

30 May 2019

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 – January 2019

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 301-303 Water Management Plan (LW301-303 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 LW301-303 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 LW301-303 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 LW301-303 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 LW301-303 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.

Analysis conducted by Hydro Engineering & Consulting (2019) in accordance with the LW301-303 WMP, identified that the performance indicator for water resources reaching the Woronora Reservoir was exceeded for dissolved (i.e. filtered <0.45 µm fraction) manganese on the Eastern Tributary at site ETWQ AU in January 2019 (as there was not a similar exceedance of the trigger recorded at control site WOWQ 2 on the Woronora River). The performance indicator was not exceeded for field filtered iron or aluminium in January 2019 and therefore these parameters are not discussed in this report.

In accordance with the LW301-303 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*.

This assessment against the water quality subsidence impact performance measure has been prepared for January 2019 in consideration of:

- pluviograph data;
- flow data from the Eastern Tributary gauging location (GS 300078);
- groundwater level and groundwater quality results for Eastern Tributary sites up to 31 January 2019¹;
- surface water quality data at site ETWQ AU/ETAU² and sites further upstream on the Eastern Tributary up to 31 January 2019;
- surface water quality data at sites downstream of ETWQ AU/ETAU² up to 31 January 2019; 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 (Table 1).

Recently, above average rainfall was recorded in October, November and December 2018, and below average rainfall was recorded in January 2019. Total rainfall in January 2019 was 58.5 mm, less than half of the average (131.8 mm), with 35.0 mm of rainfall recorded over 6 to 12 January, 20.5 mm recorded over 28 and 29 January and smaller rainfall events recorded on 1, 20, 21 and 22 January (0.5 or 1 mm). Shallow groundwater levels correlate with the rainfall trend.

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

² Site ETAU is the same as site ETWQ AU (i.e. samples are taken at the same location). The difference between the sites relates to the time of sampling. Site ETWQ AU monitoring is conducted on the same day as sites upstream of ETWQ AU/ETAU (shown on Charts 1 to 2), while site ETAU monitoring is conducted on the same day as the sites downstream of ETWQ AU/ETAU (described in Section 3 and shown on Charts 3 to 4). From 29 January 2019, water quality sampling of all sites on the Eastern Tributary was undertaken in a single day. Future reporting will identify the data at this site as site ETWQ AU.

Table 1 Monthly Rainfall Data (mm) for PV7, January 2018 to January 2019

Month/Year	Rainfall at PV7 (mm)	Rainfall at Darkes Forest (mm) [#]	Mean Monthly Rainfall at Darkes Forest (1894-2019) (mm) [#]
January 2018	48.0	12.0	132.4
February 2018	115.5	16.6	159.6
March 2018	151.0	45.0	153.9
April 2018	32.0	21.6	126.8
May 2018	12.5	8.0	129.1
June 2018	112.0	91.8	146.6
July 2018	3.5	0.4	96.4
August 2018	12.5	15.8	89.1
September 2018	52.0	41.8	76.6
October 2018	197.0	200.8	91.9
November 2018	114.5	127.8	105.4
December 2018	120.0	91.0	103.8
January 2019	58.5	55.4	131.8

[#] 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 January 2019.

2. EASTERN TRIBUTARY SURFACE WATER AND GROUNDWATER QUALITY DATA

Plots of dissolved manganese at surface water quality sites ETWQ AU, ETWQ AQ (upstream on the Eastern Tributary) and WOWQ 2 (control site) and at groundwater quality site ETGW2, are compared to rainfall at PV7 (Chart 1) and streamflow at GS 300078 (Chart 2) (Figure 1).

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.

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. <0.1 mg/L, exist in the natural creek water. Dissolved manganese is easily diluted by freshwater flow to low levels when higher creek flows occur.

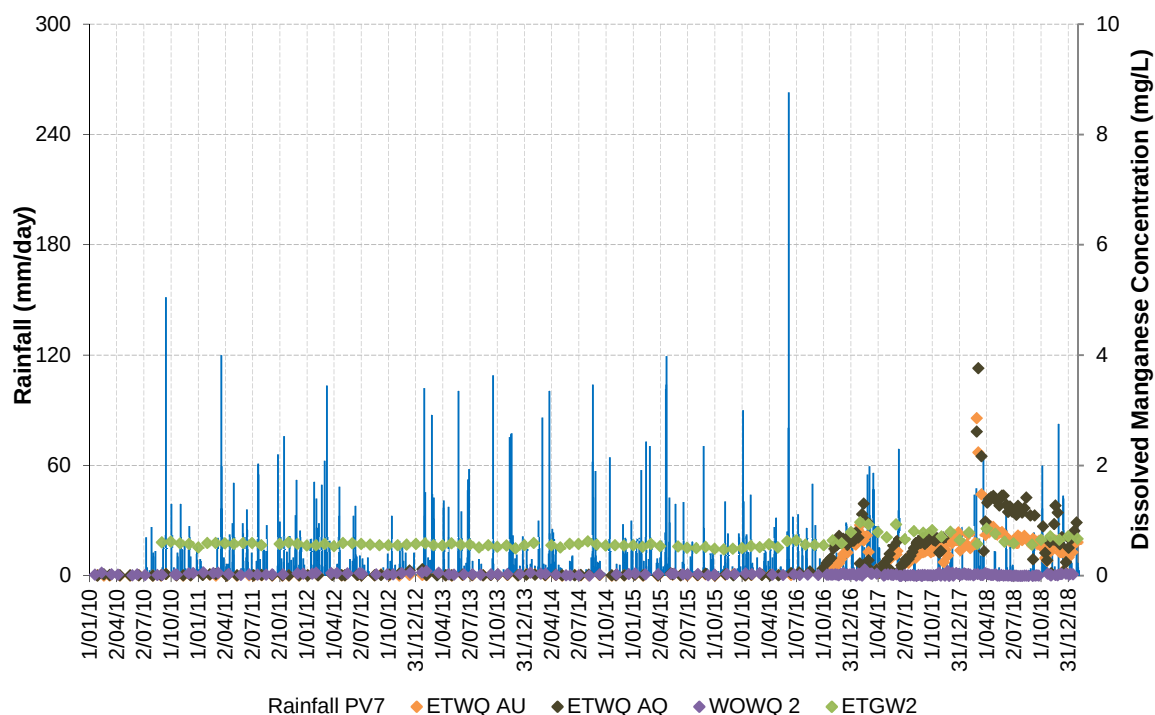


Chart 1 Dissolved Manganese Concentrations at Surface Water Quality Sites ETWQ AU, ETWQ AQ and WOWQ 2 and Groundwater Quality Site ETGW2 and Rainfall (to 31 January 2019)

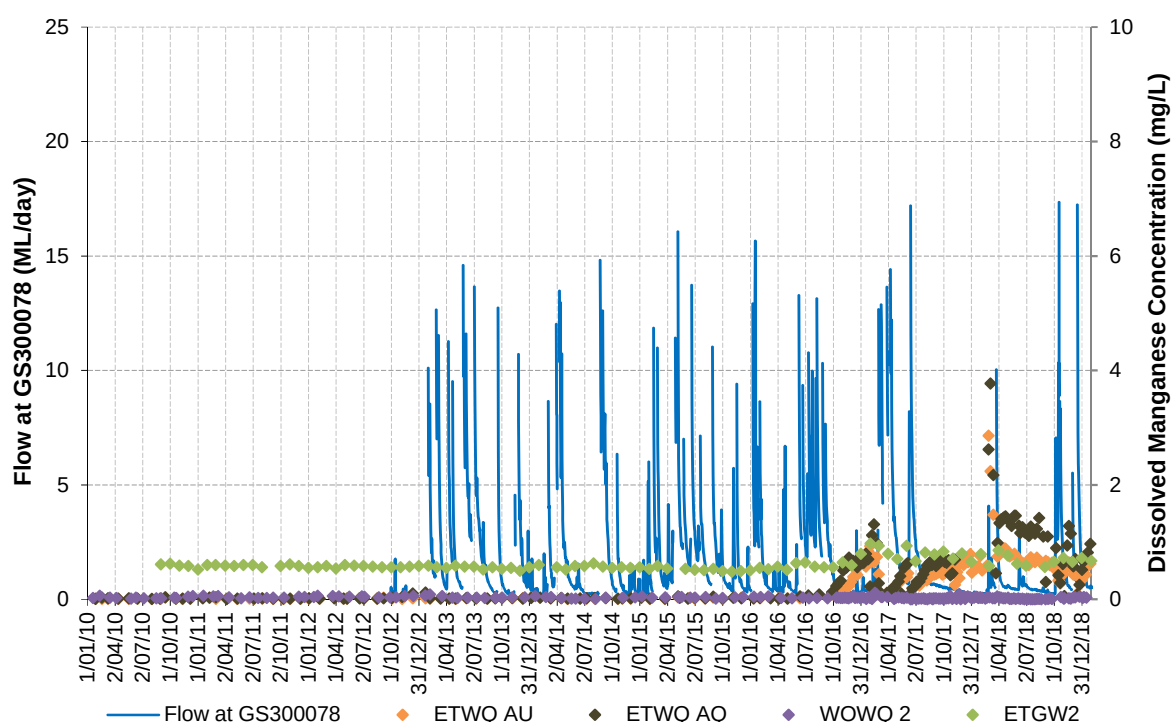
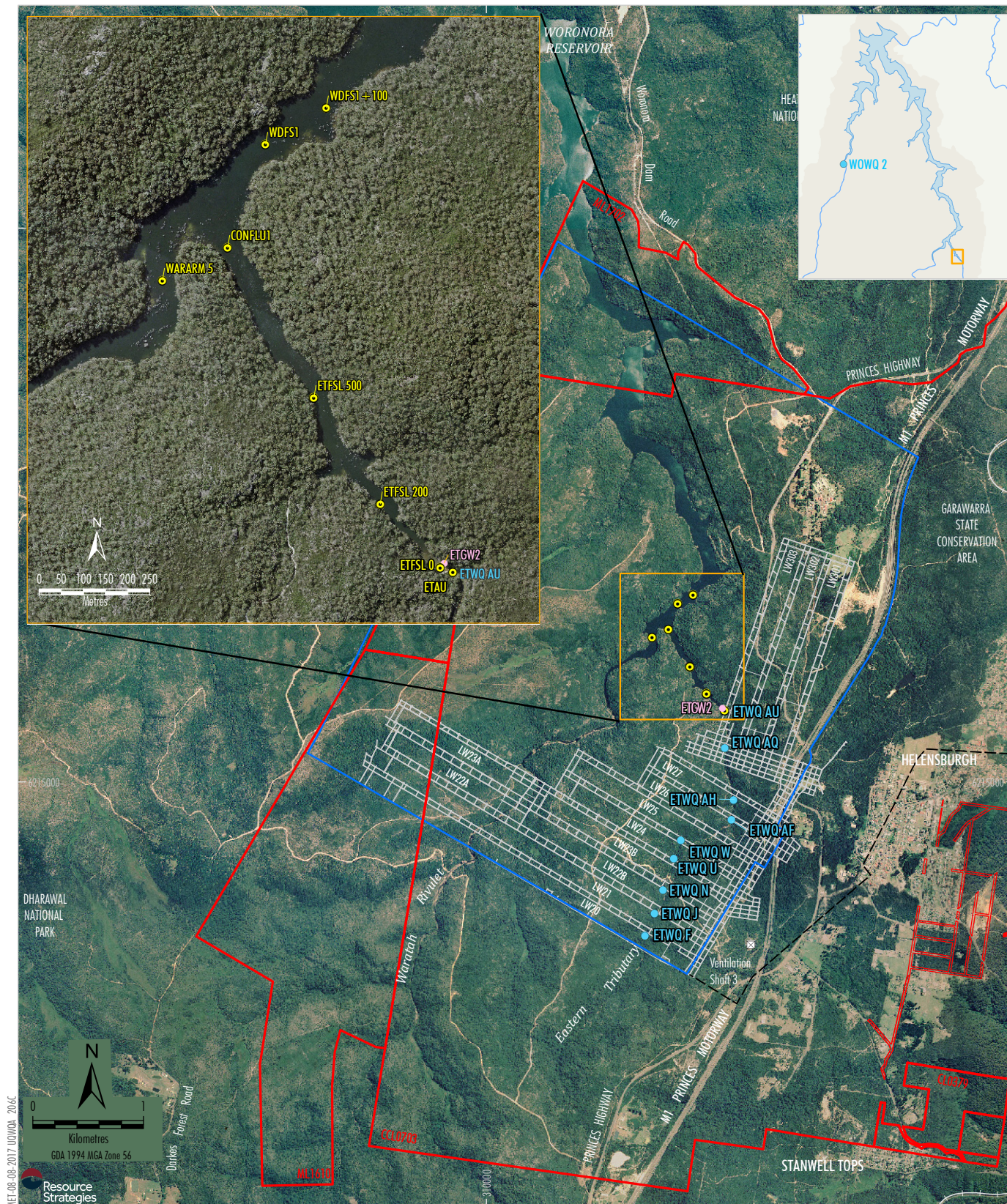


Chart 2 Dissolved Manganese Concentrations at Surface Water Quality Sites ETWQ AU, ETWQ AQ and WOWQ 2 and Groundwater Quality Site ETGW2 and Stream Flow (to 31 January 2019)



In January 2019, dissolved manganese concentrations at site ETWQ AU ranged between 0.335 mg/L and 0.620 mg/L. 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 Eastern Tributary can be diluted by creek flow. If high rainfall continues then it is likely that dissolved manganese concentrations will continue to fall to low levels. Increasing manganese levels in January 2019 are considered to be a result of below average rainfall.

Water quality parameters pertinent to the increase in manganese (dissolved-filtered <0.45 µm fraction) concentration are pH, oxidation-reduction potential (ORP) and electrical conductivity (EC). 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 oxidizing and becomes reducing when ORP is below approximately 10 mV. In January 2019 at site ETWQ AU:

- pH (lab measurement) was generally consistent (pH 6.7 to pH 7.35);
- EC concentrations (lab measurement) ranged between 268 µS/cm and 300 µS/cm; and
- ORP (field measurement) ranged between 66.8 mV and 244.1 mV.

3. WATER RESOURCES REACHING THE WORONORA RESERVOIR

In accordance with the LW301-303 WMP, site ETWQ AU on the Eastern Tributary and control site WOWQ 2 on the Woronora River are used to assess the LW301-303 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. 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.

Metropolitan Coal has taken a photographic record of the watercourse / waterbody at the time of sampling, estimated the width of the watercourse / water body 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 (HCPL, 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 and bathymetry data provided to Metropolitan Coal from WaterNSW, in January 2019 the Woronora Reservoir water level varied between 157.38 mAHD (on 3 January 2019) and 156.83 mAHD (on 31 January 2019) (water level declined steadily throughout January). The position of the reservoir water level can only be determined to the closest one metre contour, accordingly, the reservoir water level during January 2019 was approximately 1,400 m (corresponding to 157 mAHD) downstream of site ETSFL 0.

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 January 2019, the Woronora Reservoir water level was likely in the vicinity of sites WDFS1 and WDFS1+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

Water quality data for filtered and total manganese for January 2018 to January 2019 at sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400 and ETFSL 500 is provided in Attachment A. As described earlier, sampling at sites ETFSL 100, ETSFL 300 and ETFSL 400 was suspended once monitoring at sites CONFLU1, WARARM5, WDFS1 and WDFS1+100 commenced on 22 November 2018³. Water quality data for filtered and total manganese since sampling commenced on 22 November 2018 at sites CONFLU1, WARARM5, WDFS1 and WDFS1+100 is also provided in Attachment A.

As described above, the Woronora Reservoir water level dropped steadily in January 2019, but remained in the vicinity of sites WDFS1 and WDFS1+100. The results for dissolved and total manganese at sites ETAU, ETFSL 200, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100 since the commencement of monitoring to the end of January 2019, are shown on Charts 3 and 4, respectively. These sites provide a profile along the arm of the Woronora Reservoir.

³ Sampling at site ETAU was also temporarily suspended during this period but was resumed on 12 December 2018. Data from sampling undertaken at site ETWQ AU has been substituted for site ETAU during this period. Sampling at site ETAU was undertaken on 12 and 27 December 2018.

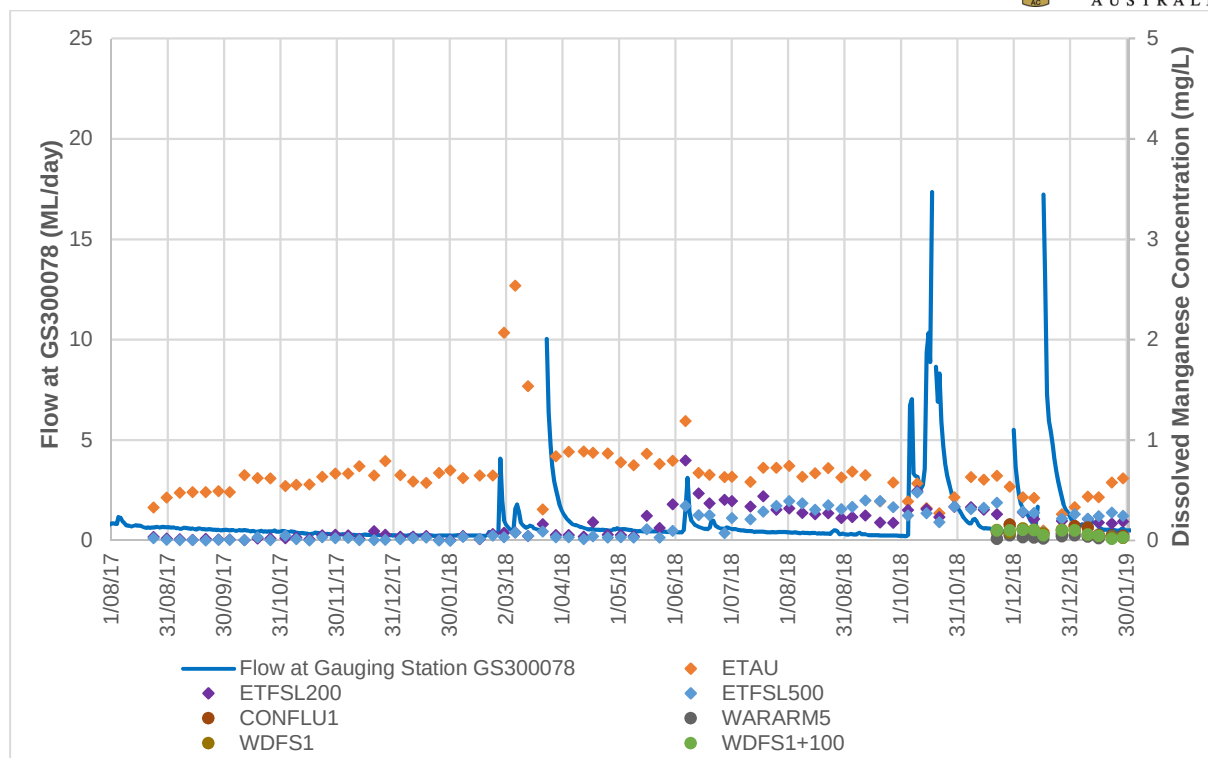


Chart 3 Dissolved Manganese Concentrations at Surface Water Quality Sites ETAU⁴, ETFSL 200, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100 and Stream Flow (August 2017 to 31 January 2019)

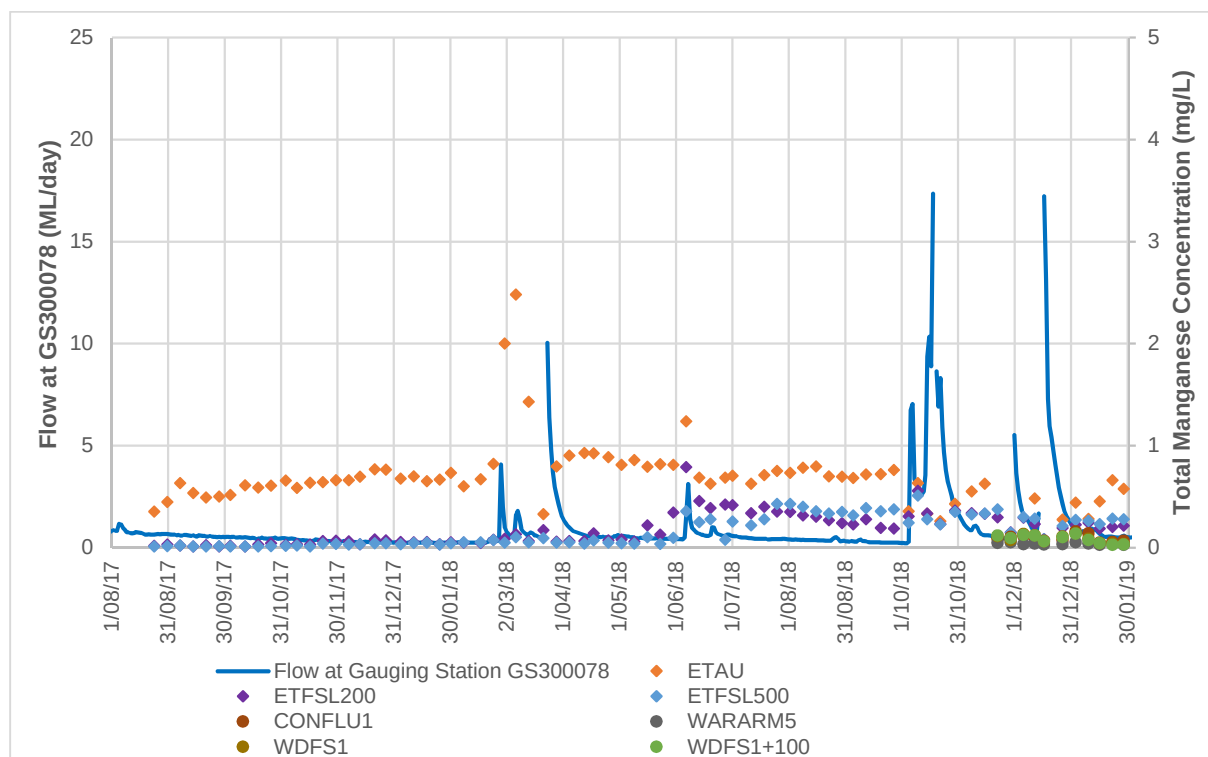


Chart 4 Total Manganese Concentrations at Surface Water Quality Sites ETAU⁵, ETFSL 200, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100 and Stream Flow (August 2017 to 31 January 2019)

⁴ Data from sampling undertaken at site ETWQ AU has been substituted for site ETAU from 22 November to 6 December 2018 and 17 December 2018. Sampling at site ETAU was undertaken on 12 and 27 December 2018.

The filtered manganese concentrations for January 2019 ranged from 0.335 mg/L to 0.620 mg/L at site ETAU, 0.159 mg/L to 0.216 mg/L at site ETFSL 200, 0.220 mg/L to 0.280 mg/L at site ETFSL 500, 0.048 mg/L to 0.143 mg/L at site CONFLU1, 0.025 mg/L to 0.055 mg/L at site WARARM5, 0.027 mg/L to 0.106 mg/L at site WDFS1 and 0.020 mg/L to 0.101 mg/L at site WDFS1+100 (Chart 3).

Total manganese concentrations for January 2019 followed similar trends, ranging from 0.282 mg/L to 0.661 mg/L at site ETAU, 0.189 mg/L to 0.246 mg/L at site ETFSL 200, 0.233 mg/L to 0.284 mg/L at site ETFSL 500, 0.049 mg/L to 0.160 mg/L at site CONFLU1, 0.028 mg/L to 0.054 mg/L at site WARARM5, 0.038 mg/L to 0.140 mg/L at site WDFS1 and 0.029 mg/L to 0.138 mg/L at site WDFS1+100 (Chart 4).

The Australian Drinking Water Guidelines (ADWG, 2011) are published by the National Health and Medical Research Council and updated most recently in 2018; 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 Australian Drinking Water Guideline before being supplied to the Helensburgh area as well as parts of the Sutherland Shire and northern Wollongong (WaterNSW, 2017).

The ADWG (2011) guidelines are based on total concentrations of manganese in water. The ADWG value is 0.5 mg/L total manganese for health. 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).

Water quality data for parameters pertinent to dissolved manganese for January 2018 to January 2019 at sites ETAU, ETFSL 200, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100 is provided in Attachment A. The water quality parameters (pH, ORP and EC) showed no unusual features. The ADWG value for pH (aesthetic) is pH 6.5 – 8.5. Samples at sites ETAU, ETFSL 200, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100 in January 2019 were within this range (Attachment A).

⁵ Total manganese is not sampled at site ETWQ AU, and therefore results were unable to be substituted for site ETAU from 22 November to 6 December 2018 and 17 December 2018. Sampling at site ETAU was undertaken on 12 and 27 December 2018.

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 January 2019, which has triggered 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.

Water reaching the Woronora Reservoir occurs where the inflowing stream water meets the reservoir waterbody. In January 2019, the Woronora Reservoir water level was in the vicinity of sites WDFS1 and WDFS1+100. The mixing zone (downstream of the reservoir water level) is variable and influenced by the rate of inflow from the Eastern Tributary. Manganese concentrations are easily diluted by freshwater flow to low levels when higher creek flows occur.

The manganese concentrations reaching the Woronora Reservoir have 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.

6. REFERENCES

- ADWG (2011) Australian Drinking Water Guidelines – National Water Quality Management Strategy. The National Health and Medical Research Council Canberra.
- Helensburgh Coal Pty Ltd (2008) Metropolitan Coal Project Environmental Assessment.
- Hydro Engineering & Consulting Pty Ltd (2019) Metropolitan Coal LW 301-303 Extraction Plan Triggers – Water Quality Analysis January 2019. Report J0604-76.I1.
- 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.
- Rayner-Canham, G. (1996) Descriptive Inorganic Chemistry; Freeman: New York. Chapter 9.
- 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

Barry N Noller

Principal Research Fellow

Centre For Mined Land Rehabilitation

ATTACHMENT A

WATER QUALITY DATA FOR SITES

ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, WARARM5, CONFLU1, WDFS1 and
WDFS1+100

JANUARY 2018 TO JANUARY 2019

ATTACHMENT A

Water Quality Data for Sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100

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)
4/01/2018	ETAU	0.652	0.678	<0.05	0.59	132	7.37	351
4/01/2018	ETFSL100	0.281	0.305	<0.05	0.82	125.3	7.75	337
4/01/2018	ETFSL200	0.042	0.057	<0.05	0.68	132.7	7.05	118
4/01/2018	ETFSL300	0.038	0.052	0.06	0.6	13.2	6.92	111
4/01/2018	ETFSL400	0.024	0.037	<0.05	0.47	129.9	6.96	110
4/01/2018	ETFSL500	0.016	0.036	<0.05	0.46	121.7	6.74	111
11/01/2018	ETAU	0.588	0.698	0.13	1.36	55.9	7.56	364
11/01/2018	ETFSL100	0.197	0.237	<0.05	0.55	24.3	7.88	345
11/01/2018	ETFSL200	0.041	0.053	<0.05	0.63	101	7.14	139
11/01/2018	ETFSL300	0.067	0.078	1.89	2.1	35.2	6.88	128
11/01/2018	ETFSL400	0.106	0.052	0.47	0.66	52	6.84	124
11/01/2018	ETFSL500	0.026	0.046	0.06	0.78	94.4	7.01	122
18/01/2018	ETAU	0.577	0.653	<0.05	1.15	136.4	7.67	366
18/01/2018	ETFSL100	0.211	0.22	<0.05	0.64	131.9	7.74	353
18/01/2018	ETFSL200	0.046	0.055	<0.05	0.79	131.2	7	129
18/01/2018	ETFSL300	0.058	0.057	0.06	0.84	125.5	6.94	126
18/01/2018	ETFSL400	0.038	0.048	<0.05	0.71	139.6	6.96	125
18/01/2018	ETFSL500	0.032	0.049	<0.05	0.78	121.4	6.94	123
25/01/2018	ETAU	0.674	0.668	<0.05	0.52	56.8	7.55	378
25/01/2018	ETFSL100	0.074	0.152	<0.05	0.46	-4.4	7.82	360
25/01/2018	ETFSL200	0.007	0.034	<0.05	0.41	70.6	7.16	120
25/01/2018	ETFSL300	0.005	0.035	<0.05	0.46	22.8	7.09	117
25/01/2018	ETFSL400	0.001	0.032	<0.05	0.41	55	7	118
25/01/2018	ETFSL500	0.002	0.03	<0.05	0.35	288.6	7.04	115
31/01/2018	ETAU	0.7	0.734	<0.05	0.67	82.3	7.46	374
31/01/2018	ETFSL100	0.089	0.147	<0.05	0.36	30.7	8.01	361
31/01/2018	ETFSL200	0.005	0.052	<0.05	0.57	79.1	7.28	139
31/01/2018	ETFSL300	0.002	0.049	<0.05	0.66	42.7	7.08	123
31/01/2018	ETFSL400	0.001	0.046	<0.05	0.54	92	7.05	122
31/01/2018	ETFSL500	0.001	0.044	<0.05	0.55	71	7.01	122
7/02/2018	ETAU	0.625	0.601	<0.05	0.65	106.9	7.39	374
7/02/2018	ETFSL100	0.102	0.129	<0.05	0.75	14.8	7.78	359
7/02/2018	ETFSL200	0.047	0.051	<0.05	0.48	80.4	7.04	119
7/02/2018	ETFSL300	0.049	0.059	<0.05	0.65	38.2	6.97	119
7/02/2018	ETFSL400	0.112	0.07	0.27	0.74	1	6.77	118
7/02/2018	ETFSL500	0.038	0.053	0.11	0.58	86.6	6.92	117
16/02/2018	ETAU	0.65	0.67	<0.05	0.66	158.8	7.54	380
16/02/2018	ETFSL100	0.075	0.126	<0.05	0.33	163.9	7.96	369
16/02/2018	ETFSL200	0.016	0.048	<0.05	0.6	152	7.05	128
16/02/2018	ETFSL300	0.023	0.058	<0.05	0.81	121.1	6.88	124
16/02/2018	ETFSL400	0.012	0.049	<0.05	0.54	143.2	6.83	121
16/02/2018	ETFSL500	0.019	0.054	<0.05	0.54	144.1	6.82	120
23/02/2018	ETAU	0.651	0.822	<0.05	1.72	163.6	7.21	400
23/02/2018	ETFSL100	0.12	0.2	<0.05	0.5	31.8	7.75	384
23/02/2018	ETFSL200	0.068	0.078	<0.05	0.93	55.8	6.92	140
23/02/2018	ETFSL300	0.065	0.07	0.07	0.88	55.2	6.8	136
23/02/2018	ETFSL400	0.062	0.075	<0.05	0.93	41.8	6.78	135
23/02/2018	ETFSL500	0.049	0.075	<0.05	1.07	-119.2	6.78	132

ATTACHMENT A (Continued)
Water Quality Data for Sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100

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)
1/03/2018	ETAU	2.07	2	5.96	5.69	83.1	6.32	492
1/03/2018	ETFSL100	1.78	1.72	2.41	2.7	36.7	6.31	464
1/03/2018	ETFSL200	0.08	0.087	0.08	0.83	59	6.45	133
1/03/2018	ETFSL300	0.059	0.069	0.16	0.79	43.5	6.36	127
1/03/2018	ETFSL400	0.05	0.064	0.1	1.03	32	6.35	125
1/03/2018	ETFSL500	0.036	0.051	0.08	0.65	2.3	6.38	123
7/03/2018	ETAU	2.54	2.48	7.52	7.23	168.1	6.12	514
7/03/2018	ETFSL100	2.21	2.15	4.12	4.43	158.6	6.11	479
7/03/2018	ETFSL200	0.082	0.132	0.07	0.92	166.8	6.29	147
7/03/2018	ETFSL300	0.108	0.12	<0.05	0.91	149	6.32	147
7/03/2018	ETFSL400	0.088	0.11	<0.05	0.78	161.1	6.79	142
7/03/2018	ETFSL500	0.083	0.102	0.07	0.76	154.5	6.32	138
14/03/2018	ETAU	1.54	1.43	3.72	6.68	41.4	6.58	450
14/03/2018	ETFSL100	0.907	1.08	0.55	3.58	31.6	6.95	431
14/03/2018	ETFSL200	0.047	0.066	<0.05	0.63	76	6.84	135
14/03/2018	ETFSL300	0.048	0.054	<0.05	0.56	41.4	6.83	133
14/03/2018	ETFSL400	0.064	0.055	0.06	0.61	3.3	6.86	132
14/03/2018	ETFSL500	0.047	0.052	<0.05	0.47	21.9	6.79	131
22/03/2018	ETAU	0.312	0.33	0.73	1.46	229.3	5.24	237
22/03/2018	ETFSL100	0.362	0.363	0.71	1.69	182.9	5.08	240
22/03/2018	ETFSL200	0.166	0.173	0.44	1.63	71.9	6.51	160
22/03/2018	ETFSL300	0.118	0.118	0.28	1.33	70.6	6.54	153
22/03/2018	ETFSL400	0.146	0.136	0.8	1.66	22.8	6.61	152
22/03/2018	ETFSL500	0.091	0.095	0.14	1.02	32.6	6.65	144
29/03/2018	ETAU	0.841	0.798	2.83	3.32	148	6.66	341
29/03/2018	ETFSL100	0.732	0.729	1.87	2.6	40.9	6.63	332
29/03/2018	ETFSL200	0.058	0.059	0.11	0.62	84.2	6.65	131
29/03/2018	ETFSL300	0.047	0.053	0.08	0.59	65.9	6.64	131
29/03/2018	ETFSL400	0.051	0.055	0.08	0.74	71.4	6.64	130
29/03/2018	ETFSL500	0.033	0.051	0.08	1.29	27.3	6.68	128
5/4/2018	ETAU	0.885	0.904	2.84	4.76	182.7	6.57	384
5/4/2018	ETFSL100	0.674	0.672	0.73	2.41	191.7	6.67	374
5/4/2018	ETFSL200	0.058	0.067	0.08	0.62	211.9	6.32	142
5/4/2018	ETFSL300	0.044	0.058	0.07	0.57	209.4	6.37	142
5/4/2018	ETFSL400	0.04	0.058	0.13	0.77	209.1	6.39	141
5/4/2018	ETFSL500	0.035	0.054	0.09	0.66	205.9	6.4	141
13/4/2018	ETAU	0.888	0.927	1.42	4.26	156.2	6.76	391
13/4/2018	ETFSL100	0.614	0.651	0.13	2.46	172.9	6.92	382
13/4/2018	ETFSL200	0.042	0.065	0.08	0.7	42.8	6.84	153
13/4/2018	ETFSL300	0.033	0.051	0.05	0.5	40.9	6.52	145
13/4/2018	ETFSL400	0.023	0.048	<0.05	0.59	64.1	6.6	147
13/4/2018	ETFSL500	0.014	0.04	<0.05	0.51	58.6	6.61	142
18/4/2018	ETAU	0.875	0.925	0.62	2.62	192.1	6.77	397
18/4/2018	ETFSL100	0.614	0.636	0.13	2.27	192.3	7.19	390
18/4/2018	ETFSL200	0.184	0.14	0.57	1.14	184.8	6.75	178
18/4/2018	ETFSL300	0.059	0.074	0.08	0.86	186.3	6.81	162
18/4/2018	ETFSL400	0.05	0.069	<0.05	0.64	181.3	6.76	159
18/4/2018	ETFSL500	0.044	0.071	0.07	0.76	185.5	6.76	160

ATTACHMENT A (Continued)
Water Quality Data for Sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100

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)
26/4/2018	ETAU	0.871	0.887	3.01	4.32	7.2	7.02	1040
26/4/2018	ETFSL100	0.587	0.631	0.1	2.06	9.6	7.42	409
26/4/2018	ETFSL200	0.059	0.071	0.08	0.69	45.1	7.01	159
26/4/2018	ETFSL300	0.043	0.055	<0.05	0.54	2.5	6.96	159
26/4/2018	ETFSL400	0.04	0.055	<0.05	0.54	36	6.97	155
26/4/2018	ETFSL500	0.03	0.05	0.05	0.51	94.3	6.96	152
3/5/2018	ETAU	0.781	0.813	2.38	2.38	76.9	6.9	362
3/5/2018	ETFSL100	0.58	0.611	0.18	3.02	20	7.47	358
3/5/2018	ETFSL200	0.056	0.081	0.07	0.78	43.5	7.01	142
3/5/2018	ETFSL300	0.053	0.059	0.13	0.55	5.3	7.02	136
3/5/2018	ETFSL400	0.044	0.052	0.06	0.45	55.3	7	132
3/5/2018	ETFSL500	0.034	0.044	0.07	0.68	60.7	7.01	128
10/5/2018	ETAU	0.752	0.86	4.66	4.66	176.7	6.75	388
10/5/2018	ETFSL100	0.553	0.628	0.06	4.58	191.5	7.19	384
10/5/2018	ETFSL200	0.044	0.061	<0.05	0.89	187.4	6.64	129
10/5/2018	ETFSL300	0.042	0.051	0.08	0.56	180.2	6.67	131
10/5/2018	ETFSL400	0.051	0.056	0.1	0.5	170.7	6.71	133
10/5/2018	ETFSL500	0.032	0.04	0.08	0.45	164	6.68	124
17/5/2018	ETAU	0.868	0.795	3.32	3.32	160	6.78	383
17/5/2018	ETFSL100	0.634	0.605	<0.05	2.66	178.5	7.12	375
17/5/2018	ETFSL200	0.249	0.22	0.25	1.87	178.5	6.85	246
17/5/2018	ETFSL300	0.176	0.178	0.12	1.57	175.8	6.84	230
17/5/2018	ETFSL400	0.146	0.14	0.1	1.32	179.3	6.78	202
17/5/2018	ETFSL500	0.113	0.102	0.12	1.36	179.6	6.65	176
24/5/2018	ETAU	0.763	0.795	3.22	3.22	192.8	7.22	381
24/5/2018	ETFSL100	0.563	0.63	<0.05	4.36	194.2	7.12	375
24/5/2018	ETFSL200	0.128	0.128	0.58	1.03	189.4	6.95	158
24/5/2018	ETFSL300	0.04	0.053	0.05	0.62	102.2	6.78	125
24/5/2018	ETFSL400	0.037	0.043	0.07	0.39	184.9	6.72	145
24/5/2018	ETFSL500	0.031	0.037	<0.05	0.33	185.2	6.76	120
31/5/2018	ETAU	0.797	0.812	3.74	3.74	193.3	7.22	378
31/5/2018	ETFSL100	0.626	0.598	<0.05	2.57	197.5	7.12	375
31/5/2018	ETFSL200	0.362	0.344	0.48	2.18	187.7	7.18	260
31/5/2018	ETFSL300	0.177	0.171	0.24	1.44	185.8	7.18	188
31/5/2018	ETFSL400	0.178	0.162	0.67	1.86	179.9	7.19	184
31/5/2018	ETFSL500	0.098	0.096	0.11	0.89	176	7.12	154
7/6/2018	ETAU	1.19	1.24	3.12	4.03	188.4	6.8	361
7/6/2018	ETFSL100	0.889	0.942	1.43	2.91	185.7	7.19	342
7/6/2018	ETFSL200	0.8	0.792	1.29	3.2	189.2	7.17	327
7/6/2018	ETFSL300	0.625	0.67	0.9	3.42	178.7	7.16	304
7/6/2018	ETFSL400	0.402	0.442	0.06	4.24	182.9	7.25	271
7/6/2018	ETFSL500	0.347	0.358	0.35	3.74	183.4	7.27	268
14/6/2018	ETAU	0.674	0.686	2.1	3.89	99.8	6.94	314
14/6/2018	ETFSL100	0.34	0.539	0.26	2.33	73.3	7.27	309
14/6/2018	ETFSL200	0.47	0.459	0.72	2.12	178.9	7.09	300
14/6/2018	ETFSL300	0.377	0.37	0.26	2.25	167.8	7.12	264
14/6/2018	ETFSL400	0.292	0.288	0.08	2.17	192.4	7.15	228
14/6/2018	ETFSL500	0.255	0.251	0.08	1.94	203.5	7.04	201

ATTACHMENT A (Continued)
Water Quality Data for Sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100

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)
20/6/2018	ETAU	0.657	0.628	3.62	5.4	188.3	6.72	337
20/6/2018	ETFSL100	0.457	0.468	0.9	3.16	19	6.9	324
20/6/2018	ETFSL200	0.371	0.39	0.72	2.4	191.4	6.95	320
20/6/2018	ETFSL300	0.384	0.377	0.34	2.42	190.5	6.98	322
20/6/2018	ETFSL400	0.331	0.333	<0.05	2.84	191.2	7	312
20/6/2018	ETFSL500	0.256	0.28	<0.05	2.67	184.8	7.01	273
28/6/2018	ETAU	0.634	0.687	4.08	7	185.8	6.6	328
28/6/2018	ETFSL100	0.501	0.559	1.04	3.95	188.8	7.02	329
28/6/2018	ETFSL200	0.409	0.422	1.45	3.94	187.2	6.82	306
28/6/2018	ETFSL300	0.176	0.207	<0.05	1.95	199.7	6.77	190
28/6/2018	ETFSL400	0.108	0.111	<0.05	1.04	198.5	6.67	128
28/6/2018	ETFSL500	0.075	0.079	0.05	0.79	179.7	6.61	118
2/7/2018	ETAU	0.637	0.706	3.29	6.24	39.9	7.05	352
2/7/2018	ETFSL100	0.519	0.558	0.97	4.38	191	7.31	351
2/7/2018	ETFSL200	0.395	0.416	0.86	2.28	191.4	7.34	344
2/7/2018	ETFSL300	0.391	0.426	1.19	3.57	193.9	7.25	342
2/7/2018	ETFSL400	0.327	0.349	0.15	3.82	195.4	7.22	311
2/7/2018	ETFSL500	0.226	0.258	0.06	2.37	194.2	7.15	252
12/7/2018	ETAU	0.587	0.626	1.11	2.33	456.6	7.31	370
12/7/2018	ETFSL100	0.501	0.492	0.63	1.6	163.5	7.59	367
12/7/2018	ETFSL200	0.342	0.338	0.73	1.42	160.3	7.5	355
12/7/2018	ETFSL300	0.324	0.373	1.16	2.87	154.8	7.49	361
12/7/2018	ETFSL400	0.338	0.353	0.44	3.85	1596	7.55	356
12/7/2018	ETFSL500	0.212	0.218	<0.05	2.45	158.3	7.37	259
19/7/2018	ETAU	0.726	0.712	0.63	3.5	177	7	377
19/7/2018	ETFSL100	0.576	0.565	0.11	3.01	202.8	7.37	371
19/7/2018	ETFSL200	0.444	0.4	0.36	2.35	200.6	7.24	360
19/7/2018	ETFSL300	0.462	0.402	1.11	3.68	202	7.21	372
19/7/2018	ETFSL400	0.431	0.374	0.57	3.48	203.3	7.33	384
19/7/2018	ETFSL500	0.288	0.279	<0.05	3.33	203.6	7.21	330
26/7/2018	ETAU	0.725	0.753	4.1	6.53	-5.9	6.59	364
26/7/2018	ETFSL100	0.522	0.566	0.19	2.89	10.8	6.78	356
26/7/2018	ETFSL200	0.31	0.353	0.29	1.73	9.8	6.79	351
26/7/2018	ETFSL300	0.35	0.35	1.59	2.55	-0.3	6.71	353
26/7/2018	ETFSL400	0.375	0.397	1.92	3.56	-12.3	6.75	370
26/7/2018	ETFSL500	0.346	0.431	<0.05	3.13	107.8	6.88	378
02/8/2018	ETAU	0.744	0.733	0.44	2.96	54.8	6.53	366
02/8/2018	ETFSL100	0.526	0.544	0.09	2.48	325	6.57	359
02/8/2018	ETFSL200	0.321	0.350	0.39	1.44	265.1	6.51	352
02/8/2018	ETFSL300	0.337	0.348	1.79	2.59	263.4	6.39	355
02/8/2018	ETFSL400	0.398	0.420	3.38	4.5	251.8	6.59	397
02/8/2018	ETFSL500	0.395	0.429	1.14	3.44	236.4	6.8	386
09/8/2018	ETAU	0.637	0.785	2.11	5.08	257.2	6.73	367
09/8/2018	ETFSL100	0.538	0.644	0.18	5.24	256.6	6.92	363
09/8/2018	ETFSL200	0.276	0.316	0.20	1.56	248.6	6.86	355
09/8/2018	ETFSL300	0.285	0.306	1.68	2.50	233.3	6.75	355
09/8/2018	ETFSL400	0.375	0.416	5.43	6.97	254.2	6.99	436
09/8/2018	ETFSL500	0.373	0.401	3.02	4.50	253.7	6.9	390

ATTACHMENT A (Continued)
Water Quality Data for Sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100

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)
16/8/2018	ETAU	0.672	0.797	1.53	3.99	250.1	6.71	365
16/8/2018	ETFSL100	0.491	0.584	0.08	2.32	264.8	7.16	362
16/8/2018	ETFSL200	0.263	0.304	0.1	1.17	265.4	7.13	353
16/8/2018	ETFSL300	0.249	0.298	1.02	1.98	267.4	6.96	349
16/8/2018	ETFSL400	0.336	0.351	3.57	4.23	260.7	7.12	405
16/8/2018	ETFSL500	0.309	0.358	1.69	3.18	261.3	6.98	386
23/8/2018	ETAU	0.724	0.701	0.92	3.12	266.4	7.03	358
23/8/2018	ETFSL100	0.489	0.505	0.07	2.26	271.7	6.97	351
23/8/2018	ETFSL200	0.274	0.270	0.1	1.01	267.1	7.11	344
23/8/2018	ETFSL300	0.227	0.273	0.83	1.83	265.6	7.04	341
23/8/2018	ETFSL400	0.267	0.279	2.11	2.50	261.8	7.05	365
23/8/2018	ETFSL500	0.352	0.337	2.34	3.41	258.1	7.23	382
30/8/2018	ETAU	0.632	0.696	<0.05	2.52	99.5	7.97	368
30/8/2018	ETFSL100	0.440	0.491	<0.05	2.09	77	7.73	354
30/8/2018	ETFSL200	0.225	0.243	0.06	0.85	23.2	7.85	350
30/8/2018	ETFSL300	0.236	0.248	0.96	1.70	256.2	7.78	345
30/8/2018	ETFSL400	0.327	0.343	3.30	4.50	252.5	8.20	399
30/8/2018	ETFSL500	0.316	0.350	2.05	3.65	228.1	8.18	387
05/9/2018	ETAU	0.688	0.683	0.66	4.54	25.2	7.44	363
05/9/2018	ETFSL100	0.476	0.483	<0.05	2.06	53.5	7.77	350
05/9/2018	ETFSL200	0.234	0.23	0.09	0.98	12.5	7.71	340
05/9/2018	ETFSL300	0.259	0.238	1.08	1.71	-12.5	7.57	333
05/9/2018	ETFSL400	0.367	0.371	4.53	5.96	-42.4	7.65	404
05/9/2018	ETFSL500	0.336	0.318	2.52	3.73	1.5	7.69	372
12/9/2018	ETAU	0.653	0.719	<0.05	3.72	178.2	7.05	360
12/9/2018	ETFSL100	0.461	0.521	<0.05	2.72	71.7	7.54	356
12/9/2018	ETFSL200	0.25	0.28	<0.05	0.96	20.1	7.49	346
12/9/2018	ETFSL300	0.3	0.301	0.41	1.73	3.1	7.38	345
12/9/2018	ETFSL400	0.389	0.34	2.15	2.77	-62.7	7.39	359
12/9/2018	ETFSL500	0.401	0.39	1.04	3.87	-17.4	7.43	381
20/9/2018	ETAU	0.392	0.721	1.14	2.49	272.4	7.11	362
20/9/2018	ETFSL100	0.179	0.467	<0.05	1.88	272.4	7.18	350
20/9/2018	ETFSL200	0.182	0.194	0.63	0.7	25.2	7.17	341
20/9/2018	ETFSL300	0.227	0.233	0.63	1.5	-11.9	7.08	337
20/9/2018	ETFSL400	0.386	0.356	2.66	5.39	-34.2	7.21	397
20/9/2018	ETFSL500	0.394	0.358	1.1	3.15	25.4	7.25	371
27/9/2018	ETAU	0.58	0.763	<0.05	2.24	234	7.33	400
27/9/2018	ETFSL100	0.434	0.493	<0.05	1.54	268.1	7.64	392
27/9/2018	ETFSL200	0.178	0.188	<0.05	0.61	272.8	7.55	381
27/9/2018	ETFSL300	0.231	0.239	0.4	1.6	270.8	7.33	377
27/9/2018	ETFSL400	0.331	0.325	1.49	3.55	263.1	7.41	400
27/9/2018	ETFSL500	0.335	0.375	0.83	3.46	266.8	7.67	416
05/10/2018	ETAU	0.39	0.359	2.14	3.49	274.6	7.28	250
05/10/2018	ETFSL100	0.297	0.686	0.32	12	271	7.57	286
05/10/2018	ETFSL200	0.305	0.308	0.29	2.72	269.7	7.67	295
05/10/2018	ETFSL300	0.272	0.305	0.32	2.72	267.7	7.66	291
05/10/2018	ETFSL400	0.364	0.299	0.63	2.95	259.8	7.73	294
05/10/2018	ETFSL500	0.251	0.245	0.36	2.11	242.9	7.58	271

ATTACHMENT A (Continued)
Water Quality Data for Sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100

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)
10/10/2018	ETAU	0.569	0.635	1.8	2.68	266.6	6.59	308
10/10/2018	ETFSL100	0.571	0.602	1.62	2.25	267.5	6.66	304
10/10/2018	ETFSL200	0.494	0.558	1.07	1.88	269.6	6.78	302
10/10/2018	ETFSL300	0.492	0.49	1.05	1.42	269.6	6.81	303
10/10/2018	ETFSL400	0.479	0.503	2.3	3.04	267.3	7.07	334
10/10/2018	ETFSL500	0.48	0.512	1.36	2	266.7	6.98	308
15/10/2018	ETAU	0.325	0.333	0.9	1.33	285.6	6.35	269
15/10/2018	ETFSL100	0.298	0.302	0.69	1.2	278.5	6.36	259
15/10/2018	ETFSL200	0.316	0.336	0.66	1.9	276.9	6.37	262
15/10/2018	ETFSL300	0.286	0.298	0.57	1.41	279.5	6.39	259
15/10/2018	ETFSL400	0.276	0.3	0.6	1.38	279.9	6.56	266
15/10/2018	ETFSL500	0.273	0.279	0.63	1.18	263	7.71	267
22/10/2018	ETAU	0.274	0.259	0.76	1.26	276.9	6.52	281
22/10/2018	ETFSL100	0.25	0.244	0.56	1.13	270.7	6.57	278
22/10/2018	ETFSL200	0.235	0.233	0.41	1.01	270.4	6.53	275
22/10/2018	ETFSL300	0.236	0.228	0.42	1	269	6.58	275
22/10/2018	ETFSL400	0.304	0.263	1.8	2.51	264.8	7.01	321
22/10/2018	ETFSL500	0.184	0.229	0.26	1.19	258.5	6.74	279
30/10/2018	ETAU	0.432	0.431	1.79	2.55	15.1	6.65	290
30/10/2018	ETFSL100	0.376	0.39	0.76	1.78	-0.4	6.91	286
30/10/2018	ETFSL200	0.336	0.363	0.37	1.47	3.8	6.92	285
30/10/2018	ETFSL300	0.341	0.35	0.39	1.32	7.6	6.99	291
30/10/2018	ETFSL400	0.36	0.364	1.58	3.1	-77.3	7.09	329
30/10/2018	ETFSL500	0.34	0.351	0.5	1.63	-4.2	7.05	296
08/11/2018	ETAU	0.635	0.553	0.76	3.15	23.3	7.07	307
08/11/2018	ETFSL100	0.429	0.433	0.14	1.59	12.9	7.35	307
08/11/2018	ETFSL200	0.333	0.34	0.06	1	20	7.31	303
08/11/2018	ETFSL300	0.333	0.329	0.06	1.1	5.4	7.32	304
08/11/2018	ETFSL400	0.431	0.403	5.31	5.49	247.1	7.47	385
08/11/2018	ETFSL500	0.315	0.325	0.37	1.54	248.4	7.30	310
15/11/2018	ETAU	0.609	0.628	0.53	2.04	264.1	7.09	334
15/11/2018	ETFSL100	0.399	0.414	<0.05	1.6	172.9	7.32	328
15/11/2018	ETFSL200	0.308	0.331	<0.05	1.34	272	7.31	325
15/11/2018	ETFSL300	0.321	0.298	0.08	1.15	271	7.28	324
15/11/2018	ETFSL400	0.396	0.383	1.44	4.72	262.5	7.35	373
15/11/2018	ETFSL500	0.328	0.336	0.24	1.76	267.3	7.38	345
19/11/2018	ETWQ AU	0.647	- ⁶	0.08	2.42	259.1	7.22	345
22/11/2018	ETFSL200	0.264	0.298	<0.05	0.82	30.9	7.29	355
22/11/2018	ETFSL500	0.38	0.376	0.67	1.88	-3.3	7.50	373
22/11/2018	CONFLU1	0.085	0.088	0.12	0.9	-1.1	7.51	307
22/11/2018	WARARM5	0.018	0.046	0.25	1	54.6	7.57	297
22/11/2018	WDFS1	0.105	0.114	0.12	1.15	40.1	7.53	307
22/11/2018	WDFS1+100	0.103	0.119	0.1	1.06	26	7.55	306

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

ATTACHMENT A (Continued)
Water Quality Data for Sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100

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)
26/11/2018	ETWQ AU	0.538	⁻⁶	<0.05	1.36	83.8	7.11	354
29/11/2018	ETFSL200	0.139	0.15	0.54	1.2	36.1	7.07	195
29/11/2018	ETFSL500	0.167	0.147	0.3	1.19	30.1	6.94	195
29/11/2018	CONFLU1	0.158	0.108	0.27	1.18	29.5	7.19	200
29/11/2018	WARARM5	0.055	0.052	0.18	0.92	66.7	7.5	206
29/11/2018	WDFS1	0.082	0.074	0.18	0.21	36.7	7.8	206
29/11/2018	WDFS1+100	0.103	0.094	0.19	1	38.4	7.36	200
4/12/2018	ETWQ AU	0.433	⁻⁶	1.65	2.36	30.6	7	266
6/12/2018	ETFSL200	0.283	0.295	0.26	1.04	242.7	6.97	260
6/12/2018	ETFSL500	0.29	0.3	0.62	1.47	249.5	7.23	270
6/12/2018	CONFLU1	0.112	0.114	0.12	1.13	243.8	7.24	243
6/12/2018	WARARM5	0.034	0.035	<0.05	0.75	250.1	7.29	238
6/12/2018	WDFS1	0.122	0.134	0.07	1.12	241.4	7.29	246
6/12/2018	WDFS1+100	0.109	0.126	<0.05	0.99	251.1	7.3	245
12/12/2018	ETAU	0.428	0.484	1.49	3.33	-	6.86	269
12/12/2018	ETFSL200	0.215	0.232	<0.05	0.42	255.3	7.4	245
12/12/2018	ETFSL500	0.276	0.284	0.27	0.89	251.9	7.41	262
12/12/2018	CONFLU1	0.081	0.091	0.45	0.8	17.9	7.39	219
12/12/2018	WARARM5	0.03	0.042	<0.05	0.58	236.4	7.53	214
12/12/2018	WDFS1	0.108	0.121	0.41	1.09	27.5	7.44	225
12/12/2018	WDFS1+100	0.105	0.12	<0.05	0.99	42.3	7.24	243
17/12/2018	ETWQ AU	0.102	⁻⁶	0.18	0.75	280.3	6.50	152
17/12/2018	ETFSL200	0.076	0.084	0.17	0.7	274.8	6.76	152
17/12/2018	ETFSL500	0.087	0.086	0.19	0.76	274.8	6.56	150
17/12/2018	CONFLU1	0.068	0.068	0.16	0.78	270.9	6.64	152
17/12/2018	WARARM5	0.023	0.032	0.08	0.54	257.5	6.77	156
17/12/2018	WDFS1	0.069	0.062	0.15	0.75	273	6.67	153
17/12/2018	WDFS1+100	0.055	0.063	0.12	0.71	278.4	6.71	154
27/12/2018	ETAU	0.263	0.277	0.61	1.81	24.3	6.72	217
27/12/2018	ETFSL200	0.196	0.194	0.09	0.93	30.6	7.11	216
27/12/2018	ETFSL500	0.219	0.213	0.3	1.37	-6.9	7.13	224
27/12/2018	CONFLU1	0.071	0.075	<0.05	0.86	21.4	7.15	208
27/12/2018	WARARM5	0.045	0.036	<0.05	0.48	3.4	7.3	206
27/12/2018	WDFS1	0.108	0.11	0.06	0.99	24.9	7.12	210
27/12/2018	WDFS1+100	0.101	0.105	<0.05	0.93	37.4	7.13	210
3/01/2019	ETWQ AU	0.335	0.443	<0.05	1.57	110.1	7.35	300
3/01/2019	ETFSL200	0.159	0.226	<0.05	0.63	113.1	7.63	290
3/01/2019	ETFSL500	0.265	0.274	0.12	1.32	11.5	7.5	302
3/01/2019	CONFLU1	0.143	0.16	<0.05	1.21	4.8	7.29	270
3/01/2019	WARARM5	0.055	0.054	<0.05	0.64	56.4	7.46	256
3/01/2019	WDFS1	0.106	0.14	<0.05	1.27	72	7.45	265
3/01/2019	WDFS1+100	0.101	0.138	<0.05	1.16	56.2	7.42	263
10/01/2019	ETWQ AU	0.438	0.282	<0.05	1.41	244.1	6.92	268
10/01/2019	ETFSL200	0.216	0.246	<0.05	0.62	26.8	8.03	279
10/01/2019	ETFSL500	0.22	0.262	<0.05	1.18	-9.3	7.64	300
10/01/2019	CONFLU1	0.129	0.141	<0.05	1.11	-33.7	7.55	269
10/01/2019	WARARM5	0.042	0.041	<0.05	0.6	90.3	7.62	252
10/01/2019	WDFS1	0.061	0.087	<0.05	0.92	22.1	7.59	242
10/01/2019	WDFS1+100	0.061	0.074	<0.05	0.97	6.9	7.58	240

ATTACHMENT A (Continued)

Water Quality Data for Sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100

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)
16/01/2019	ETWQ AU	0.433	0.454	<0.05	1.86	171.1	6.75	282
16/01/2019	ETFSL200	0.18	0.189	<0.05	0.4	258.4	7.67	275
16/01/2019	ETFSL500	0.244	0.233	0.38	1	262.4	7.65	303
16/01/2019	CONFLU1	0.058	0.049	0.12	0.86	261.2	7.68	249
16/01/2019	WARARM5	0.025	0.028	0.11	0.52	268.1	7.82	242
16/01/2019	WDFS1	0.046	0.044	0.16	0.92	263.5	7.76	256
16/01/2019	WDFS1+100	0.047	0.044	0.19	0.94	259.2	7.79	260
23/01/2019	ETWQ AU	0.579	0.661	<0.05	2.09	184.3	6.78	292
23/01/2019	ETFSL200	0.171	0.204	<0.05	0.38	96.8	7.65	286
23/01/2019	ETFSL500	0.28	0.284	0.2	1.62	-11.1	7.65	316
23/01/2019	CONFLU1	0.052	0.056	<0.05	1.11	5.6	7.7	264
23/01/2019	WARARM5	0.043	0.036	<0.05	0.74	-38.4	7.7	253
23/01/2019	WDFS1	0.032	0.042	<0.05	1.08	19.6	7.77	266
23/01/2019	WDFS1+100	0.02	0.029	<0.05	0.92	-16.6	7.83	266
29/01/2019	ETAU	0.62	0.578	0.07	1.52	66.8	6.7	294
29/01/2019	ETFSL200	0.19	0.216	<0.05	0.44	36.2	7.23	282
29/01/2019	ETFSL500	0.249	0.279	<0.05	1.48	12.1	7.34	310
29/01/2019	CONFLU1	0.048	0.07	<0.05	1.05	-20.8	7.54	282
29/01/2019	WARARM5	0.031	0.028	<0.05	0.54	49.5	7.34	251
29/01/2019	WDFS1	0.027	0.038	<0.05	0.96	29.7	7.49	260
29/01/2019	WDFS1+100	0.03	0.03	<0.05	0.91	9.9	7.49	260

7 June 2019

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 – February 2019

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 301-303 Water Management Plan (LW301-303 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 LW301-303 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 LW301-303 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 LW301-303 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 LW301-303 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.

Analysis conducted by Hydro Engineering & Consulting (2019) in accordance with the LW301-303 WMP, identified that the performance indicator for water resources reaching the Woronora Reservoir was exceeded for dissolved (i.e. filtered <0.45 µm fraction) manganese on the Eastern Tributary at site ETWQ AU in February 2019 (as there was not a similar exceedance of the trigger recorded at control site WOWQ 2 on the Woronora River). The performance indicator was not exceeded for field filtered iron or aluminium in February 2019 and therefore these parameters are not discussed in this report.

In accordance with the LW301-303 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*.

This assessment against the water quality subsidence impact performance measure has been prepared for February 2019 in consideration of:

- pluviograph data;
- flow data from the Eastern Tributary gauging location (GS 300078);
- groundwater level and groundwater quality results for Eastern Tributary sites up to 28 February 2019¹;
- surface water quality data at site ETWQ AU/ETAU² and sites further upstream on the Eastern Tributary up to 28 February 2019;
- surface water quality data at sites downstream of ETWQ AU/ETAU² up to 28 February 2019; 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 (Table 1).

Recently, above average rainfall was recorded in October, November and December 2018, and below average rainfall was recorded in January and February 2019. Total rainfall in February 2019 was 41.0 mm, approximately one quarter of the average (158.7 mm), with 11.5 mm of rainfall recorded over 2 and 3 February, 24.5 mm recorded over 20 to 24 February and smaller rainfall events recorded on 6, 7, 9 and 12 February (ranging between 0.5 and 3 mm). Shallow groundwater levels correlate with the rainfall trend.

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

² Site ETAU is the same as site ETWQ AU (i.e. samples are taken at the same location). The difference between the sites relates to the time of sampling. Site ETWQ AU monitoring is conducted on the same day as sites upstream of ETWQ AU/ETAU (shown on Charts 1 to 2), while site ETAU monitoring is conducted on the same day as the sites downstream of ETWQ AU/ETAU (described in Section 3 and shown on Charts 3 to 4). From 29 January 2019, water quality sampling of all sites on the Eastern Tributary was undertaken in a single day. Future reporting will identify the data at this site as site ETWQ AU.

Table 1 Monthly Rainfall Data (mm) for PV7, January 2018 to February 2019

Month/Year	Rainfall at PV7 (mm)	Rainfall at Darkes Forest (mm) [#]	Mean Monthly Rainfall at Darkes Forest (1894-2019) (mm) [#]
January 2018	48.0	12.0	132.4
February 2018	115.5	16.6	159.6
March 2018	151.0	45.0	153.9
April 2018	32.0	21.6	126.8
May 2018	12.5	8.0	129.1
June 2018	112.0	91.8	146.6
July 2018	3.5	0.4	96.4
August 2018	12.5	15.8	89.1
September 2018	52.0	41.8	76.6
October 2018	197.0	200.8	91.9
November 2018	114.5	127.8	105.4
December 2018	120.0	91.0	103.8
January 2019	58.5	55.4	131.8
February 2019	41.0	54.2	158.7

[#] 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 February 2019.

2. EASTERN TRIBUTARY SURFACE WATER AND GROUNDWATER QUALITY DATA

Plots of dissolved manganese at surface water quality sites ETWQ AU, ETWQ AQ (upstream on the Eastern Tributary) and WOWQ 2 (control site) and at groundwater quality site ETGW2, are compared to rainfall at PV7 (Chart 1) and streamflow at GS 300078 (Chart 2) (Figure 1).

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.

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. <0.1 mg/L, exist in the natural creek water. Dissolved manganese is easily diluted by freshwater flow to low levels when higher creek flows occur.

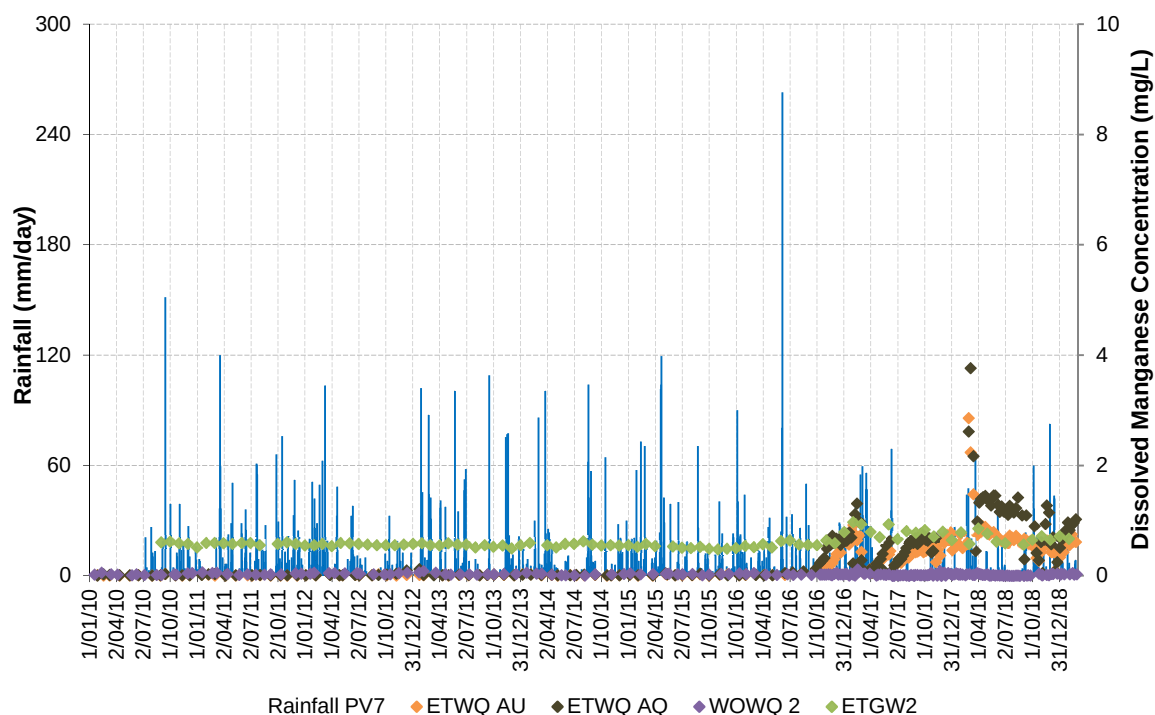


Chart 1 Dissolved Manganese Concentrations at Surface Water Quality Sites ETWQ AU, ETWQ AQ and WOWQ 2 and Groundwater Quality Site ETGW2 and Rainfall (to 28 February 2019)

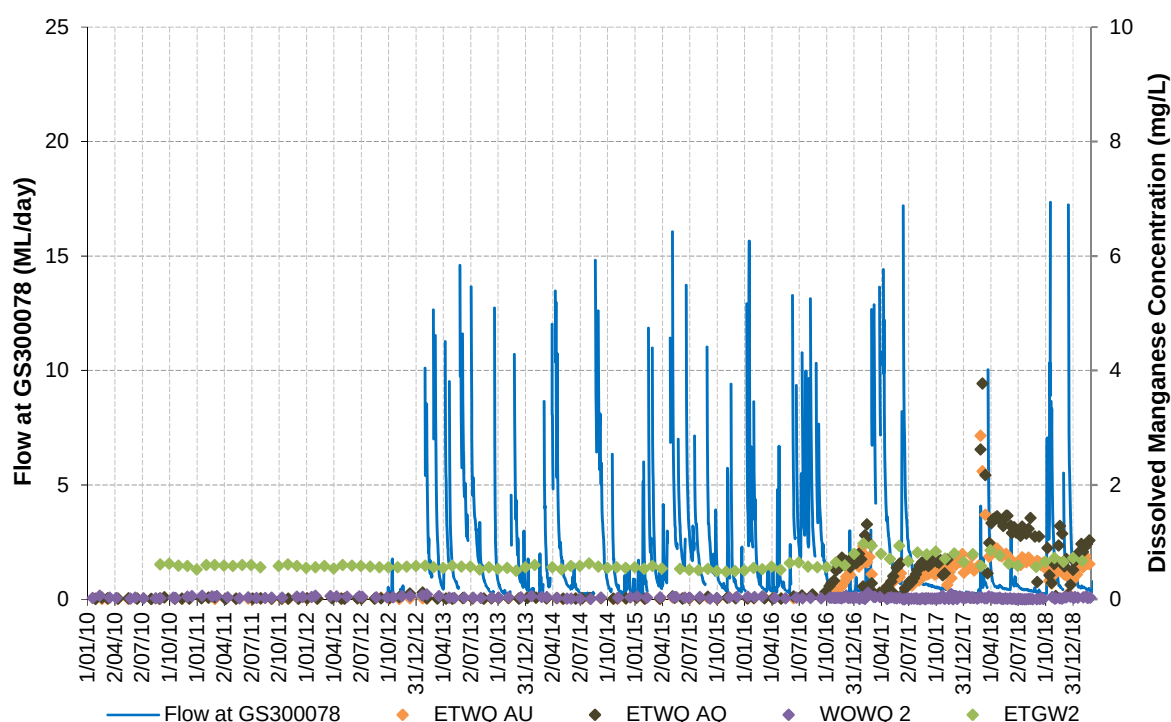


Chart 2 Dissolved Manganese Concentrations at Surface Water Quality Sites ETWQ AU, ETWQ AQ and WOWQ 2 and Groundwater Quality Site ETGW2 and Stream Flow (to 28 February 2019)

Figure 1

In February 2019, dissolved manganese concentrations at site ETWQ AU ranged between 0.559 mg/L and 0.757 mg/L. 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 Eastern Tributary can be diluted by creek flow. If high rainfalls return, then it is likely that dissolved manganese concentrations will fall to low levels again. Increased dissolved manganese levels in January and February 2019 are considered to be a result of below average rainfall.

Water quality parameters pertinent to the increase in manganese (dissolved-filtered <0.45 µm fraction) concentration are pH, oxidation-reduction potential (ORP) and electrical conductivity (EC). 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 oxidizing and becomes reducing when ORP is below approximately 10 mV. In February 2019 at site ETWQ AU:

- pH (lab measurement) was generally consistent (pH 6.80 to pH 7.19);
- EC concentrations (lab measurement) ranged between 283 µS/cm and 303 µS/cm; and
- ORP (field measurement) ranged between 51.1 mV and 273.1 mV.

3. WATER RESOURCES REACHING THE WORONORA RESERVOIR

In accordance with the LW301-303 WMP, site ETWQ AU on the Eastern Tributary and control site WOWQ 2 on the Woronora River are used to assess the LW301-303 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. 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.

Metropolitan Coal has taken a photographic record of the watercourse / waterbody at the time of sampling, estimated the width of the watercourse / water body 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 (HCPL, 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 February 2019 the Woronora Reservoir water level varied between 156.67 mAHD (on 7 February 2019) and 156.20 mAHD (on 28 February 2019) (water level declined steadily). The position of the reservoir water level can only be determined to the closest one metre contour, accordingly, the reservoir water level during February 2019 was between 1,400 m (corresponding to 157 mAHD) and 2,100 m (corresponding to 156 mAHD) downstream of site ETSFL 0.

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 February 2019, the Woronora Reservoir water level was downstream of site WDFS1+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

Water quality data for filtered and total manganese for January 2018 to February 2019 at sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400 and ETFSL 500 is provided in Attachment A. As described earlier, sampling at sites ETFSL 100, ETSFL 300 and ETFSL 400 was suspended once monitoring at sites CONFLU1, WARARM5, WDFS1 and WDFS1+100 commenced on 22 November 2018³. Water quality data for filtered and total manganese since sampling commenced on 22 November 2018 at sites CONFLU1, WARARM5, WDFS1 and WDFS1+100 is also provided in Attachment A.

As described above, the Woronora Reservoir water level dropped steadily in February 2019, and was downstream of site WDFS1+100. The results for dissolved and total manganese at sites ETAU, ETFSL 200, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100 since the commencement of monitoring to the end of February 2019, are shown on Charts 3 and 4, respectively. These sites provide a profile along the arm of the Woronora Reservoir.

³ Sampling at site ETAU was also temporarily suspended during this period but was resumed on 12 December 2018. Data from sampling undertaken at site ETWQ AU has been substituted for site ETAU during this period. Sampling at site ETAU was undertaken on 12 and 27 December 2018.

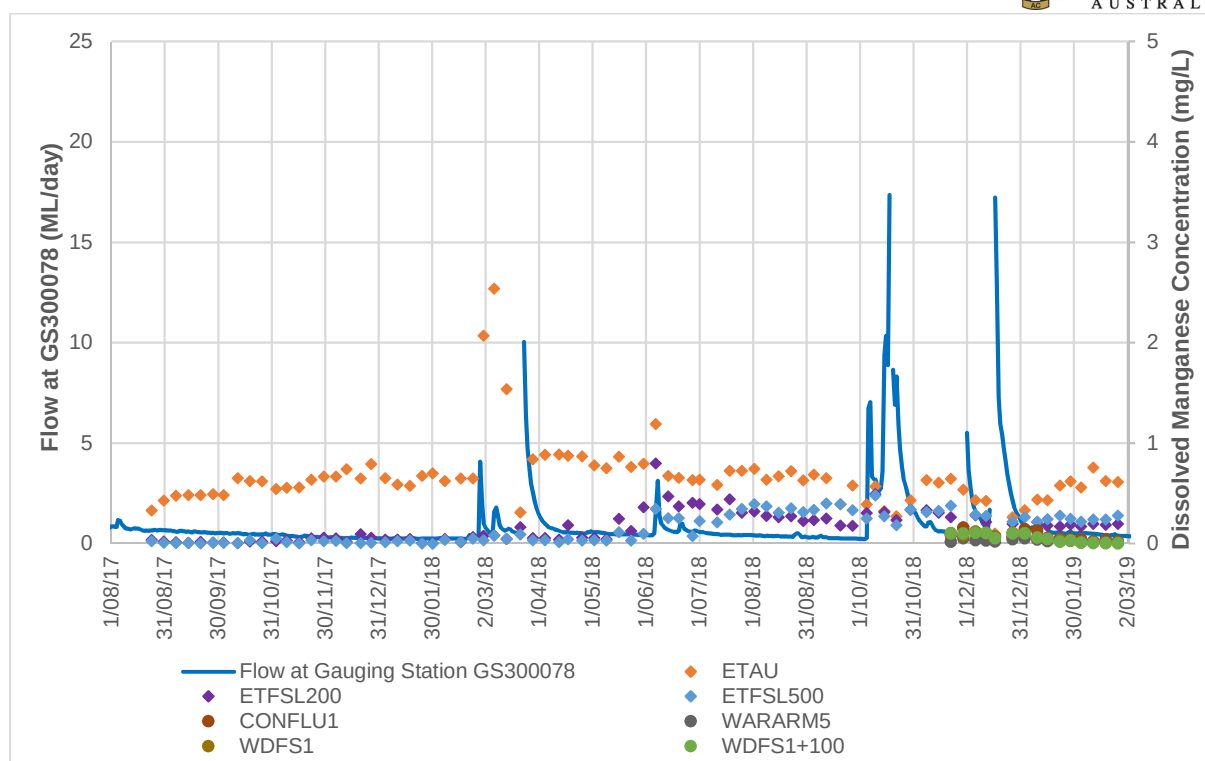


Chart 3 Dissolved Manganese Concentrations at Surface Water Quality Sites ETAU⁴, ETFSL 200, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100 and Stream Flow (August 2017 to 28 February 2019)

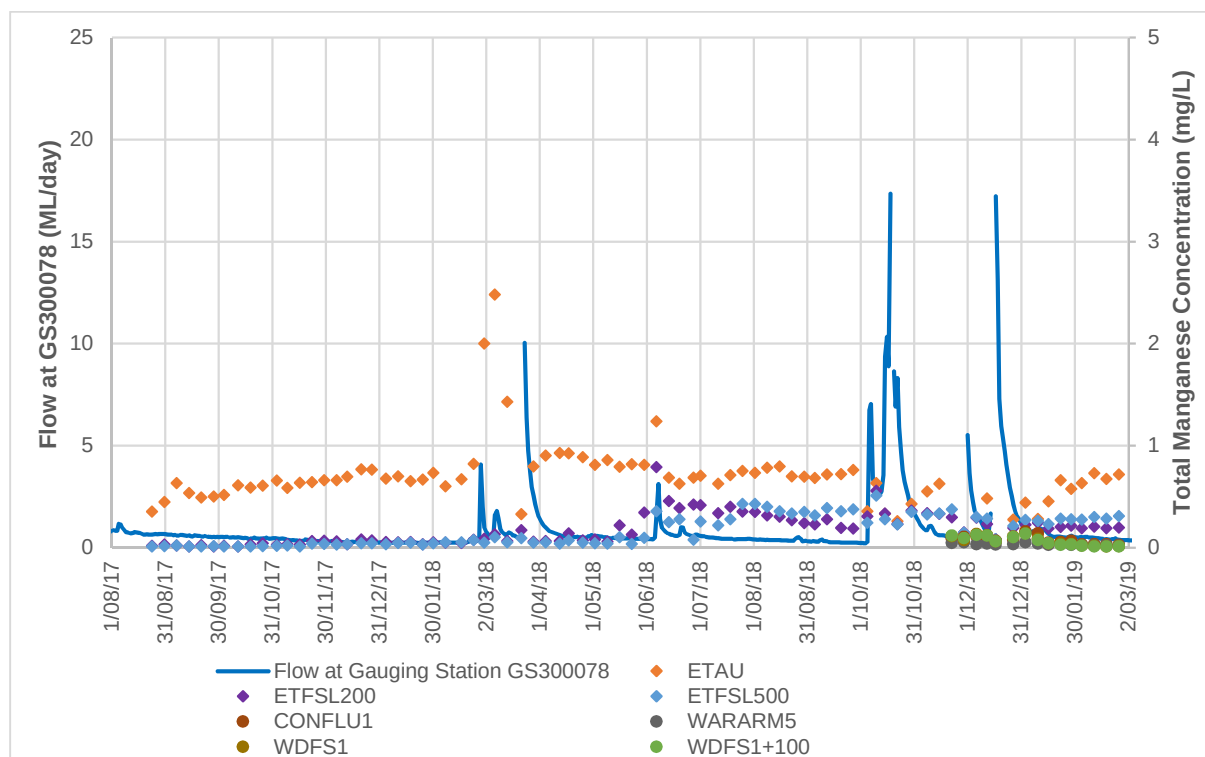


Chart 4 Total Manganese Concentrations at Surface Water Quality Sites ETAU⁵, ETFSL 200, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100 and Stream Flow (August 2017 to 28 February 2019)

⁴ Data from sampling undertaken at site ETWQ AU has been substituted for site ETAU from 22 November to 6 December 2018 and 17 December 2018. Sampling at site ETAU was undertaken on 12 and 27 December 2018.

The filtered manganese concentrations for February 2019 ranged from 0.559 mg/L to 0.757 mg/L at site ETAU, 0.173 mg/L to 0.198 mg/L at site ETFSL 200, 0.221 mg/L to 0.281 mg/L at site ETFSL 500, 0.022 mg/L to 0.043 mg/L at site CONFLU1, 0.014 mg/L to 0.023 mg/L at site WARARM5, 0.007 mg/L to 0.012 mg/L at site WDFS1 and 0.004 mg/L to 0.010 mg/L at site WDFS1+100 (Chart 3).

Total manganese concentrations for February 2019 followed similar trends, ranging from 0.635 mg/L to 0.731 mg/L at site ETAU, 0.190 mg/L to 0.206 mg/L at site ETFSL 200, 0.276 mg/L to 0.312 mg/L at site ETFSL 500, 0.027 mg/L to 0.036 mg/L at site CONFLU1, 0.023 mg/L to 0.029 mg/L at site WARARM5, 0.012 mg/L to 0.021 mg/L at site WDFS1 and 0.011 mg/L to 0.020 mg/L at site WDFS1+100 (Chart 4).

The Australian Drinking Water Guidelines (ADWG, 2011) are published by the National Health and Medical Research Council and updated most recently in 2018; 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 Australian Drinking Water Guideline before being supplied to the Helensburgh area as well as parts of the Sutherland Shire and northern Wollongong (WaterNSW, 2017).

The ADWG (2011) guidelines are based on total concentrations of manganese in water. The ADWG value is 0.5 mg/L total manganese for health. 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).

Water quality data for parameters pertinent to dissolved manganese for January 2018 to February 2019 at sites ETAU, ETFSL 200, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100 is provided in Attachment A. The water quality parameters (pH, ORP and EC) showed no unusual features. The ADWG value for pH (aesthetic) is pH 6.5 – 8.5. Samples at sites ETAU, ETFSL 200, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100 in February 2019 were within this range (Attachment A).

⁵ Total manganese is not sampled at site ETWQ AU, and therefore results were unable to be substituted for site ETAU from 22 November to 6 December 2018 and 17 December 2018. Sampling at site ETAU was undertaken on 12 and 27 December 2018.

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 February 2019, which has triggered 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.

Water reaching the Woronora Reservoir occurs where the inflowing stream water meets the reservoir waterbody. In February 2019, the Woronora Reservoir water level was downstream of site WDFS1+100. The mixing zone (downstream of the reservoir water level) is variable and influenced by the rate of inflow from the Eastern Tributary. Manganese concentrations are easily diluted by freshwater flow to low levels when higher creek flows occur.

The manganese concentrations reaching the Woronora Reservoir have 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.

6. REFERENCES

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Yours Sincerely,

Barry N. Noller

Barry N Noller

Principal Research Fellow

Centre For Mined Land Rehabilitation

ATTACHMENT A

WATER QUALITY DATA FOR SITES

ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, WARARM5, CONFLU1, WDFS1 and
WDFS1+100

JANUARY 2018 TO FEBRUARY 2019

ATTACHMENT A

Water Quality Data for Sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100

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)
4/01/2018	ETAU	0.652	0.678	<0.05	0.59	132	7.37	351
4/01/2018	ETFSL100	0.281	0.305	<0.05	0.82	125.3	7.75	337
4/01/2018	ETFSL200	0.042	0.057	<0.05	0.68	132.7	7.05	118
4/01/2018	ETFSL300	0.038	0.052	0.06	0.6	13.2	6.92	111
4/01/2018	ETFSL400	0.024	0.037	<0.05	0.47	129.9	6.96	110
4/01/2018	ETFSL500	0.016	0.036	<0.05	0.46	121.7	6.74	111
11/01/2018	ETAU	0.588	0.698	0.13	1.36	55.9	7.56	364
11/01/2018	ETFSL100	0.197	0.237	<0.05	0.55	24.3	7.88	345
11/01/2018	ETFSL200	0.041	0.053	<0.05	0.63	101	7.14	139
11/01/2018	ETFSL300	0.067	0.078	1.89	2.1	35.2	6.88	128
11/01/2018	ETFSL400	0.106	0.052	0.47	0.66	52	6.84	124
11/01/2018	ETFSL500	0.026	0.046	0.06	0.78	94.4	7.01	122
18/01/2018	ETAU	0.577	0.653	<0.05	1.15	136.4	7.67	366
18/01/2018	ETFSL100	0.211	0.22	<0.05	0.64	131.9	7.74	353
18/01/2018	ETFSL200	0.046	0.055	<0.05	0.79	131.2	7	129
18/01/2018	ETFSL300	0.058	0.057	0.06	0.84	125.5	6.94	126
18/01/2018	ETFSL400	0.038	0.048	<0.05	0.71	139.6	6.96	125
18/01/2018	ETFSL500	0.032	0.049	<0.05	0.78	121.4	6.94	123
25/01/2018	ETAU	0.674	0.668	<0.05	0.52	56.8	7.55	378
25/01/2018	ETFSL100	0.074	0.152	<0.05	0.46	-4.4	7.82	360
25/01/2018	ETFSL200	0.007	0.034	<0.05	0.41	70.6	7.16	120
25/01/2018	ETFSL300	0.005	0.035	<0.05	0.46	22.8	7.09	117
25/01/2018	ETFSL400	0.001	0.032	<0.05	0.41	55	7	118
25/01/2018	ETFSL500	0.002	0.03	<0.05	0.35	288.6	7.04	115
31/01/2018	ETAU	0.7	0.734	<0.05	0.67	82.3	7.46	374
31/01/2018	ETFSL100	0.089	0.147	<0.05	0.36	30.7	8.01	361
31/01/2018	ETFSL200	0.005	0.052	<0.05	0.57	79.1	7.28	139
31/01/2018	ETFSL300	0.002	0.049	<0.05	0.66	42.7	7.08	123
31/01/2018	ETFSL400	0.001	0.046	<0.05	0.54	92	7.05	122
31/01/2018	ETFSL500	0.001	0.044	<0.05	0.55	71	7.01	122
7/02/2018	ETAU	0.625	0.601	<0.05	0.65	106.9	7.39	374
7/02/2018	ETFSL100	0.102	0.129	<0.05	0.75	14.8	7.78	359
7/02/2018	ETFSL200	0.047	0.051	<0.05	0.48	80.4	7.04	119
7/02/2018	ETFSL300	0.049	0.059	<0.05	0.65	38.2	6.97	119
7/02/2018	ETFSL400	0.112	0.07	0.27	0.74	1	6.77	118
7/02/2018	ETFSL500	0.038	0.053	0.11	0.58	86.6	6.92	117
16/02/2018	ETAU	0.65	0.67	<0.05	0.66	158.8	7.54	380
16/02/2018	ETFSL100	0.075	0.126	<0.05	0.33	163.9	7.96	369
16/02/2018	ETFSL200	0.016	0.048	<0.05	0.6	152	7.05	128
16/02/2018	ETFSL300	0.023	0.058	<0.05	0.81	121.1	6.88	124
16/02/2018	ETFSL400	0.012	0.049	<0.05	0.54	143.2	6.83	121
16/02/2018	ETFSL500	0.019	0.054	<0.05	0.54	144.1	6.82	120
23/02/2018	ETAU	0.651	0.822	<0.05	1.72	163.6	7.21	400
23/02/2018	ETFSL100	0.12	0.2	<0.05	0.5	31.8	7.75	384
23/02/2018	ETFSL200	0.068	0.078	<0.05	0.93	55.8	6.92	140
23/02/2018	ETFSL300	0.065	0.07	0.07	0.88	55.2	6.8	136
23/02/2018	ETFSL400	0.062	0.075	<0.05	0.93	41.8	6.78	135
23/02/2018	ETFSL500	0.049	0.075	<0.05	1.07	-119.2	6.78	132

ATTACHMENT A (Continued)
Water Quality Data for Sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100

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)
1/03/2018	ETAU	2.07	2	5.96	5.69	83.1	6.32	492
1/03/2018	ETFSL100	1.78	1.72	2.41	2.7	36.7	6.31	464
1/03/2018	ETFSL200	0.08	0.087	0.08	0.83	59	6.45	133
1/03/2018	ETFSL300	0.059	0.069	0.16	0.79	43.5	6.36	127
1/03/2018	ETFSL400	0.05	0.064	0.1	1.03	32	6.35	125
1/03/2018	ETFSL500	0.036	0.051	0.08	0.65	2.3	6.38	123
7/03/2018	ETAU	2.54	2.48	7.52	7.23	168.1	6.12	514
7/03/2018	ETFSL100	2.21	2.15	4.12	4.43	158.6	6.11	479
7/03/2018	ETFSL200	0.082	0.132	0.07	0.92	166.8	6.29	147
7/03/2018	ETFSL300	0.108	0.12	<0.05	0.91	149	6.32	147
7/03/2018	ETFSL400	0.088	0.11	<0.05	0.78	161.1	6.79	142
7/03/2018	ETFSL500	0.083	0.102	0.07	0.76	154.5	6.32	138
14/03/2018	ETAU	1.54	1.43	3.72	6.68	41.4	6.58	450
14/03/2018	ETFSL100	0.907	1.08	0.55	3.58	31.6	6.95	431
14/03/2018	ETFSL200	0.047	0.066	<0.05	0.63	76	6.84	135
14/03/2018	ETFSL300	0.048	0.054	<0.05	0.56	41.4	6.83	133
14/03/2018	ETFSL400	0.064	0.055	0.06	0.61	3.3	6.86	132
14/03/2018	ETFSL500	0.047	0.052	<0.05	0.47	21.9	6.79	131
22/03/2018	ETAU	0.312	0.33	0.73	1.46	229.3	5.24	237
22/03/2018	ETFSL100	0.362	0.363	0.71	1.69	182.9	5.08	240
22/03/2018	ETFSL200	0.166	0.173	0.44	1.63	71.9	6.51	160
22/03/2018	ETFSL300	0.118	0.118	0.28	1.33	70.6	6.54	153
22/03/2018	ETFSL400	0.146	0.136	0.8	1.66	22.8	6.61	152
22/03/2018	ETFSL500	0.091	0.095	0.14	1.02	32.6	6.65	144
29/03/2018	ETAU	0.841	0.798	2.83	3.32	148	6.66	341
29/03/2018	ETFSL100	0.732	0.729	1.87	2.6	40.9	6.63	332
29/03/2018	ETFSL200	0.058	0.059	0.11	0.62	84.2	6.65	131
29/03/2018	ETFSL300	0.047	0.053	0.08	0.59	65.9	6.64	131
29/03/2018	ETFSL400	0.051	0.055	0.08	0.74	71.4	6.64	130
29/03/2018	ETFSL500	0.033	0.051	0.08	1.29	27.3	6.68	128
5/4/2018	ETAU	0.885	0.904	2.84	4.76	182.7	6.57	384
5/4/2018	ETFSL100	0.674	0.672	0.73	2.41	191.7	6.67	374
5/4/2018	ETFSL200	0.058	0.067	0.08	0.62	211.9	6.32	142
5/4/2018	ETFSL300	0.044	0.058	0.07	0.57	209.4	6.37	142
5/4/2018	ETFSL400	0.04	0.058	0.13	0.77	209.1	6.39	141
5/4/2018	ETFSL500	0.035	0.054	0.09	0.66	205.9	6.4	141
13/4/2018	ETAU	0.888	0.927	1.42	4.26	156.2	6.76	391
13/4/2018	ETFSL100	0.614	0.651	0.13	2.46	172.9	6.92	382
13/4/2018	ETFSL200	0.042	0.065	0.08	0.7	42.8	6.84	153
13/4/2018	ETFSL300	0.033	0.051	0.05	0.5	40.9	6.52	145
13/4/2018	ETFSL400	0.023	0.048	<0.05	0.59	64.1	6.6	147
13/4/2018	ETFSL500	0.014	0.04	<0.05	0.51	58.6	6.61	142
18/4/2018	ETAU	0.875	0.925	0.62	2.62	192.1	6.77	397
18/4/2018	ETFSL100	0.614	0.636	0.13	2.27	192.3	7.19	390
18/4/2018	ETFSL200	0.184	0.14	0.57	1.14	184.8	6.75	178
18/4/2018	ETFSL300	0.059	0.074	0.08	0.86	186.3	6.81	162
18/4/2018	ETFSL400	0.05	0.069	<0.05	0.64	181.3	6.76	159
18/4/2018	ETFSL500	0.044	0.071	0.07	0.76	185.5	6.76	160

ATTACHMENT A (Continued)
Water Quality Data for Sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100

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)
26/4/2018	ETAU	0.871	0.887	3.01	4.32	7.2	7.02	1040
26/4/2018	ETFSL100	0.587	0.631	0.1	2.06	9.6	7.42	409
26/4/2018	ETFSL200	0.059	0.071	0.08	0.69	45.1	7.01	159
26/4/2018	ETFSL300	0.043	0.055	<0.05	0.54	2.5	6.96	159
26/4/2018	ETFSL400	0.04	0.055	<0.05	0.54	36	6.97	155
26/4/2018	ETFSL500	0.03	0.05	0.05	0.51	94.3	6.96	152
3/5/2018	ETAU	0.781	0.813	2.38	2.38	76.9	6.9	362
3/5/2018	ETFSL100	0.58	0.611	0.18	3.02	20	7.47	358
3/5/2018	ETFSL200	0.056	0.081	0.07	0.78	43.5	7.01	142
3/5/2018	ETFSL300	0.053	0.059	0.13	0.55	5.3	7.02	136
3/5/2018	ETFSL400	0.044	0.052	0.06	0.45	55.3	7	132
3/5/2018	ETFSL500	0.034	0.044	0.07	0.68	60.7	7.01	128
10/5/2018	ETAU	0.752	0.86	4.66	4.66	176.7	6.75	388
10/5/2018	ETFSL100	0.553	0.628	0.06	4.58	191.5	7.19	384
10/5/2018	ETFSL200	0.044	0.061	<0.05	0.89	187.4	6.64	129
10/5/2018	ETFSL300	0.042	0.051	0.08	0.56	180.2	6.67	131
10/5/2018	ETFSL400	0.051	0.056	0.1	0.5	170.7	6.71	133
10/5/2018	ETFSL500	0.032	0.04	0.08	0.45	164	6.68	124
17/5/2018	ETAU	0.868	0.795	3.32	3.32	160	6.78	383
17/5/2018	ETFSL100	0.634	0.605	<0.05	2.66	178.5	7.12	375
17/5/2018	ETFSL200	0.249	0.22	0.25	1.87	178.5	6.85	246
17/5/2018	ETFSL300	0.176	0.178	0.12	1.57	175.8	6.84	230
17/5/2018	ETFSL400	0.146	0.14	0.1	1.32	179.3	6.78	202
17/5/2018	ETFSL500	0.113	0.102	0.12	1.36	179.6	6.65	176
24/5/2018	ETAU	0.763	0.795	3.22	3.22	192.8	7.22	381
24/5/2018	ETFSL100	0.563	0.63	<0.05	4.36	194.2	7.12	375
24/5/2018	ETFSL200	0.128	0.128	0.58	1.03	189.4	6.95	158
24/5/2018	ETFSL300	0.04	0.053	0.05	0.62	102.2	6.78	125
24/5/2018	ETFSL400	0.037	0.043	0.07	0.39	184.9	6.72	145
24/5/2018	ETFSL500	0.031	0.037	<0.05	0.33	185.2	6.76	120
31/5/2018	ETAU	0.797	0.812	3.74	3.74	193.3	7.22	378
31/5/2018	ETFSL100	0.626	0.598	<0.05	2.57	197.5	7.12	375
31/5/2018	ETFSL200	0.362	0.344	0.48	2.18	187.7	7.18	260
31/5/2018	ETFSL300	0.177	0.171	0.24	1.44	185.8	7.18	188
31/5/2018	ETFSL400	0.178	0.162	0.67	1.86	179.9	7.19	184
31/5/2018	ETFSL500	0.098	0.096	0.11	0.89	176	7.12	154
7/6/2018	ETAU	1.19	1.24	3.12	4.03	188.4	6.8	361
7/6/2018	ETFSL100	0.889	0.942	1.43	2.91	185.7	7.19	342
7/6/2018	ETFSL200	0.8	0.792	1.29	3.2	189.2	7.17	327
7/6/2018	ETFSL300	0.625	0.67	0.9	3.42	178.7	7.16	304
7/6/2018	ETFSL400	0.402	0.442	0.06	4.24	182.9	7.25	271
7/6/2018	ETFSL500	0.347	0.358	0.35	3.74	183.4	7.27	268
14/6/2018	ETAU	0.674	0.686	2.1	3.89	99.8	6.94	314
14/6/2018	ETFSL100	0.34	0.539	0.26	2.33	73.3	7.27	309
14/6/2018	ETFSL200	0.47	0.459	0.72	2.12	178.9	7.09	300
14/6/2018	ETFSL300	0.377	0.37	0.26	2.25	167.8	7.12	264
14/6/2018	ETFSL400	0.292	0.288	0.08	2.17	192.4	7.15	228
14/6/2018	ETFSL500	0.255	0.251	0.08	1.94	203.5	7.04	201

ATTACHMENT A (Continued)
Water Quality Data for Sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100

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)
20/6/2018	ETAU	0.657	0.628	3.62	5.4	188.3	6.72	337
20/6/2018	ETFSL100	0.457	0.468	0.9	3.16	19	6.9	324
20/6/2018	ETFSL200	0.371	0.39	0.72	2.4	191.4	6.95	320
20/6/2018	ETFSL300	0.384	0.377	0.34	2.42	190.5	6.98	322
20/6/2018	ETFSL400	0.331	0.333	<0.05	2.84	191.2	7	312
20/6/2018	ETFSL500	0.256	0.28	<0.05	2.67	184.8	7.01	273
28/6/2018	ETAU	0.634	0.687	4.08	7	185.8	6.6	328
28/6/2018	ETFSL100	0.501	0.559	1.04	3.95	188.8	7.02	329
28/6/2018	ETFSL200	0.409	0.422	1.45	3.94	187.2	6.82	306
28/6/2018	ETFSL300	0.176	0.207	<0.05	1.95	199.7	6.77	190
28/6/2018	ETFSL400	0.108	0.111	<0.05	1.04	198.5	6.67	128
28/6/2018	ETFSL500	0.075	0.079	0.05	0.79	179.7	6.61	118
2/7/2018	ETAU	0.637	0.706	3.29	6.24	39.9	7.05	352
2/7/2018	ETFSL100	0.519	0.558	0.97	4.38	191	7.31	351
2/7/2018	ETFSL200	0.395	0.416	0.86	2.28	191.4	7.34	344
2/7/2018	ETFSL300	0.391	0.426	1.19	3.57	193.9	7.25	342
2/7/2018	ETFSL400	0.327	0.349	0.15	3.82	195.4	7.22	311
2/7/2018	ETFSL500	0.226	0.258	0.06	2.37	194.2	7.15	252
12/7/2018	ETAU	0.587	0.626	1.11	2.33	456.6	7.31	370
12/7/2018	ETFSL100	0.501	0.492	0.63	1.6	163.5	7.59	367
12/7/2018	ETFSL200	0.342	0.338	0.73	1.42	160.3	7.5	355
12/7/2018	ETFSL300	0.324	0.373	1.16	2.87	154.8	7.49	361
12/7/2018	ETFSL400	0.338	0.353	0.44	3.85	1596	7.55	356
12/7/2018	ETFSL500	0.212	0.218	<0.05	2.45	158.3	7.37	259
19/7/2018	ETAU	0.726	0.712	0.63	3.5	177	7	377
19/7/2018	ETFSL100	0.576	0.565	0.11	3.01	202.8	7.37	371
19/7/2018	ETFSL200	0.444	0.4	0.36	2.35	200.6	7.24	360
19/7/2018	ETFSL300	0.462	0.402	1.11	3.68	202	7.21	372
19/7/2018	ETFSL400	0.431	0.374	0.57	3.48	203.3	7.33	384
19/7/2018	ETFSL500	0.288	0.279	<0.05	3.33	203.6	7.21	330
26/7/2018	ETAU	0.725	0.753	4.1	6.53	-5.9	6.59	364
26/7/2018	ETFSL100	0.522	0.566	0.19	2.89	10.8	6.78	356
26/7/2018	ETFSL200	0.31	0.353	0.29	1.73	9.8	6.79	351
26/7/2018	ETFSL300	0.35	0.35	1.59	2.55	-0.3	6.71	353
26/7/2018	ETFSL400	0.375	0.397	1.92	3.56	-12.3	6.75	370
26/7/2018	ETFSL500	0.346	0.431	<0.05	3.13	107.8	6.88	378
02/8/2018	ETAU	0.744	0.733	0.44	2.96	54.8	6.53	366
02/8/2018	ETFSL100	0.526	0.544	0.09	2.48	325	6.57	359
02/8/2018	ETFSL200	0.321	0.350	0.39	1.44	265.1	6.51	352
02/8/2018	ETFSL300	0.337	0.348	1.79	2.59	263.4	6.39	355
02/8/2018	ETFSL400	0.398	0.420	3.38	4.5	251.8	6.59	397
02/8/2018	ETFSL500	0.395	0.429	1.14	3.44	236.4	6.8	386
09/8/2018	ETAU	0.637	0.785	2.11	5.08	257.2	6.73	367
09/8/2018	ETFSL100	0.538	0.644	0.18	5.24	256.6	6.92	363
09/8/2018	ETFSL200	0.276	0.316	0.20	1.56	248.6	6.86	355
09/8/2018	ETFSL300	0.285	0.306	1.68	2.50	233.3	6.75	355
09/8/2018	ETFSL400	0.375	0.416	5.43	6.97	254.2	6.99	436
09/8/2018	ETFSL500	0.373	0.401	3.02	4.50	253.7	6.9	390

ATTACHMENT A (Continued)
Water Quality Data for Sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100

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)
16/8/2018	ETAU	0.672	0.797	1.53	3.99	250.1	6.71	365
16/8/2018	ETFSL100	0.491	0.584	0.08	2.32	264.8	7.16	362
16/8/2018	ETFSL200	0.263	0.304	0.1	1.17	265.4	7.13	353
16/8/2018	ETFSL300	0.249	0.298	1.02	1.98	267.4	6.96	349
16/8/2018	ETFSL400	0.336	0.351	3.57	4.23	260.7	7.12	405
16/8/2018	ETFSL500	0.309	0.358	1.69	3.18	261.3	6.98	386
23/8/2018	ETAU	0.724	0.701	0.92	3.12	266.4	7.03	358
23/8/2018	ETFSL100	0.489	0.505	0.07	2.26	271.7	6.97	351
23/8/2018	ETFSL200	0.274	0.270	0.1	1.01	267.1	7.11	344
23/8/2018	ETFSL300	0.227	0.273	0.83	1.83	265.6	7.04	341
23/8/2018	ETFSL400	0.267	0.279	2.11	2.50	261.8	7.05	365
23/8/2018	ETFSL500	0.352	0.337	2.34	3.41	258.1	7.23	382
30/8/2018	ETAU	0.632	0.696	<0.05	2.52	99.5	7.97	368
30/8/2018	ETFSL100	0.440	0.491	<0.05	2.09	77	7.73	354
30/8/2018	ETFSL200	0.225	0.243	0.06	0.85	23.2	7.85	350
30/8/2018	ETFSL300	0.236	0.248	0.96	1.70	256.2	7.78	345
30/8/2018	ETFSL400	0.327	0.343	3.30	4.50	252.5	8.20	399
30/8/2018	ETFSL500	0.316	0.350	2.05	3.65	228.1	8.18	387
05/9/2018	ETAU	0.688	0.683	0.66	4.54	25.2	7.44	363
05/9/2018	ETFSL100	0.476	0.483	<0.05	2.06	53.5	7.77	350
05/9/2018	ETFSL200	0.234	0.23	0.09	0.98	12.5	7.71	340
05/9/2018	ETFSL300	0.259	0.238	1.08	1.71	-12.5	7.57	333
05/9/2018	ETFSL400	0.367	0.371	4.53	5.96	-42.4	7.65	404
05/9/2018	ETFSL500	0.336	0.318	2.52	3.73	1.5	7.69	372
12/9/2018	ETAU	0.653	0.719	<0.05	3.72	178.2	7.05	360
12/9/2018	ETFSL100	0.461	0.521	<0.05	2.72	71.7	7.54	356
12/9/2018	ETFSL200	0.25	0.28	<0.05	0.96	20.1	7.49	346
12/9/2018	ETFSL300	0.3	0.301	0.41	1.73	3.1	7.38	345
12/9/2018	ETFSL400	0.389	0.34	2.15	2.77	-62.7	7.39	359
12/9/2018	ETFSL500	0.401	0.39	1.04	3.87	-17.4	7.43	381
20/9/2018	ETAU	0.392	0.721	1.14	2.49	272.4	7.11	362
20/9/2018	ETFSL100	0.179	0.467	<0.05	1.88	272.4	7.18	350
20/9/2018	ETFSL200	0.182	0.194	0.63	0.7	25.2	7.17	341
20/9/2018	ETFSL300	0.227	0.233	0.63	1.5	-11.9	7.08	337
20/9/2018	ETFSL400	0.386	0.356	2.66	5.39	-34.2	7.21	397
20/9/2018	ETFSL500	0.394	0.358	1.1	3.15	25.4	7.25	371
27/9/2018	ETAU	0.58	0.763	<0.05	2.24	234	7.33	400
27/9/2018	ETFSL100	0.434	0.493	<0.05	1.54	268.1	7.64	392
27/9/2018	ETFSL200	0.178	0.188	<0.05	0.61	272.8	7.55	381
27/9/2018	ETFSL300	0.231	0.239	0.4	1.6	270.8	7.33	377
27/9/2018	ETFSL400	0.331	0.325	1.49	3.55	263.1	7.41	400
27/9/2018	ETFSL500	0.335	0.375	0.83	3.46	266.8	7.67	416
05/10/2018	ETAU	0.39	0.359	2.14	3.49	274.6	7.28	250
05/10/2018	ETFSL100	0.297	0.686	0.32	12	271	7.57	286
05/10/2018	ETFSL200	0.305	0.308	0.29	2.72	269.7	7.67	295
05/10/2018	ETFSL300	0.272	0.305	0.32	2.72	267.7	7.66	291
05/10/2018	ETFSL400	0.364	0.299	0.63	2.95	259.8	7.73	294
05/10/2018	ETFSL500	0.251	0.245	0.36	2.11	242.9	7.58	271

ATTACHMENT A (Continued)
Water Quality Data for Sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100

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)
10/10/2018	ETAU	0.569	0.635	1.8	2.68	266.6	6.59	308
10/10/2018	ETFSL100	0.571	0.602	1.62	2.25	267.5	6.66	304
10/10/2018	ETFSL200	0.494	0.558	1.07	1.88	269.6	6.78	302
10/10/2018	ETFSL300	0.492	0.49	1.05	1.42	269.6	6.81	303
10/10/2018	ETFSL400	0.479	0.503	2.3	3.04	267.3	7.07	334
10/10/2018	ETFSL500	0.48	0.512	1.36	2	266.7	6.98	308
15/10/2018	ETAU	0.325	0.333	0.9	1.33	285.6	6.35	269
15/10/2018	ETFSL100	0.298	0.302	0.69	1.2	278.5	6.36	259
15/10/2018	ETFSL200	0.316	0.336	0.66	1.9	276.9	6.37	262
15/10/2018	ETFSL300	0.286	0.298	0.57	1.41	279.5	6.39	259
15/10/2018	ETFSL400	0.276	0.3	0.6	1.38	279.9	6.56	266
15/10/2018	ETFSL500	0.273	0.279	0.63	1.18	263	7.71	267
22/10/2018	ETAU	0.274	0.259	0.76	1.26	276.9	6.52	281
22/10/2018	ETFSL100	0.25	0.244	0.56	1.13	270.7	6.57	278
22/10/2018	ETFSL200	0.235	0.233	0.41	1.01	270.4	6.53	275
22/10/2018	ETFSL300	0.236	0.228	0.42	1	269	6.58	275
22/10/2018	ETFSL400	0.304	0.263	1.8	2.51	264.8	7.01	321
22/10/2018	ETFSL500	0.184	0.229	0.26	1.19	258.5	6.74	279
30/10/2018	ETAU	0.432	0.431	1.79	2.55	15.1	6.65	290
30/10/2018	ETFSL100	0.376	0.39	0.76	1.78	-0.4	6.91	286
30/10/2018	ETFSL200	0.336	0.363	0.37	1.47	3.8	6.92	285
30/10/2018	ETFSL300	0.341	0.35	0.39	1.32	7.6	6.99	291
30/10/2018	ETFSL400	0.36	0.364	1.58	3.1	-77.3	7.09	329
30/10/2018	ETFSL500	0.34	0.351	0.5	1.63	-4.2	7.05	296
08/11/2018	ETAU	0.635	0.553	0.76	3.15	23.3	7.07	307
08/11/2018	ETFSL100	0.429	0.433	0.14	1.59	12.9	7.35	307
08/11/2018	ETFSL200	0.333	0.34	0.06	1	20	7.31	303
08/11/2018	ETFSL300	0.333	0.329	0.06	1.1	5.4	7.32	304
08/11/2018	ETFSL400	0.431	0.403	5.31	5.49	247.1	7.47	385
08/11/2018	ETFSL500	0.315	0.325	0.37	1.54	248.4	7.30	310
15/11/2018	ETAU	0.609	0.628	0.53	2.04	264.1	7.09	334
15/11/2018	ETFSL100	0.399	0.414	<0.05	1.6	172.9	7.32	328
15/11/2018	ETFSL200	0.308	0.331	<0.05	1.34	272	7.31	325
15/11/2018	ETFSL300	0.321	0.298	0.08	1.15	271	7.28	324
15/11/2018	ETFSL400	0.396	0.383	1.44	4.72	262.5	7.35	373
15/11/2018	ETFSL500	0.328	0.336	0.24	1.76	267.3	7.38	345
19/11/2018	ETWQ AU	0.647	- ⁶	0.08	2.42	259.1	7.22	345
22/11/2018	ETFSL200	0.264	0.298	<0.05	0.82	30.9	7.29	355
22/11/2018	ETFSL500	0.38	0.376	0.67	1.88	-3.3	7.50	373
22/11/2018	CONFLU1	0.085	0.088	0.12	0.9	-1.1	7.51	307
22/11/2018	WARARM5	0.018	0.046	0.25	1	54.6	7.57	297
22/11/2018	WDFS1	0.105	0.114	0.12	1.15	40.1	7.53	307
22/11/2018	WDFS1+100	0.103	0.119	0.1	1.06	26	7.55	306

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

ATTACHMENT A (Continued)
Water Quality Data for Sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100

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)
26/11/2018	ETWQ AU	0.538	- ⁶	<0.05	1.36	83.8	7.11	354
29/11/2018	ETFSL200	0.139	0.15	0.54	1.2	36.1	7.07	195
29/11/2018	ETFSL500	0.167	0.147	0.3	1.19	30.1	6.94	195
29/11/2018	CONFLU1	0.158	0.108	0.27	1.18	29.5	7.19	200
29/11/2018	WARARM5	0.055	0.052	0.18	0.92	66.7	7.5	206
29/11/2018	WDFS1	0.082	0.074	0.18	0.21	36.7	7.8	206
29/11/2018	WDFS1+100	0.103	0.094	0.19	1	38.4	7.36	200
4/12/2018	ETWQ AU	0.433	- ⁶	1.65	2.36	30.6	7	266
6/12/2018	ETFSL200	0.283	0.295	0.26	1.04	242.7	6.97	260
6/12/2018	ETFSL500	0.29	0.3	0.62	1.47	249.5	7.23	270
6/12/2018	CONFLU1	0.112	0.114	0.12	1.13	243.8	7.24	243
6/12/2018	WARARM5	0.034	0.035	<0.05	0.75	250.1	7.29	238
6/12/2018	WDFS1	0.122	0.134	0.07	1.12	241.4	7.29	246
6/12/2018	WDFS1+100	0.109	0.126	<0.05	0.99	251.1	7.3	245
12/12/2018	ETAU	0.428	0.484	1.49	3.33	-	6.86	269
12/12/2018	ETFSL200	0.215	0.232	<0.05	0.42	255.3	7.4	245
12/12/2018	ETFSL500	0.276	0.284	0.27	0.89	251.9	7.41	262
12/12/2018	CONFLU1	0.081	0.091	0.45	0.8	17.9	7.39	219
12/12/2018	WARARM5	0.03	0.042	<0.05	0.58	236.4	7.53	214
12/12/2018	WDFS1	0.108	0.121	0.41	1.09	27.5	7.44	225
12/12/2018	WDFS1+100	0.105	0.12	<0.05	0.99	42.3	7.24	243
17/12/2018	ETWQ AU	0.102	- ⁶	0.18	0.75	280.3	6.50	152
17/12/2018	ETFSL200	0.076	0.084	0.17	0.7	274.8	6.76	152
17/12/2018	ETFSL500	0.087	0.086	0.19	0.76	274.8	6.56	150
17/12/2018	CONFLU1	0.068	0.068	0.16	0.78	270.9	6.64	152
17/12/2018	WARARM5	0.023	0.032	0.08	0.54	257.5	6.77	156
17/12/2018	WDFS1	0.069	0.062	0.15	0.75	273	6.67	153
17/12/2018	WDFS1+100	0.055	0.063	0.12	0.71	278.4	6.71	154
27/12/2018	ETAU	0.263	0.277	0.61	1.81	24.3	6.72	217
27/12/2018	ETFSL200	0.196	0.194	0.09	0.93	30.6	7.11	216
27/12/2018	ETFSL500	0.219	0.213	0.3	1.37	-6.9	7.13	224
27/12/2018	CONFLU1	0.071	0.075	<0.05	0.86	21.4	7.15	208
27/12/2018	WARARM5	0.045	0.036	<0.05	0.48	3.4	7.3	206
27/12/2018	WDFS1	0.108	0.11	0.06	0.99	24.9	7.12	210
27/12/2018	WDFS1+100	0.101	0.105	<0.05	0.93	37.4	7.13	210
3/01/2019	ETWQ AU	0.335	0.443	<0.05	1.57	110.1	7.35	300
3/01/2019	ETFSL200	0.159	0.226	<0.05	0.63	113.1	7.63	290
3/01/2019	ETFSL500	0.265	0.274	0.12	1.32	11.5	7.5	302
3/01/2019	CONFLU1	0.143	0.16	<0.05	1.21	4.8	7.29	270
3/01/2019	WARARM5	0.055	0.054	<0.05	0.64	56.4	7.46	256
3/01/2019	WDFS1	0.106	0.14	<0.05	1.27	72	7.45	265
3/01/2019	WDFS1+100	0.101	0.138	<0.05	1.16	56.2	7.42	263
10/01/2019	ETWQ AU	0.438	0.282	<0.05	1.41	244.1	6.92	268
10/01/2019	ETFSL200	0.216	0.246	<0.05	0.62	26.8	8.03	279
10/01/2019	ETFSL500	0.22	0.262	<0.05	1.18	-9.3	7.64	300
10/01/2019	CONFLU1	0.129	0.141	<0.05	1.11	-33.7	7.55	269
10/01/2019	WARARM5	0.042	0.041	<0.05	0.6	90.3	7.62	252
10/01/2019	WDFS1	0.061	0.087	<0.05	0.92	22.1	7.59	242
10/01/2019	WDFS1+100	0.061	0.074	<0.05	0.97	6.9	7.58	240

ATTACHMENT A (Continued)
Water Quality Data for Sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100

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)
16/01/2019	ETWQ AU	0.433	0.454	<0.05	1.86	171.1	6.75	282
16/01/2019	ETFSL200	0.18	0.189	<0.05	0.4	258.4	7.67	275
16/01/2019	ETFSL500	0.244	0.233	0.38	1	262.4	7.65	303
16/01/2019	CONFLU1	0.058	0.049	0.12	0.86	261.2	7.68	249
16/01/2019	WARARM5	0.025	0.028	0.11	0.52	268.1	7.82	242
16/01/2019	WDFS1	0.046	0.044	0.16	0.92	263.5	7.76	256
16/01/2019	WDFS1+100	0.047	0.044	0.19	0.94	259.2	7.79	260
23/01/2019	ETWQ AU	0.579	0.661	<0.05	2.09	184.3	6.78	292
23/01/2019	ETFSL200	0.171	0.204	<0.05	0.38	96.8	7.65	286
23/01/2019	ETFSL500	0.28	0.284	0.2	1.62	-11.1	7.65	316
23/01/2019	CONFLU1	0.052	0.056	<0.05	1.11	5.6	7.7	264
23/01/2019	WARARM5	0.043	0.036	<0.05	0.74	-38.4	7.7	253
23/01/2019	WDFS1	0.032	0.042	<0.05	1.08	19.6	7.77	266
23/01/2019	WDFS1+100	0.02	0.029	<0.05	0.92	-16.6	7.83	266
29/01/2019	ETAU	0.62	0.578	0.07	1.52	66.8	6.7	294
29/01/2019	ETFSL200	0.19	0.216	<0.05	0.44	36.2	7.23	282
29/01/2019	ETFSL500	0.249	0.279	<0.05	1.48	12.1	7.34	310
29/01/2019	CONFLU1	0.048	0.07	<0.05	1.05	-20.8	7.54	282
29/01/2019	WARARM5	0.031	0.028	<0.05	0.54	49.5	7.34	251
29/01/2019	WDFS1	0.027	0.038	<0.05	0.96	29.7	7.49	260
29/01/2019	WDFS1+100	0.03	0.03	<0.05	0.91	9.9	7.49	260
4/02/2019	ETAU	0.559	0.635	<0.05	1.04	51.1	6.8	283
4/02/2019	ETFSL200	0.173	0.191	<0.05	0.34	9.1	7.26	275
4/02/2019	ETFSL500	0.221	0.276	0.31	1.7	-18.6	7.35	302
4/02/2019	CONFLU1	0.043	0.036	0.16	0.85	-51.7	7.55	252
4/02/2019	WARARM5	0.023	0.029	0.19	0.74	139.1	7.58	240
4/02/2019	WDFS1	0.012	0.021	0.27	0.8	73.2	7.71	252
4/02/2019	WDFS1+100	0.01	0.02	0.29	0.74	50	7.71	255
11/02/2019	ETAU	0.757	0.731	<0.05	1.5	261.4	6.86	288
11/02/2019	ETFSL200	0.197	0.206	<0.05	0.36	6.8	7.21	280
11/02/2019	ETFSL500	0.243	0.302	0.5	1.86	-33.9	7.3	306
11/02/2019	CONFLU1	0.023	0.033	0.24	0.94	-96.7	7.48	255
11/02/2019	WARARM5	0.019	0.026	0.24	0.66	53.5	7.46	243
11/02/2019	WDFS1	0.011	0.018	0.31	0.98	-26	7.62	259
11/02/2019	WDFS1+100	0.005	0.013	0.3	0.83	64.5	7.62	258
18/02/2019	ETAU	0.624	0.675	0.17	1.51	51.8	6.91	303
18/02/2019	ETFSL200	0.189	0.19	0.19	0.36	12.8	7.27	296
18/02/2019	ETFSL500	0.243	0.284	0.23	1.77	-15.6	7.86	277
18/02/2019	CONFLU1	0.041	0.035	0.13	0.9	6.6	7.73	291
18/02/2019	WARARM5	0.022	0.024	0.19	0.64	64.1	7.46	262
18/02/2019	WDFS1	0.007	0.012	0.31	0.78	26.7	7.83	279
18/02/2019	WDFS1+100	0.006	0.011	0.24	0.64	23.3	7.84	279
25/02/2019	ETAU	0.616	0.719	<0.05	0.93	273.1	7.19	283
25/02/2019	ETFSL200	0.198	0.199	<0.05	0.54	270.5	7.06	271
25/02/2019	ETFSL500	0.281	0.312	1.72	2.11	270.6	7.3	307
25/02/2019	CONFLU1	0.022	0.027	0.06	0.86	274.6	7.37	247
25/02/2019	WARARM5	0.014	0.023	<0.05	0.53	264.2	7.4	238
25/02/2019	WDFS1	0.009	0.017	<0.05	0.79	272.6	7.55	248
25/02/2019	WDFS1+100	0.004	0.014	0.05	0.92	264.9	7.6	246

24 July 2019

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 – March 2019

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 301-303 Water Management Plan (LW301-303 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 LW301-303 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 LW301-303 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 LW301-303 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 LW301-303 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.

