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TARAGO, NSW
JUNE 2023 SURFACE WATER MONITORING REPORT

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JUNE 2023 SURFACE WATER MONITORING REPORT

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Project name	**Tarago Surface Water Monitoring**
Project no.	**318001376-007**
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.**

Revision Number	Revision	Date	Prepared by	Checked by	Approved by
0	Draft	24/07/2023	[redacted]	[redacted]	[redacted]
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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

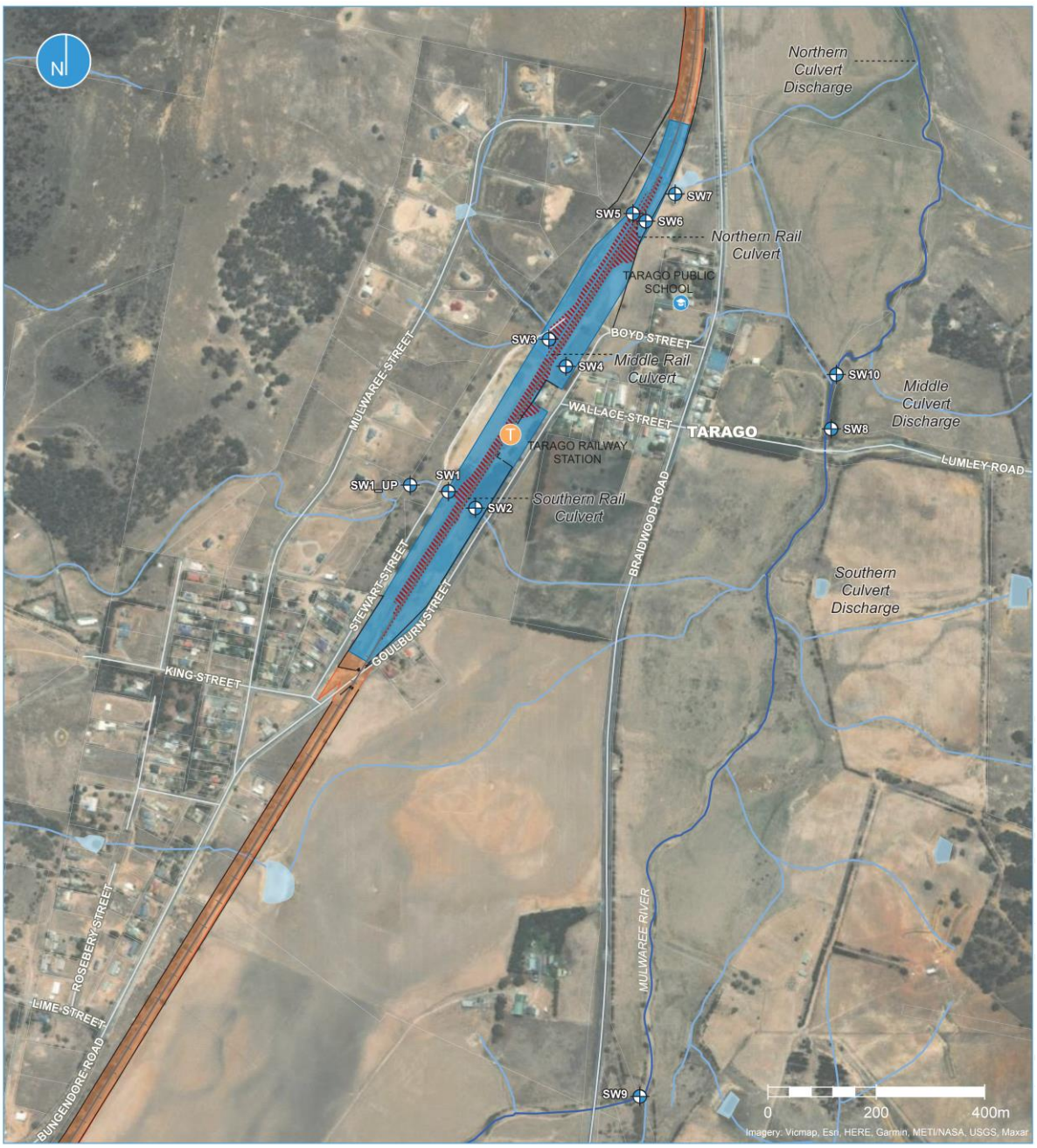
2.1 Monitoring Scope

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, arsenic, barium, beryllium, cadmium, chromium, cobalt, iron, lead, manganese, mercury, 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 prepared a Sampling and Analysis Quality Plan titled '*Sampling Analysis and Quality Plan (SAQP) – Surface Water Monitoring, Tarago Lead Management*' (Ramboll, 2020).

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 June 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. Some uncertainty surrounds the mercury results due to PQLs above for all data to date however this uncertainty does not affect the conclusions of the report because mercury is not a contaminant of concern. However, it is considered that the data is of suitable quality to meet the project objectives.

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 16 June 2023.	x	x			
Reference to sampling plan/method, including any deviations from SAQP	Sampling was undertaken in general accordance with the SAQP. SW6 could not be sampled as the location was dry.	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**. Surface water 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. 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			
Field quality assurance/quality control results (e.g., field blank, rinsate blank, trip blank, laboratory prepared trip spike)	Intra- and inter-laboratory duplicate results, are presented in **Table 13, Appendix 3**. No trip spike/blanks were collected due to the targeted contaminants of the investigation not being volatile. Relative Percent Differences (RPDs) exceeded the RPD criteria (≤30%) for:				x	x

Assessment of DQIs (as per NSW EPA, 2020)	Ramboll's Assessment	Completeness	Comparability	Representativeness	Precision	Accuracy
	• Primary (TAR_SW3_160623) and interlaboratory duplicate (QC101_160623) - Barium (total and dissolved), copper (total), iron (total and dissolved), manganese (total and dissolved), and zinc (total and dissolved) • Primary (TAR_SW3_160623) and inter-laboratory duplicate (QC201_160623) samples - aluminium (total and dissolved) and iron (dissolved) The exceedances in the RPD criteria are associated with low level concentrations less than 10-times the laboratory limit of reporting. The higher concentration was generally reported in the primary sample. These minor discrepancies are not considered to affect the reliability of the data.					
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 e.g., D01.			x		X
Statement of duplicate frequency	Intra- and inter- laboratory duplicate samples were analysed at a rate of 10%.			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, ORP and TDS. These parameters were recorded once stabilised.	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			
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			

Assessment of DQIs (as per NSW EPA, 2020)	Ramboll's Assessment	Completeness	Comparability	Representativeness	Precision	Accuracy
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	All laboratory control samples and surrogates were acceptable.	x	x			
A list of what spikes and surrogates were run with their recoveries and acceptance criteria	Laboratory spike and surrogate recoveries are detailed in the laboratory certificates provided in **Appendix 5.**		x			x
Practical quantification limits (PQL)	The PQL for dissolved mercury (<0.0001 mg/L) exceeds the adopted ecological screening criteria for 95% species protection (0.00006 mg/L). Mercury was not detected above the PQL in any of the samples collected indicating that any exceedances of the criteria are anticipated to be minor (within 0.00004 mg/L). All remaining PQLs were below the adopted assessment criteria.	x	x			
Reference laboratory control sample (LCS) and check results	The results for LCS were acceptable and no detections were made in blank samples.	x				
Laboratory frequencies	Laboratory quality control samples including duplicates and blanks were undertaken by the laboratories at appropriate frequencies. Matrix spikes were below ALS QC standard and anonymous samples from the laboratory batch were adopted for comparison.	x				x
Laboratory results	The results for laboratory duplicates were acceptable and no detections were made in blank samples. Matrix spike recovery for mercury in inter-laboratory duplicate report (ALS) was lower than the DQO. This was an anonymous sample from the laboratory batch and not applicable to the sample results.	x				x

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 $CaCO_3$) 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 – SW5	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
SW6* 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 SW6 as it was dry at the time of sampling. It has been tentatively grouped with SW7 based on its location and will be updated once hardness data is obtained during the next monitoring round.*

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 Sceening[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 5-3.**

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	10	#	0.05	0.01
Chromium[d]	NA	NA	-	#	1	1
Cobalt	NA	NA	-	0.0014	0.1	1
Copper	NA	NA	0.5	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

Twelve monitoring events have been completed between August 2019 and June 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 2023
>10% AEP	< 126	0	0	0	0	-	0	0	0	0	7.2	0	
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
Average Monthly Rainfall (mm)		42.9	44	49	40.4*	42.9	44	63.9	25.9	32.6	44.1	56.4	55.5
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

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).

**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. °C	SPC µS/cm	pH pH units	DO mg/L	ORP mV	TDS mg/L	Comments
On and Near Site									
SW1	8	Minimum	7.8	206.1	6.35	0.04	23.6	133.9	Dry January 2020.
		Maximum	17.4	783	7.77	11	175.8	434	
		Average	11.3	603.7	7.5	6.1	115.5	335.7	
SW1-UP	8	Minimum	8	205.6	7.05	0.1	-41.4	133.25	Dry January 2020. Parameters not recorded September 2019.
		Maximum	19.94	795	7.8	10.86	186.9	431	
		Average	12.2	599.8	7.5	5.8	115.0	337.0	
SW2	9	Minimum	7	213.3	6.54	0.12	48.3	137.8	Dry January 2020. Parameters not recorded September 2019.
		Maximum	17.54	803	8.27	70.8	185.9	416	
		Average	11.2	576.1	7.7	12.2	142.6	320.9	
SW3	7	Minimum	6.8	128	6	4.7	28.1	92.3	Dry January 2020 and January 2021. Parameters not recorded September 2019.
		Maximum	21.75	245	7.96	9.43	196.1	159	
		Average	11.2	199.4	6.8	6.6	140.5	130.1	
SW4	10	Minimum	5.9	128.2	5.75	1.12	58.1	99.45	Dry January 2020. Parameters not recorded September 2019.
		Maximum	20.33	388.3	8.8	10.42	263.1	251.82	
		Average	11.6	222.8	7.2	6.3	163.3	167.1	
SW5	5	Minimum	6.2	117.9	6.45	4.06	-3	76.7	Dry January, April 2020, and January 2021, September 2022 and December 2022.
		Maximum	11.95	251.2	8.35	9.33	191	121	
		Average	9.9	193.6	7.1	6.9	94.0	98.9	
SW6	4	Minimum	8.3	168.3	6.53	4.5	111	109.2	Dry January, April, October 2020, January, April 2021 and June 2023
		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	
SW7	10	Minimum	6.9	94.7	6.34	1.8	14.1	61.75	Evidence of property owner pushing material into the water body to fill to the surface.
		Maximum	23.1	2342	8.92	8.76	168	396.6	
		Average	14.7	433.5	7.3	5.5	101.0	155.4	
Offsite									
SW8	9	Minimum	7.6	170.5	7.0	3.1	31.9	107.9	---
		Maximum	23.6	1165.0	8.5	9.3	136.1	656.5	
		Average	14.9	746.1	7.5	6.4	108.9	415.8	
SW9	9	Minimum	7.2	125.3	7.2	0.3	35.7	115.7	---
		Maximum	25.0	1304.0	8.4	16.8	227.7	812.5	
		Average	14.8	679.7	7.7	8.6	128.1	452.6	
SW10	6	Minimum	7.7	682.0	7.2	3.6	3.8	454.4	---
		Maximum	20.3	1060.0	7.6	9.7	148.7	564.0	
		Average	13.2	819.7	7.4	6.3	85.2	491.5	

6.3 Analytical Results

A summary of the surface water analytical results for monitoring events from August 2019 to June 2023 is presented in **Table 6-3** for on and near site and **Table 6-5** for the Mulwaree River sampling locations, respectively. The corresponding results tables are presented in **Tables 2** through **12** of **Appendix 3.**

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

						No. above site-specific criteria		No above Tier 1 criteria					
Analyte	**No. of Samples (Cumulative)**	**No. of Detects**	**Minimum (mg/L)**	**Maximum (mg/L)**	**Average (mg/L)**	**Human Health**	**Ecology**	**Irrigation[1]**	**Stock Water[1]**	**Health-based Screening Criteria (Recreational Waters)**	**ANZG 95% Protection Fresh Water (CaC03 - extremely hard)**	**ANZG 95% Protection Fresh Water (CaC03 -soft)**	**ANZG 95% Protection Fresh Water (CaC03 – moderate)**
Total Metals													
Aluminium	63	43	0.05	11	0.880	-	-	-	-	**3**	-	-	-
Arsenic	64	35	0.001	0.016	0.003	0	-	-	-	0	-	-	-
Barium	63	63	0.03	0.36	0.074	-	-	-	-	0	-	-	-
Beryllium	64	0	-	-	-	-	-	-	-	0	-	-	-
Cadmium	64	37	0.0003	0.04	0.005	0	-	-	-	**2**	-	-	-
Chromium	63	33	0.001	0.011	0.002	-	-	-	-	0	-	-	-
Cobalt	64	24	0.001	0.014	0.003	-	-	-	-	-	-	-	-
Copper	64	54	0.001	0.31	0.043	-	-	-	-	0	-	-	-
Iron	63	62	0.06	8.9	1.414	-	-	-	-	**9**	-	-	-
Lead	69	53	0.001	0.17	0.024	0	-	-	-	**2**	-	-	-
Manganese	64	64	0.009	1.1	0.162	0	-	-	-	0	-	-	-
Mercury	64	4	0.0001	0.0001	0.000	-	-	-	-	0	-	-	-
Nickel	64	46	0.001	0.451	0.020	0	-	-	-	**1**	-	-	-
Zinc	64	58	0.005	7	0.548	-	-	-	-	0	-	-	-
Dissolved Metals													
Aluminium	61	35	0.05	3.6	0.652	-	-	0	0	-	**3**	**20**	**10**
Arsenic	62	31	0.001	0.011	0.002	-	0	0	0	-	0	0	0
Barium	61	61	0.03	0.12	0.061	-	-	-	-	-	-	-	-
Beryllium	62	0	-	-	-	-	-	0	-	-	0	0	0
Cadmium	62	32	0.0002	0.018	0.003	-	**2**	0	0	-	0	**20**	**5**
Chromium	61	16	0.001	0.003	0.002	-	-	0	0	-	0	**2**	**3**
Cobalt	62	16	0.001	0.005	0.002	-	-	0	0	-	0	**7**	**0**
Copper	62	46	0.001	0.2	0.037	-	0	0	0	-	**9**	**22**	**13**
Iron	61	44	0.06	2.6	0.834	-	-	-	-	-	**2**	**19**	**12**
Lead	62	39	0.001	0.033	0.009	-	0	0	0	-	**1**	**19**	**2**
Manganese	62	61	0.005	1	0.089	-	-	0	-	-	0	0	0
Mercury	62	0	-	-	-	-	-	0	0	-	0	0	0
Nickel	62	38	0.001	0.421	0.018	-	0	0	0	-	0	**5**	0
Zinc	62	51	0.005	2.6	0.368	-	0	0	0	-	**3**	**22**	**10**

[1] *Applicable to SW7 only*

*CaC03 Extremely Hard Category, refer to **Table 5-1** – includes sampling locations SW1, SW_UP and SW2*

*CaC03 Soft Category, refer to **Table 5-1** – includes sampling locations SW3-SW5*

*CaC03 Moderate Category, refer to **Table 5-1** – includes sampling locations SW6-SW7*

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

						No. above site-specific criteria		No above Tier 1 criteria					
Analyte	**No. of Samples (Cumulative)**	**No. of Detects**	**Minimum**	**Maximum**	**Average**	**Human Health**	**Ecology**	**Irrigation[1]**	**Stock Water[1]**	**Health-based Screening Criteria (Recreational Waters)**	**ANZG 95% Protection Fresh Water (CaC03 - extremely hard)**	**ANZG 95% Protection Fresh Water (CaC03 -soft)**	**ANZG 95% Protection Fresh Water (CaC03 – moderate)**
Total Metals													
Aluminium	7	4	0.05	1.5	0.500	-	-	-	-	0	-	-	-
Arsenic	7	4	0.001	0.002	0.002	0	-	-	-	0	-	-	-
Barium	7	7	0.03	0.08	0.067	-	-	-	-	0	-	-	-
Beryllium	7	0	-	-	-	-	-	-	-	0	-	-	-
Cadmium	7	3	0.0002	0.0064	0.002	0	-	-	-	0	-	-	-
Chromium	7	2	0.001	0.002	0.002	-	-	-	-	0	-	-	-
Cobalt	7	2	0.001	0.002	0.002	-	-	-	-	-	-	-	-
Copper	7	5	0.001	0.11	0.026	-	-	-	-	0	-	-	-
Iron	7	7	0.09	9.5	2.016	-	-	-	-	0	-	-	-
Lead	7	4	0.001	0.043	0.016	0	-	-	-	0	-	-	-
Manganese	7	7	0.016	0.25	0.086	0	-	-	-	0	-	-	-
Mercury	7	0	-	-	-	-	-	-	-	0	-	-	-
Nickel	7	4	0.001	0.013	0.005	0	-	-	-	0	-	-	-
Zinc	7	5	0.005	1.3	0.300	-	-	-	-	0	-	-	-
Dissolved Metals													
Aluminium	7	3	0.05	0.1	0.070	-	-	0	0	-	0	0	0
Arsenic	7	2	0.001	0.002	0.002	-	0	0	0	-	0	0	0
Barium	7	7	0.03	0.08	0.061	-	-	-	-	-	-	-	-
Beryllium	7	0	-	-	-	-	-	0	-	-	0	0	0
Cadmium	7	1	0.002	0.0057	0.006	-	0	0	0	-	0	0	0
Chromium	7	0	-	-	-	-	-	0	0	-	0	0	0
Cobalt	7	1	0.001	0.002	0.002	-	-	0	0	-	0	0	0
Copper	7	5	0.001	0.084	0.020	-	0	0	0	-	**1**	**1**	**1**
Iron	7	4	0.05	4.2	1.560	-	-	-	-	-	-	-	-
Lead	7	4	0.01	0.02	0.007	-	0	0	0	-	0	0	0
Manganese	7	7	0.014	0.15	0.065	-	-	0	-	-	0	0	0
Mercury	7	0	-	0	-	-	-	0	0	-	0	0	0
Nickel	7	4	0.001	0.011	0.004	-	0	0	0	-	0	0	0
Zinc	7	3	0.005	1.2	0.446	-	0	0	0	-	0	0	0

[1] *Applicable to SW7 only*

*CaC03 Extremely Hard Category, refer to **Table 5-1**– includes sampling locations SW1, SW_UP and SW2*

*CaC03 Soft Category, refer to **Table 5-1**– includes sampling locations SW3-SW5*

*CaC03 Moderate Category, refer to **Table 5-1**– includes sampling locations SW6-SW7*

Table 6-5a: 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	26	8	0.05	0.72	0.279	0	-	-	-
Arsenic	27	7	0.001	0.001	0.001	0	-	-	-
Barium	26	25	0.02	0.12	0.078	0	-	-	-
Beryllium	27	0	-	-	-	0	-	-	-
Cadmium	27	2	0.0003	0.0004	0.000	0	-	-	-
Chromium	26	4	0.001	0.002	0.002	0	-	-	-
Cobalt	27	3	0.001	0.003	0.002	-	-	-	-
Copper	27	17	0.001	0.01	0.003	0	-	-	-
Iron	26	25	0.14	3.2	0.564	**1**	-	-	-
Lead	27	7	0.001	0.002	0.002	0	-	-	-
Manganese	27	27	0.02	1.9	0.235	0	-	-	-
Mercury	27	0	-	-	-	0	-	-	-
Nickel	27	22	0.001	0.002	0.002	0	-	-	-
Zinc	27	24	0.008	0.16	0.031	0	-	-	-
Dissolved Metals									
Aluminium	24	2	0.35	0.41	0.380	-	**2**	0	0
Arsenic	25	3	0.002	0.003	0.003	-	0	0	0
Barium	24	23	0.02	0.12	0.075	-	-	-	-
Beryllium	25	0	-	-	-	-	0	0	-
Cadmium	25	2	0.0002	0.0004	0.000	-	0	0	0
Chromium	24	1	0.001	0.001	0.001	-	0	0	0
Cobalt	25	1	0.001	0.001	0.001	-	0	0	0
Copper	25	15	0.001	0.008	0.003	-	**13**	0	0
Iron	24	21	0.07	0.8	0.222	-	**3**	0	-
Lead	25	0	-	-	-	-	0	0	0
Manganese	25	25	0.012	0.85	0.140	-	0	0	-
Mercury	25	0	-	-	-	-	0	0	0
Nickel	25	17	0.001	0.002	0.001	-	0	0	0
Zinc	25	20	0.006	0.14	0.027	-	**2**	0	0

NA = not applicable

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

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

Analyte	No. of Samples	No. of Detects	Minimum	Maximum	Average	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	0	0.05	-	-	0	-	-	-
Arsenic	3	0	0.001	-	-	0	-	-	-
Barium	3	3	0.03	0.09	0.090	0	-	-	-
Beryllium	3	0	-	-	-	0	-	-	-
Cadmium	3	0	0.0002	-	-	0	-	-	-
Chromium	3	0	0.001	-	-	0	-	-	-
Cobalt	3	0	0.001	-	-	-	-	-	-
Copper	3	2	0.001	0.003	0.002	0	-	-	-
Iron	3	3	0.09	0.24	0.200	0	-	-	-
Lead	3	0	0.001	-	-	0	-	-	-
Manganese	3	3	0.016	0.11	0.077	0	-	-	-
Mercury	3	0	-	-	-	0	-	-	-
Nickel	3	0	0.001	-	-	0	-	-	-
Zinc	3	3	0.005	0.035	0.026	0	-	-	-
Dissolved Metals									
Aluminium	3	0	0.05	-	-	-	0	0	0
Arsenic	3	0	0.001	-	-	-	0	0	0
Barium	3	3	0.03	0.09	0.090	-	-	-	-
Beryllium	3	0	-	-	-	-	0	0	-
Cadmium	3	0	0.002	-	-	-	0	0	0
Chromium	3	0	-	-	-	-	0	0	0
Cobalt	3	0	0.001	-	-	-	0	0	0
Copper	3	1	0.001	0.001	0.001	-	0	0	0
Iron	3	3	0.05	0.2	0.170	-	0	0	0
Lead	3	0	0.01	-	-	-	0	0	0
Manganese	3	3	0.014	0.1	0.073	-	0	0	-
Mercury	3	0	-	-	-	-	0	0	0
Nickel	3	0	0.001	0	-	-	0	0	0
Zinc	3	3	0.005	0.034	0.024	-	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 12 monitoring events completed between August 2019 and June 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 reported in surface water samples from on and near site sample locations (SW1-UP, SW1 through to SW7). All surface water samples collected on and near the site to date have reported total lead concentrations that have fluctuated below the site-specific criterion for human health (7 mg/L). Maximum total lead concentrations recorded to date are more than 40-times lower than the criterion.

Figure 6-2 presents dissolved lead concentrations reported for the on and near site samples locations (SW1-UP, SW1 through to SW7). Data is compared to the EnRiskS (2021) site-specific ecological criterion for lead (0.1 mg/L). All samples to date have reported fluctuating dissolved lead concentrations below the criterion.

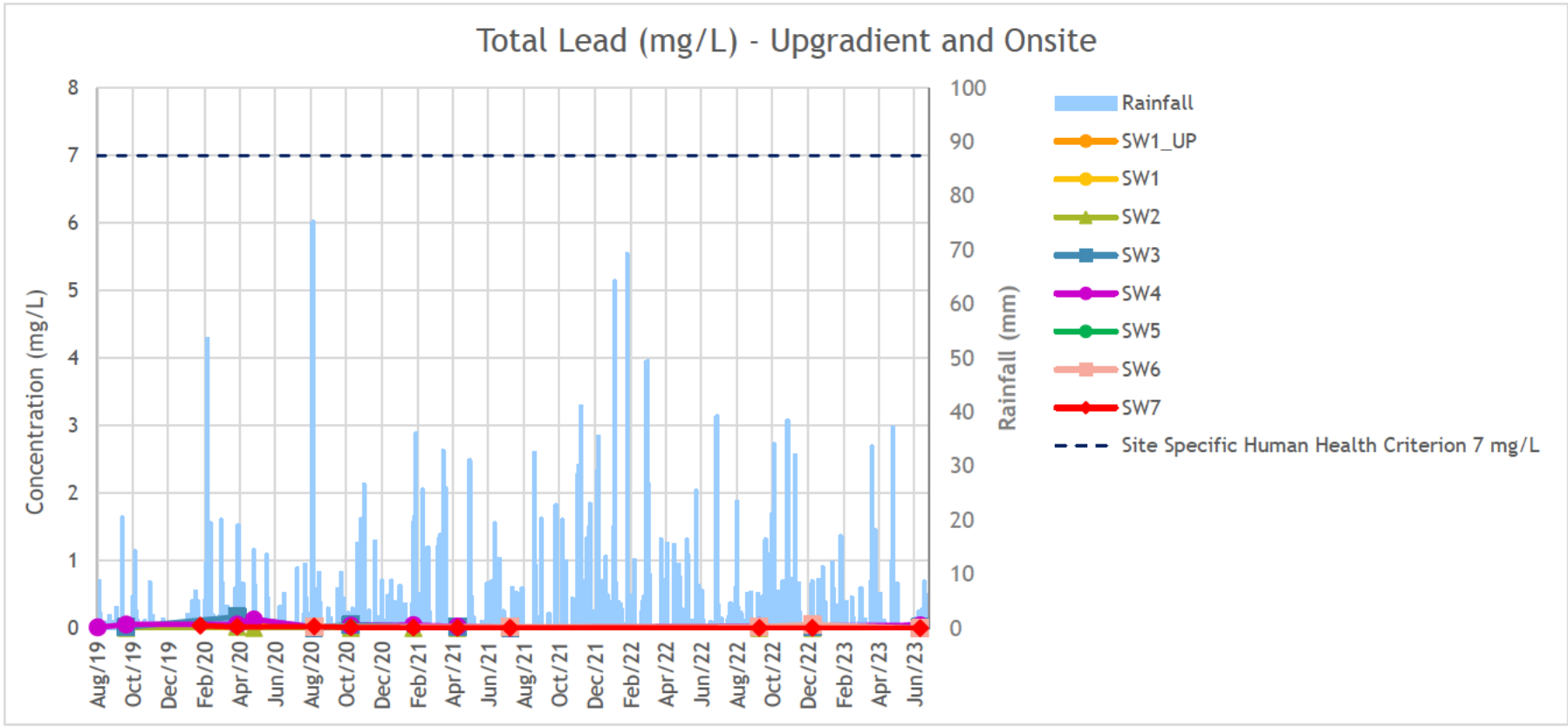


Figure 6-1: Upgradient and Onsite Total Lead Concentration Trend

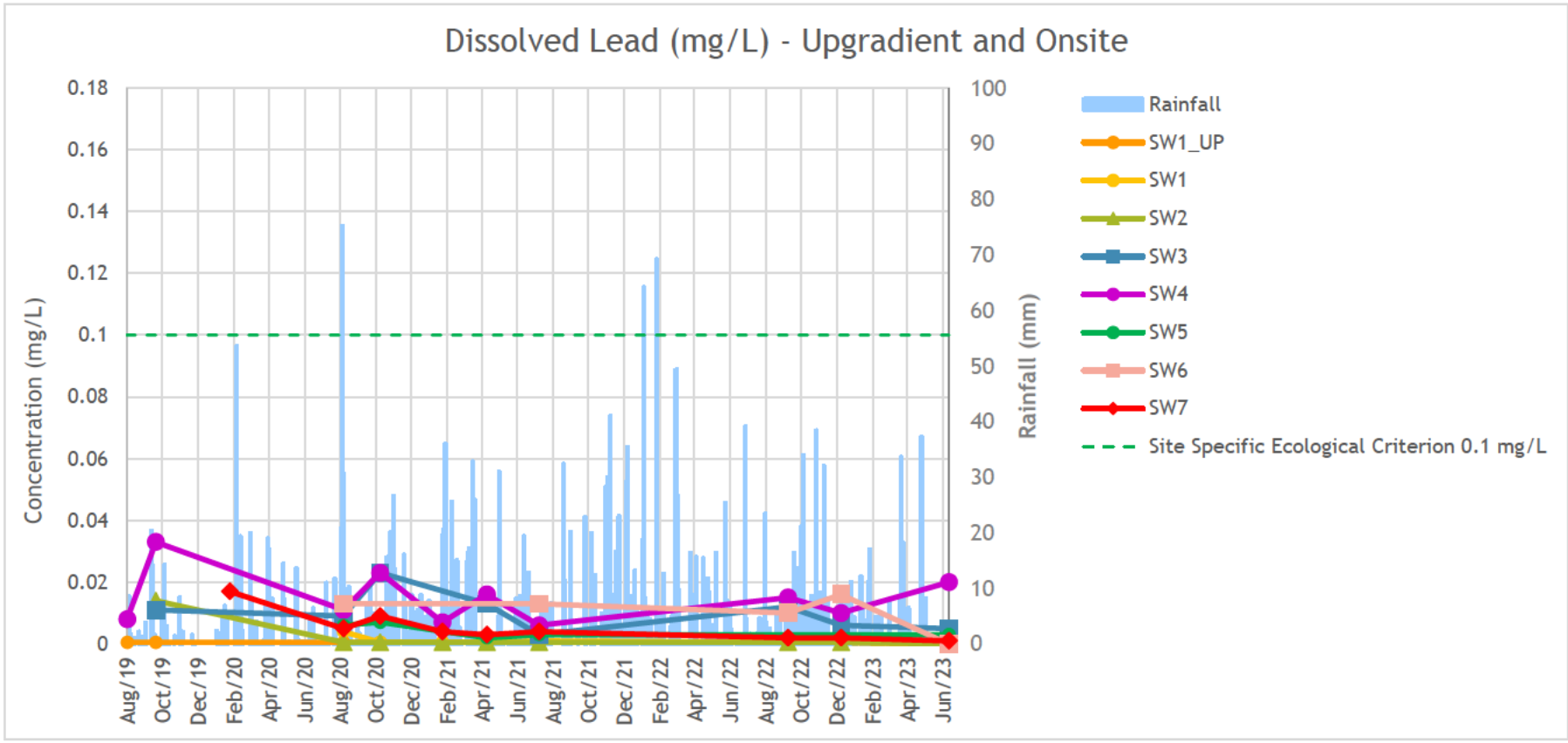


Figure 6-2: Upgradient and Onsite Dissolved Lead Concentration Trend

6.4.1.1 Lead Concentrations for Mulwaree River (Offsite)

Figure 6-3 presents total lead concentrations reported in surface water samples (SW8, SW9, SW10) collected from the Mulwaree River located offsite. Data is presented relative to 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 in samples collected from the Mulwaree River (SW8, SW9 and SW10) compared to the adopted criterion for 95% protection of species protection in freshwater aquatic ecosystems (hardness correction factor applied 0.091 mg/L) and STV irrigation (0.1 mg/L). The freshwater guideline for stock watering (5 mg/L) has not been plotted on the y-axis of the graph in order to allow visual assessment of the low concentration trends. 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.

