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CRICOS PROVIDER NUMBER 00025B

13 November 2023

Mr. Stephen Love
Environment & Community Superintendent
Metropolitan Coal
Peabody Energy Australia
PO Box 402
Helensburgh NSW 2508

Dear Stephen,

Subject: Assessment against Water Quality Performance Measure –
Quarter 1 (January to March) 2023

The Metropolitan Coal Project Approval (08_0149) requires Metropolitan Coal not to exceed the subsidence impact performance measures outlined in Table 1 of Condition 1, Schedule 3. Table 1 of Condition 1, Schedule 3 includes a performance measure for negligible reduction to the quality of water resources reaching the Woronora Reservoir.

The Metropolitan Coal Longwalls 308-310 Water Management Plan (LW308-310 WMP) establishes subsidence impact performance indicators for each performance measure. The performance indicator for negligible reduction to the quality of water resources reaching the Woronora Reservoir is:

> *Changes in the quality of water entering Woronora Reservoir are not significantly different post-mining compared to pre-mining concentrations, that are not also occurring at control site WOWQ2.*

The LW308-310 WMP requires that analysis of the performance indicator be undertaken on a quarterly basis, however, in the event that analysis identifies a Level 2 or Level 3 significance level (in accordance with the LW308-310 WMP Trigger Action Response Plan [TARP]), the frequency of data analysis is required to be increased to a monthly basis (until such time that data analysis indicates a return to Level 1).

The LW308-310 WMP describes that field filtered water quality parameters (i.e. iron, manganese and aluminium) at site WRWQ 9 on Waratah Rivulet, site ETWQ AU on Eastern Tributary and at control site WOWQ 2 on the Woronora River are used to assess the performance indicator. The LW308-310 WMP describes these as *"key water quality parameters of relevance to water supply and effects of subsidence"*.

If data analysis indicates a performance indicator has been exceeded, an assessment is to be made against the performance measure.

ATC Williams (2023a, 2023b, 2023c) conducted analysis for water resources reaching the Woronora Reservoir at site ETWQ AU on the Eastern Tributary and site WRWQ 9 on the Waratah Rivulet in accordance with the LW308-310 WMP. The water quality indicators selected for the analysis are dissolved (i.e. filtered <0.45 µm fraction) manganese, iron and aluminium. The water quality indicators are assessed against the water quality at control site WOWQ 2 on the Woronora River, in accordance with the performance criteria presented in the LW308-310 WMP (ATC Williams, 2023a; 2023b; 2023c). A summary of outcomes from the water quality analysis undertaken for Quarter 1 (January to March) 2023 (Q1 2023) is presented in Table 1.

Table 1 Summary of Water Quality Analyses from January to March 2023

Monitoring Site(s)	Parameters	Assessed Significance Level		
		January 2023	February 2023	March 2023
Site ETWQ AU on the Eastern Tributary	Iron (Fe)	Level 1	Level 1	Level 1
	Aluminium (Al)			
	Manganese (Mn)	Level 3	Level 2	Level 3
Site WRWQ 9 on the Waratah Rivulet	Iron (Fe)	Level 1	Level 1	Level 1
	Aluminium (Al)			
	Manganese (Mn)			

The analysis identified that the performance indicator was exceeded for dissolved manganese at site ETWQ AU in Q1 2023 during January and March 2023. In addition, since the performance indicator was not exceeded for dissolved iron and aluminium at site ETWQ AU and dissolved iron, aluminium and manganese at site WRWQ 9 in Q1 2023, these parameters are not discussed in this report.

In accordance with the LW308-310 WMP, exceedance of the subsidence impact performance indicator has triggered an assessment against the water quality subsidence impact performance measure, *Negligible reduction to the quality of water resources reaching the Woronora Reservoir*. The term 'negligible' is defined in the Project Approval as *small and unimportant, such as to be not worth considering.*

In accordance with the LW308-310 WMP, if the water quality parameter is greater than the historical maximum, then undertake an investigation and assess against the performance measure for that month. If the water quality parameter is less than the historical maximum, then undertake an investigation and assess against the performance measure at the end of the quarter. During January and March 2023, the dissolved manganese concentrations were below the historical maximum (2.860 mg/L recorded in February 2018). Therefore, this assessment against the performance measure was undertaken at the end of Q1 2023.

This assessment has been prepared for Q1 2023 in consideration of:

- pluviograph data;
- flow data from the Eastern Tributary gauging location (GS300078);
- groundwater level and groundwater quality results for Eastern Tributary sites up to 31 March 2023[1];
- surface water quality data at site ETWQ AU and sites further upstream on the Eastern Tributary up to 31 March 2023;
- surface water quality data at sites downstream of ETWQ AU up to 31 March 2023; and
- the Australian Drinking Water Guidelines.

1. PLUVIOGRAPH, EASTERN TRIBUTARY FLOW AND GROUNDWATER LEVEL DATA

The monthly rainfall recorded for the Eastern Tributary at PV7 has been frequently below the average monthly rainfall (Darkes Forest long term monthly mean) since 2016. Since January 2020, above average rainfall has been recorded in January to March 2020, July to August 2020, October 2020, December 2020, March 2021, October 2021 to May 2022, July 2022, September to October 2022 and January to February 2023 with below average rainfall recorded in all other months (Table 2).

Total rainfall at PV7 in January 2023 was 173.0 mm, above the monthly mean rainfall at Darkes Forest (131.7 mm), with rainfall occurring 1 to 2 January (total 7.5 mm), 4 to 8 January (total 97.5 mm), 15 to 16 January (total 1.0 mm), 19 to 26 January (total 50.5 mm) and 30 to 31 January (total 16.5 mm).

Total rainfall at PV7 in February 2023 was 274.5 mm, above the monthly mean rainfall at Darkes Forest (159.9 mm), with rainfall occurring 8 to 11 February (total 193.0 mm), 14 to 15 February (total 4.5 mm), 19 February (22.0 mm), 22 to 25 February (total 54.0 mm) and 27 to 28 February (total 1.0 mm).

Total rainfall at PV7 in March 2023 was 113.5 mm, below the monthly mean rainfall at Darkes Forest (161.5 mm), with rainfall occurring 3 to 5 March (total 15.0 mm), 13 to 15 March (total 54.0 mm), 21 to 22 March (total 18.0 mm), 24 March (4.5 mm), 26 March (5.5 mm) and 28 to 30 March (total 16.5 mm).

[1] Groundwater quality at site ETWG1 has not been able to be sampled since August 2017.

Table 2 Monthly Rainfall Data for PV7, January 2020 to March 2023

Month/Year	Rainfall at PV7 (mm)	Rainfall at Darkes Forest (mm)[#]	Monthly Mean Rainfall at Darkes Forest (1894-2023) (mm)[#]
January 2020	133.0	56.2	131.2
February 2020	730.0	255.2	159.5
March 2020	236.0	146.0*	154.3
April 2020	88.5	73.0*	126.1
May 2020	88.0	111.0*	128.1
June 2020	59.0	65.0*	145.8
July 2020	237.0	185.0*	96.0
August 2020	151.5	86.0*	88.9
September 2020	31.0	36.0	76.8
October 2020	131.5	158.0	92.0
November 2020	87.5	65.0	104.6
December 2020	106.0	104.0	103.0
January 2021	104.5	122.0	131.1
February 2021	119.5	123.0	158.4
March 2021	365.5	397.0	156.3
April 2021	12.5	19.0	125.3
May 2021	123.0	167.0	128.4
June 2021	65.5	64.0	145.1
July 2021	26.0	22.0	95.4
August 2021	63.0	64.0	88.6
September 2021	43.5	38.0	76.5
October 2021	115.5	92.0	92.0
November 2021	190.5	198.0	105.4
December 2021	133.0	135.0	103.3
January 2022	165.0	166.0	131.4
February 2022	371.0	312.0	159.7
March 2022	731.0	794.0	161.6
April 2022	447.0	465.0	128.0
May 2022	166.5	186.0	128.9
June 2022	14.5	25.0	144.1
July 2022	777.0	875.0	101.7
August 2022	22.5	21.0	88.1
September 2022	136.0	164.0	77.2
October 2022	306.0	323.0	93.9
November 2022	56.5	70.0	105.1
December 2022	19.0	36.0	102.7
January 2023	173.0	173.0	131.7
February 2023	274.5	193.0	159.9
March 2023	113.5	143.0	161.5

[#] Bureau of Meteorology Station Number 68024 established in 1894. Each monthly mean is calculated using all data obtained since the commencement of monitoring at Station 68024 to March 2023.

* Data from Station 68024 is incomplete or not available for the period of March to August 2020. Data from nearby Station 66176 (Audley) has therefore been substituted for these months.

2. EASTERN TRIBUTARY SURFACE WATER AND GROUNDWATER QUALITY DATA

2.1 Dissolved Manganese

There has been a notable increase in dissolved manganese at site ETWQ AU compared to prior concentrations since July 2016. Reducing conditions (through water saturation excluding oxygen) has solubilised manganese in the groundwater. The soluble manganese (manganese [II] ion, Mn^{2+}) has been transferred to surface water through mine-induced cracking, resulting in an increase in dissolved manganese concentrations in the Eastern Tributary. The concentration of dissolved manganese is typically higher upstream of site ETWQ AU (for example, site ETWQ AQ shown on Charts 1 and 2), where cracking and the diversion of flows has occurred (Figure 1).

Plots of dissolved manganese at surface water quality sites ETWQ AU, ETWQ AQ (upstream on the Eastern Tributary), WOWQ 2 (control site) and at groundwater quality site ETGW2, are compared to rainfall at PV7 (Chart 1) and streamflow at GS300078 (Chart 2).

While groundwater quality site ETGW2 is downstream of site ETWQ AU, the groundwater quality data are indicative of the characteristics of the groundwater. Manganese will remain dissolved in the water column as oxidation at near-neutral pH is slow (Raveendran et al*.*, 2001) and soluble manganese (II) is the most stable species (Rayner-Canham, 1996). Low levels of manganese, e.g. <0.100 mg/L, exist in the natural creek water. Dissolved manganese is easily diluted by freshwater flow to low levels when higher creek flows occur.

Dissolved and total manganese concentrations at site ETWQ AU in Q1 2023 are presented in Table 3.

Table 3 Site ETWQ AU dissolved and total manganese concentrations in Q1 2023

Water Quality Parameters		January 2023	February 2023	March 2023
Dissolved manganese	Lowest (mg/L)	0.079	0.061	0.065
	Highest (mg/L)	0.240	0.130	0.187
Total manganese	Lowest (mg/L)	0.087	0.074	0.056
	Highest (mg/L)	0.313	0.094	0.136

As described above, prior to October 2018, rainfall was well below average for an extended period of time. The low stream flows resulted in insufficient surface water to dilute the elevated concentrations of dissolved manganese from the groundwater, resulting in higher concentrations of dissolved manganese at site ETWQ AU. During October to December 2018, heavy rainfall increased flow in the Eastern Tributary sufficiently to dilute dissolved manganese at site ETWQ AU to below 0.5 mg/L and demonstrated that the high dissolved manganese in the Eastern Tributary could be diluted by creek flow. This was also evident as a result of the rainfall event observed over 17 to 21 September 2019, which increased flows in the Eastern Tributary and resulted in the dissolved manganese concentration dropping to the lowest level recorded since October 2016. This also occurred following the rainfall events in January to March, July, and August 2020 (Attachment A).

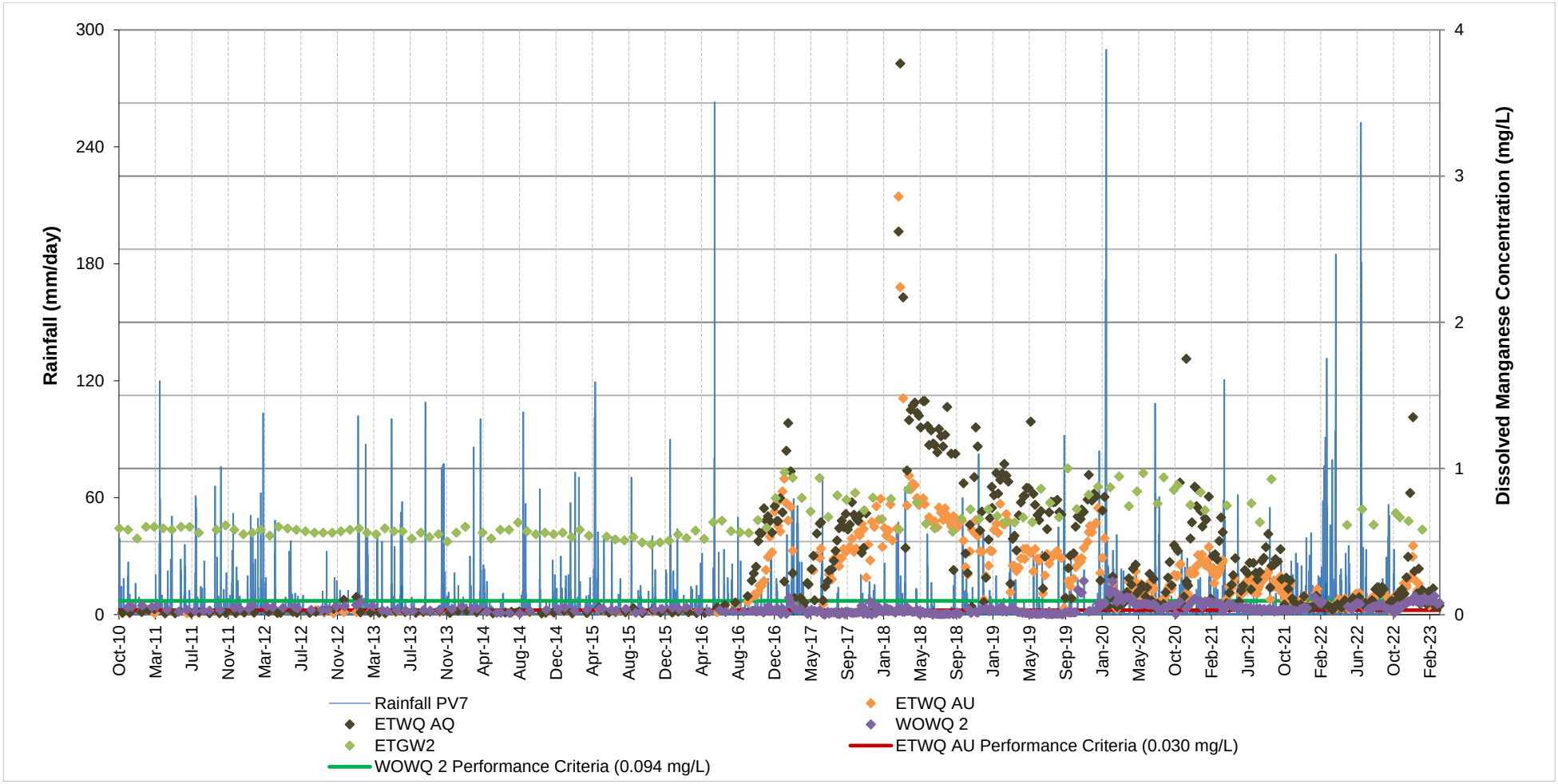


Chart 1 Dissolved Manganese Concentrations at Surface Water Quality Sites ETWQ AU, ETWQ AQ and WOWQ 2 and Groundwater Quality Site ETGW2, and Rainfall (to 31 March 2023)[2]

[2] The performance criteria shown in the figure are the adjusted baseline mean plus two standard deviations, which are used to assess the performance indicator, in accordance with LW308-310 WMP.

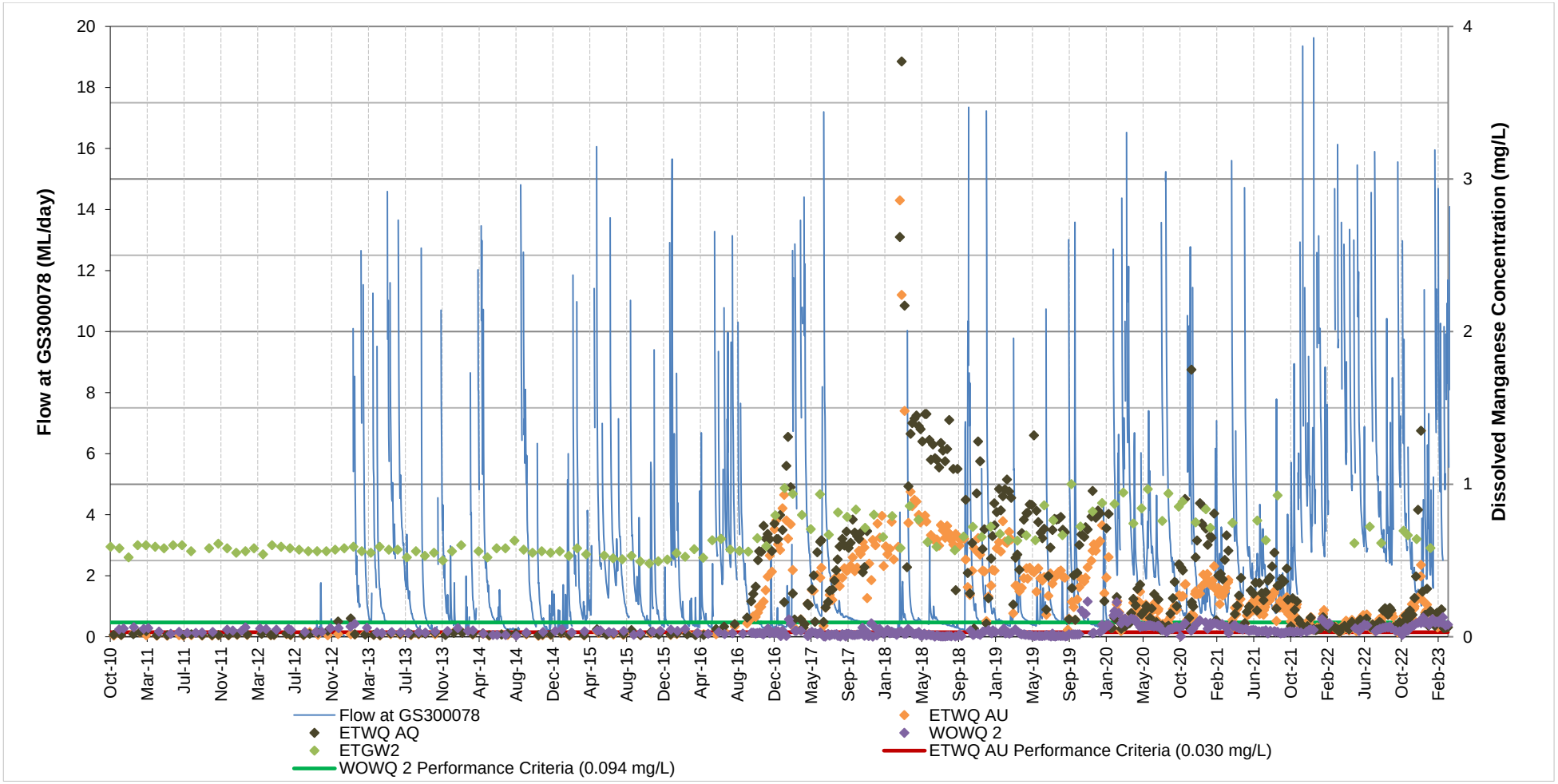
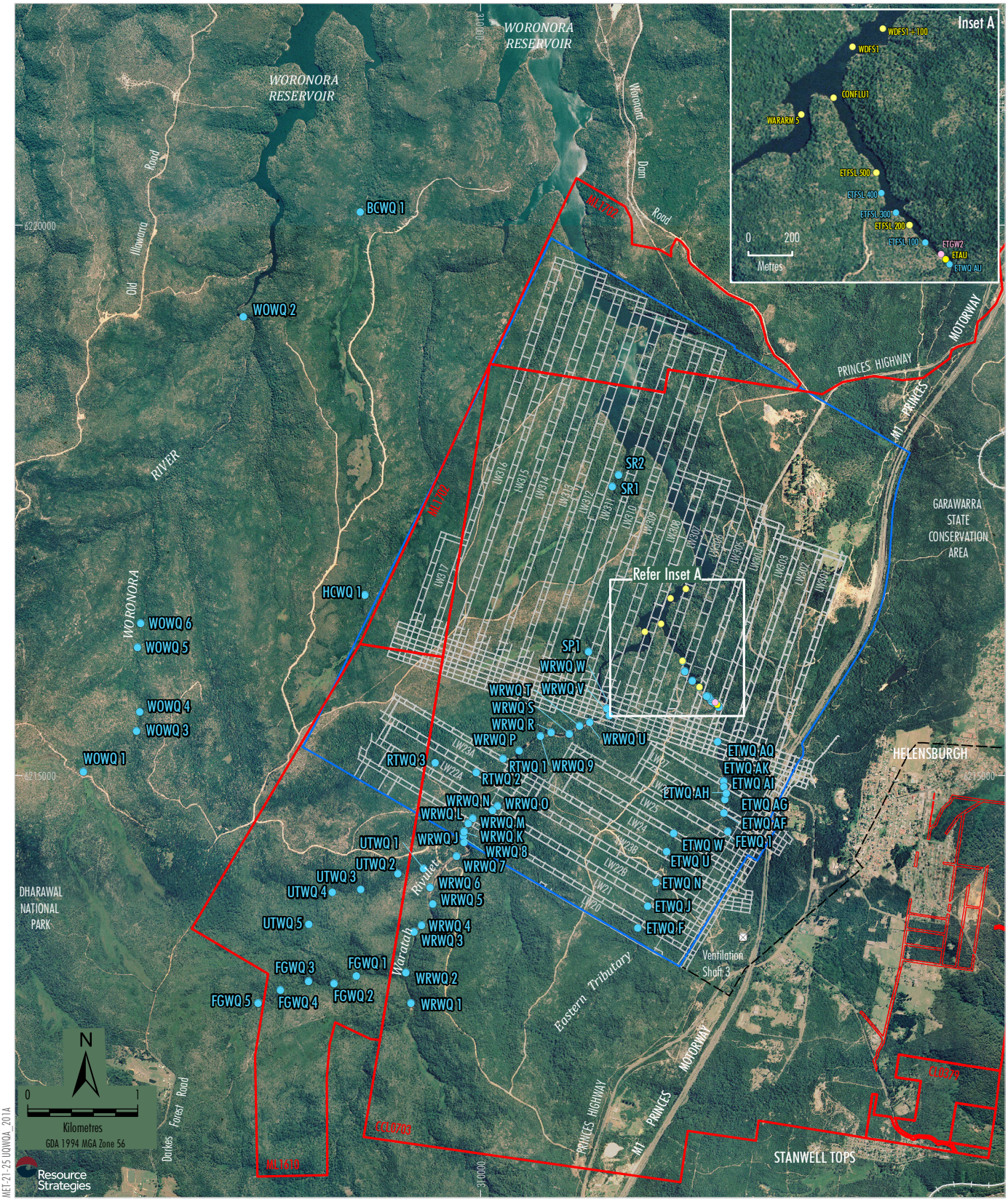


Chart 2 Dissolved Manganese Concentrations at Surface Water Quality Sites ETWQ AU, ETWQ AQ and WOWQ 2 and Groundwater Quality Site ETGW2, and Stream Flow (to 31 March 2023)[3]

[3] The performance criteria shown in the figure are the adjusted baseline mean plus two standard deviations, which are used to assess the performance indicator, in accordance with the LW308-310 WMP.