Analysis conducted by Hydro Engineering & Consulting (2019) in accordance with the LW301-303 WMP, identified that the performance indicator for water resources reaching the Woronora Reservoir was exceeded for dissolved (i.e. filtered <0.45 µm fraction) manganese on the Eastern Tributary at site ETWQ AU in March 2019 (as there was not a similar exceedance of the trigger recorded at control site WOWQ 2 on the Woronora River). The performance indicator was not exceeded for field filtered iron or aluminium in March 2019 and therefore these parameters are not discussed in this report.

In accordance with the LW301-303 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*.

This assessment against the water quality subsidence impact performance measure has been prepared for March 2019 in consideration of:

- pluviograph data;
- flow data from the Eastern Tributary gauging location (GS 300078);
- groundwater level and groundwater quality results for Eastern Tributary sites up to 31 March 2019¹;
- surface water quality data at site ETWQ AU/ETAU² and sites further upstream on the Eastern Tributary up to 31 March 2019;
- surface water quality data at sites downstream of ETWQ AU/ETAU² up to 31 March 2019; 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 (Table 1).

Recently, above average rainfall was recorded in October, November and December 2018, and below average rainfall was recorded in January and February 2019. Total rainfall in March 2019 was 149.0 mm (at PV7) which is similar to the average of 154.3 mm (at Darkes Forest). Of this, 128.0 mm of rainfall was recorded over 15 to 22 March (with 86.0 mm recorded on 17 and 18 March), 17.5 mm of rainfall was recorded on 31 March and smaller rainfall events were recorded on 2, 3, 7, 13, 14, 25 and 26 March (0.5 to 1.5 mm). Shallow groundwater levels correlate with the rainfall trend.

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

² Site ETAU is the same as site ETWQ AU (i.e. samples are taken at the same location). The difference between the sites relates to the time of sampling. Site ETWQ AU monitoring is conducted on the same day as sites upstream of ETWQ AU/ETAU (shown on Charts 1 to 2), while site ETAU monitoring is conducted on the same day as the sites downstream of ETWQ AU/ETAU (described in Section 3 and shown on Charts 3 to 4). From 29 January 2019, water quality sampling of all sites on the Eastern Tributary was undertaken in a single day. Future reporting will identify the data at this site as site ETWQ AU.

Table 1 Monthly Rainfall Data (mm) for PV7, January 2018 to March 2019

Month/Year	Rainfall at PV7 (mm)	Rainfall at Darkes Forest (mm) [#]	Mean Monthly Rainfall at Darkes Forest (1894-2019) (mm) [#]
January 2018	48.0	12.0	132.4
February 2018	115.5	16.6	159.6
March 2018	151.0	45.0	153.9
April 2018	32.0	21.6	126.8
May 2018	12.5	8.0	129.1
June 2018	112.0	91.8	146.6
July 2018	3.5	0.4	96.4
August 2018	12.5	15.8	89.1
September 2018	52.0	41.8	76.6
October 2018	197.0	200.8	91.9
November 2018	114.5	127.8	105.4
December 2018	120.0	91.0	103.8
January 2019	58.5	55.4	131.8
February 2019	41.0	54.2	158.7
March 2019	149.0	201.2	154.3

[#] 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 2019.

2. EASTERN TRIBUTARY SURFACE WATER AND GROUNDWATER QUALITY DATA

Plots of dissolved manganese at surface water quality sites ETWQ AU, ETWQ AQ (upstream on the Eastern Tributary) and WOWQ 2 (control site) and at groundwater quality site ETGW2, are compared to rainfall at PV7 (Chart 1) and streamflow at GS 300078 (Chart 2) (Figure 1).

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.

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. <0.1 mg/L, exist in the natural creek water. Dissolved manganese is easily diluted by freshwater flow to low levels when higher creek flows occur.

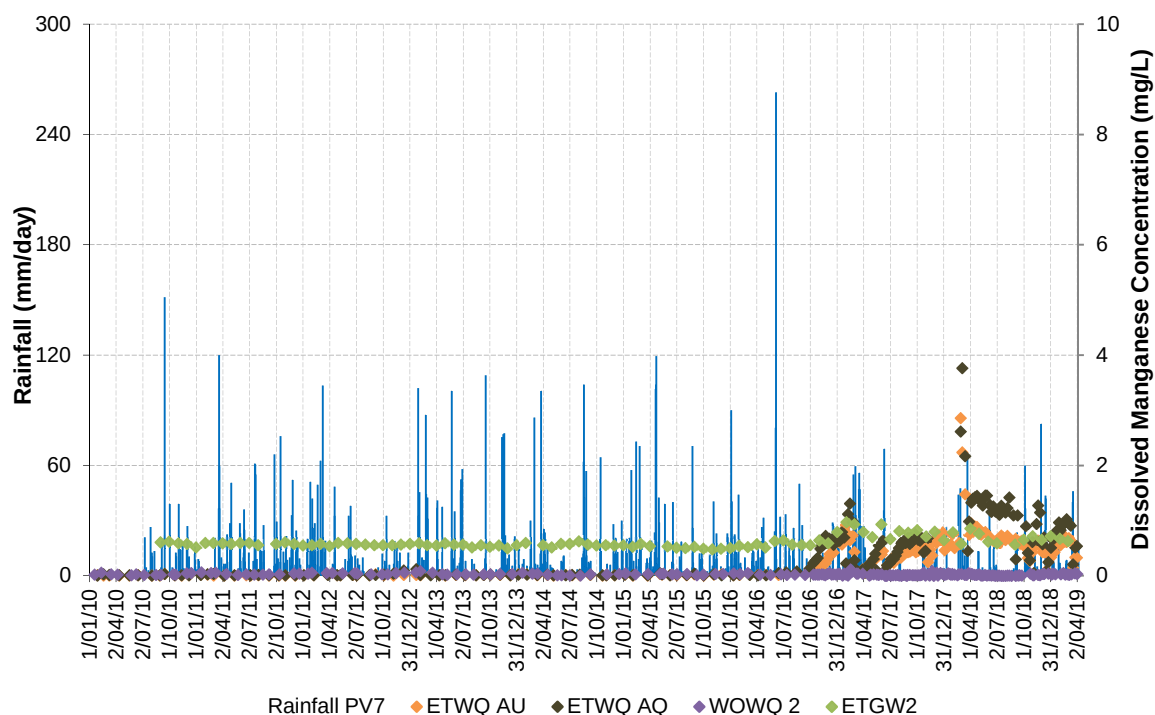


Chart 1 Dissolved Manganese Concentrations at Surface Water Quality Sites ETWQ AU, ETWQ AQ and WOWQ 2 and Groundwater Quality Site ETGW2 and Rainfall (to 31 March 2019)

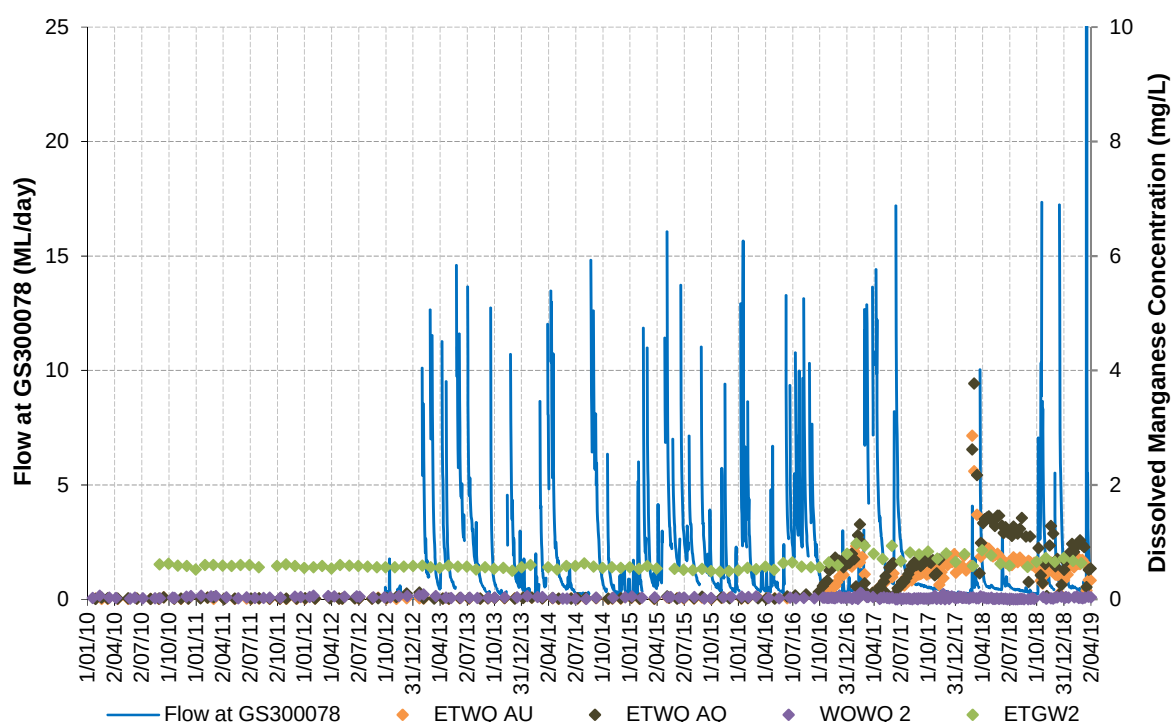
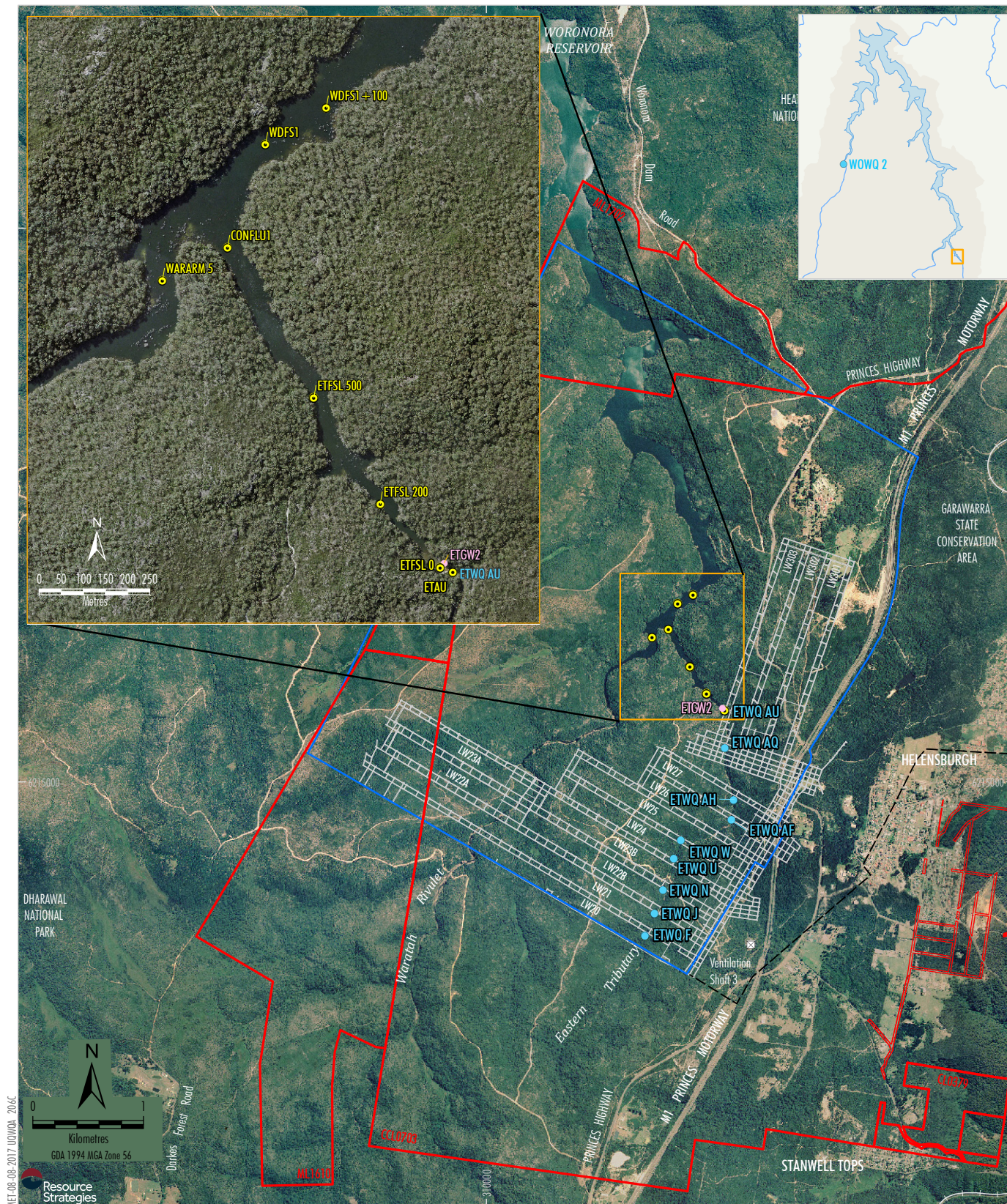


Chart 2 Dissolved Manganese Concentrations at Surface Water Quality Sites ETWQ AU, ETWQ AQ and WOWQ 2 and Groundwater Quality Site ETGW2 and Stream Flow (to 31 March 2019)



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 on Eastern Tributary
- Water Quality Site on Eastern Tributary and/or in Woronora Reservoir
- Groundwater Quality Site of Eastern Tributary

Peabody
METROPOLITAN COAL

Surface Water Quality Sampling of
Eastern Tributary Watercourse
and Woronora Reservoir

Figure 1

In March 2019, dissolved manganese concentrations at site ETWQ AU ranged between 0.153 mg/L and 0.688 mg/L. 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 Eastern Tributary can be diluted by creek flow. In January and February 2019, lower rainfalls resulted in increasing levels of dissolved manganese. As predicted, the heavy rainfall on 17 and 18 March 2019 resulted in a reduction in the dissolved manganese concentrations observed on 18 and 26 March 2019.

Water quality parameters pertinent to the increase in manganese (dissolved-filtered <0.45 µm fraction) concentration are pH, oxidation-reduction potential (ORP) and electrical conductivity (EC). 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 oxidizing and becomes reducing when ORP is below approximately 10 mV. In March 2019 at site ETWQ AU:

- pH (lab measurement) was generally consistent (pH 6.74 to pH 6.87);
- EC concentrations (lab measurement) ranged between 175 µS/cm and 322 µS/cm; and
- ORP (field measurement) ranged between 29.3 mV and 239.0 mV.

3. WATER RESOURCES REACHING THE WORONORA RESERVOIR

In accordance with the LW301-303 WMP, site ETWQ AU on the Eastern Tributary and control site WOWQ 2 on the Woronora River are used to assess the LW301-303 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. 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.

Metropolitan Coal has taken a photographic record of the watercourse / waterbody at the time of sampling, estimated the width of the watercourse / water body 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 (HCPL, 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 March 2019 the Woronora Reservoir water level varied between 156.03 mAHD (on 7 March 2019) and 155.88 mAHD (on 28 March 2019) (water level fluctuated following heavy rainfall in mid-March but overall reduced). The position of the reservoir water level can only be determined to the closest one metre contour, accordingly, the reservoir water level during March 2019 was between approximately 2,180 m (corresponding to 157 mAHD) and 2,190 m (corresponding to 156 mAHD) downstream of site ETSFL 0.

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 March 2019, the Woronora Reservoir water level was downstream of site WDFS1+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

Water quality data for filtered and total manganese for January 2018 to March 2019 at sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400 and ETFSL 500 is provided in Attachment A. As described earlier, sampling at sites ETFSL 100, ETSFL 300 and ETFSL 400 was suspended once monitoring at sites CONFLU1, WARARM5, WDFS1 and WDFS1+100 commenced on 22 November 2018³. Water quality data for filtered and total manganese since sampling commenced on 22 November 2018 at sites CONFLU1, WARARM5, WDFS1 and WDFS1+100 is also provided in Attachment A.

As described above, the Woronora Reservoir water level fluctuated in March 2019, and was downstream of site WDFS1+100. The results for dissolved and total manganese at sites ETAU, ETFSL 200, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100 since the commencement of monitoring to the end of March 2019, are shown on Charts 3 and 4, respectively. These sites provide a profile along the arm of the Woronora Reservoir.

³ Sampling at site ETAU was also temporarily suspended during this period but was resumed on 12 December 2018. Data from sampling undertaken at site ETWQ AU has been substituted for site ETAU during this period. Sampling at site ETAU was undertaken on 12 and 27 December 2018.

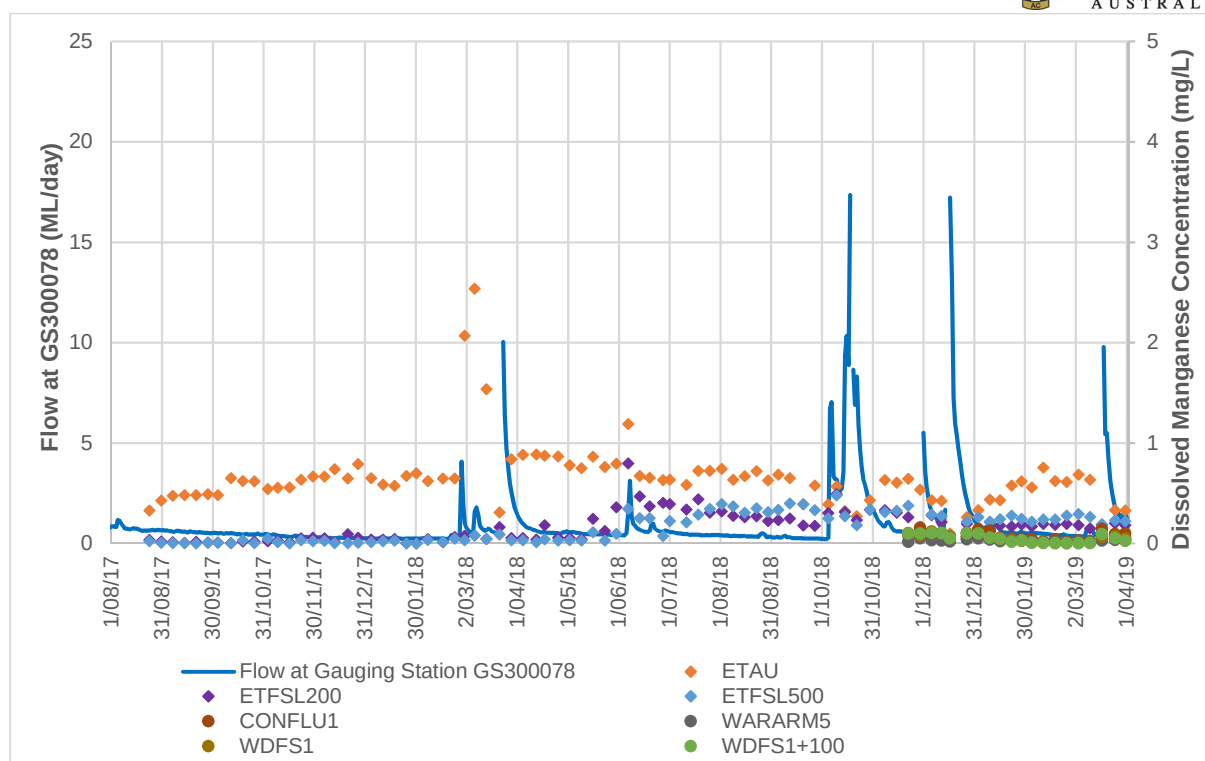


Chart 3 Dissolved Manganese Concentrations at Surface Water Quality Sites ETAU⁴, ETFSL 200, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100 and Stream Flow (August 2017 to 31 March 2019)

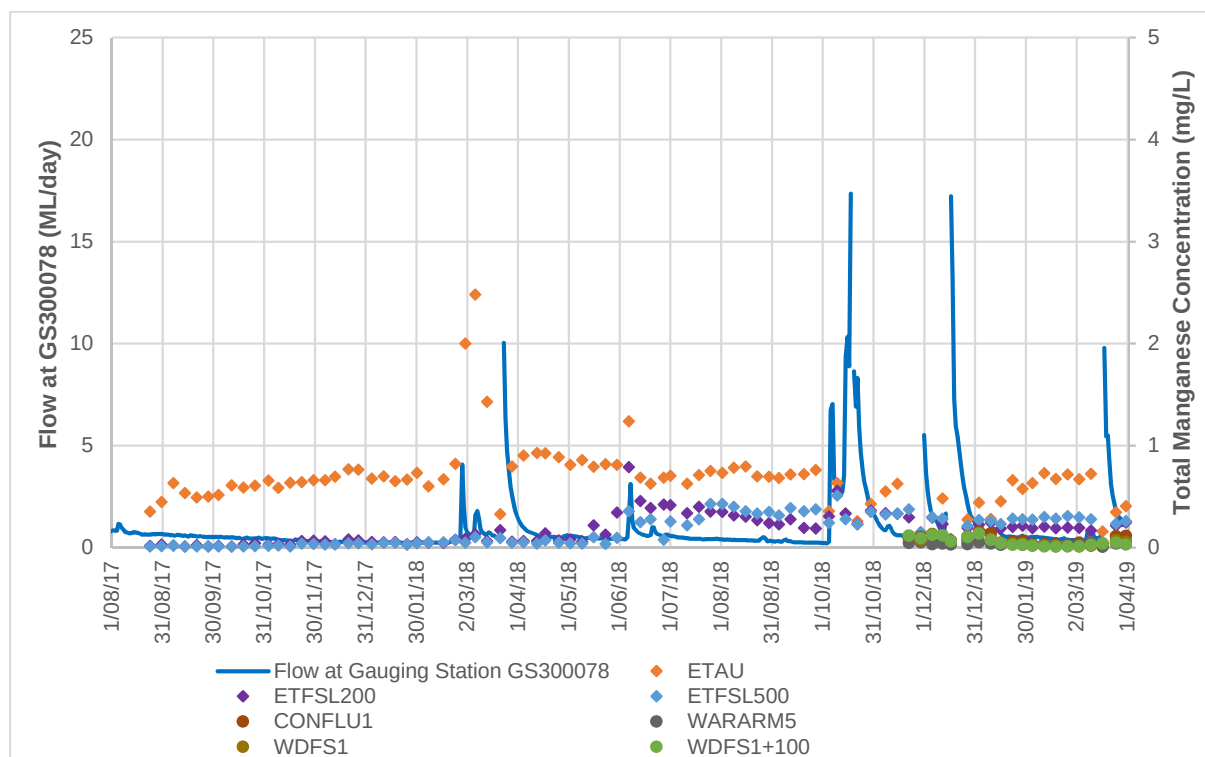


Chart 4 Total Manganese Concentrations at Surface Water Quality Sites ETAU⁵, ETFSL 200, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100 and Stream Flow (August 2017 to 31 March 2019)

⁴ Data from sampling undertaken at site ETWQ AU has been substituted for site ETAU from 22 November to 6 December 2018 and 17 December 2018. Sampling at site ETAU was undertaken on 12 and 27 December 2018.

The filtered manganese concentrations for March 2019 ranged from 0.153 mg/L to 0.688 mg/L at site ETAU, 0.152 mg/L to 0.205 mg/L at site ETFSL 200, 0.193 mg/L to 0.295 mg/L at site ETFSL 500, 0.024 mg/L to 0.146 mg/L at site CONFLU1, 0.018 mg/L to 0.039 mg/L at site WARARM5, 0.006 mg/L to 0.073 mg/L at site WDFS1 and 0.005 mg/L to 0.094 mg/L at site WDFS1+100 (Chart 3).

Total manganese concentrations for March 2019 followed similar trends, ranging from 0.160 mg/L to 0.726 mg/L at site ETAU, less than 0.010 mg/L to 0.217 mg/L at site ETFSL 200, less than 0.010 mg/L to 0.298 mg/L at site ETFSL 500, 0.020 mg/L to 0.114 mg/L at site CONFLU1, less than 0.010 mg/L to 0.052 mg/L at site WARARM5, 0.013 mg/L to 0.076 mg/L at site WDFS1 and 0.011 mg/L to 0.049 mg/L at site WDFS1+100 (Chart 4).

The Australian Drinking Water Guidelines (ADWG, 2011) are published by the National Health and Medical Research Council and updated most recently in 2018; 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 Australian Drinking Water Guideline before being supplied to the Helensburgh area as well as parts of the Sutherland Shire and northern Wollongong (WaterNSW, 2017).

The ADWG (2011) guidelines are based on total concentrations of manganese in water. The ADWG value is 0.5 mg/L total manganese for health. 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).

Water quality data for parameters pertinent to dissolved manganese for January 2018 to March 2019 at sites ETAU, ETFSL 200, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100 is provided in Attachment A. The water quality parameters (pH, ORP and EC) showed no unusual features. The ADWG value for pH (aesthetic) is pH 6.5 – 8.5. Samples at sites ETAU, ETFSL 200, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100 in March 2019 were within this range (Attachment A).

⁵ Total manganese is not sampled at site ETWQ AU, and therefore results were unable to be substituted for site ETAU from 22 November to 6 December 2018 and 17 December 2018. Sampling at site ETAU was undertaken on 12 and 27 December 2018.

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 March 2019, which has triggered 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.

Water reaching the Woronora Reservoir occurs where the inflowing stream water meets the reservoir waterbody. In March 2019, the Woronora Reservoir water level was downstream of site WDFS1+100. The mixing zone (downstream of the reservoir water level) is variable and influenced by the rate of inflow from the Eastern Tributary. Manganese concentrations are easily diluted by freshwater flow to low levels when higher creek flows occur.

The manganese concentrations reaching the Woronora Reservoir have 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.

6. REFERENCES

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Yours Sincerely,

Barry N. Noller

Barry N Noller

Principal Research Fellow

Centre For Mined Land Rehabilitation

ATTACHMENT A

WATER QUALITY DATA FOR SITES

ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, WARARM5, CONFLU1, WDFS1 and
WDFS1+100

JANUARY 2018 TO MARCH 2019

ATTACHMENT A

Water Quality Data for Sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100

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)
4/01/2018	ETAU	0.652	0.678	<0.05	0.59	132	7.37	351
4/01/2018	ETFSL100	0.281	0.305	<0.05	0.82	125.3	7.75	337
4/01/2018	ETFSL200	0.042	0.057	<0.05	0.68	132.7	7.05	118
4/01/2018	ETFSL300	0.038	0.052	0.06	0.6	13.2	6.92	111
4/01/2018	ETFSL400	0.024	0.037	<0.05	0.47	129.9	6.96	110
4/01/2018	ETFSL500	0.016	0.036	<0.05	0.46	121.7	6.74	111
11/01/2018	ETAU	0.588	0.698	0.13	1.36	55.9	7.56	364
11/01/2018	ETFSL100	0.197	0.237	<0.05	0.55	24.3	7.88	345
11/01/2018	ETFSL200	0.041	0.053	<0.05	0.63	101	7.14	139
11/01/2018	ETFSL300	0.067	0.078	1.89	2.1	35.2	6.88	128
11/01/2018	ETFSL400	0.106	0.052	0.47	0.66	52	6.84	124
11/01/2018	ETFSL500	0.026	0.046	0.06	0.78	94.4	7.01	122
18/01/2018	ETAU	0.577	0.653	<0.05	1.15	136.4	7.67	366
18/01/2018	ETFSL100	0.211	0.22	<0.05	0.64	131.9	7.74	353
18/01/2018	ETFSL200	0.046	0.055	<0.05	0.79	131.2	7	129
18/01/2018	ETFSL300	0.058	0.057	0.06	0.84	125.5	6.94	126
18/01/2018	ETFSL400	0.038	0.048	<0.05	0.71	139.6	6.96	125
18/01/2018	ETFSL500	0.032	0.049	<0.05	0.78	121.4	6.94	123
25/01/2018	ETAU	0.674	0.668	<0.05	0.52	56.8	7.55	378
25/01/2018	ETFSL100	0.074	0.152	<0.05	0.46	-4.4	7.82	360
25/01/2018	ETFSL200	0.007	0.034	<0.05	0.41	70.6	7.16	120
25/01/2018	ETFSL300	0.005	0.035	<0.05	0.46	22.8	7.09	117
25/01/2018	ETFSL400	0.001	0.032	<0.05	0.41	55	7	118
25/01/2018	ETFSL500	0.002	0.03	<0.05	0.35	288.6	7.04	115
31/01/2018	ETAU	0.7	0.734	<0.05	0.67	82.3	7.46	374
31/01/2018	ETFSL100	0.089	0.147	<0.05	0.36	30.7	8.01	361
31/01/2018	ETFSL200	0.005	0.052	<0.05	0.57	79.1	7.28	139
31/01/2018	ETFSL300	0.002	0.049	<0.05	0.66	42.7	7.08	123
31/01/2018	ETFSL400	0.001	0.046	<0.05	0.54	92	7.05	122
31/01/2018	ETFSL500	0.001	0.044	<0.05	0.55	71	7.01	122
7/02/2018	ETAU	0.625	0.601	<0.05	0.65	106.9	7.39	374
7/02/2018	ETFSL100	0.102	0.129	<0.05	0.75	14.8	7.78	359
7/02/2018	ETFSL200	0.047	0.051	<0.05	0.48	80.4	7.04	119
7/02/2018	ETFSL300	0.049	0.059	<0.05	0.65	38.2	6.97	119
7/02/2018	ETFSL400	0.112	0.07	0.27	0.74	1	6.77	118
7/02/2018	ETFSL500	0.038	0.053	0.11	0.58	86.6	6.92	117
16/02/2018	ETAU	0.65	0.67	<0.05	0.66	158.8	7.54	380
16/02/2018	ETFSL100	0.075	0.126	<0.05	0.33	163.9	7.96	369
16/02/2018	ETFSL200	0.016	0.048	<0.05	0.6	152	7.05	128
16/02/2018	ETFSL300	0.023	0.058	<0.05	0.81	121.1	6.88	124
16/02/2018	ETFSL400	0.012	0.049	<0.05	0.54	143.2	6.83	121
16/02/2018	ETFSL500	0.019	0.054	<0.05	0.54	144.1	6.82	120
23/02/2018	ETAU	0.651	0.822	<0.05	1.72	163.6	7.21	400
23/02/2018	ETFSL100	0.12	0.2	<0.05	0.5	31.8	7.75	384
23/02/2018	ETFSL200	0.068	0.078	<0.05	0.93	55.8	6.92	140
23/02/2018	ETFSL300	0.065	0.07	0.07	0.88	55.2	6.8	136
23/02/2018	ETFSL400	0.062	0.075	<0.05	0.93	41.8	6.78	135
23/02/2018	ETFSL500	0.049	0.075	<0.05	1.07	-119.2	6.78	132

ATTACHMENT A (Continued)
Water Quality Data for Sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100

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)
1/03/2018	ETAU	2.07	2	5.96	5.69	83.1	6.32	492
1/03/2018	ETFSL100	1.78	1.72	2.41	2.7	36.7	6.31	464
1/03/2018	ETFSL200	0.08	0.087	0.08	0.83	59	6.45	133
1/03/2018	ETFSL300	0.059	0.069	0.16	0.79	43.5	6.36	127
1/03/2018	ETFSL400	0.05	0.064	0.1	1.03	32	6.35	125
1/03/2018	ETFSL500	0.036	0.051	0.08	0.65	2.3	6.38	123
7/03/2018	ETAU	2.54	2.48	7.52	7.23	168.1	6.12	514
7/03/2018	ETFSL100	2.21	2.15	4.12	4.43	158.6	6.11	479
7/03/2018	ETFSL200	0.082	0.132	0.07	0.92	166.8	6.29	147
7/03/2018	ETFSL300	0.108	0.12	<0.05	0.91	149	6.32	147
7/03/2018	ETFSL400	0.088	0.11	<0.05	0.78	161.1	6.79	142
7/03/2018	ETFSL500	0.083	0.102	0.07	0.76	154.5	6.32	138
14/03/2018	ETAU	1.54	1.43	3.72	6.68	41.4	6.58	450
14/03/2018	ETFSL100	0.907	1.08	0.55	3.58	31.6	6.95	431
14/03/2018	ETFSL200	0.047	0.066	<0.05	0.63	76	6.84	135
14/03/2018	ETFSL300	0.048	0.054	<0.05	0.56	41.4	6.83	133
14/03/2018	ETFSL400	0.064	0.055	0.06	0.61	3.3	6.86	132
14/03/2018	ETFSL500	0.047	0.052	<0.05	0.47	21.9	6.79	131
22/03/2018	ETAU	0.312	0.33	0.73	1.46	229.3	5.24	237
22/03/2018	ETFSL100	0.362	0.363	0.71	1.69	182.9	5.08	240
22/03/2018	ETFSL200	0.166	0.173	0.44	1.63	71.9	6.51	160
22/03/2018	ETFSL300	0.118	0.118	0.28	1.33	70.6	6.54	153
22/03/2018	ETFSL400	0.146	0.136	0.8	1.66	22.8	6.61	152
22/03/2018	ETFSL500	0.091	0.095	0.14	1.02	32.6	6.65	144
29/03/2018	ETAU	0.841	0.798	2.83	3.32	148	6.66	341
29/03/2018	ETFSL100	0.732	0.729	1.87	2.6	40.9	6.63	332
29/03/2018	ETFSL200	0.058	0.059	0.11	0.62	84.2	6.65	131
29/03/2018	ETFSL300	0.047	0.053	0.08	0.59	65.9	6.64	131
29/03/2018	ETFSL400	0.051	0.055	0.08	0.74	71.4	6.64	130
29/03/2018	ETFSL500	0.033	0.051	0.08	1.29	27.3	6.68	128
5/4/2018	ETAU	0.885	0.904	2.84	4.76	182.7	6.57	384
5/4/2018	ETFSL100	0.674	0.672	0.73	2.41	191.7	6.67	374
5/4/2018	ETFSL200	0.058	0.067	0.08	0.62	211.9	6.32	142
5/4/2018	ETFSL300	0.044	0.058	0.07	0.57	209.4	6.37	142
5/4/2018	ETFSL400	0.04	0.058	0.13	0.77	209.1	6.39	141
5/4/2018	ETFSL500	0.035	0.054	0.09	0.66	205.9	6.4	141
13/4/2018	ETAU	0.888	0.927	1.42	4.26	156.2	6.76	391
13/4/2018	ETFSL100	0.614	0.651	0.13	2.46	172.9	6.92	382
13/4/2018	ETFSL200	0.042	0.065	0.08	0.7	42.8	6.84	153
13/4/2018	ETFSL300	0.033	0.051	0.05	0.5	40.9	6.52	145
13/4/2018	ETFSL400	0.023	0.048	<0.05	0.59	64.1	6.6	147
13/4/2018	ETFSL500	0.014	0.04	<0.05	0.51	58.6	6.61	142
18/4/2018	ETAU	0.875	0.925	0.62	2.62	192.1	6.77	397
18/4/2018	ETFSL100	0.614	0.636	0.13	2.27	192.3	7.19	390
18/4/2018	ETFSL200	0.184	0.14	0.57	1.14	184.8	6.75	178
18/4/2018	ETFSL300	0.059	0.074	0.08	0.86	186.3	6.81	162
18/4/2018	ETFSL400	0.05	0.069	<0.05	0.64	181.3	6.76	159
18/4/2018	ETFSL500	0.044	0.071	0.07	0.76	185.5	6.76	160

ATTACHMENT A (Continued)
Water Quality Data for Sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100

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)
26/4/2018	ETAU	0.871	0.887	3.01	4.32	7.2	7.02	1040
26/4/2018	ETFSL100	0.587	0.631	0.1	2.06	9.6	7.42	409
26/4/2018	ETFSL200	0.059	0.071	0.08	0.69	45.1	7.01	159
26/4/2018	ETFSL300	0.043	0.055	<0.05	0.54	2.5	6.96	159
26/4/2018	ETFSL400	0.04	0.055	<0.05	0.54	36	6.97	155
26/4/2018	ETFSL500	0.03	0.05	0.05	0.51	94.3	6.96	152
3/5/2018	ETAU	0.781	0.813	2.38	2.38	76.9	6.9	362
3/5/2018	ETFSL100	0.58	0.611	0.18	3.02	20	7.47	358
3/5/2018	ETFSL200	0.056	0.081	0.07	0.78	43.5	7.01	142
3/5/2018	ETFSL300	0.053	0.059	0.13	0.55	5.3	7.02	136
3/5/2018	ETFSL400	0.044	0.052	0.06	0.45	55.3	7	132
3/5/2018	ETFSL500	0.034	0.044	0.07	0.68	60.7	7.01	128
10/5/2018	ETAU	0.752	0.86	4.66	4.66	176.7	6.75	388
10/5/2018	ETFSL100	0.553	0.628	0.06	4.58	191.5	7.19	384
10/5/2018	ETFSL200	0.044	0.061	<0.05	0.89	187.4	6.64	129
10/5/2018	ETFSL300	0.042	0.051	0.08	0.56	180.2	6.67	131
10/5/2018	ETFSL400	0.051	0.056	0.1	0.5	170.7	6.71	133
10/5/2018	ETFSL500	0.032	0.04	0.08	0.45	164	6.68	124
17/5/2018	ETAU	0.868	0.795	3.32	3.32	160	6.78	383
17/5/2018	ETFSL100	0.634	0.605	<0.05	2.66	178.5	7.12	375
17/5/2018	ETFSL200	0.249	0.22	0.25	1.87	178.5	6.85	246
17/5/2018	ETFSL300	0.176	0.178	0.12	1.57	175.8	6.84	230
17/5/2018	ETFSL400	0.146	0.14	0.1	1.32	179.3	6.78	202
17/5/2018	ETFSL500	0.113	0.102	0.12	1.36	179.6	6.65	176
24/5/2018	ETAU	0.763	0.795	3.22	3.22	192.8	7.22	381
24/5/2018	ETFSL100	0.563	0.63	<0.05	4.36	194.2	7.12	375
24/5/2018	ETFSL200	0.128	0.128	0.58	1.03	189.4	6.95	158
24/5/2018	ETFSL300	0.04	0.053	0.05	0.62	102.2	6.78	125
24/5/2018	ETFSL400	0.037	0.043	0.07	0.39	184.9	6.72	145
24/5/2018	ETFSL500	0.031	0.037	<0.05	0.33	185.2	6.76	120
31/5/2018	ETAU	0.797	0.812	3.74	3.74	193.3	7.22	378
31/5/2018	ETFSL100	0.626	0.598	<0.05	2.57	197.5	7.12	375
31/5/2018	ETFSL200	0.362	0.344	0.48	2.18	187.7	7.18	260
31/5/2018	ETFSL300	0.177	0.171	0.24	1.44	185.8	7.18	188
31/5/2018	ETFSL400	0.178	0.162	0.67	1.86	179.9	7.19	184
31/5/2018	ETFSL500	0.098	0.096	0.11	0.89	176	7.12	154
7/6/2018	ETAU	1.19	1.24	3.12	4.03	188.4	6.8	361
7/6/2018	ETFSL100	0.889	0.942	1.43	2.91	185.7	7.19	342
7/6/2018	ETFSL200	0.8	0.792	1.29	3.2	189.2	7.17	327
7/6/2018	ETFSL300	0.625	0.67	0.9	3.42	178.7	7.16	304
7/6/2018	ETFSL400	0.402	0.442	0.06	4.24	182.9	7.25	271
7/6/2018	ETFSL500	0.347	0.358	0.35	3.74	183.4	7.27	268
14/6/2018	ETAU	0.674	0.686	2.1	3.89	99.8	6.94	314
14/6/2018	ETFSL100	0.34	0.539	0.26	2.33	73.3	7.27	309
14/6/2018	ETFSL200	0.47	0.459	0.72	2.12	178.9	7.09	300
14/6/2018	ETFSL300	0.377	0.37	0.26	2.25	167.8	7.12	264
14/6/2018	ETFSL400	0.292	0.288	0.08	2.17	192.4	7.15	228
14/6/2018	ETFSL500	0.255	0.251	0.08	1.94	203.5	7.04	201

ATTACHMENT A (Continued)
Water Quality Data for Sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100

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)
20/6/2018	ETAU	0.657	0.628	3.62	5.4	188.3	6.72	337
20/6/2018	ETFSL100	0.457	0.468	0.9	3.16	19	6.9	324
20/6/2018	ETFSL200	0.371	0.39	0.72	2.4	191.4	6.95	320
20/6/2018	ETFSL300	0.384	0.377	0.34	2.42	190.5	6.98	322
20/6/2018	ETFSL400	0.331	0.333	<0.05	2.84	191.2	7	312
20/6/2018	ETFSL500	0.256	0.28	<0.05	2.67	184.8	7.01	273
28/6/2018	ETAU	0.634	0.687	4.08	7	185.8	6.6	328
28/6/2018	ETFSL100	0.501	0.559	1.04	3.95	188.8	7.02	329
28/6/2018	ETFSL200	0.409	0.422	1.45	3.94	187.2	6.82	306
28/6/2018	ETFSL300	0.176	0.207	<0.05	1.95	199.7	6.77	190
28/6/2018	ETFSL400	0.108	0.111	<0.05	1.04	198.5	6.67	128
28/6/2018	ETFSL500	0.075	0.079	0.05	0.79	179.7	6.61	118
2/7/2018	ETAU	0.637	0.706	3.29	6.24	39.9	7.05	352
2/7/2018	ETFSL100	0.519	0.558	0.97	4.38	191	7.31	351
2/7/2018	ETFSL200	0.395	0.416	0.86	2.28	191.4	7.34	344
2/7/2018	ETFSL300	0.391	0.426	1.19	3.57	193.9	7.25	342
2/7/2018	ETFSL400	0.327	0.349	0.15	3.82	195.4	7.22	311
2/7/2018	ETFSL500	0.226	0.258	0.06	2.37	194.2	7.15	252
12/7/2018	ETAU	0.587	0.626	1.11	2.33	456.6	7.31	370
12/7/2018	ETFSL100	0.501	0.492	0.63	1.6	163.5	7.59	367
12/7/2018	ETFSL200	0.342	0.338	0.73	1.42	160.3	7.5	355
12/7/2018	ETFSL300	0.324	0.373	1.16	2.87	154.8	7.49	361
12/7/2018	ETFSL400	0.338	0.353	0.44	3.85	1596	7.55	356
12/7/2018	ETFSL500	0.212	0.218	<0.05	2.45	158.3	7.37	259
19/7/2018	ETAU	0.726	0.712	0.63	3.5	177	7	377
19/7/2018	ETFSL100	0.576	0.565	0.11	3.01	202.8	7.37	371
19/7/2018	ETFSL200	0.444	0.4	0.36	2.35	200.6	7.24	360
19/7/2018	ETFSL300	0.462	0.402	1.11	3.68	202	7.21	372
19/7/2018	ETFSL400	0.431	0.374	0.57	3.48	203.3	7.33	384
19/7/2018	ETFSL500	0.288	0.279	<0.05	3.33	203.6	7.21	330
26/7/2018	ETAU	0.725	0.753	4.1	6.53	-5.9	6.59	364
26/7/2018	ETFSL100	0.522	0.566	0.19	2.89	10.8	6.78	356
26/7/2018	ETFSL200	0.31	0.353	0.29	1.73	9.8	6.79	351
26/7/2018	ETFSL300	0.35	0.35	1.59	2.55	-0.3	6.71	353
26/7/2018	ETFSL400	0.375	0.397	1.92	3.56	-12.3	6.75	370
26/7/2018	ETFSL500	0.346	0.431	<0.05	3.13	107.8	6.88	378
02/8/2018	ETAU	0.744	0.733	0.44	2.96	54.8	6.53	366
02/8/2018	ETFSL100	0.526	0.544	0.09	2.48	325	6.57	359
02/8/2018	ETFSL200	0.321	0.350	0.39	1.44	265.1	6.51	352
02/8/2018	ETFSL300	0.337	0.348	1.79	2.59	263.4	6.39	355
02/8/2018	ETFSL400	0.398	0.420	3.38	4.5	251.8	6.59	397
02/8/2018	ETFSL500	0.395	0.429	1.14	3.44	236.4	6.8	386
09/8/2018	ETAU	0.637	0.785	2.11	5.08	257.2	6.73	367
09/8/2018	ETFSL100	0.538	0.644	0.18	5.24	256.6	6.92	363
09/8/2018	ETFSL200	0.276	0.316	0.20	1.56	248.6	6.86	355
09/8/2018	ETFSL300	0.285	0.306	1.68	2.50	233.3	6.75	355
09/8/2018	ETFSL400	0.375	0.416	5.43	6.97	254.2	6.99	436
09/8/2018	ETFSL500	0.373	0.401	3.02	4.50	253.7	6.9	390

ATTACHMENT A (Continued)
Water Quality Data for Sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100

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)
16/8/2018	ETAU	0.672	0.797	1.53	3.99	250.1	6.71	365
16/8/2018	ETFSL100	0.491	0.584	0.08	2.32	264.8	7.16	362
16/8/2018	ETFSL200	0.263	0.304	0.1	1.17	265.4	7.13	353
16/8/2018	ETFSL300	0.249	0.298	1.02	1.98	267.4	6.96	349
16/8/2018	ETFSL400	0.336	0.351	3.57	4.23	260.7	7.12	405
16/8/2018	ETFSL500	0.309	0.358	1.69	3.18	261.3	6.98	386
23/8/2018	ETAU	0.724	0.701	0.92	3.12	266.4	7.03	358
23/8/2018	ETFSL100	0.489	0.505	0.07	2.26	271.7	6.97	351
23/8/2018	ETFSL200	0.274	0.270	0.1	1.01	267.1	7.11	344
23/8/2018	ETFSL300	0.227	0.273	0.83	1.83	265.6	7.04	341
23/8/2018	ETFSL400	0.267	0.279	2.11	2.50	261.8	7.05	365
23/8/2018	ETFSL500	0.352	0.337	2.34	3.41	258.1	7.23	382
30/8/2018	ETAU	0.632	0.696	<0.05	2.52	99.5	7.97	368
30/8/2018	ETFSL100	0.440	0.491	<0.05	2.09	77	7.73	354
30/8/2018	ETFSL200	0.225	0.243	0.06	0.85	23.2	7.85	350
30/8/2018	ETFSL300	0.236	0.248	0.96	1.70	256.2	7.78	345
30/8/2018	ETFSL400	0.327	0.343	3.30	4.50	252.5	8.20	399
30/8/2018	ETFSL500	0.316	0.350	2.05	3.65	228.1	8.18	387
05/9/2018	ETAU	0.688	0.683	0.66	4.54	25.2	7.44	363
05/9/2018	ETFSL100	0.476	0.483	<0.05	2.06	53.5	7.77	350
05/9/2018	ETFSL200	0.234	0.23	0.09	0.98	12.5	7.71	340
05/9/2018	ETFSL300	0.259	0.238	1.08	1.71	-12.5	7.57	333
05/9/2018	ETFSL400	0.367	0.371	4.53	5.96	-42.4	7.65	404
05/9/2018	ETFSL500	0.336	0.318	2.52	3.73	1.5	7.69	372
12/9/2018	ETAU	0.653	0.719	<0.05	3.72	178.2	7.05	360
12/9/2018	ETFSL100	0.461	0.521	<0.05	2.72	71.7	7.54	356
12/9/2018	ETFSL200	0.25	0.28	<0.05	0.96	20.1	7.49	346
12/9/2018	ETFSL300	0.3	0.301	0.41	1.73	3.1	7.38	345
12/9/2018	ETFSL400	0.389	0.34	2.15	2.77	-62.7	7.39	359
12/9/2018	ETFSL500	0.401	0.39	1.04	3.87	-17.4	7.43	381
20/9/2018	ETAU	0.392	0.721	1.14	2.49	272.4	7.11	362
20/9/2018	ETFSL100	0.179	0.467	<0.05	1.88	272.4	7.18	350
20/9/2018	ETFSL200	0.182	0.194	0.63	0.7	25.2	7.17	341
20/9/2018	ETFSL300	0.227	0.233	0.63	1.5	-11.9	7.08	337
20/9/2018	ETFSL400	0.386	0.356	2.66	5.39	-34.2	7.21	397
20/9/2018	ETFSL500	0.394	0.358	1.1	3.15	25.4	7.25	371
27/9/2018	ETAU	0.58	0.763	<0.05	2.24	234	7.33	400
27/9/2018	ETFSL100	0.434	0.493	<0.05	1.54	268.1	7.64	392
27/9/2018	ETFSL200	0.178	0.188	<0.05	0.61	272.8	7.55	381
27/9/2018	ETFSL300	0.231	0.239	0.4	1.6	270.8	7.33	377
27/9/2018	ETFSL400	0.331	0.325	1.49	3.55	263.1	7.41	400
27/9/2018	ETFSL500	0.335	0.375	0.83	3.46	266.8	7.67	416
05/10/2018	ETAU	0.39	0.359	2.14	3.49	274.6	7.28	250
05/10/2018	ETFSL100	0.297	0.686	0.32	12	271	7.57	286
05/10/2018	ETFSL200	0.305	0.308	0.29	2.72	269.7	7.67	295
05/10/2018	ETFSL300	0.272	0.305	0.32	2.72	267.7	7.66	291
05/10/2018	ETFSL400	0.364	0.299	0.63	2.95	259.8	7.73	294
05/10/2018	ETFSL500	0.251	0.245	0.36	2.11	242.9	7.58	271

ATTACHMENT A (Continued)
Water Quality Data for Sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100

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)
10/10/2018	ETAU	0.569	0.635	1.8	2.68	266.6	6.59	308
10/10/2018	ETFSL100	0.571	0.602	1.62	2.25	267.5	6.66	304
10/10/2018	ETFSL200	0.494	0.558	1.07	1.88	269.6	6.78	302
10/10/2018	ETFSL300	0.492	0.49	1.05	1.42	269.6	6.81	303
10/10/2018	ETFSL400	0.479	0.503	2.3	3.04	267.3	7.07	334
10/10/2018	ETFSL500	0.48	0.512	1.36	2	266.7	6.98	308
15/10/2018	ETAU	0.325	0.333	0.9	1.33	285.6	6.35	269
15/10/2018	ETFSL100	0.298	0.302	0.69	1.2	278.5	6.36	259
15/10/2018	ETFSL200	0.316	0.336	0.66	1.9	276.9	6.37	262
15/10/2018	ETFSL300	0.286	0.298	0.57	1.41	279.5	6.39	259
15/10/2018	ETFSL400	0.276	0.3	0.6	1.38	279.9	6.56	266
15/10/2018	ETFSL500	0.273	0.279	0.63	1.18	263	7.71	267
22/10/2018	ETAU	0.274	0.259	0.76	1.26	276.9	6.52	281
22/10/2018	ETFSL100	0.25	0.244	0.56	1.13	270.7	6.57	278
22/10/2018	ETFSL200	0.235	0.233	0.41	1.01	270.4	6.53	275
22/10/2018	ETFSL300	0.236	0.228	0.42	1	269	6.58	275
22/10/2018	ETFSL400	0.304	0.263	1.8	2.51	264.8	7.01	321
22/10/2018	ETFSL500	0.184	0.229	0.26	1.19	258.5	6.74	279
30/10/2018	ETAU	0.432	0.431	1.79	2.55	15.1	6.65	290
30/10/2018	ETFSL100	0.376	0.39	0.76	1.78	-0.4	6.91	286
30/10/2018	ETFSL200	0.336	0.363	0.37	1.47	3.8	6.92	285
30/10/2018	ETFSL300	0.341	0.35	0.39	1.32	7.6	6.99	291
30/10/2018	ETFSL400	0.36	0.364	1.58	3.1	-77.3	7.09	329
30/10/2018	ETFSL500	0.34	0.351	0.5	1.63	-4.2	7.05	296
08/11/2018	ETAU	0.635	0.553	0.76	3.15	23.3	7.07	307
08/11/2018	ETFSL100	0.429	0.433	0.14	1.59	12.9	7.35	307
08/11/2018	ETFSL200	0.333	0.34	0.06	1	20	7.31	303
08/11/2018	ETFSL300	0.333	0.329	0.06	1.1	5.4	7.32	304
08/11/2018	ETFSL400	0.431	0.403	5.31	5.49	247.1	7.47	385
08/11/2018	ETFSL500	0.315	0.325	0.37	1.54	248.4	7.30	310
15/11/2018	ETAU	0.609	0.628	0.53	2.04	264.1	7.09	334
15/11/2018	ETFSL100	0.399	0.414	<0.05	1.6	172.9	7.32	328
15/11/2018	ETFSL200	0.308	0.331	<0.05	1.34	272	7.31	325
15/11/2018	ETFSL300	0.321	0.298	0.08	1.15	271	7.28	324
15/11/2018	ETFSL400	0.396	0.383	1.44	4.72	262.5	7.35	373
15/11/2018	ETFSL500	0.328	0.336	0.24	1.76	267.3	7.38	345
19/11/2018	ETWQ AU	0.647	⁻⁶	0.08	2.42	259.1	7.22	345
22/11/2018	ETFSL200	0.264	0.298	<0.05	0.82	30.9	7.29	355
22/11/2018	ETFSL500	0.38	0.376	0.67	1.88	-3.3	7.50	373
22/11/2018	CONFLU1	0.085	0.088	0.12	0.9	-1.1	7.51	307
22/11/2018	WARARM5	0.018	0.046	0.25	1	54.6	7.57	297
22/11/2018	WDFS1	0.105	0.114	0.12	1.15	40.1	7.53	307
22/11/2018	WDFS1+100	0.103	0.119	0.1	1.06	26	7.55	306

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

ATTACHMENT A (Continued)
Water Quality Data for Sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100

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)
26/11/2018	ETWQ AU	0.538	⁻⁶	<0.05	1.36	83.8	7.11	354
29/11/2018	ETFSL200	0.139	0.15	0.54	1.2	36.1	7.07	195
29/11/2018	ETFSL500	0.167	0.147	0.3	1.19	30.1	6.94	195
29/11/2018	CONFLU1	0.158	0.108	0.27	1.18	29.5	7.19	200
29/11/2018	WARARM5	0.055	0.052	0.18	0.92	66.7	7.5	206
29/11/2018	WDFS1	0.082	0.074	0.18	0.21	36.7	7.8	206
29/11/2018	WDFS1+100	0.103	0.094	0.19	1	38.4	7.36	200
4/12/2018	ETWQ AU	0.433	⁻⁶	1.65	2.36	30.6	7	266
6/12/2018	ETFSL200	0.283	0.295	0.26	1.04	242.7	6.97	260
6/12/2018	ETFSL500	0.29	0.3	0.62	1.47	249.5	7.23	270
6/12/2018	CONFLU1	0.112	0.114	0.12	1.13	243.8	7.24	243
6/12/2018	WARARM5	0.034	0.035	<0.05	0.75	250.1	7.29	238
6/12/2018	WDFS1	0.122	0.134	0.07	1.12	241.4	7.29	246
6/12/2018	WDFS1+100	0.109	0.126	<0.05	0.99	251.1	7.3	245
12/12/2018	ETAU	0.428	0.484	1.49	3.33	-	6.86	269
12/12/2018	ETFSL200	0.215	0.232	<0.05	0.42	255.3	7.4	245
12/12/2018	ETFSL500	0.276	0.284	0.27	0.89	251.9	7.41	262
12/12/2018	CONFLU1	0.081	0.091	0.45	0.8	17.9	7.39	219
12/12/2018	WARARM5	0.03	0.042	<0.05	0.58	236.4	7.53	214
12/12/2018	WDFS1	0.108	0.121	0.41	1.09	27.5	7.44	225
12/12/2018	WDFS1+100	0.105	0.12	<0.05	0.99	42.3	7.24	243
17/12/2018	ETWQ AU	0.102	⁻⁶	0.18	0.75	280.3	6.50	152
17/12/2018	ETFSL200	0.076	0.084	0.17	0.7	274.8	6.76	152
17/12/2018	ETFSL500	0.087	0.086	0.19	0.76	274.8	6.56	150
17/12/2018	CONFLU1	0.068	0.068	0.16	0.78	270.9	6.64	152
17/12/2018	WARARM5	0.023	0.032	0.08	0.54	257.5	6.77	156
17/12/2018	WDFS1	0.069	0.062	0.15	0.75	273	6.67	153
17/12/2018	WDFS1+100	0.055	0.063	0.12	0.71	278.4	6.71	154
27/12/2018	ETAU	0.263	0.277	0.61	1.81	24.3	6.72	217
27/12/2018	ETFSL200	0.196	0.194	0.09	0.93	30.6	7.11	216
27/12/2018	ETFSL500	0.219	0.213	0.3	1.37	-6.9	7.13	224
27/12/2018	CONFLU1	0.071	0.075	<0.05	0.86	21.4	7.15	208
27/12/2018	WARARM5	0.045	0.036	<0.05	0.48	3.4	7.3	206
27/12/2018	WDFS1	0.108	0.11	0.06	0.99	24.9	7.12	210
27/12/2018	WDFS1+100	0.101	0.105	<0.05	0.93	37.4	7.13	210
3/01/2019	ETWQ AU	0.335	0.443	<0.05	1.57	110.1	7.35	300
3/01/2019	ETFSL200	0.159	0.226	<0.05	0.63	113.1	7.63	290
3/01/2019	ETFSL500	0.265	0.274	0.12	1.32	11.5	7.5	302
3/01/2019	CONFLU1	0.143	0.16	<0.05	1.21	4.8	7.29	270
3/01/2019	WARARM5	0.055	0.054	<0.05	0.64	56.4	7.46	256
3/01/2019	WDFS1	0.106	0.14	<0.05	1.27	72	7.45	265
3/01/2019	WDFS1+100	0.101	0.138	<0.05	1.16	56.2	7.42	263
10/01/2019	ETWQ AU	0.438	0.282	<0.05	1.41	244.1	6.92	268
10/01/2019	ETFSL200	0.216	0.246	<0.05	0.62	26.8	8.03	279
10/01/2019	ETFSL500	0.22	0.262	<0.05	1.18	-9.3	7.64	300
10/01/2019	CONFLU1	0.129	0.141	<0.05	1.11	-33.7	7.55	269
10/01/2019	WARARM5	0.042	0.041	<0.05	0.6	90.3	7.62	252
10/01/2019	WDFS1	0.061	0.087	<0.05	0.92	22.1	7.59	242
10/01/2019	WDFS1+100	0.061	0.074	<0.05	0.97	6.9	7.58	240

ATTACHMENT A (Continued)
Water Quality Data for Sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100

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)
16/01/2019	ETWQ AU	0.433	0.454	<0.05	1.86	171.1	6.75	282
16/01/2019	ETFSL200	0.18	0.189	<0.05	0.4	258.4	7.67	275
16/01/2019	ETFSL500	0.244	0.233	0.38	1	262.4	7.65	303
16/01/2019	CONFLU1	0.058	0.049	0.12	0.86	261.2	7.68	249
16/01/2019	WARARM5	0.025	0.028	0.11	0.52	268.1	7.82	242
16/01/2019	WDFS1	0.046	0.044	0.16	0.92	263.5	7.76	256
16/01/2019	WDFS1+100	0.047	0.044	0.19	0.94	259.2	7.79	260
23/01/2019	ETWQ AU	0.579	0.661	<0.05	2.09	184.3	6.78	292
23/01/2019	ETFSL200	0.171	0.204	<0.05	0.38	96.8	7.65	286
23/01/2019	ETFSL500	0.28	0.284	0.2	1.62	-11.1	7.65	316
23/01/2019	CONFLU1	0.052	0.056	<0.05	1.11	5.6	7.7	264
23/01/2019	WARARM5	0.043	0.036	<0.05	0.74	-38.4	7.7	253
23/01/2019	WDFS1	0.032	0.042	<0.05	1.08	19.6	7.77	266
23/01/2019	WDFS1+100	0.02	0.029	<0.05	0.92	-16.6	7.83	266
29/01/2019	ETAU	0.62	0.578	0.07	1.52	66.8	6.7	294
29/01/2019	ETFSL200	0.19	0.216	<0.05	0.44	36.2	7.23	282
29/01/2019	ETFSL500	0.249	0.279	<0.05	1.48	12.1	7.34	310
29/01/2019	CONFLU1	0.048	0.07	<0.05	1.05	-20.8	7.54	282
29/01/2019	WARARM5	0.031	0.028	<0.05	0.54	49.5	7.34	251
29/01/2019	WDFS1	0.027	0.038	<0.05	0.96	29.7	7.49	260
29/01/2019	WDFS1+100	0.03	0.03	<0.05	0.91	9.9	7.49	260
4/02/2019	ETAU	0.559	0.635	<0.05	1.04	51.1	6.8	283
4/02/2019	ETFSL200	0.173	0.191	<0.05	0.34	9.1	7.26	275
4/02/2019	ETFSL500	0.221	0.276	0.31	1.7	-18.6	7.35	302
4/02/2019	CONFLU1	0.043	0.036	0.16	0.85	-51.7	7.55	252
4/02/2019	WARARM5	0.023	0.029	0.19	0.74	139.1	7.58	240
4/02/2019	WDFS1	0.012	0.021	0.27	0.8	73.2	7.71	252
4/02/2019	WDFS1+100	0.01	0.02	0.29	0.74	50	7.71	255
11/02/2019	ETAU	0.757	0.731	<0.05	1.5	261.4	6.86	288
11/02/2019	ETFSL200	0.197	0.206	<0.05	0.36	6.8	7.21	280
11/02/2019	ETFSL500	0.243	0.302	0.5	1.86	-33.9	7.3	306
11/02/2019	CONFLU1	0.023	0.033	0.24	0.94	-96.7	7.48	255
11/02/2019	WARARM5	0.019	0.026	0.24	0.66	53.5	7.46	243
11/02/2019	WDFS1	0.011	0.018	0.31	0.98	-26	7.62	259
11/02/2019	WDFS1+100	0.005	0.013	0.3	0.83	64.5	7.62	258
18/02/2019	ETAU	0.624	0.675	0.17	1.51	51.8	6.91	303
18/02/2019	ETFSL200	0.189	0.19	0.19	0.36	12.8	7.27	296
18/02/2019	ETFSL500	0.243	0.284	0.23	1.77	-15.6	7.86	277
18/02/2019	CONFLU1	0.041	0.035	0.13	0.9	6.6	7.73	291
18/02/2019	WARARM5	0.022	0.024	0.19	0.64	64.1	7.46	262
18/02/2019	WDFS1	0.007	0.012	0.31	0.78	26.7	7.83	279
18/02/2019	WDFS1+100	0.006	0.011	0.24	0.64	23.3	7.84	279
25/02/2019	ETAU	0.616	0.719	<0.05	0.93	273.1	7.19	283
25/02/2019	ETFSL200	0.198	0.199	<0.05	0.54	270.5	7.06	271
25/02/2019	ETFSL500	0.281	0.312	1.72	2.11	270.6	7.3	307
25/02/2019	CONFLU1	0.022	0.027	0.06	0.86	274.6	7.37	247
25/02/2019	WARARM5	0.014	0.023	<0.05	0.53	264.2	7.4	238
25/02/2019	WDFS1	0.009	0.017	<0.05	0.79	272.6	7.55	248
25/02/2019	WDFS1+100	0.004	0.014	0.05	0.92	264.9	7.6	246

ATTACHMENT A (Continued)

Water Quality Data for Sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100

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)
04/03/2019	ETAU	0.688	0.67	<0.05	0.13	104.3	6.74	306
04/03/2019	ETFSL200	0.185	0.193	0.12	0.48	259.3	7.18	294
04/03/2019	ETFSL500	0.295	0.298	0.76	2.02	271.1	7.33	334
04/03/2019	CONFLU1	0.032	0.049	0.12	1.71	277.1	7.56	274
04/03/2019	WARARM5	0.025	0.031	0.12	1.02	277.7	7.44	248
04/03/2019	WDFS1	0.006	0.013	0.13	0.81	273.6	7.75	271
04/03/2019	WDFS1+100	0.005	0.011	0.21	0.71	249.3	7.58	270
11/03/2019	ETAU	0.638	0.726	0.08	0.94		6.87	322
11/03/2019	ETFSL200	0.152	0.170	0.06	0.38	227.4	7.24	310
11/03/2019	ETFSL500	0.266	0.28	0.5	1.91	219.5	7.43	347
11/03/2019	CONFLU1	0.024	0.03	0.23	0.96	228.5	7.53	289
11/03/2019	WARARM5	0.018	0.052	0.19	0.71	202.5	7.53	269
11/03/2019	WDFS1	0.01	0.018	0.26	0.8	219.7	7.07	276
11/03/2019	WDFS1+100	0.006	0.027	0.22	1.45	215.9	7.82	289
18/03/2019	ETAU	0.153	0.16	0.84	1.21	239	6.77	175
18/03/2019	ETFSL200	0.187	<0.01	0.5	0.204	237.9	6.62	180
18/03/2019	ETFSL500	0.193	<0.01	0.63	0.197	230.4	6.7	184
18/03/2019	CONFLU1	0.146	0.02	0.5	0.156	50.3	6.72	172
18/03/2019	WARARM5	0.032	<0.01	0.3	0.034	49.3	6.67	153
18/03/2019	WDFS1	0.071	0.04	0.44	0.073	21.4	6.67	159
18/03/2019	WDFS1+100	0.094	0.04	0.42	0.099	57.1	6.61	158
26/03/2019	ETAU	0.335	0.347	0.46	1.91	29.3	6.74	230
26/03/2019	ETFSL200	0.205	0.217	<0.05	1.04	23.5	6.96	224
26/03/2019	ETFSL500	0.233	0.234	0.5	1.39	227	6.99	239
26/03/2019	CONFLU1	0.095	0.114	<0.05	0.8	237.9	7.02	206
26/03/2019	WARARM5	0.039	0.041	<0.05	0.45	241.4	6.92	195
26/03/2019	WDFS1	0.073	0.076	<0.05	0.65	236.4	7.02	200
26/03/2019	WDFS1+100	0.054	0.049	<0.05	0.64	241.1	7.03	199

26 July 2019

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 – April 2019

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 301-303 Water Management Plan (LW301-303 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 LW301-303 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 LW301-303 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 LW301-303 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 LW301-303 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.

Analysis conducted by Hydro Engineering & Consulting (2019) in accordance with the LW301-303 WMP, identified that the performance indicator for water resources reaching the Woronora Reservoir was exceeded for dissolved (i.e. filtered <0.45 µm fraction) manganese on the Eastern Tributary at site ETWQ AU in April 2019 (as there was not a similar exceedance of the trigger recorded at control site WOWQ 2 on the Woronora River). The performance indicator was not exceeded for field filtered iron or aluminium in April 2019 and therefore these parameters are not discussed in this report.

In accordance with the LW301-303 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*.

This assessment against the water quality subsidence impact performance measure has been prepared for April 2019 in consideration of:

- pluviograph data;
- flow data from the Eastern Tributary gauging location (GS 300078);
- groundwater level and groundwater quality results for Eastern Tributary sites up to 30 April 2019¹;
- surface water quality data at site ETWQ AU/ETAU² and sites further upstream on the Eastern Tributary up to 30 April 2019;
- surface water quality data at sites downstream of ETWQ AU/ETAU² up to 30 April 2019; 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 (Table 1).

Recently, above average rainfall was recorded in October 2018, November 2018, December 2018 and March 2019, and below average rainfall was recorded in January, February and April 2019. Total rainfall in April 2019 was 35.0 mm, approximately one quarter of the average (126.1 mm), with 33.5 mm of rainfall recorded over 5 and 6 April, and smaller rainfall events recorded on 2, 24 and 25 April (0.5 mm each). Shallow groundwater levels correlate with the rainfall trend.

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

² Site ETAU is the same as site ETWQ AU (i.e. samples are taken at the same location). The difference between the sites relates to the time of sampling. Site ETWQ AU monitoring is conducted on the same day as sites upstream of ETWQ AU/ETAU (shown on Charts 1 to 2), while site ETAU monitoring is conducted on the same day as the sites downstream of ETWQ AU/ETAU (described in Section 3 and shown on Charts 3 to 4). From 29 January 2019, water quality sampling of all sites on the Eastern Tributary was undertaken in a single day. Future reporting will identify the data at this site as site ETWQ AU.

Table 1 Monthly Rainfall Data (mm) for PV7, January 2018 to April 2019

Month/Year	Rainfall at PV7 (mm)	Rainfall at Darkes Forest (mm) [#]	Mean Monthly Rainfall at Darkes Forest (1894-2019) (mm) [#]
January 2018	48.0	12.0	132.4
February 2018	115.5	16.6	159.6
March 2018	151.0	45.0	153.9
April 2018	32.0	21.6	126.8
May 2018	12.5	8.0	129.1
June 2018	112.0	91.8	146.6
July 2018	3.5	0.4	96.4
August 2018	12.5	15.8	89.1
September 2018	52.0	41.8	76.6
October 2018	197.0	200.8	91.9
November 2018	114.5	127.8	105.4
December 2018	120.0	91.0	103.8
January 2019	58.5	55.4	131.8
February 2019	41.0	54.2	158.7
March 2019	149.0	201.2	154.3
April 2019	35.0	46.0	126.1

[#] 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 April 2019.

2. EASTERN TRIBUTARY SURFACE WATER AND GROUNDWATER QUALITY DATA

Plots of dissolved manganese at surface water quality sites ETWQ AU, ETWQ AQ (upstream on the Eastern Tributary) and WOWQ 2 (control site) and at groundwater quality site ETGW2, are compared to rainfall at PV7 (Chart 1) and streamflow at GS 300078 (Chart 2) (Figure 1).

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.

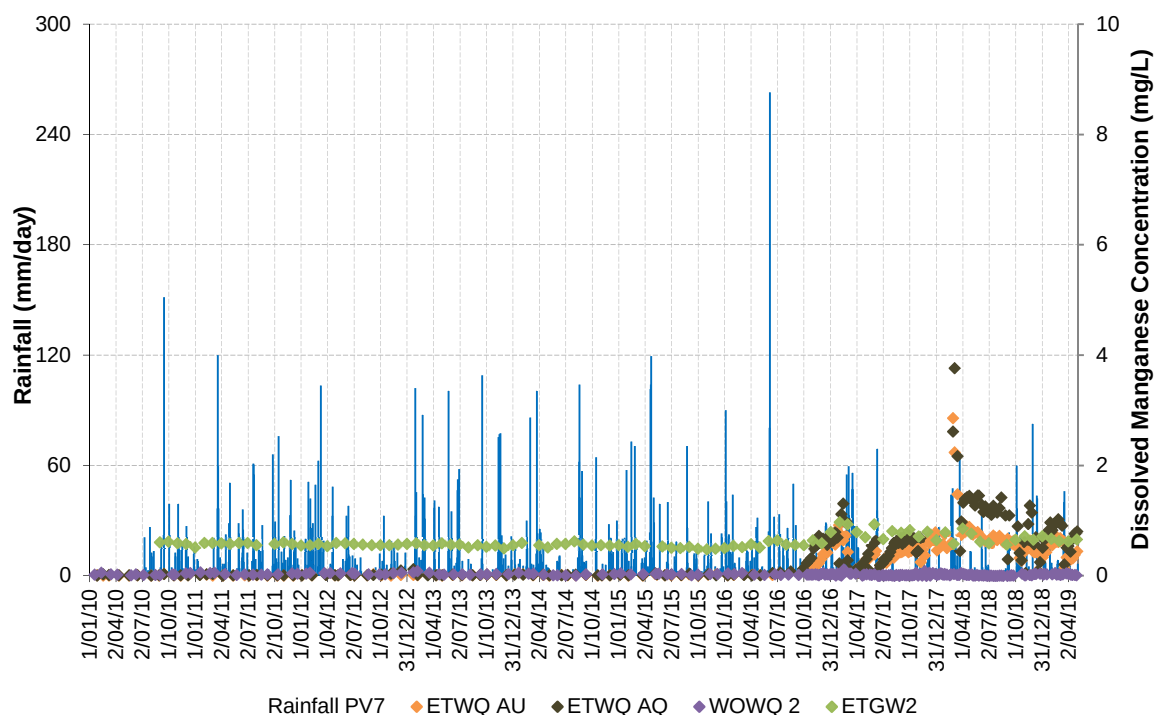


Chart 1 Dissolved Manganese Concentrations at Surface Water Quality Sites ETWQ AU, ETWQ AQ and WOWQ 2 and Groundwater Quality Site ETGW2 and Rainfall (to 30 April 2019)

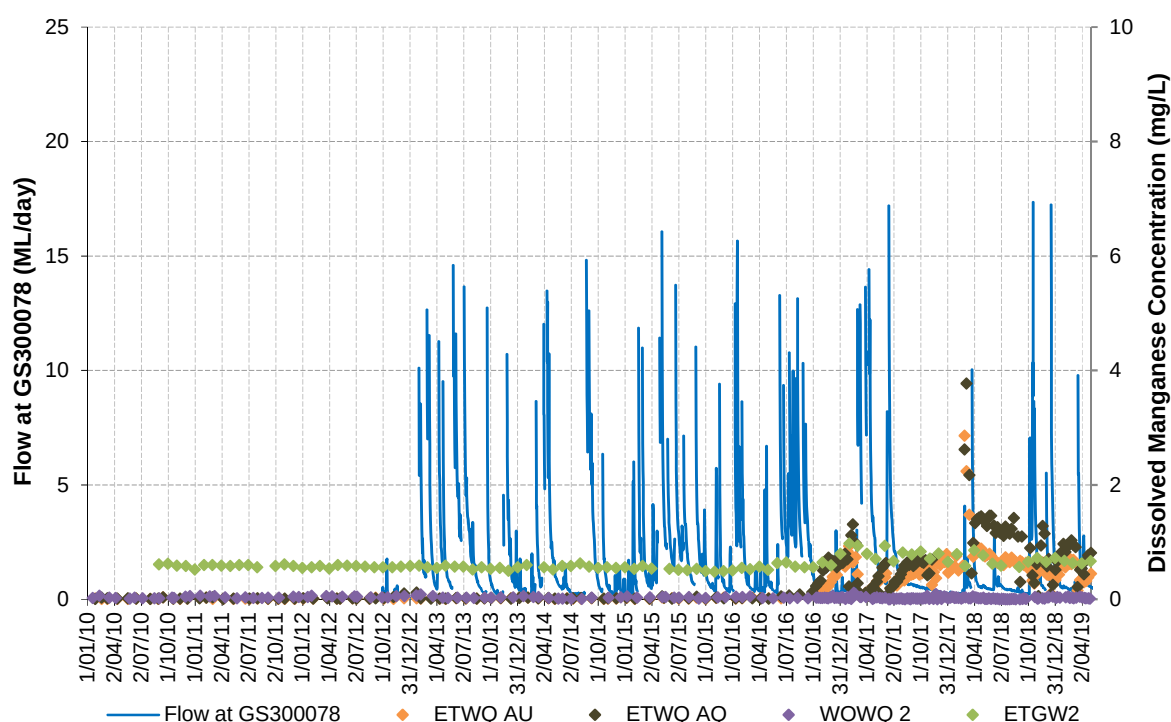
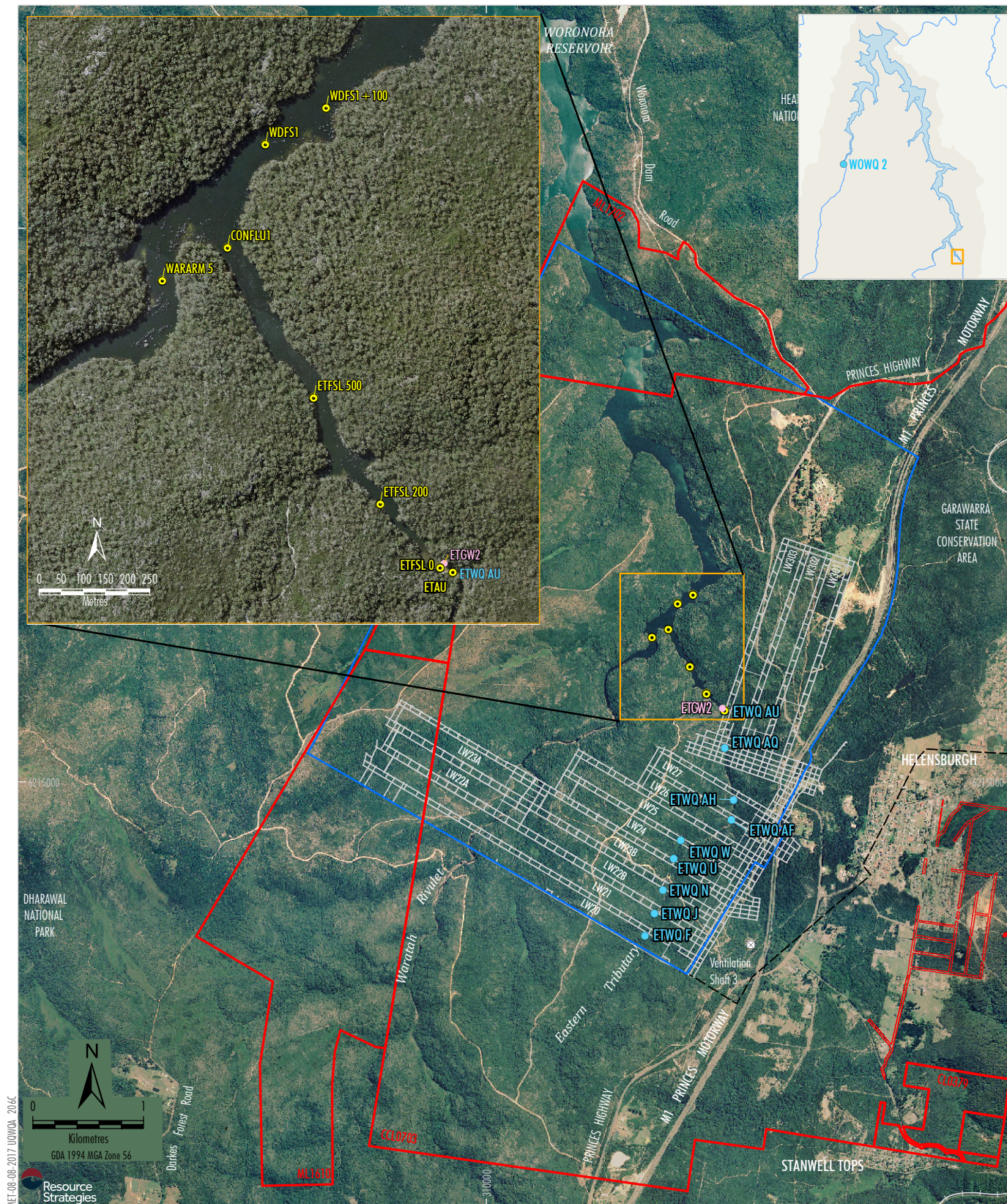


Chart 2 Dissolved Manganese Concentrations at Surface Water Quality Sites ETWQ AU, ETWQ AQ and WOWQ 2 and Groundwater Quality Site ETGW2 and Stream Flow (to 30 April 2019)



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 on Eastern Tributary
- Water Quality Site on Eastern Tributary and/or in Woronora Reservoir
- Groundwater Quality Site of Eastern Tributary

Peabody
METROPOLITAN COAL

Surface Water Quality Sampling of
Eastern Tributary Watercourse
and Woronora Reservoir

Figure 1

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. <0.1 mg/L, exist in the natural creek water. Dissolved manganese is easily diluted by freshwater flow to low levels when higher creek flows occur.

In April 2019, dissolved manganese concentrations at site ETWQ AU ranged between 0.298 mg/L and 0.384 mg/L. 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.

Water quality parameters pertinent to the increase in manganese (dissolved-filtered <0.45 µm fraction) concentration are pH, oxidation-reduction potential (ORP) and electrical conductivity (EC). 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 oxidizing and becomes reducing when ORP is below approximately 10 mV. In April 2019 at site ETWQ AU:

- pH (lab measurement) was generally consistent (pH 6.86 to pH 7.54);
- EC concentrations (lab measurement) ranged between 224 µS/cm and 256 µS/cm; and
- ORP (field measurement) ranged between 35.8 mV and 262.5 mV.

3. WATER RESOURCES REACHING THE WORONORA RESERVOIR

In accordance with the LW301-303 WMP, site ETWQ AU on the Eastern Tributary and control site WOWQ 2 on the Woronora River are used to assess the LW301-303 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. 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.

Metropolitan Coal has taken a photographic record of the watercourse / waterbody at the time of sampling, estimated the width of the watercourse / water body 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 (HCPL, 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 April 2019 the Woronora Reservoir water level varied between 155.76 mAHD (on 4 April 2019) and 155.36 mAHD (on 25 April 2019) (water level declined steadily). The position of the reservoir water level can only be determined to the closest one metre contour, accordingly, the reservoir water level during April 2019 was between approximately 2,180 m (corresponding to 156 mAHD) and 2,190 m (corresponding to 155 mAHD) downstream of site ETSFL 0.

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 April 2019, the Woronora Reservoir water level was downstream of site WDFS1+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

Water quality data for filtered and total manganese for January 2018 to April 2019 at sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400 and ETFSL 500 is provided in Attachment A. As described earlier, sampling at sites ETFSL 100, ETSFL 300 and ETFSL 400 was suspended once monitoring at sites CONFLU1, WARARM5, WDFS1 and WDFS1+100 commenced on 22 November 2018³. Water quality data for filtered and total manganese since sampling commenced on 22 November 2018 at sites CONFLU1, WARARM5, WDFS1 and WDFS1+100 is also provided in Attachment A.

As described above, the Woronora Reservoir water level dropped steadily in April 2019, and was downstream of site WDFS1+100. The results for dissolved and total manganese at sites ETAU, ETFSL 200, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100 since the commencement of monitoring to the end of April 2019, are shown on Charts 3 and 4, respectively. These sites provide a profile along the arm of the Woronora Reservoir.

³ Sampling at site ETAU was also temporarily suspended during this period but was resumed on 12 December 2018. Data from sampling undertaken at site ETWQ AU has been substituted for site ETAU during this period. Sampling at site ETAU was undertaken on 12 and 27 December 2018.

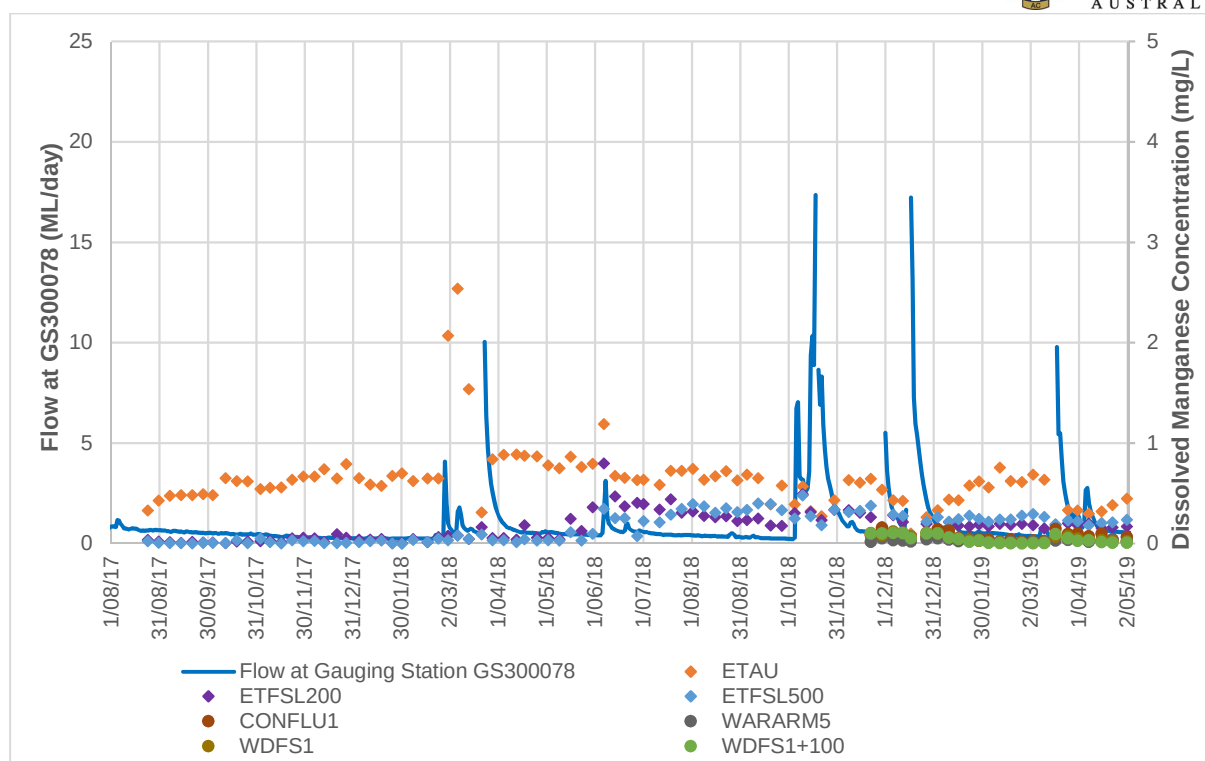


Chart 3 Dissolved Manganese Concentrations at Surface Water Quality Sites ETAU⁴, ETFSL 200, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100 and Stream Flow (August 2017 to 30 April 2019)

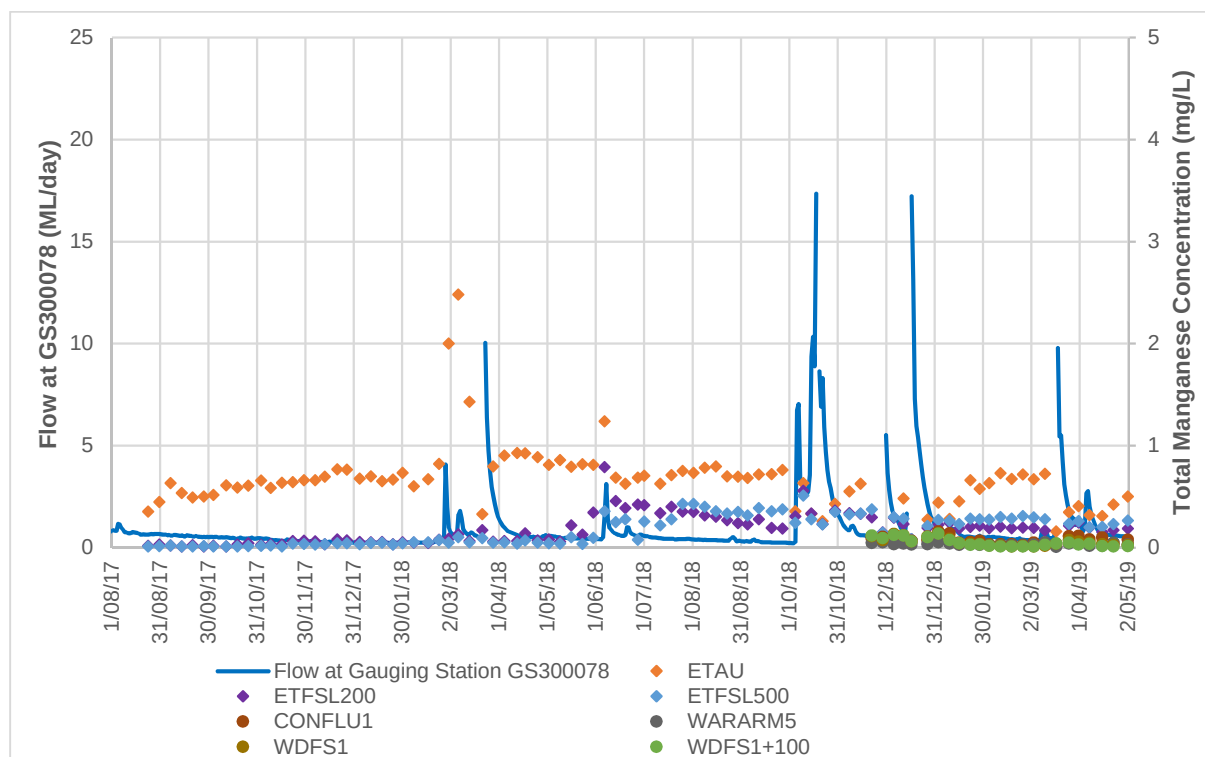


Chart 4 Total Manganese Concentrations at Surface Water Quality Sites ETAU⁵, ETFSL 200, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100 and Stream Flow (August 2017 to 30 April 2019)

⁴ Data from sampling undertaken at site ETWQ AU has been substituted for site ETAU from 22 November to 6 December 2018 and 17 December 2018. Sampling at site ETAU was undertaken on 12 and 27 December 2018.

The filtered manganese concentrations for April 2019 ranged from 0.298 mg/L to 0.384 mg/L at site ETAU, 0.156 mg/L to 0.200 mg/L at site ETFSL 200, 0.184 mg/L to 0.222 mg/L at site ETFSL 500, 0.041 mg/L to 0.103 mg/L at site CONFLU1, 0.020 mg/L to 0.041 mg/L at site WARARM5, 0.026 mg/L to 0.051 mg/L at site WDFS1 and 0.009 mg/L to 0.030 mg/L at site WDFS1+100 (Chart 3).

Total manganese concentrations for April 2019 followed similar trends, ranging from 0.310 mg/L to 0.425 mg/L at site ETAU, 0.154 mg/L to 0.248 mg/L at site ETFSL 200, 0.200 mg/L to 0.261 mg/L at site ETFSL 500, 0.046 mg/L to 0.116 mg/L at site CONFLU1, 0.018 mg/L to 0.046 mg/L at site WARARM5, 0.027 mg/L to 0.061 mg/L at site WDFS1 and 0.014 mg/L to 0.038 mg/L at site WDFS1+100 (Chart 4).

The Australian Drinking Water Guidelines (ADWG, 2011) are published by the National Health and Medical Research Council and updated most recently in 2018; 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 Australian Drinking Water Guideline before being supplied to the Helensburgh area as well as parts of the Sutherland Shire and northern Wollongong (WaterNSW, 2017).

The ADWG (2011) guidelines are based on total concentrations of manganese in water. The ADWG value is 0.5 mg/L total manganese for health. 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).

Water quality data for parameters pertinent to dissolved manganese for January 2018 to April 2019 at sites ETAU, ETFSL 200, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100 is provided in Attachment A. The water quality parameters (pH, ORP and EC) showed no unusual features. The ADWG value for pH (aesthetic) is pH 6.5 – 8.5. Samples at sites ETAU, ETFSL 200, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100 in April 2019 were within this range (Attachment A).

⁵ Total manganese is not sampled at site ETWQ AU, and therefore results were unable to be substituted for site ETAU from 22 November to 6 December 2018 and 17 December 2018. Sampling at site ETAU was undertaken on 12 and 27 December 2018.

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 April 2019, which has triggered 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.

Water reaching the Woronora Reservoir occurs where the inflowing stream water meets the reservoir waterbody. In April 2019, the Woronora Reservoir water level was downstream of site WDFS1+100. The mixing zone (downstream of the reservoir water level) is variable and influenced by the rate of inflow from the Eastern Tributary. Manganese concentrations are easily diluted by freshwater flow to low levels when higher creek flows occur.

The manganese concentrations reaching the Woronora Reservoir have 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.

6. REFERENCES

ADWG (2011) Australian Drinking Water Guidelines – National Water Quality Management Strategy. The National Health and Medical Research Council Canberra.

