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SURFACE WATER

MONITORING REPORT



TARAGO, NSW SEPTEMBER 2023 SURFACE WATER MONITORING REPORT

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 Project no. **318001376-007 Monitoring Report (September 2023)**
 Recipient **TfNSW**
 Description **This report describes the methodology and results for quarterly surface water monitoring undertaken as part of the Tarago Lead Management Project at Tarago, NSW.**

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ABBREVIATIONS

Measures	Description
ADWG	Australian Drinking Water Guidelines
ALS	Australian Laboratory Services
ANZECC	Australian and New Zealand Environment and Conservation Council
ANZG	Australian and New Zealand Guidelines (for Fresh and Marine Water Quality)
ARMCANZ	Agriculture and Resource Management Council of Australia and New Zealand
COC	Contaminants of Concern
CoPC	Contaminants of Potential Concern
DEC	Department of Environment and Conservation
DO	Dissolved Oxygen
DQI	Data Quality Indicator
EC	Electrical Conductivity
EPA	Environment Protection Authority (NSW)
EnRiskS	Environmental Risk Sciences Pty Ltd
LCS	Laboratory Control Sample
Mercury	Inorganic mercury unless noted otherwise
mg/L	Milligrams per Litre
NATA	National Association of Testing Authorities
NEPC	National Environment Protection Council
NEPM	National Environment Protection Measure
NHMRC	National Health and Medical Research Council
NSW	New South Wales
ORP	Oxidation/Reduction Potential
QA/QC	Quality Assurance/Quality Control
RPD	Relative Percent Difference
Ramboll	Ramboll Australia Pty Ltd
SAQP	Sampling and Analysis Quality Plan
TDS	Total Dissolved Solids
TfNSW	Transport for New South Wales
VMP	Voluntary Management Proposal
-	On tables is "not calculated", "no criteria" or "not applicable"

1. INTRODUCTION

Ramboll Australia Pty Ltd (Ramboll) was engaged by Transport for New South Wales (TfNSW) to complete periodic surface water monitoring downstream of contamination identified with the Goulburn – Bombala rail corridor at Tarago, New South Wales (NSW).

Contamination has been identified along approximately 900 lineal meters of the rail corridor (Ramboll, 2019). This area is herein referred to as “the Site” and is presented with surface water monitoring locations on **Figure 2-1**.

1.1 Background

The Woodlawn Mines Ore Concentrate Load-Out Complex operated within the Goulburn – Bombala rail corridor at Tarago from the 1970s to the 1990s. Concentrates were produced at the Woodlawn Mine approximately 6.5 km west and included a zinc concentrate consisting mainly of sphalerite (zinc oxide), lead concentrate of galena (lead sulphide) and copper concentrate of chalcopyrite (copper iron sulphide).

On 25 March 2020, the NSW Environment Protection Authority (NSW EPA) declared the Site as significantly contaminated under Section 11 of the *Contaminated Land Management Act 1997* (Declaration Number 20201103). TfNSW is currently managing the contamination under a Voluntary Management Proposal (VMP) which includes further assessment of site contamination and remediation to address the potential risks to human health and the environment.

An extensive body of work has been completed to characterise contaminant impacts associated with historical operation of the Site. This work has included assessment of soil, groundwater and surface water across the Site and assessment of soil, groundwater, surface water and airborne dust within the surrounding area. A previous assessment completed by Ramboll (2020) identified contaminants of potential concern (CoPC) relevant to receiving surface waters were limited to metals which exceed relevant human health and ecological assessment criteria.

In 2020, Environmental Risk Sciences Pty Ltd (EnRiskS) were commissioned to undertake a review of the existing data and provide further advice in relation to the risk to human health and the environment due to lead and other metals in areas adjacent to the Site (EnRiskS, 2021). As part of the assessment EnRiskS (2021) developed site specific criteria for metals in soil, sediment, and surface water for the drainage features accessed during surface water monitoring. These site-specific criteria have been adopted for assessment of the surface water results presented in this report.

Periodic monitoring of onsite and offsite surface water commenced in 2019 and ceased in April 2021 following consistent observation that risks to the receiving environment from site contamination were low. On 6 September 2022 the NSW EPA issued a Prevention Notice to TfNSW relating to deficiencies in the implementation of the Tarago Lead Management Plan (Ramboll, 2019). In response, surface water monitoring was reinstated to further assess temporal and geographic trends in contaminant distribution from the Site.

1.2 Objectives

The objectives of the surface water monitoring program are to:

- Collect reliable water quality data, to provide a data continuum which forms the basis for assessment of impacts from the Site on surrounding surface water receptors.
- Use this continuum of data to assess historical trends in surface water quality and present conclusions regarding potential risks to site receptors.

- Present data on rainfall preceding sampling events and as monthly averages and actuals.
- Present data to date on a quarterly basis.

2. SCOPE OF WORK

2.1 Monitoring Scope

The scope of work for each surface water monitoring event includes:







- Collection of surface water samples at 11 predefined locations, as presented in **Table 2-1** and **Figure 2-1** (plus collection of quality assurance samples).
- Measurement of surface water physico-chemical properties including pH, temperature, electrical conductivity (EC), dissolved oxygen (DO), redox potential (ORP) and total dissolved solids (TDS).
- Submission of samples to a National Association of Testing Authorities (NATA) accredited laboratory for analysis of total and dissolved metals (aluminium, cadmium, copper, lead, nickel, and zinc).
- Assessment of laboratory results against adopted assessment criteria, as presented in **Section 5**.
- Assessment of data quality and reliability.

Table 2-1: Surface Water Sampling Locations

Sample ID	Location
On and Near Site	
SW1	Adjacent to a culvert on the western side of the rail line at CH 262.600 on tributary of Mulwaree River.
SW1 - UP	Intended as an up-stream sample, located on a western tributary of the Mulwaree River, approximately 100 m west of the rail corridor at CH. 262.600.
SW2	Adjacent to a culvert on the eastern side of the rail line at CH 262.600 on tributary of Mulwaree River.
SW3	Adjacent to a culvert on the western side of the rail line at CH 262.300.
SW4	Adjacent to a culvert on the eastern side of the rail line at CH 262.300.
SW5	Adjacent to a culvert on the western side of the rail line at CH 262.000.
SW6	Adjacent to a culvert on the eastern side of the rail line at CH 262.000.
SW7	A dam located downgradient from the Site northern rail culvert forming part Lot A DP 440822.
Offsite - Mulwaree River	
SW8	Mulwaree River adjacent Lumley Road.
SW9	Mulwaree River off Braidwood Road.
SW10	Mulwaree River off Braidwood Road.



Legend

-  Surface water sampling location
-  Rail corridor
-  Rail corridor fence
-  Area of lead exceedance (within rail corridor)
-  Indicative surface water flow path (ie: not ephemeral)
-  Indicative ephemeral surface water flow path

A4
1:10,000



Figure 2-1: Surface Water Monitoring Locations

3. SAMPLING AND ANALYSIS QUALITY PLAN

Prior to the commencement of routine surface water monitoring, Ramboll (2020) prepared a Sampling and Analysis Quality Plan titled '*Sampling Analysis and Quality Plan (SAQP) – Surface Water Monitoring, Tarago Lead Management*' herein referred to as the SAQP.

The SAQP was revised in 2023 to refine the Contaminants of Concern (COC) and therefore the analytical requirements for surface water samples moving forward.

The SAQP is attached as **Appendix 1**.

4. QUALITY ASSURANCE / QUALITY CONTROL PROGRAM

4.1 QA/QC Data Evaluation

An assessment was made of data completeness, comparability, representativeness, precision and accuracy based on field and laboratory considerations, as outlined in NEPM 1999 Amendment (2013) guidelines. The DQI assessment for the September 2023 surface water monitoring event is provided in **Table 4-1**.

Overall, it is considered that the completed investigation works and the data obtained adequately complied with the requirements of NEPM 1999 Amendment (2013) guidelines.

Table 4-1: QA/QC –Assessment of DQIs

Assessment of DQIs (as per NSW EPA, 2020)	Ramboll's Assessment	Completeness	Comparability	Representativeness	Precision	Accuracy
Field QA/QC						
Sampling team	Sampling was completed by Ramboll experienced environmental scientists/engineers on 13-14 September 2023.	x	x			
Reference to sampling plan/method, including any deviations from SAQP	Sampling was undertaken in general accordance with the SAQP. SW5 and SW6 could not be sampled as the location was dry. Total dissolved solids (TDS) was not tested for at any monitoring locations.	x				
Any information that could be required to evaluate measurement uncertainty for subsequent testing	Samples were collected from 11 pre-determined locations (unless dry) for consistency between the sampling rounds. Samples were collected from 100 mm below surface, where practical.				x	x
Decontamination procedures carried out between sampling events	Samples were collected directly into laboratory supplied sampling containers using dedicated disposable sampling equipment. Disposable nitrile gloves were worn during sample collection and were changed between sample locations. Field parameters were recorded after analytical samples had been collected. Non disposable sampling equipment (i.e., water quality meter probe) were rinsed between sampling locations with a solution of Decon®90 and potable water.			x	x	x
Logs for each sample collected, including date, time, location (with GPS coordinates if possible), sampler, duplicate samples, chemical analyses to be performed, site observations and weather/environmental (i.e., surroundings) conditions.	Each sample was labelled with a unique sample ID, as presented in Table 2-1 . With the exception of TDS, all required surface water physico-chemical parameters including pH, temperature, EC, DO and ORP were measured and recorded for each of the sampling locations using a calibrated multi-parameter water quality meter. TDS measurements were not collected as the water quality meter used did not have a TDS sensor attached and was not requested for analysis on the Chain of Custody. Although a useful indicator of water quality, TDS is not required to assess contamination in surface water and therefore should not impact the overall data quality and decision making. Measurements of field parameters were recorded once parameters had stabilised. Field sheets are presented in Appendix 2 .		x	x		
Chain of custody fully identifying – for each sample – the sampler, nature of the sample, collection date, analyses to be performed, sample preservation method, departure time from the site and dispatch courier(s)	Samples were transported to the laboratory under chain of custody conditions. The chain of custody forms were signed by the laboratory on receipt of the samples. All surface water samples were placed into laboratory-supplied bottles that were prepared with the required preservatives. Surface water samples were stored in an ice filled cooler in the field and during transportation to the laboratory.	x	x			

Assessment of DQIs (as per NSW EPA, 2020)	Ramboll's Assessment	Completeness	Comparability	Representativeness	Precision	Accuracy
Field quality assurance/quality control results (e.g., field blank, rinsate blank, trip blank, laboratory prepared trip spike)	<p>Intra- and inter-laboratory duplicate results are presented in Table 13, Appendix 3.</p> <p>No trip spike/blanks were collected due to the targeted contaminants of the investigation not being volatile.</p> <p>No Relative Percent Differences (RPDs) exceeded the RPD criteria (<30%). However, two of the metal/metalloids requested for analysis at the primary laboratory (aluminium and cobalt) were not analysed at the secondary laboratory and therefore were unable to be included in the inter-laboratory duplicate assessment. Ramboll notes that the intra-laboratory duplicate results for these metals/metalloids were within an acceptable range.</p>				x	x
Sample splitting techniques – subsampling, containers/preservation	The external duplicate samples were obtained by first gathering a larger volume of water and then decanting to create three identical sub samples. Field duplicate samples were labelled with a unique identification that does not reveal the association between the primary and duplicate samples (QC100_140923 and QC200_140923).			x		X
Statement of duplicate frequency	Intra- and inter- laboratory duplicate samples were analysed at a rate of 9.1% (one intra- and inter-laboratory duplicate and 11 primary samples). Ramboll considers this duplicate frequency acceptable for meeting the requirements of the SAQP.			x	x	
Field instrument calibrations	The water quality meter was hired from a rental company who calibrated the equipment prior to hire. The calibration certificate is included in Appendix 4 .				x	x
Sampling devices and equipment	The calibrated water quality meter was used to collect field data, including pH, temperature, EC, DO and OP. These parameters were recorded once stabilised. However, TDS was not recorded at any of the required sampling locations.	x	x			
Laboratory QA/QC						
A copy of signed chain-of-custody forms acknowledging receipt date, time and temperature and identity of samples included in shipments	Copy of the signed chain of Custody forms are provided in Appendix 5 .	x	x			

Assessment of DQIs (as per NSW EPA, 2020)	Ramboll's Assessment	Completeness	Comparability	Representativeness	Precision	Accuracy
Record of holding times and a comparison with method specifications	Review of the Chain of Custody forms and laboratory certificates indicated that holding times were met.	x	x			
Analytical methods used, including any deviations	Summary analytical methods were included in the laboratory test certificates presented in Appendix 5 .	x	x			
Laboratory accreditation for analytical methods used, also noting any methods used which are not covered by accreditation	Eurofins MGT was used as the primary laboratory and ALS was used as the secondary laboratory. The laboratory certificates are NATA stamped.	x			x	
Laboratory performance for the analytical method using inter-laboratory duplicates	Analytical methods were comparable between laboratories.		x			x
Surrogates and spikes used throughout the full method process, or only in parts. Results are corrected for the recovery	<p><u>Primary laboratory (Eurofins)</u></p> <p>Matrix spike samples were completed at appropriate frequencies with results within acceptable limits except for dissolved aluminium, dissolved cadmium, dissolved cobalt, dissolved copper, dissolved nickel and dissolved zinc which were not included in the test.</p> <p>No results were corrected as all laboratory QA/C results were within acceptable limits.</p> <p>Surrogate tests were not completed.</p> <p><u>Secondary laboratory (ALS)</u></p> <p>Matrix spikes were completed at appropriate frequencies with results within acceptable limits.</p> <p>No results were corrected as all laboratory QA/C results were within acceptable limits.</p> <p>Surrogate tests were not completed.</p>	x	x			
A list of what spikes and surrogates were run with their recoveries and acceptance criteria	Laboratory spike recoveries are detailed in the laboratory certificates provided in Appendix 5 . No surrogates were completed.		x			x
Practical quantification limits (PQL)	All PQLs were below the adopted assessment criteria.	x	x			

Assessment of DQIs (as per NSW EPA, 2020)	Ramboll's Assessment	Completeness	Comparability	Representativeness	Precision	Accuracy
Reference laboratory control sample (LCS) and check results	<p><u>Primary laboratory (Eurofins)</u></p> <p>Laboratory control samples were completed at appropriate frequencies with results within acceptable limits except for dissolved aluminium, total chromium, dissolved cobalt which were not included in the test.</p> <p><u>Secondary laboratory (ALS)</u></p> <p>Laboratory control samples were completed at appropriate frequencies with results within acceptable limits. However, total and dissolved aluminium and total and dissolved cobalt were not included as analytes in the laboratory control sampling.</p>	x				
Laboratory frequencies	Laboratory quality control samples including duplicates and blanks were undertaken by the laboratories at appropriate frequencies.	x				x
Laboratory results	<p><u>Primary laboratory (Eurofins)</u></p> <p>Method blanks were completed at appropriate frequencies with results within acceptable limits except for dissolved aluminium, total chromium, dissolved cobalt which were not included in the test.</p> <p>Laboratory control samples were completed at appropriate frequencies with results within acceptable limits except for dissolved aluminium, total chromium, dissolved cobalt which were not included in the test.</p> <p>Matrix spike samples were completed at appropriate frequencies with results within acceptable limits except for dissolved aluminium, dissolved cadmium, dissolved cobalt, dissolved copper, dissolved nickel and dissolved zinc which were not included in the test.</p> <p>Laboratory duplicate samples were completed at appropriate frequencies with results within acceptable limits except for dissolved aluminium, total and dissolved arsenic, dissolved cadmium, dissolved cobalt, total and dissolved copper, total and dissolved lead, dissolved nickel and total zinc.</p> <p>No results were corrected as all laboratory QA/C results were within acceptable limits.</p> <p><u>Secondary laboratory (ALS)</u></p>	x				x

Assessment of DQIs (as per NSW EPA, 2020)	Ramboll's Assessment	Completeness	Comparability	Representativeness	Precision	Accuracy
	<p>The following laboratory QA/C sampling was completed on all analytes except for total and dissolved aluminium and total and dissolved cobalt due to an error in communicating analytical requirements to the secondary laboratory:</p> <p>Laboratory duplicates, laboratory control samples and matrix spikes were completed at appropriate frequencies with results within acceptable limits.</p> <p>No results were corrected as all laboratory QA/C results were within acceptable limits.</p>					

5. ASSESSMENT CRITERIA

The criteria adopted for the assessment of surface water contamination are sourced from the following references:

- National Environment Protection Council (NEPC), *National Environment Protection (Assessment of Site Contamination) Measure (NEPM) 1999, as amended 2013* (NEPC, 2013).
- National Health and Medical Research Council (NHMRC) (2001) *National Resource Management Ministerial Council (NRMMC) Australian Drinking Water Guidelines 6, Version 3.6 updated March 2021* (ADWG, 2011).
- National Health and Medical Research Council (NHMRC), *National Resource Management Ministerial Council (NRMMC) Guidelines for Managing Risks in Recreational Water* (NHMRC, 2008).
- Department of Environment and Conservation (DEC) *Guidelines for the Assessment and Management of Groundwater Contamination* (DEC, 2007).
- *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZG, 2018) (available at www.waterquality.gov.au/anz-guidelines).
- Australian and New Zealand Environment and Conservation Council (ANZECC) & Agriculture and Resource Management Council of Australia and New Zealand (ARMCANZ) *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZECC, 2000).
- *Advice on risks to human health and the environment: Boyd Street and publicly accessible areas, Tarago NSW, Site specific criteria – Protection of human health and terrestrial and/or aquatic ecosystems* (EnRiskS, 2021).

5.1 Rationale for Application of Guidelines

The relevance of guidelines was determined based on iterative screening from the broadest and most sensitive water usage scenario which occurs in the Mulwaree River back through agricultural land and public roads to the least sensitive scenario which occurs at the Site.

All results from Mulwaree River samples (SW8 to SW10) have been screened against Tier 1 / screening guidelines relevant to human health (incidental ingestion), freshwater ecology, irrigation and stock watering as each of these receptors occur within the receiving waters (the Mulwaree River). Should results exceed screening guidelines and indicate site contamination as the source, it would be appropriate to apply the guidelines that were exceeded to sampling locations upstream as this would inform further assessment of the Site as the potential source. Previous monitoring results do not indicate site contamination is adversely affecting the Mulwaree River. Ecological site-specific guidelines were developed for arsenic, cadmium, lead, manganese and nickel (EnRiskS, 2021) that integrate the ephemeral nature of surface water features between the Mulwaree River and the Site. Additionally, several technical refinements were identified and are relevant to guideline application. These were:

- ADWG (2011) Section 6.3.1 states that guideline values refer to the total amount of the substance present, regardless of its form (e.g., in solution or attached to suspended matter) and so analytical results from unfiltered samples should be assessed against human health criteria. The primary human health risk from contaminants in surface water from the Site is via recreational use. NHMRC (2008) suggests that 10-times the ADWG values may provide a conservative estimate of acceptable recreational exposure guidelines values. This approach was applied to derive recreational exposure criteria.
- ANZG (2018) guidelines for metals in freshwater are adopted from the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC, 2000) which states the major toxic effect of metals comes from the dissolved fraction, so it is valid to filter

samples (e.g., to 0.45 µm) and compare the filtered concentration against the trigger values.

- Water hardness is identified as a physical parameter with quantifiable effects. Correction factors are defined in the guidelines to address the effect of water hardness on the bioavailability of cadmium, chromium (III), lead, nickel and zinc.

To define appropriate hardness correction factors, surface water samples during the current monitoring round were analysed for Hardness (as CaCO₃) and compared to the hardness categories defined in Table 3.4.4 of the *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZECC, 2000). CaCO₃ reported 'soft' concentrations around the middle and northern culverts (SW3 – SW5) and 'moderate' in the dam downstream of the northern culvert (SW7). Sample locations upstream of the site, around the southern culvert and in the receiving Mulwaree River (SW1, SW1_UP, SW2, SW8, SW9 and SW10) reported 'extremely hard' concentrations (310 – 410 mg/L). Application of the hardness correction factors for each sample location and corrected guideline values are outlined in **Table 5-1**.

Table 5-1: Hardness Corrections for Tier 1 Freshwater Ecology Guidelines

Locations	Water Hardness as CaCO ₃ (mg/l)	Metals	Original guideline value (mg/L)	Hardness Correction Factor	Corrected guideline value (mg/L)
SW1, SW1_UP, SW2, SW8, SW9, SW10	310 - 410 (Extremely hard)	Cadmium	0.0002	10	0.002
		Chromium	0.001	8.4	0.0084
		Lead	0.0034	26.7	0.091
		Nickel	0.011	9.0	0.099
		Zinc	0.008	9.0	0.072
SW3	39 - 55 (Soft)	Cadmium	0.0002	TV	0.0002
		Chromium	0.001	TV	0.001
		Lead	0.0034	TV	0.0034
		Nickel	0.011	TV	0.011
		Zinc	0.008	TV	0.008
SW4 ¹ and SW7	110 (Moderate)	Cadmium	0.0002	2.7	0.00054
		Chromium	0.001	2.5	0.0025
		Lead	0.0034	4	0.0136
		Nickel	0.011	2.5	0.0275
		Zinc	0.008	2.5	0.02

TV – trigger values from ANZECC Freshwater Ecological guidelines to be used.

Analysis for hardness was not undertaken at and SW5 and SW6 as it was dry at the time of sampling.

¹ SW4 sample measured water hardness in the moderate hardness range during September 2023 monitoring round. However, all previous measured hardness has been within the soft range. September 2023 samples are compared against criteria adjusted for moderate hardness.

Application of guidelines at each sampling point is summarised in **Table 5.2**.

Table 5-2: Guidelines Applied to Sampling Points

Sampling Point	Location	Human Health - Site Specific ¹	Ecology - Site Specific ¹	Human Health - Recreational Screening ²	Ecology - Screening ³	Irrigation - Screening ³	Stock Water - Screening ³
SW1-UP	Upstream of Southern Culvert (offsite)	✓	✓	-	-	-	-
SW1	Upstream of Southern Culvert	✓	✓	-	-	-	-
SW2	Downstream of Southern Culvert	✓	✓	-	-	-	-
SW3	Upstream of Middle Culvert	✓	✓	-	-	-	-
SW4	Downstream of Middle Culvert	✓	✓	-	-	-	-
SW5	Upstream of Northern Culvert	✓	✓	-	-	-	-
SW6	Downstream of Northern Culvert	✓	✓	-	-	-	-
SW7	Dam on farm downstream of Northern Culvert (offsite)	✓	✓	✓	✓	✓	✓
SW8	Mulwaree River upstream of Middle and Northern Culvert Discharge	-	-	✓	✓	✓	✓
SW9	Mulwaree River upstream of Southern Culvert Discharge	-	-	✓	✓	✓	✓
SW10	Mulwaree River downstream of Middle and Northern Culvert Discharge	-	-	✓	✓	✓	✓

¹ EnRiskS (2021) site specific criteria for human health and protection of terrestrial and/or aquatic ecosystem applicable to SW1_UP, SW1 – SW7

² ANZG (2018)

³ ANZECC (2000)

Assessment criteria adopted under each guideline are presented in **Table 5-3**.

Table 5-3: Guideline Criteria (mg/L)

Contaminant	Human Health - Site Specific Criteria	Human Health - Recreation Criteria	Ecology - Site Specific Criteria	95% Fresh water (ANZG 2018)	STV in irrigation water	Stock Water - Screening
Total Metals						
Aluminium	-	2 ^a	NA	NA	NA	NA
Arsenic	7	0.1	NA	NA	NA	NA
Barium	-	2	NA	NA	NA	NA
Beryllium	-	0.6	NA	NA	NA	NA
Cadmium	1.4	0.002	NA	NA	NA	NA
Chromium	-	0.5	NA	NA	NA	NA
Cobalt	-	-	NA	NA	NA	NA
Copper	-	20	NA	NA	NA	NA
Iron	-	3	NA	NA	NA	NA
Lead	7	0.1	NA	NA	NA	NA
Manganese	350	5	NA	NA	NA	NA
Mercury	-	0.01	NA	NA	NA	NA
Nickel	14	0.2	NA	NA	NA	NA
Zinc	-	30 ^g	NA	NA	NA	NA
Dissolved Metals						
Aluminium	NA	NA	5	0.055 ^b	20	5
Arsenic	NA	NA	0.5	0.024 ^c	2	0.5-5
Barium	NA	NA	-	-	-	-
Beryllium	NA	NA	-	0.00013	0.5	-
Cadmium	NA	NA	0.01	#	0.05	0.01
Chromium ^d	NA	NA	-	#	1	1
Cobalt	NA	NA	-	0.0014	0.1	1
Copper	NA	NA	0.4	0.0014	5	0.4-5
Iron	NA	NA	-	0.3	10	not sufficiently toxic
Lead	NA	NA	0.1	#	5	0.1
Manganese	NA	NA	-	1.9	10	not sufficiently toxic
Mercury	NA	NA	-	0.00006 ^{e, f}	0.002	0.002
Nickel	NA	NA	1	#	2	1
Zinc	NA	NA	20	#	5	20

NA – not applicable

blank cell denoted with – indicates no criterion available.

- Hardness correction factor applied to the threshold value as detailed in ANZG 2018. See **Table 5-1** for more specific location guideline values.

^a Aluminium calculated using the ADWG (2011) aesthetic guideline based on post-flocculation problems. Insufficient data to set a guideline value based on health considerations

^b Aluminium guideline for pH > 6.5 was based on the average pH being above pH 6.5 at each surface water location.

^c Guideline value for arsenic (III).

^d Guideline value for chromium (VI).

^e Guideline value for inorganic mercury.

^f 99% species protection level DGV has been adopted to account for the bioaccumulating nature of this contaminant.

^g Zinc calculated using the ADWG (2011) aesthetic guideline. Insufficient data to set a guideline value based on health considerations

STV - The short-term trigger value (STV) is the maximum concentration (mg/L) of contaminant in the irrigation water which can be tolerated for a shorter period of time (20 years) assuming the same maximum annual irrigation loading to soil as for LTV.

6. RESULTS

6.1 Monitoring Events

Thirteen monitoring events have been completed between August 2019 and September 2023. Surface water monitoring events were completed after a period of rainfall (where possible) as this is the only occasion where surface water is present in the drainage channels.

Table 6-1 includes information on rainfall conditions preceding each monitoring event. The table includes comparison of the rainfall over the 48-hour period preceding the sampling event to the design rainfall events for the Mulwaree catchment (Wollondilly and Mulwaree Rivers Flood Study WMA Water 2016) in order to provide an indication of the significance of the rainfall event. Average monthly rainfall data compared to actual monthly rainfall data is also included to indicate the general climate conditions in the month of sampling.

Table 6-1: Indicative Summary of Rainfall Preceding Sampling Events

Event	Max Rainfall over 48hr Critical Duration (mm)	Rainfall in 48 hrs preceding monitoring events (mm)												
		13-Aug-19	24-Sep-19	29-Jan-20	1-Apr-20	11-Aug-20	13-Oct-20	28-Jan-21	14-Apr-21	13-Jul-21	12-Sep-22	12-Dec-22	16-June-23	13/14-Sep-23
>10% AEP	< 126	0	0	0	0	-	0	0	0	0	7.2	0	3.0	0.2
10% AEP	126	-	-	-	-	-	-	-	-	-	-	-	-	-
5% AEP	147	-	-	-	-	-	-	-	-	-	-	-	-	-
2% AEP	175	-	-	-	-	163	-	-	-	-	-	-	-	-
1% AEP	197	-	-	-	-	-	-	-	-	-	-	-	-	-
Monthly Rainfall Observed (mm)		19	41.2	22	79.2*	157.8	94.4	64	2.4	26	66.6	45.6	29.2	12.0
Average Monthly Rainfall (mm) ¹		42.9	44	49	40.4*	42.9	44	63.9	25.9	32.6	44.1	56.4	55.5	44.9
Comment		Dry month, dry conditions precedent	Average rainfall month, dry conditions precedent	Dry month, dry conditions precedent	Wet month, dry conditions precedent	Wet month, high rainfall event precedent	Wet month, dry conditions precedent	Average rainfall month, dry conditions precedent	Dry month, dry conditions precedent	Average rainfall moth, dry conditions precedent	Wet month, low rainfall event precedent	Average rainfall, dry conditions precedent	Average rainfall, dry conditions precedent	Below average rainfall, dry conditions precedent

Notes: All rainfall data was sourced from the Australian Bureau of Meteorology. Daily rainfall was sourced from the closest weather station with rainfall records preceding each monitoring event (Lake Bathurst, Windellama and Goulburn Airport). Monthly averages and records were sourced from the closest weather station with a complete record (Goulburn Airport).

¹ Monthly average rainfall calculated from monthly data between 1994 and current year.

*Monthly observations and averages are for rainfall in the calendar month in which each monitoring event occurred except for the 1 April 2020 event for which March data is presented. Based on this the monthly data is not a direct representation of rainfall preceding monitoring though is considered as an indicator of general conditions around each monitoring event.

AEP – Annual Exceedance Probability

6.2 Physico-Chemical Results

Surface water physico-chemical parameters were measured in the field during most sampling rounds and are summarised in **Table 6-2**. The full physico-chemical parameter dataset for all data to date is provided as **Table 1** of **Appendix 3**.

Table 6-2: Summary of Surface Water Physico-Chemical Parameters

Sample ID	Records		Temp	SPC	pH	DO	ORP	TDS	Comments from 14 September 2023
			°C	µS/cm	pH units	mg/L	mV	mg/L	
Onsite									
SW1	8	Minimum	7.8	206.1	6.35	0.04	23.6	133.9	Clear
		Maximum	17.4	733	7.77	11	175.8	434	
		Average	11.7	581.3	7.4	5.6	122.8	335.7	
SW1-UP	8	Minimum	8	205.6	7.05	0.1	-41.4	133.3	No flow, slow seepage, clear
		Maximum	19.94	704	7.8	10.86	186.9	431	
		Average	12.8	575.5	7.5	5.7	121.1	337.0	
SW2	9	Minimum	7.3	213.3	6.54	0.12	48.3	137.8	Not flowing
		Maximum	17.54	677	8.27	10.59	185.9	416	
		Average	11.7	550.9	7.8	5.7	139.5	320.9	
SW3	7	Minimum	8.54	142.5	6	4.7	64.8	92.3	Clear, still
		Maximum	21.75	245	7.96	9.43	196.1	159	
		Average	11.9	209.6	6.9	6.5	156.6	130.1	
SW4	10	Minimum	7.4	128.2	5.75	1.12	70	99.45	Still, clear
		Maximum	20.33	388.3	8.8	10.42	263.1	251.8	
		Average	12.1	227.4	7.3	6.0	173.8	167.1	
SW5	4	Minimum	8.71	117.9	6.45	4.06	-3	76.7	Not sampled
		Maximum	11.95	251.2	8.35	9.33	191	121	
		Average	10.9	187.0	7.2	7.5	106.5	98.9	
SW6	4	Minimum	8.3	168.3	6.53	4.5	111	109.2	Not sampled
		Maximum	17.6	201.2	9.07	9.73	205.8	117	
		Average	11.7	180.8	7.6	7.4	170.0	113.1	
Offsite									
SW7	9	Minimum	7.38	94.7	6.34	1.8	56	61.8	Turbid, hard to filter
		Maximum	23.1	2342	8.92	8.76	168	396.6	
		Average	15.5	445.5	7.3	5.6	110.7	155.4	
SW8	9	Minimum	8.4	170.5	7.0	3.1	84.0	107.9	---
		Maximum	23.6	1007.0	8.5	9.3	136.1	656.5	
		Average	15.7	699.6	7.5	6.3	117.5	415.8	
SW9	9	Minimum	7.7	125.3	7.2	0.3	83.0	115.7	Clear
		Maximum	25.0	1030.0	8.4	16.8	227.7	812.5	

Sample ID	Records		Temp	SPC	pH	DO	ORP	TDS	Comments from 14 September 2023
			°C	µS/cm	pH units	mg/L	mV	mg/L	
		Average	15.6	610.3	7.7	8.5	138.4	452.6	
		Minimum	7.9	682.0	7.2	3.6	3.8	454.4	
SW10	6	Maximum	20.3	978.0	7.6	8.2	148.7	564.0	Clear
		Average	14.1	779.7	7.4	5.7	94.7	491.5	

¹ TDS was not measured during the September 2023 monitoring event due to the water meter not having a TDS sensor attached.

6.3 Analytical Results

A summary of the surface water analytical results for monitoring events from August 2019 to September 2023 is presented in **Table 6-3** for on and near site locations and **Table 6-4** for the Mulwaree River sampling locations, respectively. The corresponding results tables are presented in **Tables 2** through **12** of **Appendix 3**.

Historically, barium, beryllium, manganese and mercury were included in the surface water assessments. However, as these metals are not considered Contaminants of Concern, they have been excluded from this round of monitoring.

Table 6-3: Summary of Onsite and Near Site Surface Water Analytical Results (SW1_UP, SW1, SW2, SW3, SW4, SW5, SW6, SW7) – Cumulative Since August 2019

Analyte	No. of Samples (Cumulative)	No. of Detects	Minimum (mg/L)	Maximum (mg/L)	Average (mg/L)	No. above site-specific criteria		No. above Tier 1 Criteria						
						Human Health	Ecology	Irrigation - screening ¹	Stock water - screening ¹	Health-based Screening Criteria (Recreational Waters)	ANZG 95% Protection Fresh Water (CaCO3 - extremely hard)	ANZG 95% Protection Fresh Water (CaCO3 - soft)	ANZG 95% Protection Fresh Water (CaCO3 - moderate)	ANZG 95% Protection Fresh Water (contaminants without hardness adjustments)
Total Metals														
Aluminium	70	50	<0.05	11	0.6	-	-	-	-	3	-	-	-	-
Arsenic	71	39	<0.001	0.016	0.002	0	-	-	-	0	-	-	-	-
Cadmium	71	42	<0.0002	0.04	0.003	0	-	-	-	18	-	-	-	-
Chromium	70	37	<0.001	0.011	0.001	-	-	-	-	0	-	-	-	-
Cobalt	71	29	<0.001	0.018	0.002	-	-	-	-	-	-	-	-	-
Copper	71	60	<0.001	0.31	0.03	-	-	-	-	0	-	-	-	-
Iron	70	69	<0.05	9.5	1.6	-	-	-	-	12	-	-	-	-
Lead	76	59	<0.001	0.17	0.02	0	-	-	-	2	-	-	-	-
Nickel	71	51	<0.001	0.451	0.014	0	-	-	-	1	-	-	-	-
Zinc	71	65	<0.005	7	0.52	-	-	-	-	0	-	-	-	-
Dissolved Metals														
Aluminium	68	39	<0.05	3.6	0.4	-	0	0	0	-	-	-	-	37
Arsenic	69	33	<0.001	0.011	0.001	-	0	0	0	-	-	-	-	0
Cadmium	69	34	<0.0002	0.02	0.002	-	3	0	0	-	0	21	5	-
Chromium	68	16	<0.001	0.003	0.0008	-	-	0	0	-	0	2	3	-
Cobalt	69	19	<0.001	0.005	0.001	-	-	0	0	-	-	-	-	11
Copper	69	50	<0.001	0.2	0.03	-	0	0	0	-	-	-	-	47
Iron	68	49	<0.05	4.2	0.7	-	-	-	-	-	-	-	-	36
Lead	69	43	<0.001	0.033	0.006	-	0	0	0	-	0	19	1	-
Nickel	69	42	<0.001	0.421	0.01	-	0	0	0	-	0	5	1	-
Zinc	69	55	<0.005	4.1	0.3	-	0	0	0	-	3	23	5	-

¹ Applicable to SW7 only

CaCO3 Extremely Hard Category, refer to **Table 5-1**– includes sampling locations SW1, SW_UP and SW2.

CaCO3 Soft Category, refer to **Table 5-1**– includes sampling locations SW3-SW5.

CaCO3 Moderate Category, refer to **Table 5-1**– includes sampling locations SW6-SW7.

Table 6-4: Summary of Onsite and Near Site Surface Water Analytical Results (SW1_UP, SW1, SW2, SW3, SW4, SW5, SW6, SW7) – September 2023 Round

Analyte	No. of Samples (Cumulative)	No. of Detects	Minimum (mg/L)	Maximum (mg/L)	Average (mg/L)	No. above site-specific criteria ²		No. above Tier 1 Criteria						
						Human Health	Ecology	Irrigation - screening ¹	Stock water - screening ¹	Health-based Screening Criteria (Recreational Waters)	ANZG 95% Protection Fresh Water (CaCO3 - extremely hard)	ANZG 95% Protection Fresh Water (CaCO3 -soft)	ANZG 95% Protection Fresh Water (CaCO3 – moderate)	ANZG 95% Protection Fresh Water (contaminants without hardness adjustment)
Total Metals														
Aluminium	6	6	0.05	0.73	0.32	-	-	-	-	0	-	-	-	-
Arsenic	6	3	<0.001	0.005	0.002	0	-	-	-	-	-	-	-	-
Cadmium	6	4	<0.0002	0.022	0.004	0	-	-	-	-	-	-	-	-
Chromium	6	3	<0.001	0.001	0.001	-	-	-	-	0	-	-	-	-
Cobalt	6	4	<0.001	0.018	0.004	-	-	-	-	-	-	-	-	-
Copper	6	5	<0.001	0.076	0.02	-	-	-	-	0	-	-	-	-
Iron	6	6	0.23	6.6	2.70	-	-	-	-	-	-	-	-	-
Lead	6	5	<0.001	0.028	0.02	0	-	-	-	-	-	-	-	-
Nickel	6	4	<0.001	0.037	0.01	0	-	-	-	-	-	-	-	-
Zinc	6	6	0.006	4.3	0.80	-	-	-	-	0	-	-	-	-
Dissolved Metals														
Aluminium	6	3	<0.05	0.17	0.08	-	0	0	0	-	-	-	-	3
Arsenic	6	1	<0.001	0.003	0.001	-	0	0	0	-	-	-	-	0
Cadmium	6	2	<0.0002	0.02	0.003	-	1	0	0	-	0	1	1	-
Chromium	6	0	<0.001	<0.001	<0.001	-	-	0	0	-	0	0	0	-
Cobalt	6	3	<0.001	0.018	0.004	-	-	0	0	-	-	-	-	2
Copper	6	3	<0.001	0.06	0.01	-	0	0	0	-	-	-	-	3
Iron	6	-	-	-	-	-	-	-	-	-	-	-	-	2
Lead	6	3	<0.001	0.006	0.002	-	0	0	0	-	0	0	0	-
Nickel	6	3	<0.001	0.034	0.01	-	0	0	0	-	0	0	1	-
Zinc	6	4	<0.005	4.1	0.72	-	0	0	0	-	0	1	1	-

¹ Applicable to SW7 only

² Site specific criteria applicable to SW1UP, SW1 – SW6

CaCO3 Extremely Hard Category, refer to **Table 5-1**– includes sampling locations SW1, SW_UP and SW2.

CaCO3 Soft Category, refer to **Table 5-1**– includes sampling locations SW3-SW5.

CaCO3 Moderate Category, refer to **Table 5-1**– includes sampling locations SW6-SW7.

Table 6-5: Summary of Mulwaree River Surface Water Analytical Results (SW8, SW9, SW10) – Cumulative Since January 2020

Analyte	No. of Samples	No. of Detects	Minimum (mg/L)	Maximum (mg/L)	Average (mg/L)	Health-based Screening Criteria (Recreational Waters)	Ecological Screening Criteria (ANZG 95% Protection) Fresh Water	ANZECC (2000) Fresh Water Guidelines	
								Irrigation	Stock Water
Total Metals									
Aluminium	28	11	<0.05	0.72	0.10	0	-	-	-
Arsenic	30	7	<0.001	0.001	0.001	0	-	-	-
Cadmium	30	2	<0.0002	0.0004	0.0001	0	-	-	-
Chromium	28	4	<0.001	0.002	0.001	0	-	-	-
Cobalt	30	3	<0.001	0.003	0.001	-	-	-	-
Copper	30	20	<0.001	0.01	0.002	0	-	-	-
Iron	28	28	0.14	3.2	0.53	1	-	-	-
Lead	30	7	<0.001	0.002	0.001	0	-	-	-
Nickel	30	22	<0.001	0.002	0.001	0	-	-	-
Zinc	29	27	<0.005	0.16	0.03	0	-	-	-
Dissolved Metals									
Aluminium	26	2	<0.05	0.41	0.05	-	2	0	0
Arsenic	28	3	<0.001	0.003	0.001	-	0	0	0
Cadmium	28	2	<0.0002	0.0004	0.0001	-	0	0	0
Chromium	26	1	<0.001	0.001	0.0005	-	0	0	0
Cobalt	28	1	<0.001	0.001	0.0005	-	0	0	0
Copper	28	15	<0.001	0.008	0.002	-	13	0	0
Iron	26	24	<0.05	0.8	0.2	-	4	0	-
Lead	28	0	<0.001	<0.001	<0.001	-	0	0	0
Nickel	28	17	<0.001	0.002	0.001	-	0	0	0
Zinc	25	23	<0.005	0.14	0.02	-	2	0	0

NA = not applicable

CaC03 Extremely Hard Category, refer to **Table 5-1**– includes sampling locations SW8, SW9 and SW10.

Table 6-6: Summary of Mulwaree River Surface Water Analytical Results (SW8, SW9, SW10) – September 2023 Round

Analyte	No. of Samples	No. of Detects	Minimum (mg/L)	Maximum (mg/L)	Average (mg/L)	Health-based Screening Criteria (Recreational Waters)	Ecological Screening Criteria (ANZG 95% Protection) Fresh Water	ANZECC (2000) Fresh Water Guidelines	
								Irrigation	Stock Water
Total Metals									
Aluminium	3	3	0.05	0.05	0.05	0	-	-	-
Arsenic	3	0	<0.001	<0.001	<0.001	0	-	-	-
Cadmium	3	0	<0.0002	<0.0002	<0.0002	0	-	-	-
Chromium	3	0	<0.001	<0.001	<0.001	0	-	-	-
Cobalt	3	0	<0.001	<0.001	<0.001	0	-	-	-
Copper	3	3	0.001	0.001	0.001	0	-	-	-
Iron	3	3	0.14	0.37	0.283	0	-	-	-
Lead	3	0	<0.001	<0.001	<0.001	0	-	-	-
Nickel	3	0	<0.001	<0.001	<0.001	0	-	-	-
Zinc	3	3	0.016	0.019	0.017	0	-	-	-
Dissolved Metals									
Aluminium	3	0	<0.05	<0.05	<0.05	-	0	0	0
Arsenic	3	0	<0.001	<0.001	<0.001	-	0	0	0
Cadmium	3	0	<0.0002	<0.0002	<0.0002	-	0	0	0
Chromium	3	0	<0.001	<0.001	<0.001	-	0	0	0
Cobalt	3	0	<0.001	<0.001	<0.001	-	0	0	0
Copper	3	0	<0.001	<0.001	<0.001	-	0	0	0
Iron	3	-	-	-	-	-	1	0	-
Lead	3	0	<0.001	<0.001	<0.001	-	0	0	0
Nickel	3	0	<0.001	<0.001	<0.001	-	0	0	0
Zinc	3	3	0.011	0.013	0.012	-	0	0	0

NA = not applicable

CaC03 Extremely Hard Category, refer to **Table 5-1**– includes sampling locations SW8, SW9 and SW10.

6.4 Time Series Charts

The following time series charts present total and dissolved concentrations of lead, copper and zinc for the 13 monitoring events completed between August 2019 and September 2023. Daily rainfall is presented for the same period.

