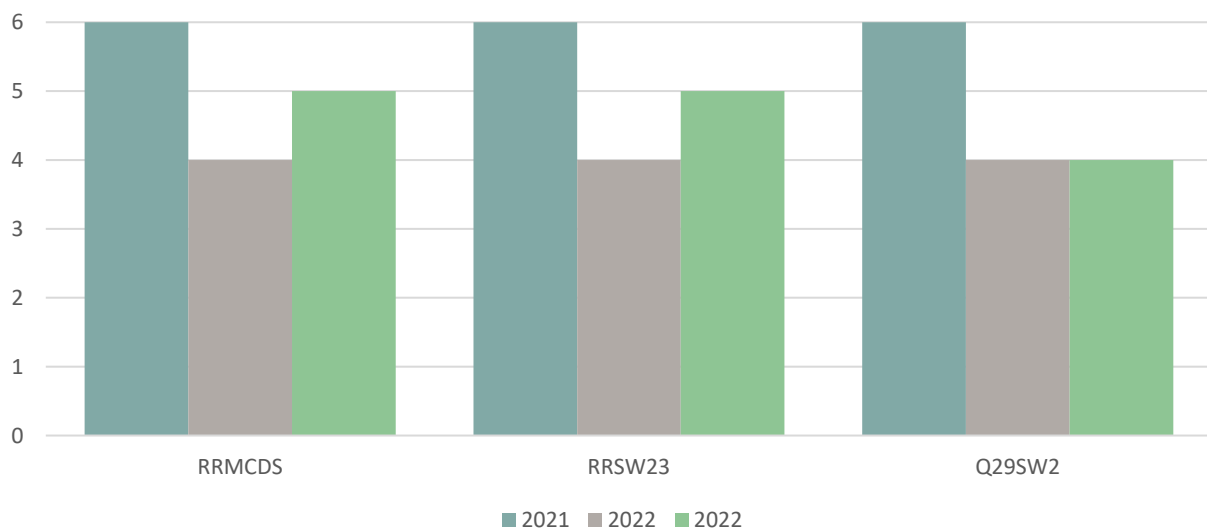


Figure 9 – PET richness results of samples collected in 2021 and 2022

4.4.4 SIGNAL-2

SIGNAL-2 scores calculated for samples collected in 2022 are presented in Figure 12. Results were similar, regardless the site's position relative to the RRPA, but were slightly higher in Marrakai Creek. The proportion of tolerant taxa for each sample followed a similar trend to SIGNAL-2 results (Figure 11), but a slightly lower result for Q29SW2 was observed. Both metrics indicate that the macroinvertebrate community is pollution tolerant, which is expected, given the ephemeral nature of the sampled watercourses.

Results from 2022 are compared to those from 2021 in Figure 12. SIGNAL-2 scores were slightly lower in Mount Bunday Creek in 2022 compared with 2021 results, with the opposite occurring in Marrakai Creek. Higher taxa richness was recorded at RRSW23 in 2022, which may account for the change in SIGNAL-2 score, seeing as it is based on an average of all taxa from the site. The same cannot be said at Q29SW2, but declines at both sites are considered to be modest and not cause for concern.