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Yours Sincerely,

Barry N. Noller

Barry N Noller

Principal Research Fellow

Centre For Mined Land Rehabilitation

ATTACHMENT A

WATER QUALITY DATA FOR SITES

ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, WARARM5, CONFLU1, WDFS1 and
WDFS1+100

JANUARY 2018 TO APRIL 2019

ATTACHMENT A

Water Quality Data for Sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100

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)
4/01/2018	ETAU	0.652	0.678	<0.05	0.59	132	7.37	351
4/01/2018	ETFSL100	0.281	0.305	<0.05	0.82	125.3	7.75	337
4/01/2018	ETFSL200	0.042	0.057	<0.05	0.68	132.7	7.05	118
4/01/2018	ETFSL300	0.038	0.052	0.06	0.6	13.2	6.92	111
4/01/2018	ETFSL400	0.024	0.037	<0.05	0.47	129.9	6.96	110
4/01/2018	ETFSL500	0.016	0.036	<0.05	0.46	121.7	6.74	111
11/01/2018	ETAU	0.588	0.698	0.13	1.36	55.9	7.56	364
11/01/2018	ETFSL100	0.197	0.237	<0.05	0.55	24.3	7.88	345
11/01/2018	ETFSL200	0.041	0.053	<0.05	0.63	101	7.14	139
11/01/2018	ETFSL300	0.067	0.078	1.89	2.1	35.2	6.88	128
11/01/2018	ETFSL400	0.106	0.052	0.47	0.66	52	6.84	124
11/01/2018	ETFSL500	0.026	0.046	0.06	0.78	94.4	7.01	122
18/01/2018	ETAU	0.577	0.653	<0.05	1.15	136.4	7.67	366
18/01/2018	ETFSL100	0.211	0.22	<0.05	0.64	131.9	7.74	353
18/01/2018	ETFSL200	0.046	0.055	<0.05	0.79	131.2	7	129
18/01/2018	ETFSL300	0.058	0.057	0.06	0.84	125.5	6.94	126
18/01/2018	ETFSL400	0.038	0.048	<0.05	0.71	139.6	6.96	125
18/01/2018	ETFSL500	0.032	0.049	<0.05	0.78	121.4	6.94	123
25/01/2018	ETAU	0.674	0.668	<0.05	0.52	56.8	7.55	378
25/01/2018	ETFSL100	0.074	0.152	<0.05	0.46	-4.4	7.82	360
25/01/2018	ETFSL200	0.007	0.034	<0.05	0.41	70.6	7.16	120
25/01/2018	ETFSL300	0.005	0.035	<0.05	0.46	22.8	7.09	117
25/01/2018	ETFSL400	0.001	0.032	<0.05	0.41	55	7	118
25/01/2018	ETFSL500	0.002	0.03	<0.05	0.35	288.6	7.04	115
31/01/2018	ETAU	0.7	0.734	<0.05	0.67	82.3	7.46	374
31/01/2018	ETFSL100	0.089	0.147	<0.05	0.36	30.7	8.01	361
31/01/2018	ETFSL200	0.005	0.052	<0.05	0.57	79.1	7.28	139
31/01/2018	ETFSL300	0.002	0.049	<0.05	0.66	42.7	7.08	123
31/01/2018	ETFSL400	0.001	0.046	<0.05	0.54	92	7.05	122
31/01/2018	ETFSL500	0.001	0.044	<0.05	0.55	71	7.01	122
7/02/2018	ETAU	0.625	0.601	<0.05	0.65	106.9	7.39	374
7/02/2018	ETFSL100	0.102	0.129	<0.05	0.75	14.8	7.78	359
7/02/2018	ETFSL200	0.047	0.051	<0.05	0.48	80.4	7.04	119
7/02/2018	ETFSL300	0.049	0.059	<0.05	0.65	38.2	6.97	119
7/02/2018	ETFSL400	0.112	0.07	0.27	0.74	1	6.77	118
7/02/2018	ETFSL500	0.038	0.053	0.11	0.58	86.6	6.92	117
16/02/2018	ETAU	0.65	0.67	<0.05	0.66	158.8	7.54	380
16/02/2018	ETFSL100	0.075	0.126	<0.05	0.33	163.9	7.96	369
16/02/2018	ETFSL200	0.016	0.048	<0.05	0.6	152	7.05	128
16/02/2018	ETFSL300	0.023	0.058	<0.05	0.81	121.1	6.88	124
16/02/2018	ETFSL400	0.012	0.049	<0.05	0.54	143.2	6.83	121
16/02/2018	ETFSL500	0.019	0.054	<0.05	0.54	144.1	6.82	120
23/02/2018	ETAU	0.651	0.822	<0.05	1.72	163.6	7.21	400
23/02/2018	ETFSL100	0.12	0.2	<0.05	0.5	31.8	7.75	384
23/02/2018	ETFSL200	0.068	0.078	<0.05	0.93	55.8	6.92	140
23/02/2018	ETFSL300	0.065	0.07	0.07	0.88	55.2	6.8	136
23/02/2018	ETFSL400	0.062	0.075	<0.05	0.93	41.8	6.78	135
23/02/2018	ETFSL500	0.049	0.075	<0.05	1.07	-119.2	6.78	132

ATTACHMENT A (Continued)
Water Quality Data for Sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100

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)
1/03/2018	ETAU	2.07	2	5.96	5.69	83.1	6.32	492
1/03/2018	ETFSL100	1.78	1.72	2.41	2.7	36.7	6.31	464
1/03/2018	ETFSL200	0.08	0.087	0.08	0.83	59	6.45	133
1/03/2018	ETFSL300	0.059	0.069	0.16	0.79	43.5	6.36	127
1/03/2018	ETFSL400	0.05	0.064	0.1	1.03	32	6.35	125
1/03/2018	ETFSL500	0.036	0.051	0.08	0.65	2.3	6.38	123
7/03/2018	ETAU	2.54	2.48	7.52	7.23	168.1	6.12	514
7/03/2018	ETFSL100	2.21	2.15	4.12	4.43	158.6	6.11	479
7/03/2018	ETFSL200	0.082	0.132	0.07	0.92	166.8	6.29	147
7/03/2018	ETFSL300	0.108	0.12	<0.05	0.91	149	6.32	147
7/03/2018	ETFSL400	0.088	0.11	<0.05	0.78	161.1	6.79	142
7/03/2018	ETFSL500	0.083	0.102	0.07	0.76	154.5	6.32	138
14/03/2018	ETAU	1.54	1.43	3.72	6.68	41.4	6.58	450
14/03/2018	ETFSL100	0.907	1.08	0.55	3.58	31.6	6.95	431
14/03/2018	ETFSL200	0.047	0.066	<0.05	0.63	76	6.84	135
14/03/2018	ETFSL300	0.048	0.054	<0.05	0.56	41.4	6.83	133
14/03/2018	ETFSL400	0.064	0.055	0.06	0.61	3.3	6.86	132
14/03/2018	ETFSL500	0.047	0.052	<0.05	0.47	21.9	6.79	131
22/03/2018	ETAU	0.312	0.33	0.73	1.46	229.3	5.24	237
22/03/2018	ETFSL100	0.362	0.363	0.71	1.69	182.9	5.08	240
22/03/2018	ETFSL200	0.166	0.173	0.44	1.63	71.9	6.51	160
22/03/2018	ETFSL300	0.118	0.118	0.28	1.33	70.6	6.54	153
22/03/2018	ETFSL400	0.146	0.136	0.8	1.66	22.8	6.61	152
22/03/2018	ETFSL500	0.091	0.095	0.14	1.02	32.6	6.65	144
29/03/2018	ETAU	0.841	0.798	2.83	3.32	148	6.66	341
29/03/2018	ETFSL100	0.732	0.729	1.87	2.6	40.9	6.63	332
29/03/2018	ETFSL200	0.058	0.059	0.11	0.62	84.2	6.65	131
29/03/2018	ETFSL300	0.047	0.053	0.08	0.59	65.9	6.64	131
29/03/2018	ETFSL400	0.051	0.055	0.08	0.74	71.4	6.64	130
29/03/2018	ETFSL500	0.033	0.051	0.08	1.29	27.3	6.68	128
5/4/2018	ETAU	0.885	0.904	2.84	4.76	182.7	6.57	384
5/4/2018	ETFSL100	0.674	0.672	0.73	2.41	191.7	6.67	374
5/4/2018	ETFSL200	0.058	0.067	0.08	0.62	211.9	6.32	142
5/4/2018	ETFSL300	0.044	0.058	0.07	0.57	209.4	6.37	142
5/4/2018	ETFSL400	0.04	0.058	0.13	0.77	209.1	6.39	141
5/4/2018	ETFSL500	0.035	0.054	0.09	0.66	205.9	6.4	141
13/4/2018	ETAU	0.888	0.927	1.42	4.26	156.2	6.76	391
13/4/2018	ETFSL100	0.614	0.651	0.13	2.46	172.9	6.92	382
13/4/2018	ETFSL200	0.042	0.065	0.08	0.7	42.8	6.84	153
13/4/2018	ETFSL300	0.033	0.051	0.05	0.5	40.9	6.52	145
13/4/2018	ETFSL400	0.023	0.048	<0.05	0.59	64.1	6.6	147
13/4/2018	ETFSL500	0.014	0.04	<0.05	0.51	58.6	6.61	142
18/4/2018	ETAU	0.875	0.925	0.62	2.62	192.1	6.77	397
18/4/2018	ETFSL100	0.614	0.636	0.13	2.27	192.3	7.19	390
18/4/2018	ETFSL200	0.184	0.14	0.57	1.14	184.8	6.75	178
18/4/2018	ETFSL300	0.059	0.074	0.08	0.86	186.3	6.81	162
18/4/2018	ETFSL400	0.05	0.069	<0.05	0.64	181.3	6.76	159
18/4/2018	ETFSL500	0.044	0.071	0.07	0.76	185.5	6.76	160

ATTACHMENT A (Continued)
Water Quality Data for Sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100

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)
26/4/2018	ETAU	0.871	0.887	3.01	4.32	7.2	7.02	1040
26/4/2018	ETFSL100	0.587	0.631	0.1	2.06	9.6	7.42	409
26/4/2018	ETFSL200	0.059	0.071	0.08	0.69	45.1	7.01	159
26/4/2018	ETFSL300	0.043	0.055	<0.05	0.54	2.5	6.96	159
26/4/2018	ETFSL400	0.04	0.055	<0.05	0.54	36	6.97	155
26/4/2018	ETFSL500	0.03	0.05	0.05	0.51	94.3	6.96	152
3/5/2018	ETAU	0.781	0.813	2.38	2.38	76.9	6.9	362
3/5/2018	ETFSL100	0.58	0.611	0.18	3.02	20	7.47	358
3/5/2018	ETFSL200	0.056	0.081	0.07	0.78	43.5	7.01	142
3/5/2018	ETFSL300	0.053	0.059	0.13	0.55	5.3	7.02	136
3/5/2018	ETFSL400	0.044	0.052	0.06	0.45	55.3	7	132
3/5/2018	ETFSL500	0.034	0.044	0.07	0.68	60.7	7.01	128
10/5/2018	ETAU	0.752	0.86	4.66	4.66	176.7	6.75	388
10/5/2018	ETFSL100	0.553	0.628	0.06	4.58	191.5	7.19	384
10/5/2018	ETFSL200	0.044	0.061	<0.05	0.89	187.4	6.64	129
10/5/2018	ETFSL300	0.042	0.051	0.08	0.56	180.2	6.67	131
10/5/2018	ETFSL400	0.051	0.056	0.1	0.5	170.7	6.71	133
10/5/2018	ETFSL500	0.032	0.04	0.08	0.45	164	6.68	124
17/5/2018	ETAU	0.868	0.795	3.32	3.32	160	6.78	383
17/5/2018	ETFSL100	0.634	0.605	<0.05	2.66	178.5	7.12	375
17/5/2018	ETFSL200	0.249	0.22	0.25	1.87	178.5	6.85	246
17/5/2018	ETFSL300	0.176	0.178	0.12	1.57	175.8	6.84	230
17/5/2018	ETFSL400	0.146	0.14	0.1	1.32	179.3	6.78	202
17/5/2018	ETFSL500	0.113	0.102	0.12	1.36	179.6	6.65	176
24/5/2018	ETAU	0.763	0.795	3.22	3.22	192.8	7.22	381
24/5/2018	ETFSL100	0.563	0.63	<0.05	4.36	194.2	7.12	375
24/5/2018	ETFSL200	0.128	0.128	0.58	1.03	189.4	6.95	158
24/5/2018	ETFSL300	0.04	0.053	0.05	0.62	102.2	6.78	125
24/5/2018	ETFSL400	0.037	0.043	0.07	0.39	184.9	6.72	145
24/5/2018	ETFSL500	0.031	0.037	<0.05	0.33	185.2	6.76	120
31/5/2018	ETAU	0.797	0.812	3.74	3.74	193.3	7.22	378
31/5/2018	ETFSL100	0.626	0.598	<0.05	2.57	197.5	7.12	375
31/5/2018	ETFSL200	0.362	0.344	0.48	2.18	187.7	7.18	260
31/5/2018	ETFSL300	0.177	0.171	0.24	1.44	185.8	7.18	188
31/5/2018	ETFSL400	0.178	0.162	0.67	1.86	179.9	7.19	184
31/5/2018	ETFSL500	0.098	0.096	0.11	0.89	176	7.12	154
7/6/2018	ETAU	1.19	1.24	3.12	4.03	188.4	6.8	361
7/6/2018	ETFSL100	0.889	0.942	1.43	2.91	185.7	7.19	342
7/6/2018	ETFSL200	0.8	0.792	1.29	3.2	189.2	7.17	327
7/6/2018	ETFSL300	0.625	0.67	0.9	3.42	178.7	7.16	304
7/6/2018	ETFSL400	0.402	0.442	0.06	4.24	182.9	7.25	271
7/6/2018	ETFSL500	0.347	0.358	0.35	3.74	183.4	7.27	268
14/6/2018	ETAU	0.674	0.686	2.1	3.89	99.8	6.94	314
14/6/2018	ETFSL100	0.34	0.539	0.26	2.33	73.3	7.27	309
14/6/2018	ETFSL200	0.47	0.459	0.72	2.12	178.9	7.09	300
14/6/2018	ETFSL300	0.377	0.37	0.26	2.25	167.8	7.12	264
14/6/2018	ETFSL400	0.292	0.288	0.08	2.17	192.4	7.15	228
14/6/2018	ETFSL500	0.255	0.251	0.08	1.94	203.5	7.04	201

ATTACHMENT A (Continued)
Water Quality Data for Sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100

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)
20/6/2018	ETAU	0.657	0.628	3.62	5.4	188.3	6.72	337
20/6/2018	ETFSL100	0.457	0.468	0.9	3.16	19	6.9	324
20/6/2018	ETFSL200	0.371	0.39	0.72	2.4	191.4	6.95	320
20/6/2018	ETFSL300	0.384	0.377	0.34	2.42	190.5	6.98	322
20/6/2018	ETFSL400	0.331	0.333	<0.05	2.84	191.2	7	312
20/6/2018	ETFSL500	0.256	0.28	<0.05	2.67	184.8	7.01	273
28/6/2018	ETAU	0.634	0.687	4.08	7	185.8	6.6	328
28/6/2018	ETFSL100	0.501	0.559	1.04	3.95	188.8	7.02	329
28/6/2018	ETFSL200	0.409	0.422	1.45	3.94	187.2	6.82	306
28/6/2018	ETFSL300	0.176	0.207	<0.05	1.95	199.7	6.77	190
28/6/2018	ETFSL400	0.108	0.111	<0.05	1.04	198.5	6.67	128
28/6/2018	ETFSL500	0.075	0.079	0.05	0.79	179.7	6.61	118
2/7/2018	ETAU	0.637	0.706	3.29	6.24	39.9	7.05	352
2/7/2018	ETFSL100	0.519	0.558	0.97	4.38	191	7.31	351
2/7/2018	ETFSL200	0.395	0.416	0.86	2.28	191.4	7.34	344
2/7/2018	ETFSL300	0.391	0.426	1.19	3.57	193.9	7.25	342
2/7/2018	ETFSL400	0.327	0.349	0.15	3.82	195.4	7.22	311
2/7/2018	ETFSL500	0.226	0.258	0.06	2.37	194.2	7.15	252
12/7/2018	ETAU	0.587	0.626	1.11	2.33	456.6	7.31	370
12/7/2018	ETFSL100	0.501	0.492	0.63	1.6	163.5	7.59	367
12/7/2018	ETFSL200	0.342	0.338	0.73	1.42	160.3	7.5	355
12/7/2018	ETFSL300	0.324	0.373	1.16	2.87	154.8	7.49	361
12/7/2018	ETFSL400	0.338	0.353	0.44	3.85	1596	7.55	356
12/7/2018	ETFSL500	0.212	0.218	<0.05	2.45	158.3	7.37	259
19/7/2018	ETAU	0.726	0.712	0.63	3.5	177	7	377
19/7/2018	ETFSL100	0.576	0.565	0.11	3.01	202.8	7.37	371
19/7/2018	ETFSL200	0.444	0.4	0.36	2.35	200.6	7.24	360
19/7/2018	ETFSL300	0.462	0.402	1.11	3.68	202	7.21	372
19/7/2018	ETFSL400	0.431	0.374	0.57	3.48	203.3	7.33	384
19/7/2018	ETFSL500	0.288	0.279	<0.05	3.33	203.6	7.21	330
26/7/2018	ETAU	0.725	0.753	4.1	6.53	-5.9	6.59	364
26/7/2018	ETFSL100	0.522	0.566	0.19	2.89	10.8	6.78	356
26/7/2018	ETFSL200	0.31	0.353	0.29	1.73	9.8	6.79	351
26/7/2018	ETFSL300	0.35	0.35	1.59	2.55	-0.3	6.71	353
26/7/2018	ETFSL400	0.375	0.397	1.92	3.56	-12.3	6.75	370
26/7/2018	ETFSL500	0.346	0.431	<0.05	3.13	107.8	6.88	378
02/8/2018	ETAU	0.744	0.733	0.44	2.96	54.8	6.53	366
02/8/2018	ETFSL100	0.526	0.544	0.09	2.48	325	6.57	359
02/8/2018	ETFSL200	0.321	0.350	0.39	1.44	265.1	6.51	352
02/8/2018	ETFSL300	0.337	0.348	1.79	2.59	263.4	6.39	355
02/8/2018	ETFSL400	0.398	0.420	3.38	4.5	251.8	6.59	397
02/8/2018	ETFSL500	0.395	0.429	1.14	3.44	236.4	6.8	386
09/8/2018	ETAU	0.637	0.785	2.11	5.08	257.2	6.73	367
09/8/2018	ETFSL100	0.538	0.644	0.18	5.24	256.6	6.92	363
09/8/2018	ETFSL200	0.276	0.316	0.20	1.56	248.6	6.86	355
09/8/2018	ETFSL300	0.285	0.306	1.68	2.50	233.3	6.75	355
09/8/2018	ETFSL400	0.375	0.416	5.43	6.97	254.2	6.99	436
09/8/2018	ETFSL500	0.373	0.401	3.02	4.50	253.7	6.9	390

ATTACHMENT A (Continued)
Water Quality Data for Sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100

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)
16/8/2018	ETAU	0.672	0.797	1.53	3.99	250.1	6.71	365
16/8/2018	ETFSL100	0.491	0.584	0.08	2.32	264.8	7.16	362
16/8/2018	ETFSL200	0.263	0.304	0.1	1.17	265.4	7.13	353
16/8/2018	ETFSL300	0.249	0.298	1.02	1.98	267.4	6.96	349
16/8/2018	ETFSL400	0.336	0.351	3.57	4.23	260.7	7.12	405
16/8/2018	ETFSL500	0.309	0.358	1.69	3.18	261.3	6.98	386
23/8/2018	ETAU	0.724	0.701	0.92	3.12	266.4	7.03	358
23/8/2018	ETFSL100	0.489	0.505	0.07	2.26	271.7	6.97	351
23/8/2018	ETFSL200	0.274	0.270	0.1	1.01	267.1	7.11	344
23/8/2018	ETFSL300	0.227	0.273	0.83	1.83	265.6	7.04	341
23/8/2018	ETFSL400	0.267	0.279	2.11	2.50	261.8	7.05	365
23/8/2018	ETFSL500	0.352	0.337	2.34	3.41	258.1	7.23	382
30/8/2018	ETAU	0.632	0.696	<0.05	2.52	99.5	7.97	368
30/8/2018	ETFSL100	0.440	0.491	<0.05	2.09	77	7.73	354
30/8/2018	ETFSL200	0.225	0.243	0.06	0.85	23.2	7.85	350
30/8/2018	ETFSL300	0.236	0.248	0.96	1.70	256.2	7.78	345
30/8/2018	ETFSL400	0.327	0.343	3.30	4.50	252.5	8.20	399
30/8/2018	ETFSL500	0.316	0.350	2.05	3.65	228.1	8.18	387
05/9/2018	ETAU	0.688	0.683	0.66	4.54	25.2	7.44	363
05/9/2018	ETFSL100	0.476	0.483	<0.05	2.06	53.5	7.77	350
05/9/2018	ETFSL200	0.234	0.23	0.09	0.98	12.5	7.71	340
05/9/2018	ETFSL300	0.259	0.238	1.08	1.71	-12.5	7.57	333
05/9/2018	ETFSL400	0.367	0.371	4.53	5.96	-42.4	7.65	404
05/9/2018	ETFSL500	0.336	0.318	2.52	3.73	1.5	7.69	372
12/9/2018	ETAU	0.653	0.719	<0.05	3.72	178.2	7.05	360
12/9/2018	ETFSL100	0.461	0.521	<0.05	2.72	71.7	7.54	356
12/9/2018	ETFSL200	0.25	0.28	<0.05	0.96	20.1	7.49	346
12/9/2018	ETFSL300	0.3	0.301	0.41	1.73	3.1	7.38	345
12/9/2018	ETFSL400	0.389	0.34	2.15	2.77	-62.7	7.39	359
12/9/2018	ETFSL500	0.401	0.39	1.04	3.87	-17.4	7.43	381
20/9/2018	ETAU	0.392	0.721	1.14	2.49	272.4	7.11	362
20/9/2018	ETFSL100	0.179	0.467	<0.05	1.88	272.4	7.18	350
20/9/2018	ETFSL200	0.182	0.194	0.63	0.7	25.2	7.17	341
20/9/2018	ETFSL300	0.227	0.233	0.63	1.5	-11.9	7.08	337
20/9/2018	ETFSL400	0.386	0.356	2.66	5.39	-34.2	7.21	397
20/9/2018	ETFSL500	0.394	0.358	1.1	3.15	25.4	7.25	371
27/9/2018	ETAU	0.58	0.763	<0.05	2.24	234	7.33	400
27/9/2018	ETFSL100	0.434	0.493	<0.05	1.54	268.1	7.64	392
27/9/2018	ETFSL200	0.178	0.188	<0.05	0.61	272.8	7.55	381
27/9/2018	ETFSL300	0.231	0.239	0.4	1.6	270.8	7.33	377
27/9/2018	ETFSL400	0.331	0.325	1.49	3.55	263.1	7.41	400
27/9/2018	ETFSL500	0.335	0.375	0.83	3.46	266.8	7.67	416
05/10/2018	ETAU	0.39	0.359	2.14	3.49	274.6	7.28	250
05/10/2018	ETFSL100	0.297	0.686	0.32	12	271	7.57	286
05/10/2018	ETFSL200	0.305	0.308	0.29	2.72	269.7	7.67	295
05/10/2018	ETFSL300	0.272	0.305	0.32	2.72	267.7	7.66	291
05/10/2018	ETFSL400	0.364	0.299	0.63	2.95	259.8	7.73	294
05/10/2018	ETFSL500	0.251	0.245	0.36	2.11	242.9	7.58	271

ATTACHMENT A (Continued)
Water Quality Data for Sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100

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)
10/10/2018	ETAU	0.569	0.635	1.8	2.68	266.6	6.59	308
10/10/2018	ETFSL100	0.571	0.602	1.62	2.25	267.5	6.66	304
10/10/2018	ETFSL200	0.494	0.558	1.07	1.88	269.6	6.78	302
10/10/2018	ETFSL300	0.492	0.49	1.05	1.42	269.6	6.81	303
10/10/2018	ETFSL400	0.479	0.503	2.3	3.04	267.3	7.07	334
10/10/2018	ETFSL500	0.48	0.512	1.36	2	266.7	6.98	308
15/10/2018	ETAU	0.325	0.333	0.9	1.33	285.6	6.35	269
15/10/2018	ETFSL100	0.298	0.302	0.69	1.2	278.5	6.36	259
15/10/2018	ETFSL200	0.316	0.336	0.66	1.9	276.9	6.37	262
15/10/2018	ETFSL300	0.286	0.298	0.57	1.41	279.5	6.39	259
15/10/2018	ETFSL400	0.276	0.3	0.6	1.38	279.9	6.56	266
15/10/2018	ETFSL500	0.273	0.279	0.63	1.18	263	7.71	267
22/10/2018	ETAU	0.274	0.259	0.76	1.26	276.9	6.52	281
22/10/2018	ETFSL100	0.25	0.244	0.56	1.13	270.7	6.57	278
22/10/2018	ETFSL200	0.235	0.233	0.41	1.01	270.4	6.53	275
22/10/2018	ETFSL300	0.236	0.228	0.42	1	269	6.58	275
22/10/2018	ETFSL400	0.304	0.263	1.8	2.51	264.8	7.01	321
22/10/2018	ETFSL500	0.184	0.229	0.26	1.19	258.5	6.74	279
30/10/2018	ETAU	0.432	0.431	1.79	2.55	15.1	6.65	290
30/10/2018	ETFSL100	0.376	0.39	0.76	1.78	-0.4	6.91	286
30/10/2018	ETFSL200	0.336	0.363	0.37	1.47	3.8	6.92	285
30/10/2018	ETFSL300	0.341	0.35	0.39	1.32	7.6	6.99	291
30/10/2018	ETFSL400	0.36	0.364	1.58	3.1	-77.3	7.09	329
30/10/2018	ETFSL500	0.34	0.351	0.5	1.63	-4.2	7.05	296
08/11/2018	ETAU	0.635	0.553	0.76	3.15	23.3	7.07	307
08/11/2018	ETFSL100	0.429	0.433	0.14	1.59	12.9	7.35	307
08/11/2018	ETFSL200	0.333	0.34	0.06	1	20	7.31	303
08/11/2018	ETFSL300	0.333	0.329	0.06	1.1	5.4	7.32	304
08/11/2018	ETFSL400	0.431	0.403	5.31	5.49	247.1	7.47	385
08/11/2018	ETFSL500	0.315	0.325	0.37	1.54	248.4	7.30	310
15/11/2018	ETAU	0.609	0.628	0.53	2.04	264.1	7.09	334
15/11/2018	ETFSL100	0.399	0.414	<0.05	1.6	172.9	7.32	328
15/11/2018	ETFSL200	0.308	0.331	<0.05	1.34	272	7.31	325
15/11/2018	ETFSL300	0.321	0.298	0.08	1.15	271	7.28	324
15/11/2018	ETFSL400	0.396	0.383	1.44	4.72	262.5	7.35	373
15/11/2018	ETFSL500	0.328	0.336	0.24	1.76	267.3	7.38	345
19/11/2018	ETWQ AU	0.647	⁻⁶	0.08	2.42	259.1	7.22	345
22/11/2018	ETFSL200	0.264	0.298	<0.05	0.82	30.9	7.29	355
22/11/2018	ETFSL500	0.38	0.376	0.67	1.88	-3.3	7.50	373
22/11/2018	CONFLU1	0.085	0.088	0.12	0.9	-1.1	7.51	307
22/11/2018	WARARM5	0.018	0.046	0.25	1	54.6	7.57	297
22/11/2018	WDFS1	0.105	0.114	0.12	1.15	40.1	7.53	307
22/11/2018	WDFS1+100	0.103	0.119	0.1	1.06	26	7.55	306

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

ATTACHMENT A (Continued)
Water Quality Data for Sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100

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)
26/11/2018	ETWQ AU	0.538	⁻⁶	<0.05	1.36	83.8	7.11	354
29/11/2018	ETFSL200	0.139	0.15	0.54	1.2	36.1	7.07	195
29/11/2018	ETFSL500	0.167	0.147	0.3	1.19	30.1	6.94	195
29/11/2018	CONFLU1	0.158	0.108	0.27	1.18	29.5	7.19	200
29/11/2018	WARARM5	0.055	0.052	0.18	0.92	66.7	7.5	206
29/11/2018	WDFS1	0.082	0.074	0.18	0.21	36.7	7.8	206
29/11/2018	WDFS1+100	0.103	0.094	0.19	1	38.4	7.36	200
4/12/2018	ETWQ AU	0.433	⁻⁶	1.65	2.36	30.6	7	266
6/12/2018	ETFSL200	0.283	0.295	0.26	1.04	242.7	6.97	260
6/12/2018	ETFSL500	0.29	0.3	0.62	1.47	249.5	7.23	270
6/12/2018	CONFLU1	0.112	0.114	0.12	1.13	243.8	7.24	243
6/12/2018	WARARM5	0.034	0.035	<0.05	0.75	250.1	7.29	238
6/12/2018	WDFS1	0.122	0.134	0.07	1.12	241.4	7.29	246
6/12/2018	WDFS1+100	0.109	0.126	<0.05	0.99	251.1	7.3	245
12/12/2018	ETAU	0.428	0.484	1.49	3.33	-	6.86	269
12/12/2018	ETFSL200	0.215	0.232	<0.05	0.42	255.3	7.4	245
12/12/2018	ETFSL500	0.276	0.284	0.27	0.89	251.9	7.41	262
12/12/2018	CONFLU1	0.081	0.091	0.45	0.8	17.9	7.39	219
12/12/2018	WARARM5	0.03	0.042	<0.05	0.58	236.4	7.53	214
12/12/2018	WDFS1	0.108	0.121	0.41	1.09	27.5	7.44	225
12/12/2018	WDFS1+100	0.105	0.12	<0.05	0.99	42.3	7.24	243
17/12/2018	ETWQ AU	0.102	⁻⁶	0.18	0.75	280.3	6.50	152
17/12/2018	ETFSL200	0.076	0.084	0.17	0.7	274.8	6.76	152
17/12/2018	ETFSL500	0.087	0.086	0.19	0.76	274.8	6.56	150
17/12/2018	CONFLU1	0.068	0.068	0.16	0.78	270.9	6.64	152
17/12/2018	WARARM5	0.023	0.032	0.08	0.54	257.5	6.77	156
17/12/2018	WDFS1	0.069	0.062	0.15	0.75	273	6.67	153
17/12/2018	WDFS1+100	0.055	0.063	0.12	0.71	278.4	6.71	154
27/12/2018	ETAU	0.263	0.277	0.61	1.81	24.3	6.72	217
27/12/2018	ETFSL200	0.196	0.194	0.09	0.93	30.6	7.11	216
27/12/2018	ETFSL500	0.219	0.213	0.3	1.37	-6.9	7.13	224
27/12/2018	CONFLU1	0.071	0.075	<0.05	0.86	21.4	7.15	208
27/12/2018	WARARM5	0.045	0.036	<0.05	0.48	3.4	7.3	206
27/12/2018	WDFS1	0.108	0.11	0.06	0.99	24.9	7.12	210
27/12/2018	WDFS1+100	0.101	0.105	<0.05	0.93	37.4	7.13	210
3/01/2019	ETWQ AU	0.335	0.443	<0.05	1.57	110.1	7.35	300
3/01/2019	ETFSL200	0.159	0.226	<0.05	0.63	113.1	7.63	290
3/01/2019	ETFSL500	0.265	0.274	0.12	1.32	11.5	7.5	302
3/01/2019	CONFLU1	0.143	0.16	<0.05	1.21	4.8	7.29	270
3/01/2019	WARARM5	0.055	0.054	<0.05	0.64	56.4	7.46	256
3/01/2019	WDFS1	0.106	0.14	<0.05	1.27	72	7.45	265
3/01/2019	WDFS1+100	0.101	0.138	<0.05	1.16	56.2	7.42	263
10/01/2019	ETWQ AU	0.438	0.282	<0.05	1.41	244.1	6.92	268
10/01/2019	ETFSL200	0.216	0.246	<0.05	0.62	26.8	8.03	279
10/01/2019	ETFSL500	0.22	0.262	<0.05	1.18	-9.3	7.64	300
10/01/2019	CONFLU1	0.129	0.141	<0.05	1.11	-33.7	7.55	269
10/01/2019	WARARM5	0.042	0.041	<0.05	0.6	90.3	7.62	252
10/01/2019	WDFS1	0.061	0.087	<0.05	0.92	22.1	7.59	242
10/01/2019	WDFS1+100	0.061	0.074	<0.05	0.97	6.9	7.58	240

ATTACHMENT A (Continued)
Water Quality Data for Sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100

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)
16/01/2019	ETWQ AU	0.433	0.454	<0.05	1.86	171.1	6.75	282
16/01/2019	ETFSL200	0.18	0.189	<0.05	0.4	258.4	7.67	275
16/01/2019	ETFSL500	0.244	0.233	0.38	1	262.4	7.65	303
16/01/2019	CONFLU1	0.058	0.049	0.12	0.86	261.2	7.68	249
16/01/2019	WARARM5	0.025	0.028	0.11	0.52	268.1	7.82	242
16/01/2019	WDFS1	0.046	0.044	0.16	0.92	263.5	7.76	256
16/01/2019	WDFS1+100	0.047	0.044	0.19	0.94	259.2	7.79	260
23/01/2019	ETWQ AU	0.579	0.661	<0.05	2.09	184.3	6.78	292
23/01/2019	ETFSL200	0.171	0.204	<0.05	0.38	96.8	7.65	286
23/01/2019	ETFSL500	0.28	0.284	0.2	1.62	-11.1	7.65	316
23/01/2019	CONFLU1	0.052	0.056	<0.05	1.11	5.6	7.7	264
23/01/2019	WARARM5	0.043	0.036	<0.05	0.74	-38.4	7.7	253
23/01/2019	WDFS1	0.032	0.042	<0.05	1.08	19.6	7.77	266
23/01/2019	WDFS1+100	0.02	0.029	<0.05	0.92	-16.6	7.83	266
29/01/2019	ETAU	0.62	0.578	0.07	1.52	66.8	6.7	294
29/01/2019	ETFSL200	0.19	0.216	<0.05	0.44	36.2	7.23	282
29/01/2019	ETFSL500	0.249	0.279	<0.05	1.48	12.1	7.34	310
29/01/2019	CONFLU1	0.048	0.07	<0.05	1.05	-20.8	7.54	282
29/01/2019	WARARM5	0.031	0.028	<0.05	0.54	49.5	7.34	251
29/01/2019	WDFS1	0.027	0.038	<0.05	0.96	29.7	7.49	260
29/01/2019	WDFS1+100	0.03	0.03	<0.05	0.91	9.9	7.49	260
4/02/2019	ETAU	0.559	0.635	<0.05	1.04	51.1	6.8	283
4/02/2019	ETFSL200	0.173	0.191	<0.05	0.34	9.1	7.26	275
4/02/2019	ETFSL500	0.221	0.276	0.31	1.7	-18.6	7.35	302
4/02/2019	CONFLU1	0.043	0.036	0.16	0.85	-51.7	7.55	252
4/02/2019	WARARM5	0.023	0.029	0.19	0.74	139.1	7.58	240
4/02/2019	WDFS1	0.012	0.021	0.27	0.8	73.2	7.71	252
4/02/2019	WDFS1+100	0.01	0.02	0.29	0.74	50	7.71	255
11/02/2019	ETAU	0.757	0.731	<0.05	1.5	261.4	6.86	288
11/02/2019	ETFSL200	0.197	0.206	<0.05	0.36	6.8	7.21	280
11/02/2019	ETFSL500	0.243	0.302	0.5	1.86	-33.9	7.3	306
11/02/2019	CONFLU1	0.023	0.033	0.24	0.94	-96.7	7.48	255
11/02/2019	WARARM5	0.019	0.026	0.24	0.66	53.5	7.46	243
11/02/2019	WDFS1	0.011	0.018	0.31	0.98	-26	7.62	259
11/02/2019	WDFS1+100	0.005	0.013	0.3	0.83	64.5	7.62	258
18/02/2019	ETAU	0.624	0.675	0.17	1.51	51.8	6.91	303
18/02/2019	ETFSL200	0.189	0.19	0.19	0.36	12.8	7.27	296
18/02/2019	ETFSL500	0.243	0.284	0.23	1.77	-15.6	7.86	277
18/02/2019	CONFLU1	0.041	0.035	0.13	0.9	6.6	7.73	291
18/02/2019	WARARM5	0.022	0.024	0.19	0.64	64.1	7.46	262
18/02/2019	WDFS1	0.007	0.012	0.31	0.78	26.7	7.83	279
18/02/2019	WDFS1+100	0.006	0.011	0.24	0.64	23.3	7.84	279
25/02/2019	ETAU	0.616	0.719	<0.05	0.93	273.1	7.19	283
25/02/2019	ETFSL200	0.198	0.199	<0.05	0.54	270.5	7.06	271
25/02/2019	ETFSL500	0.281	0.312	1.72	2.11	270.6	7.3	307
25/02/2019	CONFLU1	0.022	0.027	0.06	0.86	274.6	7.37	247
25/02/2019	WARARM5	0.014	0.023	<0.05	0.53	264.2	7.4	238
25/02/2019	WDFS1	0.009	0.017	<0.05	0.79	272.6	7.55	248
25/02/2019	WDFS1+100	0.004	0.014	0.05	0.92	264.9	7.6	246

ATTACHMENT A (Continued)
Water Quality Data for Sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100

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)
04/03/2019	ETAU	0.688	0.67	<0.05	0.13	104.3	6.74	306
04/03/2019	ETFSL200	0.185	0.193	0.12	0.48	259.3	7.18	294
04/03/2019	ETFSL500	0.295	0.298	0.76	2.02	271.1	7.33	334
04/03/2019	CONFLU1	0.032	0.049	0.12	1.71	277.1	7.56	274
04/03/2019	WARARM5	0.025	0.031	0.12	1.02	277.7	7.44	248
04/03/2019	WDFS1	0.006	0.013	0.13	0.81	273.6	7.75	271
04/03/2019	WDFS1+100	0.005	0.011	0.21	0.71	249.3	7.58	270
11/03/2019	ETAU	0.638	0.726	0.08	0.94		6.87	322
11/03/2019	ETFSL200	0.152	0.170	0.06	0.38	227.4	7.24	310
11/03/2019	ETFSL500	0.266	0.28	0.5	1.91	219.5	7.43	347
11/03/2019	CONFLU1	0.024	0.03	0.23	0.96	228.5	7.53	289
11/03/2019	WARARM5	0.018	0.052	0.19	0.71	202.5	7.53	269
11/03/2019	WDFS1	0.01	0.018	0.26	0.8	219.7	7.07	276
11/03/2019	WDFS1+100	0.006	0.027	0.22	1.45	215.9	7.82	289
18/03/2019	ETAU	0.153	0.16	0.84	1.21	239	6.77	175
18/03/2019	ETFSL200	0.187	<0.01	0.5	0.204	237.9	6.62	180
18/03/2019	ETFSL500	0.193	<0.01	0.63	0.197	230.4	6.7	184
18/03/2019	CONFLU1	0.146	0.02	0.5	0.156	50.3	6.72	172
18/03/2019	WARARM5	0.032	<0.01	0.3	0.034	49.3	6.67	153
18/03/2019	WDFS1	0.071	0.04	0.44	0.073	21.4	6.67	159
18/03/2019	WDFS1+100	0.094	0.04	0.42	0.099	57.1	6.61	158
26/03/2019	ETAU	0.335	0.347	0.46	1.91	29.3	6.74	230
26/03/2019	ETFSL200	0.205	0.217	<0.05	1.04	23.5	6.96	224
26/03/2019	ETFSL500	0.233	0.234	0.5	1.39	227	6.99	239
26/03/2019	CONFLU1	0.095	0.114	<0.05	0.8	237.9	7.02	206
26/03/2019	WARARM5	0.039	0.041	<0.05	0.45	241.4	6.92	195
26/03/2019	WDFS1	0.073	0.076	<0.05	0.65	236.4	7.02	200
26/03/2019	WDFS1+100	0.054	0.049	<0.05	0.64	241.1	7.03	199
01/04/2019	ETAU	0.332	0.407	<0.05	1.51	160	7.3	256
01/04/2019	ETFSL200	0.184	0.248	<0.05	0.78	-1.8	7.68	248
01/04/2019	ETFSL500	0.222	0.261	0.47	1.14	-4.8	7.64	263
01/04/2019	CONFLU1	0.103	0.116	0.17	0.92	9	7.68	232
01/04/2019	WARARM5	0.034	0.037	0.1	0.42	36.8	7.71	207
01/04/2019	WDFS1	0.051	0.061	0.18	0.64	0.8	7.67	221
01/04/2019	WDFS1+100	0.027	0.031	0.14	0.56	43.5	7.73	219
08/04/2019	ETAU	0.298	0.319	0.64	1.89	35.8	6.86	225
08/04/2019	ETFSL200	0.200	0.198	0.12	0.96	273.8	7.09	212
08/04/2019	ETFSL500	0.184	0.2	0.34	1.34	264	7.25	220
08/04/2019	CONFLU1	0.073	0.082	0.14	0.77	238.9	7.54	212
08/04/2019	WARARM5	0.02	0.018	0.06	0.35	252.5	7.6	204
08/04/2019	WDFS1	0.039	0.05	0.11	0.7	236.9	7.56	205
08/04/2019	WDFS1+100	0.03	0.038	0.08	0.58	242.3	7.61	205
16/04/2019	ETAU	0.321	0.31	<0.05	1.31	259.8	7.17	240
16/04/2019	ETFSL200	0.156	0.154	<0.05	0.64	83.9	7.48	233
16/04/2019	ETFSL500	0.207	0.204	0.53	1.25	11.4	7.65	262
16/04/2019	CONFLU1	0.099	0.1	0.06	0.73	3.8	7.69	235
16/04/2019	WARARM5	0.024	0.021	0.21	0.34	21.6	7.62	207
16/04/2019	WDFS1	0.035	0.035	0.13	0.62	0.9	7.6	215
16/04/2019	WDFS1+100	0.017	0.017	0.14	0.48	4.6	7.67	214

ATTACHMENT A (Continued)**Water Quality Data for Sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100**

Date	Site	Manganese (mg/L) (F)	Manganese (mg/L) (T)	Iron (mg/L) (F)	Iron (mg/L) (T)	ORP (mV)	pH Lab	EC Lab (μ S/cm)
23/04/2019	ETAU	0.384	0.425	<0.05	1.82	262.5	7.54	224
23/04/2019	ETFSL200	0.162	0.174	0.08	0.77	73.9	7.31	218
23/04/2019	ETFSL500	0.214	0.232	0.24	1.4	8.8	7.64	240
23/04/2019	CONFLU1	0.041	0.046	0.13	0.76	10.6	7.56	194
23/04/2019	WARARM5	0.041	0.046	0.13	0.76	63.3	7.56	194
23/04/2019	WDFS1	0.026	0.027	0.16	0.71	7.5	7.56	191
23/04/2019	WDFS1+100	0.009	0.014	0.18	0.6	45	7.59	190

6 August 2019

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 – May 2019

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 301-303 Water Management Plan (LW301-303 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 LW301-303 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 LW301-303 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 LW301-303 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 LW301-303 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.

Analysis conducted by Hydro Engineering & Consulting (2019) in accordance with the LW301-303 WMP, identified that the performance indicator for water resources reaching the Woronora Reservoir was exceeded for dissolved (i.e. filtered <0.45 µm fraction) manganese on the Eastern Tributary at site ETWQ AU in May 2019 (as there was not a similar exceedance of the trigger recorded at control site WOWQ 2 on the Woronora River). The performance indicator was not exceeded for field filtered iron or aluminium in May 2019 and therefore these parameters are not discussed in this report.

In accordance with the LW301-303 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*.

This assessment against the water quality subsidence impact performance measure has been prepared for May 2019 in consideration of:

- pluviograph data;
- flow data from the Eastern Tributary gauging location (GS 300078);
- groundwater level and groundwater quality results for Eastern Tributary sites up to 31 May 2019¹;
- surface water quality data at site ETWQ AU/ETAU² and sites further upstream on the Eastern Tributary up to 31 May 2019;
- surface water quality data at sites downstream of ETWQ AU/ETAU² up to 31 May 2019; 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. Recently, above average rainfall has been recorded in October 2018, November 2018, December 2018 and March 2019, and below average rainfall has been recorded in January, February, April and May 2019 (Table 1).

Total rainfall in May 2019 was 8.5 mm, approximately one quarter of the average (126.1 mm), with 6.5 mm of rainfall recorded on 4 May and 2 mm of rainfall recorded on 6 May. Shallow groundwater levels correlate with the rainfall trend.

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

² Site ETAU is the same as site ETWQ AU (i.e. samples are taken at the same location). The difference between the sites relates to the time of sampling. Site ETWQ AU monitoring is conducted on the same day as sites upstream of ETWQ AU/ETAU (shown on Charts 1 to 2), while site ETAU monitoring is conducted on the same day as the sites downstream of ETWQ AU/ETAU (described in Section 3 and shown on Charts 3 to 4). From 29 January 2019, water quality sampling of all sites on the Eastern Tributary was undertaken in a single day. Future reporting will identify the data at this site as site ETWQ AU.

Table 1 Monthly Rainfall Data (mm) for PV7, January 2018 to May 2019

Month/Year	Rainfall at PV7 (mm)	Rainfall at Darkes Forest (mm) [#]	Mean Monthly Rainfall at Darkes Forest (1894-2019) (mm) [#]
January 2018	48.0	12.0	132.4
February 2018	115.5	16.6	159.6
March 2018	151.0	45.0	153.9
April 2018	32.0	21.6	126.8
May 2018	12.5	8.0	129.1
June 2018	112.0	91.8	146.6
July 2018	3.5	0.4	96.4
August 2018	12.5	15.8	89.1
September 2018	52.0	41.8	76.6
October 2018	197.0	200.8	91.9
November 2018	114.5	127.8	105.4
December 2018	120.0	91.0	103.8
January 2019	58.5	55.4	131.8
February 2019	41.0	54.2	158.7
March 2019	149.0	201.2	154.3
April 2019	35.0	46.0	126.1
May 2019	8.5	8.0	128.1

[#] 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 May 2019.

2. EASTERN TRIBUTARY SURFACE WATER AND GROUNDWATER QUALITY DATA

Plots of dissolved manganese at surface water quality sites ETWQ AU, ETWQ AQ (upstream on the Eastern Tributary) and WOWQ 2 (control site) and at groundwater quality site ETGW2, are compared to rainfall at PV7 (Chart 1) and streamflow at GS 300078 (Chart 2) (Figure 1).

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.

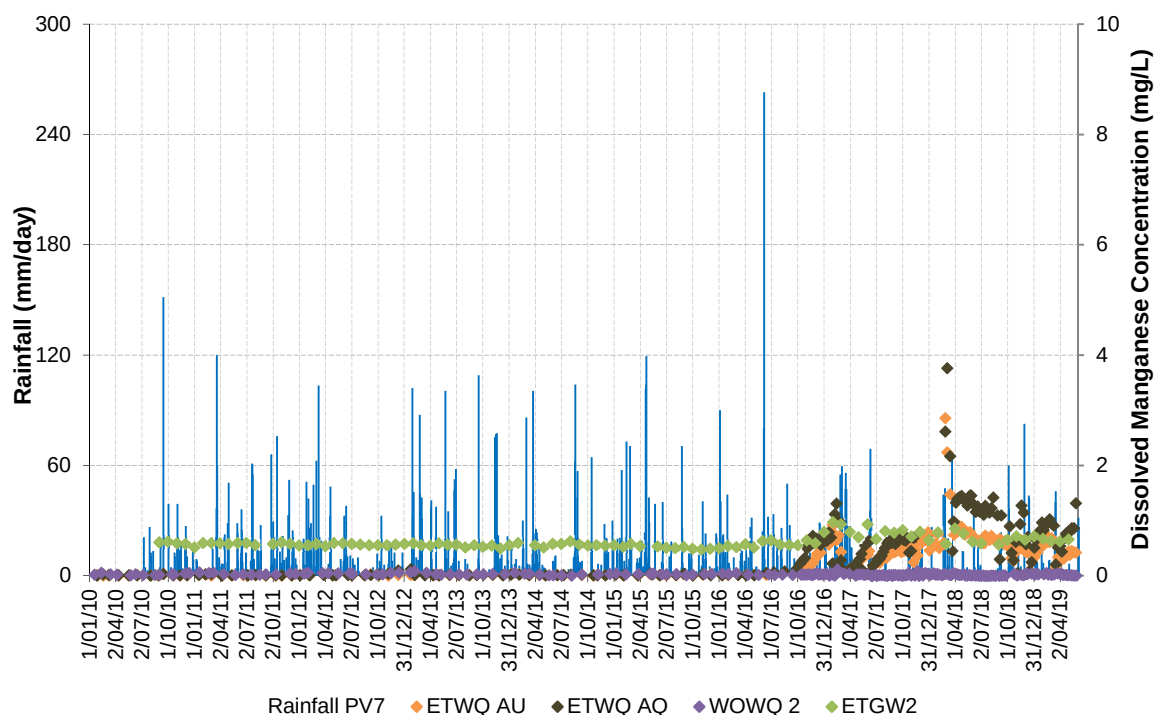


Chart 1 Dissolved Manganese Concentrations at Surface Water Quality Sites ETWQ AU, ETWQ AQ and WOWQ 2 and Groundwater Quality Site ETGW2 and Rainfall (to 31 May 2019)

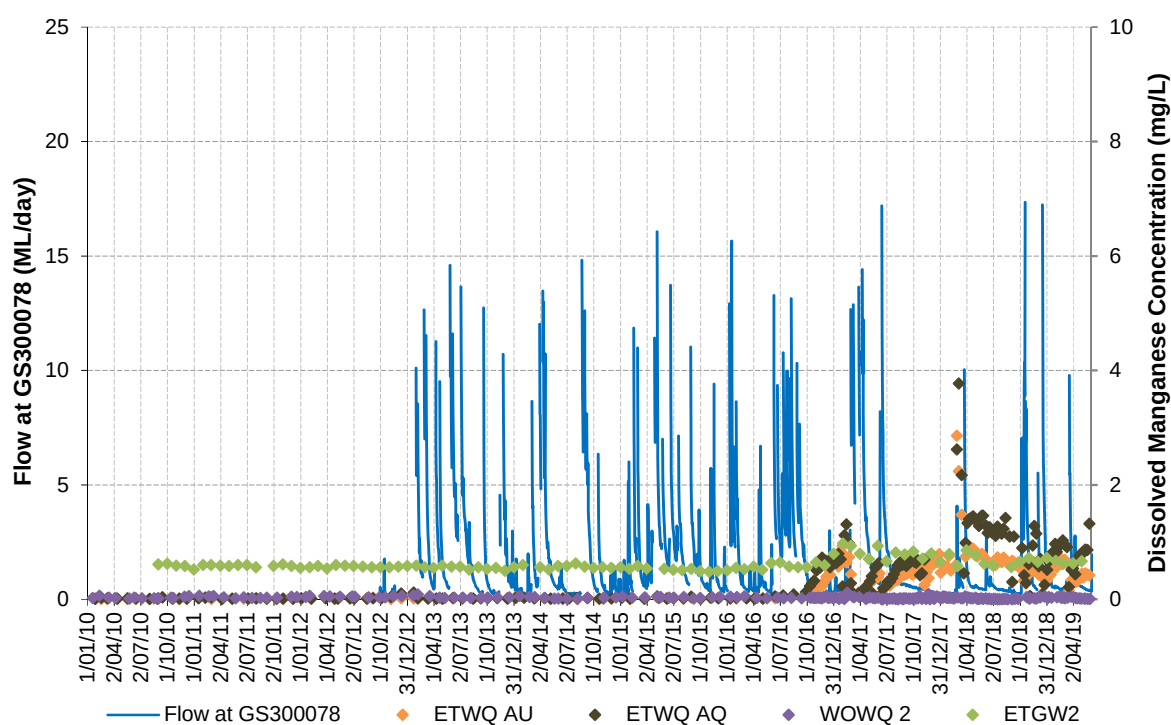
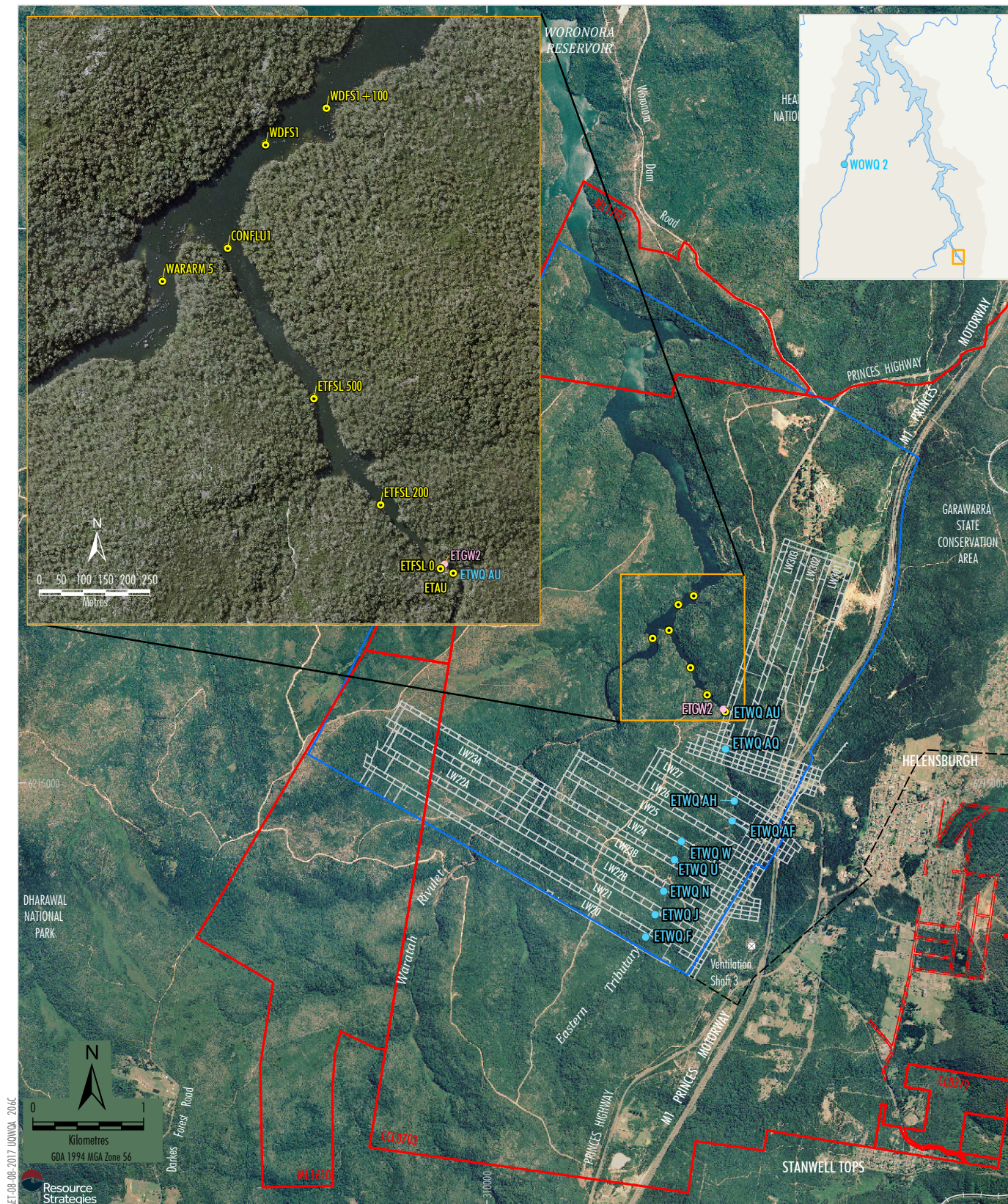


Chart 2 Dissolved Manganese Concentrations at Surface Water Quality Sites ETWQ AU, ETWQ AQ and WOWQ 2 and Groundwater Quality Site ETGW2 and Stream Flow (to 31 May 2019)



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. <0.1 mg/L, exist in the natural creek water. Dissolved manganese is easily diluted by freshwater flow to low levels when higher creek flows occur.

In May 2019, dissolved manganese concentrations at site ETWQ AU ranged between 0.381 mg/L and 0.452 mg/L. 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.

Water quality parameters pertinent to the increase in manganese (dissolved-filtered <0.45 µm fraction) concentration are pH, oxidation-reduction potential (ORP) and electrical conductivity (EC). 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 oxidizing and becomes reducing when ORP is below approximately 10 mV.

In May 2019 at site ETWQ AU:

- pH (lab measurement) was generally consistent (pH 6.89 to pH 7.15);
- EC concentrations (lab measurement) ranged between 235 µS/cm and 301 µS/cm; and
- ORP (field measurement) ranged between 78.6 mV and 270.8 mV.

3. WATER RESOURCES REACHING THE WORONORA RESERVOIR

In accordance with the LW301-303 WMP, site ETWQ AU on the Eastern Tributary and control site WOWQ 2 on the Woronora River are used to assess the LW301-303 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. 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.

Metropolitan Coal has taken a photographic record of the watercourse / waterbody at the time of sampling, estimated the width of the watercourse / water body 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 (HCPL, 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 May 2019 the Woronora Reservoir water level varied between 155.21 mAHd (on 2 May 2019) and 154.57 mAHd (on 30 May 2019) (water level declined steadily). The position of the reservoir water level can only be determined to the closest one metre contour, accordingly, the reservoir water level during May 2019 was between approximately 2,190 m (corresponding to 155 mAHd) and 2,370 m (corresponding to 154 mAHd) downstream of site ETSFL 0.

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 May 2019, the Woronora Reservoir water level was downstream of site WDFS1+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

Water quality data for filtered and total manganese for January 2018 to May 2019 at sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400 and ETFSL 500 is provided in Attachment A. As described earlier, sampling at sites ETFSL 100, ETSFL 300 and ETFSL 400 was suspended once monitoring at sites CONFLU1, WARARM5, WDFS1 and WDFS1+100 commenced on 22 November 2018³. Water quality data for filtered and total manganese since sampling commenced on 22 November 2018 at sites CONFLU1, WARARM5, WDFS1 and WDFS1+100 is also provided in Attachment A.

As described above, the Woronora Reservoir water level dropped steadily in May 2019, and was downstream of site WDFS1+100. The results for dissolved and total manganese at sites ETAU, ETFSL 200, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100 since the commencement of monitoring to the end of May 2019, are shown on Charts 3 and 4, respectively. These sites provide a profile along the arm of the Woronora Reservoir.

³ Sampling at site ETAU was also temporarily suspended during this period but was resumed on 12 December 2018. Data from sampling undertaken at site ETWQ AU has been substituted for site ETAU during this period. Sampling at site ETAU was undertaken on 12 and 27 December 2018.

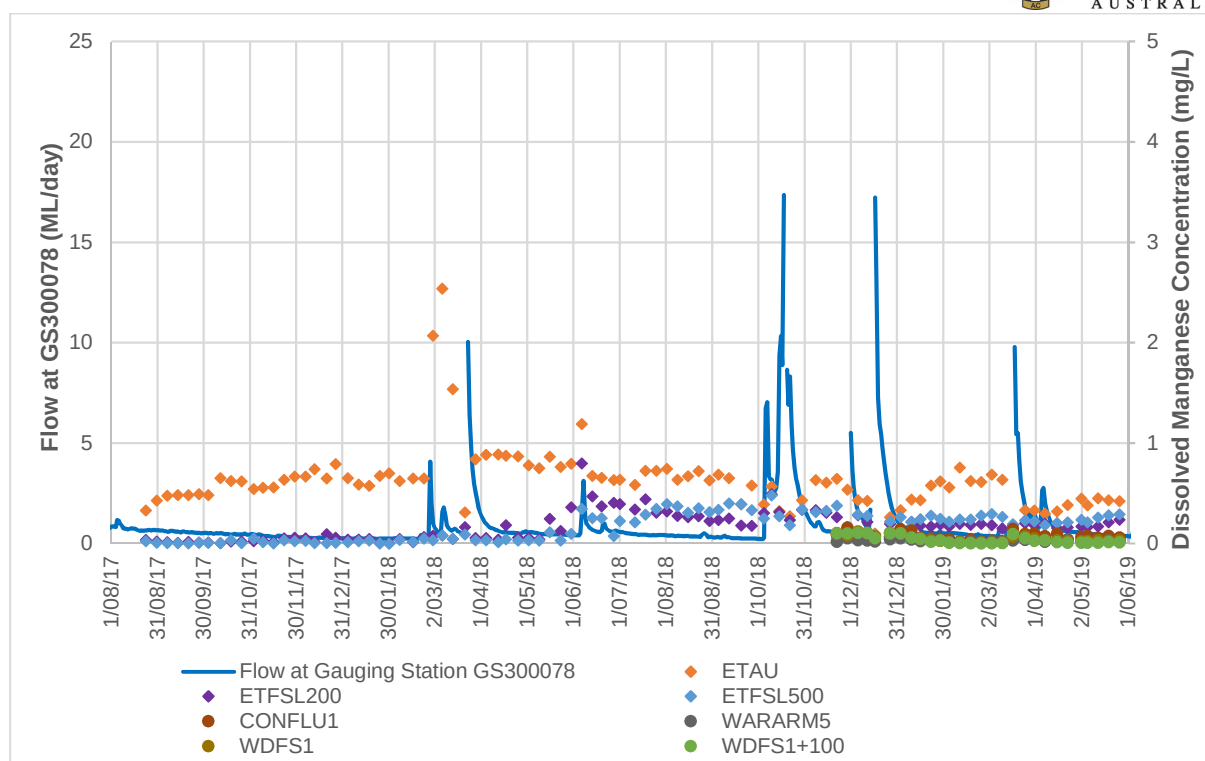


Chart 3 Dissolved Manganese Concentrations at Surface Water Quality Sites ETAU⁴, ETFSL 200, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100 and Stream Flow (August 2017 to 31 May 2019)

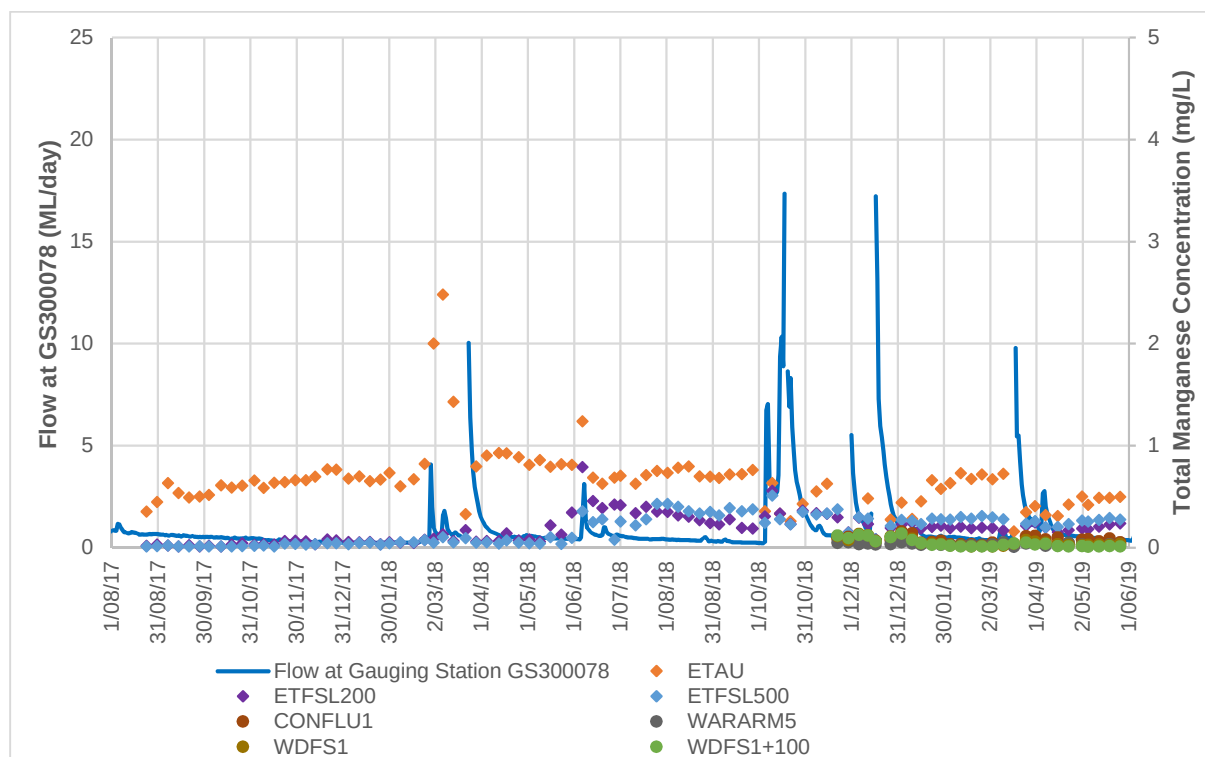


Chart 4 Total Manganese Concentrations at Surface Water Quality Sites ETAU⁵, ETFSL 200, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100 and Stream Flow (August 2017 to 31 May 2019)

⁴ Data from sampling undertaken at site ETWQ AU has been substituted for site ETAU from 22 November to 6 December 2018 and 17 December 2018. Sampling at site ETAU was undertaken on 12 and 27 December 2018.

The filtered manganese concentrations for May 2019 ranged from 0.381 mg/L to 0.452 mg/L at site ETAU, 0.164 mg/L to 0.240 mg/L at site ETFSL 200, 0.212 mg/L to 0.292 mg/L at site ETFSL 500, 0.057 mg/L to 0.076 mg/L at site CONFLU1, 0.024 mg/L to 0.035 mg/L at site WARARM5, 0.022 mg/L to 0.034 mg/L at site WDFS1 and 0.009 mg/L to 0.015 mg/L at site WDFS1+100 (Chart 3).

Total manganese concentrations for May 2019 followed similar trends, ranging from 0.421 mg/L to 0.502 mg/L at site ETAU, 0.183 mg/L to 0.239 mg/L at site ETFSL 200, 0.256 mg/L to 0.292 mg/L at site ETFSL 500, 0.053 mg/L to 0.092 mg/L at site CONFLU1, 0.023 mg/L to 0.036 mg/L at site WARARM5, 0.024 mg/L to 0.037 mg/L at site WDFS1 and 0.009 mg/L to 0.016 mg/L at site WDFS1+100 (Chart 4).

The Australian Drinking Water Guidelines (ADWG, 2011) are published by the National Health and Medical Research Council and updated most recently in 2018; 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 Australian Drinking Water Guideline before being supplied to the Helensburgh area as well as parts of the Sutherland Shire and northern Wollongong (WaterNSW, 2017).

The ADWG (2011) guidelines are based on total concentrations of manganese in water. The ADWG value is 0.5 mg/L total manganese for health. 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).

Water quality data for parameters pertinent to dissolved manganese for January 2018 to May 2019 at sites ETAU, ETFSL 200, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100 is provided in Attachment A. The water quality parameters (pH, ORP and EC) showed no unusual features. The ADWG value for pH (aesthetic) is pH 6.5 – 8.5. Samples at sites ETAU, ETFSL 200, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100 in May 2019 were within this range (Attachment A).

⁵ Total manganese is not sampled at site ETWQ AU, and therefore results were unable to be substituted for site ETAU from 22 November to 6 December 2018 and 17 December 2018. Sampling at site ETAU was undertaken on 12 and 27 December 2018.

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 May 2019, which has triggered 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.

Water reaching the Woronora Reservoir occurs where the inflowing stream water meets the reservoir waterbody. In May 2019, the Woronora Reservoir water level was downstream of site WDFS1+100. The mixing zone (downstream of the reservoir water level) is variable and influenced by the rate of inflow from the Eastern Tributary. Manganese concentrations are easily diluted by freshwater flow to low levels when higher creek flows occur.

The manganese concentrations reaching the Woronora Reservoir have 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.

6. REFERENCES

- ADWG (2011) Australian Drinking Water Guidelines – National Water Quality Management Strategy. The National Health and Medical Research Council Canberra.
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Yours Sincerely,

Barry N. Noller

Barry N Noller

Principal Research Fellow

Centre For Mined Land Rehabilitation

ATTACHMENT A

WATER QUALITY DATA FOR SITES

ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, WARARM5, CONFLU1, WDFS1 and
WDFS1+100

JANUARY 2018 TO MAY 2019

ATTACHMENT A

Water Quality Data for Sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100

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)
4/01/2018	ETAU	0.652	0.678	<0.05	0.59	132	7.37	351
4/01/2018	ETFSL100	0.281	0.305	<0.05	0.82	125.3	7.75	337
4/01/2018	ETFSL200	0.042	0.057	<0.05	0.68	132.7	7.05	118
4/01/2018	ETFSL300	0.038	0.052	0.06	0.6	13.2	6.92	111
4/01/2018	ETFSL400	0.024	0.037	<0.05	0.47	129.9	6.96	110
4/01/2018	ETFSL500	0.016	0.036	<0.05	0.46	121.7	6.74	111
11/01/2018	ETAU	0.588	0.698	0.13	1.36	55.9	7.56	364
11/01/2018	ETFSL100	0.197	0.237	<0.05	0.55	24.3	7.88	345
11/01/2018	ETFSL200	0.041	0.053	<0.05	0.63	101	7.14	139
11/01/2018	ETFSL300	0.067	0.078	1.89	2.1	35.2	6.88	128
11/01/2018	ETFSL400	0.106	0.052	0.47	0.66	52	6.84	124
11/01/2018	ETFSL500	0.026	0.046	0.06	0.78	94.4	7.01	122
18/01/2018	ETAU	0.577	0.653	<0.05	1.15	136.4	7.67	366
18/01/2018	ETFSL100	0.211	0.22	<0.05	0.64	131.9	7.74	353
18/01/2018	ETFSL200	0.046	0.055	<0.05	0.79	131.2	7	129
18/01/2018	ETFSL300	0.058	0.057	0.06	0.84	125.5	6.94	126
18/01/2018	ETFSL400	0.038	0.048	<0.05	0.71	139.6	6.96	125
18/01/2018	ETFSL500	0.032	0.049	<0.05	0.78	121.4	6.94	123
25/01/2018	ETAU	0.674	0.668	<0.05	0.52	56.8	7.55	378
25/01/2018	ETFSL100	0.074	0.152	<0.05	0.46	-4.4	7.82	360
25/01/2018	ETFSL200	0.007	0.034	<0.05	0.41	70.6	7.16	120
25/01/2018	ETFSL300	0.005	0.035	<0.05	0.46	22.8	7.09	117
25/01/2018	ETFSL400	0.001	0.032	<0.05	0.41	55	7	118
25/01/2018	ETFSL500	0.002	0.03	<0.05	0.35	288.6	7.04	115
31/01/2018	ETAU	0.7	0.734	<0.05	0.67	82.3	7.46	374
31/01/2018	ETFSL100	0.089	0.147	<0.05	0.36	30.7	8.01	361
31/01/2018	ETFSL200	0.005	0.052	<0.05	0.57	79.1	7.28	139
31/01/2018	ETFSL300	0.002	0.049	<0.05	0.66	42.7	7.08	123
31/01/2018	ETFSL400	0.001	0.046	<0.05	0.54	92	7.05	122
31/01/2018	ETFSL500	0.001	0.044	<0.05	0.55	71	7.01	122
7/02/2018	ETAU	0.625	0.601	<0.05	0.65	106.9	7.39	374
7/02/2018	ETFSL100	0.102	0.129	<0.05	0.75	14.8	7.78	359
7/02/2018	ETFSL200	0.047	0.051	<0.05	0.48	80.4	7.04	119
7/02/2018	ETFSL300	0.049	0.059	<0.05	0.65	38.2	6.97	119
7/02/2018	ETFSL400	0.112	0.07	0.27	0.74	1	6.77	118
7/02/2018	ETFSL500	0.038	0.053	0.11	0.58	86.6	6.92	117
16/02/2018	ETAU	0.65	0.67	<0.05	0.66	158.8	7.54	380
16/02/2018	ETFSL100	0.075	0.126	<0.05	0.33	163.9	7.96	369
16/02/2018	ETFSL200	0.016	0.048	<0.05	0.6	152	7.05	128
16/02/2018	ETFSL300	0.023	0.058	<0.05	0.81	121.1	6.88	124
16/02/2018	ETFSL400	0.012	0.049	<0.05	0.54	143.2	6.83	121
16/02/2018	ETFSL500	0.019	0.054	<0.05	0.54	144.1	6.82	120
23/02/2018	ETAU	0.651	0.822	<0.05	1.72	163.6	7.21	400
23/02/2018	ETFSL100	0.12	0.2	<0.05	0.5	31.8	7.75	384
23/02/2018	ETFSL200	0.068	0.078	<0.05	0.93	55.8	6.92	140
23/02/2018	ETFSL300	0.065	0.07	0.07	0.88	55.2	6.8	136
23/02/2018	ETFSL400	0.062	0.075	<0.05	0.93	41.8	6.78	135
23/02/2018	ETFSL500	0.049	0.075	<0.05	1.07	-119.2	6.78	132

ATTACHMENT A (Continued)
Water Quality Data for Sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100

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)
1/03/2018	ETAU	2.07	2	5.96	5.69	83.1	6.32	492
1/03/2018	ETFSL100	1.78	1.72	2.41	2.7	36.7	6.31	464
1/03/2018	ETFSL200	0.08	0.087	0.08	0.83	59	6.45	133
1/03/2018	ETFSL300	0.059	0.069	0.16	0.79	43.5	6.36	127
1/03/2018	ETFSL400	0.05	0.064	0.1	1.03	32	6.35	125
1/03/2018	ETFSL500	0.036	0.051	0.08	0.65	2.3	6.38	123
7/03/2018	ETAU	2.54	2.48	7.52	7.23	168.1	6.12	514
7/03/2018	ETFSL100	2.21	2.15	4.12	4.43	158.6	6.11	479
7/03/2018	ETFSL200	0.082	0.132	0.07	0.92	166.8	6.29	147
7/03/2018	ETFSL300	0.108	0.12	<0.05	0.91	149	6.32	147
7/03/2018	ETFSL400	0.088	0.11	<0.05	0.78	161.1	6.79	142
7/03/2018	ETFSL500	0.083	0.102	0.07	0.76	154.5	6.32	138
14/03/2018	ETAU	1.54	1.43	3.72	6.68	41.4	6.58	450
14/03/2018	ETFSL100	0.907	1.08	0.55	3.58	31.6	6.95	431
14/03/2018	ETFSL200	0.047	0.066	<0.05	0.63	76	6.84	135
14/03/2018	ETFSL300	0.048	0.054	<0.05	0.56	41.4	6.83	133
14/03/2018	ETFSL400	0.064	0.055	0.06	0.61	3.3	6.86	132
14/03/2018	ETFSL500	0.047	0.052	<0.05	0.47	21.9	6.79	131
22/03/2018	ETAU	0.312	0.33	0.73	1.46	229.3	5.24	237
22/03/2018	ETFSL100	0.362	0.363	0.71	1.69	182.9	5.08	240
22/03/2018	ETFSL200	0.166	0.173	0.44	1.63	71.9	6.51	160
22/03/2018	ETFSL300	0.118	0.118	0.28	1.33	70.6	6.54	153
22/03/2018	ETFSL400	0.146	0.136	0.8	1.66	22.8	6.61	152
22/03/2018	ETFSL500	0.091	0.095	0.14	1.02	32.6	6.65	144
29/03/2018	ETAU	0.841	0.798	2.83	3.32	148	6.66	341
29/03/2018	ETFSL100	0.732	0.729	1.87	2.6	40.9	6.63	332
29/03/2018	ETFSL200	0.058	0.059	0.11	0.62	84.2	6.65	131
29/03/2018	ETFSL300	0.047	0.053	0.08	0.59	65.9	6.64	131
29/03/2018	ETFSL400	0.051	0.055	0.08	0.74	71.4	6.64	130
29/03/2018	ETFSL500	0.033	0.051	0.08	1.29	27.3	6.68	128
5/4/2018	ETAU	0.885	0.904	2.84	4.76	182.7	6.57	384
5/4/2018	ETFSL100	0.674	0.672	0.73	2.41	191.7	6.67	374
5/4/2018	ETFSL200	0.058	0.067	0.08	0.62	211.9	6.32	142
5/4/2018	ETFSL300	0.044	0.058	0.07	0.57	209.4	6.37	142
5/4/2018	ETFSL400	0.04	0.058	0.13	0.77	209.1	6.39	141
5/4/2018	ETFSL500	0.035	0.054	0.09	0.66	205.9	6.4	141
13/4/2018	ETAU	0.888	0.927	1.42	4.26	156.2	6.76	391
13/4/2018	ETFSL100	0.614	0.651	0.13	2.46	172.9	6.92	382
13/4/2018	ETFSL200	0.042	0.065	0.08	0.7	42.8	6.84	153
13/4/2018	ETFSL300	0.033	0.051	0.05	0.5	40.9	6.52	145
13/4/2018	ETFSL400	0.023	0.048	<0.05	0.59	64.1	6.6	147
13/4/2018	ETFSL500	0.014	0.04	<0.05	0.51	58.6	6.61	142
18/4/2018	ETAU	0.875	0.925	0.62	2.62	192.1	6.77	397
18/4/2018	ETFSL100	0.614	0.636	0.13	2.27	192.3	7.19	390
18/4/2018	ETFSL200	0.184	0.14	0.57	1.14	184.8	6.75	178
18/4/2018	ETFSL300	0.059	0.074	0.08	0.86	186.3	6.81	162
18/4/2018	ETFSL400	0.05	0.069	<0.05	0.64	181.3	6.76	159
18/4/2018	ETFSL500	0.044	0.071	0.07	0.76	185.5	6.76	160

ATTACHMENT A (Continued)
Water Quality Data for Sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100

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)
26/4/2018	ETAU	0.871	0.887	3.01	4.32	7.2	7.02	1040
26/4/2018	ETFSL100	0.587	0.631	0.1	2.06	9.6	7.42	409
26/4/2018	ETFSL200	0.059	0.071	0.08	0.69	45.1	7.01	159
26/4/2018	ETFSL300	0.043	0.055	<0.05	0.54	2.5	6.96	159
26/4/2018	ETFSL400	0.04	0.055	<0.05	0.54	36	6.97	155
26/4/2018	ETFSL500	0.03	0.05	0.05	0.51	94.3	6.96	152
3/5/2018	ETAU	0.781	0.813	2.38	2.38	76.9	6.9	362
3/5/2018	ETFSL100	0.58	0.611	0.18	3.02	20	7.47	358
3/5/2018	ETFSL200	0.056	0.081	0.07	0.78	43.5	7.01	142
3/5/2018	ETFSL300	0.053	0.059	0.13	0.55	5.3	7.02	136
3/5/2018	ETFSL400	0.044	0.052	0.06	0.45	55.3	7	132
3/5/2018	ETFSL500	0.034	0.044	0.07	0.68	60.7	7.01	128
10/5/2018	ETAU	0.752	0.86	4.66	4.66	176.7	6.75	388
10/5/2018	ETFSL100	0.553	0.628	0.06	4.58	191.5	7.19	384
10/5/2018	ETFSL200	0.044	0.061	<0.05	0.89	187.4	6.64	129
10/5/2018	ETFSL300	0.042	0.051	0.08	0.56	180.2	6.67	131
10/5/2018	ETFSL400	0.051	0.056	0.1	0.5	170.7	6.71	133
10/5/2018	ETFSL500	0.032	0.04	0.08	0.45	164	6.68	124
17/5/2018	ETAU	0.868	0.795	3.32	3.32	160	6.78	383
17/5/2018	ETFSL100	0.634	0.605	<0.05	2.66	178.5	7.12	375
17/5/2018	ETFSL200	0.249	0.22	0.25	1.87	178.5	6.85	246
17/5/2018	ETFSL300	0.176	0.178	0.12	1.57	175.8	6.84	230
17/5/2018	ETFSL400	0.146	0.14	0.1	1.32	179.3	6.78	202
17/5/2018	ETFSL500	0.113	0.102	0.12	1.36	179.6	6.65	176
24/5/2018	ETAU	0.763	0.795	3.22	3.22	192.8	7.22	381
24/5/2018	ETFSL100	0.563	0.63	<0.05	4.36	194.2	7.12	375
24/5/2018	ETFSL200	0.128	0.128	0.58	1.03	189.4	6.95	158
24/5/2018	ETFSL300	0.04	0.053	0.05	0.62	102.2	6.78	125
24/5/2018	ETFSL400	0.037	0.043	0.07	0.39	184.9	6.72	145
24/5/2018	ETFSL500	0.031	0.037	<0.05	0.33	185.2	6.76	120
31/5/2018	ETAU	0.797	0.812	3.74	3.74	193.3	7.22	378
31/5/2018	ETFSL100	0.626	0.598	<0.05	2.57	197.5	7.12	375
31/5/2018	ETFSL200	0.362	0.344	0.48	2.18	187.7	7.18	260
31/5/2018	ETFSL300	0.177	0.171	0.24	1.44	185.8	7.18	188
31/5/2018	ETFSL400	0.178	0.162	0.67	1.86	179.9	7.19	184
31/5/2018	ETFSL500	0.098	0.096	0.11	0.89	176	7.12	154
7/6/2018	ETAU	1.19	1.24	3.12	4.03	188.4	6.8	361
7/6/2018	ETFSL100	0.889	0.942	1.43	2.91	185.7	7.19	342
7/6/2018	ETFSL200	0.8	0.792	1.29	3.2	189.2	7.17	327
7/6/2018	ETFSL300	0.625	0.67	0.9	3.42	178.7	7.16	304
7/6/2018	ETFSL400	0.402	0.442	0.06	4.24	182.9	7.25	271
7/6/2018	ETFSL500	0.347	0.358	0.35	3.74	183.4	7.27	268
14/6/2018	ETAU	0.674	0.686	2.1	3.89	99.8	6.94	314
14/6/2018	ETFSL100	0.34	0.539	0.26	2.33	73.3	7.27	309
14/6/2018	ETFSL200	0.47	0.459	0.72	2.12	178.9	7.09	300
14/6/2018	ETFSL300	0.377	0.37	0.26	2.25	167.8	7.12	264
14/6/2018	ETFSL400	0.292	0.288	0.08	2.17	192.4	7.15	228
14/6/2018	ETFSL500	0.255	0.251	0.08	1.94	203.5	7.04	201

ATTACHMENT A (Continued)
Water Quality Data for Sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100

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)
20/6/2018	ETAU	0.657	0.628	3.62	5.4	188.3	6.72	337
20/6/2018	ETFSL100	0.457	0.468	0.9	3.16	19	6.9	324
20/6/2018	ETFSL200	0.371	0.39	0.72	2.4	191.4	6.95	320
20/6/2018	ETFSL300	0.384	0.377	0.34	2.42	190.5	6.98	322
20/6/2018	ETFSL400	0.331	0.333	<0.05	2.84	191.2	7	312
20/6/2018	ETFSL500	0.256	0.28	<0.05	2.67	184.8	7.01	273
28/6/2018	ETAU	0.634	0.687	4.08	7	185.8	6.6	328
28/6/2018	ETFSL100	0.501	0.559	1.04	3.95	188.8	7.02	329
28/6/2018	ETFSL200	0.409	0.422	1.45	3.94	187.2	6.82	306
28/6/2018	ETFSL300	0.176	0.207	<0.05	1.95	199.7	6.77	190
28/6/2018	ETFSL400	0.108	0.111	<0.05	1.04	198.5	6.67	128
28/6/2018	ETFSL500	0.075	0.079	0.05	0.79	179.7	6.61	118
2/7/2018	ETAU	0.637	0.706	3.29	6.24	39.9	7.05	352
2/7/2018	ETFSL100	0.519	0.558	0.97	4.38	191	7.31	351
2/7/2018	ETFSL200	0.395	0.416	0.86	2.28	191.4	7.34	344
2/7/2018	ETFSL300	0.391	0.426	1.19	3.57	193.9	7.25	342
2/7/2018	ETFSL400	0.327	0.349	0.15	3.82	195.4	7.22	311
2/7/2018	ETFSL500	0.226	0.258	0.06	2.37	194.2	7.15	252
12/7/2018	ETAU	0.587	0.626	1.11	2.33	456.6	7.31	370
12/7/2018	ETFSL100	0.501	0.492	0.63	1.6	163.5	7.59	367
12/7/2018	ETFSL200	0.342	0.338	0.73	1.42	160.3	7.5	355
12/7/2018	ETFSL300	0.324	0.373	1.16	2.87	154.8	7.49	361
12/7/2018	ETFSL400	0.338	0.353	0.44	3.85	1596	7.55	356
12/7/2018	ETFSL500	0.212	0.218	<0.05	2.45	158.3	7.37	259
19/7/2018	ETAU	0.726	0.712	0.63	3.5	177	7	377
19/7/2018	ETFSL100	0.576	0.565	0.11	3.01	202.8	7.37	371
19/7/2018	ETFSL200	0.444	0.4	0.36	2.35	200.6	7.24	360
19/7/2018	ETFSL300	0.462	0.402	1.11	3.68	202	7.21	372
19/7/2018	ETFSL400	0.431	0.374	0.57	3.48	203.3	7.33	384
19/7/2018	ETFSL500	0.288	0.279	<0.05	3.33	203.6	7.21	330
26/7/2018	ETAU	0.725	0.753	4.1	6.53	-5.9	6.59	364
26/7/2018	ETFSL100	0.522	0.566	0.19	2.89	10.8	6.78	356
26/7/2018	ETFSL200	0.31	0.353	0.29	1.73	9.8	6.79	351
26/7/2018	ETFSL300	0.35	0.35	1.59	2.55	-0.3	6.71	353
26/7/2018	ETFSL400	0.375	0.397	1.92	3.56	-12.3	6.75	370
26/7/2018	ETFSL500	0.346	0.431	<0.05	3.13	107.8	6.88	378
02/8/2018	ETAU	0.744	0.733	0.44	2.96	54.8	6.53	366
02/8/2018	ETFSL100	0.526	0.544	0.09	2.48	325	6.57	359
02/8/2018	ETFSL200	0.321	0.350	0.39	1.44	265.1	6.51	352
02/8/2018	ETFSL300	0.337	0.348	1.79	2.59	263.4	6.39	355
02/8/2018	ETFSL400	0.398	0.420	3.38	4.5	251.8	6.59	397
02/8/2018	ETFSL500	0.395	0.429	1.14	3.44	236.4	6.8	386
09/8/2018	ETAU	0.637	0.785	2.11	5.08	257.2	6.73	367
09/8/2018	ETFSL100	0.538	0.644	0.18	5.24	256.6	6.92	363
09/8/2018	ETFSL200	0.276	0.316	0.20	1.56	248.6	6.86	355
09/8/2018	ETFSL300	0.285	0.306	1.68	2.50	233.3	6.75	355
09/8/2018	ETFSL400	0.375	0.416	5.43	6.97	254.2	6.99	436
09/8/2018	ETFSL500	0.373	0.401	3.02	4.50	253.7	6.9	390

ATTACHMENT A (Continued)
Water Quality Data for Sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100

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)
16/8/2018	ETAU	0.672	0.797	1.53	3.99	250.1	6.71	365
16/8/2018	ETFSL100	0.491	0.584	0.08	2.32	264.8	7.16	362
16/8/2018	ETFSL200	0.263	0.304	0.1	1.17	265.4	7.13	353
16/8/2018	ETFSL300	0.249	0.298	1.02	1.98	267.4	6.96	349
16/8/2018	ETFSL400	0.336	0.351	3.57	4.23	260.7	7.12	405
16/8/2018	ETFSL500	0.309	0.358	1.69	3.18	261.3	6.98	386
23/8/2018	ETAU	0.724	0.701	0.92	3.12	266.4	7.03	358
23/8/2018	ETFSL100	0.489	0.505	0.07	2.26	271.7	6.97	351
23/8/2018	ETFSL200	0.274	0.270	0.1	1.01	267.1	7.11	344
23/8/2018	ETFSL300	0.227	0.273	0.83	1.83	265.6	7.04	341
23/8/2018	ETFSL400	0.267	0.279	2.11	2.50	261.8	7.05	365
23/8/2018	ETFSL500	0.352	0.337	2.34	3.41	258.1	7.23	382
30/8/2018	ETAU	0.632	0.696	<0.05	2.52	99.5	7.97	368
30/8/2018	ETFSL100	0.440	0.491	<0.05	2.09	77	7.73	354
30/8/2018	ETFSL200	0.225	0.243	0.06	0.85	23.2	7.85	350
30/8/2018	ETFSL300	0.236	0.248	0.96	1.70	256.2	7.78	345
30/8/2018	ETFSL400	0.327	0.343	3.30	4.50	252.5	8.20	399
30/8/2018	ETFSL500	0.316	0.350	2.05	3.65	228.1	8.18	387
05/9/2018	ETAU	0.688	0.683	0.66	4.54	25.2	7.44	363
05/9/2018	ETFSL100	0.476	0.483	<0.05	2.06	53.5	7.77	350
05/9/2018	ETFSL200	0.234	0.23	0.09	0.98	12.5	7.71	340
05/9/2018	ETFSL300	0.259	0.238	1.08	1.71	-12.5	7.57	333
05/9/2018	ETFSL400	0.367	0.371	4.53	5.96	-42.4	7.65	404
05/9/2018	ETFSL500	0.336	0.318	2.52	3.73	1.5	7.69	372
12/9/2018	ETAU	0.653	0.719	<0.05	3.72	178.2	7.05	360
12/9/2018	ETFSL100	0.461	0.521	<0.05	2.72	71.7	7.54	356
12/9/2018	ETFSL200	0.25	0.28	<0.05	0.96	20.1	7.49	346
12/9/2018	ETFSL300	0.3	0.301	0.41	1.73	3.1	7.38	345
12/9/2018	ETFSL400	0.389	0.34	2.15	2.77	-62.7	7.39	359
12/9/2018	ETFSL500	0.401	0.39	1.04	3.87	-17.4	7.43	381
20/9/2018	ETAU	0.392	0.721	1.14	2.49	272.4	7.11	362
20/9/2018	ETFSL100	0.179	0.467	<0.05	1.88	272.4	7.18	350
20/9/2018	ETFSL200	0.182	0.194	0.63	0.7	25.2	7.17	341
20/9/2018	ETFSL300	0.227	0.233	0.63	1.5	-11.9	7.08	337
20/9/2018	ETFSL400	0.386	0.356	2.66	5.39	-34.2	7.21	397
20/9/2018	ETFSL500	0.394	0.358	1.1	3.15	25.4	7.25	371
27/9/2018	ETAU	0.58	0.763	<0.05	2.24	234	7.33	400
27/9/2018	ETFSL100	0.434	0.493	<0.05	1.54	268.1	7.64	392
27/9/2018	ETFSL200	0.178	0.188	<0.05	0.61	272.8	7.55	381
27/9/2018	ETFSL300	0.231	0.239	0.4	1.6	270.8	7.33	377
27/9/2018	ETFSL400	0.331	0.325	1.49	3.55	263.1	7.41	400
27/9/2018	ETFSL500	0.335	0.375	0.83	3.46	266.8	7.67	416
05/10/2018	ETAU	0.39	0.359	2.14	3.49	274.6	7.28	250
05/10/2018	ETFSL100	0.297	0.686	0.32	12	271	7.57	286
05/10/2018	ETFSL200	0.305	0.308	0.29	2.72	269.7	7.67	295
05/10/2018	ETFSL300	0.272	0.305	0.32	2.72	267.7	7.66	291
05/10/2018	ETFSL400	0.364	0.299	0.63	2.95	259.8	7.73	294
05/10/2018	ETFSL500	0.251	0.245	0.36	2.11	242.9	7.58	271

ATTACHMENT A (Continued)
Water Quality Data for Sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100

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)
10/10/2018	ETAU	0.569	0.635	1.8	2.68	266.6	6.59	308
10/10/2018	ETFSL100	0.571	0.602	1.62	2.25	267.5	6.66	304
10/10/2018	ETFSL200	0.494	0.558	1.07	1.88	269.6	6.78	302
10/10/2018	ETFSL300	0.492	0.49	1.05	1.42	269.6	6.81	303
10/10/2018	ETFSL400	0.479	0.503	2.3	3.04	267.3	7.07	334
10/10/2018	ETFSL500	0.48	0.512	1.36	2	266.7	6.98	308
15/10/2018	ETAU	0.325	0.333	0.9	1.33	285.6	6.35	269
15/10/2018	ETFSL100	0.298	0.302	0.69	1.2	278.5	6.36	259
15/10/2018	ETFSL200	0.316	0.336	0.66	1.9	276.9	6.37	262
15/10/2018	ETFSL300	0.286	0.298	0.57	1.41	279.5	6.39	259
15/10/2018	ETFSL400	0.276	0.3	0.6	1.38	279.9	6.56	266
15/10/2018	ETFSL500	0.273	0.279	0.63	1.18	263	7.71	267
22/10/2018	ETAU	0.274	0.259	0.76	1.26	276.9	6.52	281
22/10/2018	ETFSL100	0.25	0.244	0.56	1.13	270.7	6.57	278
22/10/2018	ETFSL200	0.235	0.233	0.41	1.01	270.4	6.53	275
22/10/2018	ETFSL300	0.236	0.228	0.42	1	269	6.58	275
22/10/2018	ETFSL400	0.304	0.263	1.8	2.51	264.8	7.01	321
22/10/2018	ETFSL500	0.184	0.229	0.26	1.19	258.5	6.74	279
30/10/2018	ETAU	0.432	0.431	1.79	2.55	15.1	6.65	290
30/10/2018	ETFSL100	0.376	0.39	0.76	1.78	-0.4	6.91	286
30/10/2018	ETFSL200	0.336	0.363	0.37	1.47	3.8	6.92	285
30/10/2018	ETFSL300	0.341	0.35	0.39	1.32	7.6	6.99	291
30/10/2018	ETFSL400	0.36	0.364	1.58	3.1	-77.3	7.09	329
30/10/2018	ETFSL500	0.34	0.351	0.5	1.63	-4.2	7.05	296
08/11/2018	ETAU	0.635	0.553	0.76	3.15	23.3	7.07	307
08/11/2018	ETFSL100	0.429	0.433	0.14	1.59	12.9	7.35	307
08/11/2018	ETFSL200	0.333	0.34	0.06	1	20	7.31	303
08/11/2018	ETFSL300	0.333	0.329	0.06	1.1	5.4	7.32	304
08/11/2018	ETFSL400	0.431	0.403	5.31	5.49	247.1	7.47	385
08/11/2018	ETFSL500	0.315	0.325	0.37	1.54	248.4	7.30	310
15/11/2018	ETAU	0.609	0.628	0.53	2.04	264.1	7.09	334
15/11/2018	ETFSL100	0.399	0.414	<0.05	1.6	172.9	7.32	328
15/11/2018	ETFSL200	0.308	0.331	<0.05	1.34	272	7.31	325
15/11/2018	ETFSL300	0.321	0.298	0.08	1.15	271	7.28	324
15/11/2018	ETFSL400	0.396	0.383	1.44	4.72	262.5	7.35	373
15/11/2018	ETFSL500	0.328	0.336	0.24	1.76	267.3	7.38	345
19/11/2018	ETWQ AU	0.647	⁻⁶	0.08	2.42	259.1	7.22	345
22/11/2018	ETFSL200	0.264	0.298	<0.05	0.82	30.9	7.29	355
22/11/2018	ETFSL500	0.38	0.376	0.67	1.88	-3.3	7.50	373
22/11/2018	CONFLU1	0.085	0.088	0.12	0.9	-1.1	7.51	307
22/11/2018	WARARM5	0.018	0.046	0.25	1	54.6	7.57	297
22/11/2018	WDFS1	0.105	0.114	0.12	1.15	40.1	7.53	307
22/11/2018	WDFS1+100	0.103	0.119	0.1	1.06	26	7.55	306

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

ATTACHMENT A (Continued)
Water Quality Data for Sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100

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)
26/11/2018	ETWQ AU	0.538	⁻⁶	<0.05	1.36	83.8	7.11	354
29/11/2018	ETFSL200	0.139	0.15	0.54	1.2	36.1	7.07	195
29/11/2018	ETFSL500	0.167	0.147	0.3	1.19	30.1	6.94	195
29/11/2018	CONFLU1	0.158	0.108	0.27	1.18	29.5	7.19	200
29/11/2018	WARARM5	0.055	0.052	0.18	0.92	66.7	7.5	206
29/11/2018	WDFS1	0.082	0.074	0.18	0.21	36.7	7.8	206
29/11/2018	WDFS1+100	0.103	0.094	0.19	1	38.4	7.36	200
4/12/2018	ETWQ AU	0.433	⁻⁶	1.65	2.36	30.6	7	266
6/12/2018	ETFSL200	0.283	0.295	0.26	1.04	242.7	6.97	260
6/12/2018	ETFSL500	0.29	0.3	0.62	1.47	249.5	7.23	270
6/12/2018	CONFLU1	0.112	0.114	0.12	1.13	243.8	7.24	243
6/12/2018	WARARM5	0.034	0.035	<0.05	0.75	250.1	7.29	238
6/12/2018	WDFS1	0.122	0.134	0.07	1.12	241.4	7.29	246
6/12/2018	WDFS1+100	0.109	0.126	<0.05	0.99	251.1	7.3	245
12/12/2018	ETAU	0.428	0.484	1.49	3.33	-	6.86	269
12/12/2018	ETFSL200	0.215	0.232	<0.05	0.42	255.3	7.4	245
12/12/2018	ETFSL500	0.276	0.284	0.27	0.89	251.9	7.41	262
12/12/2018	CONFLU1	0.081	0.091	0.45	0.8	17.9	7.39	219
12/12/2018	WARARM5	0.03	0.042	<0.05	0.58	236.4	7.53	214
12/12/2018	WDFS1	0.108	0.121	0.41	1.09	27.5	7.44	225
12/12/2018	WDFS1+100	0.105	0.12	<0.05	0.99	42.3	7.24	243
17/12/2018	ETWQ AU	0.102	⁻⁶	0.18	0.75	280.3	6.50	152
17/12/2018	ETFSL200	0.076	0.084	0.17	0.7	274.8	6.76	152
17/12/2018	ETFSL500	0.087	0.086	0.19	0.76	274.8	6.56	150
17/12/2018	CONFLU1	0.068	0.068	0.16	0.78	270.9	6.64	152
17/12/2018	WARARM5	0.023	0.032	0.08	0.54	257.5	6.77	156
17/12/2018	WDFS1	0.069	0.062	0.15	0.75	273	6.67	153
17/12/2018	WDFS1+100	0.055	0.063	0.12	0.71	278.4	6.71	154
27/12/2018	ETAU	0.263	0.277	0.61	1.81	24.3	6.72	217
27/12/2018	ETFSL200	0.196	0.194	0.09	0.93	30.6	7.11	216
27/12/2018	ETFSL500	0.219	0.213	0.3	1.37	-6.9	7.13	224
27/12/2018	CONFLU1	0.071	0.075	<0.05	0.86	21.4	7.15	208
27/12/2018	WARARM5	0.045	0.036	<0.05	0.48	3.4	7.3	206
27/12/2018	WDFS1	0.108	0.11	0.06	0.99	24.9	7.12	210
27/12/2018	WDFS1+100	0.101	0.105	<0.05	0.93	37.4	7.13	210
3/01/2019	ETWQ AU	0.335	0.443	<0.05	1.57	110.1	7.35	300
3/01/2019	ETFSL200	0.159	0.226	<0.05	0.63	113.1	7.63	290
3/01/2019	ETFSL500	0.265	0.274	0.12	1.32	11.5	7.5	302
3/01/2019	CONFLU1	0.143	0.16	<0.05	1.21	4.8	7.29	270
3/01/2019	WARARM5	0.055	0.054	<0.05	0.64	56.4	7.46	256
3/01/2019	WDFS1	0.106	0.14	<0.05	1.27	72	7.45	265
3/01/2019	WDFS1+100	0.101	0.138	<0.05	1.16	56.2	7.42	263
10/01/2019	ETWQ AU	0.438	0.282	<0.05	1.41	244.1	6.92	268
10/01/2019	ETFSL200	0.216	0.246	<0.05	0.62	26.8	8.03	279
10/01/2019	ETFSL500	0.22	0.262	<0.05	1.18	-9.3	7.64	300
10/01/2019	CONFLU1	0.129	0.141	<0.05	1.11	-33.7	7.55	269
10/01/2019	WARARM5	0.042	0.041	<0.05	0.6	90.3	7.62	252
10/01/2019	WDFS1	0.061	0.087	<0.05	0.92	22.1	7.59	242
10/01/2019	WDFS1+100	0.061	0.074	<0.05	0.97	6.9	7.58	240

ATTACHMENT A (Continued)
Water Quality Data for Sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100

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)
16/01/2019	ETWQ AU	0.433	0.454	<0.05	1.86	171.1	6.75	282
16/01/2019	ETFSL200	0.18	0.189	<0.05	0.4	258.4	7.67	275
16/01/2019	ETFSL500	0.244	0.233	0.38	1	262.4	7.65	303
16/01/2019	CONFLU1	0.058	0.049	0.12	0.86	261.2	7.68	249
16/01/2019	WARARM5	0.025	0.028	0.11	0.52	268.1	7.82	242
16/01/2019	WDFS1	0.046	0.044	0.16	0.92	263.5	7.76	256
16/01/2019	WDFS1+100	0.047	0.044	0.19	0.94	259.2	7.79	260
23/01/2019	ETWQ AU	0.579	0.661	<0.05	2.09	184.3	6.78	292
23/01/2019	ETFSL200	0.171	0.204	<0.05	0.38	96.8	7.65	286
23/01/2019	ETFSL500	0.28	0.284	0.2	1.62	-11.1	7.65	316
23/01/2019	CONFLU1	0.052	0.056	<0.05	1.11	5.6	7.7	264
23/01/2019	WARARM5	0.043	0.036	<0.05	0.74	-38.4	7.7	253
23/01/2019	WDFS1	0.032	0.042	<0.05	1.08	19.6	7.77	266
23/01/2019	WDFS1+100	0.02	0.029	<0.05	0.92	-16.6	7.83	266
29/01/2019	ETAU	0.62	0.578	0.07	1.52	66.8	6.7	294
29/01/2019	ETFSL200	0.19	0.216	<0.05	0.44	36.2	7.23	282
29/01/2019	ETFSL500	0.249	0.279	<0.05	1.48	12.1	7.34	310
29/01/2019	CONFLU1	0.048	0.07	<0.05	1.05	-20.8	7.54	282
29/01/2019	WARARM5	0.031	0.028	<0.05	0.54	49.5	7.34	251
29/01/2019	WDFS1	0.027	0.038	<0.05	0.96	29.7	7.49	260
29/01/2019	WDFS1+100	0.03	0.03	<0.05	0.91	9.9	7.49	260
4/02/2019	ETAU	0.559	0.635	<0.05	1.04	51.1	6.8	283
4/02/2019	ETFSL200	0.173	0.191	<0.05	0.34	9.1	7.26	275
4/02/2019	ETFSL500	0.221	0.276	0.31	1.7	-18.6	7.35	302
4/02/2019	CONFLU1	0.043	0.036	0.16	0.85	-51.7	7.55	252
4/02/2019	WARARM5	0.023	0.029	0.19	0.74	139.1	7.58	240
4/02/2019	WDFS1	0.012	0.021	0.27	0.8	73.2	7.71	252
4/02/2019	WDFS1+100	0.01	0.02	0.29	0.74	50	7.71	255
11/02/2019	ETAU	0.757	0.731	<0.05	1.5	261.4	6.86	288
11/02/2019	ETFSL200	0.197	0.206	<0.05	0.36	6.8	7.21	280
11/02/2019	ETFSL500	0.243	0.302	0.5	1.86	-33.9	7.3	306
11/02/2019	CONFLU1	0.023	0.033	0.24	0.94	-96.7	7.48	255
11/02/2019	WARARM5	0.019	0.026	0.24	0.66	53.5	7.46	243
11/02/2019	WDFS1	0.011	0.018	0.31	0.98	-26	7.62	259
11/02/2019	WDFS1+100	0.005	0.013	0.3	0.83	64.5	7.62	258
18/02/2019	ETAU	0.624	0.675	0.17	1.51	51.8	6.91	303
18/02/2019	ETFSL200	0.189	0.19	0.19	0.36	12.8	7.27	296
18/02/2019	ETFSL500	0.243	0.284	0.23	1.77	-15.6	7.86	277
18/02/2019	CONFLU1	0.041	0.035	0.13	0.9	6.6	7.73	291
18/02/2019	WARARM5	0.022	0.024	0.19	0.64	64.1	7.46	262
18/02/2019	WDFS1	0.007	0.012	0.31	0.78	26.7	7.83	279
18/02/2019	WDFS1+100	0.006	0.011	0.24	0.64	23.3	7.84	279
25/02/2019	ETAU	0.616	0.719	<0.05	0.93	273.1	7.19	283
25/02/2019	ETFSL200	0.198	0.199	<0.05	0.54	270.5	7.06	271
25/02/2019	ETFSL500	0.281	0.312	1.72	2.11	270.6	7.3	307
25/02/2019	CONFLU1	0.022	0.027	0.06	0.86	274.6	7.37	247
25/02/2019	WARARM5	0.014	0.023	<0.05	0.53	264.2	7.4	238
25/02/2019	WDFS1	0.009	0.017	<0.05	0.79	272.6	7.55	248
25/02/2019	WDFS1+100	0.004	0.014	0.05	0.92	264.9	7.6	246

ATTACHMENT A (Continued)
Water Quality Data for Sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100

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)
04/03/2019	ETAU	0.688	0.67	<0.05	0.13	104.3	6.74	306
04/03/2019	ETFSL200	0.185	0.193	0.12	0.48	259.3	7.18	294
04/03/2019	ETFSL500	0.295	0.298	0.76	2.02	271.1	7.33	334
04/03/2019	CONFLU1	0.032	0.049	0.12	1.71	277.1	7.56	274
04/03/2019	WARARM5	0.025	0.031	0.12	1.02	277.7	7.44	248
04/03/2019	WDFS1	0.006	0.013	0.13	0.81	273.6	7.75	271
04/03/2019	WDFS1+100	0.005	0.011	0.21	0.71	249.3	7.58	270
11/03/2019	ETAU	0.638	0.726	0.08	0.94		6.87	322
11/03/2019	ETFSL200	0.152	0.170	0.06	0.38	227.4	7.24	310
11/03/2019	ETFSL500	0.266	0.28	0.5	1.91	219.5	7.43	347
11/03/2019	CONFLU1	0.024	0.03	0.23	0.96	228.5	7.53	289
11/03/2019	WARARM5	0.018	0.052	0.19	0.71	202.5	7.53	269
11/03/2019	WDFS1	0.01	0.018	0.26	0.8	219.7	7.07	276
11/03/2019	WDFS1+100	0.006	0.027	0.22	1.45	215.9	7.82	289
18/03/2019	ETAU	0.153	0.16	0.84	1.21	239	6.77	175
18/03/2019	ETFSL200	0.187	<0.01	0.5	0.204	237.9	6.62	180
18/03/2019	ETFSL500	0.193	<0.01	0.63	0.197	230.4	6.7	184
18/03/2019	CONFLU1	0.146	0.02	0.5	0.156	50.3	6.72	172
18/03/2019	WARARM5	0.032	<0.01	0.3	0.034	49.3	6.67	153
18/03/2019	WDFS1	0.071	0.04	0.44	0.073	21.4	6.67	159
18/03/2019	WDFS1+100	0.094	0.04	0.42	0.099	57.1	6.61	158
26/03/2019	ETAU	0.335	0.347	0.46	1.91	29.3	6.74	230
26/03/2019	ETFSL200	0.205	0.217	<0.05	1.04	23.5	6.96	224
26/03/2019	ETFSL500	0.233	0.234	0.5	1.39	227	6.99	239
26/03/2019	CONFLU1	0.095	0.114	<0.05	0.8	237.9	7.02	206
26/03/2019	WARARM5	0.039	0.041	<0.05	0.45	241.4	6.92	195
26/03/2019	WDFS1	0.073	0.076	<0.05	0.65	236.4	7.02	200
26/03/2019	WDFS1+100	0.054	0.049	<0.05	0.64	241.1	7.03	199
01/04/2019	ETAU	0.332	0.407	<0.05	1.51	160	7.3	256
01/04/2019	ETFSL200	0.184	0.248	<0.05	0.78	-1.8	7.68	248
01/04/2019	ETFSL500	0.222	0.261	0.47	1.14	-4.8	7.64	263
01/04/2019	CONFLU1	0.103	0.116	0.17	0.92	9	7.68	232
01/04/2019	WARARM5	0.034	0.037	0.1	0.42	36.8	7.71	207
01/04/2019	WDFS1	0.051	0.061	0.18	0.64	0.8	7.67	221
01/04/2019	WDFS1+100	0.027	0.031	0.14	0.56	43.5	7.73	219
08/04/2019	ETAU	0.298	0.319	0.64	1.89	35.8	6.86	225
08/04/2019	ETFSL200	0.200	0.198	0.12	0.96	273.8	7.09	212
08/04/2019	ETFSL500	0.184	0.2	0.34	1.34	264	7.25	220
08/04/2019	CONFLU1	0.073	0.082	0.14	0.77	238.9	7.54	212
08/04/2019	WARARM5	0.02	0.018	0.06	0.35	252.5	7.6	204
08/04/2019	WDFS1	0.039	0.05	0.11	0.7	236.9	7.56	205
08/04/2019	WDFS1+100	0.03	0.038	0.08	0.58	242.3	7.61	205
16/04/2019	ETAU	0.321	0.31	<0.05	1.31	259.8	7.17	240
16/04/2019	ETFSL200	0.156	0.154	<0.05	0.64	83.9	7.48	233
16/04/2019	ETFSL500	0.207	0.204	0.53	1.25	11.4	7.65	262
16/04/2019	CONFLU1	0.099	0.1	0.06	0.73	3.8	7.69	235
16/04/2019	WARARM5	0.024	0.021	0.21	0.34	21.6	7.62	207
16/04/2019	WDFS1	0.035	0.035	0.13	0.62	0.9	7.6	215
16/04/2019	WDFS1+100	0.017	0.017	0.14	0.48	4.6	7.67	214

ATTACHMENT A (Continued)

Water Quality Data for Sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100

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)
23/04/2019	ETAU	0.384	0.425	<0.05	1.82	262.5	7.54	224
23/04/2019	ETFSL200	0.162	0.174	0.08	0.77	73.9	7.31	218
23/04/2019	ETFSL500	0.214	0.232	0.24	1.4	8.8	7.64	240
23/04/2019	CONFLU1	0.041	0.046	0.13	0.76	10.6	7.56	194
23/04/2019	WARARM5	0.041	0.046	0.13	0.76	63.3	7.56	194
23/04/2019	WDFS1	0.026	0.027	0.16	0.71	7.5	7.56	191
23/04/2019	WDFS1+100	0.009	0.014	0.18	0.6	45	7.59	190
02/05/2019	ETAU	0.448	0.502	0.33	4.37	78.6	6.97	235
02/05/2019	ETFSL200	0.171	0.187	0.07	0.86	213.6	7.2	226
02/05/2019	ETFSL500	0.24	0.267	0.5	1.4	208.1	7.31	248
02/05/2019	CONFLU1	0.068	0.078	0.12	0.9	198.7	7.41	215
02/05/2019	WARARM5	0.024	0.03	0.14	0.51	201.1	7.3	184
02/05/2019	WDFS1	0.022	0.024	0.19	0.62	194.3	7.31	195
02/05/2019	WDFS1+100	0.01	0.016	0.18	0.5	189.9	7.4	196
06/05/2019	ETAU	0.381	0.421	<0.05	1.3	148.2	6.89	284
06/05/2019	ETFSL200	0.164	0.183	0.1	0.62	252.8	7.18	278
06/05/2019	ETFSL500	0.212	0.256	0.7	1.68	256.8	7.34	314
06/05/2019	CONFLU1	0.076	0.084	0.12	0.78	236.9	7.48	271
06/05/2019	WARARM5	0.025	0.023	0.09	0.46	254.6	7.37	238
06/05/2019	WDFS1	0.024	0.028	0.14	0.71	216.8	7.43	250
06/05/2019	WDFS1+100	0.009	0.009	0.08	0.54	259.9	7.57	246
13/05/2019	ETAU	0.452	0.488	0.08	2.71	106.4	7.15	299
13/05/2019	ETFSL200	0.171	0.208	0.06	0.93	254.6	7.48	290
13/05/2019	ETFSL500	0.261	0.273	0.29	1.74	241.2	7.57	322
13/05/2019	CONFLU1	0.057	0.063	0.07	0.88	249.5	7.61	269
13/05/2019	WARARM5	0.028	0.026	0.07	0.52	249.3	7.6	248
13/05/2019	WDFS1	0.034	0.031	0.05	0.85	243.4	7.61	260
13/05/2019	WDFS1+100	0.009	0.011	<0.05	0.58	243.9	7.71	265
20/05/2019	ETAU	0.432	0.49	<0.05	1.93	270.8	6.96	297
20/05/2019	ETFSL200	0.212	0.230	0.1	1.27	97.3	7.79	291
20/05/2019	ETFSL500	0.282	0.292	1.16	2.02	-17.1	7.63	331
20/05/2019	CONFLU1	0.076	0.092	0.1	1.12	68	7.76	286
20/05/2019	WARARM5	0.035	0.036	0.15	0.54	58.2	7.66	252
20/05/2019	WDFS1	0.027	0.028	0.2	0.72	27.9	7.43	266
20/05/2019	WDFS1+100	0.015	0.016	0.12	0.57	113.4	7.74	270
27/05/2019	ETAU	0.422	0.498	<0.05	2.26	169.8	7.02	301
27/05/2019	ETFSL200	0.240	0.239	0.11	1.06	286.4	7.45	293
27/05/2019	ETFSL500	0.292	0.276	1.14	1.92	286	7.51	334
27/05/2019	CONFLU1	0.06	0.053	0.07	0.69	151.2	7.63	271
27/05/2019	WARARM5	0.026	0.024	<0.05	0.49	278	7.47	254
27/05/2019	WDFS1	0.034	0.037	0.1	0.82	274.3	7.57	270
27/05/2019	WDFS1+100	0.013	0.013	0.06	0.52	284.6	7.76	271

Sustainable Minerals Institute

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Director

Professor Neville Plint

CRICOS PROVIDER NUMBER 000258

30 September 2019

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 – June 2019

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 301-303 Water Management Plan (LW301-303 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 LW301-303 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 LW301-303 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 LW301-303 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 LW301-303 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.

