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TARAGO, NSW
DECEMBER 2022 SURFACE WATER MONITORING REPORT

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DECEMBER 2022 SURFACE WATER MONITORING REPORT

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Project name	**Tarago Surface Water Monitoring**
Project no.	**318001376-T3**
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	27/01/2023	J Kirsch	S Maxwell CEnvP (SC) 41184	F Robinson
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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	Chain of Custody
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 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.
- 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.

RAMBOLL AUSTRALIA - GIS MAP file - 318000780_GIS_P018_T22_RAPs_02_RAP_RailCorridor | F003_SurfaceWaterSamples_V01 | 13/04/2021

A4
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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

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 December 2022 surface water monitoring event is provided in **Table 4-1**.

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 between 12 and 13 December 2022.	x	x			
Reference to sampling plan/method, including any deviations from SAQP	Sampling was undertaken in general accordance with the SAQP. SW5 could not be sampled as the location was dry.	x				
Any information that could be required to evaluate measurement uncertainty for subsequent testing (analysis)	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. Include any diagrams, maps, photos.	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.		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) (where applicable)	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: • Total and dissolved iron • Total and dissolved manganese				x	x

Assessment of DQIs (as per NSW EPA, 2020)	Ramboll's Assessment	Completeness	Comparability	Representativeness	Precision	Accuracy
	• Total and dissolved zinc The exceedances in the RPD criteria are considered to be 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 (ensure unique ID for subsequent samples provided)	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 (when used)	The water quality meter was hired from a rental company who calibrated the equipment prior to hire. The calibration certificate is included in **Appendix 2**.				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 (COC) forms are provided in **Appendix 4.**	x	x			
Record of holding times and a comparison with method specifications	Review of the COC 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 4**.	x	x			
Laboratory accreditation for analytical methods used, also noting any methods used which are not covered by accreditation	Eurofins MGT was used as the primary laboratory and ALS was used as the secondary laboratory. The laboratory certificates are NATA stamped.	x			x	
Laboratory performance for the analytical method using inter-laboratory duplicates	Analytical methods were comparable between laboratories.		x			x
Surrogates and spikes used throughout the full method process, or only in parts. Results are corrected for the recovery	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 (tabulate)	Laboratory spike and surrogate recoveries are detailed in the laboratory certificates provided in **Appendix 4.**		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	x	x			

Assessment of DQIs (as per NSW EPA, 2020)	Ramboll's Assessment	Completeness	Comparability	Representativeness	Precision	Accuracy
	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.					
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 (tabulate)	Laboratory quality control samples including duplicates, surrogate spikes and blanks were undertaken by the laboratories at appropriate frequencies.	x				x
Laboratory results (tabulate)	The results for laboratory duplicates were acceptable and no detections were made in blank samples.	x				x

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.

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. 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, lead, nickel and zinc.

To define appropriate hardness correction factors, water was conservatively presumed to be moderately hard based on the Goulburn Mulwaree Regional State of the Environment Report 2004-2009 (Goulburn Mulwaree Council, 2009). Hardness correction factors were adopted from Table 3.4.4 of the *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZECC, 2000) to refine Tier 1 criteria as described in **Table 5-1** below.

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

	Original guideline value (mg/L)	Hardness Correction Factor	Corrected guideline value (mg/L)
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

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 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. RESULTS

6.1.1 Monitoring Events

A total of 11 monitoring events have been completed between August 2019 and December 2022. 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
>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
Average Monthly Rainfall (mm)		42.9	44	49	40.4*	42.9	44	63.9	25.9	32.6	44.1	56.4
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

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

6.1.2 Physico-Chemical Results

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

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

Sample ID	Records		Temp.	SPC	pH	DO	ORP	TDS	Comments
			°C	µS/cm	pH units	mg/L	mV	mg/L	
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	733	7.77	11	175.8	434	
		Average	11.7	581.3	7.4	5.6	122.8	335.7	
SW1-UP	8	Minimum	8	205.6	7.05	0.1	-41.4	133.3	Dry January 2020. Parameters not recorded September 2019.
		Maximum	19.94	704	7.8	10.86	186.9	431	
		Average	12.8	575.5	7.5	5.7	121.1	337.0	
SW2	9	Minimum	7.3	213.3	6.54	0.12	48.3	137.8	Dry January 2020. Parameters not recorded September 2019.
		Maximum	17.54	677	8.27	10.59	185.9	416	
		Average	11.7	550.9	7.8	5.7	139.5	320.9	
SW3	7	Minimum	8.54	142.5	6	4.7	64.8	92.3	Dry January 2020 and January 2021. Parameters not recorded September 2019.
		Maximum	21.75	245	7.96	9.43	196.1	159	
		Average	11.9	209.6	6.9	6.5	156.6	130.1	
SW4	10	Minimum	7.4	128.2	5.75	1.12	70	99.45	Dry January 2020. Parameters not recorded September 2019.
		Maximum	20.33	388.3	8.8	10.42	263.1	251.8	
		Average	12.1	227.4	7.3	6.0	173.8	167.1	
SW5	4	Minimum	8.71	117.9	6.45	4.06	-3	76.7	Dry January, April 2020, and January 2021, September 2022 and December 2022.
		Maximum	11.95	251.2	8.35	9.33	191	121	
		Average	10.9	187.0	7.2	7.5	106.5	98.9	
SW6	4	Minimum	8.3	168.3	6.53	4.5	111	109.2	Dry January, April, October 2020, and January, April 2021.
		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	9	Minimum	7.38	94.7	6.34	1.8	56	61.8	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	15.5	445.5	7.3	5.6	110.7	155.4	
Offsite									
SW8	9	Minimum	8.4	170.5	7.0	3.1	84.0	107.9	---
		Maximum	23.6	1007.0	8.5	9.3	136.1	656.5	
		Average	15.7	699.6	7.5	6.3	117.5	415.8	
SW9	9	Minimum	7.7	125.3	7.2	0.3	83.0	115.7	---
		Maximum	25.0	1030.0	8.4	16.8	227.7	812.5	
		Average	15.6	610.3	7.7	8.5	138.4	452.6	
SW10	6	Minimum	7.9	682.0	7.2	3.6	3.8	454.4	---
		Maximum	20.3	978.0	7.6	8.2	148.7	564.0	
		Average	14.1	779.7	7.4	5.7	94.7	491.5	

6.1.3 Analytical Results

A summary of the surface water analytical results for monitoring events from August 2019 to December 2022 is presented in **Table 6-3** and **Table 6-4** for on and near site and the Mulwaree River sampling locations, respectively. The corresponding results tables are presented in **Tables 2** through **12** of **Appendix 3**.

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

Analyte	No. of Samples	No. of Detects	Minimum	Maximum	Average	No. above site-specific criteria		No above Tier 1 criteria			
						Human Health	Ecology	ANZECC (2000) Fresh Water Guidelines		Health-based Screening Criteria (Recreational Waters)	Eco Screening Criteria (ANZG 95% Protection) Fresh Water
								Irrigation[1]	Stock Water[1]		
Total Metals											
Aluminium	57	40	0.06	11	0.934	-	-	-	-	**3**	-
Arsenic	58	32	0.001	0.016	0.003	0	-	-	-	0	-
Barium	57	57	0.03	0.36	0.075	-	-	-	-	0	-
Beryllium	58	0	-	-	-	-	-	-	-	0	-
Cadmium	58	35	0.0003	0.04	0.005	0	-	-	-	**2**	-
Chromium	57	32	0.001	0.011	0.002	-	-	-	-	0	-
Cobalt	58	23	0.001	0.014	0.004	-	-	-	-	-	-
Copper	58	50	0.001	0.31	0.044	-	-	-	-	0	-
Iron	57	56	0.06	8.9	1.483	-	-	-	-	**9**	-
Lead	63	50	0.001	0.17	0.024	0	-	-	-	**2**	-
Manganese	58	58	0.009	1.1	0.173	0	-	-	-	0	-
Mercury	58	4	0.0001	0.0001	0.000	-	-	-	-	0	-
Nickel	58	43	0.001	0.451	0.021	0	-	-	-	1	-
Zinc	58	54	0.005	7	0.562	-	-	-	-	0	-
Dissolved Metals											
Aluminium	55	33	0.05	3.6	0.688	-	-	0	0	-	**32**
Arsenic	56	30	0.001	0.011	0.002	-	0	0	0	-	0
Barium	55	55	0.03	0.12	0.061	-	-	-	-	-	-
Beryllium	56	0	-	-	-	-	-	0	-	-	0
Cadmium	56	31	0.0002	0.018	0.003	-	**2**	0	0	-	**29**
Chromium	55	16	0.001	0.003	0.002	-	-	0	0	-	**6**
Cobalt	56	15	0.001	0.005	0.002	-	-	0	0	-	**8**
Copper	56	42	0.001	0.2	0.038	-	0	0	0	-	**41**
Iron	55	41	0.06	2.6	0.845	-	-	-	-	-	**31**
Lead	56	36	0.001	0.033	0.010	-	0	0	0	-	**28**
Manganese	56	55	0.005	1	0.093	-	-	0	-	-	0
Mercury	56	0	-	-	-	-	-	0	0	-	0
Nickel	56	35	0.001	0.421	0.019	-	0	0	0	-	**8**
Zinc	56	48	0.005	2.6	0.363	-	0	0	0	-	**38**

[1] *Applicable to SW7 only*

Table 6-4: Summary of Mulwaree River Surface Water Analytical Results (SW8, SW9, SW10)

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	23	8	0.05	0.72	0.279	0	-	-	-
Arsenic	24	7	0.001	0.001	0.001	0	-	-	-
Barium	23	22	0.02	0.12	0.076	0	-	-	-
Beryllium	24	0	-	-	-	0	-	-	-
Cadmium	24	2	0.0003	0.0004	0.000	0	-	-	-
Chromium	23	4	0.001	0.002	0.002	0	-	-	-
Cobalt	24	3	0.001	0.003	0.002	-	-	-	-
Copper	24	15	0.001	0.01	0.003	0	-	-	-
Iron	23	22	0.15	3.2	0.614	**1**	-	-	-
Lead	24	7	0.001	0.002	0.002	0	-	-	-
Manganese	24	24	0.03	1.9	0.255	0	-	-	-
Mercury	24	0	-	-	-	0	-	-	-
Nickel	24	22	0.001	0.002	0.002	0	-	-	-
Zinc	24	21	0.008	0.16	0.031	0	-	-	-
Dissolved Metals									
Aluminium	21	2	0.35	0.41	0.380	-	**2**	0	0
Arsenic	22	3	0.002	0.003	0.003	-	0	0	0
Barium	21	20	0.02	0.12	0.073	-	-	-	-
Beryllium	22	0	-	-	-	-	0	0	-
Cadmium	22	2	0.0002	0.0004	0.000	-	**1**	0	0
Chromium	21	1	0.001	0.001	0.001	-	0	0	0
Cobalt	22	1	0.001	0.001	0.001	-	0	0	0
Copper	22	14	0.001	0.008	0.003	-	**13**	0	0
Iron	21	18	0.07	0.8	0.231	-	**3**	-	-
Lead	22	0	-	-	-	-	0	0	0
Manganese	22	22	0.012	0.85	0.149	-	0	0	-
Mercury	22	0	-	-	-	-	0	0	0
Nickel	22	17	0.001	0.002	0.001	-	0	0	0
Zinc	22	17	0.006	0.14	0.028	-	**7**	0	0

NA = not applicable

6.1.4 Analytical Results Trends

The following time series charts present total and dissolved concentrations of lead, copper and zinc for the 11 monitoring events completed between August 2019 and December 2022. Dailly rainfall is presented for the same period.

6.1.4.1 Lead

Concentration Trends On and Near Site

Figure 6-1 presents total lead concentrations reported in surface water samples (SW1-UP, SW1 through to SW7) collected upstream and downstream of three onsite rail culverts. All surface water samples collected on and near the site to date have reported total lead concentrations 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. Therefore, the criterion has not been plotted on the y-axis of the graph in order to allow visual assessment of the low concentration trends. Increases in total lead concentrations were reported at SW2, SW4, SW6 and SW7 (maximum increase of 0.03 mg/L at SW6) when compared to the previous monitoring event (September 2022).

Figure 6-2 presents dissolved lead concentrations reported for the samples mentioned above. Data is presented relative to the EnRiskS (2021) site-specific ecological criterion for lead (0.1 mg/L). All samples to date have reported dissolved lead concentrations below the criterion. Similar to total lead, an increase in concentration was reported at SW6 when compared to the previous monitoring event (September 2022).

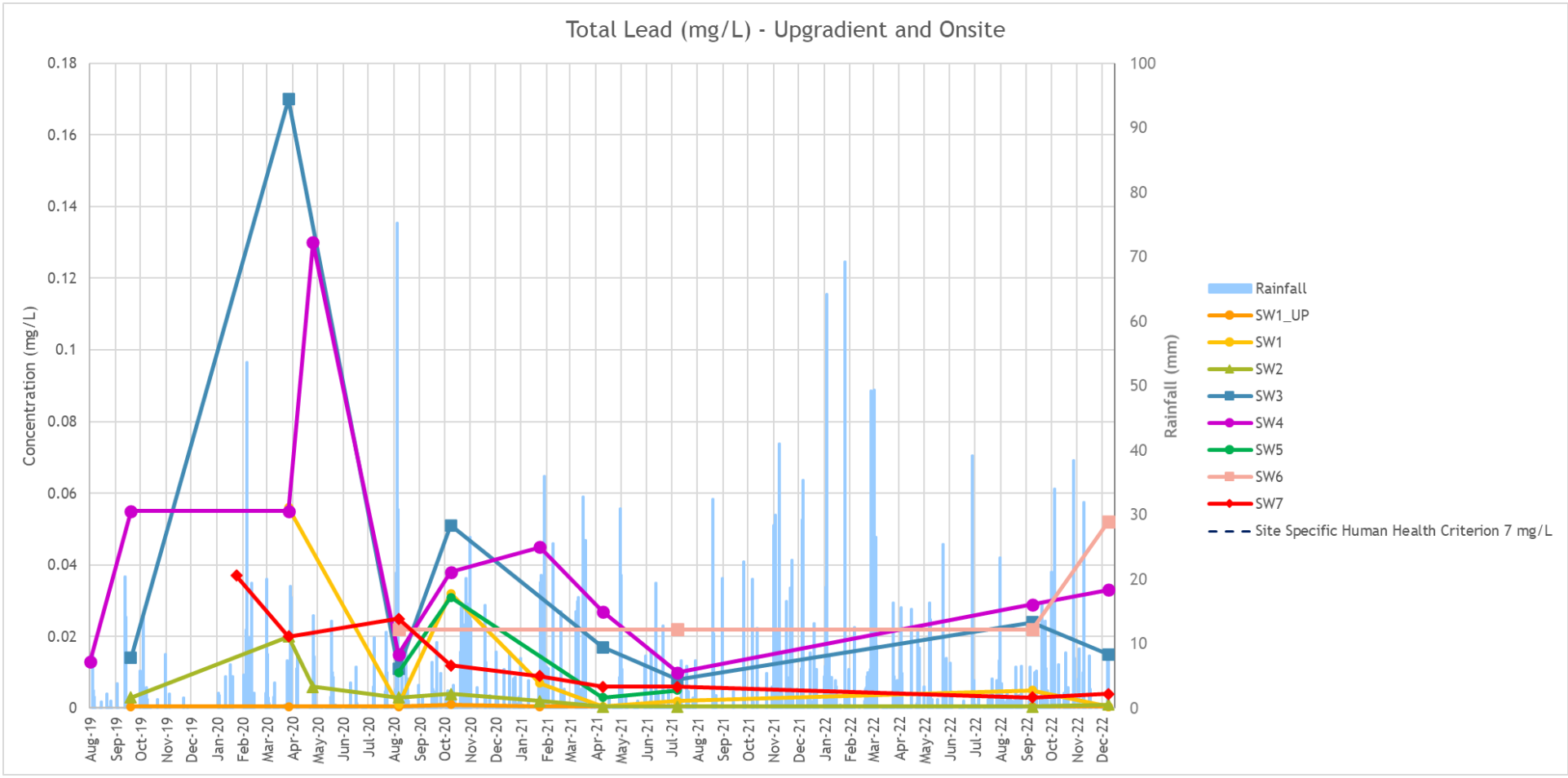

Figure 6-1: Upgradient and Onsite Total Lead Concentration Trend

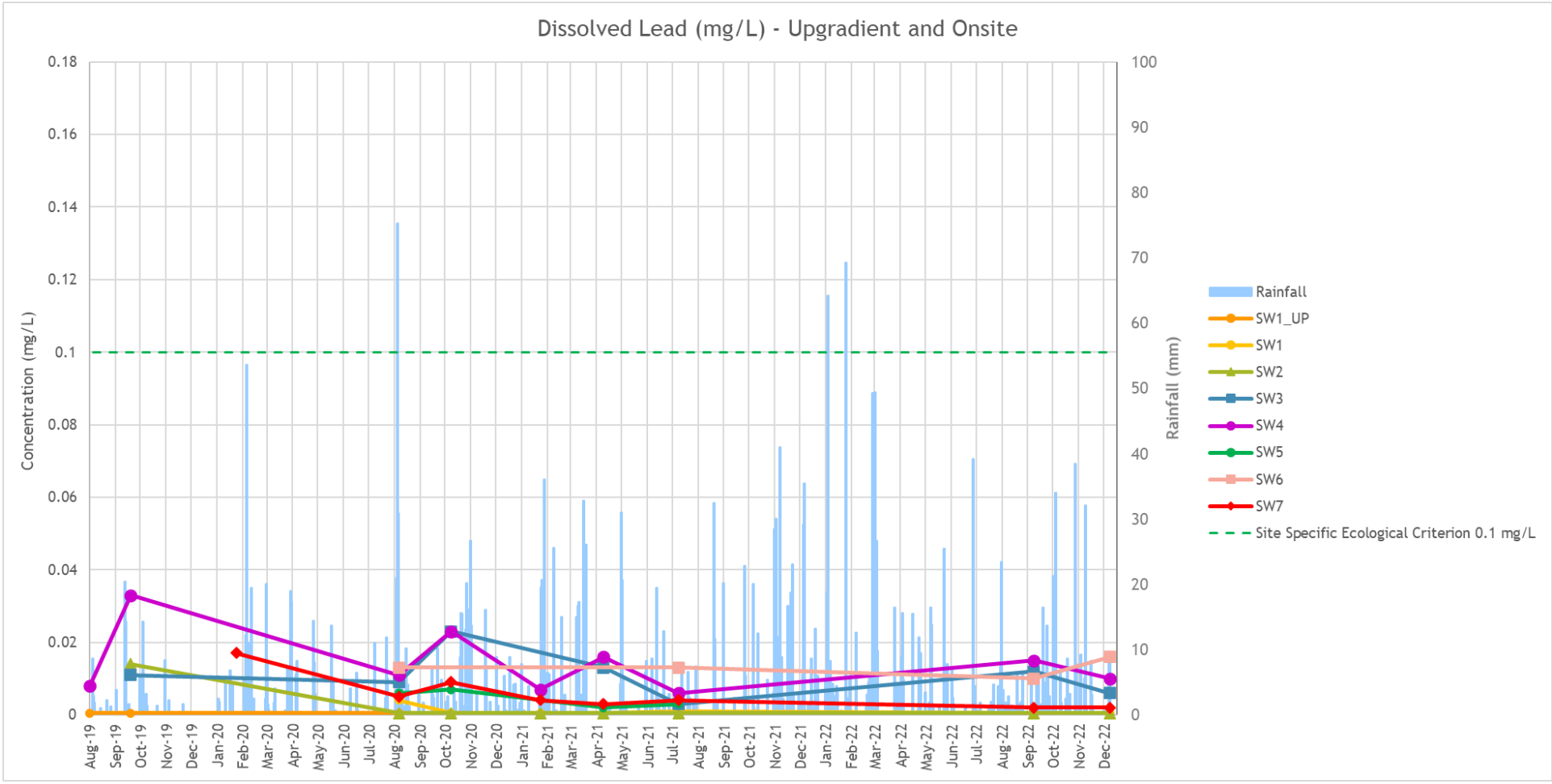

Figure 6-2: Upgradient and Onsite Dissolved Lead Concentration Trend

Concentration Trends 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.

For the assessment of ecological risk, dissolved lead concentrations in samples collected from the Mulwaree River have been plotted relative to the adopted criterion for 95% protection of species protection in freshwater aquatic ecosystems (0.0034 mg/L) and irrigation (0.1 mg/L) and presented in **Figure 6-4**. 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.