6.4.1 Lead Concentrations for On and Near Site

Figure 6-1 presents total lead concentrations from surface water locations from on and near site (SW1-UP, SW1 through to SW7) plotted with the site-specific criterion for human health (7 mg/L). All surface water samples collected on and near site locations have reported variable total lead concentrations but have all been below the site-specific criterion for human health (7 mg/L).

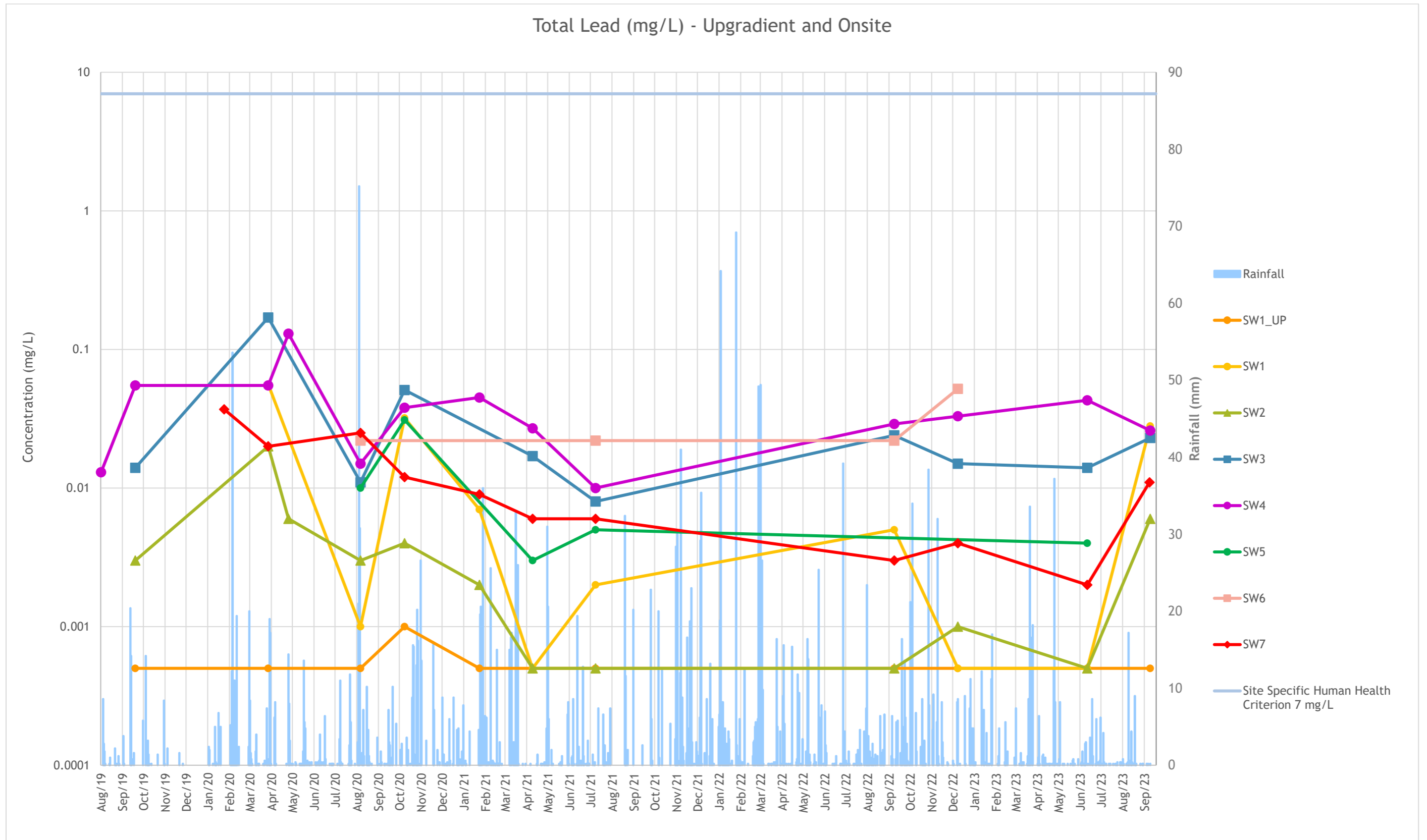


Figure 6-1: Upgradient and onsite total lead concentration (NB: left Y-axis scale log₁₀) and rainfall

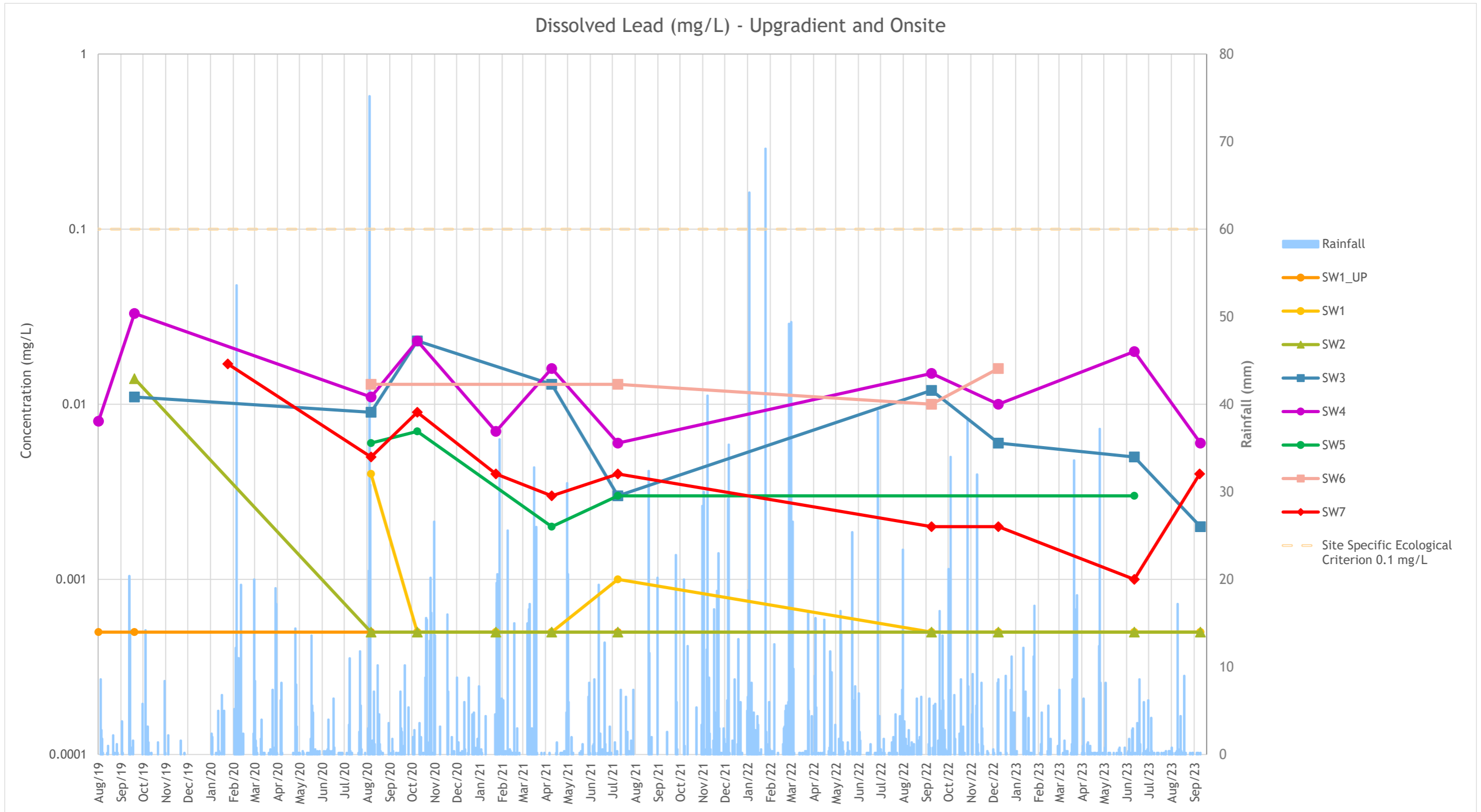


Figure 6-2: Upgradient and onsite dissolved lead concentration (NB: left Y-axis scale log₁₀) and rainfall

6.4.1.1 Lead Concentrations for Mulwaree River (Offsite)

Figure 6-3 presents total lead concentrations from surface water locations in the Mulwaree River located offsite (SW8, SW9, SW10) plotted with the adopted human health criterion for recreational water (0.1 mg/L). All surface water samples collected from the Mulwaree River to date have reported total lead concentrations at least 50-times lower than the criterion.

Figure 6-4 presents dissolved lead concentrations from surface water locations in the Mulwaree River located offsite (SW8, SW9 and SW10) plotted against the adopted criterion for 95% protection of species protection in freshwater aquatic ecosystems (hardness correction factor applied 0.091 mg/L), STV irrigation (0.1 mg/L), and the freshwater guideline for stock watering (5 mg/L). All samples collected from the Mulwaree River to date have reported dissolved lead concentrations below the laboratory PQL (<0.001 mg/L) and below adopted ecological criteria.

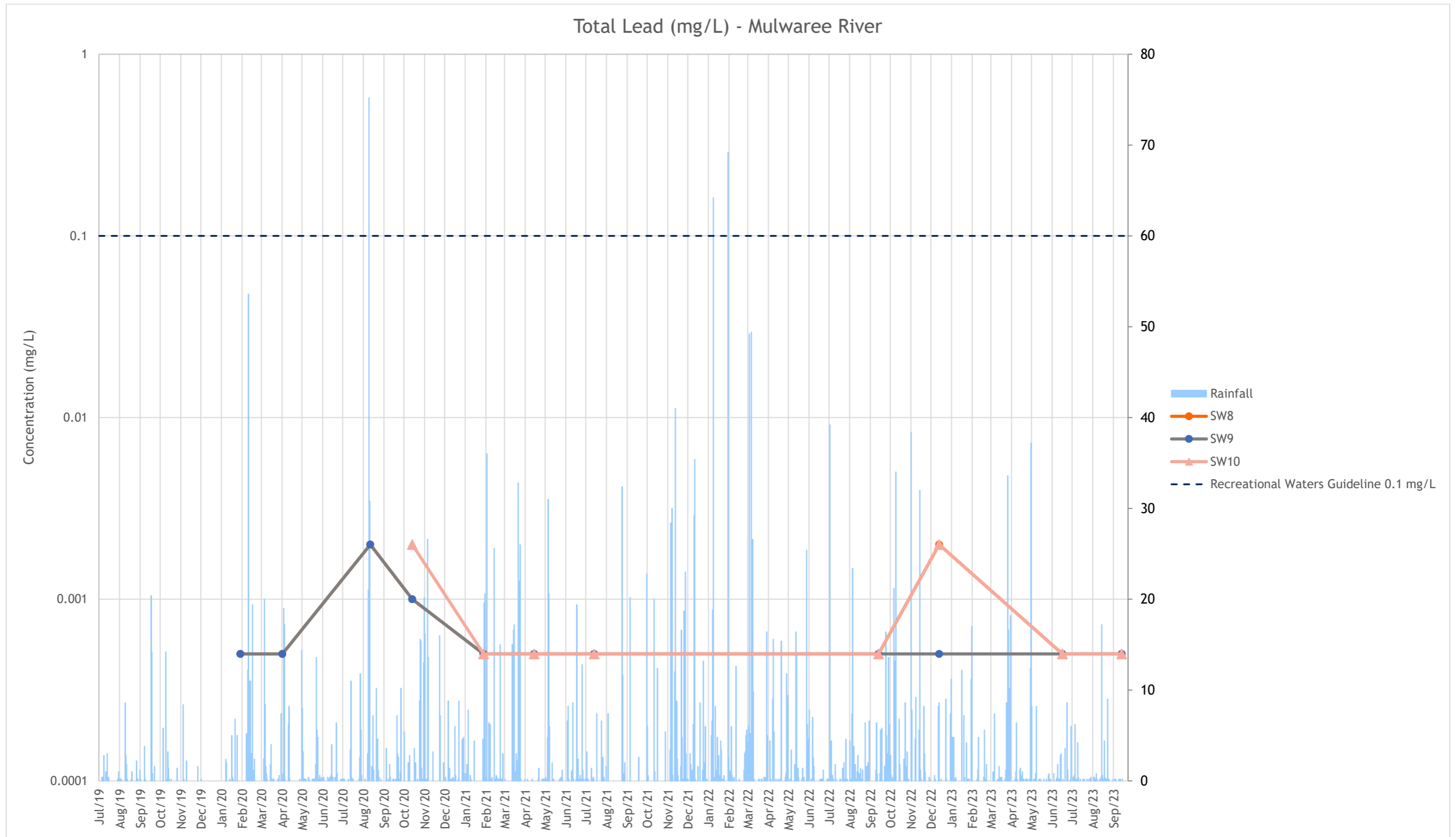


Figure 6-3: Mulwaree River (offsite) total lead concentration (NB: left Y-axis scale log₁₀) and rainfall

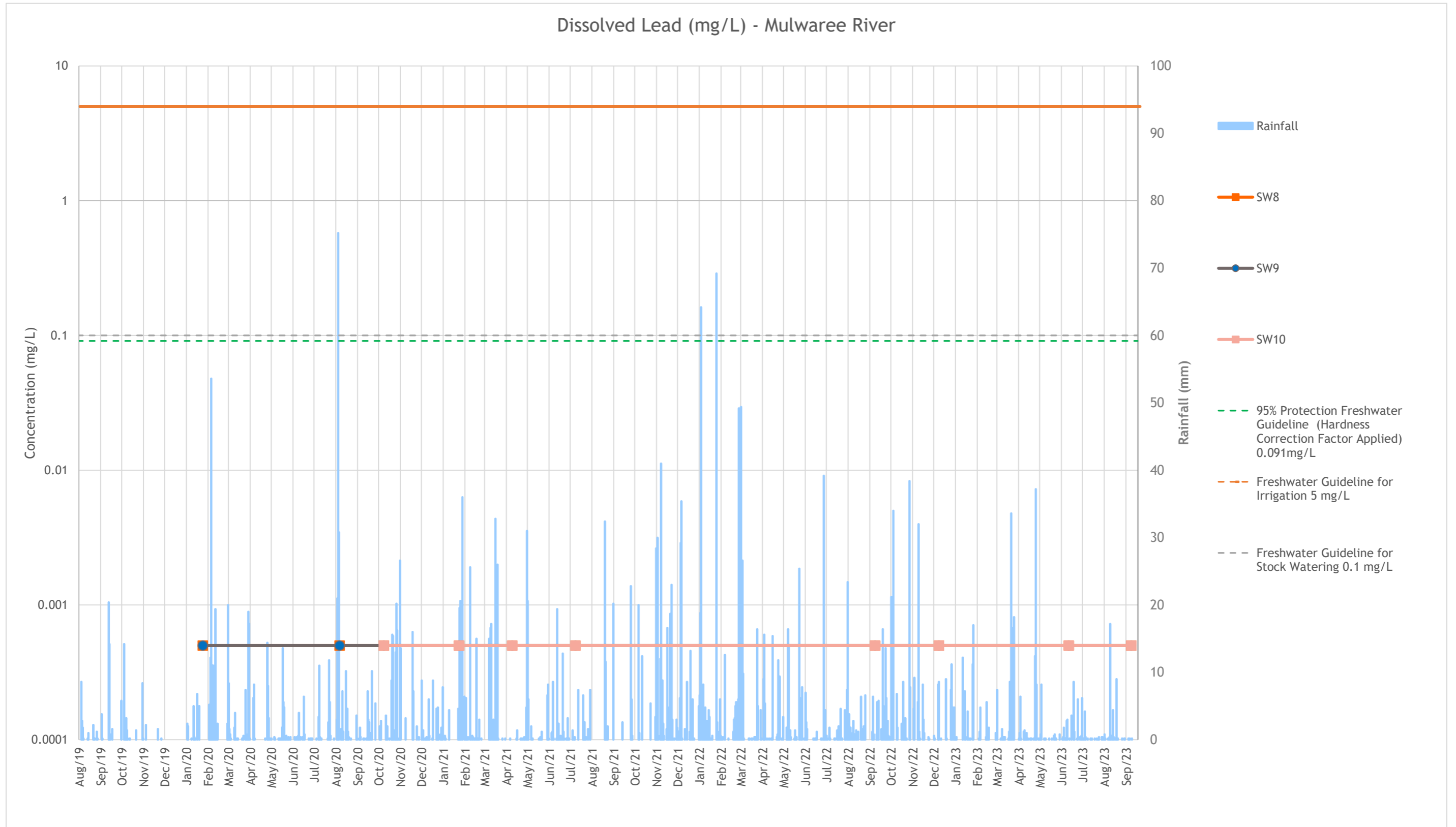


Figure 6-4: Mulwaree River offsite dissolved lead concentration (NB: left Y-axis scale log₁₀) and rainfall

6.4.1.2 Copper Concentrations for On and Near Site

Figure 6-5 presents total copper concentrations from surface water locations on and near site (SW1-UP, SW1 through to SW7) plotted with the human health recreational criterion (20 mg/L). All surface water samples collected on and near the site to date show variable total copper concentrations below the human health recreational criterion. Maximum total copper concentrations recorded to date are more than 60-times lower than the adopted human health criterion for recreational waters.

Figure 6-6 presents dissolved copper concentrations from surface water locations on and near site (SW1-UP, SW1 through to SW7) plotted with the site-specific ecological criterion (0.5 mg/L). All samples collected on and near the site show variable concentrations of dissolved copper concentrations below the site-specific ecological criterion (0.5 mg/L).

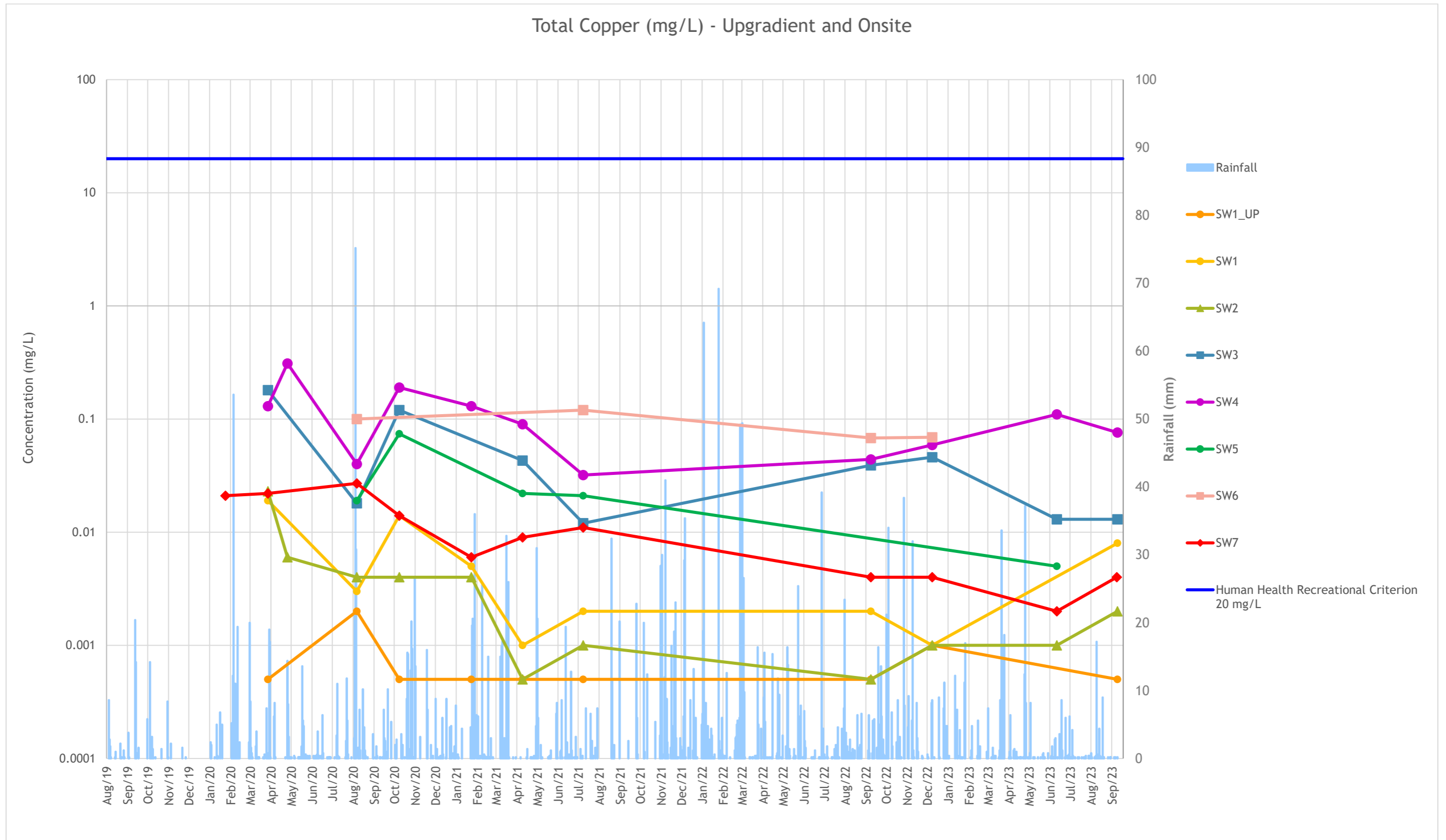


Figure 6-5: Upgradient and onsite total copper concentration (NB: left Y-axis scale log₁₀) and rainfall

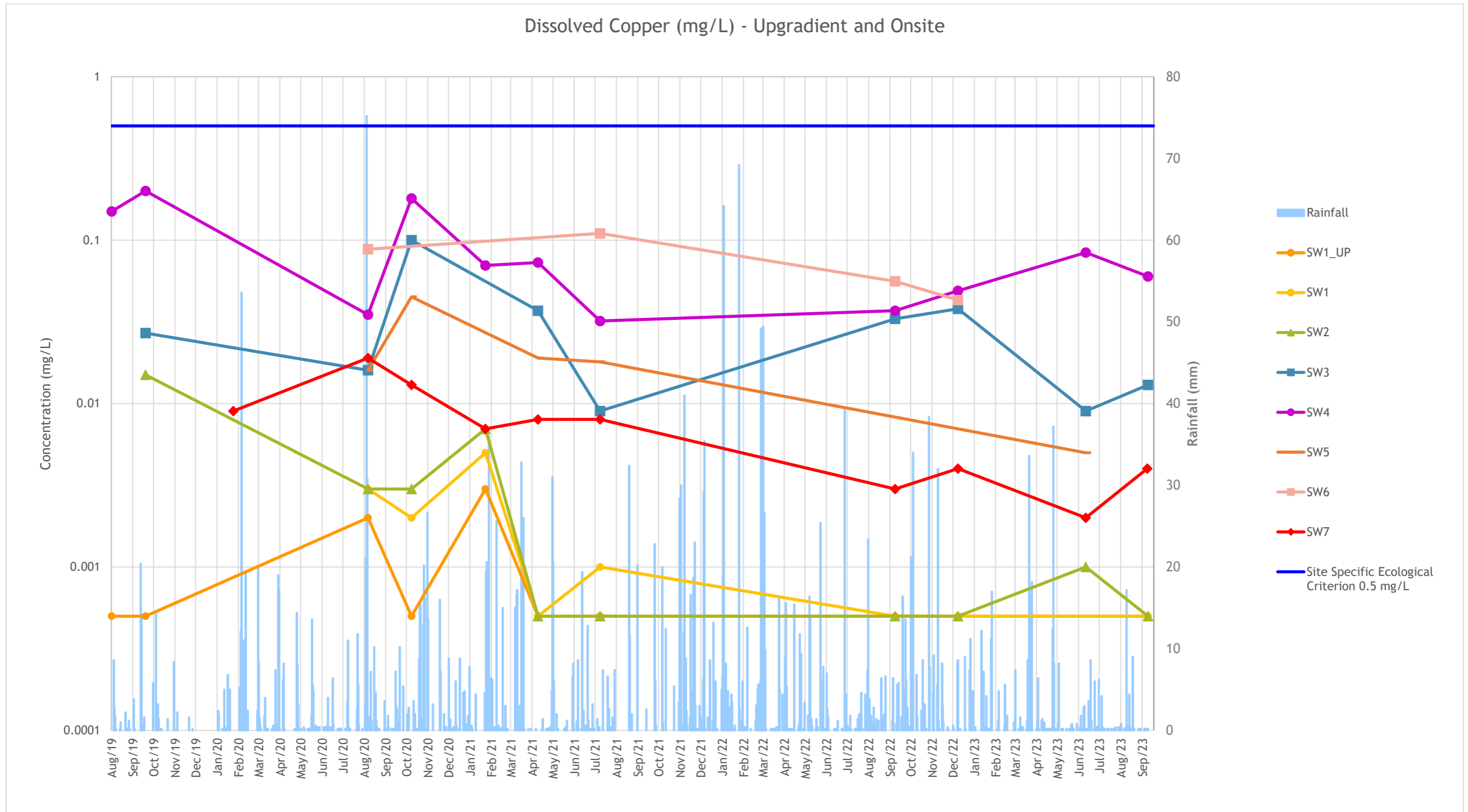


Figure 6-6: Upgradient and onsite dissolved copper concentration (NB: left Y-axis scale log₁₀) and rainfall

6.4.1.3 Copper Concentrations for Mulwaree River (Offsite)

Figure 6-7 presents total copper concentrations from offsite surface water locations in the Mulwaree River (SW8, SW9, SW10) plotted against the human health recreational criterion (20 mg/L). All samples collected from the Mulwaree River to date have reported total copper concentrations below the human health recreational criterion of 20 mg/L.

Figure 6-8 presents dissolved copper concentrations from offsite surface water locations in the Mulwaree River (SW8, SW9, SW10) plotted against freshwater guideline for irrigation (5 mg/L), freshwater guideline for stock watering (0.4 mg/L) and 95% protection of freshwater species criterion (0.0014 mg/L).

All samples reported fluctuating dissolved copper concentrations above and below the adopted 95% protection of freshwater species criterion (0.0014 mg/L). However the last three monitoring events have reported a decreasing trend in concentrations, with the most recent round reporting dissolved copper concentrations below the ecological criterion.

Dissolved copper concentrations in the Mulwaree River appear representative of background concentrations and not representative of impacts from the Site.

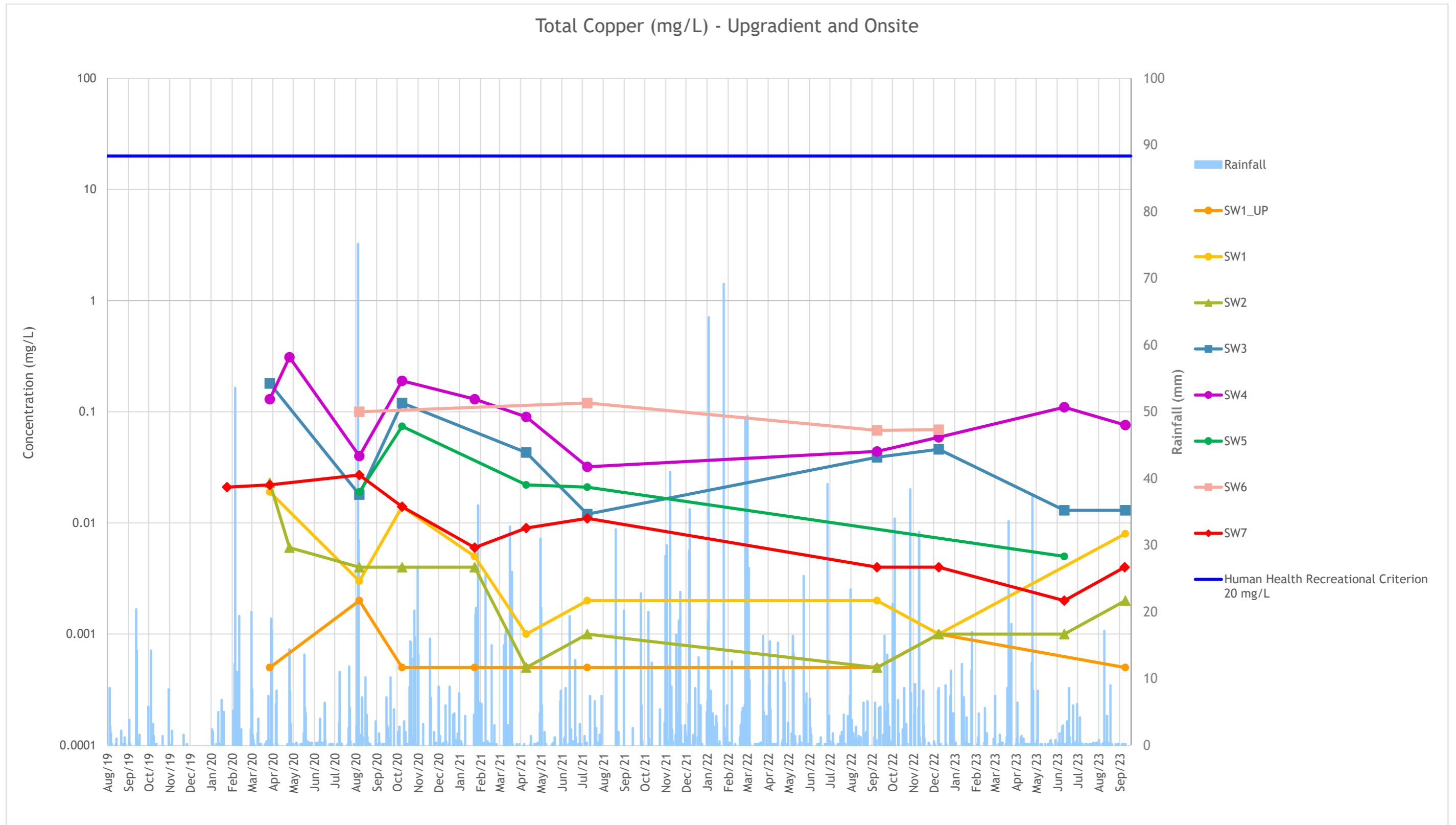


Figure 6-7: Mulwaree River (offsite) total copper concentration (NB: left Y-axis scale log₁₀) and rainfall

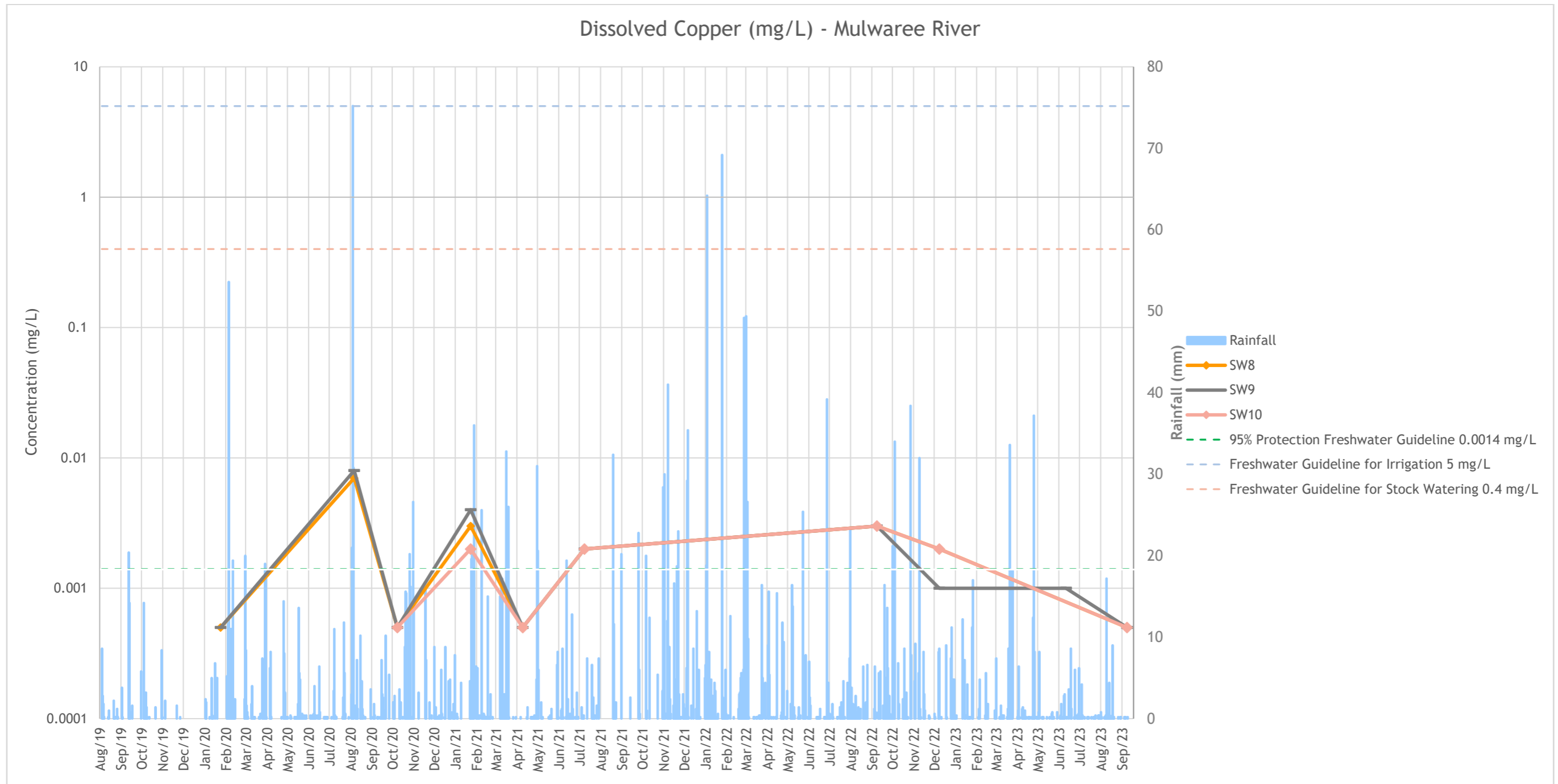


Figure 6-8: Mulwaree River (offsite) dissolved copper concentration (NB: left Y-axis scale log₁₀) and rainfall.

6.4.1.4 Zinc Concentrations for On and Near Site

Figure 6-9 presents total zinc concentrations from surface water sample locations on and near the site (SW1-UP, SW1 through to SW7) plotted with human health recreational criterion (30 mg/L). Total zinc concentrations across all on and near site locations are variable but consistently below the human health recreational criterion.

Figure 6-10 presents dissolved zinc concentrations from surface water sample locations on and near the site (SW1-UP, SW1 through to SW7) plotted with the site-specific ecological criterion (20 mg/L). Dissolved zinc concentrations across all on and near site locations are variable but consistently below the site-specific ecological criterion.

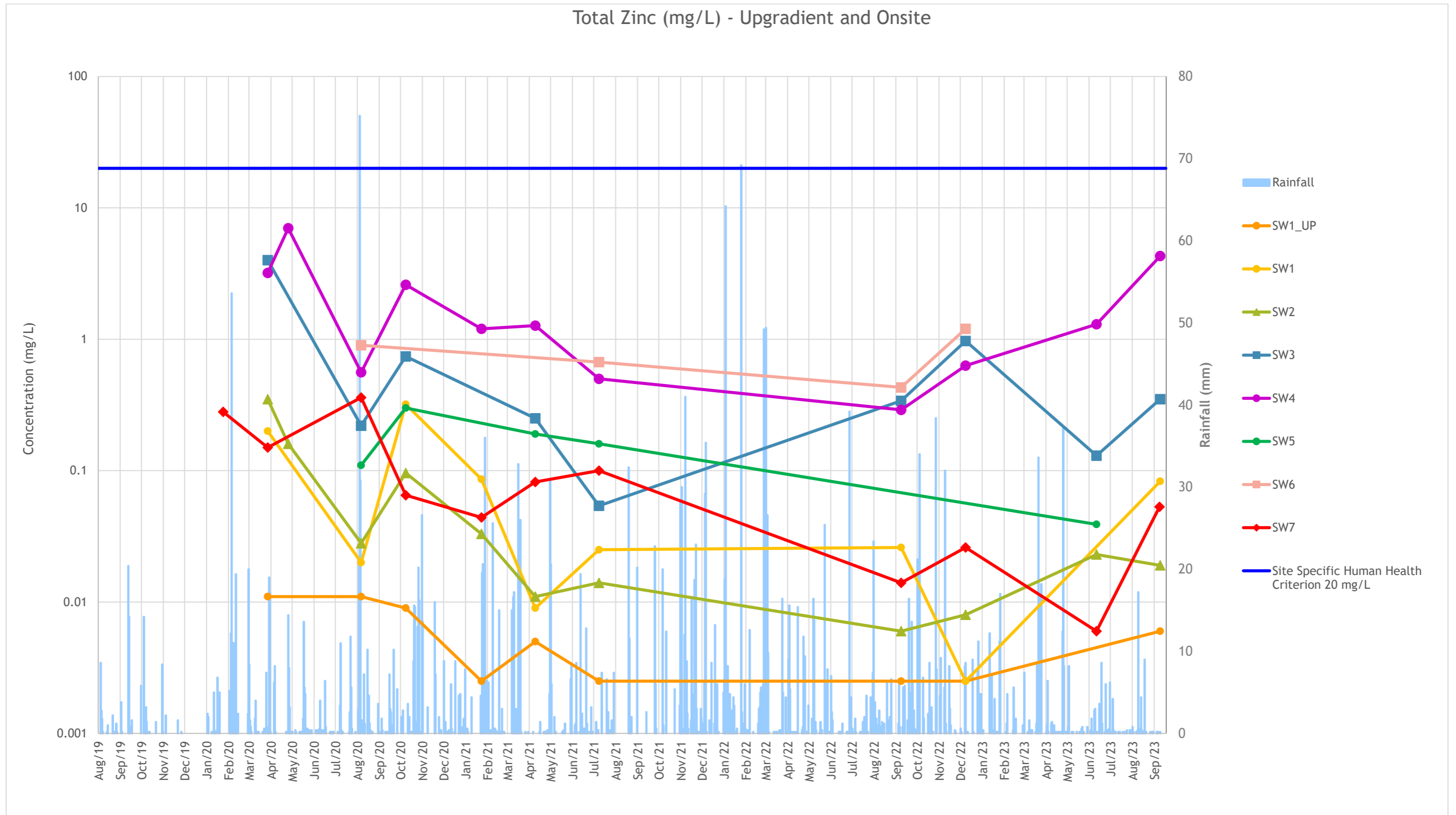


Figure 6-9: Upgradient and onsite total zinc concentration (NB: left Y-axis scale log₁₀) and rainfall.

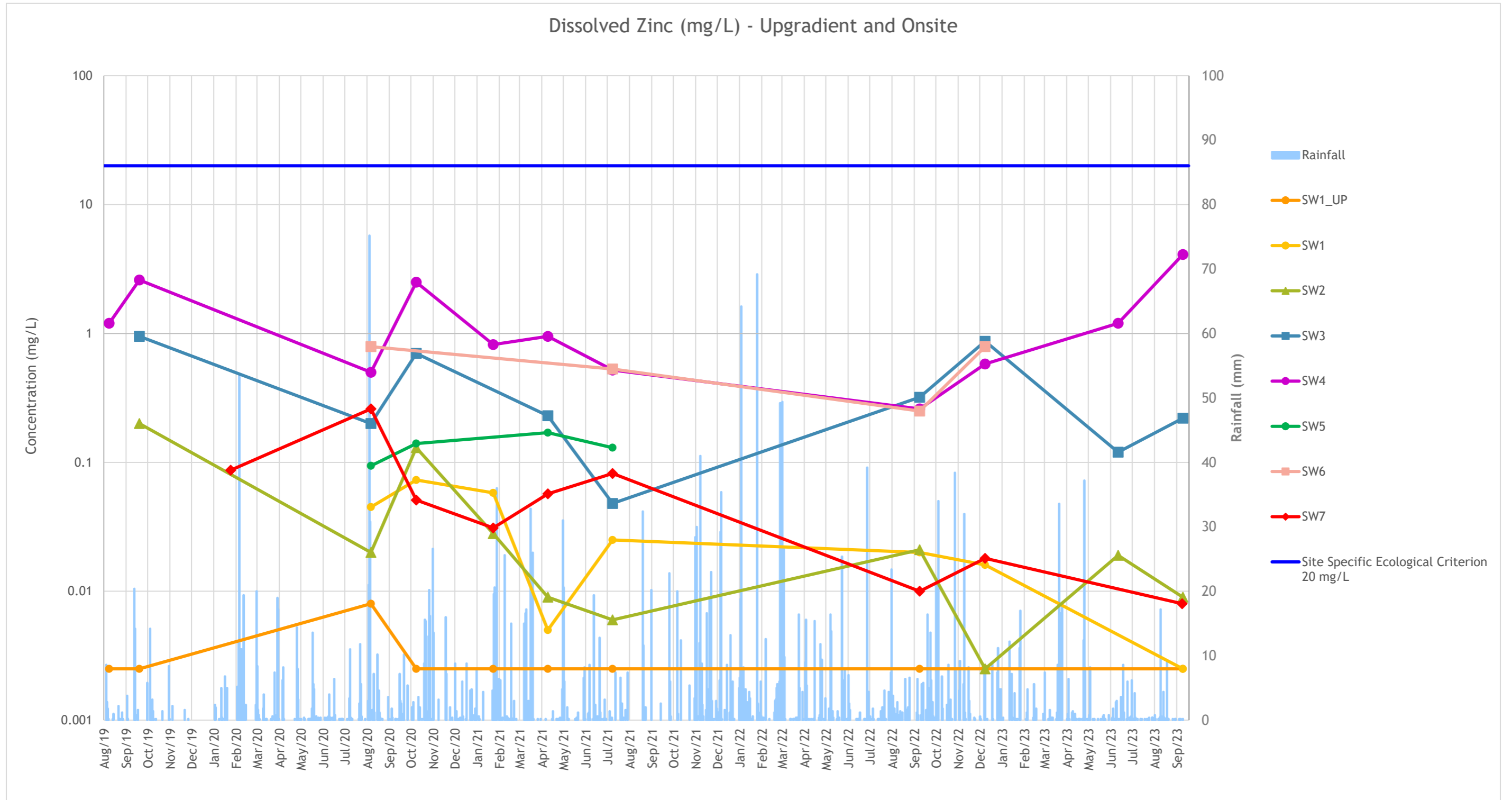


Figure 6-10: Upgradient and onsite dissolved zinc concentration (NB: left Y-axis scale log₁₀) and rainfall.

6.4.2 Zinc Concentration for Mulwaree River (Offsite)

Figure 6-7 presents total zinc concentrations from offsite surface water locations in the Mulwaree River (SW8, SW9, SW10) plotted with the human health recreational criterion (30 mg/L).

Total zinc concentrations across all the Mulwaree River (offsite) locations are variable but are below the human health recreational criterion.

Figure 6-8 presents dissolved zinc concentrations from offsite surface water locations in the Mulwaree River (SW8, SW9, SW10) plotted with the freshwater guideline for irrigation (5 mg/L), freshwater guideline for stock watering (0.4 mg/L) and the adopted 95% protection of freshwater species criterion corrected for hardness (0.072 mg/L).

Dissolved zinc concentrations across all locations are variable and generally below adopted criteria with the exception of exceedances of the adopted 95% protection of freshwater species criterion identified at SW8 and SW9 following the August 2020 sampling event.

Similar to copper, comparable zinc concentrations in the Mulwaree River both upstream and downstream of the Site indicate background conditions and are not representative of impacts from the Site.