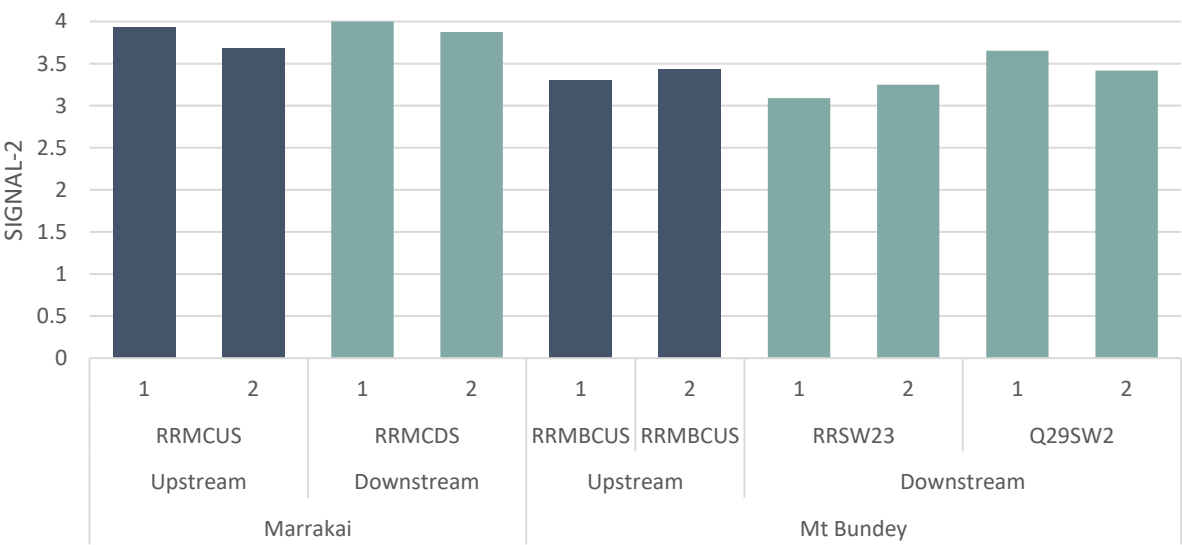


Figure 10 - SIGNAL-2 scores for samples collected at the RPA in 2022

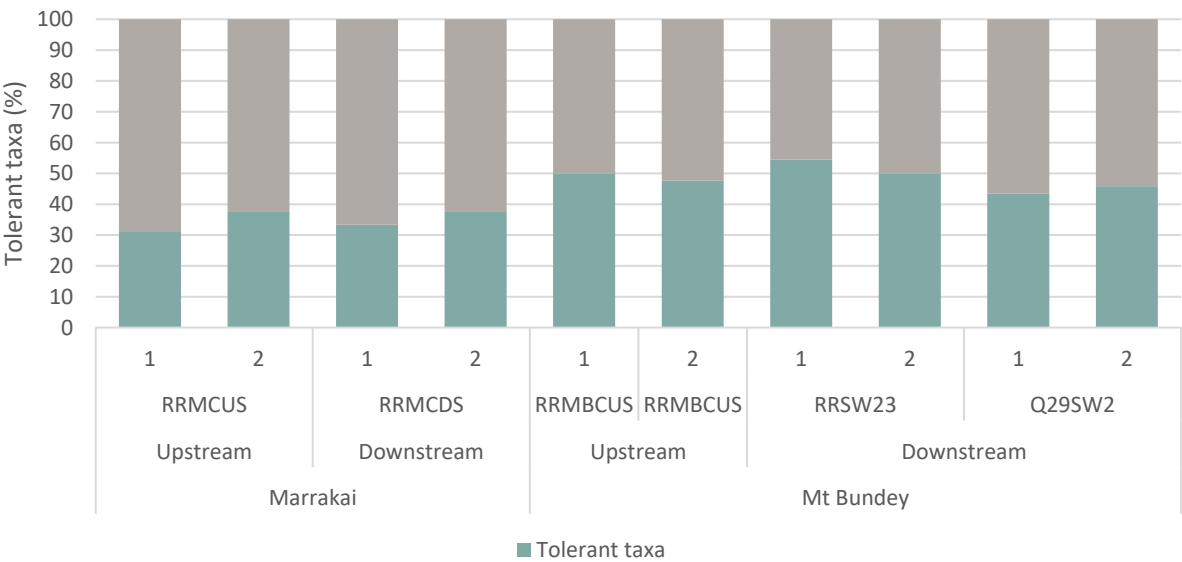


Figure 11 - Percentage of tolerant taxa found at each site

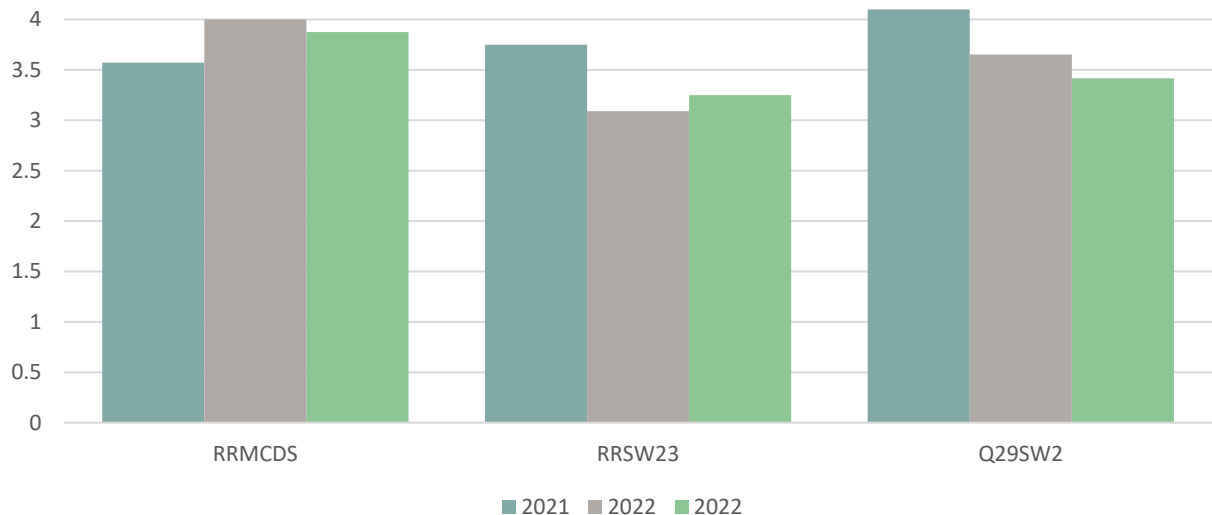


Figure 12 – SIGNAL-2 scores from samples collected in 2021 and 2022

4.4.5 Community composition

The proportion of each macroinvertebrate order in samples is presented in Figure 13. There is an observable difference in community composition between upstream and downstream sites on Marrakai Creek. True flies (Diptera) dominate the community at RRMDUS, but abundance is offset by mayflies (Ephemeroptera), whereas the two orders are more evenly distributed downstream. A higher proportion of true bugs (Hemiptera) were collected directly downstream of the RRPA, with the site upstream and furthest downstream containing similar proportions of most taxa.

The nMDS ordination (Figure 14) demonstrates the difference in community composition between the two catchments, confirming that sampling of a site upstream on the Mount Bunday Creek catchment will allow for a more nuanced assessment of impact that relates directly to each catchment.