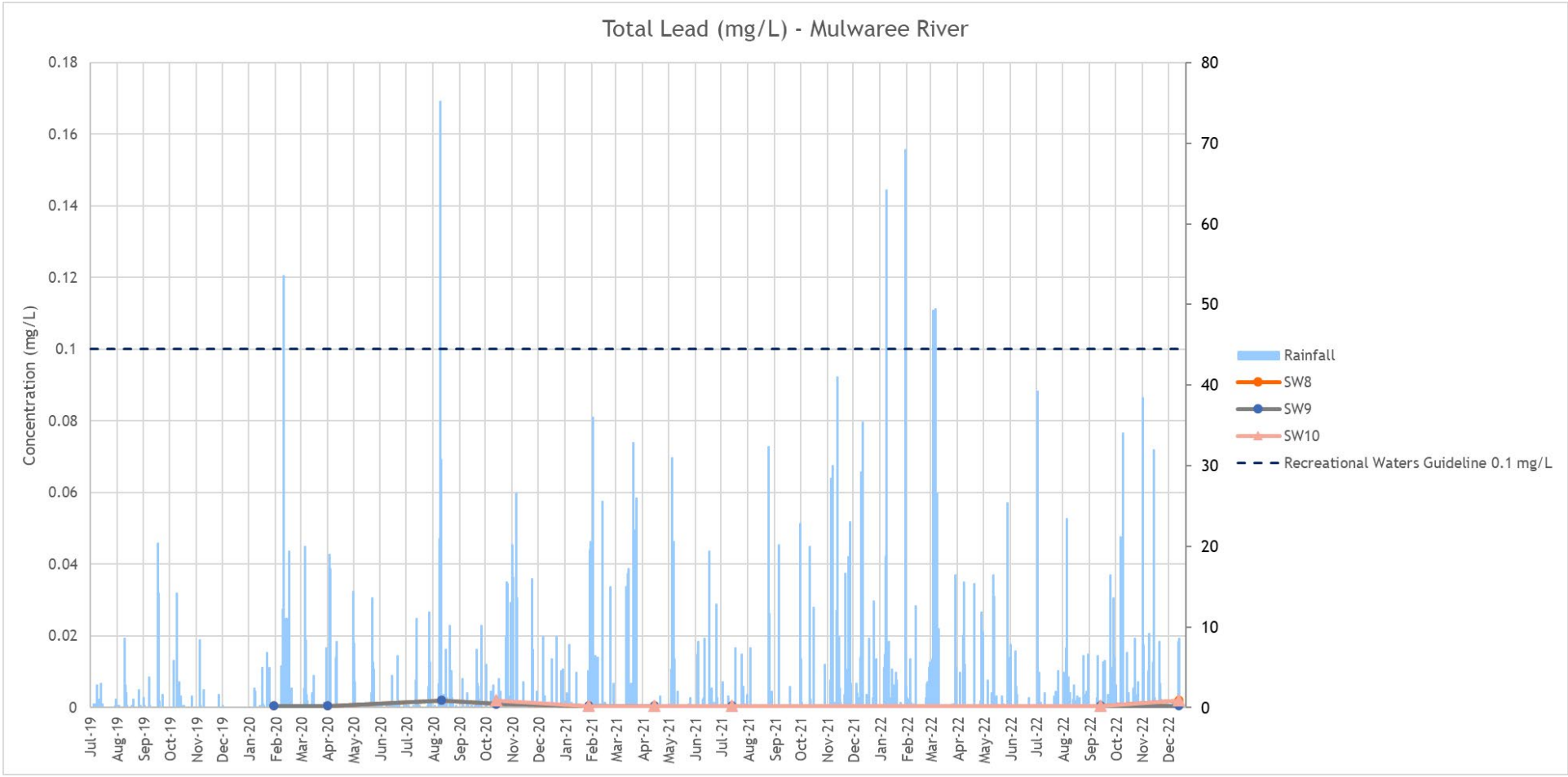

Figure 6-3: Mulwaree River (Offsite) Total Lead Concentration Trend

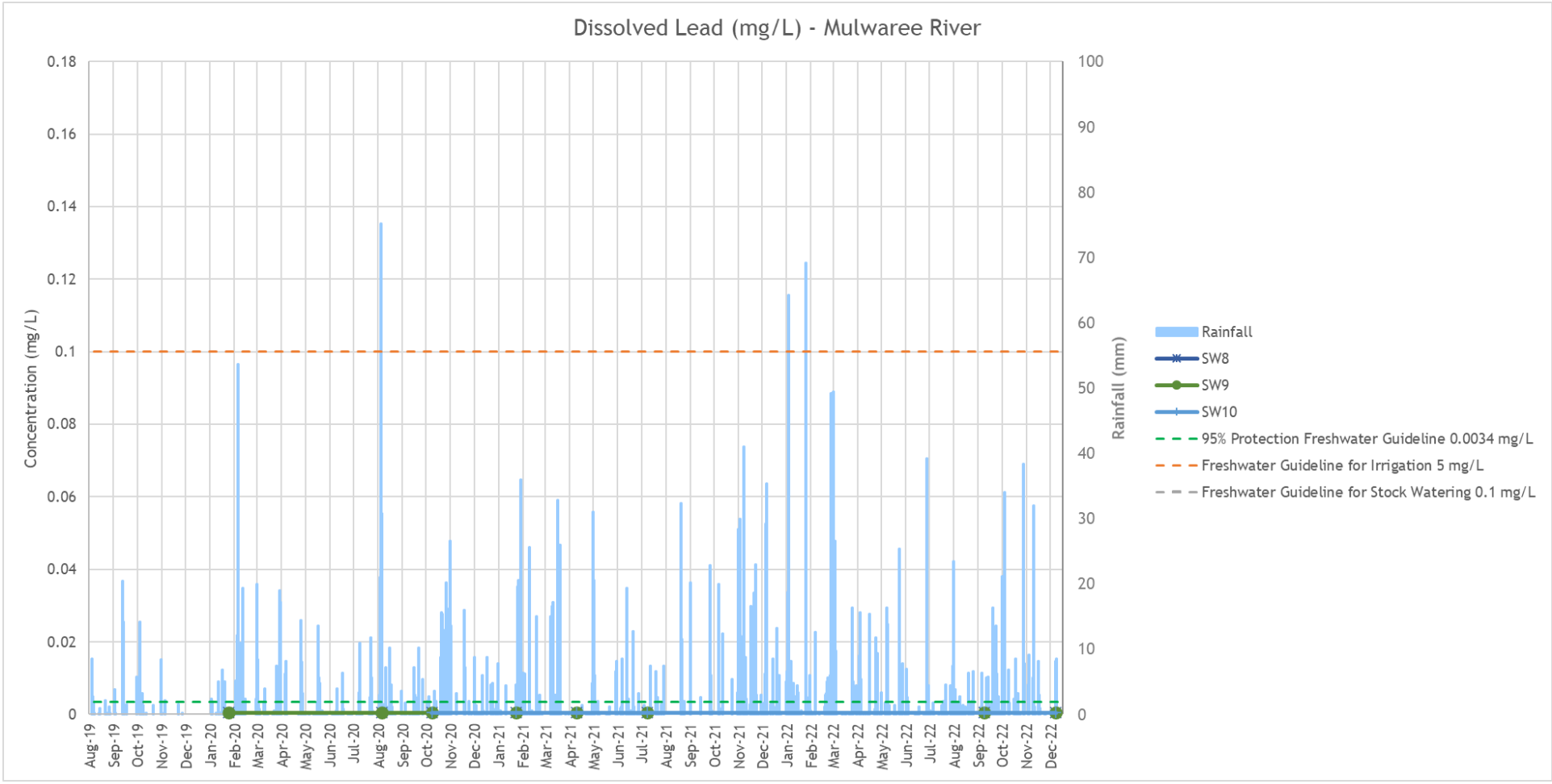

Figure 6-4: Mulwaree River Offsite Dissolved Lead Concentration Trend

6.1.4.2 Copper

Concentration Trends On and Near Site

Figure 6-5 presents total copper concentrations in surface water samples (SW1-UP, SW1 through to SW7) collected upstream and downstream of three onsite rail culverts. Maximum total copper concentrations recorded to date are more than 60-times lower than the adopted human health criterion for recreational waters (20 mg/L). Therefore, the criterion has not been plotted on the y-axis of the graph in order to allow visual assessment of the low concentration trends. All surface water samples collected on and near the Site to date have reported total copper concentrations below the human health recreational criterion. Increases in total copper concentrations were reported at SW1-UP, SW2, SW3, SW4 and SW6 when compared to the previous monitoring event (September 2022) however, the increase was minor (maximum increase of 0.015 mg/L at SW4).

Figure 6-6 presents dissolved copper concentrations reported for the samples mentioned above. The site-specific ecological criterion of 0.5 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 on and near the site to date have reported dissolved copper concentrations below the site-specific ecological criterion.

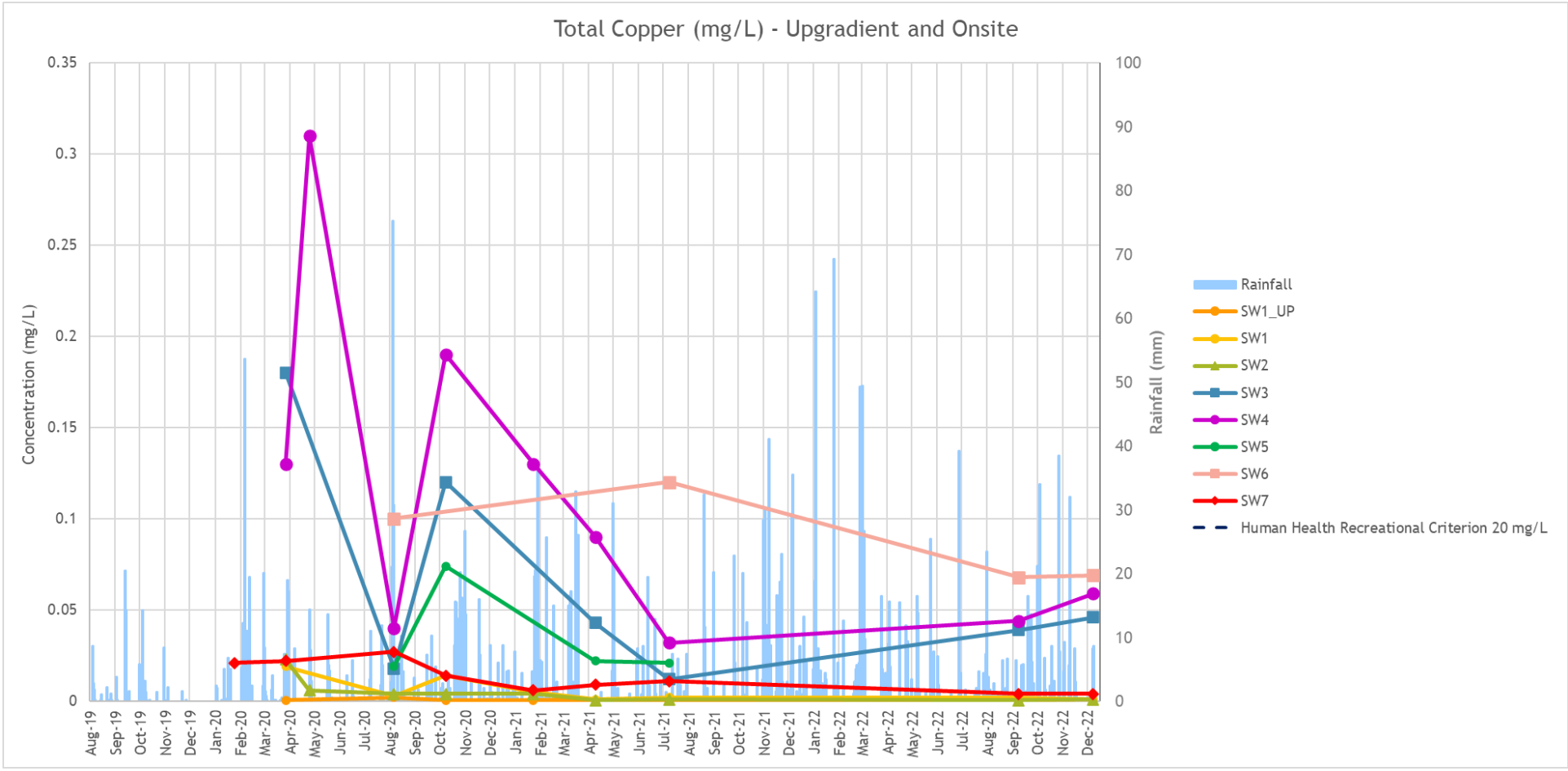

Figure 6-5: Upgradient and Onsite Total Copper Concentration Trend

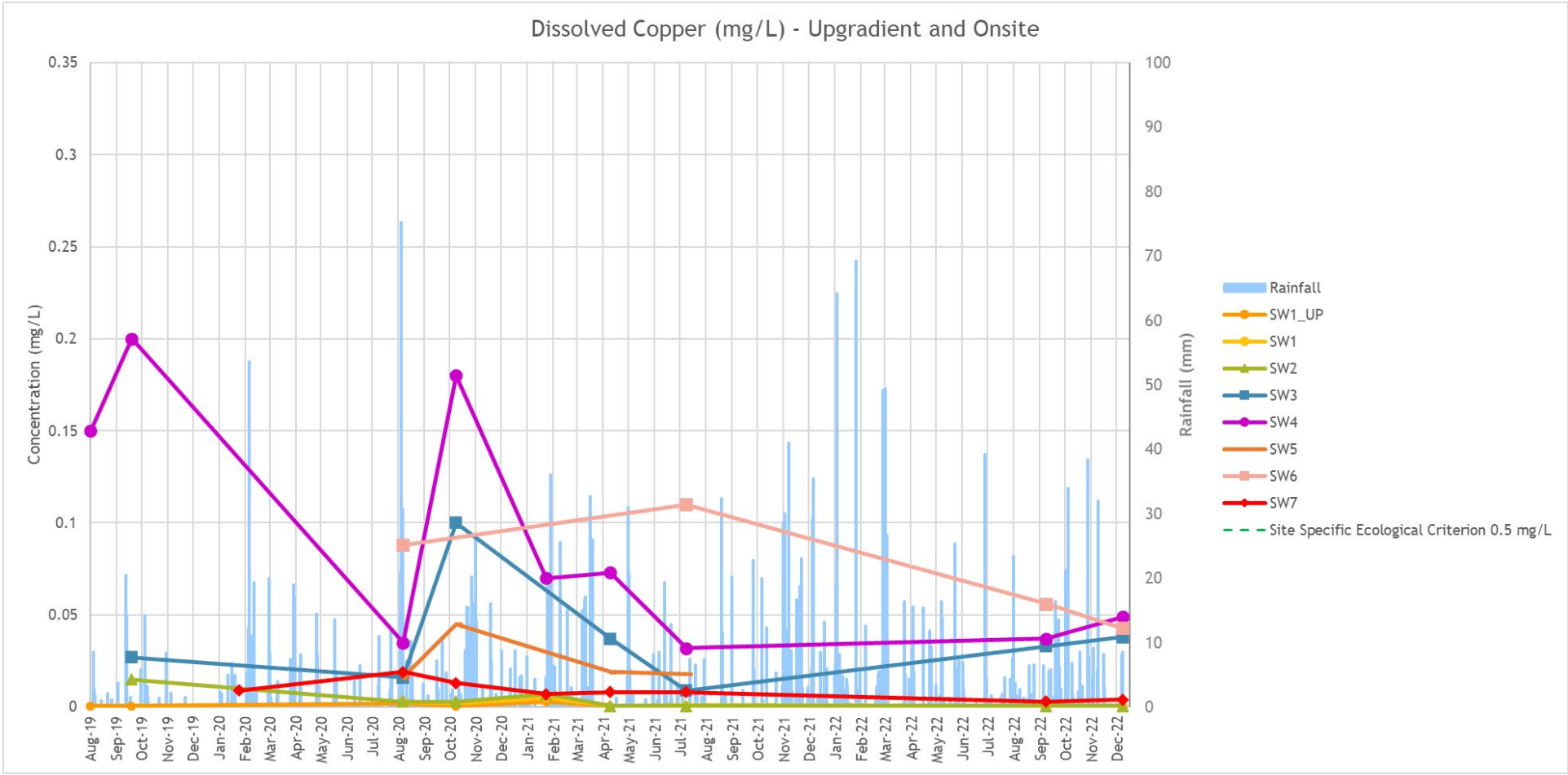

Figure 6-6: Upgradient and Onsite Dissolved Copper Concentration Trend

Concentration Trends Offsite

Figure 6-7 and **Figure 6-8** present total and dissolved copper concentrations reported in surface water samples (SW8, SW9, SW10) collected from the Mulwaree River located offsite. Both graphs have been presented on a smaller scale (maximum y-axis value of 0.02 mg/L) when compared to upgradient and onsite locations (presented in **Figure 6-5** and **Figure 6-6**) to allow visual assessment of the low concentration trends.

As presented in **Figure 6-7**, all samples collected from the Mulwaree River to date have reported total copper concentrations below the human health recreational criterion of 20 mg/L. Similar concentrations have historically been reported at SW8, SW9 and SW10. During the most recent monitoring event (December 2022), SW8 and SW10 (downstream of the Site) reported marginally higher total copper concentrations (0.002 mg/L higher) than SW9 (upstream of the Site). Concentrations across the three offsite locations are generally identical, which indicates that total copper concentrations in the Mulwaree River are likely to be influenced by sources other than the Site and represent background conditions in the receiving waters.

Concentrations of dissolved copper in samples collected from the Mulwaree River relative to the adopted ecological assessment criterion (0.0014 mg/L) for 95% protection of freshwater species (ANZG, 2018) is presented in **Figure 6-8**. The freshwater guideline for irrigation (5 mg/L) and stock watering (0.4 mg/L) have not been plotted on the y-axis of the graph in order to allow visual assessment of the low concentration trends. Dissolved copper concentrations in all samples correlate closely and have reported variable concentrations above and below the criterion for 95% protection of freshwater species since monitoring began in January 2020. Dissolved copper concentrations in the Mulwaree River appear representative of background and not representative of impacts from the Site. Samples do not exceed the less sensitive guidelines for irrigation and stock water.