SW7 is sampled from a dam receiving water from the Northern Culvert and is located at 2135 Braidwood Road. Based on repeated discussion with the owner of 2135 Braidwood Road Ramboll understands the dam is to be decommissioned and backfilled in the near future. Within this context elevated contaminant concentrations in surface water identified at this location are not considered to present a risk to human health or ecology.

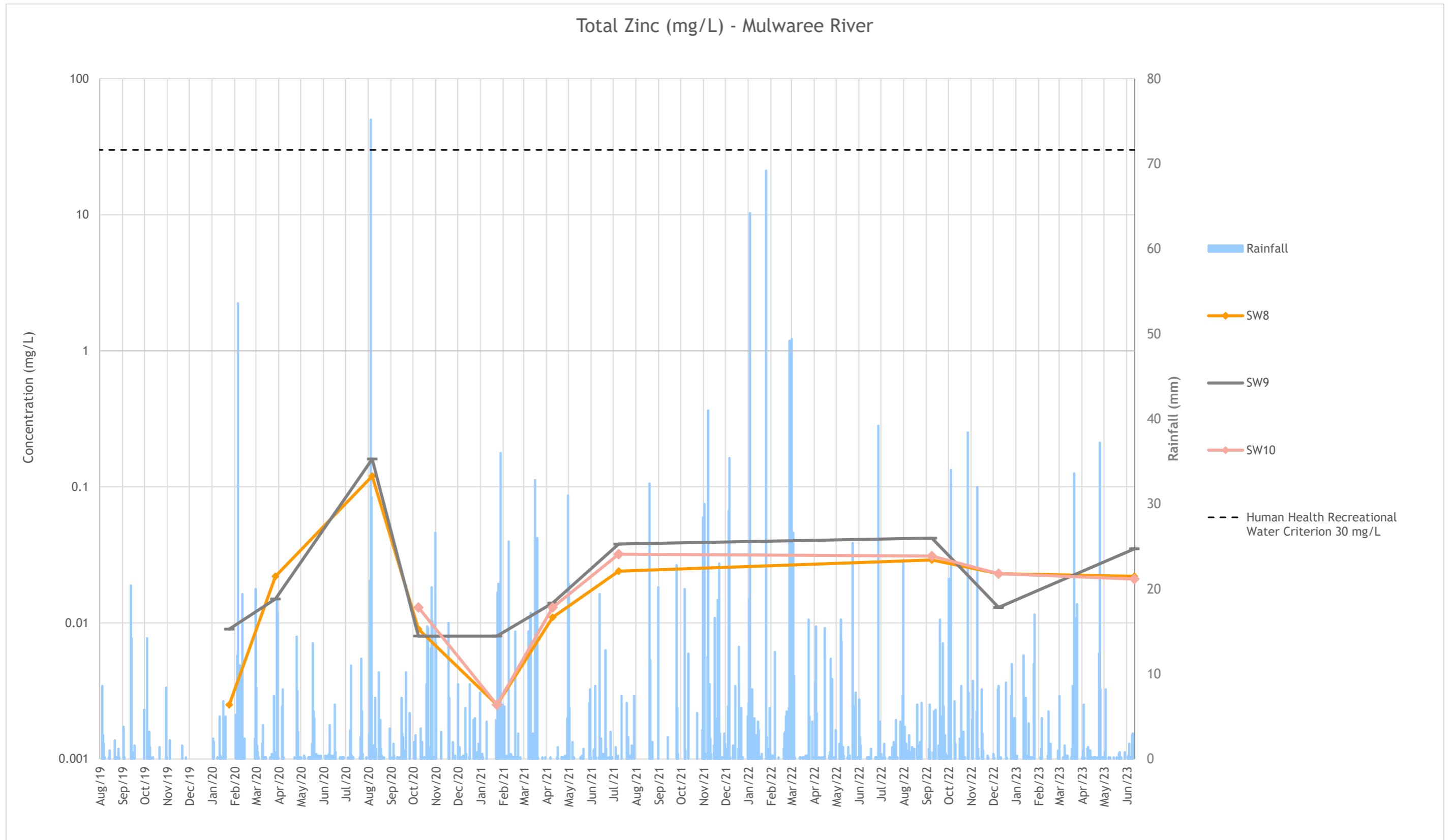


Figure 6-11: Mulwaree River (offsite) total zinc concentration (NB: left Y-axis scale log₁₀) and rainfall.

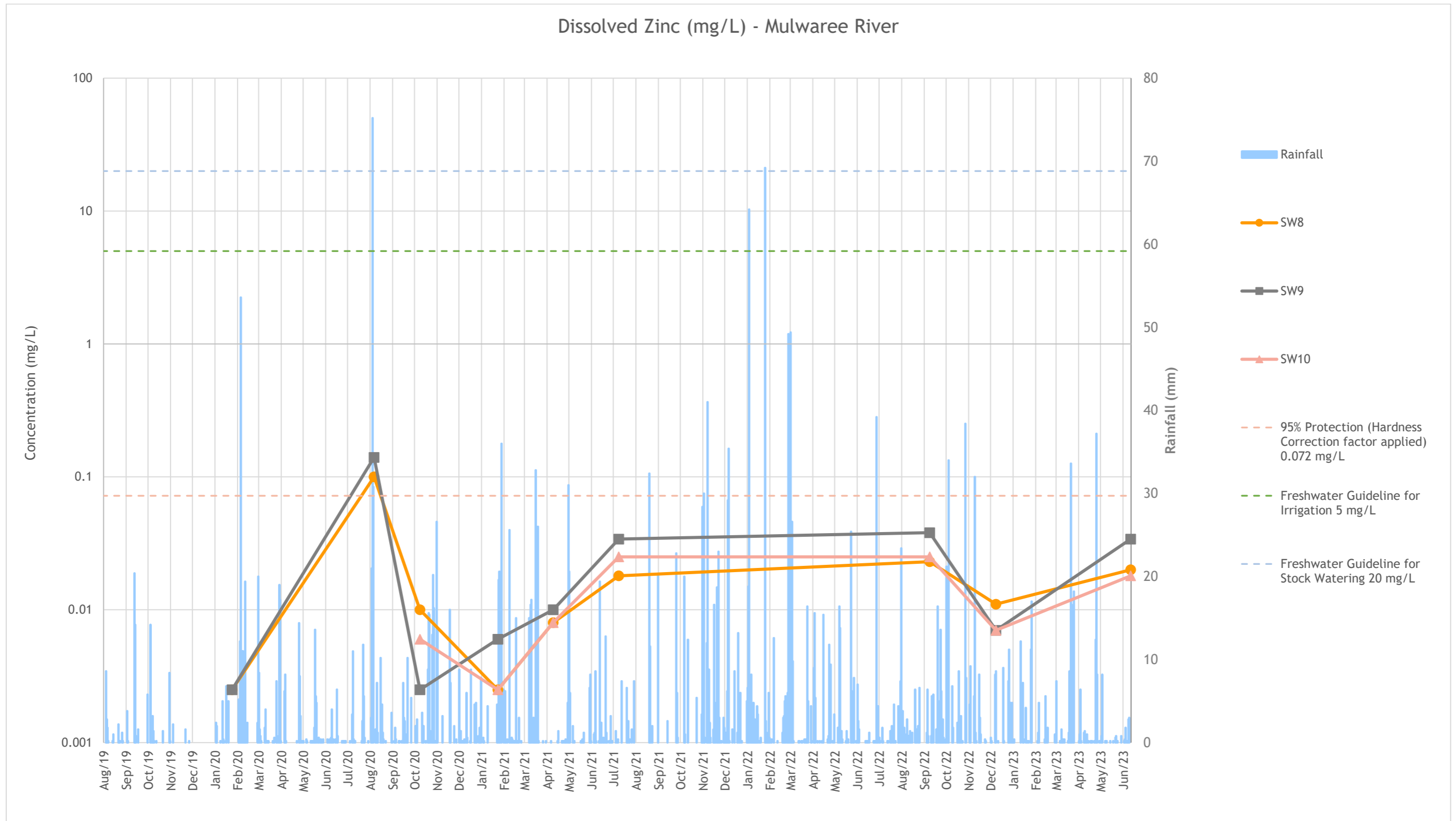


Figure 6-12: Mulwaree River (offsite) dissolved zinc concentration (NB: left Y-axis scale log₁₀) and rainfall.

6.5 Mann Kendall Trends

Ramboll applied the GSI Mann-Kendall Toolkit to analyse time-series surface water monitoring data for the purpose of quantitatively determining if the measured concentrations of a CoPC are increasing, decreasing, or stable over time. This is based upon use of the Mann-Kendall statistical method. The software was applied to data from August 2019 to September 2023 to evaluate the concentration trend of each CoPC at each monitoring location. A summary of the Mann-Kendall results is outlined below, and the results are presented in **Appendix 6**.

6.5.1 Trends for On and Near Site

- Total and dissolved lead concentration trends for SW1_UP, SW1-SW7 reported either "No Trend", "Stable" or "Decreasing" trends.
- Total and dissolved copper concentration trends for SW1_UP, SW1-SW7 reported either "Stable", "Prob. Decreasing" or "Decreasing" trends.
- Total and dissolved zinc concentration trends for SW1_UP, SW1-SW7 reported either "No Trend", "Stable" or "Decreasing" trends.

6.5.2 Trends for Mulwaree River (Offsite)

- Total and dissolved lead concentration trends for SW8-SW10 reported "Stable" trends.
- Total and dissolved copper concentration trends for SW8-SW10 reported "No Trend" or "Stable" with the exception of total copper at SW10 which reported an "Increasing" trend. Ramboll noted that the trend for dissolved copper concentration at SW10 was "Stable" and that the dissolved copper result at SW10 during the September 2023 monitoring round was less than the detection limit.
- Total and dissolved zinc concentration trends for SW8-SW10 reported "No Trend".

7. SUMMARY

A summary of CoC results with regard for human health and ecological risk is presented in **Table 7-1**.

Table 7-1: CoC Results Summary (Lead, Copper, Zinc)

Metal	Total/ Dissolved	Sample Location	Criteria	Summary
Lead	Total	On and Near Site (SW1-UP, SW1, SW2, SW3, SW4, SW5, SW6, SW7)	Site-specific human health criterion of 7 mg/L (EnRiskS, 2021).	Concentrations of total lead were below the adopted human health criteria in all samples collected to date.
		Mulwaree River/Offsite (SW8, SW9, SW10)	Recreational water criterion (0.09 mg/L).	Mann-Kendall Trend analysis reported no trend, stable or decreasing trends. There is low risk to human health from lead in surface water.
	Dissolved	On and Near Site (SW1-UP, SW1, SW2, SW3, SW4, SW5, SW6, SW7)	Site-specific ecological criterion of 0.1 mg/L (EnRiskS, 2021)	Concentrations of dissolved lead were below the adopted ecological criteria in all samples collected to date.
		Mulwaree River/Offsite (SW8, SW9, SW10)	95% species protection for freshwater ecosystems corrected for hardness (extremely hard - 0.091 mg dissolved lead/L, moderate - 0.0034 mg dissolved lead/L, soft - 0.0136 mg dissolved lead/L) (ANZG, 2018). ANZECC (2000) Freshwater guidelines for irrigation (0.1 mg dissolved lead/L) and stock water (5 mg dissolved lead/L).	Mann-Kendall Trend analysis updated with September 2023 monitoring data reported stable trends. There is low risk to ecological receptors from lead in surface water.
Copper	Total	On and Near Site (SW1-UP, SW1, SW2, SW3, SW4, SW5, SW6, SW7)	Recreational water criterion (20 mg/L).	Concentrations of total copper were below the adopted human health criteria in all samples collected to date.
		Mulwaree River/Offsite (SW8, SW9, SW10)		Mann-Kendall Trend analysis reported an increasing trend at SW10 for total copper. All other sample locations reported no trend, stable or decreasing trends. The increase in SW10 is not a concern as concentrations were below the recreational criterion (20 mg/L). There is low risk to human health from copper in surface water.
	Dissolved	On and Near Site (SW1-UP, SW1, SW2, SW3, SW4, SW5, SW6, SW7)	Site-specific ecological criterion of 0.5 mg/L (EnRiskS, 2021).	Concentrations of dissolved copper were below the adopted ecological criteria in all samples collected to date.
		Mulwaree River/Offsite (SW8, SW9, SW10)	95% species protection for freshwater ecosystems (0.0014 mg/L) (ANZG, 2018). ANZECC (2000) Freshwater guidelines for	Mann-Kendall Trend analysis reported stable or decreasing trends. There is low risk to ecological receptors from copper in surface water.
				Concentrations of dissolved copper have exceeded the adopted ecological criteria on multiple occasions.

Metal	Total/ Dissolved	Sample Location	Criteria	Summary
			irrigation (5 mg/L) and stock watering (lower limit 0.4 mg/L).	Mann-Kendall Trend analysis reported no trend or stable trends. Comparable concentrations upstream and downstream of the Site suggest concentrations of dissolved copper are derived from a background source and not a result of impacts from the Site.
Zinc	Total	On and Near Site (SW1-UP, SW1, SW2, SW3, SW4, SW5, SW6, SW7)	Recreational water criterion (30 mg/L).	Concentrations of total zinc were below the adopted human health criteria in all samples collected to date.
		Mulwaree River/Offsite (SW8, SW9, SW10)		Mann-Kendall Trend analysis reported no trend, stable or decreasing trends. There is low risk to human health from zinc in surface water.
	Dissolved	On and Near Site (SW1-UP, SW1, SW2, SW3, SW4, SW5, SW6, SW7)	Site-specific ecological criterion of 20 mg/L (EnRiskS, 2021).	Concentrations of dissolved zinc were below the adopted ecological criterion in all samples collected to date. Mann-Kendall Trend analysis reported decreasing or stable trends. There is low risk to ecological receptors from zinc in surface water.
		Mulwaree River/Offsite (SW8, SW9, SW10)	95% species protection for freshwater ecosystems (ANZG, 2018) corrected for hardness (extremely hard - 0.072 mg dissolved zinc/L, moderate - 0.02 mg dissolved zinc/L, soft - 0.0008 mg dissolved zinc/L) ANZECC (2000) Freshwater guidelines for irrigation (5 mg/L) and stock water (20 mg/L).	Concentrations of dissolved zinc were below the adopted ecological criterion in all samples collected to date except for two samples from two samples locations (SW8 and SW9) from the August 2020 sampling event. Mann-Kendall Trend analysis reported no trend. Comparable concentrations upstream and downstream of the Site suggest concentrations of zinc are derived from a background source and not a result of impacts from the Site.

8. CONCLUSIONS

Routine surface water monitoring was reinstated at Tarago NSW in September 2022 in response to a Prevention Notice issued by the NSW EPA to TfNSW. This was not mandated by the NSW EPA, however TfNSW commenced surface monitoring to assess if contaminant concentrations are migrating from the site above adopted guidelines. Surface water monitoring was completed between 13 and 14 September 2023. Results were compared against historical observations and relevant assessment criteria.

Based on review of the most recent surface water monitoring results (September 2023) and historical data, the following conclusions have been drawn:

- No evidence that contaminant concentrations are migrating from the site above adopted guidelines in surface water has been identified.
- No exceedances in the adopted human health criteria for the contaminants of concern have been reported.
- Two samples from the September 2023 monitoring round exceeded ecological criteria – one sample exceeded ecological criteria for cadmium while another sample exceeded the ecological criteria for cobalt. The two locations were both on-site. Cobalt and cadmium concentrations within the off-site receiving environment were below ecological criteria and within this context risk to ecology associated with these metals is considered acceptable.
- No exceedances of ecological criteria were reported at off-site locations in the Mulwaree River during the September 2023 monitoring round.
- Trends in contaminant concentrations were stable or decreasing with the exception of total copper at SW10. This concentration did not exceed the recreational guideline, was identified to have decreased in recent rounds and dissolved concentrations were below guidelines.

9. LIMITATIONS

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APPENDIX 1
SAQP

Intended for
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SAMPLING ANALYSIS AND QUALITY PLAN (SAQP) – SURFACE WATER MONITORING TARAGO LEAD MANAGEMENT

TARAGO LEAD MANAGEMENT SAMPLING ANALYSIS AND QUALITY PLAN (SAQP) – SURFACE WATER MONITORING

Project name **Tarago Lead Management**
 Project no. **318001376-T6-**
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APPENDICES

Appendix 1

Figures

1. INTRODUCTION

1.1 Preamble

Ramboll Australia Pty Ltd (Ramboll) was engaged by Transport for NSW (TfNSW) to complete periodic surface water monitoring upstream and downstream of contamination within the Goulburn – Bombala rail corridor at Tarago, New South Wales, Australia.

1.2 Background

The site is identified as part Lot 22 Deposited Plan (DP) 1202608 and is located in Tarago, NSW. The site occupies an area of approximately three hectares and is located approximately 32 km south of Goulburn.

The Woodlawn Mines Ore Concentrate Load-Out Complex operated within the Goulburn – Bombala rail corridor at Tarago from the 1970s – 1990s. Concentrates were produced at the Woodlawn Mine approximately 6.5 km west and included a zinc concentrate consisting mainly of sphalerite (zinc sulphide), a lead concentrate of galena (lead sulphide) and copper concentrates of chalcopyrite (copper iron sulphide).

An extensive body of work has been completed to characterise contaminant impacts associated with historic operation of the site. This work has included assessment of soil, groundwater and surface water across the site and assessment of soil, groundwater, surface water and airborne dust within the surrounding area. Recent assessments identified contaminants within approximately 900 lineal meters of the rail formation at Tarago. This area is herein referred to as the 'site' and is presented on **Figure 1, Appendix 1**.

Offsite discharge of surface water appears to be generally related to three culverts which pass beneath the rail formation onsite. Contaminants of potential concern (CoPC) relevant to receiving surface waters appear limited to metals (aluminium, cadmium, copper, lead, nickel, zinc) which exceed the adopted relevant health and/or ecological assessment criteria.

1.3 Regulation

On 25 March 2020 the NSW Environment Protection Authority (NSW EPA) declared the site as significantly contaminated under Section 11 of the Contaminated Land Management Act 1997 (Declaration Number 20201103). Transport for NSW is currently managing the contamination under a Voluntary Management Proposal (VMP) which includes further assessment of site contamination and remediation to address the potential risks to human health and the environment posed by the contamination.

1.4 Objective

The objective of the surface water monitoring is to collect reliable water quality data, providing a data continuum which forms a basis for assessment of impacts from the site on surrounding surface water receptors.

2. SITE IDENTIFICATION

The site locality is shown in **Figure 1, Appendix 1**.

The site details are presented in **Table 2-1**.

Table 2-1: Site Identification

Information	Description
Street Address:	Accessed from Stewart Street and Goulburn Street Tarago NSW
Identifier:	Part Lot 1 DP 595856
Site Area:	Approximately 7.5 ha
Local Government:	Goulburn Mulwaree Shire
Owner:	Transport for NSW
Current Site Use:	Forms part of the Goulburn to Bombala rail line and the Country Regional rail Network (CRN)

3. REGULATORY REQUIREMENTS

This SAQP has been prepared in general accordance with the following guidance documents:

1. Australia and New Zealand Environment and Conservation Council, *Guidelines for Fresh and Marine Water Quality* (ANZECC, 2018)
2. National Environment Protection Council (NEPC), *National Environment Protection (Assessment of Site Contamination) Measure 1999, as amended 2013* (NEPM, 2013)
3. NSW EPA, *Contaminated Sites: Guidelines for Consultants Reporting on Contaminated Lands* (NSW EPA 2020)
4. NSW EPA, *Guidelines for the Site Auditor Scheme (3rd Edition)* (NSW EPA, 2017)

4. SUMMARY OF CONCEPTUAL SITE MODEL

A Conceptual Site Model (CSM) was prepared as part of a Detailed Site Investigation prepared by Ramboll (2020). The CSM provides a summary of the source-pathway-receptor linkages for surface water and is summarised in **Table 4-1**.

Table 4-1 Conceptual Site Model Summary

Exposure Pathway	Onsite Workers	Onsite Ecology	Residents	Community Activities	Offsite Workers	Offsite Ecology	Irrigation and Livestock
Surface Water							
Direct contact	N	P	N	N	N	P	P
Incidental ingestion	N	P	N	N	N	P	P
Root uptake	N/A	P	N/A	N/A	N/A	P	N/A
Migration to groundwater	N	P	N	N	N	P	P

N/A – not applicable

N – no exposure route

P – possible exposure route

5. ASSESSMENT CRITERIA

The criteria adopted for the assessment of surface water contamination are sourced from the following references:

- National Environment Protection Council (NEPC), *National Environment Protection (Assessment of Site Contamination) Measure (NEPM) 1999, as amended 2013* (NEPC, 2013).
- National Health and Medical Research Council (NHMRC) (2001) *National Resource Management Ministerial Council (NRMMC) Australian Drinking Water Guidelines 6, Version 3.6 updated March 2021*, (ADWG, 2011).
- National Health and Medical Research Council (NHMRC), *National Resource Management Ministerial Council (NRMMC) Guidelines for Managing Risks in Recreational Water* (NHMRC, 2008).
- Department of Environment and Conservation (DEC) *Guidelines for the Assessment and Management of Groundwater Contamination* (DEC, 2007).
- *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZG, 2018) (available at www.waterquality.gov.au/anz-guidelines).
- Australian and New Zealand Environment and Conservation Council (ANZECC) & Agriculture and Resource Management Council of Australia and New Zealand (ARMCANZ) *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZECC, 2000).
- *Advice on risks to human health and the environment: Boyd Street and publicly accessible areas, Tarago NSW, Site specific criteria – Protection of human health and terrestrial and/or aquatic ecosystems* (EnRiskS, 2020).

5.1 Rationale for Application of Guidelines

The relevance of guidelines was determined based on iterative screening from the broadest and most sensitive water usage scenario which occurs in the Mulwaree River back through agricultural land and public roads to the least sensitive scenario which occurs at the Site.

All results from Mulwaree River samples (SW8 to SW10) have been screened against Tier 1 / screening guidelines relevant to human health (incidental ingestion), freshwater ecology, irrigation and stock watering as each of these receptors occur within the receiving waters (the Mulwaree River). Should results exceed screening guidelines and indicate site contamination as the source, it would be appropriate to apply the guidelines that were exceeded to sampling locations upstream as this would inform further assessment of the Site as the potential source. Previous monitoring results do not indicate site contamination is adversely affecting the Mulwaree River. Site-specific guidelines were developed for Arsenic, Cadmium, Lead, Manganese and Nickel (EnRiskS, 2020) that integrate the ephemeral nature of surface water features between the Mulwaree River and the Site. Additionally, several technical refinements were identified and are relevant to guideline application. These were:

- ADWG (2011) Section 6.3.1 states that guideline values refer to the total amount of the substance present, regardless of its form (e.g., in solution or attached to suspended matter) and so analytical results from unfiltered samples should be assessed against human health criteria. The primary human health risk from contaminants in surface water from the Site is via recreational use. NHMRC (2008) suggests that 10-times the ADWG values may provide a conservative estimate of acceptable recreational exposure guideline values. This approach was applied to derive recreational exposure criteria.
- ANZG (2018) guidelines for metals in freshwater are adopted from the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC, 2000) which states the major toxic effect of metals comes from the dissolved fraction, so it is valid to filter samples (e.g., to 0.45 µm) and compare the filtered concentration against the trigger values.
- Water hardness is identified as a physical parameter with quantifiable effects. Correction factors are defined in the guidelines to address the effect of water hardness on the chemical toxicity and hence the trigger value of cadmium, chromium, lead, nickel and zinc.

To define appropriate hardness correction factors, three surface water samples will be collected and analysed for hardness as CaCO₃ to validate the use of the hardness correction factor. The factors will be applied to refine Tier 1 trigger values per guidance presented in Table 3.4.4 of the *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZECC, 2000) Application of guidelines at each sampling point is summarised in **Table 5-1**.

Table 5-1: Guidelines Applied to Sampling Points

Sampling Point	Location	Human Health - Site Specific ¹	Ecology - Site Specific ¹	Human Health - Recreational Scening ²	Ecology – Screening ³	Irrigation – Screening ³	Stock Water – Screening ³
SW1-UP	Upstream of Southern Culvert (offsite)	✓	✓	✓	✓	-	-
SW1	Upstream of Southern Culvert	✓	✓	✓	✓	-	-
SW2	Downstream of Southern Culvert	✓	✓	✓	✓	-	-
SW3	Upstream of Middle Culvert	✓	✓	✓	✓	-	-
SW4	Downstream of Middle Culvert	✓	✓	✓	✓	-	-
SW5	Upstream of Northern Culvert	✓	✓	✓	✓	-	-
SW6	Downstream of Northern Culvert	✓	✓	✓	✓	-	-
SW7	Dam on farm downstream of Northern Culvert (offsite)	-	-	✓	✓	✓	✓
SW8	Mulwaree River upstream of Middle and Northern Culvert Discharge	-	-	✓	✓	✓	✓
SW9	Mulwaree River upstream of Southern Culvert Discharge	-	-	✓	✓	✓	✓
SW10	Mulwaree River downstream of Middle and Northern Culvert Discharge	-	-	✓	✓	✓	✓

¹ EnRiskS (2021)

² ANZG (2018)

³ ANZECC (2000)

Assessment criteria adopted under each guideline are presented in **Table 5-2**.

Table 5-2: Guideline Criteria (mg/L)

Contaminant	Human Health - Site Specific Criteria	Human Health - Recreation Screening	Ecology - Site Specific Criteria	95% Fresh water (ANZG 2018)	Irrigation - Screening	Stock Water - Screening
Total Metals						
Aluminium	-	2 ^a	NA	NA	NA	NA
Arsenic	7	0.1	NA	NA	NA	NA
Barium	-	2	NA	NA	NA	NA
Beryllium	-	0.6	NA	NA	NA	NA
Cadmium	1.4	0.002	NA	NA	NA	NA
Chromium	-	0.5	NA	NA	NA	NA
Cobalt	-	-	NA	NA	NA	NA
Copper	-	20	NA	NA	NA	NA
Iron	-	3	NA	NA	NA	NA
Lead	7	0.1	NA	NA	NA	NA
Manganese	350	5	NA	NA	NA	NA
Mercury	-	0.01	NA	NA	NA	NA
Nickel	14	0.2	NA	NA	NA	NA
Zinc	-	30 ^h	NA	NA	NA	NA
Dissolved Metals						
Aluminium	NA	NA	5	0.055 ^b	20	5
Arsenic	NA	NA	0.5	0.024 ^c	2	0.5-5
Barium	NA	NA	-	-	-	-
Beryllium	NA	NA	-	-	0.5	-
Cadmium	NA	NA	10	0.00054 ^g	0.05	0.01
Chromium	NA	NA	-	0.0025 ^{d g}	1	1
Cobalt	NA	NA	-	0.0014	0.1	1
Copper	NA	NA	0.5	0.0014	5	0.4-5
Iron	NA	NA	-	-	10	not sufficiently toxic
Lead	NA	NA	0.1	0.0136 ^g	5	0.1
Manganese	NA	NA	-	1.9	10	not sufficiently toxic
Mercury	NA	NA	-	0.00006 ^{e, f}	0.002	0.002
Nickel	NA	NA	1	0.0275 ^g	2	1
Zinc	NA	NA	20	0.02 ^g	5	20

NA - not applicable

blank cell denoted with - indicates no criterion available.

^a Aluminium calculated using the ADWG (2011) aesthetic guideline based on post-flocculation problems. Insufficient data to set a guideline value based on health considerations

^b Aluminium guideline for pH > 6.5 was based on the average pH being above pH 6.5 at each surface water location.

^c Guideline value for arsenic (III).

^d Guideline value for chromium (VI).

^e Guideline value for inorganic mercury.

^f 99% species protection level DGV has been adopted to account for the bioaccumulating nature of this contaminant.

^g Hardness correction factor applied to the threshold value as detailed in ANZG 2018

^h Zinc calculated using the ADWG (2011) aesthetic guideline. Insufficient data to set a guideline value based on health considerations

6. DATA QUALITY OBJECTIVES

To achieve the objectives and purpose of the surface water monitoring program, both the field and laboratory programs must result in data that is representative of the conditions at the site. As such, specific Data Quality Objectives (DQOs) have been developed for the tasks to be completed to validate the remediation of the site. The DQO process is a systematic, seven step process that defines the criteria that the validation sampling should satisfy in accordance with the *Guidelines for the NSW Site Auditor Scheme (3rd Edition)* (NSW EPA 2017).

The seven step DQOs process comprises:

1. Step 1: State the problem;
2. Step 2: Identify the decisions/ goal of the study;
3. Step 3: Identify the information inputs;
4. Step 4: Define the boundaries of the study;
5. Step 5: Develop the decision rules or analytical approach;
6. Step 6: Specify the performance or acceptance criteria;
7. Step 7: Develop the plan for obtaining data.

The seven step DQO process has been completed for surface water monitoring to be completed before, during and after site remediation.

6.1 Step 1: State the problem

Due to historic loadout of ore concentrate surface water flow over ore impacted soils has been identified to result in migration of total and dissolved metal concentrations from the site. The site has been declared significantly contaminated land by the NSW EPA and a VMP has been prepared to describe how associated risks to human health and the environment will be managed.

6.1.1 Contaminants of Concern

Contaminant of Concern relevant to receiving surface waters appear limited to metals (aluminium, cadmium, copper, lead, nickel, zinc) which exceed the adopted relevant health and/or ecological assessment criteria.

6.2 Step 2: Identify the decisions / goal of the study

The goal of the study is to assess the migration of metal(loid) contamination from the site in surface waters and the impact of migration to surface waters off site.

Based on the decision-making process for assessing urban redevelopment sites, detailed in the *NSW Site Auditor Guidelines, 3rd Edition 2017*, the following decisions must be made with respect to the targeted validation goals:

1. Is the data collected of sufficient quality to meet the project objectives?
2. Is the data reliable?
3. What is the fate and transport of contaminant offsite?
4. What are the potential risks to human health and the environment?

6.3 Step 3: Identify the information inputs

Inputs to the decisions will be sourced from:

1. Review of historical surface water monitoring results
2. Physico-chemical properties collected for each of the 10 surface water sampling locations
3. Sampling of surface water and analysis for contaminants of concern

4. Analytical results for metal(loid)s in surface water samples from each of the 10 sampling locations
5. Quality Assurance / Quality Control data review
6. Comparison of the above samples to the assessment criteria outlined in **Section 5**.
7. All sample analyses conducted using National Association of Testing Authorities (NATA) registered methods in accordance with ANZECC (1996) and NEPC (1999) guidelines
8. All samples appropriately preserved and handled in accordance with the sampling methodology
9. PQLs less than the adopted assessment criteria

6.4 Step 4: Definition of the Study Boundary

The spatial boundaries are shown on **Figure 1** and include:

1. Three tributaries of the Mulwaree River, one located approximately 100 m west of the rail corridor at CH. 262.600, one adjacent to a culvert on the western side of the rail line at CH 262.600 and one adjacent a culvert on the eastern side of the rail line at CH 262.600.
2. Four locations adjacent to culverts, one western side of the rail line at CH 262.300, one on the eastern side of the rail line at CH 262.300, one on the western side of the rail line at CH 262.000 and one on the eastern side of the rail line at CH 262.000.
3. The dam located downgradient from the site northern rail culvert forming part Lot A DP 440822, and three locations along the Mulwaree River

The vertical boundaries are limited to the depth of surface waters encountered and accessible.

The temporal boundary includes historical surface water results as well as data collected under this SAQP comprising quarterly monitoring events over pre-remediation, remediation and post-remediation periods. Two post remediation surface water monitoring events will be included in the validation report.

6.5 Step 5: Develop the decision rules or analytical approach

The decisions rules for this investigation are as follows:

1. Has contaminant migration via surface water been adequately assessed?
2. Have contaminant impacts to surface water off site been adequately assessed?
3. Is the data reliable?
4. Does the data define clear presence / absence of unacceptable risk when assessed against Tier 1 criteria?
5. If Tier 1 assessment of risk is not clear, then does Tier 2 / Tier 3 risk assessment define absence of unacceptable risk?
6. Are there any remaining data gaps?

6.6 Step 6: Specify the performance or acceptance criteria

6.6.1 The tolerable limits on decision errors are as follows:

1. Probability that 95% of data will satisfy the DQIs, therefore a limit on decision error will be 5% that a conclusive statement may be incorrect:
 - a. A 5% probability of a false negative (i.e. assessing that the average concentration of contaminants of concern are less than the assessment criteria when they are not); and
 - b. A 5% probability of a false positive (i.e. assessing that the average concentration of contaminants of concern are more than the assessment criteria when they are not).

The potential for significant errors will be minimised by:

1. Completion of QA/QC measures of the investigation data to assess if the data satisfies the DQIs.
2. Assessment of whether appropriate sampling and analytical densities were completed for the purposes of the investigation.
3. Ensuring that the criteria set for the investigation were appropriate for the land use.

DQIs have been established to set acceptance limits on field and laboratory data collected as part of the investigation and are discussed further below.

6.6.2 Evaluation of Analytical Data

Acceptable limits and the manner of addressing possible decision errors for laboratory analysis associated with water quality monitoring and verification of imported materials are outlined below.

Accuracy: Accuracy is defined as the nearness of a result to the true value, where all random errors have been statistically removed. Internal accuracy is measured using percent recovery '%R' and external accuracy is measured using the Relative Percent Difference '%RPD'.

Internal accuracy will be tested utilising:

Surrogates	Surrogates are QC monitoring spikes, which are added to all field and QA/QC samples at the beginning of the sample extraction process in the laboratory, where applicable. Surrogates are closely related to the organic target analytes being measured, are to be spiked at similar concentrations, and are not normally found in the natural environment;
Laboratory control samples	An externally prepared and supplied reference material containing representative analytes under investigation. These will be undertaken at a frequency of one per analytical batch.
Matrix spikes	Field samples which are injected with a known concentration of contaminant and then tested to determine the potential for adsorption onto the matrix. These will be undertaken at a frequency of 5%.

Recovery data shall be categorised into one of the following control limits:

- 70%-130%R confirming acceptable data, note that there are some larger %R for intractable substances.

External accuracy will be determined by the submission of inter-laboratory duplicates at a frequency of 5%. Data will be analysed in accordance with the following control limits:

- 70%-130%R confirming acceptable data, note that there are some larger %R for intractable substances.

Any data which does not conform to these acceptance criteria will be examined for determination of suitability for the purpose of site characterisation.

Precision: The degree to which data generated from replicate or repetitive measurements differ from one another due to random errors. Precision is measured using the standard deviation 'SD' or Relative Percent Difference '%RPD'.

Internal precision will be determined by the undertaking of laboratory duplicates, where two sub samples from a submitted sample are analysed. These will be undertaken at a frequency of 10%. A RPD analysis is calculated and results compared to:

- 70%-130%R confirming acceptable data, note that there are some larger %R for intractable substances.

Any data which does not conform to these acceptance criteria will be examined for determination of suitability for the purpose of site characterisation.

External precision will be determined by the submission of intra-laboratory duplicates at a frequency of 5%. The external duplicate samples are to be obtained by mixing and then splitting the primary sample to create two identical sub samples. Field duplicate samples are to be labelled with a unique identification that does not reveal the association between the primary and duplicate samples e.g., QA1.

It must be noted that significant variation in duplicate results is often observed (particularly for solid matrix samples) due to sample heterogeneity or concentrations reported near the Practical Quantification Limit (PQL).

A RPD analysis is calculated and results compared to:

- 70%-130%R confirming acceptable data, note that there are some larger %R for intractable substances.

Any data which does not conform to these acceptance criteria will be examined for determination of suitability for the purpose of site characterisation.

Blank samples will be submitted with the analytical samples and analysed for the contaminants of concern One field blank will be collected and analysed per matrix type for each batch samples/each day.

The laboratory will additionally undertake a method blank with each analytical batch of samples. Laboratory method blank analyses are to be below the PQLs. Results shall be examined, and any positive results shall be examined. Positive blank results may not be subtracted from sample results.

Positive results may be acceptable if sample analyte concentrations are significantly greater than the amount reported in the blank (ten times for laboratory reagents such as methylene chloride, chloroform, and acetone etc., and five times for all other analytes). Alternatively, the laboratory PQL may be raised to accommodate blank anomalies provided that regulatory guidelines are not compromised by any adjustment made to the PQL.

Completeness: The completeness of the data set shall be judged as:

1. The percentage of data retrieved from the field compared to the proposed scope of works. The acceptance criterion is 95%.
2. The percentage of data regarded as acceptable based on the above data quality objectives. 95% of the retrieved data must be reliable.
3. The reliability of data based on cumulative sub-standard performance of data quality objectives.
4. All PQLs are below adopted assessment criteria.

Where two or more data quality objectives indicate less reliability than what the acceptance criteria dictates, the data will be considered with uncertainty.

Representativeness: Sufficient samples must have been collected.

Samples must be collected and preserved in accordance with the sampling methodology proposed in Step 7 to ensure that the sample is representative of the assessed stratum.

Comparability: The data must show little to no inconsistencies with results and field observations and include likely associates e.g. TPH C6-C9 and BTEX.

Decision Error Protocol

If the data received is not in accordance with the defined acceptable limits outlined in Step 6, it may be considered to be an estimate or be rejected. Determination of whether this data may be used or if re-sampling is required will be based on the following considerations:

1. Closeness of the result to the guideline concentrations.
2. Specific contaminant of concern (e.g. response to carcinogens may be more conservative).
3. The area of site and the potential lateral and vertical extent of questionable information.
5. Whether the uncertainty can be effectively incorporated into site management controls.

6.7 Step 7: Develop a plan for obtaining data

The overall design of the sampling plan considers migration of surface water from the site. Further detail is provided in **Section 7**.

7. SAMPLING PLAN

The sampling plan for surface water quality will be based on quarterly monitoring events over pre-remediation, remediation and post-remediation periods. Two post remediation surface water monitoring events will be included in the validation report.

Surface water sampling will target conditions upstream and downstream of three culverts which direct surface water beneath the rail formation onsite. Surface water at the site only occurs after rainfall and is received to the surrounding environment as follows:

1. Water passing through the northern culvert discharges to an adjacent agricultural property and during high rainfall events to a dam on the agricultural property.
2. Water passing through the middle culvert discharges across a causeway on Boyd Street to an adjacent vacant block.
3. Water passing through the southern culvert discharges beneath Goulburn Street to agricultural land in a tributary to the Mulwaree River (approximately 550m east of site)

Surface water samples will be collected upstream and downstream of each culvert and in receiving water bodies as shown on **Figure 1, Appendix 1**.

7.1.1 Water Quality Monitoring Performance Criteria

Surface water sampling will be completed in accordance with performance criteria defined in **Table 7-1**.

Table 7-1 Performance Criteria

Category	Validation Criteria
Accuracy: Accuracy in the collection of field data will be controlled by:	<ol style="list-style-type: none"> 1. Calibrated measurement equipment used. The water quality meter will be calibrated by the technical rental company prior to use. 2. Appropriate sampling methodologies utilised and complied with. Works to be completed with regard for AS NZS 5667.6-1998 Water quality - Sampling - Guidance on sampling of rivers and streams. 3. Collection of one intra-laboratory duplicate for surface water. 4. Rinsate samples are not proposed to be collected due to surface water samples being collected directly into dedicated sampling containers (or field filtered using single use syringes and filters) using disposable nitrile gloves.
Precision: The degree to which data generated from replicate or repetitive measurements differ from one another due to random errors. Precision of field data will be maintained by:	<ol style="list-style-type: none"> 1. A new pair of disposable nitrile gloves to handle each sample. 2. Samples will be placed immediately into laboratory supplied and appropriately preserved sampling vessels. 3. Samples will be stored in chilled, insulated containers with ice for transportation to the laboratory. 4. Sample numbers, preservation and analytical requirements will be recorded on chain of custody documents. 5. Samples will be transported to the laboratory under chain of custody conditions.
Completeness: The completeness of the data set shall be judged by:	<ol style="list-style-type: none"> 1. All locations sampled as outlined in Sections 7.1.1 and Figure 1, Appendix 1. 2. Sampling completed by experienced personnel. 3. Field documentation completed correctly.
Representativeness: The representativeness of the field data will be judged by:	<ol style="list-style-type: none"> 1. Non-disposable sampling equipment, such as the grab sampler and water quality meter, will be thoroughly decontaminated between locations using Decon 90 solution and deionised rinsate water. 2. At each location, a pair of disposable nitrile gloves will be worn while sampling and handling the sample; gloves will be replaced between each successive sample. 3. Surface water analytical samples will be collected directly into the sampling vessels using an extendable pole sampler where appropriate.
Comparability: Comparability to existing field data will be maintained by:	<ol style="list-style-type: none"> 1. Use of the same appropriate sampling methodologies. 2. Same sampling depths for surface water (where practical). 3. Field water quality parameters will be obtained using a calibrated water quality meter and recorded on a field sheet, comprising pH, temperature, total dissolved solids (TDS), dissolved oxygen (DO), redox potential and electrical conductivity (EC).

Category	Validation Criteria
	<p>4. Samples for dissolved metal analysis and CaCO₃ will be collected in dedicated disposable 50 mL plastic syringes. Metals will be field filtered through 0.45 µm filters directly into a sample bottle containing acid preservative.</p> <p>5. Visual and olfactory observations will also be recorded on the field sheet.</p> <p>6. Photographs will be taken of sampling location conditions at the time of sampling.</p>

8. REPORTING

On completion of each monitoring event, a report will be prepared documenting the completed sampling, trend analysis, quality assurance / quality control and laboratory reports.

The report shall include the following:

1. Executive summary
2. Introduction
3. Objectives and scope of work
4. Summary of completed field sampling and laboratory analysis
5. QA/QC review
6. Temporal trend analysis
7. Conclusions

9. REFERENCES







- ADWG (2011). National Health and Medical Research Council (NHMRC) (2001) National Resource Management Ministerial Council (NRMMC) Australian Drinking Water Guidelines 6, Version 3.5 updated August 2018.
- ANZECC (2000). Australian and New Zealand Environment and Conservation Council (ANZECC) & Agriculture and Resource Management Council of Australia and New Zealand (ARMCANZ)
- ANZG (2018) *Australian and New Zealand Guidelines for Fresh and Marine Water Quality*. Australian and New Zealand Governments and Australian state and territory governments, Canberra ACT, Australia. Available at www.waterquality.gov.au/anz-guidelines
- EnRiskS (2021). *Advice on risks to human health and the environment: Boyd Street and publicly accessible areas, Tarago NSW*.
- NEPM (2013). National Environment Protection Council (NEPC), National Environment Protection (Assessment of Site Contamination) Measure 1999, as amended 2013
- NHMRC (2008). National Health and Medical Research Council (NHMRC), National Resource Management Ministerial Council (NRMMC) Guidelines for Managing Risks in Recreational Water
- NSW DEC (2007). Contaminated Sites – Guidelines for the Assessment and Management of Groundwater Contamination, Department of Environment and Conservation NSW, Sydney, March 2007.
- NSW EPA (2017). *Contaminated Land Management - Guidelines for the NSW Site Auditor Scheme (3rd Edition)*, New South Wales Environment Protection Authority, Sydney, NSW, October 2017.