LEGEND

- Mining Lease Boundary
- Railway
- Project Underground Mining Area Longwalls 20-27 and 301-317
- Existing Underground Access Drive (Main Drift)
- Surface Water Quality Site
- Groundwater Quality Site of Eastern Tributary
- Water Quality Site on Eastern Tributary and/or in Woronora Reservoir

Source: Land and Property Information (2015); Date of Aerial Photography 1998; Department of Industry (2015); Metropolitan Coal (2021); MSEC (2021)

Peabody

METROPOLITAN COAL

Surface Water Quality Sampling of Eastern Tributary Watercourse and Woronora Reservoir

Figure 1

2.2 Other Water Quality Parameters

Water quality parameters pertinent to the increase in manganese (dissolved-filtered <0.45 µm fraction) concentrations are pH, oxidation-reduction potential (ORP) and electrical conductivity (EC). The pH and ORP define the physico-chemical form of manganese that can exist in water based on whether the conditions are oxidising or reducing. The EC results indicate whether there has been an increase in salinity (following the mixing of groundwater with the creek water). Water is generally weakly oxidising and becomes reducing when ORP is below approximately 10 mV.

Water quality parameters relevant to the analysis of dissolved manganese at site ETWQ AU in Q1 2023 are presented in Table 4:

Table 4 Site ETWQ AU other water quality parameters in Q1 2023

Water Quality Parameters		January 2023	February 2023	March 2023
pH (lab measurement)	Lowest	5.89	6.49	5.94
	Highest	7.16	7.11	7.04
EC (lab measurement)	Lowest (µS/cm)	142	91	93
	Highest (µS/cm)	160	132	148
ORP (field measurement)	Lowest (mV)	4.8	91.6	43.5
	Highest (mV)	108.3	323.8	124.9

3. WATER RESOURCES REACHING THE WORONORA RESERVOIR

In accordance with the LW308-310 WMP, site ETWQ AU on the Eastern Tributary and control site WOWQ 2 on the Woronora River are used to assess the LW308-310 WMP water quality performance indicator. As described earlier, in the event the water quality performance indicator is exceeded, an assessment is required to be conducted against the water quality performance measure.

As site ETWQ AU on the Eastern Tributary does not represent where water resources reach the Woronora Reservoir, I previously recommended to Metropolitan Coal that additional sampling be conducted at, and downstream of, site ETWQ AU to inform assessments against the performance measure. The additional sampling commenced in August 2017 at sites ETFSL 100 to ETFSL 500. Due to the reducing water level in the Woronora Reservoir, in November 2018 I recommended to Metropolitan Coal that the sampling program should be extended further downstream (i.e. further into the Woronora Reservoir). The additional sampling commenced on 22 November 2018 at sites CONFLU1 to WDFS1+100 (Figure 1). Sampling at some sites downstream of site ETWQ AU was not undertaken throughout February 2020 to March 2023 due to the high flow conditions present on the Eastern Tributary arm of the Woronora Reservoir, and due to the increasing water level in the Woronora Reservoir (Attachment A).

Metropolitan Coal has taken a photographic record of the watercourse/waterbody at the time of sampling, estimated the width of the watercourse/waterbody at the sample location and recorded the depth at which the water sample was taken.

The Woronora Reservoir is a public water supply dam which supplies water to consumers within the Sutherland Shire Council area (Helensburgh Coal Pty Ltd, 2008). The Woronora River, Waratah Rivulet and Eastern Tributary are some of the tributaries which flow into the Woronora Reservoir (Figure 1). The length of the watercourse/waterbody from the start of the Eastern Tributary 'arm' of the reservoir to the reservoir wall is some 10 km (Figure 1).

The Woronora Reservoir receives flow from the Eastern Tributary which enters a mixing zone in the upper arm of the reservoir. Based on Woronora Reservoir water level data, in Q1 2023 the Woronora Reservoir water level increased from 168.42 mAHD on 1 January 2023 to 168.73 mAHD on 31 March 2023. The position of the reservoir water level can only be determined to the closest one metre contour, accordingly, the reservoir water level was upstream of site ETSFL 100 (corresponding to a water level of approximately 169.0 mAHD). In Q1 2023, the Woronora Reservoir water level exceeded the full supply level (168.88 mAHD) on 10 to 11 and 22 to 23 February 2023.

Water reaching the Woronora Reservoir occurs where the inflowing Eastern Tributary stream water meets the reservoir water body. The interface point between ponded flow from the Eastern Tributary and the reservoir water body varies constantly with the level of the reservoir and the rate of inflow from the Eastern Tributary. Throughout Q1 2023, the Woronora Reservoir water level was upstream of site ETFSL 100 (Figure 1). The mixing zone (downstream of the reservoir water level) is variable and influenced by the rate of inflow from the Eastern Tributary.

4. QUALITY OF WATER REACHING THE WORONORA RESERVOIR

4.1 Dissolved Manganese

Water quality data for filtered and total manganese for July 2020 to March 2023 at site ETWQ AU and downstream sites (Section 3) is provided in Attachment A[4].

As described above, the Woronora Reservoir water level remained consistent in Q1 2023, and was upstream of site ETFSL 100. The results for dissolved and total manganese at sites ETWQ AU, ETFSL 200, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100 since the commencement of monitoring to the end of March 2023, are shown on Charts 3 and 4, respectively. These sites provide a profile along the arm of the Woronora Reservoir. For the months in Q1 2023, no water quality monitoring at site ETFSL 500 was undertaken.

Dissolved and total manganese concentrations at site ETFSL 200 in Q1 2023 are presented in Table 5.

Table 5 Site ETFSL 200 dissolved and total manganese concentrations in Q1 2023

Water Quality Parameters		January 2023	February 2023	March 2023
Dissolved manganese	Lowest (mg/L)	0.017	0.023	0.011
	Highest (mg/L)	0.038	0.074	0.015
Total manganese	Lowest (mg/L)	0.020	0.047	0.012
	Highest (mg/L)	0.048	0.088	0.055

[4] Water quality data from January 2018 to June 2020 is provided in the *Assessment against Water Quality Performance Measure – June 2020* (The University of Queensland, 2020).

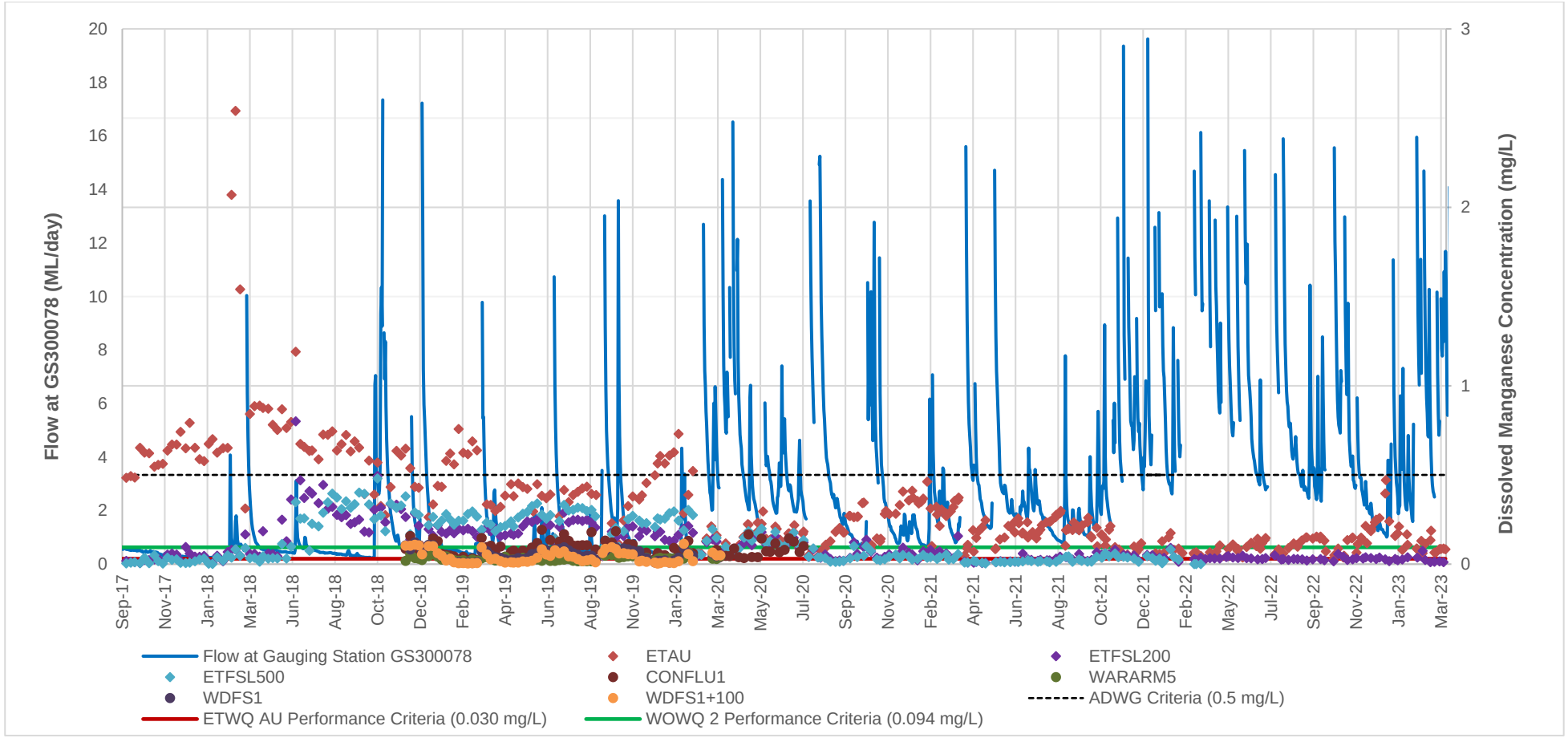


Chart 3 Dissolved Manganese Concentrations at Surface Water Quality Sites ETWQ AU[5], ETFSL 200, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100, and Stream Flow (August 2017 to March 2023)[6]

[5] Data from sampling undertaken at site ETWQ AU has been substituted for site ETWQ AU from 22 November to 6 December 2018 and 17 December 2018. Sampling at site ETWQ AU was undertaken on 12 and 27 December 2018.

[6] The performance criteria shown in the figure are the adjusted baseline mean plus two standard deviations, which are used to assess the performance indicator, in accordance with the LW308-310 WMP.

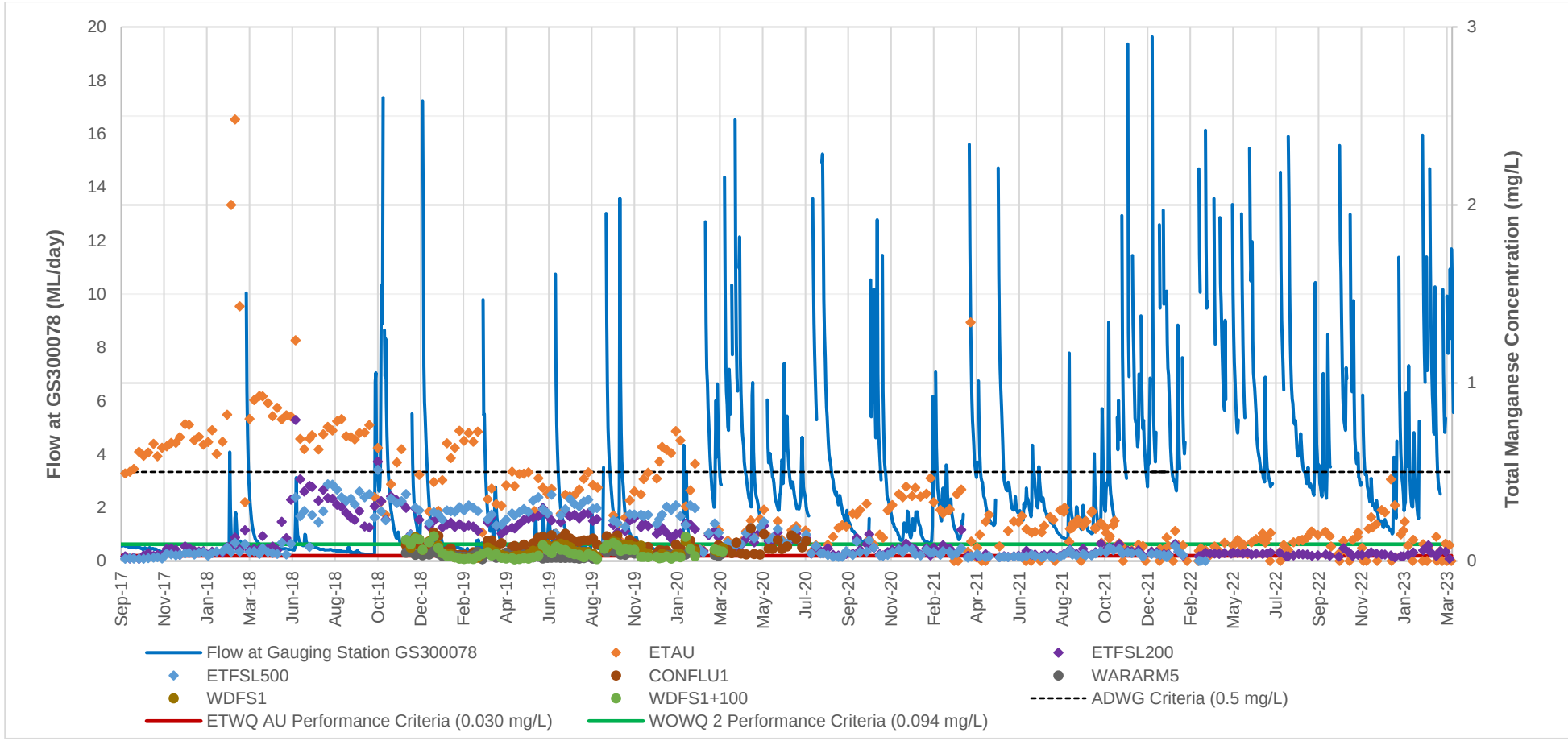


Chart 4 **Total Manganese Concentrations at Surface Water Quality Sites ETWQ AU[7], ETFSL 200, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100, and Stream Flow (August 2017 to March 2023)[8]**

[7] Total manganese is not sampled at site ETWQ AU, and therefore results were unable to be substituted for site ETWQ AU from 22 November to 6 December 2018 and 17 December 2018. Sampling at site ETWQ AU was undertaken on 12 and 27 December 2018.

[8] The performance criteria shown in the figure are the adjusted baseline mean plus two standard deviations, which are used to assess the performance indicator, in accordance with the LW308-310 WMP.

The Australian Drinking Water Guidelines (ADWG) are published by the National Health and Medical Research Council and National Resource Management Ministerial Council (NHMRC & NRMMC) and updated most recently in 2018 (NHMRC & NRMMC, 2011); the manganese guidelines remain unchanged. The Woronora Dam is operated by WaterNSW. Water from the Woronora Dam is treated in the Woronora Filtration Plant to the standards set by the ADWG before being supplied to the Helensburgh area as well as parts of the Sutherland Shire and northern Wollongong (WaterNSW, 2017).

The ADWG is based on total concentrations of manganese in water (NHMRC & NRMMC, 2011). The ADWG value is 0.5 mg/L total manganese for health, which is also shown in Charts 3 and 4. Filtered and total manganese concentrations at site ETFSL 500 have been below 0.5 mg/L for the period of record, with the exception of one total manganese result on 10 October 2018 (0.512 mg/L). All filtered and total manganese concentrations at sites CONFLU1, WARARM5, WDFS1 and WDFS1+100 have been below 0.5 mg/L for the period of record (Charts 3 and 4).

4.2 Other Water Quality Parameters

Water quality data for parameters pertinent to dissolved manganese for July 2020 to March 2023 at sites ETWQ AU, ETFSL 200 and ETFSL 500 is provided in Attachment A. The water quality parameters (ORP and EC) showed no unusual features.

The ADWG value for pH (aesthetic) is 6.5-8.5. The pH values at all sites fluctuated in Q1 2023. The site ETWQ AU decreased from 7.16 to 5.94 and the site ETFSL 200 decreased from 6.51 to 5.61. As described above, monitoring at site ETFSL 500 was not undertaken in Q1 2023. At the end of March 2023, both ETWQ AU and ETFSL 200 were below the ADWG pH range (Attachment A).

5. ASSESSMENT AGAINST THE PERFORMANCE MEASURE

The subsidence impact performance indicator for water quality reaching the Woronora Reservoir was exceeded in relation to dissolved manganese at site ETWQ AU on the Eastern Tributary in Q1 2023, which has triggered an assessment against the water quality subsidence impact performance measure.

Soluble manganese from groundwater has been transferred to surface water through mine-induced cracking. The climatic conditions in 2018 resulted in low stream flows and insufficient surface water to dilute the elevated concentrations of dissolved manganese from the groundwater, resulting in higher concentrations of dissolved manganese in the Eastern Tributary. Manganese concentrations are easily diluted by freshwater flow to low levels when higher creek flows occur.

Comparison of the photographic records in Q1 2023 show the quality of water below ETWQ AU was consistent in Q1 2023, with heavy rainfall throughout the month resulting in high flows. Sites closer to ETWQ AU continued to show some orange-yellow sediment. The presence of orange-yellow coating on the creek sediment surface, continued to be observed throughout Q1 2023, will darken in colour with time as conversion to goethite occurs.

Water reaching the Woronora Reservoir occurs where the inflowing stream water meets the reservoir waterbody. In Q1 2023, the Woronora Reservoir water level was upstream of site ETFSL 100. The mixing zone (downstream of the reservoir water level) is variable and influenced by the rate of inflow from the Eastern Tributary.

The manganese concentration reaching the Woronora Reservoir has been considered. Water quality data obtained to date is considered to represent a negligible reduction to the quality of water resources reaching the reservoir. The watercourse performance measure, *Negligible reduction to the quality of water resources reaching the Woronora Reservoir,* is not considered to have been exceeded.

The LW308-310 WMP requires that analysis of the performance indicator be undertaken on a monthly basis, however, in the event that analysis identifies a Level 2 or Level 3 significance level, the frequency of data analysis is required to be increased to a monthly basis. The assessment against the performance indicator has been undertaken on a monthly basis from January 2018 to March 2023. In addition, in accordance with the LW308-310 WMP, assessments against the water quality performance measure will be undertaken at the end of each quarter if the water quality parameter is less than the historical maximum.

There has been a notable increase in dissolved manganese at site ETWQ AU compared to prior concentrations since July 2016. Notwithstanding, results of all monthly water quality performance measures assessments undertaken since January 2018 have concluded that the watercourse performance measure, *Negligible reduction to the quality of water resources reaching the Woronora Reservoir,* has not been exceeded.

Prior to early January 2018 drier conditions resulted in interrupted creek flow into the reservoir giving shallow ponding of water or completely dry sections of the upper reservoir below ETWQ AU and increased levels of dissolved manganese and iron from ETWQ AU to ETFSL 200, but not beyond ETFSL 500 when there was sufficient volume of water. Since mid-2018 dissolved manganese concentration has not exceeded the drinking water guideline of 0.5 mg/L at ETFSL 200 or ETFSL 500 and during large rain events at ETWQ AU. In addition, the Australian and New Zealand Governments (ANZG) *Australian and New Zealand Guidelines for fresh and marine water quality* (ANZG, 2018) guideline for 95% protection of aquatic species for manganese (1.9 mg/L) was not exceeded.

6. REFERENCES

ANZG (2018) *Australian and New Zealand Guidelines for fresh and marine water quality*.

ATC Williams (2023a) *Metropolitan Coal LW 308-310 Extraction Plan Triggers – Water Quality Analysis January 2023.*

ATC Williams (2023b) *Metropolitan Coal LW 308-310 Extraction Plan Triggers – Water Quality Analysis February 2023.*

ATC Williams (2023c) *Metropolitan Coal LW 308-310 Extraction Plan Triggers – Water Quality and Pool Water Level Analysis First Quarter 2023.*

Helensburgh Coal Pty Ltd (2008) *Metropolitan Coal Project Environmental Assessment.*

NHMRC & NRMMC (2011) *Australian Drinking Water Guidelines Paper 6 National Water Quality Management Strategy*. National Health and Medical Research Council, National Resource Management Ministerial Council, Commonwealth of Australia, Canberra.

Raveendran, R., Ashworth, B. and Chatelier, B. (2001) *Manganese removal in drinking water systems*, in Proceedings of the 64th Annual Water Industry Engineers and Operations Conference, pp. 92–100, Bendigo, Australia.

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The University of Queensland (2020) *Assessment against Water Quality Performance Measure – June 2020.*

WaterNSW (2017) *Woronora Catchment – My Part of the Catchment*. Accessed from: http://www.waternsw.com.au/water-quality/catchment/sub-catchment/woronora

Yee, N., Shaw, S., Benning, L.G. and Nguyen, T.N. (2006) *The rate of ferrihydrite transformation to goethite via the Fe (II) pathway*. American Mineralogist 91: 92-96.