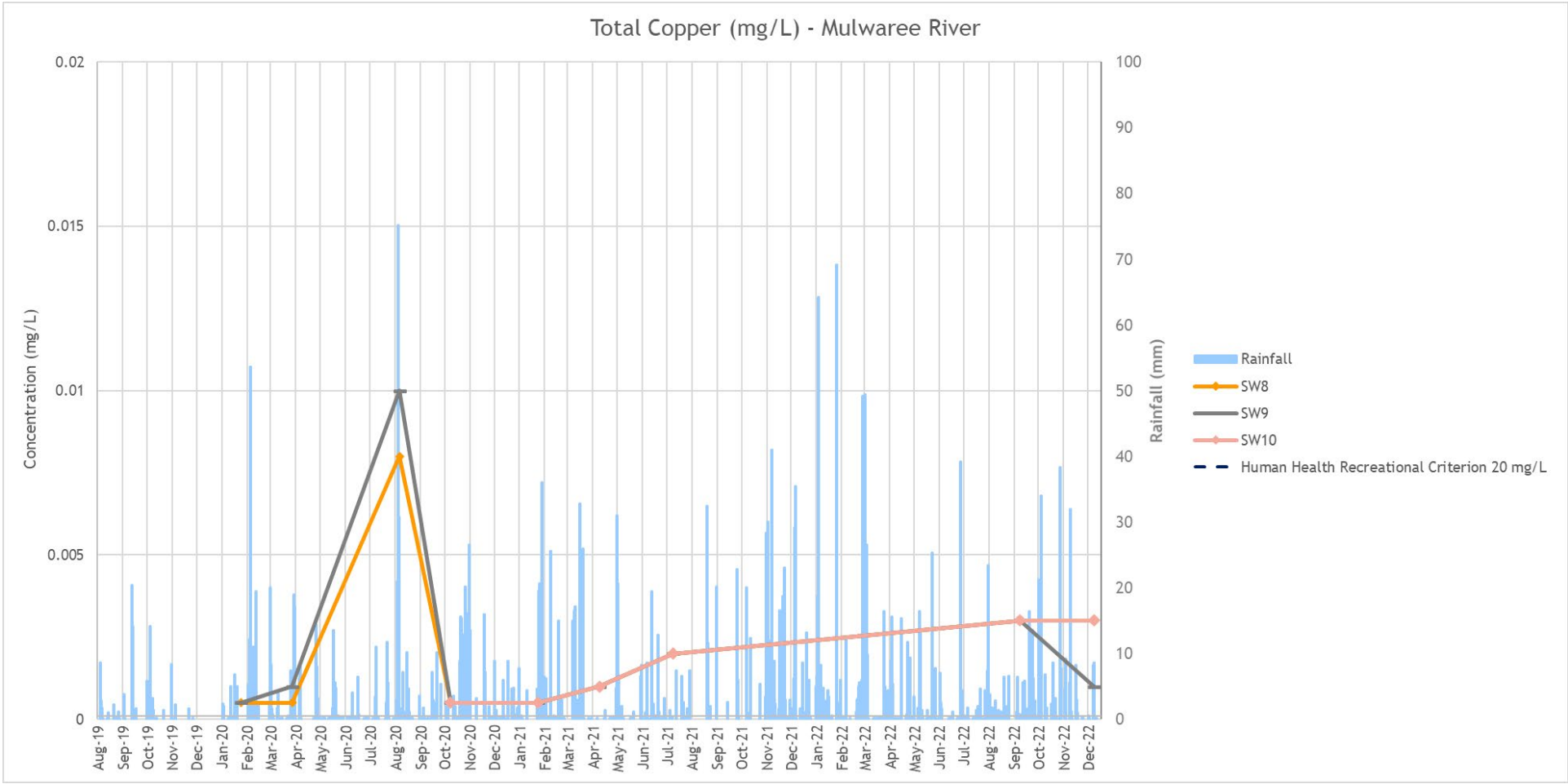

Figure 6-7: Mulwaree River (Offsite) Total Copper Concentration Trend

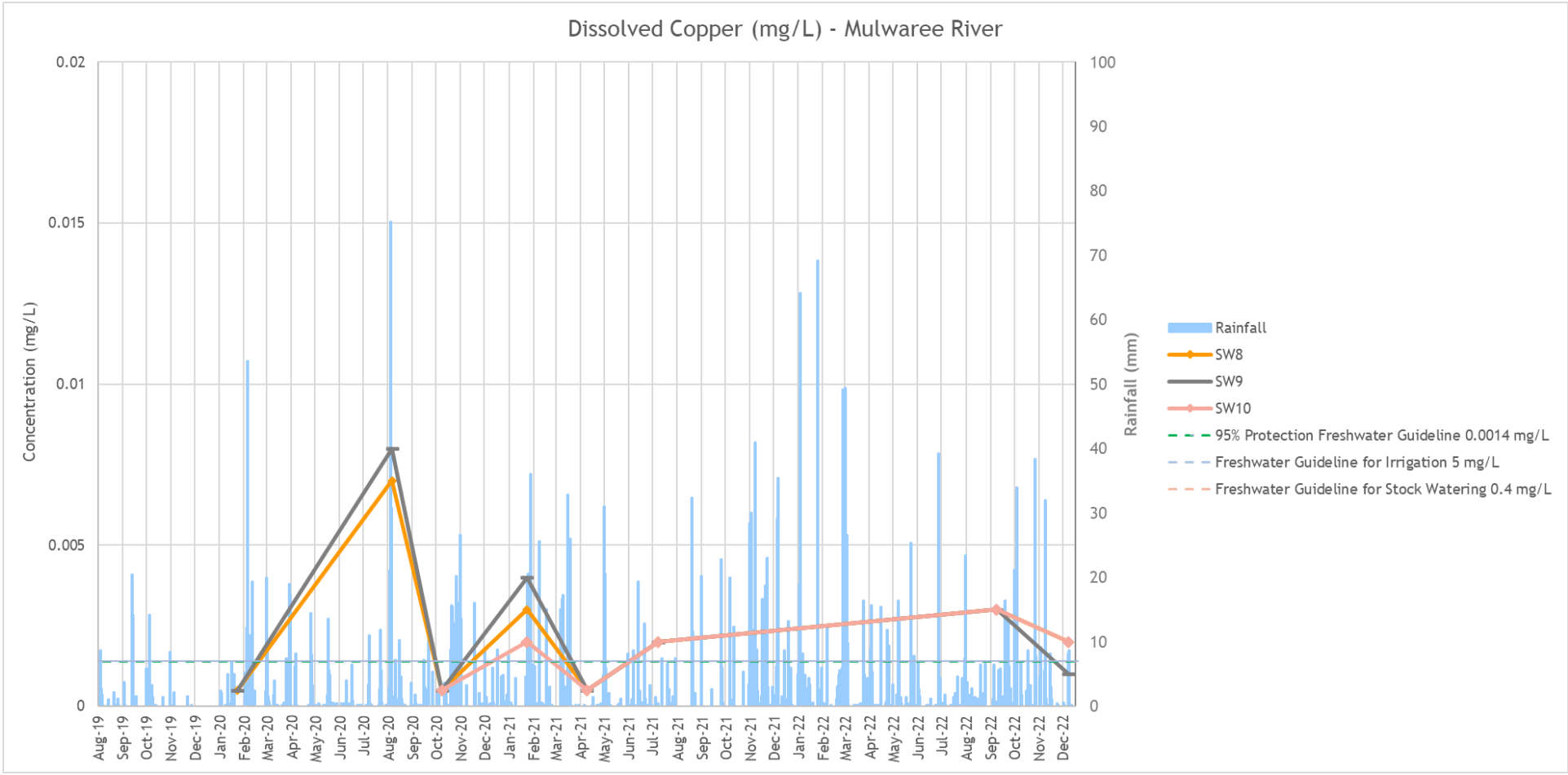

Figure 6-8: Mulwaree River (Offsite) Dissolved Copper Concentration Trend

6.1.4.3 Zinc

Concentration Trends On and Near the Site

Figure 6-9 presents total zinc concentrations reported in surface water samples (SW1-UP, SW1 through to SW7) collected upstream and downstream of three onsite rail culverts. The human health criterion for recreational water (30 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 surface water samples collected on and near the site to date have reported total zinc concentrations below the adopted human health criterion. Slight increases in total zinc concentrations were reported at SW2, SW3, SW4 and SW6 when compared to the previous monitoring event (maximum increase of 0.77 mg/L at SW6).

Figure 6-10 presents dissolved zinc concentrations reported for the samples described above. The site-specific ecological criterion of (20 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 on and near the site to date have reported dissolved zinc concentrations below the adopted criteria.

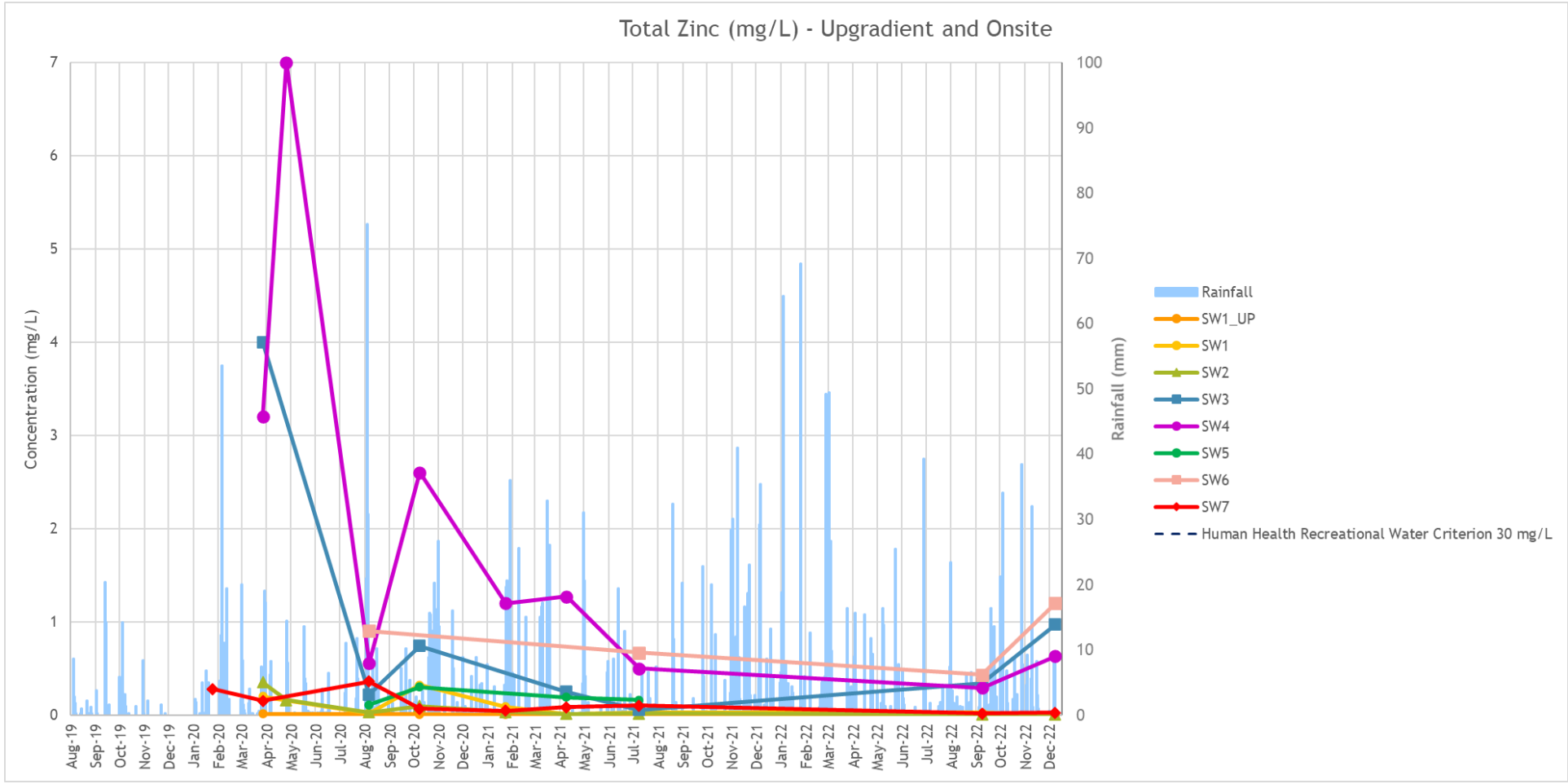

Figure 6-9: Upgradient and Onsite Total Zinc Concentration Trend

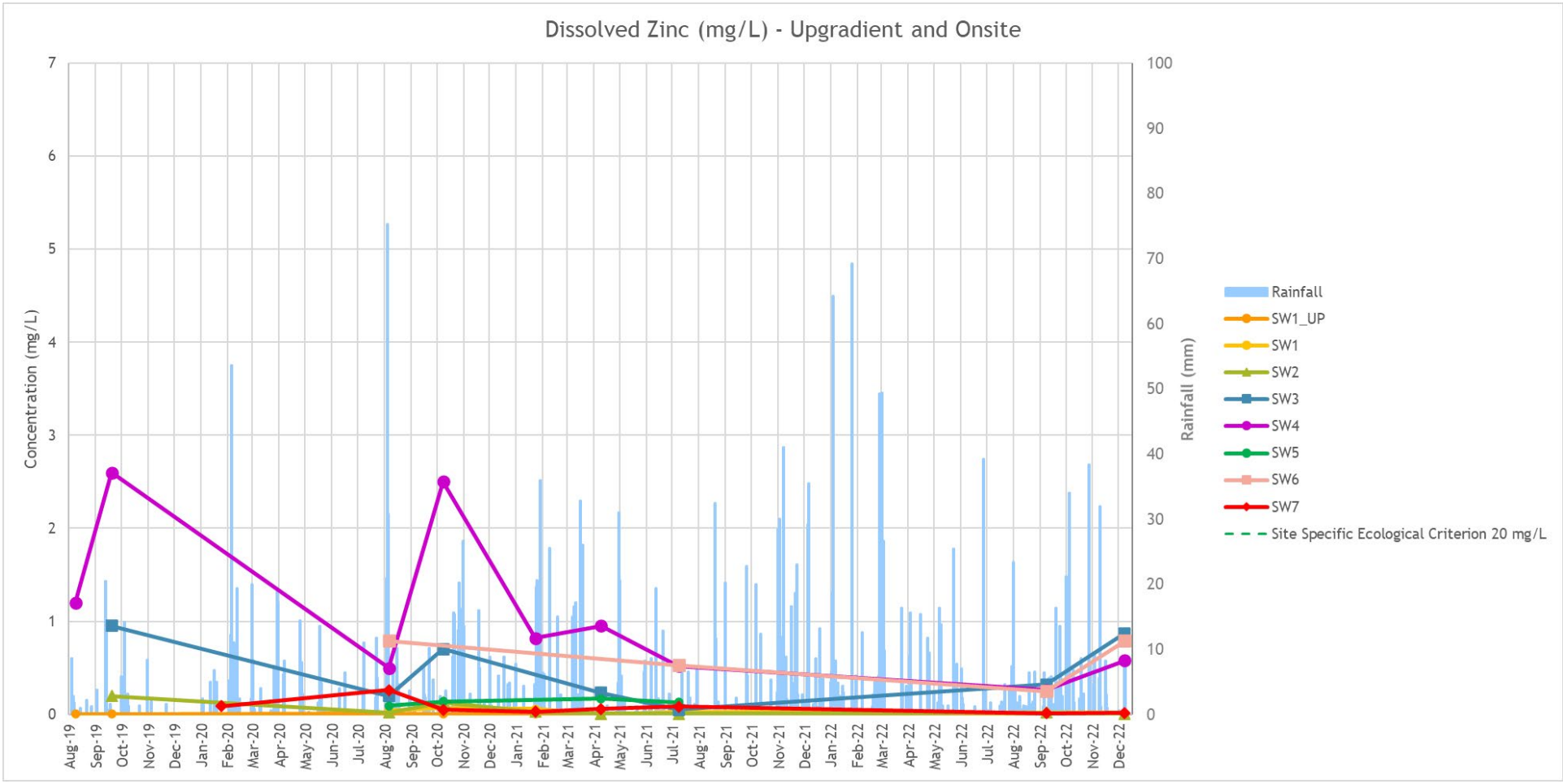

Figure 6-10: Upgradient and (Onsite) Dissolved Zinc Concentration Trend

Concentration Trends Offsite

Figure 6-11 and **Figure 6-12** present total and dissolved zinc concentrations reported in surface water samples (SW8, SW9, SW10) collected from the Mulwaree River located offsite. Both graphs have been presented on a smaller scale (maximum y-axis value of 0.2 mg/L) when compared to upgradient and onsite locations (presented in **Figure 6-9** and **Figure 6-10**) to allow visual assessment of the low concentration trends.

All samples collected from the Mulwaree River to date have reported concentrations below the adopted human health criterion (30 mg/L). The maximum total zinc concentration reported to date (0.16 mg/L during August 2020) is approximately 188-times lower than the adopted criterion. Therefore, the criterion has not been plotted on the y-axis of the graph (**Figure 6-11**) in order to allow visual assessment of the low concentration trends.

Figure 6-12 presents dissolved zinc concentrations in samples collected form the Mulwaree River relative to the adopted ecological criterion (0.02 mg/L). The less sensitive guidelines for irrigation (5 mg/L) and stock water (20 mg/L) have not been plotted on the y-axis of the graph in order to allow visual assessment of the low concentration trends. Concentrations of dissolved zinc did not exceed the criteria in December 2022 and have decreased at all offsite locations when compared to the previous monitoring event (September 2022). 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

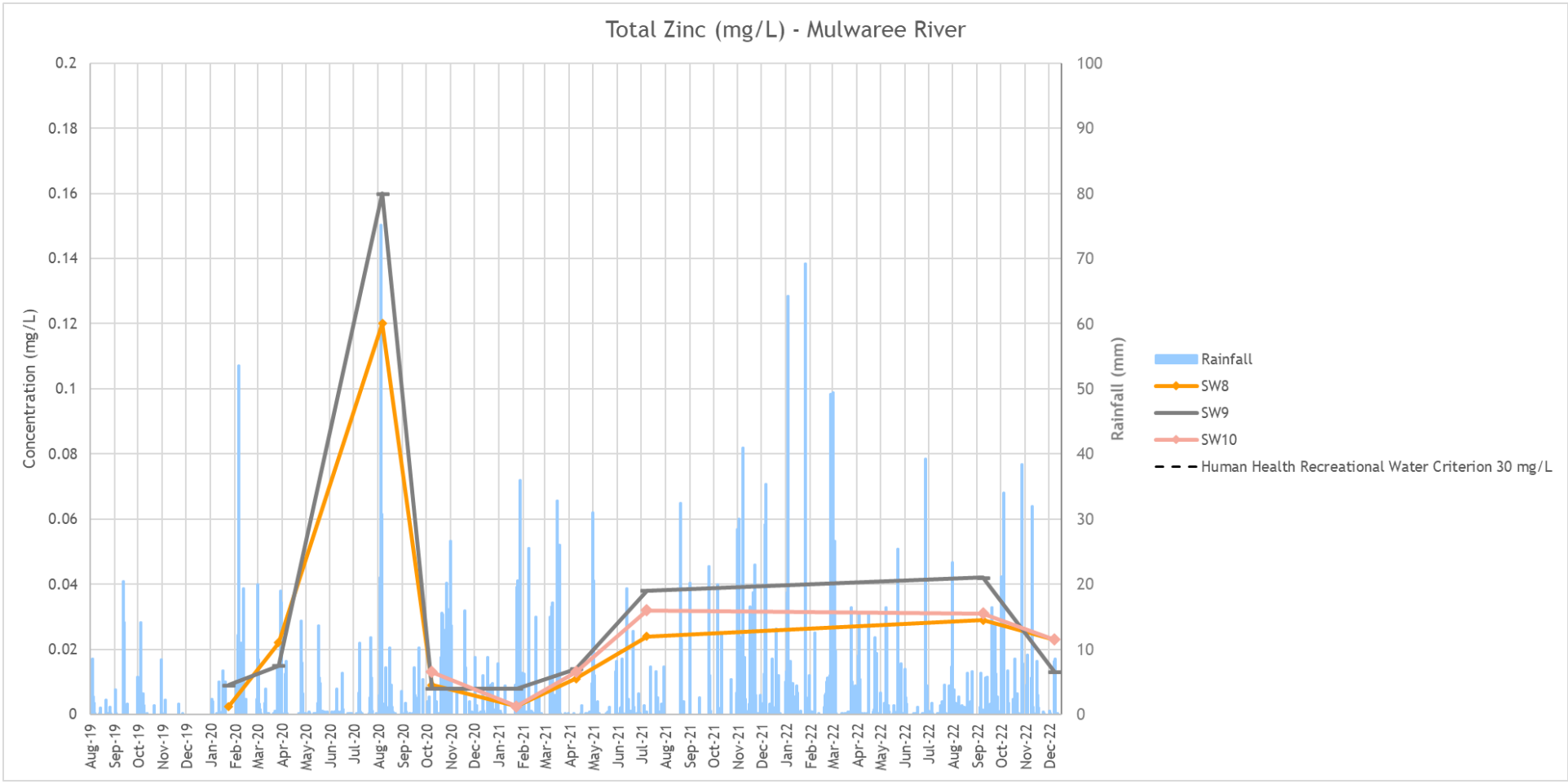

Figure 6-11: Mulwaree River (Offsite) Total Zinc Concentration Trend

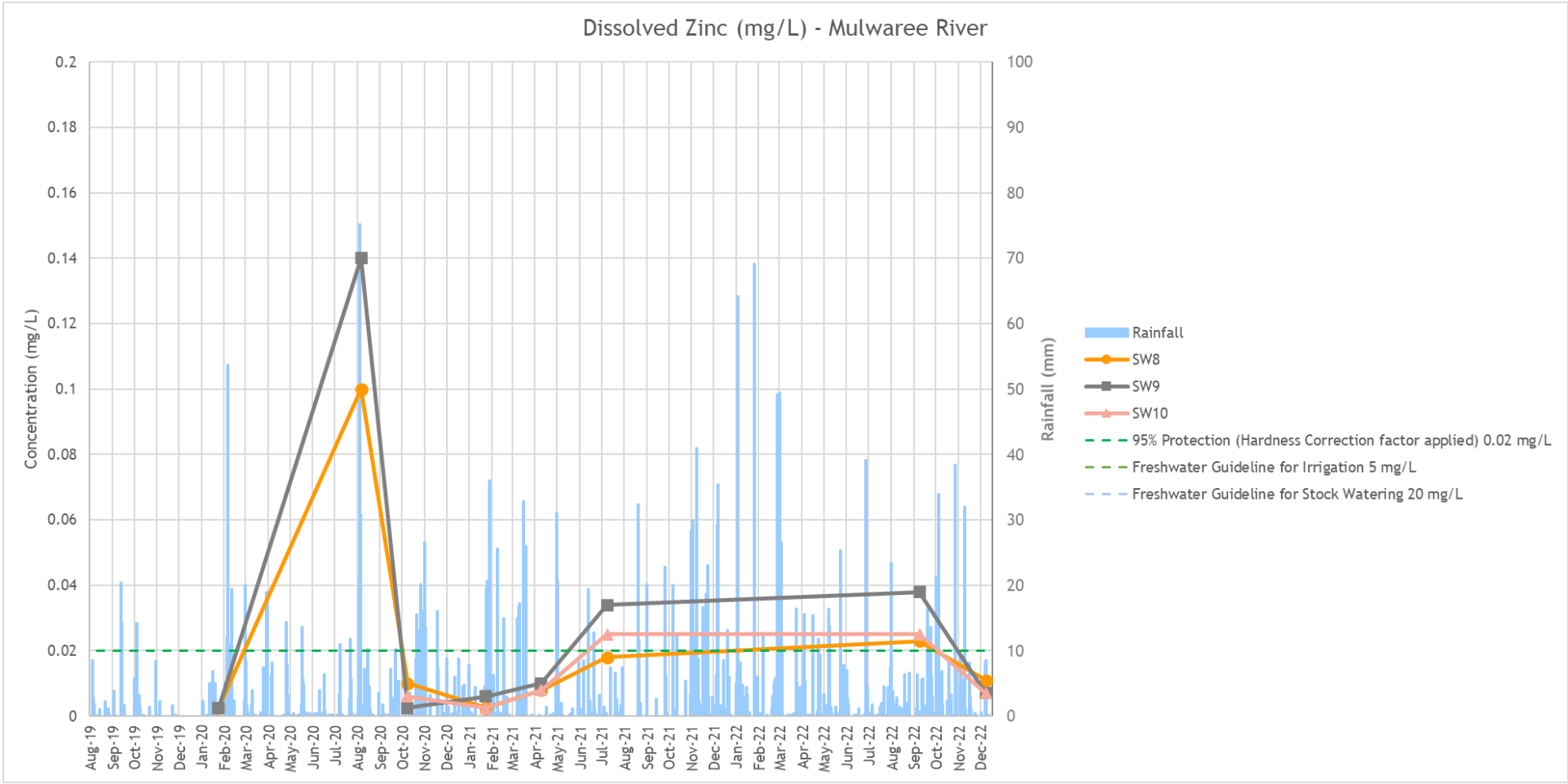

Figure 6-12: Mulwaree River (Offsite) Dissolved Zinc Concentration Trend

7. SUMMARY

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

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

Metal	Total/ Dissolved	Sample Location	Criteria	Summary	Assessment
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.	Based on the monitoring data assessed, which accounts for seasonal variation, the risk to human health from lead in surface water is considered to be low and acceptable.
		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.	Risk to ecological receptors from lead in surface water was found to be low and acceptable.
		Mulwaree River/Offsite (SW8, SW9, SW10)	95% species protection for freshwater ecosystems (0.0034 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.	The risk to human health from copper in surface water is considered low and acceptable.
		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.	Risk to ecological receptors from the drainage system is low and acceptable.
		Mulwaree River/Offsite (SW8, SW9, SW10)	95% species protection for freshwater ecosystems (0.0014 mg/L) (ANZG, 2018). ANZECC (2000) Freshwater guidelines for	Concentrations of dissolved copper exceeded the adopted ecological criteria in August 2020, January 2021, July 2021, September 2022 and December 2022 (SW8 and SW10 only). The highest concentrations were	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.