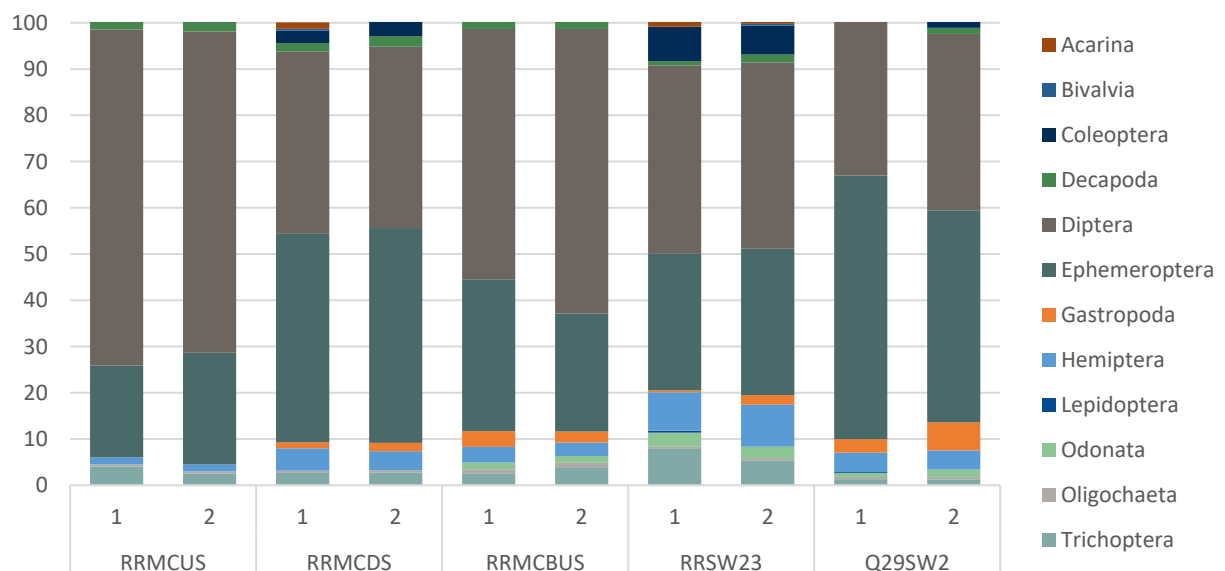


Figure 13 – Proportional abundance of macroinvertebrate orders collected in 2022



Figure 14 - NMDS demonstrating similarities and differences between samples collected in 2022

Variation in the composition of the macroinvertebrate community across Marrakai Creek sites is further demonstrated in Figure 15. The most observable similarity was approximately 10% greater similarity between samples from the same site. When comparing samples collected in 2022 to those collected in 2021 (Figure 16), there is a greater amount of similarity between samples collected in 2022, regardless of the site. The change in the upstream sampling site to more comparable habitat may have improved community composition similarities.