Yours Sincerely,

Barry N Noller

Principal Research Fellow

Centre For Mined Land Rehabilitation

ATTACHMENT A

WATER QUALITY DATA FOR SITES ETWQ AU, ETFSL 200 AND ETFSL 500

JULY 2020 TO MARCH 2023

ATTACHMENT A
Water Quality Data for Sites ETWQ AU, ETFSL 200, and ETFSL 500

Date	Site	Manganese (mg/L) (F)	Manganese (mg/L) (T)	Iron (mg/L) (F)	Iron (mg/L) (T)	ORP (mV)	pH Lab	EC Lab (µS/cm)
7/07/2020	ETWQ AU	0.179	0.195	0.4	1.62	104.1	7.45	239
7/07/2020	ETFSL200	0.147	0.155	0.06	1.00	76.3	7.63	238
7/07/2020	ETFSL500	0.176	0.177	0.45	1.36	33.6	7.57	252
8/07/2020	ETWQ AU	0.218	-	1.14	1.89	47	6.99	234
15/07/2020	ETWQ AU	0.089	-	0.51	0.99	92	6.85	206
16/07/2020	ETWQ AU	0.109	0.107	0.71	1.04	31.7	6.73	217
16/07/2020	ETFSL200	0.090	0.093	0.26	0.92	31.5	7.09	214
16/07/2020	ETFSL500	0.101	0.103	0.42	1.10	12.1	7.01	220
21/07/2020	ETWQ AU	0.170	0.171	0.48	1.32	32.2	6.58	220
22/07/2020	ETWQ AU	-	0.171	0.76	1.21	2.97	6.58	225
22/07/2020	ETFSL200	0.122	0.128	<0.05	0.70	25.8	7.07	216
22/07/2020	ETFSL500	0.134	0.148	0.36	0.92	-25.7	6.99	230
30/07/2020	ETWQ AU	0.050	0.052	0.32	0.72	109.3	6.11	113
30/07/2020	ETFSL200	0.041	0.042	0.3	0.67	120.3	6.18	109
30/07/2020	ETFSL500	0.041	0.042	0.28	0.68	124	6.17	106
4/08/2020	ETWQ AU	0.080	-	0.57	0.98	83.2	6.73	155
6/08/2020	ETWQ AU	0.084	0.088	0.57	1.00	94	6.85	148
6/08/2020	ETFSL200	0.083	0.078	0.34	0.88	89.1	7.02	147
6/08/2020	ETFSL500	0.088	0.083	0.25	0.91	126.7	7.03	146
13/08/2020	ETWQ AU	0.043	0.048	0.28	0.53	70.8	6.67	107
13/08/2020	ETFSL200	0.038	0.055	0.24	0.75	75.4	6.48	104
13/08/2020	ETFSL500	0.037	0.043	0.26	0.54	79.4	6.49	101
17/08/2020	ETWQ AU	0.061	0.068	0.43	0.80	112	6.45	133
17/08/2020	ETFSL200	0.035	0.049	0.14	0.49	180.9	6.37	106
17/08/2020	ETFSL500	0.038	0.042	0.12	0.45	214.5	6.20	105
24/08/2020	ETWQ AU	0.090	0.091	0.5	1.16	83.1	6.70	155
24/08/2020	ETFSL200	0.054	0.072	0.12	0.74	138.5	6.85	131
24/08/2020	ETFSL500	0.034	0.033	0.10	0.46	159.6	6.63	123
25/08/2020	ETWQ AU	0.109	-	0.46	1.39	49.2	6.33	160
1/09/2020	ETWQ AU	0.128	0.136	0.5	1.48	104.1	7.14	193
1/09/2020	ETFSL200	0.029	0.035	<0.05	0.47	191.5	7.43	128
1/09/2020	ETFSL500	0.014	0.024	<0.05	0.38	256.7	7.28	119
9/09/2020	ETWQ AU	0.181	0.186	0.57	1.75	45.3	7.01	193
9/09/2020	ETFSL200	0.017	0.031	<0.05	0.43	104.7	6.02	121
9/09/2020	ETFSL500	0.012	0.023	<0.05	0.38	188.5	6.46	114
15/09/2020	ETWQ AU	0.202	0.201	0.6	1.88	71.9	6.5	209
15/09/2020	ETFSL200	0.020	0.026	<0.05	0.43	188.7	6.29	131
15/09/2020	ETFSL500	0.014	0.024	<0.05	0.39	193.4	6.21	126
21/09/2020	ETWQ AU	0.177	0.193	<0.05	1.66	173.6	6.82	205
21/09/2020	ETFSL200	0.019	0.040	<0.05	0.52	204.6	6.1	123
21/09/2020	ETFSL500	0.018	0.055	<0.05	0.52	183.5	6.36	122
22/09/2020	ETWQ AU	0.177	-	0.19	1.61	75.3	6.65	212
30/09/2020	ETWQ AU	0.271	-	0.36	2.54	75.6	6.67	223

ATTACHMENT A (Continued)
Water Quality Data for Sites ETWQ AU, ETFSL 200, and ETFSL 500

Date	Site	Manganese (mg/L) (F)	Manganese (mg/L) (T)	Iron (mg/L) (F)	Iron (mg/L) (T)	ORP (mV)	pH Lab	EC Lab (µS/cm)
1/10/2020	ETWQ AU	0.27	0.266	0.33	2.35	116.5	6.83	226
1/10/2020	ETFSL200	0.035	0.262	0.05	0.59	126.8	6.59	140
1/10/2020	ETFSL500	0.032	0.034	0.05	0.58	130.5	6.49	139
7/10/2020	ETWQ AU	0.263	0.262	<0.05	1.46	80.9	6.84	248
7/10/2020	ETFSL200	0.122	0.129	0.05	1	70.8	6.95	194
7/10/2020	ETFSL500	0.101	0.109	0.05	1.05	84	6.82	173
12/10/2020	ETWQ AU	0.264	0.287	<0.05	1.16	101.2	6.97	269
12/10/2020	ETFSL200	0.058	0.062	0.05	0.79	87.8	6.78	158
12/10/2020	ETFSL500	0.04	0.05	0.06	0.77	48	6.74	150
13/10/2020	ETWQ AU	0.267	-	<0.05	1.58	45.8	6.99	246
20/10/2020	ETWQ AU	0.342	-	0.2	2.41	107	6.73	232
22/10/2020	ETWQ AU	0.345	0.322	<0.05	0.322	126.4	6.45	241
22/10/2020	ETFSL200	0.096	0.094	0.08	1.08	106.9	6.72	132
22/10/2020	ETFSL500	0.047	0.053	0.08	0.86	110.5	6.54	114
26/10/2020	ETWQ AU	0.116	0.122	0.59	1.25	63.1	6.59	132
26/10/2020	ETFSL200	0.137	0.15	0.36	1.32	67.4	6.4	133
26/10/2020	ETFSL500	0.1	0.115	0.2	1.35	142.7	6.65	116
27/10/2020	ETWQ AU	0.11	-	0.75	1.38	33.5	6.55	144
2/11/2020	ETWQ AU	0.084	0.092	0.57	1.15	42.4	7.04	170
2/11/2020	ETFSL200	0.069	0.074	0.15	1.14	45.8	7.38	166
2/11/2020	ETFSL500	0.074	0.075	0.13	1.28	118	7.41	164
3/11/2020	ETWQ AU	0.107	-	0.59	1.52	114.1	6.09	174
11/11/2020	ETWQ AU	0.144	0.148	0.2	1.5	88.6	6.89	194
11/11/2020	ETFSL200	0.036	0.038	0.07	0.88	90.6	6.9	157
11/11/2020	ETFSL500	0.027	0.032	0.07	0.88	164	6.78	151
16/11/2020	ETWQ AU	0.127	0.13	0.47	1.57	27.3	6.25	180
16/11/2020	ETFSL200	0.026	0.031	0.05	0.7	87.4	6.1	135
16/11/2020	ETFSL500	0.022	0.03	0.05	0.74	79.2	6.15	135
17/11/2020	ETWQ AU	0.142	-	0.24	1.73	85.7	6.78	191
23/11/2020	ETWQ AU	0.281	0.284	<0.05	2.69	78.8	6.88	219
23/11/2020	ETFSL200	0.041	0.05	<0.05	1.02	58.8	7.13	145
23/11/2020	ETFSL500	0.027	0.034	<0.05	0.91	77.4	6.85	136
25/11/2020	ETWQ AU	0.298	-	<0.05	1.96	205.9	6.71	217
30/11/2020	ETWQ AU	0.28	0.314	<0.05	1.64	136.8	6.53	232
30/11/2020	ETFSL200	0.055	0.063	0.52	1.31	164.5	6.27	145
30/11/2020	ETFSL500	0.042	0.05	0.46	1.2	141.5	6.08	140
10/12/2020	ETWQ AU	0.282	0.376	<0.05	1.8	109.6	7.21	249
10/12/2020	ETFSL200	0.05	0.07	<0.05	1.17	98.8	7.36	162
10/12/2020	ETFSL500	0.053	0.064	<0.05	1.26	94.9	6.95	154
16/12/2020	ETWQ AU	0.331	0.358	<0.05	1.11	88.2	7.26	268
16/12/2020	ETFSL200	0.058	0.066	0.41	0.91	58.1	6.92	130
16/12/2020	ETFSL500	0.032	0.05	0.32	1.5	67.5	6.95	129
21/12/2020	ETWQ AU	0.407	0.418	<0.05	1.9	129.9	6.96	252
21/12/2020	ETFSL200	0.092	0.098	0.05	1.12	190.3	6.66	147
21/12/2020	ETFSL500	0.051	0.069	0.34	0.99	220.3	6.66	129
30/12/2020	ETWQ AU	0.357	0.365	<0.05	2.16	79.8	7.27	259
30/12/2020	ETFSL200	0.064	0.073	<0.05	1.04	132.7	6.54	178
30/12/2020	ETFSL500	0.043	0.066	<0.05	1.15	87.4	6.41	159

ATTACHMENT A (Continued)
Water Quality Data for Sites ETWQ AU, ETFSL 200, and ETFSL 500

Date	Site	Manganese (mg/L) (F)	Manganese (mg/L) (T)	Iron (mg/L) (F)	Iron (mg/L) (T)	ORP (mV)	pH Lab	EC Lab (µS/cm)
4/1/2021	ETWQ AU	0.411	0.411	<0.05	2.73	175.4	6.89	244
4/1/2021	ETFSL200	0.054	0.063	0.07	0.8	88	6.76	136
4/1/2021	ETFSL500	0.025	0.037	0.06	0.76	150.3	6.66	125
12/1/2021	ETWQ AU	0.354	0.361	<0.05	2.04	97.3	6.61	242
12/1/2021	ETFSL200	0.022	0.035	<0.05	0.70	86.1	6.83	252
12/1/2021	ETFSL500	0.028	0.031	<0.05	0.65	94.8	6.64	130
21/1/2021	ETWQ AU	0.367	0.378	<0.05	1.78	76.4	6.38	254
21/1/2021	ETFSL200	0.072	0.072	<0.05	1.14	92.1	6.89	179
21/1/2021	ETFSL500	0.052	0.063	<0.05	1.10	186.8	6.67	147
27/1/2021	ETWQ AU	0.462	0.465	<0.05	1.35	84.9	6.88	264
27/1/2021	ETFSL200	0.062	0.031	0.28	0.65	72.1	6.66	215
27/1/2021	ETFSL500	0.035	0.046	0.23	0.97	117.6	6.56	139
1/2/2021	ETWQ AU	0.312	0.33	<0.05	2.11	142.2	6.88	226
1/2/2021	ETFSL200	0.079	0.074	0.06	1.12	99.8	6.78	147
1/2/2021	ETFSL500	0.04	0.05	<0.05	0.94	12.7	6.55	136
11/2/2021	ETWQ AU	0.278	0.287	<0.05	1.95	159.9	6.56	223
11/2/2021	ETFSL200	0.062	0.055	0.06	0.92	99.7	6.64	156
11/2/2021	ETFSL500	0.029	0.035	<0.05	1.00	192.1	6.65	147
15/2/2021	ETWQ AU	0.214	0.267	0.21	2.12	75.4	6.69	218
15/2/2021	ETFSL200	0.071	0.088	<0.05	1.16	133.8	7.05	170
15/2/2021	ETFSL500	0.04	0.054	<0.05	0.99	242.2	6.9	156
25/2/2021	ETWQ AU	0.269	0.287	<0.05	2.01	110.7	6.88	225
25/2/2021	ETFSL200	0.06	0.07	<0.05	1.44	198	7.06	192
25/2/2021	ETFSL500	0.053	0.052	<0.05	1.04	202	6.97	185
1/3/2021	ETFSL200	0.045	0.051	0.11	1.02	-1.1	6.99	181
1/3/2021	ETFSL500	0.025	0.033	<0.05	0.88	39.8	6.96	172
4/3/2021	ETWQ AU	0.296	-	<0.05	1.98	137.7	6.79	234
8/3/2021	ETWQ AU	0.320	0.374	<0.05	2.26	86.9	6.69	238
8/3/2021	ETFSL200	0.033	0.046	<0.05	0.88	58.1	7.05	175
8/3/2021	ETFSL500	0.028	0.044	<0.05	0.83	77.3	6.95	167
10/3/2021	ETWQ AU	0.355	-	<0.05	1.99	103.9	6.47	239
15/3/2021	ETWQ AU	0.358	0.401	<0.05	2.48	116.5	6.55	248
15/3/2021	ETFSL200	0.157	0.175	0.35	1.36	52.1	7.04	206
15/3/2021	ETFSL500	0.056	0.072	<0.05	0.94	123.9	6.93	179
16/3/2021	ETWQ AU	0.373	-	<0.05	2.32	125.7	6.68	248
25/3/2021	ETWQ AU	0.048	0.052	0.39	0.80	33.1	6.18	109
25/3/2021	ETFSL200	0.014	0.028	<0.05	0.40	123.8	6.24	99
25/3/2021	ETFSL500	0.009	0.019	0.06	0.35	113.7	6.35	102
29/3/2021	ETWQ AU	0.087	-	0.56	1.34	72.1	7.05	143
30/3/2021	ETWQ AU	0.108	0.109	0.53	1.39	81.0	6.68	153
30/3/2021	ETFSL200	0.009	0.025	<0.05	0.35	94.7	6.36	107
30/3/2021	ETFSL500	0.009	0.025	<0.05	0.36	113.7	6.33	108

ATTACHMENT A (Continued)
Water Quality Data for Sites ETWQ AU, ETFSL 200, and ETFSL 500

Date	Site	Manganese (mg/L) (F)	Manganese (mg/L) (T)	Iron (mg/L) (F)	Iron (mg/L) (T)	ORP (mV)	pH Lab	EC Lab (µS/cm)
7/4/2021	ETWQ AU	0.19	-	0.12	-	99.7	7.01	186
8/4/2021	ETWQ AU	0.07	0.075	0.12	1.23	105.9	7.21	160
8/4/2021	ETFSL200	0.008	0.026	<0.05	0.35	126.3	6.91	107
8/4/2021	ETFSL500	0.018	0.038	0.07	0.44	112.5	6.75	107
12/4/2021	ETWQ AU	0.147	0.148	0.16	1.65	10.2	7.11	181
12/4/2021	ETFSL200	0.012	0.027	0.05	0.45	113.5	6.87	111
12/4/2021	ETFSL500	0.012	0.025	<0.05	0.41	96.4	6.66	109
15/4/2021	ETWQ AU	0.183	-	<0.05	-	107.1	6.56	190
21/4/2021	ETWQ AU	0.205	0.221	<0.05	1.63	93.0	6.66	202
21/4/2021	ETWQ AU	0.206	-	<0.05	-	126.5	6.89	199
21/4/2021	ETFSL200	0.006	0.038	0.08	0.66	157.6	6.86	110
21/4/2021	ETFSL500	0.007	0.022	0.08	0.39	145.3	6.74	108
26/4/2021	ETWQ AU	0.246	0.259	<0.05	2.14	146.0	6.78	218
26/4/2021	ETFSL200	0.008	0.027	0.08	0.54	92.7	6.99	112
26/4/2021	ETFSL500	0.004	0.027	0.05	0.50	104.9	6.69	110
11/5/2021	ETWQ AU	0.084	-	0.43	0.91	82.1	6.9	133
12/5/2021	ETWQ AU	0.088	0.082	0.5	1.02	153.7	6.46	135
12/5/2021	ETFSL200	0.011	0.022	0.06	0.38	179	6.66	94
12/5/2021	ETFSL500	0.010	0.021	0.06	0.38	152	6.57	94
18/5/2021	ETWQ AU	0.138	-	0.4	1.48	72.4	6.81	174
19/5/2021	ETFSL200	0.017	0.027	0.08	0.46	86.2	6.51	106
19/5/2021	ETFSL500	0.013	0.024	0.08	0.41	91.1	6.52	103
25/5/2021	ETWQ AU	0.149	0.169	0.37	1.61	44.4	6.57	210
25/5/2021	ETFSL200	0.013	0.023	0.13	0.39	179	6.82	118
25/5/2021	ETFSL500	0.010	0.022	0.05	0.37	129	6.63	118
31/5/2021	ETWQ AU	0.214	-	0.37	1.8	74.2	6.86	199
3/6/2021	ETWQ AU	0.208	0.222	0.15	1.69	120.9	6.89	201
3/6/2021	ETFSL200	0.015	0.026	0.07	0.4	119.9	7.01	102
3/6/2021	ETFSL500	0.011	0.025	0.06	0.38	54.5	6.75	103
9/6/2021	ETWQ AU	0.234	-	0.66	1.9	139	6.63	195
10/6/2021	ETWQ AU	0.178	0.219	<0.05	1.67	73.7	6.43	156
10/6/2021	ETFSL200	0.014	0.030	0.06	0.42	146.8	6.93	97
10/6/2021	ETFSL500	0.014	0.025	<0.05	0.41	148	6.68	95
15/6/2021	ETWQ AU	0.256	0.253	0.58	2.09	77.3	7.12	207
15/6/2021	ETFSL200	0.014	0.024	0.14	0.38	62.4	7.37	98
15/6/2021	ETFSL500	0.012	0.022	0.07	0.37	64.7	6.66	98
16/6/2021	ETWQ AU	0.229	-	0.43	1.65	84.5	6.59	201
21/6/2021	ETWQ AU	0.171	-	0.71	1.73	53.1	6.95	190
22/6/2021	ETWQ AU	0.177	0.179	1.06	1.76	48.4	6.91	189
22/6/2021	ETFSL200	0.059	0.057	0.09	0.7	70.6	6.95	120
22/6/2021	ETFSL500	0.015	0.027	0.07	0.5	126.6	6.78	103
29/6/2021	ETWQ AU	0.235	-	0.55	1.8	143.7	6.66	201
30/6/2021	ETWQ AU	0.149	0.159	0.15	1.4	104.8	6.7	180
30/6/2021	ETFSL200	0.027	0.034	0.06	0.52	139.9	6.64	104
30/6/2021	ETFSL500	0.022	0.036	0.14	0.55	78.6	6.39	99

ATTACHMENT A (Continued)
Water Quality Data for Sites ETWQ AU, ETFSL 200, and ETFSL 500

Date	Site	Manganese (mg/L) (F)	Manganese (mg/L) (T)	Iron (mg/L) (F)	Iron (mg/L) (T)	ORP (mV)	pH Lab	EC Lab (µS/cm)
5/07/2021	ETWQ AU	0.168	0.164	0.95	1.61	108.1	7.46	181
5/07/2021	ETFSL200	0.024	0.036	0.23	0.58	84.4	7.04	97
5/07/2021	ETFSL500	0.017	0.028	0.1	0.47	81.1	6.81	96
7/07/2021	ETWQ AU	0.179	-	0.62	1.37	72.4	7.47	188
13/07/2021	ETWQ AU	0.144	-	0.49	1.24	121.9	7.04	198
15/07/2021	ETWQ AU	0.175	0.161	0.6	1.25	76.7	6.99	205
15/07/2021	ETFSL200	0.019	0.028	0.08	0.46	183.7	6.8	113
15/07/2021	ETFSL500	0.013	0.021	0.07	0.37	150	6.62	108
19/07/2021	ETWQ AU	0.194	0.198	0.2	1.45	103.2	6.55	193
19/07/2021	ETFSL200	0.024	0.035	0.11	0.57	152.8	6.84	106
19/07/2021	ETFSL500	0.017	0.027	0.08	0.52	157.3	6.57	100
21/07/2021	ETWQ AU	0.218	-	-	-	126.8	6.61	200
28/07/2021	ETWQ AU	0.235	0.246	0.33	1.63	78.1	6.89	214
29/07/2021	ETFSL200	0.022	0.039	0.05	0.52	58.4	7.11	111
29/07/2021	ETFSL500	0.016	0.025	0.07	0.45	46.5	6.89	106
2/08/2021	ETWQ AU	0.237	0.231	0.35	1.06	158	6.86	212
2/08/2021	ETFSL200	0.021	0.028	0.14	0.44	101.7	6.58	103
2/08/2021	ETFSL500	0.01	0.02	0.08	0.4	123.7	6.78	96
4/08/2021	ETWQ AU	0.242	-	0.25	2.14	37.3	7.01	208
11/08/2021	ETWQ AU	0.262	-	<0.05	2.07	83.1	6.71	217
12/08/2021	ETWQ AU	0.276	0.285	<0.05	2.21	93.3	6.81	226
12/08/2021	ETFSL200	0.031	0.029	0.08	0.54	103.2	7.13	103
12/08/2021	ETFSL500	0.013	0.025	0.1	0.5	79.7	6.75	100
18/08/2021	ETWQ AU	0.285	0.275	<0.05	1.41	110.8	6.95	254
18/08/2021	ETFSL200	0.042	0.038	0.08	0.52	71.8	7.07	126
18/08/2021	ETFSL500	0.028	0.035	0.08	0.58	82.7	6.84	124
19/08/2021	ETWQ AU	0.298	0.3	<0.05	<0.05	41	7.01	250
26/08/2021	ETWQ AU	0.103	0.108	0.47	1.19	57	6.73	171
27/08/2021	ETWQ AU	0.19	0.181	1.03	1.76	76.5	6.88	195
27/08/2021	ETFSL200	0.039	0.064	0.08	0.96	168.6	6.71	126
27/08/2021	ETFSL500	0.041	0.059	0.1	0.7	161.5	6.52	121
30/08/2021	ETWQ AU	0.199	0.183	0.31	1.65	37.6	6.28	208
31/08/2021	ETWQ AU	0.197	0.208	0.12	2	114.2	7.01	208
31/08/2021	ETFSL200	0.036	0.046	0.06	0.73	292	6.83	130
31/08/2021	ETFSL500	0.043	0.036	0.07	0.67	221.2	6.69	124
6/09/2021	ETWQ AU	0.191	0.208	0.08	1.63	83.2	6.9	205
6/09/2021	ETFSL200	0.025	0.04	<0.05	0.62	199.4	6.87	120
6/09/2021	ETFSL500	0.013	0.032	0.07	0.59	277.3	6.65	115
8/09/2021	ETWQ AU	0.234	0.233	0.28	2.03	100.4	6.82	219
13/09/2021	ETWQ AU	0.217	-	0.13	1.37	65.5	7.56	214
16/09/2021	ETWQ AU	0.189	0.198	0.09	1.79	87.6	6.99	213
16/09/2021	ETFSL200	0.057	0.068	0.14	1.14	79.7	6.9	145
16/09/2021	ETFSL500	0.026	0.039	0.08	0.72	139.9	6.56	125
20/09/2021	ETWQ AU	0.216	0.225	<0.05	1.88	126.7	6.97	217
20/09/2021	ETFSL200	0.029	0.038	0.28	0.66	137.1	7.36	123
20/09/2021	ETFSL500	0.018	0.031	0.07	0.62	121.8	7.22	118
21/09/2021	ETWQ AU	0.218	0.221	<0.05	1.92	51.5	7.97	209
29/09/2021	ETWQ AU	0.235	0.272	<0.05	2.17	167.7	6.59	230
29/09/2021	ETFSL200	0.018	0.034	0.06	0.76	127.4	6.76	114
29/09/2021	ETFSL500	0.014	0.032	0.07	0.78	125.9	6.48	108
30/09/2021	ETWQ AU	0.26	0.28	<0.05	2.2	143.5	7.8	237

ATTACHMENT A (Continued)
Water Quality Data for Sites ETWQ AU, ETFSL 200, and ETFSL 500