Metal	Total/ Dissolved	Sample Location	Criteria	Summary	Assessment
			irrigation (5 mg/L) and stock watering (lower limit 0.4 mg/L).	generally reported in the upstream sample (SW9) except during December 2022.	
Zinc	Total	On and Near Site (SW1-UP, SW1, SW2, SW3, SW4, SW5, SW6, SW7)	Recreational water criterion (30 mg/L). Recreational water guideline of 30 mg/L.	Concentrations of total zinc were below the adopted human health criteria in all samples collected to date.	Risk to human health associated with zinc in the drainage system is considered to be low and acceptable.
		Mulwaree River/Offsite (SW8, SW9, SW10)			Risks to human health associated with zinc in offsite surface water are considered to be low and acceptable.
	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.	Risks to ecology associated with zinc in the drainage system is considered to be low and acceptable.
		Mulwaree River/Offsite (SW8, SW9, SW10)	95% species protection for freshwater ecosystems (ANZG, 2018) corrected for hardness (0.02 mg/L). ANZECC (2000) Freshwater guidelines for irrigation (5 mg/L) and stock water (20 mg/L).	Dissolved zinc has been reported at variable. concentrations above and below the ecological criterion (for 95% species protection) since monitoring began in January 2020. During the most recent monitoring event (December 2022) concentrations of dissolved zinc did not exceed any of the adopted ecological criteria. Concentrations are generally comparable upstream and downstream of the Site.	Comparable concentrations upstream and downstream of the Site suggest concentration are background 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.

Monitoring results indicate no evidence of offsite migration of contaminants in surface water that would represent an unacceptable human health risk, with no reported exceedances in the adopted human health criteria for the contaminants of concern.

Similarly, monitoring results indicate no evidence of offsite migration of contaminants in surface water that would represent an unacceptable risk to ecology. Concentrations of lead, copper and zinc observed in the Mulwaree River are consistent with background concentrations and do not indicate impacts from the Site.

9. LIMITATIONS

Ramboll prepared this report in accordance with the scope of work as outlined in our proposal (ref: P210) to TfNSW dated 2 September 2022 and in accordance with our understanding and interpretation of current regulatory standards.

A representative program of sampling and laboratory analyses was undertaken as part of this investigation, based on past and present known uses of the site. While every care has been taken, concentrations of contaminants measured may not be representative of conditions between the locations sampled and investigated. We cannot therefore preclude the presence of materials that may be hazardous. Site conditions may change over time. This report is based on conditions encountered at the Site at the time of the report and Ramboll disclaims responsibility for any changes that may have occurred after this time.

The conclusions presented in this report represent Ramboll's professional judgment based on information made available during the course of this assignment and are true and correct to the best of Ramboll's knowledge as at the date of the assessment.

Ramboll did not independently verify all of the written or oral information provided to Ramboll during the course of this investigation. While Ramboll has no reason to doubt the accuracy of the information provided to it, the report is complete and accurate only to the extent that the information provided to Ramboll was itself complete and accurate.

This report does not purport to give legal advice. This advice can only be given by qualified legal advisors.

9.1 User Reliance

This report has been prepared exclusively for TfNSW and may not be relied upon by any other person or entity without Ramboll's express written permission.

10. REFERENCES

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APPENDIX 1
SAQP

Intended for
Transport for New South Wales

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

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

TARAGO LEAD MANAGEMENT

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

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Checked by	**Stephen Maxwell**
Approved by	**Fiona Robinson**
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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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**

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 bioavailability of cadmium, chromium, lead, nickel and zinc.

To define appropriate hardness correction factors, water was conservatively presumed to be moderately hard based on the Goulburn Mulwaree Regional State of the Environment Report 2004-2009 (Goulburn Mulwaree Council, 2009). Hardness correction factors were adopted from Table 3.4.4 of the *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZECC, 2000) to refine Tier 1 criteria as described in **Table 5-1** below.

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

	Original guideline value (mg/L)	Hardness Correction Factor	Corrected guideline value (mg/L)
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

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 Screening	Ecology - Site Specific Criteria	95% Fresh water (ANZG 2018)	Irrigation - Screening	Stock Water - Screening
Total Metals						
Aluminium	-	2	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[a]	20	5
Arsenic	NA	NA	0.5	0.024[b]	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	-	0.002.5[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	0.0034	5	0.1
Manganese	NA	NA	-	1.9	10	not sufficiently toxic
Mercury	NA	NA	-	0.00006[d, e]	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 guidelines for pH > 6.5, based on the pH of groundwater measured at the Site and surrounding area. This is an aesthetic criteria only based on post flocculation problems*

[b] *Guideline value for arsenic (III).*

[c] *Guideline value for chromium (VI).*

[d] *Guideline value for inorganic mercury.*

[e] *99% species protection level DGV has been adopted to account for the bioaccumulating nature of this contaminant.*

[f] *Guideline value for m-xylene. Guideline values also exist for both o-xylene and p-xylene as per ANZG (2018). The default guideline value for m-xylene guideline has been adopted as it is the most conservative*

[g] *Hardness correction factor applied to the threshold value as detailed in ANZG 2018*

[h] *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 will collected in dedicated disposable 50 mL plastic syringes and 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

ADWG (2011). National Health and Medical Research Council (NHMRC) (2001) National Resource Management Ministerial Council (NRMMC) Australian Drinking Water Guidelines 6, Version 3.5 updated August 2018.

ANZECC (2000). Australian and New Zealand Environment and Conservation Council (ANZECC) & Agriculture and Resource Management Council of Australia and New Zealand (ARMCANZ)

ANZG (2018) *Australian and New Zealand Guidelines for Fresh and Marine Water Quality*. Australian and New Zealand Governments and Australian state and territory governments, Canberra ACT, Australia. Available at www.waterquality.gov.au/anz-guidelines

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APPENDIX 1
FIGURES

RAMBOLL AUSTRALIA - GIS MAP file - 318000780_GIS_P018_T22_RAPs_02_RAP_RailCorridor | F003_SurfaceWaterSamples_V01 | 13/04/2021

A4
1:10,000

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

Figure 1 | Surface Water Monitoring

APPENDIX 2
CALIBRATION CERTIFICATE

Multi Parameter Water Meter

Instrument **YSI Quatro Pro Plus**
Serial No. **11E101629**

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
2. pH 7.00		pH 7.00		386467	pH 7.07
3. pH 4.00		pH 4.00		389384	pH 4.00
4. mV		236.26mV		393734/393728	236.2mV
5. EC		2.76mS		385789	2.765mS
6. Temp		21.2°C		MultiTherm	21.6°C
7. DO		0.0%		391223	0.0%

Calibrated by: **Adam Nikolic**

Calibration date: **6/12/2022**

Next calibration due: **5/01/2023**

APPENDIX 3
RESULTS TABLES

Table 1:
Surface Water Parameters

RAMBOLL

Sample Location	Sample Date	Time	Sample Depth (mm below surface)	Temperature (°C)	Spec Conductivity (µScm-1)	pH	Dissolved Oxygen (mg/L)	Redox (mV)	TDS (ppm)	Turbidity (NTU)	Comments
SW1_UP											
SW1_UP	13-Aug-19	7:45	*Not recorded*	*Not recorded*	*Not recorded*	*Not recorded*	*Not recorded*	*Not recorded*	*Not recorded*	*Not recorded*	Not recorded
SW1_UP	24-Sep-19	*Not recorded*	100	*Not recorded*	*Not recorded*	*Not recorded*	*Not recorded*	*Not recorded*	*Not recorded*	*Not recorded*	Clear/slightly brown. Frogs audible.
SW1_UP	29-Jan-20	---	---	---	---	---	---	---	---	*Not recorded*	DRY
SW1_UP	1-Apr-20	13:25	200	19.94	584	7.05	4.72	154	374	*Not recorded*	Clear. No turbidity. No odour. No flow.
SW1_UP	11-Aug-20	*Not recorded*	100	8	205.6	7.43	10.55	170.7	133.3	*Not recorded*	Clear to slightly brown. Flowing.
SW1_UP	13-Oct-20	7:37	400	11.89	673	7.39	2.6	94	431	*Not recorded*	Water clear/brown. Flowing.
SW1_UP	28-Jan-21	8:15	100	16.9	587	7.3	0.1	186.9	*375.7*	*Not recorded*	Clear, low-no odour, no observable contamination.
SW1_UP	14-Apr-21	8:01	100	13.6	704	7.42	10.86	-41.4	*Not recorded*	*Not recorded*	Clear, no odour. Fence panel stack at downstream end. Flowing.
SW1_UP	13-Jul-21	13:47	300	8.18	662	7.65	6.12	162	*Not recorded*	*Not recorded*	Clear, colourless, no odour. Reeds growing adjacent to pond. Flowing.
SW1_UP	12-Sep-22	14:20	100	11.10	570	7.8	4.9	107	*371.0*	*-1.0*	Clear, not murky, not turbid, very minor suspended solids, no obvious smells or odours, natural running stream.
SW1_UP	13-Dec-22	8:46	100	12.40	618	7.79	5.47	136	*Not recorded*	*Not recorded*	---
SW1											
SW1	29-Jan-20	---	---	---	---	---	---	---	---	*Not recorded*	DRY
SW1	1-Apr-20	12:45	100	17.4	575	6.35	5.88	115	368	*Not recorded*	Clear to brown, low/no turbidity, minor suspendid solids. No odour. No flow.
SW1	11-Aug-20	Not recorded	100	7.8	206.1	7.44	11.00	169.5	133.9	*Not recorded*	Brown, slightly turbid, continuous flow.
SW1	13-Oct-20	7:35	50	10.38	678	7.7	2.71	125	434	*Not recorded*	Water flowing, turbid, yellow/borwn, water level shallow.
SW1	28-Jan-21	8:35	*Not recorded*	16.5	618	7.35	0.04	175.8	395.5	*Not recorded*	Clear, no observable contamination, amongst reeds.
SW1	14-Apr-21	8:28	50	12.2	684	7.65	9.81	23.6	*Not recorded*	*Not recorded*	Clear, no odour, some suspended solids. Shallow sampled at upstream end of culvert.
SW1	13-Jul-21	13:56	100	7.93	733	7.77	5.29	76	*Not recorded*	*Not recorded*	Clear, colourless, no odour. Reeds up stream. Sampled at culvert entrance.
SW1	12-Sep-22	14:45	10	9.2	533	7.67	4.7	157	*347.0*	*0.6*	Couldn't get completely 10cm underneath waterbody due to shallow depth, clear, not murky, not turbid, very minor suspended solids, no obvious smells or odours, small natural stream flowing into a culvert adjacent to the rail corridor, some vegetation and moss on the surface and within the waterbody.
SW1	13-Dec-22	10:54	100	12.3	623.6	7.59	5.45	140.4	*Not recorded*	*Not recorded*	---
SW2											
SW2	24-Sep-19	*Not recorded*	Surface. Shallow water.	*Not recorded*	*Not recorded*	*Not recorded*	*Not recorded*	*Not recorded*	*Not recorded*	*Not recorded*	Clear.
SW2	29-Jan-20	---	---	---	---	---	---	---	---	*Not recorded*	DRY
SW2	1-Apr-20	13:50	100	17.5	358	7.25	3.84	163	233	*Not recorded*	Brown, low-medium turbidity, some suspended solids. No odour. No flow.
SW2	30-Apr-20	17:40	50	9.8	605	6.54	3.32	185.9	391.9	*Not recorded*	Collected at Goulburn Street footbridge. Clear, not flowing.
SW2	11-Aug-20	*Not recorded*	100	7.3	213.3	8.13	10.59	185.2	137.8	*Not recorded*	Clear to slightly turbid. Flowing.
SW2	13-Oct-20	8:15	200	11.8	650	8.27	5.92	96	416	*Not recorded*	Water clear, flowing, water level low.
SW2	28-Jan-21	8:45	*Not recorded*	17	614	8.07	0.12	166.7	393	*Not recorded*	Light brown, low turbidity, no observable contamination.
SW2	14-Apr-21	8:47	100	12	677	7.82	9.83	48.3	*Not recorded*	*Not recorded*	Clear, no odour.
SW2	13-Jul-21	14:05	100	7.56	670	7.98	5.66	108	*Not recorded*	*Not recorded*	Clear, colourless, no odour. Sampled at culvert.
SW2	12-Sep-22	15:05	100	9.40	545	7.81	4.7	172	*354*	*17.1*	Clear, not murky, not turbid, very minor suspended solids, no obvious smells or odours, small waterbody flowing from a culvert adjacent to the rail corridor, some vegetation and moss on the surface and within the waterbody.
SW2	13-Dec-22	10:54	100	12.90	625.5	7.92	7.23	130	Not recorded	Not recorded	---
SW3											
SW3	24-Sep-19	*Not recorded*	50	*Not recorded*	*Not recorded*	*Not recorded*	*Not recorded*	*Not recorded*	*Not recorded*	*Not recorded*	Moderate turbidity. Frogs audible.
SW3	29-Jan-20	---	---	---	---	---	---	---	---	*Not recorded*	DRY
SW3	1-Apr-20	14:20	100	21.8	245	6.23	5.24	178	159	*Not recorded*	Brown to yellow, medium turbidity, some brown matter at surface.
SW3	11-Aug-20	*Not recorded*	100	8.9	142.5	7.43	9.43	174.7	92.3	*Not recorded*	Brown to clear.
SW3	13-Oct-20	8:36	100	11.63	229	7.96	4.84	137	149	*Not recorded*	Water clear/brown to slightly trubid, flowing.
SW3	28-Jan-21	---	---	---	---	---	---	---	---	*Not recorded*	DRY
SW3	14-Apr-21	9:10	100	10.7	242.4	7	8.06	64.8	*Not recorded*	*Not recorded*	Pale yellow, no odour
SW3	13-Jul-21	13:17	300	8.54	181	6.79	7.2	186	*Not recorded*	*Not recorded*	Clear, colourless to pale green/brown, no odour. Algae and reeds growing in drainage line. Not flowing.
SW3	12-Sep-22	15:32	10	9.80	184	6.8	4.7	159	*120.0*	*11.5*	Couldn't get completely 10cm underneath the waterbody due to shallow depth, brown to light brown, slightly murky, slightly turbid, some suspended solids, no obvious smells or odours, small stream from drain leading into a culvert adjacent to the rail corridor.
SW3	13-Dec-22	9:47	100	11.80	243.5	6	5.95	196	*Not recorded*	Not recorded	---
SW4											
SW4	6-Aug-19	11:35	100	12.4	128.2	8.8	9.74	200	*Not recorded*	*Not recorded*	Stagnant pond, clear to slightly yellow.
SW4	24-Sep-19	*Not recorded*	100	*Not recorded*	*Not recorded*	*Not recorded*	*Not recorded*	*Not recorded*	*Not recorded*	*Not recorded*	Turbid. Frogs audible.
SW4	29-Jan-20	---	---	---	---	---	---	---	---	*Not recorded*	DRY
SW4	1-Apr-20	15:00	200	20.33	297	6.73	5.24	168	193	*Not recorded*	Light brown, low turbidity. No odour. No flow.
SW4	30-Apr-20	17:30	50	9	388.3	5.75	3.53	263.1	251.8	*Not recorded*	Collected at Boyd Street culvert. Flowing.
SW4	11-Aug-20	*Not recorded*	100	7.4	153.4	7.69	10.42	210.9	99.5	*Not recorded*	Brown, slightly trubid, full but flow not evident.
SW4	13-Oct-20	8:50	300	13.1	307	8.19	5.73	107	200	*Not recorded*	Water flowing, turbid, brown, no odour.
SW4	28-Jan-21	9:10	100	17.4	227.3	7.93	1.12	180.8	145.5	*Not recorded*	Brown-orange, stagnant, low-moderate turbidity, no observable contamination.
SW4	14-Apr-21	9:38	100	11.5	231.1	7.35	9.77	70	*Not recorded*	*Not recorded*	Pale yellow, no odour.
SW4	13-Jul-21	13:28	300	7.95	192	6.87	5.41	173	*Not recorded*	*Not recorded*	Clear, colourless, no odour. Not flowing.
SW4	12-Sep-22	15:45	100	9	174.3	6.79	4.9	198	*113.0*	*13.9*	Brown, murky, turbid, suspended solids, no obvious smells or odours, small stream and water body coming from a culvert adjacent to rail corridor, vegetation and moss on the surface and within the water body.
SW4	13-Dec-22	9:49	100	13.2	175.5	6.54	4.6	168.1	Not recorded	Not recorded	---
SW5											
SW5	29-Jan-20	---	---	---	---	---	---	---	---	*Not recorded*	DRY
SW5	1-Apr-20	---	---	---	---	---	---	---	---	*Not recorded*	DRY
SW5	11-Aug-20	*Not recorded*	100	11.2	117.9	7.33	7.94	163.2	76.7	*Not recorded*	Brown, turbid, flow at culvert evident beneath crushed rock.
SW5	13-Oct-20	9:06	50	11.95	187	8.35	4.06	-3	121	*Not recorded*	Water not flowing, very shallow, turbid, light brown, no odour.
SW5	28-Jan-21	---	---	---	---	---	---	---	---	*Not recorded*	DRY
SW5	14-Apr-21	10:20	100	11.6	251.2	6.85	8.75	74.9	*Not recorded*	*Not recorded*	Pale yellow, no odour. Small pool of water north of culvert, rest of area dry.
SW5	13-Jul-21	12:50	100	8.71	192	6.45	9.33	191	*Not recorded*	*Not recorded*	Turbid, pale brown, no odour. Sample taken from puddle adjacent to culvert. Not flowing.
SW5	12-Sep-22	---	---	---	---	---	---	---	---	---	DRY
SW5	13-Dec-22	---	---	---	---	---	---	---	---	---	DRY
SW6											
SW6	29-Jan-20	---	---	---	---	---	---	---	---	*Not recorded*	DRY
SW6	1-Apr-20	---	---	---	---	---	---	---	---	*Not recorded*	DRY
SW6	11-Aug-20	*Not recorded*	50	8.3	168.3	7.47	9.61	187	109.2	*Not recorded*	Brown, slightly turbid. Not flowing.
SW6	13-Oct-20	---	---	---	---	---	---	---	---	*Not recorded*	DRY
SW6	28-Jan-21	---	---	---	---	---	---	---	---	*Not recorded*	DRY
SW6	14-Apr-21	---	---	---	---	---	---	---	---	*Not recorded*	DRY
SW6	13-Jul-21	12:58	50	9.08	173	7.32	9.73	176	*Not recorded*	*Not recorded*	Clear to slightly turbid, pale yellow/brown, no odour. Flowing slightly.
SW6	12-Sep-22	15:58	10	11.8	180.6	9.07	4.5	111	*117.0*	*83.5*	Couldn't get completely 10cm underneath the waterbody due to shallow depth, brown, slightly murky, slightly turbid, some suspended solids, no obvious smells or odours, small stream coming from a culvert. Minor vegetation on the banks and surface of the water body.
SW6	13-Dec-22	10:19	100	17.6	201.2	6.53	5.7	205.8	Not recorded	Not recorded	---
SW7											
SW7	29-Jan-20	10:00	50	23.1	609	8.92	8.46	83	396.6	*Not recorded*	Silty, from dam, low level water.
SW7	2-Apr-20	*Not recorded*	10	18.1	2342	7.23	4.45	114.2	152.1	*Not recorded*	Highly turbid.
SW7	11-Aug-20	*Not recorded*	100	12.5	94.7	7.26	7.80	109.8	61.8	*Not recorded*	Brown, trubid.
SW7	12-Oct-20	17:46	200	21.34	172	7.69	5.35	56	112	*Not recorded*	Water slightly trubid, brown, not flowing.
SW7	28-Jan-21	11:30	100	18.4	148.6	7.4	1.80	168	95.1	*Not recorded*	Light brown, low-moderate turbidity, no observable contamination.
SW7	14-Apr-21	10:51	100	11.5	140.7	6.57	8.76	86.7	*Not recorded*	*Not recorded*	Pale brown, dark colour to dam, earthy odour.
SW7	13-Jul-21	14:25	200	7.38	183	7.41	5.62	120	*Not recorded*	*Not recorded*	Slightly turbid, palye yellow/brown, no odour. Reeds growing in pond. Not flowing.
SW7	12-Sep-22	9:04	100	9.9	177	6.91	5.10	123	*115.0*	*8.6*	Light brown to brown, murky, turbid, suspended solids, no obvious smells or odours, waterbody within private property coming from a drain adjacent to the rail corridor and fenceline. Minor vegetation and moss on the surface and within the water body. Evidence of property owner pushing material into the water body to fill to the surface.
SW7	13-Dec-22	10:25	100	17.5	142.6	6.34	3.18	135.5	Not recorded	Not recorded	---
SW8											
SW8	29-Jan-20	11:01	100	23.6	1007	7.77	5.22	121.6	656.5	*Not recorded*	Upstream Lumley Road bridge. Clear, vegetation. Not flowing.
SW8	2-Apr-20	9:30am	10	18	425.7	7.23	4.39	124	276.9	*Not recorded*	Grease at surface, lots of algae growing on plants.
SW8	10-Aug-20	*Not recorded*	100	9.1	170.5	8.53	9.34	123.6	107.9	*Not recorded*	Water flowing, level high, turbid, sediment sample collected higher up embankment than previous round due to water level.
SW8	12-Oct-20	17:26	200	20.12	847	7.76	7.58	84	542	*Not recorded*	Water flowing, clear/brown.
SW8	28-Jan-21	10:30	100	18.9	730	7.48	3.09	97.8	467.2	*Not recorded*	Clear, low turbidity, no observable contamination.
SW8	14-Apr-21	11:19	100	13.4	712	7.15	8.61	116.2	*Not recorded*	*Not recorded*	Clear, no odour, leaf litter on surface
SW8	13-Jul-21	14:50	300	8.43	994	7.62	7.82	123	*Not recorded*	*Not recorded*	Clear, colourless, no odour. Reeds growing in river. Flowing.
SW8	12-Sep-22	9:17	100	9.5	683	7.24	5.1	136	*444.0*	*2.8*	Clear, not murky, not turbid, very minor suspended solids, no obvious smells or odours, natural running stream, minor vegetation and moss on the banks of the stream and within the water body.
SW8	12-Dec-22	18:07	100	20	727	6.98	5.35	131	Not recorded	Not recorded	---
SW9											
SW9	29-Jan-20	12:22	300	25.0	125.3	8.35	16.8	99.4	812.5	*Not recorded*	Stagnant pond. Algae and fish present. Slightly turbid.
SW9	02-Apr-20	*Not recorded*	10	18.2	381.7	7.62	6.29	124.5	247.7	*Not recorded*	Non-turbid, slightly brown, not flowing but full.
SW9	10-Aug-20	*Not recorded*	100	8.9	178.2	7.84	10.73	173.6	115.7	*Not recorded*	High level, brown, slightly turbid, bubbles at surface.
SW9	12-Oct-20	16:47	200	21.39	852	8.17	10.04	83	545	*Not recorded*	Water flowing, clear/brown, slightly turbid.
SW9	28-Jan-21	10:00	100	18.7	820	7.5	0.32	227.7	524.8	*Not recorded*	Clear, low turbidity, no observable contamination.
SW9	14-Apr-21	12:05	100	12.7	639.4	7.57	10.32	115.1	*Not recorded*	*Not recorded*	Very pale yellow, no odour.
SW9	13-Jul-21	15:32	200	7.66	1030	7.77	11.53	130	*Not recorded*	*Not recorded*	Clear, colourless, no odour. Flowing.
SW9	12-Sep-22	8:32	100	9.1	724	7.27	5.1	121	*470.0*	*0.9*	Light brown to brown, slightly murky, slightly turbid, some suspended solids, no obvious smells or odours, natural running stream, minor vegetation and moss on the banks of the stream and within the water body.
SW9	12-Dec-22	18:50	100	18.7	742	7.19	5.6	171	*Not recorded*	Not recorded	---
SW10											
SW10	13-Oct-20	12:26	400	16.02	881	7.19	3.58	79	564	*Not recorded*	Water flowing, clear/brown, slightly turbid, no odour.
SW10	28-Jan-21	10:30	100	18.2	710	7.27	4.1	3.8	454.4	*Not recorded*	Clear, low turbidity, no observable contamination.
SW10	14-Apr-21	11:33	100	12.9	682	7.35	8.18	103.5	*Not recorded*	*Not recorded*	Clear, no odour.
SW10	13-Jul-21	15:00	100	7.87	978	7.64	6.71	108	*Not recorded*	*Not recorded*	Clear to slighty turbid, colourless, no odour. Flowing.
SW10	12-Sep-22	9:28	100	9.3	702	7.45	5.1	125	*456.0*	*3.1*	No discharge downstream of drainage line (north), clear, not murky, not turbid, very minor suspended solids, no obvious smells or odours, natural running stream, minor vegetation and moss on the banks of the stream and within the water body.
SW10	12-Dec-22	18:27	100	20.3	725	7.35	6.4	149	*Not recorded*	*Not recorded*	---