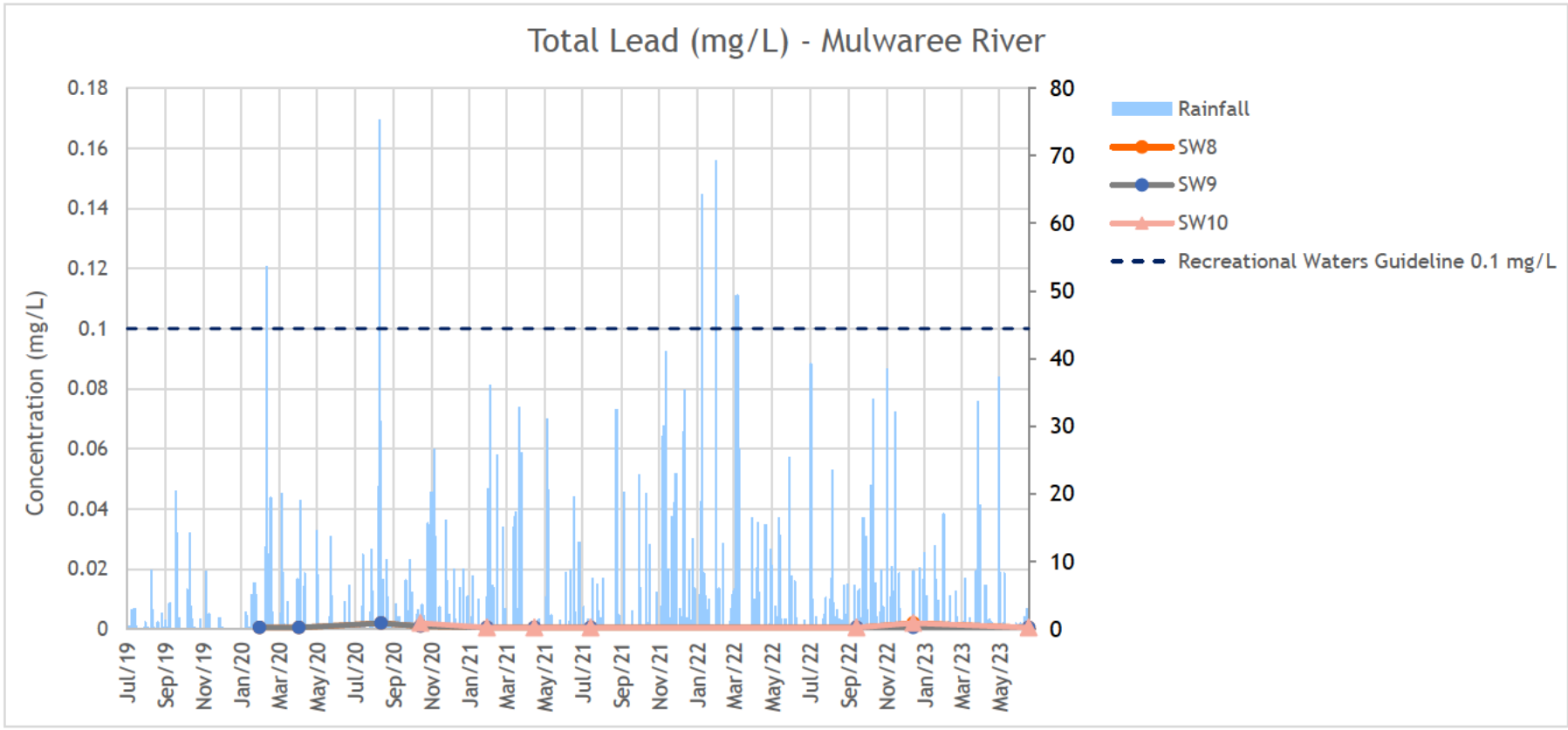


Figure 6-3: Mulwaree River (Offsite) Total Lead Concentration Trend

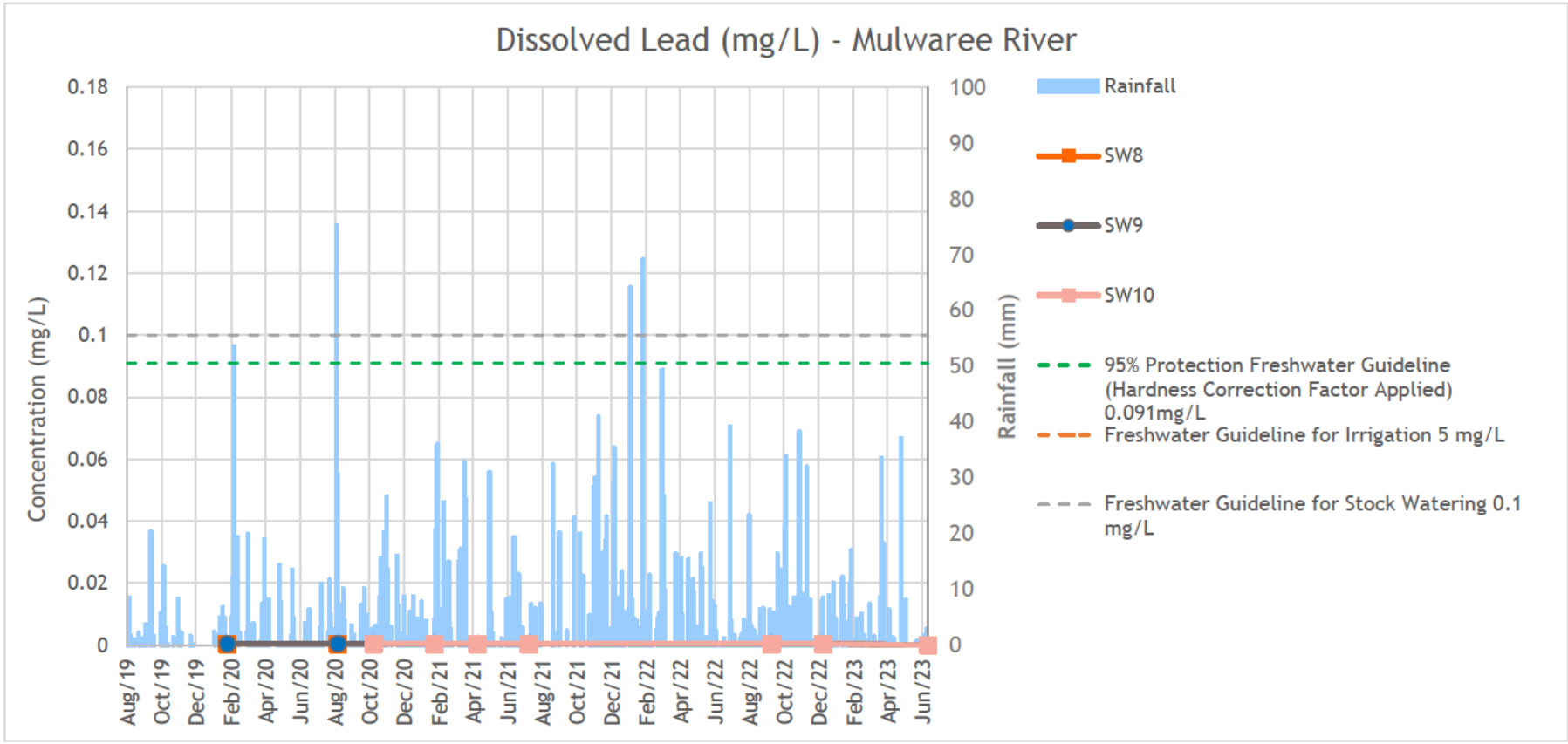


Figure 6-4: Mulwaree River Offsite Dissolved Lead Concentration Trend

6.4.1.2 Copper Concentrations for On and Near Site

Figure 6-5 presents total copper concentrations in surface water samples from on and near site sample locations (SW1-UP, SW1 through to SW7). All surface water samples collected on and near the site to date have reported fluctuating total copper concentrations below the human health recreational criterion (20 mg/L). 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 in surface water samples from on and near site sample locations (SW1-UP, SW1 through to SW7). All samples collected on and near the site to date have reported fluctuating dissolved copper concentrations below the site-specific ecological criterion (0.5 mg/L).

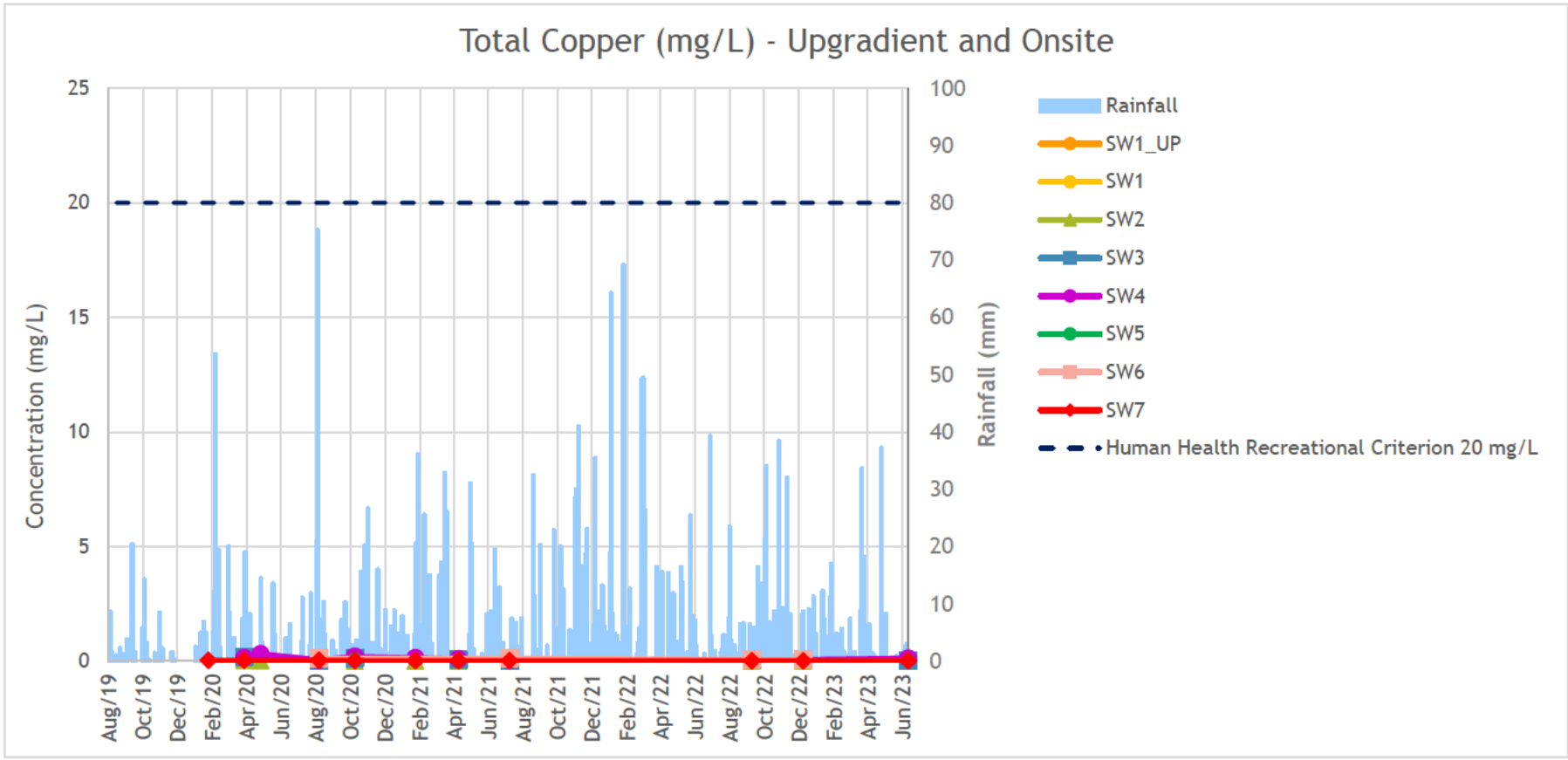


Figure 6-5: Upgradient and Onsite Total Copper Concentration Trend

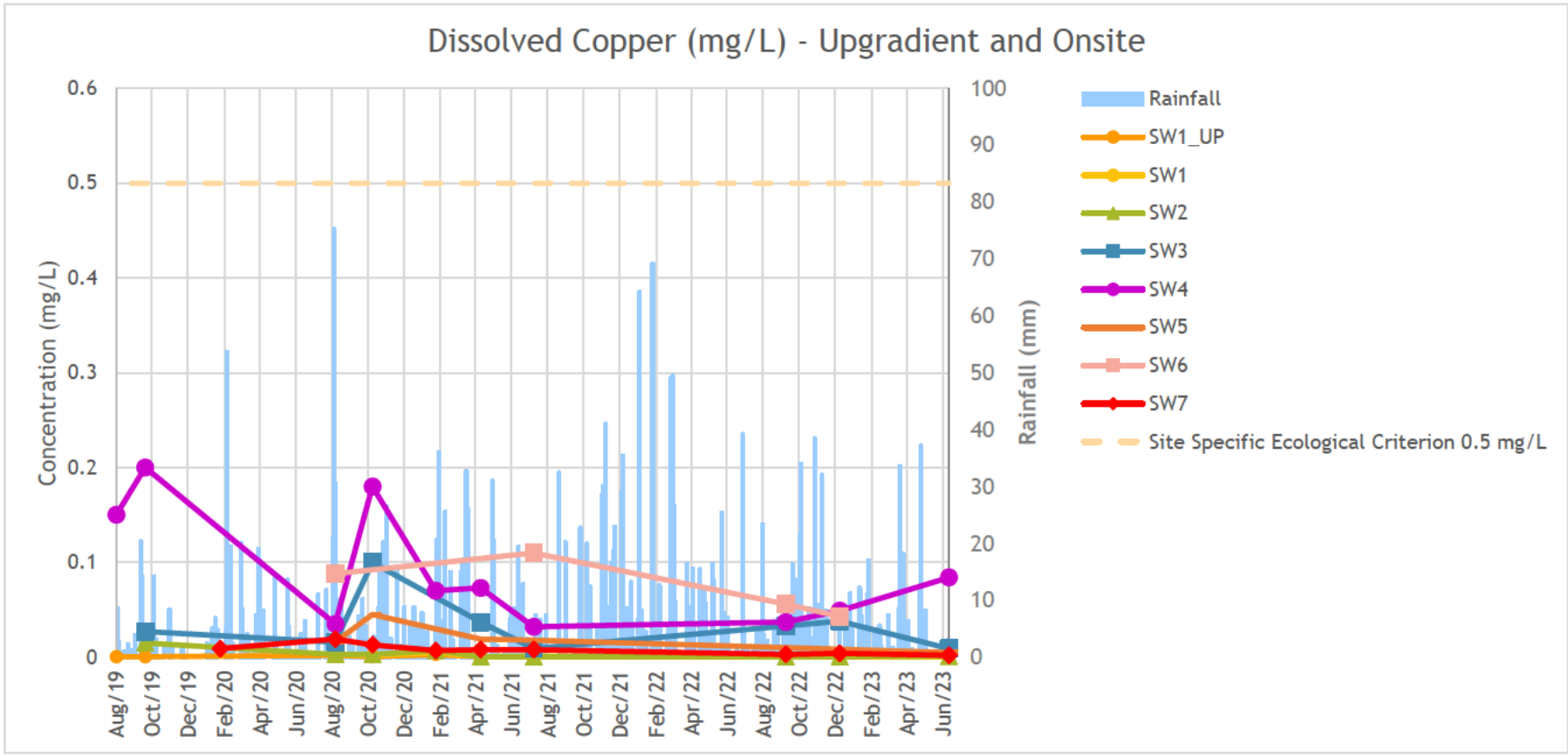


Figure 6-6: Upgradient and Onsite Dissolved Copper Concentration Trend

6.4.1.3 Copper Concentrations for Mulwaree River (Offsite)

Figure 6-7 presents total copper concentrations reported in surface water samples (SW8, SW9, SW10) collected from the Mulwaree River located offsite. 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 reported in surface water samples (SW8, SW9, SW10) collected from the Mulwaree River located offsite.

Concentrations of dissolved copper to date were well below the freshwater guideline for irrigation (5 mg/L) and stock watering (0.4 mg/L) and were no plotted on the graph in order to allow visual assessment of the low concentration trends relative to the adopted 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.

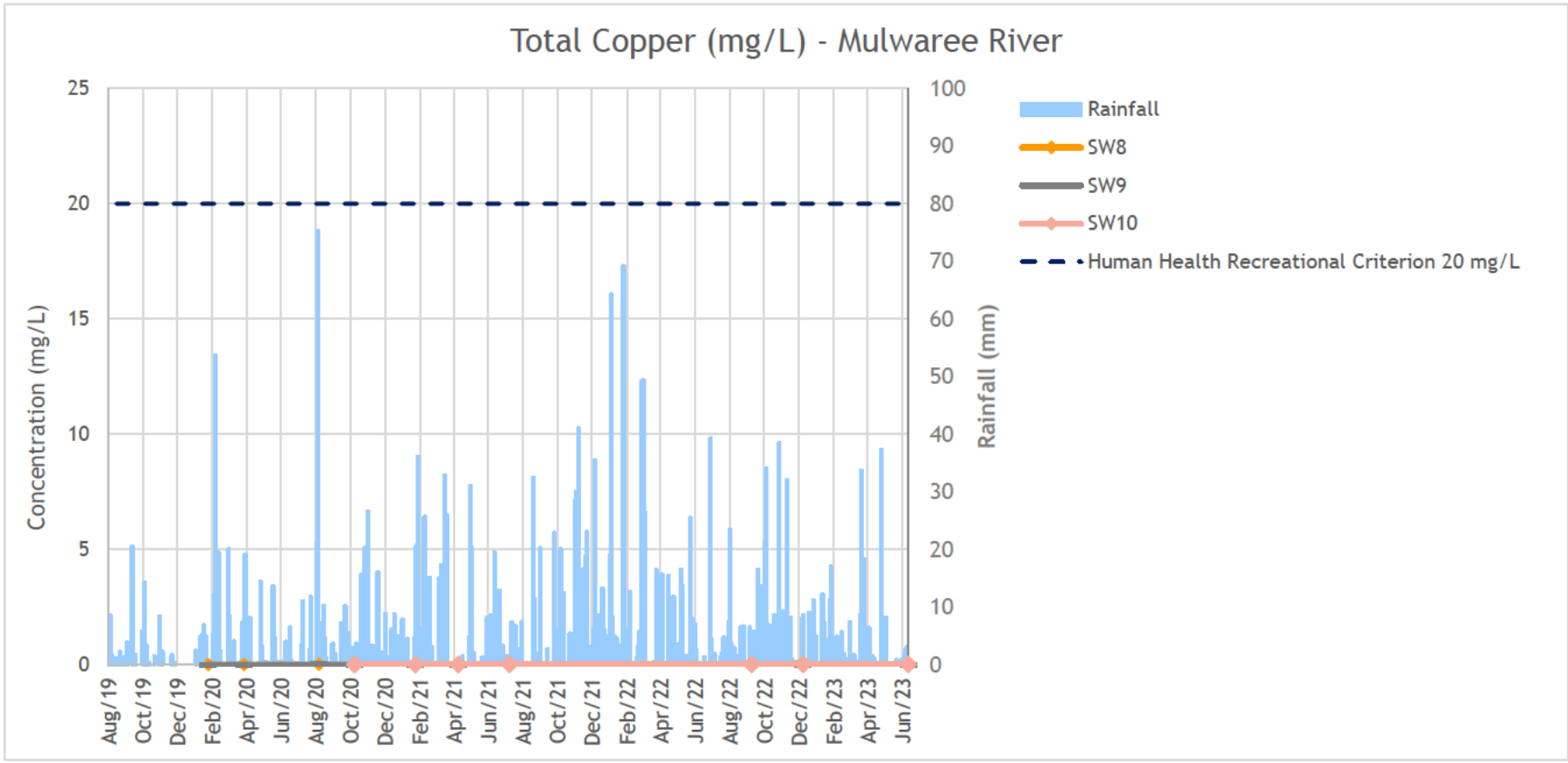


Figure 6-7: Mulwaree River (Offsite) Total Copper Concentration Trend

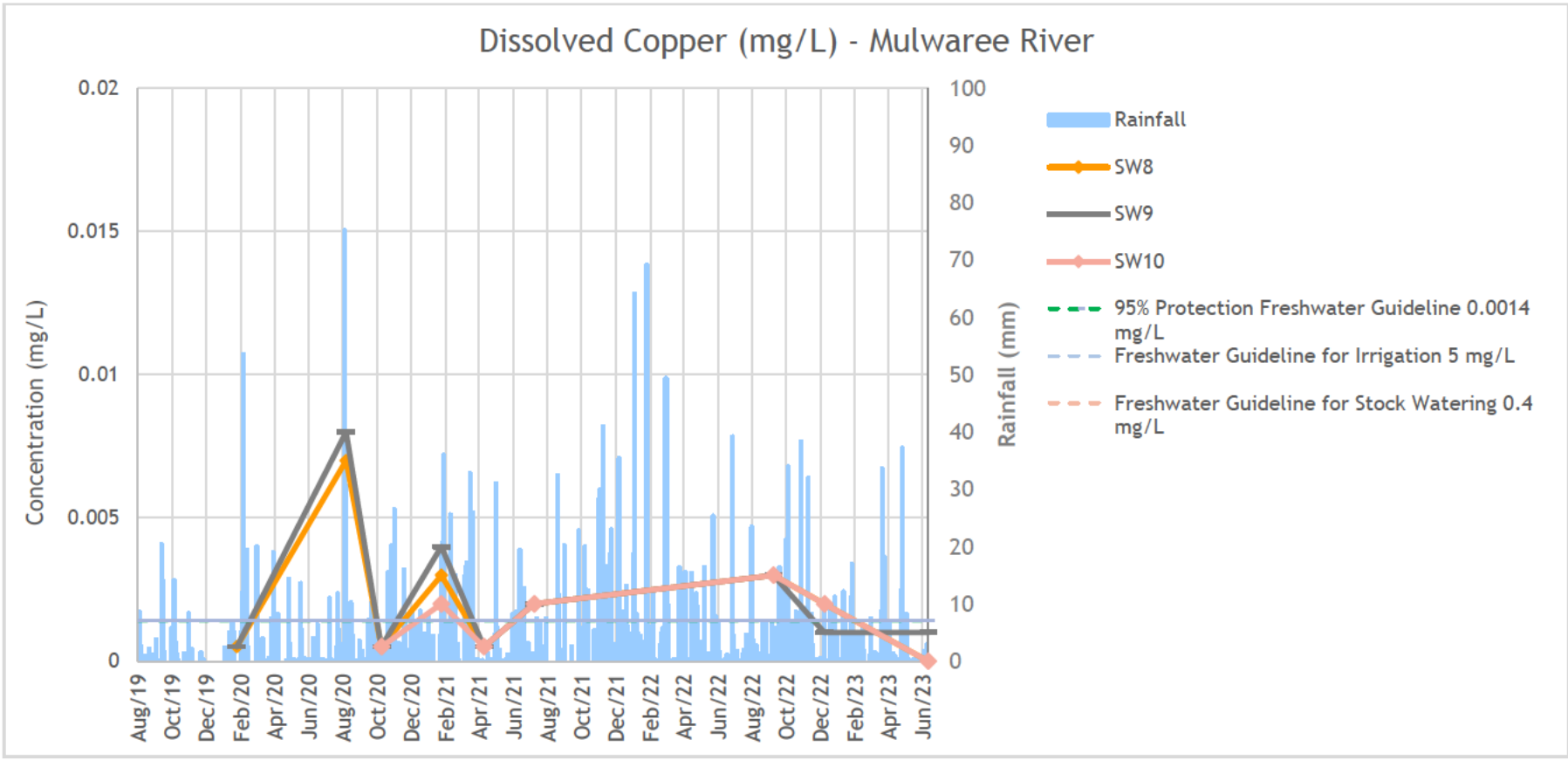


Figure 6-8: Mulwaree River (Offsite) Dissolved Copper Concentration Trend

6.4.1.4 Zinc Concentrations for On and Near Site

Figure 6-9 presents total zinc concentrations reported in surface water sample locations (SW1-UP, SW1 through to SW7) collected from on and near the site. All surface water samples to date have reported fluctuating total zinc concentrations below the human health recreational criterion of 30 mg/L.

Figure 6-10 presents dissolved zinc concentrations reported in surface water sample locations (SW1-UP, SW1 through to SW7) collected from on and near the site. All samples collected on and near the site to date have reported fluctuating dissolved zinc concentrations below the site specific ecological criterion of 20 mg/L.

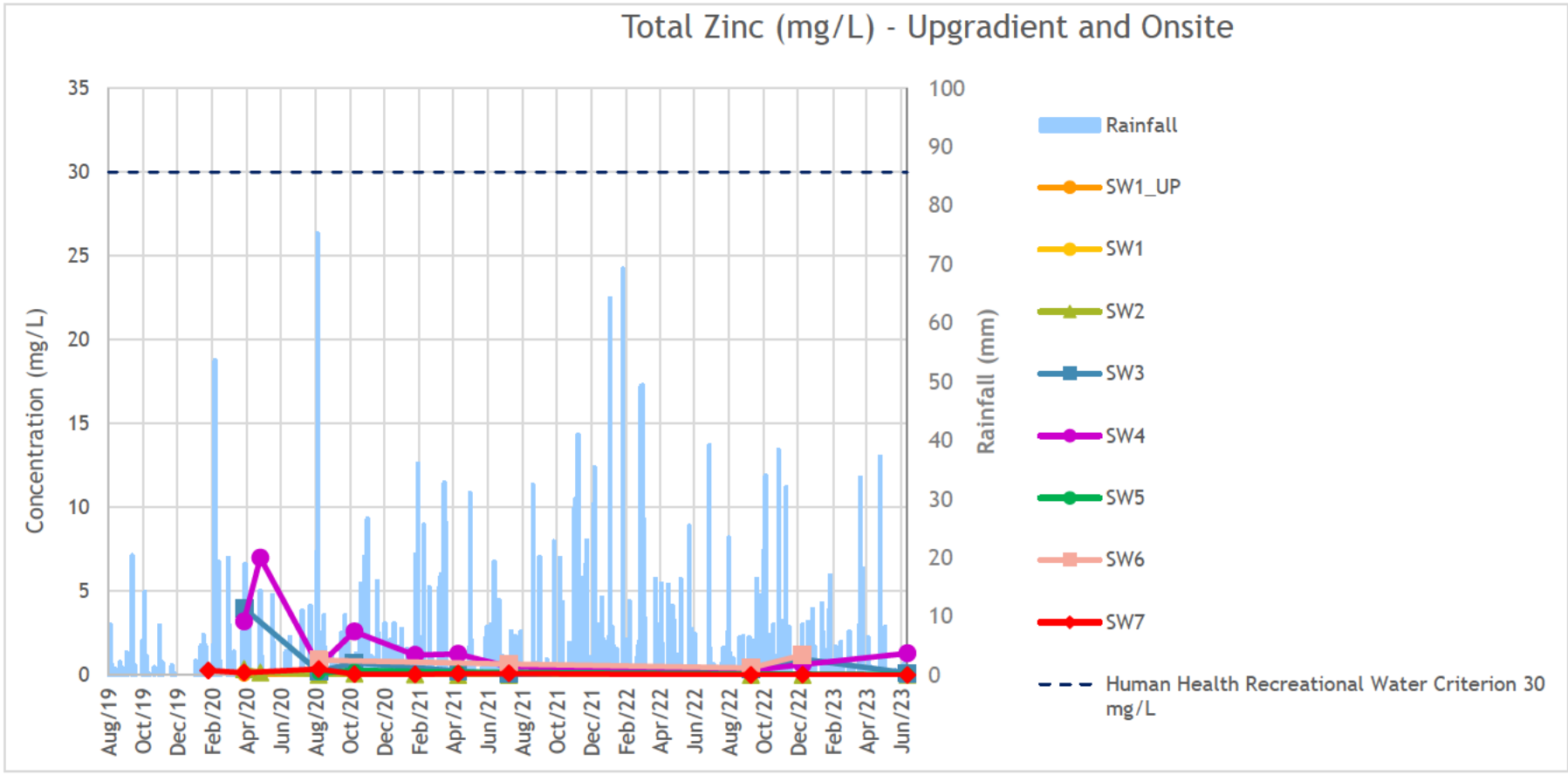


Figure 6-9: Upgradient and Onsite Total Zinc Concentration Trend

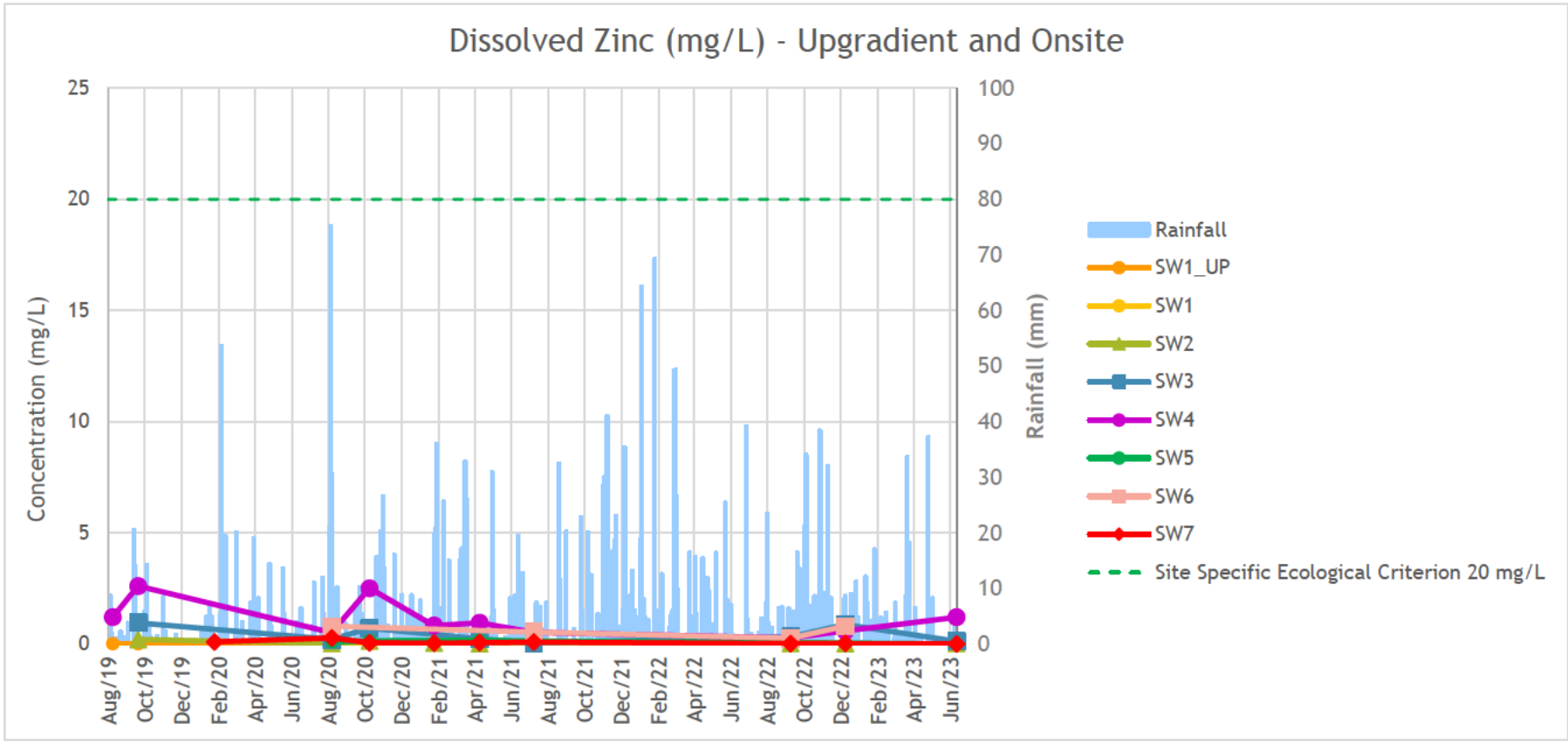


Figure 6-10: Upgradient and Onsite Dissolved Zinc Concentration Trend

6.4.2 Zinc Concentration for Mulwaree River (Offsite)

Figure 6-7 presents total zinc concentrations reported in surface water samples (SW8, SW9, SW10) collected from the Mulwaree River located offsite. All samples collected from the Mulwaree River to date have reported total zinc concentrations below the human health recreational criterion of 30 mg/L.