APPENDIX 1

FIGURES



Legend

-  Surface water sampling location
-  Rail corridor
-  Rail corridor fence
-  Area of lead exceedance (within rail corridor)
-  Indicative surface water flow path (ie: not ephemeral)
-  Indicative ephemeral surface water flow path

A4
1:10,000



Figure 1 | Surface Water Monitoring

APPENDIX 2 FIELD SHEETS

SW1

Project Name:	Tarago SWM	Ramboll Personnel:	Steve Cadman
Project No:	318001376-001		
Date:	09/14/2023		
Start Time:	08:50	Subcontractors:	
Finish Time:			

Equipment

Water Quality Meter ID: 11E101629

Water Quality Parameters

Sample ID	SW1
Sampling Method	GRAB
Time	08:51
Intake Depth From Surface (mm)	0.02
Temperature (C)	10.4
Dissolved Oxygen (mg/L)	8.87
pH	7.47
Oxido Reduction Potential (mV)	85.4
Turbidity	
Specific Conductivity	736
Comments	Sample collected from w side of culvert. Water not flowing in channel, (v sl seepage), clear.

QA/QC Checklist

Item	Yes	No	NA	Notes
Are air bubbles present in vials?		X		
Was sample for metals field filtered?	X			
Duplicate Samples Collected?		X		
Rinsate Blank Collected?		X		
Duplicate Sample ID:				
Primary Sample ID: SW1				
Rinsate Blank ID:				

Photos





SW10

Project Name:	Tarago SWM	Ramboll Personnel:	Ethan O'Connor Steve Cadman
Project No:	318001376-001		
Date:	09/13/2023		
Start Time:	14:23	Subcontractors:	
Finish Time:			

Equipment

Water Quality Meter ID: 11E101629

Water Quality Parameters

Sample ID	SW10
Sampling Method	GRAB
Time	14:24
Intake Depth From Surface (mm)	0.1
Temperature (C)	15.3
Dissolved Oxygen (mg/L)	7.54
pH	7.46
Oxido Reduction Potential (mV)	117.5
Turbidity	
Specific Conductivity	1471
Comments	Clear

QA/QC Checklist

Item	Yes	No	NA	Notes
Are air bubbles present in vials?		X		
Was sample for metals field filtered?	X			
Duplicate Samples Collected?		X		
Rinsate Blank Collected?		X		
Duplicate Sample ID:				
Primary Sample ID: SW10				
Rinsate Blank ID:				

Photos





SW1_UP

Project Name:	Tarago SWM	Ramboll Personnel:	Steve Cadman
Project No:	318001376-001		
Date:	09/14/2023		
Start Time:	09:23	Subcontractors:	
Finish Time:			

Equipment

Water Quality Meter ID: 11E101629

Water Quality Parameters

Sample ID	SW1_UP
Sampling Method	GRAB
Time	09:24
Intake Depth From Surface (mm)	0.1
Temperature (C)	10.4
Dissolved Oxygen (mg/L)	2.86
pH	7.05
Oxido Reduction Potential (mV)	65.2
Turbidity	
Specific Conductivity	710
Comments	From upstream pool, clear

QA/QC Checklist

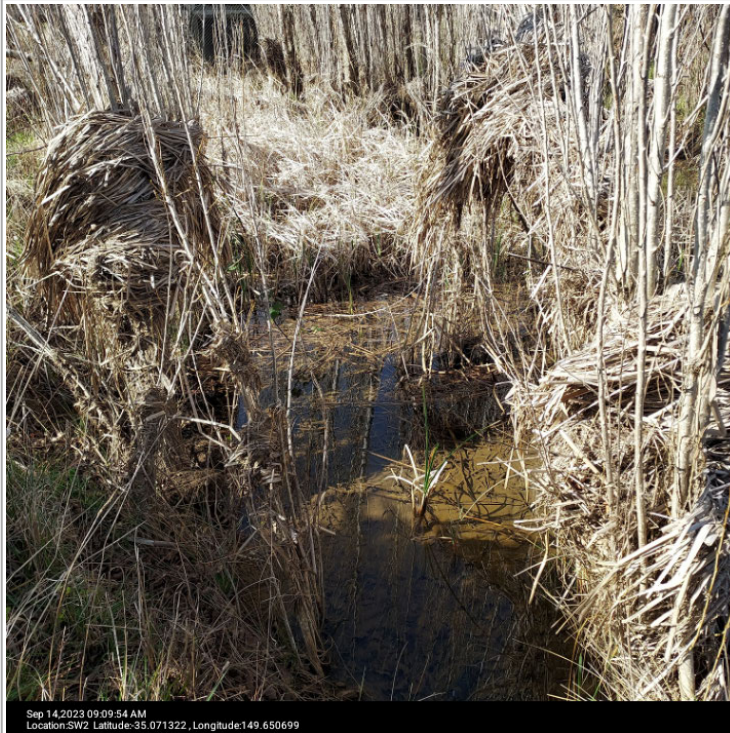
Item	Yes	No	NA	Notes
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Photos





Photos





Photos





SW4

Project Name:	Tarago SWM	Ramboll Personnel:	Ethan O'Connor Steve Cadman
Project No:	318001376-001		
Date:	09/14/2023		
Start Time:	10:09	Subcontractors:	
Finish Time:			

Equipment

Water Quality Meter ID: 11E101629

Water Quality Parameters

Sample ID	SW4
Sampling Method	GRAB
Time	10:09
Intake Depth From Surface (mm)	0.1
Temperature (C)	11.4
Dissolved Oxygen (mg/L)	11.76
pH	6.74
Oxido Reduction Potential (mV)	112.5
Turbidity	
Specific Conductivity	311.1
Comments	Still pond, east of rail line, clear.

QA/QC Checklist

Item	Yes	No	NA	Notes
Are air bubbles present in vials?		X		
Was sample for metals field filtered?	X			
Duplicate Samples Collected?	X			
Rinsate Blank Collected?		X		
Duplicate Sample ID: QC100 and QC200, dup and trip samples				
Primary Sample ID: SW4				
Rinsate Blank ID:				

Photos





SW5

Project Name:	Tarago SWM	Ramboll Personnel:	Ethan O'Connor
Project No:	318001376-001		
Date:	09/14/2023		
Start Time:	09:59	Subcontractors:	
Finish Time:			

Equipment

Water Quality Meter ID: 11E101629

Water Quality Parameters

Sample ID	SW5
Sampling Method	GRAB
Time	10:00
Intake Depth From Surface (mm)	0.1
Temperature (C)	
Dissolved Oxygen (mg/L)	
pH	
Oxido Reduction Potential (mV)	
Turbidity	
Specific Conductivity	
Comments	Not able to sample

QA/QC Checklist

Item	Yes	No	NA	Notes
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Photos



SW6

Project Name:	Tarago SWM	Ramboll Personnel:	Ethan O'Connor Steve Cadman
Project No:	318001376-001		
Date:	09/14/2023		
Start Time:	10:02	Subcontractors:	
Finish Time:			

Equipment

Water Quality Meter ID: 11E101629

Water Quality Parameters

Sample ID	SW6
Sampling Method	GRAB
Time	10:03
Intake Depth From Surface (mm)	0.1
Temperature (C)	
Dissolved Oxygen (mg/L)	
pH	
Oxido Reduction Potential (mV)	
Turbidity	
Specific Conductivity	
Comments	Not sampled

QA/QC Checklist

Item	Yes	No	NA	Notes
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Photos



Sep 14, 2023 10:03:45 AM
Location: SW6 Latitude: -35.066459, Longitude: 149.653975

SW7

Project Name:	Tarago SWM	Ramboll Personnel:	Ethan O'Connor Steve Cadman
Project No:	318001376-001		
Date:	09/13/2023		
Start Time:	15:19	Subcontractors:	
Finish Time:			

Equipment

Water Quality Meter ID: 11E101629

Water Quality Parameters

Sample ID	SW7
Sampling Method	GRAB
Time	15:20
Intake Depth From Surface (mm)	0.1
Temperature (C)	14.7
Dissolved Oxygen (mg/L)	9.14
pH	8.13
Oxido Reduction Potential (mV)	172.9
Turbidity	
Specific Conductivity	343.9
Comments	Turbid, hard to filter. Southern end of dam has been filled in

QA/QC Checklist

Item	Yes	No	NA	Notes
Are air bubbles present in vials?		X		
Was sample for metals field filtered?	X			
Duplicate Samples Collected?		X		
Rinsate Blank Collected?		X		
Duplicate Sample ID:				
Primary Sample ID: SW7				
Rinsate Blank ID:				

Photos





SW8

Project Name:	Tarago SWM	Ramboll Personnel:	Steve Cadman Ethan O'Connor
Project No:	318001376-001		
Date:	09/13/2023		
Start Time:	14:07	Subcontractors:	
Finish Time:			

Equipment

Water Quality Meter ID: 11E101629

Water Quality Parameters

Sample ID	SW8
Sampling Method	GRAB
Time	14:08
Intake Depth From Surface (mm)	0.1
Temperature (C)	14
Dissolved Oxygen (mg/L)	101.7
pH	7.09
Oxido Reduction Potential (mV)	102.9
Turbidity	
Specific Conductivity	1481
Comments	SI turbid, easy to filter

QA/QC Checklist

Item	Yes	No	NA	Notes
Are air bubbles present in vials?		X		
Was sample for metals field filtered?	X			
Duplicate Samples Collected?		X		
Rinsate Blank Collected?		X		
Duplicate Sample ID:				
Primary Sample ID: SW8				
Rinsate Blank ID:				

Photos



Sep 13, 2023 02:10:38 PM
Location: SW8 Latitude: -35.069778, Longitude: 149.657734



Sep 13, 2023 02:10:54 PM
Location: SW8 Latitude: -35.069746, Longitude: 149.657748



SW9

Project Name:	Tarago SWM	Ramboll Personnel:	Ethan O'Connor Steve Cadman
Project No:	318001376-001		
Date:	09/13/2023		
Start Time:	14:56	Subcontractors:	
Finish Time:			

Equipment

Water Quality Meter ID: 11E101629

Water Quality Parameters

Sample ID	SW9
Sampling Method	GRAB
Time	14:57
Intake Depth From Surface (mm)	0.1
Temperature (C)	13.4
Dissolved Oxygen (mg/L)	11.14
pH	7.85
Oxido Reduction Potential (mV)	174.1
Turbidity	
Specific Conductivity	1416
Comments	Clear

QA/QC Checklist

Item	Yes	No	NA	Notes
Are air bubbles present in vials?		X		
Was sample for metals field filtered?	X			
Duplicate Samples Collected?		X		
Rinsate Blank Collected?		X		
Duplicate Sample ID:				
Primary Sample ID: SW9				
Rinsate Blank ID:				

Photos





APPENDIX 3 SUMMARY OF RESULTS

Table 1:
Surface Water Parameters

SW1_UP										
	Sample Date	Time	Sample Depth (mm below surface)	Temperature (°C)	Spec Conductivity (µScm ⁻¹)	pH	Dissolved Oxygen (mg/L)	Redox (mV)	Turbidity (NTU)	Comments
Min				8.0	205.6	7.05	0.1	-41.4	-0.96	
Max				19.94	795	7.80	10.86	186.9	-0.96	
Average				12	611	7.42	5.5	110	-0.96	
SW1_UP	13/Aug/19	7:45	Not recorded	Not recorded	Not recorded	Not recorded	Not recorded	Not recorded	Not recorded	Not recorded
SW1_UP	24/Sep/19	Not recorded	100	Not recorded	Not recorded	Not recorded	Not recorded	Not recorded	Not recorded	Clear/slightly brown. Frogs audible.
SW1_UP	29/Jan/20	---	---	---	---	---	---	---	Not recorded	DRY
SW1_UP	1/Apr/20	13:25	200	19.94	584	7.05	4.72	154	Not recorded	Clear. No turbidity. No odour. No flow.
SW1_UP	11/Aug/20	Not recorded	100	8	205.6	7.43	10.55	170.7	Not recorded	Clear to slightly brown. Flowing.
SW1_UP	13/Oct/20	7:37	400	11.89	673	7.39	2.6	94	Not recorded	Water clear/brown. Flowing.
SW1_UP	28/Jan/21	8:15	100	16.9	587	7.3	0.1	186.9	Not recorded	Clear, low-no odour, no observable contamination.
SW1_UP	14/Apr/21	8:01	100	13.6	704	7.42	10.86	-41.4	Not recorded	Clear, no odour. Fence panel stack at downstream end. Flowing.
SW1_UP	13/Jul/21	13:47	300	8.18	662	7.65	6.12	162	Not recorded	Clear, colourless, no odour. Reeds growing adjacent to pond. Flowing.
SW1_UP	12/Sep/22	14:20	100	11.10	570	7.8	4.9	107	-0.96	Clear, not murky, not turbid, very minor suspended solids, no obvious smells or odours, natural running stream.
SW1_UP	13/Dec/22	8:46	100	12.40	618	7.79	5.47	136	Not recorded	---
SW1_UP	16/Jun/23	8:30	500	8.00	795	7.3	6.92	67	Not recorded	Clear, colourless, no turbidity, sediment on bottom of water body.
SW1_UP	14/Sep/23	9:24	100	10.40	710	7.05	2.86	65	Not recorded	Clear
SW1										
	Sample Date	Time	Sample Depth (mm below surface)	Temperature (°C)	Spec Conductivity (µScm ⁻¹)	pH	Dissolved Oxygen (mg/L)	Redox (mV)	Turbidity (NTU)	Comments
Min				7.8	206.1	6.35	0.04	23.6	0.61	
Max				17.4	783	7.77	11	175.8	0.61	
Average				11	617	7.46	6.4	113	0.61	
SW1	29/Jan/20	---	---	---	---	---	---	---	Not recorded	DRY
SW1	1/Apr/20	12:45	100	17.4	575	6.35	5.88	115	Not recorded	Clear to brown, low/no turbidity, minor suspended solids. No odour. No flow.
SW1	11/Aug/20	Not recorded	100	7.8	206.1	7.44	11.00	169.5	Not recorded	Brown, slightly turbid, continuous flow.
SW1	13/Oct/20	7:35	50	10.38	678	7.7	2.71	125	Not recorded	Water flowing, turbid, yellow/brown, water level shallow.
SW1	28/Jan/21	8:35	Not recorded	16.5	618	7.35	0.04	175.8	Not recorded	Clear, no observable contamination, amongst reeds.
SW1	14/Apr/21	8:28	50	12.2	684	7.65	9.81	23.6	Not recorded	Clear, no odour, some suspended solids. Shallow sampled at upstream end of culvert.
SW1	13/Jul/21	13:56	100	7.93	733	7.77	5.29	76	Not recorded	Clear, colourless, no odour. Reeds up stream. Sampled at culvert entrance.
SW1	12/Sep/22	14:45	10	9.2	533	7.67	4.7	157	0.61	Couldn't get completely 10cm underneath waterbody due to shallow depth, clear, not murky, not turbid, very minor suspended solids, no obvious smells or odours, small natural stream flowing into a culvert adjacent to the rail corridor, some vegetation and moss on the surface and within the waterbody.
SW1	13/Dec/22	10:54	100	12.3	623.6	7.59	5.45	140.4	Not recorded	---
SW1	16/Jun/23	8:13	100	7.8	783	7.6	10.28	57.6	Not recorded	Clear, colourless, no turbidity, no odour.
SW1	14/Sep/23	8:51	20	10.40	736	7.47	8.87	85.4	Not recorded	No flow, slow seepage, clear
SW2										
	Sample Date	Time	Sample Depth (mm below surface)	Temperature (°C)	Spec Conductivity (µScm ⁻¹)	pH	Dissolved Oxygen (mg/L)	Redox (mV)	Turbidity (NTU)	Comments
Min				7.0	213.3	6.54	0.12	48.3	17.10	
Max				17.54	803	8.27	10.6	185.9	17.1	
Average				11	587	7.69	6.1	135	17.10	
SW2	24/Sep/19	Not recorded	Surface. Shallow water.	Not recorded	Not recorded	Not recorded	Not recorded	Not recorded	Not recorded	Clear.
SW2	29/Jan/20	---	---	---	---	---	---	---	Not recorded	DRY
SW2	1/Apr/20	13:50	100	17.5	358	7.25	3.84	163	Not recorded	Brown, low-medium turbidity, some suspended solids. No odour. No flow.
SW2	30/Apr/20	17:40	50	9.8	605	6.54	3.32	185.9	Not recorded	Collected at Goulburn Street footbridge. Clear, not flowing.
SW2	11/Aug/20	Not recorded	100	7.3	213.3	8.13	10.59	185.2	Not recorded	Clear to slightly turbid. Flowing.
SW2	13/Oct/20	8:15	200	11.8	650	8.27	5.92	96	Not recorded	Water clear, flowing, water level low.
SW2	28/Jan/21	8:45	Not recorded	17	614	8.07	0.12	166.7	Not recorded	Light brown, low turbidity, no observable contamination.
SW2	14/Apr/21	8:47	100	12	677	7.82	9.83	48.3	Not recorded	Clear, no odour.
SW2	13/Jul/21	14:05	100	7.56	670	7.98	5.66	108	Not recorded	Clear, colourless, no odour. Sampled at culvert.
SW2	12/Sep/22	15:05	100	9.40	545	7.81	4.7	172	17.1	Clear, not murky, not turbid, very minor suspended solids, no obvious smells or odours, small waterbody flowing from a culvert adjacent to the rail corridor, some vegetation and moss on the surface and within the waterbody.
SW2	13/Dec/22	10:54	100	12.90	625.5	7.92	7.23	130	Not recorded	---
SW2	16/Jun/23	8:02	100	7.00	803	7.31	8.62	170	Not recorded	Clear, no signs of turbidity, colourless.
SW2	14/Sep/23	9:07	100	9.00	691.1	7.46	7.01	57	Not recorded	Not flowing
SW3										
	Sample Date	Time	Sample Depth (mm below surface)	Temperature (°C)	Spec Conductivity (µScm ⁻¹)	pH	Dissolved Oxygen (mg/L)	Redox (mV)	Turbidity (NTU)	Comments
Min				6.8	128.0	6.00	4.7	28.1	11.51	
Max				21.75	245	7.96	9.43	196.1	11.51	
Average				11	196	6.72	6.5	133	11.51	
SW3	24/Sep/19	Not recorded	50	Not recorded	Not recorded	Not recorded	Not recorded	Not recorded	Not recorded	Moderate turbidity. Frogs audible.
SW3	29/Jan/20	---	---	---	---	---	---	---	Not recorded	DRY
SW3	1/Apr/20	14:20	100	21.8	245	6.23	5.24	178	Not recorded	Brown to yellow, medium turbidity, some brown matter at surface.
SW3	11/Aug/20	Not recorded	100	8.9	142.5	7.43	9.43	174.7	Not recorded	Brown to clear.
SW3	13/Oct/20	8:36	100	11.63	229	7.96	4.84	137	Not recorded	Water clear/brown to slightly turbid, flowing.
SW3	28/Jan/21	---	---	---	---	---	---	---	Not recorded	DRY
SW3	14/Apr/21	9:10	100	10.7	242.4	7	8.06	64.8	Not recorded	Pale yellow, no odour
SW3	13/Jul/21	13:17	300	8.54	181	6.79	7.2	186	Not recorded	Clear, colourless to pale green/brown, no odour. Algae and reeds growing in drainage line. Not flowing.
SW3	12/Sep/22	15:32	10	9.80	184	6.8	4.7	159	11.51	Couldn't get completely 10cm underneath the waterbody due to shallow depth, brown to light brown, slightly murky, slightly turbid, some suspended solids, no obvious smells or odours, small stream from drain leading into a culvert adjacent to the rail corridor.

**Table 1:
 Surface Water Parameters**

	Sample Date	Time	Sample Depth (mm below surface)	Temperature (°C)	Spec Conductivity (µS _{cm} ⁻¹)	pH	Dissolved Oxygen (mg/L)	Redox (mV)	Turbidity (NTU)	Comments
SW3	13/Dec/22	9:47	100	11.80	243.5	6	5.95	196	Not recorded	---
SW3	16/Jun/23	8:57	200	6.80	128	6.17	7.15	28	Not recorded	Clear, slight turbidity, algae present
SW3	14/Sep/23	9:46	100	9.70	172.8	6.14	5.85	73.1	Not recorded	Clear, still
SW4										
	Sample Date	Time	Sample Depth (mm below surface)	Temperature (°C)	Spec Conductivity (µS _{cm} ⁻¹)	pH	Dissolved Oxygen (mg/L)	Redox (mV)	Turbidity (NTU)	Comments
Min				5.9	128.2	5.75	1.12	58.1	13.89	
Max				20.33	388.3	8.80	11.76	263.1	13.89	
Average				12	230	7.18	6.8	159	13.89	
SW4	6/Aug/19	11:35	100	12.4	128.2	8.8	9.74	200	Not recorded	Stagnant pond, clear to slightly yellow.
SW4	24/Sep/19	Not recorded	100	Not recorded	Not recorded	Not recorded	Not recorded	Not recorded	Not recorded	Turbid. Frogs audible.
SW4	29/Jan/20	---	---	---	---	---	---	---	Not recorded	DRY
SW4	1/Apr/20	15:00	200	20.33	297	6.73	5.24	168	Not recorded	Light brown, low turbidity. No odour. No flow.
SW4	30/Apr/20	17:30	50	9	388.3	5.75	3.53	263.1	Not recorded	Collected at Boyd Street culvert. Flowing.
SW4	11/Aug/20	Not recorded	100	7.4	153.4	7.69	10.42	210.9	Not recorded	Brown, slightly turbid, full but flow not evident.
SW4	13/Oct/20	8:50	300	13.1	307	8.19	5.73	107	Not recorded	Water flowing, turbid, brown, no odour.
SW4	28/Jan/21	9:10	100	17.4	227.3	7.93	1.12	180.8	Not recorded	Brown-orange, stagnant, low-moderate turbidity, no observable contamination.
SW4	14/Apr/21	9:38	100	11.5	231.1	7.35	9.77	70	Not recorded	Pale yellow, no odour.
SW4	13/Jul/21	13:28	300	7.95	192	6.87	5.41	173	Not recorded	Clear, colourless, no odour. Not flowing.
SW4	12/Sep/22	15:45	100	9	174.3	6.79	4.9	198	13.9	Brown, murky, turbid, suspended solids, no obvious smells or odours, small stream and water body coming from a culvert adjacent to rail corridor, vegetation and moss on the surface and within the water body.
SW4	13/Dec/22	9:49	100	13.2	175.5	6.54	4.6	168.1	Not recorded	---
SW4	16/Jun/23	9:46	200	5.9	176.5	6.72	8.99	58.1	Not recorded	Clear, low turbidity, slightly brown
SW4	14/Sep/23	10:09	100	11.40	311.1	6.74	11.76	113	Not recorded	Still, clear
SW5										
	Sample Date	Time	Sample Depth (mm below surface)	Temperature (°C)	Spec Conductivity (µS _{cm} ⁻¹)	pH	Dissolved Oxygen (mg/L)	Redox (mV)	Turbidity (NTU)	Comments
Min				6.2	117.9	6.45	4.06	-3.0	-	
Max				11.95	251.2	8.35	9.33	191	-	
Average				10	194	7.10	6.9	94	-	
SW5	29/Jan/20	---	---	---	---	---	---	---	Not recorded	DRY
SW5	1/Apr/20	---	---	---	---	---	---	---	Not recorded	DRY
SW5	11/Aug/20	Not recorded	100	11.2	117.9	7.33	7.94	163.2	Not recorded	Brown, turbid, flow at culvert evident beneath crushed rock.
SW5	13/Oct/20	9:06	50	11.95	187	8.35	4.06	-3	Not recorded	Water not flowing, very shallow, turbid, light brown, no odour.
SW5	28/Jan/21	---	---	---	---	---	---	---	Not recorded	DRY
SW5	14/Apr/21	10:20	100	11.6	251.2	6.85	8.75	74.9	Not recorded	Pale yellow, no odour. Small pool of water north of culvert, rest of area dry.
SW5	13/Jul/21	12:50	100	8.71	192	6.45	9.33	191	Not recorded	Turbid, pale brown, no odour. Sample taken from puddle adjacent to culvert. Not flowing.
SW5	12/Sep/22	---	---	---	---	---	---	---	---	DRY
SW5	13/Dec/22	---	---	---	---	---	---	---	---	DRY
SW5	16/Jun/23	9:22	50	6.2	220.1	6.5	4.47	43.7	---	Clear, slightly yellow, static.
SW5	14/Sep/23	10:00	---	---	---	---	---	---	---	Not sampled
SW6										
	Sample Date	Time	Sample Depth (mm below surface)	Temperature (°C)	Spec Conductivity (µS _{cm} ⁻¹)	pH	Dissolved Oxygen (mg/L)	Redox (mV)	Turbidity (NTU)	Comments
Min				8.3	168.3	6.53	4.5	111	83.53	
Max				17.6	201.2	9.07	9.73	205.8	83.53	
Average				12	181	7.60	7.4	170	83.53	
SW6	29/Jan/20	---	---	---	---	---	---	---	Not recorded	DRY
SW6	1/Apr/20	---	---	---	---	---	---	---	Not recorded	DRY
SW6	11/Aug/20	Not recorded	50	8.3	168.3	7.47	9.61	187	Not recorded	Brown, slightly turbid. Not flowing.
SW6	13/Oct/20	---	---	---	---	---	---	---	Not recorded	DRY
SW6	28/Jan/21	---	---	---	---	---	---	---	Not recorded	DRY
SW6	14/Apr/21	---	---	---	---	---	---	---	Not recorded	DRY
SW6	13/Jul/21	12:58	50	9.08	173	7.32	9.73	176	Not recorded	Clear to slightly turbid, pale yellow/brown, no odour. Flowing slightly.
SW6	12/Sep/22	15:58	10	11.8	180.6	9.07	4.5	111	83.53	Couldn't get completely 10cm underneath the waterbody due to shallow depth, brown, slightly murky, slightly turbid, some suspended solids, no obvious smells or odours, small stream coming from a culvert. Minor vegetation on the banks and surface of the water body.
SW6	13/Dec/22	10:19	100	17.6	201.2	6.53	5.7	205.8	Not recorded	---
SW6	16/Jun/23	---	---	---	---	---	---	---	Not recorded	DRY
SW6	14/Sep/23	10:03	---	---	---	---	---	---	---	Not sampled
SW7										
	Sample Date	Time	Sample Depth (mm below surface)	Temperature (°C)	Spec Conductivity (µS _{cm} ⁻¹)	pH	Dissolved Oxygen (mg/L)	Redox (mV)	Turbidity (NTU)	Comments
Min				6.9	94.7	6.34	1.8	14.1	8.60	
Max				23.1	2342	8.92	9.14	172.9	8.6	
Average				15	425	7.36	5.8	108	8.60	
SW7	29/Jan/20	10:00	50	23.1	609	8.92	8.46	83	Not recorded	Silty, from dam, low level water.
SW7	2/Apr/20	Not recorded	10	18.1	2342	7.23	4.45	114.2	Not recorded	Highly turbid.
SW7	11/Aug/20	Not recorded	100	12.5	94.7	7.26	7.80	109.8	Not recorded	Brown, turbid.
SW7	12/Oct/20	17:46	200	21.34	172	7.69	5.35	56	Not recorded	Water slightly turbid, brown, not flowing.
SW7	28/Jan/21	11:30	100	18.4	148.6	7.4	1.80	168	Not recorded	Light brown, low-moderate turbidity, no observable contamination.
SW7	14/Apr/21	10:51	100	11.5	140.7	6.57	8.76	86.7	Not recorded	Pale brown, dark colour to dam, earthy odour.

**Table 1:
 Surface Water Parameters**

Sample ID	Sample Date	Time	Sample Depth (mm below surface)	Temperature (°C)	Spec Conductivity (µScm ⁻¹)	pH	Dissolved Oxygen (mg/L)	Redox (mV)	Turbidity (NTU)	Comments
SW7	13/Jul/21	14:25	200	7.38	183	7.41	5.62	120	Not recorded	Slightly turbid, pale yellow/brown, no odour. Reeds growing in pond. Not flowing.
SW7	12/Sep/22	9:04	100	9.9	177	6.91	5.10	123	8.6	Light brown to brown, murky, turbid, suspended solids, no obvious smells or odours, waterbody within private property coming from a drain adjacent to the rail corridor and fence line. Minor vegetation and moss on the surface and within the water body. Evidence of property owner pushing material into the water body to fill to the surface.
SW7	13/Dec/22	10:25	100	17.5	142.6	6.34	3.18	135.5	Not recorded	---
SW7	16/Jun/23	10:14	100	6.9	325.8	7.1	4.55	14.1	Not recorded	Clear, brown/red tint, low turbidity, no observable contamination.
SW7	14/Sep/23	15:20	100	14.70	343.9	8.13	9.14	172.9	Not recorded	Turbid, hard to filter
SW8										
	Sample Date	Time	Sample Depth (mm below surface)	Temperature (°C)	Spec Conductivity (µScm⁻¹)	pH	Dissolved Oxygen (mg/L)	Redox (mV)	Turbidity (NTU)	Comments
	Min			7.6	170.5	6.98	3.09	31.9	2.84	
	Max			23.6	1481	8.53	10.2	136.1	2.84	
	Average			15	813	7.48	6.8	108	2.84	
SW8	29/Jan/20	11:01	100	23.6	1007	7.77	5.22	121.6	Not recorded	Upstream Lumley Road bridge. Clear, vegetation. Not flowing.
SW8	2/Apr/20	9:30am	10	18	425.7	7.23	4.39	124	Not recorded	Grease at surface, lots of algae growing on plants.
SW8	10/Aug/20	Not recorded	100	9.1	170.5	8.53	9.34	123.6	Not recorded	Water flowing, level high, turbid, sediment sample collected higher up embankment than previous round due to water level.
SW8	12/Oct/20	17:26	200	20.12	847	7.76	7.58	84	Not recorded	Water flowing, clear/brown.
SW8	28/Jan/21	10:30	100	18.9	730	7.48	3.09	97.8	Not recorded	Clear, low turbidity, no observable contamination.
SW8	14/Apr/21	11:19	100	13.4	712	7.15	8.61	116.2	Not recorded	Clear, no odour, leaf litter on surface
SW8	13/Jul/21	14:50	300	8.43	994	7.62	7.82	123	Not recorded	Clear, colourless, no odour. Reeds growing in river. Flowing.
SW8	12/Sep/22	9:17	100	9.5	683	7.24	5.1	136	2.8	Clear, not murky, not turbid, very minor suspended solids, no obvious smells or odours, natural running stream, minor vegetation and moss on the banks of the stream and within the water body.
SW8	12/Dec/22	18:07	100	20	727	6.98	5.35	131	Not recorded	---
SW8	16/Jun/23	10:28	300	7.6	1165	7.42	7.78	32	Not recorded	Clear, colourless, no turbidity, no observable contamination.
SW8	14/Sep/23	14:08	100	14.00	1481	7.09	10.2	103	Not recorded	
SW9										
	Sample Date	Time	Sample Depth (mm below surface)	Temperature (°C)	Spec Conductivity (µScm⁻¹)	pH	Dissolved Oxygen (mg/L)	Redox (mV)	Turbidity (NTU)	Comments
	Min			7.2	125.3	7.19	0.3	35.7	0.94	
	Max			25.0	1416	8.35	16.8	227.7	0.94	
	Average			15	747	7.71	9	132	0.94	
SW9	29/Jan/20	12:22	300	25.0	125.3	8.35	16.8	99.4	Not recorded	Stagnant pond. Algae and fish present. Slightly turbid.
SW9	02/Apr/20	Not recorded	10	18.2	381.7	7.62	6.29	124.5	Not recorded	Non-turbid, slightly brown, not flowing but full.
SW9	10/Aug/20	Not recorded	100	8.9	178.2	7.84	10.73	173.6	Not recorded	High level, brown, slightly turbid, bubbles at surface.
SW9	12/Oct/20	16:47	200	21.39	852	8.17	10.04	83	Not recorded	Water flowing, clear/brown, slightly turbid.
SW9	28/Jan/21	10:00	100	18.7	820	7.5	0.32	227.7	Not recorded	Clear, low turbidity, no observable contamination.
SW9	14/Apr/21	12:05	100	12.7	639.4	7.57	10.32	115.1	Not recorded	Very pale yellow, no odour.
SW9	13/Jul/21	15:32	200	7.66	1030	7.77	11.53	130	Not recorded	Clear, colourless, no odour. Flowing.
SW9	12/Sep/22	8:32	100	9.1	724	7.27	5.1	121	0.94	Light brown to brown, slightly murky, slightly turbid, some suspended solids, no obvious smells or odours, natural running stream, minor vegetation and moss on the banks of the stream and within the water body.
SW9	12/Dec/22	18:50	100	18.7	742	7.19	5.6	171	Not recorded	---
SW9	16/Jun/23	10:58	200	7.2	1304	7.71	9.49	36	Not recorded	Clear, colourless, slight orange tint in water body.
SW9	14/Sep/23	14:57	100	13.4	1416	7.85	11.14	174	Not recorded	Clear
SW10										
	Sample Date	Time	Sample Depth (mm below surface)	Temperature (°C)	Spec Conductivity (µScm⁻¹)	pH	Dissolved Oxygen (mg/L)	Redox (mV)	Turbidity (NTU)	Comments
	Min			7.7	682	7.19	3.6	3.8	3.08	
	Max			20.3	1471	7.64	9.72	148.7	3.08	
	Average			13	901	7.41	6.4	89	3.08	
SW10	13/Oct/20	12:26	400	16.02	881	7.19	3.58	79	Not recorded	Water flowing, clear/brown, slightly turbid, no odour.
SW10	28/Jan/21	10:30	100	18.2	710	7.27	4.1	3.8	Not recorded	Clear, low turbidity, no observable contamination.
SW10	14/Apr/21	11:33	100	12.9	682	7.35	8.18	103.5	Not recorded	Clear, no odour.
SW10	13/Jul/21	15:00	100	7.87	978	7.64	6.71	108	Not recorded	Clear to slight turbid, colourless, no odour. Flowing.
SW10	12/Sep/22	9:28	100	9.3	702	7.45	5.1	125	3.08	No discharge downstream of drainage line (north), clear, not murky, not turbid, very minor suspended solids, no obvious smells or odours, natural running stream, minor vegetation and moss on the banks of the stream and within the water body.
SW10	12/Dec/22	18:27	100	20.3	725	7.35	6.4	149	Not recorded	---
SW10	16/Jun/23	10:38	200	7.7	1060	7.6	9.72	28	Not recorded	Clear, no turbidity, colourless, aquatic vegetation next to sample location.
SW10	14/Sep/23	14:24	100	15.30	1471	7.46	7.54	117.5	Not recorded	Clear

Notes

L = Litre
 ppm = parts per million
 µScm⁻¹ = microSiemens per centimetre
 mV = milli Volts
 n/a = not applicable

DO was reported as % rather than mg/L on 16 June 2023 at SW2 (70.8%) and 13 September at SW08 (101.7%). These measurements were converted to mg/L based on temperature and salinity per *Fundamentals of Environmental Measurements* (Fondriest Environmental, Inc. 19 Nov. 2013. Access at <https://www.fondriest.com/environmental-measurements/parameters/water-quality/dissolved-oxygen/> 20/02/2024). These conversions are further described in *RE: Tarago AQM and SWM Quarterly reports* (Ramboll email 20/02/2024).

Table 2: SW1 Analytical Results



	Site Specific Human Health Criteria ^a	Site Specific Ecology Criteria (Southern Culvert) ^a	Health-based Screening Criteria (Recreational Waters) ^b	Ecological Screening Criteria (ANZG 95% Protection) Fresh Water ^c	Sample Type:	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water
					Lab ID	29/Jan/20	1/Apr/20	11/Aug/20	13/Oct/20	28/Jan/21	14/Apr/21	13/Jul/21	12/Sep/22	13/Dec/22	16/Jun/23	14/Sep/23	
Guidelines					Sample Description:	DRY	Clear to brown, low/no turbidity, minor suspended solids. No odour.	Brown, slightly turbid, continuous flow.	Water flowing, turbid, yellow/brown, water level shallow.	Clear, no observable contamination, amongst reeds	Clear, no odour, some suspended solids. Shallow sampled at upstream end of culvert	Clear, colourless, no odour. Reeds up stream. Sampled at culvert entrance.	Clear, colourless, very minor suspended solids, no odour. Reeds up stream, minor vegetation on the surface and within the waterbody. Sampled at culvert entrance, unable to completely submerge sample container 10cm below water surface.	Clear, colourless, no odour. Reeds up stream. Sampled at culvert entrance.	Clear, colourless, no turbidity, no odour. Reeds up stream. Sampled at culvert entrance.	Clear, slow seepage, water not flowing in channel	
Analyte grouping/Analyte					Units	LOR											
Total Metals																	
Aluminium	-	NA	2 ^d	NA	mg/L	0.05	-	0.13	0.88	0.61	< 0.05	< 0.05	< 0.05	0.17	< 0.05	< 0.05	0.49
Arsenic	7	NA	0.1	NA	mg/L	0.001	-	0.004	< 0.001	0.004	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.002
Barium	-	NA	2	NA	mg/L	0.001	-	0.15	0.04	0.36	0.12	0.08	0.07	0.06	0.07	0.08	-
Beryllium	-	NA	0.6	NA	mg/L	0.001	-	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	-
Cadmium	1.4	NA	0.002	NA	mg/L	0.0002	-	0.0013	< 0.0002	0.0021	0.0005	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	0.0005
Chromium	-	NA	0.5	NA	mg/L	0.001	-	< 0.001	0.002	0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.001
Cobalt	-	NA	-	NA	mg/L	0.001	-	0.014	< 0.001	0.007	0.002	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.002
Copper	-	NA	20	NA	mg/L	0.001	-	0.019	0.003	0.014	0.005	0.001	0.002	0.002	0.001	< 0.001	0.008
Iron	-	NA	3	NA	mg/L	0.05	-	4.5	0.91	1.41	0.07	0.18	0.94	0.23	0.4	6.6	
Lead	7	NA	0.1	NA	mg/L	0.001	-	0.056	0.001	0.032	< 0.001	0.002	0.005	< 0.001	< 0.001	< 0.001	0.028
Manganese	350	NA	5	NA	mg/L	0.005	-	0.76	0.024	0.706	0.28	0.032	0.036	0.093	0.042	-	
Mercury	-	NA	0.01	NA	mg/L	0.0001	-	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	-
Nickel	14	NA	0.2	NA	mg/L	0.001	-	0.003	0.002	0.002	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.001
Zinc	-	NA	30	NA	mg/L	0.005	-	0.2	0.02	0.32	0.086	0.009	0.025	0.026	0.019	< 0.005	0.083
Dissolved Metals																	
Dissolved Aluminium	NA	5	NA	0.055	mg/L	0.05	-	-	0.54	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Dissolved Arsenic	NA	0.5	NA	0.024	mg/L	0.001	-	-	< 0.001	< 0.001	0.003	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Dissolved Barium	NA	-	NA	-	mg/L	0.001	-	-	0.04	0.11	0.08	0.06	0.05	0.06	0.08	-	
Dissolved Beryllium	NA	-	NA	0.00013	mg/L	0.001	-	-	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	-
Dissolved Cadmium	NA	0.01	NA	#	mg/L	0.0002	-	-	0.0003	0.0005	0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002
Dissolved Chromium	NA	NA	NA	#	mg/L	0.001	-	-	0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Dissolved Cobalt	NA	NA	NA	0.0014	mg/L	0.001	-	-	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Dissolved Copper	NA	0.4	NA	0.0014	mg/L	0.001	-	-	0.003	0.002	0.005	< 0.001	0.001	< 0.001	< 0.001	< 0.001	< 0.001
Dissolved Iron	NA	-	NA	0.3	mg/L	0.05	-	-	0.34	< 0.05	0.13	< 0.05	0.14	0.16	0.1	< 0.05	< 0.05
Dissolved Lead	NA	0.1	NA	#	mg/L	0.001	-	-	0.004	< 0.001	< 0.001	< 0.001	0.001	< 0.001	< 0.001	< 0.001	< 0.001
Dissolved Manganese	NA	NA	NA	1.9	mg/L	0.005	-	-	0.018	0.044	0.12	0.029	0.035	0.048	0.024	0.056	-
Dissolved Mercury	NA	NA	NA	0.00006	mg/L	0.0001	-	-	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001
Dissolved Nickel	NA	1	NA	#	mg/L	0.001	-	-	0.002	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Dissolved Zinc	NA	20	NA	#	mg/L	0.005	-	-	0.045	0.073	0.058	0.005	0.025	0.02	0.016	< 0.005	< 0.005

- indicates no criterion available
 NA indicates non-applicable
 LOR = Limit of Reporting
 Concentrations below the LOR noted as <value
 NOC = No observed contamination
 Australian and New Zealand Guidelines for Fresh and Marine Water
 Australia and New Zealand Environment and Conservation Council (2000) Australian and New Zealand Guidelines for Fresh and Marine Water Quality.
 ANZECC, NEPM and NHMRC guidelines for mercury are based on total mercury.
^aEnRisks (2020) Advice on risks to human health and the environment: Boyd Street and publicly accessible areas, Tarago NSW
^bRecreational criteria adopted are 10 x Australian Drinking Water Guidelines ADWG (2011)
^cANZG (2018) Australian and New Zealand Guidelines for Fresh and Marine Water Quality.
^dThe recreational criteria for aluminium is based on aesthetic issues post flocculation and is not indicative of risks to human health.
 Concentrations in blue bold font exceed human health recreational screening or site specific criteria
 Concentrations in grey box exceed ecological screening or site specific criteria