Analysis conducted by Hydro Engineering & Consulting (2019) in accordance with the LW301-303 WMP, identified that the performance indicator for water resources reaching the Woronora Reservoir was exceeded for dissolved (i.e. filtered <0.45 µm fraction) manganese on the Eastern Tributary at site ETWQ AU in June 2019 (as there was not a similar exceedance of the trigger recorded at control site WOWQ 2 on the Woronora River). The performance indicator was not exceeded for field filtered iron or aluminium in June 2019 and therefore these parameters are not discussed in this report.

In accordance with the LW301-303 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*.

This assessment against the water quality subsidence impact performance measure has been prepared for June 2019 in consideration of:

- pluviograph data;
- flow data from the Eastern Tributary gauging location (GS 300078);
- groundwater level and groundwater quality results for Eastern Tributary sites up to 30 June 2019¹;
- surface water quality data at site ETWQ AU/ETAU² and sites further upstream on the Eastern Tributary up to 30 June 2019;
- surface water quality data at sites downstream of ETWQ AU/ETAU² up to 30 June 2019; 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 2018, above average rainfall has only been recorded in October 2018, November 2018 and December 2018, with below average rainfall recorded in all other months (Table 1).

Total rainfall in June 2019 was 115.5 mm, slightly below the average rainfall at Darkes Forest (145.8 mm). Rainfall events occurred over 4 to 6 June (61 mm) and 16 to 18 June (29.5 mm). Smaller rainfall events also occurred between 21 and 28 June (totalling 25 mm). Shallow groundwater levels correlate with the rainfall trend.

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

² Site ETAU is the same as site ETWQ AU (i.e. samples are taken at the same location). The difference between the sites relates to the time of sampling. Site ETWQ AU monitoring is conducted on the same day as sites upstream of ETWQ AU/ETAU (shown on Charts 1 to 2), while site ETAU monitoring is conducted on the same day as the sites downstream of ETWQ AU/ETAU (described in Section 3 and shown on Charts 3 to 4). From 29 January 2019, water quality sampling of all sites on the Eastern Tributary was undertaken in a single day. Future reporting will identify the data at this site as site ETWQ AU.

Table 1 Monthly Rainfall Data (mm) for PV7, January 2018 to June 2019

Month/Year	Rainfall at PV7 (mm)	Rainfall at Darkes Forest (mm) [#]	Mean Monthly Rainfall at Darkes Forest (1894-2019) (mm) [#]
January 2018	48.0	12.0	132.4
February 2018	115.5	16.6	159.6
March 2018	151.0	45.0	153.9
April 2018	32.0	21.6	126.8
May 2018	12.5	8.0	129.1
June 2018	112.0	91.8	146.6
July 2018	3.5	0.4	96.4
August 2018	12.5	15.8	89.1
September 2018	52.0	41.8	76.6
October 2018	197.0	200.8	91.9
November 2018	114.5	127.8	105.4
December 2018	120.0	91.0	103.8
January 2019	58.5	55.4	131.8
February 2019	41.0	54.2	158.7
March 2019	149.0	201.2	154.3
April 2019	35.0	46.0	126.1
May 2019	8.5	8.0	128.1
June 2019	115.5	47.4	145.8

[#] 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 2019.

2. EASTERN TRIBUTARY SURFACE WATER AND GROUNDWATER QUALITY DATA

Plots of dissolved manganese at surface water quality sites ETWQ AU, ETWQ AQ (upstream on the Eastern Tributary) and WOWQ 2 (control site) and at groundwater quality site ETGW2, are compared to rainfall at PV7 (Chart 1) and streamflow at GS 300078 (Chart 2) (Figure 1).

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.

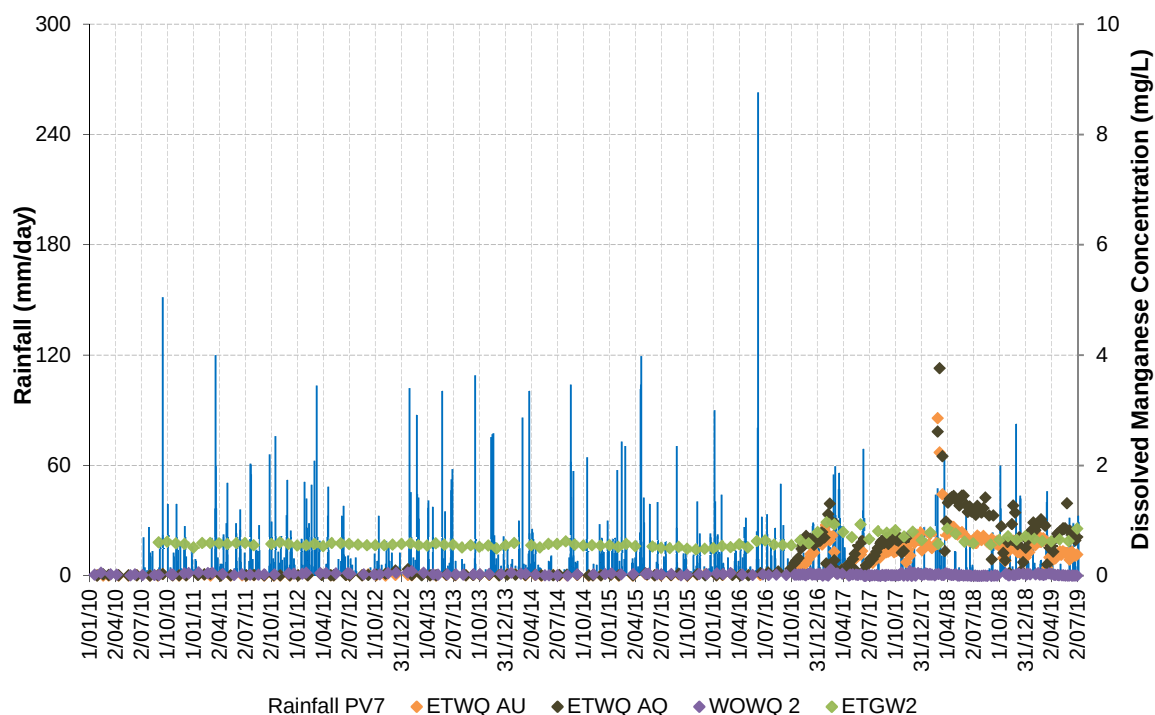


Chart 1 Dissolved Manganese Concentrations at Surface Water Quality Sites ETWQ AU, ETWQ AQ and WOWQ 2 and Groundwater Quality Site ETGW2 and Rainfall (to 30 June 2019)

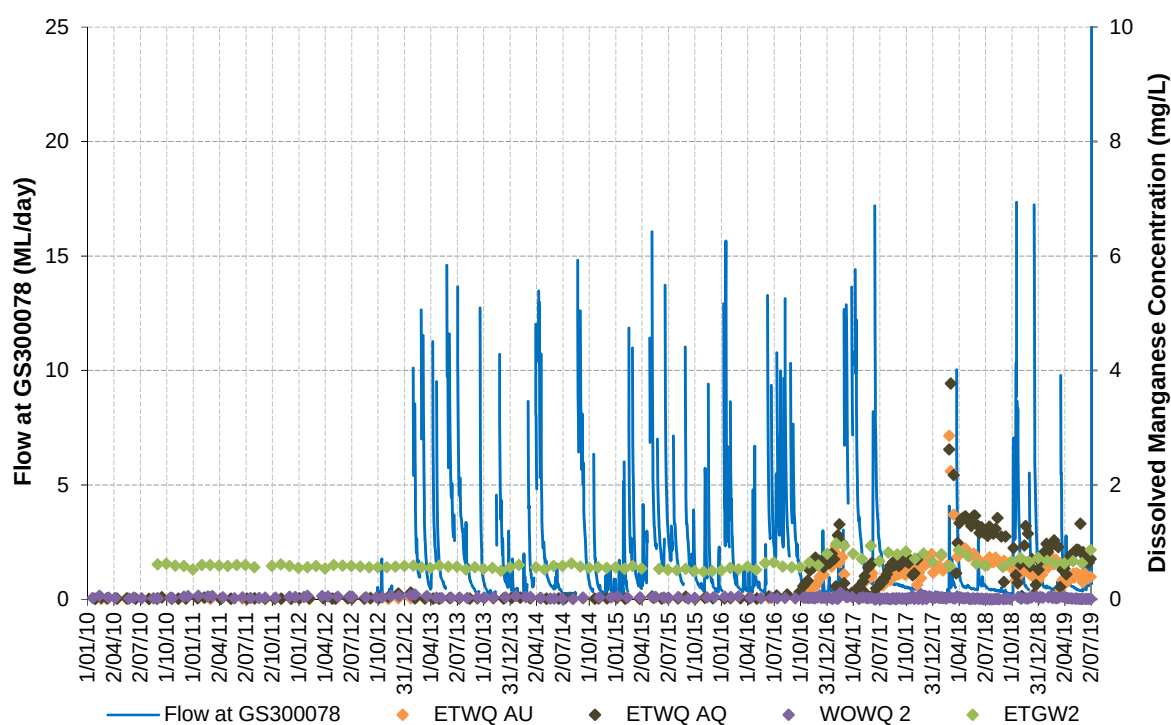
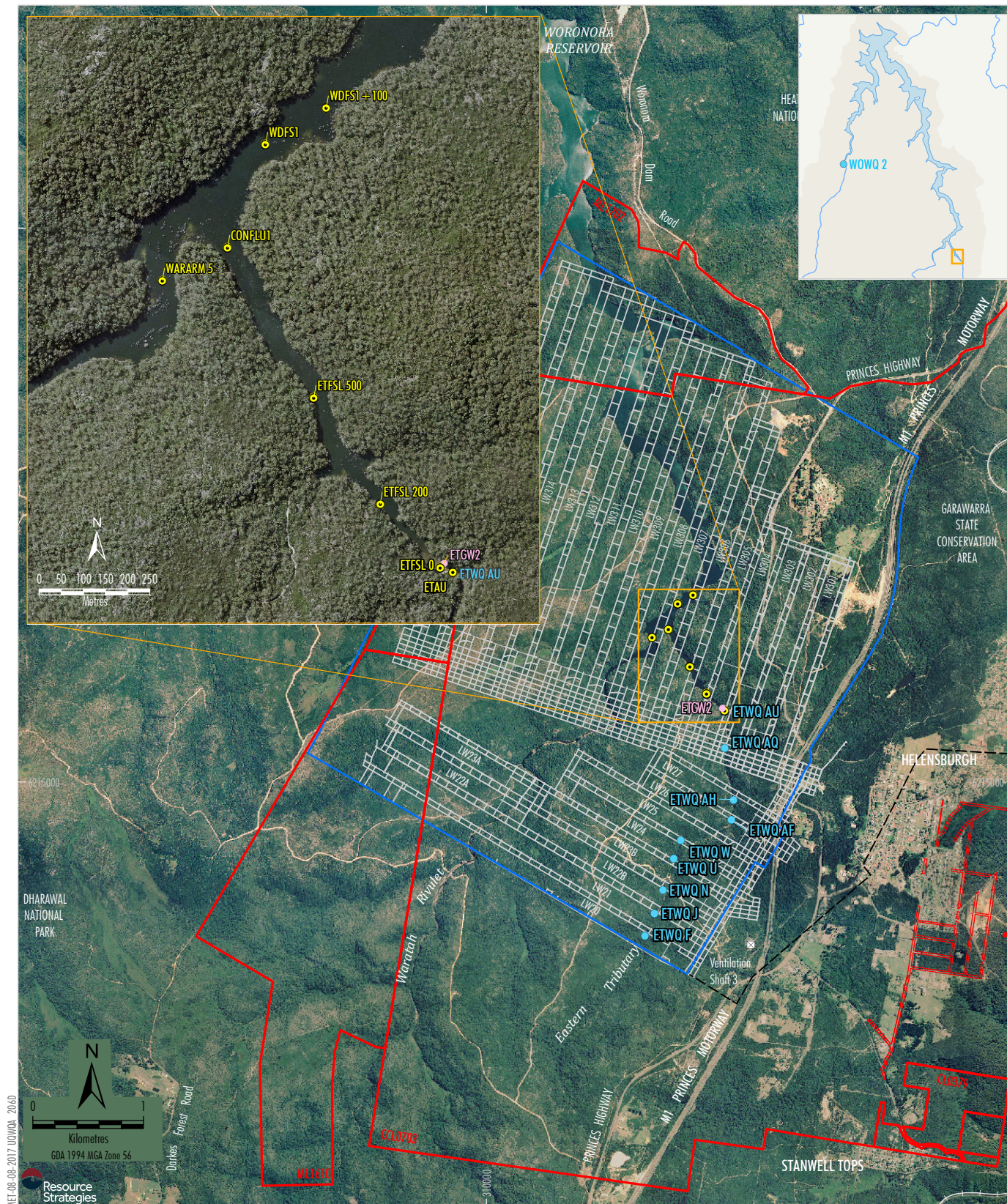


Chart 2 Dissolved Manganese Concentrations at Surface Water Quality Sites ETWQ AU, ETWQ AQ and WOWQ 2 and Groundwater Quality Site ETGW2 and Stream Flow (to 30 June 2019)



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 on Eastern Tributary
- Water Quality Site on Eastern Tributary and/or in Woronora Reservoir
- Groundwater Quality Site of Eastern Tributary

Peabody
METROPOLITAN COAL

Surface Water Quality Sampling of
Eastern Tributary Watercourse
and Woronora Reservoir

Figure 1

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. <0.1 mg/L, exist in the natural creek water. Dissolved manganese is easily diluted by freshwater flow to low levels when higher creek flows occur.

In June 2019, dissolved manganese concentrations at site ETWQ AU ranged between 0.295 mg/L and 0.448 mg/L. 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.

Water quality parameters pertinent to the increase in manganese (dissolved-filtered <0.45 µm fraction) concentration are pH, oxidation-reduction potential (ORP) and electrical conductivity (EC). 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 oxidizing and becomes reducing when ORP is below approximately 10 mV.

In June 2019 at site ETWQ AU:

- pH (lab measurement) was generally consistent (pH 6.83 to pH 7.15);
- EC concentrations (lab measurement) ranged between 228 µS/cm and 291 µS/cm; and
- ORP (field measurement) ranged between -2.6 mV and 142.8 mV.

3. WATER RESOURCES REACHING THE WORONORA RESERVOIR

In accordance with the LW301-303 WMP, site ETWQ AU on the Eastern Tributary and control site WOWQ 2 on the Woronora River are used to assess the LW301-303 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. 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.

Metropolitan Coal has taken a photographic record of the watercourse / waterbody at the time of sampling, estimated the width of the watercourse / water body 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 (HCPL, 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 June 2019 the Woronora Reservoir water level varied between 154.42 mAHd (on 6 June 2019) and 154.22 mAHd (on 27 June 2019) (water level declined slightly). The position of the reservoir water level can only be determined to the closest one metre contour, accordingly, the reservoir water level during June 2019 remained at approximately 2,390 m (corresponding to 154 mAHd) downstream of site ETSFL 0.

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 June 2019, the Woronora Reservoir water level was downstream of site WDFS1+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

Water quality data for filtered and total manganese for January 2018 to June 2019 at sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400 and ETFSL 500 is provided in Attachment A. As described earlier, sampling at sites ETFSL 100, ETSFL 300 and ETFSL 400 was suspended once monitoring at sites CONFLU1, WARARM5, WDFS1 and WDFS1+100 commenced on 22 November 2018³. Water quality data for filtered and total manganese since sampling commenced on 22 November 2018 at sites CONFLU1, WARARM5, WDFS1 and WDFS1+100 is also provided in Attachment A.

As described above, the Woronora Reservoir water level dropped slightly in June 2019, and was downstream of site WDFS1+100. The results for dissolved and total manganese at sites ETAU, ETFSL 200, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100 since the commencement of monitoring to the end of June 2019, are shown on Charts 3 and 4, respectively. These sites provide a profile along the arm of the Woronora Reservoir.

³ Sampling at site ETAU was also temporarily suspended during this period but was resumed on 12 December 2018. Data from sampling undertaken at site ETWQ AU has been substituted for site ETAU during this period. Sampling at site ETAU was undertaken on 12 and 27 December 2018.

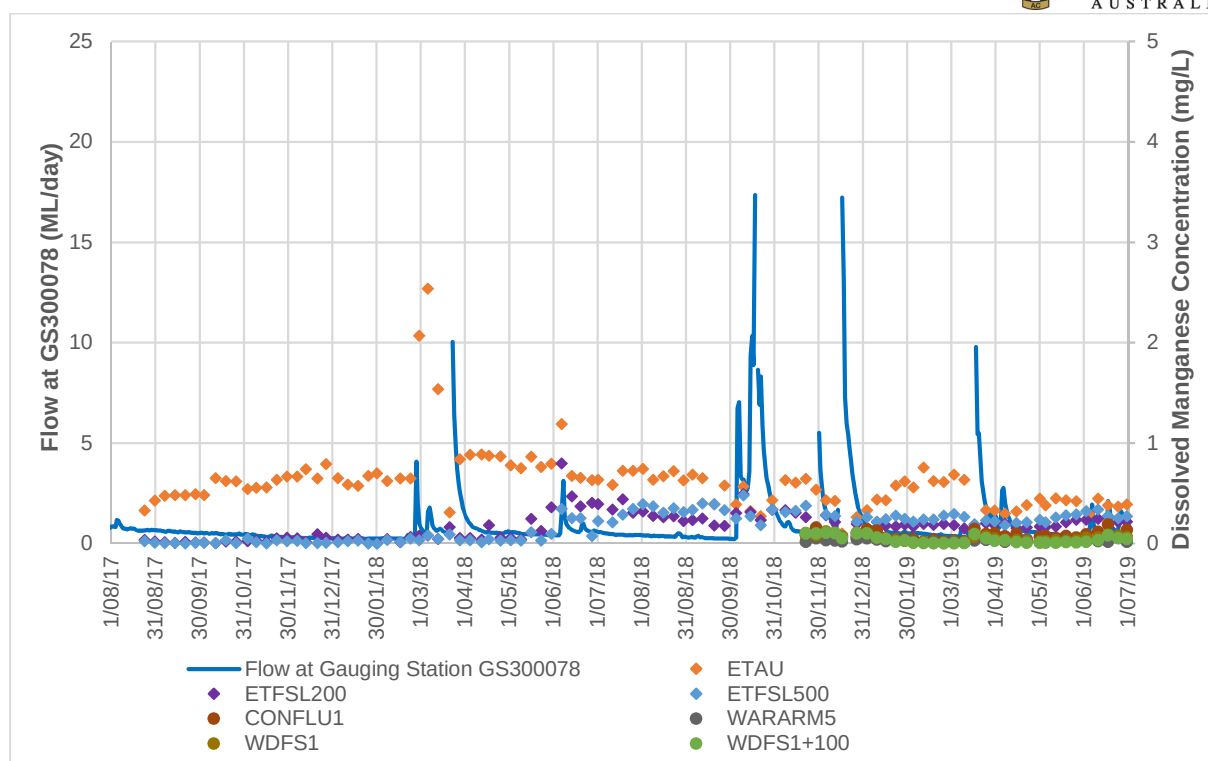


Chart 3 Dissolved Manganese Concentrations at Surface Water Quality Sites ETAU⁴, ETFSL 200, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100 and Stream Flow (August 2017 to 30 June 2019)

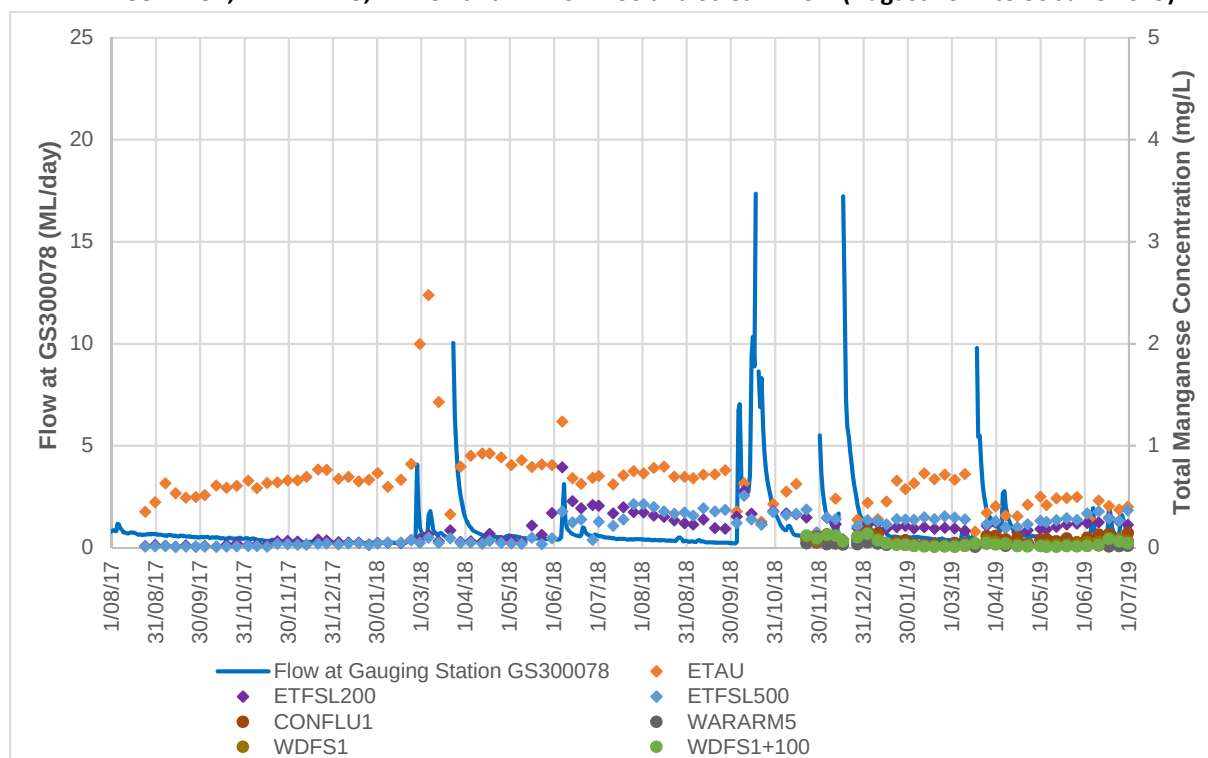


Chart 4 Total Manganese Concentrations at Surface Water Quality Sites ETAU⁵, ETFSL 200, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100 and Stream Flow (August 2017 to 30 June 2019)

⁴ Data from sampling undertaken at site ETWQ AU has been substituted for site ETAU from 22 November to 6 December 2018 and 17 December 2018. Sampling at site ETAU was undertaken on 12 and 27 December 2018. Sampling was undertaken on 5 June 2019 at site ETAU but 3 June 2019 at all downstream sites.

⁵ Total manganese is not sampled at site ETWQ AU, and therefore results were unable to be substituted for site ETAU from 22 November to 6 December 2018 and 17 December 2018. Sampling at site ETAU was undertaken on 12 and 27 December 2018.

The filtered manganese concentrations for June 2019 ranged from 0.295 mg/L to 0.448 mg/L at site ETAU, 0.217 mg/L to 0.275 mg/L at site ETFSL 200, 0.254 mg/L to 0.340 mg/L at site ETFSL 500, 0.076 mg/L to 0.192 mg/L at site CONFLU1, 0.019 mg/L to 0.066 mg/L at site WARARM5, 0.056 mg/L to 0.088 mg/L at site WDFS1 and 0.019 mg/L to 0.083 mg/L at site WDFS1+100 (Chart 3).

Total manganese concentrations for June 2019 followed similar trends, ranging from 0.280 mg/L to 0.465 mg/L at site ETAU, 0.245 mg/L to 0.296 mg/L at site ETFSL 200, 0.268 mg/L to 0.358 mg/L at site ETFSL 500, 0.090 mg/L to 0.137 mg/L at site CONFLU1, 0.014 mg/L to 0.024 mg/L at site WARARM5, 0.056 mg/L to 0.092 mg/L at site WDFS1 and 0.03 mg/L to 0.088 mg/L at site WDFS1+100 (Chart 4).

The Australian Drinking Water Guidelines (ADWG, 2011) are published by the National Health and Medical Research Council and updated most recently in 2018; 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 Australian Drinking Water Guideline before being supplied to the Helensburgh area as well as parts of the Sutherland Shire and northern Wollongong (WaterNSW, 2017).

The ADWG (2011) guidelines are based on total concentrations of manganese in water. The ADWG value is 0.5 mg/L total manganese for health. 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).

Water quality data for parameters pertinent to dissolved manganese for January 2018 to June 2019 at sites ETAU, ETFSL 200, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100 is provided in Attachment A. The water quality parameters (pH, ORP and EC) showed no unusual features. The ADWG value for pH (aesthetic) is pH 6.5 – 8.5. Samples at sites ETAU, ETFSL 200, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100 in June 2019 were within this 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 June 2019, which has triggered 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 and 2019 have 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.

Water reaching the Woronora Reservoir occurs where the inflowing stream water meets the reservoir waterbody. In June 2019, the Woronora Reservoir water level was downstream of site WDFS1+100. The mixing zone (downstream of the reservoir water level) is variable and influenced by the rate of inflow from the Eastern Tributary. Manganese concentrations are easily diluted by freshwater flow to low levels when higher creek flows occur.

The manganese concentrations reaching the Woronora Reservoir have 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.

6. REFERENCES

ADWG (2011) Australian Drinking Water Guidelines – National Water Quality Management Strategy. The National Health and Medical Research Council Canberra.

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Hydro Engineering & Consulting Pty Ltd (2019) Metropolitan Coal Surface Water Review 1 January to 30 June 2019. Draft report J0604-80.r1c.

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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WaterNSW (2017) Woronora Catchment – My Part of the Catchment. Accessed from:
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Yours Sincerely,



Barry N Noller

Principal Research Fellow

Centre For Mined Land Rehabilitation

ATTACHMENT A

WATER QUALITY DATA FOR SITES

ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, WARARM5, CONFLU1, WDFS1 and
WDFS1+100

JANUARY 2018 TO JUNE 2019

ATTACHMENT A

Water Quality Data for Sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100

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)
4/01/2018	ETAU	0.652	0.678	<0.05	0.59	132	7.37	351
4/01/2018	ETFSL100	0.281	0.305	<0.05	0.82	125.3	7.75	337
4/01/2018	ETFSL200	0.042	0.057	<0.05	0.68	132.7	7.05	118
4/01/2018	ETFSL300	0.038	0.052	0.06	0.6	13.2	6.92	111
4/01/2018	ETFSL400	0.024	0.037	<0.05	0.47	129.9	6.96	110
4/01/2018	ETFSL500	0.016	0.036	<0.05	0.46	121.7	6.74	111
11/01/2018	ETAU	0.588	0.698	0.13	1.36	55.9	7.56	364
11/01/2018	ETFSL100	0.197	0.237	<0.05	0.55	24.3	7.88	345
11/01/2018	ETFSL200	0.041	0.053	<0.05	0.63	101	7.14	139
11/01/2018	ETFSL300	0.067	0.078	1.89	2.1	35.2	6.88	128
11/01/2018	ETFSL400	0.106	0.052	0.47	0.66	52	6.84	124
11/01/2018	ETFSL500	0.026	0.046	0.06	0.78	94.4	7.01	122
18/01/2018	ETAU	0.577	0.653	<0.05	1.15	136.4	7.67	366
18/01/2018	ETFSL100	0.211	0.22	<0.05	0.64	131.9	7.74	353
18/01/2018	ETFSL200	0.046	0.055	<0.05	0.79	131.2	7	129
18/01/2018	ETFSL300	0.058	0.057	0.06	0.84	125.5	6.94	126
18/01/2018	ETFSL400	0.038	0.048	<0.05	0.71	139.6	6.96	125
18/01/2018	ETFSL500	0.032	0.049	<0.05	0.78	121.4	6.94	123
25/01/2018	ETAU	0.674	0.668	<0.05	0.52	56.8	7.55	378
25/01/2018	ETFSL100	0.074	0.152	<0.05	0.46	-4.4	7.82	360
25/01/2018	ETFSL200	0.007	0.034	<0.05	0.41	70.6	7.16	120
25/01/2018	ETFSL300	0.005	0.035	<0.05	0.46	22.8	7.09	117
25/01/2018	ETFSL400	0.001	0.032	<0.05	0.41	55	7	118
25/01/2018	ETFSL500	0.002	0.03	<0.05	0.35	288.6	7.04	115
31/01/2018	ETAU	0.7	0.734	<0.05	0.67	82.3	7.46	374
31/01/2018	ETFSL100	0.089	0.147	<0.05	0.36	30.7	8.01	361
31/01/2018	ETFSL200	0.005	0.052	<0.05	0.57	79.1	7.28	139
31/01/2018	ETFSL300	0.002	0.049	<0.05	0.66	42.7	7.08	123
31/01/2018	ETFSL400	0.001	0.046	<0.05	0.54	92	7.05	122
31/01/2018	ETFSL500	0.001	0.044	<0.05	0.55	71	7.01	122
7/02/2018	ETAU	0.625	0.601	<0.05	0.65	106.9	7.39	374
7/02/2018	ETFSL100	0.102	0.129	<0.05	0.75	14.8	7.78	359
7/02/2018	ETFSL200	0.047	0.051	<0.05	0.48	80.4	7.04	119
7/02/2018	ETFSL300	0.049	0.059	<0.05	0.65	38.2	6.97	119
7/02/2018	ETFSL400	0.112	0.07	0.27	0.74	1	6.77	118
7/02/2018	ETFSL500	0.038	0.053	0.11	0.58	86.6	6.92	117
16/02/2018	ETAU	0.65	0.67	<0.05	0.66	158.8	7.54	380
16/02/2018	ETFSL100	0.075	0.126	<0.05	0.33	163.9	7.96	369
16/02/2018	ETFSL200	0.016	0.048	<0.05	0.6	152	7.05	128
16/02/2018	ETFSL300	0.023	0.058	<0.05	0.81	121.1	6.88	124
16/02/2018	ETFSL400	0.012	0.049	<0.05	0.54	143.2	6.83	121
16/02/2018	ETFSL500	0.019	0.054	<0.05	0.54	144.1	6.82	120
23/02/2018	ETAU	0.651	0.822	<0.05	1.72	163.6	7.21	400
23/02/2018	ETFSL100	0.12	0.2	<0.05	0.5	31.8	7.75	384
23/02/2018	ETFSL200	0.068	0.078	<0.05	0.93	55.8	6.92	140
23/02/2018	ETFSL300	0.065	0.07	0.07	0.88	55.2	6.8	136
23/02/2018	ETFSL400	0.062	0.075	<0.05	0.93	41.8	6.78	135
23/02/2018	ETFSL500	0.049	0.075	<0.05	1.07	-119.2	6.78	132

ATTACHMENT A (Continued)
Water Quality Data for Sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100

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)
1/03/2018	ETAU	2.07	2	5.96	5.69	83.1	6.32	492
1/03/2018	ETFSL100	1.78	1.72	2.41	2.7	36.7	6.31	464
1/03/2018	ETFSL200	0.08	0.087	0.08	0.83	59	6.45	133
1/03/2018	ETFSL300	0.059	0.069	0.16	0.79	43.5	6.36	127
1/03/2018	ETFSL400	0.05	0.064	0.1	1.03	32	6.35	125
1/03/2018	ETFSL500	0.036	0.051	0.08	0.65	2.3	6.38	123
7/03/2018	ETAU	2.54	2.48	7.52	7.23	168.1	6.12	514
7/03/2018	ETFSL100	2.21	2.15	4.12	4.43	158.6	6.11	479
7/03/2018	ETFSL200	0.082	0.132	0.07	0.92	166.8	6.29	147
7/03/2018	ETFSL300	0.108	0.12	<0.05	0.91	149	6.32	147
7/03/2018	ETFSL400	0.088	0.11	<0.05	0.78	161.1	6.79	142
7/03/2018	ETFSL500	0.083	0.102	0.07	0.76	154.5	6.32	138
14/03/2018	ETAU	1.54	1.43	3.72	6.68	41.4	6.58	450
14/03/2018	ETFSL100	0.907	1.08	0.55	3.58	31.6	6.95	431
14/03/2018	ETFSL200	0.047	0.066	<0.05	0.63	76	6.84	135
14/03/2018	ETFSL300	0.048	0.054	<0.05	0.56	41.4	6.83	133
14/03/2018	ETFSL400	0.064	0.055	0.06	0.61	3.3	6.86	132
14/03/2018	ETFSL500	0.047	0.052	<0.05	0.47	21.9	6.79	131
22/03/2018	ETAU	0.312	0.33	0.73	1.46	229.3	5.24	237
22/03/2018	ETFSL100	0.362	0.363	0.71	1.69	182.9	5.08	240
22/03/2018	ETFSL200	0.166	0.173	0.44	1.63	71.9	6.51	160
22/03/2018	ETFSL300	0.118	0.118	0.28	1.33	70.6	6.54	153
22/03/2018	ETFSL400	0.146	0.136	0.8	1.66	22.8	6.61	152
22/03/2018	ETFSL500	0.091	0.095	0.14	1.02	32.6	6.65	144
29/03/2018	ETAU	0.841	0.798	2.83	3.32	148	6.66	341
29/03/2018	ETFSL100	0.732	0.729	1.87	2.6	40.9	6.63	332
29/03/2018	ETFSL200	0.058	0.059	0.11	0.62	84.2	6.65	131
29/03/2018	ETFSL300	0.047	0.053	0.08	0.59	65.9	6.64	131
29/03/2018	ETFSL400	0.051	0.055	0.08	0.74	71.4	6.64	130
29/03/2018	ETFSL500	0.033	0.051	0.08	1.29	27.3	6.68	128
5/4/2018	ETAU	0.885	0.904	2.84	4.76	182.7	6.57	384
5/4/2018	ETFSL100	0.674	0.672	0.73	2.41	191.7	6.67	374
5/4/2018	ETFSL200	0.058	0.067	0.08	0.62	211.9	6.32	142
5/4/2018	ETFSL300	0.044	0.058	0.07	0.57	209.4	6.37	142
5/4/2018	ETFSL400	0.04	0.058	0.13	0.77	209.1	6.39	141
5/4/2018	ETFSL500	0.035	0.054	0.09	0.66	205.9	6.4	141
13/4/2018	ETAU	0.888	0.927	1.42	4.26	156.2	6.76	391
13/4/2018	ETFSL100	0.614	0.651	0.13	2.46	172.9	6.92	382
13/4/2018	ETFSL200	0.042	0.065	0.08	0.7	42.8	6.84	153
13/4/2018	ETFSL300	0.033	0.051	0.05	0.5	40.9	6.52	145
13/4/2018	ETFSL400	0.023	0.048	<0.05	0.59	64.1	6.6	147
13/4/2018	ETFSL500	0.014	0.04	<0.05	0.51	58.6	6.61	142
18/4/2018	ETAU	0.875	0.925	0.62	2.62	192.1	6.77	397
18/4/2018	ETFSL100	0.614	0.636	0.13	2.27	192.3	7.19	390
18/4/2018	ETFSL200	0.184	0.14	0.57	1.14	184.8	6.75	178
18/4/2018	ETFSL300	0.059	0.074	0.08	0.86	186.3	6.81	162
18/4/2018	ETFSL400	0.05	0.069	<0.05	0.64	181.3	6.76	159
18/4/2018	ETFSL500	0.044	0.071	0.07	0.76	185.5	6.76	160

ATTACHMENT A (Continued)
Water Quality Data for Sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100

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)
26/4/2018	ETAU	0.871	0.887	3.01	4.32	7.2	7.02	1040
26/4/2018	ETFSL100	0.587	0.631	0.1	2.06	9.6	7.42	409
26/4/2018	ETFSL200	0.059	0.071	0.08	0.69	45.1	7.01	159
26/4/2018	ETFSL300	0.043	0.055	<0.05	0.54	2.5	6.96	159
26/4/2018	ETFSL400	0.04	0.055	<0.05	0.54	36	6.97	155
26/4/2018	ETFSL500	0.03	0.05	0.05	0.51	94.3	6.96	152
3/5/2018	ETAU	0.781	0.813	2.38	2.38	76.9	6.9	362
3/5/2018	ETFSL100	0.58	0.611	0.18	3.02	20	7.47	358
3/5/2018	ETFSL200	0.056	0.081	0.07	0.78	43.5	7.01	142
3/5/2018	ETFSL300	0.053	0.059	0.13	0.55	5.3	7.02	136
3/5/2018	ETFSL400	0.044	0.052	0.06	0.45	55.3	7	132
3/5/2018	ETFSL500	0.034	0.044	0.07	0.68	60.7	7.01	128
10/5/2018	ETAU	0.752	0.86	4.66	4.66	176.7	6.75	388
10/5/2018	ETFSL100	0.553	0.628	0.06	4.58	191.5	7.19	384
10/5/2018	ETFSL200	0.044	0.061	<0.05	0.89	187.4	6.64	129
10/5/2018	ETFSL300	0.042	0.051	0.08	0.56	180.2	6.67	131
10/5/2018	ETFSL400	0.051	0.056	0.1	0.5	170.7	6.71	133
10/5/2018	ETFSL500	0.032	0.04	0.08	0.45	164	6.68	124
17/5/2018	ETAU	0.868	0.795	3.32	3.32	160	6.78	383
17/5/2018	ETFSL100	0.634	0.605	<0.05	2.66	178.5	7.12	375
17/5/2018	ETFSL200	0.249	0.22	0.25	1.87	178.5	6.85	246
17/5/2018	ETFSL300	0.176	0.178	0.12	1.57	175.8	6.84	230
17/5/2018	ETFSL400	0.146	0.14	0.1	1.32	179.3	6.78	202
17/5/2018	ETFSL500	0.113	0.102	0.12	1.36	179.6	6.65	176
24/5/2018	ETAU	0.763	0.795	3.22	3.22	192.8	7.22	381
24/5/2018	ETFSL100	0.563	0.63	<0.05	4.36	194.2	7.12	375
24/5/2018	ETFSL200	0.128	0.128	0.58	1.03	189.4	6.95	158
24/5/2018	ETFSL300	0.04	0.053	0.05	0.62	102.2	6.78	125
24/5/2018	ETFSL400	0.037	0.043	0.07	0.39	184.9	6.72	145
24/5/2018	ETFSL500	0.031	0.037	<0.05	0.33	185.2	6.76	120
31/5/2018	ETAU	0.797	0.812	3.74	3.74	193.3	7.22	378
31/5/2018	ETFSL100	0.626	0.598	<0.05	2.57	197.5	7.12	375
31/5/2018	ETFSL200	0.362	0.344	0.48	2.18	187.7	7.18	260
31/5/2018	ETFSL300	0.177	0.171	0.24	1.44	185.8	7.18	188
31/5/2018	ETFSL400	0.178	0.162	0.67	1.86	179.9	7.19	184
31/5/2018	ETFSL500	0.098	0.096	0.11	0.89	176	7.12	154
7/6/2018	ETAU	1.19	1.24	3.12	4.03	188.4	6.8	361
7/6/2018	ETFSL100	0.889	0.942	1.43	2.91	185.7	7.19	342
7/6/2018	ETFSL200	0.8	0.792	1.29	3.2	189.2	7.17	327
7/6/2018	ETFSL300	0.625	0.67	0.9	3.42	178.7	7.16	304
7/6/2018	ETFSL400	0.402	0.442	0.06	4.24	182.9	7.25	271
7/6/2018	ETFSL500	0.347	0.358	0.35	3.74	183.4	7.27	268
14/6/2018	ETAU	0.674	0.686	2.1	3.89	99.8	6.94	314
14/6/2018	ETFSL100	0.34	0.539	0.26	2.33	73.3	7.27	309
14/6/2018	ETFSL200	0.47	0.459	0.72	2.12	178.9	7.09	300
14/6/2018	ETFSL300	0.377	0.37	0.26	2.25	167.8	7.12	264
14/6/2018	ETFSL400	0.292	0.288	0.08	2.17	192.4	7.15	228
14/6/2018	ETFSL500	0.255	0.251	0.08	1.94	203.5	7.04	201

ATTACHMENT A (Continued)
Water Quality Data for Sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100

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)
20/6/2018	ETAU	0.657	0.628	3.62	5.4	188.3	6.72	337
20/6/2018	ETFSL100	0.457	0.468	0.9	3.16	19	6.9	324
20/6/2018	ETFSL200	0.371	0.39	0.72	2.4	191.4	6.95	320
20/6/2018	ETFSL300	0.384	0.377	0.34	2.42	190.5	6.98	322
20/6/2018	ETFSL400	0.331	0.333	<0.05	2.84	191.2	7	312
20/6/2018	ETFSL500	0.256	0.28	<0.05	2.67	184.8	7.01	273
28/6/2018	ETAU	0.634	0.687	4.08	7	185.8	6.6	328
28/6/2018	ETFSL100	0.501	0.559	1.04	3.95	188.8	7.02	329
28/6/2018	ETFSL200	0.409	0.422	1.45	3.94	187.2	6.82	306
28/6/2018	ETFSL300	0.176	0.207	<0.05	1.95	199.7	6.77	190
28/6/2018	ETFSL400	0.108	0.111	<0.05	1.04	198.5	6.67	128
28/6/2018	ETFSL500	0.075	0.079	0.05	0.79	179.7	6.61	118
2/7/2018	ETAU	0.637	0.706	3.29	6.24	39.9	7.05	352
2/7/2018	ETFSL100	0.519	0.558	0.97	4.38	191	7.31	351
2/7/2018	ETFSL200	0.395	0.416	0.86	2.28	191.4	7.34	344
2/7/2018	ETFSL300	0.391	0.426	1.19	3.57	193.9	7.25	342
2/7/2018	ETFSL400	0.327	0.349	0.15	3.82	195.4	7.22	311
2/7/2018	ETFSL500	0.226	0.258	0.06	2.37	194.2	7.15	252
12/7/2018	ETAU	0.587	0.626	1.11	2.33	456.6	7.31	370
12/7/2018	ETFSL100	0.501	0.492	0.63	1.6	163.5	7.59	367
12/7/2018	ETFSL200	0.342	0.338	0.73	1.42	160.3	7.5	355
12/7/2018	ETFSL300	0.324	0.373	1.16	2.87	154.8	7.49	361
12/7/2018	ETFSL400	0.338	0.353	0.44	3.85	1596	7.55	356
12/7/2018	ETFSL500	0.212	0.218	<0.05	2.45	158.3	7.37	259
19/7/2018	ETAU	0.726	0.712	0.63	3.5	177	7	377
19/7/2018	ETFSL100	0.576	0.565	0.11	3.01	202.8	7.37	371
19/7/2018	ETFSL200	0.444	0.4	0.36	2.35	200.6	7.24	360
19/7/2018	ETFSL300	0.462	0.402	1.11	3.68	202	7.21	372
19/7/2018	ETFSL400	0.431	0.374	0.57	3.48	203.3	7.33	384
19/7/2018	ETFSL500	0.288	0.279	<0.05	3.33	203.6	7.21	330
26/7/2018	ETAU	0.725	0.753	4.1	6.53	-5.9	6.59	364
26/7/2018	ETFSL100	0.522	0.566	0.19	2.89	10.8	6.78	356
26/7/2018	ETFSL200	0.31	0.353	0.29	1.73	9.8	6.79	351
26/7/2018	ETFSL300	0.35	0.35	1.59	2.55	-0.3	6.71	353
26/7/2018	ETFSL400	0.375	0.397	1.92	3.56	-12.3	6.75	370
26/7/2018	ETFSL500	0.346	0.431	<0.05	3.13	107.8	6.88	378
02/8/2018	ETAU	0.744	0.733	0.44	2.96	54.8	6.53	366
02/8/2018	ETFSL100	0.526	0.544	0.09	2.48	325	6.57	359
02/8/2018	ETFSL200	0.321	0.350	0.39	1.44	265.1	6.51	352
02/8/2018	ETFSL300	0.337	0.348	1.79	2.59	263.4	6.39	355
02/8/2018	ETFSL400	0.398	0.420	3.38	4.5	251.8	6.59	397
02/8/2018	ETFSL500	0.395	0.429	1.14	3.44	236.4	6.8	386
09/8/2018	ETAU	0.637	0.785	2.11	5.08	257.2	6.73	367
09/8/2018	ETFSL100	0.538	0.644	0.18	5.24	256.6	6.92	363
09/8/2018	ETFSL200	0.276	0.316	0.20	1.56	248.6	6.86	355
09/8/2018	ETFSL300	0.285	0.306	1.68	2.50	233.3	6.75	355
09/8/2018	ETFSL400	0.375	0.416	5.43	6.97	254.2	6.99	436
09/8/2018	ETFSL500	0.373	0.401	3.02	4.50	253.7	6.9	390

ATTACHMENT A (Continued)
Water Quality Data for Sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100

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)
16/8/2018	ETAU	0.672	0.797	1.53	3.99	250.1	6.71	365
16/8/2018	ETFSL100	0.491	0.584	0.08	2.32	264.8	7.16	362
16/8/2018	ETFSL200	0.263	0.304	0.1	1.17	265.4	7.13	353
16/8/2018	ETFSL300	0.249	0.298	1.02	1.98	267.4	6.96	349
16/8/2018	ETFSL400	0.336	0.351	3.57	4.23	260.7	7.12	405
16/8/2018	ETFSL500	0.309	0.358	1.69	3.18	261.3	6.98	386
23/8/2018	ETAU	0.724	0.701	0.92	3.12	266.4	7.03	358
23/8/2018	ETFSL100	0.489	0.505	0.07	2.26	271.7	6.97	351
23/8/2018	ETFSL200	0.274	0.270	0.1	1.01	267.1	7.11	344
23/8/2018	ETFSL300	0.227	0.273	0.83	1.83	265.6	7.04	341
23/8/2018	ETFSL400	0.267	0.279	2.11	2.50	261.8	7.05	365
23/8/2018	ETFSL500	0.352	0.337	2.34	3.41	258.1	7.23	382
30/8/2018	ETAU	0.632	0.696	<0.05	2.52	99.5	7.97	368
30/8/2018	ETFSL100	0.440	0.491	<0.05	2.09	77	7.73	354
30/8/2018	ETFSL200	0.225	0.243	0.06	0.85	23.2	7.85	350
30/8/2018	ETFSL300	0.236	0.248	0.96	1.70	256.2	7.78	345
30/8/2018	ETFSL400	0.327	0.343	3.30	4.50	252.5	8.20	399
30/8/2018	ETFSL500	0.316	0.350	2.05	3.65	228.1	8.18	387
05/9/2018	ETAU	0.688	0.683	0.66	4.54	25.2	7.44	363
05/9/2018	ETFSL100	0.476	0.483	<0.05	2.06	53.5	7.77	350
05/9/2018	ETFSL200	0.234	0.23	0.09	0.98	12.5	7.71	340
05/9/2018	ETFSL300	0.259	0.238	1.08	1.71	-12.5	7.57	333
05/9/2018	ETFSL400	0.367	0.371	4.53	5.96	-42.4	7.65	404
05/9/2018	ETFSL500	0.336	0.318	2.52	3.73	1.5	7.69	372
12/9/2018	ETAU	0.653	0.719	<0.05	3.72	178.2	7.05	360
12/9/2018	ETFSL100	0.461	0.521	<0.05	2.72	71.7	7.54	356
12/9/2018	ETFSL200	0.25	0.28	<0.05	0.96	20.1	7.49	346
12/9/2018	ETFSL300	0.3	0.301	0.41	1.73	3.1	7.38	345
12/9/2018	ETFSL400	0.389	0.34	2.15	2.77	-62.7	7.39	359
12/9/2018	ETFSL500	0.401	0.39	1.04	3.87	-17.4	7.43	381
20/9/2018	ETAU	0.392	0.721	1.14	2.49	272.4	7.11	362
20/9/2018	ETFSL100	0.179	0.467	<0.05	1.88	272.4	7.18	350
20/9/2018	ETFSL200	0.182	0.194	0.63	0.7	25.2	7.17	341
20/9/2018	ETFSL300	0.227	0.233	0.63	1.5	-11.9	7.08	337
20/9/2018	ETFSL400	0.386	0.356	2.66	5.39	-34.2	7.21	397
20/9/2018	ETFSL500	0.394	0.358	1.1	3.15	25.4	7.25	371
27/9/2018	ETAU	0.58	0.763	<0.05	2.24	234	7.33	400
27/9/2018	ETFSL100	0.434	0.493	<0.05	1.54	268.1	7.64	392
27/9/2018	ETFSL200	0.178	0.188	<0.05	0.61	272.8	7.55	381
27/9/2018	ETFSL300	0.231	0.239	0.4	1.6	270.8	7.33	377
27/9/2018	ETFSL400	0.331	0.325	1.49	3.55	263.1	7.41	400
27/9/2018	ETFSL500	0.335	0.375	0.83	3.46	266.8	7.67	416
05/10/2018	ETAU	0.39	0.359	2.14	3.49	274.6	7.28	250
05/10/2018	ETFSL100	0.297	0.686	0.32	12	271	7.57	286
05/10/2018	ETFSL200	0.305	0.308	0.29	2.72	269.7	7.67	295
05/10/2018	ETFSL300	0.272	0.305	0.32	2.72	267.7	7.66	291
05/10/2018	ETFSL400	0.364	0.299	0.63	2.95	259.8	7.73	294
05/10/2018	ETFSL500	0.251	0.245	0.36	2.11	242.9	7.58	271

ATTACHMENT A (Continued)
Water Quality Data for Sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100

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)
10/10/2018	ETAU	0.569	0.635	1.8	2.68	266.6	6.59	308
10/10/2018	ETFSL100	0.571	0.602	1.62	2.25	267.5	6.66	304
10/10/2018	ETFSL200	0.494	0.558	1.07	1.88	269.6	6.78	302
10/10/2018	ETFSL300	0.492	0.49	1.05	1.42	269.6	6.81	303
10/10/2018	ETFSL400	0.479	0.503	2.3	3.04	267.3	7.07	334
10/10/2018	ETFSL500	0.48	0.512	1.36	2	266.7	6.98	308
15/10/2018	ETAU	0.325	0.333	0.9	1.33	285.6	6.35	269
15/10/2018	ETFSL100	0.298	0.302	0.69	1.2	278.5	6.36	259
15/10/2018	ETFSL200	0.316	0.336	0.66	1.9	276.9	6.37	262
15/10/2018	ETFSL300	0.286	0.298	0.57	1.41	279.5	6.39	259
15/10/2018	ETFSL400	0.276	0.3	0.6	1.38	279.9	6.56	266
15/10/2018	ETFSL500	0.273	0.279	0.63	1.18	263	7.71	267
22/10/2018	ETAU	0.274	0.259	0.76	1.26	276.9	6.52	281
22/10/2018	ETFSL100	0.25	0.244	0.56	1.13	270.7	6.57	278
22/10/2018	ETFSL200	0.235	0.233	0.41	1.01	270.4	6.53	275
22/10/2018	ETFSL300	0.236	0.228	0.42	1	269	6.58	275
22/10/2018	ETFSL400	0.304	0.263	1.8	2.51	264.8	7.01	321
22/10/2018	ETFSL500	0.184	0.229	0.26	1.19	258.5	6.74	279
30/10/2018	ETAU	0.432	0.431	1.79	2.55	15.1	6.65	290
30/10/2018	ETFSL100	0.376	0.39	0.76	1.78	-0.4	6.91	286
30/10/2018	ETFSL200	0.336	0.363	0.37	1.47	3.8	6.92	285
30/10/2018	ETFSL300	0.341	0.35	0.39	1.32	7.6	6.99	291
30/10/2018	ETFSL400	0.36	0.364	1.58	3.1	-77.3	7.09	329
30/10/2018	ETFSL500	0.34	0.351	0.5	1.63	-4.2	7.05	296
08/11/2018	ETAU	0.635	0.553	0.76	3.15	23.3	7.07	307
08/11/2018	ETFSL100	0.429	0.433	0.14	1.59	12.9	7.35	307
08/11/2018	ETFSL200	0.333	0.34	0.06	1	20	7.31	303
08/11/2018	ETFSL300	0.333	0.329	0.06	1.1	5.4	7.32	304
08/11/2018	ETFSL400	0.431	0.403	5.31	5.49	247.1	7.47	385
08/11/2018	ETFSL500	0.315	0.325	0.37	1.54	248.4	7.30	310
15/11/2018	ETAU	0.609	0.628	0.53	2.04	264.1	7.09	334
15/11/2018	ETFSL100	0.399	0.414	<0.05	1.6	172.9	7.32	328
15/11/2018	ETFSL200	0.308	0.331	<0.05	1.34	272	7.31	325
15/11/2018	ETFSL300	0.321	0.298	0.08	1.15	271	7.28	324
15/11/2018	ETFSL400	0.396	0.383	1.44	4.72	262.5	7.35	373
15/11/2018	ETFSL500	0.328	0.336	0.24	1.76	267.3	7.38	345
19/11/2018	ETWQ AU	0.647	⁻⁶	0.08	2.42	259.1	7.22	345
22/11/2018	ETFSL200	0.264	0.298	<0.05	0.82	30.9	7.29	355
22/11/2018	ETFSL500	0.38	0.376	0.67	1.88	-3.3	7.50	373
22/11/2018	CONFLU1	0.085	0.088	0.12	0.9	-1.1	7.51	307
22/11/2018	WARARM5	0.018	0.046	0.25	1	54.6	7.57	297
22/11/2018	WDFS1	0.105	0.114	0.12	1.15	40.1	7.53	307
22/11/2018	WDFS1+100	0.103	0.119	0.1	1.06	26	7.55	306

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

ATTACHMENT A (Continued)
Water Quality Data for Sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100

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)
26/11/2018	ETWQ AU	0.538	⁻⁶	<0.05	1.36	83.8	7.11	354
29/11/2018	ETFSL200	0.139	0.15	0.54	1.2	36.1	7.07	195
29/11/2018	ETFSL500	0.167	0.147	0.3	1.19	30.1	6.94	195
29/11/2018	CONFLU1	0.158	0.108	0.27	1.18	29.5	7.19	200
29/11/2018	WARARM5	0.055	0.052	0.18	0.92	66.7	7.5	206
29/11/2018	WDFS1	0.082	0.074	0.18	0.21	36.7	7.8	206
29/11/2018	WDFS1+100	0.103	0.094	0.19	1	38.4	7.36	200
4/12/2018	ETWQ AU	0.433	⁻⁶	1.65	2.36	30.6	7	266
6/12/2018	ETFSL200	0.283	0.295	0.26	1.04	242.7	6.97	260
6/12/2018	ETFSL500	0.29	0.3	0.62	1.47	249.5	7.23	270
6/12/2018	CONFLU1	0.112	0.114	0.12	1.13	243.8	7.24	243
6/12/2018	WARARM5	0.034	0.035	<0.05	0.75	250.1	7.29	238
6/12/2018	WDFS1	0.122	0.134	0.07	1.12	241.4	7.29	246
6/12/2018	WDFS1+100	0.109	0.126	<0.05	0.99	251.1	7.3	245
12/12/2018	ETAU	0.428	0.484	1.49	3.33	-	6.86	269
12/12/2018	ETFSL200	0.215	0.232	<0.05	0.42	255.3	7.4	245
12/12/2018	ETFSL500	0.276	0.284	0.27	0.89	251.9	7.41	262
12/12/2018	CONFLU1	0.081	0.091	0.45	0.8	17.9	7.39	219
12/12/2018	WARARM5	0.03	0.042	<0.05	0.58	236.4	7.53	214
12/12/2018	WDFS1	0.108	0.121	0.41	1.09	27.5	7.44	225
12/12/2018	WDFS1+100	0.105	0.12	<0.05	0.99	42.3	7.24	243
17/12/2018	ETWQ AU	0.102	⁻⁶	0.18	0.75	280.3	6.50	152
17/12/2018	ETFSL200	0.076	0.084	0.17	0.7	274.8	6.76	152
17/12/2018	ETFSL500	0.087	0.086	0.19	0.76	274.8	6.56	150
17/12/2018	CONFLU1	0.068	0.068	0.16	0.78	270.9	6.64	152
17/12/2018	WARARM5	0.023	0.032	0.08	0.54	257.5	6.77	156
17/12/2018	WDFS1	0.069	0.062	0.15	0.75	273	6.67	153
17/12/2018	WDFS1+100	0.055	0.063	0.12	0.71	278.4	6.71	154
27/12/2018	ETAU	0.263	0.277	0.61	1.81	24.3	6.72	217
27/12/2018	ETFSL200	0.196	0.194	0.09	0.93	30.6	7.11	216
27/12/2018	ETFSL500	0.219	0.213	0.3	1.37	-6.9	7.13	224
27/12/2018	CONFLU1	0.071	0.075	<0.05	0.86	21.4	7.15	208
27/12/2018	WARARM5	0.045	0.036	<0.05	0.48	3.4	7.3	206
27/12/2018	WDFS1	0.108	0.11	0.06	0.99	24.9	7.12	210
27/12/2018	WDFS1+100	0.101	0.105	<0.05	0.93	37.4	7.13	210
3/01/2019	ETWQ AU	0.335	0.443	<0.05	1.57	110.1	7.35	300
3/01/2019	ETFSL200	0.159	0.226	<0.05	0.63	113.1	7.63	290
3/01/2019	ETFSL500	0.265	0.274	0.12	1.32	11.5	7.5	302
3/01/2019	CONFLU1	0.143	0.16	<0.05	1.21	4.8	7.29	270
3/01/2019	WARARM5	0.055	0.054	<0.05	0.64	56.4	7.46	256
3/01/2019	WDFS1	0.106	0.14	<0.05	1.27	72	7.45	265
3/01/2019	WDFS1+100	0.101	0.138	<0.05	1.16	56.2	7.42	263
10/01/2019	ETWQ AU	0.438	0.282	<0.05	1.41	244.1	6.92	268
10/01/2019	ETFSL200	0.216	0.246	<0.05	0.62	26.8	8.03	279
10/01/2019	ETFSL500	0.22	0.262	<0.05	1.18	-9.3	7.64	300
10/01/2019	CONFLU1	0.129	0.141	<0.05	1.11	-33.7	7.55	269
10/01/2019	WARARM5	0.042	0.041	<0.05	0.6	90.3	7.62	252
10/01/2019	WDFS1	0.061	0.087	<0.05	0.92	22.1	7.59	242
10/01/2019	WDFS1+100	0.061	0.074	<0.05	0.97	6.9	7.58	240

ATTACHMENT A (Continued)
Water Quality Data for Sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100

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)
16/01/2019	ETWQ AU	0.433	0.454	<0.05	1.86	171.1	6.75	282
16/01/2019	ETFSL200	0.18	0.189	<0.05	0.4	258.4	7.67	275
16/01/2019	ETFSL500	0.244	0.233	0.38	1	262.4	7.65	303
16/01/2019	CONFLU1	0.058	0.049	0.12	0.86	261.2	7.68	249
16/01/2019	WARARM5	0.025	0.028	0.11	0.52	268.1	7.82	242
16/01/2019	WDFS1	0.046	0.044	0.16	0.92	263.5	7.76	256
16/01/2019	WDFS1+100	0.047	0.044	0.19	0.94	259.2	7.79	260
23/01/2019	ETWQ AU	0.579	0.661	<0.05	2.09	184.3	6.78	292
23/01/2019	ETFSL200	0.171	0.204	<0.05	0.38	96.8	7.65	286
23/01/2019	ETFSL500	0.28	0.284	0.2	1.62	-11.1	7.65	316
23/01/2019	CONFLU1	0.052	0.056	<0.05	1.11	5.6	7.7	264
23/01/2019	WARARM5	0.043	0.036	<0.05	0.74	-38.4	7.7	253
23/01/2019	WDFS1	0.032	0.042	<0.05	1.08	19.6	7.77	266
23/01/2019	WDFS1+100	0.02	0.029	<0.05	0.92	-16.6	7.83	266
29/01/2019	ETAU	0.62	0.578	0.07	1.52	66.8	6.7	294
29/01/2019	ETFSL200	0.19	0.216	<0.05	0.44	36.2	7.23	282
29/01/2019	ETFSL500	0.249	0.279	<0.05	1.48	12.1	7.34	310
29/01/2019	CONFLU1	0.048	0.07	<0.05	1.05	-20.8	7.54	282
29/01/2019	WARARM5	0.031	0.028	<0.05	0.54	49.5	7.34	251
29/01/2019	WDFS1	0.027	0.038	<0.05	0.96	29.7	7.49	260
29/01/2019	WDFS1+100	0.03	0.03	<0.05	0.91	9.9	7.49	260
4/02/2019	ETAU	0.559	0.635	<0.05	1.04	51.1	6.8	283
4/02/2019	ETFSL200	0.173	0.191	<0.05	0.34	9.1	7.26	275
4/02/2019	ETFSL500	0.221	0.276	0.31	1.7	-18.6	7.35	302
4/02/2019	CONFLU1	0.043	0.036	0.16	0.85	-51.7	7.55	252
4/02/2019	WARARM5	0.023	0.029	0.19	0.74	139.1	7.58	240
4/02/2019	WDFS1	0.012	0.021	0.27	0.8	73.2	7.71	252
4/02/2019	WDFS1+100	0.01	0.02	0.29	0.74	50	7.71	255
11/02/2019	ETAU	0.757	0.731	<0.05	1.5	261.4	6.86	288
11/02/2019	ETFSL200	0.197	0.206	<0.05	0.36	6.8	7.21	280
11/02/2019	ETFSL500	0.243	0.302	0.5	1.86	-33.9	7.3	306
11/02/2019	CONFLU1	0.023	0.033	0.24	0.94	-96.7	7.48	255
11/02/2019	WARARM5	0.019	0.026	0.24	0.66	53.5	7.46	243
11/02/2019	WDFS1	0.011	0.018	0.31	0.98	-26	7.62	259
11/02/2019	WDFS1+100	0.005	0.013	0.3	0.83	64.5	7.62	258
18/02/2019	ETAU	0.624	0.675	0.17	1.51	51.8	6.91	303
18/02/2019	ETFSL200	0.189	0.19	0.19	0.36	12.8	7.27	296
18/02/2019	ETFSL500	0.243	0.284	0.23	1.77	-15.6	7.86	277
18/02/2019	CONFLU1	0.041	0.035	0.13	0.9	6.6	7.73	291
18/02/2019	WARARM5	0.022	0.024	0.19	0.64	64.1	7.46	262
18/02/2019	WDFS1	0.007	0.012	0.31	0.78	26.7	7.83	279
18/02/2019	WDFS1+100	0.006	0.011	0.24	0.64	23.3	7.84	279
25/02/2019	ETAU	0.616	0.719	<0.05	0.93	273.1	7.19	283
25/02/2019	ETFSL200	0.198	0.199	<0.05	0.54	270.5	7.06	271
25/02/2019	ETFSL500	0.281	0.312	1.72	2.11	270.6	7.3	307
25/02/2019	CONFLU1	0.022	0.027	0.06	0.86	274.6	7.37	247
25/02/2019	WARARM5	0.014	0.023	<0.05	0.53	264.2	7.4	238
25/02/2019	WDFS1	0.009	0.017	<0.05	0.79	272.6	7.55	248
25/02/2019	WDFS1+100	0.004	0.014	0.05	0.92	264.9	7.6	246

ATTACHMENT A (Continued)
Water Quality Data for Sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100

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)
04/03/2019	ETAU	0.688	0.67	<0.05	0.13	104.3	6.74	306
04/03/2019	ETFSL200	0.185	0.193	0.12	0.48	259.3	7.18	294
04/03/2019	ETFSL500	0.295	0.298	0.76	2.02	271.1	7.33	334
04/03/2019	CONFLU1	0.032	0.049	0.12	1.71	277.1	7.56	274
04/03/2019	WARARM5	0.025	0.031	0.12	1.02	277.7	7.44	248
04/03/2019	WDFS1	0.006	0.013	0.13	0.81	273.6	7.75	271
04/03/2019	WDFS1+100	0.005	0.011	0.21	0.71	249.3	7.58	270
11/03/2019	ETAU	0.638	0.726	0.08	0.94		6.87	322
11/03/2019	ETFSL200	0.152	0.170	0.06	0.38	227.4	7.24	310
11/03/2019	ETFSL500	0.266	0.28	0.5	1.91	219.5	7.43	347
11/03/2019	CONFLU1	0.024	0.03	0.23	0.96	228.5	7.53	289
11/03/2019	WARARM5	0.018	0.052	0.19	0.71	202.5	7.53	269
11/03/2019	WDFS1	0.01	0.018	0.26	0.8	219.7	7.07	276
11/03/2019	WDFS1+100	0.006	0.027	0.22	1.45	215.9	7.82	289
18/03/2019	ETAU	0.153	0.16	0.84	1.21	239	6.77	175
18/03/2019	ETFSL200	0.187	<0.01	0.5	0.204	237.9	6.62	180
18/03/2019	ETFSL500	0.193	<0.01	0.63	0.197	230.4	6.7	184
18/03/2019	CONFLU1	0.146	0.02	0.5	0.156	50.3	6.72	172
18/03/2019	WARARM5	0.032	<0.01	0.3	0.034	49.3	6.67	153
18/03/2019	WDFS1	0.071	0.04	0.44	0.073	21.4	6.67	159
18/03/2019	WDFS1+100	0.094	0.04	0.42	0.099	57.1	6.61	158
26/03/2019	ETAU	0.335	0.347	0.46	1.91	29.3	6.74	230
26/03/2019	ETFSL200	0.205	0.217	<0.05	1.04	23.5	6.96	224
26/03/2019	ETFSL500	0.233	0.234	0.5	1.39	227	6.99	239
26/03/2019	CONFLU1	0.095	0.114	<0.05	0.8	237.9	7.02	206
26/03/2019	WARARM5	0.039	0.041	<0.05	0.45	241.4	6.92	195
26/03/2019	WDFS1	0.073	0.076	<0.05	0.65	236.4	7.02	200
26/03/2019	WDFS1+100	0.054	0.049	<0.05	0.64	241.1	7.03	199
01/04/2019	ETAU	0.332	0.407	<0.05	1.51	160	7.3	256
01/04/2019	ETFSL200	0.184	0.248	<0.05	0.78	-1.8	7.68	248
01/04/2019	ETFSL500	0.222	0.261	0.47	1.14	-4.8	7.64	263
01/04/2019	CONFLU1	0.103	0.116	0.17	0.92	9	7.68	232
01/04/2019	WARARM5	0.034	0.037	0.1	0.42	36.8	7.71	207
01/04/2019	WDFS1	0.051	0.061	0.18	0.64	0.8	7.67	221
01/04/2019	WDFS1+100	0.027	0.031	0.14	0.56	43.5	7.73	219
08/04/2019	ETAU	0.298	0.319	0.64	1.89	35.8	6.86	225
08/04/2019	ETFSL200	0.200	0.198	0.12	0.96	273.8	7.09	212
08/04/2019	ETFSL500	0.184	0.2	0.34	1.34	264	7.25	220
08/04/2019	CONFLU1	0.073	0.082	0.14	0.77	238.9	7.54	212
08/04/2019	WARARM5	0.02	0.018	0.06	0.35	252.5	7.6	204
08/04/2019	WDFS1	0.039	0.05	0.11	0.7	236.9	7.56	205
08/04/2019	WDFS1+100	0.03	0.038	0.08	0.58	242.3	7.61	205
16/04/2019	ETAU	0.321	0.31	<0.05	1.31	259.8	7.17	240
16/04/2019	ETFSL200	0.156	0.154	<0.05	0.64	83.9	7.48	233
16/04/2019	ETFSL500	0.207	0.204	0.53	1.25	11.4	7.65	262
16/04/2019	CONFLU1	0.099	0.1	0.06	0.73	3.8	7.69	235
16/04/2019	WARARM5	0.024	0.021	0.21	0.34	21.6	7.62	207
16/04/2019	WDFS1	0.035	0.035	0.13	0.62	0.9	7.6	215
16/04/2019	WDFS1+100	0.017	0.017	0.14	0.48	4.6	7.67	214

ATTACHMENT A (Continued)

Water Quality Data for Sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100

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)
23/04/2019	ETAU	0.384	0.425	<0.05	1.82	262.5	7.54	224
23/04/2019	ETFSL200	0.162	0.174	0.08	0.77	73.9	7.31	218
23/04/2019	ETFSL500	0.214	0.232	0.24	1.4	8.8	7.64	240
23/04/2019	CONFLU1	0.041	0.046	0.13	0.76	10.6	7.56	194
23/04/2019	WARARM5	0.041	0.046	0.13	0.76	63.3	7.56	194
23/04/2019	WDFS1	0.026	0.027	0.16	0.71	7.5	7.56	191
23/04/2019	WDFS1+100	0.009	0.014	0.18	0.6	45	7.59	190
02/05/2019	ETAU	0.448	0.502	0.33	4.37	78.6	6.97	235
02/05/2019	ETFSL200	0.171	0.187	0.07	0.86	213.6	7.2	226
02/05/2019	ETFSL500	0.24	0.267	0.5	1.4	208.1	7.31	248
02/05/2019	CONFLU1	0.068	0.078	0.12	0.9	198.7	7.41	215
02/05/2019	WARARM5	0.024	0.03	0.14	0.51	201.1	7.3	184
02/05/2019	WDFS1	0.022	0.024	0.19	0.62	194.3	7.31	195
02/05/2019	WDFS1+100	0.01	0.016	0.18	0.5	189.9	7.4	196
06/05/2019	ETAU	0.381	0.421	<0.05	1.3	148.2	6.89	284
06/05/2019	ETFSL200	0.164	0.183	0.1	0.62	252.8	7.18	278
06/05/2019	ETFSL500	0.212	0.256	0.7	1.68	256.8	7.34	314
06/05/2019	CONFLU1	0.076	0.084	0.12	0.78	236.9	7.48	271
06/05/2019	WARARM5	0.025	0.023	0.09	0.46	254.6	7.37	238
06/05/2019	WDFS1	0.024	0.028	0.14	0.71	216.8	7.43	250
06/05/2019	WDFS1+100	0.009	0.009	0.08	0.54	259.9	7.57	246
13/05/2019	ETAU	0.452	0.488	0.08	2.71	106.4	7.15	299
13/05/2019	ETFSL200	0.171	0.208	0.06	0.93	254.6	7.48	290
13/05/2019	ETFSL500	0.261	0.273	0.29	1.74	241.2	7.57	322
13/05/2019	CONFLU1	0.057	0.063	0.07	0.88	249.5	7.61	269
13/05/2019	WARARM5	0.028	0.026	0.07	0.52	249.3	7.6	248
13/05/2019	WDFS1	0.034	0.031	0.05	0.85	243.4	7.61	260
13/05/2019	WDFS1+100	0.009	0.011	<0.05	0.58	243.9	7.71	265
20/05/2019	ETAU	0.432	0.49	<0.05	1.93	270.8	6.96	297
20/05/2019	ETFSL200	0.212	0.230	0.1	1.27	97.3	7.79	291
20/05/2019	ETFSL500	0.282	0.292	1.16	2.02	-17.1	7.63	331
20/05/2019	CONFLU1	0.076	0.092	0.1	1.12	68	7.76	286
20/05/2019	WARARM5	0.035	0.036	0.15	0.54	58.2	7.66	252
20/05/2019	WDFS1	0.027	0.028	0.2	0.72	27.9	7.43	266
20/05/2019	WDFS1+100	0.015	0.016	0.12	0.57	113.4	7.74	270
27/05/2019	ETAU	0.422	0.498	<0.05	2.26	169.8	7.02	301
27/05/2019	ETFSL200	0.240	0.239	0.11	1.06	286.4	7.45	293
27/05/2019	ETFSL500	0.292	0.276	1.14	1.92	286	7.51	334
27/05/2019	CONFLU1	0.06	0.053	0.07	0.69	151.2	7.63	271
27/05/2019	WARARM5	0.026	0.024	<0.05	0.49	278	7.47	254
27/05/2019	WDFS1	0.034	0.037	0.1	0.82	274.3	7.57	270
27/05/2019	WDFS1+100	0.013	0.013	0.06	0.52	284.6	7.76	271
05/06/2019	ETAU	0.295	0.28	0.66	2.05	127.4	7.15	228
03/06/2019	ETFSL200	0.237	0.245	0.09	1.34	84	7.63	316
03/06/2019	ETFSL500	0.325	0.339	1.31	2.4	23	7.71	358
03/06/2019	CONFLU1	0.093	0.099	0.06	0.78	54.6	7.87	308
03/06/2019	WARARM5	0.024	0.02	0.07	0.41	122.6	7.78	275
03/06/2019	WDFS1	0.056	0.057	0.39	1.68	80.4	7.78	290
03/06/2019	WDFS1+100	0.019	0.021	0.15	0.56	87.6	7.92	291

ATTACHMENT A (Continued)

Water Quality Data for Sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100

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)
11/06/2019	ETAU	0.448	0.465	0.41	2.98	142.8	7.08	291
11/06/2019	ETFSL200	0.247	0.253	0.1	1.12	116.2	7.43	287
11/06/2019	ETFSL500	0.34	0.358	1.24	2.26	63.1	7.55	323
11/06/2019	CONFLU1	0.118	0.13	0.13	1.1	73.1	7.58	278
11/06/2019	WARARM5	0.026	0.024	0.05	0.45	82	7.55	234
11/06/2019	WDFS1	0.061	0.056	0.14	0.73	101.4	7.58	251
11/06/2019	WDFS1+100	0.035	0.03	<0.05	0.56	89.2	7.63	251
18/06/2019	ETAU	0.383	0.411	1.74	2.71	12.6	6.83	252
18/06/2019	ETFSL200	0.275	0.296	0.39	1.37	35.8	7.01	242
18/06/2019	ETFSL500	0.277	0.29	0.6	1.63	12.6	7.14	249
18/06/2019	CONFLU1	0.192	0.137	0.07	0.93	8.1	7.24	235
18/06/2019	WARARM5	0.019	0.014	<0.05	0.26	48.8	7.36	222
18/06/2019	WDFS1	0.088	0.092	0.11	0.73	3.4	7.25	229
18/06/2019	WDFS1+100	0.083	0.088	<0.05	0.71	13.9	7.26	226
25/06/2019	ETAU	0.369	0.377	2.13	3.62	-2.6	6.88	266
25/06/2019	ETFSL200	0.217	0.259	0.11	2.29	2.3	7.16	252
25/06/2019	ETFSL500	0.254	0.268	0.44	2.04	-28.1	7.22	266
25/06/2019	CONFLU1	0.076	0.09	<0.05	0.66	-7.1	7.4	246
25/06/2019	WARARM5	0.066	0.017	<0.05	0.35	4.7	7.43	236
25/06/2019	WDFS1	0.079	0.087	0.12	0.75	-9.4	7.38	241
25/06/2019	WDFS1+100	0.054	0.062	<0.05	0.64	-30.8	7.41	237

30 September 2019

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 – July 2019

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 Longwall 304 Water Management Plan (LW304 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 LW304 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 LW304 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 LW304 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 LW304 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.

Analysis conducted by Hydro Engineering & Consulting (2019) in accordance with the LW304 WMP, identified that the performance indicator for water resources reaching the Woronora Reservoir was exceeded for dissolved (i.e. filtered <0.45 µm fraction) manganese and dissolved iron on the Eastern Tributary at site ETWQ AU in July 2019 (as there was not a similar exceedance of the trigger recorded at control site WOWQ 2 on the Woronora River). The performance indicator was not exceeded for field filtered aluminium in July 2019 and therefore this parameter is not discussed in this report.

In accordance with the LW304 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*.

This assessment against the water quality subsidence impact performance measure has been prepared for July 2019 in consideration of:

- pluviograph data;
- flow data from the Eastern Tributary gauging location (GS 300078);
- groundwater level and groundwater quality results for Eastern Tributary sites up to 31 July 2019¹;
- surface water quality data at site ETWQ AU/ETAU² and sites further upstream on the Eastern Tributary up to 31 July 2019;
- surface water quality data at sites downstream of ETWQ AU/ETAU² up to 31 July 2019; 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 2018, above average rainfall has only been recorded in October 2018, November 2018 and December 2018, with below average rainfall recorded in all other months (Table 1).

Total rainfall in July 2019 was 56.0 mm, below the average rainfall at Darkes Forest (96.0 mm), with rainfall events occurring over 4 to 9 July (totalling 55.5 mm rainfall, with the majority [53.0 mm] falling over 5 and 6 July) and on 12 July 2019 (0.5 mm). Shallow groundwater levels correlate with the rainfall trend.

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

² Site ETAU is the same as site ETWQ AU (i.e. samples are taken at the same location). The difference between the sites relates to the time of sampling. Site ETWQ AU monitoring is conducted on the same day as sites upstream of ETWQ AU/ETAU (shown on Charts 1 to 2), while site ETAU monitoring is conducted on the same day as the sites downstream of ETWQ AU/ETAU (described in Section 3 and shown on Charts 3 to 4). From 29 January 2019, water quality sampling of all sites on the Eastern Tributary was undertaken in a single day. Future reporting will identify the data at this site as site ETWQ AU.

Table 1 Monthly Rainfall Data (mm) for PV7, January 2018 to July 2019

Month/Year	Rainfall at PV7 (mm)	Rainfall at Darkes Forest (mm) [#]	Mean Monthly Rainfall at Darkes Forest (1894-2019) (mm) [#]
January 2018	48.0	12.0	132.4
February 2018	115.5	16.6	159.6
March 2018	151.0	45.0	153.9
April 2018	32.0	21.6	126.8
May 2018	12.5	8.0	129.1
June 2018	112.0	91.8	146.6
July 2018	3.5	0.4	96.4
August 2018	12.5	15.8	89.1
September 2018	52.0	41.8	76.6
October 2018	197.0	200.8	91.9
November 2018	114.5	127.8	105.4
December 2018	120.0	91.0	103.8
January 2019	58.5	55.4	131.8
February 2019	41.0	54.2	158.7
March 2019	149.0	201.2	154.3
April 2019	35.0	46.0	126.1
May 2019	8.5	8.0	128.1
June 2019	115.5	47.4	145.8
July 2019	56.0	46.4	96.0

[#] 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 July 2019.

2. EASTERN TRIBUTARY SURFACE WATER AND GROUNDWATER QUALITY DATA

2.1 Dissolved Manganese

Plots of dissolved manganese at surface water quality sites ETWQ AU, ETWQ AQ (upstream on the Eastern Tributary) and WOWQ 2 (control site) and at groundwater quality site ETGW2, are compared to rainfall at PV7 (Chart 1) and streamflow at GS 300078 (Chart 2) (Figure 1).

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.

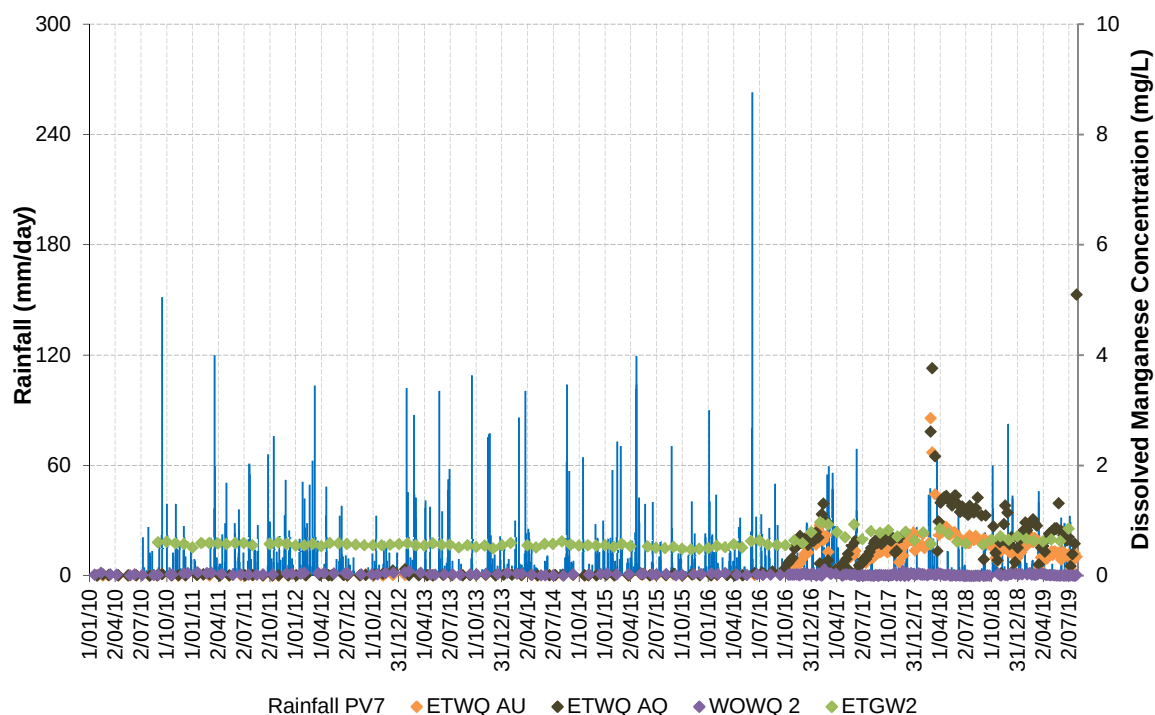


Chart 1 Dissolved Manganese Concentrations at Surface Water Quality Sites ETWQ AU, ETWQ AQ and WOWQ 2 and Groundwater Quality Site ETGW2 and Rainfall (to 31 July 2019)

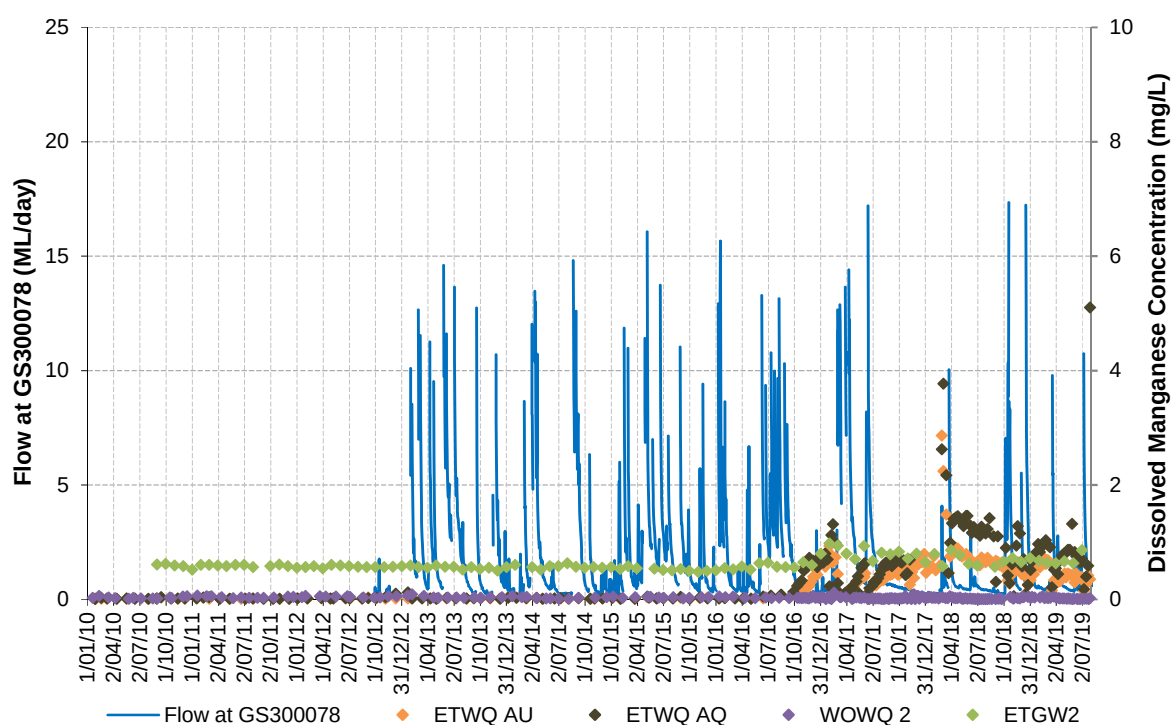
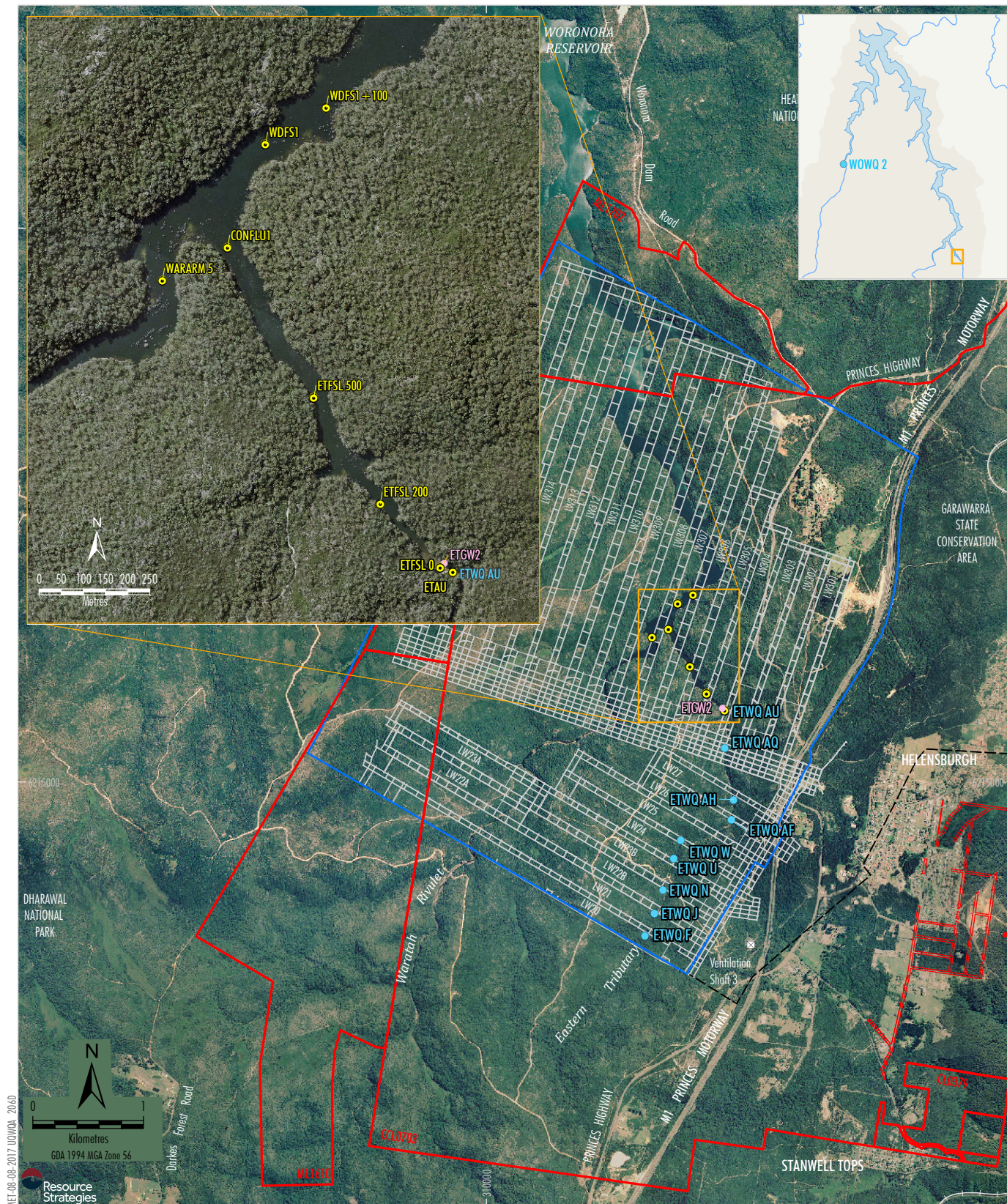


Chart 2 Dissolved Manganese Concentrations at Surface Water Quality Sites ETWQ AU, ETWQ AQ and WOWQ 2 and Groundwater Quality Site ETGW2 and Stream Flow (to 31 July 2019)



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 on Eastern Tributary
- Water Quality Site on Eastern Tributary and/or in Woronora Reservoir
- Groundwater Quality Site of Eastern Tributary

Source: Land and Property Information (2015); Date of Aerial Photography 1998 and 2017; Department of Industry (2015); Metropolitan Coal (2018); WaterNSW (2018)

Peabody

METROPOLITAN COAL

Surface Water Quality Sampling of
Eastern Tributary Watercourse
and Woronora Reservoir

Figure 1

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. <0.1 mg/L, exist in the natural creek water. Dissolved manganese is easily diluted by freshwater flow to low levels when higher creek flows occur.

In July 2019, dissolved manganese concentrations at site ETWQ AU ranged between 0.144 mg/L and 0.415 mg/L. 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.

2.2 Dissolved Iron

Plots of dissolved iron at surface water quality sites ETWQ AU, ETWQ AQ (upstream on the Eastern Tributary) and WOWQ 2 (control site) and at groundwater quality site ETGW2, are compared to rainfall at PV7 (Chart 3) and streamflow at GS 300078 (Chart 4).

Similar to manganese, reducing conditions in the groundwater has solubilised iron. The groundwater quality data for site ETGW2 are indicative of the dissolved iron concentrations in the groundwater (Charts 3 and 4). The soluble iron (iron (II) ion, Fe^{2+}), rapidly oxidises to iron (III) Fe^{3+} , and forms insoluble hydrated ferric hydroxide in colloidal (<0.45 μm) and particulate (>0.45 μm) forms. This results in an increase in dissolved iron (if colloidal, i.e. able to pass through a 0.45 μm membrane filter) concentrations in the Eastern Tributary when the flows return to the surface. This is evident on Charts 3 and 4 where the concentration of dissolved iron is higher upstream of site ETWQ AU (e.g. at site ETWQ AQ) where cracking and flow diversion has occurred.

Iron is most stable under oxidising conditions (ORP > 50 mV) as insoluble hydrated ferric hydroxide in colloidal (<0.45 μm) and particulate (>0.45 μm) forms, until it deposits into sediment or on sandstone surfaces, but its concentration is not lowered by dilution. Instead, particulate or colloidal iron, both insoluble forms, is dispersed in the water column by creek flow.

Iron oxidising bacteria can also create oxidised iron precipitate (ADWG, 2011). The iron floc provided is a mixture of precipitated iron oxyhydroxide material >0.45 μm size and colloidal material which is <0.45 μm size. The colloidal material also coagulates to give the larger size precipitated material and coats the creek bed rock surfaces. The iron oxyhydroxide gradually converts to goethite (Yee *et al.* 2006) which has a darker colour and is commonly found in the creek sediment. The transported material becomes part of the sediment.

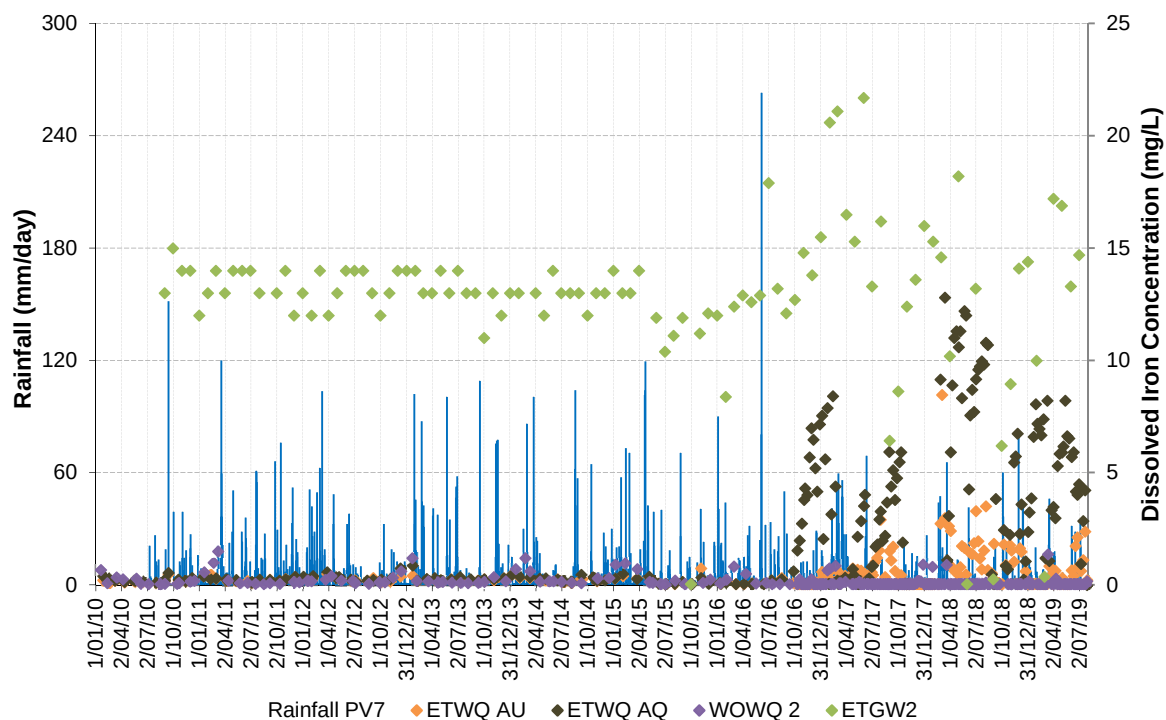


Chart 3 Dissolved Iron Concentrations at Surface Water Quality Sites ETWQ AU, ETWQ AQ and WOWQ 2 and Groundwater Quality Site ETGW2 and Rainfall (to 31 July 2019)

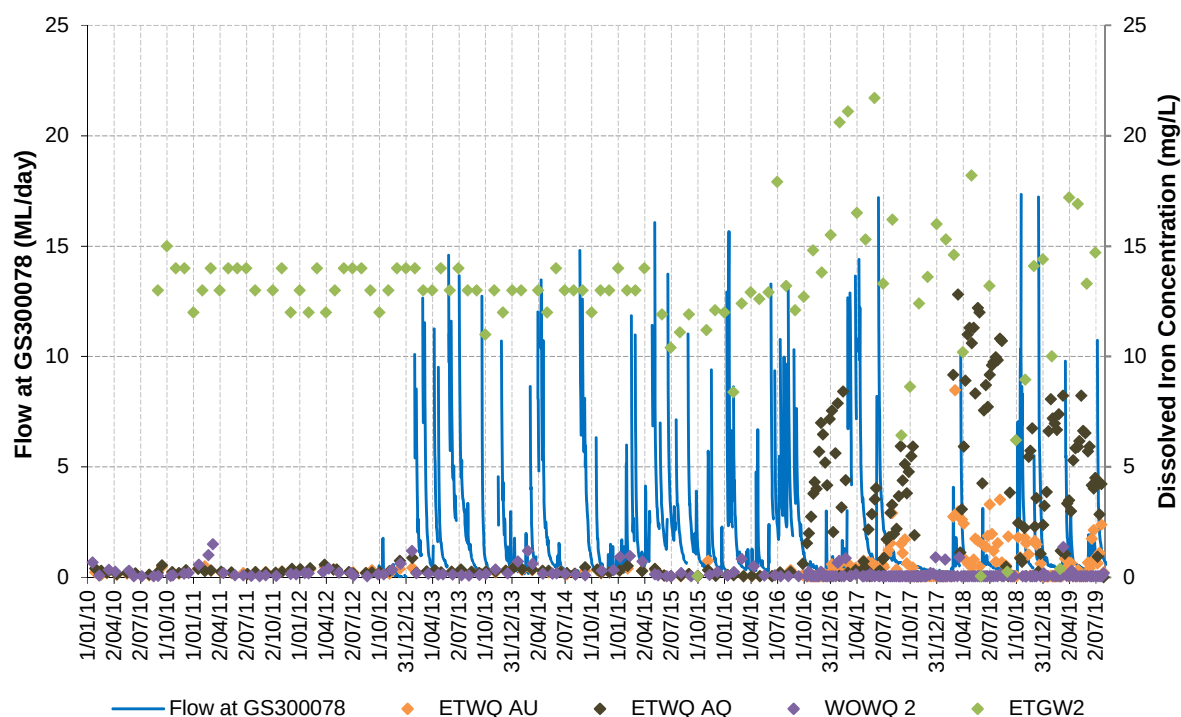


Chart 4 Dissolved Iron Concentrations at Surface Water Quality Sites ETWQ AU, ETWQ AQ and WOWQ 2 and Groundwater Quality Site ETGW2 and Stream Flow (to 31 July 2019)

Plots of dissolved iron at site ETWQ AU compared to rainfall at PV7 (Chart 3) and streamflow at GS300078 (Chart 4) show that concentrations in July 2019 ranged between 0.22 mg/L and 2.39 mg/L.

2.3 Other Water Quality Parameters

Water quality parameters pertinent to the increase in manganese and iron (dissolved-filtered <0.45 µm fraction) concentration are pH, oxidation-reduction potential (ORP) and electrical conductivity (EC). 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 oxidizing and becomes reducing when ORP is below approximately 10 mV.

In July 2019 at site ETWQ AU:

- pH (lab measurement) was generally consistent (pH 6.3 to pH 7.32);
- EC concentrations (lab measurement) ranged between 177 µS/cm and 315 µS/cm; and
- ORP (field measurement) ranged between -3.8 mV and 53 mV.

3. WATER RESOURCES REACHING THE WORONORA RESERVOIR

In accordance with the LW304 WMP, site ETWQ AU on the Eastern Tributary and control site WOWQ 2 on the Woronora River are used to assess the LW304 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. 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.

Metropolitan Coal has taken a photographic record of the watercourse / waterbody at the time of sampling, estimated the width of the watercourse / water body 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 (HCPL, 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 July 2019 the Woronora Reservoir water level varied between 154.13 mAHD (on 4 July 2019) and 153.82 mAHD (on 25 July 2019) (water level declined slightly). The position of the reservoir water level can only be determined to the closest one metre contour, accordingly, the reservoir water level during July 2019 remained at approximately 2,390 m (corresponding to 154 mAHD) downstream of site ETSFL 0.

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 July 2019, the Woronora Reservoir water level was downstream of site WDFS1+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 January 2018 to July 2019 at sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400 and ETFSL 500 is provided in Attachment A. As described earlier, sampling at sites ETFSL 100, ETSFL 300 and ETFSL 400 was suspended once monitoring at sites CONFLU1, WARARM5, WDFS1 and WDFS1+100 commenced on 22 November 2018³. Water quality data for filtered and total manganese since sampling commenced on 22 November 2018 at sites CONFLU1, WARARM5, WDFS1 and WDFS1+100 is also provided in Attachment A.

As described above, the Woronora Reservoir water level dropped slightly in July 2019, and was downstream of site WDFS1+100. The results for dissolved and total manganese at sites ETAU, ETFSL 200, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100 since the commencement of monitoring to the end of July 2019, are shown on Charts 5 and 6, respectively. These sites provide a profile along the arm of the Woronora Reservoir.

The filtered manganese concentrations for July 2019 ranged from 0.144 mg/L to 0.415 mg/L at site ETAU, 0.130 mg/L to 0.289 mg/L at site ETFSL 200, 0.143 mg/L to 0.332 mg/L at site ETFSL 500, 0.082 mg/L to 0.168 mg/L at site CONFLU1, 0.018 mg/L to 0.029 mg/L at site WARARM5, 0.065 mg/L to 0.094 mg/L at site WDFS1 and 0.044 mg/L to 0.078 mg/L at site WDFS1+100 (Chart 5).