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

Client: TfNSW
Job No: 3180001376
Project Name: December 2022 Surface Water Monitoring Report
12-01-23

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
					Lab ID		-	S20-Ap12286	S20-Au23115	S20-Oc25141	S21-Ja34960	S21-Ap22332	N21-Jl30451	S22-Se00368	N22-De0031035
					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
					Sample ID:		SW1	SW1	SW1	SW1	SW1	SW1	SW1	SW1	SW1
					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
					Project No:		318000780	318000780	318000780	318000780	318000780	318000780	318000780	318001376	318001376-001
					Sample Location		Tarago Rail Loop	Tarago Rail Loop	Tarago Rail Loop	Tarago Rail Loop	Tarago Rail Loop	Tarago Rail Loop	Tarago Rail Loop	Tarago Rail 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	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.
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
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
Barium	-	NA	20	NA	mg/L	0.001	-	0.15	0.04	0.36	0.12	0.08	0.07	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
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
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
Cobalt	-	NA	-	NA	mg/L	0.001	-	0.014	< 0.001	0.007	0.002	< 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
Iron	-	NA	3	NA	mg/L	0.05	-	4.5	0.91	1.41	1.1	0.07	0.18	0.94	0.23
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
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
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	-	0.003	0.002	0.002	< 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
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
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
Dissolved Barium	NA	-	NA	-	mg/L	0.001	-	-	0.04	0.11	0.12	0.08	0.06	0.05	0.06
Dissolved Beryllium	NA	-	NA	-	mg/L	0.001	-	-	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	<0.001	< 0.001
Dissolved Cadmium	NA	0.01	NA	NA	mg/L	0.0002	-	-	0.0003	0.0005	0.0002	< 0.0002	< 0.0002	<0.0002	< 0.0002
Dissolved Chromium	NA	NA	NA	0.0025	mg/L	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
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
Dissolved Iron	NA	-	NA	-	mg/L	0.05	-	-	0.34	< 0.05	0.13	< 0.05	0.14	0.16	0.1
Dissolved Lead	NA	0.1	NA	NA	mg/L	0.001	-	-	0.004	< 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
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
Dissolved Nickel	NA	1	NA	-	mg/L	0.001	-	-	0.002	< 0.001	< 0.001	< 0.001	< 0.001	<0.001	< 0.001
Dissolved Zinc	NA	20	NA	-	mg/L	0.005	-	-	0.045	0.073	0.058	0.005	0.025	0.02	0.016

- 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
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: 3180001376
Project Name: December 2022 Surface Water Monitoring Report
12-01-23

Table 3: SW1_UP 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
					Lab ID		S19-Au17273	S19-Se37061	-	S20-Ap12287	S20-Au23116	S20-Oc25321	S21-Ja34959	S21-Ap22331	N21-Jl30450	S22-Se00368	N22-De0031034
					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
					Sample ID:		SW1-UP	SW1-UP	SW1_UP	SW1-UP	SW1_UP	SW1_UP	SW1_UP	SW1_UP	SW1_UP	SW1_UP	SW1_UP
					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	318000781	318001376	318001376-001
					Sample Location		Tarago Rail Loop	Tarago Rail Loop	Tarago Rail Loop	Tarago Rail Loop	Tarago Rail Loop	Tarago Rail Loop	Tarago Rail Loop	Tarago Rail Loop	Tarago Rail Loop	Tarago Rail Corridor	Tarago Rail Corridor
					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:		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.
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
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
Barium	-	NA	20	NA	mg/L	0.001	-	-	-	0.1	0.05	0.1	0.11	0.08	0.07	0.05	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
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
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
Cobalt	-	NA	-	NA	mg/L	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
Iron	-	NA	3	NA	mg/L	0.05	-	-	-	0.26	0.93	0.12	0.19	0.07	0.06	0.07	0.12
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
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
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	-	-	-	< 0.001	0.002	< 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
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
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
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
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
Dissolved Cadmium	NA	0.01	NA	NA	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	NA	NA	0.0025	mg/L	0.001	< 0.001	0.001	-	-	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	<0.001	< 0.001
Dissolved Cobalt	NA	NA	NA	0.0014	mg/L	0.001	< 0.001	<0.001	-	-	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	<0.001	< 0.001
Dissolved Copper	NA	0.5	NA	NA	mg/L	0.001	< 0.001	<0.001	-	-	0.002	< 0.001	0.003	< 0.001	< 0.001	<0.001	< 0.001
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
Dissolved Lead	NA	0.1	NA	NA	mg/L	0.001	< 0.001	0.001	-	-	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	<0.001	< 0.001
Dissolved 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
Dissolved Mercury	NA	NA	NA	0.00006	mg/L	0.0001	< 0.0001	< 0.0001	-	-	<0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	<0.0001	< 0.0001
Dissolved Nickel	NA	1	NA	-	mg/L	0.001	< 0.001	<0.001	-	-	0.002	< 0.001	< 0.001	< 0.001	< 0.001	<0.001	< 0.001
Dissolved Zinc	NA	20	NA	-	mg/L	0.005	< 0.005	0.005	-	-	0.008	< 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

Client: TfNSW
Job No: 3180001376
Project Name: December 2022 Surface Water Monitoring Report
12-01-23

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
					Lab ID		S19-Se37062	-	S20-Ap12288	S20-My01341	S20-Au23117	S20-Oc25143	S21-Ja34961	S21-Ap22333	N21-Jl30452	S22-Se00368	N22-De0031036
					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
					Sample ID:		SW2	SW2	SW2	SW2	SW2	SW2	SW2	SW2	SW2	SW2	SW2
					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	318000781	318001376	318001376-001
					Sample Location		Tarago Rail Loop	Tarago Rail Loop	Tarago Rail Loop	Tarago Rail Loop	Tarago Rail Loop	Tarago Rail Loop	Tarago Rail Loop	Tarago Rail Loop	Tarago Rail Loop	Tarago Rail Corridor	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
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.
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
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
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
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	-	-	0.0019	0.0004	< 0.0002	0.0007	< 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
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
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
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
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
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
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		-	0.002	< 0.001	0.002	< 0.001	< 0.001	< 0.001	0.001	<0.001	0.002
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
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
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
Barium (filtered)	NA	-	NA	-	mg/L	0.001	0.07	-	-	-	0.04	0.11	0.11	0.08	0.06	0.05	0.06
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	NA	mg/L	0.0002	0.0014	-	-	-	< 0.0002	0.0007	< 0.0002	< 0.0002	< 0.0002	<0.0002	< 0.0002
Chromium (filtered)	NA	NA	NA	0.0025	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	< 0.001	-	-	-	< 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
Iron (filtered)	NA	-	NA	-	mg/L	0.05	< 0.05	-	-	-	0.31	< 0.05	< 0.05	< 0.05	< 0.05	0.08	0.06
Lead (filtered)	NA	0.1	NA	NA	mg/L	0.001	0.014	-	-	-	< 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
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	-	mg/L	0.001	< 0.001	-	-	-	0.002	< 0.001	< 0.001	< 0.001	< 0.001	<0.001	< 0.001
Zinc (filtered)	NA	20	NA	-	mg/L	0.005	0.2	-	-	-	0.02	0.13	0.028	0.009	0.006	0.021	< 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	<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

Client: TfNSW
Job No: 3180001376
Project Name: December 2022 Surface Water Monitoring Report
12-01-23

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
					Lab ID		S19-Se37063	-	S20-Ap12289	S20-Au23118	S20-Oc25145	-	S21-Ap22334	N21-Jl30453	S22-Se00368	N22-De0031037
					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
					Sample ID:		SW3	SW3	SW3	SW3	SW3	SW3	SW3	SW3	SW3	SW3
					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	318000780	318001376	318001376-001
					Sample Location		Tarago Rail Loop	Tarago Rail Loop	Tarago Rail Loop	Tarago Rail Loop	Tarago Rail Loop	Tarago Rail Loop	Tarago Rail Loop	Tarago Rail Loop	Tarago Rail Corridor	Tarago Rail Corridor
					Sampling Method:		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
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
Arsenic	7	NA	NA	NA	mg/L	0.001	-	-	0.004	< 0.001	0.003	-	0.002	< 0.001	0.002	0.001
Barium	-	NA	20	NA	mg/L	0.001	-	-	0.1	0.05	0.07	-	0.06	0.04	0.05	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
Cadmium	1.4	NA	NA	NA	mg/L	0.0002	-	-	0.021	0.0011	0.0036	-	0.0011	0.0003	0.0016	0.0045
Chromium	-	NA	0.5	NA	mg/L	0.001	-	-	0.002	0.001	0.001	-	0.001	< 0.001	<0.001	0.002
Cobalt	-	NA	-	NA	mg/L	0.001	-	-	0.006	< 0.001	< 0.001	-	0.001	< 0.001	0.004	0.003
Copper	-	NA	20	NA	mg/L	0.001	-	-	0.18	0.018	0.12	-	0.043	0.012	0.039	0.046
Iron	-	NA	3	NA	mg/L	0.05	-	-	1.8	0.6	1.4	-	1.4	0.82	1.4	0.67
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
Manganese	350	NA	NA	NA	mg/L	0.005	-	-	0.52	0.017	0.042	-	0.071	0.011	0.24	0.3
Mercury	-	NA	0.01	NA	mg/L	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
Zinc	-	NA	30	NA	mg/L	0.005	-	-	4	0.22	0.74	-	0.25	0.054	0.34	0.97
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
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
Barium (filtered)	NA	-	NA	-	mg/L	0.001	0.08	-	-	0.05	0.07	-	0.05	0.04	0.05	0.07
Beryllium (filtered)	NA	-	NA	-	mg/L	0.001	<0.001	-	-	< 0.001	< 0.001	-	< 0.001	< 0.001	<0.001	< 0.001
Cadmium (filtered)	NA	0.01	NA	NA	mg/L	0.0002	0.0053	-	-	0.001	0.0033	-	0.001	0.0002	0.0015	0.0038
Chromium (filtered)	NA	NA	NA	0.0025	mg/L	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
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
Iron (filtered)	NA	-	NA	-	mg/L	0.05	0.33	-	-	0.46	1.1	-	1.1	0.54	0.98	0.31
Lead (filtered)	NA	0.1	NA	NA	mg/L	0.001	0.011	-	-	0.009	0.023	-	0.013	0.003	0.012	0.006
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
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
Nickel (filtered)	NA	1	NA	-	mg/L	0.001	0.002	-	-	0.002	0.011	-	0.003	0.001	0.004	0.007
Zinc (filtered)	NA	20	NA	-	mg/L	0.005	0.95	-	-	0.2	0.7	-	0.23	0.048	0.32	0.87
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

Client: TfNSW
Job No: 3180001376
Project Name: December 2022 Surface Water Monitoring Report
12-01-23

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 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-Au07234	S19-Se37064	-	S20-Ap12290	S20-My01342	S20-Au23119	S20-Oc25147	S21-Ja34962	S21-Ap22335	N21-Jl30453	S22-Se00368	N22-De0031039
					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
					Sample ID:		SW4	SW4	SW4	SW4	SW4	SW4	SW4	SW4	SW4	SW4	SW4	SW4
					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	318000780	318000780	318001376	318001376-001
					Sample Location		Tarago Rail Loop	Tarago Rail Loop	Tarago Rail Loop	Tarago Rail Loop	Tarago Rail Loop	Tarago Rail Loop	Tarago Rail Loop	Tarago Rail Loop	Tarago Rail Loop	Tarago Rail Loop	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:		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
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
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
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
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	-	-	-	0.019	0.04	0.003	0.019	0.0066	0.0025	0.0025	0.0015	0.0035
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
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
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
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
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
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
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	-	-	-	0.037	0.12	0.006	0.038	0.027	0.451	0.004	0.004	0.009
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
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
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
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
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	NA	mg/L	0.0002	0.0056	0.013	-	-	-	0.0029	0.018	0.0051	0.0021	0.0025	0.0013	0.003
Chromium (filtered)	NA	NA	NA	0.0025	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	0.003	-	-	-	< 0.001	0.004	0.001	< 0.001	< 0.001	0.002	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
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
Lead (filtered)	NA	0.1	NA	NA	mg/L	0.001	0.008	0.033	-	-	-	0.011	0.023	0.007	0.016	0.006	0.015	0.01
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
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	-	mg/L	0.001	0.014	0.019	-	-	-	0.006	0.038	0.022	0.421	0.004	0.004	0.008
Zinc (filtered)	NA	20	NA	-	mg/L	0.005	1.2	2.6	-	-	-	0.5	2.5	0.82	0.95	0.52	0.26	0.58
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

Client: TfNSW
Job No: 3180001376
Project Name: December 2022 Surface Water Monitoring Report
12-01-23

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 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
					Lab ID		-	-	S20-Au23120	S20-Oc25149	-	S21-Ap22336	N21-Jl30455	S22-Se00368	-
					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
					Sample ID:		SW5	SW5	SW5	SW5	SW5	SW5	SW5	SW5	SW5
					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
					Project No:		318000780	318000785	318000785	318000785	318000780	318000780	318000780	318001376	318001376-001
					Sample Location		Tarago Rail Loop	Tarago Rail Loop	Tarago Rail Loop	Tarago Rail Loop	Tarago Rail Loop	Tarago Rail Loop	Tarago Rail Loop	Tarago Rail Corridor	Tarago Rail Corridor
					Sampling Method:		-	-	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
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	-	-
Arsenic	7	NA	NA	NA	mg/L	0.001	-	-	0.001	0.005	-	0.002	0.001	-	-
Barium	-	NA	20	NA	mg/L	0.001	-	-	0.03	0.17	-	0.08	0.04	-	-
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	-	-	0.0009	0.0021	-	0.0009	0.0008	-	-
Chromium	-	NA	0.5	NA	mg/L	0.001	-	-	0.003	0.011	-	0.001	0.002	-	-
Cobalt	-	NA	-	NA	mg/L	0.001	-	-	< 0.001	0.003	-	< 0.001	< 0.001	-	-
Copper	-	NA	20	NA	mg/L	0.001	-	-	0.019	0.074	-	0.022	0.021	-	-
Iron	-	NA	3	NA	mg/L	0.05	-	-	1.5	8.9	-	0.97	1.1	-	-
Lead	7	NA	NA	NA	mg/L	0.001	-	-	0.01	0.031	-	0.003	0.005	-	-
Manganese	350	NA	NA	NA	mg/L	0.005	-	-	0.012	0.15	-	0.061	0.017	-	-
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	-	-	0.002	0.007	-	0.004	0.003	-	-
Zinc	-	NA	30	NA	mg/L	0.005	-	-	0.11	0.3	-	0.19	0.16	-	-
Dissolved Metals															
Aluminium (filtered)	NA	5	NA	NA	mg/L	0.05	-	-	3.2	0.28	-	0.25	1.1	-	-
Arsenic (filtered)	NA	0.5	NA	NA	mg/L	0.001	-	-	0.001	0.002	-	0.001	< 0.001	-	-
Barium (filtered)	NA	-	NA	-	mg/L	0.001	-	-	0.03	0.08	-	0.07	0.04	-	-
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	-	-	0.0009	0.001	-	0.0006	0.0006	-	-
Chromium (filtered)	NA	NA	NA	0.0025	mg/L	0.001	-	-	0.003	< 0.001	-	< 0.001	0.002	-	-
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	-	-	0.016	0.045	-	0.019	0.018	-	-
Iron (filtered)	NA	-	NA	-	mg/L	0.05	-	-	1.4	0.54	-	0.74	0.78	-	-
Lead (filtered)	NA	0.1	NA	NA	mg/L	0.001	-	-	0.006	0.007	-	0.002	0.003	-	-
Manganese (filtered)	NA	NA	NA	1.9	mg/L	0.005	-	-	0.008	0.09	-	0.044	0.013	-	-
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	-	-	0.002	0.003	-	0.004	0.003	-	-
Zinc (filtered)	NA	20	NA	-	mg/L	0.005	-	-	0.094	0.14	-	0.17	0.13	-	-
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: 3180001376
Project Name: December 2022 Surface Water Monitoring Report
12-01-23

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 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
					Lab ID		-	-	S20-Au23121	-	-	-	N21-Jl30451	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
					Sample ID:		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
					Project No:		318000780	318000785	318000785	318000785	318000785	318000785	318000785	318001376	318001376-001
					Sample Location		Tarago Rail Loop	Tarago Rail Loop	Tarago Rail Loop	Tarago Rail Loop	Tarago Rail Loop	Tarago Rail Loop	Tarago Rail Loop	Tarago Rail Corridor	Tarago Rail Corridor
					Sampling Method:		-	-	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.
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
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: 3180001376
Project Name: December 2022 Surface Water Monitoring Report
12-01-23

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
					Lab ID		S20-Ja29060	S20-Ap12291	S20-Au23122	S20-Oc25163	S21-Ja34963	S21-Ap22337	N21-Jl30457	S22-Se00368	N22-De0031040
					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
					Sample ID:		SW7	SW7	SW7	SW7	SW7	SW7	SW7	SW7	SW7
					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
					Project No:		318000780	318000780	318000780	318000780	318000780	318000780	318000780	318001376	318001376-001
					Sample Location		Tarago Rail Loop	Tarago Rail Loop	Tarago Rail Loop	Tarago Rail Loop	Tarago Rail Loop	Tarago Rail Loop	Tarago Rail Loop	Tarago Rail 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:		Silty, from dam, low level water.	Highly turbid.	Brown, turbid.	Water slightly trubid, brown, not flowing.	Light brown, low-moderate turbidity, no observable contamination	Pale brown, dark colour to dam, earthy odour	Slightly turbid, palye yellow/brown, no odour. Reeds growing in pond. Not flowing.	Light brown to brown, slightly murky, slightly turbid, suspended solids, no odour. Reeds growing in pond. Not flowing, minor vegetation on the surface and within the waterbody	Clear, slightly brown, no odour. Reeds and vegetation growing throuhgout water body. Dead vegetation at bottom of water body
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	-	-	-	-	-	-	-	-
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	7.4	-	-	-	-	-	-	-	-
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 Nitrogen (as N)	0.8	-	-	25-125	mg/L	0.2	15	-	-	-	-	-	-	-	-
Total Nitrogen (as N)	-	-	-	-	mg/L	0.2	15	-	-	-	-	-	-	-	-
Total Suspended Solids Dried at 105°C	-	0.7	-	-	mg/L	0.005	0.25	-	-	-	-	-	-	-	-
Turbidity	-	-			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
Arsenic	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
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
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
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
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
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
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
Iron	3	NA	NA	NA	mg/L	0.05	-	4.22	1.8	3	4	3.3	3.8	3.3	5
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
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
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
Nickel	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
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
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
Dissolved Arsenic	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
Dissolved Barium	NA	-	-	-	mg/L	0.001	-	-	0.03	0.05	0.05	0.03	0.04	0.03	0.03
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
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
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
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
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
Dissolved Iron	NA	-	-	10	mg/L	0.05	-	-	0.57	2.4	1.8	1.6	2.5	2.6	2.6
Dissolved Lead	NA	0.0034	**0.1**	5	mg/L	0.001	0.017	-	0.005	0.009	0.004	0.003	0.004	0.002	0.002
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
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
Dissolved Nickel	NA	-	**1**	2	mg/L	0.001	0.009	-	0.003	0.003	0.002	0.002	0.002	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
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	-	-	-	-	-	-	-	-