Sample Type:	Surface Water																
	Lab ID	S19-Sc37063	-	S20-Sc12289	S20-Au23118	S20-Sc25145	-	S21-Sc22334	N21-J130453	S22-Sc00368	N22-De0031037	S23-Jn0046777	S23-Sc0034057	-	-		
Sample ID:	24/Sep/19	29/Jun/20	17/Apr/20	11/Aug/20	13/Oct/20	28/Jan/21	14/Apr/21	13/Jul/21	12/Sep/22	13/Dec/22	16/Jun/23	14/Sep/23	-	-	-		
Project Name:	Tarago SW Monitoring	Tarago SW Monitoring	Tarago SW Monitoring	Tarago SW Monitoring	Tarago SW Monitoring	Tarago SW Monitoring	Tarago SW Monitoring	Tarago SW Monitoring	Tarago SW Monitoring	Tarago SW Monitoring	Tarago SW Monitoring	Tarago SW Monitoring	Tarago SW Monitoring	-	-		
Project No:	318000780	318000780	318000780	318000780	318000780	318000780	318000780	318000780	318000780	318001376	318001376-001	318001376-007	318001376-001	-	-		
Sample Location:	Tarago Rail Loop	Tarago Rail Loop	Tarago Rail Loop	Tarago Rail Loop	Tarago Rail Loop	Tarago Rail Loop	Tarago Rail Loop	Tarago Rail Loop	Tarago Rail Loop	Tarago Rail Corridor	Tarago Rail Corridor	Tarago Rail Corridor	Tarago Rail Corridor	-	-		
Sampling Method:	Grab Sample	-	Grab Sample	Grab Sample	Grab Sample	Grab Sample	Grab Sample	Grab Sample	Grab Sample	Grab Sample	Grab Sample	Grab Sample	Grab Sample	-	-		
Sample Description:	Moderate turbidity.	DRY	Brown to yellow, medium turbidity, some brown matter at surface.	Brown to clear.	Water clear/brown to slightly turbid, flowing.	DRY	Pale yellow, no odour	Clear, colourless to pale green/brown, no odour. Algae and reeds growing in drainage line. Not flowing.	Slightly murky, slightly turbid, light brown to brown, some suspended solids, no odour. Algae and reeds growing in drainage line, unable to completely submerge sample container 10cm below water surface. Not flowing.	Clear, colourless to pale yellow/brown. Low flow, staining observed in culvert	Clear, colourless to pale yellow/brown. Slight turbidity, algae present in water body.	Clear	-	-	-		
Analyte grouping/Analyte	Units	LOR															
Inorganics																	
Ammonia (as N)	-	-	0.5	0.9	mg/L	0.01	0.001	-	-	-	-	-	-	-	-	-	
Conductivity (at 25°C)	-	-	-	-	µS/cm	100	170	-	-	-	-	-	-	-	-	-	
Nitrate & Nitrite (as N)	-	-	-	-	mg/L	0.05	3.8	-	-	-	-	-	-	-	-	-	
Nitrate (as N)	-	-	50	3.5	mg/L	0.02	3.7	-	-	-	-	-	-	-	-	-	
Nitrite (as N)	-	-	30	-	mg/L	0.02	<0.02	-	-	-	-	-	-	-	-	-	
pH (at 25°C)	-	-	-	-	pH units	0.1	6	-	-	-	-	-	-	-	-	-	
Phosphate total (as P)	-	-	-	-	mg/L	0.05	0.06	-	-	-	-	-	-	-	-	-	
Total Dissolved Solids Dried at 180°C ± 2°C	-	-	-	-	mg/L	0.005	0.13	-	-	-	-	-	-	-	-	-	
Total Kjeldahl Nitrogen (as N)	-	-	0.8	-	mg/L	0.2	0.6	-	-	-	-	-	-	-	-	-	
Total Nitrogen (as N)	-	-	-	-	mg/L	0.2	4.4	-	-	-	-	-	-	-	-	-	
Total Suspended Solids Dried at 105°C	-	-	-	0.7	mg/L	0.005	0.0072	-	-	-	-	-	-	-	-	-	
Turbidity	-	-	-	-	NTU	1	37	-	-	-	-	-	-	-	-	-	
Total Metals																	
Aluminium	-	NA	2 ^d	NA	mg/L	0.05	-	0.92	0.61	0.46	-	0.16	0.3	0.26	0.25	0.05	0.31
Arsenic	7	NA	0.1	NA	mg/L	0.001	-	0.004	< 0.001	0.003	-	0.002	< 0.001	0.002	0.001	0.001	0.001
Barium	-	NA	2	NA	mg/L	0.001	NA	0.1	0.05	0.07	-	0.06	0.04	0.05	0.08	0.03	-
Beryllium	-	NA	0.6	NA	mg/L	0.001	-	< 0.001	< 0.001	< 0.001	-	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	-
Cadmium	1.4	NA	0.002	NA	mg/L	0.0002	NA	0.021	0.0011	0.0036	-	0.0011	0.0003	0.0016	0.0045	0.0003	0.0013
Chromium	-	NA	5	NA	mg/L	0.001	-	0.002	0.001	0.001	-	0.001	< 0.001	< 0.001	0.002	< 0.001	< 0.001
Cobalt	-	NA	20	NA	mg/L	0.001	NA	0.006	< 0.001	< 0.001	-	0.001	< 0.001	0.004	0.003	0.002	0.018
Copper	-	NA	3	NA	mg/L	0.05	NA	1.8	0.6	1.4	-	1.4	0.82	1.4	0.67	1.1	2.5
Lead	7	NA	0.1	NA	mg/L	0.001	NA	0.17	0.011	0.051	-	0.017	0.008	0.024	0.015	0.014	0.023
Manganese	350	NA	5	NA	mg/L	0.005	NA	0.52	0.017	0.042	-	0.071	0.011	0.24	0.3	0.15	-
Mercury	-	NA	0.01	NA	mg/L	0.0001	NA	< 0.0001	< 0.0001	< 0.0001	-	< 0.0001	< 0.0001	0.0001	< 0.0001	< 0.0001	-
Nickel	14	NA	0.2	NA	mg/L	0.001	NA	0.036	0.002	0.011	-	0.004	0.001	0.004	0.008	0.002	0.002
Zinc	-	NA	30	NA	mg/L	0.005	NA	4	0.22	0.74	-	0.25	0.054	0.34	0.13	0.97	0.35
Dissolved Metals																	
Aluminium (filtered)	NA	5	NA	0.055	mg/L	0.05	-	0.3	0.69	0.4	-	0.08	0.28	0.26	0.08	0.05	0.08
Arsenic (filtered)	NA	0.5	NA	0.024	mg/L	0.001	-	0.001	< 0.001	0.002	-	0.002	< 0.001	0.001	0.001	< 0.001	< 0.001
Barium (filtered)	NA	-	NA	-	mg/L	0.001	-	0.08	0.07	0.07	-	0.05	0.04	0.05	0.07	0.03	-
Beryllium (filtered)	NA	-	NA	0.00013	mg/L	0.001	-	< 0.001	< 0.001	< 0.001	-	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	-
Cadmium (filtered)	NA	0.01	NA	#	mg/L	0.0002	NA	0.0053	0.001	0.0033	-	0.001	0.0002	0.0015	0.0038	< 0.0002	0.0005
Chromium (filtered)	NA	NA	NA	#	mg/L	0.001	-	0.001	0.001	0.001	-	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Cobalt (filtered)	NA	NA	NA	0.0014	mg/L	0.001	NA	0.005	< 0.001	< 0.001	-	0.001	< 0.001	0.004	0.003	0.002	0.004
Copper (filtered)	NA	0.4	NA	0.0014	mg/L	0.001	-	0.027	0.016	0.1	-	0.037	0.009	0.033	0.038	0.009	0.005
Iron (filtered)	NA	-	NA	0.3	mg/L	0.05	NA	0.33	0.46	1.1	-	1.1	0.54	0.98	0.31	0.51	0.38
Lead (filtered)	NA	0.1	NA	#	mg/L	0.001	-	0.011	0.009	0.023	-	0.013	0.003	0.012	0.006	0.005	0.002
Manganese (filtered)	NA	NA	NA	1.9	mg/L	0.005	NA	0.015	0.014	0.029	-	0.065	0.008	0.23	0.14	-	-
Mercury (filtered)	NA	NA	NA	0.00006	mg/L	0.0001	NA	< 0.0001	< 0.0001	< 0.0001	-	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	-
Nickel (filtered)	NA	1	NA	#	mg/L	0.001	NA	0.002	0.002	0.011	-	0.003	0.001	0.004	0.007	0.004	0.002
Zinc (filtered)	NA	20	NA	#	mg/L	0.005	NA	0.95	-	0.2	-	0.23	0.048	0.32	0.87	0.12	0.22
Total Recoverable Hydrocarbons - 2013 NEPM Fractions																	
Naphthalene	-	-	17	16	µg/L	10	<10	-	-	-	-	-	-	-	-	-	-
TRH >C10-C16	-	-	-	-	µg/L	50	<50	-	-	-	-	-	-	-	-	-	-
TRH >C10-C16 less Naphthalene (F2)	-	-	-	-	µg/L	50	<50	-	-	-	-	-	-	-	-	-	-
TRH >C10-C40 (total)*	-	-	-	-	µg/L	100	<100	-	-	-	-	-	-	-	-	-	-
TRH >C16-C34	-	-	-	-	µg/L	100	<100	-	-	-	-	-	-	-	-	-	-
TRH >C34-C40	-	-	-	-	µg/L	100	<100	-	-	-	-	-	-	-	-	-	-
TRH C6-C10	-	-	-	-	µg/L	20	<20	-	-	-	-	-	-	-	-	-	-
TRH C6-C10 less BTEX (F1)	-	-	-	-	µg/L	20	<20	-	-	-	-	-	-	-	-	-	-
BTEX																	
Benzene	-	-	10	950	µg/L	1	<1	-	-	-	-	-	-	-	-	-	-
Ethylbenzene	-	-	3000	80	µg/L	1	<2	-	-	-	-	-	-	-	-	-	-
m&p-Xylenes	-	-	-	-	µg/L	2	<2	-	-	-	-	-	-	-	-	-	-
o-Xylene	-	-	-	-	µg/L	1	<2	-	-	-	-	-	-	-	-	-	-
Toluene	-	-	8000	180	µg/L	1	<2	-	-	-	-	-	-	-	-	-	-
Xylenes - Total	-	-	6000	200	µg/L	3	<3	-	-	-	-	-	-	-	-	-	-

- indicates no criterion available
 LOR = Limit of Reporting
 Concentrations below the LOR noted as <value
 NOC = No observed contamination
 Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG 2018)
 Australia and New Zealand Environment and Conservation Council (2000) Australian and New Zealand Guidelines for Fresh and Marine Water Quality.
 ANZECC, NEPM and NHMRC guidelines for mercury are based on total mercury.
 *EnRisks (2020) Advice on risks to human health and the environment: Boyd Street and publicly accessible areas, Tarago NSW
 *Recreational criteria adopted are 10 x Australian Drinking Water Guidelines ADWG (2011)
 *ANZG (2018) Australian and New Zealand Guidelines for Fresh and Marine Water Quality.
 *The recreational criteria for aluminium is based on aesthetic issues post flocculation and is not indicative of risks to human health.
 Concentrations in blue bold font exceed human health recreational screening or site specific criteria
 Concentrations in grey box exceed ecological screening or site specific criteria

Table 7: SW5 Analytical Results



	Site Specific Human Health Criteria ^a	Site Specific Ecology Criteria (Middle and Northern Culverts) ^a	Health-based Screening Criteria (Recreational Waters) ^b	Ecological Screening Criteria (ANZG 95% Protection) Fresh Water ^c	Sample Type:		Surface Water	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water	
					Lab ID	Sample date:	Sample ID:	Project Name:	Project No:	Sample Location	Sampling Method:	Sample Description:	Units	LOR			
							29/Jan/20	1/Apr/20	520-Au23120	520-Oc25149	28/Jan/21	14/Apr/21	13/Jul/21	12/Sep/22	13/Dec/22	16/Jun/23	14/Sep/23
							SW5	SW5	SW5	SW5	SW5	SW5	SW5	SW5	SW5	TAR_SW5_160623	SW5
							Tarago SW Monitoring	Tarago SW Monitoring	Tarago SW Monitoring	Tarago SW Monitoring	Tarago SW Monitoring	Tarago SW Monitoring	Tarago SW Monitoring	Tarago SW Monitoring	Tarago SW Monitoring	Tarago SW Monitoring	Tarago SW Monitoring
							318000780	318000785	318000785	318000785	318000780	318000780	318000780	318000780	318001376-001	318001376-007	318001376-007
							Tarago Rail Loop	Tarago Rail Loop	Tarago Rail Loop	Tarago Rail Loop	Tarago Rail Loop	Tarago Rail Loop	Tarago Rail Loop	Tarago Rail Corridor	Tarago Rail Corridor	Tarago Rail Corridor	Tarago Rail Corridor
							-	-	Grab Sample	Grab Sample	Grab Sample	Grab Sample	Grab Sample	Grab Sample	Grab Sample	Grab Sample	Grab Sample
Guidelines							DRY	DRY	Brown, turbid, flow at culvert evident beneath crushed rock.	Water not flowing, very shallow, turbid, light brown, no odour.	DRY	Pale yellow, no odour. Small pool of water north of culvert, rest of area dry	Turbid, pale brown, no odour. Sample taken from puddle adjacent to culvert. Not flowing.	DRY	DRY	Clear, low turbidity, slightly yellow, static. Sample taken from small puddle pooled to the north of the culvert.	DRY
Analyte grouping/Analyte																	
Inorganics																	
Ammonia (as N)	-	-	0.5	0.9	mg/L	0.01	-	-	-	-	-	-	-	-	-	-	-
Conductivity (at 25°C)	-	-	-	-	µS/cm	100	-	-	-	-	-	-	-	-	-	-	-
Nitrate & Nitrite (as N)	-	-	-	-	mg/L	0.05	-	-	-	-	-	-	-	-	-	-	-
Nitrate (as N)	-	-	50	3.5	mg/L	0.02	-	-	-	-	-	-	-	-	-	-	-
Nitrite (as N)	-	-	30	-	mg/L	0.02	-	-	-	-	-	-	-	-	-	-	-
pH (at 25°C)	-	-	-	-	pH units	0.1	-	-	-	-	-	-	-	-	-	-	-
Phosphate total (as P)	-	-	-	-	mg/L	0.05	-	-	-	-	-	-	-	-	-	-	-
Total Dissolved Solids Dried at 180°C ± 2°C	-	-	-	-	mg/L	0.005	-	-	-	-	-	-	-	-	-	-	-
Total Kjeldahl Nitrogen (as N)	-	-	0.8	-	mg/L	0.2	-	-	-	-	-	-	-	-	-	-	-
Total Nitrogen (as N)	-	-	-	-	mg/L	0.2	-	-	-	-	-	-	-	-	-	-	-
Total Suspended Solids Dried at 105°C	-	-	-	0.7	mg/L	0.005	-	-	-	-	-	-	-	-	-	-	-
Turbidity	-	-	-	-	NTU	1	-	-	-	-	-	-	-	-	-	-	-
Total Metals																	
Aluminium	-	NA	2 ^d	NA	mg/L	0.05	-	-	1.8	11	-	0.29	1.3	-	-	1.5	-
Arsenic	7	NA	0.1	NA	mg/L	0.001	-	-	0.001	0.005	-	0.002	0.001	-	-	0.002	-
Barium	-	NA	2	NA	mg/L	0.001	-	-	0.03	0.17	-	0.08	0.04	-	-	0.08	-
Beryllium	-	NA	0.6	NA	mg/L	0.001	-	-	< 0.001	< 0.001	-	< 0.001	< 0.001	-	-	< 0.001	-
Cadmium	1.4	NA	0.002	NA	mg/L	0.0002	-	-	0.0009	0.0021	-	0.0009	0.0008	-	-	0.0003	-
Chromium	-	NA	0.5	NA	mg/L	0.001	-	-	0.003	0.011	-	0.001	0.002	-	-	0.002	-
Cobalt	-	NA	-	NA	mg/L	0.001	-	-	< 0.001	0.003	-	< 0.001	< 0.001	-	-	0.001	-
Copper	-	NA	20	NA	mg/L	0.001	-	-	0.019	0.074	-	0.022	0.021	-	-	0.005	-
Iron	-	NA	3	NA	mg/L	0.05	-	-	1.5	8.9	-	0.97	1.1	-	-	9.5	-
Lead	7	NA	0.1	NA	mg/L	0.001	-	-	0.01	0.031	-	0.003	0.005	-	-	0.004	-
Manganese	350	NA	5	NA	mg/L	0.005	-	-	0.012	0.15	-	0.061	0.017	-	-	0.25	-
Mercury	-	NA	0.01	NA	mg/L	0.0001	-	-	< 0.0001	< 0.0001	-	< 0.0001	< 0.0001	-	-	< 0.0001	-
Nickel	14	NA	0.2	NA	mg/L	0.001	-	-	0.002	0.007	-	0.004	0.003	-	-	0.002	-
Zinc	-	NA	30	NA	mg/L	0.005	-	-	0.11	0.3	-	0.19	0.16	-	-	0.039	-
Dissolved Metals																	
Aluminium (filtered)	NA	5	NA	0.055	mg/L	0.05	-	-	3.2	0.28	-	0.25	1.1	-	-	0.1	-
Arsenic (filtered)	NA	0.5	NA	0.024	mg/L	0.001	-	-	0.001	0.002	-	0.001	< 0.001	-	-	0.001	-
Barium (filtered)	NA	-	NA	-	mg/L	0.001	-	-	0.03	0.08	-	0.07	0.04	-	-	0.06	-
Beryllium (filtered)	NA	-	NA	0.00013	mg/L	0.001	-	-	< 0.001	< 0.001	-	< 0.001	< 0.001	-	-	< 0.001	-
Cadmium (filtered)	NA	0.01	NA	#	mg/L	0.0002	-	-	0.0009	0.001	-	0.0006	0.0006	-	-	< 0.0002	-
Chromium (filtered)	NA	NA	NA	#	mg/L	0.001	-	-	0.003	< 0.001	-	< 0.001	0.002	-	-	< 0.001	-
Cobalt (filtered)	NA	NA	NA	0.0014	mg/L	0.001	-	-	< 0.001	0.001	-	< 0.001	< 0.001	-	-	< 0.001	-
Copper (filtered)	NA	0.4	NA	0.0014	mg/L	0.001	-	-	0.016	0.045	-	0.019	0.018	-	-	0.005	-
Iron (filtered)	NA	-	NA	0.3	mg/L	0.05	-	-	1.4	0.54	-	0.74	0.78	-	-	4.2	-
Lead (filtered)	NA	0.1	NA	#	mg/L	0.001	-	-	0.006	0.007	-	0.002	0.003	-	-	0.003	-
Manganese (filtered)	NA	NA	NA	1.9	mg/L	0.005	-	-	0.008	0.09	-	0.044	0.013	-	-	0.15	-
Mercury (filtered)	NA	NA	NA	0.00006	mg/L	0.0001	-	-	< 0.0001	< 0.0001	-	< 0.0001	< 0.0001	-	-	< 0.0001	-
Nickel (filtered)	NA	1	NA	#	mg/L	0.001	-	-	0.002	0.003	-	0.004	0.003	-	-	0.001	-
Zinc (filtered)	NA	20	NA	#	mg/L	0.005	-	-	0.094	0.14	-	0.17	0.13	-	-	< 0.005	-
Total Recoverable Hydrocarbons - 2013 NEPM Fractions																	
Naphthalene	-	-	17	16	µg/L	10	-	-	-	-	-	-	-	-	-	-	-
TRH >C10-C16	-	-	-	-	µg/L	50	-	-	-	-	-	-	-	-	-	-	-
TRH >C10-C16 less Naphthalene (F2)	-	-	-	-	µg/L	50	-	-	-	-	-	-	-	-	-	-	-
TRH >C10-C40 (total)*	-	-	-	-	µg/L	100	-	-	-	-	-	-	-	-	-	-	-
TRH >C16-C34	-	-	-	-	µg/L	100	-	-	-	-	-	-	-	-	-	-	-
TRH >C34-C40	-	-	-	-	µg/L	100	-	-	-	-	-	-	-	-	-	-	-
TRH C6-C10	-	-	-	-	µg/L	20	-	-	-	-	-	-	-	-	-	-	-
TRH C6-C10 less BTEX (F1)	-	-	-	-	µg/L	20	-	-	-	-	-	-	-	-	-	-	-
BTEX																	
Benzene	-	-	10	950	µg/L	1	-	-	-	-	-	-	-	-	-	-	-
Ethylbenzene	-	-	3000	80	µg/L	1	-	-	-	-	-	-	-	-	-	-	-
m&p-Xylenes	-	-	-	-	µg/L	2	-	-	-	-	-	-	-	-	-	-	-
o-Xylene	-	-	-	-	µg/L	1	-	-	-	-	-	-	-	-	-	-	-
Toluene	-	-	8000	180	µg/L	1	-	-	-	-	-	-	-	-	-	-	-
Xylenes - Total	-	-	6000	200	µg/L	3	-	-	-	-	-	-	-	-	-	-	-

- indicates no criterion available
 LOR = Limit of Reporting
 Concentrations below the LOR noted as <value
 NOC = No observed contamination
 Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG 2018)
 Australia and New Zealand Environment and Conservation Council (2000) Australian and New Zealand Guidelines for Fresh and Marine Water Quality.
 ANZECC, NEPM and NHMRC guidelines for mercury are based on total mercury.
^aEnRiskS (2020) Advice on risks to human health and the environment: Boyd Street and publicly accessible areas, Tarago NSW
^bRecreational criteria adopted are 10 x Australian Drinking Water Guidelines ADWG (2011)
^cANZG (2018) Australian and New Zealand Guidelines for Fresh and Marine Water Quality.
^dThe recreational criteria for aluminium is based on aesthetic issues post flocculation and is not indicative of risks to human health.
 Concentrations in blue bold font exceed human health recreational screening or site specific criteria
 Concentrations in grey box exceed ecological screening or site specific criteria

	Site Specific Human Health Criteria ^a	Site Specific Ecology Criteria (Middle and Northern Culverts) ^a	Health-based Screening Criteria (Recreational Waters) ^b	Ecological Screening Criteria (ANZG 95% Protection) Fresh Water ^c	Sample Type:	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water		
					Lab ID												
					Sample date:	29/Jan/20	1/Apr/20	11/Aug/20	13/Oct/20	28/Jan/21	14/Apr/21	13/Jul/21	12/Sep/22	13/Dec/22	13/Jun/23	14/Sep/23	
					Sample ID:	SW6	SW6	SW6	SW6	SW6	SW6	SW6	SW6	SW6	SW6	SW6	
					Project Name:	Tarago SW Monitoring	Tarago SW Monitoring	Tarago SW Monitoring	Tarago SW Monitoring	Tarago SW Monitoring	Tarago SW Monitoring	Tarago SW Monitoring	Tarago SW Monitoring	Tarago SW Monitoring	Tarago SW Monitoring	Tarago SW Monitoring	
					Project No:	318000780	318000785	318000785	318000785	318000785	318000785	318000785	318000785	318001376	318001376-001	318001376-007	318001376-001
					Sample Location	Tarago Rail Loop	Tarago Rail Loop	Tarago Rail Loop	Tarago Rail Loop	Tarago Rail Loop	Tarago Rail Loop	Tarago Rail Loop	Tarago Rail Loop	Tarago Rail Corridor	Tarago Rail Corridor	Tarago Rail Corridor	Tarago Rail Corridor
					Sampling Method:	-	-	Grab Sample	Grab Sample	Grab Sample	Grab Sample	Grab Sample	Grab Sample	Grab Sample	Grab Sample	Grab Sample	Grab Sample
Guidelines					Sample Description:	DRY	DRY	Brown, slightly turbid. Not flowing.	DRY	DRY	DRY	DRY	Clear to slightly turbid, pale yellow/brown, no odour. Flowing slightly.	brown, slightly murky, slightly turbid, some suspended solids, no odour. Flowing slightly, minor vegetation on the surface and banks of the water body. Unable to completely submerge sample container 10cm below water surface.	Cloudy yellow/brown with some suspended solids, no odour. Not flowing. Minor vegetation on the banks and within water body.	DRY	DRY
Analyte grouping/Analyte					Units	LOR											
Inorganics																	
Ammonia (as N)	-	-	0.5	0.9	mg/L	0.01	-	-	-	-	-	-	-	-	-	-	-
Conductivity (at 25@°C)	-	-	-	-	µS/cm	100	-	-	-	-	-	-	-	-	-	-	-
Nitrate & Nitrite (as N)	-	-	-	-	mg/L	0.05	-	-	-	-	-	-	-	-	-	-	-
Nitrate (as N)	-	-	50	3.5	mg/L	0.02	-	-	-	-	-	-	-	-	-	-	-
Nitrite (as N)	-	-	30	-	mg/L	0.02	-	-	-	-	-	-	-	-	-	-	-
pH (at 25@°C)	-	-	-	-	pH units	0.1	-	-	-	-	-	-	-	-	-	-	-
Phosphate total (as P)	-	-	-	-	mg/L	0.05	-	-	-	-	-	-	-	-	-	-	-
Total Dissolved Solids Dried at 180°C ± 2°C	-	-	-	-	mg/L	0.005	-	-	-	-	-	-	-	-	-	-	-
Total Kjeldahl Nitrogen (as N)	-	-	0.8	-	mg/L	0.2	-	-	-	-	-	-	-	-	-	-	-
Total Nitrogen (as N)	-	-	-	-	mg/L	0.2	-	-	-	-	-	-	-	-	-	-	-
Total Suspended Solids Dried at 105°C	-	-	-	0.7	mg/L	0.005	-	-	-	-	-	-	-	-	-	-	-
Turbidity	-	-	-	-	NTU	1	-	-	-	-	-	-	-	-	-	-	-
Total Metals																	
Aluminium	-	NA	2 ^d	NA	mg/L	0.05	-	-	1.8	-	-	-	2.4	1.1	4	-	-
Arsenic	7	NA	0.1	NA	mg/L	0.001	-	-	0.002	-	-	-	0.002	0.002	0.003	-	-
Barium	-	NA	2	NA	mg/L	0.001	-	-	0.06	-	-	-	0.05	0.07	0.08	-	-
Beryllium	-	NA	0.6	NA	mg/L	0.001	-	-	< 0.001	-	-	-	< 0.001	< 0.001	< 0.001	-	-
Cadmium	1.4	NA	0.002	NA	mg/L	0.0002	-	-	0.0072	-	-	-	0.004	0.002	0.0037	-	-
Chromium	-	NA	0.5	NA	mg/L	0.001	-	-	0.003	-	-	-	0.003	0.002	0.004	-	-
Cobalt	-	NA	-	NA	mg/L	0.001	-	-	< 0.001	-	-	-	< 0.001	0.002	0.002	-	-
Copper	-	NA	20	NA	mg/L	0.001	-	-	0.1	-	-	-	0.12	0.068	0.069	-	-
Iron	-	NA	3	NA	mg/L	0.05	-	-	1.4	-	-	-	1.9	1.9	4.5	-	-
Lead	7	NA	0.1	NA	mg/L	0.001	-	-	0.022	-	-	-	0.022	0.022	0.052	-	-
Manganese	350	NA	5	NA	mg/L	0.005	-	-	0.018	-	-	-	0.021	0.01	0.17	-	-
Mercury	-	NA	0.01	NA	mg/L	0.0001	-	-	< 0.0001	-	-	-	< 0.0001	0.0001	< 0.0001	-	-
Nickel	14	NA	0.2	NA	mg/L	0.001	-	-	0.029	-	-	-	0.022	0.012	0.012	-	-
Zinc	-	NA	30	NA	mg/L	0.005	-	-	0.9	-	-	-	0.67	0.43	1.2	-	-
Dissolved Metals																	
Aluminium (filtered)	NA	5	NA	0.055	mg/L	0.05	-	-	2.4	-	-	-	3.2	3.6	0.34	-	-
Arsenic (filtered)	NA	0.5	NA	0.024	mg/L	0.001	-	-	0.001	-	-	-	0.002	0.002	0.001	-	-
Barium (filtered)	NA	-	NA	-	mg/L	0.001	-	-	0.05	-	-	-	0.04	0.04	0.05	-	-
Beryllium (filtered)	NA	-	NA	0.00013	mg/L	0.001	-	-	< 0.001	-	-	-	< 0.001	< 0.001	< 0.001	-	-
Cadmium (filtered)	NA	0.01	NA	#	mg/L	0.0002	-	-	0.0063	-	-	-	0.0034	0.0013	0.0025	-	-
Chromium (filtered)	NA	NA	NA	#	mg/L	0.001	-	-	0.003	-	-	-	0.003	0.003	< 0.001	-	-
Cobalt (filtered)	NA	NA	NA	0.0014	mg/L	0.001	-	-	< 0.001	-	-	-	< 0.001	0.001	0.001	-	-
Copper (filtered)	NA	0.4	NA	0.0014	mg/L	0.001	-	-	0.088	-	-	-	0.11	0.056	0.043	-	-
Iron (filtered)	NA	-	NA	0.3	mg/L	0.05	-	-	1.1	-	-	-	1.7	2	0.82	-	-
Lead (filtered)	NA	0.1	NA	#	mg/L	0.001	-	-	0.013	-	-	-	0.013	0.01	0.016	-	-
Manganese (filtered)	NA	NA	NA	1.9	mg/L	0.005	-	-	0.013	-	-	-	0.012	0.04	0.12	-	-
Mercury (filtered)	NA	NA	NA	0.00006	mg/L	0.0001	-	-	< 0.0001	-	-	-	< 0.0001	< 0.0001	< 0.0001	-	-
Nickel (filtered)	NA	1	NA	#	mg/L	0.001	-	-	0.026	-	-	-	0.019	0.012	0.008	-	-
Zinc (filtered)	NA	20	NA	#	mg/L	0.005	-	-	0.79	-	-	-	0.53	0.25	0.79	-	-
Total Recoverable Hydrocarbons - 2013 NEPM Fractions																	
Naphthalene	-	-	17	16	µg/L	10	-	-	-	-	-	-	-	-	-	-	-
TRH >C10-C16	-	-	-	-	µg/L	50	-	-	-	-	-	-	-	-	-	-	-
TRH >C10-C16 less Naphthalene (F2)	-	-	-	-	µg/L	50	-	-	-	-	-	-	-	-	-	-	-
TRH >C10-C40 (total)*	-	-	-	-	µg/L	100	-	-	-	-	-	-	-	-	-	-	-
TRH >C16-C34	-	-	-	-	µg/L	100	-	-	-	-	-	-	-	-	-	-	-
TRH >C34-C40	-	-	-	-	µg/L	100	-	-	-	-	-	-	-	-	-	-	-
TRH C6-C10	-	-	-	-	µg/L	20	-	-	-	-	-	-	-	-	-	-	-
TRH C6-C10 less BTEX (F1)	-	-	-	-	µg/L	20	-	-	-	-	-	-	-	-	-	-	-
BTEX																	
Benzene	-	-	10	950	µg/L	1	-	-	-	-	-	-	-	-	-	-	-
Ethylbenzene	-	-	3000	80	µg/L	1	-	-	-	-	-	-	-	-	-	-	-
m&p-Xylenes	-	-	-	-	µg/L	2	-	-	-	-	-	-	-	-	-	-	-
o-Xylene	-	-	-	-	µg/L	1	-	-	-	-	-	-	-	-	-	-	-
Toluene	-	-	8000	180	µg/L	1	-	-	-	-	-	-	-	-	-	-	-
Xylenes - Total	-	-	6000	200	µg/L	3	-	-	-	-	-	-	-	-	-	-	-

- Indicates no criterion available
 LOR = Limit of Reporting
 Concentrations below the LOR noted as <value
 NOC = No observed contamination
 Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG 2018)
 Australia and New Zealand Environment and Conservation Council (2000) Australian and New Zealand Guidelines for Fresh and Marine Water Quality.
 ANZECC, NEPM and NHMRC guidelines for mercury are based on total mercury.
^aEnRisks (2020) Advice on risks to human health and the environment: Boyd Street and publicly accessible areas, Tarago NSW
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 Concentrations in blue bold font exceed human health recreational screening or site specific criteria
 Concentrations in grey box exceed ecological screening or site specific criteria

Table 10: SW8 Analytical Results



Sample Type:	Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water					
	Lab ID	Sample date:	Sample ID:	Project Name:	Project No:	Sample Location	Sampling Method:	Sample Description:	Units	LOR										
	S20-Ja29061	29/Jan/20	SW8	Tarago SW Monitoring	318000780	Tarago Rail Loop	Grab Sample	Clear, vegetation. Not flowing.												
	S20-Ap12292	2/Apr/20	SW8	Tarago SW Monitoring	318000780	Tarago Rail Loop	Grab Sample	Grease at surface, lots of algae growing on plants.												
	S20-Au23123	10/Aug/20	SW8	Tarago SW Monitoring	318000780	Tarago Rail Loop	Grab Sample	Water flowing, level high, turbid.												
	S20-Oc25165	12/Oct/20	SW8	Tarago SW Monitoring	318000780	Tarago Rail Loop	Grab Sample	Water flowing, clear/brown.												
	S21-Ja34964	28/Jan/21	SW8	Tarago SW Monitoring	318000780	Tarago Rail Loop	Grab Sample	Clear, low turbidity, no observable contamination												
	S21-Ap22338	14/Apr/21	SW8	Tarago SW Monitoring	318000780	Tarago Rail Loop	Grab Sample	Clear, no odour, leaf litter on surface												
	N21-Jl30457	13/Jul/21	SW8	Tarago SW Monitoring	318000780	Tarago Rail Loop	Grab Sample	Clear, colourless, no odour. Reeds growing in river. Flowing.												
	S22-Se00368	13/Sep/22	SW8	Tarago SW Monitoring	318001376	Tarago Rail Corridor	Grab Sample	Clear, colourless, very minor suspended solids, no odour. Reeds growing on river bank. Flowing. Very minor vegetation within water body.												
	N22-De0031041	12/Dec/22	SW8	Tarago SW Monitoring	318001376-001	Tarago Rail Corridor	Grab Sample	Clear, colourless, no odour. Reeds growing on river bank. Flowing. Very minor vegetation within water body.												
	S23-Jn0046782	16/Jun/23	TAR SW8_160623	Tarago SW Monitoring	318001376-007	Tarago Rail Corridor	Grab Sample	Clear, colourless, no odour. No turbidity.												
	S23-Se0034060	13/Sep/23	SW8_130923	Tarago SW Monitoring	318001376-001	Tarago Rail Corridor	Grab Sample	Slightly turbid, easy to filter												
Guidelines																				
Analyte grouping/Analyte																				
Inorganics																				
Ammonia (as N)	0.5	0.9	-	-	-	-	-	mg/L	0.01	<0.01	-	-	-	-	-	-	-			
Conductivity (at 25°C)	-	-	-	-	-	-	-	µS/cm	100	1000	-	-	-	-	-	-	-			
Nitrate & Nitrite (as N)	-	-	400	100	-	-	-	mg/L	0.05	<0.05	-	-	-	-	-	-	-			
Nitrate (as N)	50	3.5	30	10	-	-	-	mg/L	0.02	<0.02	-	-	-	-	-	-	-			
Nitrite (as N)	30	-	-	-	-	-	-	mg/L	0.02	<0.02	-	-	-	-	-	-	-			
pH (at 25°C)	-	-	-	800-1200	-	-	-	pH units	0.1	7.7	-	-	-	-	-	-	-			
Phosphate total (as P)	-	-	-	-	-	-	-	mg/L	0.05	0.04	-	-	-	-	-	-	-			
Total Dissolved Solids Dried at 180°C ± 2°C	-	-	-	-	-	-	-	mg/L	0.005	0.55	-	-	-	-	-	-	-			
Total Kjeldahl Nitrogen (as N)	0.8	-	-	25-125	-	-	-	mg/L	0.2	0.5	-	-	-	-	-	-	-			
Total Nitrogen (as N)	-	-	-	-	-	-	-	mg/L	0.2	0.5	-	-	-	-	-	-	-			
Total Suspended Solids Dried at 105°C	-	0.7	-	-	-	-	-	mg/L	0.005	0.0064	-	-	-	-	-	-	-			
Turbidity	-	-	-	-	-	-	-	NTU	1	2.7	-	-	-	-	-	-	-			
Total Metals																				
Aluminium	2 ^d	NA	NA	NA	NA	NA	NA	mg/L	0.05	-	< 0.05	0.72	< 0.05	< 0.05	< 0.05	< 0.05	0.09	0.26	< 0.05	0.05
Arsenic	0.1	NA	NA	NA	NA	NA	NA	mg/L	0.001	0.0005	0.001	< 0.001	0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Barium	2	NA	NA	NA	NA	NA	NA	mg/L	0.001	-	0.12	0.02	0.08	0.1	0.06	0.06	0.07	0.08	< 0.001	< 0.001
Beryllium	0.6	NA	NA	NA	NA	NA	NA	mg/L	0.001	0.0005	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Cadmium	0.002	NA	NA	NA	NA	NA	NA	mg/L	0.0002	0.0001	< 0.0002	0.0003	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002
Chromium	0.5	NA	NA	NA	NA	NA	NA	mg/L	0.001	-	< 0.001	0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.002	< 0.001	< 0.001	< 0.001
Cobalt	-	NA	NA	NA	NA	NA	NA	mg/L	0.001	0.0005	0.003	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Copper	20	NA	NA	NA	NA	NA	NA	mg/L	0.001	0.0005	< 0.001	0.008	< 0.001	< 0.001	0.001	0.002	0.003	0.003	< 0.001	0.001
Iron	3	NA	NA	NA	NA	NA	NA	mg/L	0.05	-	3.2	0.76	0.51	0.27	0.17	0.3	0.51	0.66	< 0.001	0.001
Lead	0.1	NA	NA	NA	NA	NA	NA	mg/L	0.001	0.0005	< 0.001	0.002	0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.002	< 0.001	< 0.001
Manganese	5	NA	NA	NA	NA	NA	NA	mg/L	0.005	0.37	1.9	0.035	0.066	0.12	0.033	0.07	0.13	0.4	< 0.001	< 0.001
Mercury	0.01	NA	NA	NA	NA	NA	NA	mg/L	0.0001	0.00005	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001
Nickel	0.2	NA	NA	NA	NA	NA	NA	mg/L	0.001	0.001	0.002	0.002	0.001	< 0.001	0.002	0.002	0.002	< 0.001	< 0.001	< 0.001
Zinc	30	NA	NA	NA	NA	NA	NA	mg/L	0.005	0.0025	0.022	0.12	0.009	< 0.005	0.011	0.024	0.029	0.023	0.022	0.019
Dissolved Metals																				
Dissolved Aluminium	NA	0.055	20	5	NA	NA	NA	mg/L	0.05	-	-	0.41	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Dissolved Arsenic	NA	0.024	2	0.5-5	NA	NA	NA	mg/L	0.001	0.0005	-	< 0.001	< 0.001	0.003	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Dissolved Barium	NA	-	-	-	NA	NA	NA	mg/L	0.001	-	0.02	0.09	0.09	0.11	0.06	0.07	0.07	0.07	< 0.001	< 0.001
Dissolved Beryllium	NA	0.00013	0.5	-	NA	NA	NA	mg/L	0.001	0.0005	-	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Dissolved Cadmium	NA	#	0.05	0.01	NA	NA	NA	mg/L	0.0002	0.0001	-	0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002
Dissolved Chromium	NA	#	1	1	NA	NA	NA	mg/L	0.001	-	-	0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Dissolved Cobalt	NA	0.0014	0.1	1	NA	NA	NA	mg/L	0.001	0.0005	-	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Dissolved Copper	NA	0.0014	5	0.4-5	NA	NA	NA	mg/L	0.001	0.0005	-	0.007	< 0.001	0.003	< 0.001	0.002	0.003	0.002	< 0.001	< 0.001
Dissolved Iron	NA	0.3	10	not sufficiently toxic	NA	NA	NA	mg/L	0.05	-	-	0.31	0.15	0.09	0.07	0.18	0.23	0.09	0.19	0.08
Dissolved Lead	NA	#	5	0.1	NA	NA	NA	mg/L	0.001	0.0005	-	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Dissolved Manganese	NA	1.9	10	not sufficiently toxic	NA	NA	NA	mg/L	0.005	0.33	-	0.028	0.064	0.11	0.03	0.061	0.12	0.33	0.1	-
Dissolved Mercury	NA	0.00006	0.002	0.002	NA	NA	NA	mg/L	0.0001	0.00005	-	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001
Dissolved Nickel	NA	#	2	1	NA	NA	NA	mg/L	0.001	0.0005	-	0.002	0.001	< 0.001	0.002	0.001	0.001	0.001	< 0.001	< 0.001
Dissolved Zinc	NA	#	5	20	NA	NA	NA	mg/L	0.005	0.0025	-	0.1	0.01	< 0.005	0.008	0.018	0.023	0.011	0.02	0.013
Total Recoverable Hydrocarbons - 2013 NEPM Fractions																				
Naphthalene	17	16	-	-	NA	NA	NA	µg/L	10	<10	-	-	-	-	-	-	-	-	-	-
TRH >C10-C16	-	-	-	-	NA	NA	NA	µg/L	50	<50	-	-	-	-	-	-	-	-	-	-
TRH >C10-C16 less Naphthalene (F2)	-	-	-	-	NA	NA	NA	µg/L	50	<50	-	-	-	-	-	-	-	-	-	-
TRH >C10-C40 (total)*	-	-	-	-	NA	NA	NA	µg/L	100	<100	-	-	-	-	-	-	-	-	-	-
TRH >C16-C34	-	-	-	-	NA	NA	NA	µg/L	100	<100	-	-	-	-	-	-	-	-	-	-
TRH >C34-C40	-	-	-	-	NA	NA	NA	µg/L	100	<100	-	-	-	-	-	-	-	-	-	-
TRH C6-C10	-	-	-	-	NA	NA	NA	µg/L	20	<20	-	-	-	-	-	-	-	-	-	-
TRH C6-C10 less BTEX (F1)	-	-	-	-	NA	NA	NA	µg/L	20	<20	-	-	-	-	-	-	-	-	-	-
BTEX																				
Benzene	10	950	-	-	NA	NA	NA	µg/L	1	< 1	-	-	-	-	-	-	-	-	-	-
Ethylbenzene	3000	80	-	-	NA	NA	NA	µg/L	1	< 1	-	-	-	-	-	-	-	-	-	-
m&p-Xylenes	-	-	-	-	NA															