Total manganese concentrations for July 2019 followed similar trends, ranging from 0.154 mg/L to 0.405 mg/L at site ETAU, 0.142 mg/L to 0.272 mg/L at site ETFSL 200, 0.153 mg/L to 0.372 mg/L at site ETFSL 500, 0.091 mg/L to 0.153 mg/L at site CONFLU1, 0.017 mg/L to 0.019 mg/L at site WARARM5, 0.066 mg/L to 0.097 mg/L at site WDFS1 and 0.044 mg/L to 0.081 mg/L at site WDFS1+100 (Chart 6).

³ Sampling at site ETAU was also temporarily suspended during this period but was resumed on 12 December 2018. Data from sampling undertaken at site ETWQ AU has been substituted for site ETAU during this period. Sampling at site ETAU was undertaken on 12 and 27 December 2018.

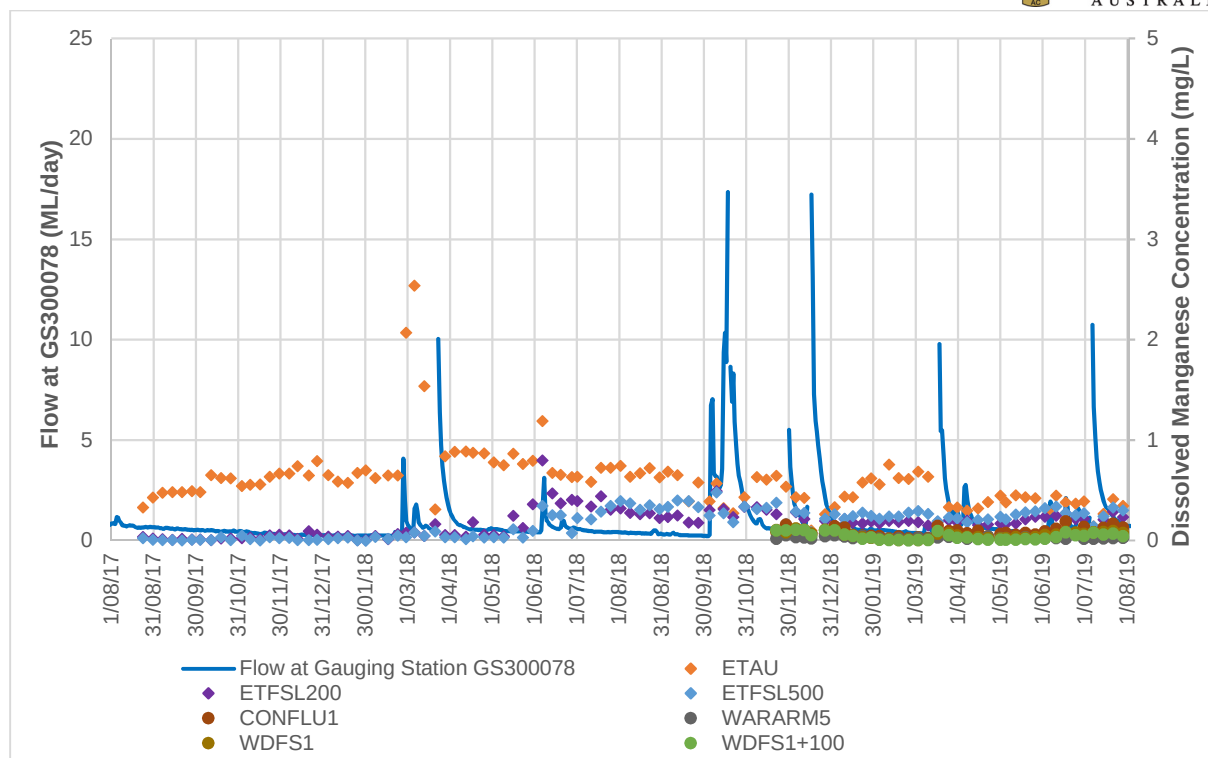


Chart 5 Dissolved Manganese Concentrations at Surface Water Quality Sites ETAU⁴, ETFSL 200, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100 and Stream Flow (August 2017 to 31 July 2019)

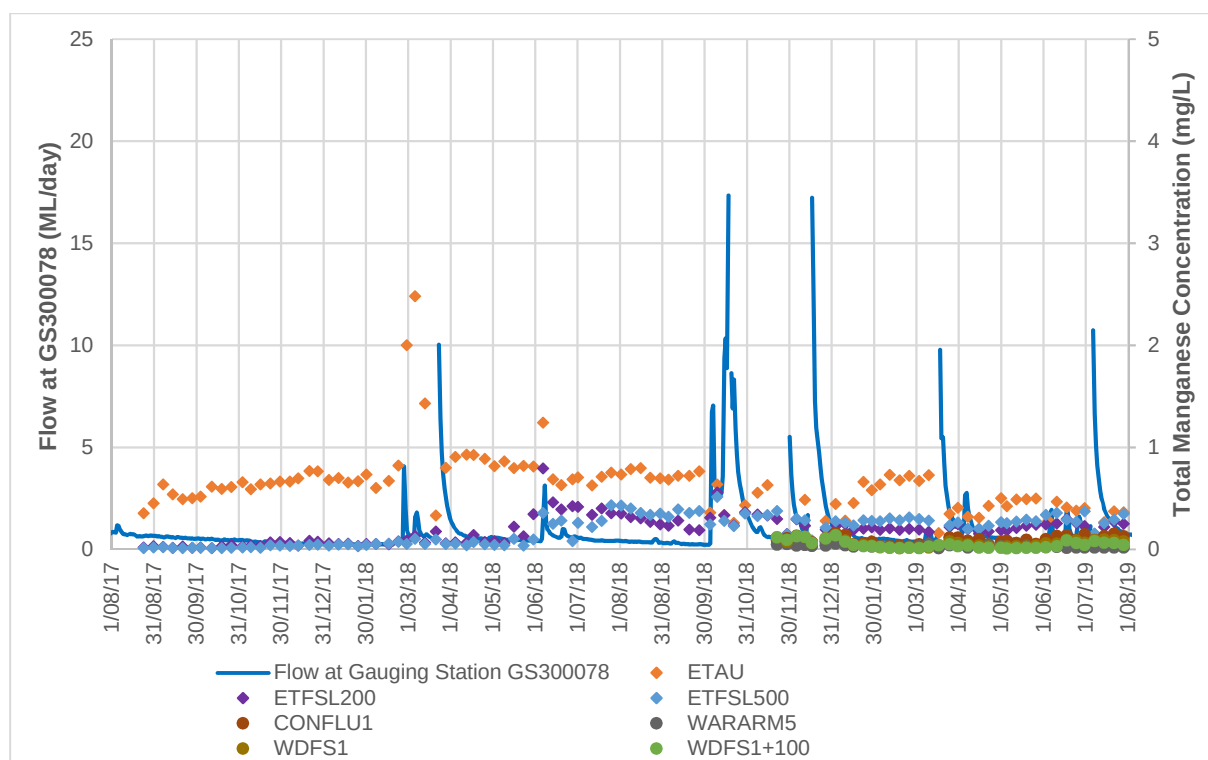


Chart 6 Total Manganese Concentrations at Surface Water Quality Sites ETAU⁵, ETFSL 200, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100 and Stream Flow (August 2017 to 31 July 2019)

⁴ Data from sampling undertaken at site ETWQ AU has been substituted for site ETAU from 22 November to 6 December 2018 and 17 December 2018. Sampling at site ETAU was undertaken on 12 and 27 December 2018.

⁵ Total manganese is not sampled at site ETWQ AU, and therefore results were unable to be substituted for site ETAU from 22 November to 6 December 2018 and 17 December 2018. Sampling at site ETAU was undertaken on 12 and 27 December 2018.

The Australian Drinking Water Guidelines (ADWG, 2011) are published by the National Health and Medical Research Council and updated most recently in 2018; 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 Australian Drinking Water Guideline before being supplied to the Helensburgh area as well as parts of the Sutherland Shire and northern Wollongong (WaterNSW, 2017).

The ADWG (2011) guidelines are based on total concentrations of manganese in water. The ADWG value is 0.5 mg/L total manganese for health. 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 5 and 6).

4.2 Dissolved Iron

The results for filtered and total iron at sites ETAU, ETFSL 200, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100 for August 2017 to July 2019, are shown on Charts 7 and 8, respectively.

The filtered iron concentrations in July 2019 ranged from 0.22 mg/L to 2.39 mg/L at site ETAU, <0.05 mg/L to 0.52 mg/L at site ETFSL 200, 0.56 mg/L to 1.37 mg/L at site ETFSL 500, 0.06 mg/L to 0.33 mg/L at site CONFLU1, <0.05 mg/L to 0.1 mg/L at site WARARM5, 0.05 mg/L to 0.36 mg/L at site WDFS1 and <0.05 mg/L to 0.26 mg/L at site WDFS1+100 (Chart 7).

Total iron concentrations in July 2019 ranged from 1.33 mg/L to 3.55 mg/L at site ETAU, 0.99 mg/L to 1.47 mg/L at site ETFSL 200, 1.08 mg/L to 2.78 mg/L at site ETFSL 500, 0.84 mg/L to 1.28 mg/L at site CONFLU1, 0.37 mg/L to 0.58 mg/L at site WARARM5, 0.80 mg/L to 0.95 mg/L at site WDFS1 and 0.55 mg/L to 0.79 mg/L at site WDFS1+100 (Chart 8).

The ADWG (2011) guidelines for iron in water are based on total concentrations. The ADWG value for iron is 0.3 mg/L for aesthetic considerations (precipitation of iron from solution and taste). No health-based guideline value has been set for iron. As the iron oxyhydroxide precipitates and converts to goethite it will likely become part of the reservoir sediment material with little likelihood of affecting the Woronora Reservoir water supply.

4.3 Other Water Quality Parameters

Water quality data for parameters pertinent to dissolved manganese for January 2018 to July 2019 at sites ETAU, ETFSL 200, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100 is provided in Attachment A. The water quality parameters (pH, ORP and EC) showed no unusual features. The ADWG value for pH (aesthetic) is pH 6.5 – 8.5. Samples at sites ETFSL 500, CONFLU1, WARARM5 and WDFS1 in July 2019 were within this range, while the pH values at sites ETAU, ETFSL 200 and WDFS1+100 dropped slightly below pH 6.5 at the end of July 2019 (Attachment A). The pH of creek water flow following limited rain events may fluctuate slightly because dry iron oxyhydroxide in contact with water undergoes hydrolysis. However, the creek water pH is within the measured range and tends to increase with time.

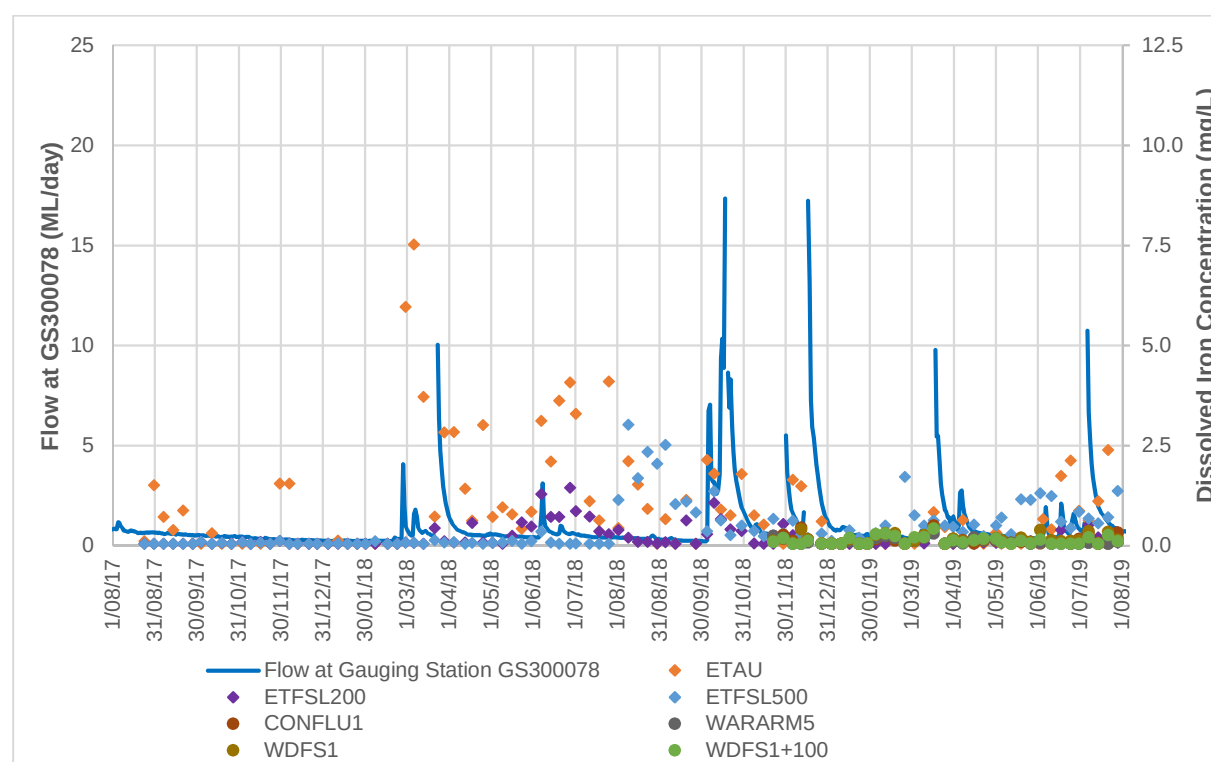


Chart 7 Dissolved Iron Concentrations at Surface Water Quality Sites ETAU, ETFSL 200, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100 and Stream Flow (August 2017 to 31 July 2019)

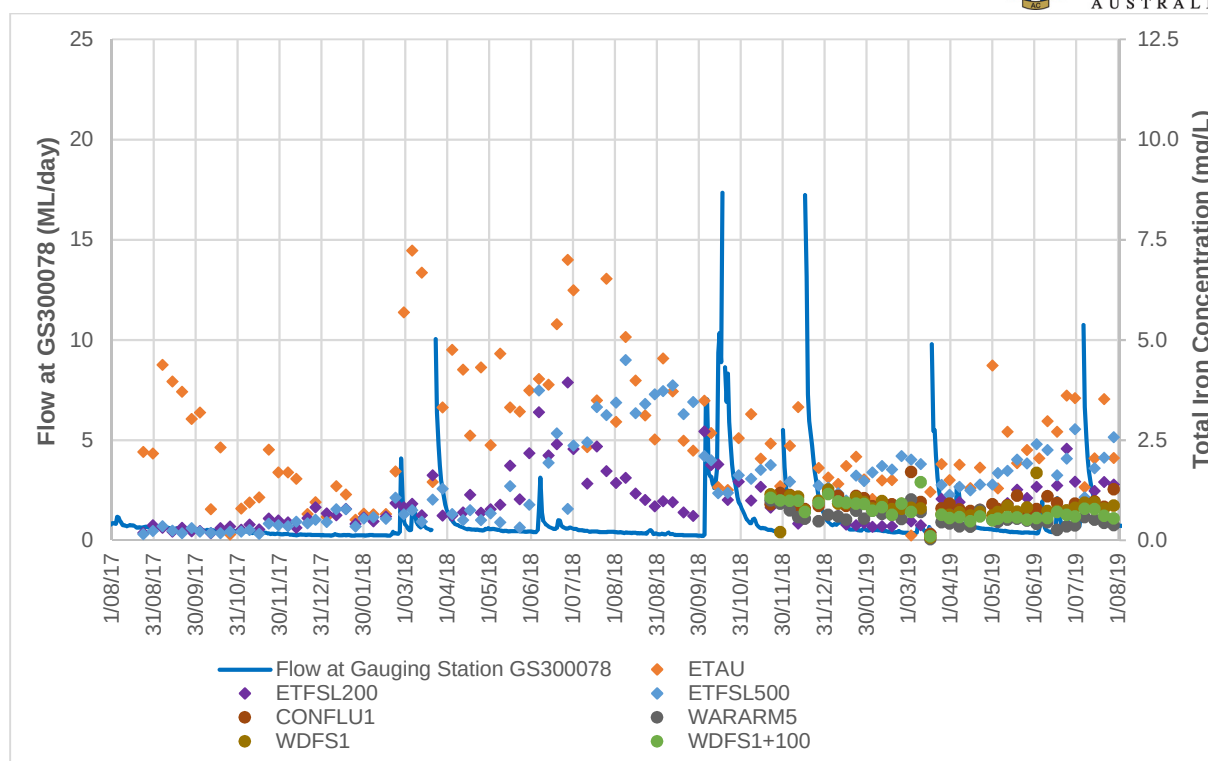


Chart 8 Total Iron Concentrations at Surface Water Quality Sites ETAU, ETFSL 200, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100 and Stream Flow (August 2017 to 31 July 2019)

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 and dissolved iron at site ETWQ AU on the Eastern Tributary in July 2019, which has triggered 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.

The soluble iron rapidly oxidises to iron (III) Fe^{3+} , and forms insoluble iron oxyhydroxide in colloidal ($<0.45 \mu\text{m}$) and particulate ($>0.45 \mu\text{m}$) forms, giving dissolved iron concentrations down to $<0.05 \text{ mg/L}$ in Woronora Reservoir. While the heavy rainfall increased flow in the Eastern Tributary sufficiently to dilute dissolved manganese at ETWQ AU to below 0.5 mg/L and demonstrated that the high dissolved manganese can be diluted by creek flow, the situation with dissolved and particulate iron is different. The climatically-dry period resulted in high dissolved iron concentrations from groundwater seepage being evaporated and becoming an orange-yellow coating on the bed rock surface. High rainfall can wash away loosely bound insoluble iron floc material and disperse the very fine colloidal material as a floc suspension which may be visible downstream.

Comparison of the photographic records for July 2019, show mild turbidity below ETAU which varied between the creek flow events associated with rainfall. The presence of orange-yellow coating on the creek sediment surface is observed which will darken with time as conversion to goethite occurs.

Water reaching the Woronora Reservoir occurs where the inflowing stream water meets the reservoir waterbody. In July 2019, the Woronora Reservoir water level was downstream of site WDFS1+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 and iron concentrations reaching the Woronora Reservoir have 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.

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

ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, WARARM5, CONFLU1, WDFS1 and
WDFS1+100

JANUARY 2018 TO JULY 2019

ATTACHMENT A

Water Quality Data for Sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100

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)
4/01/2018	ETAU	0.652	0.678	<0.05	0.59	132	7.37	351
4/01/2018	ETFSL100	0.281	0.305	<0.05	0.82	125.3	7.75	337
4/01/2018	ETFSL200	0.042	0.057	<0.05	0.68	132.7	7.05	118
4/01/2018	ETFSL300	0.038	0.052	0.06	0.6	13.2	6.92	111
4/01/2018	ETFSL400	0.024	0.037	<0.05	0.47	129.9	6.96	110
4/01/2018	ETFSL500	0.016	0.036	<0.05	0.46	121.7	6.74	111
11/01/2018	ETAU	0.588	0.698	0.13	1.36	55.9	7.56	364
11/01/2018	ETFSL100	0.197	0.237	<0.05	0.55	24.3	7.88	345
11/01/2018	ETFSL200	0.041	0.053	<0.05	0.63	101	7.14	139
11/01/2018	ETFSL300	0.067	0.078	1.89	2.1	35.2	6.88	128
11/01/2018	ETFSL400	0.106	0.052	0.47	0.66	52	6.84	124
11/01/2018	ETFSL500	0.026	0.046	0.06	0.78	94.4	7.01	122
18/01/2018	ETAU	0.577	0.653	<0.05	1.15	136.4	7.67	366
18/01/2018	ETFSL100	0.211	0.22	<0.05	0.64	131.9	7.74	353
18/01/2018	ETFSL200	0.046	0.055	<0.05	0.79	131.2	7	129
18/01/2018	ETFSL300	0.058	0.057	0.06	0.84	125.5	6.94	126
18/01/2018	ETFSL400	0.038	0.048	<0.05	0.71	139.6	6.96	125
18/01/2018	ETFSL500	0.032	0.049	<0.05	0.78	121.4	6.94	123
25/01/2018	ETAU	0.674	0.668	<0.05	0.52	56.8	7.55	378
25/01/2018	ETFSL100	0.074	0.152	<0.05	0.46	-4.4	7.82	360
25/01/2018	ETFSL200	0.007	0.034	<0.05	0.41	70.6	7.16	120
25/01/2018	ETFSL300	0.005	0.035	<0.05	0.46	22.8	7.09	117
25/01/2018	ETFSL400	0.001	0.032	<0.05	0.41	55	7	118
25/01/2018	ETFSL500	0.002	0.03	<0.05	0.35	288.6	7.04	115
31/01/2018	ETAU	0.7	0.734	<0.05	0.67	82.3	7.46	374
31/01/2018	ETFSL100	0.089	0.147	<0.05	0.36	30.7	8.01	361
31/01/2018	ETFSL200	0.005	0.052	<0.05	0.57	79.1	7.28	139
31/01/2018	ETFSL300	0.002	0.049	<0.05	0.66	42.7	7.08	123
31/01/2018	ETFSL400	0.001	0.046	<0.05	0.54	92	7.05	122
31/01/2018	ETFSL500	0.001	0.044	<0.05	0.55	71	7.01	122
7/02/2018	ETAU	0.625	0.601	<0.05	0.65	106.9	7.39	374
7/02/2018	ETFSL100	0.102	0.129	<0.05	0.75	14.8	7.78	359
7/02/2018	ETFSL200	0.047	0.051	<0.05	0.48	80.4	7.04	119
7/02/2018	ETFSL300	0.049	0.059	<0.05	0.65	38.2	6.97	119
7/02/2018	ETFSL400	0.112	0.07	0.27	0.74	1	6.77	118
7/02/2018	ETFSL500	0.038	0.053	0.11	0.58	86.6	6.92	117
16/02/2018	ETAU	0.65	0.67	<0.05	0.66	158.8	7.54	380
16/02/2018	ETFSL100	0.075	0.126	<0.05	0.33	163.9	7.96	369
16/02/2018	ETFSL200	0.016	0.048	<0.05	0.6	152	7.05	128
16/02/2018	ETFSL300	0.023	0.058	<0.05	0.81	121.1	6.88	124
16/02/2018	ETFSL400	0.012	0.049	<0.05	0.54	143.2	6.83	121
16/02/2018	ETFSL500	0.019	0.054	<0.05	0.54	144.1	6.82	120
23/02/2018	ETAU	0.651	0.822	<0.05	1.72	163.6	7.21	400
23/02/2018	ETFSL100	0.12	0.2	<0.05	0.5	31.8	7.75	384
23/02/2018	ETFSL200	0.068	0.078	<0.05	0.93	55.8	6.92	140
23/02/2018	ETFSL300	0.065	0.07	0.07	0.88	55.2	6.8	136
23/02/2018	ETFSL400	0.062	0.075	<0.05	0.93	41.8	6.78	135
23/02/2018	ETFSL500	0.049	0.075	<0.05	1.07	-119.2	6.78	132

ATTACHMENT A (Continued)
Water Quality Data for Sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100

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)
1/03/2018	ETAU	2.07	2	5.96	5.69	83.1	6.32	492
1/03/2018	ETFSL100	1.78	1.72	2.41	2.7	36.7	6.31	464
1/03/2018	ETFSL200	0.08	0.087	0.08	0.83	59	6.45	133
1/03/2018	ETFSL300	0.059	0.069	0.16	0.79	43.5	6.36	127
1/03/2018	ETFSL400	0.05	0.064	0.1	1.03	32	6.35	125
1/03/2018	ETFSL500	0.036	0.051	0.08	0.65	2.3	6.38	123
7/03/2018	ETAU	2.54	2.48	7.52	7.23	168.1	6.12	514
7/03/2018	ETFSL100	2.21	2.15	4.12	4.43	158.6	6.11	479
7/03/2018	ETFSL200	0.082	0.132	0.07	0.92	166.8	6.29	147
7/03/2018	ETFSL300	0.108	0.12	<0.05	0.91	149	6.32	147
7/03/2018	ETFSL400	0.088	0.11	<0.05	0.78	161.1	6.79	142
7/03/2018	ETFSL500	0.083	0.102	0.07	0.76	154.5	6.32	138
14/03/2018	ETAU	1.54	1.43	3.72	6.68	41.4	6.58	450
14/03/2018	ETFSL100	0.907	1.08	0.55	3.58	31.6	6.95	431
14/03/2018	ETFSL200	0.047	0.066	<0.05	0.63	76	6.84	135
14/03/2018	ETFSL300	0.048	0.054	<0.05	0.56	41.4	6.83	133
14/03/2018	ETFSL400	0.064	0.055	0.06	0.61	3.3	6.86	132
14/03/2018	ETFSL500	0.047	0.052	<0.05	0.47	21.9	6.79	131
22/03/2018	ETAU	0.312	0.33	0.73	1.46	229.3	5.24	237
22/03/2018	ETFSL100	0.362	0.363	0.71	1.69	182.9	5.08	240
22/03/2018	ETFSL200	0.166	0.173	0.44	1.63	71.9	6.51	160
22/03/2018	ETFSL300	0.118	0.118	0.28	1.33	70.6	6.54	153
22/03/2018	ETFSL400	0.146	0.136	0.8	1.66	22.8	6.61	152
22/03/2018	ETFSL500	0.091	0.095	0.14	1.02	32.6	6.65	144
29/03/2018	ETAU	0.841	0.798	2.83	3.32	148	6.66	341
29/03/2018	ETFSL100	0.732	0.729	1.87	2.6	40.9	6.63	332
29/03/2018	ETFSL200	0.058	0.059	0.11	0.62	84.2	6.65	131
29/03/2018	ETFSL300	0.047	0.053	0.08	0.59	65.9	6.64	131
29/03/2018	ETFSL400	0.051	0.055	0.08	0.74	71.4	6.64	130
29/03/2018	ETFSL500	0.033	0.051	0.08	1.29	27.3	6.68	128
5/4/2018	ETAU	0.885	0.904	2.84	4.76	182.7	6.57	384
5/4/2018	ETFSL100	0.674	0.672	0.73	2.41	191.7	6.67	374
5/4/2018	ETFSL200	0.058	0.067	0.08	0.62	211.9	6.32	142
5/4/2018	ETFSL300	0.044	0.058	0.07	0.57	209.4	6.37	142
5/4/2018	ETFSL400	0.04	0.058	0.13	0.77	209.1	6.39	141
5/4/2018	ETFSL500	0.035	0.054	0.09	0.66	205.9	6.4	141
13/4/2018	ETAU	0.888	0.927	1.42	4.26	156.2	6.76	391
13/4/2018	ETFSL100	0.614	0.651	0.13	2.46	172.9	6.92	382
13/4/2018	ETFSL200	0.042	0.065	0.08	0.7	42.8	6.84	153
13/4/2018	ETFSL300	0.033	0.051	0.05	0.5	40.9	6.52	145
13/4/2018	ETFSL400	0.023	0.048	<0.05	0.59	64.1	6.6	147
13/4/2018	ETFSL500	0.014	0.04	<0.05	0.51	58.6	6.61	142
18/4/2018	ETAU	0.875	0.925	0.62	2.62	192.1	6.77	397
18/4/2018	ETFSL100	0.614	0.636	0.13	2.27	192.3	7.19	390
18/4/2018	ETFSL200	0.184	0.14	0.57	1.14	184.8	6.75	178
18/4/2018	ETFSL300	0.059	0.074	0.08	0.86	186.3	6.81	162
18/4/2018	ETFSL400	0.05	0.069	<0.05	0.64	181.3	6.76	159
18/4/2018	ETFSL500	0.044	0.071	0.07	0.76	185.5	6.76	160

ATTACHMENT A (Continued)

Water Quality Data for Sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100

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)
26/4/2018	ETAU	0.871	0.887	3.01	4.32	7.2	7.02	1040
26/4/2018	ETFSL100	0.587	0.631	0.1	2.06	9.6	7.42	409
26/4/2018	ETFSL200	0.059	0.071	0.08	0.69	45.1	7.01	159
26/4/2018	ETFSL300	0.043	0.055	<0.05	0.54	2.5	6.96	159
26/4/2018	ETFSL400	0.04	0.055	<0.05	0.54	36	6.97	155
26/4/2018	ETFSL500	0.03	0.05	0.05	0.51	94.3	6.96	152
3/5/2018	ETAU	0.781	0.813	2.38	2.38	76.9	6.9	362
3/5/2018	ETFSL100	0.58	0.611	0.18	3.02	20	7.47	358
3/5/2018	ETFSL200	0.056	0.081	0.07	0.78	43.5	7.01	142
3/5/2018	ETFSL300	0.053	0.059	0.13	0.55	5.3	7.02	136
3/5/2018	ETFSL400	0.044	0.052	0.06	0.45	55.3	7	132
3/5/2018	ETFSL500	0.034	0.044	0.07	0.68	60.7	7.01	128
10/5/2018	ETAU	0.752	0.86	4.66	4.66	176.7	6.75	388
10/5/2018	ETFSL100	0.553	0.628	0.06	4.58	191.5	7.19	384
10/5/2018	ETFSL200	0.044	0.061	<0.05	0.89	187.4	6.64	129
10/5/2018	ETFSL300	0.042	0.051	0.08	0.56	180.2	6.67	131
10/5/2018	ETFSL400	0.051	0.056	0.1	0.5	170.7	6.71	133
10/5/2018	ETFSL500	0.032	0.04	0.08	0.45	164	6.68	124
17/5/2018	ETAU	0.868	0.795	3.32	3.32	160	6.78	383
17/5/2018	ETFSL100	0.634	0.605	<0.05	2.66	178.5	7.12	375
17/5/2018	ETFSL200	0.249	0.22	0.25	1.87	178.5	6.85	246
17/5/2018	ETFSL300	0.176	0.178	0.12	1.57	175.8	6.84	230
17/5/2018	ETFSL400	0.146	0.14	0.1	1.32	179.3	6.78	202
17/5/2018	ETFSL500	0.113	0.102	0.12	1.36	179.6	6.65	176
24/5/2018	ETAU	0.763	0.795	3.22	3.22	192.8	7.22	381
24/5/2018	ETFSL100	0.563	0.63	<0.05	4.36	194.2	7.12	375
24/5/2018	ETFSL200	0.128	0.128	0.58	1.03	189.4	6.95	158
24/5/2018	ETFSL300	0.04	0.053	0.05	0.62	102.2	6.78	125
24/5/2018	ETFSL400	0.037	0.043	0.07	0.39	184.9	6.72	145
24/5/2018	ETFSL500	0.031	0.037	<0.05	0.33	185.2	6.76	120
31/5/2018	ETAU	0.797	0.812	3.74	3.74	193.3	7.22	378
31/5/2018	ETFSL100	0.626	0.598	<0.05	2.57	197.5	7.12	375
31/5/2018	ETFSL200	0.362	0.344	0.48	2.18	187.7	7.18	260
31/5/2018	ETFSL300	0.177	0.171	0.24	1.44	185.8	7.18	188
31/5/2018	ETFSL400	0.178	0.162	0.67	1.86	179.9	7.19	184
31/5/2018	ETFSL500	0.098	0.096	0.11	0.89	176	7.12	154
7/6/2018	ETAU	1.19	1.24	3.12	4.03	188.4	6.8	361
7/6/2018	ETFSL100	0.889	0.942	1.43	2.91	185.7	7.19	342
7/6/2018	ETFSL200	0.8	0.792	1.29	3.2	189.2	7.17	327
7/6/2018	ETFSL300	0.625	0.67	0.9	3.42	178.7	7.16	304
7/6/2018	ETFSL400	0.402	0.442	0.06	4.24	182.9	7.25	271
7/6/2018	ETFSL500	0.347	0.358	0.35	3.74	183.4	7.27	268
14/6/2018	ETAU	0.674	0.686	2.1	3.89	99.8	6.94	314
14/6/2018	ETFSL100	0.34	0.539	0.26	2.33	73.3	7.27	309
14/6/2018	ETFSL200	0.47	0.459	0.72	2.12	178.9	7.09	300
14/6/2018	ETFSL300	0.377	0.37	0.26	2.25	167.8	7.12	264
14/6/2018	ETFSL400	0.292	0.288	0.08	2.17	192.4	7.15	228
14/6/2018	ETFSL500	0.255	0.251	0.08	1.94	203.5	7.04	201

ATTACHMENT A (Continued)
Water Quality Data for Sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100

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)
20/6/2018	ETAU	0.657	0.628	3.62	5.4	188.3	6.72	337
20/6/2018	ETFSL100	0.457	0.468	0.9	3.16	19	6.9	324
20/6/2018	ETFSL200	0.371	0.39	0.72	2.4	191.4	6.95	320
20/6/2018	ETFSL300	0.384	0.377	0.34	2.42	190.5	6.98	322
20/6/2018	ETFSL400	0.331	0.333	<0.05	2.84	191.2	7	312
20/6/2018	ETFSL500	0.256	0.28	<0.05	2.67	184.8	7.01	273
28/6/2018	ETAU	0.634	0.687	4.08	7	185.8	6.6	328
28/6/2018	ETFSL100	0.501	0.559	1.04	3.95	188.8	7.02	329
28/6/2018	ETFSL200	0.409	0.422	1.45	3.94	187.2	6.82	306
28/6/2018	ETFSL300	0.176	0.207	<0.05	1.95	199.7	6.77	190
28/6/2018	ETFSL400	0.108	0.111	<0.05	1.04	198.5	6.67	128
28/6/2018	ETFSL500	0.075	0.079	0.05	0.79	179.7	6.61	118
2/7/2018	ETAU	0.637	0.706	3.29	6.24	39.9	7.05	352
2/7/2018	ETFSL100	0.519	0.558	0.97	4.38	191	7.31	351
2/7/2018	ETFSL200	0.395	0.416	0.86	2.28	191.4	7.34	344
2/7/2018	ETFSL300	0.391	0.426	1.19	3.57	193.9	7.25	342
2/7/2018	ETFSL400	0.327	0.349	0.15	3.82	195.4	7.22	311
2/7/2018	ETFSL500	0.226	0.258	0.06	2.37	194.2	7.15	252
12/7/2018	ETAU	0.587	0.626	1.11	2.33	456.6	7.31	370
12/7/2018	ETFSL100	0.501	0.492	0.63	1.6	163.5	7.59	367
12/7/2018	ETFSL200	0.342	0.338	0.73	1.42	160.3	7.5	355
12/7/2018	ETFSL300	0.324	0.373	1.16	2.87	154.8	7.49	361
12/7/2018	ETFSL400	0.338	0.353	0.44	3.85	1596	7.55	356
12/7/2018	ETFSL500	0.212	0.218	<0.05	2.45	158.3	7.37	259
19/7/2018	ETAU	0.726	0.712	0.63	3.5	177	7	377
19/7/2018	ETFSL100	0.576	0.565	0.11	3.01	202.8	7.37	371
19/7/2018	ETFSL200	0.444	0.4	0.36	2.35	200.6	7.24	360
19/7/2018	ETFSL300	0.462	0.402	1.11	3.68	202	7.21	372
19/7/2018	ETFSL400	0.431	0.374	0.57	3.48	203.3	7.33	384
19/7/2018	ETFSL500	0.288	0.279	<0.05	3.33	203.6	7.21	330
26/7/2018	ETAU	0.725	0.753	4.1	6.53	-5.9	6.59	364
26/7/2018	ETFSL100	0.522	0.566	0.19	2.89	10.8	6.78	356
26/7/2018	ETFSL200	0.31	0.353	0.29	1.73	9.8	6.79	351
26/7/2018	ETFSL300	0.35	0.35	1.59	2.55	-0.3	6.71	353
26/7/2018	ETFSL400	0.375	0.397	1.92	3.56	-12.3	6.75	370
26/7/2018	ETFSL500	0.346	0.431	<0.05	3.13	107.8	6.88	378
02/8/2018	ETAU	0.744	0.733	0.44	2.96	54.8	6.53	366
02/8/2018	ETFSL100	0.526	0.544	0.09	2.48	325	6.57	359
02/8/2018	ETFSL200	0.321	0.350	0.39	1.44	265.1	6.51	352
02/8/2018	ETFSL300	0.337	0.348	1.79	2.59	263.4	6.39	355
02/8/2018	ETFSL400	0.398	0.420	3.38	4.5	251.8	6.59	397
02/8/2018	ETFSL500	0.395	0.429	1.14	3.44	236.4	6.8	386
09/8/2018	ETAU	0.637	0.785	2.11	5.08	257.2	6.73	367
09/8/2018	ETFSL100	0.538	0.644	0.18	5.24	256.6	6.92	363
09/8/2018	ETFSL200	0.276	0.316	0.20	1.56	248.6	6.86	355
09/8/2018	ETFSL300	0.285	0.306	1.68	2.50	233.3	6.75	355
09/8/2018	ETFSL400	0.375	0.416	5.43	6.97	254.2	6.99	436
09/8/2018	ETFSL500	0.373	0.401	3.02	4.50	253.7	6.9	390

ATTACHMENT A (Continued)

Water Quality Data for Sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100

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)
16/8/2018	ETAU	0.672	0.797	1.53	3.99	250.1	6.71	365
16/8/2018	ETFSL100	0.491	0.584	0.08	2.32	264.8	7.16	362
16/8/2018	ETFSL200	0.263	0.304	0.1	1.17	265.4	7.13	353
16/8/2018	ETFSL300	0.249	0.298	1.02	1.98	267.4	6.96	349
16/8/2018	ETFSL400	0.336	0.351	3.57	4.23	260.7	7.12	405
16/8/2018	ETFSL500	0.309	0.358	1.69	3.18	261.3	6.98	386
23/8/2018	ETAU	0.724	0.701	0.92	3.12	266.4	7.03	358
23/8/2018	ETFSL100	0.489	0.505	0.07	2.26	271.7	6.97	351
23/8/2018	ETFSL200	0.274	0.270	0.1	1.01	267.1	7.11	344
23/8/2018	ETFSL300	0.227	0.273	0.83	1.83	265.6	7.04	341
23/8/2018	ETFSL400	0.267	0.279	2.11	2.50	261.8	7.05	365
23/8/2018	ETFSL500	0.352	0.337	2.34	3.41	258.1	7.23	382
30/8/2018	ETAU	0.632	0.696	<0.05	2.52	99.5	7.97	368
30/8/2018	ETFSL100	0.440	0.491	<0.05	2.09	77	7.73	354
30/8/2018	ETFSL200	0.225	0.243	0.06	0.85	23.2	7.85	350
30/8/2018	ETFSL300	0.236	0.248	0.96	1.70	256.2	7.78	345
30/8/2018	ETFSL400	0.327	0.343	3.30	4.50	252.5	8.20	399
30/8/2018	ETFSL500	0.316	0.350	2.05	3.65	228.1	8.18	387
05/9/2018	ETAU	0.688	0.683	0.66	4.54	25.2	7.44	363
05/9/2018	ETFSL100	0.476	0.483	<0.05	2.06	53.5	7.77	350
05/9/2018	ETFSL200	0.234	0.23	0.09	0.98	12.5	7.71	340
05/9/2018	ETFSL300	0.259	0.238	1.08	1.71	-12.5	7.57	333
05/9/2018	ETFSL400	0.367	0.371	4.53	5.96	-42.4	7.65	404
05/9/2018	ETFSL500	0.336	0.318	2.52	3.73	1.5	7.69	372
12/9/2018	ETAU	0.653	0.719	<0.05	3.72	178.2	7.05	360
12/9/2018	ETFSL100	0.461	0.521	<0.05	2.72	71.7	7.54	356
12/9/2018	ETFSL200	0.25	0.28	<0.05	0.96	20.1	7.49	346
12/9/2018	ETFSL300	0.3	0.301	0.41	1.73	3.1	7.38	345
12/9/2018	ETFSL400	0.389	0.34	2.15	2.77	-62.7	7.39	359
12/9/2018	ETFSL500	0.401	0.39	1.04	3.87	-17.4	7.43	381
20/9/2018	ETAU	0.392	0.721	1.14	2.49	272.4	7.11	362
20/9/2018	ETFSL100	0.179	0.467	<0.05	1.88	272.4	7.18	350
20/9/2018	ETFSL200	0.182	0.194	0.63	0.7	25.2	7.17	341
20/9/2018	ETFSL300	0.227	0.233	0.63	1.5	-11.9	7.08	337
20/9/2018	ETFSL400	0.386	0.356	2.66	5.39	-34.2	7.21	397
20/9/2018	ETFSL500	0.394	0.358	1.1	3.15	25.4	7.25	371
27/9/2018	ETAU	0.58	0.763	<0.05	2.24	234	7.33	400
27/9/2018	ETFSL100	0.434	0.493	<0.05	1.54	268.1	7.64	392
27/9/2018	ETFSL200	0.178	0.188	<0.05	0.61	272.8	7.55	381
27/9/2018	ETFSL300	0.231	0.239	0.4	1.6	270.8	7.33	377
27/9/2018	ETFSL400	0.331	0.325	1.49	3.55	263.1	7.41	400
27/9/2018	ETFSL500	0.335	0.375	0.83	3.46	266.8	7.67	416
05/10/2018	ETAU	0.39	0.359	2.14	3.49	274.6	7.28	250
05/10/2018	ETFSL100	0.297	0.686	0.32	12	271	7.57	286
05/10/2018	ETFSL200	0.305	0.308	0.29	2.72	269.7	7.67	295
05/10/2018	ETFSL300	0.272	0.305	0.32	2.72	267.7	7.66	291
05/10/2018	ETFSL400	0.364	0.299	0.63	2.95	259.8	7.73	294
05/10/2018	ETFSL500	0.251	0.245	0.36	2.11	242.9	7.58	271

ATTACHMENT A (Continued)

Water Quality Data for Sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100

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)
10/10/2018	ETAU	0.569	0.635	1.8	2.68	266.6	6.59	308
10/10/2018	ETFSL100	0.571	0.602	1.62	2.25	267.5	6.66	304
10/10/2018	ETFSL200	0.494	0.558	1.07	1.88	269.6	6.78	302
10/10/2018	ETFSL300	0.492	0.49	1.05	1.42	269.6	6.81	303
10/10/2018	ETFSL400	0.479	0.503	2.3	3.04	267.3	7.07	334
10/10/2018	ETFSL500	0.48	0.512	1.36	2	266.7	6.98	308
15/10/2018	ETAU	0.325	0.333	0.9	1.33	285.6	6.35	269
15/10/2018	ETFSL100	0.298	0.302	0.69	1.2	278.5	6.36	259
15/10/2018	ETFSL200	0.316	0.336	0.66	1.9	276.9	6.37	262
15/10/2018	ETFSL300	0.286	0.298	0.57	1.41	279.5	6.39	259
15/10/2018	ETFSL400	0.276	0.3	0.6	1.38	279.9	6.56	266
15/10/2018	ETFSL500	0.273	0.279	0.63	1.18	263	7.71	267
22/10/2018	ETAU	0.274	0.259	0.76	1.26	276.9	6.52	281
22/10/2018	ETFSL100	0.25	0.244	0.56	1.13	270.7	6.57	278
22/10/2018	ETFSL200	0.235	0.233	0.41	1.01	270.4	6.53	275
22/10/2018	ETFSL300	0.236	0.228	0.42	1	269	6.58	275
22/10/2018	ETFSL400	0.304	0.263	1.8	2.51	264.8	7.01	321
22/10/2018	ETFSL500	0.184	0.229	0.26	1.19	258.5	6.74	279
30/10/2018	ETAU	0.432	0.431	1.79	2.55	15.1	6.65	290
30/10/2018	ETFSL100	0.376	0.39	0.76	1.78	-0.4	6.91	286
30/10/2018	ETFSL200	0.336	0.363	0.37	1.47	3.8	6.92	285
30/10/2018	ETFSL300	0.341	0.35	0.39	1.32	7.6	6.99	291
30/10/2018	ETFSL400	0.36	0.364	1.58	3.1	-77.3	7.09	329
30/10/2018	ETFSL500	0.34	0.351	0.5	1.63	-4.2	7.05	296
08/11/2018	ETAU	0.635	0.553	0.76	3.15	23.3	7.07	307
08/11/2018	ETFSL100	0.429	0.433	0.14	1.59	12.9	7.35	307
08/11/2018	ETFSL200	0.333	0.34	0.06	1	20	7.31	303
08/11/2018	ETFSL300	0.333	0.329	0.06	1.1	5.4	7.32	304
08/11/2018	ETFSL400	0.431	0.403	5.31	5.49	247.1	7.47	385
08/11/2018	ETFSL500	0.315	0.325	0.37	1.54	248.4	7.30	310
15/11/2018	ETAU	0.609	0.628	0.53	2.04	264.1	7.09	334
15/11/2018	ETFSL100	0.399	0.414	<0.05	1.6	172.9	7.32	328
15/11/2018	ETFSL200	0.308	0.331	<0.05	1.34	272	7.31	325
15/11/2018	ETFSL300	0.321	0.298	0.08	1.15	271	7.28	324
15/11/2018	ETFSL400	0.396	0.383	1.44	4.72	262.5	7.35	373
15/11/2018	ETFSL500	0.328	0.336	0.24	1.76	267.3	7.38	345
19/11/2018	ETWQ AU	0.647	- ⁶	0.08	2.42	259.1	7.22	345
22/11/2018	ETFSL200	0.264	0.298	<0.05	0.82	30.9	7.29	355
22/11/2018	ETFSL500	0.38	0.376	0.67	1.88	-3.3	7.50	373
22/11/2018	CONFLU1	0.085	0.088	0.12	0.9	-1.1	7.51	307
22/11/2018	WARARM5	0.018	0.046	0.25	1	54.6	7.57	297
22/11/2018	WDFS1	0.105	0.114	0.12	1.15	40.1	7.53	307
22/11/2018	WDFS1+100	0.103	0.119	0.1	1.06	26	7.55	306

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

ATTACHMENT A (Continued)

Water Quality Data for Sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100

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)
26/11/2018	ETWQ AU	0.538	- ⁶	<0.05	1.36	83.8	7.11	354
29/11/2018	ETFSL200	0.139	0.15	0.54	1.2	36.1	7.07	195
29/11/2018	ETFSL500	0.167	0.147	0.3	1.19	30.1	6.94	195
29/11/2018	CONFLU1	0.158	0.108	0.27	1.18	29.5	7.19	200
29/11/2018	WARARM5	0.055	0.052	0.18	0.92	66.7	7.5	206
29/11/2018	WDFS1	0.082	0.074	0.18	0.21	36.7	7.8	206
29/11/2018	WDFS1+100	0.103	0.094	0.19	1	38.4	7.36	200
4/12/2018	ETWQ AU	0.433	- ⁶	1.65	2.36	30.6	7	266
6/12/2018	ETFSL200	0.283	0.295	0.26	1.04	242.7	6.97	260
6/12/2018	ETFSL500	0.29	0.3	0.62	1.47	249.5	7.23	270
6/12/2018	CONFLU1	0.112	0.114	0.12	1.13	243.8	7.24	243
6/12/2018	WARARM5	0.034	0.035	<0.05	0.75	250.1	7.29	238
6/12/2018	WDFS1	0.122	0.134	0.07	1.12	241.4	7.29	246
6/12/2018	WDFS1+100	0.109	0.126	<0.05	0.99	251.1	7.3	245
12/12/2018	ETAU	0.428	0.484	1.49	3.33	-	6.86	269
12/12/2018	ETFSL200	0.215	0.232	<0.05	0.42	255.3	7.4	245
12/12/2018	ETFSL500	0.276	0.284	0.27	0.89	251.9	7.41	262
12/12/2018	CONFLU1	0.081	0.091	0.45	0.8	17.9	7.39	219
12/12/2018	WARARM5	0.03	0.042	<0.05	0.58	236.4	7.53	214
12/12/2018	WDFS1	0.108	0.121	0.41	1.09	27.5	7.44	225
12/12/2018	WDFS1+100	0.105	0.12	<0.05	0.99	42.3	7.24	243
17/12/2018	ETWQ AU	0.102	- ⁶	0.18	0.75	280.3	6.50	152
17/12/2018	ETFSL200	0.076	0.084	0.17	0.7	274.8	6.76	152
17/12/2018	ETFSL500	0.087	0.086	0.19	0.76	274.8	6.56	150
17/12/2018	CONFLU1	0.068	0.068	0.16	0.78	270.9	6.64	152
17/12/2018	WARARM5	0.023	0.032	0.08	0.54	257.5	6.77	156
17/12/2018	WDFS1	0.069	0.062	0.15	0.75	273	6.67	153
17/12/2018	WDFS1+100	0.055	0.063	0.12	0.71	278.4	6.71	154
27/12/2018	ETAU	0.263	0.277	0.61	1.81	24.3	6.72	217
27/12/2018	ETFSL200	0.196	0.194	0.09	0.93	30.6	7.11	216
27/12/2018	ETFSL500	0.219	0.213	0.3	1.37	-6.9	7.13	224
27/12/2018	CONFLU1	0.071	0.075	<0.05	0.86	21.4	7.15	208
27/12/2018	WARARM5	0.045	0.036	<0.05	0.48	3.4	7.3	206
27/12/2018	WDFS1	0.108	0.11	0.06	0.99	24.9	7.12	210
27/12/2018	WDFS1+100	0.101	0.105	<0.05	0.93	37.4	7.13	210
3/01/2019	ETWQ AU	0.335	0.443	<0.05	1.57	110.1	7.35	300
3/01/2019	ETFSL200	0.159	0.226	<0.05	0.63	113.1	7.63	290
3/01/2019	ETFSL500	0.265	0.274	0.12	1.32	11.5	7.5	302
3/01/2019	CONFLU1	0.143	0.16	<0.05	1.21	4.8	7.29	270
3/01/2019	WARARM5	0.055	0.054	<0.05	0.64	56.4	7.46	256
3/01/2019	WDFS1	0.106	0.14	<0.05	1.27	72	7.45	265
3/01/2019	WDFS1+100	0.101	0.138	<0.05	1.16	56.2	7.42	263
10/01/2019	ETWQ AU	0.438	0.282	<0.05	1.41	244.1	6.92	268
10/01/2019	ETFSL200	0.216	0.246	<0.05	0.62	26.8	8.03	279
10/01/2019	ETFSL500	0.22	0.262	<0.05	1.18	-9.3	7.64	300
10/01/2019	CONFLU1	0.129	0.141	<0.05	1.11	-33.7	7.55	269
10/01/2019	WARARM5	0.042	0.041	<0.05	0.6	90.3	7.62	252
10/01/2019	WDFS1	0.061	0.087	<0.05	0.92	22.1	7.59	242
10/01/2019	WDFS1+100	0.061	0.074	<0.05	0.97	6.9	7.58	240

ATTACHMENT A (Continued)

Water Quality Data for Sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100

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)
16/01/2019	ETWQ AU	0.433	0.454	<0.05	1.86	171.1	6.75	282
16/01/2019	ETFSL200	0.18	0.189	<0.05	0.4	258.4	7.67	275
16/01/2019	ETFSL500	0.244	0.233	0.38	1	262.4	7.65	303
16/01/2019	CONFLU1	0.058	0.049	0.12	0.86	261.2	7.68	249
16/01/2019	WARARM5	0.025	0.028	0.11	0.52	268.1	7.82	242
16/01/2019	WDFS1	0.046	0.044	0.16	0.92	263.5	7.76	256
16/01/2019	WDFS1+100	0.047	0.044	0.19	0.94	259.2	7.79	260
23/01/2019	ETWQ AU	0.579	0.661	<0.05	2.09	184.3	6.78	292
23/01/2019	ETFSL200	0.171	0.204	<0.05	0.38	96.8	7.65	286
23/01/2019	ETFSL500	0.28	0.284	0.2	1.62	-11.1	7.65	316
23/01/2019	CONFLU1	0.052	0.056	<0.05	1.11	5.6	7.7	264
23/01/2019	WARARM5	0.043	0.036	<0.05	0.74	-38.4	7.7	253
23/01/2019	WDFS1	0.032	0.042	<0.05	1.08	19.6	7.77	266
23/01/2019	WDFS1+100	0.02	0.029	<0.05	0.92	-16.6	7.83	266
29/01/2019	ETAU	0.62	0.578	0.07	1.52	66.8	6.7	294
29/01/2019	ETFSL200	0.19	0.216	<0.05	0.44	36.2	7.23	282
29/01/2019	ETFSL500	0.249	0.279	<0.05	1.48	12.1	7.34	310
29/01/2019	CONFLU1	0.048	0.07	<0.05	1.05	-20.8	7.54	282
29/01/2019	WARARM5	0.031	0.028	<0.05	0.54	49.5	7.34	251
29/01/2019	WDFS1	0.027	0.038	<0.05	0.96	29.7	7.49	260
29/01/2019	WDFS1+100	0.03	0.03	<0.05	0.91	9.9	7.49	260
4/02/2019	ETAU	0.559	0.635	<0.05	1.04	51.1	6.8	283
4/02/2019	ETFSL200	0.173	0.191	<0.05	0.34	9.1	7.26	275
4/02/2019	ETFSL500	0.221	0.276	0.31	1.7	-18.6	7.35	302
4/02/2019	CONFLU1	0.043	0.036	0.16	0.85	-51.7	7.55	252
4/02/2019	WARARM5	0.023	0.029	0.19	0.74	139.1	7.58	240
4/02/2019	WDFS1	0.012	0.021	0.27	0.8	73.2	7.71	252
4/02/2019	WDFS1+100	0.01	0.02	0.29	0.74	50	7.71	255
11/02/2019	ETAU	0.757	0.731	<0.05	1.5	261.4	6.86	288
11/02/2019	ETFSL200	0.197	0.206	<0.05	0.36	6.8	7.21	280
11/02/2019	ETFSL500	0.243	0.302	0.5	1.86	-33.9	7.3	306
11/02/2019	CONFLU1	0.023	0.033	0.24	0.94	-96.7	7.48	255
11/02/2019	WARARM5	0.019	0.026	0.24	0.66	53.5	7.46	243
11/02/2019	WDFS1	0.011	0.018	0.31	0.98	-26	7.62	259
11/02/2019	WDFS1+100	0.005	0.013	0.3	0.83	64.5	7.62	258
18/02/2019	ETAU	0.624	0.675	0.17	1.51	51.8	6.91	303
18/02/2019	ETFSL200	0.189	0.19	0.19	0.36	12.8	7.27	296
18/02/2019	ETFSL500	0.243	0.284	0.23	1.77	-15.6	7.86	277
18/02/2019	CONFLU1	0.041	0.035	0.13	0.9	6.6	7.73	291
18/02/2019	WARARM5	0.022	0.024	0.19	0.64	64.1	7.46	262
18/02/2019	WDFS1	0.007	0.012	0.31	0.78	26.7	7.83	279
18/02/2019	WDFS1+100	0.006	0.011	0.24	0.64	23.3	7.84	279
25/02/2019	ETAU	0.616	0.719	<0.05	0.93	273.1	7.19	283
25/02/2019	ETFSL200	0.198	0.199	<0.05	0.54	270.5	7.06	271
25/02/2019	ETFSL500	0.281	0.312	1.72	2.11	270.6	7.3	307
25/02/2019	CONFLU1	0.022	0.027	0.06	0.86	274.6	7.37	247
25/02/2019	WARARM5	0.014	0.023	<0.05	0.53	264.2	7.4	238
25/02/2019	WDFS1	0.009	0.017	<0.05	0.79	272.6	7.55	248
25/02/2019	WDFS1+100	0.004	0.014	0.05	0.92	264.9	7.6	246

ATTACHMENT A (Continued)

Water Quality Data for Sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100

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)
04/03/2019	ETAU	0.688	0.67	<0.05	0.13	104.3	6.74	306
04/03/2019	ETFSL200	0.185	0.193	0.12	0.48	259.3	7.18	294
04/03/2019	ETFSL500	0.295	0.298	0.76	2.02	271.1	7.33	334
04/03/2019	CONFLU1	0.032	0.049	0.12	1.71	277.1	7.56	274
04/03/2019	WARARM5	0.025	0.031	0.12	1.02	277.7	7.44	248
04/03/2019	WDFS1	0.006	0.013	0.13	0.81	273.6	7.75	271
04/03/2019	WDFS1+100	0.005	0.011	0.21	0.71	249.3	7.58	270
11/03/2019	ETAU	0.638	0.726	0.08	0.94		6.87	322
11/03/2019	ETFSL200	0.152	0.170	0.06	0.38	227.4	7.24	310
11/03/2019	ETFSL500	0.266	0.28	0.5	1.91	219.5	7.43	347
11/03/2019	CONFLU1	0.024	0.03	0.23	0.96	228.5	7.53	289
11/03/2019	WARARM5	0.018	0.052	0.19	0.71	202.5	7.53	269
11/03/2019	WDFS1	0.01	0.018	0.26	0.8	219.7	7.07	276
11/03/2019	WDFS1+100	0.006	0.027	0.22	1.45	215.9	7.82	289
18/03/2019	ETAU	0.153	0.16	0.84	1.21	239	6.77	175
18/03/2019	ETFSL200	0.187	<0.01	0.5	0.204	237.9	6.62	180
18/03/2019	ETFSL500	0.193	<0.01	0.63	0.197	230.4	6.7	184
18/03/2019	CONFLU1	0.146	0.02	0.5	0.156	50.3	6.72	172
18/03/2019	WARARM5	0.032	<0.01	0.3	0.034	49.3	6.67	153
18/03/2019	WDFS1	0.071	0.04	0.44	0.073	21.4	6.67	159
18/03/2019	WDFS1+100	0.094	0.04	0.42	0.099	57.1	6.61	158
26/03/2019	ETAU	0.335	0.347	0.46	1.91	29.3	6.74	230
26/03/2019	ETFSL200	0.205	0.217	<0.05	1.04	23.5	6.96	224
26/03/2019	ETFSL500	0.233	0.234	0.5	1.39	227	6.99	239
26/03/2019	CONFLU1	0.095	0.114	<0.05	0.8	237.9	7.02	206
26/03/2019	WARARM5	0.039	0.041	<0.05	0.45	241.4	6.92	195
26/03/2019	WDFS1	0.073	0.076	<0.05	0.65	236.4	7.02	200
26/03/2019	WDFS1+100	0.054	0.049	<0.05	0.64	241.1	7.03	199
01/04/2019	ETAU	0.332	0.407	<0.05	1.51	160	7.3	256
01/04/2019	ETFSL200	0.184	0.248	<0.05	0.78	-1.8	7.68	248
01/04/2019	ETFSL500	0.222	0.261	0.47	1.14	-4.8	7.64	263
01/04/2019	CONFLU1	0.103	0.116	0.17	0.92	9	7.68	232
01/04/2019	WARARM5	0.034	0.037	0.1	0.42	36.8	7.71	207
01/04/2019	WDFS1	0.051	0.061	0.18	0.64	0.8	7.67	221
01/04/2019	WDFS1+100	0.027	0.031	0.14	0.56	43.5	7.73	219
08/04/2019	ETAU	0.298	0.319	0.64	1.89	35.8	6.86	225
08/04/2019	ETFSL200	0.200	0.198	0.12	0.96	273.8	7.09	212
08/04/2019	ETFSL500	0.184	0.2	0.34	1.34	264	7.25	220
08/04/2019	CONFLU1	0.073	0.082	0.14	0.77	238.9	7.54	212
08/04/2019	WARARM5	0.02	0.018	0.06	0.35	252.5	7.6	204
08/04/2019	WDFS1	0.039	0.05	0.11	0.7	236.9	7.56	205
08/04/2019	WDFS1+100	0.03	0.038	0.08	0.58	242.3	7.61	205
16/04/2019	ETAU	0.321	0.31	<0.05	1.31	259.8	7.17	240
16/04/2019	ETFSL200	0.156	0.154	<0.05	0.64	83.9	7.48	233
16/04/2019	ETFSL500	0.207	0.204	0.53	1.25	11.4	7.65	262
16/04/2019	CONFLU1	0.099	0.1	0.06	0.73	3.8	7.69	235
16/04/2019	WARARM5	0.024	0.021	0.21	0.34	21.6	7.62	207
16/04/2019	WDFS1	0.035	0.035	0.13	0.62	0.9	7.6	215
16/04/2019	WDFS1+100	0.017	0.017	0.14	0.48	4.6	7.67	214

ATTACHMENT A (Continued)

Water Quality Data for Sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100

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)
23/04/2019	ETAU	0.384	0.425	<0.05	1.82	262.5	7.54	224
23/04/2019	ETFSL200	0.162	0.174	0.08	0.77	73.9	7.31	218
23/04/2019	ETFSL500	0.214	0.232	0.24	1.4	8.8	7.64	240
23/04/2019	CONFLU1	0.041	0.046	0.13	0.76	10.6	7.56	194
23/04/2019	WARARM5	0.041	0.046	0.13	0.76	63.3	7.56	194
23/04/2019	WDFS1	0.026	0.027	0.16	0.71	7.5	7.56	191
23/04/2019	WDFS1+100	0.009	0.014	0.18	0.6	45	7.59	190
02/05/2019	ETAU	0.448	0.502	0.33	4.37	78.6	6.97	235
02/05/2019	ETFSL200	0.171	0.187	0.07	0.86	213.6	7.2	226
02/05/2019	ETFSL500	0.24	0.267	0.5	1.4	208.1	7.31	248
02/05/2019	CONFLU1	0.068	0.078	0.12	0.9	198.7	7.41	215
02/05/2019	WARARM5	0.024	0.03	0.14	0.51	201.1	7.3	184
02/05/2019	WDFS1	0.022	0.024	0.19	0.62	194.3	7.31	195
02/05/2019	WDFS1+100	0.01	0.016	0.18	0.5	189.9	7.4	196
06/05/2019	ETAU	0.381	0.421	<0.05	1.3	148.2	6.89	284
06/05/2019	ETFSL200	0.164	0.183	0.1	0.62	252.8	7.18	278
06/05/2019	ETFSL500	0.212	0.256	0.7	1.68	256.8	7.34	314
06/05/2019	CONFLU1	0.076	0.084	0.12	0.78	236.9	7.48	271
06/05/2019	WARARM5	0.025	0.023	0.09	0.46	254.6	7.37	238
06/05/2019	WDFS1	0.024	0.028	0.14	0.71	216.8	7.43	250
06/05/2019	WDFS1+100	0.009	0.009	0.08	0.54	259.9	7.57	246
13/05/2019	ETAU	0.452	0.488	0.08	2.71	106.4	7.15	299
13/05/2019	ETFSL200	0.171	0.208	0.06	0.93	254.6	7.48	290
13/05/2019	ETFSL500	0.261	0.273	0.29	1.74	241.2	7.57	322
13/05/2019	CONFLU1	0.057	0.063	0.07	0.88	249.5	7.61	269
13/05/2019	WARARM5	0.028	0.026	0.07	0.52	249.3	7.6	248
13/05/2019	WDFS1	0.034	0.031	0.05	0.85	243.4	7.61	260
13/05/2019	WDFS1+100	0.009	0.011	<0.05	0.58	243.9	7.71	265
20/05/2019	ETAU	0.432	0.49	<0.05	1.93	270.8	6.96	297
20/05/2019	ETFSL200	0.212	0.230	0.1	1.27	97.3	7.79	291
20/05/2019	ETFSL500	0.282	0.292	1.16	2.02	-17.1	7.63	331
20/05/2019	CONFLU1	0.076	0.092	0.1	1.12	68	7.76	286
20/05/2019	WARARM5	0.035	0.036	0.15	0.54	58.2	7.66	252
20/05/2019	WDFS1	0.027	0.028	0.2	0.72	27.9	7.43	266
20/05/2019	WDFS1+100	0.015	0.016	0.12	0.57	113.4	7.74	270
27/05/2019	ETAU	0.422	0.498	<0.05	2.26	169.8	7.02	301
27/05/2019	ETFSL200	0.240	0.239	0.11	1.06	286.4	7.45	293
27/05/2019	ETFSL500	0.292	0.276	1.14	1.92	286	7.51	334
27/05/2019	CONFLU1	0.06	0.053	0.07	0.69	151.2	7.63	271
27/05/2019	WARARM5	0.026	0.024	<0.05	0.49	278	7.47	254
27/05/2019	WDFS1	0.034	0.037	0.1	0.82	274.3	7.57	270
27/05/2019	WDFS1+100	0.013	0.013	0.06	0.52	284.6	7.76	271
05/06/2019	ETAU	0.295	0.28	0.66	2.05	127.4	7.15	228
03/06/2019	ETFSL200	0.237	0.245	0.09	1.34	84	7.63	316
03/06/2019	ETFSL500	0.325	0.339	1.31	2.4	23	7.71	358
03/06/2019	CONFLU1	0.093	0.099	0.06	0.78	54.6	7.87	308
03/06/2019	WARARM5	0.024	0.02	0.07	0.41	122.6	7.78	275
03/06/2019	WDFS1	0.056	0.057	0.39	1.68	80.4	7.78	290
03/06/2019	WDFS1+100	0.019	0.021	0.15	0.56	87.6	7.92	291

ATTACHMENT A (Continued)

Water Quality Data for Sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100

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)
11/06/2019	ETAU	0.0448	0.465	0.41	2.98	142.8	7.08	291
11/06/2019	ETFSL200	0.247	0.253	0.1	1.12	116.2	7.43	287
11/06/2019	ETFSL500	0.34	0.358	1.24	2.26	63.1	7.55	323
11/06/2019	CONFLU1	0.118	0.13	0.13	1.1	73.1	7.58	278
11/06/2019	WARARM5	0.026	0.024	0.05	0.45	82	7.55	234
11/06/2019	WDFS1	0.061	0.056	0.14	0.73	101.4	7.58	251
11/06/2019	WDFS1+100	0.035	0.03	<0.05	0.56	89.2	7.63	251
18/06/2019	ETAU	0.383	0.411	1.74	2.71	12.6	6.83	252
18/06/2019	ETFSL200	0.275	0.296	0.39	1.37	35.8	7.01	242
18/06/2019	ETFSL500	0.277	0.29	0.6	1.63	12.6	7.14	249
18/06/2019	CONFLU1	0.192	0.137	0.07	0.93	8.1	7.24	235
18/06/2019	WARARM5	0.019	0.014	<0.05	0.26	48.8	7.36	222
18/06/2019	WDFS1	0.088	0.092	0.11	0.73	3.4	7.25	229
18/06/2019	WDFS1+100	0.083	0.088	<0.05	0.71	13.9	7.26	226
25/06/2019	ETAU	0.369	0.377	2.13	3.62	-2.6	6.88	266
25/06/2019	ETFSL200	0.217	0.259	0.11	2.29	2.3	7.16	252
25/06/2019	ETFSL500	0.254	0.268	0.44	2.04	-28.1	7.22	266
25/06/2019	CONFLU1	0.076	0.09	<0.05	0.66	-7.1	7.4	246
25/06/2019	WARARM5	0.066	0.017	<0.05	0.35	4.7	7.43	236
25/06/2019	WDFS1	0.079	0.087	0.12	0.75	-9.4	7.38	241
25/06/2019	WDFS1+100	0.054	0.062	<0.05	0.64	-30.8	7.41	237
01/07/2019	ETAU	0.39	0.405	0.87	3.55	37.4	7.32	261
01/07/2019	ETFSL200	0.219	0.228	<0.05	1.47	20.7	7.21	247
01/07/2019	ETFSL500	0.275	0.372	0.85	2.78	-28.7	7.3	276
01/07/2019	CONFLU1	0.135	0.145	0.17	0.92	-10.8	7.45	250
01/07/2019	WARARM5	0.018	0.018	<0.05	0.37	5.3	7.51	226
01/07/2019	WDFS1	0.065	0.066	0.14	0.81	-13	7.39	234
01/07/2019	WDFS1+100	0.046	0.044	<0.05	0.6	-7.2	7.47	234
08/07/2019	ETAU	0.144	0.154	0.63	1.33	42.7	6.59	177
08/07/2019	ETFSL200	0.13	0.142	0.52	0.99	30.2	6.72	176
08/07/2019	ETFSL500	0.143	0.153	0.68	1.08	13	6.77	180
08/07/2019	CONFLU1	0.082	0.091	0.31	0.91	-32.7	7.01	191
08/07/2019	WARARM5	0.018	0.019	0.07	0.58	17.1	7.15	201
08/07/2019	WDFS1	0.082	0.089	0.36	0.94	1.5	6.98	190
08/07/2019	WDFS1+100	0.078	0.081	0.21	0.79	-5	7.01	188
15/07/2019	ETAU	0.268	0.266	1.11	2.05	-3.8	6.66	221
15/07/2019	ETFSL200	0.209	0.219	0.21	1.24	-4.9	6.76	218
15/07/2019	ETFSL500	0.241	0.256	0.56	1.8	-13.9	6.84	232
15/07/2019	CONFLU1	0.126	0.127	0.07	0.97	6.6	6.89	221
15/07/2019	WARARM5	0.023	0.017	<0.05	0.52	19.7	6.98	222
15/07/2019	WDFS1	0.086	0.097	0.05	0.95	15	6.9	215
15/07/2019	WDFS1+100	0.06	0.064	<0.05	0.78	-1.6	6.87	210
22/07/2019	ETAU	0.415	0.372	2.39	3.53	28.3	7.04	243
22/07/2019	ETFSL200	0.289	0.272	0.08	1.46	3.8	6.45	235
22/07/2019	ETFSL500	0.332	0.291	0.71	2.07	-38.1	6.65	254
22/07/2019	CONFLU1	0.168	0.153	0.06	0.84	10.3	6.66	233
22/07/2019	WARARM5	0.025	0.017	<0.05	0.44	9	6.66	222
22/07/2019	WDFS1	0.094	0.091	0.34	0.8	14	6.63	226
22/07/2019	WDFS1+100	0.071	0.061	0.26	0.61	-1.6	6.63	227

ATTACHMENT A (Continued)

Water Quality Data for Sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100

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)
29/07/2019	ETAU	0.348	0.363	0.22	2.06	53	6.3	315
29/07/2019	ETFSL200	0.234	0.25	0.07	1.4	56.1	6.41	311
29/07/2019	ETFSL500	0.301	0.348	1.37	2.58	-3.8	6.51	342
29/07/2019	CONFLU1	0.13	0.127	0.33	1.28	14.3	6.51	312
29/07/2019	WARARM5	0.029	0.018	0.1	0.38	36.1	6.52	291
29/07/2019	WDFS1	0.077	0.078	0.15	0.87	21.1	6.58	306
29/07/2019	WDFS1+100	0.044	0.044	0.11	0.55	13.7	6.48	302

Sustainable Minerals Institute

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Director

Professor Neville Plint

CRICOS PROVIDER NUMBER 000258

28 October 2019

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 – August 2019

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 Longwall 304 Water Management Plan (LW304 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 LW304 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 LW304 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 LW304 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 LW304 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.

Analysis conducted by Hydro Engineering & Consulting (2019) in accordance with the LW304 WMP, identified that the performance indicator for water resources reaching the Woronora Reservoir was exceeded for dissolved (i.e. filtered <0.45 µm fraction) manganese and dissolved iron on the Eastern Tributary at site ETWQ AU in August 2019 (as there was not a similar exceedance of the trigger recorded at control site WOWQ 2 on the Woronora River). The performance indicator was not exceeded for field filtered aluminium in August 2019 and therefore this parameter is not discussed in this report.

In accordance with the LW304 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*.

This assessment against the water quality subsidence impact performance measure has been prepared for August 2019 in consideration of:

- pluviograph data;
- flow data from the Eastern Tributary gauging location (GS 300078);
- groundwater level and groundwater quality results for Eastern Tributary sites up to 31 August 2019¹;
- surface water quality data at site ETWQ AU/ETAU² and sites further upstream on the Eastern Tributary up to 31 August 2019;
- surface water quality data at sites downstream of ETWQ AU/ETAU² up to 31 August 2019; 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 2018, above average rainfall has only been recorded in October 2018, November 2018 and December 2018, with below average rainfall recorded in all other months (Table 1).

Total rainfall in August 2019 was 53.0 mm, below the average rainfall at Darkes Forest (88.9 mm), with rainfall events occurring over 27 to 31 August (totalling 52 mm rainfall, with the majority [45.0 mm] falling on 30 August) and on 8 August 2019 (1 mm). Shallow groundwater levels correlate with the rainfall trend.

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

² Site ETAU is the same as site ETWQ AU (i.e. samples are taken at the same location). The difference between the sites relates to the time of sampling. Site ETWQ AU monitoring is conducted on the same day as sites upstream of ETWQ AU/ETAU (shown on Charts 1 to 2), while site ETAU monitoring is conducted on the same day as the sites downstream of ETWQ AU/ETAU (described in Section 3 and shown on Charts 3 to 4). From 29 January 2019, water quality sampling of all sites on the Eastern Tributary was undertaken in a single day. Future reporting will identify the data at this site as site ETWQ AU.

Table 1 Monthly Rainfall Data (mm) for PV7, January 2018 to August 2019

Month/Year	Rainfall at PV7 (mm)	Rainfall at Darkes Forest (mm) [#]	Mean Monthly Rainfall at Darkes Forest (1894-2019) (mm) [#]
January 2018	48.0	12.0	132.4
February 2018	115.5	16.6	159.6
March 2018	151.0	45.0	153.9
April 2018	32.0	21.6	126.8
May 2018	12.5	8.0	129.1
June 2018	112.0	91.8	146.6
July 2018	3.5	0.4	96.4
August 2018	12.5	15.8	89.1
September 2018	52.0	41.8	76.6
October 2018	197.0	200.8	91.9
November 2018	114.5	127.8	105.4
December 2018	120.0	91.0	103.8
January 2019	58.5	55.4	131.8
February 2019	41.0	54.2	158.7
March 2019	149.0	201.2	154.3
April 2019	35.0	46.0	126.1
May 2019	8.5	8.0	128.1
June 2019	115.5	47.4	145.8
July 2019	56.0	46.4	96.0
August 2019	53.0	58.6	88.9

[#] 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 August 2019.

2. EASTERN TRIBUTARY SURFACE WATER AND GROUNDWATER QUALITY DATA

2.1 Dissolved Manganese

Plots of dissolved manganese at surface water quality sites ETWQ AU, ETWQ AQ (upstream on the Eastern Tributary) and WOWQ 2 (control site) and at groundwater quality site ETGW2, are compared to rainfall at PV7 (Chart 1) and streamflow at GS 300078 (Chart 2) (Figure 1).

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.

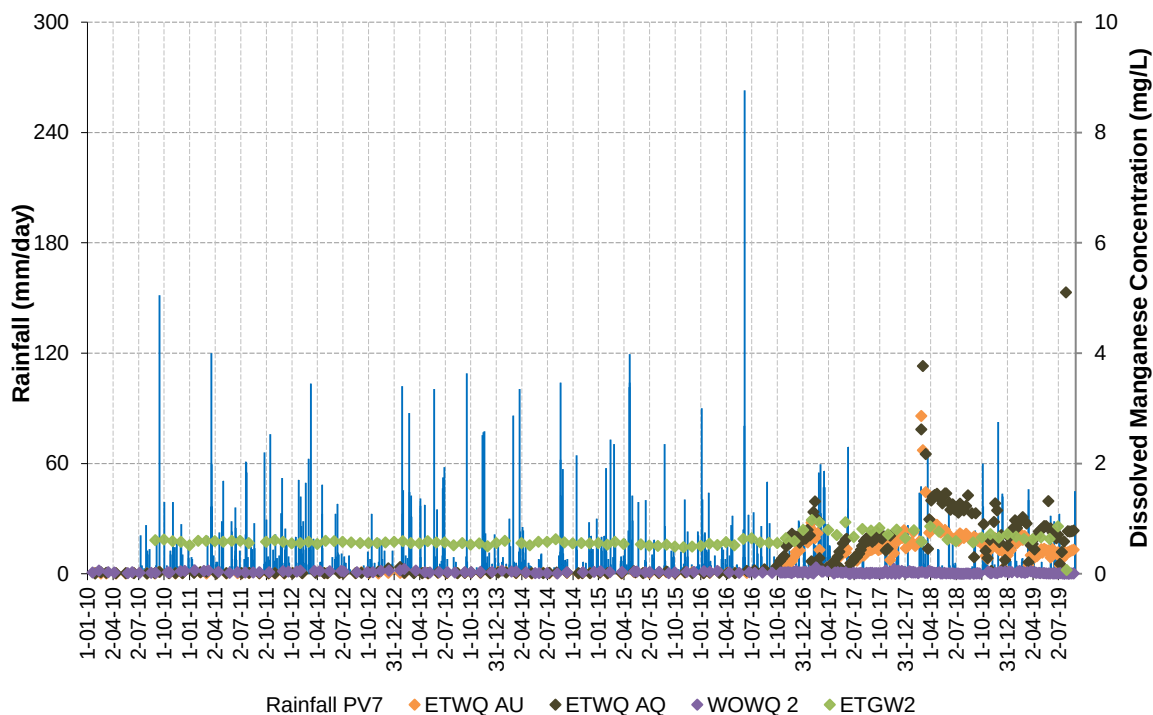


Chart 1 Dissolved Manganese Concentrations at Surface Water Quality Sites ETWQ AU, ETWQ AQ and WOWQ 2 and Groundwater Quality Site ETGW2 and Rainfall (to 31 August 2019)

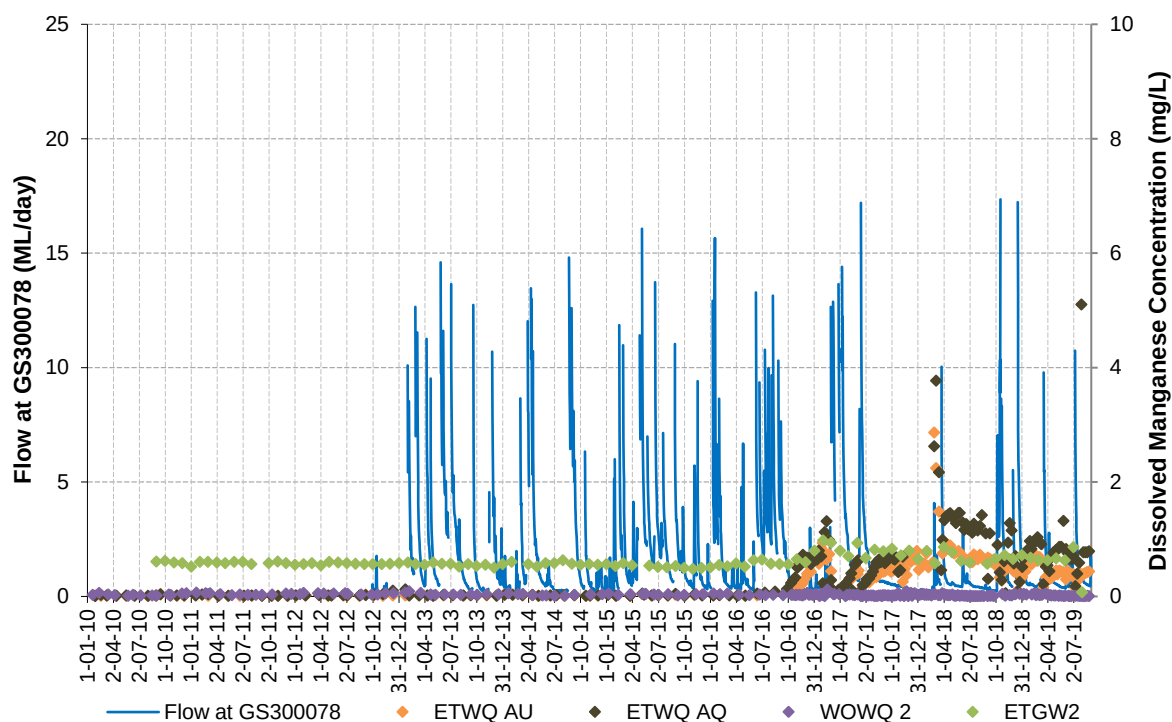
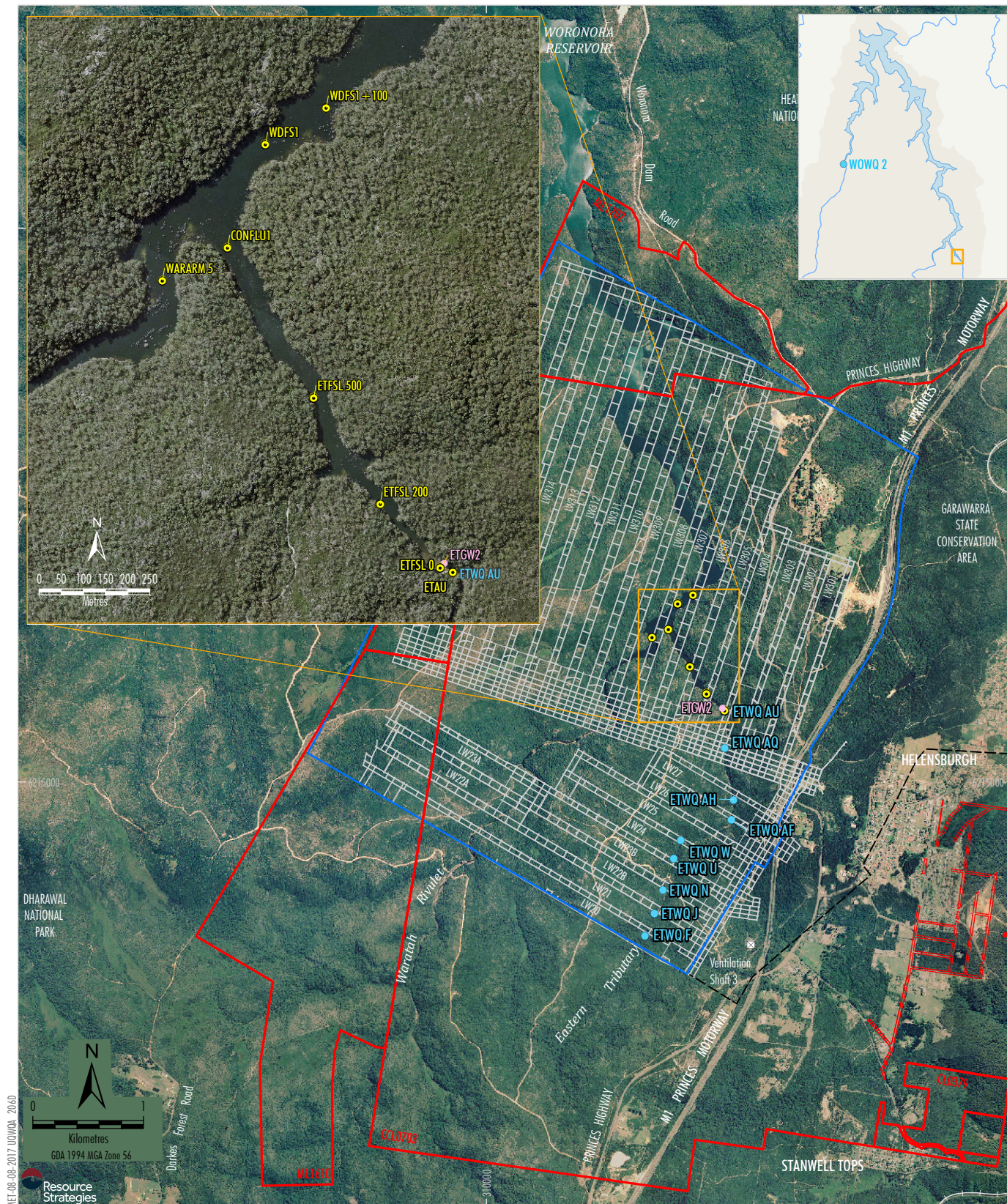


Chart 2 Dissolved Manganese Concentrations at Surface Water Quality Sites ETWQ AU, ETWQ AQ and WOWQ 2 and Groundwater Quality Site ETGW2 and Stream Flow (to 31 August 2019)



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 on Eastern Tributary
- Water Quality Site on Eastern Tributary and/or in Woronora Reservoir
- Groundwater Quality Site of Eastern Tributary

Peabody
METROPOLITAN COAL

Surface Water Quality Sampling of
Eastern Tributary Watercourse
and Woronora Reservoir

Figure 1

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. <0.1 mg/L, exist in the natural creek water. Dissolved manganese is easily diluted by freshwater flow to low levels when higher creek flows occur.

In August 2019, dissolved manganese concentrations at site ETWQ AU ranged between 0.387 mg/L and 0.434 mg/L. 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.

2.2 Dissolved Iron

Plots of dissolved iron at surface water quality sites ETWQ AU, ETWQ AQ (upstream on the Eastern Tributary) and WOWQ 2 (control site) and at groundwater quality site ETGW2, are compared to rainfall at PV7 (Chart 3) and streamflow at GS 300078 (Chart 4).

Similar to manganese, reducing conditions in the groundwater has solubilised iron. The groundwater quality data for site ETGW2 are indicative of the dissolved iron concentrations in the groundwater (Charts 3 and 4). The soluble iron (iron (II) ion, Fe^{2+}), rapidly oxidises to iron (III) Fe^{3+} , and forms insoluble hydrated ferric hydroxide in colloidal (<0.45 μm) and particulate (>0.45 μm) forms. This results in an increase in dissolved iron (if colloidal, i.e. able to pass through a 0.45 μm membrane filter) concentrations in the Eastern Tributary when the flows return to the surface. This is evident on Charts 3 and 4 where the concentration of dissolved iron is higher upstream of site ETWQ AU (e.g. at site ETWQ AQ) where cracking and flow diversion has occurred.

Iron is most stable under oxidising conditions (ORP > 50 mV) as insoluble hydrated ferric hydroxide in colloidal (<0.45 μm) and particulate (>0.45 μm) forms, until it deposits into sediment or on sandstone surfaces, but its concentration is not lowered by dilution. Instead, particulate or colloidal iron, both insoluble forms, is dispersed in the water column by creek flow.

Iron oxidising bacteria can also create oxidised iron precipitate (ADWG, 2011). The iron floc provided is a mixture of precipitated iron oxyhydroxide material >0.45 μm size and colloidal material which is <0.45 μm size. The colloidal material also coagulates to give the larger size precipitated material and coats the creek bed rock surfaces. The iron oxyhydroxide gradually converts to goethite (Yee *et al.* 2006) which has a darker colour and is commonly found in the creek sediment. The transported material becomes part of the sediment.

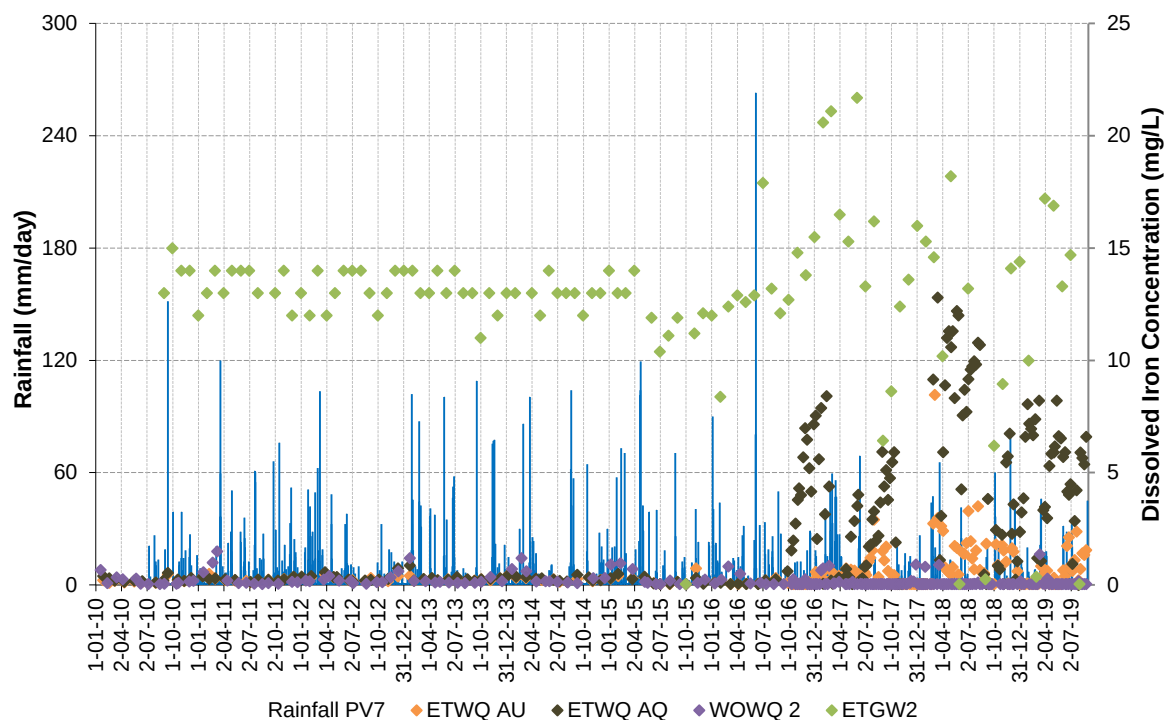


Chart 3 Dissolved Iron Concentrations at Surface Water Quality Sites ETWQ AU, ETWQ AQ and WOWQ 2 and Groundwater Quality Site ETGW2 and Rainfall (to 31 August 2019)

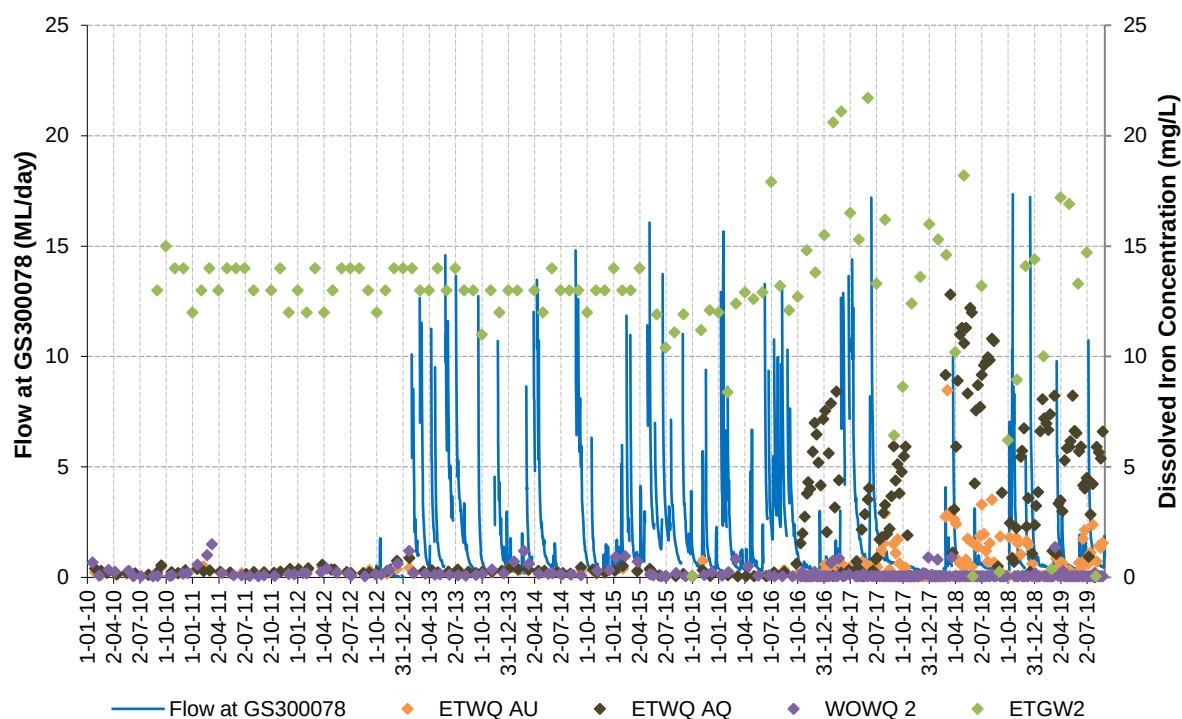


Chart 4 Dissolved Iron Concentrations at Surface Water Quality Sites ETWQ AU, ETWQ AQ and WOWQ 2 and Groundwater Quality Site ETGW2 and Stream Flow (to 31 August 2019)

Plots of dissolved iron at site ETWQ AU compared to rainfall at PV7 (Chart 3) and streamflow at GS300078 (Chart 4) show that concentrations in August 2019 ranged between 0.72 mg/L and 1.56 mg/L.

2.3 Other Water Quality Parameters

Water quality parameters pertinent to the increase in manganese and iron (dissolved-filtered <0.45 µm fraction) concentration are pH, oxidation-reduction potential (ORP) and electrical conductivity (EC). 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 oxidizing and becomes reducing when ORP is below approximately 10 mV.

In August 2019 at site ETWQ AU:

- pH (lab measurement) was generally consistent (pH 6.29 to pH 6.93);
- EC concentrations (lab measurement) ranged between 292 µS/cm and 323 µS/cm; and
- ORP (field measurement) ranged between 2.7 mV and 34 mV.

3. WATER RESOURCES REACHING THE WORONORA RESERVOIR

In accordance with the LW304 WMP, site ETWQ AU on the Eastern Tributary and control site WOWQ 2 on the Woronora River are used to assess the LW304 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. 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.

Metropolitan Coal has taken a photographic record of the watercourse / waterbody at the time of sampling, estimated the width of the watercourse / water body 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 (HCPL, 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 August 2019 the Woronora Reservoir water level varied between 153.7 mAHD (on 1 August 2019) and 152.73 mAHD (on 29 August 2019) (water level declined slightly). The position of the reservoir water level can only be determined to the closest one metre contour, accordingly, the reservoir water level during August 2019 was between approximately 2,390 m (corresponding to 154 mAHD) and 3,490 m (corresponding to 153 mAHD) downstream of site ETSFL 0.

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 August 2019, the Woronora Reservoir water level was downstream of site WDFS1+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 January 2018 to August 2019 at sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400 and ETFSL 500 is provided in Attachment A. As described earlier, sampling at sites ETFSL 100, ETSFL 300 and ETFSL 400 was suspended once monitoring at sites CONFLU1, WARARM5, WDFS1 and WDFS1+100 commenced on 22 November 2018³. Water quality data for filtered and total manganese since sampling commenced on 22 November 2018 at sites CONFLU1, WARARM5, WDFS1 and WDFS1+100 is also provided in Attachment A.

As described above, the Woronora Reservoir water level dropped slightly in August 2019, and was downstream of site WDFS1+100. The results for dissolved and total manganese at sites ETAU, ETFSL 200, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100 since the commencement of monitoring to the end of August 2019, are shown on Charts 5 and 6, respectively. These sites provide a profile along the arm of the Woronora Reservoir.

The filtered manganese concentrations for August 2019 ranged from 0.387 mg/L to 0.434 mg/L at site ETAU, 0.242 mg/L to 0.249 mg/L at site ETFSL 200, 0.297 mg/L to 0.317 mg/L at site ETFSL 500, 0.104 mg/L to 0.106 mg/L at site CONFLU1, 0.016 mg/L to 0.019 mg/L at site WARARM5, 0.042 mg/L to 0.061 mg/L at site WDFS1 and 0.017 mg/L to 0.041 mg/L at site WDFS1+100 (Chart 5).

Total manganese concentrations for August 2019 followed similar trends, ranging from 0.371 mg/L to 0.498 mg/L at site ETAU, 0.240 mg/L to 0.267 mg/L at site ETFSL 200, 0.306 mg/L to 0.345 mg/L at site ETFSL 500, 0.107 mg/L to 0.116 mg/L at site CONFLU1, 0.013 mg/L to 0.023 mg/L at site WARARM5, 0.051 mg/L to 0.055 mg/L at site WDFS1 and 0.021 mg/L to 0.038 mg/L at site WDFS1+100 (Chart 6).

³ Sampling at site ETAU was also temporarily suspended during this period but was resumed on 12 December 2018. Data from sampling undertaken at site ETWQ AU has been substituted for site ETAU during this period. Sampling at site ETAU was undertaken on 12 and 27 December 2018.

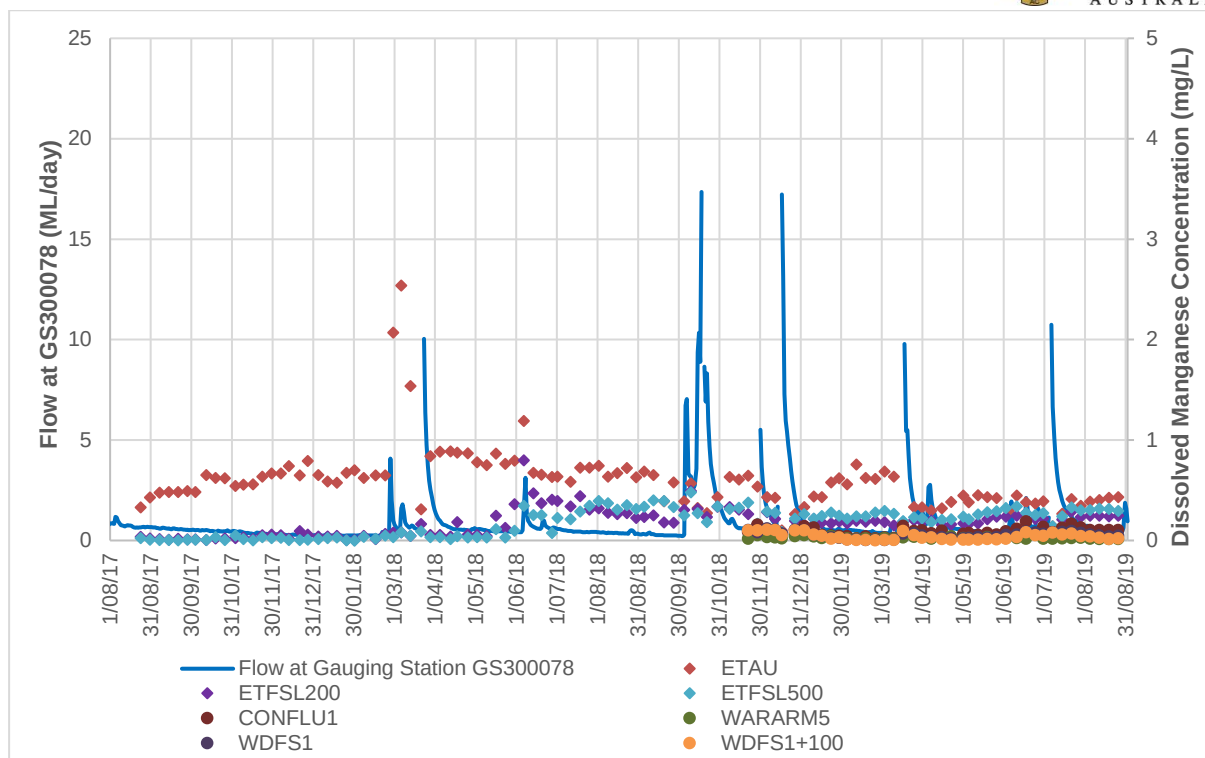


Chart 5 Dissolved Manganese Concentrations at Surface Water Quality Sites ETAU⁴, ETFSL 200, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100 and Stream Flow (August 2017 to 31 August 2019)

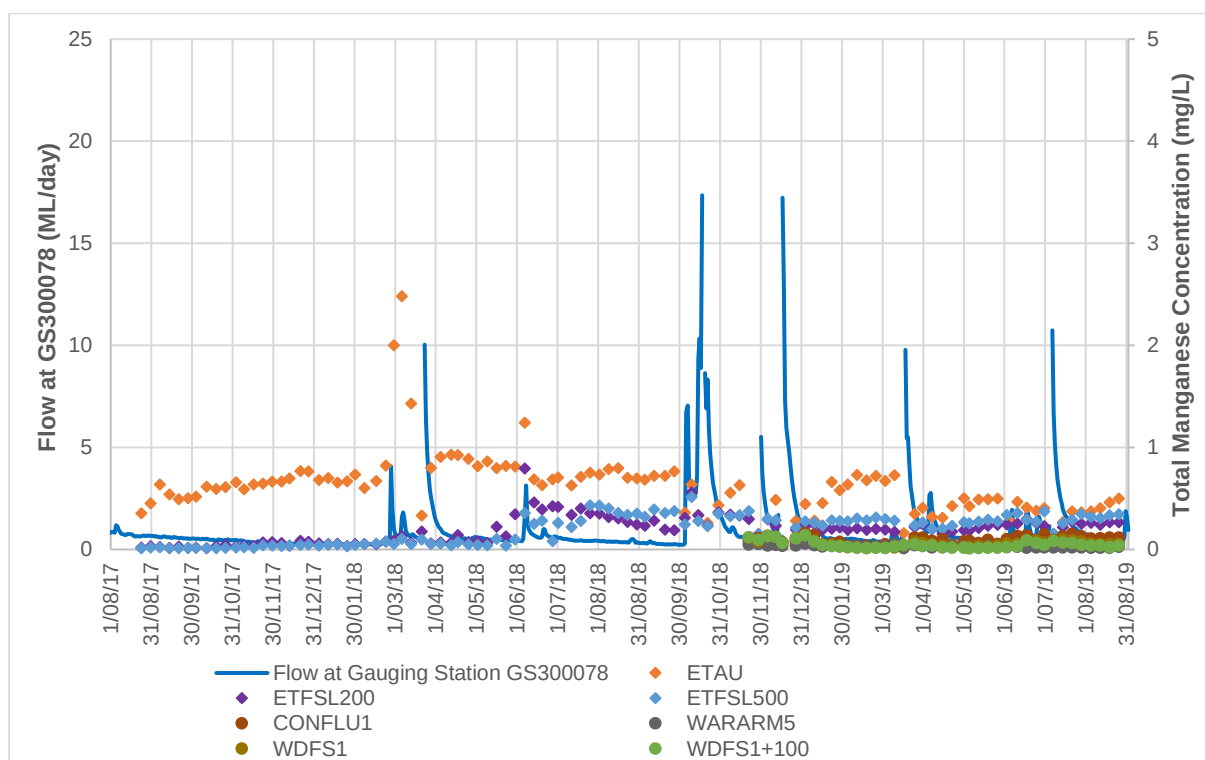


Chart 6 Total Manganese Concentrations at Surface Water Quality Sites ETAU⁵, ETFSL 200, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100 and Stream Flow (August 2017 to 31 August 2019)

⁴ Data from sampling undertaken at site ETWQ AU has been substituted for site ETAU from 22 November to 6 December 2018 and 17 December 2018. Sampling at site ETAU was undertaken on 12 and 27 December 2018.

⁵ Total manganese is not sampled at site ETWQ AU, and therefore results were unable to be substituted for site ETAU from 22 November to 6 December 2018 and 17 December 2018. Sampling at site ETAU was undertaken on 12 and 27 December 2018.

The Australian Drinking Water Guidelines (ADWG, 2011) are published by the National Health and Medical Research Council and updated most recently in 2018; 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 Australian Drinking Water Guideline before being supplied to the Helensburgh area as well as parts of the Sutherland Shire and northern Wollongong (WaterNSW, 2017).

The ADWG (2011) guidelines are based on total concentrations of manganese in water. The ADWG value is 0.5 mg/L total manganese for health. 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 5 and 6).

4.2 Dissolved Iron

The results for filtered and total iron at sites ETAU, ETFSL 200, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100 for August 2017 to August 2019, are shown on Charts 7 and 8, respectively.

The filtered iron concentrations in August 2019 ranged from 0.72 mg/L to 1.56 mg/L at site ETAU, 0.12 mg/L to 0.28 mg/L at site ETFSL 200, 1.28 mg/L to 1.52 mg/L at site ETFSL 500, 0.08 mg/L to 0.26 mg/L at site CONFLU1, 0.08 mg/L to 0.17 mg/L at site WARARM5, 0.1 mg/L to 0.43 mg/L at site WDFS1 and 0.11 mg/L to 0.14 mg/L at site WDFS1+100 (Chart 7).

Total iron concentrations in August 2019 ranged from 3.36 mg/L to 4.11 mg/L at site ETAU, 1.32 mg/L to 1.47 mg/L at site ETFSL 200, 2.2 mg/L to 2.66 mg/L at site ETFSL 500, 0.7 mg/L to 1.0 mg/L at site CONFLU1, 0.31 mg/L to 0.64 mg/L at site WARARM5, 0.58 mg/L to 0.86 mg/L at site WDFS1 and 0.52 mg/L to 1.65 mg/L at site WDFS1+100 (Chart 8).

The ADWG (2011) guidelines for iron in water are based on total concentrations. The ADWG value for iron is 0.3 mg/L for aesthetic considerations (precipitation of iron from solution and taste). No health-based guideline value has been set for iron. As the iron oxyhydroxide precipitates and converts to goethite it will likely become part of the reservoir sediment material with little likelihood of affecting the Woronora Reservoir water supply.

4.3 Other Water Quality Parameters

Water quality data for parameters pertinent to dissolved manganese for January 2018 to August 2019 at sites ETAU, ETFSL 200, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100 is provided in Attachment A. The water quality parameters (pH, ORP and EC) showed no unusual features. The ADWG value for pH (aesthetic) is pH 6.5 – 8.5. The pH values at all sites dropped slightly below pH 6.5 in August 2019, however the pH values recovered to above 6.5 by the end of August 2019 (Attachment A). The pH of creek water flow following limited rain events may fluctuate slightly because dry iron oxyhydroxide in contact with water undergoes hydrolysis. However, the creek water pH is within the measured range and tends to increase with time.