Date	Site	Manganese (mg/L) (F)	Manganese (mg/L) (T)	Iron (mg/L) (F)	Iron (mg/L) (T)	ORP (mV)	pH Lab	EC Lab (µS/cm)
4/10/2021	ETWQ AU	0.157	0.186	0.84	1.74	64.1	7.19	195
5/10/2021	ETWQ AU	0.149	0.18	0.4	1.68	91	7.46	187
5/10/2021	ETFSL200	0.023	0.049	<0.05	0.81	141.5	7.12	112
5/10/2021	ETFSL500	0.014	0.043	<0.05	0.7	128.6	7.08	110
13/10/2021	ETWQ AU	0.204	0.214	<0.05	1.95	138.3	7.15	196
13/10/2021	ETFSL200	0.066	0.097	0.06	1.11	113.6	7.15	123
13/10/2021	ETFSL500	0.041	0.054	0.12	0.79	118	6.6	112
14/10/2021	ETWQ AU	0.1	0.102	0.35	1.04	92	7.73	173
20/10/2021	ETWQ AU	0.165	0.188	0.29	1.42	147.1	7.23	187
21/10/2021	ETWQ AU	0.165	0.158	0.37	1.32	96.3	7.03	184
21/10/2021	ETFSL200	0.053	0.064	0.07	0.89	159.3	7.21	128
21/10/2021	ETFSL500	0.035	0.05	0.08	0.85	188.4	7.07	122
26/10/2021	ETWQ AU	0.104	0.126	0.4	1.17	97.2	7.19	160
26/10/2021	ETFSL200	0.059	0.076	0.09	0.9	161.4	7.42	140
26/10/2021	ETFSL500	0.061	0.074	0.24	0.92	242.2	7.43	141
27/10/2021	ETWQ AU	0.138	0.139	0.59	1.34	93.6	7.6	169
1/11/2021	ETWQ AU	0.192	0.201	0.06	1.44	133.2	7.43	193
1/11/2021	ETFSL200	0.055	0.072	0.05	0.98	140	7.38	139
1/11/2021	ETFSL500	0.044	0.061	<0.05	0.95	139	7.42	136
3/11/2021	ETWQ AU	0.213	0.226	0.19	1.92	143.4	6.89	201
10/11/2021	ETWQ AU	0.095	0.099	0.43	1.01	209	7.21	154
10/11/2021	ETFSL200	0.081	0.094	0.13	1.06	214	7.22	136
10/11/2021	ETFSL500	0.06	0.067	0.17	0.94	442	7.31	134
15/11/2021	ETWQ AU	0.071	0.078	0.55	0.97	200	6.92	162
15/11/2021	ETFSL200	0.043	0.05	0.16	0.94	212	6.96	144
15/11/2021	ETFSL500	0.038	0.042	0.13	0.76	106	7.07	145
16/11/2021	ETWQ AU	0.082	-	0.4	1.02	108.1	6.97	147
23/11/2021	ETWQ AU	0.054	0.058	0.36	0.82	279	6.8	157
23/11/2021	ETFSL200	0.051	0.057	0.1	0.91	256	6.84	148
23/11/2021	ETFSL500	0.041	0.049	0.07	0.89	324	6.83	144
29/11/2021	ETWQ AU	0.053	0.059	0.32	0.76	212	6.88	146
29/11/2021	ETFSL200	0.048	0.053	0.39	0.70	216	6.45	141
29/11/2021	ETFSL500	0.037	0.044	0.38	0.71	213	6.82	132
9/12/2021	ETWQ AU	0.099	0.092	0.19	1.05	52.6	6.81	149
9/12/2021	ETFSL200	0.048	0.059	0.06	0.95	78.5	6.89	130
9/12/2021	ETFSL500	0.03	0.047	0.06	0.89	109	6.76	128
13/12/2021	ETWQ AU	0.067	0.07	0.32	0.86	91.5	6.34	140
16/12/2021	ETWQ AU	0.083	0.084	0.24	0.99	98.3	6.82	164
16/12/2021	ETFSL200	0.02	0.031	0.09	0.68	35.5	6.9	140
16/12/2021	ETFSL500	0.013	0.024	0.1	0.65	86.6	6.83	138
20/12/2021	ETWQ AU	0.117	-	0.19	1.28	96.5	6.19	195
21/01/2021	ETWQ AU	0.128	0.131	0.18	1.23	55	6.97	164
21/01/2021	ETFSL200	0.011	0.031	<0.05	0.68	47.3	7.02	121
21/01/2021	ETFSL500	0.005	0.022	<0.05	0.66	153.6	6.91	118
29/12/2021	ETWQ AU	0.046	0.052	0.21	0.78	97.8	6.63	97.8
29/12/2021	ETFSL200	0.051	0.053	0.24	0.85	92.5	6.76	112
29/12/2021	ETFSL500	0.045	0.039	0.21	0.42	122.4	6.45	103

ATTACHMENT A (Continued)
Water Quality Data for Sites ETWQ AU, ETFSL 200, and ETFSL 500

Date	Site	Manganese (mg/L) (F)	Manganese (mg/L) (T)	Iron (mg/L) (F)	Iron (mg/L) (T)	ORP (mV)	pH Lab	EC Lab (µS/cm)
6/01/2022	ETWQ AU	0.049	0.049	0.14	0.87	98.2	6.81	133
6/01/2022	ETFSL200	0.05	0.049	0.06	0.77	104.3	6.89	144
6/01/2022	ETFSL500	0.034	0.04	<0.05	0.71	153	6.75	126
10/01/2022	ETWQ AU	0.05	-	0.31	0.8	83	6.79	140
11/01/2022	ETWQ AU	0.061	0.067	0.33	0.93	80.7	6.84	120
11/01/2022	ETFSL200	0.026	0.034	0.1	0.69	102.3	6.65	102
11/01/2022	ETFSL500	0.019	0.035	0.08	0.71	87	6.67	102
17/01/2022	ETWQ AU	0.056	0.062	0.32	0.98	95.1	6.73	117
17/01/2022	ETFSL200	0.036	0.038	0.16	0.63	126.6	6.72	102
17/01/2022	ETFSL500	0.03	0.033	0.14	0.62	116.9	6.68	101
24/01/2022	ETWQ AU	0.062	0.083	0.14	1.22	69.9	6.82	134
24/01/2022	ETFSL200	0.035	0.037	0.08	0.69	121.4	6.77	108
24/01/2022	ETFSL500	0.018	0.033	0.09	0.76	264	6.82	109
31/01/2022	ETWQ AU	0.15	-	0.12	1.53	97.5	7.29	166
3/02/2022	ETWQ AU	0.174	0.169	0.06	1.51	87.2	6.89	152
3/02/2022	ETFSL200	0.091	0.095	<0.05	1.08	269	6.98	124
3/02/2022	ETFSL500	0.082	0.084	0.07	0.90	264	6.88	115
8/02/2022	ETWQ AU	0.080	0.087	0.12	1.30	114.3	6.89	144
8/02/2022	ETFSL200	0.040	0.052	0.08	0.90	84	6.99	118
8/02/2022	ETFSL500	0.040	0.055	0.06	0.94	247	6.97	119
15/02/2022	ETWQ AU	0.087	0.087	0.13	1.11	56.3	6.5	154
15/02/2022	ETFSL200	0.013	0.031	<0.05	0.70	140.9	6.45	123
15/02/2022	ETFSL500	0.025	0.034	<0.05	0.73	148.8	6.43	123
21/02/2022	ETWQ AU	0.062	-	0.26	0.76	111	6.83	137
10/03/2022[1]	ETWQ AU	0.061	-	0.45	1.31	140.7	6.62	66
11/03/2022	ETWQ AU	0.055	0.057	0.5	1.46	85.2	7.05	79
11/03/2022	ETFSL200	0.028	0.026	0.32	1.06	54.4	6.64	40
11/03/2022	ETFSL500	-	-	-	-	-	-	-
14/03/2022	ETWQ AU	0.066	0.072	0.27	1.43	58.9	8.11	101
14/03/2022	ETFSL200	0.022	0.028	0.13	0.68	96.4	6.22	55
14/03/2022	ETFSL500	-	-	-	-	-	-	-
21/03/2022	ETWQ AU	0.046	0.060	0.40	1.35	63.7	7.05	80
21/03/2022	ETFSL200	0.035	0.046	0.11	0.72	59.5	6.62	79
21/03/2022	ETFSL500	-	-	-	-	-	-	-
28/03/2022	ETWQ AU	0.029	0.034	0.40	1.10	151.9	5.79	55
28/03/2022	ETFSL200	0.028	0.043	0.15	1.87	100.8	6.72	80
4/04/2022[1]	ETWQ AU	0.066	0.081	0.61	1.56	54.4	6.89	93
4/04/2022	ETFSL200	0.033	0.042	0.12	0.70	66.4	6.56	75
11/04/2022	ETWQ AU	0.045	0.054	0.43	1.19	86	6.89	64
11/04/2022	ETFSL200	0.032	0.04	0.16	0.73	75	6.66	62
14/04/2022	ETWQ AU	0.071	-	0.30	1.49	90.3	7.12	95
19/04/2022	ETWQ AU	0.105	0.102	0.24	0.24	97.6	7.06	115
19/04/2022	ETFSL200	0.031	0.045	0.18	0.72	74.4	6.88	72
29/04/2022	ETWQ AU	0.042	0.043	0.30	1.05	116.5	6.67	73
29/04/2022	ETFSL200	0.040	0.042	0.20	0.77	47.7	6.54	72
2/05/2022[1]	ETWQ AU	0.086	0.087	0.66	1.54	93.6	6.95	98
2/05/2022	ETFSL200	0.45	0.46	0.51	0.88	172.5	6.58	74
9/05/2022	ETWQ AU	0.11	0.119	0.28	1.9	54	6.86	124
9/05/2022	ETFSL200	0.37	0.45	0.16	0.85	62.4	6.76	73
17/05/2022	ETWQ AU	0.086	0.094	0.36	1.61	246.1	6.99	108
17/05/2022	ETFSL200	0.34	0.42	0.14	0.76	327.7	6.62	74
24/05/2022	ETWQ AU	0.037	0.039	0.43	0.99	218.4	5.91	162
24/05/2022	ETFSL200	0.47	0.47	0.24	0.84	218.7	5.78	68

ATTACHMENT A (Continued)
Water Quality Data for Sites ETWQ AU, ETFSL 200, and ETFSL 500

Date	Site	Manganese (mg/L) (F)	Manganese (mg/L) (T)	Iron (mg/L) (F)	Iron (mg/L) (T)	ORP (mV)	pH Lab	EC Lab (µS/cm)
30/05/2022	ETWQ AU	0.096	0.104	0.47	1.71	83.8	6.89	102
30/05/2022	ETFSL200	0.33	0.036	0.22	0.22	85.4	6.42	70
6/06/2022[1]	ETWQ AU	0.119	0.122	0.4	1.7	135	7.06	144
6/06/2022	ETFSL200	0.032	0.041	0.17	0.67	230.4	6.54	68
14/06/2022	ETWQ AU	0.101	0.123	0.07	1.61	163.3	7.28	134
16/06/2022	ETWQ AU	0.142	0.155	0.38	1.95	134.5	7.06	146
16/06/2022	ETFSL200	0.027	0.04	0.11	0.73	127	6.41	67
20/06/2022	ETWQ AU	0.086	0.103	0.08	1.42	150	6.77	131
23/06/2022	ETWQ AU	0.118	0.126	<0.05	1.82	101.4	6.23	142
23/06/2022	ETFSL200	0.028	0.043	0.1	0.8	198.3	5.98	67
27/06/2022	ETWQ AU	0.136	-	0.42	1.57	83.5	6.82	163
28/06/2022	ETWQ AU	0.146	0.157	0.35	1.44	101.4	6.79	150
28/06/2022	ETFSL200	0.034	0.048	0.17	0.88	182.2	6.9	71
12/07/2022	ETWQ AU	0.054	0.051	0.3	0.66	106.6	6.99	75
12/07/2022	ETFSL200	0.049	0.046	0.45	0.89	167.7	6.2	63
13/07/2022	ETWQ AU	0.057	-	0.3	0.7	119.7	6.81	82
18/07/2022	ETWQ AU	0.083	0.09	0.36	1.22	93.7	6.69	106
22/07/2022	ETWQ AU	0.042	0.04	0.26	0.6	104.3	6.57	83
22/07/2022	ETFSL200	0.026	0.027	0.12	0.56	125.5	6.46	57
25/07/2022	ETWQ AU	0.059	0.063	0.33	0.81	64.5	6.55	83
25/07/2022	ETFSL200	0.028	0.027	0.17	0.58	119.1	6.59	55
2/08/2022	ETWQ AU	0.09	0.105	0.34	1.42	63.7	6.97	125
2/08/2022	ETFSL200	0.024	0.031	0.13	0.7	113.7	6.25	58
10/08/2022	ETWQ AU	0.116	0.113	0.18	1.32	41.1	6.93	128
10/08/2022	ETFSL200	0.029	0.039	0.11	0.74	138.5	6.52	57
15/08/2022	ETWQ AU	0.107	0.118	0.1	1.39	80	7.06	144
16/08/2022	ETWQ AU	0.097	0.116	0.06	1.35	75.6	7.01	139
16/08/2022	ETFSL200	0.028	0.037	0.11	0.62	87.5	6.39	57
22/08/2022	ETWQ AU	0.131	0.13	0.19	1.4	63.5	6.93	152
23/08/2022	ETWQ AU	0.133	0.133	<0.05	1.42	95.3	6.9	153
23/08/2022	ETFSL200	0.027	0.036	0.1	0.66	128.6	6.66	62
29/08/2022	ETWQ AU	0.15	0.165	0.41	1.68	34.6	7.1	162
30/08/2022	ETWQ AU	0.149	0.165	0.32	1.54	78.2	7.02	164
30/08/2022	ETFSL200	0.02	0.029	0.1	0.68	167.5	6.56	58
8/09/2022	ETWQ AU	0.143	0.146	0.51	1.82	19.5	6.79	155
8/09/2022	ETFSL200	0.027	0.032	0.1	0.64	119.2	6.57	63
14/09/2022	ETWQ AU	0.154	-	0.21	1.45	48.9	7.12	168
19/09/2022	ETWQ AU	0.143	0.164	0.07	1.8	39.9	7.05	155
20/09/2022	ETWQ AU	0.154	0.163	0.24	1.74	56.1	7.07	149
20/09/2022	ETFSL200	0.028	0.037	0.06	0.59	85.9	6.5	60
26/09/2022	ETWQ AU	0.131	0.139	0.34	1.64	46	6.89	155
26/09/2022	ETFSL200	0.022	0.03	0.07	0.59	58.7	6.46	65
28/09/2022	ETWQ AU	0.071	0.081	0.15	1.28	76	6.84	129
10/10/2022	ETWQ AU	0.029	0.042	0.32	0.87	87.9	6.15	66
10/10/2022	ETFSL200	0.016	0.024	0.29	0.84	77.7	5.63	42
11/10/2022	ETWQ AU	0.05	-	0.27	0.91	76	6.33	80
17/10/2022	ETWQ AU	0.087	0.112	0.2	1.72	40.9	6.04	117
17/10/2022	ETFSL200	0.056	0.072	0.2	1.37	120.3	5.85	71
25/10/2022	ETWQ AU	0.037	0.042	0.33	1.26	55.7	6.84	67
25/10/2022	ETFSL200	0.041	0.049	0.15	1.09	54.9	5.88	64
26/10/2022	ETWQ AU	0.047	-	0.35	1.16	40.9	6.57	73
31/10/2022	ETWQ AU	0.135	0.118	0.53	1.95	90.1	7.03	115
31/10/2022	ETFSL200	0.023	0.028	0.1	0.76	45.6	6.46	64

ATTACHMENT A (Continued)
Water Quality Data for Sites ETWQ AU, ETFSL 200, and ETFSL 500

Date	Site	Manganese (mg/L) (F)	Manganese (mg/L) (T)	Iron (mg/L) (F)	Iron (mg/L) (T)	ORP (mV)	pH Lab	EC Lab (µS/cm)
7/11/2022	ETWQ AU	0.145	0.136	0.14	1.01	54	6.95	139
8/11/2022	ETWQ AU	0.149	0.16	0.1	2.2	79.2	7.05	145
8/11/2022	ETFSL200	0.027	0.035	0.07	0.97	63.5	6.5	68
14/11/2022	ETWQ AU	0.064	0.073	0.16	1.35	82.6	7.09	102
14/11/2022	ETFSL200	0.033	0.035	0.08	0.76	127.9	6.7	71
16/11/2022	ETWQ AU	0.112	-	0.21	1.8	65.8	6.79	113
21/11/2022	ETWQ AU	0.148	-	0.33	1.93	29.9	7.2	142
24/11/2022	ETWQ AU	0.135	0.181	<0.05	2.18	149.5	6.85	148
24/11/2022	ETFSL200	0.031	0.041	0.05	1.01	104.4	6.52	68
28/11/2022	ETWQ AU	0.214	0.246	0.08	2.3	80	7.18	156
28/11/2022	ETFSL200	0.038	0.049	0.06	1.19	133.9	6.74	76
30/11/2022	ETWQ AU	0.117	0.188	0.06	2.02	78.5	7.13	159
6/12/2022	ETWQ AU	0.185	0.207	<0.05	2.06	105.5	7.1	165
6/12/2022	ETFSL200	0.034	0.041	<0.05	0.9	36.8	6.8	75
7/12/2022	ETWQ AU	0.199	-	<0.05	2.19	87.5	7.11	159
12/12/2022	ETWQ AU	0.235	-	<0.05	1.92	63	7.17	168
14/12/2022	ETWQ AU	0.249	0.286	<0.05	2.39	66.1	7.21	173
14/12/2022	ETFSL200	0.028	0.037	0.06	1.05	78.2	6.56	65
19/12/2022	ETWQ AU	0.258	0.273	<0.05	2.39	71.6	6.89	173
19/12/2022	ETFSL200	0.037	0.036	0.08	0.55	100.2	6.33	60
28/12/2022	ETWQ AU	0.396	0.458	<0.05	2.82	94.4	6.67	203
28/12/2022	ETFSL200	0.027	0.031	0.06	0.57	63.2	5.95	74
29/12/2022	ETWQ AU	0.471	-	0.09	2.87	74.1	6.99	206
3/01/2023	ETWQ AU	0.24	0.313	<0.05	1.89	83.5	7.16	153
3/01/2023	ETFSL200	0.017	0.02	<0.05	0.31	105	6.51	56
12/01/2023	ETWQ AU	0.158	0.149	0.17	1.61	57.5	6.75	144
12/01/2023	ETFSL200	0.029	0.026	<0.05	0.41	94.2	6.04	64
16/01/2023	ETWQ AU	0.172	0.171	<0.05	1.57	56.5	7.11	155
16/01/2023	ETFSL200	0.022	0.026	0.07	0.53	62	6.44	62
18/01/2023	ETWQ AU	0.21	0.221	<0.05	2.06	108.3	6.88	158
23/01/2023	ETWQ AU	0.079	0.087	0.07	1.3	4.8	5.89	142
23/01/2023	ETFSL200	0.026	0.034	0.05	0.8	75.3	5.88	65
30/01/2023	ETWQ AU	0.166	-	<0.05	1.33	58.5	5.95	160
31/01/2023	ETWQ AU	0.108	0.119	0.11	1.57	61.7	5.97	146
31/01/2023	ETFSL200	0.038	0.048	0.06	1.03	60	5.76	72
14/02/2023	ETWQ AU	0.088	-	0.14	1.33	323.8	6.88	116
15/02/2023	ETWQ AU	0.082	0.094	0.08	1.27	221.3	6.49	122
15/02/2023	ETFSL200	0.037	0.060	<0.05	1.04	358.3	5.55	63
21/02/2023	ETWQ AU	0.13	-	0.52	1.64	94.2	6.75	132
23/02/2023	ETWQ AU	0.061	0.074	0.31	0.93	164.7	6.85	91
23/02/2023	ETFSL200	0.074	0.088	0.9	1.23	194.3	6.5	64
27/02/2023	ETWQ AU	0.114	-	0.12	1.44	91.6	7.11	120
27/02/2023	ETFSL200	0.023	0.047	0.05	0.76	181.7	6.36	67

ATTACHMENT A (Continued)
Water Quality Data for Sites ETWQ AU, ETFSL 200, and ETFSL 500

Date	Site	Manganese (mg/L) (F)	Manganese (mg/L) (T)	Iron (mg/L) (F)	Iron (mg/L) (T)	ORP (mV)	pH Lab	EC Lab (µS/cm)
7/03/2023	ETWQ AU	0.134	0.136	0.18	1.76	124.9	7.02	141
7/03/2023	ETFSL200	0.011	0.028	0.06	0.68	257.7	6.41	64
8/03/2023	ETWQ AU	0.187	-	0.15	2.16	116.1	6.63	148
13/03/2023	ETWQ AU	0.065	0.056	0.18	0.89	89.2	7.04	93
13/03/2023	ETFSL200	0.013	0.055	0.08	0.93	182.5	6.39	69
16/03/2023	ETWQ AU	0.068	-	0.29	1.1	52.1	6.44	117
21/03/2023	ETWQ AU	0.084	0.097	0.08	1.28	113.3	6.36	130
21/03/2023	ETFSL200	0.015	0.052	<0.05	0.92	133.2	5.94	71
23/03/2023	ETWQ AU	0.085	-	0.17	1.11	56.8	6.7	124
27/03/2023	ETWQ AU	0.087	0.088	0.35	1.29	43.5	6.2	133
27/03/2023	ETFSL200	0.011	0.012	0.35	0.39	77	5.61	61
30/03/2023	ETWQ AU	0.083	0.09	0.21	1.31	65.7	5.94	116

1 For the period of March, April, May, June, July, August, September, October, November, December 2022, January, February and March 2023, site ETFSL 500 was not sampled.

THE UNIVERSITY OF QUEENSLAND
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Director
Professor Neville Plint
CRICOS PROVIDER NUMBER 00025B

15 February 2024

Mr. Stephen Love
Environment & Community Superintendent
Metropolitan Coal
Peabody Energy Australia
PO Box 402
Helensburgh NSW 2508

Dear Stephen,

Subject: Assessment against Water Quality Performance Measure –
Quarter 2 (April to June) 2023

The Metropolitan Coal Project Approval (08_0149) requires Metropolitan Coal not to exceed the subsidence impact performance measures outlined in Table 1 of Condition 1, Schedule 3. Table 1 of Condition 1, Schedule 3 includes a performance measure for negligible reduction to the quality of water resources reaching the Woronora Reservoir.

The Metropolitan Coal Longwalls 308-310 Water Management Plan (LW308-310 WMP) establishes subsidence impact performance indicators for each performance measure. The performance indicator for negligible reduction to the quality of water resources reaching the Woronora Reservoir is:

> *Changes in the quality of water entering Woronora Reservoir are not significantly different post-mining compared to pre-mining concentrations, that are not also occurring at control site WOWQ2.*

The LW308-310 WMP requires that analysis of the performance indicator be undertaken on a quarterly basis, however, in the event that analysis identifies a Level 2 or Level 3 significance level (in accordance with the LW308-310 WMP Trigger Action Response Plan [TARP]), the frequency of data analysis is required to be increased to a monthly basis (until such time that data analysis indicates a return to Level 1).