Figure 6-8 presents dissolved zinc concentrations reported in surface water samples (SW8, SW9, SW10) collected from the Mulwaree River located offsite.

Concentrations of dissolved zinc to date were well below the freshwater guideline for irrigation (5 mg/L) and stock watering (0.4 mg/L) and were not plotted on the graph. This allowed for visual assessment of the low concentration trends relative to the adopted 95% protection of freshwater species criterion, corrected for hardness (0.072 mg/L).

All samples reported fluctuating dissolved zinc concentrations generally below the adopted 95% protection of freshwater species criterion (0.072 mg/L) except for SW8 and SW9 in August 2020.

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

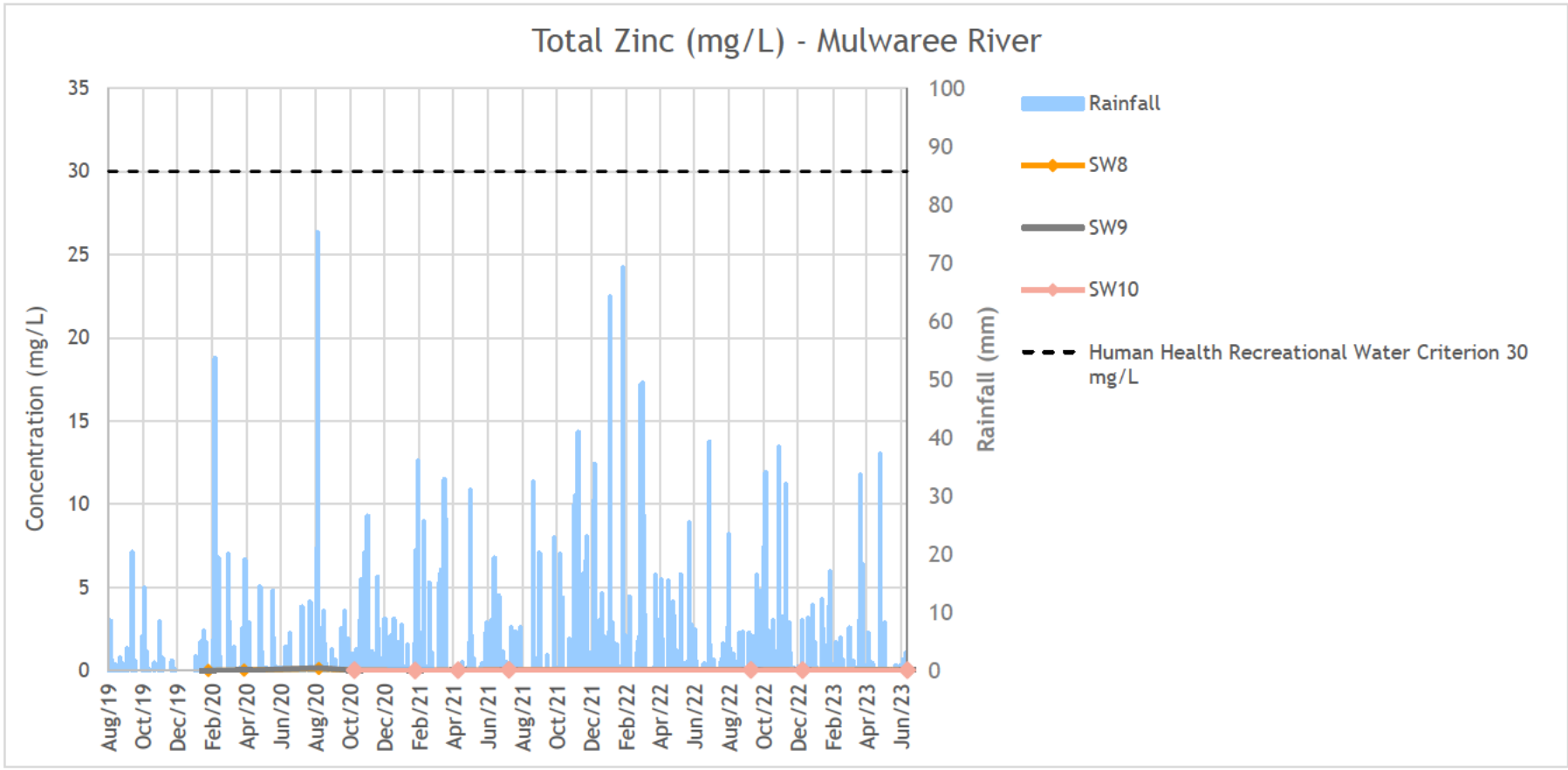


Figure 6-11: Mulwaree River (Offsite) Total Zinc Concentration Trend

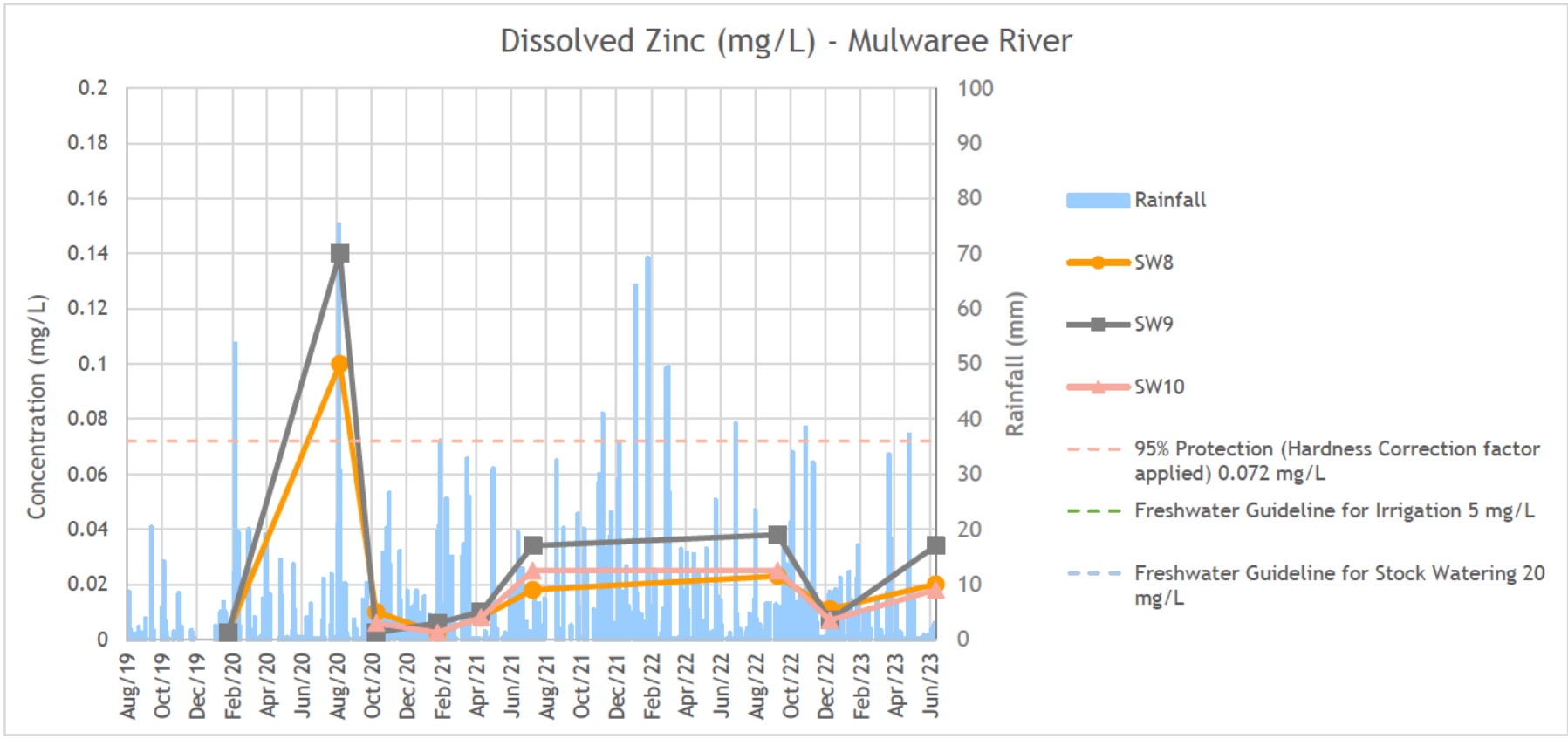


Figure 6-12: Mulwaree River (Offsite) Dissolved Zinc Concentration Trend

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 June 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 "No Trend", "Stable" or "Decreasing" trends.
- Total and dissolved zinc concentration trends for SW1_UP, SW1-SW7 reported either "No Trend", "Stable", "Prob. Decreasing" 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 and SW9 reported "No Trend". Total copper concentration for SW10 reported an "Increasing" trend, however the dissolved copper concentration for SW10 reported a "Stable" trend.
- Total and dissolved zinc concentration trends for (SW8-SW10 reported "No Trend".

The Mann-Kendall trend analysis reported an increasing trend at SW10 for total zinc, however the concentration is well below the human health recreational criterion of 30 mg/L. In addition, the dissolved zinc concentration at SW10 reported a stable trend The reported increase in total zinc concentration is not a concern and does not pose a risk to human health in the Mulwaree River.

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. Mann-Kendall Trend analysis reported no trend, stable or decreasing trends. There is low risk to human health from lead in surface water.
		Mulwaree River/Offsite (SW8, SW9, SW10)	Recreational water criterion (0.1 mg/L).	
	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 assessment criteria in all samples collected to date. Mann-Kendall Trend analysis reported no trend, stable or decreasing trends. There is low risk to ecological receptors from lead in surface water.
		Mulwaree River/Offsite (SW8, SW9, SW10)	95% species protection for freshwater ecosystems corrected for hardness (0.091 mg/L) (ANZG, 2018). ANZECC (2000) Freshwater guidelines for irrigation (5 mg/L) and stock water (0.1 mg/L).	
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. 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.
		Mulwaree River/Offsite (SW8, SW9, SW10)		
	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. Mann-Kendall Trend analysis reported stable or decreasing

Metal	Total/ Dissolved	Sample Location	Criteria	Summary
				trends. There is low risk to ecological receptors from copper in surface water.
		Mulwaree River/Offsite (SW8, SW9, SW10)	95% species protection for freshwater ecosystems (0.0014 mg/L) (ANZG, 2018). ANZECC (2000) Freshwater guidelines for irrigation (5 mg/L) and stock watering (lower limit 0.4 mg/L).	Concentrations of dissolved copper exceeded the adopted ecological criteria on several occasions during the reporting period. Mann-Kendall Trend analysis reported no trend or stable trends. Comparable concentrations upstream and downstream of the Site suggest concentrations of 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. Mann-Kendall Trend analysis reported no trend, stable or decreasing trends. There is low risk to human health from zinc in surface water.
		Mulwaree River/Offsite (SW8, SW9, SW10)		
	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 (0.072 mg/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 August 2020. 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 the risks to community health and safety. Surface water monitoring was completed between 12 and 13 December 2022. Results were compared against historical observations and relevant assessment criteria.

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

- No evidence of offsite migration of contaminants in surface water has been identified.
- No exceedances in the adopted human health criteria for the contaminants of concern have been reported.
- No exceedances in the ecological criteria for the contaminants of concern have been reported except for in zinc and copper concentrations within the Mulwaree River. Concentrations of copper and zinc observed in the Mulwaree River are considered consistent with background concentrations and not to indicate impacts from the Site.
- No significant increasing trends in surface water concentrations that would represent an unacceptable human health risk or ecology have been identified.

Further, the cumulative monitoring data set supports conclusion that barium, beryllium, manganese and mercury are not contaminants of concern and that future monitoring need not consider these metals.

9. LIMITATIONS

This report is produced by Ramboll at the request of the client for the purposes detailed herein. This report and accompanying documents are intended solely for the use and benefit of the client and the Transport Asset Holding Entity for this purpose only and may not be used by or disclosed to, in whole or in part, any other person without the express written consent of Ramboll. Ramboll neither owes nor accepts any duty to any third party and shall not be liable for any loss, damage or expense of whatsoever nature which is caused by their reliance on the information contained in this report.

10. REFERENCES

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APPENDIX 1
SAQP

Intended for
Transport for New South Wales

Document type
Plan

Date
April 2023

Project Number
Sampling Analysis and Quality Plan (SAQP) – Surface Water Monitoring

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

TARAGO LEAD MANAGEMENT

RAMBOLL Bright ideas. Sustainable change.

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

Project name	**Tarago Lead Management**
Project no.	**318001376-T6-**
Recipient	**Joanne McLoughlin - Transport for New South Wales** **E: Joanne.Mcloughlin@transport.nsw.gov.au**
Document type	**Plan**
Description	**This document comprises the Sampling Analysis and Quality Plan (SAQP) for surface water monitoring associated with management of lead contamination from the Tarago rail corridor.**

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Revision	Update	Date	Prepared by	Checked by	Approved by
0	Draft	6/08/2020	J Kirsch	S Maxwell	F Robinson
1	Revised draft	7/10/2022	J Kirsch	S Maxwell CEnvP	F Robinson
2	Updated	08/02/2023	N Gilbert	S Maxwell CEnvP	F Robinson
3	Final	18/04/2023	N Gilbert	S Maxwell CEnvP (SC) 41184	F Robinson

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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 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 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 Sceening[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 that 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:	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:	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:	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:	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:	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
	4. Samples for dissolved metal analysis and $CaCO_3$ 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. 5. Visual and olfactory observations will also be recorded on the field sheet. 6. Photographs will be taken of sampling location conditions at the time of sampling.

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

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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

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Surface Water Sampling Sheet

Project Name: TARAGO SWM	Ramboll Personnel:
Project No: 318001376-007	JA/IM
Date: 16/06/23	
Start time:	Subcontractors:
Finish time:	n/a

Equipment

Water Quality Meter ID:

Water Quality Parameters

Sample ID	*TAR_SW1_160623	
Sampling Method	Surface water grab sample	
Time	8:13am	
Intake Depth From Surface (mm)	100	
Temperature (°C)	7.8°C	
Dissolved Oxygen (mg/L)	10.28	
pH	7.6	
Oxido Reduction Potential (mV)	57.6	
Turbidity	/	
Specific Conductivity uS/cm	783	
Comments	clear, colourless, no turbidity, no odour	
No. of Contrainers used	3	

QA/QC Checklist

Are air bubbles present in vials?	☐ Y	☐ N	☑ N/A	
Was sample for metals field filtered?	☑ Y	☐ N	☐ N/A	
+ total				
Duplicate Samples Collected?	☐ Y	☑ N		Duplicate Sample ID:
Rinsate Blank Collected?	☐ Y	☑ N		Primary Sample ID:
				Rinsate Blank ID:

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Surface Water Sampling Sheet

Project Name: TARAGO SWM	Ramboll Personnel:
Project No: 318001376-007	JA/IM
Date: 16/06/23	
Start time:	Subcontractors:
Finish time:	n/a

Equipment

Water Quality Meter ID:

Water Quality Parameters

Sample ID	TAR_SW1_UP_160623	
Sampling Method	SW Grab Sample	
Time	8:30 am	
Intake Depth From Surface (mm)	500	
Temperature (°C)	8.0	
Dissolved Oxygen (mg/L)	6.92	
pH	7.3	
Oxido Reduction Potential (mV)	66.6	
Turbidity	—	
Specific Conductivity	795	
Comments	clear, colourless, no turbidity, Sediment on bottom of water body	
No. of Contrainers used	3	

QA/QC Checklist

Are air bubbles present in vials?	☐ Y ☐ N ☑ N/A	
Was sample for metals field filtered?	☑ Y ☐ N ☐ N/A + total	
Duplicate Samples Collected?	☐ Y ☑ N	Duplicate Sample ID:
Rinsate Blank Collected?	☐ Y ☑ N	Primary Sample ID:
		Rinsate Blank ID:

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Surface Water Sampling Sheet

Project Name: TARAGO SWM	Ramboll Personnel:
Project No: 31800137G-007	JA/IM
Date: 16/06/23	
Start time:	Subcontractors:
Finish time:	n/a

Equipment

Water Quality Meter ID:

Water Quality Parameters

Sample ID	TAR_SW2_16062023	
Sampling Method	Surface water grab sample	
Time	8.02	
Intake Depth From Surface (mm)	200 100	
Temperature (°C)	7 °C	
Dissolved Oxygen ~~(mg/L)~~ %	70.8	
pH	7.31	
Oxido Reduction Potential (mV)	170.0	
Turbidity	———	
Specific Conductivity	803	
Comments	clear, no signs of turbidity, colourless algae at base	
No. of Contrainers used	3	

QA/QC Checklist

Are air bubbles present in vials?	☐ Y ☐ N ☑ N/A	
Was sample for metals field filtered?	☑ Y ☐ N ☐ N/A *total metals	Both total & dissolved
Duplicate Samples Collected?	☐ Y ☑ N	Duplicate Sample ID:
Rinsate Blank Collected?	☐ Y ☑ N	Primary Sample ID:
		Rinsate Blank ID:

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Surface Water Sampling Sheet

Project Name: 318001376-0075	Ramboll Personnel:
Project No: TARAGO SWM	JA/IM
Date: 16/06/23	
Start time:	Subcontractors:
Finish time:	n/a

Equipment

Water Quality Meter ID:

Water Quality Parameters

		Dup
Sample ID	TAR_SW3_160623	
Sampling Method	Surface water Grab sample	
Time	8.57 am	
Intake Depth From Surface (mm)	200	
Temperature (°C)	6.8	
Dissolved Oxygen (mg/L)	7.15	
pH	6.17	
Oxido Reduction Potential (mV)	28.1	
Turbidity	–	
Specific Conductivity	128.0	
Comments	Clear, ~~and~~ slight turbidity, algae present	
No. of Contrainers used	9	

QA/QC Checklist

Are air bubbles present in vials?	☐ Y ☐ N ☑ N/A	
Was sample for metals field filtered?	☑ Y ☐ N ☐ N/A Both total & dissolved	
Duplicate Samples Collected?	☑ Y ☐ N + triplicate	Duplicate Sample ID: QA101_160623
Rinsate Blank Collected?	☐ Y ☑ N	~~Primary~~ Sample ID: TRIP QC201_160623
		Rinsate Blank ID:

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Surface Water Sampling Sheet

Project Name: ~~TR~~ TARAGO SWM	Ramboll Personnel:
Project No: 318001376-007	JA/IM
Date: 16/06/23	
Start time:	Subcontractors:
Finish time:	n/a

Equipment

Water Quality Meter ID:

Water Quality Parameters

Sample ID	TAR_SW~~R~~_160623	
Sampling Method	SW-4 grab sample	
Time	9:46am	
Intake Depth From Surface (mm)	200	
Temperature (°C)	5.9	
Dissolved Oxygen (mg/L)	8.99	
pH	6.72	
Oxido Reduction Potential (mV)	58.1	
Turbidity	/	
Specific Conductivity	176.5	
Comments	clear, low turbidity, slightly brown, NOC	
No. of Contrainers used	3	

QA/QC Checklist

Are air bubbles present in vials?	☐ Y	☐ N	☑ N/A	
Was sample for metals field filtered?	☑ Y	☐ N	☑ N/A	total + dissolved
Duplicate Samples Collected?	☐ Y	☑ N		Duplicate Sample ID:
Rinsate Blank Collected?	☐ Y	☑ N		Primary Sample ID:
				Rinsate Blank ID:

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Surface Water Sampling Sheet

Project Name: TARAGO SWM	Ramboll Personnel:
Project No: 318001376-007	JA/IM
Date: 16/06/23	
Start time:	Subcontractors:
Finish time:	n/a

Equipment

Water Quality Meter ID:

Water Quality Parameters

Sample ID	TAR_SW5_160623	
Sampling Method	SW - Grab Sample	
Time	9:22	
Intake Depth From Surface (mm)	50	
Temperature (°C)	6.2	
Dissolved Oxygen (mg/L)	4.47	
pH	6.50	
Oxido Reduction Potential (mV)	43.7	
Turbidity	—	
Specific Conductivity	220.1	
Comments	Clear, slightly yellow, static	
No. of Contrainers used	3	

QA/QC Checklist

Are air bubbles present in vials?	☐ Y	☐ N	☑ N/A	
Was sample for metals field filtered?	☑ Y & total	☐ N	☐ N/A	
Duplicate Samples Collected?	☐ Y	☑ N		Duplicate Sample ID: MWR_SW5_160623
Rinsate Blank Collected?	☐ Y	☑ N		Primary Sample ID:
				Rinsate Blank ID:

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Project No: 318001316-007	JA/IM
Date: 16/06/23	
Start time:	Subcontractors:
Finish time:	n/a

Equipment

Water Quality Meter ID:

Water Quality Parameters

Sample ID	SW6	
Sampling Method		
Time		
Intake Depth From Surface (mm)		
Temperature (°C)		
Dissolved Oxygen (mg/L)		
pH		
Oxido Reduction Potential (mV)		
Turbidity		
Specific Conductivity		
Comments	No Surface water	
No. of Contrainers used		

QA/QC Checklist

Are air bubbles present in vials?	☐ Y	☐ N	☐ N/A	
Was sample for metals field filtered?	☐ Y	☐ N	☐ N/A	
Duplicate Samples Collected?	☐ Y	☐ N		Duplicate Sample ID:
Rinsate Blank Collected?	☐ Y	☐ N		Primary Sample ID:
				Rinsate Blank ID:

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Surface Water Sampling Sheet

Project Name: TARAGO SWM	Ramboll Personnel:
Project No: 318001376-007	JA/IM
Date: 16/06/23	
Start time:	Subcontractors:
Finish time:	n/a

Equipment

Water Quality Meter ID:

Water Quality Parameters

Sample ID	TAR_SW7_160623	
Sampling Method	SW, grab sample	
Time	10:14am	
Intake Depth From Surface (mm)	100	
Temperature (°C)	6.9	
Dissolved Oxygen (mg/L)	4.55	
pH	7.1	
Oxido Reduction Potential (mV)	14.1	
Turbidity	/	
Specific Conductivity	325.8	
Comments	clear, brown/red tint, low turbidity, NOC	
No. of Contrainers used	3	

QA/QC Checklist

Are air bubbles present in vials?	☐ Y	☐ N	☑ N/A	
Was sample for metals field filtered?	☐ Y	☐ N	☑ N/A	
Duplicate Samples Collected?	☐ Y	☑ N		Duplicate Sample ID:
Rinsate Blank Collected?	☐ Y	☑ N		Primary Sample ID:
				Rinsate Blank ID:

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Surface Water Sampling Sheet

Project Name: TARAGO SWM	Ramboll Personnel:
Project No: 318001376-007	JA / IM
Date: 16/06/23	
Start time:	Subcontractors: n/a
Finish time:	

Equipment

Water Quality Meter ID:

Water Quality Parameters

Sample ID	TAR_SW8_160623	
Sampling Method	SW - grab sample	
Time	10:28am	
Intake Depth From Surface (mm)	300	
Temperature (°C)	7.6	
Dissolved Oxygen (mg/L)	7.78	
pH	7.42	
Oxido Reduction Potential (mV)	31.9	
Turbidity	—	
Specific Conductivity	1165	
Comments	clear, colourless, no turbidity, NOC	
No. of Contrainers used	3	

QA/QC Checklist

Are air bubbles present in vials?	☐ Y ☐ N ☑ N/A	
Was sample for metals field filtered?	☐ Y ☑ N ☐ N/A	
– to be lab filtered + total		
Duplicate Samples Collected?	☐ Y ☑ N	Duplicate Sample ID:
Rinsate Blank Collected?	☐ Y ☑ N	Primary Sample ID:
		Rinsate Blank ID:

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Surface Water Sampling Sheet

Project Name: TARAGO SWM	Ramboll Personnel:
Project No: 318001376-007	JA/IM
Date: 16/06/23	
Start time:	Subcontractors:
Finish time:	n/a

Equipment

Water Quality Meter ID:

Water Quality Parameters

Sample ID	TAR_SW9_16062023	
Sampling Method	SW - grab sample	
Time	10:58	
Intake Depth From Surface (mm)	200	
Temperature (°C)	7.2	
Dissolved Oxygen (mg/L)	9.49	
pH	7.71	
Oxido Reduction Potential (mV)	35.7	
Turbidity	—	
Specific Conductivity	1304	
Comments	clear colourless slight orange tint in water body	
No. of Contrainers used	3	

QA/QC Checklist

Are air bubbles present in vials?	☐ Y	☐ N	☑ N/A	
Was sample for metals field filtered?	☐ Y	☑ N	☐ N/A	
no, needs lab filter				
Duplicate Samples Collected?	☐ Y	☑ N		Duplicate Sample ID:
Rinsate Blank Collected?	☐ Y	☑ N		Primary Sample ID:
				Rinsate Blank ID:

RAMBOLL

Surface Water Sampling Sheet

Project Name: TARAGO SWM	Ramboll Personnel:
Project No: 318001376-007	JA / ~~BK~~ IM
Date: 16/06/23	
Start time:	Subcontractors:
Finish time:	n/a

Equipment

Water Quality Meter ID:

Water Quality Parameters

Sample ID	TAR_SW10_16062023	
Sampling Method	SW grab sample	
Time	10.38am	
Intake Depth From Surface (mm)	200	
Temperature (°C)	7.7	
Dissolved Oxygen (mg/L)	9.72	
pH	7.60	
Oxido Reduction Potential (mV)	28.2	
Turbidity	—	
Specific Conductivity	1060	
Comments	clear no turbidity colourless Aquatic veg next to sample location	
No. of Contrainers used	3	

QA/QC Checklist

Are air bubbles present in vials?	☐ Y	☐ N	☑ N/A	
Was sample for metals field filtered?	☐ Y	☑ N	☐ N/A	~~Not~~ dissolved to be field filtered
Duplicate Samples Collected?	☐ Y	☑ N		Duplicate Sample ID:
Rinsate Blank Collected?	☐ Y	☑ N		Primary Sample ID:
				Rinsate Blank ID:

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APPENDIX 3
SUMMARY OF RESULTS