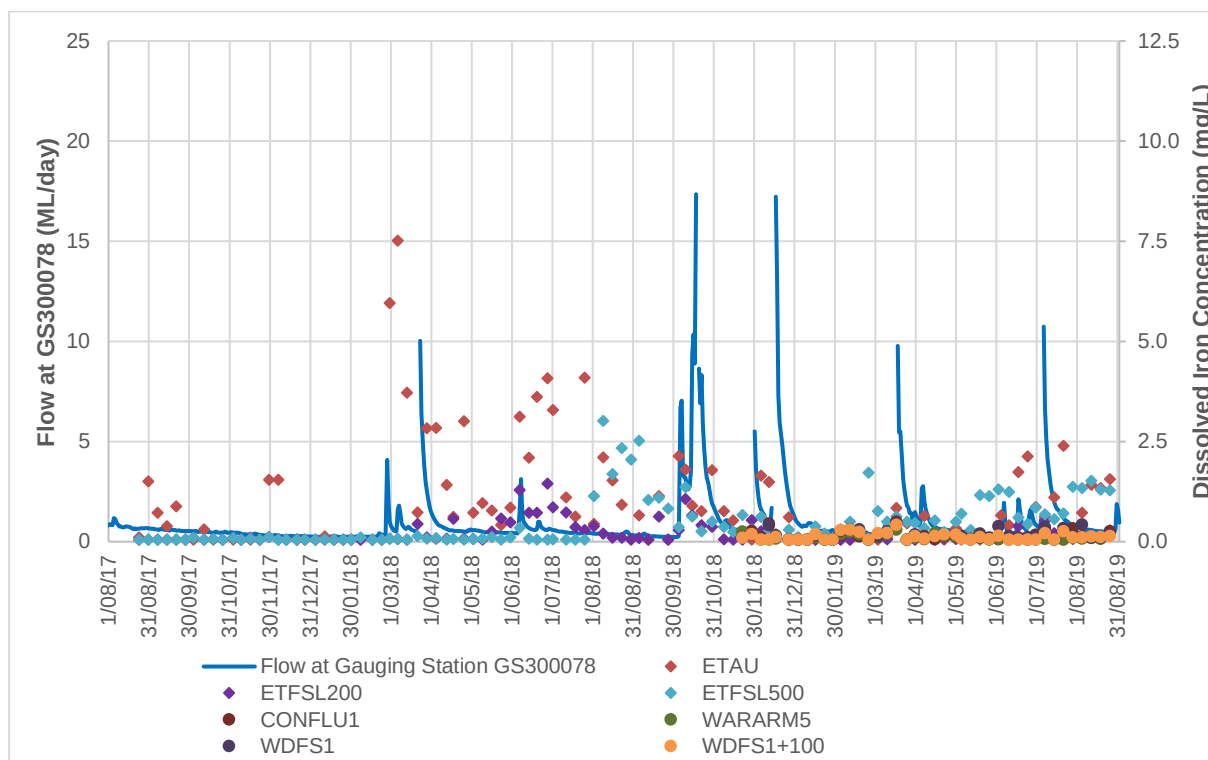


Chart 7 Dissolved Iron Concentrations at Surface Water Quality Sites ETAU, ETFSL 200, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100 and Stream Flow (August 2017 to 31 August 2019)

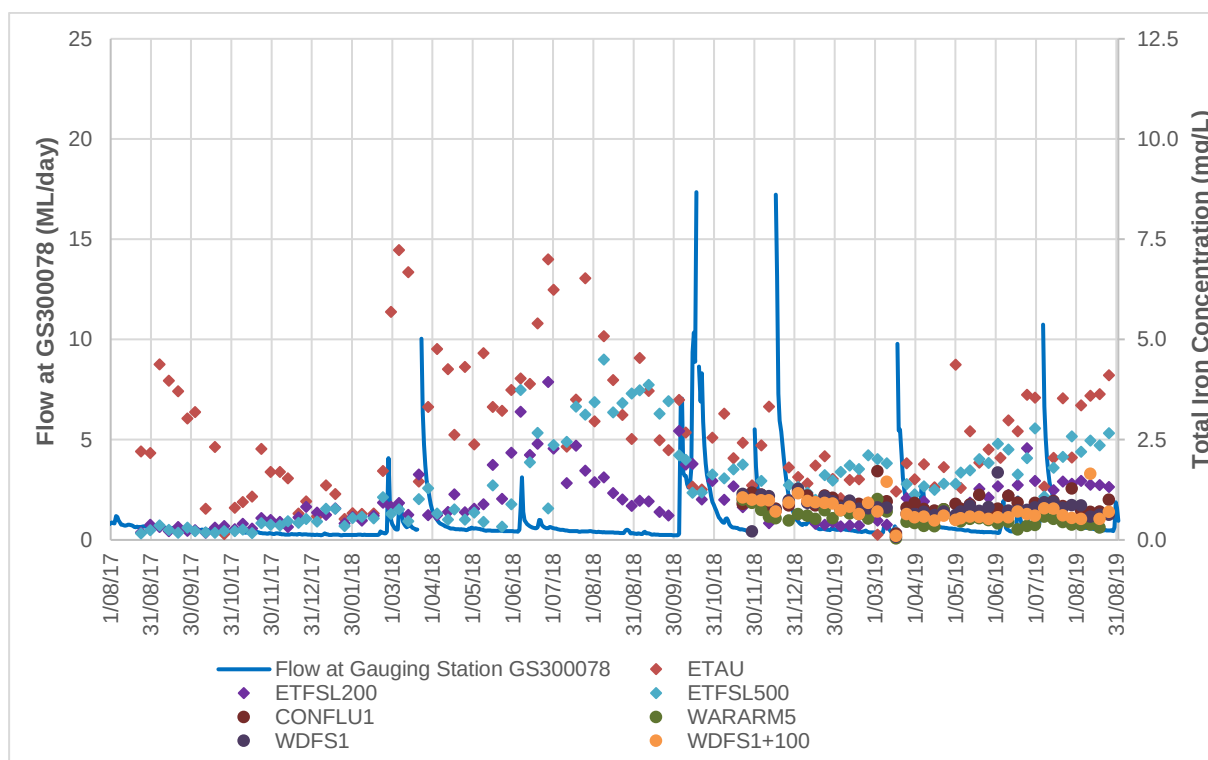


Chart 8 Total Iron Concentrations at Surface Water Quality Sites ETAU, ETFSL 200, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100 and Stream Flow (August 2017 to 31 August 2019)

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 and dissolved iron at site ETWQ AU on the Eastern Tributary in August 2019, which has triggered 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.

The soluble iron rapidly oxidises to iron (III) Fe^{3+} , and forms insoluble iron oxyhydroxide in colloidal ($<0.45 \mu\text{m}$) and particulate ($>0.45 \mu\text{m}$) forms, giving dissolved iron concentrations down to $<0.05 \text{ mg/L}$ in Woronora Reservoir. While the heavy rainfall increased flow in the Eastern Tributary sufficiently to dilute dissolved manganese at ETWQ AU to below 0.5 mg/L and demonstrated that the high dissolved manganese can be diluted by creek flow, the situation with dissolved and particulate iron is different. The climatically-dry period resulted in high dissolved iron concentrations from groundwater seepage being evaporated and becoming an orange-yellow coating on the bed rock surface. High rainfall can wash away loosely bound insoluble iron floc material and disperse the very fine colloidal material as a floc suspension which may be visible downstream.

Comparison of the photographic records for August 2019, show mild turbidity below ETAU which continued throughout August 2019 due to the lack of rainfall during the month. The presence of orange-yellow coating on the creek sediment surface is observed which will darken with time as conversion to goethite occurs.

Water reaching the Woronora Reservoir occurs where the inflowing stream water meets the reservoir waterbody. In August 2019, the Woronora Reservoir water level was downstream of site WDFS1+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 and iron concentrations reaching the Woronora Reservoir have 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.

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

ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, WARARM5, CONFLU1, WDFS1 and
WDFS1+100

JANUARY 2018 TO AUGUST 2019

ATTACHMENT A

Water Quality Data for Sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100

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)
4/01/2018	ETAU	0.652	0.678	<0.05	0.59	132	7.37	351
4/01/2018	ETFSL100	0.281	0.305	<0.05	0.82	125.3	7.75	337
4/01/2018	ETFSL200	0.042	0.057	<0.05	0.68	132.7	7.05	118
4/01/2018	ETFSL300	0.038	0.052	0.06	0.6	13.2	6.92	111
4/01/2018	ETFSL400	0.024	0.037	<0.05	0.47	129.9	6.96	110
4/01/2018	ETFSL500	0.016	0.036	<0.05	0.46	121.7	6.74	111
11/01/2018	ETAU	0.588	0.698	0.13	1.36	55.9	7.56	364
11/01/2018	ETFSL100	0.197	0.237	<0.05	0.55	24.3	7.88	345
11/01/2018	ETFSL200	0.041	0.053	<0.05	0.63	101	7.14	139
11/01/2018	ETFSL300	0.067	0.078	1.89	2.1	35.2	6.88	128
11/01/2018	ETFSL400	0.106	0.052	0.47	0.66	52	6.84	124
11/01/2018	ETFSL500	0.026	0.046	0.06	0.78	94.4	7.01	122
18/01/2018	ETAU	0.577	0.653	<0.05	1.15	136.4	7.67	366
18/01/2018	ETFSL100	0.211	0.22	<0.05	0.64	131.9	7.74	353
18/01/2018	ETFSL200	0.046	0.055	<0.05	0.79	131.2	7	129
18/01/2018	ETFSL300	0.058	0.057	0.06	0.84	125.5	6.94	126
18/01/2018	ETFSL400	0.038	0.048	<0.05	0.71	139.6	6.96	125
18/01/2018	ETFSL500	0.032	0.049	<0.05	0.78	121.4	6.94	123
25/01/2018	ETAU	0.674	0.668	<0.05	0.52	56.8	7.55	378
25/01/2018	ETFSL100	0.074	0.152	<0.05	0.46	-4.4	7.82	360
25/01/2018	ETFSL200	0.007	0.034	<0.05	0.41	70.6	7.16	120
25/01/2018	ETFSL300	0.005	0.035	<0.05	0.46	22.8	7.09	117
25/01/2018	ETFSL400	0.001	0.032	<0.05	0.41	55	7	118
25/01/2018	ETFSL500	0.002	0.03	<0.05	0.35	288.6	7.04	115
31/01/2018	ETAU	0.7	0.734	<0.05	0.67	82.3	7.46	374
31/01/2018	ETFSL100	0.089	0.147	<0.05	0.36	30.7	8.01	361
31/01/2018	ETFSL200	0.005	0.052	<0.05	0.57	79.1	7.28	139
31/01/2018	ETFSL300	0.002	0.049	<0.05	0.66	42.7	7.08	123
31/01/2018	ETFSL400	0.001	0.046	<0.05	0.54	92	7.05	122
31/01/2018	ETFSL500	0.001	0.044	<0.05	0.55	71	7.01	122
7/02/2018	ETAU	0.625	0.601	<0.05	0.65	106.9	7.39	374
7/02/2018	ETFSL100	0.102	0.129	<0.05	0.75	14.8	7.78	359
7/02/2018	ETFSL200	0.047	0.051	<0.05	0.48	80.4	7.04	119
7/02/2018	ETFSL300	0.049	0.059	<0.05	0.65	38.2	6.97	119
7/02/2018	ETFSL400	0.112	0.07	0.27	0.74	1	6.77	118
7/02/2018	ETFSL500	0.038	0.053	0.11	0.58	86.6	6.92	117
16/02/2018	ETAU	0.65	0.67	<0.05	0.66	158.8	7.54	380
16/02/2018	ETFSL100	0.075	0.126	<0.05	0.33	163.9	7.96	369
16/02/2018	ETFSL200	0.016	0.048	<0.05	0.6	152	7.05	128
16/02/2018	ETFSL300	0.023	0.058	<0.05	0.81	121.1	6.88	124
16/02/2018	ETFSL400	0.012	0.049	<0.05	0.54	143.2	6.83	121
16/02/2018	ETFSL500	0.019	0.054	<0.05	0.54	144.1	6.82	120
23/02/2018	ETAU	0.651	0.822	<0.05	1.72	163.6	7.21	400
23/02/2018	ETFSL100	0.12	0.2	<0.05	0.5	31.8	7.75	384
23/02/2018	ETFSL200	0.068	0.078	<0.05	0.93	55.8	6.92	140
23/02/2018	ETFSL300	0.065	0.07	0.07	0.88	55.2	6.8	136
23/02/2018	ETFSL400	0.062	0.075	<0.05	0.93	41.8	6.78	135
23/02/2018	ETFSL500	0.049	0.075	<0.05	1.07	-119.2	6.78	132

ATTACHMENT A (Continued)
Water Quality Data for Sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100

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)
1/03/2018	ETAU	2.07	2	5.96	5.69	83.1	6.32	492
1/03/2018	ETFSL100	1.78	1.72	2.41	2.7	36.7	6.31	464
1/03/2018	ETFSL200	0.08	0.087	0.08	0.83	59	6.45	133
1/03/2018	ETFSL300	0.059	0.069	0.16	0.79	43.5	6.36	127
1/03/2018	ETFSL400	0.05	0.064	0.1	1.03	32	6.35	125
1/03/2018	ETFSL500	0.036	0.051	0.08	0.65	2.3	6.38	123
7/03/2018	ETAU	2.54	2.48	7.52	7.23	168.1	6.12	514
7/03/2018	ETFSL100	2.21	2.15	4.12	4.43	158.6	6.11	479
7/03/2018	ETFSL200	0.082	0.132	0.07	0.92	166.8	6.29	147
7/03/2018	ETFSL300	0.108	0.12	<0.05	0.91	149	6.32	147
7/03/2018	ETFSL400	0.088	0.11	<0.05	0.78	161.1	6.79	142
7/03/2018	ETFSL500	0.083	0.102	0.07	0.76	154.5	6.32	138
14/03/2018	ETAU	1.54	1.43	3.72	6.68	41.4	6.58	450
14/03/2018	ETFSL100	0.907	1.08	0.55	3.58	31.6	6.95	431
14/03/2018	ETFSL200	0.047	0.066	<0.05	0.63	76	6.84	135
14/03/2018	ETFSL300	0.048	0.054	<0.05	0.56	41.4	6.83	133
14/03/2018	ETFSL400	0.064	0.055	0.06	0.61	3.3	6.86	132
14/03/2018	ETFSL500	0.047	0.052	<0.05	0.47	21.9	6.79	131
22/03/2018	ETAU	0.312	0.33	0.73	1.46	229.3	5.24	237
22/03/2018	ETFSL100	0.362	0.363	0.71	1.69	182.9	5.08	240
22/03/2018	ETFSL200	0.166	0.173	0.44	1.63	71.9	6.51	160
22/03/2018	ETFSL300	0.118	0.118	0.28	1.33	70.6	6.54	153
22/03/2018	ETFSL400	0.146	0.136	0.8	1.66	22.8	6.61	152
22/03/2018	ETFSL500	0.091	0.095	0.14	1.02	32.6	6.65	144
29/03/2018	ETAU	0.841	0.798	2.83	3.32	148	6.66	341
29/03/2018	ETFSL100	0.732	0.729	1.87	2.6	40.9	6.63	332
29/03/2018	ETFSL200	0.058	0.059	0.11	0.62	84.2	6.65	131
29/03/2018	ETFSL300	0.047	0.053	0.08	0.59	65.9	6.64	131
29/03/2018	ETFSL400	0.051	0.055	0.08	0.74	71.4	6.64	130
29/03/2018	ETFSL500	0.033	0.051	0.08	1.29	27.3	6.68	128
5/4/2018	ETAU	0.885	0.904	2.84	4.76	182.7	6.57	384
5/4/2018	ETFSL100	0.674	0.672	0.73	2.41	191.7	6.67	374
5/4/2018	ETFSL200	0.058	0.067	0.08	0.62	211.9	6.32	142
5/4/2018	ETFSL300	0.044	0.058	0.07	0.57	209.4	6.37	142
5/4/2018	ETFSL400	0.04	0.058	0.13	0.77	209.1	6.39	141
5/4/2018	ETFSL500	0.035	0.054	0.09	0.66	205.9	6.4	141
13/4/2018	ETAU	0.888	0.927	1.42	4.26	156.2	6.76	391
13/4/2018	ETFSL100	0.614	0.651	0.13	2.46	172.9	6.92	382
13/4/2018	ETFSL200	0.042	0.065	0.08	0.7	42.8	6.84	153
13/4/2018	ETFSL300	0.033	0.051	0.05	0.5	40.9	6.52	145
13/4/2018	ETFSL400	0.023	0.048	<0.05	0.59	64.1	6.6	147
13/4/2018	ETFSL500	0.014	0.04	<0.05	0.51	58.6	6.61	142
18/4/2018	ETAU	0.875	0.925	0.62	2.62	192.1	6.77	397
18/4/2018	ETFSL100	0.614	0.636	0.13	2.27	192.3	7.19	390
18/4/2018	ETFSL200	0.184	0.14	0.57	1.14	184.8	6.75	178
18/4/2018	ETFSL300	0.059	0.074	0.08	0.86	186.3	6.81	162
18/4/2018	ETFSL400	0.05	0.069	<0.05	0.64	181.3	6.76	159
18/4/2018	ETFSL500	0.044	0.071	0.07	0.76	185.5	6.76	160

ATTACHMENT A (Continued)
Water Quality Data for Sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100

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)
26/4/2018	ETAU	0.871	0.887	3.01	4.32	7.2	7.02	1040
26/4/2018	ETFSL100	0.587	0.631	0.1	2.06	9.6	7.42	409
26/4/2018	ETFSL200	0.059	0.071	0.08	0.69	45.1	7.01	159
26/4/2018	ETFSL300	0.043	0.055	<0.05	0.54	2.5	6.96	159
26/4/2018	ETFSL400	0.04	0.055	<0.05	0.54	36	6.97	155
26/4/2018	ETFSL500	0.03	0.05	0.05	0.51	94.3	6.96	152
3/5/2018	ETAU	0.781	0.813	2.38	2.38	76.9	6.9	362
3/5/2018	ETFSL100	0.58	0.611	0.18	3.02	20	7.47	358
3/5/2018	ETFSL200	0.056	0.081	0.07	0.78	43.5	7.01	142
3/5/2018	ETFSL300	0.053	0.059	0.13	0.55	5.3	7.02	136
3/5/2018	ETFSL400	0.044	0.052	0.06	0.45	55.3	7	132
3/5/2018	ETFSL500	0.034	0.044	0.07	0.68	60.7	7.01	128
10/5/2018	ETAU	0.752	0.86	4.66	4.66	176.7	6.75	388
10/5/2018	ETFSL100	0.553	0.628	0.06	4.58	191.5	7.19	384
10/5/2018	ETFSL200	0.044	0.061	<0.05	0.89	187.4	6.64	129
10/5/2018	ETFSL300	0.042	0.051	0.08	0.56	180.2	6.67	131
10/5/2018	ETFSL400	0.051	0.056	0.1	0.5	170.7	6.71	133
10/5/2018	ETFSL500	0.032	0.04	0.08	0.45	164	6.68	124
17/5/2018	ETAU	0.868	0.795	3.32	3.32	160	6.78	383
17/5/2018	ETFSL100	0.634	0.605	<0.05	2.66	178.5	7.12	375
17/5/2018	ETFSL200	0.249	0.22	0.25	1.87	178.5	6.85	246
17/5/2018	ETFSL300	0.176	0.178	0.12	1.57	175.8	6.84	230
17/5/2018	ETFSL400	0.146	0.14	0.1	1.32	179.3	6.78	202
17/5/2018	ETFSL500	0.113	0.102	0.12	1.36	179.6	6.65	176
24/5/2018	ETAU	0.763	0.795	3.22	3.22	192.8	7.22	381
24/5/2018	ETFSL100	0.563	0.63	<0.05	4.36	194.2	7.12	375
24/5/2018	ETFSL200	0.128	0.128	0.58	1.03	189.4	6.95	158
24/5/2018	ETFSL300	0.04	0.053	0.05	0.62	102.2	6.78	125
24/5/2018	ETFSL400	0.037	0.043	0.07	0.39	184.9	6.72	145
24/5/2018	ETFSL500	0.031	0.037	<0.05	0.33	185.2	6.76	120
31/5/2018	ETAU	0.797	0.812	3.74	3.74	193.3	7.22	378
31/5/2018	ETFSL100	0.626	0.598	<0.05	2.57	197.5	7.12	375
31/5/2018	ETFSL200	0.362	0.344	0.48	2.18	187.7	7.18	260
31/5/2018	ETFSL300	0.177	0.171	0.24	1.44	185.8	7.18	188
31/5/2018	ETFSL400	0.178	0.162	0.67	1.86	179.9	7.19	184
31/5/2018	ETFSL500	0.098	0.096	0.11	0.89	176	7.12	154
7/6/2018	ETAU	1.19	1.24	3.12	4.03	188.4	6.8	361
7/6/2018	ETFSL100	0.889	0.942	1.43	2.91	185.7	7.19	342
7/6/2018	ETFSL200	0.8	0.792	1.29	3.2	189.2	7.17	327
7/6/2018	ETFSL300	0.625	0.67	0.9	3.42	178.7	7.16	304
7/6/2018	ETFSL400	0.402	0.442	0.06	4.24	182.9	7.25	271
7/6/2018	ETFSL500	0.347	0.358	0.35	3.74	183.4	7.27	268
14/6/2018	ETAU	0.674	0.686	2.1	3.89	99.8	6.94	314
14/6/2018	ETFSL100	0.34	0.539	0.26	2.33	73.3	7.27	309
14/6/2018	ETFSL200	0.47	0.459	0.72	2.12	178.9	7.09	300
14/6/2018	ETFSL300	0.377	0.37	0.26	2.25	167.8	7.12	264
14/6/2018	ETFSL400	0.292	0.288	0.08	2.17	192.4	7.15	228
14/6/2018	ETFSL500	0.255	0.251	0.08	1.94	203.5	7.04	201

ATTACHMENT A (Continued)
Water Quality Data for Sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100

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)
20/6/2018	ETAU	0.657	0.628	3.62	5.4	188.3	6.72	337
20/6/2018	ETFSL100	0.457	0.468	0.9	3.16	19	6.9	324
20/6/2018	ETFSL200	0.371	0.39	0.72	2.4	191.4	6.95	320
20/6/2018	ETFSL300	0.384	0.377	0.34	2.42	190.5	6.98	322
20/6/2018	ETFSL400	0.331	0.333	<0.05	2.84	191.2	7	312
20/6/2018	ETFSL500	0.256	0.28	<0.05	2.67	184.8	7.01	273
28/6/2018	ETAU	0.634	0.687	4.08	7	185.8	6.6	328
28/6/2018	ETFSL100	0.501	0.559	1.04	3.95	188.8	7.02	329
28/6/2018	ETFSL200	0.409	0.422	1.45	3.94	187.2	6.82	306
28/6/2018	ETFSL300	0.176	0.207	<0.05	1.95	199.7	6.77	190
28/6/2018	ETFSL400	0.108	0.111	<0.05	1.04	198.5	6.67	128
28/6/2018	ETFSL500	0.075	0.079	0.05	0.79	179.7	6.61	118
2/7/2018	ETAU	0.637	0.706	3.29	6.24	39.9	7.05	352
2/7/2018	ETFSL100	0.519	0.558	0.97	4.38	191	7.31	351
2/7/2018	ETFSL200	0.395	0.416	0.86	2.28	191.4	7.34	344
2/7/2018	ETFSL300	0.391	0.426	1.19	3.57	193.9	7.25	342
2/7/2018	ETFSL400	0.327	0.349	0.15	3.82	195.4	7.22	311
2/7/2018	ETFSL500	0.226	0.258	0.06	2.37	194.2	7.15	252
12/7/2018	ETAU	0.587	0.626	1.11	2.33	456.6	7.31	370
12/7/2018	ETFSL100	0.501	0.492	0.63	1.6	163.5	7.59	367
12/7/2018	ETFSL200	0.342	0.338	0.73	1.42	160.3	7.5	355
12/7/2018	ETFSL300	0.324	0.373	1.16	2.87	154.8	7.49	361
12/7/2018	ETFSL400	0.338	0.353	0.44	3.85	1596	7.55	356
12/7/2018	ETFSL500	0.212	0.218	<0.05	2.45	158.3	7.37	259
19/7/2018	ETAU	0.726	0.712	0.63	3.5	177	7	377
19/7/2018	ETFSL100	0.576	0.565	0.11	3.01	202.8	7.37	371
19/7/2018	ETFSL200	0.444	0.4	0.36	2.35	200.6	7.24	360
19/7/2018	ETFSL300	0.462	0.402	1.11	3.68	202	7.21	372
19/7/2018	ETFSL400	0.431	0.374	0.57	3.48	203.3	7.33	384
19/7/2018	ETFSL500	0.288	0.279	<0.05	3.33	203.6	7.21	330
26/7/2018	ETAU	0.725	0.753	4.1	6.53	-5.9	6.59	364
26/7/2018	ETFSL100	0.522	0.566	0.19	2.89	10.8	6.78	356
26/7/2018	ETFSL200	0.31	0.353	0.29	1.73	9.8	6.79	351
26/7/2018	ETFSL300	0.35	0.35	1.59	2.55	-0.3	6.71	353
26/7/2018	ETFSL400	0.375	0.397	1.92	3.56	-12.3	6.75	370
26/7/2018	ETFSL500	0.346	0.431	<0.05	3.13	107.8	6.88	378
02/8/2018	ETAU	0.744	0.733	0.44	2.96	54.8	6.53	366
02/8/2018	ETFSL100	0.526	0.544	0.09	2.48	325	6.57	359
02/8/2018	ETFSL200	0.321	0.350	0.39	1.44	265.1	6.51	352
02/8/2018	ETFSL300	0.337	0.348	1.79	2.59	263.4	6.39	355
02/8/2018	ETFSL400	0.398	0.420	3.38	4.5	251.8	6.59	397
02/8/2018	ETFSL500	0.395	0.429	1.14	3.44	236.4	6.8	386
09/8/2018	ETAU	0.637	0.785	2.11	5.08	257.2	6.73	367
09/8/2018	ETFSL100	0.538	0.644	0.18	5.24	256.6	6.92	363
09/8/2018	ETFSL200	0.276	0.316	0.20	1.56	248.6	6.86	355
09/8/2018	ETFSL300	0.285	0.306	1.68	2.50	233.3	6.75	355
09/8/2018	ETFSL400	0.375	0.416	5.43	6.97	254.2	6.99	436
09/8/2018	ETFSL500	0.373	0.401	3.02	4.50	253.7	6.9	390

ATTACHMENT A (Continued)
Water Quality Data for Sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100

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)
16/8/2018	ETAU	0.672	0.797	1.53	3.99	250.1	6.71	365
16/8/2018	ETFSL100	0.491	0.584	0.08	2.32	264.8	7.16	362
16/8/2018	ETFSL200	0.263	0.304	0.1	1.17	265.4	7.13	353
16/8/2018	ETFSL300	0.249	0.298	1.02	1.98	267.4	6.96	349
16/8/2018	ETFSL400	0.336	0.351	3.57	4.23	260.7	7.12	405
16/8/2018	ETFSL500	0.309	0.358	1.69	3.18	261.3	6.98	386
23/8/2018	ETAU	0.724	0.701	0.92	3.12	266.4	7.03	358
23/8/2018	ETFSL100	0.489	0.505	0.07	2.26	271.7	6.97	351
23/8/2018	ETFSL200	0.274	0.270	0.1	1.01	267.1	7.11	344
23/8/2018	ETFSL300	0.227	0.273	0.83	1.83	265.6	7.04	341
23/8/2018	ETFSL400	0.267	0.279	2.11	2.50	261.8	7.05	365
23/8/2018	ETFSL500	0.352	0.337	2.34	3.41	258.1	7.23	382
30/8/2018	ETAU	0.632	0.696	<0.05	2.52	99.5	7.97	368
30/8/2018	ETFSL100	0.440	0.491	<0.05	2.09	77	7.73	354
30/8/2018	ETFSL200	0.225	0.243	0.06	0.85	23.2	7.85	350
30/8/2018	ETFSL300	0.236	0.248	0.96	1.70	256.2	7.78	345
30/8/2018	ETFSL400	0.327	0.343	3.30	4.50	252.5	8.20	399
30/8/2018	ETFSL500	0.316	0.350	2.05	3.65	228.1	8.18	387
05/9/2018	ETAU	0.688	0.683	0.66	4.54	25.2	7.44	363
05/9/2018	ETFSL100	0.476	0.483	<0.05	2.06	53.5	7.77	350
05/9/2018	ETFSL200	0.234	0.23	0.09	0.98	12.5	7.71	340
05/9/2018	ETFSL300	0.259	0.238	1.08	1.71	-12.5	7.57	333
05/9/2018	ETFSL400	0.367	0.371	4.53	5.96	-42.4	7.65	404
05/9/2018	ETFSL500	0.336	0.318	2.52	3.73	1.5	7.69	372
12/9/2018	ETAU	0.653	0.719	<0.05	3.72	178.2	7.05	360
12/9/2018	ETFSL100	0.461	0.521	<0.05	2.72	71.7	7.54	356
12/9/2018	ETFSL200	0.25	0.28	<0.05	0.96	20.1	7.49	346
12/9/2018	ETFSL300	0.3	0.301	0.41	1.73	3.1	7.38	345
12/9/2018	ETFSL400	0.389	0.34	2.15	2.77	-62.7	7.39	359
12/9/2018	ETFSL500	0.401	0.39	1.04	3.87	-17.4	7.43	381
20/9/2018	ETAU	0.392	0.721	1.14	2.49	272.4	7.11	362
20/9/2018	ETFSL100	0.179	0.467	<0.05	1.88	272.4	7.18	350
20/9/2018	ETFSL200	0.182	0.194	0.63	0.7	25.2	7.17	341
20/9/2018	ETFSL300	0.227	0.233	0.63	1.5	-11.9	7.08	337
20/9/2018	ETFSL400	0.386	0.356	2.66	5.39	-34.2	7.21	397
20/9/2018	ETFSL500	0.394	0.358	1.1	3.15	25.4	7.25	371
27/9/2018	ETAU	0.58	0.763	<0.05	2.24	234	7.33	400
27/9/2018	ETFSL100	0.434	0.493	<0.05	1.54	268.1	7.64	392
27/9/2018	ETFSL200	0.178	0.188	<0.05	0.61	272.8	7.55	381
27/9/2018	ETFSL300	0.231	0.239	0.4	1.6	270.8	7.33	377
27/9/2018	ETFSL400	0.331	0.325	1.49	3.55	263.1	7.41	400
27/9/2018	ETFSL500	0.335	0.375	0.83	3.46	266.8	7.67	416
05/10/2018	ETAU	0.39	0.359	2.14	3.49	274.6	7.28	250
05/10/2018	ETFSL100	0.297	0.686	0.32	12	271	7.57	286
05/10/2018	ETFSL200	0.305	0.308	0.29	2.72	269.7	7.67	295
05/10/2018	ETFSL300	0.272	0.305	0.32	2.72	267.7	7.66	291
05/10/2018	ETFSL400	0.364	0.299	0.63	2.95	259.8	7.73	294
05/10/2018	ETFSL500	0.251	0.245	0.36	2.11	242.9	7.58	271

ATTACHMENT A (Continued)

Water Quality Data for Sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100

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)
10/10/2018	ETAU	0.569	0.635	1.8	2.68	266.6	6.59	308
10/10/2018	ETFSL100	0.571	0.602	1.62	2.25	267.5	6.66	304
10/10/2018	ETFSL200	0.494	0.558	1.07	1.88	269.6	6.78	302
10/10/2018	ETFSL300	0.492	0.49	1.05	1.42	269.6	6.81	303
10/10/2018	ETFSL400	0.479	0.503	2.3	3.04	267.3	7.07	334
10/10/2018	ETFSL500	0.48	0.512	1.36	2	266.7	6.98	308
15/10/2018	ETAU	0.325	0.333	0.9	1.33	285.6	6.35	269
15/10/2018	ETFSL100	0.298	0.302	0.69	1.2	278.5	6.36	259
15/10/2018	ETFSL200	0.316	0.336	0.66	1.9	276.9	6.37	262
15/10/2018	ETFSL300	0.286	0.298	0.57	1.41	279.5	6.39	259
15/10/2018	ETFSL400	0.276	0.3	0.6	1.38	279.9	6.56	266
15/10/2018	ETFSL500	0.273	0.279	0.63	1.18	263	7.71	267
22/10/2018	ETAU	0.274	0.259	0.76	1.26	276.9	6.52	281
22/10/2018	ETFSL100	0.25	0.244	0.56	1.13	270.7	6.57	278
22/10/2018	ETFSL200	0.235	0.233	0.41	1.01	270.4	6.53	275
22/10/2018	ETFSL300	0.236	0.228	0.42	1	269	6.58	275
22/10/2018	ETFSL400	0.304	0.263	1.8	2.51	264.8	7.01	321
22/10/2018	ETFSL500	0.184	0.229	0.26	1.19	258.5	6.74	279
30/10/2018	ETAU	0.432	0.431	1.79	2.55	15.1	6.65	290
30/10/2018	ETFSL100	0.376	0.39	0.76	1.78	-0.4	6.91	286
30/10/2018	ETFSL200	0.336	0.363	0.37	1.47	3.8	6.92	285
30/10/2018	ETFSL300	0.341	0.35	0.39	1.32	7.6	6.99	291
30/10/2018	ETFSL400	0.36	0.364	1.58	3.1	-77.3	7.09	329
30/10/2018	ETFSL500	0.34	0.351	0.5	1.63	-4.2	7.05	296
08/11/2018	ETAU	0.635	0.553	0.76	3.15	23.3	7.07	307
08/11/2018	ETFSL100	0.429	0.433	0.14	1.59	12.9	7.35	307
08/11/2018	ETFSL200	0.333	0.34	0.06	1	20	7.31	303
08/11/2018	ETFSL300	0.333	0.329	0.06	1.1	5.4	7.32	304
08/11/2018	ETFSL400	0.431	0.403	5.31	5.49	247.1	7.47	385
08/11/2018	ETFSL500	0.315	0.325	0.37	1.54	248.4	7.30	310
15/11/2018	ETAU	0.609	0.628	0.53	2.04	264.1	7.09	334
15/11/2018	ETFSL100	0.399	0.414	<0.05	1.6	172.9	7.32	328
15/11/2018	ETFSL200	0.308	0.331	<0.05	1.34	272	7.31	325
15/11/2018	ETFSL300	0.321	0.298	0.08	1.15	271	7.28	324
15/11/2018	ETFSL400	0.396	0.383	1.44	4.72	262.5	7.35	373
15/11/2018	ETFSL500	0.328	0.336	0.24	1.76	267.3	7.38	345
19/11/2018	ETWQ AU	0.647	⁶	0.08	2.42	259.1	7.22	345
22/11/2018	ETFSL200	0.264	0.298	<0.05	0.82	30.9	7.29	355
22/11/2018	ETFSL500	0.38	0.376	0.67	1.88	-3.3	7.50	373
22/11/2018	CONFLU1	0.085	0.088	0.12	0.9	-1.1	7.51	307
22/11/2018	WARARM5	0.018	0.046	0.25	1	54.6	7.57	297
22/11/2018	WDFS1	0.105	0.114	0.12	1.15	40.1	7.53	307
22/11/2018	WDFS1+100	0.103	0.119	0.1	1.06	26	7.55	306

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

ATTACHMENT A (Continued)

Water Quality Data for Sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100

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)
26/11/2018	ETWQ AU	0.538	- ⁶	<0.05	1.36	83.8	7.11	354
29/11/2018	ETFSL200	0.139	0.15	0.54	1.2	36.1	7.07	195
29/11/2018	ETFSL500	0.167	0.147	0.3	1.19	30.1	6.94	195
29/11/2018	CONFLU1	0.158	0.108	0.27	1.18	29.5	7.19	200
29/11/2018	WARARM5	0.055	0.052	0.18	0.92	66.7	7.5	206
29/11/2018	WDFS1	0.082	0.074	0.18	0.21	36.7	7.8	206
29/11/2018	WDFS1+100	0.103	0.094	0.19	1	38.4	7.36	200
4/12/2018	ETWQ AU	0.433	- ⁶	1.65	2.36	30.6	7	266
6/12/2018	ETFSL200	0.283	0.295	0.26	1.04	242.7	6.97	260
6/12/2018	ETFSL500	0.29	0.3	0.62	1.47	249.5	7.23	270
6/12/2018	CONFLU1	0.112	0.114	0.12	1.13	243.8	7.24	243
6/12/2018	WARARM5	0.034	0.035	<0.05	0.75	250.1	7.29	238
6/12/2018	WDFS1	0.122	0.134	0.07	1.12	241.4	7.29	246
6/12/2018	WDFS1+100	0.109	0.126	<0.05	0.99	251.1	7.3	245
12/12/2018	ETAU	0.428	0.484	1.49	3.33	-	6.86	269
12/12/2018	ETFSL200	0.215	0.232	<0.05	0.42	255.3	7.4	245
12/12/2018	ETFSL500	0.276	0.284	0.27	0.89	251.9	7.41	262
12/12/2018	CONFLU1	0.081	0.091	0.45	0.8	17.9	7.39	219
12/12/2018	WARARM5	0.03	0.042	<0.05	0.58	236.4	7.53	214
12/12/2018	WDFS1	0.108	0.121	0.41	1.09	27.5	7.44	225
12/12/2018	WDFS1+100	0.105	0.12	<0.05	0.99	42.3	7.24	243
17/12/2018	ETWQ AU	0.102	- ⁶	0.18	0.75	280.3	6.50	152
17/12/2018	ETFSL200	0.076	0.084	0.17	0.7	274.8	6.76	152
17/12/2018	ETFSL500	0.087	0.086	0.19	0.76	274.8	6.56	150
17/12/2018	CONFLU1	0.068	0.068	0.16	0.78	270.9	6.64	152
17/12/2018	WARARM5	0.023	0.032	0.08	0.54	257.5	6.77	156
17/12/2018	WDFS1	0.069	0.062	0.15	0.75	273	6.67	153
17/12/2018	WDFS1+100	0.055	0.063	0.12	0.71	278.4	6.71	154
27/12/2018	ETAU	0.263	0.277	0.61	1.81	24.3	6.72	217
27/12/2018	ETFSL200	0.196	0.194	0.09	0.93	30.6	7.11	216
27/12/2018	ETFSL500	0.219	0.213	0.3	1.37	-6.9	7.13	224
27/12/2018	CONFLU1	0.071	0.075	<0.05	0.86	21.4	7.15	208
27/12/2018	WARARM5	0.045	0.036	<0.05	0.48	3.4	7.3	206
27/12/2018	WDFS1	0.108	0.11	0.06	0.99	24.9	7.12	210
27/12/2018	WDFS1+100	0.101	0.105	<0.05	0.93	37.4	7.13	210
3/01/2019	ETWQ AU	0.335	0.443	<0.05	1.57	110.1	7.35	300
3/01/2019	ETFSL200	0.159	0.226	<0.05	0.63	113.1	7.63	290
3/01/2019	ETFSL500	0.265	0.274	0.12	1.32	11.5	7.5	302
3/01/2019	CONFLU1	0.143	0.16	<0.05	1.21	4.8	7.29	270
3/01/2019	WARARM5	0.055	0.054	<0.05	0.64	56.4	7.46	256
3/01/2019	WDFS1	0.106	0.14	<0.05	1.27	72	7.45	265
3/01/2019	WDFS1+100	0.101	0.138	<0.05	1.16	56.2	7.42	263
10/01/2019	ETWQ AU	0.438	0.282	<0.05	1.41	244.1	6.92	268
10/01/2019	ETFSL200	0.216	0.246	<0.05	0.62	26.8	8.03	279
10/01/2019	ETFSL500	0.22	0.262	<0.05	1.18	-9.3	7.64	300
10/01/2019	CONFLU1	0.129	0.141	<0.05	1.11	-33.7	7.55	269
10/01/2019	WARARM5	0.042	0.041	<0.05	0.6	90.3	7.62	252
10/01/2019	WDFS1	0.061	0.087	<0.05	0.92	22.1	7.59	242
10/01/2019	WDFS1+100	0.061	0.074	<0.05	0.97	6.9	7.58	240

ATTACHMENT A (Continued)

Water Quality Data for Sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100

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)
16/01/2019	ETWQ AU	0.433	0.454	<0.05	1.86	171.1	6.75	282
16/01/2019	ETFSL200	0.18	0.189	<0.05	0.4	258.4	7.67	275
16/01/2019	ETFSL500	0.244	0.233	0.38	1	262.4	7.65	303
16/01/2019	CONFLU1	0.058	0.049	0.12	0.86	261.2	7.68	249
16/01/2019	WARARM5	0.025	0.028	0.11	0.52	268.1	7.82	242
16/01/2019	WDFS1	0.046	0.044	0.16	0.92	263.5	7.76	256
16/01/2019	WDFS1+100	0.047	0.044	0.19	0.94	259.2	7.79	260
23/01/2019	ETWQ AU	0.579	0.661	<0.05	2.09	184.3	6.78	292
23/01/2019	ETFSL200	0.171	0.204	<0.05	0.38	96.8	7.65	286
23/01/2019	ETFSL500	0.28	0.284	0.2	1.62	-11.1	7.65	316
23/01/2019	CONFLU1	0.052	0.056	<0.05	1.11	5.6	7.7	264
23/01/2019	WARARM5	0.043	0.036	<0.05	0.74	-38.4	7.7	253
23/01/2019	WDFS1	0.032	0.042	<0.05	1.08	19.6	7.77	266
23/01/2019	WDFS1+100	0.02	0.029	<0.05	0.92	-16.6	7.83	266
29/01/2019	ETAU	0.62	0.578	0.07	1.52	66.8	6.7	294
29/01/2019	ETFSL200	0.19	0.216	<0.05	0.44	36.2	7.23	282
29/01/2019	ETFSL500	0.249	0.279	<0.05	1.48	12.1	7.34	310
29/01/2019	CONFLU1	0.048	0.07	<0.05	1.05	-20.8	7.54	282
29/01/2019	WARARM5	0.031	0.028	<0.05	0.54	49.5	7.34	251
29/01/2019	WDFS1	0.027	0.038	<0.05	0.96	29.7	7.49	260
29/01/2019	WDFS1+100	0.03	0.03	<0.05	0.91	9.9	7.49	260
4/02/2019	ETAU	0.559	0.635	<0.05	1.04	51.1	6.8	283
4/02/2019	ETFSL200	0.173	0.191	<0.05	0.34	9.1	7.26	275
4/02/2019	ETFSL500	0.221	0.276	0.31	1.7	-18.6	7.35	302
4/02/2019	CONFLU1	0.043	0.036	0.16	0.85	-51.7	7.55	252
4/02/2019	WARARM5	0.023	0.029	0.19	0.74	139.1	7.58	240
4/02/2019	WDFS1	0.012	0.021	0.27	0.8	73.2	7.71	252
4/02/2019	WDFS1+100	0.01	0.02	0.29	0.74	50	7.71	255
11/02/2019	ETAU	0.757	0.731	<0.05	1.5	261.4	6.86	288
11/02/2019	ETFSL200	0.197	0.206	<0.05	0.36	6.8	7.21	280
11/02/2019	ETFSL500	0.243	0.302	0.5	1.86	-33.9	7.3	306
11/02/2019	CONFLU1	0.023	0.033	0.24	0.94	-96.7	7.48	255
11/02/2019	WARARM5	0.019	0.026	0.24	0.66	53.5	7.46	243
11/02/2019	WDFS1	0.011	0.018	0.31	0.98	-26	7.62	259
11/02/2019	WDFS1+100	0.005	0.013	0.3	0.83	64.5	7.62	258
18/02/2019	ETAU	0.624	0.675	0.17	1.51	51.8	6.91	303
18/02/2019	ETFSL200	0.189	0.19	0.19	0.36	12.8	7.27	296
18/02/2019	ETFSL500	0.243	0.284	0.23	1.77	-15.6	7.86	277
18/02/2019	CONFLU1	0.041	0.035	0.13	0.9	6.6	7.73	291
18/02/2019	WARARM5	0.022	0.024	0.19	0.64	64.1	7.46	262
18/02/2019	WDFS1	0.007	0.012	0.31	0.78	26.7	7.83	279
18/02/2019	WDFS1+100	0.006	0.011	0.24	0.64	23.3	7.84	279
25/02/2019	ETAU	0.616	0.719	<0.05	0.93	273.1	7.19	283
25/02/2019	ETFSL200	0.198	0.199	<0.05	0.54	270.5	7.06	271
25/02/2019	ETFSL500	0.281	0.312	1.72	2.11	270.6	7.3	307
25/02/2019	CONFLU1	0.022	0.027	0.06	0.86	274.6	7.37	247
25/02/2019	WARARM5	0.014	0.023	<0.05	0.53	264.2	7.4	238
25/02/2019	WDFS1	0.009	0.017	<0.05	0.79	272.6	7.55	248
25/02/2019	WDFS1+100	0.004	0.014	0.05	0.92	264.9	7.6	246

ATTACHMENT A (Continued)

Water Quality Data for Sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100

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)
04/03/2019	ETAU	0.688	0.67	<0.05	0.13	104.3	6.74	306
04/03/2019	ETFSL200	0.185	0.193	0.12	0.48	259.3	7.18	294
04/03/2019	ETFSL500	0.295	0.298	0.76	2.02	271.1	7.33	334
04/03/2019	CONFLU1	0.032	0.049	0.12	1.71	277.1	7.56	274
04/03/2019	WARARM5	0.025	0.031	0.12	1.02	277.7	7.44	248
04/03/2019	WDFS1	0.006	0.013	0.13	0.81	273.6	7.75	271
04/03/2019	WDFS1+100	0.005	0.011	0.21	0.71	249.3	7.58	270
11/03/2019	ETAU	0.638	0.726	0.08	0.94		6.87	322
11/03/2019	ETFSL200	0.152	0.170	0.06	0.38	227.4	7.24	310
11/03/2019	ETFSL500	0.266	0.28	0.5	1.91	219.5	7.43	347
11/03/2019	CONFLU1	0.024	0.03	0.23	0.96	228.5	7.53	289
11/03/2019	WARARM5	0.018	0.052	0.19	0.71	202.5	7.53	269
11/03/2019	WDFS1	0.01	0.018	0.26	0.8	219.7	7.07	276
11/03/2019	WDFS1+100	0.006	0.027	0.22	1.45	215.9	7.82	289
18/03/2019	ETAU	0.153	0.16	0.84	1.21	239	6.77	175
18/03/2019	ETFSL200	0.187	<0.01	0.5	0.204	237.9	6.62	180
18/03/2019	ETFSL500	0.193	<0.01	0.63	0.197	230.4	6.7	184
18/03/2019	CONFLU1	0.146	0.02	0.5	0.156	50.3	6.72	172
18/03/2019	WARARM5	0.032	<0.01	0.3	0.034	49.3	6.67	153
18/03/2019	WDFS1	0.071	0.04	0.44	0.073	21.4	6.67	159
18/03/2019	WDFS1+100	0.094	0.04	0.42	0.099	57.1	6.61	158
26/03/2019	ETAU	0.335	0.347	0.46	1.91	29.3	6.74	230
26/03/2019	ETFSL200	0.205	0.217	<0.05	1.04	23.5	6.96	224
26/03/2019	ETFSL500	0.233	0.234	0.5	1.39	227	6.99	239
26/03/2019	CONFLU1	0.095	0.114	<0.05	0.8	237.9	7.02	206
26/03/2019	WARARM5	0.039	0.041	<0.05	0.45	241.4	6.92	195
26/03/2019	WDFS1	0.073	0.076	<0.05	0.65	236.4	7.02	200
26/03/2019	WDFS1+100	0.054	0.049	<0.05	0.64	241.1	7.03	199
01/04/2019	ETAU	0.332	0.407	<0.05	1.51	160	7.3	256
01/04/2019	ETFSL200	0.184	0.248	<0.05	0.78	-1.8	7.68	248
01/04/2019	ETFSL500	0.222	0.261	0.47	1.14	-4.8	7.64	263
01/04/2019	CONFLU1	0.103	0.116	0.17	0.92	9	7.68	232
01/04/2019	WARARM5	0.034	0.037	0.1	0.42	36.8	7.71	207
01/04/2019	WDFS1	0.051	0.061	0.18	0.64	0.8	7.67	221
01/04/2019	WDFS1+100	0.027	0.031	0.14	0.56	43.5	7.73	219
08/04/2019	ETAU	0.298	0.319	0.64	1.89	35.8	6.86	225
08/04/2019	ETFSL200	0.200	0.198	0.12	0.96	273.8	7.09	212
08/04/2019	ETFSL500	0.184	0.2	0.34	1.34	264	7.25	220
08/04/2019	CONFLU1	0.073	0.082	0.14	0.77	238.9	7.54	212
08/04/2019	WARARM5	0.02	0.018	0.06	0.35	252.5	7.6	204
08/04/2019	WDFS1	0.039	0.05	0.11	0.7	236.9	7.56	205
08/04/2019	WDFS1+100	0.03	0.038	0.08	0.58	242.3	7.61	205
16/04/2019	ETAU	0.321	0.31	<0.05	1.31	259.8	7.17	240
16/04/2019	ETFSL200	0.156	0.154	<0.05	0.64	83.9	7.48	233
16/04/2019	ETFSL500	0.207	0.204	0.53	1.25	11.4	7.65	262
16/04/2019	CONFLU1	0.099	0.1	0.06	0.73	3.8	7.69	235
16/04/2019	WARARM5	0.024	0.021	0.21	0.34	21.6	7.62	207
16/04/2019	WDFS1	0.035	0.035	0.13	0.62	0.9	7.6	215
16/04/2019	WDFS1+100	0.017	0.017	0.14	0.48	4.6	7.67	214

ATTACHMENT A (Continued)

Water Quality Data for Sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100

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)
23/04/2019	ETAU	0.384	0.425	<0.05	1.82	262.5	7.54	224
23/04/2019	ETFSL200	0.162	0.174	0.08	0.77	73.9	7.31	218
23/04/2019	ETFSL500	0.214	0.232	0.24	1.4	8.8	7.64	240
23/04/2019	CONFLU1	0.041	0.046	0.13	0.76	10.6	7.56	194
23/04/2019	WARARM5	0.041	0.046	0.13	0.76	63.3	7.56	194
23/04/2019	WDFS1	0.026	0.027	0.16	0.71	7.5	7.56	191
23/04/2019	WDFS1+100	0.009	0.014	0.18	0.6	45	7.59	190
02/05/2019	ETAU	0.448	0.502	0.33	4.37	78.6	6.97	235
02/05/2019	ETFSL200	0.171	0.187	0.07	0.86	213.6	7.2	226
02/05/2019	ETFSL500	0.24	0.267	0.5	1.4	208.1	7.31	248
02/05/2019	CONFLU1	0.068	0.078	0.12	0.9	198.7	7.41	215
02/05/2019	WARARM5	0.024	0.03	0.14	0.51	201.1	7.3	184
02/05/2019	WDFS1	0.022	0.024	0.19	0.62	194.3	7.31	195
02/05/2019	WDFS1+100	0.01	0.016	0.18	0.5	189.9	7.4	196
06/05/2019	ETAU	0.381	0.421	<0.05	1.3	148.2	6.89	284
06/05/2019	ETFSL200	0.164	0.183	0.1	0.62	252.8	7.18	278
06/05/2019	ETFSL500	0.212	0.256	0.7	1.68	256.8	7.34	314
06/05/2019	CONFLU1	0.076	0.084	0.12	0.78	236.9	7.48	271
06/05/2019	WARARM5	0.025	0.023	0.09	0.46	254.6	7.37	238
06/05/2019	WDFS1	0.024	0.028	0.14	0.71	216.8	7.43	250
06/05/2019	WDFS1+100	0.009	0.009	0.08	0.54	259.9	7.57	246
13/05/2019	ETAU	0.452	0.488	0.08	2.71	106.4	7.15	299
13/05/2019	ETFSL200	0.171	0.208	0.06	0.93	254.6	7.48	290
13/05/2019	ETFSL500	0.261	0.273	0.29	1.74	241.2	7.57	322
13/05/2019	CONFLU1	0.057	0.063	0.07	0.88	249.5	7.61	269
13/05/2019	WARARM5	0.028	0.026	0.07	0.52	249.3	7.6	248
13/05/2019	WDFS1	0.034	0.031	0.05	0.85	243.4	7.61	260
13/05/2019	WDFS1+100	0.009	0.011	<0.05	0.58	243.9	7.71	265
20/05/2019	ETAU	0.432	0.49	<0.05	1.93	270.8	6.96	297
20/05/2019	ETFSL200	0.212	0.230	0.1	1.27	97.3	7.79	291
20/05/2019	ETFSL500	0.282	0.292	1.16	2.02	-17.1	7.63	331
20/05/2019	CONFLU1	0.076	0.092	0.1	1.12	68	7.76	286
20/05/2019	WARARM5	0.035	0.036	0.15	0.54	58.2	7.66	252
20/05/2019	WDFS1	0.027	0.028	0.2	0.72	27.9	7.43	266
20/05/2019	WDFS1+100	0.015	0.016	0.12	0.57	113.4	7.74	270
27/05/2019	ETAU	0.422	0.498	<0.05	2.26	169.8	7.02	301
27/05/2019	ETFSL200	0.240	0.239	0.11	1.06	286.4	7.45	293
27/05/2019	ETFSL500	0.292	0.276	1.14	1.92	286	7.51	334
27/05/2019	CONFLU1	0.06	0.053	0.07	0.69	151.2	7.63	271
27/05/2019	WARARM5	0.026	0.024	<0.05	0.49	278	7.47	254
27/05/2019	WDFS1	0.034	0.037	0.1	0.82	274.3	7.57	270
27/05/2019	WDFS1+100	0.013	0.013	0.06	0.52	284.6	7.76	271
05/06/2019	ETAU	0.295	0.28	0.66	2.05	127.4	7.15	228
03/06/2019	ETFSL200	0.237	0.245	0.09	1.34	84	7.63	316
03/06/2019	ETFSL500	0.325	0.339	1.31	2.4	23	7.71	358
03/06/2019	CONFLU1	0.093	0.099	0.06	0.78	54.6	7.87	308
03/06/2019	WARARM5	0.024	0.02	0.07	0.41	122.6	7.78	275
03/06/2019	WDFS1	0.056	0.057	0.39	1.68	80.4	7.78	290
03/06/2019	WDFS1+100	0.019	0.021	0.15	0.56	87.6	7.92	291

ATTACHMENT A (Continued)

Water Quality Data for Sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100

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)
11/06/2019	ETAU	0.0448	0.465	0.41	2.98	142.8	7.08	291
11/06/2019	ETFSL200	0.247	0.253	0.1	1.12	116.2	7.43	287
11/06/2019	ETFSL500	0.34	0.358	1.24	2.26	63.1	7.55	323
11/06/2019	CONFLU1	0.118	0.13	0.13	1.1	73.1	7.58	278
11/06/2019	WARARM5	0.026	0.024	0.05	0.45	82	7.55	234
11/06/2019	WDFS1	0.061	0.056	0.14	0.73	101.4	7.58	251
11/06/2019	WDFS1+100	0.035	0.03	<0.05	0.56	89.2	7.63	251
18/06/2019	ETAU	0.383	0.411	1.74	2.71	12.6	6.83	252
18/06/2019	ETFSL200	0.275	0.296	0.39	1.37	35.8	7.01	242
18/06/2019	ETFSL500	0.277	0.29	0.6	1.63	12.6	7.14	249
18/06/2019	CONFLU1	0.192	0.137	0.07	0.93	8.1	7.24	235
18/06/2019	WARARM5	0.019	0.014	<0.05	0.26	48.8	7.36	222
18/06/2019	WDFS1	0.088	0.092	0.11	0.73	3.4	7.25	229
18/06/2019	WDFS1+100	0.083	0.088	<0.05	0.71	13.9	7.26	226
25/06/2019	ETAU	0.369	0.377	2.13	3.62	-2.6	6.88	266
25/06/2019	ETFSL200	0.217	0.259	0.11	2.29	2.3	7.16	252
25/06/2019	ETFSL500	0.254	0.268	0.44	2.04	-28.1	7.22	266
25/06/2019	CONFLU1	0.076	0.09	<0.05	0.66	-7.1	7.4	246
25/06/2019	WARARM5	0.066	0.017	<0.05	0.35	4.7	7.43	236
25/06/2019	WDFS1	0.079	0.087	0.12	0.75	-9.4	7.38	241
25/06/2019	WDFS1+100	0.054	0.062	<0.05	0.64	-30.8	7.41	237
01/07/2019	ETAU	0.39	0.405	0.87	3.55	37.4	7.32	261
01/07/2019	ETFSL200	0.219	0.228	<0.05	1.47	20.7	7.21	247
01/07/2019	ETFSL500	0.275	0.372	0.85	2.78	-28.7	7.3	276
01/07/2019	CONFLU1	0.135	0.145	0.17	0.92	-10.8	7.45	250
01/07/2019	WARARM5	0.018	0.018	<0.05	0.37	5.3	7.51	226
01/07/2019	WDFS1	0.065	0.066	0.14	0.81	-13	7.39	234
01/07/2019	WDFS1+100	0.046	0.044	<0.05	0.6	-7.2	7.47	234
08/07/2019	ETAU	0.144	0.154	0.63	1.33	42.7	6.59	177
08/07/2019	ETFSL200	0.13	0.142	0.52	0.99	30.2	6.72	176
08/07/2019	ETFSL500	0.143	0.153	0.68	1.08	13	6.77	180
08/07/2019	CONFLU1	0.082	0.091	0.31	0.91	-32.7	7.01	191
08/07/2019	WARARM5	0.018	0.019	0.07	0.58	17.1	7.15	201
08/07/2019	WDFS1	0.082	0.089	0.36	0.94	1.5	6.98	190
08/07/2019	WDFS1+100	0.078	0.081	0.21	0.79	-5	7.01	188
15/07/2019	ETAU	0.268	0.266	1.11	2.05	-3.8	6.66	221
15/07/2019	ETFSL200	0.209	0.219	0.21	1.24	-4.9	6.76	218
15/07/2019	ETFSL500	0.241	0.256	0.56	1.8	-13.9	6.84	232
15/07/2019	CONFLU1	0.126	0.127	0.07	0.97	6.6	6.89	221
15/07/2019	WARARM5	0.023	0.017	<0.05	0.52	19.7	6.98	222
15/07/2019	WDFS1	0.086	0.097	0.05	0.95	15	6.9	215
15/07/2019	WDFS1+100	0.06	0.064	<0.05	0.78	-1.6	6.87	210
22/07/2019	ETAU	0.415	0.372	2.39	3.53	28.3	7.04	243
22/07/2019	ETFSL200	0.289	0.272	0.08	1.46	3.8	6.45	235
22/07/2019	ETFSL500	0.332	0.291	0.71	2.07	-38.1	6.65	254
22/07/2019	CONFLU1	0.168	0.153	0.06	0.84	10.3	6.66	233
22/07/2019	WARARM5	0.025	0.017	<0.05	0.44	9	6.66	222
22/07/2019	WDFS1	0.094	0.091	0.34	0.8	14	6.63	226
22/07/2019	WDFS1+100	0.071	0.061	0.26	0.61	-1.6	6.63	227

ATTACHMENT A (Continued)

Water Quality Data for Sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100

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)
29/07/2019	ETAU	0.348	0.363	0.22	2.06	53	6.3	315
29/07/2019	ETFSL200	0.234	0.25	0.07	1.4	56.1	6.41	311
29/07/2019	ETFSL500	0.301	0.348	1.37	2.58	-3.8	6.51	342
29/07/2019	CONFLU1	0.13	0.127	0.33	1.28	14.3	6.51	312
29/07/2019	WARARM5	0.029	0.018	0.1	0.38	36.1	6.52	291
29/07/2019	WDFS1	0.077	0.078	0.15	0.87	21.1	6.58	306
29/07/2019	WDFS1+100	0.044	0.044	0.11	0.55	13.7	6.48	302
05/08/2019	ETAU	0.387	0.371	0.72	3.36	34	6.35	323
05/08/2019	ETFSL200	0.247	0.259	0.13	1.47	16.2	6.5	317
05/08/2019	ETFSL500	0.304	0.319	1.34	2.2	-8.3	6.67	354
05/08/2019	CONFLU1	0.104	0.107	0.13	0.74	4.1	6.64	311
05/08/2019	WARARM5	0.019	0.016	0.08	0.37	1.6	6.63	291
05/08/2019	WDFS1	0.061	0.055	0.43	0.86	5.9	6.61	299
05/08/2019	WDFS1+100	0.041	0.038	0.11	0.52	32.5	6.54	305
12/08/2019	ETAU	0.405	0.402	1.42	3.6	29	6.45	292
12/08/2019	ETFSL200	0.249	0.240	0.16	1.38	69.3	6.22	287
12/08/2019	ETFSL500	0.317	0.306	1.52	2.48	13.1	6.35	314
12/08/2019	CONFLU1	0.104	0.108	0.13	0.7	32.9	6.34	283
12/08/2019	WARARM5	0.016	0.013	0.09	0.38	47.9	6.32	263
12/08/2019	WDFS1	0.052	0.052	0.1	0.58	37.6	6.26	275
12/08/2019	WDFS1+100	0.028	0.035	0.13	1.65	11.2	6.35	275
19/08/2019	ETAU	0.425	0.461	1.34	3.64	14	6.29	297
19/08/2019	ETFSL200	0.242	0.264	0.12	1.37	143	6.47	290
19/08/2019	ETFSL500	0.314	0.334	1.3	2.36	-36.1	6.65	319
19/08/2019	CONFLU1	0.106	0.116	0.08	0.71	-16.8	6.62	290
19/08/2019	WARARM5	0.016	0.016	0.08	0.31	7.7	6.43	267
19/08/2019	WDFS1	0.042	0.051	0.1	0.63	-25.6	6.64	279
19/08/2019	WDFS1+100	0.017	0.021	0.12	0.52	-0.5	6.61	279
26/08/2019	ETAU	0.434	0.498	1.56	4.11	2.7	6.93	321
26/08/2019	ETFSL200	0.249	0.267	0.28	1.32	40.1	7.16	317
26/08/2019	ETFSL500	0.297	0.345	1.28	2.66	-33.7	7.21	358
26/08/2019	CONFLU1	0.106	0.115	0.26	1.0	-29	7.36	316
26/08/2019	WARARM5	0.016	0.023	0.17	0.64	-26.1	7.32	287
26/08/2019	WDFS1	0.047	0.051	0.19	0.63	-43.4	7.39	306
26/08/2019	WDFS1+100	0.021	0.038	0.14	0.7	-12.2	7.42	304

Sustainable Minerals Institute

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Director

Professor Neville Plint

CRICOS PROVIDER NUMBER 000258

20 January 2020

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 – September 2019

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 Longwall 304 Water Management Plan (LW304 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 LW304 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 LW304 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 LW304 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 LW304 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.

Analysis conducted by Hydro Engineering & Consulting (2019) in accordance with the LW304 WMP, identified that the performance indicator for water resources reaching the Woronora Reservoir was exceeded for dissolved (i.e. filtered <0.45 µm fraction) manganese and dissolved iron on the Eastern Tributary at site ETWQ AU in September 2019 (as there was not a similar exceedance of the trigger recorded at control site WOWQ 2 on the Woronora River). The performance indicator was not exceeded for field filtered aluminium in September 2019 and therefore this parameter is not discussed in this report.

In accordance with the LW304 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*.

This assessment against the water quality subsidence impact performance measure has been prepared for September 2019 in consideration of:

- pluviograph data;
- flow data from the Eastern Tributary gauging location (GS 300078);
- groundwater level and groundwater quality results for Eastern Tributary sites up to 30 September 2019¹;
- surface water quality data at site ETWQ AU/ETAU² and sites further upstream on the Eastern Tributary up to 30 September 2019;
- surface water quality data at sites downstream of ETWQ AU/ETAU² up to 30 September 2019; 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 2018, above average rainfall has only been recorded in October 2018, November 2018, December 2018 and now September 2019, with below average rainfall recorded in all other months (Table 1).

Total rainfall in September 2019 was 162.5 mm, above the average rainfall at Darkes Forest (77.2 mm), with the majority of the rainfall occurring in a single event over 17 to 21 September 2019 (totalling 161 mm rainfall, with the majority [92.0 mm] falling on 19 September) and additional rainfall events recorded on 1 and 23 September 2019 (1.5 mm). Shallow groundwater levels correlate with the rainfall trend.

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

² Site ETAU is the same as site ETWQ AU (i.e. samples are taken at the same location). The difference between the sites relates to the time of sampling. Site ETWQ AU monitoring is conducted on the same day as sites upstream of ETWQ AU/ETAU (shown on Charts 1 to 2), while site ETAU monitoring is conducted on the same day as the sites downstream of ETWQ AU/ETAU (described in Section 3 and shown on Charts 3 to 4). From 29 January 2019, water quality sampling of all sites on the Eastern Tributary was undertaken in a single day. Future reporting will identify the data at this site as site ETWQ AU.

Table 1 Monthly Rainfall Data (mm) for PV7, January 2018 to September 2019

Month/Year	Rainfall at PV7 (mm)	Rainfall at Darkes Forest (mm) [#]	Mean Monthly Rainfall at Darkes Forest (1894-2019) (mm) [#]
January 2018	48.0	12.0	132.4
February 2018	115.5	16.6	159.6
March 2018	151.0	45.0	153.9
April 2018	32.0	21.6	126.8
May 2018	12.5	8.0	129.1
June 2018	112.0	91.8	146.6
July 2018	3.5	0.4	96.4
August 2018	12.5	15.8	89.1
September 2018	52.0	41.8	76.6
October 2018	197.0	200.8	91.9
November 2018	114.5	127.8	105.4
December 2018	120.0	91.0	103.8
January 2019	58.5	55.4	131.8
February 2019	41.0	54.2	158.7
March 2019	149.0	201.2	154.3
April 2019	35.0	46.0	126.1
May 2019	8.5	8.0	128.1
June 2019	115.5	47.4	145.8
July 2019	56.0	46.4	96.0
August 2019	53.0	58.8	88.9
September 2019	162.5	150.2	77.2

[#] 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 September 2019.

2. EASTERN TRIBUTARY SURFACE WATER AND GROUNDWATER QUALITY DATA

2.1 Dissolved Manganese

Plots of dissolved manganese at surface water quality sites ETWQ AU, ETWQ AQ (upstream on the Eastern Tributary) and WOWQ 2 (control site) and at groundwater quality site ETGW2, are compared to rainfall at PV7 (Chart 1) and streamflow at GS 300078 (Chart 2) (Figure 1).

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.

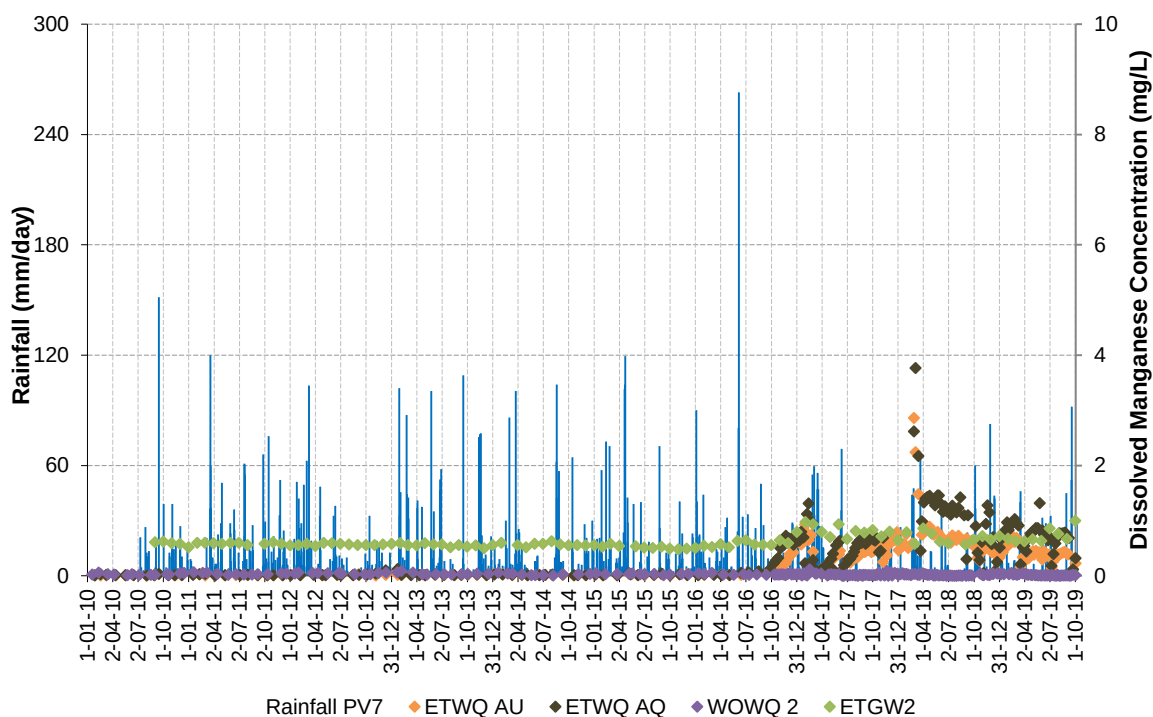


Chart 1 Dissolved Manganese Concentrations at Surface Water Quality Sites ETWQ AU, ETWQ AQ and WOWQ 2 and Groundwater Quality Site ETGW2 and Rainfall (to 30 September 2019)

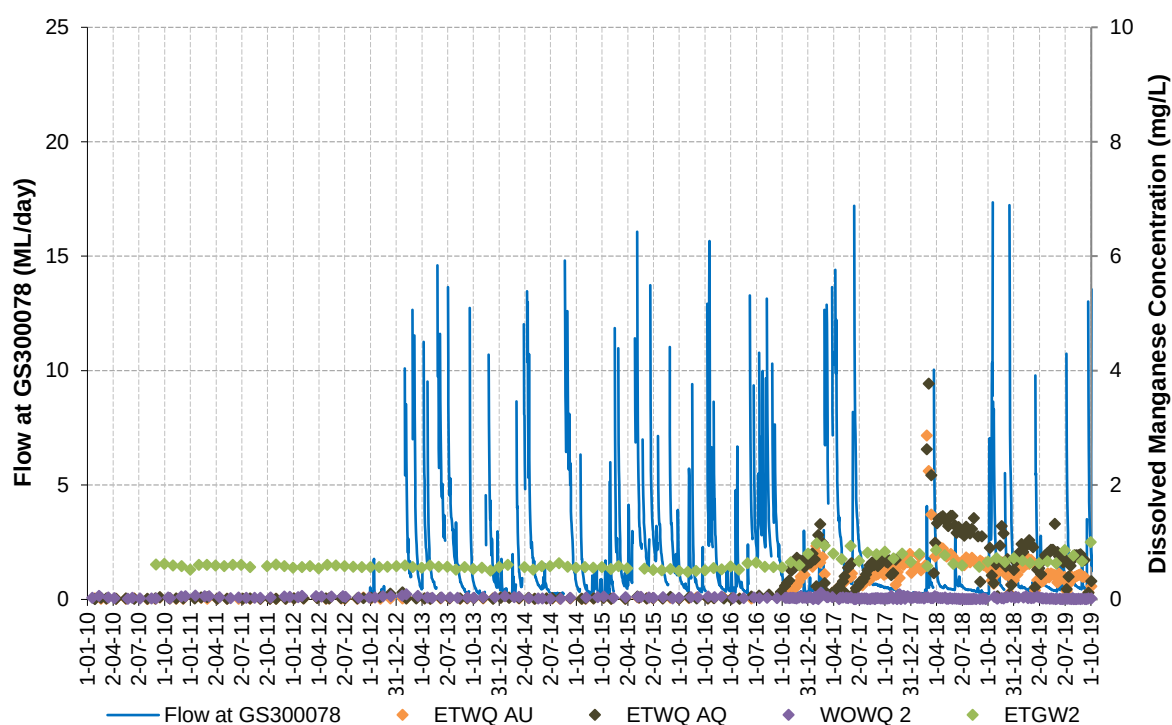
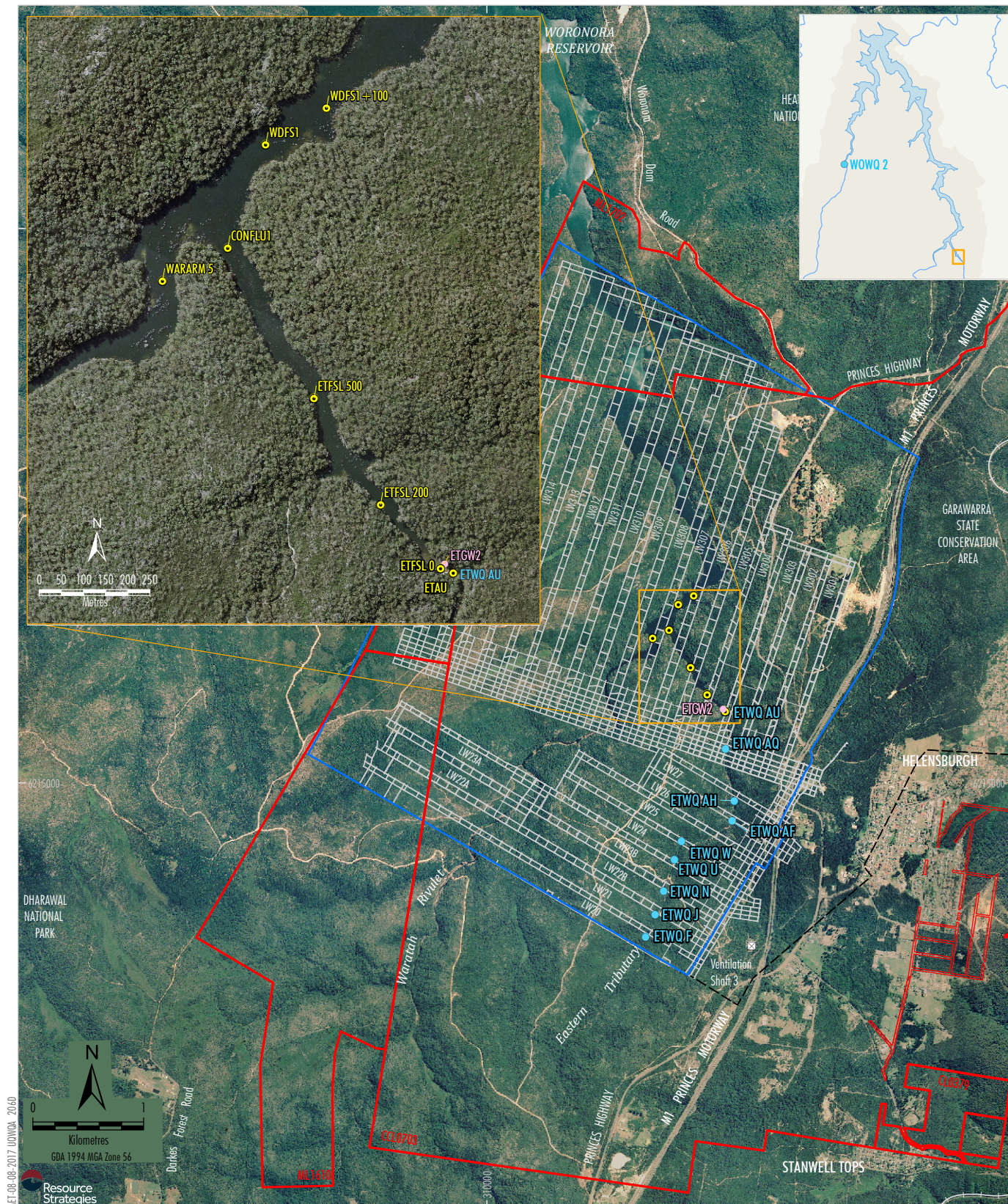


Chart 2 Dissolved Manganese Concentrations at Surface Water Quality Sites ETWQ AU, ETWQ AQ and WOWQ 2 and Groundwater Quality Site ETGW2 and Stream Flow (to 30 September 2019)



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 on Eastern Tributary
- Water Quality Site on Eastern Tributary and/or in Woronora Reservoir
- Groundwater Quality Site of Eastern Tributary

Peabody
METROPOLITAN COAL

Surface Water Quality Sampling of
Eastern Tributary Watercourse
and Woronora Reservoir

Figure 1

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. <0.1 mg/L, exist in the natural creek water. Dissolved manganese is easily diluted by freshwater flow to low levels when higher creek flows occur.

In September 2019, dissolved manganese concentrations at site ETWQ AU ranged between 0.045 mg/L and 0.394 mg/L. 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. The dilution of dissolved manganese concentrations during high flows was also evident as a result of the rainfall event observed over 17 to 21 September, which increased flows in the Eastern Tributary and resulted in the dissolved manganese concentration dropping to the lowest level recorded since October 2016. Concentrations subsequently increased, but remained notably lower than those recorded prior to the rainfall event.

2.2 Dissolved Iron

Plots of dissolved iron at surface water quality sites ETWQ AU, ETWQ AQ (upstream on the Eastern Tributary) and WOWQ 2 (control site) and at groundwater quality site ETGW2, are compared to rainfall at PV7 (Chart 3) and streamflow at GS 300078 (Chart 4).

Similar to manganese, reducing conditions in the groundwater has solubilised iron. The groundwater quality data for site ETGW2 are indicative of the dissolved iron concentrations in the groundwater (Charts 3 and 4). The soluble iron (iron (II) ion, Fe^{2+}), rapidly oxidises to iron (III) Fe^{3+} , and forms insoluble hydrated ferric hydroxide in colloidal (<0.45 μm) and particulate (>0.45 μm) forms. This results in an increase in dissolved iron (if colloidal, i.e. able to pass through a 0.45 μm membrane filter) concentrations in the Eastern Tributary when the flows return to the surface. This is evident on Charts 3 and 4 where the concentration of dissolved iron is higher upstream of site ETWQ AU (e.g. at site ETWQ AQ) where cracking and flow diversion has occurred.

Iron is most stable under oxidising conditions (ORP > 50 mV) as insoluble hydrated ferric hydroxide in colloidal (<0.45 μm) and particulate (>0.45 μm) forms, until it deposits into sediment or on sandstone surfaces, but its concentration is not lowered by dilution. Instead, particulate or colloidal iron, both insoluble forms, is dispersed in the water column by creek flow.

Iron oxidising bacteria can also create oxidised iron precipitate (ADWG, 2011). The iron floc provided is a mixture of precipitated iron oxyhydroxide material $>0.45 \mu\text{m}$ size and colloidal material which is $<0.45 \mu\text{m}$ size. The colloidal material also coagulates to give the larger size precipitated material and coats the creek bed rock surfaces. The iron oxyhydroxide gradually converts to goethite (Yee *et al.* 2006) which has a darker colour and is commonly found in the creek sediment. The transported material becomes part of the sediment.

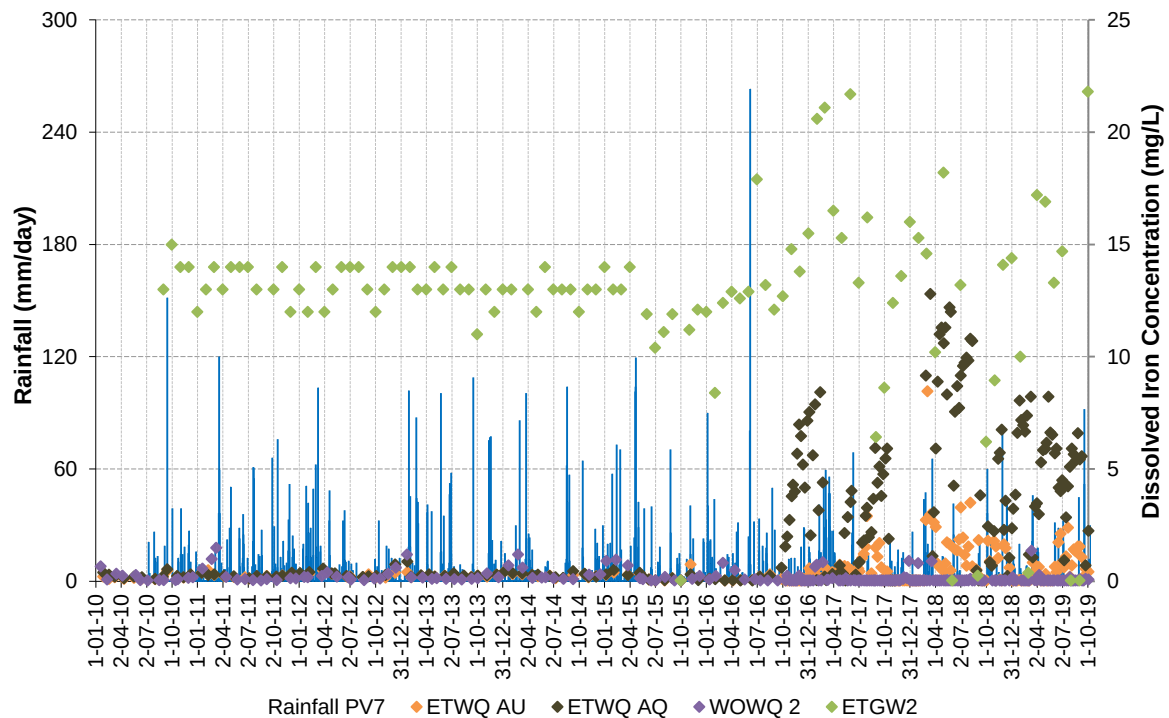


Chart 3 Dissolved Iron Concentrations at Surface Water Quality Sites ETWQ AU, ETWQ AQ and WOWQ 2 and Groundwater Quality Site ETGW2 and Rainfall (to 30 September 2019)

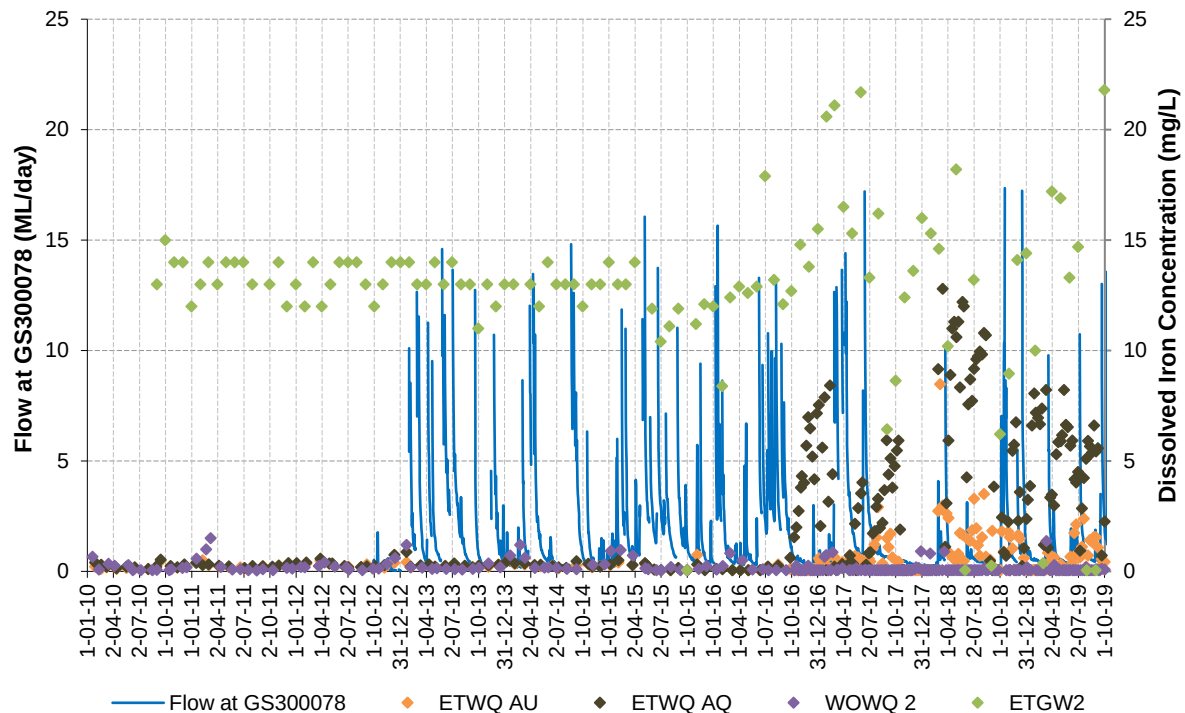


Chart 4 Dissolved Iron Concentrations at Surface Water Quality Sites ETWQ AU, ETWQ AQ and WOWQ 2 and Groundwater Quality Site ETGW2 and Stream Flow (to 30 September 2019)

Plots of dissolved iron at site ETWQ AU compared to rainfall at PV7 (Chart 3) and streamflow at GS300078 (Chart 4) show that concentrations in September 2019 ranged between 0.25 mg/L and 1.55 mg/L.

2.3 Other Water Quality Parameters

Water quality parameters pertinent to the increase in manganese and iron (dissolved-filtered <0.45 μm fraction) concentration are pH, oxidation-reduction potential (ORP) and electrical conductivity (EC). 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 oxidizing and becomes reducing when ORP is below approximately 10 mV.

In September 2019 at site ETWQ AU:

- pH (lab measurement) was generally consistent (pH 6.08 to pH 8.48);
- EC concentrations (lab measurement) ranged between 128 $\mu\text{S}/\text{cm}$ and 314 $\mu\text{S}/\text{cm}$; and
- ORP (field measurement) ranged between 1.2 mV and 108.8 mV.

3. WATER RESOURCES REACHING THE WORONORA RESERVOIR

In accordance with the LW304 WMP, site ETWQ AU on the Eastern Tributary and control site WOWQ 2 on the Woronora River are used to assess the LW304 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. 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.

Metropolitan Coal has taken a photographic record of the watercourse / waterbody at the time of sampling, estimated the width of the watercourse / water body 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 (HCPL, 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 September 2019 the Woronora Reservoir water level varied between 152.4 mAHD (on 12 September 2019) and 153 mAHD (on 26 September 2019) (water level increased slightly). The position of the reservoir water level can only be determined to the closest one metre contour, accordingly, the reservoir water level during September 2019 was approximately 3,490 m (corresponding to 152 mAHD and 153 mAHD) downstream of site ETSFL 0.

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 September 2019, the Woronora Reservoir water level was downstream of site WDFS1+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 January 2018 to September 2019 at sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400 and ETFSL 500 is provided in Attachment A. As described earlier, sampling at sites ETFSL 100, ETSFL 300 and ETFSL 400 was suspended once monitoring at sites CONFLU1, WARARM5, WDFS1 and WDFS1+100 commenced on 22 November 2018³. Water quality data for filtered and total manganese since sampling commenced on 22 November 2018 at sites CONFLU1, WARARM5, WDFS1 and WDFS1+100 is also provided in Attachment A.

As described above, the Woronora Reservoir water level increased slightly in September 2019, and was downstream of site WDFS1+100. The results for dissolved and total manganese at sites ETAU, ETFSL 200, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100 since the commencement of monitoring to the end of September 2019, are shown on Charts 5 and 6, respectively. These sites provide a profile along the arm of the Woronora Reservoir.

The filtered manganese concentrations for September 2019 ranged from 0.045 mg/L to 0.394 mg/L at site ETAU, 0.046 mg/L to 0.233 mg/L at site ETFSL 200, 0.048 mg/L to 0.304 mg/L at site ETFSL 500, 0.058 mg/L to 0.179 mg/L at site CONFLU1, 0.016 mg/L to 0.056 mg/L at site WARARM5, 0.025 mg/L to 0.074 mg/L at site WDFS1 and 0.01 mg/L to 0.086 mg/L at site WDFS1+100 (Chart 5).

Total manganese concentrations for September 2019 followed similar trends, ranging from 0.052 mg/L to 0.427 mg/L at site ETAU, 0.054 mg/L to 0.235 mg/L at site ETFSL 200, 0.059 mg/L to 0.297 mg/L at site ETFSL 500, 0.068 mg/L to 0.139 mg/L at site CONFLU1, 0.013 mg/L to 0.068 mg/L at site WARARM5, 0.025 mg/L to 0.075 mg/L at site WDFS1 and 0.01 mg/L to 0.089 mg/L at site WDFS1+100 (Chart 6).

³ Sampling at site ETAU was also temporarily suspended during this period but was resumed on 12 December 2018. Data from sampling undertaken at site ETWQ AU has been substituted for site ETAU during this period. Sampling at site ETAU was undertaken on 12 and 27 December 2018.

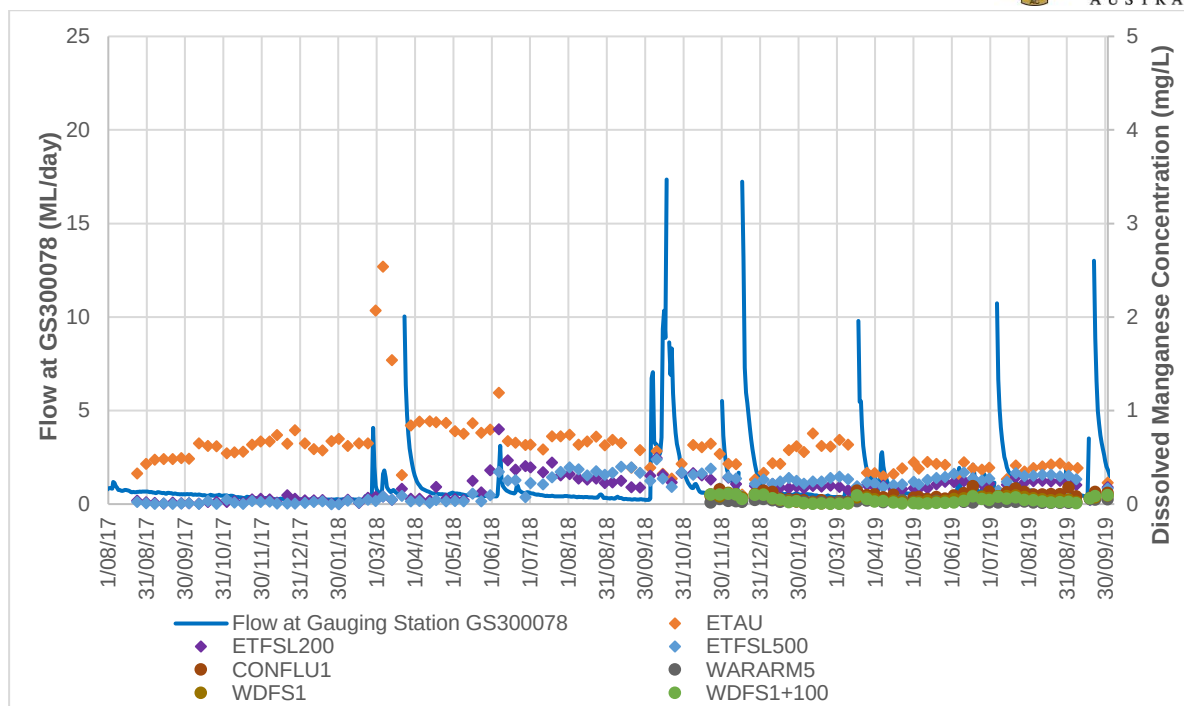


Chart 5 Dissolved Manganese Concentrations at Surface Water Quality Sites ETAU⁴, ETFSL 200, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100 and Stream Flow (August 2017 to 30 September 2019)

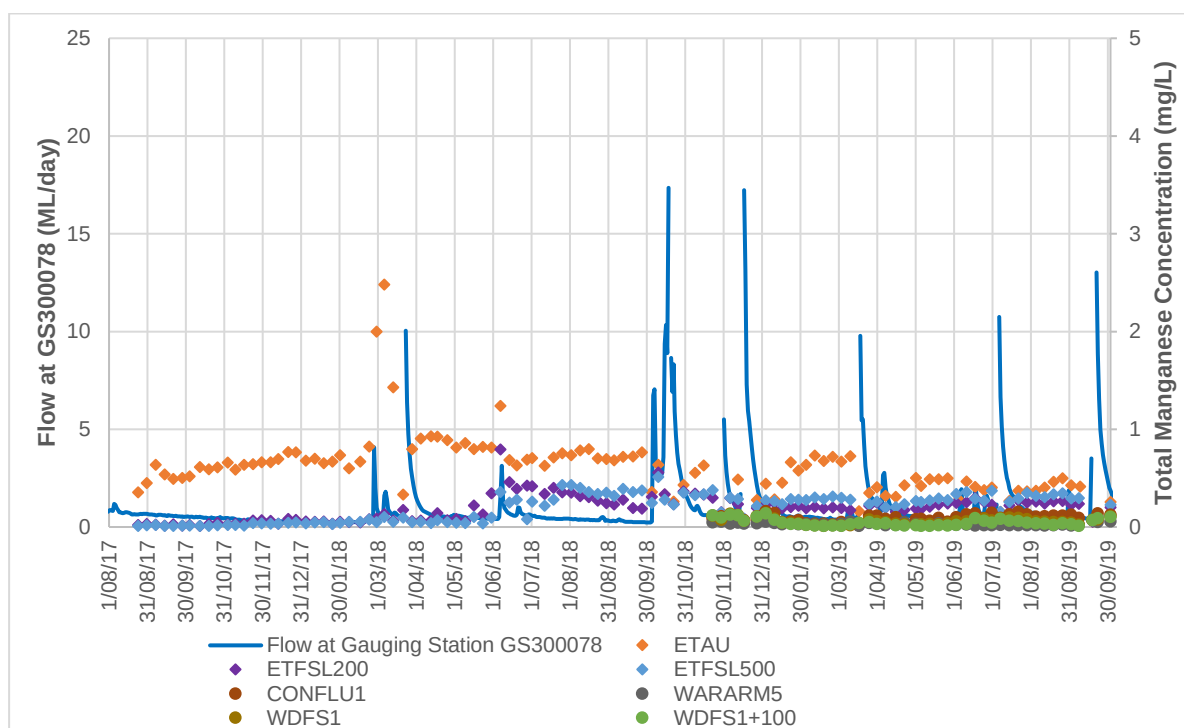


Chart 6 Total Manganese Concentrations at Surface Water Quality Sites ETAU⁵, ETFSL 200, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100 and Stream Flow (August 2017 to 30 September 2019)

⁴ Data from sampling undertaken at site ETWQ AU has been substituted for site ETAU from 22 November to 6 December 2018 and 17 December 2018. Sampling at site ETAU was undertaken on 12 and 27 December 2018.

⁵ Total manganese is not sampled at site ETWQ AU, and therefore results were unable to be substituted for site ETAU from 22 November to 6 December 2018 and 17 December 2018. Sampling at site ETAU was undertaken on 12 and 27 December 2018.

The Australian Drinking Water Guidelines (ADWG, 2011) are published by the National Health and Medical Research Council and updated most recently in 2018; 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 Australian Drinking Water Guideline before being supplied to the Helensburgh area as well as parts of the Sutherland Shire and northern Wollongong (WaterNSW, 2017).

The ADWG (2011) guidelines are based on total concentrations of manganese in water. The ADWG value is 0.5 mg/L total manganese for health. 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 5 and 6).

4.2 Dissolved Iron

The results for filtered and total iron at sites ETAU, ETFSL 200, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100 for August 2017 to September 2019, are shown on Charts 7 and 8, respectively.

The filtered iron concentrations in September 2019 ranged from 0.25 mg/L to 1.55 mg/L at site ETAU, <0.05 mg/L to 0.41 mg/L at site ETFSL 200, 0.27 mg/L to 1.08 mg/L at site ETFSL 500, <0.05 mg/L to 0.35 mg/L at site CONFLU1, <0.05 mg/L to 0.21 mg/L at site WARARM5, <0.05 mg/L to 0.25 mg/L at site WDFS1 and <0.05 mg/L to 0.27 mg/L at site WDFS1+100 (Chart 7).

Total iron concentrations in September 2019 ranged from 0.7 mg/L to 3.69 mg/L at site ETAU, 0.73 mg/L to 1.58 mg/L at site ETFSL 200, 0.88 mg/L to 2.04 mg/L at site ETFSL 500, 0.72 mg/L to 1.17 mg/L at site CONFLU1, 0.3 mg/L to 0.77 mg/L at site WARARM5, 0.49 mg/L to 0.75 mg/L at site WDFS1 and 0.47 mg/L to 0.68 mg/L at site WDFS1+100 (Chart 8).

The ADWG (2011) guidelines for iron in water are based on total concentrations. The ADWG value for iron is 0.3 mg/L for aesthetic considerations (precipitation of iron from solution and taste). No health-based guideline value has been set for iron. As the iron oxyhydroxide precipitates and converts to goethite it will likely become part of the reservoir sediment material with little likelihood of affecting the Woronora Reservoir water supply.

4.3 Other Water Quality Parameters

Water quality data for parameters pertinent to dissolved manganese for January 2018 to September 2019 at sites ETAU, ETFSL 200, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100 is provided in Attachment A. The water quality parameters (pH, ORP and EC) showed no unusual features.

The ADWG value for pH (aesthetic) is 6.5 – 8.5. Between 26 August and 2 September 2019, the pH value at site ETWQ AU increased to 8.48 from 6.93, indicating addition of salinity and alkalinity, before falling steadily over the rest of the month to 6.08 on 23 September 2019. The pH values at all other sites (i.e. ETFSL 200, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100) fluctuated during September 2019, starting slightly below 6.5, increasing to approximately 7.5, before dropping to approximately 6.1 after the rainfall event starting on 17 September (Attachment A). The pH values at all sites were below the ADWG range at the end of September 2019.

The pH of creek water following limited rain events may fluctuate slightly because dry iron oxyhydroxide in contact with water undergoes hydrolysis. However, the significant rainfall event recorded in September showed that significant natural creek flow restores pH to consistent values.

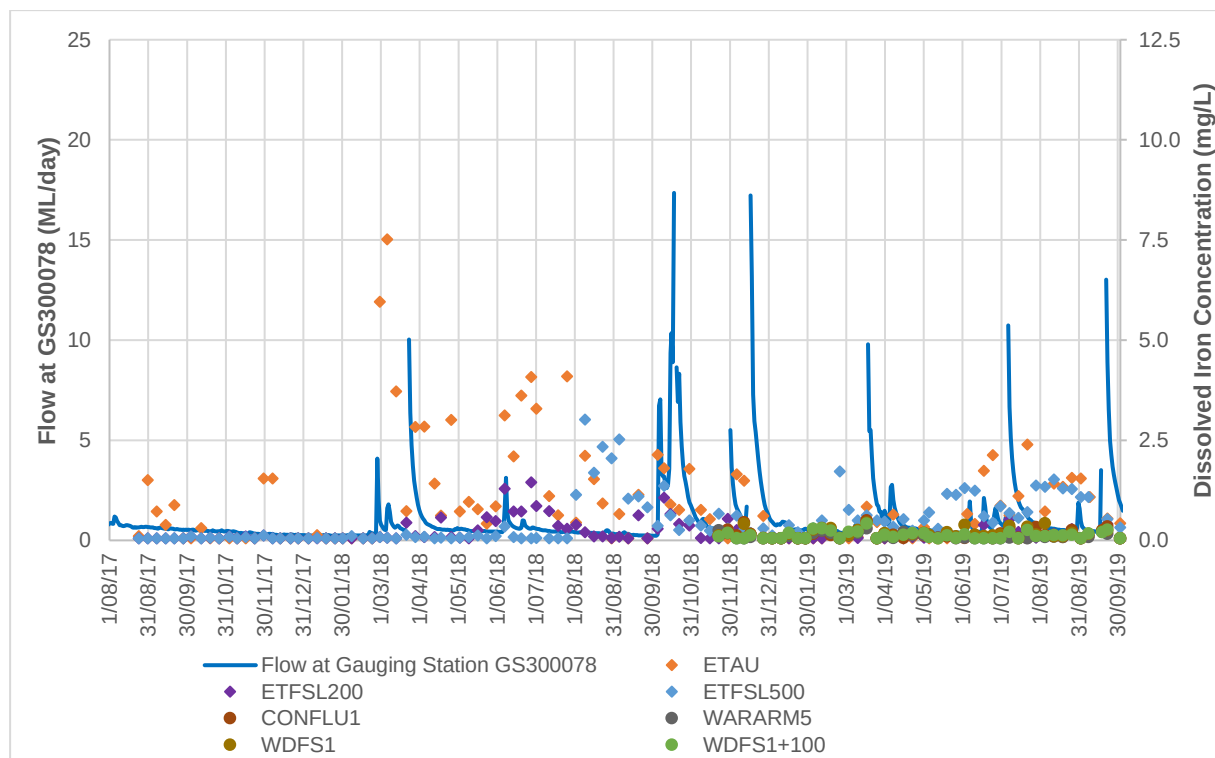


Chart 7 Dissolved Iron Concentrations at Surface Water Quality Sites ETAU, ETFSL 200, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100 and Stream Flow (August 2017 to 30 September 2019)

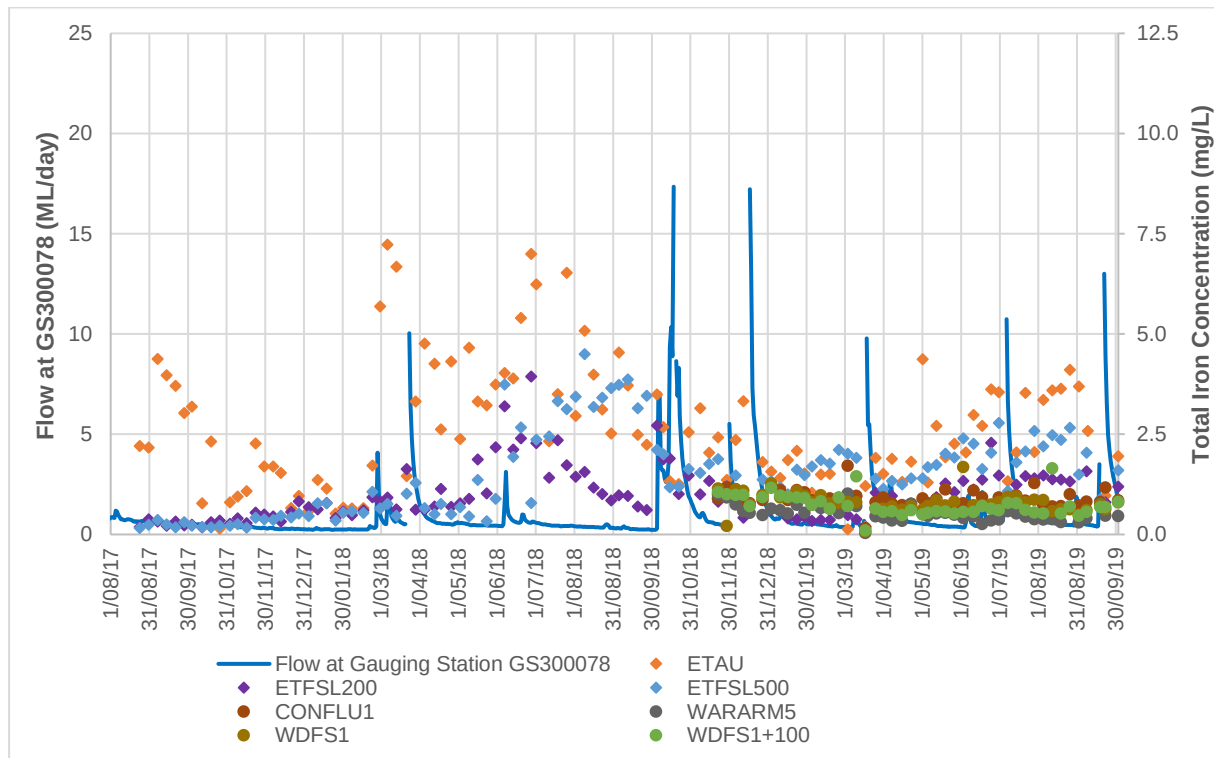


Chart 8 Total Iron Concentrations at Surface Water Quality Sites ETAU, ETFSL 200, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100 and Stream Flow (August 2017 to 30 September 2019)

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 and dissolved iron at site ETWQ AU on the Eastern Tributary in September 2019, which has triggered 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.

The soluble iron rapidly oxidises to iron (III) Fe^{3+} , and forms insoluble iron oxyhydroxide in colloidal ($<0.45 \mu\text{m}$) and particulate ($>0.45 \mu\text{m}$) forms, giving dissolved iron concentrations down to $<0.05 \text{ mg/L}$ in Woronora Reservoir. While the heavy rainfall increased flow in the Eastern Tributary sufficiently to dilute dissolved manganese at ETWQ AU to below 0.5 mg/L and demonstrated that the high dissolved manganese can be diluted by creek flow, the situation with dissolved and particulate iron is different. The climatically-dry period resulted in high dissolved iron concentrations from groundwater seepage being evaporated and becoming an orange-yellow coating on the bed rock surface. High rainfall can wash away loosely bound insoluble iron floc material and disperse the very fine colloidal material as a floc suspension which may be visible downstream.

Comparison of the photographic records for September 2019, show mild turbidity below ETAU at the start of September 2019 due to the lack of rainfall, but after the major rainfall event mid-September, the water was clear and a reduction in the presence of orange-yellow coating on the bed rock surfaces of the sites was observed. The presence of orange-yellow coating on the creek sediment surface will darken with time as conversion to goethite occurs.

Water reaching the Woronora Reservoir occurs where the inflowing stream water meets the reservoir waterbody. In September 2019, the Woronora Reservoir water level was downstream of site WDFS1+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 and iron concentrations reaching the Woronora Reservoir have 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.