Table 11: SW9 Analytical Results



	Health-based Screening Criteria (Recreational Waters) ^B	Ecological Screening Criteria (ANZG 95% Protection) Fresh Water ^C	ANZECC Fresh Water Guidelines - Irrigation ^D	ANZECC Fresh Water Guidelines - Stock Water ^E	Sample Type:		Surface Water	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water	
					Lab ID	Sample date:	Sample ID:	Project Name:	Project No:	Sample Location	Sampling Method:	Sample Description:	Units	LOR				
							S20-Ja29062	S20-Ap12293	S20-Au23124	S20-oc25167	S21-Ja34965	S21-Ap22339	N21-Ji30459	S22-Se00368	N22-De0031042	S23-Jn0046783	S23-Se0034061	
							29/Jan/20	2/Apr/20	20/Aug/20	12/Oct/20	28/Jan/21	14/Apr/21	13/Jul/21	13/Sep/22	12/Dec/22	16/Jun/23	13/Sep/23	
							SW9	SW9	SW9	SW9	SW9	SW9	SW9	SW9	SW9	TAR_SW9_160623	SW9_130923	
							Tarago SW Monitoring	Tarago SW Monitoring	Tarago SW Monitoring	Tarago SW Monitoring	Tarago SW Monitoring	Tarago SW Monitoring	Tarago SW Monitoring	Tarago SW Monitoring	Tarago SW Monitoring	Tarago SW Monitoring	Tarago SW Monitoring	
							318000780	318000780	318000780	318000780	318000780	318000780	318000780	318000780	318001376	318001376-001	318001376-007	318001376-001
							Tarago Rail Loop	Tarago Rail Loop	Tarago Rail Loop	Tarago Rail Loop	Tarago Rail Loop	Tarago Rail Loop	Tarago Rail Loop	Tarago Rail Loop	Tarago Rail Corridor	Tarago Rail Corridor	Tarago Rail Corridor	Tarago Rail Corridor
							Grab Sample	Grab Sample	Grab Sample	Grab Sample	Grab Sample	Grab Sample	Grab Sample	Grab Sample	Grab Sample	Grab Sample	Grab Sample	
							Stagnant pond. Algae and fish present. Slightly turbid.	Non-turbid, slightly brown, not flowing but full.	High level, brown, slightly turbid, bubbles at surface.	Water flowing, clear/brown, slightly turbid.	Clear, low turbidity, no observable contamination	Very pale yellow, no odour	Clear, colourless, no odour. Flowing.	Light brown to brown, slightly murky, slightly turbid, no odour. Flowing, minor vegetation and moss on the banks of the stream and within the waterbody.	Clear, slightly brown, very slightly turbid, no odour. Grasses growing along river bank. River flowing. Erosion observed on river bank from recent heavy rainfall	Clear, colourless, slight organics tint in water body. No odour.	Clear	
Analyte grouping/Analyte																		
Inorganics																		
Ammonia (as N)	0.5	0.9	-	-	mg/L	0.01	-	-	-	-	-	-	-	-	-	-	-	
Conductivity (at 25°C)	-	-	-	-	µS/cm	100	-	-	-	-	-	-	-	-	-	-	-	
Nitrate & Nitrite (as N)	-	-	400	100	mg/L	0.05	-	-	-	-	-	-	-	-	-	-	-	
Nitrate (as N)	50	3.5	30	10	mg/L	0.02	-	-	-	-	-	-	-	-	-	-	-	
Nitrite (as N)	30	-	-	-	mg/L	0.02	-	-	-	-	-	-	-	-	-	-	-	
pH (at 25°C)	-	-	-	800-1200	pH units	0.1	-	-	-	-	-	-	-	-	-	-	-	
Phosphate total (as P)	-	-	-	-	mg/L	0.05	-	-	-	-	-	-	-	-	-	-	-	
Total Dissolved Solids Dried at 180°C ± 2°C	-	-	-	-	mg/L	0.005	-	-	-	-	-	-	-	-	-	-	-	
Total Kjeldahl Nitrogen (as N)	0.8	-	-	25-125	mg/L	0.2	-	-	-	-	-	-	-	-	-	-	-	
Total Nitrogen (as N)	-	-	-	-	mg/L	0.2	-	-	-	-	-	-	-	-	-	-	-	
Total Suspended Solids Dried at 105°C	-	0.7	-	-	mg/L	0.005	-	-	-	-	-	-	-	-	-	-	-	
Turbidity	-	-	-	-	NTU	1	-	-	-	-	-	-	-	-	-	-	-	
Total Metals																		
Aluminium	2 ^g	NA	NA	NA	mg/L	0.05	-	0.05	0.53	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.07	< 0.05	0.05	
Arsenic	0.1	NA	NA	NA	mg/L	0.001	0.001	0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.001	< 0.001	< 0.001	
Barium	2	NA	NA	NA	mg/L	0.001	-	0.08	0.02	0.09	0.11	0.06	0.07	0.07	0.1	0.09	-	
Beryllium	0.6	NA	NA	NA	mg/L	0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	
Cadmium	0.002	NA	NA	NA	mg/L	0.0002	< 0.0002	< 0.0002	0.0004	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	
Chromium	0.5	NA	NA	NA	mg/L	0.001	< 0.001	< 0.001	0.002	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	
Cobalt	-	NA	NA	NA	mg/L	0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	
Copper	20	NA	NA	NA	mg/L	0.001	< 0.001	0.001	0.01	< 0.001	< 0.001	0.001	0.002	0.001	0.001	0.001	0.01	
Iron	3	NA	NA	NA	mg/L	0.05	-	0.54	0.6	0.15	0.15	0.25	0.29	0.46	1.5	0.14	0.14	
Lead	0.1	NA	NA	NA	mg/L	0.001	< 0.001	< 0.001	0.002	0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	
Manganese	5	NA	NA	NA	mg/L	0.005	0.19	0.33	0.041	0.03	0.24	0.044	0.033	0.084	0.96	0.02	< 0.001	
Mercury	0.01	NA	NA	NA	mg/L	0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	
Nickel	0.2	NA	NA	NA	mg/L	0.001	0.002	0.002	0.002	0.001	0.001	0.002	0.002	0.001	0.002	< 0.001	< 0.001	
Zinc	30	NA	NA	NA	mg/L	0.005	0.009	0.015	0.16	0.008	0.008	0.014	0.038	0.042	0.013	0.035	0.016	
Dissolved Metals																		
Dissolved Aluminium	NA	0.055	20	5	mg/L	0.05	-	-	0.35	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	
Dissolved Arsenic	NA	0.024	2	0.5-5	mg/L	0.001	< 0.001	-	< 0.001	< 0.001	0.003	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	
Dissolved Barium	NA	-	-	-	mg/L	0.001	-	0.02	0.09	0.12	0.06	0.06	0.06	0.06	0.08	0.09	-	
Dissolved Beryllium	NA	0.00013	0.5	-	mg/L	0.001	< 0.001	-	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	-	
Dissolved Cadmium	NA	#	0.05	0.01	mg/L	0.0002	< 0.0002	-	0.0004	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	
Dissolved Chromium	NA	#	1	1	mg/L	0.001	-	-	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	
Dissolved Cobalt	NA	0.0014	0.1	1	mg/L	0.001	< 0.001	-	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	
Dissolved Copper	NA	0.0014	5	0.4-5	mg/L	0.001	< 0.001	-	0.008	< 0.001	0.004	< 0.001	0.002	0.003	0.001	0.001	< 0.001	
Dissolved Iron	NA	0.3	10	not sufficiently toxic	mg/L	0.05	-	-	0.29	< 0.05	< 0.05	0.12	0.19	0.26	0.69	0.12	< 0.05	
Dissolved Lead	NA	#	5	0.1	mg/L	0.001	< 0.001	-	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	
Dissolved Manganese	NA	1.9	10	not sufficiently toxic	mg/L	0.005	0.012	-	0.036	0.023	0.17	0.04	0.03	0.078	0.85	0.02	-	
Dissolved Mercury	NA	0.00006	0.002	0.002	mg/L	0.0001	< 0.0001	-	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	-	
Dissolved Nickel	NA	#	2	1	mg/L	0.001	< 0.001	-	0.002	0.001	< 0.001	0.002	0.001	0.002	< 0.001	< 0.001	< 0.001	
Dissolved Zinc	NA	#	5	20	mg/L	0.005	< 0.005	-	0.14	< 0.005	0.006	0.01	0.034	0.038	0.007	0.034	0.011	
Total Recoverable Hydrocarbons - 2013 NEPM Fractions																		
Naphthalene	17	16	-	-	µg/L	10	< 10	-	-	-	-	-	-	-	-	-	-	
TRH >C10-C16	-	-	-	-	µg/L	50	< 50	-	-	-	-	-	-	-	-	-	-	
TRH >C10-C16 less Naphthalene (F2)	-	-	-	-	µg/L	50	< 50	-	-	-	-	-	-	-	-	-	-	
TRH >C10-C40 (total)*	-	-	-	-	µg/L	100	< 100	-	-	-	-	-	-	-	-	-	-	
TRH >C16-C34	-	-	-	-	µg/L	100	< 100	-	-	-	-	-	-	-	-	-	-	
TRH >C34-C40	-	-	-	-	µg/L	100	< 100	-	-	-	-	-	-	-	-	-	-	
TRH C6-C10	-	-	-	-	µg/L	20	< 20	-	-	-	-	-	-	-	-	-	-	
TRH C6-C10 less BTEX (F1)	-	-	-	-	µg/L	20	< 20	-	-	-	-	-	-	-	-	-	-	
BTEX																		
Benzene	10	950	-	-	µg/L	1	< 1	-	-	-	-	-	-	-	-	-	-	
Ethylbenzene	3000	80	-	-	µg/L	1	< 1	-	-	-	-	-	-	-	-	-	-	
m&p-Xylenes	-	-	-	-	µg/L	2	< 2	-	-	-	-	-	-	-	-	-	-	
o-Xylene	-	-	-	-	µg/L	1	< 1	-	-	-	-	-	-	-	-	-	-	
Toluene	8000	180	-	-	µg/L	1	< 1	-	-	-	-	-	-	-	-	-	-	
Xylenes - Total	6000	200	-	-	µg/L	3	< 3	-	-	-	-	-	-	-	-	-	-	

- indicates no criterion available
 LOR = Limit of Reporting
 Concentrations below the LOR noted as <value
 NOC = No observed contamination
 Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG 2018)
 Australia and New Zealand Environment and Conservation Council (2000) Australian and New Zealand Guidelines for Fresh and Marine Water Quality.
 ANZECC, NEPM and NHMRC guidelines for mercury are based on total mercury.
^gEnRiskS (2020) Advice on risks to human health and the environment: Boyd Street and publicly accessible areas, Tarago NSW
^BRecreational criteria adopted are 10 x Australian Drinking Water Guidelines ADWG (2011)
^CANZG (2018) Australian and New Zealand Guidelines for Fresh and Marine Water Quality.
^DThe recreational criteria for aluminium is based on aesthetic issues post flocculation and is not indicative of risks to human health.
 Concentrations in blue font exceed human health screening criteria
 Concentrations in grey box exceed ecological screening criteria

Table 12: SW10 Analytical Results



Guidelines	Health-based Screening Criteria (Recreational Waters) ^B	Ecological Screening Criteria (ANZG 95% Protection) Fresh Water ^C	ANZECC Fresh Water Guidelines - Irrigation ^D	ANZECC Fresh Water Guidelines - Stock Water ^E	Sample Type:	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water	
					Lab ID	S20-Oc25153	S21-Ja34966	S21-Ap22340	N21-Jl30460	S22-Se00368	N22-De0031043	S23-Jn0046784	S23-Se0034062	
					Sample date:	13/Oct/20	28/Jan/21	14/Apr/21	13/Jul/21	13/Sep/22	12/Dec/22	16/Jun/23	13/Sep/23	
					Sample ID:	SW10	SW10	SW10	SW10	SW10	SW10	SW10	SW10_130923	
					Project Name:	Tarago SW Monitoring	Tarago SW Monitoring	Tarago SW Monitoring	Tarago SW Monitoring	Tarago SW Monitoring	Tarago SW Monitoring	Tarago SW Monitoring	Tarago SW Monitoring	
					Project No:	318000780	318000780	318000780	318000780	318001376	318001376-001	318001376-007	318001376-001	
					Sample Location	Tarago Rail Loop	Tarago Rail Loop	Tarago Rail Loop	Tarago Rail Loop	Tarago Rail Corridor	Tarago Rail Corridor	Tarago Rail Corridor	Tarago Rail Corridor	
					Sampling Method:	Grab Sample	Grab Sample	Grab Sample	Grab Sample	Grab Sample	Grab Sample	Grab Sample	Grab Sample	
					Sample Description:	Water flowing, clear/brown, slightly turbid, no odour.	Clear, low turbidity, no observable contamination	Clear, no odour	Clear to slightly turbid, colourless, no odour. Flowing.	Clear, colourless, very minor suspended solids, no odour. Flowing, minor vegetation and moss on the banks of the stream and within the waterbody.	Clear, colourless, no odour. Flowing. Reeds and grasses growing on river bank	Clear, colourless, no turbidity, no odour. Aquatic vegetation in water next to sample location.	Clear	
					Analyte grouping/Analyte	Units	LOR							
Total Metals														
Aluminium	2 ^d	NA	NA	NA	mg/L	0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.09	0.42	<0.05	0.05
Arsenic	0.1	NA	NA	NA	mg/L	0.001	0.001	< 0.001	< 0.001	< 0.001	<0.001	< 0.001	< 0.001	< 0.001
Barium	2	NA	NA	NA	mg/L	0.001	0.1	0.1	0.06	0.07	0.07	0.09	0.09	-
Beryllium	0.6	NA	NA	NA	mg/L	0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	-
Cadmium	0.002	NA	NA	NA	mg/L	0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002
Chromium	0.5	NA	NA	NA	mg/L	0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.002	< 0.001	< 0.001	< 0.001
Cobalt	-	NA	NA	NA	mg/L	0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Copper	20	NA	NA	NA	mg/L	0.001	< 0.001	< 0.001	0.001	0.002	0.003	0.003	0.003	0.001
Iron	3	NA	NA	NA	mg/L	0.05	0.55	0.79	0.24	0.29	0.53	0.79	0.24	0.34
Lead	0.1	NA	NA	NA	mg/L	0.001	0.002	< 0.001	< 0.001	< 0.001	< 0.001	0.002	< 0.001	< 0.001
Manganese	5	NA	NA	NA	mg/L	0.005	0.089	0.31	0.036	0.066	0.13	0.41	0.1	-
Mercury	0.01	NA	NA	NA	mg/L	0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	-
Nickel	0.2	NA	NA	NA	mg/L	0.001	0.001	< 0.001	0.002	0.002	0.002	0.002	< 0.001	< 0.001
Zinc	30	NA	NA	NA	mg/L	0.005	0.013	< 0.005	0.013	0.032	0.031	0.023	0.021	0.016
Dissolved Metals														
Aluminium (filtered)	NA	0.055	20	5	mg/L	0.05	< 0.05	< 0.05	< 0.05	< 0.05	<0.05	< 0.05	<0.05	<0.05
Arsenic (filtered)	NA	0.024	2	0.5-5	mg/L	0.001	< 0.001	0.002	< 0.001	< 0.001	<0.001	< 0.001	< 0.001	< 0.001
Barium (filtered)	NA	-	-	-	mg/L	0.001	0.11	0.11	0.06	0.06	0.07	0.08	0.09	-
Beryllium (filtered)	NA	0.00013	0.5	-	mg/L	0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	-
Cadmium (filtered)	NA	#	0.05	0.01	mg/L	0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002
Chromium (filtered)	NA	#	1	1	mg/L	0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Cobalt (filtered)	NA	0.0014	0.1	1	mg/L	0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Copper (filtered)	NA	0.0014	5	0.4-5	mg/L	0.001	< 0.001	0.003	< 0.001	0.002	0.003	0.002	< 0.001	< 0.001
Iron (filtered)	NA	0.3	10	not sufficiently toxic	mg/L	0.05	0.11	0.8	0.08	0.18	0.24	0.08	0.2	0.08
Lead (filtered)	NA	#	5	0.1	mg/L	0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Manganese (filtered)	NA	1.9	10	not sufficiently toxic	mg/L	0.005	0.089	0.33	0.023	0.057	0.12	0.35	0.1	-
Mercury (filtered)	NA	0.00006	0.002	0.002	mg/L	0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	-
Nickel (filtered)	NA	#	2	1	mg/L	0.001	< 0.001	< 0.001	0.001	0.001	0.001	0.002	< 0.001	< 0.001
Zinc (filtered)	NA	#	5	20	mg/L	0.005	0.006	< 0.005	0.008	0.025	0.025	0.007	0.018	0.011

- indicates no criterion available
 LOR = Limit of Reporting
 Concentrations below the LOR noted as <value
 NOC = No observed contamination
 Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG 2018)
 Australia and New Zealand Environment and Conservation Council (2000) Australian and New Zealand Guidelines for Fresh and Marine Water Quality.
 ANZECC, NEPM and NHMRC guidelines for mercury are based on total mercury.
^BEnRisks (2020) Advice on risks to human health and the environment: Boyd Street and publicly accessible areas, Tarago NSW
^CRecreational criteria adopted are 10 x Australian Drinking Water Guidelines ADWG (2011)
^DANZG (2018) Australian and New Zealand Guidelines for Fresh and Marine Water Quality.
^EThe recreational criteria for aluminium is based on aesthetic issues post flocculation and is not indicative of risks to human health.
 Concentrations in blue font exceed human health recreational screening criteria
 Concentrations in grey box exceed ecological screening criteria

**APPENDIX 4
CALIBRATION CERTIFICATE**

Multi Parameter Water Meter



Instrument **YSI Quatro Pro Plus**
Serial No. **17C103049**

Air-Met Scientific Pty Ltd
1300 137 067

Item	Test	Pass	Comments
Battery	Charge Condition	✓	
	Fuses	✓	
	Capacity	✓	
Switch/keypad	Operation	✓	
	Display		
Display	Intensity	✓	
	Operation (segments)	✓	
Grill Filter	Condition	✓	
	Seal	✓	
PCB	Condition	✓	
Connectors	Condition	✓	
Sensor	1. pH	✓	
	2. mV	✓	
	3. EC	✓	
	4. D.O	✓	
	5. Temp	✓	
Alarms	Beeper		
	Settings		
Software	Version		
Data logger	Operation		
Download	Operation		
Other tests:			

Certificate of Calibration

This is to certify that the above instrument has been calibrated to the following specifications:

Sensor	Serial no	Standard Solutions	Certified	Solution Bottle Number	Instrument Reading
1. pH 7.00		pH 7.00		399304	pH 6.97
2. pH 4.00		pH 4.00		399527	pH 3.99
3. mV		2394.94mV		A393379/B398193	236.5mV
4. EC		2760 mS		401089	2754uS/cm
5. D.O		0%		399958	-0.1%
6. Temp		22.3C		MultiTherm	22.3C

Calibrated by:

Guido Camera

Calibration date:

4/09/2023

Next calibration due:

4/10/2023

APPENDIX 5 LABORATORY REPORTS



CHAIN OF CUSTODY RECORD

Eurofins | Environment Testing ABN 50 005 085 521

Sydney Laboratory
Unit F3 Bld.F 16 Mars Road Lane Cove West NSW 2066
02 9300 8400 EnviroSampleNSW@eurofins.com

Brisbane Laboratory
Unit 1 21 Smallwood Place Muramba QLD 4172
07 3902 4600 EnviroSampleQLD@eurofins.com

Perth Laboratory
Unit 2 91 Leach Highway Kewdale WA 6105
08 9251 9600 EnviroSampleWA@eurofins.com

Melbourne Laboratory
6 Monterey Road Dandenong South VIC 3175
03 8584 5000 EnviroSampleVic@eurofins.com

Company	Ramboll	Project No	318001376-007	Project Manager	Stephen Maxwell	Sampler(s)	Ethan O'Connor & Steven Cadman		
Address	3/100 Pacific Highway, North Sydney 2060, NSW	Project Name	Tarago Surface Water Monitoring	EDD Format ESdat, EQuIS etc	EQuIS	Handed over by	Ethan O'Connor		
Contact Name	Ethan O'Connor	Analyses Where metals are requested, please specify 'Total' or 'Filtered'. SUITE code must be used to attract SUITE pricing.	8 Metals Filtered (As, Cd, Cr, Cu, Pb, Ni, Zn, Hg)	8 Metals Total (As, Cd, Cr, Cu, Pb, Ni, Zn, Hg)	Hardness as CaCO3	Send to ALS	HOLD		
Phone No	0427 061 712							Email for Invoice	jauld@ramboll.com; asiapac-accounts@ramboll.com
Special Directions	Page 1 of 2							Email for Results	jauld@ramboll.com; imarshall@ramboll.com; smaxwell@ramboll.com
Purchase Order								Containers Change container type & size if necessary.	
Quote ID No								Required Turnaround Time (TAT) Default will be 5 days if not ticked.	

No	Sampled Date/Time dd/mm/yy hh:mm	Matrix Solid (S) Water (W)	8 Metals Filtered (As, Cd, Cr, Cu, Pb, Ni, Zn, Hg)	8 Metals Total (As, Cd, Cr, Cu, Pb, Ni, Zn, Hg)	Hardness as CaCO3	Containers						Required Turnaround Time (TAT) Default will be 5 days if not ticked.		
						500mL Plastic	250mL Plastic	125mL Plastic	200mL Amber Glass	40mL VOA vial	500mL PFAS Bottle		Jar (Glass or HDPE)	Asbestos Bag
1	SW1_UP_140923	14/09/23	W	X	X	X								
2	SW1_140923	14/09/23	W	X	X	X								
3	SW2_140923	14/09/23	W	X	X	X								
4	SW3_140923	14/09/23	W	X	X	X								
5	SW4_140923	14/09/23	W	X	X	X								
6	SW7_130923	13/09/23	W	X	X	X								
7	SW8_130923	13/09/23	W	X	X	X								
8	SW9_130923	13/09/23	W	X	X	X								
9	SW10_130923	13/09/23	W	X	X	X								
10	QC100_140923	14/09/23	W	X	X	X								
Total Counts				10	10	10								

Method of Shipment	<input checked="" type="checkbox"/> Courier (# HG8473)	<input type="checkbox"/> Hand Delivered	<input type="checkbox"/> Postal	Name	Ethan O'Connor	Signature	Ethan O'C	Date	14/09/2023	Time	
Laboratory Use Only	Received By	Mam Ann	SYD BNE MEL PER ADL NTL DRW	Signature	<i>[Signature]</i>	Date	14/9	Time	10:30 PM	Temperature	11.9
	Received By		SYD BNE MEL PER ADL NTL DRW	Signature		Date		Time		Report No	

1026255

RE: AMENDED :Eurofins Sample Receipt Advice - Report 1026255 : Site TARAGO SURFACE WATER MONITORING (318001376-007)

Stephen Maxwell <smaxwell@ramboll.com>

Mon 2023-09-18 4:02 PM

To:#AU25_Enviro_Sample_NSW <EnviroSampleNSW@eurofins.com>

Cc:Andrew Black <AndrewBlack@eurofins.com>;Ethan O'Connor <EOCONNOR@ramboll.com>

CAUTION: EXTERNAL EMAIL - Sent from an email domain that is not formally trusted by Eurofins. Do not click on links or open attachments unless you recognise the sender and are certain that the content is safe.

Hi

Can we please amend this work order to describe that all samples will be analysed for total and filtered Al, As, Cd, Cr, Co, Cu, Fe, Pb, Ni, Zn?

Kind regards

Stephen Maxwell

Managing Consultant

D +61 249625444

M +61 478658194

smaxwell@ramboll.com

Connect with us 

Ramboll
Level 2, Suite 18 Eastpoint
50 Glebe Road
PO Box 435
The Junction
NSW 2291
Australia

<https://ramboll.com>

Ramboll Australia Pty Ltd.

ACN 095 437 442

ABN 49 095 437 442



Eurofins Environment Testing Australia Pty Ltd

ABN: 50 005 085 521

Melbourne	Geelong	Sydney	Canberra	Brisbane	Newcastle
6 Monterey Road Dandenong South VIC 3175 Tel: +61 3 8564 5000 NATA# 1261 Site# 1254	19/8 Lewalan Street Grovedale VIC 3216 Tel: +61 3 8564 5000 NATA# 1261 Site# 25403	179 Magowar Road Girraween NSW 2145 Tel: +61 2 9900 8400 NATA# 1261 Site# 18217	Unit 1,2 Dacre Street Mitchell ACT 2911 Tel: +61 2 6113 8091 NATA# 1261 Site# 25466	1/21 Smallwood Place Murarrie QLD 4172 Tel: +61 7 3902 4600 NATA# 1261 Site# 20794	1/2 Frost Drive Mayfield West NSW 2304 Tel: +61 2 4968 8448 NATA# 1261 Site# 25079 & 25289

Eurofins ARL Pty Ltd

ABN: 91 05 0159 898

Perth
46-48 Banksia Road Welshpool WA 6106 Tel: +61 8 6253 4444 NATA# 2377 Site# 2370

Eurofins Environment Testing NZ Ltd

NZBN: 9429046024954

Auckland	Christchurch	Tauranga
35 O'Rorke Road Penrose, Auckland 1061 Tel: +64 9 526 4551 IANZ# 1327	43 Detroit Drive Rolleston, Christchurch 7675 Tel: +64 3 343 5201 IANZ# 1290	1277 Cameron Road, Gate Pa, Tauranga 3112 Tel: +64 9 525 0568 IANZ# 1402

Sample Receipt Advice

Company name:	Ramboll Australia Pty Ltd
Contact name:	Stephen Maxwell
Project name:	TARAGO SURFACE WATER MONITORING
Project ID:	318001376-007
Turnaround time:	5 Day
Date/Time received	Sep 14, 2023 6:30 PM
Eurofins reference	1026255

Sample Information

- ✓ A detailed list of analytes logged into our LIMS, is included in the attached summary table.
- ✓ All samples have been received as described on the above COC.
- ✓ COC has been completed correctly.
- ✓ Attempt to chill was evident.
- ✓ Appropriately preserved sample containers have been used.
- ✓ All samples were received in good condition.
- ✓ Samples have been provided with adequate time to commence analysis in accordance with the relevant holding times.
- ✓ Appropriate sample containers have been used.
- ✓ Sample containers for volatile analysis received with zero headspace.
- ✓ Split sample sent to requested external lab.
- ✗ Some samples have been subcontracted.
- N/A Custody Seals intact (if used).

Notes

Samples received by the laboratory after 5.30pm are deemed to have been received the following working day.

Contact

If you have any questions with respect to these samples, please contact your Analytical Services Manager:

Andrew Black on phone : (+61) 2 9900 8490 or by email: AndrewBlack@eurofins.com

Results will be delivered electronically via email to Stephen Maxwell - smaxwell@ramboll.com.

Note: A copy of these results will also be delivered to the general Ramboll Australia Pty Ltd email address.



web: www.eurofins.com.au
email: EnviroSales@eurofins.com

Melbourne 6 Monterey Road Dandenong South VIC 3175 Tel: +61 3 8564 5000 NATA# 1261 Site# 1254	Geelong 19/8 Lewalan Street Grovedale VIC 3216 Tel: +61 3 8564 5000 NATA# 1261 Site# 25403	Sydney 179 Magowar Road Girraween NSW 2145 Tel: +61 2 9900 8400 NATA# 1261 Site# 18217	Canberra Unit 1,2 Dacre Street Mitchell ACT 2911 Tel: +61 2 6113 8091 NATA# 1261 Site# 25466	Brisbane 1/21 Smallwood Place Murarrie QLD 4172 Tel: +61 7 3902 4600 NATA# 1261 Site# 20794	Newcastle 1/2 Frost Drive Mayfield West NSW 2304 Tel: +61 2 4968 8448 NATA# 1261 Site# 25079 & 25289
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Perth 46-48 Banksia Road Welshpool WA 6106 Tel: +61 8 6253 4444 NATA# 2377 Site# 2370
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Auckland 35 O'Rorke Road Penrose, Auckland 1061 Tel: +64 9 526 4551 IANZ# 1327	Christchurch 43 Detroit Drive Rolleston, Christchurch 7675 Tel: +64 3 343 5201 IANZ# 1290	Tauranga 1277 Cameron Road, Gate Pa, Tauranga 3112 Tel: +64 9 525 0568 IANZ# 1402
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Company Name: Ramboll Australia Pty Ltd	Order No.:	Received: Sep 14, 2023 6:30 PM
Address: Level 3/100 Pacific Highway North Sydney NSW 2060	Report #: 1026255	Due: Sep 21, 2023
	Phone: 02 9954 8118	Priority: 5 Day
	Fax: 02 9954 8150	Contact Name: Stephen Maxwell
Project Name: TARAGO SURFACE WATER MONITORING		
Project ID: 318001376-007		

Eurofins Analytical Services Manager : Andrew Black

Sample Detail						Aluminium	Aluminium (filtered)	CANCELLED	Cobalt	Cobalt (filtered)	Metals M7	Metals M7 filtered	Hardness Set
Melbourne Laboratory - NATA # 1261 Site # 1254											X	X	
Sydney Laboratory - NATA # 1261 Site # 18217						X	X	X	X	X	X	X	X
External Laboratory													
No	Sample ID	Sample Date	Sampling Time	Matrix	LAB ID								
1	SW1_UP_140923	Sep 14, 2023		Water	S23-Se0034054	X	X		X	X	X	X	X
2	SW1_140923	Sep 14, 2023		Water	S23-Se0034055	X	X		X	X	X	X	X
3	SW2_140923	Sep 14, 2023		Water	S23-Se0034056	X	X		X	X	X	X	X
4	SW3_140923	Sep 14, 2023		Water	S23-Se0034057	X	X		X	X	X	X	X
5	SW4_140923	Sep 14, 2023		Water	S23-Se0034058	X	X		X	X	X	X	X
6	SW7_130923	Sep 13, 2023		Water	S23-Se0034059	X	X		X	X	X	X	X
7	SW8_130923	Sep 13, 2023		Water	S23-Se0034060	X	X		X	X	X	X	X
8	SW9_130923	Sep 13, 2023		Water	S23-Se0034061	X	X		X	X	X	X	X
9	SW10_130923	Sep 13, 2023		Water	S23-Se0034062	X	X		X	X	X	X	X
10	QC100_140923	Sep 14, 2023		Water	S23-Se0034063	X	X		X	X	X	X	X
11	QC200_140923	Sep 14, 2023		Water	S23-Se0034064			X					



Eurofins Environment Testing Australia Pty Ltd

ABN: 50 005 085 521

Melbourne 6 Monterey Road Dandenong South VIC 3175 Tel: +61 3 8564 5000 NATA# 1261 Site# 1254	Geelong 19/8 Lewalan Street Grovedale VIC 3216 Tel: +61 3 8564 5000 NATA# 1261 Site# 25403	Sydney 179 Magowar Road Girraween NSW 2145 Tel: +61 2 9900 8400 NATA# 1261 Site# 18217	Canberra Unit 1,2 Dacre Street Mitchell ACT 2911 Tel: +61 2 6113 8091 NATA# 1261 Site# 25466	Brisbane 1/21 Smallwood Place Murarrie QLD 4172 Tel: +61 7 3902 4600 NATA# 1261 Site# 20794	Newcastle 1/2 Frost Drive Mayfield West NSW 2304 Tel: +61 2 4968 8448 NATA# 1261 Site# 25079 & 25289
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web: www.eurofins.com.au
email: EnviroSales@eurofins.com

Company Name:	Ramboll Australia Pty Ltd	Order No.:		Received:	Sep 14, 2023 6:30 PM
Address:	Level 3/100 Pacific Highway North Sydney NSW 2060	Report #:	1026255	Due:	Sep 21, 2023
		Phone:	02 9954 8118	Priority:	5 Day
		Fax:	02 9954 8150	Contact Name:	Stephen Maxwell
Project Name:	TARAGO SURFACE WATER MONITORING				
Project ID:	318001376-007				

Eurofins Analytical Services Manager : Andrew Black

Sample Detail				Aluminium	Aluminium (filtered)	CANCELLED	Cobalt	Cobalt (filtered)	Metals M7	Metals M7 filtered	Hardness Set
Melbourne Laboratory - NATA # 1261 Site # 1254									X	X	
Sydney Laboratory - NATA # 1261 Site # 18217				X	X	X	X	X	X	X	X
3											
Test Counts				10	10	1	10	10	10	10	10

Ramboll Australia Pty Ltd
 Level 3/100 Pacific Highway
 North Sydney
 NSW 2060



NATA Accredited
Accreditation Number 1261
Site Number 18217

Accredited for compliance with ISO/IEC 17025 – Testing
 NATA is a signatory to the ILAC Mutual Recognition
 Arrangement for the mutual recognition of the
 equivalence of testing, medical testing, calibration,
 inspection, proficiency testing scheme providers and
 reference materials producers reports and certificates.

Attention: Stephen Maxwell

Report 1026255-W-V2
 Project name TARAGO SURFACE WATER MONITORING
 Project ID 318001376-007
 Received Date Sep 14, 2023

Client Sample ID			SW1_UP_140923	SW1_140923	SW2_140923	SW3_140923
Sample Matrix			Water	Water	Water	Water
Eurofins Sample No.			S23-Se0034054	S23-Se0034055	S23-Se0034056	S23-Se0034057
Date Sampled			Sep 14, 2023	Sep 14, 2023	Sep 14, 2023	Sep 14, 2023
Test/Reference	LOR	Unit				
Hardness mg equivalent CaCO3/L	1	mg/L	280	280	270	38
Heavy Metals						
Aluminium	0.05	mg/L	0.05	0.49	0.09	0.31
Aluminium (filtered)	0.05	mg/L	< 0.05	< 0.05	< 0.05	0.08
Arsenic	0.001	mg/L	< 0.001	0.002	< 0.001	0.001
Arsenic (filtered)	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Cadmium	0.0002	mg/L	< 0.0002	0.0005	< 0.0002	0.0013
Cadmium (filtered)	0.0002	mg/L	< 0.0002	< 0.0002	< 0.0002	0.0005
Chromium	0.001	mg/L	< 0.001	0.001	< 0.001	< 0.001
Chromium (filtered)	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Cobalt	0.001	mg/L	< 0.001	0.002	< 0.001	0.018
Cobalt (filtered)	0.001	mg/L	< 0.001	< 0.001	< 0.001	0.004
Copper	0.001	mg/L	< 0.001	0.008	0.002	0.013
Copper (filtered)	0.001	mg/L	< 0.001	< 0.001	< 0.001	0.005
Iron	0.05	mg/L	0.23	6.6	0.87	2.5
Iron (filtered)	0.05	mg/L	< 0.05	< 0.05	0.25	0.38
Lead	0.001	mg/L	< 0.001	0.028	0.006	0.023
Lead (filtered)	0.001	mg/L	< 0.001	< 0.001	< 0.001	0.002
Nickel	0.001	mg/L	< 0.001	0.001	< 0.001	0.002
Nickel (filtered)	0.001	mg/L	< 0.001	< 0.001	< 0.001	0.002
Zinc	0.005	mg/L	0.006	0.083	0.019	0.35
Zinc (filtered)	0.005	mg/L	< 0.005	< 0.005	0.009	0.22
Alkali Metals						
Calcium	0.5	mg/L	55	55	53	5.4
Magnesium	0.5	mg/L	34	34	33	5.9

Client Sample ID			SW4_140923	SW7_130923	SW8_130923	SW9_130923
Sample Matrix			Water	Water	Water	Water
Eurofins Sample No.			S23-Se0034058	S23-Se0034059	S23-Se0034060	S23-Se0034061
Date Sampled			Sep 14, 2023	Sep 13, 2023	Sep 13, 2023	Sep 13, 2023
Test/Reference	LOR	Unit				
Hardness mg equivalent CaCO3/L	1	mg/L	95	100	410	390
Heavy Metals						
Aluminium	0.05	mg/L	0.73	0.27	0.05	< 0.05
Aluminium (filtered)	0.05	mg/L	0.17	0.13	< 0.05	< 0.05
Arsenic	0.001	mg/L	< 0.001	0.005	< 0.001	< 0.001
Arsenic (filtered)	0.001	mg/L	< 0.001	0.003	< 0.001	< 0.001
Cadmium	0.0002	mg/L	0.022	0.0002	< 0.0002	< 0.0002
Cadmium (filtered)	0.0002	mg/L	0.020	< 0.0002	< 0.0002	< 0.0002
Chromium	0.001	mg/L	0.001	0.001	< 0.001	< 0.001
Chromium (filtered)	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Cobalt	0.001	mg/L	0.001	0.003	< 0.001	< 0.001
Cobalt (filtered)	0.001	mg/L	< 0.001	0.002	< 0.001	< 0.001
Copper	0.001	mg/L	0.076	0.004	0.001	0.001
Copper (filtered)	0.001	mg/L	0.060	0.004	< 0.001	0.001
Iron	0.05	mg/L	0.59	5.4	0.37	0.14
Iron (filtered)	0.05	mg/L	0.18	2.7	0.08	< 0.05
Lead	0.001	mg/L	0.026	0.011	< 0.001	< 0.001
Lead (filtered)	0.001	mg/L	0.006	0.004	< 0.001	< 0.001
Nickel	0.001	mg/L	0.037	0.003	< 0.001	< 0.001
Nickel (filtered)	0.001	mg/L	0.034	0.003	< 0.001	< 0.001
Zinc	0.005	mg/L	4.3	0.053	0.019	0.024
Zinc (filtered)	0.005	mg/L	4.1	0.008	0.013	0.015
Alkali Metals						
Calcium	0.5	mg/L	24	22	69	65
Magnesium	0.5	mg/L	8.5	12	58	55

Client Sample ID			SW10_130923	QC100_140923
Sample Matrix			Water	Water
Eurofins Sample No.			S23-Se0034062	S23-Se0034063
Date Sampled			Sep 13, 2023	Sep 14, 2023
Test/Reference	LOR	Unit		
Hardness mg equivalent CaCO3/L	1	mg/L	410	95
Heavy Metals				
Aluminium	0.05	mg/L	0.05	0.72
Aluminium (filtered)	0.05	mg/L	< 0.05	0.19
Arsenic	0.001	mg/L	< 0.001	< 0.001
Arsenic (filtered)	0.001	mg/L	< 0.001	< 0.001
Cadmium	0.0002	mg/L	< 0.0002	0.022
Cadmium (filtered)	0.0002	mg/L	< 0.0002	0.021
Chromium	0.001	mg/L	< 0.001	0.001
Chromium (filtered)	0.001	mg/L	< 0.001	< 0.001
Cobalt	0.001	mg/L	< 0.001	< 0.001
Cobalt (filtered)	0.001	mg/L	< 0.001	< 0.001
Copper	0.001	mg/L	0.001	0.075
Copper (filtered)	0.001	mg/L	< 0.001	0.060
Iron	0.05	mg/L	0.34	0.57
Iron (filtered)	0.05	mg/L	0.08	0.18

Client Sample ID			SW10_130923	QC100_140923
Sample Matrix			Water	Water
Eurofins Sample No.			S23-Se0034062	S23-Se0034063
Date Sampled			Sep 13, 2023	Sep 14, 2023
Test/Reference	LOR	Unit		
Heavy Metals				
Lead	0.001	mg/L	< 0.001	0.025
Lead (filtered)	0.001	mg/L	< 0.001	0.006
Nickel	0.001	mg/L	< 0.001	0.036
Nickel (filtered)	0.001	mg/L	< 0.001	0.034
Zinc	0.005	mg/L	0.016	4.3
Zinc (filtered)	0.005	mg/L	0.011	4.1
Alkali Metals				
Calcium	0.5	mg/L	69	24
Magnesium	0.5	mg/L	58	8.5

Sample History

Where samples are submitted/analysed over several days, the last date of extraction is reported.

If the date and time of sampling are not provided, the Laboratory will not be responsible for compromised results should testing be performed outside the recommended holding time.

Description	Testing Site	Extracted	Holding Time
Hardness Set			
Hardness mg equivalent CaCO ₃ /L - Method: E020.1 Hardness in water	Sydney	Sep 18, 2023	28 Days
Alkali Metals - Method: LTM-MET-3040 Metals in Waters, Soils & Sediments by ICP-MS	Sydney	Sep 18, 2023	180 Days
Heavy Metals - Method: LTM-MET-3040 Metals in Waters, Soils & Sediments by ICP-MS	Sydney	Oct 20, 2023	28 Days
Heavy Metals (filtered) - Method: LTM-MET-3040 Metals in Waters, Soils & Sediments by ICP-MS	Sydney	Oct 20, 2023	180 Days
Metals M7 - Method: LTM-MET-3040 Metals in Waters, Soils & Sediments by ICP-MS	Sydney	Sep 18, 2023	180 Days
Metals M7 filtered - Method: LTM-MET-3040 Metals in Waters, Soils & Sediments by ICP-MS	Sydney	Sep 18, 2023	180 Days

Melbourne 6 Monterey Road Dandenong South VIC 3175 Tel: +61 3 8564 5000 NATA# 1261 Site# 1254	Geelong 19/8 Lewalan Street Grovedale VIC 3216 Tel: +61 3 8564 5000 NATA# 1261 Site# 25403	Sydney 179 Magowar Road Girraween NSW 2145 Tel: +61 2 9900 8400 NATA# 1261 Site# 18217	Canberra Unit 1,2 Dacre Street Mitchell ACT 2911 Tel: +61 2 6113 8091 NATA# 1261 Site# 25466	Brisbane 1/21 Smallwood Place Murarrie QLD 4172 Tel: +61 7 3902 4600 NATA# 1261 Site# 20794	Newcastle 1/2 Frost Drive Mayfield West NSW 2304 Tel: +61 2 4968 8448 NATA# 1261 Site# 25079 & 25289
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Company Name: Ramboll Australia Pty Ltd
Address: Level 3/100 Pacific Highway
 North Sydney
 NSW 2060

Order No.:
Report #: 1026255
Phone: 02 9954 8118
Fax: 02 9954 8150

Received: Sep 14, 2023 6:30 PM
Due: Sep 21, 2023
Priority: 5 Day
Contact Name: Stephen Maxwell

Project Name: TARAGO SURFACE WATER MONITORING
Project ID: 318001376-007

Eurofins Analytical Services Manager : Andrew Black

Sample Detail						Aluminium	Aluminium (filtered)	CANCELLED	Cobalt	Cobalt (filtered)	Metals M7	Metals M7 filtered	Hardness Set
Melbourne Laboratory - NATA # 1261 Site # 1254											X	X	
Sydney Laboratory - NATA # 1261 Site # 18217						X	X	X	X	X	X	X	X
External Laboratory													
No	Sample ID	Sample Date	Sampling Time	Matrix	LAB ID								
1	SW1_UP_140923	Sep 14, 2023		Water	S23-Se0034054	X	X		X	X	X	X	X
2	SW1_140923	Sep 14, 2023		Water	S23-Se0034055	X	X		X	X	X	X	X
3	SW2_140923	Sep 14, 2023		Water	S23-Se0034056	X	X		X	X	X	X	X
4	SW3_140923	Sep 14, 2023		Water	S23-Se0034057	X	X		X	X	X	X	X
5	SW4_140923	Sep 14, 2023		Water	S23-Se0034058	X	X		X	X	X	X	X
6	SW7_130923	Sep 13, 2023		Water	S23-Se0034059	X	X		X	X	X	X	X
7	SW8_130923	Sep 13, 2023		Water	S23-Se0034060	X	X		X	X	X	X	X
8	SW9_130923	Sep 13, 2023		Water	S23-Se0034061	X	X		X	X	X	X	X
9	SW10_130923	Sep 13, 2023		Water	S23-Se0034062	X	X		X	X	X	X	X
10	QC100_140923	Sep 14, 2023		Water	S23-Se0034063	X	X		X	X	X	X	X
11	QC200_14092	Sep 14, 2023		Water	S23-Se0034064			X					

web: www.eurofins.com.au
 email: EnviroSales@eurofins.com

Melbourne	Geelong	Sydney	Canberra	Brisbane	Newcastle
6 Monterey Road Dandenong South VIC 3175 Tel: +61 3 8564 5000 NATA# 1261 Site# 1254	19/8 Lewalan Street Grovedale VIC 3216 Tel: +61 3 8564 5000 NATA# 1261 Site# 25403	179 Magowar Road Girraween NSW 2145 Tel: +61 2 9900 8400 NATA# 1261 Site# 18217	Unit 1,2 Dacre Street Mitchell ACT 2911 Tel: +61 2 6113 8091 NATA# 1261 Site# 25466	1/21 Smallwood Place Murarrie QLD 4172 Tel: +61 7 3902 4600 NATA# 1261 Site# 20794	1/2 Frost Drive Mayfield West NSW 2304 Tel: +61 2 4968 8448 NATA# 1261 Site# 25079 & 25289

Perth
46-48 Banksia Road Welshpool WA 6106 Tel: +61 8 6253 4444 NATA# 2377 Site# 2370

Auckland	Christchurch	Tauranga
35 O'Rorke Road Penrose, Auckland 1061 Tel: +64 9 526 4551 IANZ# 1327	43 Detroit Drive Rolleston, Christchurch 7675 Tel: +64 3 343 5201 IANZ# 1290	1277 Cameron Road, Gate Pa, Tauranga 3112 Tel: +64 9 525 0568 IANZ# 1402

Company Name: Ramboll Australia Pty Ltd	Order No.:	Received: Sep 14, 2023 6:30 PM
Address: Level 3/100 Pacific Highway North Sydney NSW 2060	Report #: 1026255	Due: Sep 21, 2023
	Phone: 02 9954 8118	Priority: 5 Day
	Fax: 02 9954 8150	Contact Name: Stephen Maxwell
Project Name: TARAGO SURFACE WATER MONITORING		
Project ID: 318001376-007		

Eurofins Analytical Services Manager : Andrew Black

Sample Detail	Aluminium	Aluminium (filtered)	CANCELLED	Cobalt	Cobalt (filtered)	Metals M7	Metals M7 filtered	Hardness Set
Melbourne Laboratory - NATA # 1261 Site # 1254						X	X	
Sydney Laboratory - NATA # 1261 Site # 18217	X	X	X	X	X	X	X	X
3								
Test Counts	10	10	1	10	10	10	10	10

Internal Quality Control Review and Glossary

General

- Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples follows guidelines delineated in the National Environment Protection (Assessment of Site Contamination) Measure 1999, as amended May 2013 and are included in this QC report where applicable. Additional QC data may be available on request.
- All soil/sediment/solid results are reported on a dry basis, unless otherwise stated.
- All biota/food results are reported on a wet weight basis on the edible portion, unless otherwise stated.
- Actual LORs are matrix dependant. Quoted LORs may be raised where sample extracts are diluted due to interferences.
- Results are uncorrected for matrix spikes or surrogate recoveries except for PFAS compounds.
- SVOC analysis on waters are performed on homogenised, unfiltered samples, unless noted otherwise.
- Samples were analysed on an 'as received' basis.
- Information identified on this report with blue colour, indicates data provided by customer that may have an impact on the results.
- This report replaces any interim results previously issued.