- 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
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
Concentrations in **bold** exceed irrigation screening criteria
Concentrations in *italics* exceed stockwatering screening criteria

Client: TfNSW
Job No: 3180001376
Project Name: December 2022 Surface Water Monitoring Report
12-01-23

Table 10: SW8 Analytical Results

					Sample Type:		**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
					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
					Sample ID:		SW8	SW8	SW8	SW8	SW8	SW8	SW8	SW8	SW8
					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
					Project No:		318000780	318000780	318000780	318000780	318000780	318000780	318000780	318001376	318001376-001
					Sample Location		Tarago Rail Loop	Tarago Rail Loop	Tarago Rail Loop	Tarago Rail Loop	Tarago Rail Loop	Tarago Rail Loop	Tarago Rail Loop	Tarago Rail 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	**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 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.
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
Dissolved Barium	NA	-	**-**	-	mg/L	0.001	-	-	0.02	0.09	0.11	0.06	0.06	0.07	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
Dissolved Cadmium	NA	0.00054	**0.05**	0.01	mg/L	0.0002	< 0.0002	-	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	-	-	0.001	< 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
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
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
Dissolved Lead	NA	0.0034	**5**	0.1	mg/L	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
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
Dissolved Nickel	NA	0.0275	**2**	1	mg/L	0.001	< 0.001	-	0.002	0.001	< 0.001	0.002	0.001	0.001	0.001
Dissolved Zinc	NA	0.02	**5**	20	mg/L	0.005	< 0.005	-	0.1	0.01	< 0.005	0.008	0.018	0.023	0.011
Total Recoverable Hydrocarbons - 2013 NEPM Fractions															
Naphthalene	17	16	-	-	µg/L	10	<10	-	-	-	-	-	-	-	-
TRH >C10-C16	-	-	-	-	µg/L	50	<50	-	-	-	-	-	-	-	-
TRH >C10-C16 less Naphthalene (F2)	-	-	-	-	µg/L	50	<50	-	-	-	-	-	-	-	-
TRH >C10-C40 (total)*	-	-	-	-	µg/L	100	<100	-	-	-	-	-	-	-	-
TRH >C16-C34	-	-	-	-	µg/L	100	<100	-	-	-	-	-	-	-	-
TRH >C34-C40	-	-	-	-	µg/L	100	<100	-	-	-	-	-	-	-	-
TRH C6-C10	-	-	-	-	µg/L	20	<20	-	-	-	-	-	-	-	-
TRH C6-C10 less BTEX (F1)	-	-	-	-	µg/L	20	<20	-	-	-	-	-	-	-	-
BTEX															
Benzene	10	950	-	-	µg/L	1	< 1	-	-	-	-	-	-	-	-
Ethylbenzene	3000	80	-	-	µg/L	1	< 1	-	-	-	-	-	-	-	-
m&p-Xylenes	-	-	-	-	µg/L	2	< 2	-	-	-	-	-	-	-	-
o-Xylene	-	-	-	-	µg/L	1	< 1	-	-	-	-	-	-	-	-
Toluene	8000	180	-	-	µg/L	1	< 1	-	-	-	-	-	-	-	-
Xylenes - Total	6000	200	-	-	µg/L	3	< 3	-	-	-	-	-	-	-	-

- indicates no criterion available
LOR = Limit of Reporting
Concentrations below the LOR noted as <value
NOC = No observed contamination
Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG 2018)
Australia and New Zealand Environment and Conservation Council (2000) Australian and New Zealand Guidelines for Fresh and Marine Water Quality.
ANZECC, NEPM and NHMRC guidelines for mercury are based on total mercury.
[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
Concentrations in **bold** exceed irrigation screening criteria
Concentrations in *italics* exceed stockwatering screening criteria

Client: TfNSW
Job No: 3180001376
Project Name: December 2022 Surface Water Monitoring Report
12-01-23

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
					Lab ID		S20-Ja29062	S20-Ap12293	S20-Au23124	S20-Oc25167	S21-Ja34965	S21-Ap22339	N21-Jl30459	S22-Se00368	N22-De0031042
					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
					Sample ID:		SW9	SW9	SW9	SW9	SW9	SW9	SW9	SW9	SW9
					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
					Project No:		318000780	318000780	318000780	318000780	318000780	318000780	318000780	318001376	318001376-001
					Sample Location		Tarago Rail Loop	Tarago Rail Loop	Tarago Rail Loop	Tarago Rail Loop	Tarago Rail Loop	Tarago Rail Loop	Tarago Rail Loop	Tarago Rail 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:		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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
Dissolved Barium	NA	-	**-**	-	mg/L	0.001	-	-	0.02	0.09	0.12	0.06	0.06	0.06	0.08
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
Dissolved Cadmium	NA	0.00054	**0.05**	0.01	mg/L	0.0002	< 0.0002	-	0.0004	< 0.0002	< 0.0002	< 0.0002	< 0.0002	<0.0002	< 0.0002
Dissolved Chromium	NA	0.0025	**1**	1	mg/L	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
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
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
Dissolved Lead	NA	0.0034	**5**	0.1	mg/L	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
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
Dissolved Nickel	NA	0.0275	**2**	1	mg/L	0.001	< 0.001	-	0.002	0.001	0.001	0.002	0.001	0.001	0.002
Dissolved Zinc	NA	0.02	**5**	20	mg/L	0.005	< 0.005	-	0.14	< 0.005	0.006	0.01	0.034	0.038	0.007
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
Concentrations in **bold** exceed irrigation screening criteria
Concentrations in *italics* exceed stockwatering screening criteria

Client: TfNSW
Job No: 3180001376
Project Name: December 2022 Surface Water Monitoring Report
12-01-23

Table 12: SW10 Analytical Results

	Health-based Screening Criteria (Recreational Waters)[B]	Ecological Screening Criteria (ANZG 95% Protection) Fresh Water[C]	ANZECC Fresh Water Guidelines - Irrigation[D]	ANZECC Fresh Water Guidelines - Stock Water[E]								
Sample Type:							**Surface Water**	**Surface Water**	**Surface Water**	**Surface Water**	**Surface Water**	**Surface Water**
Lab ID							S20-Oc25153	S21-Ja34966	S21-Ap22340	N21-Jl30460	S22-Se00368	N22-De0031043
Sample date:							13-Oct-20	28-Jan-21	14-Apr-21	13-Jul-21	13-Sep-22	12-Dec-22
Sample ID:							SW10	SW10	SW10	SW10	SW10	SW10
Project Name:							Tarago SW Monitoring	Tarago SW Monitoring	Tarago SW Monitoring	Tarago SW Monitoring	Tarago SW Monitoring	Tarago SW Monitoring
Project No:							318000780	318000780	318000780	318000780	318001376	318001376-001
Sample Location							Tarago Rail Loop	Tarago Rail Loop	Tarago Rail Loop	Tarago Rail Loop	Tarago Rail Corridor	Tarago Rail Corridor
Sampling Method:							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
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
Arsenic	0.1	NA	NA	NA	mg/L	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
Beryllium	0.6	NA	NA	NA	mg/L	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
Chromium	0.5	NA	NA	NA	mg/L	0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.002	< 0.001
Cobalt	-	NA	NA	NA	mg/L	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
Iron	3	NA	NA	NA	mg/L	0.05	0.55	0.79	0.24	0.29	0.53	0.79
Lead	0.1	NA	NA	NA	mg/L	0.001	0.002	< 0.001	< 0.001	< 0.001	<0.001	0.002
Manganese	5	NA	NA	NA	mg/L	0.005	0.089	0.31	0.036	0.066	0.13	0.41
Mercury	0.01	NA	NA	NA	mg/L	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
Zinc	30	NA	NA	NA	mg/L	0.005	0.013	< 0.005	0.013	0.032	0.031	0.023
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
Arsenic (filtered)	NA	0.024	**2**	0.5-5	mg/L	0.001	< 0.001	0.002	< 0.001	< 0.001	<0.001	< 0.001
Barium (filtered)	NA	-	**-**	-	mg/L	0.001	0.11	0.11	0.06	0.06	0.07	0.08
Beryllium (filtered)	NA	-	**0.5**	-	mg/L	0.001	< 0.001	< 0.001	< 0.001	< 0.001	<0.001	< 0.001
Cadmium (filtered)	NA	0.00054	**0.05**	0.01	mg/L	0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	<0.0002	< 0.0002
Chromium (filtered)	NA	0.0025	**1**	1	mg/L	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
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
Iron (filtered)	NA	-	**10**	not sufficiently toxic	mg/L	0.05	0.11	0.8	0.08	0.18	0.24	0.08
Lead (filtered)	NA	0.0034	**5**	0.1	mg/L	0.001	< 0.001	< 0.001	< 0.001	< 0.001	<0.001	< 0.001
Manganese (filtered)	NA	1.9	**10**	not sufficiently toxic	mg/L	0.005	0.089	0.33	0.023	0.057	0.12	0.35
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
Nickel (filtered)	NA	0.0275	**2**	1	mg/L	0.001	< 0.001	< 0.001	0.001	0.001	0.001	0.002
Zinc (filtered)	NA	0.02	**5**	20	mg/L	0.005	0.006	< 0.005	0.008	0.025	0.025	0.007

- 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
Concentrations in **bold** exceed irrigation screening criteria
Concentrations in *italics* exceed stockwatering screening criteria

Client: TfNSW
Job No: 3180001376
Project Name: December 2022 Surface Water Monitoring Report
12-01-23

Table 13: QA/QC Assessment

	Sample Type:		Surface Water	Surface Water	RPD %	Surface Water	Surface Water	RPD %
	Duplicate Type:		Intra-Laboratory Duplicate			Inter-Laboratory Duplicate		
	Lab ID		N22-De0031035	N22-De0031044		N22-De0031035	ES2245721001	
	Sample date:		13-Dec-23	13-Dec-23		13-Dec-23	13-Dec-23	
	Sample ID:		SW1	D01		SW1	T01	
	Project Name:		Tarago SW Monitoring	Tarago SW Monitoring		Tarago SW Monitoring	Tarago SW Monitoring	
	Project No:		318001376-001	318001376-001		318001376-001	318001376-001	
	Sample Location		Tarago Rail Corridor	Tarago Rail Corridor		Tarago Rail Corridor	Tarago Rail Corridor	
	Sampling Method:		Grab Sample	Grab Sample		Grab Sample	Grab Sample	
Analyte grouping/Analyte	**Units**	**LOR**						
Inorganics								
Ammonia (as N)	µg/L	10	-	-	-	-	-	-
Ammonium Ion (as N)	µg/L	10	-	-	-	-	-	-
Conductivity (at 25@°C)	µS/cm	1	-	-	-	-	-	-
Nitrate & Nitrite (as N)	µg/L	50	-	-	-	-	-	-
Nitrate (as N)	µg/L	20	-	-	-	-	-	-
Nitrite (as N)	µg/L	20	-	-	-	-	-	-
pH (at 25@°C)	pH units	0.1	-	-	-	-	-	-
Phosphate total (as P)	µg/L	50	-	-	-	-	-	-
Total Dissolved Solids Dried at 180°C ± 2°C	mg/L	10	-	-	-	-	-	-
Total Kjeldahl Nitrogen (as N)	µg/L	200	-	-	-	-	-	-
Total Nitrogen (as N)	µg/L	200	-	-	-	-	-	-
Total Suspended Solids Dried at 105°C	mg/L	5	-	-	-	-	-	-
Turbidity	NTU	1	-	-	-	-	-	-
Total Metals								
Aluminium	mg/L	0.05	< 0.05	< 0.05	-	< 0.05	0.02	-
Arsenic	mg/L	0.001	< 0.001	< 0.001	-	< 0.001	<0.001	-
Barium	mg/L	0.001	0.07	0.06	15.4	0.07	0.052	29.5
Beryllium	mg/L	0.001	< 0.001	< 0.001	-	< 0.001	<0.001	-
Cadmium	mg/L	0.0002	< 0.0002	< 0.0002	-	< 0.0002	<0.0001	-
Chromium	mg/L	0.001	< 0.001	< 0.001	-	< 0.001	<0.001	-
Cobalt	mg/L	0.001	< 0.001	< 0.001	-	< 0.001	<0.001	-
Copper	mg/L	0.001	0.00	0.00	0.0	0.00	<0.001	-
Iron	mg/L	0.05	0.23	0.23	0.0	0.23	0.14	**48.6**
Lead	mg/L	0.001	< 0.001	< 0.001	-	< 0.001	<0.001	-
Manganese	mg/L	0.005	0.03	0.03	7.4	0.03	0.02	**36.4**
Mercury	mg/L	0.0001	< 0.0001	< 0.0001	-	< 0.0001	<0.0001	-
Nickel	mg/L	0.001	0.00	< 0.001	-	0.001	<0.001	-
Zinc	mg/L	0.005	0.02	0.02	5.4	0.019	0.008	**81.5**
Dissolved Metals								
Aluminium (filtered)	mg/L	0.05	< 0.05	< 0.05	-	< 0.05	<0.01	-
Arsenic (filtered)	mg/L	0.001	< 0.001	< 0.001	-	< 0.001	<0.001	-
Barium (filtered)	mg/L	0.001	0.06	0.06	0.0	0.060	0.052	14.3
Beryllium (filtered)	mg/L	0.001	< 0.001	< 0.001	-	< 0.001	<0.001	-
Cadmium (filtered)	mg/L	0.0002	< 0.0002	< 0.0002	-	< 0.0002	<0.0001	-
Chromium (filtered)	mg/L	0.001	< 0.001	< 0.001	-	< 0.001	<0.001	-
Cobalt (filtered)	mg/L	0.001	< 0.001	< 0.001	-	< 0.001	<0.001	-
Copper (filtered)	mg/L	0.001	< 0.001	< 0.001	-	< 0.001	<0.001	-
Iron (filtered)	mg/L	0.05	0.10	0.09	10.5	0.10	0.14	**33.3**
Lead (filtered)	mg/L	0.001	< 0.001	< 0.001	-	< 0.001	<0.001	-
Manganese (filtered)	mg/L	0.005	0.02	0.02	4.3	0.024	0.015	**46.2**
Mercury (filtered)	mg/L	0.0001	< 0.0001	< 0.0001	-	< 0.0001	<0.0001	-
Nickel (filtered)	mg/L	0.001	< 0.001	< 0.001	-	< 0.001	<0.001	-
Zinc (filtered)	mg/L	0.005	0.02	0.02	0.0	0.016	0.007	**78.3**
Total Recoverable Hydrocarbons - 1999 NEPM Fractions								
TRH C10-C14	µg/L	50	-	-	-	-	-	-
TRH C10-C36 (Total)	µg/L	100	-	-	-	-	-	-
TRH C15-C28	µg/L	100	-	-	-	-	-	-
TRH C29-C36	µg/L	100	-	-	-	-	-	-
TRH C6-C9	µg/L	20	-	-	-	-	-	-
Total Recoverable Hydrocarbons - 2013 NEPM Fractions								
Naphthalene	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	µg/L	1	-	-	-	-	-	-
Ethylbenzene	µg/L	1	-	-	-	-	-	-
m&p-Xylenes	µg/L	2	-	-	-	-	-	-
o-Xylene	µg/L	1	-	-	-	-	-	-
Toluene	µg/L	1	-	-	-	-	-	-
Xylenes - Total	µg/L	3	-	-	-	-	-	-

LOR = Limit of Reporting
ND = 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 indicates not analysed

APPENDIX 4
LABORATORY REPORTS

CHAIN OF CUSTODY RECORD

Eurofins | Environment Testing ABN 50 005 085 521

☐ Sydney Laboratory
179 Magowar Road, Girraween, NSW 2145
+61 2 9900 8400 EnviroSampleNSW@eurofins.com

☐ Brisbane Laboratory
Unit 1/21 Smallwood Place, Murarrie, QLD 4172
+61 7 3902 4600 EnviroSampleQLD@eurofins.com

☐ Perth Laboratory
46-48 Banksia Road, Welshpool, WA 6106
+61 8 6253 4444 EnviroSampleWA@eurofins.com

☐ Melbourne Laboratory
6 Monterey Road Dandenong South VIC 3175
+61 3 8564 5000 EnviroSampleVic@eurofins.com

Company	Ramboll Australia	Project №	318001376	Project Manager	Stephen Maxwell
Address	50 Glebe Road, The Junction, NSW 2291	Project Name	318001376	EDD Format (ESdat, EQuIS etc)	Esdat, EQuIS, PDF, Excel
Contact Name	Sam Buckley				
Phone №	0481 384 112				
Special Directions					
Purchase Order					
Quote ID №					

Sampler(s)	S. Buckley / J. Cowburn
Handed over by	S. Buckley
Email for Invoice	smaxwell@ramboll.com
Email for Results	smaxwell@ramboll.com / sbuckley@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( )

№	Client Sample ID	Sampled Date/Time dd/mm/yy hh:mm	Matrix Solid (S) Water (W)	Analyses: Total Metals (Al, As, Ba, Be, Cd, Cr, Co, Cu, Fe, Pb, Mn, Hg, Ni, Zn)	Analyses: Dissolved Metals (Al, As, Ba, Be, Cd, Cr, Co, Cu, Fe, Pb, Mn, Hg, Ni, Zn)	Containers: 500mL Plastic	250mL Plastic	125mL Plastic	200mL Amber Glass	40mL VOA vial	500mL PFAS Bottle	60mL Plastic Bottle (Total)	60mL Plastic Bottle (Dissolved)	Sample Comments / Dangerous Goods Hazard Warning
1	SW1_UP	13/12/22	W	X	X							1	1	
2	SW1	13/12/22	W	X	X							1	1	
3	SW2	13/12/22	W	X	X							1	1	
4	SW3	13/12/22	W	X	X							1	1	
5	SW4	13/12/22	W	X	X							1	1	
6	SW6	13/12/22	W	X	X							1	1	
7	SW7	13/12/22	W	X	X							1	1	
8	SW8	12/12/22	W	X	X							1	1	
9	SW9	12/12/22	W	X	X							1	1	
10	SW10	12/12/22	W	X	X							1	1	
	Total Counts			10	10							10	10	

Method of Shipment	☐ Courier (#)	☑ Hand Delivered	☐ Postal	Name	Sam Buckley	Signature		Date	44909	Time	
Laboratory Use Only	Received By	Jaidyn Slowgrove	SYD | BNE | MEL | PER | ADL | NTL | DRW	Signature		Date	14/12/22	Time	9:00 AM	Temperature	8
	Received By		SYD | BNE | MEL | PER | ADL | NTL | DRW	Signature		Date		Time		Report №	95004?