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

ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, WARARM5, CONFLU1, WDFS1 and
WDFS1+100

JANUARY 2018 TO SEPTEMBER 2019

ATTACHMENT A

Water Quality Data for Sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100

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)
4/01/2018	ETAU	0.652	0.678	<0.05	0.59	132	7.37	351
4/01/2018	ETFSL100	0.281	0.305	<0.05	0.82	125.3	7.75	337
4/01/2018	ETFSL200	0.042	0.057	<0.05	0.68	132.7	7.05	118
4/01/2018	ETFSL300	0.038	0.052	0.06	0.6	13.2	6.92	111
4/01/2018	ETFSL400	0.024	0.037	<0.05	0.47	129.9	6.96	110
4/01/2018	ETFSL500	0.016	0.036	<0.05	0.46	121.7	6.74	111
11/01/2018	ETAU	0.588	0.698	0.13	1.36	55.9	7.56	364
11/01/2018	ETFSL100	0.197	0.237	<0.05	0.55	24.3	7.88	345
11/01/2018	ETFSL200	0.041	0.053	<0.05	0.63	101	7.14	139
11/01/2018	ETFSL300	0.067	0.078	1.89	2.1	35.2	6.88	128
11/01/2018	ETFSL400	0.106	0.052	0.47	0.66	52	6.84	124
11/01/2018	ETFSL500	0.026	0.046	0.06	0.78	94.4	7.01	122
18/01/2018	ETAU	0.577	0.653	<0.05	1.15	136.4	7.67	366
18/01/2018	ETFSL100	0.211	0.22	<0.05	0.64	131.9	7.74	353
18/01/2018	ETFSL200	0.046	0.055	<0.05	0.79	131.2	7	129
18/01/2018	ETFSL300	0.058	0.057	0.06	0.84	125.5	6.94	126
18/01/2018	ETFSL400	0.038	0.048	<0.05	0.71	139.6	6.96	125
18/01/2018	ETFSL500	0.032	0.049	<0.05	0.78	121.4	6.94	123
25/01/2018	ETAU	0.674	0.668	<0.05	0.52	56.8	7.55	378
25/01/2018	ETFSL100	0.074	0.152	<0.05	0.46	-4.4	7.82	360
25/01/2018	ETFSL200	0.007	0.034	<0.05	0.41	70.6	7.16	120
25/01/2018	ETFSL300	0.005	0.035	<0.05	0.46	22.8	7.09	117
25/01/2018	ETFSL400	0.001	0.032	<0.05	0.41	55	7	118
25/01/2018	ETFSL500	0.002	0.03	<0.05	0.35	288.6	7.04	115
31/01/2018	ETAU	0.7	0.734	<0.05	0.67	82.3	7.46	374
31/01/2018	ETFSL100	0.089	0.147	<0.05	0.36	30.7	8.01	361
31/01/2018	ETFSL200	0.005	0.052	<0.05	0.57	79.1	7.28	139
31/01/2018	ETFSL300	0.002	0.049	<0.05	0.66	42.7	7.08	123
31/01/2018	ETFSL400	0.001	0.046	<0.05	0.54	92	7.05	122
31/01/2018	ETFSL500	0.001	0.044	<0.05	0.55	71	7.01	122
7/02/2018	ETAU	0.625	0.601	<0.05	0.65	106.9	7.39	374
7/02/2018	ETFSL100	0.102	0.129	<0.05	0.75	14.8	7.78	359
7/02/2018	ETFSL200	0.047	0.051	<0.05	0.48	80.4	7.04	119
7/02/2018	ETFSL300	0.049	0.059	<0.05	0.65	38.2	6.97	119
7/02/2018	ETFSL400	0.112	0.07	0.27	0.74	1	6.77	118
7/02/2018	ETFSL500	0.038	0.053	0.11	0.58	86.6	6.92	117
16/02/2018	ETAU	0.65	0.67	<0.05	0.66	158.8	7.54	380
16/02/2018	ETFSL100	0.075	0.126	<0.05	0.33	163.9	7.96	369
16/02/2018	ETFSL200	0.016	0.048	<0.05	0.6	152	7.05	128
16/02/2018	ETFSL300	0.023	0.058	<0.05	0.81	121.1	6.88	124
16/02/2018	ETFSL400	0.012	0.049	<0.05	0.54	143.2	6.83	121
16/02/2018	ETFSL500	0.019	0.054	<0.05	0.54	144.1	6.82	120
23/02/2018	ETAU	0.651	0.822	<0.05	1.72	163.6	7.21	400
23/02/2018	ETFSL100	0.12	0.2	<0.05	0.5	31.8	7.75	384
23/02/2018	ETFSL200	0.068	0.078	<0.05	0.93	55.8	6.92	140
23/02/2018	ETFSL300	0.065	0.07	0.07	0.88	55.2	6.8	136
23/02/2018	ETFSL400	0.062	0.075	<0.05	0.93	41.8	6.78	135
23/02/2018	ETFSL500	0.049	0.075	<0.05	1.07	-119.2	6.78	132

ATTACHMENT A (Continued)
Water Quality Data for Sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100

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)
1/03/2018	ETAU	2.07	2	5.96	5.69	83.1	6.32	492
1/03/2018	ETFSL100	1.78	1.72	2.41	2.7	36.7	6.31	464
1/03/2018	ETFSL200	0.08	0.087	0.08	0.83	59	6.45	133
1/03/2018	ETFSL300	0.059	0.069	0.16	0.79	43.5	6.36	127
1/03/2018	ETFSL400	0.05	0.064	0.1	1.03	32	6.35	125
1/03/2018	ETFSL500	0.036	0.051	0.08	0.65	2.3	6.38	123
7/03/2018	ETAU	2.54	2.48	7.52	7.23	168.1	6.12	514
7/03/2018	ETFSL100	2.21	2.15	4.12	4.43	158.6	6.11	479
7/03/2018	ETFSL200	0.082	0.132	0.07	0.92	166.8	6.29	147
7/03/2018	ETFSL300	0.108	0.12	<0.05	0.91	149	6.32	147
7/03/2018	ETFSL400	0.088	0.11	<0.05	0.78	161.1	6.79	142
7/03/2018	ETFSL500	0.083	0.102	0.07	0.76	154.5	6.32	138
14/03/2018	ETAU	1.54	1.43	3.72	6.68	41.4	6.58	450
14/03/2018	ETFSL100	0.907	1.08	0.55	3.58	31.6	6.95	431
14/03/2018	ETFSL200	0.047	0.066	<0.05	0.63	76	6.84	135
14/03/2018	ETFSL300	0.048	0.054	<0.05	0.56	41.4	6.83	133
14/03/2018	ETFSL400	0.064	0.055	0.06	0.61	3.3	6.86	132
14/03/2018	ETFSL500	0.047	0.052	<0.05	0.47	21.9	6.79	131
22/03/2018	ETAU	0.312	0.33	0.73	1.46	229.3	5.24	237
22/03/2018	ETFSL100	0.362	0.363	0.71	1.69	182.9	5.08	240
22/03/2018	ETFSL200	0.166	0.173	0.44	1.63	71.9	6.51	160
22/03/2018	ETFSL300	0.118	0.118	0.28	1.33	70.6	6.54	153
22/03/2018	ETFSL400	0.146	0.136	0.8	1.66	22.8	6.61	152
22/03/2018	ETFSL500	0.091	0.095	0.14	1.02	32.6	6.65	144
29/03/2018	ETAU	0.841	0.798	2.83	3.32	148	6.66	341
29/03/2018	ETFSL100	0.732	0.729	1.87	2.6	40.9	6.63	332
29/03/2018	ETFSL200	0.058	0.059	0.11	0.62	84.2	6.65	131
29/03/2018	ETFSL300	0.047	0.053	0.08	0.59	65.9	6.64	131
29/03/2018	ETFSL400	0.051	0.055	0.08	0.74	71.4	6.64	130
29/03/2018	ETFSL500	0.033	0.051	0.08	1.29	27.3	6.68	128
5/4/2018	ETAU	0.885	0.904	2.84	4.76	182.7	6.57	384
5/4/2018	ETFSL100	0.674	0.672	0.73	2.41	191.7	6.67	374
5/4/2018	ETFSL200	0.058	0.067	0.08	0.62	211.9	6.32	142
5/4/2018	ETFSL300	0.044	0.058	0.07	0.57	209.4	6.37	142
5/4/2018	ETFSL400	0.04	0.058	0.13	0.77	209.1	6.39	141
5/4/2018	ETFSL500	0.035	0.054	0.09	0.66	205.9	6.4	141
13/4/2018	ETAU	0.888	0.927	1.42	4.26	156.2	6.76	391
13/4/2018	ETFSL100	0.614	0.651	0.13	2.46	172.9	6.92	382
13/4/2018	ETFSL200	0.042	0.065	0.08	0.7	42.8	6.84	153
13/4/2018	ETFSL300	0.033	0.051	0.05	0.5	40.9	6.52	145
13/4/2018	ETFSL400	0.023	0.048	<0.05	0.59	64.1	6.6	147
13/4/2018	ETFSL500	0.014	0.04	<0.05	0.51	58.6	6.61	142
18/4/2018	ETAU	0.875	0.925	0.62	2.62	192.1	6.77	397
18/4/2018	ETFSL100	0.614	0.636	0.13	2.27	192.3	7.19	390
18/4/2018	ETFSL200	0.184	0.14	0.57	1.14	184.8	6.75	178
18/4/2018	ETFSL300	0.059	0.074	0.08	0.86	186.3	6.81	162
18/4/2018	ETFSL400	0.05	0.069	<0.05	0.64	181.3	6.76	159
18/4/2018	ETFSL500	0.044	0.071	0.07	0.76	185.5	6.76	160

ATTACHMENT A (Continued)
Water Quality Data for Sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100

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)
26/4/2018	ETAU	0.871	0.887	3.01	4.32	7.2	7.02	1040
26/4/2018	ETFSL100	0.587	0.631	0.1	2.06	9.6	7.42	409
26/4/2018	ETFSL200	0.059	0.071	0.08	0.69	45.1	7.01	159
26/4/2018	ETFSL300	0.043	0.055	<0.05	0.54	2.5	6.96	159
26/4/2018	ETFSL400	0.04	0.055	<0.05	0.54	36	6.97	155
26/4/2018	ETFSL500	0.03	0.05	0.05	0.51	94.3	6.96	152
3/5/2018	ETAU	0.781	0.813	2.38	2.38	76.9	6.9	362
3/5/2018	ETFSL100	0.58	0.611	0.18	3.02	20	7.47	358
3/5/2018	ETFSL200	0.056	0.081	0.07	0.78	43.5	7.01	142
3/5/2018	ETFSL300	0.053	0.059	0.13	0.55	5.3	7.02	136
3/5/2018	ETFSL400	0.044	0.052	0.06	0.45	55.3	7	132
3/5/2018	ETFSL500	0.034	0.044	0.07	0.68	60.7	7.01	128
10/5/2018	ETAU	0.752	0.86	4.66	4.66	176.7	6.75	388
10/5/2018	ETFSL100	0.553	0.628	0.06	4.58	191.5	7.19	384
10/5/2018	ETFSL200	0.044	0.061	<0.05	0.89	187.4	6.64	129
10/5/2018	ETFSL300	0.042	0.051	0.08	0.56	180.2	6.67	131
10/5/2018	ETFSL400	0.051	0.056	0.1	0.5	170.7	6.71	133
10/5/2018	ETFSL500	0.032	0.04	0.08	0.45	164	6.68	124
17/5/2018	ETAU	0.868	0.795	3.32	3.32	160	6.78	383
17/5/2018	ETFSL100	0.634	0.605	<0.05	2.66	178.5	7.12	375
17/5/2018	ETFSL200	0.249	0.22	0.25	1.87	178.5	6.85	246
17/5/2018	ETFSL300	0.176	0.178	0.12	1.57	175.8	6.84	230
17/5/2018	ETFSL400	0.146	0.14	0.1	1.32	179.3	6.78	202
17/5/2018	ETFSL500	0.113	0.102	0.12	1.36	179.6	6.65	176
24/5/2018	ETAU	0.763	0.795	3.22	3.22	192.8	7.22	381
24/5/2018	ETFSL100	0.563	0.63	<0.05	4.36	194.2	7.12	375
24/5/2018	ETFSL200	0.128	0.128	0.58	1.03	189.4	6.95	158
24/5/2018	ETFSL300	0.04	0.053	0.05	0.62	102.2	6.78	125
24/5/2018	ETFSL400	0.037	0.043	0.07	0.39	184.9	6.72	145
24/5/2018	ETFSL500	0.031	0.037	<0.05	0.33	185.2	6.76	120
31/5/2018	ETAU	0.797	0.812	3.74	3.74	193.3	7.22	378
31/5/2018	ETFSL100	0.626	0.598	<0.05	2.57	197.5	7.12	375
31/5/2018	ETFSL200	0.362	0.344	0.48	2.18	187.7	7.18	260
31/5/2018	ETFSL300	0.177	0.171	0.24	1.44	185.8	7.18	188
31/5/2018	ETFSL400	0.178	0.162	0.67	1.86	179.9	7.19	184
31/5/2018	ETFSL500	0.098	0.096	0.11	0.89	176	7.12	154
7/6/2018	ETAU	1.19	1.24	3.12	4.03	188.4	6.8	361
7/6/2018	ETFSL100	0.889	0.942	1.43	2.91	185.7	7.19	342
7/6/2018	ETFSL200	0.8	0.792	1.29	3.2	189.2	7.17	327
7/6/2018	ETFSL300	0.625	0.67	0.9	3.42	178.7	7.16	304
7/6/2018	ETFSL400	0.402	0.442	0.06	4.24	182.9	7.25	271
7/6/2018	ETFSL500	0.347	0.358	0.35	3.74	183.4	7.27	268
14/6/2018	ETAU	0.674	0.686	2.1	3.89	99.8	6.94	314
14/6/2018	ETFSL100	0.34	0.539	0.26	2.33	73.3	7.27	309
14/6/2018	ETFSL200	0.47	0.459	0.72	2.12	178.9	7.09	300
14/6/2018	ETFSL300	0.377	0.37	0.26	2.25	167.8	7.12	264
14/6/2018	ETFSL400	0.292	0.288	0.08	2.17	192.4	7.15	228
14/6/2018	ETFSL500	0.255	0.251	0.08	1.94	203.5	7.04	201

ATTACHMENT A (Continued)

Water Quality Data for Sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100

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)
20/6/2018	ETAU	0.657	0.628	3.62	5.4	188.3	6.72	337
20/6/2018	ETFSL100	0.457	0.468	0.9	3.16	19	6.9	324
20/6/2018	ETFSL200	0.371	0.39	0.72	2.4	191.4	6.95	320
20/6/2018	ETFSL300	0.384	0.377	0.34	2.42	190.5	6.98	322
20/6/2018	ETFSL400	0.331	0.333	<0.05	2.84	191.2	7	312
20/6/2018	ETFSL500	0.256	0.28	<0.05	2.67	184.8	7.01	273
28/6/2018	ETAU	0.634	0.687	4.08	7	185.8	6.6	328
28/6/2018	ETFSL100	0.501	0.559	1.04	3.95	188.8	7.02	329
28/6/2018	ETFSL200	0.409	0.422	1.45	3.94	187.2	6.82	306
28/6/2018	ETFSL300	0.176	0.207	<0.05	1.95	199.7	6.77	190
28/6/2018	ETFSL400	0.108	0.111	<0.05	1.04	198.5	6.67	128
28/6/2018	ETFSL500	0.075	0.079	0.05	0.79	179.7	6.61	118
2/7/2018	ETAU	0.637	0.706	3.29	6.24	39.9	7.05	352
2/7/2018	ETFSL100	0.519	0.558	0.97	4.38	191	7.31	351
2/7/2018	ETFSL200	0.395	0.416	0.86	2.28	191.4	7.34	344
2/7/2018	ETFSL300	0.391	0.426	1.19	3.57	193.9	7.25	342
2/7/2018	ETFSL400	0.327	0.349	0.15	3.82	195.4	7.22	311
2/7/2018	ETFSL500	0.226	0.258	0.06	2.37	194.2	7.15	252
12/7/2018	ETAU	0.587	0.626	1.11	2.33	456.6	7.31	370
12/7/2018	ETFSL100	0.501	0.492	0.63	1.6	163.5	7.59	367
12/7/2018	ETFSL200	0.342	0.338	0.73	1.42	160.3	7.5	355
12/7/2018	ETFSL300	0.324	0.373	1.16	2.87	154.8	7.49	361
12/7/2018	ETFSL400	0.338	0.353	0.44	3.85	1596	7.55	356
12/7/2018	ETFSL500	0.212	0.218	<0.05	2.45	158.3	7.37	259
19/7/2018	ETAU	0.726	0.712	0.63	3.5	177	7	377
19/7/2018	ETFSL100	0.576	0.565	0.11	3.01	202.8	7.37	371
19/7/2018	ETFSL200	0.444	0.4	0.36	2.35	200.6	7.24	360
19/7/2018	ETFSL300	0.462	0.402	1.11	3.68	202	7.21	372
19/7/2018	ETFSL400	0.431	0.374	0.57	3.48	203.3	7.33	384
19/7/2018	ETFSL500	0.288	0.279	<0.05	3.33	203.6	7.21	330
26/7/2018	ETAU	0.725	0.753	4.1	6.53	-5.9	6.59	364
26/7/2018	ETFSL100	0.522	0.566	0.19	2.89	10.8	6.78	356
26/7/2018	ETFSL200	0.31	0.353	0.29	1.73	9.8	6.79	351
26/7/2018	ETFSL300	0.35	0.35	1.59	2.55	-0.3	6.71	353
26/7/2018	ETFSL400	0.375	0.397	1.92	3.56	-12.3	6.75	370
26/7/2018	ETFSL500	0.346	0.431	<0.05	3.13	107.8	6.88	378
02/8/2018	ETAU	0.744	0.733	0.44	2.96	54.8	6.53	366
02/8/2018	ETFSL100	0.526	0.544	0.09	2.48	325	6.57	359
02/8/2018	ETFSL200	0.321	0.350	0.39	1.44	265.1	6.51	352
02/8/2018	ETFSL300	0.337	0.348	1.79	2.59	263.4	6.39	355
02/8/2018	ETFSL400	0.398	0.420	3.38	4.5	251.8	6.59	397
02/8/2018	ETFSL500	0.395	0.429	1.14	3.44	236.4	6.8	386
09/8/2018	ETAU	0.637	0.785	2.11	5.08	257.2	6.73	367
09/8/2018	ETFSL100	0.538	0.644	0.18	5.24	256.6	6.92	363
09/8/2018	ETFSL200	0.276	0.316	0.20	1.56	248.6	6.86	355
09/8/2018	ETFSL300	0.285	0.306	1.68	2.50	233.3	6.75	355
09/8/2018	ETFSL400	0.375	0.416	5.43	6.97	254.2	6.99	436
09/8/2018	ETFSL500	0.373	0.401	3.02	4.50	253.7	6.9	390

ATTACHMENT A (Continued)

Water Quality Data for Sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100

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)
16/8/2018	ETAU	0.672	0.797	1.53	3.99	250.1	6.71	365
16/8/2018	ETFSL100	0.491	0.584	0.08	2.32	264.8	7.16	362
16/8/2018	ETFSL200	0.263	0.304	0.1	1.17	265.4	7.13	353
16/8/2018	ETFSL300	0.249	0.298	1.02	1.98	267.4	6.96	349
16/8/2018	ETFSL400	0.336	0.351	3.57	4.23	260.7	7.12	405
16/8/2018	ETFSL500	0.309	0.358	1.69	3.18	261.3	6.98	386
23/8/2018	ETAU	0.724	0.701	0.92	3.12	266.4	7.03	358
23/8/2018	ETFSL100	0.489	0.505	0.07	2.26	271.7	6.97	351
23/8/2018	ETFSL200	0.274	0.270	0.1	1.01	267.1	7.11	344
23/8/2018	ETFSL300	0.227	0.273	0.83	1.83	265.6	7.04	341
23/8/2018	ETFSL400	0.267	0.279	2.11	2.50	261.8	7.05	365
23/8/2018	ETFSL500	0.352	0.337	2.34	3.41	258.1	7.23	382
30/8/2018	ETAU	0.632	0.696	<0.05	2.52	99.5	7.97	368
30/8/2018	ETFSL100	0.440	0.491	<0.05	2.09	77	7.73	354
30/8/2018	ETFSL200	0.225	0.243	0.06	0.85	23.2	7.85	350
30/8/2018	ETFSL300	0.236	0.248	0.96	1.70	256.2	7.78	345
30/8/2018	ETFSL400	0.327	0.343	3.30	4.50	252.5	8.20	399
30/8/2018	ETFSL500	0.316	0.350	2.05	3.65	228.1	8.18	387
05/9/2018	ETAU	0.688	0.683	0.66	4.54	25.2	7.44	363
05/9/2018	ETFSL100	0.476	0.483	<0.05	2.06	53.5	7.77	350
05/9/2018	ETFSL200	0.234	0.23	0.09	0.98	12.5	7.71	340
05/9/2018	ETFSL300	0.259	0.238	1.08	1.71	-12.5	7.57	333
05/9/2018	ETFSL400	0.367	0.371	4.53	5.96	-42.4	7.65	404
05/9/2018	ETFSL500	0.336	0.318	2.52	3.73	1.5	7.69	372
12/9/2018	ETAU	0.653	0.719	<0.05	3.72	178.2	7.05	360
12/9/2018	ETFSL100	0.461	0.521	<0.05	2.72	71.7	7.54	356
12/9/2018	ETFSL200	0.25	0.28	<0.05	0.96	20.1	7.49	346
12/9/2018	ETFSL300	0.3	0.301	0.41	1.73	3.1	7.38	345
12/9/2018	ETFSL400	0.389	0.34	2.15	2.77	-62.7	7.39	359
12/9/2018	ETFSL500	0.401	0.39	1.04	3.87	-17.4	7.43	381
20/9/2018	ETAU	0.392	0.721	1.14	2.49	272.4	7.11	362
20/9/2018	ETFSL100	0.179	0.467	<0.05	1.88	272.4	7.18	350
20/9/2018	ETFSL200	0.182	0.194	0.63	0.7	25.2	7.17	341
20/9/2018	ETFSL300	0.227	0.233	0.63	1.5	-11.9	7.08	337
20/9/2018	ETFSL400	0.386	0.356	2.66	5.39	-34.2	7.21	397
20/9/2018	ETFSL500	0.394	0.358	1.1	3.15	25.4	7.25	371
27/9/2018	ETAU	0.58	0.763	<0.05	2.24	234	7.33	400
27/9/2018	ETFSL100	0.434	0.493	<0.05	1.54	268.1	7.64	392
27/9/2018	ETFSL200	0.178	0.188	<0.05	0.61	272.8	7.55	381
27/9/2018	ETFSL300	0.231	0.239	0.4	1.6	270.8	7.33	377
27/9/2018	ETFSL400	0.331	0.325	1.49	3.55	263.1	7.41	400
27/9/2018	ETFSL500	0.335	0.375	0.83	3.46	266.8	7.67	416
05/10/2018	ETAU	0.39	0.359	2.14	3.49	274.6	7.28	250
05/10/2018	ETFSL100	0.297	0.686	0.32	12	271	7.57	286
05/10/2018	ETFSL200	0.305	0.308	0.29	2.72	269.7	7.67	295
05/10/2018	ETFSL300	0.272	0.305	0.32	2.72	267.7	7.66	291
05/10/2018	ETFSL400	0.364	0.299	0.63	2.95	259.8	7.73	294
05/10/2018	ETFSL500	0.251	0.245	0.36	2.11	242.9	7.58	271

ATTACHMENT A (Continued)

Water Quality Data for Sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100

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)
10/10/2018	ETAU	0.569	0.635	1.8	2.68	266.6	6.59	308
10/10/2018	ETFSL100	0.571	0.602	1.62	2.25	267.5	6.66	304
10/10/2018	ETFSL200	0.494	0.558	1.07	1.88	269.6	6.78	302
10/10/2018	ETFSL300	0.492	0.49	1.05	1.42	269.6	6.81	303
10/10/2018	ETFSL400	0.479	0.503	2.3	3.04	267.3	7.07	334
10/10/2018	ETFSL500	0.48	0.512	1.36	2	266.7	6.98	308
15/10/2018	ETAU	0.325	0.333	0.9	1.33	285.6	6.35	269
15/10/2018	ETFSL100	0.298	0.302	0.69	1.2	278.5	6.36	259
15/10/2018	ETFSL200	0.316	0.336	0.66	1.9	276.9	6.37	262
15/10/2018	ETFSL300	0.286	0.298	0.57	1.41	279.5	6.39	259
15/10/2018	ETFSL400	0.276	0.3	0.6	1.38	279.9	6.56	266
15/10/2018	ETFSL500	0.273	0.279	0.63	1.18	263	7.71	267
22/10/2018	ETAU	0.274	0.259	0.76	1.26	276.9	6.52	281
22/10/2018	ETFSL100	0.25	0.244	0.56	1.13	270.7	6.57	278
22/10/2018	ETFSL200	0.235	0.233	0.41	1.01	270.4	6.53	275
22/10/2018	ETFSL300	0.236	0.228	0.42	1	269	6.58	275
22/10/2018	ETFSL400	0.304	0.263	1.8	2.51	264.8	7.01	321
22/10/2018	ETFSL500	0.184	0.229	0.26	1.19	258.5	6.74	279
30/10/2018	ETAU	0.432	0.431	1.79	2.55	15.1	6.65	290
30/10/2018	ETFSL100	0.376	0.39	0.76	1.78	-0.4	6.91	286
30/10/2018	ETFSL200	0.336	0.363	0.37	1.47	3.8	6.92	285
30/10/2018	ETFSL300	0.341	0.35	0.39	1.32	7.6	6.99	291
30/10/2018	ETFSL400	0.36	0.364	1.58	3.1	-77.3	7.09	329
30/10/2018	ETFSL500	0.34	0.351	0.5	1.63	-4.2	7.05	296
08/11/2018	ETAU	0.635	0.553	0.76	3.15	23.3	7.07	307
08/11/2018	ETFSL100	0.429	0.433	0.14	1.59	12.9	7.35	307
08/11/2018	ETFSL200	0.333	0.34	0.06	1	20	7.31	303
08/11/2018	ETFSL300	0.333	0.329	0.06	1.1	5.4	7.32	304
08/11/2018	ETFSL400	0.431	0.403	5.31	5.49	247.1	7.47	385
08/11/2018	ETFSL500	0.315	0.325	0.37	1.54	248.4	7.30	310
15/11/2018	ETAU	0.609	0.628	0.53	2.04	264.1	7.09	334
15/11/2018	ETFSL100	0.399	0.414	<0.05	1.6	172.9	7.32	328
15/11/2018	ETFSL200	0.308	0.331	<0.05	1.34	272	7.31	325
15/11/2018	ETFSL300	0.321	0.298	0.08	1.15	271	7.28	324
15/11/2018	ETFSL400	0.396	0.383	1.44	4.72	262.5	7.35	373
15/11/2018	ETFSL500	0.328	0.336	0.24	1.76	267.3	7.38	345
19/11/2018	ETWQ AU	0.647	- ⁶	0.08	2.42	259.1	7.22	345
22/11/2018	ETFSL200	0.264	0.298	<0.05	0.82	30.9	7.29	355
22/11/2018	ETFSL500	0.38	0.376	0.67	1.88	-3.3	7.50	373
22/11/2018	CONFLU1	0.085	0.088	0.12	0.9	-1.1	7.51	307
22/11/2018	WARARM5	0.018	0.046	0.25	1	54.6	7.57	297
22/11/2018	WDFS1	0.105	0.114	0.12	1.15	40.1	7.53	307
22/11/2018	WDFS1+100	0.103	0.119	0.1	1.06	26	7.55	306

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

ATTACHMENT A (Continued)

Water Quality Data for Sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100

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)
26/11/2018	ETWQ AU	0.538	- ⁶	<0.05	1.36	83.8	7.11	354
29/11/2018	ETFSL200	0.139	0.15	0.54	1.2	36.1	7.07	195
29/11/2018	ETFSL500	0.167	0.147	0.3	1.19	30.1	6.94	195
29/11/2018	CONFLU1	0.158	0.108	0.27	1.18	29.5	7.19	200
29/11/2018	WARARM5	0.055	0.052	0.18	0.92	66.7	7.5	206
29/11/2018	WDFS1	0.082	0.074	0.18	0.21	36.7	7.8	206
29/11/2018	WDFS1+100	0.103	0.094	0.19	1	38.4	7.36	200
4/12/2018	ETWQ AU	0.433	- ⁶	1.65	2.36	30.6	7	266
6/12/2018	ETFSL200	0.283	0.295	0.26	1.04	242.7	6.97	260
6/12/2018	ETFSL500	0.29	0.3	0.62	1.47	249.5	7.23	270
6/12/2018	CONFLU1	0.112	0.114	0.12	1.13	243.8	7.24	243
6/12/2018	WARARM5	0.034	0.035	<0.05	0.75	250.1	7.29	238
6/12/2018	WDFS1	0.122	0.134	0.07	1.12	241.4	7.29	246
6/12/2018	WDFS1+100	0.109	0.126	<0.05	0.99	251.1	7.3	245
12/12/2018	ETAU	0.428	0.484	1.49	3.33	-	6.86	269
12/12/2018	ETFSL200	0.215	0.232	<0.05	0.42	255.3	7.4	245
12/12/2018	ETFSL500	0.276	0.284	0.27	0.89	251.9	7.41	262
12/12/2018	CONFLU1	0.081	0.091	0.45	0.8	17.9	7.39	219
12/12/2018	WARARM5	0.03	0.042	<0.05	0.58	236.4	7.53	214
12/12/2018	WDFS1	0.108	0.121	0.41	1.09	27.5	7.44	225
12/12/2018	WDFS1+100	0.105	0.12	<0.05	0.99	42.3	7.24	243
17/12/2018	ETWQ AU	0.102	- ⁶	0.18	0.75	280.3	6.50	152
17/12/2018	ETFSL200	0.076	0.084	0.17	0.7	274.8	6.76	152
17/12/2018	ETFSL500	0.087	0.086	0.19	0.76	274.8	6.56	150
17/12/2018	CONFLU1	0.068	0.068	0.16	0.78	270.9	6.64	152
17/12/2018	WARARM5	0.023	0.032	0.08	0.54	257.5	6.77	156
17/12/2018	WDFS1	0.069	0.062	0.15	0.75	273	6.67	153
17/12/2018	WDFS1+100	0.055	0.063	0.12	0.71	278.4	6.71	154
27/12/2018	ETAU	0.263	0.277	0.61	1.81	24.3	6.72	217
27/12/2018	ETFSL200	0.196	0.194	0.09	0.93	30.6	7.11	216
27/12/2018	ETFSL500	0.219	0.213	0.3	1.37	-6.9	7.13	224
27/12/2018	CONFLU1	0.071	0.075	<0.05	0.86	21.4	7.15	208
27/12/2018	WARARM5	0.045	0.036	<0.05	0.48	3.4	7.3	206
27/12/2018	WDFS1	0.108	0.11	0.06	0.99	24.9	7.12	210
27/12/2018	WDFS1+100	0.101	0.105	<0.05	0.93	37.4	7.13	210
3/01/2019	ETWQ AU	0.335	0.443	<0.05	1.57	110.1	7.35	300
3/01/2019	ETFSL200	0.159	0.226	<0.05	0.63	113.1	7.63	290
3/01/2019	ETFSL500	0.265	0.274	0.12	1.32	11.5	7.5	302
3/01/2019	CONFLU1	0.143	0.16	<0.05	1.21	4.8	7.29	270
3/01/2019	WARARM5	0.055	0.054	<0.05	0.64	56.4	7.46	256
3/01/2019	WDFS1	0.106	0.14	<0.05	1.27	72	7.45	265
3/01/2019	WDFS1+100	0.101	0.138	<0.05	1.16	56.2	7.42	263
10/01/2019	ETWQ AU	0.438	0.282	<0.05	1.41	244.1	6.92	268
10/01/2019	ETFSL200	0.216	0.246	<0.05	0.62	26.8	8.03	279
10/01/2019	ETFSL500	0.22	0.262	<0.05	1.18	-9.3	7.64	300
10/01/2019	CONFLU1	0.129	0.141	<0.05	1.11	-33.7	7.55	269
10/01/2019	WARARM5	0.042	0.041	<0.05	0.6	90.3	7.62	252
10/01/2019	WDFS1	0.061	0.087	<0.05	0.92	22.1	7.59	242
10/01/2019	WDFS1+100	0.061	0.074	<0.05	0.97	6.9	7.58	240

ATTACHMENT A (Continued)

Water Quality Data for Sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100

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)
16/01/2019	ETWQ AU	0.433	0.454	<0.05	1.86	171.1	6.75	282
16/01/2019	ETFSL200	0.18	0.189	<0.05	0.4	258.4	7.67	275
16/01/2019	ETFSL500	0.244	0.233	0.38	1	262.4	7.65	303
16/01/2019	CONFLU1	0.058	0.049	0.12	0.86	261.2	7.68	249
16/01/2019	WARARM5	0.025	0.028	0.11	0.52	268.1	7.82	242
16/01/2019	WDFS1	0.046	0.044	0.16	0.92	263.5	7.76	256
16/01/2019	WDFS1+100	0.047	0.044	0.19	0.94	259.2	7.79	260
23/01/2019	ETWQ AU	0.579	0.661	<0.05	2.09	184.3	6.78	292
23/01/2019	ETFSL200	0.171	0.204	<0.05	0.38	96.8	7.65	286
23/01/2019	ETFSL500	0.28	0.284	0.2	1.62	-11.1	7.65	316
23/01/2019	CONFLU1	0.052	0.056	<0.05	1.11	5.6	7.7	264
23/01/2019	WARARM5	0.043	0.036	<0.05	0.74	-38.4	7.7	253
23/01/2019	WDFS1	0.032	0.042	<0.05	1.08	19.6	7.77	266
23/01/2019	WDFS1+100	0.02	0.029	<0.05	0.92	-16.6	7.83	266
29/01/2019	ETAU	0.62	0.578	0.07	1.52	66.8	6.7	294
29/01/2019	ETFSL200	0.19	0.216	<0.05	0.44	36.2	7.23	282
29/01/2019	ETFSL500	0.249	0.279	<0.05	1.48	12.1	7.34	310
29/01/2019	CONFLU1	0.048	0.07	<0.05	1.05	-20.8	7.54	282
29/01/2019	WARARM5	0.031	0.028	<0.05	0.54	49.5	7.34	251
29/01/2019	WDFS1	0.027	0.038	<0.05	0.96	29.7	7.49	260
29/01/2019	WDFS1+100	0.03	0.03	<0.05	0.91	9.9	7.49	260
4/02/2019	ETAU	0.559	0.635	<0.05	1.04	51.1	6.8	283
4/02/2019	ETFSL200	0.173	0.191	<0.05	0.34	9.1	7.26	275
4/02/2019	ETFSL500	0.221	0.276	0.31	1.7	-18.6	7.35	302
4/02/2019	CONFLU1	0.043	0.036	0.16	0.85	-51.7	7.55	252
4/02/2019	WARARM5	0.023	0.029	0.19	0.74	139.1	7.58	240
4/02/2019	WDFS1	0.012	0.021	0.27	0.8	73.2	7.71	252
4/02/2019	WDFS1+100	0.01	0.02	0.29	0.74	50	7.71	255
11/02/2019	ETAU	0.757	0.731	<0.05	1.5	261.4	6.86	288
11/02/2019	ETFSL200	0.197	0.206	<0.05	0.36	6.8	7.21	280
11/02/2019	ETFSL500	0.243	0.302	0.5	1.86	-33.9	7.3	306
11/02/2019	CONFLU1	0.023	0.033	0.24	0.94	-96.7	7.48	255
11/02/2019	WARARM5	0.019	0.026	0.24	0.66	53.5	7.46	243
11/02/2019	WDFS1	0.011	0.018	0.31	0.98	-26	7.62	259
11/02/2019	WDFS1+100	0.005	0.013	0.3	0.83	64.5	7.62	258
18/02/2019	ETAU	0.624	0.675	0.17	1.51	51.8	6.91	303
18/02/2019	ETFSL200	0.189	0.19	0.19	0.36	12.8	7.27	296
18/02/2019	ETFSL500	0.243	0.284	0.23	1.77	-15.6	7.86	277
18/02/2019	CONFLU1	0.041	0.035	0.13	0.9	6.6	7.73	291
18/02/2019	WARARM5	0.022	0.024	0.19	0.64	64.1	7.46	262
18/02/2019	WDFS1	0.007	0.012	0.31	0.78	26.7	7.83	279
18/02/2019	WDFS1+100	0.006	0.011	0.24	0.64	23.3	7.84	279
25/02/2019	ETAU	0.616	0.719	<0.05	0.93	273.1	7.19	283
25/02/2019	ETFSL200	0.198	0.199	<0.05	0.54	270.5	7.06	271
25/02/2019	ETFSL500	0.281	0.312	1.72	2.11	270.6	7.3	307
25/02/2019	CONFLU1	0.022	0.027	0.06	0.86	274.6	7.37	247
25/02/2019	WARARM5	0.014	0.023	<0.05	0.53	264.2	7.4	238
25/02/2019	WDFS1	0.009	0.017	<0.05	0.79	272.6	7.55	248
25/02/2019	WDFS1+100	0.004	0.014	0.05	0.92	264.9	7.6	246

ATTACHMENT A (Continued)

Water Quality Data for Sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100

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)
04/03/2019	ETAU	0.688	0.67	<0.05	0.13	104.3	6.74	306
04/03/2019	ETFSL200	0.185	0.193	0.12	0.48	259.3	7.18	294
04/03/2019	ETFSL500	0.295	0.298	0.76	2.02	271.1	7.33	334
04/03/2019	CONFLU1	0.032	0.049	0.12	1.71	277.1	7.56	274
04/03/2019	WARARM5	0.025	0.031	0.12	1.02	277.7	7.44	248
04/03/2019	WDFS1	0.006	0.013	0.13	0.81	273.6	7.75	271
04/03/2019	WDFS1+100	0.005	0.011	0.21	0.71	249.3	7.58	270
11/03/2019	ETAU	0.638	0.726	0.08	0.94		6.87	322
11/03/2019	ETFSL200	0.152	0.170	0.06	0.38	227.4	7.24	310
11/03/2019	ETFSL500	0.266	0.28	0.5	1.91	219.5	7.43	347
11/03/2019	CONFLU1	0.024	0.03	0.23	0.96	228.5	7.53	289
11/03/2019	WARARM5	0.018	0.052	0.19	0.71	202.5	7.53	269
11/03/2019	WDFS1	0.01	0.018	0.26	0.8	219.7	7.07	276
11/03/2019	WDFS1+100	0.006	0.027	0.22	1.45	215.9	7.82	289
18/03/2019	ETAU	0.153	0.16	0.84	1.21	239	6.77	175
18/03/2019	ETFSL200	0.187	<0.01	0.5	0.204	237.9	6.62	180
18/03/2019	ETFSL500	0.193	<0.01	0.63	0.197	230.4	6.7	184
18/03/2019	CONFLU1	0.146	0.02	0.5	0.156	50.3	6.72	172
18/03/2019	WARARM5	0.032	<0.01	0.3	0.034	49.3	6.67	153
18/03/2019	WDFS1	0.071	0.04	0.44	0.073	21.4	6.67	159
18/03/2019	WDFS1+100	0.094	0.04	0.42	0.099	57.1	6.61	158
26/03/2019	ETAU	0.335	0.347	0.46	1.91	29.3	6.74	230
26/03/2019	ETFSL200	0.205	0.217	<0.05	1.04	23.5	6.96	224
26/03/2019	ETFSL500	0.233	0.234	0.5	1.39	227	6.99	239
26/03/2019	CONFLU1	0.095	0.114	<0.05	0.8	237.9	7.02	206
26/03/2019	WARARM5	0.039	0.041	<0.05	0.45	241.4	6.92	195
26/03/2019	WDFS1	0.073	0.076	<0.05	0.65	236.4	7.02	200
26/03/2019	WDFS1+100	0.054	0.049	<0.05	0.64	241.1	7.03	199
01/04/2019	ETAU	0.332	0.407	<0.05	1.51	160	7.3	256
01/04/2019	ETFSL200	0.184	0.248	<0.05	0.78	-1.8	7.68	248
01/04/2019	ETFSL500	0.222	0.261	0.47	1.14	-4.8	7.64	263
01/04/2019	CONFLU1	0.103	0.116	0.17	0.92	9	7.68	232
01/04/2019	WARARM5	0.034	0.037	0.1	0.42	36.8	7.71	207
01/04/2019	WDFS1	0.051	0.061	0.18	0.64	0.8	7.67	221
01/04/2019	WDFS1+100	0.027	0.031	0.14	0.56	43.5	7.73	219
08/04/2019	ETAU	0.298	0.319	0.64	1.89	35.8	6.86	225
08/04/2019	ETFSL200	0.200	0.198	0.12	0.96	273.8	7.09	212
08/04/2019	ETFSL500	0.184	0.2	0.34	1.34	264	7.25	220
08/04/2019	CONFLU1	0.073	0.082	0.14	0.77	238.9	7.54	212
08/04/2019	WARARM5	0.02	0.018	0.06	0.35	252.5	7.6	204
08/04/2019	WDFS1	0.039	0.05	0.11	0.7	236.9	7.56	205
08/04/2019	WDFS1+100	0.03	0.038	0.08	0.58	242.3	7.61	205
16/04/2019	ETAU	0.321	0.31	<0.05	1.31	259.8	7.17	240
16/04/2019	ETFSL200	0.156	0.154	<0.05	0.64	83.9	7.48	233
16/04/2019	ETFSL500	0.207	0.204	0.53	1.25	11.4	7.65	262
16/04/2019	CONFLU1	0.099	0.1	0.06	0.73	3.8	7.69	235
16/04/2019	WARARM5	0.024	0.021	0.21	0.34	21.6	7.62	207
16/04/2019	WDFS1	0.035	0.035	0.13	0.62	0.9	7.6	215
16/04/2019	WDFS1+100	0.017	0.017	0.14	0.48	4.6	7.67	214

ATTACHMENT A (Continued)

Water Quality Data for Sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100

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)
23/04/2019	ETAU	0.384	0.425	<0.05	1.82	262.5	7.54	224
23/04/2019	ETFSL200	0.162	0.174	0.08	0.77	73.9	7.31	218
23/04/2019	ETFSL500	0.214	0.232	0.24	1.4	8.8	7.64	240
23/04/2019	CONFLU1	0.041	0.046	0.13	0.76	10.6	7.56	194
23/04/2019	WARARM5	0.041	0.046	0.13	0.76	63.3	7.56	194
23/04/2019	WDFS1	0.026	0.027	0.16	0.71	7.5	7.56	191
23/04/2019	WDFS1+100	0.009	0.014	0.18	0.6	45	7.59	190
02/05/2019	ETAU	0.448	0.502	0.33	4.37	78.6	6.97	235
02/05/2019	ETFSL200	0.171	0.187	0.07	0.86	213.6	7.2	226
02/05/2019	ETFSL500	0.24	0.267	0.5	1.4	208.1	7.31	248
02/05/2019	CONFLU1	0.068	0.078	0.12	0.9	198.7	7.41	215
02/05/2019	WARARM5	0.024	0.03	0.14	0.51	201.1	7.3	184
02/05/2019	WDFS1	0.022	0.024	0.19	0.62	194.3	7.31	195
02/05/2019	WDFS1+100	0.01	0.016	0.18	0.5	189.9	7.4	196
06/05/2019	ETAU	0.381	0.421	<0.05	1.3	148.2	6.89	284
06/05/2019	ETFSL200	0.164	0.183	0.1	0.62	252.8	7.18	278
06/05/2019	ETFSL500	0.212	0.256	0.7	1.68	256.8	7.34	314
06/05/2019	CONFLU1	0.076	0.084	0.12	0.78	236.9	7.48	271
06/05/2019	WARARM5	0.025	0.023	0.09	0.46	254.6	7.37	238
06/05/2019	WDFS1	0.024	0.028	0.14	0.71	216.8	7.43	250
06/05/2019	WDFS1+100	0.009	0.009	0.08	0.54	259.9	7.57	246
13/05/2019	ETAU	0.452	0.488	0.08	2.71	106.4	7.15	299
13/05/2019	ETFSL200	0.171	0.208	0.06	0.93	254.6	7.48	290
13/05/2019	ETFSL500	0.261	0.273	0.29	1.74	241.2	7.57	322
13/05/2019	CONFLU1	0.057	0.063	0.07	0.88	249.5	7.61	269
13/05/2019	WARARM5	0.028	0.026	0.07	0.52	249.3	7.6	248
13/05/2019	WDFS1	0.034	0.031	0.05	0.85	243.4	7.61	260
13/05/2019	WDFS1+100	0.009	0.011	<0.05	0.58	243.9	7.71	265
20/05/2019	ETAU	0.432	0.49	<0.05	1.93	270.8	6.96	297
20/05/2019	ETFSL200	0.212	0.230	0.1	1.27	97.3	7.79	291
20/05/2019	ETFSL500	0.282	0.292	1.16	2.02	-17.1	7.63	331
20/05/2019	CONFLU1	0.076	0.092	0.1	1.12	68	7.76	286
20/05/2019	WARARM5	0.035	0.036	0.15	0.54	58.2	7.66	252
20/05/2019	WDFS1	0.027	0.028	0.2	0.72	27.9	7.43	266
20/05/2019	WDFS1+100	0.015	0.016	0.12	0.57	113.4	7.74	270
27/05/2019	ETAU	0.422	0.498	<0.05	2.26	169.8	7.02	301
27/05/2019	ETFSL200	0.240	0.239	0.11	1.06	286.4	7.45	293
27/05/2019	ETFSL500	0.292	0.276	1.14	1.92	286	7.51	334
27/05/2019	CONFLU1	0.06	0.053	0.07	0.69	151.2	7.63	271
27/05/2019	WARARM5	0.026	0.024	<0.05	0.49	278	7.47	254
27/05/2019	WDFS1	0.034	0.037	0.1	0.82	274.3	7.57	270
27/05/2019	WDFS1+100	0.013	0.013	0.06	0.52	284.6	7.76	271
05/06/2019	ETAU	0.295	0.28	0.66	2.05	127.4	7.15	228
03/06/2019	ETFSL200	0.237	0.245	0.09	1.34	84	7.63	316
03/06/2019	ETFSL500	0.325	0.339	1.31	2.4	23	7.71	358
03/06/2019	CONFLU1	0.093	0.099	0.06	0.78	54.6	7.87	308
03/06/2019	WARARM5	0.024	0.02	0.07	0.41	122.6	7.78	275
03/06/2019	WDFS1	0.056	0.057	0.39	1.68	80.4	7.78	290
03/06/2019	WDFS1+100	0.019	0.021	0.15	0.56	87.6	7.92	291

ATTACHMENT A (Continued)

Water Quality Data for Sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100

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)
11/06/2019	ETAU	0.0448	0.465	0.41	2.98	142.8	7.08	291
11/06/2019	ETFSL200	0.247	0.253	0.1	1.12	116.2	7.43	287
11/06/2019	ETFSL500	0.34	0.358	1.24	2.26	63.1	7.55	323
11/06/2019	CONFLU1	0.118	0.13	0.13	1.1	73.1	7.58	278
11/06/2019	WARARM5	0.026	0.024	0.05	0.45	82	7.55	234
11/06/2019	WDFS1	0.061	0.056	0.14	0.73	101.4	7.58	251
11/06/2019	WDFS1+100	0.035	0.03	<0.05	0.56	89.2	7.63	251
18/06/2019	ETAU	0.383	0.411	1.74	2.71	12.6	6.83	252
18/06/2019	ETFSL200	0.275	0.296	0.39	1.37	35.8	7.01	242
18/06/2019	ETFSL500	0.277	0.29	0.6	1.63	12.6	7.14	249
18/06/2019	CONFLU1	0.192	0.137	0.07	0.93	8.1	7.24	235
18/06/2019	WARARM5	0.019	0.014	<0.05	0.26	48.8	7.36	222
18/06/2019	WDFS1	0.088	0.092	0.11	0.73	3.4	7.25	229
18/06/2019	WDFS1+100	0.083	0.088	<0.05	0.71	13.9	7.26	226
25/06/2019	ETAU	0.369	0.377	2.13	3.62	-2.6	6.88	266
25/06/2019	ETFSL200	0.217	0.259	0.11	2.29	2.3	7.16	252
25/06/2019	ETFSL500	0.254	0.268	0.44	2.04	-28.1	7.22	266
25/06/2019	CONFLU1	0.076	0.09	<0.05	0.66	-7.1	7.4	246
25/06/2019	WARARM5	0.066	0.017	<0.05	0.35	4.7	7.43	236
25/06/2019	WDFS1	0.079	0.087	0.12	0.75	-9.4	7.38	241
25/06/2019	WDFS1+100	0.054	0.062	<0.05	0.64	-30.8	7.41	237
01/07/2019	ETAU	0.39	0.405	0.87	3.55	37.4	7.32	261
01/07/2019	ETFSL200	0.219	0.228	<0.05	1.47	20.7	7.21	247
01/07/2019	ETFSL500	0.275	0.372	0.85	2.78	-28.7	7.3	276
01/07/2019	CONFLU1	0.135	0.145	0.17	0.92	-10.8	7.45	250
01/07/2019	WARARM5	0.018	0.018	<0.05	0.37	5.3	7.51	226
01/07/2019	WDFS1	0.065	0.066	0.14	0.81	-13	7.39	234
01/07/2019	WDFS1+100	0.046	0.044	<0.05	0.6	-7.2	7.47	234
08/07/2019	ETAU	0.144	0.154	0.63	1.33	42.7	6.59	177
08/07/2019	ETFSL200	0.13	0.142	0.52	0.99	30.2	6.72	176
08/07/2019	ETFSL500	0.143	0.153	0.68	1.08	13	6.77	180
08/07/2019	CONFLU1	0.082	0.091	0.31	0.91	-32.7	7.01	191
08/07/2019	WARARM5	0.018	0.019	0.07	0.58	17.1	7.15	201
08/07/2019	WDFS1	0.082	0.089	0.36	0.94	1.5	6.98	190
08/07/2019	WDFS1+100	0.078	0.081	0.21	0.79	-5	7.01	188
15/07/2019	ETAU	0.268	0.266	1.11	2.05	-3.8	6.66	221
15/07/2019	ETFSL200	0.209	0.219	0.21	1.24	-4.9	6.76	218
15/07/2019	ETFSL500	0.241	0.256	0.56	1.8	-13.9	6.84	232
15/07/2019	CONFLU1	0.126	0.127	0.07	0.97	6.6	6.89	221
15/07/2019	WARARM5	0.023	0.017	<0.05	0.52	19.7	6.98	222
15/07/2019	WDFS1	0.086	0.097	0.05	0.95	15	6.9	215
15/07/2019	WDFS1+100	0.06	0.064	<0.05	0.78	-1.6	6.87	210
22/07/2019	ETAU	0.415	0.372	2.39	3.53	28.3	7.04	243
22/07/2019	ETFSL200	0.289	0.272	0.08	1.46	3.8	6.45	235
22/07/2019	ETFSL500	0.332	0.291	0.71	2.07	-38.1	6.65	254
22/07/2019	CONFLU1	0.168	0.153	0.06	0.84	10.3	6.66	233
22/07/2019	WARARM5	0.025	0.017	<0.05	0.44	9	6.66	222
22/07/2019	WDFS1	0.094	0.091	0.34	0.8	14	6.63	226
22/07/2019	WDFS1+100	0.071	0.061	0.26	0.61	-1.6	6.63	227

ATTACHMENT A (Continued)

Water Quality Data for Sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100

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)
29/07/2019	ETAU	0.348	0.363	0.22	2.06	53	6.3	315
29/07/2019	ETFSL200	0.234	0.25	0.07	1.4	56.1	6.41	311
29/07/2019	ETFSL500	0.301	0.348	1.37	2.58	-3.8	6.51	342
29/07/2019	CONFLU1	0.13	0.127	0.33	1.28	14.3	6.51	312
29/07/2019	WARARM5	0.029	0.018	0.1	0.38	36.1	6.52	291
29/07/2019	WDFS1	0.077	0.078	0.15	0.87	21.1	6.58	306
29/07/2019	WDFS1+100	0.044	0.044	0.11	0.55	13.7	6.48	302
05/08/2019	ETAU	0.387	0.371	0.72	3.36	34	6.35	323
05/08/2019	ETFSL200	0.247	0.259	0.13	1.47	16.2	6.5	317
05/08/2019	ETFSL500	0.304	0.319	1.34	2.2	-8.3	6.67	354
05/08/2019	CONFLU1	0.104	0.107	0.13	0.74	4.1	6.64	311
05/08/2019	WARARM5	0.019	0.016	0.08	0.37	1.6	6.63	291
05/08/2019	WDFS1	0.061	0.055	0.43	0.86	5.9	6.61	299
05/08/2019	WDFS1+100	0.041	0.038	0.11	0.52	32.5	6.54	305
12/08/2019	ETAU	0.405	0.402	1.42	3.6	29	6.45	292
12/08/2019	ETFSL200	0.249	0.240	0.16	1.38	69.3	6.22	287
12/08/2019	ETFSL500	0.317	0.306	1.52	2.48	13.1	6.35	314
12/08/2019	CONFLU1	0.104	0.108	0.13	0.7	32.9	6.34	283
12/08/2019	WARARM5	0.016	0.013	0.09	0.38	47.9	6.32	263
12/08/2019	WDFS1	0.052	0.052	0.1	0.58	37.6	6.26	275
12/08/2019	WDFS1+100	0.028	0.035	0.13	1.65	11.2	6.35	275
19/08/2019	ETAU	0.425	0.461	1.34	3.64	14	6.29	297
19/08/2019	ETFSL200	0.242	0.264	0.12	1.37	143	6.47	290
19/08/2019	ETFSL500	0.314	0.334	1.3	2.36	-36.1	6.65	319
19/08/2019	CONFLU1	0.106	0.116	0.08	0.71	-16.8	6.62	290
19/08/2019	WARARM5	0.016	0.016	0.08	0.31	7.7	6.43	267
19/08/2019	WDFS1	0.042	0.051	0.1	0.63	-25.6	6.64	279
19/08/2019	WDFS1+100	0.017	0.021	0.12	0.52	-0.5	6.61	279
26/08/2019	ETAU	0.434	0.498	1.56	4.11	2.7	6.93	321
26/08/2019	ETFSL200	0.249	0.267	0.28	1.32	40.1	7.16	317
26/08/2019	ETFSL500	0.297	0.345	1.28	2.66	-33.7	7.21	358
26/08/2019	CONFLU1	0.106	0.115	0.26	1.0	-29	7.36	316
26/08/2019	WARARM5	0.016	0.023	0.17	0.64	-26.1	7.32	287
26/08/2019	WDFS1	0.047	0.051	0.19	0.63	-43.4	7.39	306
26/08/2019	WDFS1+100	0.021	0.038	0.14	0.7	-12.2	7.42	304
02/09/2019	ETAU	0.394	0.427	1.55	3.69	1.2	8.48	308
02/09/2019	ETFSL200	0.233	0.225	<0.05	0.73	31.4	6.13	292
02/09/2019	ETFSL500	0.304	0.293	1.08	1.5	-24.4	6.4	326
02/09/2019	CONFLU1	0.179	0.126	<0.05	0.72	16.3	6.42	290
02/09/2019	WARARM5	0.016	0.013	<0.05	0.3	223.6	6.41	262
02/09/2019	WDFS1	0.047	0.042	<0.05	0.49	4.7	6.41	272
02/09/2019	WDFS1+100	0.026	0.028	<0.05	0.47	33.7	6.41	269
09/09/2019	ETAU	0.387	0.412	1.08	2.58	1.9	7.24	314
08/09/2019	ETFSL200	0.205	0.235	0.12	1.58	41.5	7.34	306
08/09/2019	ETFSL500	0.268	0.297	1.08	2.04	-18.2	7.52	345
08/09/2019	CONFLU1	0.082	0.093	0.1	0.82	-2	7.54	300
08/09/2019	WARARM5	0.018	0.018	0.08	0.4	44.8	7.47	255
08/09/2019	WDFS1	0.025	0.025	0.16	0.61	-55.2	7.53	273
08/09/2019	WDFS1+100	0.01	0.01	0.17	0.56	34.8	7.53	275

ATTACHMENT A (Continued)

Water Quality Data for Sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100

Date	Site	Manganese (mg/L) (F)	Manganese (mg/L) (T)	Iron (mg/L) (F)	Iron (mg/L) (T)	ORP (mV)	pH Lab	EC Lab (μ S/cm)
19/09/2019	ETAU	0.045	0.052	0.25	0.7	108.8	7.13	128
19/09/2019	ETFSL200	0.046	0.054	0.26	0.76	111.5	5.94	132
19/09/2019	ETFSL500	0.048	0.059	0.27	0.88	114	5.94	127
19/09/2019	CONFLU1	0.058	0.068	0.25	0.81	127.9	5.93	128
19/09/2019	WARARM5	0.056	0.068	0.21	0.77	118	5.93	140
19/09/2019	WDFS1	0.064	0.073	0.22	0.75	127.2	5.93	139
19/09/2019	WDFS1+100	0.062	0.069	0.2	0.68	148.8	5.81	136
23/09/2019	ETAU	0.118	0.109	0.55	0.97	73.4	6.08	197
23/09/2019	ETFSL200	0.095	0.098	0.41	0.8	40.6	6.09	194
23/09/2019	ETFSL500	0.104	0.112	0.53	1.16	29.8	6.15	200
23/09/2019	CONFLU1	0.132	0.139	0.35	1.17	36.5	6.15	198
23/09/2019	WARARM5	0.047	0.049	0.16	0.47	72.6	6.17	199
23/09/2019	WDFS1	0.074	0.075	0.25	0.63	32.7	6.15	197
23/09/2019	WDFS1+100	0.086	0.089	0.27	0.68	14.4	6.14	196

20 January 2019

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 – October 2019

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 Longwall 304 Water Management Plan (LW304 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 LW304 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 LW304 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 LW304 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 LW304 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.

Analysis conducted by Hydro Engineering & Consulting (2019) in accordance with the LW304 WMP, identified that the performance indicator for water resources reaching the Woronora Reservoir was exceeded for dissolved (i.e. filtered <0.45 µm fraction) manganese on the Eastern Tributary at site ETWQ AU in October 2019 (as there was not a similar exceedance of the trigger recorded at control site WOWQ 2 on the Woronora River). The performance indicator was not exceeded for field filtered iron or aluminium in October 2019 and therefore these parameters are not discussed in this report.

In accordance with the LW304 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*.

This assessment against the water quality subsidence impact performance measure has been prepared for October 2019 in consideration of:

- pluviograph data;
- flow data from the Eastern Tributary gauging location (GS 300078);
- groundwater level and groundwater quality results for Eastern Tributary sites up to 31 October 2019¹;
- surface water quality data at site ETWQ AU/ETAU² and sites further upstream on the Eastern Tributary up to 31 October 2019;
- surface water quality data at sites downstream of ETWQ AU/ETAU² up to 31 October 2019; 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 2018, above average rainfall has only been recorded in October 2018, November 2018, December 2018 and September 2019, with below average rainfall recorded in all other months, including October 2019 (Table 1).

Total rainfall in October 2019 was 53.0 mm, below the average rainfall at Darkes Forest (91.5 mm), with rainfall occurring on 6 October (12 mm rainfall), 12 to 14 October 2019 (totalling 40.5 mm rainfall) and on 29 October 2019 (0.5 mm rainfall). Shallow groundwater levels correlate with the rainfall trend.

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

² Site ETAU is the same as site ETWQ AU (i.e. samples are taken at the same location). The difference between the sites relates to the time of sampling. Site ETWQ AU monitoring is conducted on the same day as sites upstream of ETWQ AU/ETAU (shown on Charts 1 to 2), while site ETAU monitoring is conducted on the same day as the sites downstream of ETWQ AU/ETAU (described in Section 3 and shown on Charts 3 to 4). From 29 January 2019, water quality sampling of all sites on the Eastern Tributary was undertaken in a single day. Future reporting will identify the data at this site as site ETWQ AU.

Table 1 Monthly Rainfall Data (mm) for PV7, January 2018 to October 2019

Month/Year	Rainfall at PV7 (mm)	Rainfall at Darkes Forest (mm) [#]	Mean Monthly Rainfall at Darkes Forest (1894-2019) (mm) [#]
January 2018	48.0	12.0	132.4
February 2018	115.5	16.6	159.6
March 2018	151.0	45.0	153.9
April 2018	32.0	21.6	126.8
May 2018	12.5	8.0	129.1
June 2018	112.0	91.8	146.6
July 2018	3.5	0.4	96.4
August 2018	12.5	15.8	89.1
September 2018	52.0	41.8	76.6
October 2018	197.0	200.8	91.9
November 2018	114.5	127.8	105.4
December 2018	120.0	91.0	103.8
January 2019	58.5	55.4	131.8
February 2019	41.0	54.2	158.7
March 2019	149.0	201.2	154.3
April 2019	35.0	46.0	126.1
May 2019	8.5	8.0	128.1
June 2019	115.5	47.4	145.8
July 2019	56.0	46.4	96.0
August 2019	53.0	58.8	88.9
September 2019	162.5	150.2	77.2
October 2019	53.0	37.4	91.5

[#] 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 October 2019.

2. EASTERN TRIBUTARY SURFACE WATER AND GROUNDWATER QUALITY DATA

Plots of dissolved manganese at surface water quality sites ETWQ AU, ETWQ AQ (upstream on the Eastern Tributary) and WOWQ 2 (control site) and at groundwater quality site ETGW2, are compared to rainfall at PV7 (Chart 1) and streamflow at GS 300078 (Chart 2) (Figure 1).

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.

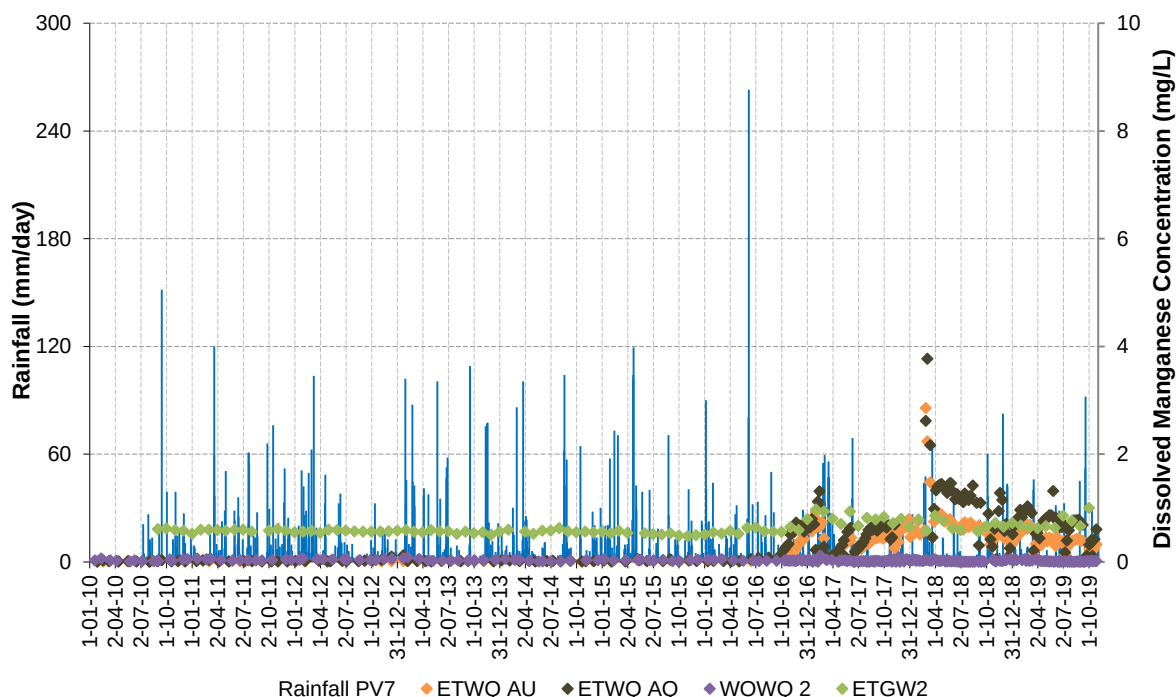


Chart 1 Dissolved Manganese Concentrations at Surface Water Quality Sites ETWQ AU, ETWQ AQ and WOWQ 2 and Groundwater Quality Site ETGW2 and Rainfall (to 31 October 2019)

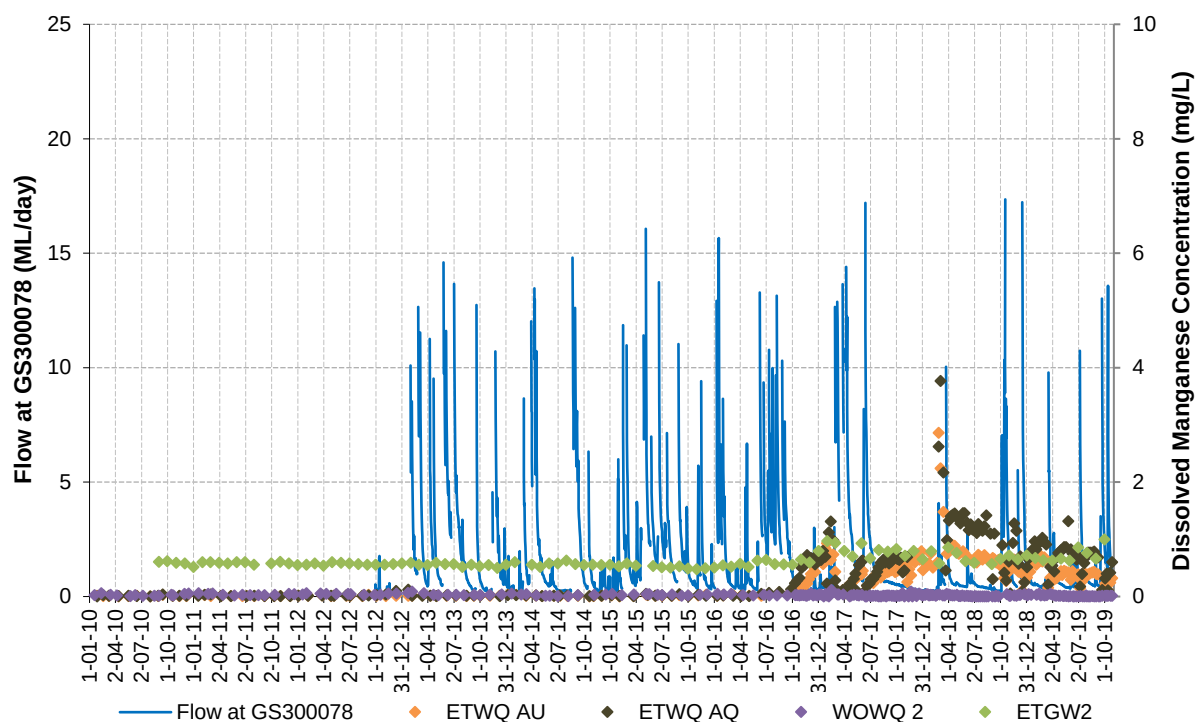
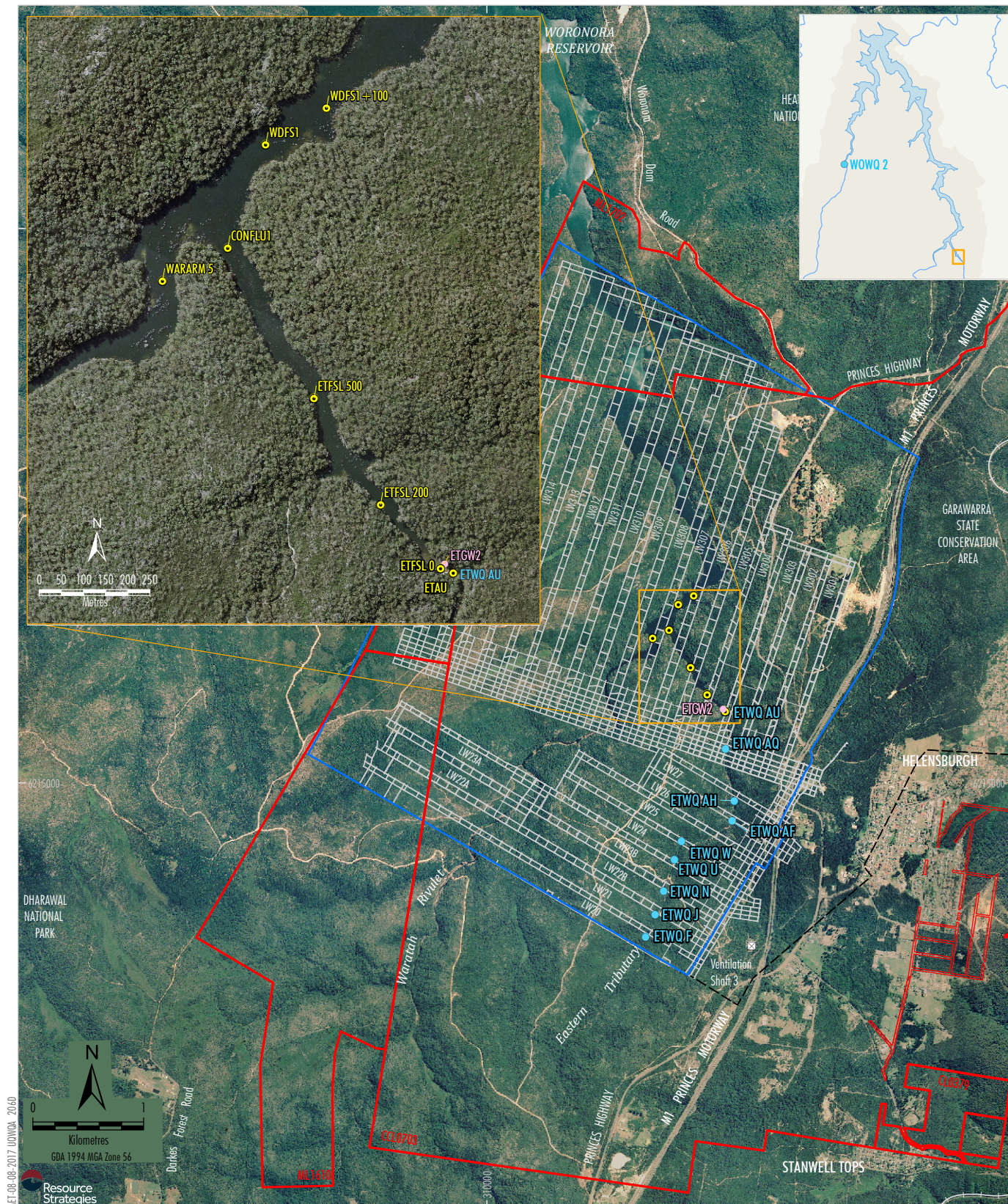


Chart 2 Dissolved Manganese Concentrations at Surface Water Quality Sites ETWQ AU, ETWQ AQ and WOWQ 2 and Groundwater Quality Site ETGW2 and Stream Flow (to 31 October 2019)



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 on Eastern Tributary
- Water Quality Site on Eastern Tributary and/or in Woronora Reservoir
- Groundwater Quality Site of Eastern Tributary

Peabody
METROPOLITAN COAL

Surface Water Quality Sampling of
Eastern Tributary Watercourse
and Woronora Reservoir

Figure 1

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. <0.1 mg/L, exist in the natural creek water. Dissolved manganese is easily diluted by freshwater flow to low levels when higher creek flows occur.

In October 2019, dissolved manganese concentrations at site ETWQ AU ranged between 0.111 mg/L and 0.325 mg/L. 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. The dilution of dissolved manganese concentrations during high flows 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. Concentrations subsequently increased, but remained notably lower than those recorded prior to the rainfall event.

Water quality parameters pertinent to the increase in manganese and iron (dissolved-filtered <0.45 µm fraction) concentration are pH, oxidation-reduction potential (ORP) and electrical conductivity (EC). 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 oxidizing and becomes reducing when ORP is below approximately 10 mV.

In October 2019 at site ETWQ AU:

- pH (lab measurement) was generally consistent (pH 6.08 to pH 7.44);
- EC concentrations (lab measurement) ranged between 199 µS/cm and 281 µS/cm; and
- ORP (field measurement) ranged between 53 mV and 173 mV.

3. WATER RESOURCES REACHING THE WORONORA RESERVOIR

In accordance with the LW304 WMP, site ETWQ AU on the Eastern Tributary and control site WOWQ 2 on the Woronora River are used to assess the LW304 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. 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.

Metropolitan Coal has taken a photographic record of the watercourse / waterbody at the time of sampling, estimated the width of the watercourse / water body 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 (HCPL, 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 October 2019 the Woronora Reservoir water level varied between 152.9 mAHD (on 3 October 2019) and 152.4 mAHD (on 31 October 2019) (water level decreased slightly). The position of the reservoir water level can only be determined to the closest one metre contour, accordingly, the reservoir water level during October 2019 was approximately 3,491 m (corresponding to 152 mAHD) downstream of site ETSFL 0.

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 October 2019, the Woronora Reservoir water level was downstream of site WDFS1+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

Water quality data for filtered and total manganese for January 2018 to October 2019 at sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400 and ETFSL 500 is provided in Attachment A. As described earlier, sampling at sites ETFSL 100, ETFSL 300 and ETFSL 400 was suspended once monitoring at sites CONFLU1, WARARM5, WDFS1 and WDFS1+100 commenced on 22 November 2018³. Water quality data for filtered and total manganese since sampling commenced on 22 November 2018 at sites CONFLU1, WARARM5, WDFS1 and WDFS1+100 is also provided in Attachment A.

As described above, the Woronora Reservoir water level decreased slightly in October 2019, and was downstream of site WDFS1+100. The results for dissolved and total manganese at sites ETAU, ETFSL 200, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100 since the commencement of monitoring to the end of October 2019, are shown on Charts 3 and 4, respectively. These sites provide a profile along the arm of the Woronora Reservoir.

The filtered manganese concentrations for October 2019 ranged from 0.111 mg/L to 0.325 mg/L at site ETAU, 0.094 mg/L to 0.206 mg/L at site ETFSL 200, 0.096 mg/L to 0.251 mg/L at site ETFSL 500, 0.063 mg/L to 0.184 mg/L at site CONFLU1, 0.04 mg/L to 0.054 mg/L at site WARARM5, 0.065 mg/L to 0.094 mg/L at site WDFS1 and 0.056 mg/L to 0.095 mg/L at site WDFS1+100 (Chart 3).

Total manganese concentrations for October 2019 followed similar trends, ranging from 0.112 mg/L to 0.34 mg/L at site ETAU, 0.099 mg/L to 0.228 mg/L at site ETFSL 200, 0.093 mg/L to 0.262 mg/L at site ETFSL 500, 0.069 mg/L to 0.143 mg/L at site CONFLU1, 0.035 mg/L to 0.056 mg/L at site WARARM5, 0.071 mg/L to 0.109 mg/L at site WDFS1 and 0.057 mg/L to 0.101 mg/L at site WDFS1+100 (Chart 4).

³ Sampling at site ETAU was also temporarily suspended during this period but was resumed on 12 December 2018. Data from sampling undertaken at site ETWQ AU has been substituted for site ETAU during this period. Sampling at site ETAU was undertaken on 12 and 27 December 2018.

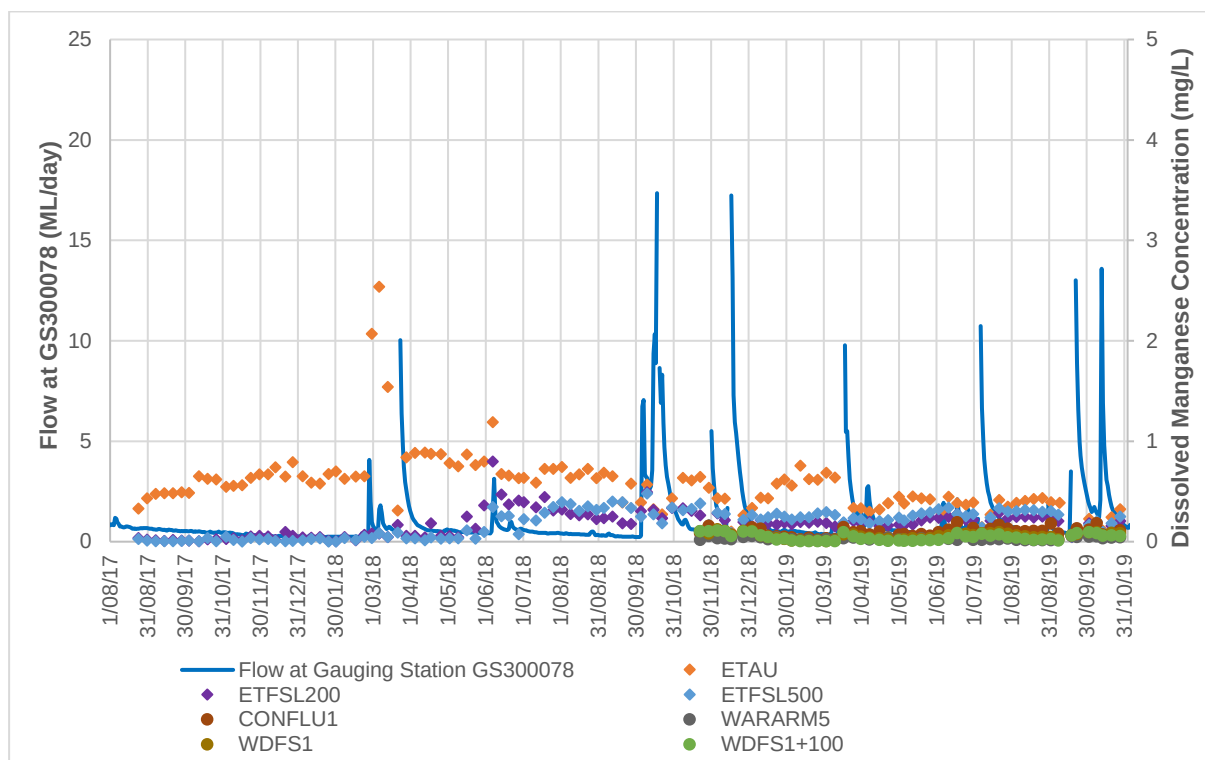


Chart 3 Dissolved Manganese Concentrations at Surface Water Quality Sites ETAU⁴, ETFSL 200, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100 and Stream Flow (August 2017 to 31 October 2019)

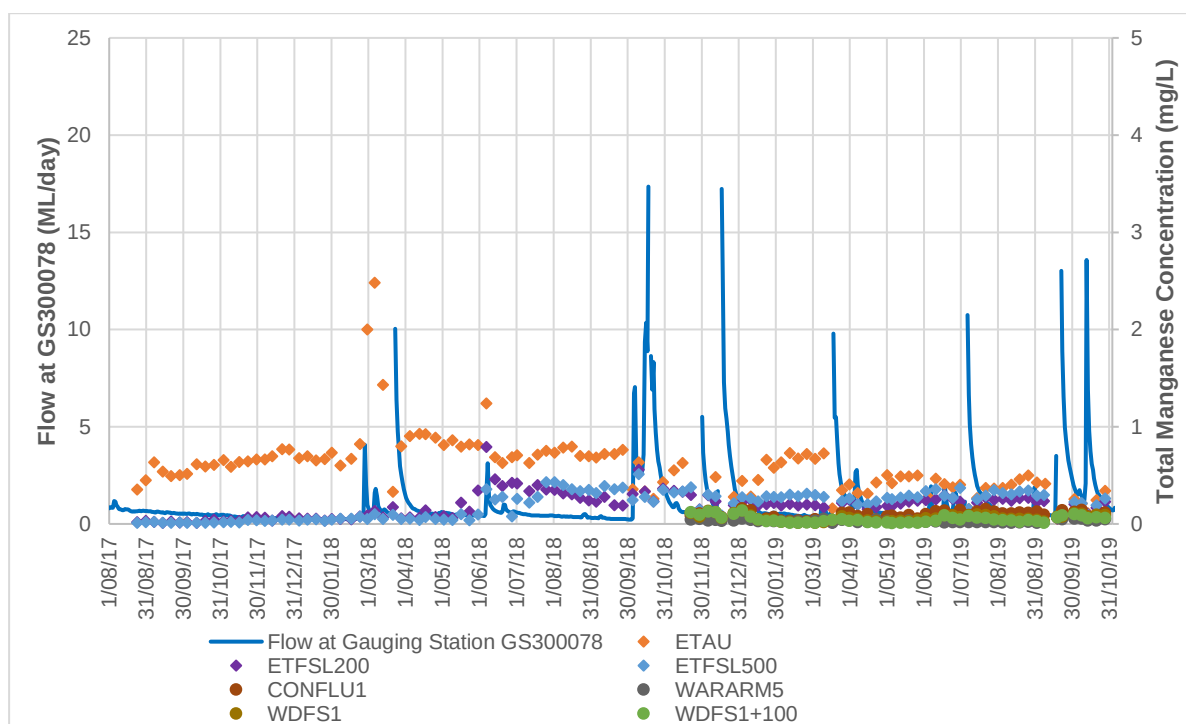


Chart 4 Total Manganese Concentrations at Surface Water Quality Sites ETAU⁵, ETFSL 200, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100 and Stream Flow (August 2017 to 31 October 2019)

⁴ Data from sampling undertaken at site ETWQ AU has been substituted for site ETAU from 22 November to 6 December 2018 and 17 December 2018. Sampling at site ETAU was undertaken on 12 and 27 December 2018.

⁵ Total manganese is not sampled at site ETWQ AU, and therefore results were unable to be substituted for site ETAU from 22 November to 6 December 2018 and 17 December 2018. Sampling at site ETAU was undertaken on 12 and 27 December 2018.

The Australian Drinking Water Guidelines (ADWG, 2011) are published by the National Health and Medical Research Council and updated most recently in 2018; 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 Australian Drinking Water Guideline before being supplied to the Helensburgh area as well as parts of the Sutherland Shire and northern Wollongong (WaterNSW, 2017).

The ADWG (2011) guidelines are based on total concentrations of manganese in water. The ADWG value is 0.5 mg/L total manganese for health. 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).

Water quality data for parameters pertinent to dissolved manganese for January 2018 to October 2019 at sites ETAU, ETFSL 200, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100 is provided in Attachment A. The water quality parameters (pH, ORP and EC) showed no unusual features.

The ADWG value for pH (aesthetic) is 6.5 – 8.5. At the end of September 2019, all sites were below the minimum ADWG value for pH (6.5). The pH values at all sites increased during October 2019, starting at marginally below 6.5 (6.08) and increasing to between 6.6 at ETWQ AU to 7.7 at WDFS1+100 by the end of October (Attachment A). The pH of creek water flow following limited rain events may fluctuate slightly because dry iron oxyhydroxide in contact with water undergoes hydrolysis. Given the rainfall events recorded in October were below average, the fluctuations within the creek water pH are considered to be natural.

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 October 2019, which has triggered 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 for October 2019, show the quality of water below ETAU fluctuated during October 2019, with the water observed to be clear at the start of October due to the major rainfall event mid-September 2019, after which the water showed mild turbidity until mid-October (after the rainfall event) where it cleared again, before ending the month with the water showing mild turbidity. A slight increase in the presence of orange-yellow coating on the bed rock surfaces of the sites was observed by the end of October 2019. The presence of orange-yellow coating on the creek sediment surface will darken with time as conversion to goethite occurs.

Water reaching the Woronora Reservoir occurs where the inflowing stream water meets the reservoir waterbody. In October 2019, the Woronora Reservoir water level was downstream of site WDFS1+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.

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

ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, WARARM5, CONFLU1, WDFS1 and
WDFS1+100

JANUARY 2018 TO OCTOBER 2019

ATTACHMENT A

Water Quality Data for Sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100

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)
4/01/2018	ETAU	0.652	0.678	<0.05	0.59	132	7.37	351
4/01/2018	ETFSL100	0.281	0.305	<0.05	0.82	125.3	7.75	337
4/01/2018	ETFSL200	0.042	0.057	<0.05	0.68	132.7	7.05	118
4/01/2018	ETFSL300	0.038	0.052	0.06	0.6	13.2	6.92	111
4/01/2018	ETFSL400	0.024	0.037	<0.05	0.47	129.9	6.96	110
4/01/2018	ETFSL500	0.016	0.036	<0.05	0.46	121.7	6.74	111
11/01/2018	ETAU	0.588	0.698	0.13	1.36	55.9	7.56	364
11/01/2018	ETFSL100	0.197	0.237	<0.05	0.55	24.3	7.88	345
11/01/2018	ETFSL200	0.041	0.053	<0.05	0.63	101	7.14	139
11/01/2018	ETFSL300	0.067	0.078	1.89	2.1	35.2	6.88	128
11/01/2018	ETFSL400	0.106	0.052	0.47	0.66	52	6.84	124
11/01/2018	ETFSL500	0.026	0.046	0.06	0.78	94.4	7.01	122
18/01/2018	ETAU	0.577	0.653	<0.05	1.15	136.4	7.67	366
18/01/2018	ETFSL100	0.211	0.22	<0.05	0.64	131.9	7.74	353
18/01/2018	ETFSL200	0.046	0.055	<0.05	0.79	131.2	7	129
18/01/2018	ETFSL300	0.058	0.057	0.06	0.84	125.5	6.94	126
18/01/2018	ETFSL400	0.038	0.048	<0.05	0.71	139.6	6.96	125
18/01/2018	ETFSL500	0.032	0.049	<0.05	0.78	121.4	6.94	123
25/01/2018	ETAU	0.674	0.668	<0.05	0.52	56.8	7.55	378
25/01/2018	ETFSL100	0.074	0.152	<0.05	0.46	-4.4	7.82	360
25/01/2018	ETFSL200	0.007	0.034	<0.05	0.41	70.6	7.16	120
25/01/2018	ETFSL300	0.005	0.035	<0.05	0.46	22.8	7.09	117
25/01/2018	ETFSL400	0.001	0.032	<0.05	0.41	55	7	118
25/01/2018	ETFSL500	0.002	0.03	<0.05	0.35	288.6	7.04	115
31/01/2018	ETAU	0.7	0.734	<0.05	0.67	82.3	7.46	374
31/01/2018	ETFSL100	0.089	0.147	<0.05	0.36	30.7	8.01	361
31/01/2018	ETFSL200	0.005	0.052	<0.05	0.57	79.1	7.28	139
31/01/2018	ETFSL300	0.002	0.049	<0.05	0.66	42.7	7.08	123
31/01/2018	ETFSL400	0.001	0.046	<0.05	0.54	92	7.05	122
31/01/2018	ETFSL500	0.001	0.044	<0.05	0.55	71	7.01	122
7/02/2018	ETAU	0.625	0.601	<0.05	0.65	106.9	7.39	374
7/02/2018	ETFSL100	0.102	0.129	<0.05	0.75	14.8	7.78	359
7/02/2018	ETFSL200	0.047	0.051	<0.05	0.48	80.4	7.04	119
7/02/2018	ETFSL300	0.049	0.059	<0.05	0.65	38.2	6.97	119
7/02/2018	ETFSL400	0.112	0.07	0.27	0.74	1	6.77	118
7/02/2018	ETFSL500	0.038	0.053	0.11	0.58	86.6	6.92	117
16/02/2018	ETAU	0.65	0.67	<0.05	0.66	158.8	7.54	380
16/02/2018	ETFSL100	0.075	0.126	<0.05	0.33	163.9	7.96	369
16/02/2018	ETFSL200	0.016	0.048	<0.05	0.6	152	7.05	128
16/02/2018	ETFSL300	0.023	0.058	<0.05	0.81	121.1	6.88	124
16/02/2018	ETFSL400	0.012	0.049	<0.05	0.54	143.2	6.83	121
16/02/2018	ETFSL500	0.019	0.054	<0.05	0.54	144.1	6.82	120
23/02/2018	ETAU	0.651	0.822	<0.05	1.72	163.6	7.21	400
23/02/2018	ETFSL100	0.12	0.2	<0.05	0.5	31.8	7.75	384
23/02/2018	ETFSL200	0.068	0.078	<0.05	0.93	55.8	6.92	140
23/02/2018	ETFSL300	0.065	0.07	0.07	0.88	55.2	6.8	136
23/02/2018	ETFSL400	0.062	0.075	<0.05	0.93	41.8	6.78	135
23/02/2018	ETFSL500	0.049	0.075	<0.05	1.07	-119.2	6.78	132

ATTACHMENT A (Continued)
Water Quality Data for Sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100

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)
1/03/2018	ETAU	2.07	2	5.96	5.69	83.1	6.32	492
1/03/2018	ETFSL100	1.78	1.72	2.41	2.7	36.7	6.31	464
1/03/2018	ETFSL200	0.08	0.087	0.08	0.83	59	6.45	133
1/03/2018	ETFSL300	0.059	0.069	0.16	0.79	43.5	6.36	127
1/03/2018	ETFSL400	0.05	0.064	0.1	1.03	32	6.35	125
1/03/2018	ETFSL500	0.036	0.051	0.08	0.65	2.3	6.38	123
7/03/2018	ETAU	2.54	2.48	7.52	7.23	168.1	6.12	514
7/03/2018	ETFSL100	2.21	2.15	4.12	4.43	158.6	6.11	479
7/03/2018	ETFSL200	0.082	0.132	0.07	0.92	166.8	6.29	147
7/03/2018	ETFSL300	0.108	0.12	<0.05	0.91	149	6.32	147
7/03/2018	ETFSL400	0.088	0.11	<0.05	0.78	161.1	6.79	142
7/03/2018	ETFSL500	0.083	0.102	0.07	0.76	154.5	6.32	138
14/03/2018	ETAU	1.54	1.43	3.72	6.68	41.4	6.58	450
14/03/2018	ETFSL100	0.907	1.08	0.55	3.58	31.6	6.95	431
14/03/2018	ETFSL200	0.047	0.066	<0.05	0.63	76	6.84	135
14/03/2018	ETFSL300	0.048	0.054	<0.05	0.56	41.4	6.83	133
14/03/2018	ETFSL400	0.064	0.055	0.06	0.61	3.3	6.86	132
14/03/2018	ETFSL500	0.047	0.052	<0.05	0.47	21.9	6.79	131
22/03/2018	ETAU	0.312	0.33	0.73	1.46	229.3	5.24	237
22/03/2018	ETFSL100	0.362	0.363	0.71	1.69	182.9	5.08	240
22/03/2018	ETFSL200	0.166	0.173	0.44	1.63	71.9	6.51	160
22/03/2018	ETFSL300	0.118	0.118	0.28	1.33	70.6	6.54	153
22/03/2018	ETFSL400	0.146	0.136	0.8	1.66	22.8	6.61	152
22/03/2018	ETFSL500	0.091	0.095	0.14	1.02	32.6	6.65	144
29/03/2018	ETAU	0.841	0.798	2.83	3.32	148	6.66	341
29/03/2018	ETFSL100	0.732	0.729	1.87	2.6	40.9	6.63	332
29/03/2018	ETFSL200	0.058	0.059	0.11	0.62	84.2	6.65	131
29/03/2018	ETFSL300	0.047	0.053	0.08	0.59	65.9	6.64	131
29/03/2018	ETFSL400	0.051	0.055	0.08	0.74	71.4	6.64	130
29/03/2018	ETFSL500	0.033	0.051	0.08	1.29	27.3	6.68	128
5/4/2018	ETAU	0.885	0.904	2.84	4.76	182.7	6.57	384
5/4/2018	ETFSL100	0.674	0.672	0.73	2.41	191.7	6.67	374
5/4/2018	ETFSL200	0.058	0.067	0.08	0.62	211.9	6.32	142
5/4/2018	ETFSL300	0.044	0.058	0.07	0.57	209.4	6.37	142
5/4/2018	ETFSL400	0.04	0.058	0.13	0.77	209.1	6.39	141
5/4/2018	ETFSL500	0.035	0.054	0.09	0.66	205.9	6.4	141
13/4/2018	ETAU	0.888	0.927	1.42	4.26	156.2	6.76	391
13/4/2018	ETFSL100	0.614	0.651	0.13	2.46	172.9	6.92	382
13/4/2018	ETFSL200	0.042	0.065	0.08	0.7	42.8	6.84	153
13/4/2018	ETFSL300	0.033	0.051	0.05	0.5	40.9	6.52	145
13/4/2018	ETFSL400	0.023	0.048	<0.05	0.59	64.1	6.6	147
13/4/2018	ETFSL500	0.014	0.04	<0.05	0.51	58.6	6.61	142
18/4/2018	ETAU	0.875	0.925	0.62	2.62	192.1	6.77	397
18/4/2018	ETFSL100	0.614	0.636	0.13	2.27	192.3	7.19	390
18/4/2018	ETFSL200	0.184	0.14	0.57	1.14	184.8	6.75	178
18/4/2018	ETFSL300	0.059	0.074	0.08	0.86	186.3	6.81	162
18/4/2018	ETFSL400	0.05	0.069	<0.05	0.64	181.3	6.76	159
18/4/2018	ETFSL500	0.044	0.071	0.07	0.76	185.5	6.76	160

ATTACHMENT A (Continued)
Water Quality Data for Sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100

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)
26/4/2018	ETAU	0.871	0.887	3.01	4.32	7.2	7.02	1040
26/4/2018	ETFSL100	0.587	0.631	0.1	2.06	9.6	7.42	409
26/4/2018	ETFSL200	0.059	0.071	0.08	0.69	45.1	7.01	159
26/4/2018	ETFSL300	0.043	0.055	<0.05	0.54	2.5	6.96	159
26/4/2018	ETFSL400	0.04	0.055	<0.05	0.54	36	6.97	155
26/4/2018	ETFSL500	0.03	0.05	0.05	0.51	94.3	6.96	152
3/5/2018	ETAU	0.781	0.813	2.38	2.38	76.9	6.9	362
3/5/2018	ETFSL100	0.58	0.611	0.18	3.02	20	7.47	358
3/5/2018	ETFSL200	0.056	0.081	0.07	0.78	43.5	7.01	142
3/5/2018	ETFSL300	0.053	0.059	0.13	0.55	5.3	7.02	136
3/5/2018	ETFSL400	0.044	0.052	0.06	0.45	55.3	7	132
3/5/2018	ETFSL500	0.034	0.044	0.07	0.68	60.7	7.01	128
10/5/2018	ETAU	0.752	0.86	4.66	4.66	176.7	6.75	388
10/5/2018	ETFSL100	0.553	0.628	0.06	4.58	191.5	7.19	384
10/5/2018	ETFSL200	0.044	0.061	<0.05	0.89	187.4	6.64	129
10/5/2018	ETFSL300	0.042	0.051	0.08	0.56	180.2	6.67	131
10/5/2018	ETFSL400	0.051	0.056	0.1	0.5	170.7	6.71	133
10/5/2018	ETFSL500	0.032	0.04	0.08	0.45	164	6.68	124
17/5/2018	ETAU	0.868	0.795	3.32	3.32	160	6.78	383
17/5/2018	ETFSL100	0.634	0.605	<0.05	2.66	178.5	7.12	375
17/5/2018	ETFSL200	0.249	0.22	0.25	1.87	178.5	6.85	246
17/5/2018	ETFSL300	0.176	0.178	0.12	1.57	175.8	6.84	230
17/5/2018	ETFSL400	0.146	0.14	0.1	1.32	179.3	6.78	202
17/5/2018	ETFSL500	0.113	0.102	0.12	1.36	179.6	6.65	176
24/5/2018	ETAU	0.763	0.795	3.22	3.22	192.8	7.22	381
24/5/2018	ETFSL100	0.563	0.63	<0.05	4.36	194.2	7.12	375
24/5/2018	ETFSL200	0.128	0.128	0.58	1.03	189.4	6.95	158
24/5/2018	ETFSL300	0.04	0.053	0.05	0.62	102.2	6.78	125
24/5/2018	ETFSL400	0.037	0.043	0.07	0.39	184.9	6.72	145
24/5/2018	ETFSL500	0.031	0.037	<0.05	0.33	185.2	6.76	120
31/5/2018	ETAU	0.797	0.812	3.74	3.74	193.3	7.22	378
31/5/2018	ETFSL100	0.626	0.598	<0.05	2.57	197.5	7.12	375
31/5/2018	ETFSL200	0.362	0.344	0.48	2.18	187.7	7.18	260
31/5/2018	ETFSL300	0.177	0.171	0.24	1.44	185.8	7.18	188
31/5/2018	ETFSL400	0.178	0.162	0.67	1.86	179.9	7.19	184
31/5/2018	ETFSL500	0.098	0.096	0.11	0.89	176	7.12	154
7/6/2018	ETAU	1.19	1.24	3.12	4.03	188.4	6.8	361
7/6/2018	ETFSL100	0.889	0.942	1.43	2.91	185.7	7.19	342
7/6/2018	ETFSL200	0.8	0.792	1.29	3.2	189.2	7.17	327
7/6/2018	ETFSL300	0.625	0.67	0.9	3.42	178.7	7.16	304
7/6/2018	ETFSL400	0.402	0.442	0.06	4.24	182.9	7.25	271
7/6/2018	ETFSL500	0.347	0.358	0.35	3.74	183.4	7.27	268
14/6/2018	ETAU	0.674	0.686	2.1	3.89	99.8	6.94	314
14/6/2018	ETFSL100	0.34	0.539	0.26	2.33	73.3	7.27	309
14/6/2018	ETFSL200	0.47	0.459	0.72	2.12	178.9	7.09	300
14/6/2018	ETFSL300	0.377	0.37	0.26	2.25	167.8	7.12	264
14/6/2018	ETFSL400	0.292	0.288	0.08	2.17	192.4	7.15	228
14/6/2018	ETFSL500	0.255	0.251	0.08	1.94	203.5	7.04	201

ATTACHMENT A (Continued)
Water Quality Data for Sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100

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)
20/6/2018	ETAU	0.657	0.628	3.62	5.4	188.3	6.72	337
20/6/2018	ETFSL100	0.457	0.468	0.9	3.16	19	6.9	324
20/6/2018	ETFSL200	0.371	0.39	0.72	2.4	191.4	6.95	320
20/6/2018	ETFSL300	0.384	0.377	0.34	2.42	190.5	6.98	322
20/6/2018	ETFSL400	0.331	0.333	<0.05	2.84	191.2	7	312
20/6/2018	ETFSL500	0.256	0.28	<0.05	2.67	184.8	7.01	273
28/6/2018	ETAU	0.634	0.687	4.08	7	185.8	6.6	328
28/6/2018	ETFSL100	0.501	0.559	1.04	3.95	188.8	7.02	329
28/6/2018	ETFSL200	0.409	0.422	1.45	3.94	187.2	6.82	306
28/6/2018	ETFSL300	0.176	0.207	<0.05	1.95	199.7	6.77	190
28/6/2018	ETFSL400	0.108	0.111	<0.05	1.04	198.5	6.67	128
28/6/2018	ETFSL500	0.075	0.079	0.05	0.79	179.7	6.61	118
2/7/2018	ETAU	0.637	0.706	3.29	6.24	39.9	7.05	352
2/7/2018	ETFSL100	0.519	0.558	0.97	4.38	191	7.31	351
2/7/2018	ETFSL200	0.395	0.416	0.86	2.28	191.4	7.34	344
2/7/2018	ETFSL300	0.391	0.426	1.19	3.57	193.9	7.25	342
2/7/2018	ETFSL400	0.327	0.349	0.15	3.82	195.4	7.22	311
2/7/2018	ETFSL500	0.226	0.258	0.06	2.37	194.2	7.15	252
12/7/2018	ETAU	0.587	0.626	1.11	2.33	456.6	7.31	370
12/7/2018	ETFSL100	0.501	0.492	0.63	1.6	163.5	7.59	367
12/7/2018	ETFSL200	0.342	0.338	0.73	1.42	160.3	7.5	355
12/7/2018	ETFSL300	0.324	0.373	1.16	2.87	154.8	7.49	361
12/7/2018	ETFSL400	0.338	0.353	0.44	3.85	1596	7.55	356
12/7/2018	ETFSL500	0.212	0.218	<0.05	2.45	158.3	7.37	259
19/7/2018	ETAU	0.726	0.712	0.63	3.5	177	7	377
19/7/2018	ETFSL100	0.576	0.565	0.11	3.01	202.8	7.37	371
19/7/2018	ETFSL200	0.444	0.4	0.36	2.35	200.6	7.24	360
19/7/2018	ETFSL300	0.462	0.402	1.11	3.68	202	7.21	372
19/7/2018	ETFSL400	0.431	0.374	0.57	3.48	203.3	7.33	384
19/7/2018	ETFSL500	0.288	0.279	<0.05	3.33	203.6	7.21	330
26/7/2018	ETAU	0.725	0.753	4.1	6.53	-5.9	6.59	364
26/7/2018	ETFSL100	0.522	0.566	0.19	2.89	10.8	6.78	356
26/7/2018	ETFSL200	0.31	0.353	0.29	1.73	9.8	6.79	351
26/7/2018	ETFSL300	0.35	0.35	1.59	2.55	-0.3	6.71	353
26/7/2018	ETFSL400	0.375	0.397	1.92	3.56	-12.3	6.75	370
26/7/2018	ETFSL500	0.346	0.431	<0.05	3.13	107.8	6.88	378
02/8/2018	ETAU	0.744	0.733	0.44	2.96	54.8	6.53	366
02/8/2018	ETFSL100	0.526	0.544	0.09	2.48	325	6.57	359
02/8/2018	ETFSL200	0.321	0.350	0.39	1.44	265.1	6.51	352
02/8/2018	ETFSL300	0.337	0.348	1.79	2.59	263.4	6.39	355
02/8/2018	ETFSL400	0.398	0.420	3.38	4.5	251.8	6.59	397
02/8/2018	ETFSL500	0.395	0.429	1.14	3.44	236.4	6.8	386
09/8/2018	ETAU	0.637	0.785	2.11	5.08	257.2	6.73	367
09/8/2018	ETFSL100	0.538	0.644	0.18	5.24	256.6	6.92	363
09/8/2018	ETFSL200	0.276	0.316	0.20	1.56	248.6	6.86	355
09/8/2018	ETFSL300	0.285	0.306	1.68	2.50	233.3	6.75	355
09/8/2018	ETFSL400	0.375	0.416	5.43	6.97	254.2	6.99	436
09/8/2018	ETFSL500	0.373	0.401	3.02	4.50	253.7	6.9	390

ATTACHMENT A (Continued)
Water Quality Data for Sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100

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)
16/8/2018	ETAU	0.672	0.797	1.53	3.99	250.1	6.71	365
16/8/2018	ETFSL100	0.491	0.584	0.08	2.32	264.8	7.16	362
16/8/2018	ETFSL200	0.263	0.304	0.1	1.17	265.4	7.13	353
16/8/2018	ETFSL300	0.249	0.298	1.02	1.98	267.4	6.96	349
16/8/2018	ETFSL400	0.336	0.351	3.57	4.23	260.7	7.12	405
16/8/2018	ETFSL500	0.309	0.358	1.69	3.18	261.3	6.98	386
23/8/2018	ETAU	0.724	0.701	0.92	3.12	266.4	7.03	358
23/8/2018	ETFSL100	0.489	0.505	0.07	2.26	271.7	6.97	351
23/8/2018	ETFSL200	0.274	0.270	0.1	1.01	267.1	7.11	344
23/8/2018	ETFSL300	0.227	0.273	0.83	1.83	265.6	7.04	341
23/8/2018	ETFSL400	0.267	0.279	2.11	2.50	261.8	7.05	365
23/8/2018	ETFSL500	0.352	0.337	2.34	3.41	258.1	7.23	382
30/8/2018	ETAU	0.632	0.696	<0.05	2.52	99.5	7.97	368
30/8/2018	ETFSL100	0.440	0.491	<0.05	2.09	77	7.73	354
30/8/2018	ETFSL200	0.225	0.243	0.06	0.85	23.2	7.85	350
30/8/2018	ETFSL300	0.236	0.248	0.96	1.70	256.2	7.78	345
30/8/2018	ETFSL400	0.327	0.343	3.30	4.50	252.5	8.20	399
30/8/2018	ETFSL500	0.316	0.350	2.05	3.65	228.1	8.18	387
05/9/2018	ETAU	0.688	0.683	0.66	4.54	25.2	7.44	363
05/9/2018	ETFSL100	0.476	0.483	<0.05	2.06	53.5	7.77	350
05/9/2018	ETFSL200	0.234	0.23	0.09	0.98	12.5	7.71	340
05/9/2018	ETFSL300	0.259	0.238	1.08	1.71	-12.5	7.57	333
05/9/2018	ETFSL400	0.367	0.371	4.53	5.96	-42.4	7.65	404
05/9/2018	ETFSL500	0.336	0.318	2.52	3.73	1.5	7.69	372
12/9/2018	ETAU	0.653	0.719	<0.05	3.72	178.2	7.05	360
12/9/2018	ETFSL100	0.461	0.521	<0.05	2.72	71.7	7.54	356
12/9/2018	ETFSL200	0.25	0.28	<0.05	0.96	20.1	7.49	346
12/9/2018	ETFSL300	0.3	0.301	0.41	1.73	3.1	7.38	345
12/9/2018	ETFSL400	0.389	0.34	2.15	2.77	-62.7	7.39	359
12/9/2018	ETFSL500	0.401	0.39	1.04	3.87	-17.4	7.43	381
20/9/2018	ETAU	0.392	0.721	1.14	2.49	272.4	7.11	362
20/9/2018	ETFSL100	0.179	0.467	<0.05	1.88	272.4	7.18	350
20/9/2018	ETFSL200	0.182	0.194	0.63	0.7	25.2	7.17	341
20/9/2018	ETFSL300	0.227	0.233	0.63	1.5	-11.9	7.08	337
20/9/2018	ETFSL400	0.386	0.356	2.66	5.39	-34.2	7.21	397
20/9/2018	ETFSL500	0.394	0.358	1.1	3.15	25.4	7.25	371
27/9/2018	ETAU	0.58	0.763	<0.05	2.24	234	7.33	400
27/9/2018	ETFSL100	0.434	0.493	<0.05	1.54	268.1	7.64	392
27/9/2018	ETFSL200	0.178	0.188	<0.05	0.61	272.8	7.55	381
27/9/2018	ETFSL300	0.231	0.239	0.4	1.6	270.8	7.33	377
27/9/2018	ETFSL400	0.331	0.325	1.49	3.55	263.1	7.41	400
27/9/2018	ETFSL500	0.335	0.375	0.83	3.46	266.8	7.67	416
05/10/2018	ETAU	0.39	0.359	2.14	3.49	274.6	7.28	250
05/10/2018	ETFSL100	0.297	0.686	0.32	12	271	7.57	286
05/10/2018	ETFSL200	0.305	0.308	0.29	2.72	269.7	7.67	295
05/10/2018	ETFSL300	0.272	0.305	0.32	2.72	267.7	7.66	291
05/10/2018	ETFSL400	0.364	0.299	0.63	2.95	259.8	7.73	294
05/10/2018	ETFSL500	0.251	0.245	0.36	2.11	242.9	7.58	271

ATTACHMENT A (Continued)