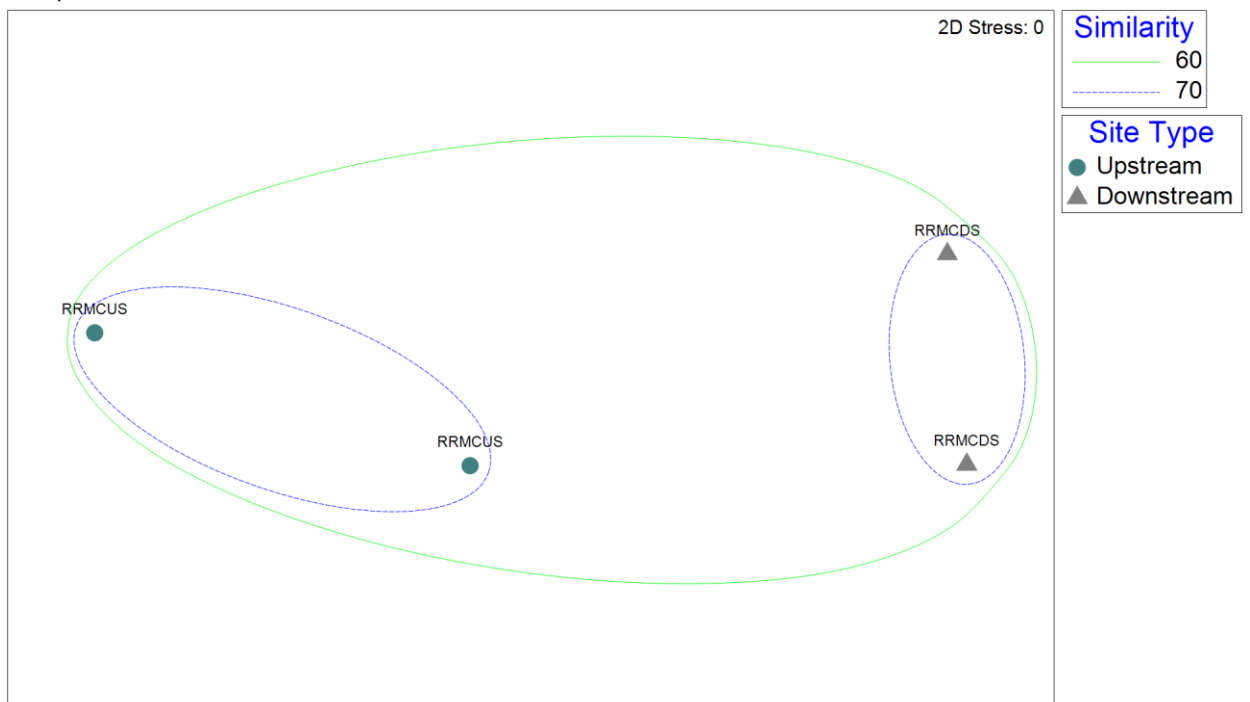


Figure 15 - NMDS plot showing variation in community composition between sites on Marrakai Creek in 2022

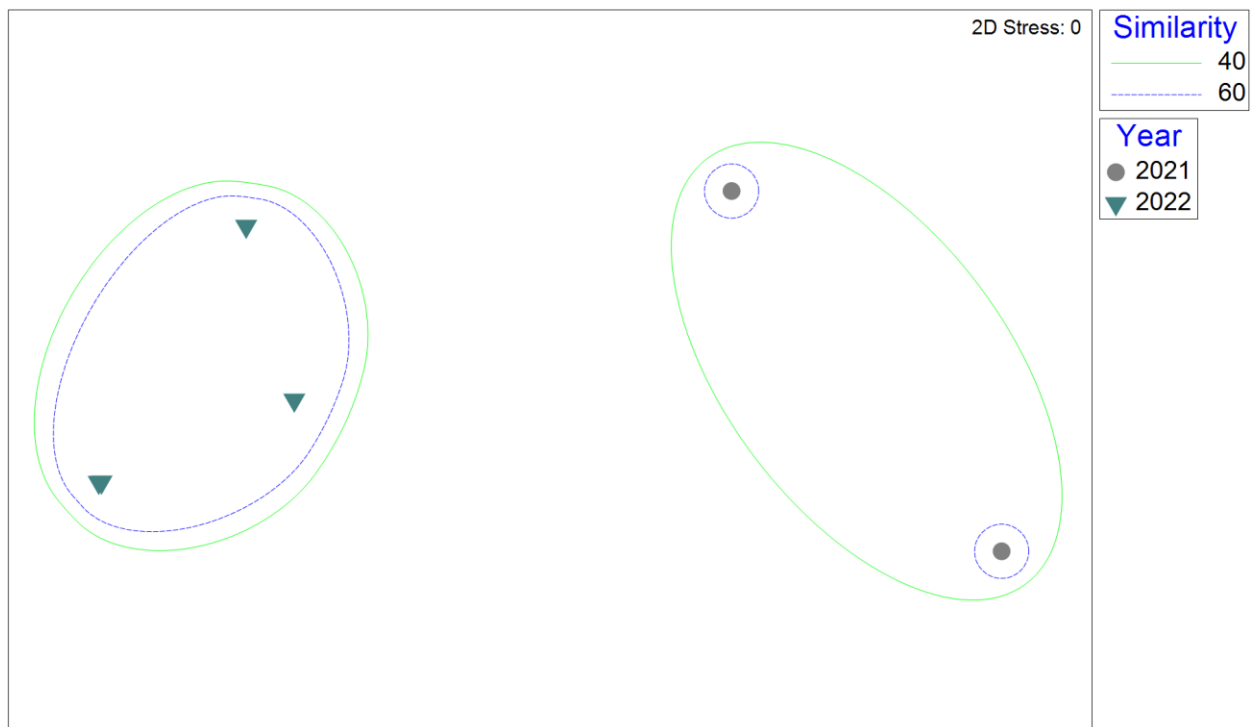


Figure 16 – Community composition differences between samples collected in 2021 and 2022

Community composition similarities at sites on Mount Bunday Creek are further demonstrated in Figure 17. Overall similarity of 60% was found between all samples, with the upstream and furthest downstream site showing the greatest similarities. Differences in habitat availability at RRSW23 is one of the most likely causes of difference between sites. There were stark differences in community composition between 2021 and 2022 (Figure 18), which is likely to be related to the much higher abundances of macroinvertebrates collected at downstream sites in 2022.