CHAIN OF CUSTODY RECORD

Eurofins | Environment Testing ABN 50 005 085 521

☐ Sydney Laboratory
179 Magowar Road, Girraween, NSW 2145
+61 2 9900 8400 EnviroSampleNSW@eurofins.com

☐ Brisbane Laboratory
Unit 1/21 Smallwood Place, Murarrie, QLD 4172
+61 7 3902 4600 EnviroSampleQLD@eurofins.com

☐ Perth Laboratory
46-48 Banksia Road, Welshpool, WA 6106
+61 8 6253 4444 EnviroSampleWA@eurofins.com

☐ Melbourne Laboratory
6 Monterey Road Dandenong South VIC 3175
+61 3 8564 5000 EnviroSampleVic@eurofins.com

Company	Ramboll Australia	Project №	318001376	Project Manager	Stephen Maxwell
Address	50 Glebe Road, The Junction, NSW 2291	Project Name	318001376	EDD Format (ESdat, EQuIS etc)	Esdat, EQuIS, PDF, Excel
Contact Name	Sam Buckley				
Phone №	481384112				
Special Directions					
Purchase Order					
Quote ID №					

Sampler(s)	S. Buckley / J. Cowburn	
Handed over by	S. Buckley	
Email for Invoice	smaxwell@ramboll.com	
Email for Results	smaxwell@ramboll.com / sbuckley@ramboll.com	

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

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( )

№	Client Sample ID	Sampled Date/Time dd/mm/yy hh:mm	Matrix Solid (S) Water (W)	Total Metals (Al, As, Ba, Be, Cd, Cr, Co, Cu, Fe, Pb, Mn, Hg, Ni, Zn)	Dissolved Metals (Al, As, Ba, Be, Cd, Cr, Co, Cu, Fe, Pb, Mn, Hg, Ni, Zn)	500mL Plastic	250mL Plastic	125mL Plastic	200mL Amber Glass	40mL VOA vial	500mL PFAS Bottle	60mL Plastic Bottle (Total)	60mL Plastic Bottle (Dissolved)	Sample Comments / Dangerous Goods Hazard Warning
1	D01	13/12/22	W	✖	✖							1	1	
2	T01	13/12/22	W	✖	✖							1	1	Please forward to ALS
3														
4														
5														
6														
7														
8														
9														
10														
	Total Counts			2	2							2	2	

Method of Shipment	☐ Courier (#)	☑ Hand Delivered	☐ Postal	Name	Sam Buckley	Signature		Date	14/12/2022	Time	
Laboratory Use Only	Received By	Bridget Slaymaker	SYD | BNE | MEL | PER | ADL | (NTL) | DRW	Signature		Date	14/12/22	Time	9:00AM	Temperature	8
	Received By		SYD | BNE | MEL | PER | ADL | NTL | DRW	Signature		Date		Time		Report №	95004

eurofins | Environment Testing

www.eurofins.com.au EnviroSales@eurofins.com

Eurofins Environment Testing Australia Pty Ltd

ABN: 50 005 085 521

Melbourne	Geelong	Sydney	Canberra	Brisbane	Newcastle
6 Monterey Road	19/8 Lewalan Street	179 Magowar Road	Unit 1,2 Dacre Street	1/21 Smallwood Place	4/52 Industrial Drive
Dandenong South	Grovedale	Girraween	Mitchell	Murarrie	Mayfield East NSW 2304
VIC 3175	VIC 3216	NSW 2145	ACT 2911	QLD 4172	PO Box 60 Wickham 2293
Tel: +61 3 8564 5000	Tel: +61 3 8564 5000	Tel: +61 2 9900 8400	Tel: +61 2 6113 8091	Tel: +61 7 3902 4600	Tel: +61 2 4968 8448
NATA# 1261 Site# 1254	NATA# 1261 Site# 1254	NATA# 1261 Site# 18217		NATA# 1261 Site# 20794	NATA# 1261 Site# 25079

Eurofins ARL Pty Ltd

ABN: 91 05 0159 898

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

Eurofins Environment Testing NZ Ltd

NZBN: 9429046024954

Auckland	Christchurch
35 O'Rorke Road	43 Detroit Drive
Penrose,	Rolleston,
Auckland 1061	Christchurch 7675
Tel: +64 9 526 45 51	Tel: 0800 856 450
IANZ# 1327	IANZ# 1290

Sample Receipt Advice

Company name:	Ramboll Australia Pty Ltd
Contact name:	Stephen Maxwell
Project name:	318001376
Project ID:	318001376
Turnaround time:	5 Day
Date/Time received	Dec 14, 2022 9:00 AM
Eurofins reference	950047

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

T01 sent to ALS.

Contact

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

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

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

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

eurofins

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

Eurofins Environment Testing Australia Pty Ltd
ABN: 50 005 085 521

Melbourne
6 Monterey Road
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VIC 3175
Tel: +61 3 8564 5000
NATA# 1261 Site# 1254

Geelong
19/8 Lewalan Street
Grovedale
VIC 3216
Tel: +61 3 8564 5000
NATA# 1261 Site# 1254

Sydney
179 Magowar Road
Girraween
NSW 2145
Tel: +61 2 9900 8400
NATA# 1261 Site# 18217

Canberra
Unit 1,2 Dacre Street
Mitchell
ACT 2911
Tel: +61 2 6113 8091

Brisbane
1/21 Smallwood Place
Murarrie
QLD 4172
Tel: +61 7 3902 4600
NATA# 1261 Site# 20794

Newcastle
4/52 Industrial Drive
Mayfield East NSW 2304
PO Box 60 Wickham 2293
Tel: +61 2 4968 8448
NATA# 1261 Site# 25079

Eurofins ARL Pty Ltd
ABN: 91 05 0159 898

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

Eurofins Environment Testing NZ Ltd
NZBN: 9429046024954

Auckland
35 O'Rorke Road
Penrose,
Auckland 1061
Tel: +64 9 526 45 51
IANZ# 1327

Christchurch
43 Detroit Drive
Rolleston,
Christchurch 7675
Tel: 0800 856 450
IANZ# 1290

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

Project Name: 318001376
Project ID: 318001376

Order No.:
Report #: 950047
Phone: 02 9954 8118
Fax: 02 9954 8150

Received: Dec 14, 2022 9:00 AM
Due: Dec 21, 2022
Priority: 5 Day
Contact Name: Stephen Maxwell

Eurofins Analytical Services Manager : Andrew Black

Sample Detail						Aluminium	Aluminium (filtered)	Barium	Barium (filtered)	Beryllium	Beryllium (filtered)	Cobalt	Cobalt (filtered)	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
External Laboratory																			
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**														
1	SW1_UP	Dec 13, 2022		Water	N22-De0031034	X	X	X	X	X	X	X	X	X	X	X	X	X	X
2	SW1	Dec 13, 2022		Water	N22-De0031035	X	X	X	X	X	X	X	X	X	X	X	X	X	X
3	SW2	Dec 13, 2022		Water	N22-De0031036	X	X	X	X	X	X	X	X	X	X	X	X	X	X
4	SW3	Dec 13, 2022		Water	N22-De0031037	X	X	X	X	X	X	X	X	X	X	X	X	X	X
5	SW4	Dec 13, 2022		Water	N22-De0031038	X	X	X	X	X	X	X	X	X	X	X	X	X	X
6	SW6	Dec 13, 2022		Water	N22-De0031039	X	X	X	X	X	X	X	X	X	X	X	X	X	X
7	SW7	Dec 13, 2022		Water	N22-De0031040	X	X	X	X	X	X	X	X	X	X	X	X	X	X
8	SW8	Dec 13, 2022		Water	N22-De0031041	X	X	X	X	X	X	X	X	X	X	X	X	X	X
9	SW9	Dec 13, 2022		Water	N22-De0031042	X	X	X	X	X	X	X	X	X	X	X	X	X	X
10	SW10	Dec 13, 2022		Water	N22-De0031043	X	X	X	X	X	X	X	X	X	X	X	X	X	X
11	D01	Dec 13, 2022		Water	N22-De0031044	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Test Counts						11	11	11	11	11	11	11	11	11	11	11	11	11	11

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

Attention: **Stephen Maxwell**

Report **950047-W**
Project name 318001376
Project ID 318001376
Received Date Dec 14, 2022

Client Sample ID			**SW1_UP**	**SW1**	**SW2**	**SW3**
Sample Matrix			**Water**	**Water**	**Water**	**Water**
Eurofins Sample No.			**N22-De0031034**	**N22-De0031035**	**N22-De0031036**	**N22-De0031037**
Date Sampled			**Dec 13, 2022**	**Dec 13, 2022**	**Dec 13, 2022**	**Dec 13, 2022**
Test/Reference	LOR	Unit				
Heavy Metals						
Aluminium	0.05	mg/L	< 0.05	< 0.05	< 0.05	0.25
Aluminium (filtered)	0.05	mg/L	< 0.05	< 0.05	< 0.05	0.08
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	0.06	0.07	0.06	0.08
Barium (filtered)	0.02	mg/L	0.07	0.06	0.06	0.07
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	0.0045
Cadmium (filtered)	0.0002	mg/L	< 0.0002	< 0.0002	< 0.0002	0.0038
Chromium	0.001	mg/L	< 0.001	< 0.001	0.001	0.002
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	0.003
Cobalt (filtered)	0.001	mg/L	< 0.001	< 0.001	< 0.001	0.003
Copper	0.001	mg/L	0.001	0.001	0.001	0.046
Copper (filtered)	0.001	mg/L	< 0.001	< 0.001	< 0.001	0.038
Iron	0.05	mg/L	0.12	0.23	0.24	0.67
Iron (filtered)	0.05	mg/L	0.07	0.10	0.06	0.31
Lead	0.001	mg/L	< 0.001	< 0.001	0.001	0.015
Lead (filtered)	0.001	mg/L	< 0.001	< 0.001	< 0.001	0.006
Manganese	0.005	mg/L	0.024	0.026	0.036	0.30
Manganese (filtered)	0.005	mg/L	0.027	0.024	0.034	0.27
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	0.002	0.008
Nickel (filtered)	0.001	mg/L	< 0.001	< 0.001	< 0.001	0.007
Zinc	0.005	mg/L	< 0.005	0.019	0.008	0.97
Zinc (filtered)	0.005	mg/L	< 0.005	0.016	< 0.005	0.87

Client Sample ID			SW4	SW6	SW7	SW8
Sample Matrix			Water	Water	Water	Water
Eurofins Sample No.			N22-De0031038	N22-De0031039	N22-De0031040	N22-De0031041
Date Sampled			Dec 13, 2022	Dec 13, 2022	Dec 13, 2022	Dec 13, 2022
Test/Reference	LOR	Unit				
Heavy Metals						
Aluminium	0.05	mg/L	0.66	4.0	0.22	0.26
Aluminium (filtered)	0.05	mg/L	0.19	0.34	< 0.05	< 0.05
Arsenic	0.001	mg/L	0.002	0.003	0.003	< 0.001
Arsenic (filtered)	0.001	mg/L	< 0.001	0.001	0.002	< 0.001
Barium	0.02	mg/L	0.07	0.08	0.03	0.08
Barium (filtered)	0.02	mg/L	0.06	0.05	0.03	0.07
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	0.0035	0.0037	< 0.0002	< 0.0002
Cadmium (filtered)	0.0002	mg/L	0.0030	0.0025	< 0.0002	< 0.0002
Chromium	0.001	mg/L	0.002	0.004	0.001	< 0.001
Chromium (filtered)	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Cobalt	0.001	mg/L	0.001	0.002	< 0.001	0.001
Cobalt (filtered)	0.001	mg/L	0.001	0.001	< 0.001	< 0.001
Copper	0.001	mg/L	0.059	0.069	0.004	0.003
Copper (filtered)	0.001	mg/L	0.049	0.043	0.004	0.002
Iron	0.05	mg/L	0.88	4.5	5.0	0.66
Iron (filtered)	0.05	mg/L	0.43	0.82	2.6	0.09
Lead	0.001	mg/L	0.033	0.052	0.004	0.002
Lead (filtered)	0.001	mg/L	0.010	0.016	0.002	< 0.001
Manganese	0.005	mg/L	0.13	0.17	0.16	0.40
Manganese (filtered)	0.005	mg/L	0.11	0.12	0.15	0.33
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	0.009	0.012	0.002	0.002
Nickel (filtered)	0.001	mg/L	0.008	0.008	0.001	0.001
Zinc	0.005	mg/L	0.63	1.2	0.026	0.023
Zinc (filtered)	0.005	mg/L	0.58	0.79	0.018	0.011

Client Sample ID			SW9	SW10	D01
Sample Matrix			Water	Water	Water
Eurofins Sample No.			N22-De0031042	N22-De0031043	N22-De0031044
Date Sampled			Dec 13, 2022	Dec 13, 2022	Dec 13, 2022
Test/Reference	LOR	Unit			
Heavy Metals					
Aluminium	0.05	mg/L	0.07	0.42	< 0.05
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	0.10	0.09	0.06
Barium (filtered)	0.02	mg/L	0.08	0.08	0.06
Beryllium	0.001	mg/L	< 0.001	< 0.001	< 0.001
Beryllium (filtered)	0.001	mg/L	< 0.001	< 0.001	< 0.001
Cadmium	0.0002	mg/L	< 0.0002	< 0.0002	< 0.0002
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

Client Sample ID			SW9	SW10	D01
Sample Matrix			Water	Water	Water
Eurofins Sample No.			N22-De0031042	N22-De0031043	N22-De0031044
Date Sampled			Dec 13, 2022	Dec 13, 2022	Dec 13, 2022
Test/Reference	LOR	Unit			
Heavy Metals					
Cobalt	0.001	mg/L	0.001	< 0.001	< 0.001
Cobalt (filtered)	0.001	mg/L	0.001	< 0.001	< 0.001
Copper	0.001	mg/L	0.001	0.003	0.001
Copper (filtered)	0.001	mg/L	0.001	0.002	< 0.001
Iron	0.05	mg/L	1.5	0.79	0.23
Iron (filtered)	0.05	mg/L	0.69	0.08	0.09
Lead	0.001	mg/L	< 0.001	0.002	< 0.001
Lead (filtered)	0.001	mg/L	< 0.001	< 0.001	< 0.001
Manganese	0.005	mg/L	0.96	0.41	0.028
Manganese (filtered)	0.005	mg/L	0.85	0.35	0.023
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	0.002	0.002	< 0.001
Nickel (filtered)	0.001	mg/L	0.002	0.002	< 0.001
Zinc	0.005	mg/L	0.013	0.023	0.018
Zinc (filtered)	0.005	mg/L	0.007	0.007	0.016

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
Heavy Metals	Sydney	Dec 16, 2022	28 Days
- Method: LTM-MET-3040 Metals in Waters, Soils & Sediments by ICP-MS			
Heavy Metals (filtered)	Sydney	Dec 16, 2022	180 Days
- Method: LTM-MET-3040 Metals in Waters, Soils & Sediments by ICP-MS			
Metals M8	Sydney	Dec 16, 2022	28 Days
- Method: LTM-MET-3040 Metals in Waters, Soils & Sediments by ICP-MS			
Metals M8 filtered	Sydney	Dec 16, 2022	28 Days
- Method: LTM-MET-3040 Metals in Waters, Soils & Sediments by ICP-MS			

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

Project Name: 318001376
Project ID: 318001376

Order No.:
Report #: 950047
Phone: 02 9954 8118
Fax: 02 9954 8150

Received: Dec 14, 2022 9:00 AM
Due: Dec 21, 2022
Priority: 5 Day
Contact Name: Stephen Maxwell

Eurofins Analytical Services Manager : Andrew Black

Sample Detail						Aluminium	Aluminium (filtered)	Barium	Barium (filtered)	Beryllium	Beryllium (filtered)	Cobalt	Cobalt (filtered)	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
External Laboratory																			
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**														
1	SW1_UP	Dec 13, 2022		Water	N22-De0031034	X	X	X	X	X	X	X	X	X	X	X	X	X	X
2	SW1	Dec 13, 2022		Water	N22-De0031035	X	X	X	X	X	X	X	X	X	X	X	X	X	X
3	SW2	Dec 13, 2022		Water	N22-De0031036	X	X	X	X	X	X	X	X	X	X	X	X	X	X
4	SW3	Dec 13, 2022		Water	N22-De0031037	X	X	X	X	X	X	X	X	X	X	X	X	X	X
5	SW4	Dec 13, 2022		Water	N22-De0031038	X	X	X	X	X	X	X	X	X	X	X	X	X	X
6	SW6	Dec 13, 2022		Water	N22-De0031039	X	X	X	X	X	X	X	X	X	X	X	X	X	X
7	SW7	Dec 13, 2022		Water	N22-De0031040	X	X	X	X	X	X	X	X	X	X	X	X	X	X
8	SW8	Dec 13, 2022		Water	N22-De0031041	X	X	X	X	X	X	X	X	X	X	X	X	X	X
9	SW9	Dec 13, 2022		Water	N22-De0031042	X	X	X	X	X	X	X	X	X	X	X	X	X	X
10	SW10	Dec 13, 2022		Water	N22-De0031043	X	X	X	X	X	X	X	X	X	X	X	X	X	X
11	D01	Dec 13, 2022		Water	N22-De0031044	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Test Counts						11	11	11	11	11	11	11	11	11	11	11	11	11	11

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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

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	
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	%	113			80-120	Pass	
Aluminium (filtered)	%	103			80-120	Pass	
Arsenic	%	104			80-120	Pass	
Arsenic (filtered)	%	99			80-120	Pass	
Barium	%	106			80-120	Pass	
Barium (filtered)	%	101			80-120	Pass	
Beryllium	%	118			80-120	Pass	
Cadmium	%	105			80-120	Pass	
Cadmium (filtered)	%	100			80-120	Pass	
Chromium	%	107			80-120	Pass	
Chromium (filtered)	%	107			80-120	Pass	
Cobalt	%	100			80-120	Pass	
Cobalt (filtered)	%	105			80-120	Pass	
Copper	%	96			80-120	Pass	
Copper (filtered)	%	104			80-120	Pass	
Iron	%	103			80-120	Pass	
Iron (filtered)	%	104			80-120	Pass	
Lead	%	103			80-120	Pass	
Lead (filtered)	%	102			80-120	Pass	
Manganese	%	103			80-120	Pass	
Manganese (filtered)	%	103			80-120	Pass	

Test			Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Mercury			%	108			80-120	Pass	
Mercury (filtered)			%	103			80-120	Pass	
Nickel			%	112			80-120	Pass	
Nickel (filtered)			%	106			80-120	Pass	
Zinc			%	104			80-120	Pass	
Zinc (filtered)			%	104			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 (filtered)	S22-De0035827	NCP	%	106			75-125	Pass	
Arsenic (filtered)	S22-De0035827	NCP	%	100			75-125	Pass	
Barium (filtered)	S22-De0035827	NCP	%	91			75-125	Pass	
Beryllium (filtered)	S22-De0035827	NCP	%	106			75-125	Pass	
Cadmium (filtered)	S22-De0035827	NCP	%	95			75-125	Pass	
Chromium (filtered)	S22-De0035827	NCP	%	95			75-125	Pass	
Cobalt (filtered)	S22-De0035827	NCP	%	94			75-125	Pass	
Copper (filtered)	S22-De0035827	NCP	%	91			75-125	Pass	
Iron (filtered)	S22-De0035827	NCP	%	95			75-125	Pass	
Lead (filtered)	S22-De0035827	NCP	%	95			75-125	Pass	
Manganese (filtered)	S22-De0035827	NCP	%	93			75-125	Pass	
Mercury (filtered)	S22-De0035827	NCP	%	100			75-125	Pass	
Nickel (filtered)	S22-De0035827	NCP	%	91			75-125	Pass	
Zinc (filtered)	S22-De0035827	NCP	%	89			75-125	Pass	
Spike - % Recovery									
Heavy Metals				Result 1					
Aluminium	N22-De0031044	CP	%	105			75-125	Pass	
Arsenic	N22-De0031044	CP	%	102			75-125	Pass	
Barium	N22-De0031044	CP	%	103			75-125	Pass	
Beryllium	N22-De0031044	CP	%	113			75-125	Pass	
Cadmium	N22-De0031044	CP	%	100			75-125	Pass	
Chromium	N22-De0031044	CP	%	99			75-125	Pass	
Cobalt	N22-De0031044	CP	%	97			75-125	Pass	
Copper	N22-De0031044	CP	%	95			75-125	Pass	
Iron	N22-De0031044	CP	%	99			75-125	Pass	
Lead	N22-De0031044	CP	%	100			75-125	Pass	
Manganese	N22-De0031044	CP	%	99			75-125	Pass	
Mercury	N22-De0031044	CP	%	107			75-125	Pass	
Nickel	N22-De0031044	CP	%	94			75-125	Pass	
Zinc	N22-De0031044	CP	%	95			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			
Chromium (filtered)	S22-De0034651	NCP	mg/L	0.017	0.018	4.2	30%	Pass	
Mercury	S22-De0028860	NCP	mg/L	< 0.0001	< 0.0001	<1	30%	Pass	
Mercury (filtered)	S22-De0034307	NCP	mg/L	< 0.0001	< 0.0001	<1	30%	Pass	
Duplicate									
Heavy Metals				Result 1	Result 2	RPD			
Aluminium	N22-De0031035	CP	mg/L	< 0.05	< 0.05	<1	30%	Pass	
Arsenic	N22-De0031035	CP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Barium	N22-De0031035	CP	mg/L	0.07	0.07	<1	30%	Pass	
Beryllium	N22-De0031035	CP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Cadmium	N22-De0031035	CP	mg/L	< 0.0002	< 0.0002	<1	30%	Pass	
Chromium	N22-De0031035	CP	mg/L	< 0.001	< 0.001	<1	30%	Pass	

Duplicate									
Heavy Metals				Result 1	Result 2	RPD			
Cobalt	N22-De0031035	CP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Copper	N22-De0031035	CP	mg/L	0.001	0.001	9.9	30%	Pass	
Iron	N22-De0031035	CP	mg/L	0.23	0.23	2.7	30%	Pass	
Lead	N22-De0031035	CP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Manganese	N22-De0031035	CP	mg/L	0.026	0.025	4.5	30%	Pass	
Nickel	N22-De0031035	CP	mg/L	0.001	< 0.001	39	30%	Fail	Q15
Zinc	N22-De0031035	CP	mg/L	0.019	0.018	3.4	30%	Pass	
Duplicate									
Heavy Metals				Result 1	Result 2	RPD			
Aluminium (filtered)	N22-De0031039	CP	mg/L	0.34	0.32	6.5	30%	Pass	
Arsenic (filtered)	N22-De0031039	CP	mg/L	0.001	< 0.001	5.3	30%	Pass	
Barium (filtered)	N22-De0031039	CP	mg/L	0.05	0.05	1.2	30%	Pass	
Beryllium (filtered)	N22-De0031039	CP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Cadmium (filtered)	N22-De0031039	CP	mg/L	0.0025	0.0025	2.8	30%	Pass	
Cobalt (filtered)	N22-De0031039	CP	mg/L	0.001	0.001	2.6	30%	Pass	
Copper (filtered)	N22-De0031039	CP	mg/L	0.043	0.042	1.7	30%	Pass	
Iron (filtered)	N22-De0031039	CP	mg/L	0.82	0.82	<1	30%	Pass	
Lead (filtered)	N22-De0031039	CP	mg/L	0.016	0.016	<1	30%	Pass	
Manganese (filtered)	N22-De0031039	CP	mg/L	0.12	0.12	1.1	30%	Pass	
Nickel (filtered)	N22-De0031039	CP	mg/L	0.008	0.008	1.6	30%	Pass	
Zinc (filtered)	N22-De0031039	CP	mg/L	0.79	0.80	<1	30%	Pass	