Table 1:
Surface Water Parameters

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Sample Location	Sample Date	Time	Temperature (°C)	Sample Depth (mm below surface)	Spec Conductivity (µScm⁻¹)	pH	Dissolved Oxygen (mg/L)	Redox (mV)	TDS (ppm)	Turbidity (NTU)	Comments
SW1_UP											
SW1_U	13/Aug/19	7 45	*Not eco ded*	*Not eco ded*	*Not eco ded*	*Not eco ded*	*Not eco ded*	*Not eco ded*	*Not eco ded*	*Not eco ded*	Not eco ded
SW1_U	24/Sep/19	*Not eco ded*	100	*Not eco ded*	*Not eco ded*	*Not eco ded*	*Not eco ded*	*Not eco ded*	*Not eco ded*	*Not eco ded*	Cla /gl ghty b own ogs audible
SW1_U	29/Jan/20	---	---	---	---	---	---	---	---	---	DR
SW1_U	1/Ap /20	13 25	200	19 94	584	7 05	4 72	154	374	*Not eco ded*	Cla No tu d t ty No odou No tow
SW1_U	11/Aug/20	*Not eco ded*	100	8	205 6	7 43	10 55	170 7	133 3	*Not eco ded*	Cla to sl ghtly b own lowing
SW1_U	13/Oct/20	7 37	400	11 89	6/3	7 39	2 6	94	431	*Not eco ded*	Wa e cla /b own lowing
SW1_U	28/Jan/21	8 15	100	16 9	587	7 3	0 1	186 9	375 7	*Not eco ded*	Cla ,low-mo odou , no obse vable contamination
SW1_U	14/Ap /21	8 01	100	13 6	704	7 42	10 86	-41 4	*Not eco ded*	*Not eco ded*	Cla , no odou ence panel attack at downst eam end lowing
SW1_U	13/Jul/21	13 47	300	8 18	662	7 45	6 12	162	*Not eco ded*	*Not eco ded*	Cla , colou lass, no odou Reeds g ow ng adjacent to pond low ng
SW1_U	12/Sep/22	14 20	100	11 10	570	7 8	4 9	107	*371 0*	*-1 0*	Cla , ruct mu ky, ruct tu b d, ve y rmno suspended solids, no obv ous smells o odou s, natu al. unn ng st eam
SW1_U	13/Dec/22	8 46	100	12 40	618	7 79	5 47	136	*Not eco ded*	*Not eco ded*	---
SW1_U	16/Jun/23	8 30	500	8 00	795	7 3	6 92	67	*Not eco ded*	*Not eco ded*	Cla , colou lass, no tu bid ty, sediment on bottom of wate body
SW1											
SW1	29/Jan/20	---	---	---	---	---	---	---	---	---	DR
SW1	1/Ap /20	12 45	100	17 4	575	6 35	5 88	115	368	*Not eco ded*	Cla to b own, low/no tu bid ty, mno suspended sol ds No odou No tow
SW1	11/Aug/20	*Not eco ded*	100	7 8	206 1	7 44	11 00	169 5	133 9	*Not eco ded*	B own, slightly tu bid, continuous flow
SW1	13/Oct/20	7 35	50	10 38	678	7 7	2 71	125	434	*Not eco ded*	Wate flowing, tu b d, yellow/b own, wate level shallow
SW1	28/Jan/21	8 35	*Not eco ded*	16 5	618	7 35	0 04	175 8	395 5	*Not eco ded*	Cla , no obse vable contamination on, amongst eeds
SW1	14/Ap /21	8 28	50	12 2	684	7 65	9 81	23 6	*Not eco ded*	*Not eco ded*	Cla , no odou , some suspended sol ds. Shallow sampled at upst eam end of curve t
SW1	13/Jul/21	13 56	100	7 93	733	7 77	5 29	76	*Not eco ded*	*Not eco ded*	Cla , colou lass, no odou Reeds up st eam. Sampled at curve t ent ance
SW1	12/Sep/22	14 45	10	9 2	533	7 67	4 7	157	*347 0*	*0 6*	Cmdn't get completely 15cm unde neath wate body due to shallow depth. Cla , ruct mu ky, ruct tu b d, ve y rmno suspended solids, no obv ous smells o odou s, sma l natu al sl eam flow ng into a curve t adjacent o the all co ido , some vegetation and moss on the su face and within the wate body
SW1	13/Dec/22	10 54	100	12 3	623 6	7 59	5 45	140 4	*Not eco ded*	---	---
SW1	16/Jun/23	8 13	100	7 8	783	7 6	10 28	57 6	*Not eco ded*	*Not eco ded*	Cla , colou lass, no tu bid ty, no odou
SW2											
SW2	24/Sep/19	*Not eco ded*	*Not eco ded*	Su face Sha low wate	*Not eco ded*	*Not eco ded*	*Not eco ded*	*Not eco ded*	*Not eco ded*	*Not eco ded*	Cla
SW2	29/Jan/20	---	---	---	---	---	---	---	---	---	DR
SW2	1/Ap /20	13 50	100	17 5	358	7 25	3 84	163	233	*Not eco ded*	B own, low-medium u b d ty, some suspended sol ds No odou No tow
SW2	30/Jul/20	17 40	50	9 8	605	6 54	3 32	185 9	391 9	*Not eco ded*	Collected at Gaddon n St eet footb dge Cla , not flowing
SW2	11/Aug/20	*Not eco ded*	100	7 3	213 3	8 13	10 59	185 2	137 8	*Not eco ded*	Cla to sl ghtly tu bid low ng
SW2	13/Oct/20	8 15	200	11 8	650	8 27	5 92	96	416	*Not eco ded*	Wate cla ,flowing, wate level low
SW2	28/Jan/21	8 45	*Not eco ded*	17	614	8 07	0 12	166 7	393	*Not eco ded*	ght b own, low tu bidity, no obse vable contaminat on
SW2	14/Ap /21	8 47	100	12	677	7 82	9 83	48 3	*Not eco ded*	*Not eco ded*	Cla , no odou
SW2	13/Jul/21	14 05	100	7 56	670	7 98	5 66	108	*Not eco ded*	*Not eco ded*	Cla , colou lass, no odou Sampled at curve t
SW2	12/Sep/22	15 05	100	9 40	545	7 81	4 7	172	354	*17 1*	Cla , ruct mu ky, ruct tu b d, ve y rmno suspended solids, no obv ous smells o odou s, small wate body lowing f om a curve t adjacent to the a i co ido , some vegetation and moss on the sur face and within the wate body
SW2	13/Dec/22	10 54	100	12 90	625 5	7 92	7 23	130	*Not eco ded*	---	---
SW2	16/Jun/23	8 02	100	7 00	803	7 31	70 8	170	*Not eco ded*	*Not eco ded*	Cla , no s gns of tu bid ty, colou lass
SW3	24/Sep/19	*Not eco ded*	50	*Not eco ded*	*Not eco ded*	*Not eco ded*	*Not eco ded*	*Not eco ded*	*Not eco ded*	*Not eco ded*	Mode ate tu bid ty oge audible
SW3	29/Jan/20	---	---	---	---	---	---	---	---	---	DR
SW3	1/Ap /20	14 20	100	21 8	245	6 23	5 24	178	159	*Not eco ded*	B own to yellow, med um tu bid ty, some sp ots mate al ace face
SW3	11/Aug/20	*Not eco ded*	100	8 9	142 5	7 43	9 43	174 7	92 3	*Not eco ded*	B own to cla

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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 Sceening 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		-	S20-Ap12286	S20-Au23115	S20-Oc25141	S21-Ja34960	S21-Ap22332	N21-Jl30451	S22-Se00368	N22-De0031035	S23-Jn0046774
					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	16/Jun/23
					Sample ID:		SW1	SW1	SW1	SW1	SW1	SW1	SW1	SW1	SW1	TAR_SW1_160623
					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
					Project No:		318000780	318000780	318000780	318000780	318000780	318000780	318000780	318001376	318001376-001	318001376-007
					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 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
Guidelines					**Sample Description:**		DRY	Clear to brown, low/no turbidity, minor suspendid 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.
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
Arsenic	7	NA	NA	NA	mg/L	0.001	-	0.004	< 0.001	0.004	< 0.001	< 0.001	< 0.001	<0.001	< 0.001	< 0 001
Barium	-	NA	20	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	NA	NA	mg/L	0.0002	-	0.0013	< 0.0002	0.0021	0.0005	< 0.0002	< 0 0002	<0.0002	< 0.0002	< 0.0002
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
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
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
Iron	-	NA	3	NA	mg/L	0.05	-	4.5	0.91	1.41	1.1	0.07	0.18	0.94	0.23	0.4
Lead	7	NA	NA	NA	mg/L	0.001	-	0.056	0.001	0.032	0.007	< 0.001	0.002	0.005	< 0.001	< 0 001
Manganese	350	NA	NA	NA	mg/L	0.005	-	0.76	0.024	0.706	0 28	0.032	0.036	0.093	0.026	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	NA	NA	mg/L	0.001	-	0.003	0.002	0.002	< 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
Dissolved Metals																
Dissolved Aluminium	NA	5	NA	NA	mg/L	0.05	-	-	0.54	< 0.05	< 0 05	< 0.05	< 0.05	<0.05	< 0.05	< 0.05
Dissolved Arsenic	NA	0.5	NA	NA	mg/L	0.001	-	-	< 0.001	< 0.001	0.003	< 0.001	< 0.001	<0.001	< 0.001	< 0 001
Dissolved Barium	NA	-	NA	-	mg/L	0.001	-	-	0.04	0.11	0.12	0.08	0.06	0.05	0.06	0.08
Dissolved Beryllium	NA	-	NA	-	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	0.002	mg/L	0.0002	-	-	0.0003	0.0005	0.0002	< 0.0002	< 0 0002	<0.0002	< 0.0002	< 0.0002
Dissolved Chromium	NA	NA	NA	0.0084	mg/L	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
Dissolved Copper	NA	0.5	NA	NA	mg/L	0.001	-	-	0.003	0.002	0.005	< 0.001	0.001	<0.001	< 0.001	< 0 001
Dissolved Iron	NA	-	NA	-	mg/L	0.05	-	-	0.34	< 0.05	0.13	< 0.05	0.14	0.16	0.1	< 0.05
Dissolved Lead	NA	0.1	NA	0.09078	mg/L	0.001	-	-	0.004	< 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	0 036
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
Dissolved Nickel	NA	1	NA	0.099	mg/L	0.001	-	-	0.002	< 0.001	< 0.001	< 0.001	< 0.001	<0.001	< 0.001	< 0 001
Dissolved Zinc	NA	20	NA	0.072	mg/L	0.005	-	-	0.045	0.073	0.058	0.005	0.025	0.02	0.016	< 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.
[a]EnRiskS (2020) Advice on risks to human health and the environment: Boyd Street and publicly accessible areas, Tarago NSW
[b]Recreational criteria adopted are 10 x Australian Drinking Water Gudielines ADWG (2011)
[c]ANZG (2018) Australian and New Zealand Guidelines for Fresh and Marine Water Quality.
[d]The recreational criteria for aluminium is based on aesthtic 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

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Table 3: SW1_UP Analytical Results

RAMBOLL

	Site Specific Human Health Criteria[a]	Site Specific Ecology Criteria (Southern Culvert)[a]	Health-based Screening Criteria (Recreational Waters)[b]	Ecological Sceening 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		S19-Au17273	S19-Se37061	-	S20-Ap12287	S20-Au23116	S20-Oc25321	S21-Ja34959	S21-Ap22331	N21-JI30450	S22-Se00368	N22-De0031034	S23-Jn0046775
					Sample date:		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	13/Dec/22	16/Jun/23
					Sample ID:		SW1-UP	SW1-UP	SW1_UP	SW1-UP	SW1_UP	SW1_UP	SW1_UP	SW1_UP	SW1_UP	SW1_UP	SW1_UP	TAR_SW1_UP_160623
					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
					Project No:		318000780	318000780	318000780	318000780	318000780	318000780	318000780	318000780	318000781	318001376	318001376-001	318001376-007
					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
					Sampling Method:		Grab Sample	Grab Sample	-	Grab Sample	Grab Sample	Grab Sample	Grab Sample	Grab Sample	Grab Sample	Grab Sample	Grab Sample	Grab Sample
Guidelines					Sample Description:		Not recorded.	Clear/slightly brown.	DRY	Clear. No turbidity. No odour.	Clear to slightly brown. Flowing.	Water clear/brown, flowing.	Clear, low-no odour, no observable contamination	Clear, no odour. Fence panel stack at downstream end. Flowing	Clear, colourless, no odour. Reeds growing adjacent to pond. Flowing.	Clear, colourless, very minor suspended solids no odour. Reeds growing adjacent to pond. Flowing.	Clear, colourless, very minor suspended solids no odour. Reeds growing adjacent to pond. Flowing.	Clear, colourless, no turbidity, sediment on bottom of water body.
Analyte grouping/Analyte					**Units**	**LOR**												
Inorganics																		
Ammonia (as N)	-	-	0.5	0.9	mg/L	0.01	0.01	<0 01	-	-	-	-	-	-	-	-	-	-
Conductivity (at 25@°C)	-	-	-	-	µS/cm	100	820	730	-	-	-	-	-	-	-	-	-	-
Nitrate & Nitrite (as N)	-	-	-	-	mg/L	0.05	< 0.05	< 0.05	-	-	-	-	-	-	-	-	-	-
Nitrate (as N)	-	-	50	3.5	mg/L	0.02	< 0.02	< 0.02	-	-	-	-	-	-	-	-	-	-
Nitrite (as N)	-	-	30	-	mg/L	0.02	< 0.02	< 0.02	-	-	-	-	-	-	-	-	-	-
pH (at 25@°C)	-	-	-	-	pH units	0.1	7.9	7.6	-	-	-	-	-	-	-	-	-	-
Phosphate total (as P)	-	-	-	-	mg/L	0.05	< 0.05	< 0.05	-	-	-	-	-	-	-	-	-	-
Total Dissolved Solids Dried at 180°C ± 2°C	-	-	-	-	mg/L	0 005	0.42	0.37	-	-	-	-	-	-	-	-	-	-
Total Kjeldahl Nitrogen (as N)	-	-	0.8	-	mg/L	0 2	<0 2	<0.2	-	-	-	-	-	-	-	-	-	-
Total Nitrogen (as N)	-	-	-	-	mg/L	0 2	<0 2	<0.2	-	-	-	-	-	-	-	-	-	-
Total Suspended Solids Dried at 105°C	-	-	-	0.7	mg/L	0 005	<0.005	5.6	-	-	-	-	-	-	-	-	-	-
Turbidity	-	-	-	-	NTU	1	1	1.3	-	-	-	-	-	-	-	-	-	-
Total Metals																		
Aluminium	-	NA	2[d]	NA	mg/L	0.05	-	-	-	< 0.05	0 85	< 0 05	< 0.05	< 0.05	< 0.05	<0 05	< 0 05	< 0.05
Arsenic	7	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
Barium	-	NA	20	NA	mg/L	0.001	-	-	-	0.1	0 05	0.1	0.11	0 08	0 07	0 05	0.06	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	NA	NA	mg/L	0.0002	-	-	-	< 0 0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	<0 0002	< 0.0002	< 0.0002
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
Cobalt	-	NA	-	NA	mg/L	0.001	-	-	-	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	<0.001	< 0.001	< 0.001
Copper	-	NA	20	NA	mg/L	0.001	-	-	-	< 0.001	0.002	< 0.001	< 0.001	< 0.001	< 0.001	<0.001	0.001	< 0.001
Iron	-	NA	3	NA	mg/L	0.05	-	-	-	0.26	0.93	0.12	0.19	0 07	0 06	0 07	0.12	0.09
Lead	7	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
Manganese	350	NA	NA	NA	mg/L	0.005	-	-	-	0.044	0.026	0.022	0.054	0.037	0.009	0 01	0.024	0.016
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	NA	NA	mg/L	0.001	-	-	-	< 0.001	0.002	< 0.001	< 0.001	< 0.001	< 0.001	<0.001	0.001	< 0.001
Zinc	-	NA	30	NA	mg/L	0.005	-	-	-	0.011	0.011	0.009	< 0.005	0.005	< 0.005	<0.005	< 0.005	< 0.005
Dissolved Metals																		
Dissolved Aluminium	NA	5	NA	NA	mg/L	0.05	< 0.05	< 0.05	-	-	0.45	< 0 05	< 0.05	< 0.05	< 0.05	<0 05	< 0 05	< 0.05
Dissolved Arsenic	NA	0.5	NA	NA	mg/L	0.001	< 0.001	0.001	-	-	< 0.001	< 0.001	0.003	< 0.001	< 0.001	<0.001	< 0.001	< 0.001
Dissolved Barium	NA	-	NA	-	mg/L	0.001	0.1	0.1	-	-	0 04	0.1	0.12	0 08	0 05	0 05	0.07	0.07
Dissolved Beryllium	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
Dissolved Cadmium	NA	0.01	NA	0.002	mg/L	0.0002	< 0.0002	<0.0002	-	-	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	<0 0002	< 0.0002	< 0.0002
Dissolved Chromium	NA	NA	NA	0.0084	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 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	< 0.001
Dissolved Copper	NA	0.5	NA	NA	mg/L	0.001	< 0.001	<0.001	-	-	0.002	< 0.001	0.003	< 0.001	< 0.001	<0.001	< 0.001	< 0.001
Dissolved Iron	NA	-	NA	-	mg/L	0.05	< 0.05	< 0.05	-	-	0.3	< 0 05	< 0.05	< 0.05	< 0.05	<0 05	0 07	< 0.05
Dissolved Lead	NA	0.1	NA	0.09078	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	NA	NA	1.9	mg/L	0.005	< 0.005	0.005	-	-	0 02	0.022	0.056	0.034	0.007	0.009	0.027	0.014
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	< 0.0001
Dissolved Nickel	NA	1	NA	0.099	mg/L	0.001	< 0.001	<0.001	-	-	0.002	< 0.001	< 0.001	< 0.001	< 0.001	<0.001	< 0.001	< 0.001
Dissolved Zinc	NA	20	NA	0.072	mg/L	0.005	< 0.005	0.005	-	-	0.008	< 0.005	< 0.005	< 0.005	< 0.005	<0.005	< 0.005	< 0.005
Total Recoverable Hydrocarbons - 2013 NEPM Fractions																		
Naphthalene	-	-	17	16	µg/L	10	<10	<10	-	-	-	-	-	-	-	-	-	-
TRH >C10-C16	-	-	-	-	µg/L	50	<50	<50	-	-	-	-	-	-	-	-	-	-
TRH >C10-C16 less Naphthalene (F2)	-	-	-	-	µg/L	50	<50	<50	-	-	-	-	-	-	-	-	-	-
TRH >C10-C40 (total)*	-	-	-	-	µg/L	100	<100	<100	-	-	-	-	-	-	-	-	-	-
TRH >C16-C34	-	-	-	-	µg/L	100	<100	<100	-	-	-	-	-	-	-	-	-	-
TRH >C34-C40	-	-	-	-	µg/L	100	<100	<100	-	-	-	-	-	-	-	-	-	-
TRH C6-C10	-	-	-	-	µg/L	20	<20	<20	-	-	-	-	-	-	-	-	-	-
TRH C6-C10 less BTEX (F1)	-	-	-	-	µg/L	20	<20	<20	-	-	-	-	-	-	-	-	-	-
BTEX																		
Benzene	-	-	10	950	µg/L	1	<1	<1	-	-	-	-	-	-	-	-	-	-
Ethylbenzene	-	-	3000	80	µg/L	1	<1	<2	-	-	-	-	-	-	-	-	-	-
m&p-Xylenes	-	-	-	-	µg/L	2	<2	<2	-	-	-	-	-	-	-	-	-	-
o-Xylene	-	-	-	-	µg/L	1	<1	<2	-	-	-	-	-	-	-	-	-	-
Toluene	-	-	8000	180	µg/L	1	<1	<2	-	-	-	-	-	-	-	-	-	-
Xylenes - Total	-	-	6000	200	µg/L	3	<3	<3	-	-	-	-	-	-	-	-	-	-

- 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 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.
[a]EnRiskS (2020) Advice on risks to human health and the environment: Boyd Street and publicly accessible areas, Tarago NSW
[b]Recreational criteria adopted are 10 x Australian Drinking Water Gudielines ADWG (2011)
[c]ANZG (2018) Australian and New Zealand Guidelines for Fresh and Marine Water Quality.
[d]The recreational criteria for aluminium is based on aesthtic 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

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Table 4: SW2 Analytical Results

	Site Specific Human Health Criteria[A]	Site Specific Ecology Criteria (Southern Culvert)[A]	Health-based Screening Criteria (Recreational Waters)[B]	Ecological Sceening 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		519-Se37062	-	S20-Ap12288	S20-My01341	S20-Au23117	S20-Oc25143	S21-Ja34961	S21-Ap22333	N21-Jl30452	S22-Se00368	N22-De0031036	S23-Jn0046776
					Sample date:		24/Sep/19	29/Jan/20	1/Apr/20	30/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
					Sample ID:		SW2	SW2	SW2	SW2	SW2	SW2	SW2	SW2	SW2	SW2	SW2	TAR_SW2_160623
					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
					Project No:		318000780	318000780	318000780	318000780	318000780	318000780	318000780	318000780	318000781	318001376	318001376-001	318001376-007
					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	Tarrago Rail Corridor	Tarrago 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
Guidelines					Sample Description:		Clear.	DRY	Brown, low-medium turbidity, some suspended solids. No odour.	Collected at Goulburn Street footbridge. Not flowing.	Clear to slightly turbid. Flowing.	Water clear, flowing, water level low.	Light brown, low turbidity, no observable contamination	Clear, no odour	Clear, colourless, no odour. Sampled at culvert.	Clear, colourless, no odour. Sampled at culvert, minor vegeatation and moss on the surface and within the waterbody.	Clear, colourless, no odour. Sampled at culvert, reeds and minor vegetation within waterbody. Small piece of sheet metal at mouth of culvert.	Clear, colourless, no odour. No signs of turbidity, algae at base of water body.
Analyte grouping/Analyte					**Units**	**LOR**												
Inorganics																		
Ammonia (as N)	-	-	0.5	0.9	mg/L	0.01	0.15	-	-	-	-	-	-	-	-	-	-	-
Conductivity (at 25@°C)	-	-	-	-	µS/cm	100	520	-	-	-	-	-	-	-	-	-	-	-
Nitrate & Nitrite (as N)	-	-	-	-	mg/L	0.05	0.22	-	-	-	-	-	-	-	-	-	-	-
Nitrate (as N)	-	-	50	3.5	mg/L	0.02	0.22	-	-	-	-	-	-	-	-	-	-	-
Nitrite (as N)	-	-	30	-	mg/L	0.02	<0.02	-	-	-	-	-	-	-	-	-	-	-
pH (at 25@°C)	-	-	-	-	pH units	0.1	8	-	-	-	-	-	-	-	-	-	-	-
Phosphate total (as P)	-	-	-	-	mg/L	0 05	<0.05	-	-	-	-	-	-	-	-	-	-	-
Total Dissolved Solids Dried at 180°C ± 2°C	-	-	-	-	mg/L	0.005	0.29	-	-	-	-	-	-	-	-	-	-	-
Total Kjeldahl Nitrogen (as N)	-	-	0.8	-	mg/L	0.2	<0.2	-	-	-	-	-	-	-	-	-	-	-
Total Nitrogen (as N)	-	-	-	-	mg/L	0.2	0.22	-	-	-	-	-	-	-	-	-	-	-
Total Suspended Solids Dried at 105°C	-	-	-	0.7	mg/L	0.005	<0.005	-	-	-	-	-	-	-	-	-	-	-
Turbidity	-	-	-	-	NTU	1	3	-	-	-	-	-	-	-	-	-	-	-
Total Metals																		
Aluminium	-	NA	2[d]	NA	mg/L	0.05	-	-	0.08	0.06	0.95	< 0.05	< 0.05	< 0.05	< 0.05	<0.05	< 0.05	< 0.05
Arsenic	7	NA	NA	NA	mg/L	0.001	-	-	0.002	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	<0.001	< 0.001	< 0.001
Barium	-	NA	20	NA	mg/L	0.001	-	-	0.1	0.08	0.05	0.11	0.1	0.08	0.07	0.05	0.06	0.07
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	< 0.001
Cadmium	1.4	NA	NA	NA	mg/L	0.0002	-	-	0.0019	0.0004	< 0.0002	0.0007	< 0.0002	< 0.0002	< 0.0002	<0.0002	< 0.0002	< 0.0002
Chromium	-	NA	0.5	NA	mg/L	0.001		-	0.001	< 0.001	0.002	< 0.001	< 0.001	< 0.001	0.006	<0.001	0.001	< 0.001
Cobalt	-	NA	-	NA	mg/L	0.001	-	-	0.004	0.002	< 0.001	< 0.001	0.001	< 0.001	< 0.001	<0.001	< 0.001	< 0.001
Copper	-	NA	20	NA	mg/L	0.001	-	-	0.023	0.006	0.004	0.004	0.004	< 0.001	0.001	<0.001	0.001	0.001
Iron	-	NA	3	NA	mg/L	0.05	-	-	0.94	0.75	1	< 0.05	0.41	0.14	0.14	0.19	0.24	0.15
Lead	7	NA	NA	NA	mg/L	0.001	0.003	-	0.02	0.006	0.003	0.004	0.002	< 0.001	< 0.001	<0.001	0.001	< 0.001
Manganese	350	NA	NA	NA	mg/L	0.005	-	-	0.41	0.26	0.043	0.017	0.21	0.062	0.015	0.024	0.036	0.027
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	< 0.0001
Nickel	14	NA	NA	NA	mg/L	0.001		-	0.002	< 0.001	0.002	< 0.001	< 0.001	< 0.001	0.001	<0.001	0.002	< 0.001
Zinc	-	NA	30	NA	mg/L	0.005		-	0.35	0.16	0.028	0.096	0.033	0.011	0.014	0.006	0.008	0.023
Dissolved Metals																		
Aluminium (filtered)	NA	5	NA	NA	mg/L	0.05	< 0.05	-	-	-	0.47	< 0.05	< 0.05	< 0.05	< 0.05	<0.05	< 0.05	< 0.05
Arsenic (filtered)	NA	0.5	NA	NA	mg/L	0.001	< 0.001	-	-	-	< 0.001	< 0.001	0.004	< 0.001	< 0.001	<0.001	< 0.001	< 0.001
Barium (filtered)	NA	-	NA	-	mg/L	0.001	0.07	-	-	-	0.04	0.11	0.11	0.08	0.06	0.05	0.06	0.07
Beryllium (filtered)	NA	-	NA	-	mg/L	0.001	< 0.001	-	-	-	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	<0.001	< 0.001	< 0.001
Cadmium (filtered)	NA	0.01	NA	0.002	mg/L	0.0002	0.0014	-	-	-	< 0.0002	0.0007	< 0.0002	< 0.0002	< 0.0002	<0.0002	< 0.0002	< 0.0002
Chromium (filtered)	NA	NA	NA	0.0084	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	< 0.001	-	-	-	< 0.001	< 0.001	0.001	< 0.001	< 0.001	<0.001	< 0.001	< 0.001
Copper (filtered)	NA	0.5	NA	NA	mg/L	0.001	0.015	-	-	-	0.003	0.003	0.007	< 0.001	< 0.001	<0.001	< 0.001	0.001
Iron (filtered)	NA	-	NA	-	mg/L	0.05	< 0.05	-	-	-	0.31	< 0.05	< 0.05	< 0.05	< 0.05	0.08	0.06	< 0.05
Lead (filtered)	NA	0.1	NA	0.09078	mg/L	0.001	0.014	-	-	-	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	<0.001	< 0.001	< 0.001
Manganese (filtered)	NA	NA	NA	1.9	mg/L	0.005	0.014	-	-	-	0.015	0.017	0.22	0.06	0.011	0.028	0.034	0.025
Mercury (filtered)	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
Nickel (filtered)	NA	1	NA	0.099	mg/L	0.001	< 0.001	-	-	-	0.002	< 0.001	< 0.001	< 0.001	< 0.001	<0.001	< 0.001	< 0.001
Zinc (filtered)	NA	20	NA	0.072	mg/L	0.005	0.2	-	-	-	0.02	0.13	0.028	0.009	0.006	0.021	< 0.005	0.019
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
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 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.
[A]EnRiskS (2020) Advice on risks to human health and the environment: Boyd Street and publicly accessible areas, Tarago NSW
[B]Recreational criteria adopted are 10 x Australian Drinking Water Gudielines ADWG (2011)
[C]ANZG (2018) Australian and New Zealand Guidelines for Fresh and Marine Water Quality.
[d]The recreational criteria for aluminium is based on aesthtic 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

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Table 5: SW3 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 Sceening 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
					Lab ID		S19-Se37063	-	S20-Ap12289	S20-Au23118	S20-Oc25145	-	S21-Ap22334	N21-Jl30453	S22-Se00368	N22-De0031037	S23-Jn0046777
					Sample date:		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	13/Dec/22	16/Jun/23
					Sample ID:		SW3	SW3	SW3	SW3	SW3	SW3	SW3	SW3	SW3	SW3	TAR_SW3_160623
					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	318000780	318000780	318000780	318000780	318000780	318000780	318000780	318001376	318001376-001	318001376-007
					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
					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:		Moderate turbidity.	DRY	Brown to yellow, medium turbidity, some brown matter at surface.	Brown to clear.	Water clear/brown to slightly trubid, 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.
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
Arsenic	7	NA	NA	NA	mg/L	0.001	-	-	0.004	< 0.001	0.003	-	0.002	< 0.001	0.002	0.001	0.001
Barium	-	NA	20	NA	mg/L	0.001	-	-	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	NA	NA	mg/L	0 0002	-	-	0.021	0 0011	0 0036	-	0 0011	0 0003	0.0016	0.0045	0.0003
Chromium	-	NA	0.5	NA	mg/L	0.001	-	-	0.002	0.001	0.001	-	0.001	< 0.001	<0.001	0.002	< 0.001
Cobalt	-	NA	-	NA	mg/L	0.001	-	-	0.006	< 0.001	< 0.001	-	0.001	< 0.001	0.004	0.003	0.002
Copper	-	NA	20	NA	mg/L	0.001	-	-	0.18	0.018	0.12	-	0.043	0.012	0.039	0.046	0.013
Iron	-	NA	3	NA	mg/L	0.05	-	-	1 8	0.6	1.4	-	1.4	0 82	1.4	0.67	1.1
Lead	7	NA	NA	NA	mg/L	0.001	0 014	-	0.17	0.011	0.051	-	0.017	0.008	0.024	0.015	0.014
Manganese	350	NA	NA	NA	mg/L	0.005	-	-	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	-	-	< 0.0001	< 0 0001	< 0 0001	-	< 0.0001	< 0.0001	0.0001	< 0.0001	< 0.0001
Nickel	14	NA	NA	NA	mg/L	0.001	-	-	0.036	0.002	0.011	-	0.004	0.001	0.004	0.008	0.002
Zinc	-	NA	30	NA	mg/L	0.005	-	-	4	0.22	0.74	-	0 25	0.054	0.34	0.97	0.13
Dissolved Metals																	
Aluminium (filtered)	NA	5	NA	NA	mg/L	0.05	0.3	-	-	0.69	0.4	-	0 08	0 28	0.26	0.08	0 05
Arsenic (filtered)	NA	0.5	NA	NA	mg/L	0.001	0 001	-	-	< 0.001	0.002	-	0.002	< 0.001	0.001	0.001	< 0.001
Barium (filtered)	NA	-	NA	-	mg/L	0.001	0.08	-	-	0.05	0.07	-	0 05	0 04	0.05	0.07	0 03
Beryllium (filtered)	NA	-	NA	-	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	0.0002	mg/L	0 0002	0.0053	-	-	0.001	0 0033	-	0.001	0 0002	0.0015	0.0038	< 0.0002
Chromium (filtered)	NA	NA	NA	0.001	mg/L	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	0 005	-	-	< 0.001	< 0.001	-	0.001	< 0.001	0.004	0.003	0.002
Copper (filtered)	NA	0.5	NA	NA	mg/L	0.001	0 027	-	-	0.016	0.1	-	0.037	0.009	0.033	0.038	0.009
Iron (filtered)	NA	-	NA	-	mg/L	0.05	0.33	-	-	0.46	1.1	-	1.1	0 54	0.98	0.31	0 51
Lead (filtered)	NA	0.1	NA	0.0034	mg/L	0.001	0 011	-	-	0.009	0.023	-	0.013	0.003	0.012	0.006	0.005
Manganese (filtered)	NA	NA	NA	1.9	mg/L	0.005	0 015	-	-	0.014	0.029	-	0.065	0.008	0.23	0.27	0.14
Mercury (filtered)	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
Nickel (filtered)	NA	1	NA	0.011	mg/L	0.001	0 002	-	-	0.002	0.011	-	0.003	0.001	0.004	0.007	0.002
Zinc (filtered)	NA	20	NA	0.008	mg/L	0.005	0.95	-	-	0.2	0.7	-	0 23	0.048	0.32	0.87	0.12
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.
[a]EnRiskS (2020) Advice on risks to human health and the environment: Boyd Street and publicly accessible areas, Tarago NSW
[b]Recreational criteria adopted are 10 x Australian Drinking Water Gudielines ADWG (2011)
[c]ANZG (2018) Australian and New Zealand Guidelines for Fresh and Marine Water Quality.
[d]The recreational criteria for aluminium is based on aesthtic 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