Holding Times

Please refer to 'Sample Preservation and Container Guide' for holding times (QS3001).

For samples received on the last day of holding time, notification of testing requirements should have been received at least 6 hours prior to sample receipt deadlines as stated on the SRA.

If the Laboratory did not receive the information in the required timeframe, and regardless of any other integrity issues, suitably qualified results may still be reported.

Holding times apply from the date of sampling, therefore compliance to these may be outside the laboratory's control.

For VOCs containing vinyl chloride, styrene and 2-chloroethyl vinyl ether the holding time is 7 days however for all other VOCs such as BTEX or C6-10 TRH then the holding time is 14 days.

Units

mg/kg: milligrams per kilogram	mg/L: milligrams per litre	µg/L: micrograms per litre
ppm: parts per million	ppb: parts per billion	%: Percentage
org/100 mL: Organisms per 100 millilitres	NTU: Nephelometric Turbidity Units	MPN/100 mL: Most Probable Number of organisms per 100 millilitres
CFU: Colony forming unit		

Terms

APHA	American Public Health Association
COC	Chain of Custody
CP	Client Parent - QC was performed on samples pertaining to this report
CRM	Certified Reference Material (ISO17034) - reported as percent recovery.
Dry	Where a moisture has been determined on a solid sample the result is expressed on a dry basis.
Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
LOR	Limit of Reporting.
LCS	Laboratory Control Sample - reported as percent recovery.
Method Blank	In the case of solid samples these are performed on laboratory certified clean sands and in the case of water samples these are performed on de-ionised water.
NCP	Non-Client Parent - QC performed on samples not pertaining to this report, QC is representative of the sequence or batch that client samples were analysed within.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
SPIKE	Addition of the analyte to the sample and reported as percentage recovery.
SRA	Sample Receipt Advice
Surr - Surrogate	The addition of a like compound to the analyte target and reported as percentage recovery.
TBTO	Tributyltin oxide (<i>bis</i> -tributyltin oxide) - individual tributyltin compounds cannot be identified separately in the environment however free tributyltin was measured and its values were converted stoichiometrically into tributyltin oxide for comparison with regulatory limits.
TCLP	Toxicity Characteristic Leaching Procedure
TEQ	Toxic Equivalency Quotient or Total Equivalence
QSM	US Department of Defense Quality Systems Manual Version 5.4
US EPA	United States Environmental Protection Agency
WA DWER	Sum of PFBA, PFPa, PFHxA, PFHpA, PFOA, PFBS, PFHxS, PFOS, 6:2 FTSA, 8:2 FTSA

QC - Acceptance Criteria

The acceptance criteria should be used as a guide only and may be different when site specific Sampling Analysis and Quality Plan (SAQP) have been implemented

RPD Duplicates: Global RPD Duplicates Acceptance Criteria is 30% however the following acceptance guidelines are equally applicable:

Results <10 times the LOR: No Limit

Results between 10-20 times the LOR: RPD must lie between 0-50%

Results >20 times the LOR: RPD must lie between 0-30%

NOTE: pH duplicates are reported as a range not as RPD

Surrogate Recoveries: Recoveries must lie between 20-130% for Speciated Phenols & 50-150% for PFAS. SVOCs recoveries 20 – 150%

PFAS field samples that contain surrogate recoveries in excess of the QC limit designated in QSM 5.4 where no positive PFAS results have been reported have been reviewed and no data was affected.

QC Data General Comments

- Where a result is reported as a less than (<), higher than the nominated LOR, this is due to either matrix interference, extract dilution required due to interferences or contaminant levels within the sample, high moisture content or insufficient sample provided.
- Duplicate data shown within this report that states the word "BATCH" is a Batch Duplicate from outside of your sample batch, but within the laboratory sample batch at a 1:10 ratio. The Parent and Duplicate data shown is not data from your samples.
- pH and Free Chlorine analysed in the laboratory - Analysis on this test must begin within 30 minutes of sampling. Therefore, laboratory analysis is unlikely to be completed within holding time. Analysis will begin as soon as possible after sample receipt.
- Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of recovery the term "INT" appears against that analyte.
- For Matrix Spikes and LCS results a dash "-" in the report means that the specific analyte was not added to the QC sample.
- Duplicate RPDs are calculated from raw analytical data thus it is possible to have two sets of data.

Quality Control Results

Test			Units	Result 1		Acceptance Limits	Pass Limits	Qualifying Code
Method Blank								
Heavy Metals								
Aluminium			mg/L	< 0.05		0.05	Pass	
Arsenic			mg/L	< 0.001		0.001	Pass	
Arsenic (filtered)			mg/L	< 0.001		0.001	Pass	
Cadmium			mg/L	< 0.0002		0.0002	Pass	
Cadmium (filtered)			mg/L	< 0.0002		0.0002	Pass	
Chromium (filtered)			mg/L	< 0.001		0.001	Pass	
Cobalt			mg/L	< 0.001		0.001	Pass	
Copper			mg/L	< 0.001		0.001	Pass	
Copper (filtered)			mg/L	< 0.001		0.001	Pass	
Lead			mg/L	< 0.001		0.001	Pass	
Lead (filtered)			mg/L	< 0.001		0.001	Pass	
Nickel (filtered)			mg/L	< 0.001		0.001	Pass	
Zinc			mg/L	< 0.005		0.005	Pass	
Zinc (filtered)			mg/L	< 0.005		0.005	Pass	
Method Blank								
Alkali Metals								
Calcium			mg/L	< 0.5		0.5	Pass	
Magnesium			mg/L	< 0.5		0.5	Pass	
LCS - % Recovery								
Heavy Metals								
Aluminium			%	94		80-120	Pass	
Arsenic			%	103		80-120	Pass	
Arsenic (filtered)			%	102		80-120	Pass	
Cadmium			%	90		80-120	Pass	
Cadmium (filtered)			%	97		80-120	Pass	
Chromium			%	89		80-120	Pass	
Chromium (filtered)			%	97		80-120	Pass	
Cobalt			%	93		80-120	Pass	
Copper			%	87		80-120	Pass	
Copper (filtered)			%	97		80-120	Pass	
Lead			%	92		80-120	Pass	
Lead (filtered)			%	103		80-120	Pass	
Nickel			%	88		80-120	Pass	
Nickel (filtered)			%	97		80-120	Pass	
Zinc			%	87		80-120	Pass	
Zinc (filtered)			%	99		80-120	Pass	
LCS - % Recovery								
Alkali Metals								
Calcium			%	101		80-120	Pass	
Magnesium			%	114		80-120	Pass	
Test	Lab Sample ID	QA Source	Units	Result 1		Acceptance Limits	Pass Limits	Qualifying Code
Spike - % Recovery								
Heavy Metals				Result 1				
Aluminium	S23-Se0029799	NCP	%	85		75-125	Pass	
Cobalt	S23-Se0029799	NCP	%	85		75-125	Pass	
Lead	S23-Se0029799	NCP	%	92		75-125	Pass	
Zinc	S23-Se0029799	NCP	%	82		75-125	Pass	
Spike - % Recovery								
Alkali Metals				Result 1				

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Calcium	S23-Se0029799	NCP	%	89			75-125	Pass	
Magnesium	S23-Se0029799	NCP	%	100			75-125	Pass	
Spike - % Recovery									
Heavy Metals				Result 1					
Arsenic	S23-Se0034063	CP	%	85			75-125	Pass	
Arsenic (filtered)	S23-Se0034063	CP	%	88			75-125	Pass	
Cadmium	S23-Se0034063	CP	%	82			75-125	Pass	
Chromium	S23-Se0034063	CP	%	86			75-125	Pass	
Chromium (filtered)	S23-Se0034063	CP	%	83			75-125	Pass	
Cobalt (filtered)	S23-Se0034063	CP	%	83			75-125	Pass	
Copper	S23-Se0034063	CP	%	87			75-125	Pass	
Iron (filtered)	S23-Se0034063	CP	%	97			75-125	Pass	
Lead (filtered)	S23-Se0034063	CP	%	87			75-125	Pass	
Nickel	S23-Se0034063	CP	%	86			75-125	Pass	
Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Duplicate									
Heavy Metals				Result 1	Result 2	RPD			
Aluminium	N23-Se0027400	NCP	mg/L	0.37	0.43	13	30%	Pass	
Cadmium	B23-Au0080871	NCP	mg/L	< 0.0002	< 0.0002	<1	30%	Pass	
Cobalt	N23-Se0027400	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Nickel	B23-Au0080872	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Zinc (filtered)	B23-Au0080871	NCP	mg/L	< 0.005	< 0.005	<1	30%	Pass	
Duplicate									
Alkali Metals				Result 1	Result 2	RPD			
Calcium	N23-Se0027400	NCP	mg/L	97	96	<1	30%	Pass	
Magnesium	N23-Se0027400	NCP	mg/L	160	160	<1	30%	Pass	

Comments

V2- new version to add in iron and iron filtered as per client request.

Sample Integrity

Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	Yes
Sample correctly preserved	Yes
Appropriate sample containers have been used	Yes
Sample containers for volatile analysis received with minimal headspace	Yes
Samples received within HoldingTime	Yes
Some samples have been subcontracted	No

Authorised by:

Andrew Black Analytical Services Manager
Mickael Ros Senior Analyst-Metal



Glenn Jackson
Managing Director

Final Report – this report replaces any previously issued Report

- Indicates Not Requested

* Indicates NATA accreditation does not cover the performance of this service

Measurement uncertainty of test data is available on request or please [click here](#).

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CERTIFICATE OF ANALYSIS

Work Order : **ES2331591**
Client : **RAMBOLL AUSTRALIA PTY LTD**
Contact : MR STEPHEN MAXWELL
Address : 100 PACIFIC HIGHWAY
NORTH SYDNEY 2060
Telephone : ----
Project : 318001376-007 Tarago Surface Water Monitoring
Order number : ----
C-O-C number : ----
Sampler : Ethan O'Connor & Steven Cadman
Site : ----
Quote number : EN/222
No. of samples received : 1
No. of samples analysed : 1

Page : 1 of 3
Laboratory : Environmental Division Sydney
Contact : Customer Services ES
Address : 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone : +61-2-8784 8555
Date Samples Received : 15-Sep-2023 14:00
Date Analysis Commenced : 19-Sep-2023
Issue Date : 20-Sep-2023 11:26



This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Ankit Joshi	Senior Chemist - Inorganics	Sydney Inorganics, Smithfield, NSW



General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contract for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- Sodium Adsorption Ratio (where reported): Where results for Na, Ca or Mg are <LOR, a concentration at half the reported LOR is incorporated into the SAR calculation. This represents a conservative approach for Na relative to the assumption that <LOR = zero concentration and a conservative approach for Ca & Mg relative to the assumption that <LOR is equivalent to the LOR concentration.



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Sample ID	QC200_140923	----	----	----	----
			Sampling date / time	14-Sep-2023 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit	ES2331591-001	-----	-----	-----	-----
				Result	----	----	----	----
EA065: Total Hardness as CaCO3								
Total Hardness as CaCO3	----	1	mg/L	105	----	----	----	----
EG020F: Dissolved Metals by ICP-MS								
Arsenic	7440-38-2	0.001	mg/L	<0.001	----	----	----	----
Cadmium	7440-43-9	0.0001	mg/L	0.0262	----	----	----	----
Chromium	7440-47-3	0.001	mg/L	<0.001	----	----	----	----
Copper	7440-50-8	0.001	mg/L	0.063	----	----	----	----
Nickel	7440-02-0	0.001	mg/L	0.036	----	----	----	----
Lead	7439-92-1	0.001	mg/L	0.006	----	----	----	----
Zinc	7440-66-6	0.005	mg/L	4.64	----	----	----	----
EG020T: Total Metals by ICP-MS								
Arsenic	7440-38-2	0.001	mg/L	<0.001	----	----	----	----
Cadmium	7440-43-9	0.0001	mg/L	0.0268	----	----	----	----
Chromium	7440-47-3	0.001	mg/L	<0.001	----	----	----	----
Copper	7440-50-8	0.001	mg/L	0.089	----	----	----	----
Nickel	7440-02-0	0.001	mg/L	0.042	----	----	----	----
Lead	7439-92-1	0.001	mg/L	0.031	----	----	----	----
Zinc	7440-66-6	0.005	mg/L	5.04	----	----	----	----
EG035F: Dissolved Mercury by FIMS								
Mercury	7439-97-6	0.0001	mg/L	<0.0001	----	----	----	----
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.0001	mg/L	<0.0001	----	----	----	----



QUALITY CONTROL REPORT

Work Order	: ES2331591	Page	: 1 of 5
Client	: RAMBOLL AUSTRALIA PTY LTD	Laboratory	: Environmental Division Sydney
Contact	: MR STEPHEN MAXWELL	Contact	: Customer Services ES
Address	: 100 PACIFIC HIGHWAY NORTH SYDNEY 2060	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: ----	Telephone	: +61-2-8784 8555
Project	: 318001376-007 Tarago Surface Water Monitoring	Date Samples Received	: 15-Sep-2023
Order number	: ----	Date Analysis Commenced	: 19-Sep-2023
C-O-C number	: ----	Issue Date	: 20-Sep-2023
Sampler	: Ethan O'Connor & Steven Cadman		
Site	: ----		
Quote number	: EN/222		
No. of samples received	: 1		
No. of samples analysed	: 1		



This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB) and Laboratory Control Spike (LCS) Report; Recovery and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	Position	Accreditation Category
Ankit Joshi	Senior Chemist - Inorganics	Sydney Inorganics, Smithfield, NSW



General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis. Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Key :
 Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
 CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
 LOR = Limit of reporting
 RPD = Relative Percentage Difference
 # = Indicates failed QC

Laboratory Duplicate (DUP) Report

The quality control term Laboratory Duplicate refers to a randomly selected intralaboratory split. Laboratory duplicates provide information regarding method precision and sample heterogeneity. The permitted ranges for the Relative Percent Deviation (RPD) of Laboratory Duplicates are specified in ALS Method QWI-EN/38 and are dependent on the magnitude of results in comparison to the level of reporting: Result < 10 times LOR: No Limit; Result between 10 and 20 times LOR: 0% - 50%; Result > 20 times LOR: 0% - 20%.

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EG020F: Dissolved Metals by ICP-MS (QC Lot: 5305621)									
ES2331578-009	Anonymous	EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	0.0	No Limit
		EG020A-F: Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Copper	7440-50-8	0.001	mg/L	<0.001	0.001	0.0	No Limit
		EG020A-F: Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Nickel	7440-02-0	0.001	mg/L	0.054	0.053	0.0	0% - 20%
		EG020A-F: Zinc	7440-66-6	0.005	mg/L	0.588	0.602	2.4	0% - 20%
ES2331579-010	Anonymous	EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	0.0	No Limit
		EG020A-F: Arsenic	7440-38-2	0.001	mg/L	<0.001	0.001	0.0	No Limit
		EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Copper	7440-50-8	0.001	mg/L	0.003	0.002	0.0	No Limit
		EG020A-F: Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Nickel	7440-02-0	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Zinc	7440-66-6	0.005	mg/L	<0.005	<0.005	0.0	No Limit
EG020T: Total Metals by ICP-MS (QC Lot: 5307136)									
ES2331035-001	Anonymous	EG020A-T: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	0.0	No Limit
		EG020A-T: Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-T: Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-T: Copper	7440-50-8	0.001	mg/L	0.013	0.013	0.0	0% - 50%
		EG020A-T: Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-T: Nickel	7440-02-0	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-T: Zinc	7440-66-6	0.005	mg/L	0.010	0.012	12.1	No Limit
ES2331445-003	Anonymous	EG020A-T: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	0.0	No Limit
		EG020A-T: Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	0.0	No Limit

Page : 3 of 5
 Work Order : ES2331591
 Client : RAMBOLL AUSTRALIA PTY LTD
 Project : 318001376-007 Tarago Surface Water Monitoring



Sub-Matrix: WATER				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EG020T: Total Metals by ICP-MS (QC Lot: 5307136) - continued									
ES2331445-003	Anonymous	EG020A-T: Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-T: Copper	7440-50-8	0.001	mg/L	0.002	0.001	0.0	No Limit
		EG020A-T: Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-T: Nickel	7440-02-0	0.001	mg/L	0.004	0.004	0.0	No Limit
		EG020A-T: Zinc	7440-66-6	0.005	mg/L	<0.005	<0.005	0.0	No Limit
EG035F: Dissolved Mercury by FIMS (QC Lot: 5305620)									
ES2331579-001	Anonymous	EG035F: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.0	No Limit
ES2331579-009	Anonymous	EG035F: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.0	No Limit
EG035T: Total Recoverable Mercury by FIMS (QC Lot: 5305731)									
ES2331591-001	QC200_140923	EG035T: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.0	No Limit
ES2331636-002	Anonymous	EG035T: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.0	No Limit



Method Blank (MB) and Laboratory Control Sample (LCS) Report

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC parameter is to monitor potential laboratory contamination. The quality control term Laboratory Control Sample (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
				Result	Spike Concentration	Spike Recovery (%) LCS	Acceptable Limits (%) Low	High
EG020F: Dissolved Metals by ICP-MS (QCLot: 5305621)								
EG020A-F: Arsenic	7440-38-2	0.001	mg/L	<0.001	0.1 mg/L	94.7	85.0	114
EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	0.1 mg/L	102	84.0	110
EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	0.1 mg/L	97.3	85.0	111
EG020A-F: Copper	7440-50-8	0.001	mg/L	<0.001	0.1 mg/L	90.9	81.0	111
EG020A-F: Lead	7439-92-1	0.001	mg/L	<0.001	0.1 mg/L	96.3	83.0	111
EG020A-F: Nickel	7440-02-0	0.001	mg/L	<0.001	0.1 mg/L	87.5	82.0	112
EG020A-F: Zinc	7440-66-6	0.005	mg/L	<0.005	0.1 mg/L	91.5	81.0	117
EG020T: Total Metals by ICP-MS (QCLot: 5307136)								
EG020A-T: Arsenic	7440-38-2	0.001	mg/L	<0.001	0.1 mg/L	100	82.0	114
EG020A-T: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	0.1 mg/L	100	84.0	112
EG020A-T: Chromium	7440-47-3	0.001	mg/L	<0.001	0.1 mg/L	98.8	86.0	116
EG020A-T: Copper	7440-50-8	0.001	mg/L	<0.001	0.1 mg/L	98.1	83.0	118
EG020A-T: Lead	7439-92-1	0.001	mg/L	<0.001	0.1 mg/L	98.0	85.0	115
EG020A-T: Nickel	7440-02-0	0.001	mg/L	<0.001	0.1 mg/L	94.9	84.0	116
EG020A-T: Zinc	7440-66-6	0.005	mg/L	<0.005	0.1 mg/L	99.6	79.0	117
EG035F: Dissolved Mercury by FIMS (QCLot: 5305620)								
EG035F: Mercury	7439-97-6	0.0001	mg/L	<0.0001	0.01 mg/L	97.1	83.0	105
EG035T: Total Recoverable Mercury by FIMS (QCLot: 5305731)								
EG035T: Mercury	7439-97-6	0.0001	mg/L	<0.0001	0.01 mg/L	94.6	77.0	111

Matrix Spike (MS) Report

The quality control term Matrix Spike (MS) refers to an intralaboratory split sample spiked with a representative set of target analytes. The purpose of this QC parameter is to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQOs). Ideal recovery ranges stated may be waived in the event of sample matrix interference.

Sub-Matrix: **WATER**

Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Matrix Spike (MS) Report			
				Spike Concentration	Spike Recovery (%) MS	Acceptable Limits (%) Low	High
EG020F: Dissolved Metals by ICP-MS (QCLot: 5305621)							
ES2331579-003	Anonymous	EG020A-F: Arsenic	7440-38-2	1 mg/L	116	70.0	130
		EG020A-F: Cadmium	7440-43-9	0.25 mg/L	129	70.0	130
		EG020A-F: Chromium	7440-47-3	1 mg/L	121	70.0	130
		EG020A-F: Copper	7440-50-8	1 mg/L	114	70.0	130



Sub-Matrix: WATER				Matrix Spike (MS) Report			
				Spike Concentration	Spike Recovery(%) MS	Acceptable Limits (%)	
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EG020F: Dissolved Metals by ICP-MS (QCLot: 5305621) - continued							
ES2331579-003	Anonymous	EG020A-F: Lead	7439-92-1	1 mg/L	129	70.0	130
		EG020A-F: Nickel	7440-02-0	1 mg/L	113	70.0	130
		EG020A-F: Zinc	7440-66-6	1 mg/L	118	70.0	130
EG020T: Total Metals by ICP-MS (QCLot: 5307136)							
ES2331376-001	Anonymous	EG020A-T: Arsenic	7440-38-2	1 mg/L	97.9	70.0	130
		EG020A-T: Cadmium	7440-43-9	0.25 mg/L	98.6	70.0	130
		EG020A-T: Chromium	7440-47-3	1 mg/L	95.5	70.0	130
		EG020A-T: Copper	7440-50-8	1 mg/L	97.2	70.0	130
		EG020A-T: Lead	7439-92-1	1 mg/L	94.8	70.0	130
		EG020A-T: Nickel	7440-02-0	1 mg/L	94.7	70.0	130
		EG020A-T: Zinc	7440-66-6	1 mg/L	97.3	70.0	130
EG035F: Dissolved Mercury by FIMS (QCLot: 5305620)							
ES2331579-002	Anonymous	EG035F: Mercury	7439-97-6	0.01 mg/L	86.0	70.0	130
EG035T: Total Recoverable Mercury by FIMS (QCLot: 5305731)							
ES2331613-001	Anonymous	EG035T: Mercury	7439-97-6	0.01 mg/L	83.0	70.0	130



QA/QC Compliance Assessment to assist with Quality Review

Work Order	: ES2331591	Page	: 1 of 4
Client	: RAMBOLL AUSTRALIA PTY LTD	Laboratory	: Environmental Division Sydney
Contact	: MR STEPHEN MAXWELL	Telephone	: +61-2-8784 8555
Project	: 318001376-007 Tarago Surface Water Monitoring	Date Samples Received	: 15-Sep-2023
Site	: ----	Issue Date	: 20-Sep-2023
Sampler	: Ethan O'Connor & Steven Cadman	No. of samples received	: 1
Order number	: ----	No. of samples analysed	: 1

This report is automatically generated by the ALS LIMS through interpretation of the ALS Quality Control Report and several Quality Assurance parameters measured by ALS. This automated reporting highlights any non-conformances, facilitates faster and more accurate data validation and is designed to assist internal expert and external Auditor review. Many components of this report contribute to the overall DQO assessment and reporting for guideline compliance.

Brief method summaries and references are also provided to assist in traceability.

Summary of Outliers

Outliers : Quality Control Samples

This report highlights outliers flagged in the Quality Control (QC) Report.

- **NO Method Blank value outliers occur.**
- **NO Duplicate outliers occur.**
- **NO Laboratory Control outliers occur.**
- **NO Matrix Spike outliers occur.**
- **For all regular sample matrices, NO surrogate recovery outliers occur.**

Outliers : Analysis Holding Time Compliance

- **NO Analysis Holding Time Outliers exist.**

Outliers : Frequency of Quality Control Samples

- **NO Quality Control Sample Frequency Outliers exist.**



Analysis Holding Time Compliance

If samples are identified below as having been analysed or extracted outside of recommended holding times, this should be taken into consideration when interpreting results.

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times (referencing USEPA SW 846, APHA, AS and NEPM) based on the sample container provided. Dates reported represent first date of extraction or analysis and preclude subsequent dilutions and reruns. A listing of breaches (if any) is provided herein.

Holding time for leachate methods (e.g. TCLP) vary according to the analytes reported. Assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These are: organics 14 days, mercury 28 days & other metals 180 days. A recorded breach does not guarantee a breach for all non-volatile parameters.

Holding times for VOC in soils vary according to analytes of interest. Vinyl Chloride and Styrene holding time is 7 days; others 14 days. A recorded breach does not guarantee a breach for all VOC analytes and should be verified in case the reported breach is a false positive or Vinyl Chloride and Styrene are not key analytes of interest/concern.

Matrix: **WATER**

Evaluation: * = Holding time breach ; ✓ = Within holding time.

Method Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EG020F: Dissolved Metals by ICP-MS							
Clear Plastic Bottle - Nitric Acid; Filtered (EG020A-F) QC200_140923	14-Sep-2023	----	----	----	19-Sep-2023	12-Mar-2024	✓
EG020T: Total Metals by ICP-MS							
Clear Plastic Bottle - Nitric Acid; Unfiltered (EG020A-T) QC200_140923	14-Sep-2023	19-Sep-2023	12-Mar-2024	✓	19-Sep-2023	12-Mar-2024	✓
EG035F: Dissolved Mercury by FIMS							
Clear Plastic Bottle - Nitric Acid; Filtered (EG035F) QC200_140923	14-Sep-2023	----	----	----	20-Sep-2023	12-Oct-2023	✓
EG035T: Total Recoverable Mercury by FIMS							
Clear Plastic Bottle - Nitric Acid; Unfiltered (EG035T) QC200_140923	14-Sep-2023	----	----	----	20-Sep-2023	12-Oct-2023	✓



Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(were) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **WATER** Evaluation: ✖ = Quality Control frequency not within specification ; ✔ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	Method	QC	Regular	Actual	Expected	Evaluation	
Laboratory Duplicates (DUP)							
Dissolved Mercury by FIMS	EG035F	2	20	10.00	10.00	✔	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	2	20	10.00	10.00	✔	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	2	19	10.53	10.00	✔	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	EG020A-T	2	12	16.67	10.00	✔	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Dissolved Mercury by FIMS	EG035F	1	20	5.00	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	20	5.00	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	1	19	5.26	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	EG020A-T	1	12	8.33	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Dissolved Mercury by FIMS	EG035F	1	20	5.00	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	20	5.00	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	1	19	5.26	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	EG020A-T	1	12	8.33	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Dissolved Mercury by FIMS	EG035F	1	20	5.00	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	20	5.00	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	1	19	5.26	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	EG020A-T	1	12	8.33	5.00	✔	NEPM 2013 B3 & ALS QC Standard



Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

<i>Analytical Methods</i>	<i>Method</i>	<i>Matrix</i>	<i>Method Descriptions</i>
Hardness as CaCO ₃	EA065	WATER	In house: Referenced to APHA 2340 B. This method is compliant with NEPM Schedule B(3)
Dissolved Metals by ICP-MS - Suite A	EG020A-F	WATER	In house: Referenced to APHA 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020. Samples are 0.45µm filtered prior to analysis. The ICPMS technique utilizes a highly efficient argon plasma to ionize selected elements. Ions are then passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to their measurement by a discrete dynode ion detector.
Total Metals by ICP-MS - Suite A	EG020A-T	WATER	In house: Referenced to APHA 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020. The ICPMS technique utilizes a highly efficient argon plasma to ionize selected elements. Ions are then passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to their measurement by a discrete dynode ion detector.
Dissolved Mercury by FIMS	EG035F	WATER	In house: Referenced to APHA 3112 Hg - B (Flow-injection (SnCl ₂)(Cold Vapour generation) AAS) Samples are 0.45µm filtered prior to analysis. FIM-AAS is an automated flameless atomic absorption technique. A bromate/bromide reagent is used to oxidise any organic mercury compounds in the filtered sample. The ionic mercury is reduced online to atomic mercury vapour by SnCl ₂ which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM Schedule B(3).
Total Mercury by FIMS	EG035T	WATER	In house: Referenced to APHA 3112 Hg - B (Flow-injection (SnCl ₂)(Cold Vapour generation) AAS) FIM-AAS is an automated flameless atomic absorption technique. A bromate/bromide reagent is used to oxidise any organic mercury compounds in the unfiltered sample. The ionic mercury is reduced online to atomic mercury vapour by SnCl ₂ which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM Schedule B(3).
<i>Preparation Methods</i>	<i>Method</i>	<i>Matrix</i>	<i>Method Descriptions</i>
Digestion for Total Recoverable Metals	EN25	WATER	In house: Referenced to USEPA SW846-3005. Method 3005 is a Nitric/Hydrochloric acid digestion procedure used to prepare surface and ground water samples for analysis by ICPAES or ICPMS. This method is compliant with NEPM Schedule B(3)



SAMPLE RECEIPT NOTIFICATION (SRN)

Work Order : **ES2331591**

Client	: RAMBOLL AUSTRALIA PTY LTD	Laboratory	: Environmental Division Sydney
Contact	: MR STEPHEN MAXWELL	Contact	: Customer Services ES
Address	: 100 PACIFIC HIGHWAY NORTH SYDNEY 2060	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: smaxwell@ramboll.com	E-mail	: ALSEnviro.Sydney@ALSGlobal.com
Telephone	: ----	Telephone	: +61-2-8784 8555
Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: 318001376-007 Tarago Surface Water Monitoring	Page	: 1 of 3
Order number	: ----	Quote number	: EB2017ENVIAUS0001 (EN/222)
C-O-C number	: ----	QC Level	: NEPM 2013 B3 & ALS QC Standard
Site	: ----		
Sampler	: Ethan O'Connor & Steven Cadman		

Dates

Date Samples Received	: 15-Sep-2023 14:00	Issue Date	: 16-Sep-2023
Client Requested Due Date	: 21-Sep-2023	Scheduled Reporting Date	: 21-Sep-2023

Delivery Details

Mode of Delivery	: Carrier	Security Seal	: Not Available
No. of coolers/boxes	: 1	Temperature	: 14.0°C, 13.4°C, 14.2°C - Ice Bricks present
Receipt Detail	:	No. of samples received / analysed	: 1 / 1

General Comments

- This report contains the following information:
 - Sample Container(s)/Preservation Non-Compliances
 - Summary of Sample(s) and Requested Analysis
 - Proactive Holding Time Report
 - Requested Deliverables
- This is an updated SRN which indicates the correction of sample receipt date
- **Please refer to the Proactive Holding Time Report table below which summarises breaches of recommended holding times that have occurred prior to samples/instructions being received at the laboratory. The laboratory will process these samples unless instructions are received from you indicating you do not wish to proceed. The absence of this summary table indicates that all samples have been received within the recommended holding times for the analysis requested.**
- Please direct any queries you have regarding this work order to the above ALS laboratory contact.
- Analytical work for this work order will be conducted at ALS Sydney.
- Sample Disposal - Aqueous (3 weeks), Solid (2 months ± 1 week) from receipt of samples.
- Please be aware that APHA/NEPM recommends water and soil samples be chilled to less than or equal to 6°C for chemical analysis, and less than or equal to 10°C but unfrozen for Microbiological analysis. Where samples are received above this temperature, it should be taken into consideration when interpreting results. Refer to ALS EnviroMail 85 for ALS recommendations of the best practice for chilling samples after sampling and for maintaining a cool temperature during transit.



Sample Container(s)/Preservation Non-Compliances

All comparisons are made against pretreatment/preservation AS, APHA, USEPA standards.

- No sample container / preservation non-compliance exists.

Summary of Sample(s) and Requested Analysis

Some items described below may be part of a laboratory process necessary for the execution of client requested tasks. Packages may contain additional analyses, such as the determination of moisture content and preparation tasks, that are included in the package.

If no sampling time is provided, the sampling time will default 00:00 on the date of sampling. If no sampling date is provided, the sampling date will be assumed by the laboratory and displayed in brackets without a time component

Matrix: **WATER**

Laboratory sample ID	Sampling date / time	Sample ID	WATER - EA065 Total Hardness as CaCO3	WATER - W-02 8 Metals	WATER - W-02T 8 metals (Total)
ES2331591-001	14-Sep-2023 00:00	QC200_140923	✓	✓	✓

Proactive Holding Time Report

Sample(s) have been received within the recommended holding times for the requested analysis.



Requested Deliverables

ACCOUNTS PAYABLE

- A4 - AU Tax Invoice (INV) Email AsiaPac-Accounts@Ramboll.com

Isobel Marshall

- *AU Certificate of Analysis - NATA (COA) Email imarshall@ramboll.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI) Email imarshall@ramboll.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC) Email imarshall@ramboll.com
- A4 - AU Sample Receipt Notification - Environmental HT (SRN) Email imarshall@ramboll.com
- Chain of Custody (CoC) (COC) Email imarshall@ramboll.com
- EDI Format - EQUIS_RAMBOLL_APAC (EQUIS_RAMBOLL_APAC) Email imarshall@ramboll.com
- EDI Format - ESDAT (ESDAT) Email imarshall@ramboll.com
- EDI Format - SRAENV (SRAENV) Email imarshall@ramboll.com
- EDI Format - XTab (XTAB) Email imarshall@ramboll.com

JENNY AULD

- *AU Certificate of Analysis - NATA (COA) Email jauld@ramboll.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI) Email jauld@ramboll.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC) Email jauld@ramboll.com
- A4 - AU Sample Receipt Notification - Environmental HT (SRN) Email jauld@ramboll.com
- A4 - AU Tax Invoice (INV) Email jauld@ramboll.com
- Chain of Custody (CoC) (COC) Email jauld@ramboll.com
- EDI Format - EQUIS_RAMBOLL_APAC (EQUIS_RAMBOLL_APAC) Email jauld@ramboll.com
- EDI Format - ESDAT (ESDAT) Email jauld@ramboll.com
- EDI Format - SRAENV (SRAENV) Email jauld@ramboll.com
- EDI Format - XTab (XTAB) Email jauld@ramboll.com

STEPHEN MAXWELL

- *AU Certificate of Analysis - NATA (COA) Email smaxwell@ramboll.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI) Email smaxwell@ramboll.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC) Email smaxwell@ramboll.com
- A4 - AU Sample Receipt Notification - Environmental HT (SRN) Email smaxwell@ramboll.com
- Chain of Custody (CoC) (COC) Email smaxwell@ramboll.com
- EDI Format - EQUIS_RAMBOLL_APAC (EQUIS_RAMBOLL_APAC) Email smaxwell@ramboll.com
- EDI Format - ESDAT (ESDAT) Email smaxwell@ramboll.com
- EDI Format - SRAENV (SRAENV) Email smaxwell@ramboll.com
- EDI Format - XTab (XTAB) Email smaxwell@ramboll.com

Sydney Laboratory
Unit F3 B&F 16 Main Road Lane Cove West NSW 2066
02 9900 8400 Email: SampleSMS@eurofins.com

Brisbane Laboratory
Unit 1 21 Smallwood Place Murarie QLD 4172
07 3802 4900 Email: SampleQLD@eurofins.com

Perth Laboratory
Unit 2 91 Leach Highway Kewdale WA 6105
08 9251 9600 Email: SampleWA@eurofins.com

Melbourne Laboratory
6 Montevy Road Dandenong South VIC 3175
03 8594 5000 Email: SampleVoj@eurofins.com

Company Ramboll
Address 3/100 Pacific Highway, North Sydney 2060, NSW
Contact Name Ethan O'Connor
Phone No 0427 061 712

Special Directors Page 1 of 2
Purchase Order
Quote ID No

Project Name	Project No	Project Manager	EDD Format	EQUS
Tango Surface Water Monitoring	318001376-007	Stephen Maxwell	ES&H, EQUS etc	EQUS

Analyses
Where metals are requested, please specify "Total" or "Filtered".
SUITE code must be used to attract SUITE pricing.

Analyses	Requested Turnaround Time (TAT)
8 Metals Filtered (As, Cd, Cr, Cu, Pb, Ni, Zn, Hg)	Overnight (reporting by 9am) <input type="checkbox"/>
8 Metals Total (As, Cd, Cr, Cu, Pb, Ni, Zn, Hg)	Same day <input type="checkbox"/>
Hardness as CaCO3	2 days <input type="checkbox"/>
	3 days <input type="checkbox"/>
	5 days (Standard) <input type="checkbox"/>
	Other! <input type="checkbox"/>

Containers
Change container type & size if necessary.

Container	Quantity
500mL Plastic	1
250mL Plastic	1
125mL Plastic	1
200mL Amber Glass	1
40mL VOA vial	1
500mL PFAS Bottle	1
Jar (Glass or HDPE)	1
Asbestos Bag	1

Required Turnaround Time (TAT)
Default will be 5 days if not listed.
*Surcharge will apply

Sample Comments
/ Dangerous Goods Hazard Warning

No	Sampled Date/Time	Matrix	Project Name	Analyses	Handed over by	Sampler(s)	Date	Time	Temperature
1	SW1_UP_140923	W			Ethan O'Connor	Ethan O'Connor & Steven Cadman	14/09/2023	11:09	11.9
2	SW1_140923	W							
3	SW2_140923	W							
4	SW3_140923	W							
5	SW4_140923	W							
6	SW7_130923	W							
7	SW8_130923	W							
8	SW9_130923	W							
9	SW10_130923	W							
10	QC100_140923	W							
Total Counts									

Environmental Division
Sydney
Work Order Reference
ES2331591
Telephone: - 61-2-07 84 8666



Method of Shipment Courier# HG8473 Hand Delivered Postal

Laboratory Use Only
Received By: *Mary Ann*
Received By: *[Signature]*
Signature: *[Signature]*
Date: *14/9*
Time: *10:26:25*

Submitter of samples to the laboratory will be deemed as acceptance of Eurofins Environmental Testing Standard Terms and Conditions upon receipt of samples. A copy is available on request.

Company Ramboll
Address 31/00 Pacific Highway, North Sydney 2060, NSW
Contact Name Ethan O'Connor
Phone No 0247 061 712
Special Directions Page 2 of 2
Purchase Order
Quote ID No

Project No 318001376-007
Project Name Tarago Surface Water Monitoring
Analyses
 Where metals are requested, please specify "Total" or "Filtered".
 SUITE code must be used to attract SUITE pricing
 8 Metals Filtered (As, Cd, Cr, Cu, Pb, Ni, Zn, Hg)
 8 Metals Total (As, Cd, Cr, Cu, Pb, Ni, Zn, Hg)
 Hardness as CaCO3

Project Manager Stephen Maxwell
EDD Format EQUIS
Signature Ethan O'Connor
Date 14/09/2023

Handed over by Ethan O'Connor
Sampler(s) Ethan O'Connor & Steven Cadman
Email for Invoice jaud@ramboll.com; aslapac-accounts@ramboll.com
Email for Results jaud@ramboll.com; imarshall@ramboll.com; smaxwell@ramboll.com
Containers
 500mL Plastic
 250mL Plastic
 125mL Plastic
 200mL Amber Glass
 40mL VOA vial
 500mL PFAS Bottle
 Jar (Glass or HDPE)
 Asbestos Bag
Required Turnaround Time (TAT)
 Default will be 5 days if not ticked.
 *Surcharge will apply
 Overnight (reporting by 9am)
 Same day
 1 day
 2 days
 3 days
 5 days (Standard)
 Other
Sample Comments
 / Dangerous Goods Hazard Warning
 please send to ALS for same analysis

No	Sampled Date/Time	Matrix	Analyses	Signature	Date	Time
1	14/09/23	W	8 Metals Filtered (As, Cd, Cr, Cu, Pb, Ni, Zn, Hg) 8 Metals Total (As, Cd, Cr, Cu, Pb, Ni, Zn, Hg) Hardness as CaCO3	Ethan O'Connor	14/09/23	14:00
2						
3						
4						
5						
6						
7						
8						
9						
10						
Total Counts						

Method of Shipment Counter/# HG8473 Hand Delivered Postal
Signature Ethan O'Connor
Date 14/09/2023
Time
Temperature
Report No

Rec: 1400
 15/09/23

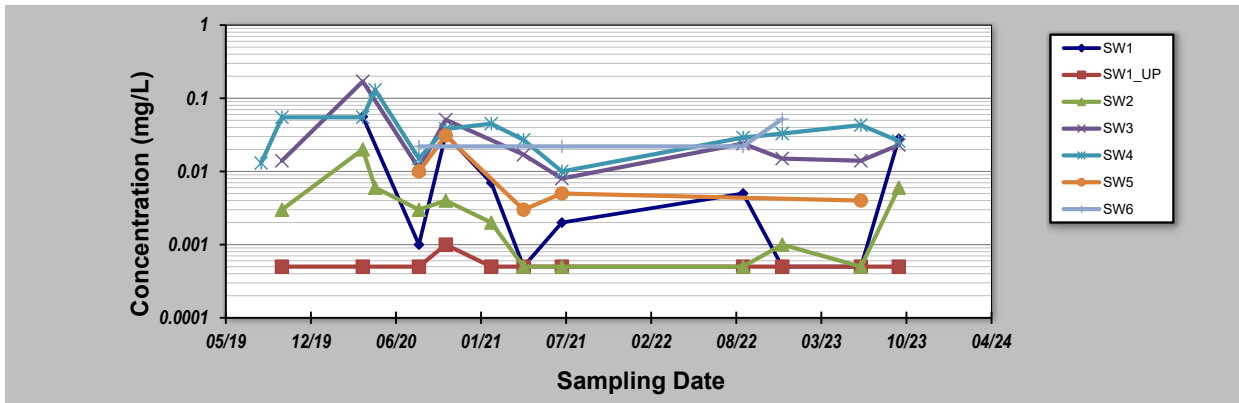
Submission samples to the laboratory will be deemed as acceptance of Eurofins | Environment Testing Standard Terms and Conditions unless agreed otherwise. A copy is available on request.