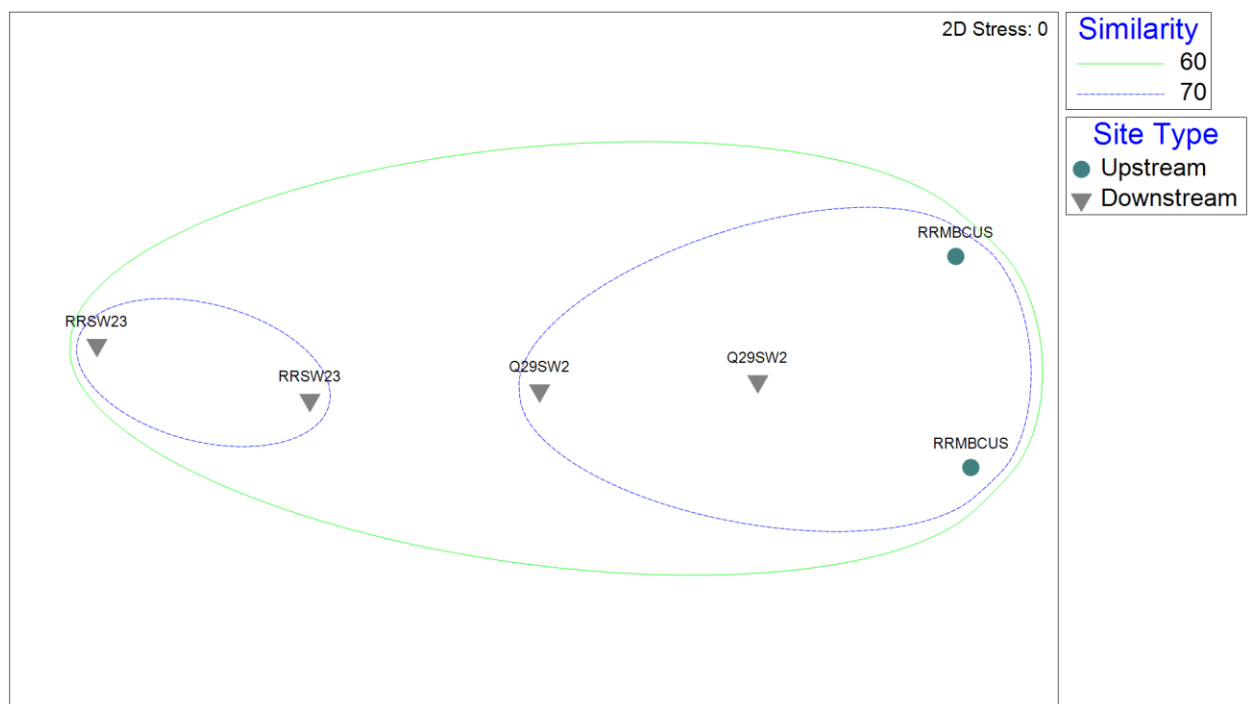


Figure 17 - NMDS plot showing variation in community composition between sites on Mount Bunday Creek in 2022