The LW308-310 WMP describes that field filtered water quality parameters (i.e. iron, manganese and aluminium) at site WRWQ 9 on Waratah Rivulet, site ETWQ AU on Eastern Tributary and at control site WOWQ 2 on the Woronora River are used to assess the performance indicator. The LW308-310 WMP describes these as *"key water quality parameters of relevance to water supply and effects of subsidence"*.

If data analysis indicates a performance indicator has been exceeded, an assessment is to be made against the performance measure.

ATC Williams (2023a, 2023b, 2023c) conducted analysis for water resources reaching the Woronora Reservoir at site ETWQ AU on the Eastern Tributary and site WRWQ 9 on the Waratah Rivulet in accordance with the LW308-310 WMP. The water quality indicators selected for the analysis are dissolved (i.e. filtered <0.45 µm fraction) manganese, iron and aluminium. The water quality indicators are assessed against the water quality at control site WOWQ 2 on the Woronora River, in accordance with the performance criteria presented in the LW308-310 WMP (ATC Williams, 2023a; 2023b; 2023c). A summary of outcomes from the water quality analysis undertaken for Quarter 2 (April to June) 2023 (Q2 2023) is presented in Table 1.

Table 1 Summary of Water Quality Analyses from April to June 2023

Monitoring Site(s)	Parameters	Assessed Significance Level		
		April 2023	May 2023	June 2023
Site ETWQ AU on the Eastern Tributary	Iron (Fe)	Level 1	Level 1	Level 1
	Aluminium (Al)			
	Manganese (Mn)	Level 3	Level 3	Level 3
Site WRWQ 9 on the Waratah Rivulet	Iron (Fe)	Level 1	Level 1	Level 1
	Aluminium (Al)			
	Manganese (Mn)			

The analysis identified that the performance indicator was exceeded for dissolved manganese at site ETWQ AU in Q2 2023 during April and June 2023. In addition, since the performance indicator was not exceeded for dissolved iron and aluminium at site ETWQ AU and dissolved iron, aluminium and manganese at site WRWQ 9 in Q2 2023, these parameters are not discussed in this report.

In accordance with the LW308-310 WMP, exceedance of the subsidence impact performance indicator has triggered an assessment against the water quality subsidence impact performance measure, *Negligible reduction to the quality of water resources reaching the Woronora Reservoir*. The term 'negligible' is defined in the Project Approval as *small and unimportant, such as to be not worth considering.*

In accordance with the LW308-310 WMP, if the water quality parameter is greater than the historical maximum, then undertake an investigation and assess against the performance measure for that month. If the water quality parameter is less than the historical maximum, then undertake an investigation and assess against the performance measure at the end of the quarter. During April and June 2023, the dissolved manganese concentrations were below the historical maximum (2.860 mg/L recorded in February 2018). Therefore, this assessment against the performance measure was undertaken at the end of Q2 2023.

This assessment has been prepared for Q2 2023 in consideration of:

- pluviograph data;
- flow data from the Eastern Tributary gauging location (GS300078);
- groundwater level and groundwater quality results for Eastern Tributary sites up to 30 June 2023[1];
- surface water quality data at site ETWQ AU and sites further upstream on the Eastern Tributary up to 30 June 2023;
- surface water quality data at sites downstream of ETWQ AU up to 30 June 2023; and
- the Australian Drinking Water Guidelines.

1. PLUVIOGRAPH, EASTERN TRIBUTARY FLOW AND GROUNDWATER LEVEL DATA

The monthly rainfall recorded for the Eastern Tributary at PV7 has been frequently below the average monthly rainfall (Darkes Forest long term monthly mean) since 2016. Since January 2020, above average rainfall has been recorded in January to March 2020, July to August 2020, October 2020, December 2020, March 2021, October 2021 to May 2022, July 2022, September to October 2022, January to February 2023 and April 2023 with below average rainfall recorded in all other months (Table 2).

Total rainfall at PV7 in April 2023 was 146.5 mm, above the monthly mean rainfall at Darkes Forest (128.1 mm), with rainfall occurring 2 to 4 April (total 40.5 mm), 8 April (25.5 mm), 14 to 15 April (total 20.0 mm), 17 April (0.5 mm), 21 April (32.0 mm), 24 to 25 April (total 9.0 mm) and 30 April (total 19.0 mm).

Total rainfall at PV7 in May 2023 was 32.0 mm, below the monthly mean rainfall at Darkes Forest (128.1 mm), with rainfall occurring 1 May (4.5 mm), 8 May (15.5 mm), 14 to 15 May (total 8.0 mm) and 17 to 19 May (total 4.0 mm).

Total rainfall at PV7 in June 2023 was 17.0 mm, below the monthly mean rainfall at Darkes Forest (143.1 mm), with rainfall occurring 5 to 7 June (total 7.5 mm), 9 June (1.5 mm), 13 June (1.0 mm), 23 to 24 June (total 5.5 mm) and 29 June (1.5 mm).

[1] Groundwater quality at site ETWG1 has not been able to be sampled since August 2017.

Table 2 Monthly Rainfall Data for PV7, January 2020 to June 2023

Month/Year	Rainfall at PV7 (mm)	Rainfall at Darkes Forest (mm)#	Monthly Mean Rainfall at Darkes Forest (1894-2023) (mm)#
January 2020	133.0	56.2	131.2
February 2020	730.0	255.2	159.5
March 2020	236.0	146.0*	154.3
April 2020	88.5	73.0*	126.1
May 2020	88.0	111.0*	128.1
June 2020	59.0	65.0*	145.8
July 2020	237.0	185.0*	96.0
August 2020	151.5	86.0*	88.9
September 2020	31.0	36.0	76.8
October 2020	131.5	158.0	92.0
November 2020	87.5	65.0	104.6
December 2020	106.0	104.0	103.0
January 2021	104.5	122.0	131.1
February 2021	119.5	123.0	158.4
March 2021	365.5	397.0	156.3
April 2021	12.5	19.0	125.3
May 2021	123.0	167.0	128.4
June 2021	65.5	64.0	145.1
July 2021	26.0	22.0	95.4
August 2021	63.0	64.0	88.6
September 2021	43.5	38.0	76.5
October 2021	115.5	92.0	92.0
November 2021	190.5	198.0	105.4
December 2021	133.0	135.0	103.3
January 2022	165.0	166.0	131.4
February 2022	371.0	312.0	159.7
March 2022	731.0	794.0	161.6
April 2022	447.0	465.0	128.0
May 2022	166.5	186.0	128.9
June 2022	14.5	25.0	144.1
July 2022	777.0	875.0	101.7
August 2022	22.5	21.0	88.1
September 2022	136.0	164.0	77.2
October 2022	306.0	323.0	93.9
November 2022	56.5	70.0	105.1
December 2022	19.0	36.0	102.7
January 2023	173.0	173.0	131.7
February 2023	274.5	193.0	159.9
March 2023	113.5	143.0	161.5
April 2023	146.5	140.0	128.1
May 2023	32.0	25.0	128.1
June 2023	17.0	10.0	143.1

Bureau of Meteorology Station Number 68024 established in 1894. Each monthly mean is calculated using all data obtained since the commencement of monitoring at Station 68024 to June 2023.

* Data from Station 68024 is incomplete or not available for the period of March to August 2020. Data from nearby Station 66176 (Audley) has therefore been substituted for these months.

2. EASTERN TRIBUTARY SURFACE WATER AND GROUNDWATER QUALITY DATA

2.1 Dissolved Manganese

There has been a notable increase in dissolved manganese at site ETWQ AU compared to prior concentrations since July 2016. Reducing conditions (through water saturation excluding oxygen) has solubilised manganese in the groundwater. The soluble manganese (manganese [II] ion, Mn^{2+}) has been transferred to surface water through mine-induced cracking, resulting in an increase in dissolved manganese concentrations in the Eastern Tributary. The concentration of dissolved manganese is typically higher upstream of site ETWQ AU (for example, site ETWQ AQ shown on Charts 1 and 2), where cracking and the diversion of flows has occurred (Figure 1).

Plots of dissolved manganese at surface water quality sites ETWQ AU, ETWQ AQ (upstream on the Eastern Tributary), WOWQ 2 (control site) and at groundwater quality site ETGW2, are compared to rainfall at PV7 (Chart 1) and streamflow at GS300078 (Chart 2).

While groundwater quality site ETGW2 is downstream of site ETWQ AU, the groundwater quality data are indicative of the characteristics of the groundwater. Manganese will remain dissolved in the water column as oxidation at near-neutral pH is slow (Raveendran et al*.,* 2001) and soluble manganese (II) is the most stable species (Rayner-Canham, 1996). Low levels of manganese, e.g. <0.100 mg/L, exist in the natural creek water. Dissolved manganese is easily diluted by freshwater flow to low levels when higher creek flows occur.

Dissolved and total manganese concentrations at site ETWQ AU in Q2 2023 are presented in Table 3.

Table 3 Site ETWQ AU dissolved and total manganese concentrations in Q2 2023

Water Quality Parameters		April 2023	May 2023	June 2023
Dissolved manganese	Lowest (mg/L)	0.053	0.063	0.161
	Highest (mg/L)	0.094	0.140	0.274
Total manganese	Lowest (mg/L)	0.060	0.075	0.168
	Highest (mg/L)	0.102	0.162	0.246

As described above, prior to October 2018, rainfall was well below average for an extended period of time. The low stream flows resulted in insufficient surface water to dilute the elevated concentrations of dissolved manganese from the groundwater, resulting in higher concentrations of dissolved manganese at site ETWQ AU. During October to December 2018, heavy rainfall increased flow in the Eastern Tributary sufficiently to dilute dissolved manganese at site ETWQ AU to below 0.5 mg/L and demonstrated that the high dissolved manganese in the Eastern Tributary could be diluted by creek flow. This was also evident as a result of the rainfall event observed over 17 to 21 September 2019, which increased flows in the Eastern Tributary and resulted in the dissolved manganese concentration dropping to the lowest level recorded since October 2016. This also occurred following the rainfall events in January to March, July, and August 2020 (Attachment A).

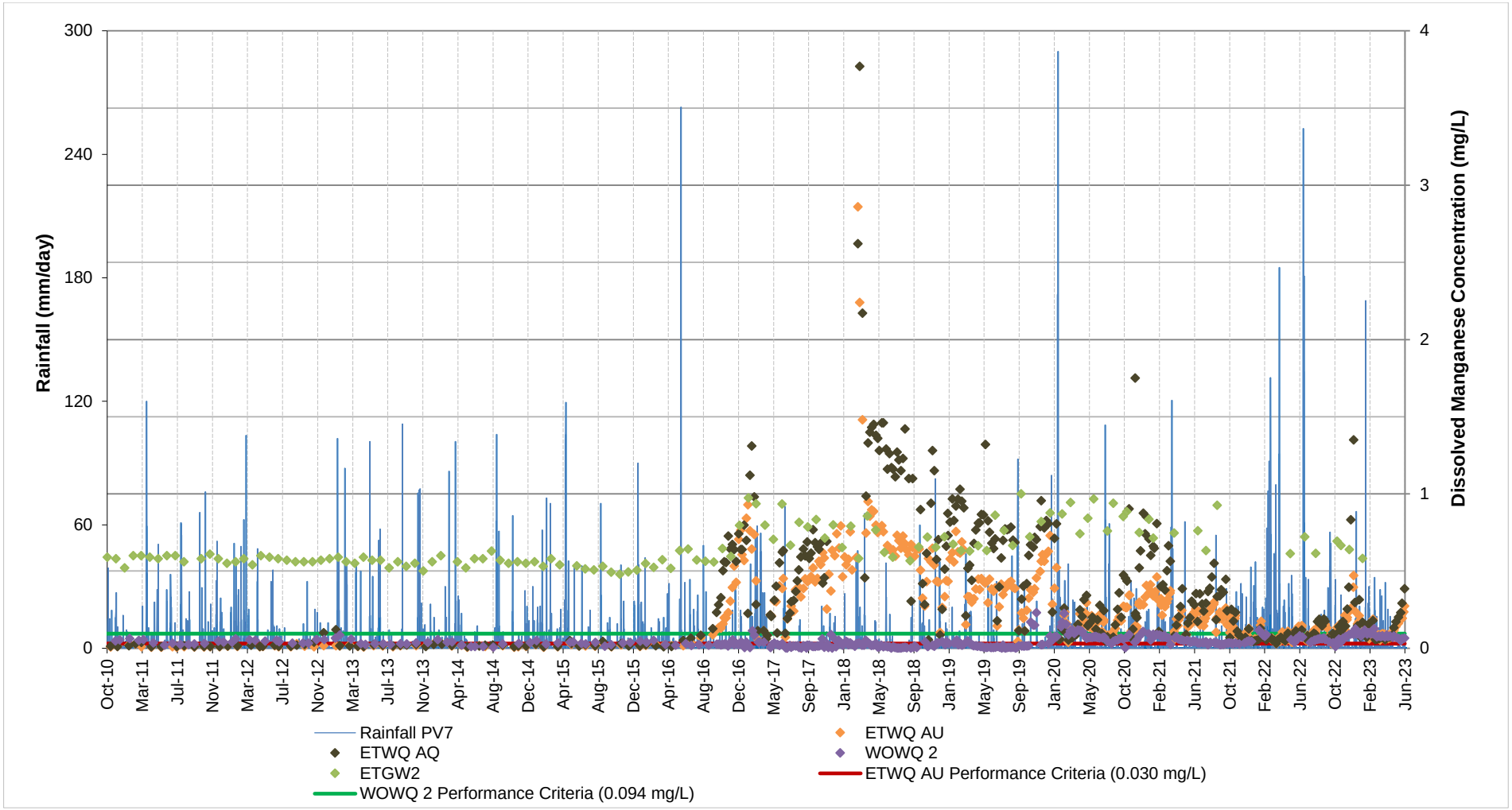


Chart 1 Dissolved Manganese Concentrations at Surface Water Quality Sites ETWQ AU, ETWQ AQ and WOWQ 2 and Groundwater Quality Site ETGW2, and Rainfall (to 30 June 2023)[2]

[2] The performance criteria shown in the figure are the adjusted baseline mean plus two standard deviations, which are used to assess the performance indicator, in accordance with LW308-310 WMP.

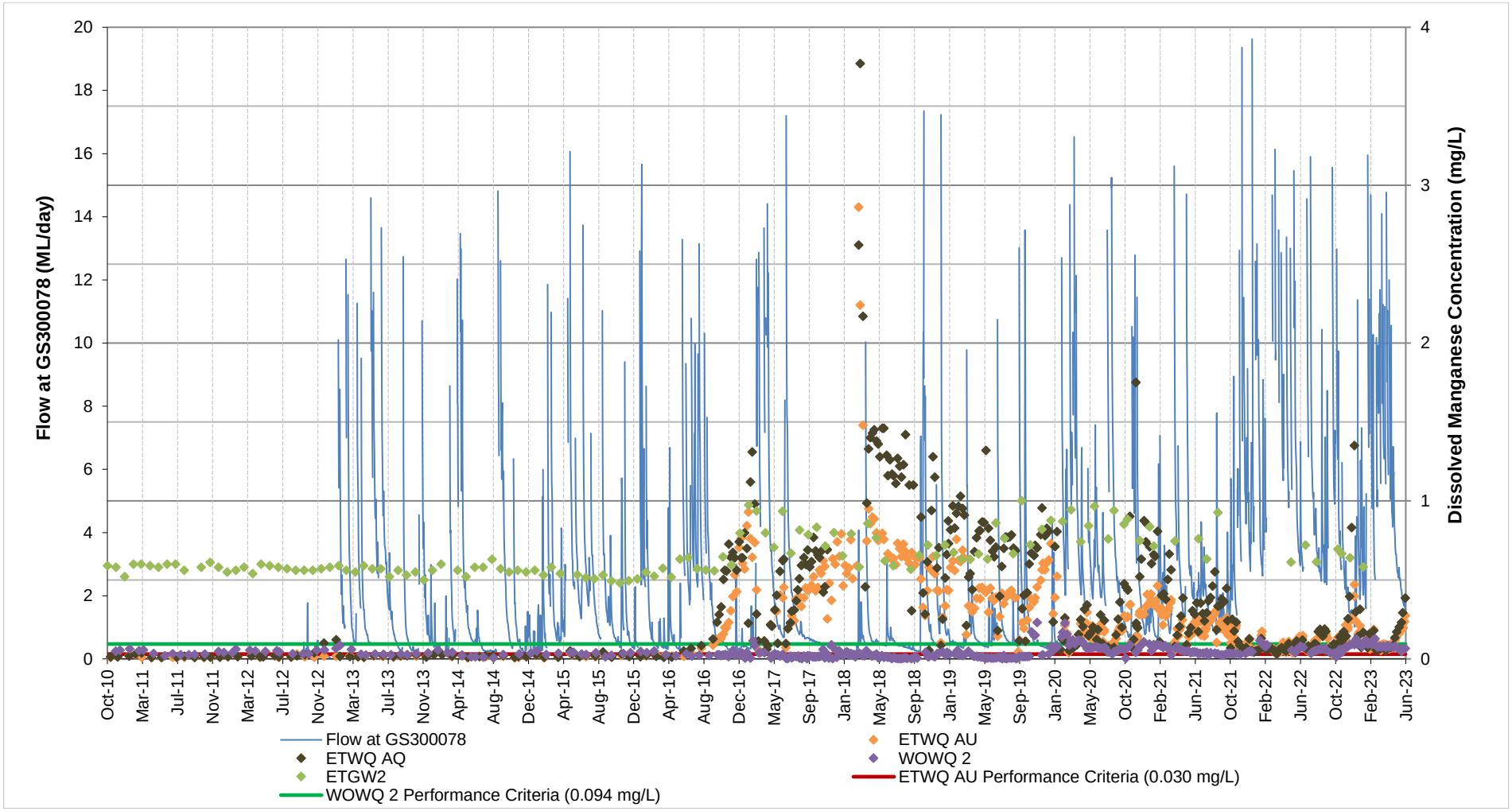
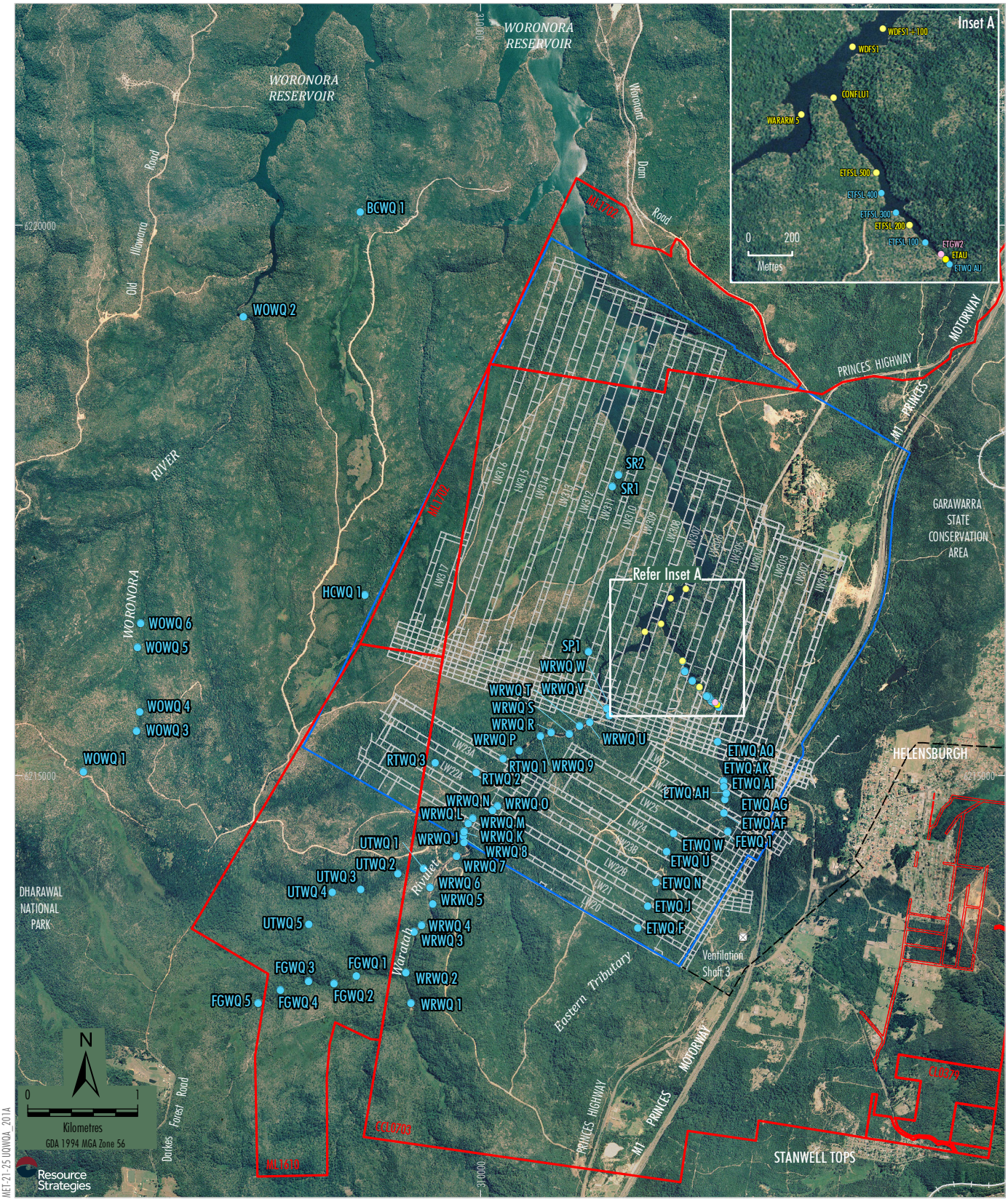


Chart 2 Dissolved Manganese Concentrations at Surface Water Quality Sites ETWQ AU, ETWQ AQ and WOWQ 2 and Groundwater Quality Site ETGW2, and Stream Flow (to 30 June 2023)[3]

[3] The performance criteria shown in the figure are the adjusted baseline mean plus two standard deviations, which are used to assess the performance indicator, in accordance with the LW308-310 WMP.



LEGEND

- Mining Lease Boundary
- Railway
- Project Underground Mining Area Longwalls 20-27 and 301-317
- Existing Underground Access Drive (Main Drift)
- Surface Water Quality Site
- Groundwater Quality Site of Eastern Tributary
- Water Quality Site on Eastern Tributary and/or in Woronora Reservoir

Source: Land and Property Information (2015); Date of Aerial Photography 1998; Department of Industry (2015); Metropolitan Coal (2021); MSEC (2021)

Peabody

METROPOLITAN COAL

Surface Water Quality Sampling of Eastern Tributary Watercourse and Woronora Reservoir

Figure 1

2.2 Other Water Quality Parameters

Water quality parameters pertinent to the increase in manganese (dissolved-filtered <0.45 µm fraction) concentrations are pH, oxidation-reduction potential (ORP) and electrical conductivity (EC). The pH and ORP define the physico-chemical form of manganese that can exist in water based on whether the conditions are oxidising or reducing. The EC results indicate whether there has been an increase in salinity (following the mixing of groundwater with the creek water). Water is generally weakly oxidising and becomes reducing when ORP is below approximately 10 mV.