2/2

CHAIN OF CUSTODY RECORD

Eurofins | Environment Testing ABN 50 005 085 521

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Address	50 Glebe Road, The Junction, NSW 2291
Contact Name	Sam Buckley
Phone №	481384112
Special Directions	
Purchase Order	
Quote ID №	
Project №	318001376
Project Name	318001376
Project Manager	Stephen Maxwell
EDD Format (Esdat, EQuIS, etc)	Esdat, EQuIS, PDF, Excel
Sampler(s)	S. Buckley / J. Cowburn
Handed over by	S. Buckley
Email for Invoice	smaxwell@ramboll.com
Email for Results	smaxwell@ramboll.com / sbuckley@ramboll.com

Environmental Division
Sydney
Work Order Reference
ES2245721
Telephone : + 61-2-8784 8555

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

№	Client Sample ID	Sampled Date/Time (dd/mm/yy hh:mm)	Matrix (Solid (S) Water (W))	Total Metals (Al, As, Ba, Be, Cd, Cr, Co, Cu, Fe, Pb, Mn, Hg, Ni, Zn)	Dissolved Metals (Al, As, Ba, Be, Cd, Cr, Co, Cu, Fe, Pb, Mn, Hg, Ni, Zn)	500mL Plastic	250mL Plastic	125mL Plastic	200mL Amber Glass	40mL VOA vial	500mL PFAS Bottle	60mL Plastic Bottle (Total)	60mL Plastic Bottle (Dissolved)	Sample Comments / Dangerous Goods Hazard Warning
1 (2)	D01	13/12/22	W	X	X							1	1	
2 (1)	T01	13/12/22	W	X	X							1	1	Please forward to ALS
3														
4														
5														
6														
7														
8														
9														
10														
	Total Counts			2	2							2	2	

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( )

Method of Shipment	☐ Courier (#) ☑ Hand Delivered ☐ Postal	Name	Sam Buckley	Signature	[signature]	Date	14/12/2022	Time	
Laboratory Use Only — Received By	[signature] SYD | BNE | MEL | PER | ADL | (NTL) | DRW	Signature	[signature]	Date	14/12/22	Time	9:00 am	Temperature	8
Received By	SYD | BNE | MEL | PER | ADL | NTL | DRW	Signature		Date		Time		Report №	95004

Eurofins Environment Testing Australia Pty Ltd EnviroSales@eurofins.com

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.

rec: Fadi [signature] 16/12/22 12:52

SAMPLE RECEIPT NOTIFICATION (SRN)

Work Order : **ES2245721**

Client	: **RAMBOLL AUSTRALIA PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: S BUCKLEY	Contact	: Cez Bautista
Address	: EASTPOINT COMPLEX SUITE 19B, LEVEL 2 50 GLEBE ROAD THE JUNCTION NSW 2291	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: sbuckley@ramboll.com	E-mail	: cez.bautista@alsglobal.com
Telephone	: ----	Telephone	: +61-2-8784 8555
Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: 318001376	Page	: 1 of 2
Order number	: ----	Quote number	: EB2017ENVIAUS0001 (EN/222)
C-O-C number	: ----	QC Level	: NEPM 2013 B3 & ALS QC Standard
Site	: ----		
Sampler	: JILLIAN COWBURN, S BUCKLEY		

Dates

Date Samples Received	: 16-Dec-2022 12:50	Issue Date	: 16-Dec-2022
Client Requested Due Date	: 28-Dec-2022	Scheduled Reporting Date	: **28-Dec-2022**

Delivery Details

Mode of Delivery	: Carrier	Security Seal	: Intact.
No. of coolers/boxes	: 1	Temperature	: 10.1'C - Ice Bricks present
Receipt Detail	:	No. of samples received / analysed	: 1 / 1

General Comments

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

Sample Container(s)/Preservation Non-Compliances

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

- **No sample container / preservation non-compliance exists.**

Summary of Sample(s) and Requested Analysis

Some items described below may be part of a laboratory process necessary for the execution of client requested tasks. Packages may contain additional analyses, such as the determination of moisture content and preparation tasks, that are included in the package.
If no sampling time is provided, the sampling time will default 00:00 on the date of sampling. If no sampling date is provided, the sampling date will be assumed by the laboratory and displayed in brackets without a time component

Matrix: **WATER**

Laboratory sample ID	Sampling date / time	Sample ID	WATER - EG020F Dissolved Metals by ICP/MS	WATER - EG020T Total Metals by ICP/MS (including digestion)	WATER - W-02 8 Metals	WATER - W-02T 8 metals (Total)
ES2245721-001	13-Dec-2022 00:00	T01	✓	✓	✓	✓

Proactive Holding Time Report

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

Requested Deliverables

ACCOUNTS PAYABLE

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

S BUCKLEY

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

STEPHEN MAXWELL

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

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **ES2245721**	Page	: 1 of 3
Client	: **RAMBOLL AUSTRALIA PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: S BUCKLEY	Contact	: Cez Bautista
Address	: EASTPOINT COMPLEX SUITE 19B, LEVEL 2 50 GLEBE ROAD THE JUNCTION NSW 2291	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: ----	Telephone	: +61-2-8784 8555
Project	: 318001376	Date Samples Received	: 16-Dec-2022 12:50
Order number	: ----	Date Analysis Commenced	: 21-Dec-2022
C-O-C number	: ----	Issue Date	: 28-Dec-2022 16:30
Sampler	: JILLIAN COWBURN, S BUCKLEY		
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*
Wisam Marassa	Inorganics Coordinator	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.

- EG020: It is recognised that total concentration is less than dissolved for some metal analytes. However, the difference is within experimental variation of the methods.

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	T01	----	----	----	----
				Sampling date / time	13-Dec-2022 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit		ES2245721-001	--------	--------	--------	--------
					Result	----	----	----	----
EG020F: Dissolved Metals by ICP-MS									
Aluminium	7429-90-5	10	µg/L		<10	----	----	----	----
Arsenic	7440-38-2	1	µg/L		<1	----	----	----	----
Beryllium	7440-41-7	1	µg/L		<1	----	----	----	----
Barium	7440-39-3	1	µg/L		**55**	----	----	----	----
Cadmium	7440-43-9	0.1	µg/L		<0.1	----	----	----	----
Chromium	7440-47-3	1	µg/L		<1	----	----	----	----
Copper	7440-50-8	1	µg/L		<1	----	----	----	----
Cobalt	7440-48-4	1	µg/L		<1	----	----	----	----
Nickel	7440-02-0	1	µg/L		<1	----	----	----	----
Lead	7439-92-1	1	µg/L		<1	----	----	----	----
Zinc	7440-66-6	5	µg/L		**8**	----	----	----	----
Manganese	7439-96-5	1	µg/L		**15**	----	----	----	----
Iron	7439-89-6	50	µg/L		**50**	----	----	----	----
EG020T: Total Metals by ICP-MS									
Aluminium	7429-90-5	10	µg/L		**20**	----	----	----	----
Arsenic	7440-38-2	1	µg/L		<1	----	----	----	----
Beryllium	7440-41-7	1	µg/L		<1	----	----	----	----
Barium	7440-39-3	1	µg/L		**52**	----	----	----	----
Cadmium	7440-43-9	0.1	µg/L		<0.1	----	----	----	----
Chromium	7440-47-3	1	µg/L		<1	----	----	----	----
Copper	7440-50-8	1	µg/L		<1	----	----	----	----
Cobalt	7440-48-4	1	µg/L		<1	----	----	----	----
Nickel	7440-02-0	1	µg/L		<1	----	----	----	----
Lead	7439-92-1	1	µg/L		<1	----	----	----	----
Zinc	7440-66-6	5	µg/L		**7**	----	----	----	----
Manganese	7439-96-5	1	µg/L		**18**	----	----	----	----
Iron	7439-89-6	50	µg/L		**140**	----	----	----	----
EG035F: Dissolved Mercury by FIMS									
Mercury	7439-97-6	0.1	µg/L		<0.1	----	----	----	----
EG035T: Total Recoverable Mercury by FIMS									
Mercury	7439-97-6	0.1	µg/L		<0.1	----	----	----	----

QUALITY CONTROL REPORT

Work Order	: **ES2245721**	Page	: 1 of 5
Client	: **RAMBOLL AUSTRALIA PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: S BUCKLEY	Contact	: Cez Bautista
Address	: EASTPOINT COMPLEX SUITE 19B, LEVEL 2 50 GLEBE ROAD THE JUNCTION NSW 2291	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: ----	Telephone	: +61-2-8784 8555
Project	: 318001376	Date Samples Received	: 16-Dec-2022
Order number	: ----	Date Analysis Commenced	: 21-Dec-2022
C-O-C number	: ----	Issue Date	: 28-Dec-2022
Sampler	: JILLIAN COWBURN, S BUCKLEY		
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

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*
Wisam Marassa	Inorganics Coordinator	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: 4786235)									
ES2245740-002	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	0.141	0.142	1.1	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	<0.001	<0.001	0.0	No Limit
		EG020A-F: Copper	7440-50-8	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Manganese	7439-96-5	0.001	mg/L	0.155	0.156	0.0	0% - 20%
		EG020A-F: Nickel	7440-02-0	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Zinc	7440-66-6	0.005	mg/L	<0.005	<0.005	0.0	No Limit
		EG020A-F: Aluminium	7429-90-5	0.01	mg/L	0.05	0.05	0.0	No Limit
		EG020A-F: Iron	7439-89-6	0.05	mg/L	<0.05	<0.05	0.0	No Limit
ES2244433-003	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	0.002	<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	0.057	0.057	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	<0.001	<0.001	0.0	No Limit
		EG020A-F: Copper	7440-50-8	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Manganese	7439-96-5	0.001	mg/L	0.039	0.040	0.0	0% - 20%
		EG020A-F: Nickel	7440-02-0	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Zinc	7440-66-6	0.005	mg/L	0.055	0.053	3.9	0% - 50%

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: 4786235) - continued									
ES2244433-003	Anonymous	EG020A-F: Aluminium	7429-90-5	0.01	mg/L	<0.01	<0.01	0.0	No Limit
		EG020A-F: Iron	7439-89-6	0.05	mg/L	0.83	0.82	0.0	0% - 50%
EG020T: Total Metals by ICP-MS (QC Lot: 4783295)									
ES2245675-001	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	0.010	0.010	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	0.357	0.335	6.3	0% - 20%
		EG020A-T: Lead	7439-92-1	0.001	mg/L	0.009	0.009	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	0.040	0.032	23.1	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	<0.05	<0.05	0.0	No Limit
ES2245761-002	Anonymous	EG020A-T: Barium	7440-39-3	0.001	mg/L	0.020	0.020	0.0	0% - 50%
ES2245761-002	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: 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	0.002	0.001	0.0	No Limit
		EG020A-T: Copper	7440-50-8	0.001	mg/L	0.007	0.007	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	0.010	0.011	0.0	0% - 50%
		EG020A-T: Nickel	7440-02-0	0.001	mg/L	0.008	0.007	0.0	No Limit
		EG020A-T: Zinc	7440-66-6	0.005	mg/L	0.017	0.017	0.0	No Limit
		EG020A-T: Aluminium	7429-90-5	0.01	mg/L	0.06	0.06	0.0	No Limit
		EG020A-T: Iron	7439-89-6	0.05	mg/L	<0.05	<0.05	0.0	No Limit
EG035F: Dissolved Mercury by FIMS (QC Lot: 4786234)									
ES2244433-002	Anonymous	EG035F: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.0	No Limit
ES2245760-004	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: 4786342)									
ES2245141-016	Anonymous	EG035T: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.0	No Limit
ES2245729-002	Anonymous	EG035T: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.0	No Limit

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

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

Sub-Matrix: **WATER**

				Method 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: 4786235)								
EG020A-F: Aluminium	7429-90-5	0.01	mg/L	<0.01	0.5 mg/L	94.9	80.0	116
EG020A-F: Arsenic	7440-38-2	0.001	mg/L	<0.001	0.1 mg/L	96.2	85.0	114
EG020A-F: Beryllium	7440-41-7	0.001	mg/L	<0.001	0.1 mg/L	99.6	85.0	115
EG020A-F: Barium	7440-39-3	0.001	mg/L	<0.001	0.1 mg/L	95.1	82.0	110
EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	0.1 mg/L	96.0	84.0	110
EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	0.1 mg/L	100	85.0	111
EG020A-F: Cobalt	7440-48-4	0.001	mg/L	<0.001	0.1 mg/L	94.7	82.0	112
EG020A-F: Copper	7440-50-8	0.001	mg/L	<0.001	0.1 mg/L	94.6	81.0	111
EG020A-F: Lead	7439-92-1	0.001	mg/L	<0.001	0.1 mg/L	93.1	83.0	111
EG020A-F: Manganese	7439-96-5	0.001	mg/L	<0.001	0.1 mg/L	98.7	82.0	110
EG020A-F: Nickel	7440-02-0	0.001	mg/L	<0.001	0.1 mg/L	95.4	82.0	112
EG020A-F: Zinc	7440-66-6	0.005	mg/L	<0.005	0.1 mg/L	96.4	81.0	117
EG020A-F: Iron	7439-89-6	0.05	mg/L	<0.05	0.5 mg/L	94.2	82.0	112
EG020T: Total Metals by ICP-MS (QCLot: 4783295)								
EG020A-T: Aluminium	7429-90-5	0.01	mg/L	<0.01	0.5 mg/L	86.7	82.0	120
EG020A-T: Arsenic	7440-38-2	0.001	mg/L	<0.001	0.1 mg/L	96.6	82.0	114
EG020A-T: Beryllium	7440-41-7	0.001	mg/L	<0.001	0.1 mg/L	91.2	79.0	119
EG020A-T: Barium	7440-39-3	0.001	mg/L	<0.001	0.1 mg/L	94.5	84.0	116
EG020A-T: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	0.1 mg/L	96.2	84.0	112
EG020A-T: Chromium	7440-47-3	0.001	mg/L	<0.001	0.1 mg/L	95.1	86.0	116
EG020A-T: Cobalt	7440-48-4	0.001	mg/L	<0.001	0.1 mg/L	94.5	84.0	116
EG020A-T: Copper	7440-50-8	0.001	mg/L	<0.001	0.1 mg/L	93.9	83.0	118
EG020A-T: Lead	7439-92-1	0.001	mg/L	<0.001	0.1 mg/L	92.0	85.0	115
EG020A-T: Manganese	7439-96-5	0.001	mg/L	<0.001	0.1 mg/L	94.6	85.0	113
EG020A-T: Nickel	7440-02-0	0.001	mg/L	<0.001	0.1 mg/L	89.0	84.0	116
EG020A-T: Zinc	7440-66-6	0.005	mg/L	<0.005	0.1 mg/L	90.3	79.0	117
EG020A-T: Iron	7439-89-6	0.05	mg/L	<0.05	0.5 mg/L	91.8	85.0	117
EG035F: Dissolved Mercury by FIMS (QCLot: 4786234)								
EG035F: Mercury	7439-97-6	0.0001	mg/L	<0.0001	0.01 mg/L	84.8	83.0	105
EG035T: Total Recoverable Mercury by FIMS (QCLot: 4786342)								
EG035T: Mercury	7439-97-6	0.0001	mg/L	<0.0001	0.01 mg/L	84.5	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**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Acceptable Limits (%)	
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EG020F: Dissolved Metals by ICP-MS (QCLot: 4786235)							
ES2244433-004	Anonymous	EG020A-F: Arsenic	7440-38-2	2 mg/L	71.4	70.0	130
		EG020A-F: Beryllium	7440-41-7	2 mg/L	77.1	70.0	130
		EG020A-F: Barium	7440-39-3	2 mg/L	70.4	70.0	130
		EG020A-F: Cadmium	7440-43-9	0.5 mg/L	72.3	70.0	130
		EG020A-F: Chromium	7440-47-3	2 mg/L	73.5	70.0	130
		EG020A-F: Cobalt	7440-48-4	2 mg/L	70.6	70.0	130
		EG020A-F: Copper	7440-50-8	2 mg/L	70.9	70.0	130
		EG020A-F: Lead	7439-92-1	2 mg/L	71.1	70.0	130
		EG020A-F: Manganese	7439-96-5	2 mg/L	73.1	70.0	130
		EG020A-F: Nickel	7440-02-0	2 mg/L	70.7	70.0	130
		EG020A-F: Zinc	7440-66-6	2 mg/L	71.0	70.0	130
EG020T: Total Metals by ICP-MS (QCLot: 4783295)							
ES2245675-002	Anonymous	EG020A-T: Arsenic	7440-38-2	1 mg/L	94.6	70.0	130
		EG020A-T: Beryllium	7440-41-7	1 mg/L	87.5	70.0	130
		EG020A-T: Barium	7440-39-3	1 mg/L	92.1	70.0	130
		EG020A-T: Cadmium	7440-43-9	0.25 mg/L	96.1	70.0	130
		EG020A-T: Chromium	7440-47-3	1 mg/L	98.2	70.0	130
		EG020A-T: Cobalt	7440-48-4	1 mg/L	94.5	70.0	130
		EG020A-T: Copper	7440-50-8	1 mg/L	96.0	70.0	130
		EG020A-T: Lead	7439-92-1	1 mg/L	97.1	70.0	130
		EG020A-T: Manganese	7439-96-5	1 mg/L	101	70.0	130
		EG020A-T: Nickel	7440-02-0	1 mg/L	91.8	70.0	130
		EG020A-T: Zinc	7440-66-6	1 mg/L	90.5	70.0	130
EG035F: Dissolved Mercury by FIMS (QCLot: 4786234)							
ES2244433-001	Anonymous	EG035F: Mercury	7439-97-6	0.01 mg/L	91.8	70.0	130
EG035T: Total Recoverable Mercury by FIMS (QCLot: 4786342)							
ES2245398-067	Anonymous	EG035T: Mercury	7439-97-6	0.01 mg/L	76.8	70.0	130

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:

Andrew Black	Analytical Services Manager
Mickael Ros	Senior Analyst-Metal

Glenn Jackson
General Manager

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.

ALS Environmental

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: **ES2245721**	Page	: 1 of 4
Client	: **RAMBOLL AUSTRALIA PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: S BUCKLEY	Telephone	: +61-2-8784 8555
Project	: 318001376	Date Samples Received	: 16-Dec-2022
Site	: ----	Issue Date	: 28-Dec-2022
Sampler	: JILLIAN COWBURN, S BUCKLEY	No. of samples received	: 1
Order number	: ----	No. of samples analysed	: 1

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

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

Summary of Outliers

Outliers : Quality Control Samples

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

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

Outliers : Analysis Holding Time Compliance

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

Outliers : Frequency of Quality Control Samples

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

Analysis Holding Time Compliance

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

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

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

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

Matrix: **WATER**

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

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EG020F: Dissolved Metals by ICP-MS							
Clear Plastic Bottle - Nitric Acid; Filtered (EG020A-F)							
T01	**13-Dec-2022**	**----**	----	----	**23-Dec-2022**	11-Jun-2023	✓
EG020T: Total Metals by ICP-MS							
Clear Plastic Bottle - Nitric Acid; Unfiltered (EG020A-T)							
T01	**13-Dec-2022**	**21-Dec-2022**	11-Jun-2023	✓	**21-Dec-2022**	11-Jun-2023	✓
EG035F: Dissolved Mercury by FIMS							
Clear Plastic Bottle - Nitric Acid; Filtered (EG035F)							
T01	**13-Dec-2022**	**----**	----	----	**22-Dec-2022**	10-Jan-2023	✓
EG035T: Total Recoverable Mercury by FIMS							
Clear Plastic Bottle - Nitric Acid; Unfiltered (EG035T)							
T01	**13-Dec-2022**	**----**	----	----	**28-Dec-2022**	10-Jan-2023	✓

Quality Control Parameter Frequency Compliance

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

Matrix: **WATER**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Duplicates (DUP)							
Dissolved Mercury by FIMS	EG035F	2	19	**10.53**	**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	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	EG020A-T	3	20	**15.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Dissolved Mercury by FIMS	EG035F	1	19	**5.26**	**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	20	**5.00**	**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
Method Blanks (MB)							
Dissolved Mercury by FIMS	EG035F	1	19	**5.26**	**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	20	**5.00**	**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
Matrix Spikes (MS)							
Dissolved Mercury by FIMS	EG035F	1	19	**5.26**	**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	20	**5.00**	**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
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 5
SITE PHOTOGRAPHS

Photo 1: Image of embankment adjacent to monitoring location SW1. Signs of erosion from recent heavy rain events.

Photo 2: Image of culvert adjacent to monitoring location SW1 facing east.

Photo 3: Image of monitoring location SW1_UP facing west.

Photo 4: Image of bank opposite monitoring location SW1_UP showing signs of erosion from recent heavy rainfall events.

Photo 5: Image of culvert adjacent to monitoring location SW4 facing west.

Photo 6: Image facing east of monitoring location SW4. Water appears to pool at this location.

Photo 7: Metal tubing and concrete waste adjacent to monitoring location SW4

Photo 8: Image of monitoring location SW5. Both culverts and surrounding ballast were dry.

Photo 9: Image of right-side culvert of monitoring location SW5. Image shows staining and sediment build up from times of flowing water.

Photo 10: Image of culvert adjacent to monitoring location SW6. Water pools at this location and contains sediment colloids.

Photo 11: Image of monitoring location SW7 facing north. Location is a small dam containing reeds, and vegetative debris.

Photo 12: Image of monitoring location SW7 facing west towards the rail line. Image shows fencing debris and chicken wire mid image.