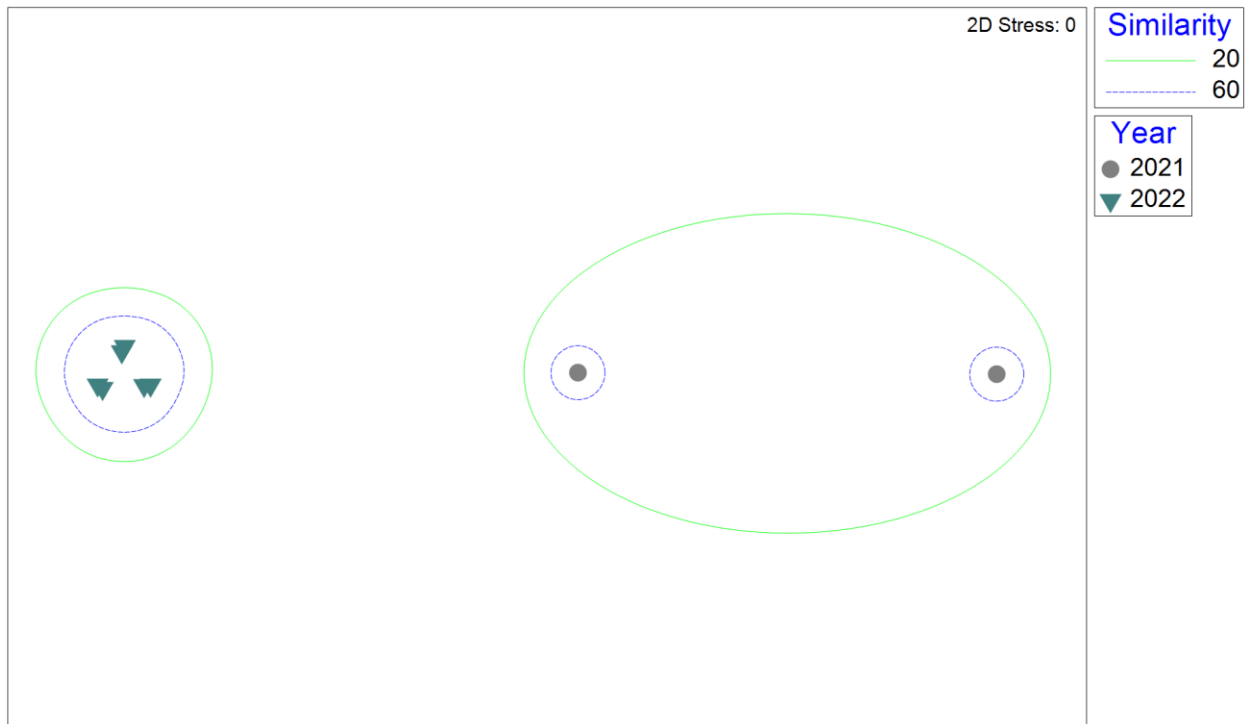


Figure 18 - Community composition differences between samples collected in 2021 and 2022

4.5 Discussion

Biological monitoring conducted at the RRPA in 2022 has demonstrated that the macroinvertebrate community of Marrakai Creek and upper Mount Bunday Creek catchments are tolerant of pollution and highly influenced by habitat availability. Improvements to the sampling design appear to have assisted with comparability of sites on Marrakai Creek, and the addition of an upstream site on Mount Bunday Creek will allow for a more robust assessment of discharge impacts.

Water quality and sediment results from sites on Mount Bunday Creek do not suggest any risk to aquatic ecosystems. Although dissolved oxygen was below the guideline range in Mount Bunday Creek, this was occurring both upstream and downstream of the RRPA and so was considered to be a natural process related to reductions in stream flow in the early dry season.

Macroinvertebrate metrics at sites on Mount Bunday Creek suggest that the community was in slightly poorer condition in 2022 compared with 2021 sampling, prior to discharges. Changes in community composition from 2021 may be attributed to differences in samplers between years and changes to flow as a result of discharges. Future monitoring events should consider a longer period between cease of flow and macroinvertebrate sampling to allow for establishment of the macroinvertebrate community downstream. On the same note, ceasing of discharge could be stepped to allow for gradual change in water levels in the Mount Bunday Creek catchment to mimic natural end of wet season flows.

The differences in the macroinvertebrate community between sites highlights the importance of sampling prior to mining/dewatering activities recommencing at the RRPA, and provides the first year of comparison to baseline conditions. Differences in the macroinvertebrate community from baseline were likely attributed to flow factors around discharge, rather than water quality. Sampler bias may also be a factor, given that

different consultants undertook sampling in 2021 and 2022. Similarity between samples collected in 2022 gives assurance that results and analysis are robust and can be used for future comparison of historical data. Ongoing monitoring of the receiving environment is the most effective tool in adaptive management of the discharge strategy if needed, and it is recommended that monitoring continue in the post-wet season of 2023.