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Job No 318001376-007
Project Name June 2023 Surface Water Monitoring Report
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Table 6: SW4 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	Surface Water	Surface Water
					Lab ID		S19-Au07234	S19-Se37064	-	S20-Ap12290	S20-My01342	S20-Au23119	S20-Oc25147	S21-Ja34962	S21-Ap22335	N21-Jl30453	S22-Se00368	N22-De0031039	S23-Jn0046778
					Sample date:		06/Aug/19	24/Sep/19	29/Jan/20	1/Apr/20	30/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
					Sample ID:		SW4	SW4	SW4	SW4	SW4	SW4	SW4	SW4	SW4	SW4	SW4	SW4	TAR SW4 160623
					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	318000780	318001376	318001376-001	318001376-007
					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 Loop	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
Guidelines					Sample Description:		Stagnant pond, clear to slightly yellow.	Turbid.	DRY	Light brown, low turbidity. No odour.	Collected at Boyd Street culvert. Flowing.	Brown, slightly trubid, full but flow not evident.	Water flowing, turbid, brown, no odour.	Brown-orange, stagnant, low-moderate turbidity, no observable contamination	Pale yellow, no odour	Clear, colourless, no odour. Not flowing.	Brown, murky, turbid, some suspended solids, no odour. Not flowing, minor vegetation on the surface and within the water body	Brown, murky, turbid, some suspended solids, no odour. Not flowing, water appears to pool at this location	Clear, low turbidity, slightly brown. No odour.
Analyte grouping/Analyte					Units	LOR													
Inorganics																			
Ammonia (as N)	-	-	0 5	0.9	mg/L	0 01	<0.01	0.09	-	-	-	-	-	-	-	-	-	-	-
Conductivity (at 25@°C)	-	-	-	-	µS/cm	100	170	180	-	-	-	-	-	-	-	-	-	-	-
Nitrate & Nitrite (as N)	-	-	-	-	mg/L	0 05	<0.05	2.1	-	-	-	-	-	-	-	-	-	-	-
Nitrate (as N)	-	-	50	3.5	mg/L	0 02	<0.02	2.1	-	-	-	-	-	-	-	-	-	-	-
Nitrite (as N)	-	-	30	-	mg/L	0 02	<0.02	<0.02	-	-	-	-	-	-	-	-	-	-	-
pH (at 25@°C)	-	-	-	-	pH units	0.1	6.9	6 5	-	-	-	-	-	-	-	-	-	-	-
Phosphate total (as P)	-	-	-	-	mg/L	0 01	0.03	<0.01	-	-	-	-	-	-	-	-	-	-	-
Total Dissolved Solids Dried at 180°C ± 2°C	-	-	-	-	mg/L	0 01	<0.01	0 014	-	-	-	-	-	-	-	-	-	-	-
Total Kjeldahl Nitrogen (as N)	-	-	0 8	-	mg/L	0.2	1.2	1 6	-	-	-	-	-	-	-	-	-	-	-
Total Nitrogen (as N)	-	-	-	-	mg/L	0.2	1.2	3.7	-	-	-	-	-	-	-	-	-	-	-
Total Suspended Solids Dried at 105°C	-	-	-	0.7	mg/L	0.005	0.007	0 012	-	-	-	-	-	-	-	-	-	-	-
Turbidity	-	-	-	-	NTU	1	6	39	-	-	-	-	-	-	-	-	-	-	-
Total Metals																			
Aluminium	-	NA	2[d]	NA	mg/L	0.05	-	-	-	0.18	0.49	0.59	0.36	0.23	0.18	0.25	0 28	0 66	0.39
Arsenic	7	NA	NA	NA	mg/L	0.001	-	-	-	0.002	0.002	< 0 001	0.003	0 003	0.003	< 0.001	0.002	0.002	0.001
Barium	-	NA	20	NA	mg/L	0.001	-	-	-	0.07	0 07	0.05	0.08	0.07	0.06	0.04	0 05	0 07	0.06
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	< 0.001
Cadmium	1.4	NA	NA	NA	mg/L	0.0002	-	-	-	0.019	0 04	0.003	0.019	0.0066	0.0025	0.0025	0 0015	0 0035	0.0064
Chromium	-	NA	0 5	NA	mg/L	0.001	-	-	-	< 0.001	0.001	0.001	0.001	< 0.001	0.001	0.001	0.002	0.002	0.001
Cobalt	-	NA	-	NA	mg/L	0.001	-	-	-	0.005	0.009	0.001	0.004	0 002	< 0.001	< 0.001	0.002	0.001	< 0.001
Copper	-	NA	20	NA	mg/L	0.001	-	-	-	0.13	0 31	0.04	0.19	0.13	0.09	0.032	0.044	0.059	0.11
Iron	-	NA	3	NA	mg/L	0.05	-	-	-	0.68	0 83	0.57	1.3	1 8	1.4	0.64	1.3	0 88	0.67
Lead	7	NA	NA	NA	mg/L	0.001	0.013	0 055	-	0.055	0.13	0.015	0.038	0 045	0.027	0.01	0.029	0.033	0.043
Manganese	350	NA	NA	NA	mg/L	0.005	-	-	-	0.42	0 63	0.045	0.37	0 3	0.024	0.016	0.13	0.13	0.034
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	< 0.0001
Nickel	14	NA	NA	NA	mg/L	0.001	-	-	-	0.037	0.12	0.006	0.038	0 027	0.451	0.004	0.004	0.009	0.013
Zinc	-	NA	30	NA	mg/L	0.005	-	-	-	3.2	7	0.56	2.6	1 2	1.27	0.5	0 29	0 63	1.3
Dissolved Metals																			
Aluminium (filtered)	NA	5	NA	NA	mg/L	0.05	0.17	0.38	-	-	-	0.63	0.28	0.05	0.19	0.34	0 32	0.19	0.06
Arsenic (filtered)	NA	0.5	NA	NA	mg/L	0.001	0.001	0 001	-	-	-	< 0 001	0.002	0 005	0.002	< 0.001	0.001	< 0.001	< 0.001
Barium (filtered)	NA	-	NA	-	mg/L	0.001	0.04	0.05	-	-	-	0.04	0.08	0.07	0.05	0.04	0 04	0 06	0.05
Beryllium (filtered)	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
Cadmium (filtered)	NA	0.01	NA	0.0002	mg/L	0.0002	0.0056	0 013	-	-	-	0.0029	0.018	0.0051	0.0021	0.0025	0 0013	0.003	0.0057
Chromium (filtered)	NA	NA	NA	0.001	mg/L	0.001	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	<0.001	0 003	-	-	-	< 0 001	0.004	0 001	< 0.001	< 0.001	0.002	0.001	< 0.001
Copper (filtered)	NA	0.5	NA	NA	mg/L	0.001	0.15	0 2	-	-	-	0.035	0.18	0.07	0.073	0.032	0.037	0.049	0.084
Iron (filtered)	NA	-	NA	-	mg/L	0.05	0.22	0.37	-	-	-	0.47	0.89	0.28	0.89	0.52	0.91	0.43	0.23
Lead (filtered)	NA	0.1	NA	0.0034	mg/L	0.001	0.008	0 033	-	-	-	0.011	0.023	0 007	0.016	0.006	0.015	0 01	0.02
Manganese (filtered)	NA	NA	NA	1.9	mg/L	0.005	0.015	0 2	-	-	-	0.041	0.38	0.26	0.014	0.015	0.12	0.11	0.019
Mercury (filtered)	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	< 0.001
Nickel (filtered)	NA	1	NA	0.011	mg/L	0.001	0.014	0 019	-	-	-	0.006	0.038	0 022	0.421	0.004	0.004	0.008	0.011
Zinc (filtered)	NA	20	NA	0.008	mg/L	0.005	1.2	2 6	-	-	-	0.5	2.5	0.82	0.95	0.52	0 26	0 58	1.2
Total Recoverable Hydrocarbons - 2013 NEPM Fractions																			
Naphthalene	-	-	17	16	mg/L	10	<10	<10	-	-	-	-	-	-	-	-	-	-	-
TRH >C10-C16	-	-	-	-	mg/L	50	<50	<50	-	-	-	-	-	-	-	-	-	-	-
TRH >C10-C16 less Naphthalene (F2)	-	-	-	-	mg/L	50	<50	<50	-	-	-	-	-	-	-	-	-	-	-
TRH >C10-C40 (total)*	-	-	-	-	mg/L	100	<100	<100	-	-	-	-	-	-	-	-	-	-	-
TRH >C16-C34	-	-	-	-	mg/L	100	<100	<100	-	-	-	-	-	-	-	-	-	-	-
TRH >C34-C40	-	-	-	-	mg/L	100	<100	<100	-	-	-	-	-	-	-	-	-	-	-
TRH C6-C10	-	-	-	-	mg/L	20	<20	<20	-	-	-	-	-	-	-	-	-	-	-
TRH C6-C10 less BTEX (F1)	-	-	-	-	mg/L	20	<20	<20	-	-	-	-	-	-	-	-	-	-	-
BTEX																			
Benzene	-	-	10	950	mg/L	1	<1	<1	-	-	-	-	-	-	-	-	-	-	-
Ethylbenzene	-	-	3000	80	mg/L	1	<1	<2	-	-	-	-	-	-	-	-	-	-	-
m&p-Xylenes	-	-	-	-	mg/L	2	<2	<2	-	-	-	-	-	-	-	-	-	-	-
o-Xylene	-	-	-	-	mg/L	1	<1	<2	-	-	-	-	-	-	-	-	-	-	-
Toluene	-	-	8000	180	mg/L	1	<1	<2	-	-	-	-	-	-	-	-	-	-	-
Xylenes - Total	-	-	6000	200	mg/L	3	<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.
[a]EnRiskS (2020) Advice on risks to human health and the environment: Boyd Street and publicly accessible areas, Tarago NSW
[b]Recreational criteria adopted are 10 x Australian Drinking Water Gudielines ADWG (2011)
[c]ANZG (2018) Australian and New Zealand Guidelines for Fresh and Marine Water Quality.
[d]The recreational criteria for aluminium is based on aesthtic 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

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Job No: 318001376-007
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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		-	-	S20-Au23120	S20-Oc25149	-	S21-Ap22336	N21-Jl30455	S22-Se00368	-	S23-Jn0046779
					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	16/Jun/23
					Sample ID:		SW5	SW5	SW5	SW5	SW5	SW5	SW5	SW5	SW5	TAR_SW5_160623
					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
					Project No:		318000780	318000785	318000785	318000785	318000780	318000780	318000780	318001376	318001376-001	318001376-007
					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 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
Guidelines					Sample Description:		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.
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	11	-	0.29	1.3	-	-	1.5
Arsenic	7	NA	NA	NA	mg/L	0.001	-	-	0.001	0.005	-	0.002	0.001	-	-	0.002
Barium	-	NA	20	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	NA	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	NA	NA	mg/L	0.001	-	-	0.01	0.031	-	0.003	0.005	-	-	0.004
Manganese	350	NA	NA	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	NA	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	NA	mg/L	0.05	-	-	3.2	0.28	-	0.25	1.1	-	-	0.1
Arsenic (filtered)	NA	0 5	NA	NA	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	-	mg/L	0.001	-	-	< 0.001	< 0.001	-	< 0.001	< 0.001	-	-	< 0.001
Cadmium (filtered)	NA	0.01	NA	0.0002	mg/L	0.0002	-	-	0.0009	0.001	-	0.0006	0.0006	-	-	< 0.0002
Chromium (filtered)	NA	NA	NA	0 001	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 5	NA	NA	mg/L	0.001	-	-	0.016	0.045	-	0.019	0.018	-	-	0.005
Iron (filtered)	NA	-	NA	-	mg/L	0.05	-	-	1.4	0.54	-	0.74	0.78	-	-	4.2
Lead (filtered)	NA	0.1	NA	0.0034	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	0 011	mg/L	0.001	-	-	0.002	0.003	-	0.004	0.003	-	-	0.001
Zinc (filtered)	NA	20	NA	0 008	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.
[a]EnRiskS (2020) Advice on risks to human health and the environment: Boyd Street and publicly accessible areas, Tarago NSW
[b]Recreational criteria adopted are 10 x Australian Drinking Water Gudielines ADWG (2011)
[c]ANZG (2018) Australian and New Zealand Guidelines for Fresh and Marine Water Quality.
[d]The recreational criteria for aluminium is based on aesthtic 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

Client: TfNSW
Job No: 318001376-007
Project Name: June 2023 Surface Water Monitoring Report
23/07/2023

Table 8: SW6 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 Secening 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		-	-	S20-Au23121	-	-	-	N21-JI30451	S22-Se00368	N22-De0031039	-
					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
					Sample ID:		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
					Project No:		318000780	318000785	318000785	318000785	318000785	318000785	318000785	318001376	318001376-001	318001376-007
					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 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
Guidelines					Sample Description:		DRY	DRY	Brown, slightly turbid. Not flowing.	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
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	NA	NA	mg/L	0.001	-	-	0.002	-	-	-	0.002	0.002	0.003	-
Barium	-	NA	20	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	NA	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	NA	NA	mg/L	0.001	-	-	0.022	-	-	-	0.022	0.022	0.052	-
Manganese	350	NA	NA	NA	mg/L	0.005	-	-	0.018	-	-	-	0.021	0.1	0.17	-
Mercury	-	NA	0.01	NA	mg/L	0.0001	-	-	< 0 0001	-	-	-	< 0.0001	0.0001	< 0.0001	-
Nickel	14	NA	NA	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	NA	mg/L	0.05	-	-	2.4	-	-	-	3.2	3.6	0.34	-
Arsenic (filtered)	NA	0.5	NA	NA	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	-	mg/L	0.001	-	-	< 0.001	-	-	-	< 0.001	<0.001	< 0.001	-
Cadmium (filtered)	NA	0 01	NA	NA	mg/L	0.0002	-	-	0.0063	-	-	-	0.0034	0.0013	0.0025	-
Chromium (filtered)	NA	NA	NA	0.0025	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	0.5	NA	NA	mg/L	0.001	-	-	0.088	-	-	-	0.11	0.056	0.043	-
Iron (filtered)	NA	-	NA	-	mg/L	0.05	-	-	1.1	-	-	-	1.7	2	0.82	-
Lead (filtered)	NA	0.1	NA	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.
[a]EnRiskS (2020) Advice on risks to human health and the environment: Boyd Street and publicly accessible areas, Tarago NSW
[b]Recreational criteria adopted are 10 x Australian Drinking Water Gudielines ADWG (2011)
[c]ANZG (2018) Australian and New Zealand Guidelines for Fresh and Marine Water Quality.
[d]The recreational criteria for aluminium is based on aesthtic 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

Client: TfNSW
Job No: 318001376-007
Project Name: June 2023 Surface Water Monitoring Report
23/07/2023

Table 9: SW7 Analytical Results

	Health-based Screening Criteria (Recreational Waters)[b]	Ecological Sceening Criteria (ANZG 95% Protection) Fresh Water[c]	ANZECC Fresh Water Guidelines - Irrigation[c]	ANZECC Fresh Water Guidelines - Stock 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		S20-Ja29060	S20-Ap12291	S20-Au23122	S20-Oc25163	S21-Ja34963	S21-Ap22337	N21-Jl30457	S22-Se00368	N22-De0031040	S23-Jn0046781
					Sample date:		29/Jan/20	2/Apr/20	11/Aug/20	12/Oct/20	28/Jan/21	14/Apr/21	13/Jul/21	13/Sep/22	13/Dec/22	16/Jun/23
					Sample ID:		SW7	SW7	SW7	SW7	SW7	SW7	SW7	SW7	SW7	TAR_SW7_160623
					Project Name:		Tarago SW Monitoring	Tarago SW Mon toring	Tarago SW Mon toring	Tarago SW Mon toring	Tarago SW Monitoring	Tarago SW Mon toring	Tarago SW Mon toring	Tarago SW Monitoring	Tarago SW Monitoring	Tarago SW Monitoring
					Project No:		318000780	318000780	318000780	318000780	318000780	318000780	318000780	318001376	318001376-001	318001376-007
					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 Corr dor	Tarago Rail Corr dor	Tarago Rail Corr dor
					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:		Silty, from dam, low level water.	Highly turb d.	Brown, turb d.	Water slightly trub d, brown, not flowing.	Light brown, low-moderate turbidity, no observable contaminat on	Pale brown, dark colour to dam, earthy odour	Slightly turb d, palye yellow/brown, no odour. Reeds growing in pond. Not flowing.	Light brown to brown, slightly murky, slightly turb d, suspended sol ds, no odour. Reeds growing in pond. Not flowing, minor vegetat on on the surface and w thin the waterbody.	Clear, slightly brown, no odour. Reeds and vegetat on growing throuhgout water body. Dead vegetation at bottom of water body	Clear, brown with red tint, low turbidity, no odour. Reeds growing in pond.
Analyte grouping/Analyte					**Units**	**LOR**										
Inorganics																
Ammonia (as N)	0.5	0.9	-	-	mg/L	0.01	0.02	-	-	-	-	-	-	-	-	-
Conductivity (at 25@°C)	-	-	-	-	µS/cm	100	580	-	-	-	-	-	-	-	-	-
N trate & N tr te (as N)	-	-	**400**	100	mg/L	0.05	<0.05	-	-	-	-	-	-	-	-	-
N trate (as N)	50	3.5	**30**	10	mg/L	0.02	<0.02	-	-	-	-	-	-	-	-	-
N tr te (as N)	30	-	-	-	mg/L	0.02	<0.02	-	-	-	-	-	-	-	-	-
pH (at 25@°C)	-	-	-	800-1200	pH units	0.1	7.4	-	-	-	-	-	-	-	-	-
Phosphate total (as P)	-	-	-	-	mg/L	0.05	0.69	-	-	-	-	-	-	-	-	-
Total Dissolved Solids Dried at 180°C ± 2°C	-	-	-	-	mg/L	0.005	0.56	-	-	-	-	-	-	-	-	-
Total Kjeldahl N trogen (as N)	0.8	-	-	25-125	mg/L	0.2	15	-	-	-	-	-	-	-	-	-
Total N trogen (as N)	-	-	-	-	mg/L	0.2	15	-	-	-	-	-	-	-	-	-
Total Suspended Solids Dried at 105°C	-	0.7	-	-	mg/L	0.005	0.25	-	-	-	-	-	-	-	-	-
Turb d ty	-	-			NTU	1	160	-	-	-	-				-	-
Total Metals																
Aluminium	2[d]	NA	NA	NA	mg/L	0.05	-	0.29	1.7	0.33	0.41	0.15	0.46	0.2	0.22	0.06
Arsen c	NA	NA	NA	NA	mg/L	0.001	0.016	0.004	0.003	0.005	0.003	0.002	0.002	0.002	0.003	0.002
Barium	20	NA	NA	NA	mg/L	0.001	-	0.08	0.04	0.05	0.09	0.04	0.04	0.03	0.03	0.07
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
Cadmium	NA	NA	NA	NA	mg/L	0.0002	0.0016	0.0009	0.0014	0.0003	< 0.0002	0.0004	< 0.0002	<0.0002	< 0.0002	< 0.0002
Chromium	0.5	NA	NA	NA	mg/L	0.001	-	0.001	0.002	0.001	< 0.001	< 0.001	0.001	<0.001	0.001	< 0.001
Cobalt	-	NA	NA	NA	mg/L	0.001	0.002	0.002	< 0.001	< 0.001	0.002	< 0.001	< 0.001	<0.001	< 0.001	< 0.001
Copper	20	NA	NA	NA	mg/L	0.001	0.021	0.022	0.027	0.014	0.006	0.009	0.011	0.004	0.004	0.002
Iron	3	NA	NA	NA	mg/L	0.05	-	4.22	1.8	3	4	3.3	3.8	3.3	5	2.2
Lead	NA	NA	NA	NA	mg/L	0.001	0.037	0.02	0.025	0.012	0.009	0.006	0.006	0.003	0.004	0.002
Manganese	NA	NA	NA	NA	mg/L	0.005	1.1	0.41	0.032	0.063	1	0.072	0.083	0.04	0.16	0.08
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
N ckel	NA	NA	NA	NA	mg/L	0.001	0.012	0.006	0.003	0.003	0.003	0.002	0.002	0.002	0.002	0.001
Zinc	30	NA	NA	NA	mg/L	0.005	0.28	0.15	0.36	0.065	0.044	0.082	0.1	0.014	0.026	0.006
Dissolved Metals																
Dissolved Aluminium	NA	0.055	**5**	20	mg/L	0.05	-	-	0.95	0.18	0.52	0.14	0.37	0.08	< 0.05	< 0.05
Dissolved Arsen c	NA	NA	**0.5**	2	mg/L	0.001	0.011	-	0.001	0.004	0.005	0.001	0.001	0.002	0.002	0.002
Dissolved Barium	NA	-	-	-	mg/L	0.001	-	-	0.03	0.05	0.05	0.03	0.04	0.03	0.03	0.07
Dissolved Beryllium	NA	-	-	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	0.00054	**0.01**	0.05	mg/L	0.0002	0.0005	-	0.001	< 0.0002	< 0.0002	< 0.0002	< 0.0002	<0.0002	< 0.0002	< 0.0002
Dissolved Chromium	NA	0.0025	**1**	1	mg/L	0.001	-	-	0.002	< 0.001	0.001	< 0.001	< 0.001	0.001	< 0.001	< 0.001
Dissolved Cobalt	NA	0.0014	**1**	0.1	mg/L	0.001	0.002	-	< 0.001	< 0.001	0.002	< 0.001	< 0.001	<0.001	< 0.001	< 0.001
Dissolved Copper	NA	0.0014	**0.5**	0.1	mg/L	0.001	0.009	-	0.019	0.013	0.007	0.008	0.008	0.003	0.004	0.002
Dissolved Iron	NA	-	-	10	mg/L	0.05	-	-	0.57	2.4	1.8	1.6	2.5	2.6	2.6	1.3
Dissolved Lead	NA	0.0136	**0.1**	5	mg/L	0.001	0.017	-	0.005	0.009	0.004	0.003	0.004	0.002	0.002	0.001
Dissolved Manganese	NA	1.9	**10**	2.5	mg/L	0.005	0.68	-	0.028	0.056	1	0.063	0.07	0.035	0.15	0.069
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	0.0275	**1**	2	mg/L	0.001	0.009	-	0.003	0.003	0.002	0.002	0.002	0.001	0.001	0.001
Dissolved Zinc	NA	0.02	**20**	5	mg/L	0.005	0.087	-	0.26	0.051	0.031	0.057	0.082	0.01	0.018	< 0.005
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	2	-	-	-	-	-	-	-	-	-
Xylenes - Total	6000	200	-	-	µg/L	3	< 3	-	-	-	-	-	-	-	-	-

- ind cates no cr ter on available
LOR = Lim t of Reporting
Concentrations below the LOR noted as <value
NOC = No observed contamination
Australian and New Zealand Gu delines for Fresh
Australia and New Zealand Environment and Conservat on Council (2000) Australian and New Zealand Guidelines for Fresh and Marine Water Quality.
ANZECC, NEPM and NHMRC gu delines for mercury are based on total mercury.
[a]EnRiskS (2020) Adv ce on risks to human health and the environment: Boyd Street and publicly accessible areas, Tarago NSW
[b]Recreational cr teria adopted are 10 x Australian Drinking Water Gudielines ADWG (2011)
[c]ANZG (2018) Australian and New Zealand Guidelines for Fresh and Marine Water Quality.
[d]The recreat onal criteria for aluminium is based on aesthtic issues post flocculat on and is not ind cative of risks to human health.
Concentrations in blue font exceed human health recreat onal screening criteria
Concentrations in grey box exceed ecological screening criteria

Client: TfNSW
Job No: 318001376-007
Project Name: June 2023 Surface Water Monitoring Report
23/07/2023

Table 10: SW8 Analytical Results

	Health-based Screening Criteria (Recreational Waters)[b]	Ecological Sceening Criteria (ANZG 95% Protection) Fresh Water[c]	ANZECC Fresh Water Guidelines - Irrigation[c]	ANZECC Fresh Water Guidelines - Stock 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		S20-Ja29061	S20-Ap12292	S20-Au23123	S20-Oc25165	S21-Ja34964	S21-Ap22338	N21-Jl30457	S22-Se00368	N22-De0031041	S23-Jn0046782
					Sample date:		29/Jan/20	2/Apr/20	10/Aug/20	12/Oct/20	28/Jan/21	14/Apr/21	13/Jul/21	13/Sep/22	12/Dec/22	16/Jun/23
					Sample ID:		SW8	SW8	SW8	SW8	SW8	SW8	SW8	SW8	SW8	TAR_SW8_160623
					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
					Project No:		318000780	318000780	318000780	318000780	318000780	318000780	318000780	318001376	318001376-001	318001376-007
					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 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:		Clear, vegetation. Not flowing.	Grease at surface, lots of algae growing on plants.	Water flowing, level high, turbid.	Water flowing, clear/brown.	Clear, low turbidity, no observable contamination	Clear, no odour, leaf litter on surface	Clear, colourless, no odour. Reeds growing in river. Flowing.	Clear, colourless, very minor suspended solids, no odour. Reeds growing in river. Flowing, minor vegetation on the banks of the stream and within the water body	Clear, colourless, no odour. Reeds growing on river bank. Flowing. Very minor vegetation within water body.	Clear, colourless, no odour. No turbidity.
Analyte grouping/Analyte					**Units**	**LOR**										
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	mg/L	0.05	-	< 0.05	0.72	< 0.05	< 0.05	< 0.05	< 0.05	0.09	0 26	< 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
Barium	2	NA	NA	NA	mg/L	0.001	-	0.12	0.02	0.08	0.1	0.06	0.06	0.07	0 08	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
Cadmium	0.002	NA	NA	NA	mg/L	0.0002	< 0 0002	< 0.0002	0.0003	< 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	< 0.001	< 0.001	0.002	< 0.001	< 0.001
Cobalt	-	NA	NA	NA	mg/L	0.001	< 0.001	0 003	< 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	0.008	< 0.001	< 0.001	0.001	0.002	0.003	0.003	< 0.001
Iron	3	NA	NA	NA	mg/L	0.05	-	3.2	0.76	0.51	0.27	0.17	0 3	0.51	0 66	0.22
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	0.002	< 0.001
Manganese	5	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	0.11
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
Nickel	0.2	NA	NA	NA	mg/L	0.001	0.001	0 002	0.002	0 001	< 0.001	0.002	0.001	0.002	0.002	< 0.001
Zinc	30	NA	NA	NA	mg/L	0.005	< 0.005	0 022	0.12	0 009	< 0.005	0.011	0.024	0.029	0.023	0.022
Dissolved Metals																
Dissolved Aluminium	NA	0.055	**20**	5	mg/L	0.05	-	-	0.41	< 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
Dissolved Barium	NA	-	**-**	-	mg/L	0.001	-	-	0.02	0.09	0.11	0.06	0.06	0.07	0.07	0.09
Dissolved Beryllium	NA	-	**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	0.002	**0.05**	0.01	mg/L	0.0002	< 0 0002	-	0.0002	< 0.0002	< 0.0002	< 0.0002	< 0 0002	<0.0002	< 0.0002	< 0.0002
Dissolved Chromium	NA	0.0084	**1**	1	mg/L	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
Dissolved Copper	NA	0.0014	**5**	0.4-5	mg/L	0.001	< 0.001	-	0.007	< 0.001	0.003	< 0.001	0.002	0.003	0.002	< 0.001
Dissolved Iron	NA	-	**10**	not sufficiently toxic	mg/L	0.05	-	-	0.31	0.15	0.09	0.07	0.18	0.23	0.09	0.19
Dissolved Lead	NA	0.09078	**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
Dissolved Manganese	NA	1.9	**10**	not sufficiently toxic	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	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	0.099	**2**	1	mg/L	0.001	< 0.001	-	0.002	0 001	< 0.001	0.002	0.001	0.001	0.001	< 0.001
Dissolved Zinc	NA	0.072	**5**	20	mg/L	0.005	< 0.005	-	0.1	0.01	< 0.005	0 008	0.018	0.023	0.011	0.02
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.
[a]EnRiskS (2020) Advice on risks to human health and the environment: Boyd Street and publicly accessible areas, Tarago NSW
[b]Recreational criteria adopted are 10 x Australian Drinking Water Gudielines ADWG (2011)
[c]ANZG (2018) Australian and New Zealand Guidelines for Fresh and Marine Water Quality.
[d]The recreational criteria for aluminium is based on aesthtic 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

Client: TfNSW
Job No: 318001376-007
Project Name: June 2023 Surface Water Monitoring Report
23/07/2023