**APPENDIX 6
MANN-KENDALL RESULTS**

GSI MANN-KENDALL TOOLKIT for Constituent Trend Analysis

Evaluation Date: **3-Oct-23** Job ID: **318001376-007**
 Facility Name: **Tarago Surface Water Monitoring** Constituent: **Lead (Total)**
 Conducted By: **Jillian Cowburn** Concentration Units: **mg/L**

Sampling Point ID:		SW1	SW1_UP	SW2	SW3	SW4	SW5	SW6
Sampling Event	Sampling Date	LEAD (TOTAL) CONCENTRATION (mg/L)						
1	06/Aug/19					0.013		
2	24/Sep/19		0.0005	0.003	0.014	0.055		
3	29/Jan/20							
4	1/Apr/20	0.056	0.0005	0.02	0.17	0.055		
5	30/Apr/20			0.006		0.13		
6	11/Aug/20	0.001	0.0005	0.003	0.011	0.015	0.01	0.022
7	13/Oct/20	0.032	0.001	0.004	0.051	0.038	0.031	
8	28/Jan/21	0.007	0.0005	0.002		0.045		
9	14/Apr/21	0.0005	0.0005	0.0005	0.017	0.027	0.003	
10	13/Jul/21	0.002	0.0005	0.0005	0.008	0.01	0.005	0.022
11	12/Sep/22	0.005	0.0005	0.0005	0.024	0.029		0.022
12	13/Dec/22	0.0005	0.0005	0.001	0.015	0.033		0.052
13	16/Jun/23	0.0005	0.0005	0.0005	0.014	0.043	0.004	
14	13-Sep-23	0.028	0.0005	0.006	0.023	0.026		
15								
16								
17								
18								
19								
20								
Coefficient of Variation:		1.44	0.28	1.39	1.41	0.77	1.11	0.51
Mann-Kendall Statistic (S):		-14	-4	-26	-4	-13	-4	3
Confidence Factor:		87.3%	59.0%	95.7%	60.3%	76.4%	75.8%	72.9%
Concentration Trend:		No Trend	Stable	Decreasing	No Trend	Stable	No Trend	No Trend



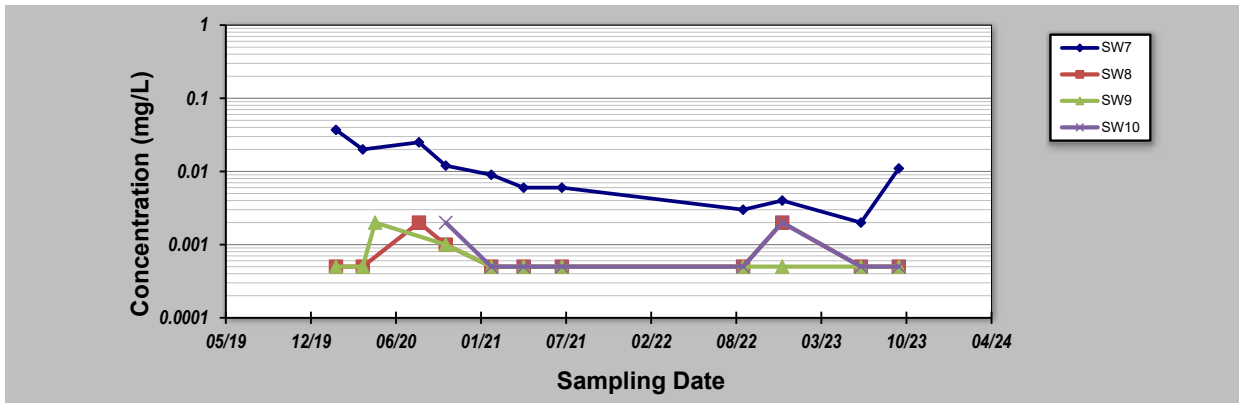
- Notes:**
- At least four independent sampling events per well are required for calculating the trend. *Methodology is valid for 4 to 40 samples.*
 - Confidence in Trend = Confidence (in percent) that constituent concentration is increasing (S>0) or decreasing (S<0): >95% = Increasing or Decreasing; ≥ 90% = Probably Increasing or Probably Decreasing; < 90% and S>0 = No Trend; < 90%, S≤0, and COV ≥ 1 = No Trend; < 90% and COV < 1 = Stable.
 - Methodology based on "MAROS: A Decision Support System for Optimizing Monitoring Plans", J.J. Aziz, M. Ling, H.S. Rifai, C.J. Newell, and J.R. Gonzales, *Ground Water*, 41(3):355-367, 2003.

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GSI MANN-KENDALL TOOLKIT for Constituent Trend Analysis

Evaluation Date: 3-Oct-23	Job ID: 318001376-007
Facility Name: Tarago Surface Water Monitoring	Constituent: Lead (Total)
Conducted By: Jillian Cowburn	Concentration Units: mg/L

Sampling Event	Sampling Date	LEAD (TOTAL) CONCENTRATION (mg/L)			
		SW7	SW8	SW9	SW10
1	06/Aug/19				
2	24/Sep/19				
3	29/Jan/20	0.037	0.0005	0.0005	
4	1/Apr/20	0.02	0.0005	0.0005	
5	30/Apr/20			0.002	
6	11/Aug/20	0.025	0.002		
7	13/Oct/20	0.012	0.001	0.001	0.002
8	28/Jan/21	0.009	0.0005	0.0005	0.0005
9	14/Apr/21	0.006	0.0005	0.0005	0.0005
10	13/Jul/21	0.006	0.0005	0.0005	0.0005
11	12/Sep/22	0.003	0.0005	0.0005	0.0005
12	13/Dec/22	0.004	0.002	0.0005	0.002
13	16/Jun/23	0.002	0.0005	0.0005	0.0005
14	13-Sep-23	0.011	0.0005	0.0005	0.0005
15					
16					
17					
18					
19					
20					
Coefficient of Variation:		0.89	0.74	0.68	0.79
Mann-Kendall Statistic (S):		-38	-4	-11	-4
Confidence Factor:		99.9%	59.0%	77.7%	64.0%
Concentration Trend:		Decreasing	Stable	Stable	Stable



Notes:

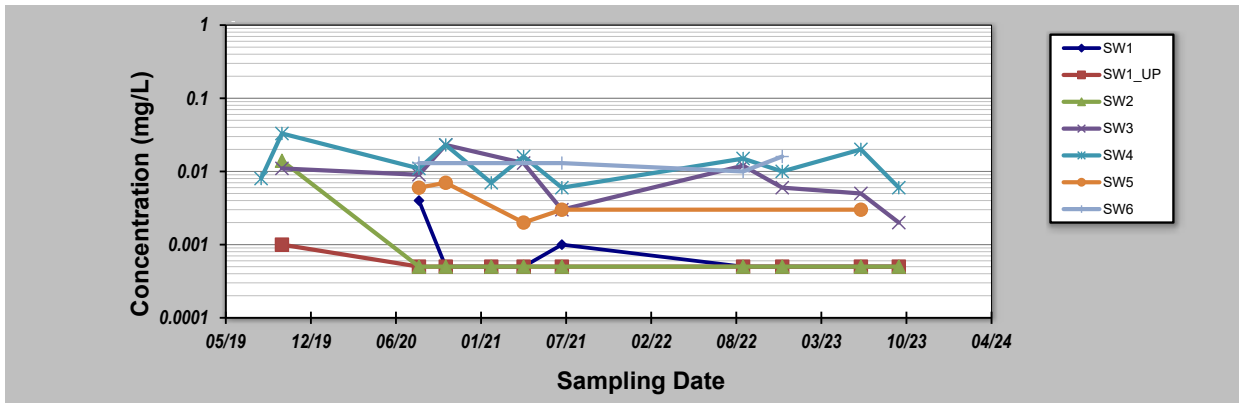
- At least four independent sampling events per well are required for calculating the trend. *Methodology is valid for 4 to 40 samples.*
- Confidence in Trend = Confidence (in percent) that constituent concentration is increasing (S>0) or decreasing (S<0): >95% = Increasing or Decreasing; ≥ 90% = Probably Increasing or Probably Decreasing; < 90% and S=0 = No Trend; < 90%, S≤0, and COV ≥ 1 = No Trend; < 90% and COV < 1 = Stable.
- Methodology based on "MAROS: A Decision Support System for Optimizing Monitoring Plans", J.J. Aziz, M. Ling, H.S. Rifai, C.J. Newell, and J.R. Gonzales, *Ground Water*, 41(3):355-367, 2003.

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GSI MANN-KENDALL TOOLKIT for Constituent Trend Analysis

Evaluation Date: **3-Oct-23** Job ID: **318001376-007**
 Facility Name: **Tarago Surface Water Monitoring** Constituent: **Lead (Dissolved)**
 Conducted By: **Jillian Cowburn** Concentration Units: **mg/L**

Sampling Point ID:		SW1	SW1_UP	SW2	SW3	SW4	SW5	SW6
Sampling Event	Sampling Date	LEAD (DISSOLVED) CONCENTRATION (mg/L)						
1	06/Aug/19					0.008		
2	24/Sep/19		0.001	0.014	0.011	0.033		
3	29/Jan/20							
4	1/Apr/20							
5	30/Apr/20							
6	11/Aug/20	0.004	0.0005	0.0005	0.009	0.011	0.006	0.013
7	13/Oct/20	0.0005	0.0005	0.0005	0.023	0.023	0.007	
8	28/Jan/21	0.0005	0.0005	0.0005		0.007		
9	14/Apr/21	0.0005	0.0005	0.0005	0.013	0.016	0.002	
10	13/Jul/21	0.001	0.0005	0.0005	0.003	0.006	0.003	0.013
11	12/Sep/22	0.0005	0.0005	0.0005	0.012	0.015		0.01
12	13/Dec/22	0.0005	0.0005	0.0005	0.006	0.01		0.016
13	16/Jun/23	0.0005	0.0005	0.0005	0.005	0.02	0.003	
14	13-Sep-23	0.0005	0.0005	0.0005	0.002	0.006		
15								
16								
17								
18								
19								
20								
Coefficient of Variation:		1.23	0.29	2.31	0.69	0.60	0.52	0.19
Mann-Kendall Statistic (S):		-9	-9	-9	-18	-12	-3	1
Confidence Factor:		79.2%	75.8%	75.8%	96.2%	79.9%	67.5%	50.0%
Concentration Trend:		No Trend	Stable	No Trend	Decreasing	Stable	Stable	No Trend



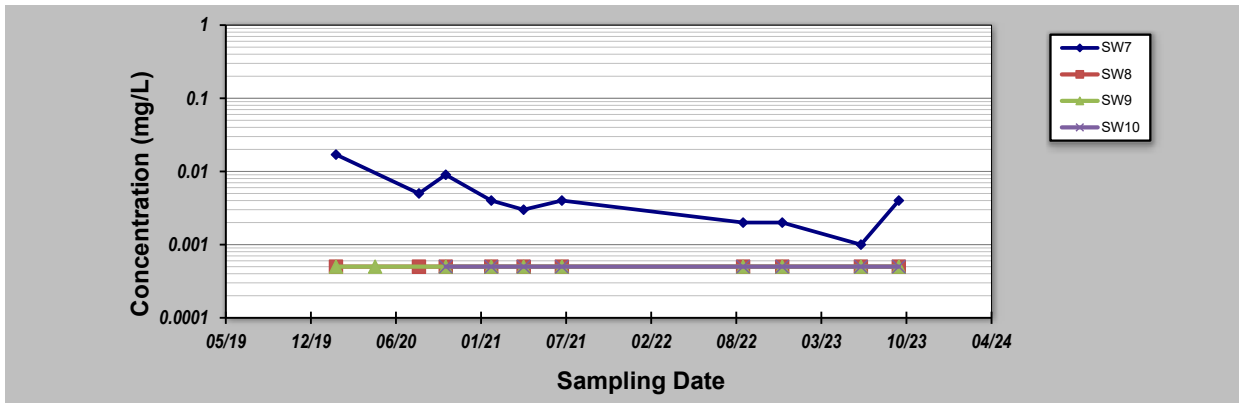
- Notes:**
- At least four independent sampling events per well are required for calculating the trend. *Methodology is valid for 4 to 40 samples.*
 - Confidence in Trend = Confidence (in percent) that constituent concentration is increasing (S>0) or decreasing (S<0): >95% = Increasing or Decreasing; ≥ 90% = Probably Increasing or Probably Decreasing; < 90% and S=0 = No Trend; < 90%, S≤0, and COV ≥ 1 = No Trend; < 90% and COV < 1 = Stable.
 - Methodology based on "MAROS: A Decision Support System for Optimizing Monitoring Plans", J.J. Aziz, M. Ling, H.S. Rifai, C.J. Newell, and J.R. Gonzales, *Ground Water*, 41(3):355-367, 2003.

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GSI MANN-KENDALL TOOLKIT for Constituent Trend Analysis

Evaluation Date: 3-Oct-23	Job ID: 318001376-007
Facility Name: Tarago Surface Water Monitoring	Constituent: Lead (Dissolved)
Conducted By: Jillian Cowburn	Concentration Units: mg/L

Sampling Event	Sampling Date	LEAD (DISSOLVED) CONCENTRATION (mg/L)			
		SW7	SW8	SW9	SW10
1	06/Aug/19				
2	24/Sep/19				
3	29/Jan/20	0.017	0.0005	0.0005	
4	1/Apr/20				
5	30/Apr/20			0.0005	
6	11/Aug/20	0.005	0.0005		
7	13/Oct/20	0.009	0.0005	0.0005	0.0005
8	28/Jan/21	0.004	0.0005	0.0005	0.0005
9	14/Apr/21	0.003	0.0005	0.0005	0.0005
10	13/Jul/21	0.004	0.0005	0.0005	0.0005
11	12/Sep/22	0.002	0.0005	0.0005	0.0005
12	13/Dec/22	0.002	0.0005	0.0005	0.0005
13	16/Jun/23	0.001	0.0005	0.0005	0.0005
14	13-Sep-23	0.004	0.0005	0.0005	0.0005
15					
16					
17					
18					
19					
20					
Coefficient of Variation:		0.93	0.00	0.00	0.00
Mann-Kendall Statistic (S):		-29	0	0	0
Confidence Factor:		99.5%	45.6%	45.6%	45.2%
Concentration Trend:		Decreasing	Stable	Stable	Stable



Notes:

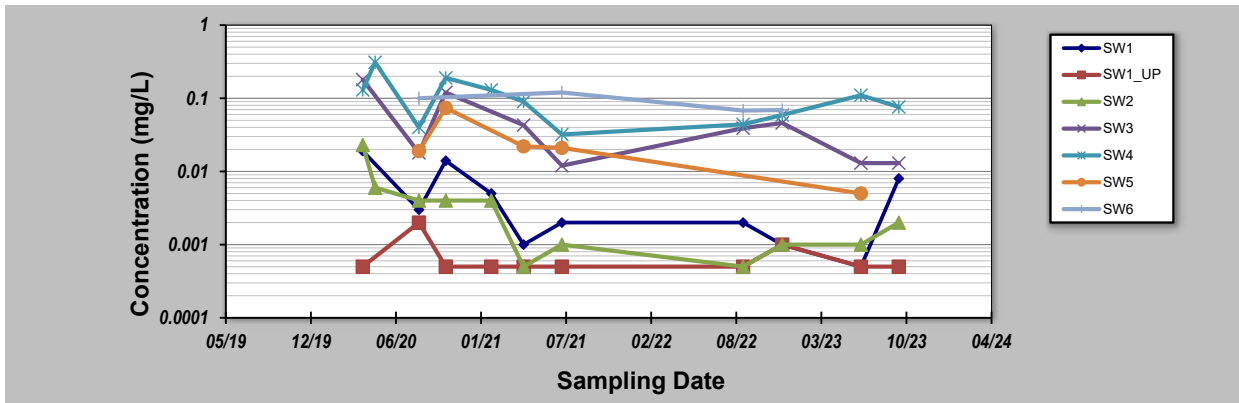
- At least four independent sampling events per well are required for calculating the trend. *Methodology is valid for 4 to 40 samples.*
- Confidence in Trend = Confidence (in percent) that constituent concentration is increasing (S>0) or decreasing (S<0): >95% = Increasing or Decreasing; ≥ 90% = Probably Increasing or Probably Decreasing; < 90% and S>0 = No Trend; < 90%, S≤0, and COV ≥ 1 = No Trend; < 90% and COV < 1 = Stable.
- Methodology based on "MAROS: A Decision Support System for Optimizing Monitoring Plans", J.J. Aziz, M. Ling, H.S. Rifai, C.J. Newell, and J.R. Gonzales, *Ground Water*, 41(3):355-367, 2003.

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GSI MANN-KENDALL TOOLKIT for Constituent Trend Analysis

Evaluation Date: 3-Oct-23	Job ID: 318001376-007
Facility Name: Tarago Surface Water Monitoring	Constituent: Copper (Total)
Conducted By: Jillian Cowburn	Concentration Units: mg/L

Sampling Point ID:	SW1	SW1_UP	SW2	SW3	SW4	SW5	SW6
Sampling Event	COPPER (TOTAL) CONCENTRATION (mg/L)						
1	06/Aug/19						
2	24/Sep/19						
3	29/Jan/20						
4	1/Apr/20	0.019	0.0005	0.023	0.18	0.13	
5	30/Apr/20			0.006		0.31	
6	11/Aug/20	0.003	0.002	0.004	0.018	0.04	0.1
7	13/Oct/20	0.014	0.0005	0.004	0.12	0.19	0.074
8	28/Jan/21	0.005	0.0005	0.004		0.13	
9	14/Apr/21	0.001	0.0005	0.0005	0.043	0.09	0.022
10	13/Jul/21	0.002	0.0005	0.001	0.012	0.032	0.12
11	12/Sep/22	0.002	0.0005	0.0005	0.039	0.044	0.068
12	13/Dec/22	0.001	0.001	0.001	0.046	0.059	0.069
13	16/Jun/23	0.0005	0.0005	0.001	0.013	0.11	0.005
14	13-Sep-23	0.008	0.0005	0.002	0.013	0.076	
15							
16							
17							
18							
19							
20							
Coefficient of Variation:	1.14	0.69	1.52	1.08	0.74	0.94	0.28
Mann-Kendall Statistic (S):	-21	-3	-28	-15	-16	-4	-2
Confidence Factor:	96.4%	56.9%	98.4%	92.5%	87.5%	75.8%	62.5%
Concentration Trend:	Decreasing	Stable	Decreasing	Prob. Decreasing	Stable	Stable	Stable



Notes:

- At least four independent sampling events per well are required for calculating the trend. *Methodology is valid for 4 to 40 samples.*
- Confidence in Trend = Confidence (in percent) that constituent concentration is increasing (S>0) or decreasing (S<0): >95% = Increasing or Decreasing; ≥ 90% = Probably Increasing or Probably Decreasing; < 90% and S>0 = No Trend; < 90%, S≤0, and COV ≥ 1 = No Trend; < 90% and COV < 1 = Stable.
- Methodology based on "MAROS: A Decision Support System for Optimizing Monitoring Plans", J.J. Aziz, M. Ling, H.S. Rifai, C.J. Newell, and J.R. Gonzales, *Ground Water*, 41(3):355-367, 2003.

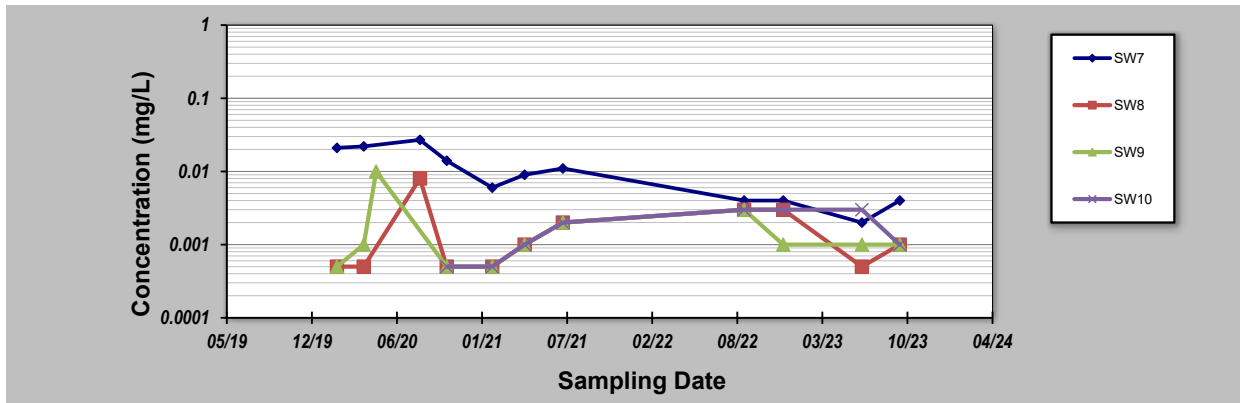
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GSI MANN-KENDALL TOOLKIT for Constituent Trend Analysis

Evaluation Date: **3-Oct-23** Job ID: **318001376-007**
 Facility Name: **Tarago Surface Water Monitoring** Constituent: **Copper (Total)**
 Conducted By: **Jillian Cowburn** Concentration Units: **mg/L**

Sampling Point ID: **SW7** **SW8** **SW9** **SW10**

Sampling Event	Sampling Date	COPPER (TOTAL) CONCENTRATION (mg/L)			
1	06/Aug/19				
2	24/Sep/19				
3	29/Jan/20	0.021	0.0005	0.0005	
4	1/Apr/20	0.022	0.0005	0.001	
5	30/Apr/20			0.01	
6	11/Aug/20	0.027	0.008		
7	13/Oct/20	0.014	0.0005	0.0005	0.0005
8	28/Jan/21	0.006	0.0005	0.0005	0.0005
9	14/Apr/21	0.009	0.001	0.001	0.001
10	13/Jul/21	0.011	0.002	0.002	0.002
11	12/Sep/22	0.004	0.003	0.003	0.003
12	13/Dec/22	0.004	0.003	0.001	0.003
13	16/Jun/23	0.002	0.0005	0.001	0.003
14	13-Sep-23	0.004	0.001	0.001	0.001
15					
16					
17					
18					
19					
20					
Coefficient of Variation:		0.76	1.21	1.42	0.65
Mann-Kendall Statistic (S):		-38	13	10	15
Confidence Factor:		99.9%	82.1%	75.3%	95.8%
Concentration Trend:		Decreasing	No Trend	No Trend	Increasing



Notes:

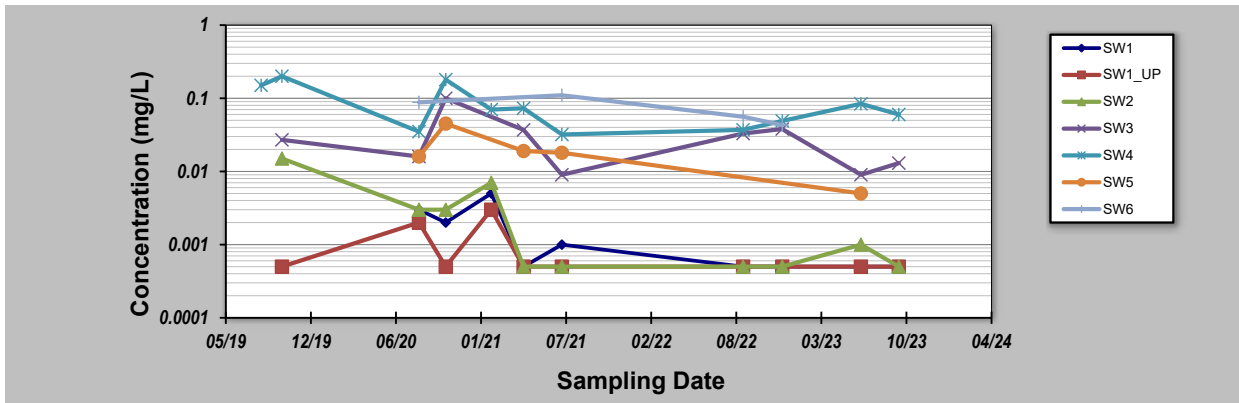
- At least four independent sampling events per well are required for calculating the trend. *Methodology is valid for 4 to 40 samples.*
- Confidence in Trend = Confidence (in percent) that constituent concentration is increasing (S>0) or decreasing (S<0): >95% = Increasing or Decreasing; ≥ 90% = Probably Increasing or Probably Decreasing; < 90% and S=0 = No Trend; < 90%, S≤0, and COV ≥ 1 = No Trend; < 90% and COV < 1 = Stable.
- Methodology based on "MAROS: A Decision Support System for Optimizing Monitoring Plans", J.J. Aziz, M. Ling, H.S. Rifai, C.J. Newell, and J.R. Gonzales, *Ground Water*, 41(3):355-367, 2003.

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GSI MANN-KENDALL TOOLKIT for Constituent Trend Analysis

Evaluation Date: **3-Oct-23** Job ID: **318001376-007**
 Facility Name: **Tarago Surface Water Monitoring** Constituent: **Copper (Dissolved)**
 Conducted By: **Jillian Cowburn** Concentration Units: **mg/L**

Sampling Point ID:		SW1	SW1_UP	SW2	SW3	SW4	SW5	SW6
Sampling Event	Sampling Date	COPPER (DISSOLVED) CONCENTRATION (mg/L)						
1	06/Aug/19					0.15		
2	24/Sep/19		0.0005	0.015	0.027	0.2		
3	29/Jan/20							
4	1/Apr/20							
5	30/Apr/20							
6	11/Aug/20	0.003	0.002	0.003	0.016	0.035	0.016	0.088
7	13/Oct/20	0.002	0.0005	0.003	0.1	0.18	0.045	
8	28/Jan/21	0.005	0.003	0.007		0.07		
9	14/Apr/21	0.0005	0.0005	0.0005	0.037	0.073	0.019	
10	13/Jul/21	0.001	0.0005	0.0005	0.009	0.032	0.018	0.11
11	12/Sep/22	0.0005	0.0005	0.0005	0.033	0.037		0.056
12	13/Dec/22	0.0005	0.0005	0.0005	0.038	0.049		0.043
13	16/Jun/23	0.0005	0.0005	0.001	0.009	0.084	0.005	
14	13-Sep-23	0.0005	0.0005	0.0005	0.013	0.06		
15								
16								
17								
18								
19								
20								
Coefficient of Variation:		1.05	0.97	1.48	0.90	0.68	0.72	0.41
Mann-Kendall Statistic (S):		-20	-9	-22	-7	-13	-4	-4
Confidence Factor:		97.8%	75.8%	97.1%	72.8%	82.1%	75.8%	83.3%
Concentration Trend:		Decreasing	Stable	Decreasing	Stable	Stable	Stable	Stable



Notes:

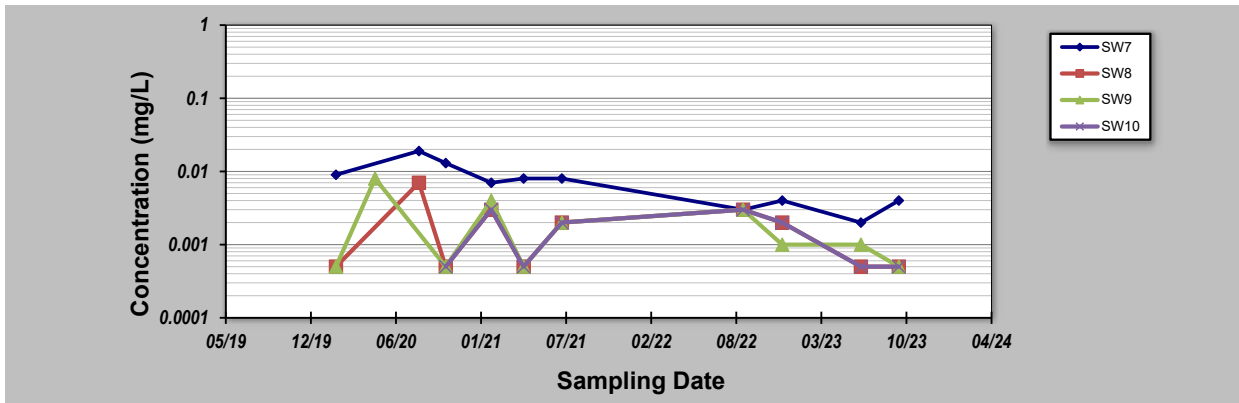
- At least four independent sampling events per well are required for calculating the trend. *Methodology is valid for 4 to 40 samples.*
- Confidence in Trend = Confidence (in percent) that constituent concentration is increasing (S>0) or decreasing (S<0): >95% = Increasing or Decreasing; ≥ 90% = Probably Increasing or Probably Decreasing; < 90% and S>0 = No Trend; < 90%, S≤0, and COV ≥ 1 = No Trend; < 90% and COV < 1 = Stable.
- Methodology based on "MAROS: A Decision Support System for Optimizing Monitoring Plans", J.J. Aziz, M. Ling, H.S. Rifai, C.J. Newell, and J.R. Gonzales, *Ground Water*, 41(3):355-367, 2003.

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GSI MANN-KENDALL TOOLKIT for Constituent Trend Analysis

Evaluation Date: 3-Oct-23	Job ID: 318001376-007
Facility Name: Tarago Surface Water Monitoring	Constituent: Copper (Dissolved)
Conducted By: Jillian Cowburn	Concentration Units: mg/L

Sampling Event	Sampling Date	COPPER (DISSOLVED) CONCENTRATION (mg/L)			
		SW7	SW8	SW9	SW10
1	06/Aug/19				
2	24/Sep/19				
3	29/Jan/20	0.009	0.0005	0.0005	
4	1/Apr/20				
5	30/Apr/20			0.008	
6	11/Aug/20	0.019	0.007		
7	13/Oct/20	0.013	0.0005	0.0005	0.0005
8	28/Jan/21	0.007	0.003	0.004	0.003
9	14/Apr/21	0.008	0.0005	0.0005	0.0005
10	13/Jul/21	0.008	0.002	0.002	0.002
11	12/Sep/22	0.003	0.003	0.003	0.003
12	13/Dec/22	0.004	0.002	0.001	0.002
13	16/Jun/23	0.002	0.0005	0.001	0.0005
14	13-Sep-23	0.004	0.0005	0.0005	0.0005
15					
16					
17					
18					
19					
20					
Coefficient of Variation:		0.67	1.06	1.14	0.76
Mann-Kendall Statistic (S):		-29	-7	-6	-4
Confidence Factor:		99.5%	70.0%	66.8%	64.0%
Concentration Trend:		Decreasing	No Trend	No Trend	Stable



Notes:

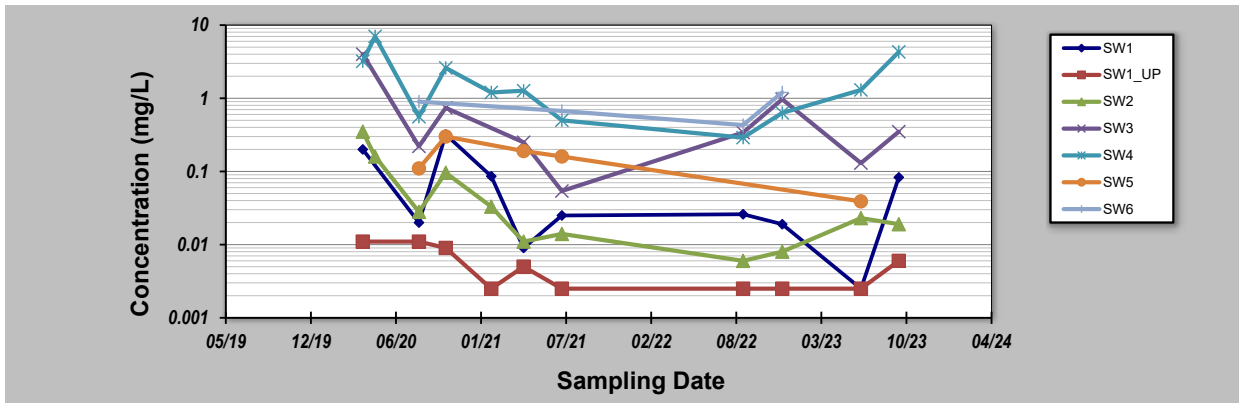
- At least four independent sampling events per well are required for calculating the trend. *Methodology is valid for 4 to 40 samples.*
- Confidence in Trend = Confidence (in percent) that constituent concentration is increasing (S>0) or decreasing (S<0): >95% = Increasing or Decreasing; ≥ 90% = Probably Increasing or Probably Decreasing; < 90% and S=0 = No Trend; < 90%, S≤0, and COV ≥ 1 = No Trend; < 90% and COV < 1 = Stable.
- Methodology based on "MAROS: A Decision Support System for Optimizing Monitoring Plans", J.J. Aziz, M. Ling, H.S. Rifai, C.J. Newell, and J.R. Gonzales, *Ground Water*, 41(3):355-367, 2003.

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GSI MANN-KENDALL TOOLKIT for Constituent Trend Analysis

Evaluation Date: 3-Oct-23	Job ID: 318001376-007
Facility Name: Tarago Surface Water Monitoring	Constituent: Zinc (Total)
Conducted By: Jillian Cowburn	Concentration Units: mg/L

Sampling Point ID:		SW1	SW1_UP	SW2	SW3	SW4	SW5	SW6
Sampling Event	Sampling Date	ZINC (TOTAL) CONCENTRATION (mg/L)						
1	06/Aug/19							
2	24/Sep/19							
3	29/Jan/20							
4	1/Apr/20	0.2	0.011	0.35	4	3.2		
5	30/Apr/20			0.16		7		
6	11/Aug/20	0.02	0.011	0.028	0.22	0.56	0.11	0.9
7	13/Oct/20	0.32	0.009	0.096	0.74	2.6	0.3	
8	28/Jan/21	0.086	0.0025	0.033		1.2		
9	14/Apr/21	0.009	0.005	0.011	0.25	1.27	0.19	
10	13/Jul/21	0.025	0.0025	0.014	0.054	0.5	0.16	0.67
11	12/Sep/22	0.026	0.0025	0.006	0.34	0.29		0.43
12	13/Dec/22	0.019	0.0025	0.008	0.97	0.63		1.2
13	16/Jun/23	0.0025	0.0025	0.023	0.13	1.3	0.039	
14	13-Sep-23	0.083	0.006	0.019	0.35	4.3		
15								
16								
17								
18								
19								
20								
Coefficient of Variation:		1.31	0.67	1.54	1.58	1.00	0.61	0.41
Mann-Kendall Statistic (S):		-15	-20	-31	-4	-9	-4	0
Confidence Factor:		89.2%	95.5%	99.2%	61.9%	72.9%	75.8%	37.5%
Concentration Trend:		No Trend	Decreasing	Decreasing	No Trend	Stable	Stable	Stable



Notes:

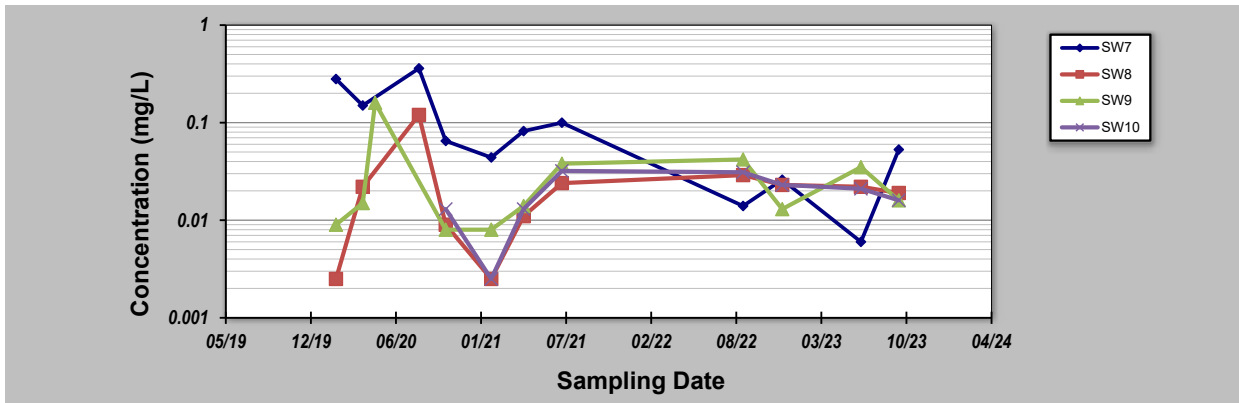
- At least four independent sampling events per well are required for calculating the trend. *Methodology is valid for 4 to 40 samples.*
- Confidence in Trend = Confidence (in percent) that constituent concentration is increasing (S>0) or decreasing (S<0); >95% = Increasing or Decreasing; ≥ 90% = Probably Increasing or Probably Decreasing; < 90% and S=0 = No Trend; < 90%, S≤0, and COV ≥ 1 = No Trend; < 90% and COV < 1 = Stable.
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GSI MANN-KENDALL TOOLKIT for Constituent Trend Analysis

Evaluation Date: 3-Oct-23	Job ID: 318001376-007
Facility Name: Tarago Surface Water Monitoring	Constituent: Zinc (Total)
Conducted By: Jillian Cowburn	Concentration Units: mg/L

Sampling Event	Sampling Date	ZINC (TOTAL) CONCENTRATION (mg/L)			
1	06/Aug/19				
2	24/Sep/19				
3	29/Jan/20	0.28	0.0025	0.009	
4	1/Apr/20	0.15	0.022	0.015	
5	30/Apr/20			0.16	
6	11/Aug/20	0.36	0.12		
7	13/Oct/20	0.065	0.009	0.008	0.013
8	28/Jan/21	0.044	0.0025	0.008	0.0025
9	14/Apr/21	0.082	0.011	0.014	0.013
10	13/Jul/21	0.1	0.024	0.038	0.032
11	12/Sep/22	0.014	0.029	0.042	0.031
12	13/Dec/22	0.026	0.023	0.013	0.023
13	16/Jun/23	0.006	0.022	0.035	0.021
14	13-Sep-23	0.053	0.019	0.016	0.016
15					
16					
17					
18					
19					
20					
Coefficient of Variation:		1.06	1.26	1.35	0.52
Mann-Kendall Statistic (S):		-31	9	10	5
Confidence Factor:		99.2%	72.9%	75.3%	68.3%
Concentration Trend:		Decreasing	No Trend	No Trend	No Trend



Notes:

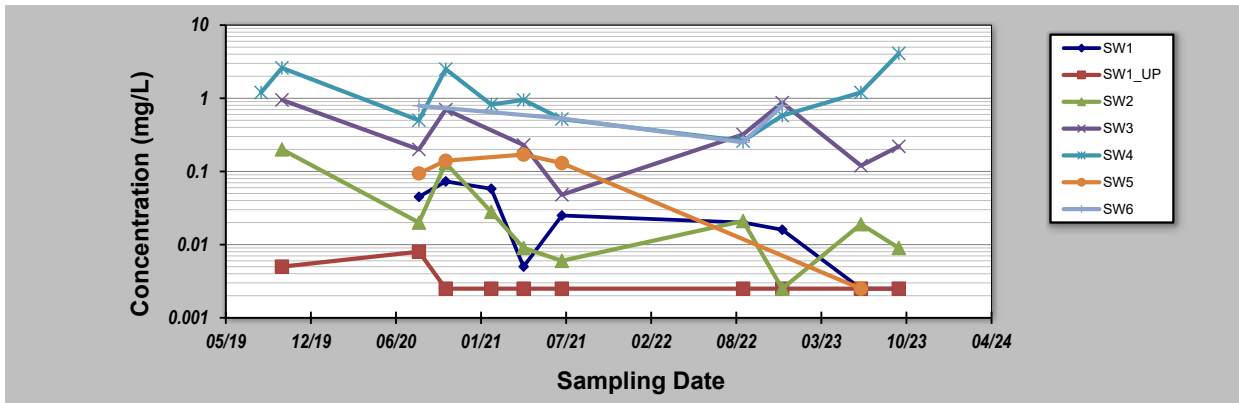
1. At least four independent sampling events per well are required for calculating the trend. *Methodology is valid for 4 to 40 samples.*
2. Confidence in Trend = Confidence (in percent) that constituent concentration is increasing (S>0) or decreasing (S<0): >95% = Increasing or Decreasing; ≥ 90% = Probably Increasing or Probably Decreasing; < 90% and S>0 = No Trend; < 90%, S≤0, and COV ≥ 1 = No Trend; < 90% and COV < 1 = Stable.
3. Methodology based on "MAROS: A Decision Support System for Optimizing Monitoring Plans", J.J. Aziz, M. Ling, H.S. Rifai, C.J. Newell, and J.R. Gonzales, *Ground Water*, 41(3):355-367, 2003.

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GSI MANN-KENDALL TOOLKIT for Constituent Trend Analysis

Evaluation Date: 3-Oct-23	Job ID: 318001376-007
Facility Name: Tarago Surface Water Monitoring	Constituent: Zinc (Dissolved)
Conducted By: Jillian Cowburn	Concentration Units: mg/L

Sampling Point ID:		SW1	SW1_UP	SW2	SW3	SW4	SW5	SW6
Sampling Event	Sampling Date	ZINC (DISSOLVED) CONCENTRATION (mg/L)						
1	06/Aug/19					1.2		
2	24/Sep/19		0.005	0.2	0.95	2.6		
3	29/Jan/20							
4	1/Apr/20							
5	30/Apr/20							
6	11/Aug/20	0.045	0.008	0.02	0.2	0.5	0.094	0.79
7	13/Oct/20	0.073	0.0025	0.13	0.7	2.5	0.14	
8	28/Jan/21	0.058	0.0025	0.028		0.82		
9	14/Apr/21	0.005	0.0025	0.009	0.23	0.95	0.17	
10	13/Jul/21	0.025	0.0025	0.006	0.048	0.52	0.13	0.53
11	12/Sep/22	0.02	0.0025	0.021	0.32	0.26		0.25
12	13/Dec/22	0.016	0.0025	0.0025	0.87	0.58		0.79
13	16/Jun/23	0.0025	0.0025	0.019	0.12	1.2	0.0025	
14	13-Sep-23	0.0025	0.0025	0.009	0.22	4.1		
15								
16								
17								
18								
19								
20								
Coefficient of Variation:		0.93	0.55	1.49	0.84	0.86	0.60	0.44
Mann-Kendall Statistic (S):		-25	-15	-24	-8	-2	-2	-1
Confidence Factor:		99.6%	89.2%	98.2%	76.2%	53.0%	59.2%	50.0%
Concentration Trend:		Decreasing	Stable	Decreasing	Stable	Stable	Stable	Stable



Notes:

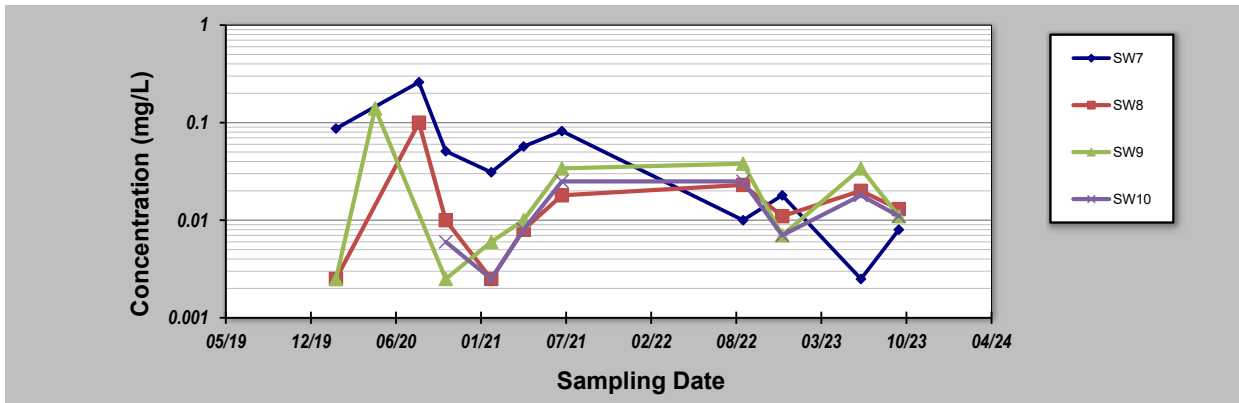
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GSI MANN-KENDALL TOOLKIT for Constituent Trend Analysis

Evaluation Date: 3-Oct-23	Job ID: 318001376-007
Facility Name: Tarago Surface Water Monitoring	Constituent: Zinc (Dissolved)
Conducted By: Jillian Cowburn	Concentration Units: mg/L

Sampling Event	Sampling Date	ZINC (DISSOLVED) CONCENTRATION (mg/L)			
		SW7	SW8	SW9	SW10
1	06/Aug/19				
2	24/Sep/19				
3	29/Jan/20	0.087	0.0025	0.0025	
4	1/Apr/20				
5	30/Apr/20			0.14	
6	11/Aug/20	0.26	0.1		
7	13/Oct/20	0.051	0.01	0.0025	0.006
8	28/Jan/21	0.031	0.0025	0.006	0.0025
9	14/Apr/21	0.057	0.008	0.01	0.008
10	13/Jul/21	0.082	0.018	0.034	0.025
11	12/Sep/22	0.01	0.023	0.038	0.025
12	13/Dec/22	0.018	0.011	0.007	0.007
13	16/Jun/23	0.0025	0.02	0.034	0.018
14	13-Sep-23	0.008	0.013	0.011	0.011
15					
16					
17					
18					
19					
20					
Coefficient of Variation:		1.26	1.38	1.46	0.68
Mann-Kendall Statistic (S):		-29	12	13	9
Confidence Factor:		99.5%	83.2%	85.4%	83.2%
Concentration Trend:		Decreasing	No Trend	No Trend	No Trend



Notes:

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