Water quality parameters relevant to the analysis of dissolved manganese at site ETWQ AU in Q2 2023 are presented in Table 4:

Table 4 Site ETWQ AU other water quality parameters in Q2 2023

Water Quality Parameters		April 2023	May 2023	June 2023
pH (lab measurement)	Lowest	5.8	6.32	6.39
	Highest	7.2	6.86	6.94
EC (lab measurement)	Lowest (µS/cm)	101	115	156
	Highest (µS/cm)	127	155	185
ORP (field measurement)	Lowest (mV)	50.3	20	41
	Highest (mV)	151	183.5	86.2

3. WATER RESOURCES REACHING THE WORONORA RESERVOIR

In accordance with the LW308-310 WMP, site ETWQ AU on the Eastern Tributary and control site WOWQ 2 on the Woronora River are used to assess the LW308-310 WMP water quality performance indicator. As described earlier, in the event the water quality performance indicator is exceeded, an assessment is required to be conducted against the water quality performance measure.

As site ETWQ AU on the Eastern Tributary does not represent where water resources reach the Woronora Reservoir, I previously recommended to Metropolitan Coal that additional sampling be conducted at, and downstream of, site ETWQ AU to inform assessments against the performance measure. The additional sampling commenced in August 2017 at sites ETFSL 100 to ETFSL 500. Due to the reducing water level in the Woronora Reservoir, in November 2018 I recommended to Metropolitan Coal that the sampling program should be extended further downstream (i.e. further into the Woronora Reservoir). The additional sampling commenced on 22 November 2018 at sites CONFLU1 to WDFS1+100 (Figure 1). Sampling at some sites downstream of site ETWQ AU was not undertaken throughout February 2020 to June 2023 due to the high flow conditions present on the Eastern Tributary arm of the Woronora Reservoir, and due to the increasing water level in the Woronora Reservoir (Attachment A).

Metropolitan Coal has taken a photographic record of the watercourse/waterbody at the time of sampling, estimated the width of the watercourse/waterbody at the sample location and recorded the depth at which the water sample was taken.

The Woronora Reservoir is a public water supply dam which supplies water to consumers within the Sutherland Shire Council area (Helensburgh Coal Pty Ltd, 2008). The Woronora River, Waratah Rivulet and Eastern Tributary are some of the tributaries which flow into the Woronora Reservoir (Figure 1). The length of the watercourse/waterbody from the start of the Eastern Tributary 'arm' of the reservoir to the reservoir wall is some 10 km (Figure 1).

The Woronora Reservoir receives flow from the Eastern Tributary which enters a mixing zone in the upper arm of the reservoir. Based on Woronora Reservoir water level data, in Q2 2023 the Woronora Reservoir water level decreased from 168.72 mAHD on 1 April 2023 to 168.36 mAHD on 30 June 2023. The position of the reservoir water level can only be determined to the closest one metre contour, accordingly, the reservoir water level was upstream of site ETSFL 100 (corresponding to a water level of approximately 169.0 mAHD). In Q2 2023, the Woronora Reservoir water level exceeded the full supply level (168.88 mAHD) on 30 April to 2 May and 23 May 2023.

Water reaching the Woronora Reservoir occurs where the inflowing Eastern Tributary stream water meets the reservoir water body. The interface point between ponded flow from the Eastern Tributary and the reservoir water body varies constantly with the level of the reservoir and the rate of inflow from the Eastern Tributary. Throughout Q2 2023, the Woronora Reservoir water level was upstream of site ETFSL 100 (Figure 1). The mixing zone (downstream of the reservoir water level) is variable and influenced by the rate of inflow from the Eastern Tributary.

4. QUALITY OF WATER REACHING THE WORONORA RESERVOIR

4.1 Dissolved Manganese

Water quality data for filtered and total manganese for July 2020 to June 2023 at site ETWQ AU and downstream sites (Section 3) is provided in Attachment A[4].

As described above, the Woronora Reservoir water level remained consistent in Q2 2023, and was upstream of site ETFSL 100. The results for dissolved and total manganese at sites ETWQ AU, ETFSL 200, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100 since the commencement of monitoring to the end of June 2023, are shown on Charts 3 and 4, respectively. These sites provide a profile along the arm of the Woronora Reservoir. For the months in Q2 2023, no water quality monitoring at site ETFSL 500 was undertaken.

Dissolved and total manganese concentrations at site ETFSL 200 in Q2 2023 are presented in Table 5.

Table 5 Site ETFSL 200 dissolved and total manganese concentrations in Q2 2023

Water Quality Parameters		April 2023	May 2023	June 2023
Dissolved manganese	Lowest (mg/L)	0.016	0.008	0.009
	Highest (mg/L)	0.023	0.014	0.018
Total manganese	Lowest (mg/L)	0.026	0.025	0.023
	Highest (mg/L)	0.042	0.036	0.028

[4] Water quality data from January 2018 to June 2020 is provided in the *Assessment against Water Quality Performance Measure – June 2020* (The University of Queensland, 2020).

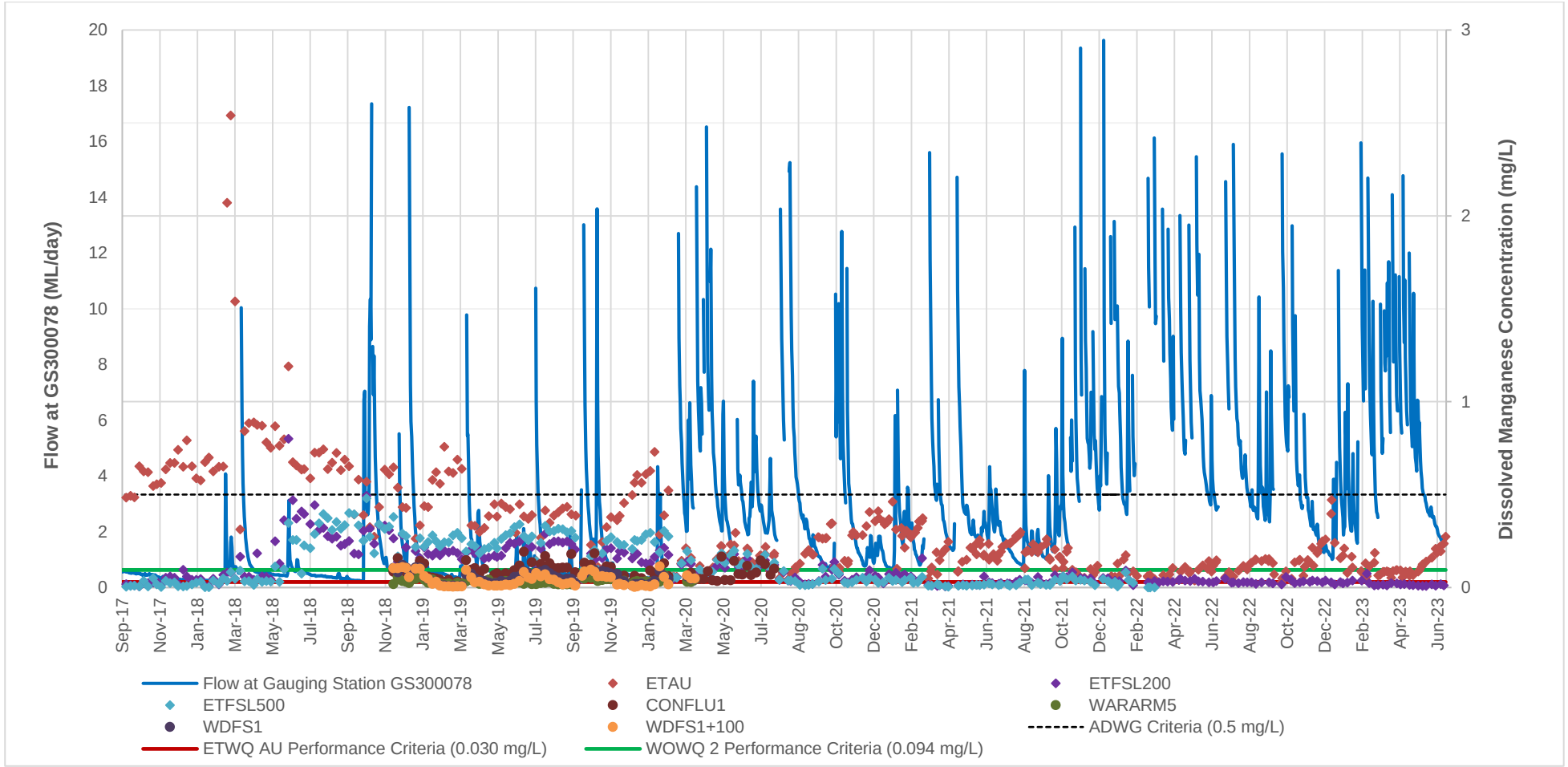


Chart 3 Dissolved Manganese Concentrations at Surface Water Quality Sites ETWQ AU[5], ETFSL 200, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100, and Stream Flow (August 2017 to June 2023)[6]

[5] Data from sampling undertaken at site ETWQ AU has been substituted for site ETWQ AU from 22 November to 6 December 2018 and 17 December 2018. Sampling at site ETWQ AU was undertaken on 12 and 27 December 2018.

[6] The performance criteria shown in the figure are the adjusted baseline mean plus two standard deviations, which are used to assess the performance indicator, in accordance with the LW308-310 WMP.

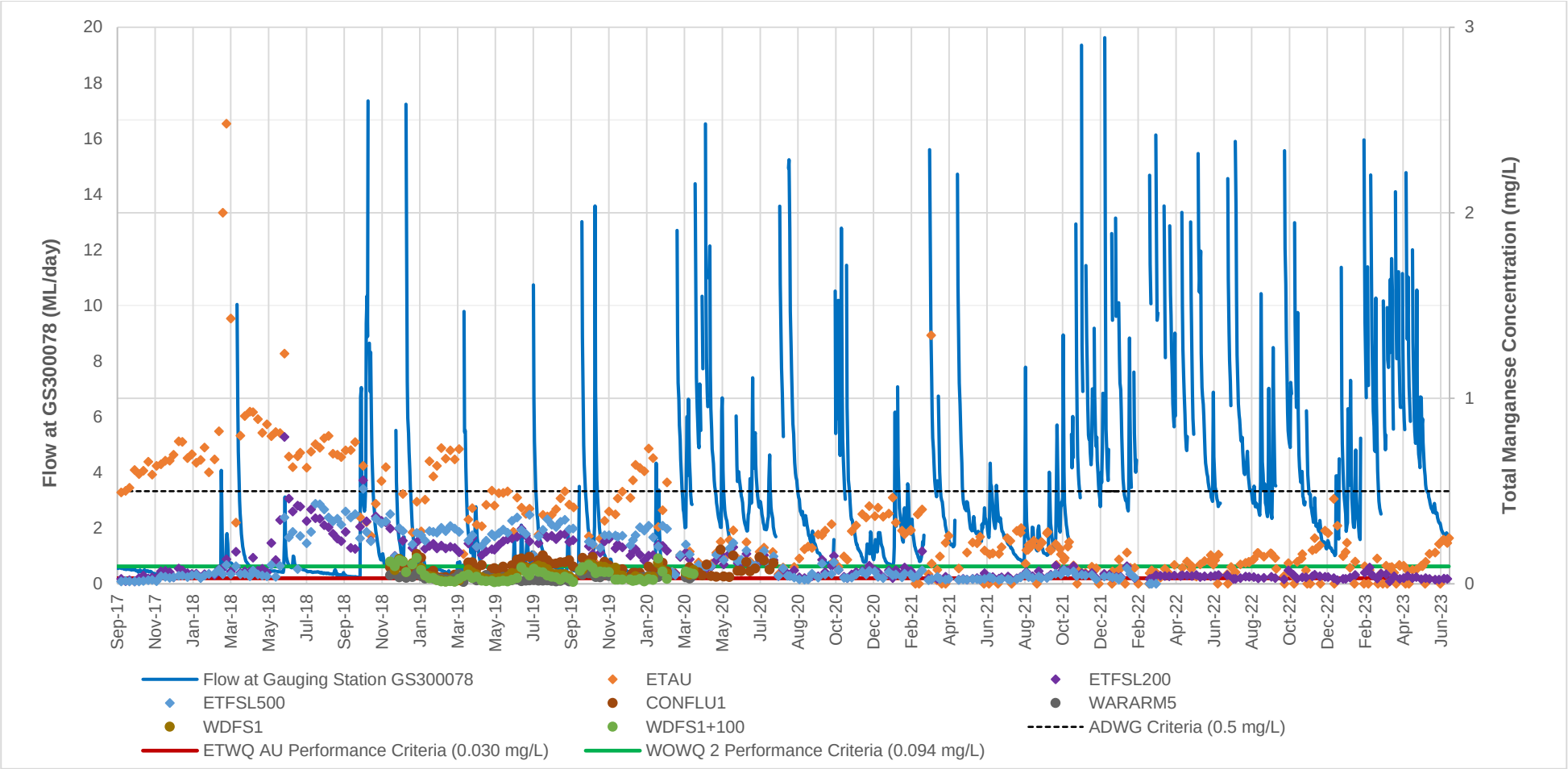


Chart 4 Total Manganese Concentrations at Surface Water Quality Sites ETWQ AU[7], ETFSL 200, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100, and Stream Flow (August 2017 to June 2023)[8]

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7 Total manganese is not sampled at site ETWQ AU, and therefore results were unable to be substituted for site ETWQ AU from 22 November to 6 December 2018 and 17 December 2018. Sampling at site ETWQ AU was undertaken on 12 and 27 December 2018.

8. The performance criteria shown in the figure are the adjusted baseline mean plus two standard deviations, which are used to assess the performance indicator, in accordance with the LW308-310 WMP.

The Australian Drinking Water Guidelines (ADWG) are published by the National Health and Medical Research Council and National Resource Management Ministerial Council (NHMRC & NRMMC) and updated most recently in 2018 (NHMRC & NRMMC, 2011); the manganese guidelines remain unchanged. The Woronora Dam is operated by WaterNSW. Water from the Woronora Dam is treated in the Woronora Filtration Plant to the standards set by the ADWG before being supplied to the Helensburgh area as well as parts of the Sutherland Shire and northern Wollongong (WaterNSW, 2017).

The ADWG is based on total concentrations of manganese in water (NHMRC & NRMMC, 2011). The ADWG value is 0.5 mg/L total manganese for health, which is also shown in Charts 3 and 4. Filtered and total manganese concentrations at site ETFSL 500 have been below 0.5 mg/L for the period of record, with the exception of one total manganese result on 10 October 2018 (0.512 mg/L). All filtered and total manganese concentrations at sites CONFLU1, WARARM5, WDFS1 and WDFS1+100 have been below 0.5 mg/L for the period of record (Charts 3 and 4).

4.2 Other Water Quality Parameters

Water quality data for parameters pertinent to dissolved manganese for July 2020 to June 2023 at sites ETWQ AU, ETFSL 200 and ETFSL 500 is provided in Attachment A. The water quality parameters (ORP and EC) showed no unusual features.

The ADWG value for pH (aesthetic) is 6.5-8.5. The pH values at all sites fluctuated in Q2 2023. The site ETWQ AU increased from 5.8 to 6.39 and the site ETFSL 200 increased from 5.54 to 6.02. As described above, monitoring at site ETFSL 500 was not undertaken in Q2 2023. At the end of June 2023, both ETWQ AU and ETFSL 200 were below the ADWG pH range (Attachment A).

5. ASSESSMENT AGAINST THE PERFORMANCE MEASURE

The subsidence impact performance indicator for water quality reaching the Woronora Reservoir was exceeded in relation to dissolved manganese at site ETWQ AU on the Eastern Tributary in Q2 2023, which has triggered an assessment against the water quality subsidence impact performance measure.

Soluble manganese from groundwater has been transferred to surface water through mine-induced cracking. The climatic conditions in 2018 resulted in low stream flows and insufficient surface water to dilute the elevated concentrations of dissolved manganese from the groundwater, resulting in higher concentrations of dissolved manganese in the Eastern Tributary. Manganese concentrations are easily diluted by freshwater flow to low levels when higher creek flows occur.

Comparison of the photographic records in Q2 2023 show the quality of water below ETWQ AU was consistent in Q2 2023, with heavy rainfall throughout the month resulting in high flows. Sites closer to ETWQ AU continued to show some orange-yellow sediment. The presence of orange-yellow coating on the creek sediment surface, continued to be observed throughout Q2 2023, will darken in colour with time as conversion to goethite occurs.

Water reaching the Woronora Reservoir occurs where the inflowing stream water meets the reservoir waterbody. In Q2 2023, the Woronora Reservoir water level was upstream of site ETFSL 100. The mixing zone (downstream of the reservoir water level) is variable and influenced by the rate of inflow from the Eastern Tributary.

The manganese concentration reaching the Woronora Reservoir has been considered. Water quality data obtained to date is considered to represent a negligible reduction to the quality of water resources reaching the reservoir. The watercourse performance measure, *Negligible reduction to the quality of water resources reaching the Woronora Reservoir,* is not considered to have been exceeded.

The LW308-310 WMP requires that analysis of the performance indicator be undertaken on a monthly basis, however, in the event that analysis identifies a Level 2 or Level 3 significance level, the frequency of data analysis is required to be increased to a monthly basis. The assessment against the performance indicator has been undertaken on a monthly basis from January 2018 to June 2023. In addition, in accordance with the LW308-310 WMP, assessments against the water quality performance measure will be undertaken at the end of each quarter if the water quality parameter is less than the historical maximum.

There has been a notable increase in dissolved manganese at site ETWQ AU compared to prior concentrations since July 2016. Notwithstanding, results of all monthly water quality performance measures assessments undertaken since January 2018 have concluded that the watercourse performance measure, *Negligible reduction to the quality of water resources reaching the Woronora Reservoir,* has not been exceeded.

Prior to early January 2018 drier conditions resulted in interrupted creek flow into the reservoir giving shallow ponding of water or completely dry sections of the upper reservoir below ETWQ AU and increased levels of dissolved manganese and iron from ETWQ AU to ETFSL 200, but not beyond ETFSL 500 when there was sufficient volume of water. Since mid-2018 dissolved manganese concentration has not exceeded the drinking water guideline of 0.5 mg/L at ETFSL 200 or ETFSL 500 and during large rain events at ETWQ AU. In addition, the Australian and New Zealand Governments (ANZG) *Australian and New Zealand Guidelines for fresh and marine water quality* (ANZG, 2018) guideline for 95% protection of aquatic species for manganese (1.9 mg/L) was not exceeded.

6. REFERENCES

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Yours Sincerely,

Barry N Noller

Principal Research Fellow

Centre For Mined Land Rehabilitation

ATTACHMENT A

WATER QUALITY DATA FOR SITES ETWQ AU, ETFSL 200 AND ETFSL 500

JULY 2020 TO JUNE 2023

ATTACHMENT A
Water Quality Data for Sites ETWQ AU, ETFSL 200, and ETFSL 500

Date	Site	Manganese (mg/L) (F)	Manganese (mg/L) (T)	Iron (mg/L) (F)	Iron (mg/L) (T)	ORP (mV)	pH Lab	EC Lab (µS/cm)
7/07/2020	ETWQ AU	0.179	0.195	0.4	1.62	104.1	7.45	239
7/07/2020	ETFSL200	0.147	0.155	0.06	1.00	76.3	7.63	238
7/07/2020	ETFSL500	0.176	0.177	0.45	1.36	33.6	7.57	252
8/07/2020	ETWQ AU	0.218	-	1.14	1.89	47	6.99	234
15/07/2020	ETWQ AU	0.089	-	0.51	0.99	92	6.85	206
16/07/2020	ETWQ AU	0.109	0.107	0.71	1.04	31.7	6.73	217
16/07/2020	ETFSL200	0.090	0.093	0.26	0.92	31.5	7.09	214
16/07/2020	ETFSL500	0.101	0.103	0.42	1.10	12.1	7.01	220
21/07/2020	ETWQ AU	0.170	0.171	0.48	1.32	32.2	6.58	220
22/07/2020	ETWQ AU	-	0.171	0.76	1.21	2.97	6.58	225
22/07/2020	ETFSL200	0.122	0.128	<0.05	0.70	25.8	7.07	216
22/07/2020	ETFSL500	0.134	0.148	0.36	0.92	-25.7	6.99	230
30/07/2020	ETWQ AU	0.050	0.052	0.32	0.72	109.3	6.11	113
30/07/2020	ETFSL200	0.041	0.042	0.3	0.67	120.3	6.18	109
30/07/2020	ETFSL500	0.041	0.042	0.28	0.68	124	6.17	106
4/08/2020	ETWQ AU	0.080	-	0.57	0.98	83.2	6.73	155
6/08/2020	ETWQ AU	0.084	0.088	0.57	1.00	94	6.85	148
6/08/2020	ETFSL200	0.083	0.078	0.34	0.88	89.1	7.02	147
6/08/2020	ETFSL500	0.088	0.083	0.25	0.91	126.7	7.03	146
13/08/2020	ETWQ AU	0.043	0.048	0.28	0.53	70.8	6.67	107
13/08/2020	ETFSL200	0.038	0.055	0.24	0.75	75.4	6.48	104
13/08/2020	ETFSL500	0.037	0.043	0.26	0.54	79.4	6.49	101
17/08/2020	ETWQ AU	0.061	0.068	0.43	0.80	112	6.45	133
17/08/2020	ETFSL200	0.035	0.049	0.14	0.49	180.9	6.37	106
17/08/2020	ETFSL500	0.038	0.042	0.12	0.45	214.5	6.20	105
24/08/2020	ETWQ AU	0.090	0.091	0.5	1.16	83.1	6.70	155
24/08/2020	ETFSL200	0.054	0.072	0.12	0.74	138.5	6.85	131
24/08/2020	ETFSL500	0.034	0.033	0.10	0.46	159.6	6.63	123
25/08/2020	ETWQ AU	0.109	-	0.46	1.39	49.2	6.33	160
1/09/2020	ETWQ AU	0.128	0.136	0.5	1.48	104.1	7.14	193
1/09/2020	ETFSL200	0.029	0.035	<0.05	0.47	191.5	7.43	128
1/09/2020	ETFSL500	0.014	0.024	<0.05	0.38	256.7	7.28	119
9/09/2020	ETWQ AU	0.181	0.186	0.57	1.75	45.3	7.01	193
9/09/2020	ETFSL200	0.017	0.031	<0.05	0.43	104.7	6.02	121
9/09/2020	ETFSL500	0.012	0.023	<0.05	0.38	188.5	6.46	114
15/09/2020	ETWQ AU	0.202	0.201	0.6	1.88	71.9	6.5	209
15/09/2020	ETFSL200	0.020	0.026	<0.05	0.43	188.7	6.29	131
15/09/2020	ETFSL500	0.014	0.024	<0.05	0.39	193.4	6.21	126
21/09/2020	ETWQ AU	0.177	0.193	<0.05	1.66	173.6	6.82	205
21/09/2020	ETFSL200	0.019	0.040	<0.05	0.52	204.6	6.1	123
21/09/2020	ETFSL500	0.018	0.055	<0.05	0.52	183.5	6.36	122
22/09/2020	ETWQ AU	0.177	-	0.19	1.61	75.3	6.65	212
30/09/2020	ETWQ AU	0.271	-	0.36	2.54	75.6	6.67	223