Table 11: SW9 Analytical Results

	Health-based Screening Criteria (Recreational Waters)[B]	Ecological Sceening 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
					Lab ID		S20-Ja29062	S20-Ap12293	S20-Au23124	S20-Oc25167	S21-Ja34965	S21-Ap22339	N21-Jl30459	S22-Se00368	N22-De0031042	S23-Jn0046783
					Sample date:		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
					Sample ID:		SW9	SW9	SW9	SW9	SW9	SW9	SW9	SW9	SW9	TAR_SW9_160623
					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
					Project No:		318000780	318000780	318000780	318000780	318000780	318000780	318000780	318001376	318001376-001	318001376-007
					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 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:		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 organse tint in water body. No odour.
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)	-	-	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[d]	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
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
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
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
Chromium	0.5	NA	NA	NA	mg/L	0.001	-	< 0.001	0.002	< 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
Copper	20	NA	NA	NA	mg/L	0.001	< 0.001	0 001	0.01	< 0.001	< 0.001	0.001	0.002	0.003	0.001	0.001
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
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
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
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
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
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
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
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
Dissolved Barium	NA	-	**-**	-	mg/L	0.001	-	-	0.02	0.09	0.12	0.06	0.06	0.06	0.08	0.09
Dissolved Beryllium	NA	-	**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	0.002	**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
Dissolved Chromium	NA	0.0084	**1**	1	mg/L	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
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
Dissolved Iron	NA	-	**10**	not sufficiently toxic	mg/L	0.05	-	-	0.29	< 0.05	< 0.05	0.12	0.19	0.26	0.69	0.12
Dissolved Lead	NA	0.09078	**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
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	0.099	**2**	1	mg/L	0.001	< 0.001	-	0.002	0.001	0.001	0.002	0.001	0.001	0.002	< 0 001
Dissolved Zinc	NA	0.072	**5**	20	mg/L	0.005	< 0.005	-	0.14	< 0.005	0.006	0.01	0.034	0.038	0.007	0.034
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.
[a]EnRiskS (2020) Advice on risks to human health and the environment: Boyd Street and publicly accessible areas, Tarago NSW
[b]Recreational criteria adopted are 10 x Australian Drinking Water Gudielines ADWG (2011)
[c]ANZG (2018) Australian and New Zealand Guidelines for Fresh and Marine Water Quality.
[d]The recreational criteria for aluminium is based on aesthtic 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

Client: TfNSW
Job No: 318001376-007
Project Name: June 2023 Surface Water Monitoring Report
23/07/2023

Table 12: SW10 Analytical Results

	Health-based Screening Criteria (Recreational Waters)[B]	Ecological Sceening 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
Lab ID							S20-Oc25153	S21-Ja34966	S21-Ap22340	N21-Jl30460	S22-Se00368	N22-De0031043	S23-Jn0046784
Sample date:							13/Oct/20	28/Jan/21	14/Apr/21	13/Jul/21	13/Sep/22	12/Dec/22	16/Jun/23
Sample ID:							SW10	SW10	SW10	SW10	SW10	SW10	SW10
Project Name:							Tarago SW Mon toring	Tarago SW Monitoring	Tarago SW Monitoring	Tarago SW Monitoring	Tarago SW Mon toring	Tarago SW Monitoring	Tarago SW Mon toring
Project No:							318000780	318000780	318000780	318000780	318001376	318001376-001	318001376-007
Sample Location							Tarago Rail Loop	Tarago Rail Loop	Tarago Rail Loop	Tarago Rail Loop	Tarago Rail Corr dor	Tarago Rail Corridor	Tarago Rail Corr dor
Sampling Method:							Grab Sample	Grab Sample	Grab Sample	Grab Sample	Grab Sample	Grab Sample	Grab Sample
Guidelines					**Sample Description:**		Water flowing, clear/brown, slightly turbid, no odour.	Clear, low turbidity, no observable contamination	Clear, no odour	Clear to slighty 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.
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
Arsen c	0.1	NA	NA	NA	mg/L	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
Chromium	0.5	NA	NA	NA	mg/L	0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.002	< 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
Copper	20	NA	NA	NA	mg/L	0.001	< 0.001	< 0.001	0.001	0.002	0.003	0.003	0.003
Iron	3	NA	NA	NA	mg/L	0.05	0.55	0.79	0.24	0.29	0.53	0.79	0.24
Lead	0.1	NA	NA	NA	mg/L	0.001	0.002	< 0.001	< 0.001	< 0.001	<0.001	0.002	< 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
Zinc	30	NA	NA	NA	mg/L	0.005	0.013	< 0.005	0.013	0.032	0.031	0.023	0.021
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
Arsen c (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
Barium (filtered)	NA	-	**-**	-	mg/L	0.001	0.11	0.11	0.06	0.06	0.07	0.08	0.09
Beryllium (filtered)	NA	-	**0.5**	-	mg/L	0.001	< 0.001	< 0.001	< 0.001	< 0.001	<0.001	< 0.001	< 0.001
Cadmium (filtered)	NA	0.002	**0.05**	0.01	mg/L	0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	<0.0002	< 0.0002	< 0.0002
Chromium (filtered)	NA	0.0084	**1**	1	mg/L	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
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
Iron (filtered)	NA	-	**10**	not sufficiently tox c	mg/L	0.05	0.11	0.8	0.08	0.18	0.24	0.08	0.2
Lead (filtered)	NA	0.09078	**5**	0.1	mg/L	0.001	< 0.001	< 0.001	< 0.001	< 0.001	<0.001	< 0.001	< 0.001
Manganese (filtered)	NA	1.9	**10**	not sufficiently tox c	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	0.099	**2**	1	mg/L	0.001	< 0.001	< 0.001	0.001	0.001	0.001	0.002	< 0.001
Zinc (filtered)	NA	0.072	**5**	20	mg/L	0.005	0.006	< 0.005	0.008	0.025	0.025	0.007	0.018

- indicates no criter on available
LOR = Limit of Reporting
Concentrat ons below the LOR noted as <value
NOC = No observed contamination
Australian and New Zealand Gu delines 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 Qual ty.
ANZECC, NEPM and NHMRC guidelines for mercury are based on total mercury.
[a]EnRiskS (2020) Advice on risks to human health and the environment: Boyd Street and publ cly accessible areas, Tarago NSW
[b]Recreational criteria adopted are 10 x Australian Drinking Water Gudielines ADWG (2011)
[c]ANZG (2018) Australian and New Zealand Gu delines for Fresh and Marine Water Qual ty.
[d]The recreational cr teria for aluminium is based on aestht c issues post flocculation and is not indicative of risks to human health.
Concentrat ons in blue font exceed human health recreational screening criteria
Concentrat ons in grey box exceed ecological screening criteria

Client: TfNSW
Job No: 318001376-007
Project Name: June 2023 Surface Water Monitoring Report
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Table 13: QA/QC Assessment

	Sample Type:		**Surface Water**	**Surface Water**	**RPD %**	**Surface Water**	**Surface Water**	**RPD %**
	Duplicate Type:		Primary	intralaboratory dupl cate		Primary	inter-laboratory duplicate	
	Lab ID		S23-Jn0046777	S23-Jn0046785		S23-Jn0046777	ES2320808001	
	Sample date:		16/Jun/23	13/Dec/23		16/Jun/23	16/Jun/23	
	Sample ID:		TAR_SW3_160623	QC101_160623		TAR_SW3_160623	QC201_160623	
	Project Name:		Tarago SW Monitoring	Tarago SW Monitoring		Tarago SW Monitoring	Tarago SW Monitoring	
	Project No:		318001376-007	318001376-001		318001376-007	318001376-007	
	Sample Location		Tarago Rail Corridor	Tarago Rail Corr dor		Tarago Rail Corridor	Tarago Rail Corridor	
	Sampling Method:		Grab Sample	Grab Sample		Grab Sample	Grab Sample	
Analyte grouping/Analyte	**Units**	**LOR**						
ED093F: SAR and Hardness Calculations								
Total Hardness as CaCO3	mg/L	1	39	38	2.6	39	40	2.5
Total Metals								
Aluminium	mg/L	0.05	0.05	< 0.05	*nc*	0.05	0.15	**100.0**
Arsen c	mg/L	0.001	0.001	< 0.001	*nc*	0.001	<0.001	*nc*
Barium	mg/L	0.001	0.03	0.06	**66.7**	0.03	0.032	6.5
Beryllium	mg/L	0.001	< 0.001	< 0.001	*nc*	< 0.001	<0.001	*nc*
Cadmium	mg/L	0.0002	0.0003	< 0.0002	*nc*	0.0003	0.0003	0.0
Chromium	mg/L	0.001	< 0.001	< 0.001	*nc*	< 0.001	<0.001	*nc*
Cobalt	mg/L	0.001	0.002	< 0.001	*nc*	0.002	0.002	0.0
Copper	mg/L	0.001	0.013	0.001	**171.4**	0.013	0.012	8.0
Iron	mg/L	0.05	1.1	0.23	**130.8**	1.1	1.01	8.5
Lead	mg/L	0.001	0.014	< 0.001	*nc*	0.014	0.013	7.4
Manganese	mg/L	0.005	0.15	0.03	**137.1**	0.15	0.144	4.1
Mercury	mg/L	0.0001	< 0.0001	< 0.0001	*nc*	< 0.0001	<0.0001	*nc*
Nickel	mg/L	0.001	0.002	< 0.001	*nc*	0.002	0.002	0.0
Zinc	mg/L	0.005	0.13	0.02	**151.4**	0.13	0.128	1.6
Dissolved Metals								
Aluminium (filtered)	mg/L	0.05	0.05	< 0.05	*nc*	0.05	0.07	**33.3**
Arsen c (filtered)	mg/L	0.001	< 0.001	< 0.001	*nc*	< 0.001	<0.001	*nc*
Barium (filtered)	mg/L	0.001	0.03	0.06	**66.7**	0.03	0.03	0.0
Beryllium (filtered)	mg/L	0.001	< 0.001	< 0.001	*nc*	< 0.001	<0.001	*nc*
Cadmium (filtered)	mg/L	0.0002	< 0.0002	< 0.0002	*nc*	< 0.0002	0.0002	*nc*
Chromium (filtered)	mg/L	0.001	< 0.001	< 0.001	*nc*	< 0.001	<0.001	*nc*
Cobalt (filtered)	mg/L	0.001	0.002	< 0.001	*nc*	0.002	0.002	0.0
Copper (filtered)	mg/L	0.001	0.009	< 0.001	*nc*	0.009	0.009	0.0
Iron (filtered)	mg/L	0.05	0.51	0.09	**140.0**	0.51	0.37	**31.8**
Lead (filtered)	mg/L	0.001	0.005	< 0.001	*nc*	0.005	0.004	22.2
Manganese (filtered)	mg/L	0.005	0.14	0.02	**143.6**	0.14	0.139	0.7
Mercury (filtered)	mg/L	0.0001	< 0.0001	< 0.0001	*nc*	< 0.0001	<0.0001	*nc*
Nickel (filtered)	mg/L	0.001	0.002	< 0.001	*nc*	0.002	0.002	0.0
Zinc (filtered)	mg/L	0.005	0.12	0.02	**152.9**	0.12	0.125	4.1

LOR = Limit of Reporting
NC = not calculated as one or more results are below the LOR.
Bold and Shaded cells exceed RPD >30%
Bold indicates when above the acceptance criteria for Trip Spikes/Blanks and Rinsates
Blank Cell ind cates not analysed

APPENDIX 4
CALIBRATION CERTIFICATE

Multi Parameter Water Meter

Instrument YSI Quatro Pro Plus
Serial No. 12D100009

airmet
Air-Met Scientific Pty Ltd
1300 137 067

Item	Test	Pass	Comments
Battery	Charge Condition	✓	
	Fuses	✓	
	Capacity	✓	
Switch/keypad	Operation	✓	
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. D.O		0%		12110	-0.2%
2. Conductivity		2760mS		401089	2767mS
3. pH7		pH 7.00		399304	pH 7.02
4. pH4		pH 4.00		399527	pH 3.97
5. ORP		235.16mV		A393379/B400204	236.1mV
6. Actual Temp		22.2°C		Instrument Temp	22.2°C

Calibrated by: Guido Camera

Calibration date: 13/06/2023

Next calibration due: 10/12/2023

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 9900 8400 EnviroSampleNSW@eurofins.com

☐ **Brisbane Laboratory** Unit 1 21 Smallwood Place Murarrie 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 8564 5000 EnviroSampleVic@eurofins.com

Company	Ramboll	Project №	318001376-007	Project Manager	Stephen Maxwell
Address	3/100 Pacific Highway, North Sydney 2060, NSW	Project Name	Tarago Surface Water Monitoring	EDD Format (ESdat, EQuIS etc)	EQuIS
Contact Name	Jenny Auld				
Phone №	0421 672 019				
Special Directions	Page 1 of 2				
Purchase Order					
Quote ID №					

Sampler(s)	Jenny Auld / Isobel Marshall				
Handed over by	Isobel Marshall				
Email for Invoice	jauld@ramboll.com; aslapac-accounts@ramboll.com				
Email for Results	jauld@ramboll.com; imarshall@ramboll.com; smaxwell@ramboll.com				

Containers (Change container type & size if necessary.)

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( )

№		Sampled Date/Time dd/mm/yy hh:mm	Matrix Solid (S) Water (W)	Analyses (Where metals are requested, please specify "Total" or "Filtered". SUITE code must be used to attract SUITE pricing.) Metals Filtered (Al, As, Ba, Be, Cd, Cr, Cu, Co, Fe, Pb, Mn, Ni, Zn, Hg)	Metals Total (Al, As, Ba, Be, Cd, Cr, Cu, Co, Fe, Pb, Mn, Ni, Zn, Hg)	Hardness as CaCO3	Lab filter of metals	Send to ALS	HOLD	500mL Plastic	250mL Plastic	125mL Plastic	200mL Amber Glass	40mL VOA vial	500mL PFAS Bottle	Jar (Glass or HDPE)	Asbestos Bag	Sample Comments / Dangerous Goods Hazard Warning
1	TAR_SW1_160623	16/06/23	W	X	X	X				1		2						
2	TAR_SW1_UP_160623	16/06/23	W	X	X	X				1		2						
3	TAR_SW2_160623	16/06/23	W	X	X	X				1		2						
4	TAR_SW3_160623	16/06/23	W	X	X	X				1		2						
5	TAR_SW4_160623	16/06/23	W	X	X	X				1		2						
6	TAR_SW5_160623	16/06/23	W	X	X	X				1		2						
7	TAR_SW6_160623	16/06/23	W	X	X	X				1		2						
8	TAR_SW7_160623	16/06/23	W	X	X	X				1		2						
9	TAR_SW8_160623	16/06/23	W	X	X	X	X			1		2						please lab filter for filtered metals analysis
10	TAR_SW9_160623	16/06/23	W	X	X	X	X			1		2						please lab filter for filtered metals analysis
		Total Counts		10	10	10	2			10		20						

Method of Shipment	☐ Courier (#)	☑ Hand Delivered	☐ Postal	Name	Isobel Marshall	Signature		Date	6/16/2023	Time	
Laboratory Use Only	Received By		SYD | BNE | MEL | PER | ADL | NTL | DRW	Signature		Date	16/6	Time	7:26	Temperature	-1.0
	Received By		SYD | BNE | MEL | PER | ADL | NTL | DRW	Signature		Date		Time		Report №	

Eurofins Environment Testing Australia Pty Ltd

*Submission of 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.

A 000862

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 9900 8400 EnviroSampleNSW@eurofins.com

☐ Brisbane Laboratory
Unit 1 21 Smallwood Place Murarrie 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 8564 5000 EnviroSampleVic@eurofins.com

Company	Ramboll	Project №	318001376-007	Project Manager	Stephen Maxwell
Address	3/100 Pacific Highway, North Sydney 2060, NSW	Project Name	Tarago Surface Water Monitoring	EDD Format (ESdat, EQuIS etc)	EQuIS
Contact Name	Jenny Auld				
Phone №	0421 672 019				
Special Directions	Page 2 of 2				
Purchase Order					
Quote ID №					

Sampler(s)	Jenny Auld / Isobel Marshall
Handed over by	Isobel Marshall
Email for Invoice	jauld@ramboll.com; aslapac-accounts@ramboll.com
Email for Results	jauld@ramboll.com; imarshall@ramboll.com; smaxwell@ramboll.com

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( )

Analyses — Where metals are required, please specify 'Total' or 'Filtered'. SUITE code must be used to attract SUITE pricing.

Containers — Change container type & size if necessary.

№	Sample ID	Sampled Date/Time dd/mm/yy hh:mm	Matrix Solid (S) Water (W)	Metals Filtered (Al, As, Ba, Be, Cd, Cr, Cu, Co, Fe, Pb, Mn, Ni, Zn, Hg)	Metals Total (Al, As, Ba, Be, Cd, Cr, Cu, Co, Fe, Pb, Mn, Ni, Zn, Hg)	Hardness as CaCO3	Lab filter of metals						Send to ALS	HOLD	500mL Plastic	250mL Plastic	125mL Plastic	200mL Amber Glass	40mL VOA vial	500mL PFAS Bottle	Jar (Glass or HDPE)	Asbetos Bag	Sample Comments / Dangerous Goods Hazard Warning
1	TAR_SW10_160623	16/06/23	W	X	X	X	X								1		2						Please lab filter for filtered metals analysis
2	QC101_160623	16/06/23	W	X	X	X									1		2						
3	QC201_160623	16/06/23	W	X	X	X							X		1		2						please send to ALS for same analysis
4	QC301_160623	16/06/23	W	X	X										1		2						
5																							
6																							
7																							
8																							
9																							
10																							
	Total Counts			14	14	13	3						1		14		28						

Method of Shipment	☐ Courier (#)	☑ Hand Delivered	☐ Postal	Name	Isobel Marshall	Signature	Date 6/16/2023 Time

Laboratory Use Only							
Received By		SYD | BNE | MEL | PER | ADL | NTL | DRW	Signature		Date		Time	Temperature
Received By		SYD | BNE | MEL | PER | ADL | NTL | DRW	Signature		Date		Time	Report №

1000862

eurofins | Environment Testing

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IANZ# 1327

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Rolleston,
Christchurch 7675
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IANZ# 1290

Sample Receipt Advice

Company name:	Ramboll Australia Pty Ltd
Contact name:	Jenny Auld
Project name:	Tarago Surface Water Monitoring
Project ID:	318001376-007
Turnaround time:	5 Day
Date/Time received	Jun 16, 2023 4:46 PM
Eurofins reference	1000862

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

TAR_SW6_160623 and QC301_160623 not received.

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 Jenny Auld - jauld@ramboll.com.

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

eurofins

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

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IANZ# 1290

Company Name: Ramboll Australia Pty Ltd
Address: Level 3/100 Pacific Highway
North Sydney
NSW 2060

Project Name: Tarago Surface Water Monitoring
Project ID: 318001376-007

Order No.:
Report #: 1000862
Phone: 02 9954 8118
Fax: 02 9954 8150

Received: Jun 16, 2023 4:46 PM
Due: Jun 23, 2023
Priority: 5 Day
Contact Name: Jenny Auld

Eurofins Analytical Services Manager : Andrew Black

Sample Detail						Aluminium	Aluminium (filtered)	Barium	Barium (filtered)	Beryllium	Beryllium (filtered)	Cobalt	Cobalt (filtered)	Hardness mg equivalent CaCO3/L	Iron	Iron (filtered)	Manganese	Manganese (filtered)	Metals M8	Metals M8 filtered
Melbourne Laboratory - NATA # 1261 Site # 1254																			X	X
Sydney Laboratory - NATA # 1261 Site # 18217						X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
External Laboratory																				
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**															
1	TAR_SW1_160623	Jun 16, 2023		Water	S23-Jn0046774	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
2	TAR_SW1_UP_160623	Jun 16, 2023		Water	S23-Jn0046775	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
3	TAR_SW2_160623	Jun 16, 2023		Water	S23-Jn0046776	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
4	TAR_SW3_160623	Jun 16, 2023		Water	S23-Jn0046777	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
5	TAR_SW4_160623	Jun 16, 2023		Water	S23-Jn0046778	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
6	TAR_SW5_160623	Jun 16, 2023		Water	S23-Jn0046779	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
7	TAR_SW6_160623	Jun 16, 2023		Water	S23-Jn0046780	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

eurofins

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email: EnviroSales@eurofins.com

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Christchurch 7675
Tel: +64 3 343 5201
IANZ# 1290

Company Name: Ramboll Australia Pty Ltd
Address: Level 3/100 Pacific Highway
North Sydney
NSW 2060

Project Name: Tarago Surface Water Monitoring
Project ID: 318001376-007

Order No.:
Report #: 1000862
Phone: 02 9954 8118
Fax: 02 9954 8150

Received: Jun 16, 2023 4:46 PM
Due: Jun 23, 2023
Priority: 5 Day
Contact Name: Jenny Auld

Eurofins Analytical Services Manager : Andrew Black

Sample Detail						Aluminium	Aluminium (filtered)	Barium	Barium (filtered)	Beryllium	Beryllium (filtered)	Cobalt	Cobalt (filtered)	Hardness mg equivalent CaCO3/L	Iron	Iron (filtered)	Manganese	Manganese (filtered)	Metals M8	Metals M8 filtered
Melbourne Laboratory - NATA # 1261 Site # 1254																			X	X
Sydney Laboratory - NATA # 1261 Site # 18217						X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
8	TAR_SW7_160623	Jun 16, 2023		Water	S23-Jn0046781	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
9	TAR_SW8_160623	Jun 16, 2023		Water	S23-Jn0046782	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
10	TAR_SW9_160623	Jun 16, 2023		Water	S23-Jn0046783	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
11	TAR_SW10_160623	Jun 16, 2023		Water	S23-Jn0046784	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
12	QC101_160623	Jun 16, 2023		Water	S23-Jn0046785	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
13	QC301_160623	Jun 16, 2023		Water	S23-Jn0046786	X	X	X	X	X	X	X	X		X	X	X	X	X	X
Test Counts						13	13	13	13	13	13	13	13	12	13	13	13	13	13	13

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: **Jenny Auld**

Report **1000862-W**
Project name Tarago Surface Water Monitoring
Project ID 318001376-007
Received Date Jun 16, 2023

Client Sample ID			**TAR_SW1_160623**	**TAR_SW1_UP_160623**	**TAR_SW2_160623**	**TAR_SW3_160623**
Sample Matrix			**Water**	**Water**	**Water**	**Water**
Eurofins Sample No.			**S23-Jn0046774**	**S23-Jn0046775**	**S23-Jn0046776**	**S23-Jn0046777**
Date Sampled			**Jun 16, 2023**	**Jun 16, 2023**	**Jun 16, 2023**	**Jun 16, 2023**
Test/Reference	LOR	Unit				
Hardness mg equivalent CaCO3/L	1	mg/L	320	330	310	39
Heavy Metals						
Aluminium	0.05	mg/L	< 0.05	< 0.05	< 0.05	0.05
Aluminium (filtered)	0.05	mg/L	< 0.05	< 0.05	< 0.05	0.05
Arsenic	0.001	mg/L	< 0.001	< 0.001	< 0.001	0.001
Arsenic (filtered)	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Barium	0.02	mg/L	0.08	0.08	0.07	0.03
Barium (filtered)	0.02	mg/L	0.08	0.07	0.07	0.03
Beryllium	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Beryllium (filtered)	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Cadmium	0.0002	mg/L	< 0.0002	< 0.0002	< 0.0002	0.0003
Cadmium (filtered)	0.0002	mg/L	< 0.0002	< 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	< 0.001	< 0.001	0.002
Cobalt (filtered)	0.001	mg/L	< 0.001	< 0.001	< 0.001	0.002
Copper	0.001	mg/L	< 0.001	< 0.001	0.001	0.013
Copper (filtered)	0.001	mg/L	< 0.001	< 0.001	0.001	0.009
Iron	0.05	mg/L	0.40	0.09	0.15	1.1
Iron (filtered)	0.05	mg/L	< 0.05	< 0.05	< 0.05	0.51
Lead	0.001	mg/L	< 0.001	< 0.001	< 0.001	0.014
Lead (filtered)	0.001	mg/L	< 0.001	< 0.001	< 0.001	0.005
Manganese	0.005	mg/L	0.042	0.016	0.027	0.15
Manganese (filtered)	0.005	mg/L	0.036	0.014	0.025	0.14
Mercury	0.0001	mg/L	< 0.0001	< 0.0001	< 0.0001	< 0.0001
Mercury (filtered)	0.0001	mg/L	< 0.0001	< 0.0001	< 0.0001	< 0.0001
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	< 0.005	< 0.005	0.023	0.13
Zinc (filtered)	0.005	mg/L	< 0.005	< 0.005	0.019	0.12

Client Sample ID			TAR_SW4_160623	TAR_SW5_160623	TAR_SW7_160623	TAR_SW8_160623
Sample Matrix			Water	Water	Water	Water
Eurofins Sample No.			S23-Jn0046778	S23-Jn0046779	S23-Jn0046781	S23-Jn0046782
Date Sampled			Jun 16, 2023	Jun 16, 2023	Jun 16, 2023	Jun 16, 2023
Test/Reference	LOR	Unit				
Hardness mg equivalent CaCO3/L	1	mg/L	45	55	110	370
Heavy Metals						
Aluminium	0.05	mg/L	0.39	1.5	0.06	< 0.05
Aluminium (filtered)	0.05	mg/L	0.06	0.10	< 0.05	< 0.05
Arsenic	0.001	mg/L	0.001	0.002	0.002	< 0.001
Arsenic (filtered)	0.001	mg/L	< 0.001	0.001	0.002	< 0.001
Barium	0.02	mg/L	0.06	0.08	0.07	0.09
Barium (filtered)	0.02	mg/L	0.05	0.06	0.07	0.09
Beryllium	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Beryllium (filtered)	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Cadmium	0.0002	mg/L	0.0064	0.0003	< 0.0002	< 0.0002
Cadmium (filtered)	0.0002	mg/L	0.0057	< 0.0002	< 0.0002	< 0.0002
Chromium	0.001	mg/L	0.001	0.002	< 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	0.001	< 0.001	< 0.001
Cobalt (filtered)	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Copper	0.001	mg/L	0.11	0.008	0.002	< 0.001
Copper (filtered)	0.001	mg/L	0.084	0.005	0.002	< 0.001
Iron	0.05	mg/L	0.67	9.5	2.2	0.22
Iron (filtered)	0.05	mg/L	0.23	4.2	1.3	0.19
Lead	0.001	mg/L	0.043	0.007	0.002	< 0.001
Lead (filtered)	0.001	mg/L	0.020	0.003	0.001	< 0.001
Manganese	0.005	mg/L	0.034	0.25	0.080	0.11
Manganese (filtered)	0.005	mg/L	0.019	0.15	0.069	0.10
Mercury	0.0001	mg/L	< 0.0001	< 0.0001	< 0.0001	< 0.0001
Mercury (filtered)	0.0001	mg/L	< 0.0001	< 0.0001	< 0.0001	< 0.0001
Nickel	0.001	mg/L	0.013	0.002	0.001	< 0.001
Nickel (filtered)	0.001	mg/L	0.011	< 0.001	0.001	< 0.001
Zinc	0.005	mg/L	1.3	0.039	0.006	0.022
Zinc (filtered)	0.005	mg/L	1.2	0.017	< 0.005	0.020

Client Sample ID			TAR_SW9_160623	TAR_SW10_160623	QC101_160623
Sample Matrix			Water	Water	Water
Eurofins Sample No.			S23-Jn0046783	S23-Jn0046784	S23-Jn0046785
Date Sampled			Jun 16, 2023	Jun 16, 2023	Jun 16, 2023
Test/Reference	LOR	Unit			
Hardness mg equivalent CaCO3/L	1	mg/L	410	360	38
Heavy Metals					
Aluminium	0.05	mg/L	< 0.05	< 0.05	0.06
Aluminium (filtered)	0.05	mg/L	< 0.05	< 0.05	< 0.05
Arsenic	0.001	mg/L	< 0.001	< 0.001	0.001
Arsenic (filtered)	0.001	mg/L	< 0.001	< 0.001	< 0.001
Barium	0.02	mg/L	0.09	0.09	0.03
Barium (filtered)	0.02	mg/L	0.09	0.09	0.03
Beryllium	0.001	mg/L	< 0.001	< 0.001	< 0.001
Beryllium (filtered)	0.001	mg/L	< 0.001	< 0.001	< 0.001

Client Sample ID			TAR_SW9_160623	TAR_SW10_160623	QC101_160623
Sample Matrix			**Water**	**Water**	**Water**
Eurofins Sample No.			**S23-Jn0046783**	**S23-Jn0046784**	**S23-Jn0046785**
Date Sampled			**Jun 16, 2023**	**Jun 16, 2023**	**Jun 16, 2023**
Test/Reference	LOR	Unit			
Heavy Metals					
Cadmium	0.0002	mg/L	< 0.0002	< 0.0002	0.0003
Cadmium (filtered)	0.0002	mg/L	< 0.0002	< 0.0002	< 0.0002
Chromium	0.001	mg/L	< 0.001	< 0.001	< 0.001
Chromium (filtered)	0.001	mg/L	< 0.001	< 0.001	< 0.001
Cobalt	0.001	mg/L	< 0.001	< 0.001	0.002
Cobalt (filtered)	0.001	mg/L	< 0.001	< 0.001	0.002
Copper	0.001	mg/L	0.001	0.003	0.013
Copper (filtered)	0.001	mg/L	0.001	< 0.001	0.009
Iron	0.05	mg/L	0.14	0.24	1.1
Iron (filtered)	0.05	mg/L	0.12	0.20	0.48
Lead	0.001	mg/L	< 0.001	< 0.001	0.014
Lead (filtered)	0.001	mg/L	< 0.001	< 0.001	0.005
Manganese	0.005	mg/L	0.020	0.10	0.14
Manganese (filtered)	0.005	mg/L	0.020	0.10	0.14
Mercury	0.0001	mg/L	< 0.0001	< 0.0001	< 0.0001
Mercury (filtered)	0.0001	mg/L	< 0.0001	< 0.0001	< 0.0001
Nickel	0.001	mg/L	< 0.001	< 0.001	0.002
Nickel (filtered)	0.001	mg/L	< 0.001	< 0.001	0.002
Zinc	0.005	mg/L	0.035	0.021	0.13
Zinc (filtered)	0.005	mg/L	0.034	0.018	0.12