5. References

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Appendix A. Raw Macroinvertebrate Data

Order	Family/ Sub-family	RRMCUS	RRMCUS	RRMCDS	RRMCDS	RRMBCUS	RRMBCUS	RRSW23	RRSW23	Q29SW2	Q29SW2
Replicate		1	2	1	2	1	2	1	2	1	2
Acarina	Acarina	0	10	14	0	5	0	20	10	8	14
Bivalvia	Hyriidae	0	0	7	0	0	6	0	10	0	0
Coleoptera	Dytiscidae	0	0	0	0	0	0	20	10	0	7
Coleoptera	Elmidae	10	0	0	0	0	0	0	0	4	0
Coleoptera	Hydraenidae	0	0	0	7	5	6	20	20	4	14
Coleoptera	Hydrochidae	0	0	7	13	0	0	40	20	0	7
Coleoptera	Hydrophilidae	10	10	29	20	5	6	80	90	4	7
Decapoda	Palaemonidae	40	20	14	13	5	6	0	10	4	7
Decapoda	Parathelphusidae	0	10	7	13	10	13	10	20	8	7
Diptera	Ceratopogonidae	40	30	136	93	45	50	60	80	60	57
Diptera	Chironominae	770	800	129	80	435	619	410	430	392	393
Diptera	Culicidae	20	10	0	0	5	6	110	100	0	7
Diptera	Orthocladiinae	10	10	0	0	5	0	20	10	4	7
Diptera	Tanypodinae	610	550	379	400	65	113	330	350	172	193
Diptera	Tipulidae	0	0	0	0	0	6	0	0	4	7
Ephemeroptera	Baetidae	50	70	114	73	60	88	340	420	24	14
Ephemeroptera	Caenidae	320	400	614	600	275	238	330	340	1068	786
Ephemeroptera	Leptophlebiidae	20	10	7	7	0	0	0	0	0	0
Gastropoda	Ancylidae (Planorbidae)	0	0	14	20	30	31	10	50	56	107
Gastropoda	Planorbidae	0	0	7	7	5	0	0	0	0	0
Hemiptera	Gerridae	0	0	0	0	10	6	0	0	0	0
Hemiptera	Mesoveliidae	0	0	0	0	5	6	0	10	4	0
Hemiptera	Micronectidae (Corixidae)	0	10	71	53	5	0	80	100	56	50

Order	Family/ Sub-family	RRMCUS	RRMCUS	RRMCDS	RRMCDS	RRMBCUS	RRMBCUS	RRSW23	RRSW23	Q29SW2	Q29SW2
Hemiptera	Notonectidae	10	10	0	0	10	13	10	20	8	7
Hemiptera	Pleidae	10	0	0	0	0	6	90	80	4	7
Hemiptera	Veliidae	0	0	0	0	0	0	10	0	4	0
Lepidoptera	Crambidae	0	0	0	0	0	0	20	20	0	7
Odonata	Coenagrionidae	0	0	0	0	0	6	50	40	8	7
Odonata	Corduliidae	0	0	0	0	0	0	0	0	4	7
Odonata	Gomphidae	0	0	0	0	15	13	0	0	4	7
Odonata	Isostictidae	0	0	0	0	5	6	0	0	0	0
Odonata	Libellulidae	20	10	0	0	0	0	10	0	0	0
Oligochaeta	Oligochaeta	50	40	43	33	25	50	160	120	20	14
Trichoptera	Ecnomidae	10	0	0	7	0	0	10	10	4	7
Trichoptera	Hydroptilidae	0	10	0	0	0	0	70	60	0	0
Trichoptera	Leptoceridae	10	20	57	40	5	6	0	10	4	14

Appendix B. Macroinvertebrate QA

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Good science at a fair price