ATTACHMENT A (Continued)
Water Quality Data for Sites ETWQ AU, ETFSL 200, and ETFSL 500

Date	Site	Manganese (mg/L) (F)	Manganese (mg/L) (T)	Iron (mg/L) (F)	Iron (mg/L) (T)	ORP (mV)	pH Lab	EC Lab (µS/cm)
1/10/2020	ETWQ AU	0.27	0.266	0.33	2.35	116.5	6.83	226
1/10/2020	ETFSL200	0.035	0.262	0.05	0.59	126.8	6.59	140
1/10/2020	ETFSL500	0.032	0.034	0.05	0.58	130.5	6.49	139
7/10/2020	ETWQ AU	0.263	0.262	<0.05	1.46	80.9	6.84	248
7/10/2020	ETFSL200	0.122	0.129	0.05	1	70.8	6.95	194
7/10/2020	ETFSL500	0.101	0.109	0.05	1.05	84	6.82	173
12/10/2020	ETWQ AU	0.264	0.287	<0.05	1.16	101.2	6.97	269
12/10/2020	ETFSL200	0.058	0.062	0.05	0.79	87.8	6.78	158
12/10/2020	ETFSL500	0.04	0.05	0.06	0.77	48	6.74	150
13/10/2020	ETWQ AU	0.267	-	<0.05	1.58	45.8	6.99	246
20/10/2020	ETWQ AU	0.342	-	0.2	2.41	107	6.73	232
22/10/2020	ETWQ AU	0.345	0.322	<0.05	0.322	126.4	6.45	241
22/10/2020	ETFSL200	0.096	0.094	0.08	1.08	106.9	6.72	132
22/10/2020	ETFSL500	0.047	0.053	0.08	0.86	110.5	6.54	114
26/10/2020	ETWQ AU	0.116	0.122	0.59	1.25	63.1	6.59	132
26/10/2020	ETFSL200	0.137	0.15	0.36	1.32	67.4	6.4	133
26/10/2020	ETFSL500	0.1	0.115	0.2	1.35	142.7	6.65	116
27/10/2020	ETWQ AU	0.11	-	0.75	1.38	33.5	6.55	144
2/11/2020	ETWQ AU	0.084	0.092	0.57	1.15	42.4	7.04	170
2/11/2020	ETFSL200	0.069	0.074	0.15	1.14	45.8	7.38	166
2/11/2020	ETFSL500	0.074	0.075	0.13	1.28	118	7.41	164
3/11/2020	ETWQ AU	0.107	-	0.59	1.52	114.1	6.09	174
11/11/2020	ETWQ AU	0.144	0.148	0.2	1.5	88.6	6.89	194
11/11/2020	ETFSL200	0.036	0.038	0.07	0.88	90.6	6.9	157
11/11/2020	ETFSL500	0.027	0.032	0.07	0.88	164	6.78	151
16/11/2020	ETWQ AU	0.127	0.13	0.47	1.57	27.3	6.25	180
16/11/2020	ETFSL200	0.026	0.031	0.05	0.7	87.4	6.1	135
16/11/2020	ETFSL500	0.022	0.03	0.05	0.74	79.2	6.15	135
17/11/2020	ETWQ AU	0.142	-	0.24	1.73	85.7	6.78	191
23/11/2020	ETWQ AU	0.281	0.284	<0.05	2.69	78.8	6.88	219
23/11/2020	ETFSL200	0.041	0.05	<0.05	1.02	58.8	7.13	145
23/11/2020	ETFSL500	0.027	0.034	<0.05	0.91	77.4	6.85	136
25/11/2020	ETWQ AU	0.298	-	<0.05	1.96	205.9	6.71	217
30/11/2020	ETWQ AU	0.28	0.314	<0.05	1.64	136.8	6.53	232
30/11/2020	ETFSL200	0.055	0.063	0.52	1.31	164.5	6.27	145
30/11/2020	ETFSL500	0.042	0.05	0.46	1.2	141.5	6.08	140
10/12/2020	ETWQ AU	0.282	0.376	<0.05	1.8	109.6	7.21	249
10/12/2020	ETFSL200	0.05	0.07	<0.05	1.17	98.8	7.36	162
10/12/2020	ETFSL500	0.053	0.064	<0.05	1.26	94.9	6.95	154
16/12/2020	ETWQ AU	0.331	0.358	<0.05	1.11	88.2	7.26	268
16/12/2020	ETFSL200	0.058	0.066	0.41	0.91	58.1	6.92	130
16/12/2020	ETFSL500	0.032	0.05	0.32	1.5	67.5	6.95	129
21/12/2020	ETWQ AU	0.407	0.418	<0.05	1.9	129.9	6.96	252
21/12/2020	ETFSL200	0.092	0.098	0.05	1.12	190.3	6.66	147
21/12/2020	ETFSL500	0.051	0.069	0.34	0.99	220.3	6.66	129
30/12/2020	ETWQ AU	0.357	0.365	<0.05	2.16	79.8	7.27	259
30/12/2020	ETFSL200	0.064	0.073	<0.05	1.04	132.7	6.54	178
30/12/2020	ETFSL500	0.043	0.066	<0.05	1.15	87.4	6.41	159

ATTACHMENT A (Continued)
Water Quality Data for Sites ETWQ AU, ETFSL 200, and ETFSL 500

Date	Site	Manganese (mg/L) (F)	Manganese (mg/L) (T)	Iron (mg/L) (F)	Iron (mg/L) (T)	ORP (mV)	pH Lab	EC Lab (µS/cm)
4/1/2021	ETWQ AU	0.411	0.411	<0.05	2.73	175.4	6.89	244
4/1/2021	ETFSL200	0.054	0.063	0.07	0.8	88	6.76	136
4/1/2021	ETFSL500	0.025	0.037	0.06	0.76	150.3	6.66	125
12/1/2021	ETWQ AU	0.354	0.361	<0.05	2.04	97.3	6.61	242
12/1/2021	ETFSL200	0.022	0.035	<0.05	0.70	86.1	6.83	252
12/1/2021	ETFSL500	0.028	0.031	<0.05	0.65	94.8	6.64	130
21/1/2021	ETWQ AU	0.367	0.378	<0.05	1.78	76.4	6.38	254
21/1/2021	ETFSL200	0.072	0.072	<0.05	1.14	92.1	6.89	179
21/1/2021	ETFSL500	0.052	0.063	<0.05	1.10	186.8	6.67	147
27/1/2021	ETWQ AU	0.462	0.465	<0.05	1.35	84.9	6.88	264
27/1/2021	ETFSL200	0.062	0.031	0.28	0.65	72.1	6.66	215
27/1/2021	ETFSL500	0.035	0.046	0.23	0.97	117.6	6.56	139
1/2/2021	ETWQ AU	0.312	0.33	<0.05	2.11	142.2	6.88	226
1/2/2021	ETFSL200	0.079	0.074	0.06	1.12	99.8	6.78	147
1/2/2021	ETFSL500	0.04	0.05	<0.05	0.94	12.7	6.55	136
11/2/2021	ETWQ AU	0.278	0.287	<0.05	1.95	159.9	6.56	223
11/2/2021	ETFSL200	0.062	0.055	0.06	0.92	99.7	6.64	156
11/2/2021	ETFSL500	0.029	0.035	<0.05	1.00	192.1	6.65	147
15/2/2021	ETWQ AU	0.214	0.267	0.21	2.12	75.4	6.69	218
15/2/2021	ETFSL200	0.071	0.088	<0.05	1.16	133.8	7.05	170
15/2/2021	ETFSL500	0.04	0.054	<0.05	0.99	242.2	6.9	156
25/2/2021	ETWQ AU	0.269	0.287	<0.05	2.01	110.7	6.88	225
25/2/2021	ETFSL200	0.06	0.07	<0.05	1.44	198	7.06	192
25/2/2021	ETFSL500	0.053	0.052	<0.05	1.04	202	6.97	185
1/3/2021	ETFSL200	0.045	0.051	0.11	1.02	-1.1	6.99	181
1/3/2021	ETFSL500	0.025	0.033	<0.05	0.88	39.8	6.96	172
4/3/2021	ETWQ AU	0.296	-	<0.05	1.98	137.7	6.79	234
8/3/2021	ETWQ AU	0.320	0.374	<0.05	2.26	86.9	6.69	238
8/3/2021	ETFSL200	0.033	0.046	<0.05	0.88	58.1	7.05	175
8/3/2021	ETFSL500	0.028	0.044	<0.05	0.83	77.3	6.95	167
10/3/2021	ETWQ AU	0.355	-	<0.05	1.99	103.9	6.47	239
15/3/2021	ETWQ AU	0.358	0.401	<0.05	2.48	116.5	6.55	248
15/3/2021	ETFSL200	0.157	0.175	0.35	1.36	52.1	7.04	206
15/3/2021	ETFSL500	0.056	0.072	<0.05	0.94	123.9	6.93	179
16/3/2021	ETWQ AU	0.373	-	<0.05	2.32	125.7	6.68	248
25/3/2021	ETWQ AU	0.048	0.052	0.39	0.80	33.1	6.18	109
25/3/2021	ETFSL200	0.014	0.028	<0.05	0.40	123.8	6.24	99
25/3/2021	ETFSL500	0.009	0.019	0.06	0.35	113.7	6.35	102
29/3/2021	ETWQ AU	0.087	-	0.56	1.34	72.1	7.05	143
30/3/2021	ETWQ AU	0.108	0.109	0.53	1.39	81.0	6.68	153
30/3/2021	ETFSL200	0.009	0.025	<0.05	0.35	94.7	6.36	107
30/3/2021	ETFSL500	0.009	0.025	<0.05	0.36	113.7	6.33	108

ATTACHMENT A (Continued)
Water Quality Data for Sites ETWQ AU, ETFSL 200, and ETFSL 500

Date	Site	Manganese (mg/L) (F)	Manganese (mg/L) (T)	Iron (mg/L) (F)	Iron (mg/L) (T)	ORP (mV)	pH Lab	EC Lab (µS/cm)
7/4/2021	ETWQ AU	0.19	-	0.12	-	99.7	7.01	186
8/4/2021	ETWQ AU	0.07	0.075	0.12	1.23	105.9	7.21	160
8/4/2021	ETFSL200	0.008	0.026	<0.05	0.35	126.3	6.91	107
8/4/2021	ETFSL500	0.018	0.038	0.07	0.44	112.5	6.75	107
12/4/2021	ETWQ AU	0.147	0.148	0.16	1.65	10.2	7.11	181
12/4/2021	ETFSL200	0.012	0.027	0.05	0.45	113.5	6.87	111
12/4/2021	ETFSL500	0.012	0.025	<0.05	0.41	96.4	6.66	109
15/4/2021	ETWQ AU	0.183	-	<0.05	-	107.1	6.56	190
21/4/2021	ETWQ AU	0.205	0.221	<0.05	1.63	93.0	6.66	202
21/4/2021	ETWQ AU	0.206	-	<0.05	-	126.5	6.89	199
21/4/2021	ETFSL200	0.006	0.038	0.08	0.66	157.6	6.86	110
21/4/2021	ETFSL500	0.007	0.022	0.08	0.39	145.3	6.74	108
26/4/2021	ETWQ AU	0.246	0.259	<0.05	2.14	146.0	6.78	218
26/4/2021	ETFSL200	0.008	0.027	0.08	0.54	92.7	6.99	112
26/4/2021	ETFSL500	0.004	0.027	0.05	0.50	104.9	6.69	110
11/5/2021	ETWQ AU	0.084	-	0.43	0.91	82.1	6.9	133
12/5/2021	ETWQ AU	0.088	0.082	0.5	1.02	153.7	6.46	135
12/5/2021	ETFSL200	0.011	0.022	0.06	0.38	179	6.66	94
12/5/2021	ETFSL500	0.010	0.021	0.06	0.38	152	6.57	94
18/5/2021	ETWQ AU	0.138	-	0.4	1.48	72.4	6.81	174
19/5/2021	ETFSL200	0.017	0.027	0.08	0.46	86.2	6.51	106
19/5/2021	ETFSL500	0.013	0.024	0.08	0.41	91.1	6.52	103
25/5/2021	ETWQ AU	0.149	0.169	0.37	1.61	44.4	6.57	210
25/5/2021	ETFSL200	0.013	0.023	0.13	0.39	179	6.82	118
25/5/2021	ETFSL500	0.010	0.022	0.05	0.37	129	6.63	118
31/5/2021	ETWQ AU	0.214	-	0.37	1.8	74.2	6.86	199
3/6/2021	ETWQ AU	0.208	0.222	0.15	1.69	120.9	6.89	201
3/6/2021	ETFSL200	0.015	0.026	0.07	0.4	119.9	7.01	102
3/6/2021	ETFSL500	0.011	0.025	0.06	0.38	54.5	6.75	103
9/6/2021	ETWQ AU	0.234	-	0.66	1.9	139	6.63	195
10/6/2021	ETWQ AU	0.178	0.219	<0.05	1.67	73.7	6.43	156
10/6/2021	ETFSL200	0.014	0.030	0.06	0.42	146.8	6.93	97
10/6/2021	ETFSL500	0.014	0.025	<0.05	0.41	148	6.68	95
15/6/2021	ETWQ AU	0.256	0.253	0.58	2.09	77.3	7.12	207
15/6/2021	ETFSL200	0.014	0.024	0.14	0.38	62.4	7.37	98
15/6/2021	ETFSL500	0.012	0.022	0.07	0.37	64.7	6.66	98
16/6/2021	ETWQ AU	0.229	-	0.43	1.65	84.5	6.59	201
21/6/2021	ETWQ AU	0.171	-	0.71	1.73	53.1	6.95	190
22/6/2021	ETWQ AU	0.177	0.179	1.06	1.76	48.4	6.91	189
22/6/2021	ETFSL200	0.059	0.057	0.09	0.7	70.6	6.95	120
22/6/2021	ETFSL500	0.015	0.027	0.07	0.5	126.6	6.78	103
29/6/2021	ETWQ AU	0.235	-	0.55	1.8	143.7	6.66	201
30/6/2021	ETWQ AU	0.149	0.159	0.15	1.4	104.8	6.7	180
30/6/2021	ETFSL200	0.027	0.034	0.06	0.52	139.9	6.64	104
30/6/2021	ETFSL500	0.022	0.036	0.14	0.55	78.6	6.39	99

ATTACHMENT A (Continued)
Water Quality Data for Sites ETWQ AU, ETFSL 200, and ETFSL 500

Date	Site	Manganese (mg/L) (F)	Manganese (mg/L) (T)	Iron (mg/L) (F)	Iron (mg/L) (T)	ORP (mV)	pH Lab	EC Lab (µS/cm)
5/07/2021	ETWQ AU	0.168	0.164	0.95	1.61	108.1	7.46	181
5/07/2021	ETFSL200	0.024	0.036	0.23	0.58	84.4	7.04	97
5/07/2021	ETFSL500	0.017	0.028	0.1	0.47	81.1	6.81	96
7/07/2021	ETWQ AU	0.179	-	0.62	1.37	72.4	7.47	188
13/07/2021	ETWQ AU	0.144	-	0.49	1.24	121.9	7.04	198
15/07/2021	ETWQ AU	0.175	0.161	0.6	1.25	76.7	6.99	205
15/07/2021	ETFSL200	0.019	0.028	0.08	0.46	183.7	6.8	113
15/07/2021	ETFSL500	0.013	0.021	0.07	0.37	150	6.62	108
19/07/2021	ETWQ AU	0.194	0.198	0.2	1.45	103.2	6.55	193
19/07/2021	ETFSL200	0.024	0.035	0.11	0.57	152.8	6.84	106
19/07/2021	ETFSL500	0.017	0.027	0.08	0.52	157.3	6.57	100
21/07/2021	ETWQ AU	0.218	-	-	-	126.8	6.61	200
28/07/2021	ETWQ AU	0.235	0.246	0.33	1.63	78.1	6.89	214
29/07/2021	ETFSL200	0.022	0.039	0.05	0.52	58.4	7.11	111
29/07/2021	ETFSL500	0.016	0.025	0.07	0.45	46.5	6.89	106
2/08/2021	ETWQ AU	0.237	0.231	0.35	1.06	158	6.86	212
2/08/2021	ETFSL200	0.021	0.028	0.14	0.44	101.7	6.58	103
2/08/2021	ETFSL500	0.01	0.02	0.08	0.4	123.7	6.78	96
4/08/2021	ETWQ AU	0.242	-	0.25	2.14	37.3	7.01	208
11/08/2021	ETWQ AU	0.262	-	<0.05	2.07	83.1	6.71	217
12/08/2021	ETWQ AU	0.276	0.285	<0.05	2.21	93.3	6.81	226
12/08/2021	ETFSL200	0.031	0.029	0.08	0.54	103.2	7.13	103
12/08/2021	ETFSL500	0.013	0.025	0.1	0.5	79.7	6.75	100
18/08/2021	ETWQ AU	0.285	0.275	<0.05	1.41	110.8	6.95	254
18/08/2021	ETFSL200	0.042	0.038	0.08	0.52	71.8	7.07	126
18/08/2021	ETFSL500	0.028	0.035	0.08	0.58	82.7	6.84	124
19/08/2021	ETWQ AU	0.298	0.3	<0.05	<0.05	41	7.01	250
26/08/2021	ETWQ AU	0.103	0.108	0.47	1.19	57	6.73	171
27/08/2021	ETWQ AU	0.19	0.181	1.03	1.76	76.5	6.88	195
27/08/2021	ETFSL200	0.039	0.064	0.08	0.96	168.6	6.71	126
27/08/2021	ETFSL500	0.041	0.059	0.1	0.7	161.5	6.52	121
30/08/2021	ETWQ AU	0.199	0.183	0.31	1.65	37.6	6.28	208
31/08/2021	ETWQ AU	0.197	0.208	0.12	2	114.2	7.01	208
31/08/2021	ETFSL200	0.036	0.046	0.06	0.73	292	6.83	130
31/08/2021	ETFSL500	0.043	0.036	0.07	0.67	221.2	6.69	124
6/09/2021	ETWQ AU	0.191	0.208	0.08	1.63	83.2	6.9	205
6/09/2021	ETFSL200	0.025	0.04	<0.05	0.62	199.4	6.87	120
6/09/2021	ETFSL500	0.013	0.032	0.07	0.59	277.3	6.65	115
8/09/2021	ETWQ AU	0.234	0.233	0.28	2.03	100.4	6.82	219
13/09/2021	ETWQ AU	0.217	-	0.13	1.37	65.5	7.56	214
16/09/2021	ETWQ AU	0.189	0.198	0.09	1.79	87.6	6.99	213
16/09/2021	ETFSL200	0.057	0.068	0.14	1.14	79.7	6.9	145
16/09/2021	ETFSL500	0.026	0.039	0.08	0.72	139.9	6.56	125
20/09/2021	ETWQ AU	0.216	0.225	<0.05	1.88	126.7	6.97	217
20/09/2021	ETFSL200	0.029	0.038	0.28	0.66	137.1	7.36	123
20/09/2021	ETFSL500	0.018	0.031	0.07	0.62	121.8	7.22	118
21/09/2021	ETWQ AU	0.218	0.221	<0.05	1.92	51.5	7.97	209
29/09/2021	ETWQ AU	0.235	0.272	<0.05	2.17	167.7	6.59	230
29/09/2021	ETFSL200	0.018	0.034	0.06	0.76	127.4	6.76	114
29/09/2021	ETFSL500	0.014	0.032	0.07	0.78	125.9	6.48	108
30/09/2021	ETWQ AU	0.26	0.28	<0.05	2.2	143.5	7.8	237

ATTACHMENT A (Continued)
Water Quality Data for Sites ETWQ AU, ETFSL 200, and ETFSL 500

Date	Site	Manganese (mg/L) (F)	Manganese (mg/L) (T)	Iron (mg/L) (F)	Iron (mg/L) (T)	ORP (mV)	pH Lab	EC Lab (µS/cm)
4/10/2021	ETWQ AU	0.157	0.186	0.84	1.74	64.1	7.19	195
5/10/2021	ETWQ AU	0.149	0.18	0.4	1.68	91	7.46	187
5/10/2021	ETFSL200	0.023	0.049	<0.05	0.81	141.5	7.12	112
5/10/2021	ETFSL500	0.014	0.043	<0.05	0.7	128.6	7.08	110
13/10/2021	ETWQ AU	0.204	0.214	<0.05	1.95	138.3	7.15	196
13/10/2021	ETFSL200	0.066	0.097	0.06	1.11	113.6	7.15	123
13/10/2021	ETFSL500	0.041	0.054	0.12	0.79	118	6.6	112
14/10/2021	ETWQ AU	0.1	0.102	0.35	1.04	92	7.73	173
20/10/2021	ETWQ AU	0.165	0.188	0.29	1.42	147.1	7.23	187
21/10/2021	ETWQ AU	0.165	0.158	0.37	1.32	96.3	7.03	184
21/10/2021	ETFSL200	0.053	0.064	0.07	0.89	159.3	7.21	128
21/10/2021	ETFSL500	0.035	0.05	0.08	0.85	188.4	7.07	122
26/10/2021	ETWQ AU	0.104	0.126	0.4	1.17	97.2	7.19	160
26/10/2021	ETFSL200	0.059	0.076	0.09	0.9	161.4	7.42	140
26/10/2021	ETFSL500	0.061	0.074	0.24	0.92	242.2	7.43	141
27/10/2021	ETWQ AU	0.138	0.139	0.59	1.34	93.6	7.6	169
1/11/2021	ETWQ AU	0.192	0.201	0.06	1.44	133.2	7.43	193
1/11/2021	ETFSL200	0.055	0.072	0.05	0.98	140	7.38	139
1/11/2021	ETFSL500	0.044	0.061	<0.05	0.95	139	7.42	136
3/11/2021	ETWQ AU	0.213	0.226	0.19	1.92	143.4	6.89	201
10/11/2021	ETWQ AU	0.095	0.099	0.43	1.01	209	7.21	154
10/11/2021	ETFSL200	0.081	0.094	0.13	1.06	214	7.22	136
10/11/2021	ETFSL500	0.06	0.067	0.17	0.94	442	7.31	134
15/11/2021	ETWQ AU	0.071	0.078	0.55	0.97	200	6.92	162
15/11/2021	ETFSL200	0.043	0.05	0.16	0.94	212	6.96	144
15/11/2021	ETFSL500	0.038	0.042	0.13	0.76	106	7.07	145
16/11/2021	ETWQ AU	0.082	-	0.4	1.02	108.1	6.97	147
23/11/2021	ETWQ AU	0.054	0.058	0.36	0.82	279	6.8	157
23/11/2021	ETFSL200	0.051	0.057	0.1	0.91	256	6.84	148
23/11/2021	ETFSL500	0.041	0.049	0.07	0.89	324	6.83	144
29/11/2021	ETWQ AU	0.053	0.059	0.32	0.76	212	6.88	146
29/11/2021	ETFSL200	0.048	0.053	0.39	0.70	216	6.45	141
29/11/2021	ETFSL500	0.037	0.044	0.38	0.71	213	6.82	132
9/12/2021	ETWQ AU	0.099	0.092	0.19	1.05	52.6	6.81	149
9/12/2021	ETFSL200	0.048	0.059	0.06	0.95	78.5	6.89	130
9/12/2021	ETFSL500	0.03	0.047	0.06	0.89	109	6.76	128
13/12/2021	ETWQ AU	0.067	0.07	0.32	0.86	91.5	6.34	140
16/12/2021	ETWQ AU	0.083	0.084	0.24	0.99	98.3	6.82	164
16/12/2021	ETFSL200	0.02	0.031	0.09	0.68	35.5	6.9	140
16/12/2021	ETFSL500	0.013	0.024	0.1	0.65	86.6	6.83	138
20/12/2021	ETWQ AU	0.117	-	0.19	1.28	96.5	6.19	195
21/01/2021	ETWQ AU	0.128	0.131	0.18	1.23	55	6.97	164
21/01/2021	ETFSL200	0.011	0.031	<0.05	0.68	47.3	7.02	121
21/01/2021	ETFSL500	0.005	0.022	<0.05	0.66	153.6	6.91	118
29/12/2021	ETWQ AU	0.046	0.052	0.21	0.78	97.8	6.63	97.8
29/12/2021	ETFSL200	0.051	0.053	0.24	0.85	92.5	6.76	112
29/12/2021	ETFSL500	0.045	0.039	0.21	0.42	122.4	6.45	103