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 mg equivalent CaCO3/L	Sydney	Jun 21, 2023	28 Days
- Method: E020.1 Hardness in water			
Heavy Metals	Sydney	Jun 22, 2023	28 Days
- Method: LTM-MET-3040 Metals in Waters, Soils & Sediments by ICP-MS			
Heavy Metals (filtered)	Sydney	Jun 22, 2023	180 Days
- Method: LTM-MET-3040 Metals in Waters, Soils & Sediments by ICP-MS			
Metals M8	Sydney	Jun 21, 2023	28 Days
- Method: LTM-MET-3040 Metals in Waters, Soils & Sediments by ICP-MS			
Metals M8 filtered	Sydney	Jun 21, 2023	28 Days
- Method: LTM-MET-3040 Metals in Waters, Soils & Sediments by ICP-MS			

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NATA# 1261 Site# 1254

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NATA# 1261 Site# 18217

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NATA# 1261 Site# 25466

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Company Name: Ramboll Australia Pty Ltd
Address: Level 3/100 Pacific Highway
North Sydney
NSW 2060

Order No.:
Report #: 1000862
Phone: 02 9954 8118
Fax: 02 9954 8150

Received: Jun 16, 2023 4:46 PM
Due: Jun 23, 2023
Priority: 5 Day
Contact Name: Jenny Auld

Project Name: Tarago Surface Water Monitoring
Project ID: 318001376-007

Eurofins Analytical Services Manager : Andrew Black

Sample Detail						Aluminium	Aluminium (filtered)	Barium	Barium (filtered)	Beryllium	Beryllium (filtered)	Cobalt	Cobalt (filtered)	Hardness mg equivalent CaCO3/L	Iron	Iron (filtered)	Manganese	Manganese (filtered)	Metals M8	Metals M8 filtered
Melbourne Laboratory - NATA # 1261 Site # 1254																			X	X
Sydney Laboratory - NATA # 1261 Site # 18217						X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
External Laboratory																				
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**															
1	TAR_SW1_160623	Jun 16, 2023		Water	S23-Jn0046774	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
2	TAR_SW1_UP_160623	Jun 16, 2023		Water	S23-Jn0046775	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
3	TAR_SW2_160623	Jun 16, 2023		Water	S23-Jn0046776	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
4	TAR_SW3_160623	Jun 16, 2023		Water	S23-Jn0046777	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
5	TAR_SW4_160623	Jun 16, 2023		Water	S23-Jn0046778	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
6	TAR_SW5_160623	Jun 16, 2023		Water	S23-Jn0046779	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
7	TAR_SW6_160623	Jun 16, 2023		Water	S23-Jn0046780	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

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Company Name: Ramboll Australia Pty Ltd
Address: Level 3/100 Pacific Highway
North Sydney
NSW 2060

Project Name: Tarago Surface Water Monitoring
Project ID: 318001376-007

Order No.:
Report #: 1000862
Phone: 02 9954 8118
Fax: 02 9954 8150

Received: Jun 16, 2023 4:46 PM
Due: Jun 23, 2023
Priority: 5 Day
Contact Name: Jenny Auld

Eurofins Analytical Services Manager : Andrew Black

Sample Detail						Aluminium	Aluminium (filtered)	Barium	Barium (filtered)	Beryllium	Beryllium (filtered)	Cobalt	Cobalt (filtered)	Hardness mg equivalent CaCO3/L	Iron	Iron (filtered)	Manganese	Manganese (filtered)	Metals M8	Metals M8 filtered
Melbourne Laboratory - NATA # 1261 Site # 1254																			X	X
Sydney Laboratory - NATA # 1261 Site # 18217						X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
8	TAR_SW7_160623	Jun 16, 2023		Water	S23-Jn0046781	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
9	TAR_SW8_160623	Jun 16, 2023		Water	S23-Jn0046782	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
10	TAR_SW9_160623	Jun 16, 2023		Water	S23-Jn0046783	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
11	TAR_SW10_160623	Jun 16, 2023		Water	S23-Jn0046784	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
12	QC101_160623	Jun 16, 2023		Water	S23-Jn0046785	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
13	QC301_160623	Jun 16, 2023		Water	S23-Jn0046786	X	X	X	X	X	X	X	X		X	X	X	X	X	X
Test Counts						13	13	13	13	13	13	13	13	12	13	13	13	13	13	13

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Internal Quality Control Review and Glossary

General

1. 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.
2. All soil/sediment/solid results are reported on a dry basis, unless otherwise stated.
3. All biota/food results are reported on a wet weight basis on the edible portion, unless otherwise stated.
4. Actual LORs are matrix dependant. Quoted LORs may be raised where sample extracts are diluted due to interferences.
5. Results are uncorrected for matrix spikes or surrogate recoveries except for PFAS compounds.
6. SVOC analysis on waters are performed on homogenised, unfiltered samples, unless noted otherwise.
7. Samples were analysed on an 'as received' basis.
8. Information identified on this report with blue colour, indicates data provided by customer that may have an impact on the results.
9. 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 (*bis*-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, PFPeA, 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

1. 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.
2. 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.
3. 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.
4. Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of recovery the term "INT" appears against that analyte.
5. For Matrix Spikes and LCS results a dash "-" in the report means that the specific analyte was not added to the QC sample.
6. 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	
Aluminium (filtered)	mg/L	< 0.05			0.05	Pass	
Arsenic	mg/L	< 0.001			0.001	Pass	
Arsenic (filtered)	mg/L	< 0.001			0.001	Pass	
Barium	mg/L	< 0.02			0.02	Pass	
Barium (filtered)	mg/L	< 0.02			0.02	Pass	
Beryllium	mg/L	< 0.001			0.001	Pass	
Beryllium (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	mg/L	< 0.001			0.001	Pass	
Chromium (filtered)	mg/L	< 0.001			0.001	Pass	
Cobalt	mg/L	< 0.001			0.001	Pass	
Cobalt (filtered)	mg/L	< 0.001			0.001	Pass	
Copper	mg/L	< 0.001			0.001	Pass	
Copper (filtered)	mg/L	< 0.001			0.001	Pass	
Iron	mg/L	< 0.05			0.05	Pass	
Iron (filtered)	mg/L	< 0.05			0.05	Pass	
Lead	mg/L	< 0.001			0.001	Pass	
Lead (filtered)	mg/L	< 0.001			0.001	Pass	
Manganese	mg/L	< 0.005			0.005	Pass	
Manganese (filtered)	mg/L	< 0.005			0.005	Pass	
Mercury	mg/L	< 0.0001			0.0001	Pass	
Mercury (filtered)	mg/L	< 0.0001			0.0001	Pass	
Nickel	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	
LCS - % Recovery							
Heavy Metals							
Aluminium	%	85			80-120	Pass	
Aluminium (filtered)	%	88			80-120	Pass	
Arsenic	%	94			80-120	Pass	
Arsenic (filtered)	%	92			80-120	Pass	
Barium	%	98			80-120	Pass	
Barium (filtered)	%	94			80-120	Pass	
Beryllium	%	82			80-120	Pass	
Cadmium	%	92			80-120	Pass	
Cadmium (filtered)	%	88			80-120	Pass	
Chromium	%	96			80-120	Pass	
Chromium (filtered)	%	95			80-120	Pass	
Cobalt	%	98			80-120	Pass	
Cobalt (filtered)	%	94			80-120	Pass	
Copper	%	94			80-120	Pass	
Copper (filtered)	%	91			80-120	Pass	
Iron	%	103			80-120	Pass	
Iron (filtered)	%	98			80-120	Pass	
Lead	%	96			80-120	Pass	
Lead (filtered)	%	94			80-120	Pass	
Manganese	%	92			80-120	Pass	

Test			Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Manganese (filtered)			%	90			80-120	Pass	
Mercury			%	98			80-120	Pass	
Mercury (filtered)			%	93			80-120	Pass	
Nickel			%	95			80-120	Pass	
Nickel (filtered)			%	95			80-120	Pass	
Zinc			%	92			80-120	Pass	
Zinc (filtered)			%	90			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-Jn0037678	NCP	%	85			75-125	Pass	
Aluminium (filtered)	S23-Jn0050947	NCP	%	87			75-125	Pass	
Arsenic	S23-Jn0037678	NCP	%	93			75-125	Pass	
Arsenic (filtered)	S23-Jn0050947	NCP	%	91			75-125	Pass	
Barium	S23-Jn0037678	NCP	%	95			75-125	Pass	
Barium (filtered)	S23-Jn0050947	NCP	%	91			75-125	Pass	
Beryllium	S23-Jn0037678	NCP	%	82			75-125	Pass	
Beryllium (filtered)	S23-Jn0050947	NCP	%	81			75-125	Pass	
Cadmium	S23-Jn0037678	NCP	%	90			75-125	Pass	
Cadmium (filtered)	S23-Jn0050947	NCP	%	89			75-125	Pass	
Chromium	S23-Jn0037678	NCP	%	94			75-125	Pass	
Chromium (filtered)	S23-Jn0050947	NCP	%	93			75-125	Pass	
Cobalt	S23-Jn0037678	NCP	%	95			75-125	Pass	
Cobalt (filtered)	S23-Jn0050947	NCP	%	92			75-125	Pass	
Copper	S23-Jn0037678	NCP	%	93			75-125	Pass	
Copper (filtered)	S23-Jn0050947	NCP	%	89			75-125	Pass	
Iron	S23-Jn0037678	NCP	%	88			75-125	Pass	
Iron (filtered)	S23-Jn0050947	NCP	%	96			75-125	Pass	
Lead	S23-Jn0037678	NCP	%	97			75-125	Pass	
Lead (filtered)	S23-Jn0050947	NCP	%	92			75-125	Pass	
Manganese	S23-Jn0037678	NCP	%	93			75-125	Pass	
Manganese (filtered)	S23-Jn0050947	NCP	%	87			75-125	Pass	
Mercury	S23-Jn0037678	NCP	%	101			75-125	Pass	
Mercury (filtered)	S23-Jn0050947	NCP	%	92			75-125	Pass	
Nickel	S23-Jn0037678	NCP	%	94			75-125	Pass	
Nickel (filtered)	S23-Jn0050947	NCP	%	93			75-125	Pass	
Zinc	S23-Jn0037678	NCP	%	89			75-125	Pass	
Zinc (filtered)	S23-Jn0050947	NCP	%	88			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	S23-Jn0045471	NCP	mg/L	1.0	0.98	1.5	30%	Pass	
Arsenic	S23-Jn0045471	NCP	mg/L	0.001	0.001	<1	30%	Pass	
Barium	S23-Jn0045471	NCP	mg/L	< 0.02	< 0.02	<1	30%	Pass	
Beryllium	S23-Jn0045471	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Beryllium (filtered)	S23-Jn0036112	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Cadmium	S23-Jn0045471	NCP	mg/L	< 0.0002	< 0.0002	<1	30%	Pass	
Cadmium (filtered)	S23-Jn0036112	NCP	mg/L	< 0.0002	< 0.0002	<1	30%	Pass	
Chromium	S23-Jn0045471	NCP	mg/L	0.003	0.003	11	30%	Pass	
Cobalt	S23-Jn0045471	NCP	mg/L	0.001	0.001	1.3	30%	Pass	
Copper	S23-Jn0045471	NCP	mg/L	0.004	0.002	72	30%	Fail	Q15
Iron	S23-Jn0045471	NCP	mg/L	0.13	0.11	17	30%	Pass	
Lead	S23-Jn0045471	NCP	mg/L	0.002	0.002	4.4	30%	Pass	

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Duplicate									
Heavy Metals				Result 1	Result 2	RPD			
Lead (filtered)	S23-Jn0036112	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Manganese	S23-Jn0045471	NCP	mg/L	< 0.005	< 0.005	<1	30%	Pass	
Mercury	S23-Jn0045471	NCP	mg/L	< 0.0001	< 0.0001	<1	30%	Pass	
Nickel	S23-Jn0045471	NCP	mg/L	0.003	0.003	5.4	30%	Pass	
Zinc	S23-Jn0045471	NCP	mg/L	0.76	0.77	1.8	30%	Pass	
Duplicate									
Heavy Metals				Result 1	Result 2	RPD			
Aluminium (filtered)	S23-Jn0046782	CP	mg/L	< 0.05	< 0.05	<1	30%	Pass	
Arsenic (filtered)	S23-Jn0046782	CP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Barium (filtered)	S23-Jn0046782	CP	mg/L	0.09	0.09	<1	30%	Pass	
Chromium (filtered)	S23-Jn0046782	CP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Cobalt (filtered)	S23-Jn0046782	CP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Copper (filtered)	S23-Jn0046782	CP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Iron (filtered)	S23-Jn0046782	CP	mg/L	0.19	0.18	1.9	30%	Pass	
Manganese (filtered)	S23-Jn0046782	CP	mg/L	0.10	0.10	<1	30%	Pass	
Mercury (filtered)	S23-Jn0046782	CP	mg/L	< 0.0001	< 0.0001	<1	30%	Pass	
Nickel (filtered)	S23-Jn0046782	CP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Zinc (filtered)	S23-Jn0046782	CP	mg/L	0.020	0.020	1.4	30%	Pass	

Comments

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

Qualifier Codes/Comments

Code	Description
Q15	The RPD reported passes Eurofins Environment Testing's QC - Acceptance Criteria as defined in the Internal Quality Control Review and Glossary page of this report.

Authorised by:

Ursula Long	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.

CERTIFICATE OF ANALYSIS

Work Order	: **ES2320808**	Page	: 1 of 4
Client	: **RAMBOLL AUSTRALIA PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: JENNY AULD	Contact	: Customer Services ES
Address	: PO BOX 560 NORTH SYDNEY NSW, AUSTRALIA 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	: 22-Jun-2023 13:45
Order number	: ----	Date Analysis Commenced	: 26-Jun-2023
C-O-C number	: ----	Issue Date	: 28-Jun-2023 13:43
Sampler	: Isobel Marshall, JENNY AULD		
Site	: ----		
Quote number	: EN/222		
No. of samples received	1		
No. of samples analysed	: 1		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

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.

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.

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.

- EG035: Poor matrix spike recovery was obtained for Mercury on sample ES2320713 #1. Confirmed by re-analysis.
- 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	QC201_160623	----	----	----	----
			Sampling date / time	16-Jun-2023 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit	ES2320808-001	--------	--------	--------	--------
				Result	---	---	---	---
ED093F: SAR and Hardness Calculations								
Total Hardness as CaCO3	----	1	mg/L	**40**	----	----	----	----
EG020F: Dissolved Metals by ICP-MS								
Aluminium	7429-90-5	0.01	mg/L	**0.07**	----	----	----	----
Arsenic	7440-38-2	0.001	mg/L	<0.001	----	----	----	----
Beryllium	7440-41-7	0.001	mg/L	<0.001	----	----	----	----
Barium	7440-39-3	0.001	mg/L	**0.030**	----	----	----	----
Cadmium	7440-43-9	0.0001	mg/L	**0.0002**	----	----	----	----
Chromium	7440-47-3	0.001	mg/L	<0.001	----	----	----	----
Copper	7440-50-8	0.001	mg/L	**0.009**	----	----	----	----
Cobalt	7440 48 4	0.001	mg/L	**0.002**	----	----	----	----
Nickel	7440-02-0	0.001	mg/L	**0.002**	----	----	----	----
Lead	7439-92-1	0.001	mg/L	**0.004**	----	----	----	----
Zinc	7440-66-6	0.005	mg/L	**0.125**	----	----	----	----
Manganese	7439-96-5	0.001	mg/L	**0.139**	----	----	----	----
Iron	7439-89-6	0.05	mg/L	**0.37**	----	----	----	----
EG020T: Total Metals by ICP-MS								
Aluminium	7429-90-5	0.01	mg/L	**0.15**	----	----	----	----
Arsenic	7440-38-2	0.001	mg/L	<0.001	----	----	----	----
Beryllium	7440-41-7	0.001	mg/L	<0.001	----	----	----	----
Barium	7440-39-3	0.001	mg/L	**0.032**	----	----	----	----
Cadmium	7440-43-9	0.0001	mg/L	**0.0003**	----	----	----	----
Chromium	7440-47-3	0.001	mg/L	<0.001	----	----	----	----
Copper	7440-50-8	0.001	mg/L	**0.012**	----	----	----	----
Cobalt	7440-48-4	0.001	mg/L	**0.002**	----	----	----	----
Nickel	7440-02-0	0.001	mg/L	**0.002**	----	----	----	----
Lead	7439-92-1	0.001	mg/L	**0.013**	----	----	----	----
Zinc	7440-66-6	0.005	mg/L	**0.128**	----	----	----	----
Manganese	7439-96-5	0.001	mg/L	**0.144**	----	----	----	----
Iron	7439-89-6	0.05	mg/L	**1.01**	----	----	----	----
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	: **ES2320808**	Page	: 1 of 5
Client	: **RAMBOLL AUSTRALIA PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: JENNY AULD	Contact	: Customer Services ES
Address	: PO BOX 560 NORTH SYDNEY NSW, AUSTRALIA 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	: 22-Jun-2023
Order number	: ----	Date Analysis Commenced	: 26-Jun-2023
C-O-C number	: ----	Issue Date	: 28-Jun-2023
Sampler	: Isobel Marshall, JENNY AULD		
Site	: ----		
Quote number	: EN/222		
No. of samples received	: 1		
No. of samples analysed	: 1		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

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

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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: 5132884)									
ES2320598-001	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: Beryllium	7440-41-7	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Barium	7440-39-3	0.001	mg/L	0.077	0.078	0.0	0% - 20%
		EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Cobalt	7440-48-4	0.001	mg/L	0.261	0.260	0.4	0% - 20%
		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: Manganese	7439-96-5	0.001	mg/L	9.76	9.85	1.0	0% - 20%
		EG020A-F: Nickel	7440-02-0	0.001	mg/L	0.176	0.175	0.0	0% - 20%
		EG020A-F: Zinc	7440-66-6	0.005	mg/L	0.087	0.086	1.6	0% - 50%
		EG020A-F: Aluminium	7429-90-5	0.01	mg/L	0.06	0.06	0.0	No Limit
		EG020A-F: Iron	7439-89-6	0.05	mg/L	0.46	0.47	0.0	No Limit
ES2321021-001	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	0.009	0.009	0.0	No Limit
		EG020A-F: Beryllium	7440-41-7	0.001	mg/L	0.001	<0.001	0.0	No Limit
		EG020A-F: Barium	7440-39-3	0.001	mg/L	0.070	0.068	2.8	0% - 20%
		EG020A-F: Chromium	7440-47-3	0.001	mg/L	0.011	0.011	0.0	0% - 50%
		EG020A-F: Cobalt	7440-48-4	0.001	mg/L	0.019	0.019	0.0	0% - 50%
		EG020A-F: Copper	7440-50-8	0.001	mg/L	0.010	0.010	0.0	0% - 50%
		EG020A-F: Lead	7439-92-1	0.001	mg/L	0.007	0.007	0.0	No Limit
		EG020A-F: Manganese	7439-96-5	0.001	mg/L	0.055	0.054	2.8	0% - 20%
		EG020A-F: Nickel	7440-02-0	0.001	mg/L	0.016	0.016	0.0	0% - 50%
		EG020A-F: Zinc	7440-66-6	0.005	mg/L	0.044	0.043	0.0	No Limit

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: 5132884) - continued									
ES2321021-001	Anonymous	EG020A-F: Aluminium	7429-90-5	0.01	mg/L	7.47	7.91	5.8	0% - 20%
		EG020A-F: Iron	7439-89-6	0.05	mg/L	2.25	2.41	6.7	0% - 20%
EG020T: Total Metals by ICP-MS (QC Lot: 5132967)									
EW2302663-001	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: Beryllium	7440-41-7	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-T: Barium	7440-39-3	0.001	mg/L	0.008	0.008	0.0	No Limit
		EG020A-T: Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-T: Cobalt	7440-48-4	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-T: Copper	7440-50-8	0.001	mg/L	<0.001	<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: Manganese	7439-96-5	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	0.017	0.008	70.1	No Limit
		EG020A-T: Aluminium	7429-90-5	0.01	mg/L	0.03	0.03	0.0	No Limit
		EG020A-T: Iron	7439-89-6	0.05	mg/L	<0.05	<0.05	0.0	No Limit
ES2320780-001	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: Beryllium	7440-41-7	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-T: Barium	7440-39-3	0.001	mg/L	0.067	0.069	3.0	0% - 20%
		EG020A-T: Chromium	7440-47-3	0.001	mg/L	<0.001	0.001	0.0	No Limit
		EG020A-T: Cobalt	7440-48-4	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-T: Copper	7440-50-8	0.001	mg/L	0.028	0.029	0.0	0% - 20%
		EG020A-T: Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-T: Manganese	7439-96-5	0.001	mg/L	0.004	0.004	0.0	No Limit
		EG020A-T: Nickel	7440-02-0	0.001	mg/L	0.002	0.002	0.0	No Limit
		EG020A-T: Zinc	7440-66-6	0.005	mg/L	0.034	0.029	13.5	No Limit
		EG020A-T: Aluminium	7429-90-5	0.01	mg/L	<0.01	0.01	0.0	No Limit
		EG020A-T: Iron	7439-89-6	0.05	mg/L	0.12	0.14	15.2	No Limit
EG035F: Dissolved Mercury by FIMS (QC Lot: 5132885)									
ES2320808-001	QC201_160623	EG035F: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.0	No Limit
WN2307715-002	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: 5132971)									
ES2320792-001	Anonymous	EG035T: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.0	No Limit
WN2307715-003	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 Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EG020F: Dissolved Metals by ICP-MS (QCLot: 5132884)								
EG020A-F: Aluminium	7429-90-5	0.01	mg/L	<0.01	0.5 mg/L	84.8	80.0	116
EG020A-F: Arsenic	7440-38-2	0.001	mg/L	<0.001	0.1 mg/L	89.4	85.0	114
EG020A-F: Beryllium	7440-41-7	0.001	mg/L	<0.001	0.1 mg/L	101	85.0	115
EG020A-F: Barium	7440-39-3	0.001	mg/L	<0.001	0.1 mg/L	90.3	82.0	110
EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	0.1 mg/L	87.6	84.0	110
EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	0.1 mg/L	87.9	85.0	111
EG020A-F: Cobalt	7440-48-4	0.001	mg/L	<0.001	0.1 mg/L	87.6	82.0	112
EG020A-F: Copper	7440-50-8	0.001	mg/L	<0.001	0.1 mg/L	87.3	81.0	111
EG020A-F: Lead	7439-92-1	0.001	mg/L	<0.001	0.1 mg/L	86.8	83.0	111
EG020A-F: Manganese	7439-96-5	0.001	mg/L	<0.001	0.1 mg/L	89.6	82.0	110
EG020A-F: Nickel	7440-02-0	0.001	mg/L	<0.001	0.1 mg/L	86.8	82.0	112
EG020A-F: Zinc	7440-66-6	0.005	mg/L	<0.005	0.1 mg/L	92.3	81.0	117
EG020A-F: Iron	7439-89-6	0.05	mg/L	<0.05	0.5 mg/L	89.1	82.0	112
EG020T: Total Metals by ICP-MS (QCLot: 5132967)								
EG020A-T: Aluminium	7429-90-5	0.01	mg/L	<0.01	0.5 mg/L	88.1	82.0	120
EG020A-T: Arsenic	7440-38-2	0.001	mg/L	<0.001	0.1 mg/L	93.9	82.0	114
EG020A-T: Beryllium	7440-41-7	0.001	mg/L	<0.001	0.1 mg/L	105	79.0	119
EG020A-T: Barium	7440-39-3	0.001	mg/L	<0.001	0.1 mg/L	95.8	84.0	116
EG020A-T: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	0.1 mg/L	91.7	84.0	112
EG020A-T: Chromium	7440-47-3	0.001	mg/L	<0.001	0.1 mg/L	91.2	86.0	116
EG020A-T: Cobalt	7440-48-4	0.001	mg/L	<0.001	0.1 mg/L	93.0	84.0	116
EG020A-T: Copper	7440-50-8	0.001	mg/L	<0.001	0.1 mg/L	92.4	83.0	118
EG020A-T: Lead	7439-92-1	0.001	mg/L	<0.001	0.1 mg/L	92.8	85.0	115
EG020A-T: Manganese	7439-96-5	0.001	mg/L	<0.001	0.1 mg/L	91.1	85.0	113
EG020A-T: Nickel	7440-02-0	0.001	mg/L	<0.001	0.1 mg/L	92.5	84.0	116
EG020A-T: Zinc	7440-66-6	0.005	mg/L	<0.005	0.1 mg/L	94.3	79.0	117
EG020A-T: Iron	7439-89-6	0.05	mg/L	<0.05	0.5 mg/L	95.5	85.0	117
EG035F: Dissolved Mercury by FIMS (QCLot: 5132885)								
EG035F: Mercury	7439-97-6	0.0001	mg/L	<0.0001	0.01 mg/L	101	83.0	105
EG035T: Total Recoverable Mercury by FIMS (QCLot: 5132971)								

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report: Result	Laboratory Control Spike (LCS) Report: Spike Concentration	Spike Recovery (%): LCS	Acceptable Limits (%): Low	Acceptable Limits (%): High
EG035T: Total Recoverable Mercury by FIMS (QCLot: 5132971) - continued								
EG035T: Mercury	7439-97-6	0.0001	mg/L	<0.0001	0.01 mg/L	79.5	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	SpikeRecovery(%): MS	Acceptable Limits (%): Low	Acceptable Limits (%): High
EG020F: Dissolved Metals by ICP-MS (QCLot: 5132884)							
ES2320609-001	Anonymous	EG020A-F: Arsenic	7440-38-2	1 mg/L	118	70.0	130
		EG020A-F: Beryllium	7440-41-7	1 mg/L	111	70.0	130
		EG020A-F: Barium	7440-39-3	1 mg/L	116	70.0	130
		EG020A-F: Cadmium	7440-43-9	0.25 mg/L	71.7	70.0	130
		EG020A-F: Chromium	7440-47-3	1 mg/L	95 8	70.0	130
		EG020A-F: Cobalt	7440-48-4	1 mg/L	122	70.0	130
		EG020A-F: Copper	7440-50-8	1 mg/L	81 9	70.0	130
		EG020A-F: Lead	7439-92-1	1 mg/L	97 8	70.0	130
		EG020A-F: Manganese	7439-96-5	1 mg/L	126	70.0	130
		EG020A-F: Nickel	7440-02-0	1 mg/L	114	70.0	130
		EG020A-F: Zinc	7440-66-6	1 mg/L	98 2	70.0	130
EG020T: Total Metals by ICP-MS (QCLot: 5132967)							
ES2320780-002	Anonymous	EG020A-T: Arsenic	7440-38-2	1 mg/L	92 9	70.0	130
		EG020A-T: Beryllium	7440-41-7	1 mg/L	94 2	70.0	130
		EG020A-T: Barium	7440-39-3	1 mg/L	92 0	70.0	130
		EG020A-T: Cadmium	7440-43-9	0.25 mg/L	90.1	70.0	130
		EG020A-T: Chromium	7440-47-3	1 mg/L	93.4	70.0	130
		EG020A-T: Cobalt	7440-48-4	1 mg/L	98 3	70.0	130
		EG020A-T: Copper	7440-50-8	1 mg/L	96.1	70.0	130
		EG020A-T: Lead	7439-92-1	1 mg/L	98.4	70.0	130
		EG020A-T: Manganese	7439-96-5	1 mg/L	93 2	70.0	130
		EG020A-T: Nickel	7440-02-0	1 mg/L	90.1	70.0	130
		EG020A-T: Zinc	7440-66-6	1 mg/L	90 8	70.0	130
EG035F: Dissolved Mercury by FIMS (QCLot: 5132885)							
ES2320713-001	Anonymous	EG035F: Mercury	7439-97-6	0.01 mg/L	# 60.8	70.0	130

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: **ES2320808**	Page	: 1 of 4
Client	: **RAMBOLL AUSTRALIA PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: JENNY AULD	Telephone	: +61-2-8784 8555
Project	: 318001376-007 Tarago Surface Water Monitoring	Date Samples Received	: 22-Jun-2023
Site	: ----	Issue Date	: 28-Jun-2023
Sampler	: Isobel Marshall, JENNY AULD	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.**
- **Matrix Spike outliers exist - please see following pages for full details.**
- **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

- **Quality Control Sample Frequency Outliers exist - please see following pages for full details.**

Outliers : Quality Control Samples

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: **WATER**

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Matrix Spike (MS) Recoveries							
EG035F: Dissolved Mercury by FIMS	ES2320713--001	Anonymous	**Mercury**	7439-97-6	60.8 %	70.0-130%	**Recovery less than lower data quality objective**

Outliers : Frequency of Quality Control Samples

Matrix: **WATER**

Quality Control Sample Type	Count		Rate (%)		Quality Control Specification
Method	QC	Regular	Actual	Expected	
	0				
Matrix Spikes (MS)					
Total Mercury by FIMS	0	18	0.00	5.00	NEPM 2013 B3 & ALS QC Standard

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; o hers 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*
ED093F SAR and Hardness Calculations							
Clear Plastic Bottle - Nitric Acid; Filtered (ED093F) QC201_160623	**16-Jun-2023**	**----**	----	----	**26-Jun-2023**	14-Jul-2023	✓
EG020F: Dissolved Metals by ICP-MS							
Clear Plastic Bottle - Nitric Acid; Filtered (EG020A-F) QC201_160623	**16-Jun-2023**	**----**	----	----	**26-Jun-2023**	13-Dec-2023	✓
EG020T: Total Metals by ICP-MS							
Clear Plastic Bottle Nitric Acid; Unfiltered (EG020A T) QC201_160623	**16-Jun-2023**	**26-Jun-2023**	13-Dec-2023	✓	**26-Jun-2023**	13-Dec-2023	✓
EG035F: Dissolved Mercury by FIMS							
Clear Plastic Bottle - Nitric Acid; Filtered (EG035F) QC201_160623	**16-Jun-2023**	**----**	----	----	**27-Jun-2023**	14-Jul-2023	✓
EG035T: Total Recoverable Mercury by FIMS							
Clear Plastic Bottle - Nitric Acid; Unfiltered (EG035T) QC201 160623	**16-Jun-2023**	**----**	----	----	**28-Jun-2023**	14-Jul-2023	✓

Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within he 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	14	**14.29**	**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	18	**11.11**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	EG020A-T	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Dissolved Mercury by FIMS	EG035F	1	14	**7.14**	**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	18	**5.56**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	EG020A-T	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Dissolved Mercury by FIMS	EG035F	1	14	**7.14**	**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	18	**5.56**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	EG020A-T	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Dissolved Mercury by FIMS	EG035F	1	14	**7.14**	**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	0	18	**0.00**	**5.00**	×	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	EG020A-T	1	20	**5.00**	**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.

Analytical Methods	Method	Matrix	Method Descriptions
Major Cations - Dissolved	ED093F	WATER	In house: Referenced to APHA 3120 and 3125; USEPA SW 846 - 6010 and 6020; Cations are determined by either ICP-AES or ICP-MS techniques. This method is compliant with NEPM Schedule B(3) Sodium Adsorption Ratio is calculated from Ca, Mg and Na which determined by ALS in house method QWI-EN/ED093F. This method is compliant with NEPM Schedule B(3) Hardness parameters are calculated based on 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 (SnCl2)(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 SnCl2 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 (SnCl2)(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 SnCl2 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).

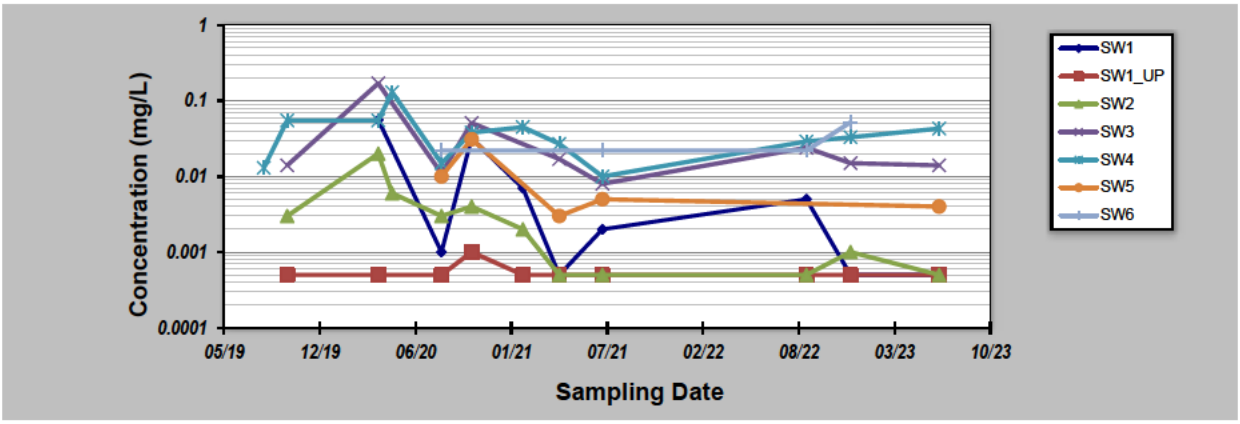
Preparation Methods	Method	Matrix	Method Descriptions
Digestion for Total Recoverable Metals	EN25	WATER	In house: Referenced to USEPA SW846-3005. Method 3005 is a Nitric/Hydrochloric acid digestion procedure used to prepare surface and ground water samples for analysis by ICPAES or ICPMS. This method is compliant with NEPM Schedule B(3)

APPENDIX 6
MANN-KENDALL RESULTS

GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date:	21-Jul-23	Job ID:	318001376-007
Facility Name:	Tarago Surface Water Monitoring	Constituent:	Lead (Total)
Conducted By:	Natalie Gilbert	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								
15								
16								
17								
18								
19								
20								
Coefficient of Variation:		1.68	0.29	1.53	1.44	0.78	1.11	0.51
Mann-Kendall Statistic (S):		-19	-3	-34	-7	-7	-4	3
Confidence Factor:		97.0%	56.9%	99.6%	72.8%	65.6%	75.8%	72.9%
Concentration Trend:		Decreasing	Stable	Decreasing	No Trend	Stable	No Trend	No Trend



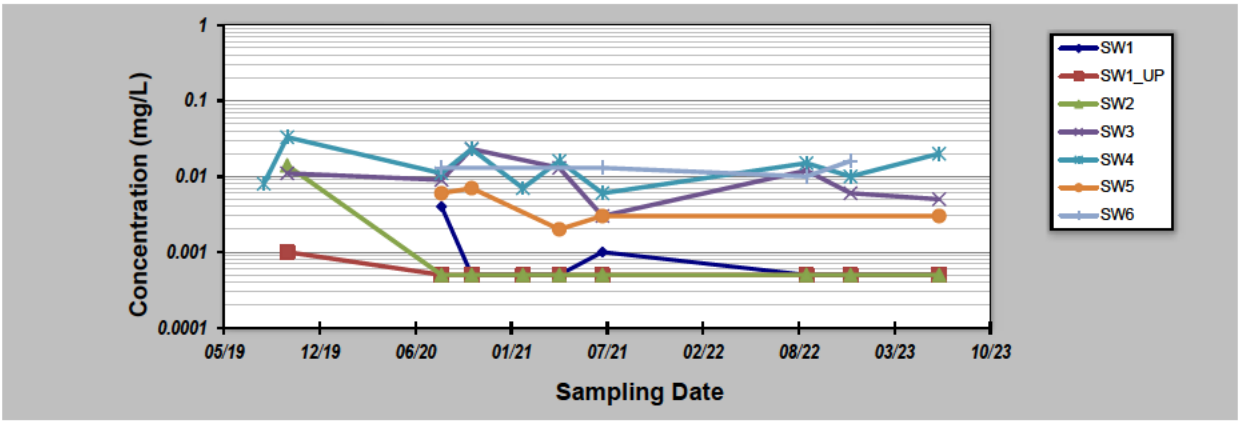
Notes

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.

GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date:	21-Jul-23	Job ID:	318001376-007
Facility Name:	Tarago Surface Water Monitoring	Constituent:	Lead (Dissolved)
Conducted By:	Natalie Gilbert	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								
15								
16								
17								
18								
19								
20								
Coefficient of Variation:		1.22	0.30	2.25	0.61	0.57	0.52	0.19
Mann-Kendall Statistic (S):		-7	-8	-8	-10	-3	-3	1
Confidence Factor:		76.4%	76.2%	76.2%	86.2%	56.9%	67.5%	50.0%
Concentration Trend:		No Trend	Stable	No Trend	Stable	Stable	Stable	No Trend



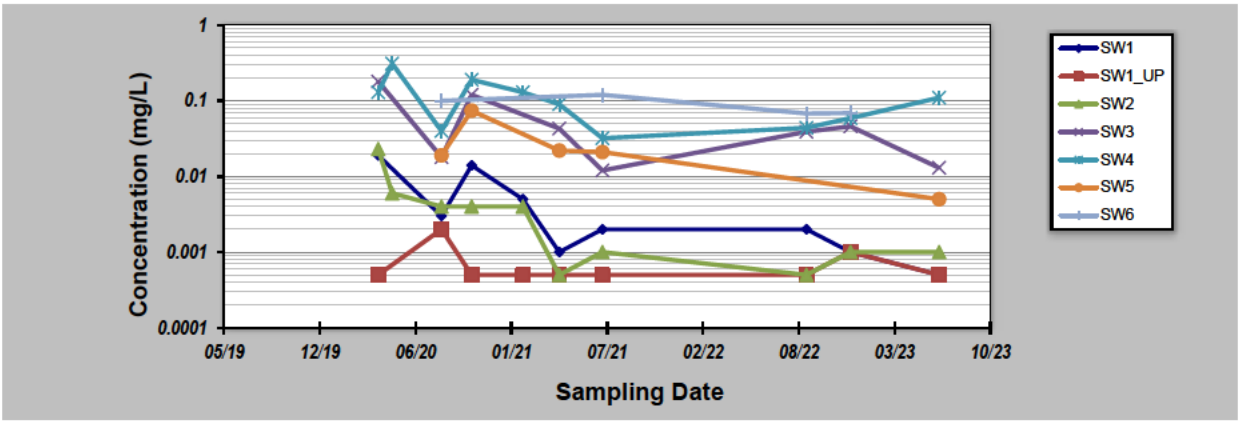
Notes

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.

GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date:	21-Jul-23	Job ID:	318001376-007
Facility Name:	Tarago Surface Water Monitoring	Constituent:	Copper (Total)
Conducted By:	Natalie Gilbert	Concentration Units:	mg/L

Sampling Point ID:	SW1	SW1 UP	SW2	SW3	SW4	SW5	SW6
Sampling Event	Sampling Date	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	0.019	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	0.021	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								
15								
16								
17								
18								
19								
20								
Coefficient of Variation:		1.25	0.70	1.51	1.02	0.75	0.94	0.28
Mann-Kendall Statistic (S):		-26	-1	-28	-10	-14	-4	-2
Confidence Factor:		99.7%	50.0%	99.4%	86.2%	87.3%	75.8%	62.5%
Concentration Trend:		Decreasing	Stable	Decreasing	No Trend	Stable	Stable	Stable



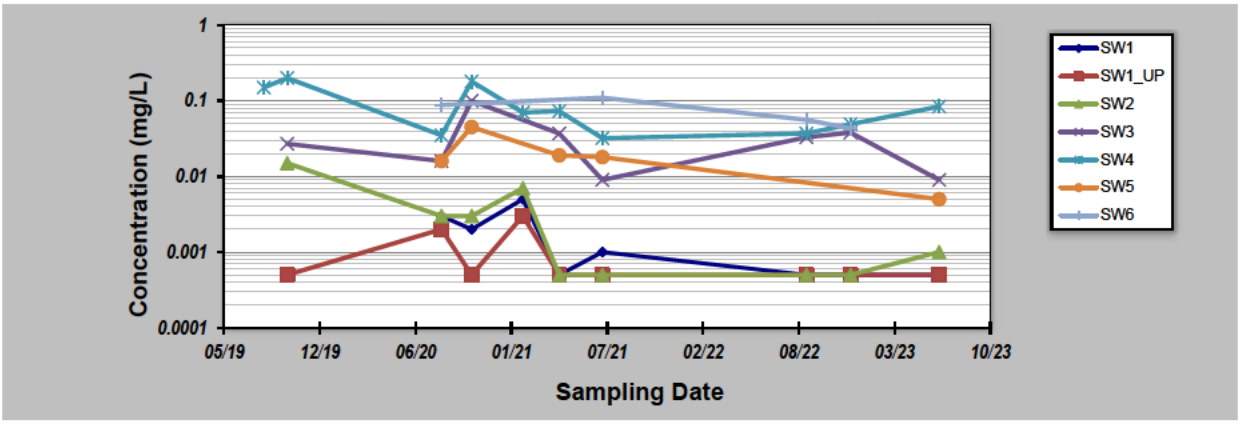
Notes

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.

GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date:	21-Jul-23	Job ID:	318001376-007
Facility Name:	Tarago Surface Water Monitoring	Constituent:	Copper (Dissolved)
Conducted By:	Natalie Gilbert	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								
15								
16								
17								
18								
19								
20								
Coefficient of Variation:		1.01	0.97	1.40	0.87	0.69	0.72	0.41
Mann-Kendall Statistic (S):		-16	-7	-17	-3	-11	-4	-4
Confidence Factor:		96.9%	72.8%	95.1%	59.4%	81.0%	75.8%	83.3%
Concentration Trend:		Decreasing	Stable	Decreasing	Stable	Stable	Stable	Stable



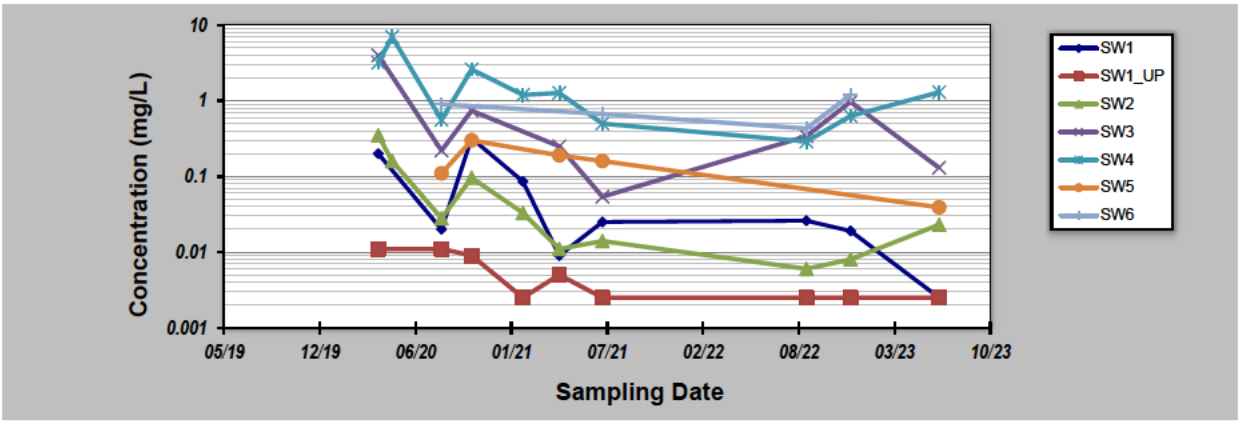
Notes

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.

GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date:	21-Jul-23	Job ID:	318001376-007
Facility Name:	Tarago Surface Water Monitoring	Constituent:	Zinc (Total)
Conducted By:	Natalie Gilbert	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								
15								
16								
17								
18								
19								
20								
Coefficient of Variation:		1.40	0.71	1.50	1.57	1.10	0.61	0.41
Mann-Kendall Statistic (S):		-18	-23	-29	-6	-17	-4	0
Confidence Factor:		96.2%	99.1%	99.5%	72.6%	92.2%	75.8%	37.5%
Concentration Trend:		Decreasing	Decreasing	Decreasing	No Trend	Prob. Decreasing	Stable	Stable



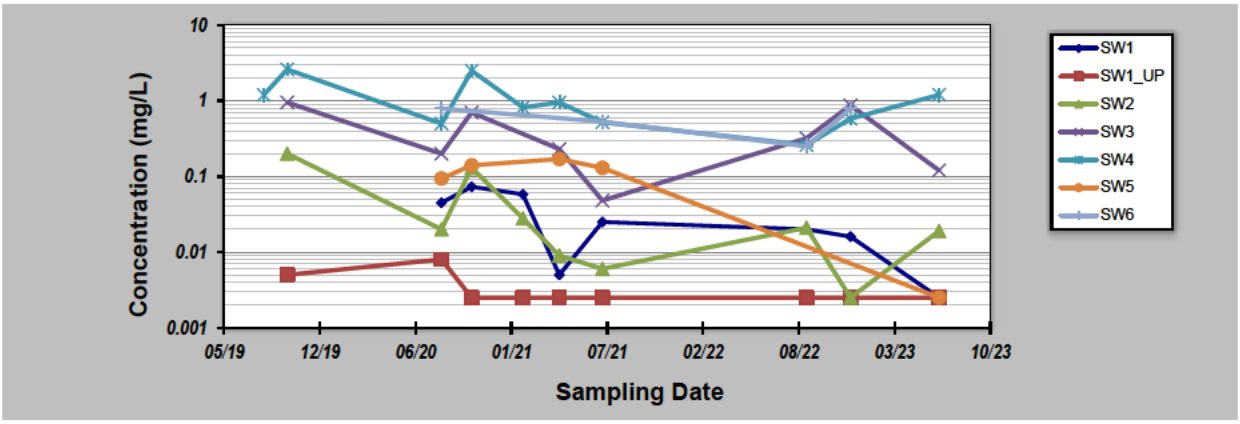
Notes

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.

GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date:	21-Jul-23	Job ID:	318001376-007
Facility Name:	Tarago Surface Water Monitoring	Constituent:	Zinc (Dissolved)
Conducted By:	Natalie Gilbert	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								
15								
16								
17								
18								
19								
20								
Coefficient of Variation:		0.83	0.57	1.42	0.83	0.73	0.60	0.44
Mann-Kendall Statistic (S):		-18	-13	-20	-6	-12	-2	-1
Confidence Factor:		98.4%	89.0%	97.8%	72.6%	83.2%	59.2%	50.0%
Concentration Trend:		Decreasing	Stable	Decreasing	Stable	Stable	Stable	Stable



Notes

1. At least four independent sampling events per well are required for calculating the trend. *Methodology is valid for 4 to 40 samples.*
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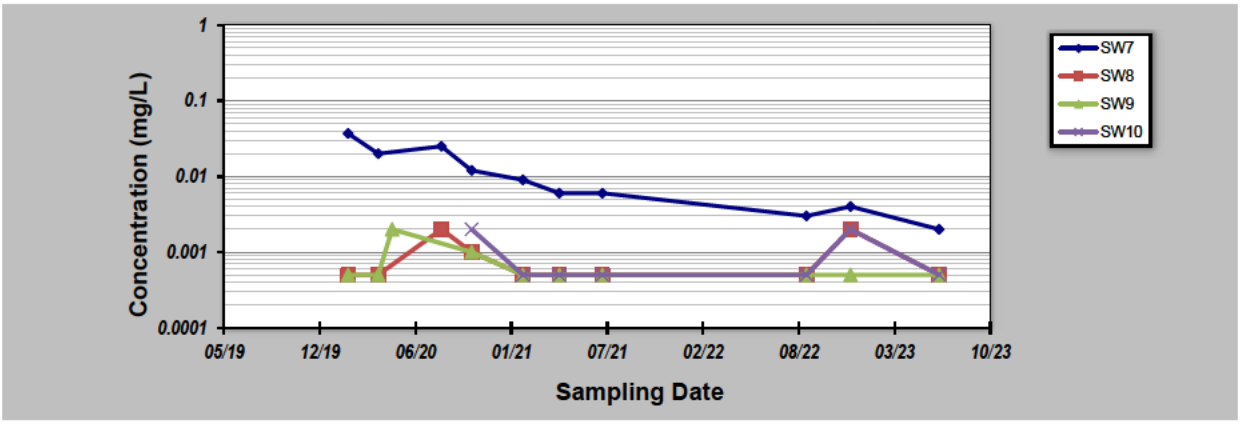
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date:	21-Jul-23	Job ID:	318001376-007
Facility Name:	Tarago Surface Water Monitoring	Constituent:	Lead (Total)
Conducted By:	Natalie Gilbert	Concentration Units:	mg/L

Sampling Point ID:	SW7	SW8	SW9	SW10			
Sampling Event	Sampling Date	LEAD (TOTAL) CONCENTRATION (mg/L)						
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								
15								
16								
17								
18								
19								
20								
Coefficient of Variation:		0.92	0.74	0.69	0.79			
Mann-Kendall Statistic (S):		-40	-1	-9	-2			
Confidence Factor:		>99.9%	50.0%	75.8%	55.7%			
Concentration Trend:		Decreasing	Stable	Stable	Stable			



Notes

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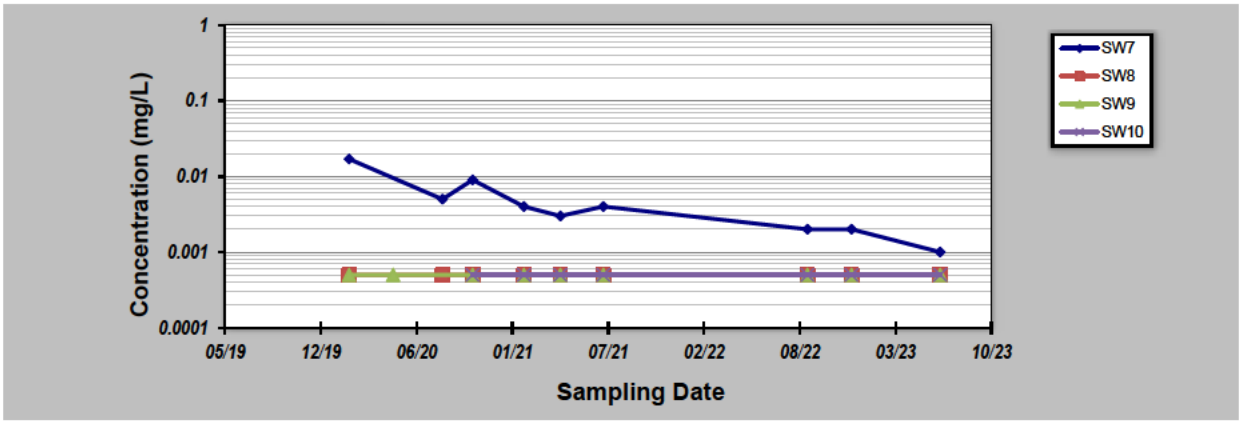
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date:	21-Jul-23	Job ID:	318001376-007
Facility Name:	Tarago Surface Water Monitoring	Constituent:	Lead (Dissolved)
Conducted By:	Natalie Gilbert	Concentration Units:	mg/L

Sampling Point ID:	SW7	SW8	SW9	SW10			
Sampling Event	Sampling Date	LEAD (DISSOLVED) CONCENTRATION (mg/L)						
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								
15								
16								
17								
18								
19								
20								
Coefficient of Variation:		0.96	0.00	0.00	0.00			
Mann-Kendall Statistic (S):		-30	0	0	0			
Confidence Factor:		100.0%	46.0%	46.0%	37.9%			
Concentration Trend:		Decreasing	Stable	Stable	Stable			



Notes

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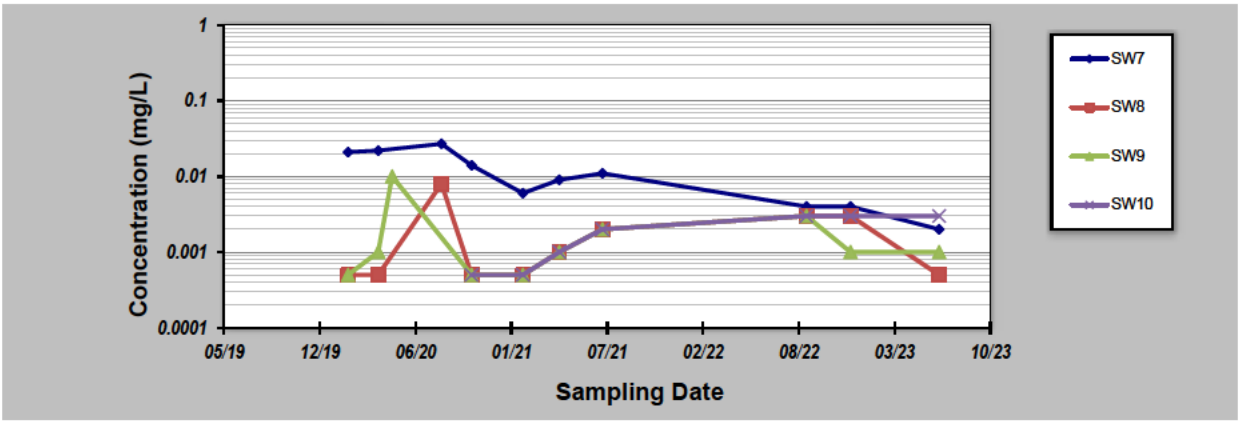
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date:	21-Jul-23	Job ID:	318001376-007
Facility Name:	Tarago Surface Water Monitoring	Constituent:	Copper (Total)
Conducted By:	Natalie Gilbert	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								
15								
16								
17								
18								
19								
20								
Coefficient of Variation:		0.73	1.21	1.41	0.64			
Mann-Kendall Statistic (S):		-32	12	10	17			
Confidence Factor:		99.9%	83.2%	78.4%	99.5%			
Concentration Trend:		Decreasing	No Trend	No Trend	Increasing			



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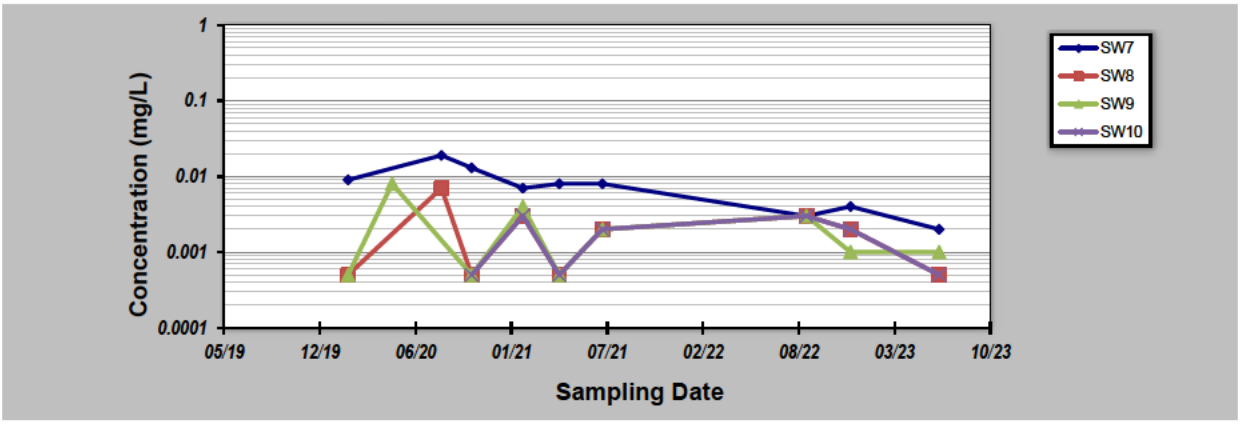
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date:	21-Jul-23	Job ID:	318001376-007
Facility Name:	Tarago Surface Water Monitoring	Constituent:	Copper (Dissolved)
Conducted By:	Natalie Gilbert	Concentration Units:	mg/L

Sampling Point ID:	SW7	SW8	SW9	SW10			
Sampling Event	Sampling Date	COPPER (DISSOLVED) CONCENTRATION (mg/L)						
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								
15								
16								
17								
18								
19								
20								
Coefficient of Variation:		0.65	1.00	1.09	0.70			
Mann-Kendall Statistic (S):		-25	-2	0	0			
Confidence Factor:		99.6%	54.0%	46.0%	37.9%			
Concentration Trend:		Decreasing	No Trend	No Trend	Stable			



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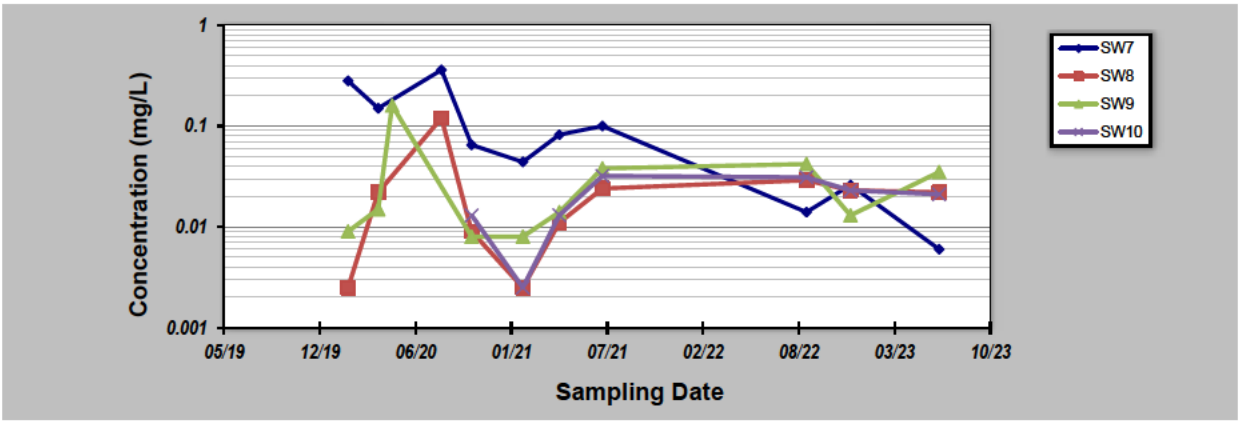
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date:	21-Jul-23	Job ID:	318001376-007
Facility Name:	Tarago Surface Water Monitoring	Constituent:	Zinc (Total)
Conducted By:	Natalie Gilbert	Concentration Units:	mg/L

Sampling Point ID:	SW7	SW8	SW9	SW10			
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								
15								
16								
17								
18								
19								
20								
Coefficient of Variation:		1.06	1.29	1.35	0.55			
Mann-Kendall Statistic (S):		-29	11	8	6			
Confidence Factor:		99.5%	81.0%	72.9%	76.4%			
Concentration Trend:		Decreasing	No Trend	No Trend	No Trend			



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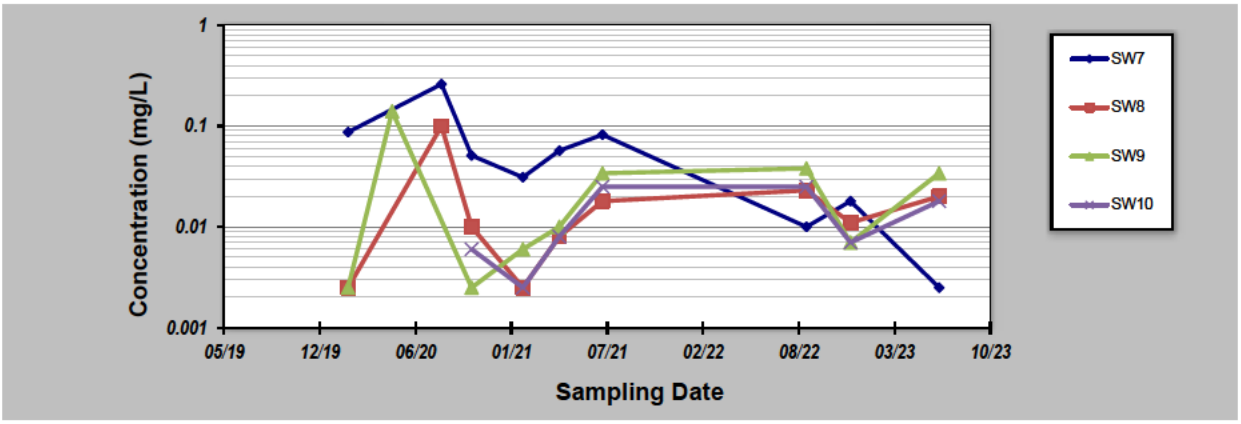
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date:	21-Jul-23	Job ID:	318001376-007
Facility Name:	Tarago Surface Water Monitoring	Constituent:	Zinc (Dissolved)
Conducted By:	Natalie Gilbert	Concentration Units:	mg/L

Sampling Point ID:	SW7	SW8	SW9	SW10			
Sampling Event	Sampling Date	ZINC (DISSOLVED) CONCENTRATION (mg/L)						
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								
15								
16								
17								
18								
19								
20								
Coefficient of Variation:		1.18	1.40	1.43	0.72			
Mann-Kendall Statistic (S):		-22	11	12	8			
Confidence Factor:		98.8%	84.6%	87.0%	84.5%			
Concentration Trend:		Decreasing	No Trend	No Trend	No Trend			



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