ATTACHMENT A (Continued)
Water Quality Data for Sites ETWQ AU, ETFSL 200, and ETFSL 500

Date	Site	Manganese (mg/L) (F)	Manganese (mg/L) (T)	Iron (mg/L) (F)	Iron (mg/L) (T)	ORP (mV)	pH Lab	EC Lab (µS/cm)
6/01/2022	ETWQ AU	0.049	0.049	0.14	0.87	98.2	6.81	133
6/01/2022	ETFSL200	0.05	0.049	0.06	0.77	104.3	6.89	144
6/01/2022	ETFSL500	0.034	0.04	<0.05	0.71	153	6.75	126
10/01/2022	ETWQ AU	0.05	-	0.31	0.8	83	6.79	140
11/01/2022	ETWQ AU	0.061	0.067	0.33	0.93	80.7	6.84	120
11/01/2022	ETFSL200	0.026	0.034	0.1	0.69	102.3	6.65	102
11/01/2022	ETFSL500	0.019	0.035	0.08	0.71	87	6.67	102
17/01/2022	ETWQ AU	0.056	0.062	0.32	0.98	95.1	6.73	117
17/01/2022	ETFSL200	0.036	0.038	0.16	0.63	126.6	6.72	102
17/01/2022	ETFSL500	0.03	0.033	0.14	0.62	116.9	6.68	101
24/01/2022	ETWQ AU	0.062	0.083	0.14	1.22	69.9	6.82	134
24/01/2022	ETFSL200	0.035	0.037	0.08	0.69	121.4	6.77	108
24/01/2022	ETFSL500	0.018	0.033	0.09	0.76	264	6.82	109
31/01/2022	ETWQ AU	0.15	-	0.12	1.53	97.5	7.29	166
3/02/2022	ETWQ AU	0.174	0.169	0.06	1.51	87.2	6.89	152
3/02/2022	ETFSL200	0.091	0.095	<0.05	1.08	269	6.98	124
3/02/2022	ETFSL500	0.082	0.084	0.07	0.90	264	6.88	115
8/02/2022	ETWQ AU	0.080	0.087	0.12	1.30	114.3	6.89	144
8/02/2022	ETFSL200	0.040	0.052	0.08	0.90	84	6.99	118
8/02/2022	ETFSL500	0.040	0.055	0.06	0.94	247	6.97	119
15/02/2022	ETWQ AU	0.087	0.087	0.13	1.11	56.3	6.5	154
15/02/2022	ETFSL200	0.013	0.031	<0.05	0.70	140.9	6.45	123
15/02/2022	ETFSL500	0.025	0.034	<0.05	0.73	148.8	6.43	123
21/02/2022	ETWQ AU	0.062	-	0.26	0.76	111	6.83	137
10/03/2022[1]	ETWQ AU	0.061	-	0.45	1.31	140.7	6.62	66
11/03/2022	ETWQ AU	0.055	0.057	0.5	1.46	85.2	7.05	79
11/03/2022	ETFSL200	0.028	0.026	0.32	1.06	54.4	6.64	40
11/03/2022	ETFSL500	-	-	-	-	-	-	-
14/03/2022	ETWQ AU	0.066	0.072	0.27	1.43	58.9	8.11	101
14/03/2022	ETFSL200	0.022	0.028	0.13	0.68	96.4	6.22	55
14/03/2022	ETFSL500	-	-	-	-	-	-	-
21/03/2022	ETWQ AU	0.046	0.060	0.40	1.35	63.7	7.05	80
21/03/2022	ETFSL200	0.035	0.046	0.11	0.72	59.5	6.62	79
21/03/2022	ETFSL500	-	-	-	-	-	-	-
28/03/2022	ETWQ AU	0.029	0.034	0.40	1.10	151.9	5.79	55
28/03/2022	ETFSL200	0.028	0.043	0.15	1.87	100.8	6.72	80
4/04/2022[1]	ETWQ AU	0.066	0.081	0.61	1.56	54.4	6.89	93
4/04/2022	ETFSL200	0.033	0.042	0.12	0.70	66.4	6.56	75
11/04/2022	ETWQ AU	0.045	0.054	0.43	1.19	86	6.89	64
11/04/2022	ETFSL200	0.032	0.04	0.16	0.73	75	6.66	62
14/04/2022	ETWQ AU	0.071	-	0.30	1.49	90.3	7.12	95
19/04/2022	ETWQ AU	0.105	0.102	0.24	0.24	97.6	7.06	115
19/04/2022	ETFSL200	0.031	0.045	0.18	0.72	74.4	6.88	72
29/04/2022	ETWQ AU	0.042	0.043	0.30	1.05	116.5	6.67	73
29/04/2022	ETFSL200	0.040	0.042	0.20	0.77	47.7	6.54	72
2/05/2022[1]	ETWQ AU	0.086	0.087	0.66	1.54	93.6	6.95	98
2/05/2022	ETFSL200	0.45	0.46	0.51	0.88	172.5	6.58	74
9/05/2022	ETWQ AU	0.11	0.119	0.28	1.9	54	6.86	124
9/05/2022	ETFSL200	0.37	0.45	0.16	0.85	62.4	6.76	73
17/05/2022	ETWQ AU	0.086	0.094	0.36	1.61	246.1	6.99	108
17/05/2022	ETFSL200	0.34	0.42	0.14	0.76	327.7	6.62	74
24/05/2022	ETWQ AU	0.037	0.039	0.43	0.99	218.4	5.91	162
24/05/2022	ETFSL200	0.47	0.47	0.24	0.84	218.7	5.78	68

ATTACHMENT A (Continued)
Water Quality Data for Sites ETWQ AU, ETFSL 200, and ETFSL 500

Date	Site	Manganese (mg/L) (F)	Manganese (mg/L) (T)	Iron (mg/L) (F)	Iron (mg/L) (T)	ORP (mV)	pH Lab	EC Lab (µS/cm)
30/05/2022	ETWQ AU	0.096	0.104	0.47	1.71	83.8	6.89	102
30/05/2022	ETFSL200	0.33	0.036	0.22	0.22	85.4	6.42	70
6/06/2022[1]	ETWQ AU	0.119	0.122	0.4	1.7	135	7.06	144
6/06/2022	ETFSL200	0.032	0.041	0.17	0.67	230.4	6.54	68
14/06/2022	ETWQ AU	0.101	0.123	0.07	1.61	163.3	7.28	134
16/06/2022	ETWQ AU	0.142	0.155	0.38	1.95	134.5	7.06	146
16/06/2022	ETFSL200	0.027	0.04	0.11	0.73	127	6.41	67
20/06/2022	ETWQ AU	0.086	0.103	0.08	1.42	150	6.77	131
23/06/2022	ETWQ AU	0.118	0.126	<0.05	1.82	101.4	6.23	142
23/06/2022	ETFSL200	0.028	0.043	0.1	0.8	198.3	5.98	67
27/06/2022	ETWQ AU	0.136	-	0.42	1.57	83.5	6.82	163
28/06/2022	ETWQ AU	0.146	0.157	0.35	1.44	101.4	6.79	150
28/06/2022	ETFSL200	0.034	0.048	0.17	0.88	182.2	6.9	71
12/07/2022	ETWQ AU	0.054	0.051	0.3	0.66	106.6	6.99	75
12/07/2022	ETFSL200	0.049	0.046	0.45	0.89	167.7	6.2	63
13/07/2022	ETWQ AU	0.057	-	0.3	0.7	119.7	6.81	82
18/07/2022	ETWQ AU	0.083	0.09	0.36	1.22	93.7	6.69	106
22/07/2022	ETWQ AU	0.042	0.04	0.26	0.6	104.3	6.57	83
22/07/2022	ETFSL200	0.026	0.027	0.12	0.56	125.5	6.46	57
25/07/2022	ETWQ AU	0.059	0.063	0.33	0.81	64.5	6.55	83
25/07/2022	ETFSL200	0.028	0.027	0.17	0.58	119.1	6.59	55
2/08/2022	ETWQ AU	0.09	0.105	0.34	1.42	63.7	6.97	125
2/08/2022	ETFSL200	0.024	0.031	0.13	0.7	113.7	6.25	58
10/08/2022	ETWQ AU	0.116	0.113	0.18	1.32	41.1	6.93	128
10/08/2022	ETFSL200	0.029	0.039	0.11	0.74	138.5	6.52	57
15/08/2022	ETWQ AU	0.107	0.118	0.1	1.39	80	7.06	144
16/08/2022	ETWQ AU	0.097	0.116	0.06	1.35	75.6	7.01	139
16/08/2022	ETFSL200	0.028	0.037	0.11	0.62	87.5	6.39	57
22/08/2022	ETWQ AU	0.131	0.13	0.19	1.4	63.5	6.93	152
23/08/2022	ETWQ AU	0.133	0.133	<0.05	1.42	95.3	6.9	153
23/08/2022	ETFSL200	0.027	0.036	0.1	0.66	128.6	6.66	62
29/08/2022	ETWQ AU	0.15	0.165	0.41	1.68	34.6	7.1	162
30/08/2022	ETWQ AU	0.149	0.165	0.32	1.54	78.2	7.02	164
30/08/2022	ETFSL200	0.02	0.029	0.1	0.68	167.5	6.56	58
8/09/2022	ETWQ AU	0.143	0.146	0.51	1.82	19.5	6.79	155
8/09/2022	ETFSL200	0.027	0.032	0.1	0.64	119.2	6.57	63
14/09/2022	ETWQ AU	0.154	-	0.21	1.45	48.9	7.12	168
19/09/2022	ETWQ AU	0.143	0.164	0.07	1.8	39.9	7.05	155
20/09/2022	ETWQ AU	0.154	0.163	0.24	1.74	56.1	7.07	149
20/09/2022	ETFSL200	0.028	0.037	0.06	0.59	85.9	6.5	60
26/09/2022	ETWQ AU	0.131	0.139	0.34	1.64	46	6.89	155
26/09/2022	ETFSL200	0.022	0.03	0.07	0.59	58.7	6.46	65
28/09/2022	ETWQ AU	0.071	0.081	0.15	1.28	76	6.84	129
10/10/2022	ETWQ AU	0.029	0.042	0.32	0.87	87.9	6.15	66
10/10/2022	ETFSL200	0.016	0.024	0.29	0.84	77.7	5.63	42
11/10/2022	ETWQ AU	0.05	-	0.27	0.91	76	6.33	80
17/10/2022	ETWQ AU	0.087	0.112	0.2	1.72	40.9	6.04	117
17/10/2022	ETFSL200	0.056	0.072	0.2	1.37	120.3	5.85	71
25/10/2022	ETWQ AU	0.037	0.042	0.33	1.26	55.7	6.84	67
25/10/2022	ETFSL200	0.041	0.049	0.15	1.09	54.9	5.88	64
26/10/2022	ETWQ AU	0.047	-	0.35	1.16	40.9	6.57	73
31/10/2022	ETWQ AU	0.135	0.118	0.53	1.95	90.1	7.03	115
31/10/2022	ETFSL200	0.023	0.028	0.1	0.76	45.6	6.46	64

ATTACHMENT A (Continued)
Water Quality Data for Sites ETWQ AU, ETFSL 200, and ETFSL 500

Date	Site	Manganese (mg/L) (F)	Manganese (mg/L) (T)	Iron (mg/L) (F)	Iron (mg/L) (T)	ORP (mV)	pH Lab	EC Lab (µS/cm)
7/11/2022	ETWQ AU	0.145	0.136	0.14	1.01	54	6.95	139
8/11/2022	ETWQ AU	0.149	0.16	0.1	2.2	79.2	7.05	145
8/11/2022	ETFSL200	0.027	0.035	0.07	0.97	63.5	6.5	68
14/11/2022	ETWQ AU	0.064	0.073	0.16	1.35	82.6	7.09	102
14/11/2022	ETFSL200	0.033	0.035	0.08	0.76	127.9	6.7	71
16/11/2022	ETWQ AU	0.112	-	0.21	1.8	65.8	6.79	113
21/11/2022	ETWQ AU	0.148	-	0.33	1.93	29.9	7.2	142
24/11/2022	ETWQ AU	0.135	0.181	<0.05	2.18	149.5	6.85	148
24/11/2022	ETFSL200	0.031	0.041	0.05	1.01	104.4	6.52	68
28/11/2022	ETWQ AU	0.214	0.246	0.08	2.3	80	7.18	156
28/11/2022	ETFSL200	0.038	0.049	0.06	1.19	133.9	6.74	76
30/11/2022	ETWQ AU	0.117	0.188	0.06	2.02	78.5	7.13	159
6/12/2022	ETWQ AU	0.185	0.207	<0.05	2.06	105.5	7.1	165
6/12/2022	ETFSL200	0.034	0.041	<0.05	0.9	36.8	6.8	75
7/12/2022	ETWQ AU	0.199	-	<0.05	2.19	87.5	7.11	159
12/12/2022	ETWQ AU	0.235	-	<0.05	1.92	63	7.17	168
14/12/2022	ETWQ AU	0.249	0.286	<0.05	2.39	66.1	7.21	173
14/12/2022	ETFSL200	0.028	0.037	0.06	1.05	78.2	6.56	65
19/12/2022	ETWQ AU	0.258	0.273	<0.05	2.39	71.6	6.89	173
19/12/2022	ETFSL200	0.037	0.036	0.08	0.55	100.2	6.33	60
28/12/2022	ETWQ AU	0.396	0.458	<0.05	2.82	94.4	6.67	203
28/12/2022	ETFSL200	0.027	0.031	0.06	0.57	63.2	5.95	74
29/12/2022	ETWQ AU	0.471	-	0.09	2.87	74.1	6.99	206
3/01/2023	ETWQ AU	0.24	0.313	<0.05	1.89	83.5	7.16	153
3/01/2023	ETFSL200	0.017	0.02	<0.05	0.31	105	6.51	56
12/01/2023	ETWQ AU	0.158	0.149	0.17	1.61	57.5	6.75	144
12/01/2023	ETFSL200	0.029	0.026	<0.05	0.41	94.2	6.04	64
16/01/2023	ETWQ AU	0.172	0.171	<0.05	1.57	56.5	7.11	155
16/01/2023	ETFSL200	0.022	0.026	0.07	0.53	62	6.44	62
18/01/2023	ETWQ AU	0.21	0.221	<0.05	2.06	108.3	6.88	158
23/01/2023	ETWQ AU	0.079	0.087	0.07	1.3	4.8	5.89	142
23/01/2023	ETFSL200	0.026	0.034	0.05	0.8	75.3	5.88	65
30/01/2023	ETWQ AU	0.166	-	<0.05	1.33	58.5	5.95	160
31/01/2023	ETWQ AU	0.108	0.119	0.11	1.57	61.7	5.97	146
31/01/2023	ETFSL200	0.038	0.048	0.06	1.03	60	5.76	72
14/02/2023	ETWQ AU	0.088	-	0.14	1.33	323.8	6.88	116
15/02/2023	ETWQ AU	0.082	0.094	0.08	1.27	221.3	6.49	122
15/02/2023	ETFSL200	0.037	0.060	<0.05	1.04	358.3	5.55	63
21/02/2023	ETWQ AU	0.13	-	0.52	1.64	94.2	6.75	132
23/02/2023	ETWQ AU	0.061	0.074	0.31	0.93	164.7	6.85	91
23/02/2023	ETFSL200	0.074	0.088	0.9	1.23	194.3	6.5	64
27/02/2023	ETWQ AU	0.114	-	0.12	1.44	91.6	7.11	120
27/02/2023	ETFSL200	0.023	0.047	0.05	0.76	181.7	6.36	67

ATTACHMENT A (Continued)
Water Quality Data for Sites ETWQ AU, ETFSL 200, and ETFSL 500

Date	Site	Manganese (mg/L) (F)	Manganese (mg/L) (T)	Iron (mg/L) (F)	Iron (mg/L) (T)	ORP (mV)	pH Lab	EC Lab (µS/cm)
7/03/2023	ETWQ AU	0.134	0.136	0.18	1.76	124.9	7.02	141
7/03/2023	ETFSL200	0.011	0.028	0.06	0.68	257.7	6.41	64
8/03/2023	ETWQ AU	0.187	-	0.15	2.16	116.1	6.63	148
13/03/2023	ETWQ AU	0.065	0.056	0.18	0.89	89.2	7.04	93
13/03/2023	ETFSL200	0.013	0.055	0.08	0.93	182.5	6.39	69
16/03/2023	ETWQ AU	0.068	-	0.29	1.1	52.1	6.44	117
21/03/2023	ETWQ AU	0.084	0.097	0.08	1.28	113.3	6.36	130
21/03/2023	ETFSL200	0.015	0.052	<0.05	0.92	133.2	5.94	71
23/03/2023	ETWQ AU	0.085	-	0.17	1.11	56.8	6.7	124
27/03/2023	ETWQ AU	0.087	0.088	0.35	1.29	43.5	6.2	133
27/03/2023	ETFSL200	0.011	0.012	0.35	0.39	77	5.61	61
30/03/2023	ETWQ AU	0.083	0.09	0.21	1.31	65.7	5.94	116
3/04/2023	ETWQ AU	0.053	0.06	0.28	0.77	62.2	5.8	101
3/04/2023	ETFSL200	0.023	0.041	0.74	1.58	113.6	5.54	69
6/04/2023	ETWQ AU	0.088	-	0.25	1.12	82.1	6.86	119
11/04/2023	ETWQ AU	0.092	0.102	0.3	1.44	64.9	6.2	118
12/04/2023	ETWQ AU	0.094	0.096	0.59	1.44	69.5	6.75	120
12/04/2023	ETFSL200	0.022	0.026	0.37	0.59	178.7	6.37	62
18/04/2023	ETWQ AU	0.092	0.097	0.28	1.38	50.3	6.65	127
18/04/2023	ETFSL200	0.016	0.03	0.06	0.62	145	6.16	63
21/04/2023	ETWQ AU	0.054	-	0.22	0.84	118.6	7.2	101
24/04/2023	ETWQ AU	0.073	0.072	0.18	1.12	134.9	6.86	122
24/04/2023	ETFSL200	0.018	0.042	0.12	0.82	179.9	6.11	62
26/04/2023	ETWQ AU	0.086	-	0.21	1.38	151	6.56	126
2/05/2023	ETWQ AU	0.063	0.075	0.24	1.17	115.2	6.83	115
2/05/2023	ETFSL200	0.014	0.03	0.08	0.65	196.4	6.3	63
3/05/2023	ETWQ AU	0.087	-	0.26	1.19	104.2	6.72	125
8/05/2023	ETWQ AU	0.067	0.077	0.08	1.39	98.7	6.74	129
8/05/2023	ETFSL200	0.012	0.036	<0.05	0.93	161.4	6.3	64
16/05/2023	ETWQ AU	0.086	0.097	0.17	1.08	75	6.83	139
16/05/2023	ETFSL200	0.01	0.025	0.08	0.64	125.7	6.25	63
18/05/2023	ETWQ AU	0.094	0.094	0.4	1.02	20	6.32	141
22/05/2023	ETWQ AU	0.114	-	0.32	1.26	83.7	6.58	155
23/05/2023	ETWQ AU	0.124	0.118	0.16	1.24	183.5	6.86	148
23/05/2023	ETFSL200	0.008	0.031	<0.05	0.72	162.4	6.35	64
29/05/2023	ETWQ AU	0.14	0.162	0.42	1.58	107.7	6.35	154
29/05/2023	ETFSL200	0.008	0.026	0.06	0.72	219.5	5.93	62
7/06/2023	ETWQ AU	0.161	0.168	0.29	1.77	67.4	6.42	156
7/06/2023	ETFSL200	0.017	0.023	0.05	0.57	148.3	6.18	61
13/06/2023	ETWQ AU	0.209	0.214	0.86	1.99	80.2	6.51	169
13/06/2023	ETFSL200	0.009	0.023	0.12	0.54	186.6	6.09	65
15/06/2023	ETWQ AU	0.186	-	0.74	2.14	86.2	6.57	176
20/06/2023	ETWQ AU	0.22	0.238	0.8	2.05	41	6.45	185
21/06/2023	ETWQ AU	0.195	0.236	0.43	2.03	61.1	6.94	176
21/06/2023	ETFSL200	0.018	0.028	0.24	0.64	111.1	6.14	69
26/06/2023	ETWQ AU	0.236	0.22	0.29	1.82	71.6	6.53	178
26/06/2023	ETFSL200	0.011	0.027	0.11	0.69	190	6.02	68
29/06/2023	ETWQ AU	0.274	0.246	0.78	2.27	50.6	6.39	183

1 For the period of March, April, May, June, July, August, September, October, November, December 2022, January, February, March, April, May and June 2023, site ETFSL 500 was not sampled.