Water Quality Data for Sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100

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)
10/10/2018	ETAU	0.569	0.635	1.8	2.68	266.6	6.59	308
10/10/2018	ETFSL100	0.571	0.602	1.62	2.25	267.5	6.66	304
10/10/2018	ETFSL200	0.494	0.558	1.07	1.88	269.6	6.78	302
10/10/2018	ETFSL300	0.492	0.49	1.05	1.42	269.6	6.81	303
10/10/2018	ETFSL400	0.479	0.503	2.3	3.04	267.3	7.07	334
10/10/2018	ETFSL500	0.48	0.512	1.36	2	266.7	6.98	308
15/10/2018	ETAU	0.325	0.333	0.9	1.33	285.6	6.35	269
15/10/2018	ETFSL100	0.298	0.302	0.69	1.2	278.5	6.36	259
15/10/2018	ETFSL200	0.316	0.336	0.66	1.9	276.9	6.37	262
15/10/2018	ETFSL300	0.286	0.298	0.57	1.41	279.5	6.39	259
15/10/2018	ETFSL400	0.276	0.3	0.6	1.38	279.9	6.56	266
15/10/2018	ETFSL500	0.273	0.279	0.63	1.18	263	7.71	267
22/10/2018	ETAU	0.274	0.259	0.76	1.26	276.9	6.52	281
22/10/2018	ETFSL100	0.25	0.244	0.56	1.13	270.7	6.57	278
22/10/2018	ETFSL200	0.235	0.233	0.41	1.01	270.4	6.53	275
22/10/2018	ETFSL300	0.236	0.228	0.42	1	269	6.58	275
22/10/2018	ETFSL400	0.304	0.263	1.8	2.51	264.8	7.01	321
22/10/2018	ETFSL500	0.184	0.229	0.26	1.19	258.5	6.74	279
30/10/2018	ETAU	0.432	0.431	1.79	2.55	15.1	6.65	290
30/10/2018	ETFSL100	0.376	0.39	0.76	1.78	-0.4	6.91	286
30/10/2018	ETFSL200	0.336	0.363	0.37	1.47	3.8	6.92	285
30/10/2018	ETFSL300	0.341	0.35	0.39	1.32	7.6	6.99	291
30/10/2018	ETFSL400	0.36	0.364	1.58	3.1	-77.3	7.09	329
30/10/2018	ETFSL500	0.34	0.351	0.5	1.63	-4.2	7.05	296
08/11/2018	ETAU	0.635	0.553	0.76	3.15	23.3	7.07	307
08/11/2018	ETFSL100	0.429	0.433	0.14	1.59	12.9	7.35	307
08/11/2018	ETFSL200	0.333	0.34	0.06	1	20	7.31	303
08/11/2018	ETFSL300	0.333	0.329	0.06	1.1	5.4	7.32	304
08/11/2018	ETFSL400	0.431	0.403	5.31	5.49	247.1	7.47	385
08/11/2018	ETFSL500	0.315	0.325	0.37	1.54	248.4	7.30	310
15/11/2018	ETAU	0.609	0.628	0.53	2.04	264.1	7.09	334
15/11/2018	ETFSL100	0.399	0.414	<0.05	1.6	172.9	7.32	328
15/11/2018	ETFSL200	0.308	0.331	<0.05	1.34	272	7.31	325
15/11/2018	ETFSL300	0.321	0.298	0.08	1.15	271	7.28	324
15/11/2018	ETFSL400	0.396	0.383	1.44	4.72	262.5	7.35	373
15/11/2018	ETFSL500	0.328	0.336	0.24	1.76	267.3	7.38	345
19/11/2018	ETWQ AU	0.647	- ⁶	0.08	2.42	259.1	7.22	345
22/11/2018	ETFSL200	0.264	0.298	<0.05	0.82	30.9	7.29	355
22/11/2018	ETFSL500	0.38	0.376	0.67	1.88	-3.3	7.50	373
22/11/2018	CONFLU1	0.085	0.088	0.12	0.9	-1.1	7.51	307
22/11/2018	WARARM5	0.018	0.046	0.25	1	54.6	7.57	297
22/11/2018	WDFS1	0.105	0.114	0.12	1.15	40.1	7.53	307
22/11/2018	WDFS1+100	0.103	0.119	0.1	1.06	26	7.55	306

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

ATTACHMENT A (Continued)

Water Quality Data for Sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100

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)
26/11/2018	ETWQ AU	0.538	- ⁶	<0.05	1.36	83.8	7.11	354
29/11/2018	ETFSL200	0.139	0.15	0.54	1.2	36.1	7.07	195
29/11/2018	ETFSL500	0.167	0.147	0.3	1.19	30.1	6.94	195
29/11/2018	CONFLU1	0.158	0.108	0.27	1.18	29.5	7.19	200
29/11/2018	WARARM5	0.055	0.052	0.18	0.92	66.7	7.5	206
29/11/2018	WDFS1	0.082	0.074	0.18	0.21	36.7	7.8	206
29/11/2018	WDFS1+100	0.103	0.094	0.19	1	38.4	7.36	200
4/12/2018	ETWQ AU	0.433	- ⁶	1.65	2.36	30.6	7	266
6/12/2018	ETFSL200	0.283	0.295	0.26	1.04	242.7	6.97	260
6/12/2018	ETFSL500	0.29	0.3	0.62	1.47	249.5	7.23	270
6/12/2018	CONFLU1	0.112	0.114	0.12	1.13	243.8	7.24	243
6/12/2018	WARARM5	0.034	0.035	<0.05	0.75	250.1	7.29	238
6/12/2018	WDFS1	0.122	0.134	0.07	1.12	241.4	7.29	246
6/12/2018	WDFS1+100	0.109	0.126	<0.05	0.99	251.1	7.3	245
12/12/2018	ETAU	0.428	0.484	1.49	3.33	-	6.86	269
12/12/2018	ETFSL200	0.215	0.232	<0.05	0.42	255.3	7.4	245
12/12/2018	ETFSL500	0.276	0.284	0.27	0.89	251.9	7.41	262
12/12/2018	CONFLU1	0.081	0.091	0.45	0.8	17.9	7.39	219
12/12/2018	WARARM5	0.03	0.042	<0.05	0.58	236.4	7.53	214
12/12/2018	WDFS1	0.108	0.121	0.41	1.09	27.5	7.44	225
12/12/2018	WDFS1+100	0.105	0.12	<0.05	0.99	42.3	7.24	243
17/12/2018	ETWQ AU	0.102	- ⁶	0.18	0.75	280.3	6.50	152
17/12/2018	ETFSL200	0.076	0.084	0.17	0.7	274.8	6.76	152
17/12/2018	ETFSL500	0.087	0.086	0.19	0.76	274.8	6.56	150
17/12/2018	CONFLU1	0.068	0.068	0.16	0.78	270.9	6.64	152
17/12/2018	WARARM5	0.023	0.032	0.08	0.54	257.5	6.77	156
17/12/2018	WDFS1	0.069	0.062	0.15	0.75	273	6.67	153
17/12/2018	WDFS1+100	0.055	0.063	0.12	0.71	278.4	6.71	154
27/12/2018	ETAU	0.263	0.277	0.61	1.81	24.3	6.72	217
27/12/2018	ETFSL200	0.196	0.194	0.09	0.93	30.6	7.11	216
27/12/2018	ETFSL500	0.219	0.213	0.3	1.37	-6.9	7.13	224
27/12/2018	CONFLU1	0.071	0.075	<0.05	0.86	21.4	7.15	208
27/12/2018	WARARM5	0.045	0.036	<0.05	0.48	3.4	7.3	206
27/12/2018	WDFS1	0.108	0.11	0.06	0.99	24.9	7.12	210
27/12/2018	WDFS1+100	0.101	0.105	<0.05	0.93	37.4	7.13	210
3/01/2019	ETWQ AU	0.335	0.443	<0.05	1.57	110.1	7.35	300
3/01/2019	ETFSL200	0.159	0.226	<0.05	0.63	113.1	7.63	290
3/01/2019	ETFSL500	0.265	0.274	0.12	1.32	11.5	7.5	302
3/01/2019	CONFLU1	0.143	0.16	<0.05	1.21	4.8	7.29	270
3/01/2019	WARARM5	0.055	0.054	<0.05	0.64	56.4	7.46	256
3/01/2019	WDFS1	0.106	0.14	<0.05	1.27	72	7.45	265
3/01/2019	WDFS1+100	0.101	0.138	<0.05	1.16	56.2	7.42	263
10/01/2019	ETWQ AU	0.438	0.282	<0.05	1.41	244.1	6.92	268
10/01/2019	ETFSL200	0.216	0.246	<0.05	0.62	26.8	8.03	279
10/01/2019	ETFSL500	0.22	0.262	<0.05	1.18	-9.3	7.64	300
10/01/2019	CONFLU1	0.129	0.141	<0.05	1.11	-33.7	7.55	269
10/01/2019	WARARM5	0.042	0.041	<0.05	0.6	90.3	7.62	252
10/01/2019	WDFS1	0.061	0.087	<0.05	0.92	22.1	7.59	242
10/01/2019	WDFS1+100	0.061	0.074	<0.05	0.97	6.9	7.58	240

ATTACHMENT A (Continued)

Water Quality Data for Sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100

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)
16/01/2019	ETWQ AU	0.433	0.454	<0.05	1.86	171.1	6.75	282
16/01/2019	ETFSL200	0.18	0.189	<0.05	0.4	258.4	7.67	275
16/01/2019	ETFSL500	0.244	0.233	0.38	1	262.4	7.65	303
16/01/2019	CONFLU1	0.058	0.049	0.12	0.86	261.2	7.68	249
16/01/2019	WARARM5	0.025	0.028	0.11	0.52	268.1	7.82	242
16/01/2019	WDFS1	0.046	0.044	0.16	0.92	263.5	7.76	256
16/01/2019	WDFS1+100	0.047	0.044	0.19	0.94	259.2	7.79	260
23/01/2019	ETWQ AU	0.579	0.661	<0.05	2.09	184.3	6.78	292
23/01/2019	ETFSL200	0.171	0.204	<0.05	0.38	96.8	7.65	286
23/01/2019	ETFSL500	0.28	0.284	0.2	1.62	-11.1	7.65	316
23/01/2019	CONFLU1	0.052	0.056	<0.05	1.11	5.6	7.7	264
23/01/2019	WARARM5	0.043	0.036	<0.05	0.74	-38.4	7.7	253
23/01/2019	WDFS1	0.032	0.042	<0.05	1.08	19.6	7.77	266
23/01/2019	WDFS1+100	0.02	0.029	<0.05	0.92	-16.6	7.83	266
29/01/2019	ETAU	0.62	0.578	0.07	1.52	66.8	6.7	294
29/01/2019	ETFSL200	0.19	0.216	<0.05	0.44	36.2	7.23	282
29/01/2019	ETFSL500	0.249	0.279	<0.05	1.48	12.1	7.34	310
29/01/2019	CONFLU1	0.048	0.07	<0.05	1.05	-20.8	7.54	282
29/01/2019	WARARM5	0.031	0.028	<0.05	0.54	49.5	7.34	251
29/01/2019	WDFS1	0.027	0.038	<0.05	0.96	29.7	7.49	260
29/01/2019	WDFS1+100	0.03	0.03	<0.05	0.91	9.9	7.49	260
4/02/2019	ETAU	0.559	0.635	<0.05	1.04	51.1	6.8	283
4/02/2019	ETFSL200	0.173	0.191	<0.05	0.34	9.1	7.26	275
4/02/2019	ETFSL500	0.221	0.276	0.31	1.7	-18.6	7.35	302
4/02/2019	CONFLU1	0.043	0.036	0.16	0.85	-51.7	7.55	252
4/02/2019	WARARM5	0.023	0.029	0.19	0.74	139.1	7.58	240
4/02/2019	WDFS1	0.012	0.021	0.27	0.8	73.2	7.71	252
4/02/2019	WDFS1+100	0.01	0.02	0.29	0.74	50	7.71	255
11/02/2019	ETAU	0.757	0.731	<0.05	1.5	261.4	6.86	288
11/02/2019	ETFSL200	0.197	0.206	<0.05	0.36	6.8	7.21	280
11/02/2019	ETFSL500	0.243	0.302	0.5	1.86	-33.9	7.3	306
11/02/2019	CONFLU1	0.023	0.033	0.24	0.94	-96.7	7.48	255
11/02/2019	WARARM5	0.019	0.026	0.24	0.66	53.5	7.46	243
11/02/2019	WDFS1	0.011	0.018	0.31	0.98	-26	7.62	259
11/02/2019	WDFS1+100	0.005	0.013	0.3	0.83	64.5	7.62	258
18/02/2019	ETAU	0.624	0.675	0.17	1.51	51.8	6.91	303
18/02/2019	ETFSL200	0.189	0.19	0.19	0.36	12.8	7.27	296
18/02/2019	ETFSL500	0.243	0.284	0.23	1.77	-15.6	7.86	277
18/02/2019	CONFLU1	0.041	0.035	0.13	0.9	6.6	7.73	291
18/02/2019	WARARM5	0.022	0.024	0.19	0.64	64.1	7.46	262
18/02/2019	WDFS1	0.007	0.012	0.31	0.78	26.7	7.83	279
18/02/2019	WDFS1+100	0.006	0.011	0.24	0.64	23.3	7.84	279
25/02/2019	ETAU	0.616	0.719	<0.05	0.93	273.1	7.19	283
25/02/2019	ETFSL200	0.198	0.199	<0.05	0.54	270.5	7.06	271
25/02/2019	ETFSL500	0.281	0.312	1.72	2.11	270.6	7.3	307
25/02/2019	CONFLU1	0.022	0.027	0.06	0.86	274.6	7.37	247
25/02/2019	WARARM5	0.014	0.023	<0.05	0.53	264.2	7.4	238
25/02/2019	WDFS1	0.009	0.017	<0.05	0.79	272.6	7.55	248
25/02/2019	WDFS1+100	0.004	0.014	0.05	0.92	264.9	7.6	246

ATTACHMENT A (Continued)

Water Quality Data for Sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100

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)
04/03/2019	ETAU	0.688	0.67	<0.05	0.13	104.3	6.74	306
04/03/2019	ETFSL200	0.185	0.193	0.12	0.48	259.3	7.18	294
04/03/2019	ETFSL500	0.295	0.298	0.76	2.02	271.1	7.33	334
04/03/2019	CONFLU1	0.032	0.049	0.12	1.71	277.1	7.56	274
04/03/2019	WARARM5	0.025	0.031	0.12	1.02	277.7	7.44	248
04/03/2019	WDFS1	0.006	0.013	0.13	0.81	273.6	7.75	271
04/03/2019	WDFS1+100	0.005	0.011	0.21	0.71	249.3	7.58	270
11/03/2019	ETAU	0.638	0.726	0.08	0.94		6.87	322
11/03/2019	ETFSL200	0.152	0.170	0.06	0.38	227.4	7.24	310
11/03/2019	ETFSL500	0.266	0.28	0.5	1.91	219.5	7.43	347
11/03/2019	CONFLU1	0.024	0.03	0.23	0.96	228.5	7.53	289
11/03/2019	WARARM5	0.018	0.052	0.19	0.71	202.5	7.53	269
11/03/2019	WDFS1	0.01	0.018	0.26	0.8	219.7	7.07	276
11/03/2019	WDFS1+100	0.006	0.027	0.22	1.45	215.9	7.82	289
18/03/2019	ETAU	0.153	0.16	0.84	1.21	239	6.77	175
18/03/2019	ETFSL200	0.187	<0.01	0.5	0.204	237.9	6.62	180
18/03/2019	ETFSL500	0.193	<0.01	0.63	0.197	230.4	6.7	184
18/03/2019	CONFLU1	0.146	0.02	0.5	0.156	50.3	6.72	172
18/03/2019	WARARM5	0.032	<0.01	0.3	0.034	49.3	6.67	153
18/03/2019	WDFS1	0.071	0.04	0.44	0.073	21.4	6.67	159
18/03/2019	WDFS1+100	0.094	0.04	0.42	0.099	57.1	6.61	158
26/03/2019	ETAU	0.335	0.347	0.46	1.91	29.3	6.74	230
26/03/2019	ETFSL200	0.205	0.217	<0.05	1.04	23.5	6.96	224
26/03/2019	ETFSL500	0.233	0.234	0.5	1.39	227	6.99	239
26/03/2019	CONFLU1	0.095	0.114	<0.05	0.8	237.9	7.02	206
26/03/2019	WARARM5	0.039	0.041	<0.05	0.45	241.4	6.92	195
26/03/2019	WDFS1	0.073	0.076	<0.05	0.65	236.4	7.02	200
26/03/2019	WDFS1+100	0.054	0.049	<0.05	0.64	241.1	7.03	199
01/04/2019	ETAU	0.332	0.407	<0.05	1.51	160	7.3	256
01/04/2019	ETFSL200	0.184	0.248	<0.05	0.78	-1.8	7.68	248
01/04/2019	ETFSL500	0.222	0.261	0.47	1.14	-4.8	7.64	263
01/04/2019	CONFLU1	0.103	0.116	0.17	0.92	9	7.68	232
01/04/2019	WARARM5	0.034	0.037	0.1	0.42	36.8	7.71	207
01/04/2019	WDFS1	0.051	0.061	0.18	0.64	0.8	7.67	221
01/04/2019	WDFS1+100	0.027	0.031	0.14	0.56	43.5	7.73	219
08/04/2019	ETAU	0.298	0.319	0.64	1.89	35.8	6.86	225
08/04/2019	ETFSL200	0.200	0.198	0.12	0.96	273.8	7.09	212
08/04/2019	ETFSL500	0.184	0.2	0.34	1.34	264	7.25	220
08/04/2019	CONFLU1	0.073	0.082	0.14	0.77	238.9	7.54	212
08/04/2019	WARARM5	0.02	0.018	0.06	0.35	252.5	7.6	204
08/04/2019	WDFS1	0.039	0.05	0.11	0.7	236.9	7.56	205
08/04/2019	WDFS1+100	0.03	0.038	0.08	0.58	242.3	7.61	205
16/04/2019	ETAU	0.321	0.31	<0.05	1.31	259.8	7.17	240
16/04/2019	ETFSL200	0.156	0.154	<0.05	0.64	83.9	7.48	233
16/04/2019	ETFSL500	0.207	0.204	0.53	1.25	11.4	7.65	262
16/04/2019	CONFLU1	0.099	0.1	0.06	0.73	3.8	7.69	235
16/04/2019	WARARM5	0.024	0.021	0.21	0.34	21.6	7.62	207
16/04/2019	WDFS1	0.035	0.035	0.13	0.62	0.9	7.6	215
16/04/2019	WDFS1+100	0.017	0.017	0.14	0.48	4.6	7.67	214

ATTACHMENT A (Continued)

Water Quality Data for Sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100

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)
23/04/2019	ETAU	0.384	0.425	<0.05	1.82	262.5	7.54	224
23/04/2019	ETFSL200	0.162	0.174	0.08	0.77	73.9	7.31	218
23/04/2019	ETFSL500	0.214	0.232	0.24	1.4	8.8	7.64	240
23/04/2019	CONFLU1	0.041	0.046	0.13	0.76	10.6	7.56	194
23/04/2019	WARARM5	0.041	0.046	0.13	0.76	63.3	7.56	194
23/04/2019	WDFS1	0.026	0.027	0.16	0.71	7.5	7.56	191
23/04/2019	WDFS1+100	0.009	0.014	0.18	0.6	45	7.59	190
02/05/2019	ETAU	0.448	0.502	0.33	4.37	78.6	6.97	235
02/05/2019	ETFSL200	0.171	0.187	0.07	0.86	213.6	7.2	226
02/05/2019	ETFSL500	0.24	0.267	0.5	1.4	208.1	7.31	248
02/05/2019	CONFLU1	0.068	0.078	0.12	0.9	198.7	7.41	215
02/05/2019	WARARM5	0.024	0.03	0.14	0.51	201.1	7.3	184
02/05/2019	WDFS1	0.022	0.024	0.19	0.62	194.3	7.31	195
02/05/2019	WDFS1+100	0.01	0.016	0.18	0.5	189.9	7.4	196
06/05/2019	ETAU	0.381	0.421	<0.05	1.3	148.2	6.89	284
06/05/2019	ETFSL200	0.164	0.183	0.1	0.62	252.8	7.18	278
06/05/2019	ETFSL500	0.212	0.256	0.7	1.68	256.8	7.34	314
06/05/2019	CONFLU1	0.076	0.084	0.12	0.78	236.9	7.48	271
06/05/2019	WARARM5	0.025	0.023	0.09	0.46	254.6	7.37	238
06/05/2019	WDFS1	0.024	0.028	0.14	0.71	216.8	7.43	250
06/05/2019	WDFS1+100	0.009	0.009	0.08	0.54	259.9	7.57	246
13/05/2019	ETAU	0.452	0.488	0.08	2.71	106.4	7.15	299
13/05/2019	ETFSL200	0.171	0.208	0.06	0.93	254.6	7.48	290
13/05/2019	ETFSL500	0.261	0.273	0.29	1.74	241.2	7.57	322
13/05/2019	CONFLU1	0.057	0.063	0.07	0.88	249.5	7.61	269
13/05/2019	WARARM5	0.028	0.026	0.07	0.52	249.3	7.6	248
13/05/2019	WDFS1	0.034	0.031	0.05	0.85	243.4	7.61	260
13/05/2019	WDFS1+100	0.009	0.011	<0.05	0.58	243.9	7.71	265
20/05/2019	ETAU	0.432	0.49	<0.05	1.93	270.8	6.96	297
20/05/2019	ETFSL200	0.212	0.230	0.1	1.27	97.3	7.79	291
20/05/2019	ETFSL500	0.282	0.292	1.16	2.02	-17.1	7.63	331
20/05/2019	CONFLU1	0.076	0.092	0.1	1.12	68	7.76	286
20/05/2019	WARARM5	0.035	0.036	0.15	0.54	58.2	7.66	252
20/05/2019	WDFS1	0.027	0.028	0.2	0.72	27.9	7.43	266
20/05/2019	WDFS1+100	0.015	0.016	0.12	0.57	113.4	7.74	270
27/05/2019	ETAU	0.422	0.498	<0.05	2.26	169.8	7.02	301
27/05/2019	ETFSL200	0.240	0.239	0.11	1.06	286.4	7.45	293
27/05/2019	ETFSL500	0.292	0.276	1.14	1.92	286	7.51	334
27/05/2019	CONFLU1	0.06	0.053	0.07	0.69	151.2	7.63	271
27/05/2019	WARARM5	0.026	0.024	<0.05	0.49	278	7.47	254
27/05/2019	WDFS1	0.034	0.037	0.1	0.82	274.3	7.57	270
27/05/2019	WDFS1+100	0.013	0.013	0.06	0.52	284.6	7.76	271
05/06/2019	ETAU	0.295	0.28	0.66	2.05	127.4	7.15	228
03/06/2019	ETFSL200	0.237	0.245	0.09	1.34	84	7.63	316
03/06/2019	ETFSL500	0.325	0.339	1.31	2.4	23	7.71	358
03/06/2019	CONFLU1	0.093	0.099	0.06	0.78	54.6	7.87	308
03/06/2019	WARARM5	0.024	0.02	0.07	0.41	122.6	7.78	275
03/06/2019	WDFS1	0.056	0.057	0.39	1.68	80.4	7.78	290
03/06/2019	WDFS1+100	0.019	0.021	0.15	0.56	87.6	7.92	291

ATTACHMENT A (Continued)

Water Quality Data for Sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100

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)
11/06/2019	ETAU	0.0448	0.465	0.41	2.98	142.8	7.08	291
11/06/2019	ETFSL200	0.247	0.253	0.1	1.12	116.2	7.43	287
11/06/2019	ETFSL500	0.34	0.358	1.24	2.26	63.1	7.55	323
11/06/2019	CONFLU1	0.118	0.13	0.13	1.1	73.1	7.58	278
11/06/2019	WARARM5	0.026	0.024	0.05	0.45	82	7.55	234
11/06/2019	WDFS1	0.061	0.056	0.14	0.73	101.4	7.58	251
11/06/2019	WDFS1+100	0.035	0.03	<0.05	0.56	89.2	7.63	251
18/06/2019	ETAU	0.383	0.411	1.74	2.71	12.6	6.83	252
18/06/2019	ETFSL200	0.275	0.296	0.39	1.37	35.8	7.01	242
18/06/2019	ETFSL500	0.277	0.29	0.6	1.63	12.6	7.14	249
18/06/2019	CONFLU1	0.192	0.137	0.07	0.93	8.1	7.24	235
18/06/2019	WARARM5	0.019	0.014	<0.05	0.26	48.8	7.36	222
18/06/2019	WDFS1	0.088	0.092	0.11	0.73	3.4	7.25	229
18/06/2019	WDFS1+100	0.083	0.088	<0.05	0.71	13.9	7.26	226
25/06/2019	ETAU	0.369	0.377	2.13	3.62	-2.6	6.88	266
25/06/2019	ETFSL200	0.217	0.259	0.11	2.29	2.3	7.16	252
25/06/2019	ETFSL500	0.254	0.268	0.44	2.04	-28.1	7.22	266
25/06/2019	CONFLU1	0.076	0.09	<0.05	0.66	-7.1	7.4	246
25/06/2019	WARARM5	0.066	0.017	<0.05	0.35	4.7	7.43	236
25/06/2019	WDFS1	0.079	0.087	0.12	0.75	-9.4	7.38	241
25/06/2019	WDFS1+100	0.054	0.062	<0.05	0.64	-30.8	7.41	237
01/07/2019	ETAU	0.39	0.405	0.87	3.55	37.4	7.32	261
01/07/2019	ETFSL200	0.219	0.228	<0.05	1.47	20.7	7.21	247
01/07/2019	ETFSL500	0.275	0.372	0.85	2.78	-28.7	7.3	276
01/07/2019	CONFLU1	0.135	0.145	0.17	0.92	-10.8	7.45	250
01/07/2019	WARARM5	0.018	0.018	<0.05	0.37	5.3	7.51	226
01/07/2019	WDFS1	0.065	0.066	0.14	0.81	-13	7.39	234
01/07/2019	WDFS1+100	0.046	0.044	<0.05	0.6	-7.2	7.47	234
08/07/2019	ETAU	0.144	0.154	0.63	1.33	42.7	6.59	177
08/07/2019	ETFSL200	0.13	0.142	0.52	0.99	30.2	6.72	176
08/07/2019	ETFSL500	0.143	0.153	0.68	1.08	13	6.77	180
08/07/2019	CONFLU1	0.082	0.091	0.31	0.91	-32.7	7.01	191
08/07/2019	WARARM5	0.018	0.019	0.07	0.58	17.1	7.15	201
08/07/2019	WDFS1	0.082	0.089	0.36	0.94	1.5	6.98	190
08/07/2019	WDFS1+100	0.078	0.081	0.21	0.79	-5	7.01	188
15/07/2019	ETAU	0.268	0.266	1.11	2.05	-3.8	6.66	221
15/07/2019	ETFSL200	0.209	0.219	0.21	1.24	-4.9	6.76	218
15/07/2019	ETFSL500	0.241	0.256	0.56	1.8	-13.9	6.84	232
15/07/2019	CONFLU1	0.126	0.127	0.07	0.97	6.6	6.89	221
15/07/2019	WARARM5	0.023	0.017	<0.05	0.52	19.7	6.98	222
15/07/2019	WDFS1	0.086	0.097	0.05	0.95	15	6.9	215
15/07/2019	WDFS1+100	0.06	0.064	<0.05	0.78	-1.6	6.87	210
22/07/2019	ETAU	0.415	0.372	2.39	3.53	28.3	7.04	243
22/07/2019	ETFSL200	0.289	0.272	0.08	1.46	3.8	6.45	235
22/07/2019	ETFSL500	0.332	0.291	0.71	2.07	-38.1	6.65	254
22/07/2019	CONFLU1	0.168	0.153	0.06	0.84	10.3	6.66	233
22/07/2019	WARARM5	0.025	0.017	<0.05	0.44	9	6.66	222
22/07/2019	WDFS1	0.094	0.091	0.34	0.8	14	6.63	226
22/07/2019	WDFS1+100	0.071	0.061	0.26	0.61	-1.6	6.63	227

ATTACHMENT A (Continued)

Water Quality Data for Sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100

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)
29/07/2019	ETAU	0.348	0.363	0.22	2.06	53	6.3	315
29/07/2019	ETFSL200	0.234	0.25	0.07	1.4	56.1	6.41	311
29/07/2019	ETFSL500	0.301	0.348	1.37	2.58	-3.8	6.51	342
29/07/2019	CONFLU1	0.13	0.127	0.33	1.28	14.3	6.51	312
29/07/2019	WARARM5	0.029	0.018	0.1	0.38	36.1	6.52	291
29/07/2019	WDFS1	0.077	0.078	0.15	0.87	21.1	6.58	306
29/07/2019	WDFS1+100	0.044	0.044	0.11	0.55	13.7	6.48	302
05/08/2019	ETAU	0.387	0.371	0.72	3.36	34	6.35	323
05/08/2019	ETFSL200	0.247	0.259	0.13	1.47	16.2	6.5	317
05/08/2019	ETFSL500	0.304	0.319	1.34	2.2	-8.3	6.67	354
05/08/2019	CONFLU1	0.104	0.107	0.13	0.74	4.1	6.64	311
05/08/2019	WARARM5	0.019	0.016	0.08	0.37	1.6	6.63	291
05/08/2019	WDFS1	0.061	0.055	0.43	0.86	5.9	6.61	299
05/08/2019	WDFS1+100	0.041	0.038	0.11	0.52	32.5	6.54	305
12/08/2019	ETAU	0.405	0.402	1.42	3.6	29	6.45	292
12/08/2019	ETFSL200	0.249	0.240	0.16	1.38	69.3	6.22	287
12/08/2019	ETFSL500	0.317	0.306	1.52	2.48	13.1	6.35	314
12/08/2019	CONFLU1	0.104	0.108	0.13	0.7	32.9	6.34	283
12/08/2019	WARARM5	0.016	0.013	0.09	0.38	47.9	6.32	263
12/08/2019	WDFS1	0.052	0.052	0.1	0.58	37.6	6.26	275
12/08/2019	WDFS1+100	0.028	0.035	0.13	1.65	11.2	6.35	275
19/08/2019	ETAU	0.425	0.461	1.34	3.64	14	6.29	297
19/08/2019	ETFSL200	0.242	0.264	0.12	1.37	143	6.47	290
19/08/2019	ETFSL500	0.314	0.334	1.3	2.36	-36.1	6.65	319
19/08/2019	CONFLU1	0.106	0.116	0.08	0.71	-16.8	6.62	290
19/08/2019	WARARM5	0.016	0.016	0.08	0.31	7.7	6.43	267
19/08/2019	WDFS1	0.042	0.051	0.1	0.63	-25.6	6.64	279
19/08/2019	WDFS1+100	0.017	0.021	0.12	0.52	-0.5	6.61	279
26/08/2019	ETAU	0.434	0.498	1.56	4.11	2.7	6.93	321
26/08/2019	ETFSL200	0.249	0.267	0.28	1.32	40.1	7.16	317
26/08/2019	ETFSL500	0.297	0.345	1.28	2.66	-33.7	7.21	358
26/08/2019	CONFLU1	0.106	0.115	0.26	1.0	-29	7.36	316
26/08/2019	WARARM5	0.016	0.023	0.17	0.64	-26.1	7.32	287
26/08/2019	WDFS1	0.047	0.051	0.19	0.63	-43.4	7.39	306
26/08/2019	WDFS1+100	0.021	0.038	0.14	0.7	-12.2	7.42	304
02/09/2019	ETAU	0.394	0.427	1.55	3.69	1.2	8.48	308
02/09/2019	ETFSL200	0.233	0.225	<0.05	0.73	31.4	6.13	292
02/09/2019	ETFSL500	0.304	0.293	1.08	1.5	-24.4	6.4	326
02/09/2019	CONFLU1	0.179	0.126	<0.05	0.72	16.3	6.42	290
02/09/2019	WARARM5	0.016	0.013	<0.05	0.3	223.6	6.41	262
02/09/2019	WDFS1	0.047	0.042	<0.05	0.49	4.7	6.41	272
02/09/2019	WDFS1+100	0.026	0.028	<0.05	0.47	33.7	6.41	269
09/09/2019	ETAU	0.387	0.412	1.08	2.58	1.9	7.24	314
08/09/2019	ETFSL200	0.205	0.235	0.12	1.58	41.5	7.34	306
08/09/2019	ETFSL500	0.268	0.297	1.08	2.04	-18.2	7.52	345
08/09/2019	CONFLU1	0.082	0.093	0.1	0.82	-2	7.54	300
08/09/2019	WARARM5	0.018	0.018	0.08	0.4	44.8	7.47	255
08/09/2019	WDFS1	0.025	0.025	0.16	0.61	-55.2	7.53	273
08/09/2019	WDFS1+100	0.01	0.01	0.17	0.56	34.8	7.53	275

ATTACHMENT A (Continued)

Water Quality Data for Sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100

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)
19/09/2019	ETAU	0.045	0.052	0.25	0.7	108.8	7.13	128
19/09/2019	ETFSL200	0.046	0.054	0.26	0.76	111.5	5.94	132
19/09/2019	ETFSL500	0.048	0.059	0.27	0.88	114	5.94	127
19/09/2019	CONFLU1	0.058	0.068	0.25	0.81	127.9	5.93	128
19/09/2019	WARARM5	0.056	0.068	0.21	0.77	118	5.93	140
19/09/2019	WDFS1	0.064	0.073	0.22	0.75	127.2	5.93	139
19/09/2019	WDFS1+100	0.062	0.069	0.2	0.68	148.8	5.81	136
23/09/2019	ETAU	0.118	0.109	0.55	0.97	73.4	6.08	197
23/09/2019	ETFSL200	0.095	0.098	0.41	0.8	40.6	6.09	194
23/09/2019	ETFSL500	0.104	0.112	0.53	1.16	29.8	6.15	200
23/09/2019	CONFLU1	0.132	0.139	0.35	1.17	36.5	6.15	198
23/09/2019	WARARM5	0.047	0.049	0.16	0.47	72.6	6.17	199
23/09/2019	WDFS1	0.074	0.075	0.25	0.63	32.7	6.15	197
23/09/2019	WDFS1+100	0.086	0.089	0.27	0.68	14.4	6.14	196
03/10/2019	ETAU	0.229	0.256	0.43	1.95	56.4	6.08	248
03/10/2019	ETFSL200	0.182	0.202	<0.05	1.19	47.2	6.14	245
03/10/2019	ETFSL500	0.168	0.227	0.32	1.6	4.1	6.28	270
03/10/2019	CONFLU1	0.121	0.125	<0.05	0.85	27.7	6.2	248
03/10/2019	WARARM5	0.051	0.056	<0.05	0.46	36.2	6.19	238
03/10/2019	WDFS1	0.094	0.109	<0.05	0.8	20.8	6.2	242
03/10/2019	WDFS1+100	0.095	0.101	<0.05	0.81	34.1	6.39	247
09/10/2019	ETAU	0.194	0.208	0.07	1.74	113.8	6.68	241
09/10/2019	ETFSL200	0.148	0.161	<0.05	1.33	63.3	6.98	245
09/10/2019	ETFSL500	0.202	0.214	0.47	1.87	9	7.16	274
09/10/2019	CONFLU1	0.184	0.143	<0.05	0.98	39.6	7.22	256
09/10/2019	WARARM5	0.054	0.053	0.07	0.46	62.2	7.15	243
09/10/2019	WDFS1	0.094	0.103	<0.05	0.91	62.2	7.2	250
09/10/2019	WDFS1+100	0.084	0.087	0.08	0.91	71.8	7.22	246
14/10/2019	ETAU	0.111	0.112	0.67	1.18	53	6.6	199
14/10/2019	ETFSL200	0.094	0.099	0.41	0.97	36.1	6.77	195
14/10/2019	ETFSL500	0.096	0.093	0.54	0.95	32.3	6.87	206
14/10/2019	CONFLU1	0.072	0.076	0.23	0.75	33.7	7.08	224
14/10/2019	WARARM5	0.035	0.036	0.05	0.33	35	7.19	248
14/10/2019	WDFS1	0.065	0.071	0.16	0.65	23.5	7.07	229
14/10/2019	WDFS1+100	0.06	0.057	0.16	0.6	-18.3	7.02	224
21/10/2019	ETAU	0.245	0.244	0.81	2.12	81.3	7.44	260
21/10/2019	ETFSL200	0.157	0.167	<0.05	1.18	108.5	7.45	262
21/10/2019	ETFSL500	0.184	0.193	0.46	1.58	43.2	7.59	282
21/10/2019	CONFLU1	0.063	0.069	<0.05	0.61	70.3	7.58	260
21/10/2019	WARARM5	0.04	0.035	0.07	0.36	79.6	7.61	260
21/10/2019	WDFS1	0.088	0.093	<0.05	0.75	40.8	7.63	262
21/10/2019	WDFS1+100	0.061	0.066	0.09	0.73	38.9	7.64	260
28/10/2019	ETAU	0.325	0.34	<0.05	2.13	173	6.61	281
28/10/2019	ETFSL200	0.206	0.228	0.06	1.31	165.1	7.31	277
28/10/2019	ETFSL500	0.251	0.262	0.88	1.74	83.3	7.1	308
28/10/2019	CONFLU1	0.113	0.118	0.19	0.89	156.2	7.45	288
28/10/2019	WARARM5	0.044	0.047	0.19	0.41	160.3	7.44	279
28/10/2019	WDFS1	0.083	0.091	0.19	0.92	151.6	7.42	286
28/10/2019	WDFS1+100	0.056	0.062	0.18	0.7	116.1	7.71	283

Sustainable Minerals Institute

Sir James Foots Building
Cnr College and Staff House Road
St Lucia QLD 4072 Australia

Director

Professor Neville Plint

CRICOS PROVIDER NUMBER 000258

20 January 2020

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 – November 2019

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 Longwall 304 Water Management Plan (LW304 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 LW304 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 LW304 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 LW304 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 LW304 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.

Analysis conducted by Hydro Engineering & Consulting (2019) in accordance with the LW304 WMP, identified that the performance indicator for water resources reaching the Woronora Reservoir was exceeded for dissolved (i.e. filtered <0.45 µm fraction) manganese on the Eastern Tributary at site ETWQ AU in November 2019 (as there was not a similar exceedance of the trigger recorded at control site WOWQ 2 on the Woronora River). The performance indicator was not exceeded for field filtered iron or aluminium in November 2019 and therefore these parameters are not discussed in this report.

In accordance with the LW304 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*.

This assessment against the water quality subsidence impact performance measure has been prepared for November 2019 in consideration of:

- pluviograph data;
- flow data from the Eastern Tributary gauging location (GS 300078);
- groundwater level and groundwater quality results for Eastern Tributary sites up to 30 November 2019¹;
- surface water quality data at site ETWQ AU/ETAU² and sites further upstream on the Eastern Tributary up to 30 November 2019;
- surface water quality data at sites downstream of ETWQ AU/ETAU² up to 30 November 2019; 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 2018, above average rainfall has only been recorded in October 2018, November 2018, December 2018 and September 2019, with below average rainfall recorded in all other months, including November 2019 (Table 1).

Total rainfall in November 2019 was 47.0 mm, below the average rainfall at Darkes Forest (104.9 mm), with rainfall occurring on 4 November (18.5 mm rainfall), 19 November (0.5 mm rainfall) and from 24 to 27 November 2019 (totalling 28 mm rainfall). Shallow groundwater levels correlate with the rainfall trend.

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

² Site ETAU is the same as site ETWQ AU (i.e. samples are taken at the same location). The difference between the sites relates to the time of sampling. Site ETWQ AU monitoring is conducted on the same day as sites upstream of ETWQ AU/ETAU (shown on Charts 1 to 2), while site ETAU monitoring is conducted on the same day as the sites downstream of ETWQ AU/ETAU (described in Section 3 and shown on Charts 3 to 4). From 29 January 2019, water quality sampling of all sites on the Eastern Tributary was undertaken in a single day. Future reporting will identify the data at this site as site ETWQ AU.

Table 1 Monthly Rainfall Data (mm) for PV7, January 2018 to November 2019

Month/Year	Rainfall at PV7 (mm)	Rainfall at Darkes Forest (mm) [#]	Mean Monthly Rainfall at Darkes Forest (1894-2019) (mm) [#]
January 2018	48.0	12.0	132.4
February 2018	115.5	16.6	159.6
March 2018	151.0	45.0	153.9
April 2018	32.0	21.6	126.8
May 2018	12.5	8.0	129.1
June 2018	112.0	91.8	146.6
July 2018	3.5	0.4	96.4
August 2018	12.5	15.8	89.1
September 2018	52.0	41.8	76.6
October 2018	197.0	200.8	91.9
November 2018	114.5	127.8	105.4
December 2018	120.0	91.0	103.8
January 2019	58.5	55.4	131.8
February 2019	41.0	54.2	158.7
March 2019	149.0	201.2	154.3
April 2019	35.0	46.0	126.1
May 2019	8.5	8.0	128.1
June 2019	115.5	47.4	145.8
July 2019	56.0	46.4	96.0
August 2019	53.0	58.8	88.9
September 2019	162.5	150.2	77.2
October 2019	53.0	37.4	91.5
November 2019	47.0	43.8	104.9

[#] 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 November 2019.

2. EASTERN TRIBUTARY SURFACE WATER AND GROUNDWATER QUALITY DATA

Plots of dissolved manganese at surface water quality sites ETWQ AU, ETWQ AQ (upstream on the Eastern Tributary) and WOWQ 2 (control site) and at groundwater quality site ETGW2, are compared to rainfall at PV7 (Chart 1) and streamflow at GS 300078 (Chart 2) (Figure 1).

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.

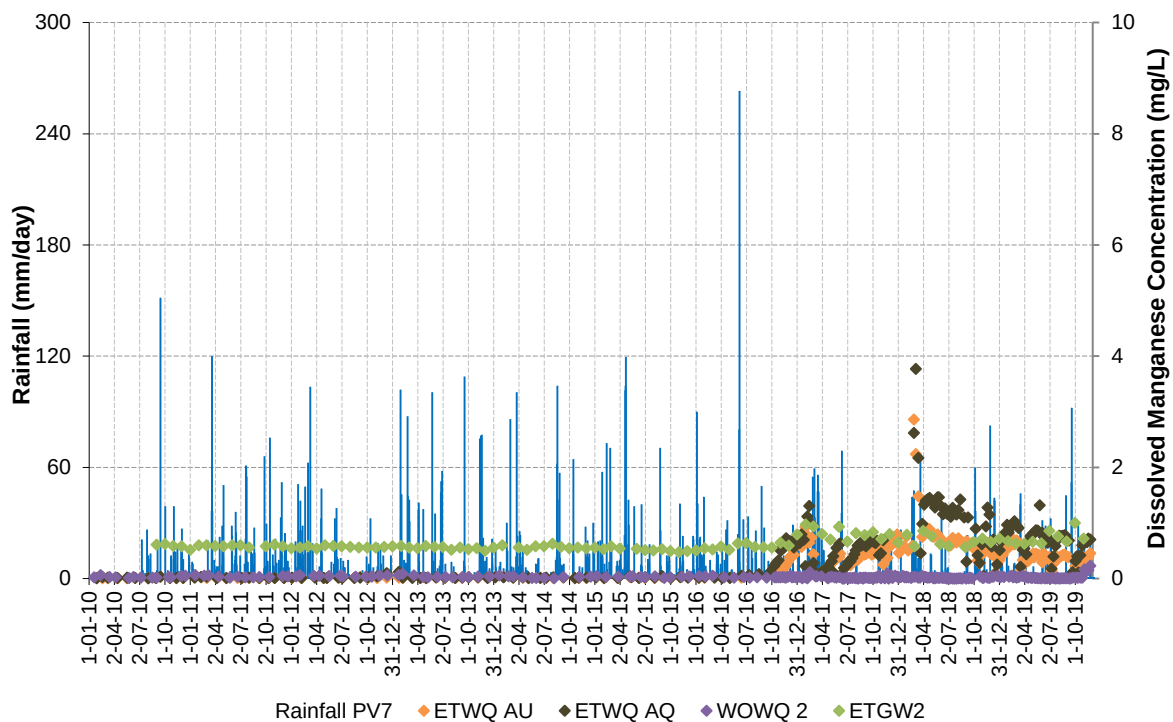


Chart 1 Dissolved Manganese Concentrations at Surface Water Quality Sites ETWQ AU, ETWQ AQ and WOWQ 2 and Groundwater Quality Site ETGW2 and Rainfall (to 30 November 2019)

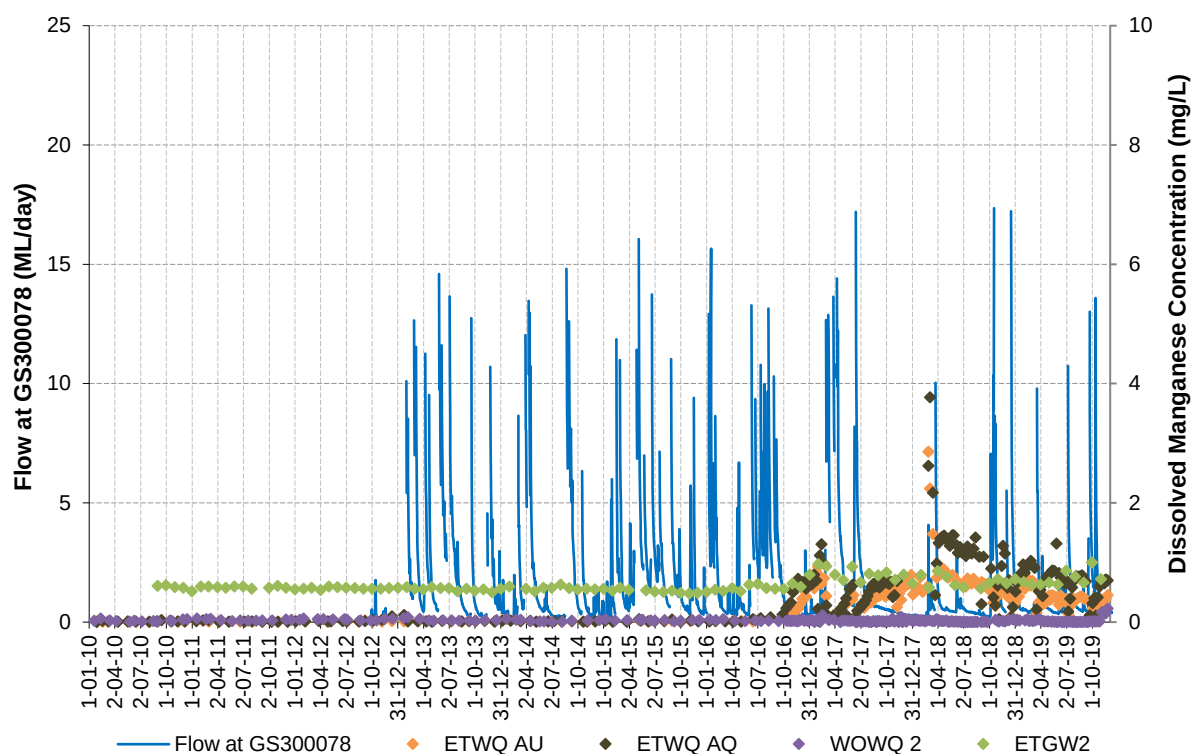
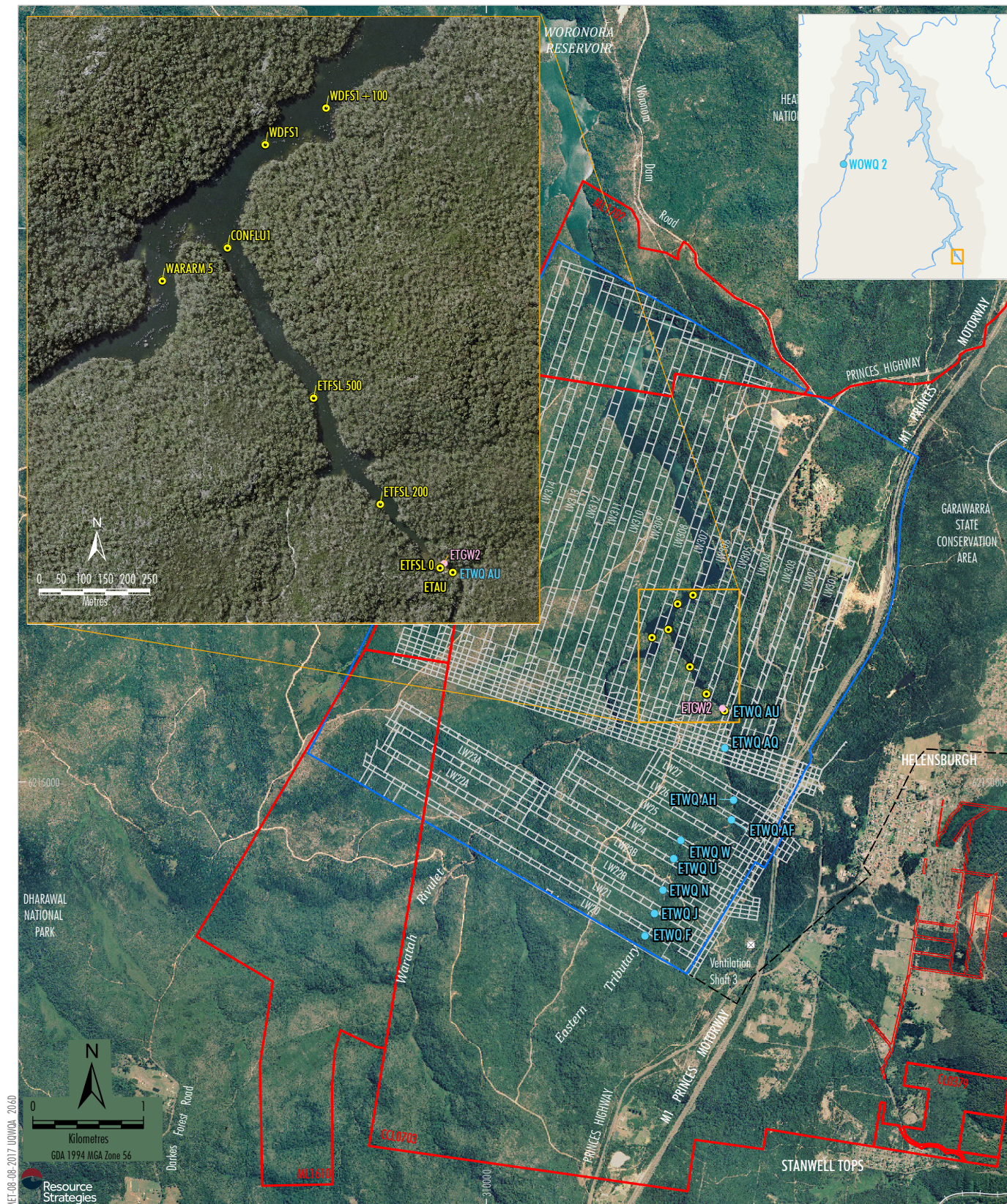


Chart 2 Dissolved Manganese Concentrations at Surface Water Quality Sites ETWQ AU, ETWQ AQ and WOWQ 2 and Groundwater Quality Site ETGW2 and Stream Flow (to 30 November 2019)



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 on Eastern Tributary
- Water Quality Site on Eastern Tributary and/or in Woronora Reservoir
- Groundwater Quality Site of Eastern Tributary

Peabody
METROPOLITAN COAL

Surface Water Quality Sampling of
Eastern Tributary Watercourse
and Woronora Reservoir

Figure 1

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. <0.1 mg/L, exist in the natural creek water. Dissolved manganese is easily diluted by freshwater flow to low levels when higher creek flows occur.

In November 2019, dissolved manganese concentrations at site ETWQ AU ranged between 0.362 mg/L and 0.455 mg/L. 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. The dilution of dissolved manganese concentrations during high flows 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. Concentrations subsequently increased, but remained notably lower than those recorded prior to the rainfall event.

Water quality parameters pertinent to the increase in manganese and iron (dissolved-filtered <0.45 μm fraction) concentration are pH, oxidation-reduction potential (ORP) and electrical conductivity (EC). 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 oxidizing and becomes reducing when ORP is below approximately 10 mV.

In November 2019 at site ETWQ AU:

- pH (lab measurement) was generally consistent (pH 6.58 to pH 6.81);
- EC concentrations (lab measurement) ranged between 286 $\mu\text{S}/\text{cm}$ and 300 $\mu\text{S}/\text{cm}$; and
- ORP (field measurement) ranged between 185.3 mV and 307.7 mV.

3. WATER RESOURCES REACHING THE WORONORA RESERVOIR

In accordance with the LW304 WMP, site ETWQ AU on the Eastern Tributary and control site WOWQ 2 on the Woronora River are used to assess the LW304 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. 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.

Metropolitan Coal has taken a photographic record of the watercourse / waterbody at the time of sampling, estimated the width of the watercourse / water body 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 (HCPL, 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 November 2019 the Woronora Reservoir water level varied between 152.24 mAHD (on 7 November 2019) and 151.91 mAHD (on 28 November 2019) (water level decreased slightly). The position of the reservoir water level can only be determined to the closest one metre contour, accordingly, the reservoir water level during November 2019 was approximately 3,491 m (corresponding to 152 mAHD) downstream of site ETSFL 0.

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 November 2019, the Woronora Reservoir water level was downstream of site WDFS1+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

Water quality data for filtered and total manganese for January 2018 to November 2019 at sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400 and ETFSL 500 is provided in Attachment A. As described earlier, sampling at sites ETFSL 100, ETFSL 300 and ETFSL 400 was suspended once monitoring at sites CONFLU1, WARARM5, WDFS1 and WDFS1+100 commenced on 22 November 2018³. Water quality data for filtered and total manganese since sampling commenced on 22 November 2018 at sites CONFLU1, WARARM5, WDFS1 and WDFS1+100 is also provided in Attachment A.

As described above, the Woronora Reservoir water level decreased slightly in November 2019, and was downstream of site WDFS1+100. The results for dissolved and total manganese at sites ETAU, ETFSL 200, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100 since the commencement of monitoring to the end of November 2019, are shown on Charts 3 and 4, respectively. These sites provide a profile along the arm of the Woronora Reservoir.

The filtered manganese concentrations for November 2019 ranged from 0.362 mg/L to 0.455 mg/L at site ETAU, 0.156 mg/L to 0.211 mg/L at site ETFSL 200, 0.23 mg/L to 0.271 mg/L at site ETFSL 500, 0.04 mg/L to 0.111 mg/L at site CONFLU1, 0.03 mg/L to 0.044 mg/L at site WARARM5, 0.033 mg/L to 0.074 mg/L at site WDFS1 and 0.013 mg/L to 0.055 mg/L at site WDFS1+100 (Chart 3).

Total manganese concentrations for November 2019 followed similar trends, ranging from 0.374 mg/L to 0.496 mg/L at site ETAU, 0.190 mg/L to 0.242 mg/L at site ETFSL 200, 0.253 mg/L to 0.261 mg/L at site ETFSL 500, 0.046 mg/L to 0.099 mg/L at site CONFLU1, 0.032 mg/L to 0.042 mg/L at site WARARM5, 0.043 mg/L to 0.086 mg/L at site WDFS1 and 0.22 mg/L to 0.62 mg/L at site WDFS1+100 (Chart 4).

³ Sampling at site ETAU was also temporarily suspended during this period but was resumed on 12 December 2018. Data from sampling undertaken at site ETWQ AU has been substituted for site ETAU during this period. Sampling at site ETAU was undertaken on 12 and 27 December 2018.

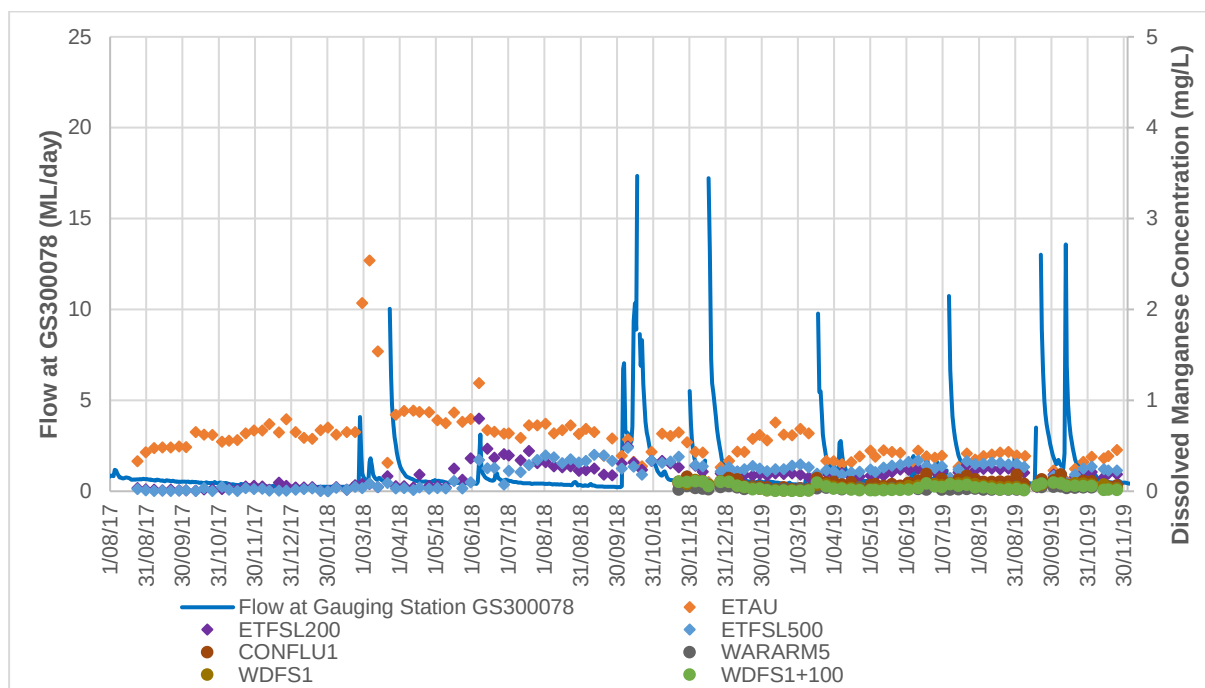


Chart 3 Dissolved Manganese Concentrations at Surface Water Quality Sites ETAU⁴, ETFSL 200, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100 and Stream Flow (August 2017 to 30 November 2019)

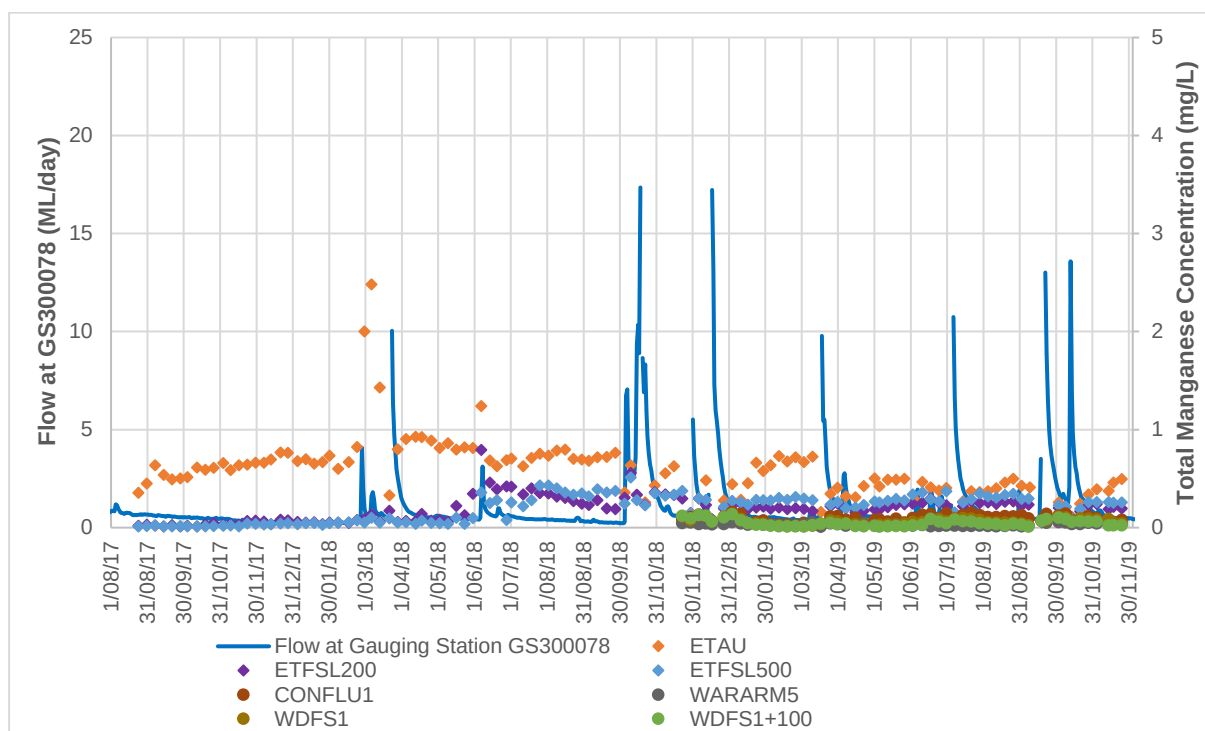


Chart 4 Total Manganese Concentrations at Surface Water Quality Sites ETAU⁵, ETFSL 200, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100 and Stream Flow (August 2017 to 30 November 2019)

⁴ Data from sampling undertaken at site ETWQ AU has been substituted for site ETAU from 22 November to 6 December 2018 and 17 December 2018. Sampling at site ETAU was undertaken on 12 and 27 December 2018.

⁵ Total manganese is not sampled at site ETWQ AU, and therefore results were unable to be substituted for site ETAU from 22 November to 6 December 2018 and 17 December 2018. Sampling at site ETAU was undertaken on 12 and 27 December 2018.

The Australian Drinking Water Guidelines (ADWG, 2011) are published by the National Health and Medical Research Council and updated most recently in 2018; 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 Australian Drinking Water Guideline before being supplied to the Helensburgh area as well as parts of the Sutherland Shire and northern Wollongong (WaterNSW, 2017).

The ADWG (2011) guidelines are based on total concentrations of manganese in water. The ADWG value is 0.5 mg/L total manganese for health. 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).

Water quality data for parameters pertinent to dissolved manganese for January 2018 to November 2019 at sites ETAU, ETFSL 200, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100 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 during November 2019, with sites ETAU, ETFSL200, ETFSL500 and WARARM5 reducing by the end of the month (from 6.81 to 6.58, 7.48 to 6.89, 7.42 to 7.22 and 7.78 to 7.69, respectively) and sites CONFLU1, WDFS1 and WDFS1+100 increasing by the end of the month (from 7.69 to 7.80, 7.62 to 7.89 and 7.84 to 8.7, respectively). At the end of November 2019, all sites were within the ADWG value range for pH, excepting WDFS1+100 (8.7) (Attachment A).

The groundwater at ETGW2 below ETAU on 21 October 2019 was pH 7.14 and 20 November 2019 was pH 6.27, indicating that seeping groundwater was not a source of higher pH water entering the reservoir.

The pH of creek water following limited rain events may fluctuate slightly because dry iron oxyhydroxide in contact with water undergoes hydrolysis. It is possible that the higher pH water in the reservoir is linked to the limited rain events recorded at PV7 since September 2019, as both arms of the Woronora Reservoir appear to have increasing pH of water associated with a limnological process. Given the limited rain events recorded leading up to and in November 2019, the fluctuations within the creek water pH are considered to be natural. In November 2019, the pH values at all sites were within the ADWG value range apart from at site WDFS1+100, which showed no associated increases in dissolved manganese in the reservoir (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 November 2019, which has triggered 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 for November 2019, show the quality of water below ETAU fluctuated during November 2019, with the water observed to be clear at the start of November due to the rainfall event on 4 November 2019, after which the water showed mild turbidity. A slight increase in the presence of orange-yellow coating on the bed rock surfaces of the sites was observed by the end of November 2019. The presence of orange-yellow coating on the creek sediment surface will darken with time as conversion to goethite occurs.

Water reaching the Woronora Reservoir occurs where the inflowing stream water meets the reservoir waterbody. In November 2019, the Woronora Reservoir water level was downstream of site WDFS1+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.

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

ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, WARARM5, CONFLU1, WDFS1 and
WDFS1+100

JANUARY 2018 TO NOVEMBER 2019

ATTACHMENT A

Water Quality Data for Sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100

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)
4/01/2018	ETAU	0.652	0.678	<0.05	0.59	132	7.37	351
4/01/2018	ETFSL100	0.281	0.305	<0.05	0.82	125.3	7.75	337
4/01/2018	ETFSL200	0.042	0.057	<0.05	0.68	132.7	7.05	118
4/01/2018	ETFSL300	0.038	0.052	0.06	0.6	13.2	6.92	111
4/01/2018	ETFSL400	0.024	0.037	<0.05	0.47	129.9	6.96	110
4/01/2018	ETFSL500	0.016	0.036	<0.05	0.46	121.7	6.74	111
11/01/2018	ETAU	0.588	0.698	0.13	1.36	55.9	7.56	364
11/01/2018	ETFSL100	0.197	0.237	<0.05	0.55	24.3	7.88	345
11/01/2018	ETFSL200	0.041	0.053	<0.05	0.63	101	7.14	139
11/01/2018	ETFSL300	0.067	0.078	1.89	2.1	35.2	6.88	128
11/01/2018	ETFSL400	0.106	0.052	0.47	0.66	52	6.84	124
11/01/2018	ETFSL500	0.026	0.046	0.06	0.78	94.4	7.01	122
18/01/2018	ETAU	0.577	0.653	<0.05	1.15	136.4	7.67	366
18/01/2018	ETFSL100	0.211	0.22	<0.05	0.64	131.9	7.74	353
18/01/2018	ETFSL200	0.046	0.055	<0.05	0.79	131.2	7	129
18/01/2018	ETFSL300	0.058	0.057	0.06	0.84	125.5	6.94	126
18/01/2018	ETFSL400	0.038	0.048	<0.05	0.71	139.6	6.96	125
18/01/2018	ETFSL500	0.032	0.049	<0.05	0.78	121.4	6.94	123
25/01/2018	ETAU	0.674	0.668	<0.05	0.52	56.8	7.55	378
25/01/2018	ETFSL100	0.074	0.152	<0.05	0.46	-4.4	7.82	360
25/01/2018	ETFSL200	0.007	0.034	<0.05	0.41	70.6	7.16	120
25/01/2018	ETFSL300	0.005	0.035	<0.05	0.46	22.8	7.09	117
25/01/2018	ETFSL400	0.001	0.032	<0.05	0.41	55	7	118
25/01/2018	ETFSL500	0.002	0.03	<0.05	0.35	288.6	7.04	115
31/01/2018	ETAU	0.7	0.734	<0.05	0.67	82.3	7.46	374
31/01/2018	ETFSL100	0.089	0.147	<0.05	0.36	30.7	8.01	361
31/01/2018	ETFSL200	0.005	0.052	<0.05	0.57	79.1	7.28	139
31/01/2018	ETFSL300	0.002	0.049	<0.05	0.66	42.7	7.08	123
31/01/2018	ETFSL400	0.001	0.046	<0.05	0.54	92	7.05	122
31/01/2018	ETFSL500	0.001	0.044	<0.05	0.55	71	7.01	122
7/02/2018	ETAU	0.625	0.601	<0.05	0.65	106.9	7.39	374
7/02/2018	ETFSL100	0.102	0.129	<0.05	0.75	14.8	7.78	359
7/02/2018	ETFSL200	0.047	0.051	<0.05	0.48	80.4	7.04	119
7/02/2018	ETFSL300	0.049	0.059	<0.05	0.65	38.2	6.97	119
7/02/2018	ETFSL400	0.112	0.07	0.27	0.74	1	6.77	118
7/02/2018	ETFSL500	0.038	0.053	0.11	0.58	86.6	6.92	117
16/02/2018	ETAU	0.65	0.67	<0.05	0.66	158.8	7.54	380
16/02/2018	ETFSL100	0.075	0.126	<0.05	0.33	163.9	7.96	369
16/02/2018	ETFSL200	0.016	0.048	<0.05	0.6	152	7.05	128
16/02/2018	ETFSL300	0.023	0.058	<0.05	0.81	121.1	6.88	124
16/02/2018	ETFSL400	0.012	0.049	<0.05	0.54	143.2	6.83	121
16/02/2018	ETFSL500	0.019	0.054	<0.05	0.54	144.1	6.82	120
23/02/2018	ETAU	0.651	0.822	<0.05	1.72	163.6	7.21	400
23/02/2018	ETFSL100	0.12	0.2	<0.05	0.5	31.8	7.75	384
23/02/2018	ETFSL200	0.068	0.078	<0.05	0.93	55.8	6.92	140
23/02/2018	ETFSL300	0.065	0.07	0.07	0.88	55.2	6.8	136
23/02/2018	ETFSL400	0.062	0.075	<0.05	0.93	41.8	6.78	135
23/02/2018	ETFSL500	0.049	0.075	<0.05	1.07	-119.2	6.78	132

ATTACHMENT A (Continued)
Water Quality Data for Sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100

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)
1/03/2018	ETAU	2.07	2	5.96	5.69	83.1	6.32	492
1/03/2018	ETFSL100	1.78	1.72	2.41	2.7	36.7	6.31	464
1/03/2018	ETFSL200	0.08	0.087	0.08	0.83	59	6.45	133
1/03/2018	ETFSL300	0.059	0.069	0.16	0.79	43.5	6.36	127
1/03/2018	ETFSL400	0.05	0.064	0.1	1.03	32	6.35	125
1/03/2018	ETFSL500	0.036	0.051	0.08	0.65	2.3	6.38	123
7/03/2018	ETAU	2.54	2.48	7.52	7.23	168.1	6.12	514
7/03/2018	ETFSL100	2.21	2.15	4.12	4.43	158.6	6.11	479
7/03/2018	ETFSL200	0.082	0.132	0.07	0.92	166.8	6.29	147
7/03/2018	ETFSL300	0.108	0.12	<0.05	0.91	149	6.32	147
7/03/2018	ETFSL400	0.088	0.11	<0.05	0.78	161.1	6.79	142
7/03/2018	ETFSL500	0.083	0.102	0.07	0.76	154.5	6.32	138
14/03/2018	ETAU	1.54	1.43	3.72	6.68	41.4	6.58	450
14/03/2018	ETFSL100	0.907	1.08	0.55	3.58	31.6	6.95	431
14/03/2018	ETFSL200	0.047	0.066	<0.05	0.63	76	6.84	135
14/03/2018	ETFSL300	0.048	0.054	<0.05	0.56	41.4	6.83	133
14/03/2018	ETFSL400	0.064	0.055	0.06	0.61	3.3	6.86	132
14/03/2018	ETFSL500	0.047	0.052	<0.05	0.47	21.9	6.79	131
22/03/2018	ETAU	0.312	0.33	0.73	1.46	229.3	5.24	237
22/03/2018	ETFSL100	0.362	0.363	0.71	1.69	182.9	5.08	240
22/03/2018	ETFSL200	0.166	0.173	0.44	1.63	71.9	6.51	160
22/03/2018	ETFSL300	0.118	0.118	0.28	1.33	70.6	6.54	153
22/03/2018	ETFSL400	0.146	0.136	0.8	1.66	22.8	6.61	152
22/03/2018	ETFSL500	0.091	0.095	0.14	1.02	32.6	6.65	144
29/03/2018	ETAU	0.841	0.798	2.83	3.32	148	6.66	341
29/03/2018	ETFSL100	0.732	0.729	1.87	2.6	40.9	6.63	332
29/03/2018	ETFSL200	0.058	0.059	0.11	0.62	84.2	6.65	131
29/03/2018	ETFSL300	0.047	0.053	0.08	0.59	65.9	6.64	131
29/03/2018	ETFSL400	0.051	0.055	0.08	0.74	71.4	6.64	130
29/03/2018	ETFSL500	0.033	0.051	0.08	1.29	27.3	6.68	128
5/4/2018	ETAU	0.885	0.904	2.84	4.76	182.7	6.57	384
5/4/2018	ETFSL100	0.674	0.672	0.73	2.41	191.7	6.67	374
5/4/2018	ETFSL200	0.058	0.067	0.08	0.62	211.9	6.32	142
5/4/2018	ETFSL300	0.044	0.058	0.07	0.57	209.4	6.37	142
5/4/2018	ETFSL400	0.04	0.058	0.13	0.77	209.1	6.39	141
5/4/2018	ETFSL500	0.035	0.054	0.09	0.66	205.9	6.4	141
13/4/2018	ETAU	0.888	0.927	1.42	4.26	156.2	6.76	391
13/4/2018	ETFSL100	0.614	0.651	0.13	2.46	172.9	6.92	382
13/4/2018	ETFSL200	0.042	0.065	0.08	0.7	42.8	6.84	153
13/4/2018	ETFSL300	0.033	0.051	0.05	0.5	40.9	6.52	145
13/4/2018	ETFSL400	0.023	0.048	<0.05	0.59	64.1	6.6	147
13/4/2018	ETFSL500	0.014	0.04	<0.05	0.51	58.6	6.61	142
18/4/2018	ETAU	0.875	0.925	0.62	2.62	192.1	6.77	397
18/4/2018	ETFSL100	0.614	0.636	0.13	2.27	192.3	7.19	390
18/4/2018	ETFSL200	0.184	0.14	0.57	1.14	184.8	6.75	178
18/4/2018	ETFSL300	0.059	0.074	0.08	0.86	186.3	6.81	162
18/4/2018	ETFSL400	0.05	0.069	<0.05	0.64	181.3	6.76	159
18/4/2018	ETFSL500	0.044	0.071	0.07	0.76	185.5	6.76	160

ATTACHMENT A (Continued)
Water Quality Data for Sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100

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)
26/4/2018	ETAU	0.871	0.887	3.01	4.32	7.2	7.02	1040
26/4/2018	ETFSL100	0.587	0.631	0.1	2.06	9.6	7.42	409
26/4/2018	ETFSL200	0.059	0.071	0.08	0.69	45.1	7.01	159
26/4/2018	ETFSL300	0.043	0.055	<0.05	0.54	2.5	6.96	159
26/4/2018	ETFSL400	0.04	0.055	<0.05	0.54	36	6.97	155
26/4/2018	ETFSL500	0.03	0.05	0.05	0.51	94.3	6.96	152
3/5/2018	ETAU	0.781	0.813	2.38	2.38	76.9	6.9	362
3/5/2018	ETFSL100	0.58	0.611	0.18	3.02	20	7.47	358
3/5/2018	ETFSL200	0.056	0.081	0.07	0.78	43.5	7.01	142
3/5/2018	ETFSL300	0.053	0.059	0.13	0.55	5.3	7.02	136
3/5/2018	ETFSL400	0.044	0.052	0.06	0.45	55.3	7	132
3/5/2018	ETFSL500	0.034	0.044	0.07	0.68	60.7	7.01	128
10/5/2018	ETAU	0.752	0.86	4.66	4.66	176.7	6.75	388
10/5/2018	ETFSL100	0.553	0.628	0.06	4.58	191.5	7.19	384
10/5/2018	ETFSL200	0.044	0.061	<0.05	0.89	187.4	6.64	129
10/5/2018	ETFSL300	0.042	0.051	0.08	0.56	180.2	6.67	131
10/5/2018	ETFSL400	0.051	0.056	0.1	0.5	170.7	6.71	133
10/5/2018	ETFSL500	0.032	0.04	0.08	0.45	164	6.68	124
17/5/2018	ETAU	0.868	0.795	3.32	3.32	160	6.78	383
17/5/2018	ETFSL100	0.634	0.605	<0.05	2.66	178.5	7.12	375
17/5/2018	ETFSL200	0.249	0.22	0.25	1.87	178.5	6.85	246
17/5/2018	ETFSL300	0.176	0.178	0.12	1.57	175.8	6.84	230
17/5/2018	ETFSL400	0.146	0.14	0.1	1.32	179.3	6.78	202
17/5/2018	ETFSL500	0.113	0.102	0.12	1.36	179.6	6.65	176
24/5/2018	ETAU	0.763	0.795	3.22	3.22	192.8	7.22	381
24/5/2018	ETFSL100	0.563	0.63	<0.05	4.36	194.2	7.12	375
24/5/2018	ETFSL200	0.128	0.128	0.58	1.03	189.4	6.95	158
24/5/2018	ETFSL300	0.04	0.053	0.05	0.62	102.2	6.78	125
24/5/2018	ETFSL400	0.037	0.043	0.07	0.39	184.9	6.72	145
24/5/2018	ETFSL500	0.031	0.037	<0.05	0.33	185.2	6.76	120
31/5/2018	ETAU	0.797	0.812	3.74	3.74	193.3	7.22	378
31/5/2018	ETFSL100	0.626	0.598	<0.05	2.57	197.5	7.12	375
31/5/2018	ETFSL200	0.362	0.344	0.48	2.18	187.7	7.18	260
31/5/2018	ETFSL300	0.177	0.171	0.24	1.44	185.8	7.18	188
31/5/2018	ETFSL400	0.178	0.162	0.67	1.86	179.9	7.19	184
31/5/2018	ETFSL500	0.098	0.096	0.11	0.89	176	7.12	154
7/6/2018	ETAU	1.19	1.24	3.12	4.03	188.4	6.8	361
7/6/2018	ETFSL100	0.889	0.942	1.43	2.91	185.7	7.19	342
7/6/2018	ETFSL200	0.8	0.792	1.29	3.2	189.2	7.17	327
7/6/2018	ETFSL300	0.625	0.67	0.9	3.42	178.7	7.16	304
7/6/2018	ETFSL400	0.402	0.442	0.06	4.24	182.9	7.25	271
7/6/2018	ETFSL500	0.347	0.358	0.35	3.74	183.4	7.27	268
14/6/2018	ETAU	0.674	0.686	2.1	3.89	99.8	6.94	314
14/6/2018	ETFSL100	0.34	0.539	0.26	2.33	73.3	7.27	309
14/6/2018	ETFSL200	0.47	0.459	0.72	2.12	178.9	7.09	300
14/6/2018	ETFSL300	0.377	0.37	0.26	2.25	167.8	7.12	264
14/6/2018	ETFSL400	0.292	0.288	0.08	2.17	192.4	7.15	228
14/6/2018	ETFSL500	0.255	0.251	0.08	1.94	203.5	7.04	201

ATTACHMENT A (Continued)

Water Quality Data for Sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100

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)
20/6/2018	ETAU	0.657	0.628	3.62	5.4	188.3	6.72	337
20/6/2018	ETFSL100	0.457	0.468	0.9	3.16	19	6.9	324
20/6/2018	ETFSL200	0.371	0.39	0.72	2.4	191.4	6.95	320
20/6/2018	ETFSL300	0.384	0.377	0.34	2.42	190.5	6.98	322
20/6/2018	ETFSL400	0.331	0.333	<0.05	2.84	191.2	7	312
20/6/2018	ETFSL500	0.256	0.28	<0.05	2.67	184.8	7.01	273
28/6/2018	ETAU	0.634	0.687	4.08	7	185.8	6.6	328
28/6/2018	ETFSL100	0.501	0.559	1.04	3.95	188.8	7.02	329
28/6/2018	ETFSL200	0.409	0.422	1.45	3.94	187.2	6.82	306
28/6/2018	ETFSL300	0.176	0.207	<0.05	1.95	199.7	6.77	190
28/6/2018	ETFSL400	0.108	0.111	<0.05	1.04	198.5	6.67	128
28/6/2018	ETFSL500	0.075	0.079	0.05	0.79	179.7	6.61	118
2/7/2018	ETAU	0.637	0.706	3.29	6.24	39.9	7.05	352
2/7/2018	ETFSL100	0.519	0.558	0.97	4.38	191	7.31	351
2/7/2018	ETFSL200	0.395	0.416	0.86	2.28	191.4	7.34	344
2/7/2018	ETFSL300	0.391	0.426	1.19	3.57	193.9	7.25	342
2/7/2018	ETFSL400	0.327	0.349	0.15	3.82	195.4	7.22	311
2/7/2018	ETFSL500	0.226	0.258	0.06	2.37	194.2	7.15	252
12/7/2018	ETAU	0.587	0.626	1.11	2.33	456.6	7.31	370
12/7/2018	ETFSL100	0.501	0.492	0.63	1.6	163.5	7.59	367
12/7/2018	ETFSL200	0.342	0.338	0.73	1.42	160.3	7.5	355
12/7/2018	ETFSL300	0.324	0.373	1.16	2.87	154.8	7.49	361
12/7/2018	ETFSL400	0.338	0.353	0.44	3.85	1596	7.55	356
12/7/2018	ETFSL500	0.212	0.218	<0.05	2.45	158.3	7.37	259
19/7/2018	ETAU	0.726	0.712	0.63	3.5	177	7	377
19/7/2018	ETFSL100	0.576	0.565	0.11	3.01	202.8	7.37	371
19/7/2018	ETFSL200	0.444	0.4	0.36	2.35	200.6	7.24	360
19/7/2018	ETFSL300	0.462	0.402	1.11	3.68	202	7.21	372
19/7/2018	ETFSL400	0.431	0.374	0.57	3.48	203.3	7.33	384
19/7/2018	ETFSL500	0.288	0.279	<0.05	3.33	203.6	7.21	330
26/7/2018	ETAU	0.725	0.753	4.1	6.53	-5.9	6.59	364
26/7/2018	ETFSL100	0.522	0.566	0.19	2.89	10.8	6.78	356
26/7/2018	ETFSL200	0.31	0.353	0.29	1.73	9.8	6.79	351
26/7/2018	ETFSL300	0.35	0.35	1.59	2.55	-0.3	6.71	353
26/7/2018	ETFSL400	0.375	0.397	1.92	3.56	-12.3	6.75	370
26/7/2018	ETFSL500	0.346	0.431	<0.05	3.13	107.8	6.88	378
02/8/2018	ETAU	0.744	0.733	0.44	2.96	54.8	6.53	366
02/8/2018	ETFSL100	0.526	0.544	0.09	2.48	325	6.57	359
02/8/2018	ETFSL200	0.321	0.350	0.39	1.44	265.1	6.51	352
02/8/2018	ETFSL300	0.337	0.348	1.79	2.59	263.4	6.39	355
02/8/2018	ETFSL400	0.398	0.420	3.38	4.5	251.8	6.59	397
02/8/2018	ETFSL500	0.395	0.429	1.14	3.44	236.4	6.8	386
09/8/2018	ETAU	0.637	0.785	2.11	5.08	257.2	6.73	367
09/8/2018	ETFSL100	0.538	0.644	0.18	5.24	256.6	6.92	363
09/8/2018	ETFSL200	0.276	0.316	0.20	1.56	248.6	6.86	355
09/8/2018	ETFSL300	0.285	0.306	1.68	2.50	233.3	6.75	355
09/8/2018	ETFSL400	0.375	0.416	5.43	6.97	254.2	6.99	436
09/8/2018	ETFSL500	0.373	0.401	3.02	4.50	253.7	6.9	390

ATTACHMENT A (Continued)

Water Quality Data for Sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100

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)
16/8/2018	ETAU	0.672	0.797	1.53	3.99	250.1	6.71	365
16/8/2018	ETFSL100	0.491	0.584	0.08	2.32	264.8	7.16	362
16/8/2018	ETFSL200	0.263	0.304	0.1	1.17	265.4	7.13	353
16/8/2018	ETFSL300	0.249	0.298	1.02	1.98	267.4	6.96	349
16/8/2018	ETFSL400	0.336	0.351	3.57	4.23	260.7	7.12	405
16/8/2018	ETFSL500	0.309	0.358	1.69	3.18	261.3	6.98	386
23/8/2018	ETAU	0.724	0.701	0.92	3.12	266.4	7.03	358
23/8/2018	ETFSL100	0.489	0.505	0.07	2.26	271.7	6.97	351
23/8/2018	ETFSL200	0.274	0.270	0.1	1.01	267.1	7.11	344
23/8/2018	ETFSL300	0.227	0.273	0.83	1.83	265.6	7.04	341
23/8/2018	ETFSL400	0.267	0.279	2.11	2.50	261.8	7.05	365
23/8/2018	ETFSL500	0.352	0.337	2.34	3.41	258.1	7.23	382
30/8/2018	ETAU	0.632	0.696	<0.05	2.52	99.5	7.97	368
30/8/2018	ETFSL100	0.440	0.491	<0.05	2.09	77	7.73	354
30/8/2018	ETFSL200	0.225	0.243	0.06	0.85	23.2	7.85	350
30/8/2018	ETFSL300	0.236	0.248	0.96	1.70	256.2	7.78	345
30/8/2018	ETFSL400	0.327	0.343	3.30	4.50	252.5	8.20	399
30/8/2018	ETFSL500	0.316	0.350	2.05	3.65	228.1	8.18	387
05/9/2018	ETAU	0.688	0.683	0.66	4.54	25.2	7.44	363
05/9/2018	ETFSL100	0.476	0.483	<0.05	2.06	53.5	7.77	350
05/9/2018	ETFSL200	0.234	0.23	0.09	0.98	12.5	7.71	340
05/9/2018	ETFSL300	0.259	0.238	1.08	1.71	-12.5	7.57	333
05/9/2018	ETFSL400	0.367	0.371	4.53	5.96	-42.4	7.65	404
05/9/2018	ETFSL500	0.336	0.318	2.52	3.73	1.5	7.69	372
12/9/2018	ETAU	0.653	0.719	<0.05	3.72	178.2	7.05	360
12/9/2018	ETFSL100	0.461	0.521	<0.05	2.72	71.7	7.54	356
12/9/2018	ETFSL200	0.25	0.28	<0.05	0.96	20.1	7.49	346
12/9/2018	ETFSL300	0.3	0.301	0.41	1.73	3.1	7.38	345
12/9/2018	ETFSL400	0.389	0.34	2.15	2.77	-62.7	7.39	359
12/9/2018	ETFSL500	0.401	0.39	1.04	3.87	-17.4	7.43	381
20/9/2018	ETAU	0.392	0.721	1.14	2.49	272.4	7.11	362
20/9/2018	ETFSL100	0.179	0.467	<0.05	1.88	272.4	7.18	350
20/9/2018	ETFSL200	0.182	0.194	0.63	0.7	25.2	7.17	341
20/9/2018	ETFSL300	0.227	0.233	0.63	1.5	-11.9	7.08	337
20/9/2018	ETFSL400	0.386	0.356	2.66	5.39	-34.2	7.21	397
20/9/2018	ETFSL500	0.394	0.358	1.1	3.15	25.4	7.25	371
27/9/2018	ETAU	0.58	0.763	<0.05	2.24	234	7.33	400
27/9/2018	ETFSL100	0.434	0.493	<0.05	1.54	268.1	7.64	392
27/9/2018	ETFSL200	0.178	0.188	<0.05	0.61	272.8	7.55	381
27/9/2018	ETFSL300	0.231	0.239	0.4	1.6	270.8	7.33	377
27/9/2018	ETFSL400	0.331	0.325	1.49	3.55	263.1	7.41	400
27/9/2018	ETFSL500	0.335	0.375	0.83	3.46	266.8	7.67	416
05/10/2018	ETAU	0.39	0.359	2.14	3.49	274.6	7.28	250
05/10/2018	ETFSL100	0.297	0.686	0.32	12	271	7.57	286
05/10/2018	ETFSL200	0.305	0.308	0.29	2.72	269.7	7.67	295
05/10/2018	ETFSL300	0.272	0.305	0.32	2.72	267.7	7.66	291
05/10/2018	ETFSL400	0.364	0.299	0.63	2.95	259.8	7.73	294
05/10/2018	ETFSL500	0.251	0.245	0.36	2.11	242.9	7.58	271

ATTACHMENT A (Continued)
Water Quality Data for Sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100

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)
10/10/2018	ETAU	0.569	0.635	1.8	2.68	266.6	6.59	308
10/10/2018	ETFSL100	0.571	0.602	1.62	2.25	267.5	6.66	304
10/10/2018	ETFSL200	0.494	0.558	1.07	1.88	269.6	6.78	302
10/10/2018	ETFSL300	0.492	0.49	1.05	1.42	269.6	6.81	303
10/10/2018	ETFSL400	0.479	0.503	2.3	3.04	267.3	7.07	334
10/10/2018	ETFSL500	0.48	0.512	1.36	2	266.7	6.98	308
15/10/2018	ETAU	0.325	0.333	0.9	1.33	285.6	6.35	269
15/10/2018	ETFSL100	0.298	0.302	0.69	1.2	278.5	6.36	259
15/10/2018	ETFSL200	0.316	0.336	0.66	1.9	276.9	6.37	262
15/10/2018	ETFSL300	0.286	0.298	0.57	1.41	279.5	6.39	259
15/10/2018	ETFSL400	0.276	0.3	0.6	1.38	279.9	6.56	266
15/10/2018	ETFSL500	0.273	0.279	0.63	1.18	263	7.71	267
22/10/2018	ETAU	0.274	0.259	0.76	1.26	276.9	6.52	281
22/10/2018	ETFSL100	0.25	0.244	0.56	1.13	270.7	6.57	278
22/10/2018	ETFSL200	0.235	0.233	0.41	1.01	270.4	6.53	275
22/10/2018	ETFSL300	0.236	0.228	0.42	1	269	6.58	275
22/10/2018	ETFSL400	0.304	0.263	1.8	2.51	264.8	7.01	321
22/10/2018	ETFSL500	0.184	0.229	0.26	1.19	258.5	6.74	279
30/10/2018	ETAU	0.432	0.431	1.79	2.55	15.1	6.65	290
30/10/2018	ETFSL100	0.376	0.39	0.76	1.78	-0.4	6.91	286
30/10/2018	ETFSL200	0.336	0.363	0.37	1.47	3.8	6.92	285
30/10/2018	ETFSL300	0.341	0.35	0.39	1.32	7.6	6.99	291
30/10/2018	ETFSL400	0.36	0.364	1.58	3.1	-77.3	7.09	329
30/10/2018	ETFSL500	0.34	0.351	0.5	1.63	-4.2	7.05	296
08/11/2018	ETAU	0.635	0.553	0.76	3.15	23.3	7.07	307
08/11/2018	ETFSL100	0.429	0.433	0.14	1.59	12.9	7.35	307
08/11/2018	ETFSL200	0.333	0.34	0.06	1	20	7.31	303
08/11/2018	ETFSL300	0.333	0.329	0.06	1.1	5.4	7.32	304
08/11/2018	ETFSL400	0.431	0.403	5.31	5.49	247.1	7.47	385
08/11/2018	ETFSL500	0.315	0.325	0.37	1.54	248.4	7.30	310
15/11/2018	ETAU	0.609	0.628	0.53	2.04	264.1	7.09	334
15/11/2018	ETFSL100	0.399	0.414	<0.05	1.6	172.9	7.32	328
15/11/2018	ETFSL200	0.308	0.331	<0.05	1.34	272	7.31	325
15/11/2018	ETFSL300	0.321	0.298	0.08	1.15	271	7.28	324
15/11/2018	ETFSL400	0.396	0.383	1.44	4.72	262.5	7.35	373
15/11/2018	ETFSL500	0.328	0.336	0.24	1.76	267.3	7.38	345
19/11/2018	ETWQ AU	0.647	- ⁶	0.08	2.42	259.1	7.22	345
22/11/2018	ETFSL200	0.264	0.298	<0.05	0.82	30.9	7.29	355
22/11/2018	ETFSL500	0.38	0.376	0.67	1.88	-3.3	7.50	373
22/11/2018	CONFLU1	0.085	0.088	0.12	0.9	-1.1	7.51	307
22/11/2018	WARARM5	0.018	0.046	0.25	1	54.6	7.57	297
22/11/2018	WDFS1	0.105	0.114	0.12	1.15	40.1	7.53	307
22/11/2018	WDFS1+100	0.103	0.119	0.1	1.06	26	7.55	306

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

ATTACHMENT A (Continued)

Water Quality Data for Sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100

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)
26/11/2018	ETWQ AU	0.538	- ⁶	<0.05	1.36	83.8	7.11	354
29/11/2018	ETFSL200	0.139	0.15	0.54	1.2	36.1	7.07	195
29/11/2018	ETFSL500	0.167	0.147	0.3	1.19	30.1	6.94	195
29/11/2018	CONFLU1	0.158	0.108	0.27	1.18	29.5	7.19	200
29/11/2018	WARARM5	0.055	0.052	0.18	0.92	66.7	7.5	206
29/11/2018	WDFS1	0.082	0.074	0.18	0.21	36.7	7.8	206
29/11/2018	WDFS1+100	0.103	0.094	0.19	1	38.4	7.36	200
4/12/2018	ETWQ AU	0.433	- ⁶	1.65	2.36	30.6	7	266
6/12/2018	ETFSL200	0.283	0.295	0.26	1.04	242.7	6.97	260
6/12/2018	ETFSL500	0.29	0.3	0.62	1.47	249.5	7.23	270
6/12/2018	CONFLU1	0.112	0.114	0.12	1.13	243.8	7.24	243
6/12/2018	WARARM5	0.034	0.035	<0.05	0.75	250.1	7.29	238
6/12/2018	WDFS1	0.122	0.134	0.07	1.12	241.4	7.29	246
6/12/2018	WDFS1+100	0.109	0.126	<0.05	0.99	251.1	7.3	245
12/12/2018	ETAU	0.428	0.484	1.49	3.33	-	6.86	269
12/12/2018	ETFSL200	0.215	0.232	<0.05	0.42	255.3	7.4	245
12/12/2018	ETFSL500	0.276	0.284	0.27	0.89	251.9	7.41	262
12/12/2018	CONFLU1	0.081	0.091	0.45	0.8	17.9	7.39	219
12/12/2018	WARARM5	0.03	0.042	<0.05	0.58	236.4	7.53	214
12/12/2018	WDFS1	0.108	0.121	0.41	1.09	27.5	7.44	225
12/12/2018	WDFS1+100	0.105	0.12	<0.05	0.99	42.3	7.24	243
17/12/2018	ETWQ AU	0.102	- ⁶	0.18	0.75	280.3	6.50	152
17/12/2018	ETFSL200	0.076	0.084	0.17	0.7	274.8	6.76	152
17/12/2018	ETFSL500	0.087	0.086	0.19	0.76	274.8	6.56	150
17/12/2018	CONFLU1	0.068	0.068	0.16	0.78	270.9	6.64	152
17/12/2018	WARARM5	0.023	0.032	0.08	0.54	257.5	6.77	156
17/12/2018	WDFS1	0.069	0.062	0.15	0.75	273	6.67	153
17/12/2018	WDFS1+100	0.055	0.063	0.12	0.71	278.4	6.71	154
27/12/2018	ETAU	0.263	0.277	0.61	1.81	24.3	6.72	217
27/12/2018	ETFSL200	0.196	0.194	0.09	0.93	30.6	7.11	216
27/12/2018	ETFSL500	0.219	0.213	0.3	1.37	-6.9	7.13	224
27/12/2018	CONFLU1	0.071	0.075	<0.05	0.86	21.4	7.15	208
27/12/2018	WARARM5	0.045	0.036	<0.05	0.48	3.4	7.3	206
27/12/2018	WDFS1	0.108	0.11	0.06	0.99	24.9	7.12	210
27/12/2018	WDFS1+100	0.101	0.105	<0.05	0.93	37.4	7.13	210
3/01/2019	ETWQ AU	0.335	0.443	<0.05	1.57	110.1	7.35	300
3/01/2019	ETFSL200	0.159	0.226	<0.05	0.63	113.1	7.63	290
3/01/2019	ETFSL500	0.265	0.274	0.12	1.32	11.5	7.5	302
3/01/2019	CONFLU1	0.143	0.16	<0.05	1.21	4.8	7.29	270
3/01/2019	WARARM5	0.055	0.054	<0.05	0.64	56.4	7.46	256
3/01/2019	WDFS1	0.106	0.14	<0.05	1.27	72	7.45	265
3/01/2019	WDFS1+100	0.101	0.138	<0.05	1.16	56.2	7.42	263
10/01/2019	ETWQ AU	0.438	0.282	<0.05	1.41	244.1	6.92	268
10/01/2019	ETFSL200	0.216	0.246	<0.05	0.62	26.8	8.03	279
10/01/2019	ETFSL500	0.22	0.262	<0.05	1.18	-9.3	7.64	300
10/01/2019	CONFLU1	0.129	0.141	<0.05	1.11	-33.7	7.55	269
10/01/2019	WARARM5	0.042	0.041	<0.05	0.6	90.3	7.62	252
10/01/2019	WDFS1	0.061	0.087	<0.05	0.92	22.1	7.59	242
10/01/2019	WDFS1+100	0.061	0.074	<0.05	0.97	6.9	7.58	240

ATTACHMENT A (Continued)

Water Quality Data for Sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100

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)
16/01/2019	ETWQ AU	0.433	0.454	<0.05	1.86	171.1	6.75	282
16/01/2019	ETFSL200	0.18	0.189	<0.05	0.4	258.4	7.67	275
16/01/2019	ETFSL500	0.244	0.233	0.38	1	262.4	7.65	303
16/01/2019	CONFLU1	0.058	0.049	0.12	0.86	261.2	7.68	249
16/01/2019	WARARM5	0.025	0.028	0.11	0.52	268.1	7.82	242
16/01/2019	WDFS1	0.046	0.044	0.16	0.92	263.5	7.76	256
16/01/2019	WDFS1+100	0.047	0.044	0.19	0.94	259.2	7.79	260
23/01/2019	ETWQ AU	0.579	0.661	<0.05	2.09	184.3	6.78	292
23/01/2019	ETFSL200	0.171	0.204	<0.05	0.38	96.8	7.65	286
23/01/2019	ETFSL500	0.28	0.284	0.2	1.62	-11.1	7.65	316
23/01/2019	CONFLU1	0.052	0.056	<0.05	1.11	5.6	7.7	264
23/01/2019	WARARM5	0.043	0.036	<0.05	0.74	-38.4	7.7	253
23/01/2019	WDFS1	0.032	0.042	<0.05	1.08	19.6	7.77	266
23/01/2019	WDFS1+100	0.02	0.029	<0.05	0.92	-16.6	7.83	266
29/01/2019	ETAU	0.62	0.578	0.07	1.52	66.8	6.7	294
29/01/2019	ETFSL200	0.19	0.216	<0.05	0.44	36.2	7.23	282
29/01/2019	ETFSL500	0.249	0.279	<0.05	1.48	12.1	7.34	310
29/01/2019	CONFLU1	0.048	0.07	<0.05	1.05	-20.8	7.54	282
29/01/2019	WARARM5	0.031	0.028	<0.05	0.54	49.5	7.34	251
29/01/2019	WDFS1	0.027	0.038	<0.05	0.96	29.7	7.49	260
29/01/2019	WDFS1+100	0.03	0.03	<0.05	0.91	9.9	7.49	260
4/02/2019	ETAU	0.559	0.635	<0.05	1.04	51.1	6.8	283
4/02/2019	ETFSL200	0.173	0.191	<0.05	0.34	9.1	7.26	275
4/02/2019	ETFSL500	0.221	0.276	0.31	1.7	-18.6	7.35	302
4/02/2019	CONFLU1	0.043	0.036	0.16	0.85	-51.7	7.55	252
4/02/2019	WARARM5	0.023	0.029	0.19	0.74	139.1	7.58	240
4/02/2019	WDFS1	0.012	0.021	0.27	0.8	73.2	7.71	252
4/02/2019	WDFS1+100	0.01	0.02	0.29	0.74	50	7.71	255
11/02/2019	ETAU	0.757	0.731	<0.05	1.5	261.4	6.86	288
11/02/2019	ETFSL200	0.197	0.206	<0.05	0.36	6.8	7.21	280
11/02/2019	ETFSL500	0.243	0.302	0.5	1.86	-33.9	7.3	306
11/02/2019	CONFLU1	0.023	0.033	0.24	0.94	-96.7	7.48	255
11/02/2019	WARARM5	0.019	0.026	0.24	0.66	53.5	7.46	243
11/02/2019	WDFS1	0.011	0.018	0.31	0.98	-26	7.62	259
11/02/2019	WDFS1+100	0.005	0.013	0.3	0.83	64.5	7.62	258
18/02/2019	ETAU	0.624	0.675	0.17	1.51	51.8	6.91	303
18/02/2019	ETFSL200	0.189	0.19	0.19	0.36	12.8	7.27	296
18/02/2019	ETFSL500	0.243	0.284	0.23	1.77	-15.6	7.86	277
18/02/2019	CONFLU1	0.041	0.035	0.13	0.9	6.6	7.73	291
18/02/2019	WARARM5	0.022	0.024	0.19	0.64	64.1	7.46	262
18/02/2019	WDFS1	0.007	0.012	0.31	0.78	26.7	7.83	279
18/02/2019	WDFS1+100	0.006	0.011	0.24	0.64	23.3	7.84	279
25/02/2019	ETAU	0.616	0.719	<0.05	0.93	273.1	7.19	283
25/02/2019	ETFSL200	0.198	0.199	<0.05	0.54	270.5	7.06	271
25/02/2019	ETFSL500	0.281	0.312	1.72	2.11	270.6	7.3	307
25/02/2019	CONFLU1	0.022	0.027	0.06	0.86	274.6	7.37	247
25/02/2019	WARARM5	0.014	0.023	<0.05	0.53	264.2	7.4	238
25/02/2019	WDFS1	0.009	0.017	<0.05	0.79	272.6	7.55	248
25/02/2019	WDFS1+100	0.004	0.014	0.05	0.92	264.9	7.6	246

ATTACHMENT A (Continued)

Water Quality Data for Sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100

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)
04/03/2019	ETAU	0.688	0.67	<0.05	0.13	104.3	6.74	306
04/03/2019	ETFSL200	0.185	0.193	0.12	0.48	259.3	7.18	294
04/03/2019	ETFSL500	0.295	0.298	0.76	2.02	271.1	7.33	334
04/03/2019	CONFLU1	0.032	0.049	0.12	1.71	277.1	7.56	274
04/03/2019	WARARM5	0.025	0.031	0.12	1.02	277.7	7.44	248
04/03/2019	WDFS1	0.006	0.013	0.13	0.81	273.6	7.75	271
04/03/2019	WDFS1+100	0.005	0.011	0.21	0.71	249.3	7.58	270
11/03/2019	ETAU	0.638	0.726	0.08	0.94		6.87	322
11/03/2019	ETFSL200	0.152	0.170	0.06	0.38	227.4	7.24	310
11/03/2019	ETFSL500	0.266	0.28	0.5	1.91	219.5	7.43	347
11/03/2019	CONFLU1	0.024	0.03	0.23	0.96	228.5	7.53	289
11/03/2019	WARARM5	0.018	0.052	0.19	0.71	202.5	7.53	269
11/03/2019	WDFS1	0.01	0.018	0.26	0.8	219.7	7.07	276
11/03/2019	WDFS1+100	0.006	0.027	0.22	1.45	215.9	7.82	289
18/03/2019	ETAU	0.153	0.16	0.84	1.21	239	6.77	175
18/03/2019	ETFSL200	0.187	<0.01	0.5	0.204	237.9	6.62	180
18/03/2019	ETFSL500	0.193	<0.01	0.63	0.197	230.4	6.7	184
18/03/2019	CONFLU1	0.146	0.02	0.5	0.156	50.3	6.72	172
18/03/2019	WARARM5	0.032	<0.01	0.3	0.034	49.3	6.67	153
18/03/2019	WDFS1	0.071	0.04	0.44	0.073	21.4	6.67	159
18/03/2019	WDFS1+100	0.094	0.04	0.42	0.099	57.1	6.61	158
26/03/2019	ETAU	0.335	0.347	0.46	1.91	29.3	6.74	230
26/03/2019	ETFSL200	0.205	0.217	<0.05	1.04	23.5	6.96	224
26/03/2019	ETFSL500	0.233	0.234	0.5	1.39	227	6.99	239
26/03/2019	CONFLU1	0.095	0.114	<0.05	0.8	237.9	7.02	206
26/03/2019	WARARM5	0.039	0.041	<0.05	0.45	241.4	6.92	195
26/03/2019	WDFS1	0.073	0.076	<0.05	0.65	236.4	7.02	200
26/03/2019	WDFS1+100	0.054	0.049	<0.05	0.64	241.1	7.03	199
01/04/2019	ETAU	0.332	0.407	<0.05	1.51	160	7.3	256
01/04/2019	ETFSL200	0.184	0.248	<0.05	0.78	-1.8	7.68	248
01/04/2019	ETFSL500	0.222	0.261	0.47	1.14	-4.8	7.64	263
01/04/2019	CONFLU1	0.103	0.116	0.17	0.92	9	7.68	232
01/04/2019	WARARM5	0.034	0.037	0.1	0.42	36.8	7.71	207
01/04/2019	WDFS1	0.051	0.061	0.18	0.64	0.8	7.67	221
01/04/2019	WDFS1+100	0.027	0.031	0.14	0.56	43.5	7.73	219
08/04/2019	ETAU	0.298	0.319	0.64	1.89	35.8	6.86	225
08/04/2019	ETFSL200	0.200	0.198	0.12	0.96	273.8	7.09	212
08/04/2019	ETFSL500	0.184	0.2	0.34	1.34	264	7.25	220
08/04/2019	CONFLU1	0.073	0.082	0.14	0.77	238.9	7.54	212
08/04/2019	WARARM5	0.02	0.018	0.06	0.35	252.5	7.6	204
08/04/2019	WDFS1	0.039	0.05	0.11	0.7	236.9	7.56	205
08/04/2019	WDFS1+100	0.03	0.038	0.08	0.58	242.3	7.61	205
16/04/2019	ETAU	0.321	0.31	<0.05	1.31	259.8	7.17	240
16/04/2019	ETFSL200	0.156	0.154	<0.05	0.64	83.9	7.48	233
16/04/2019	ETFSL500	0.207	0.204	0.53	1.25	11.4	7.65	262
16/04/2019	CONFLU1	0.099	0.1	0.06	0.73	3.8	7.69	235
16/04/2019	WARARM5	0.024	0.021	0.21	0.34	21.6	7.62	207
16/04/2019	WDFS1	0.035	0.035	0.13	0.62	0.9	7.6	215
16/04/2019	WDFS1+100	0.017	0.017	0.14	0.48	4.6	7.67	214

ATTACHMENT A (Continued)

Water Quality Data for Sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100

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)
23/04/2019	ETAU	0.384	0.425	<0.05	1.82	262.5	7.54	224
23/04/2019	ETFSL200	0.162	0.174	0.08	0.77	73.9	7.31	218
23/04/2019	ETFSL500	0.214	0.232	0.24	1.4	8.8	7.64	240
23/04/2019	CONFLU1	0.041	0.046	0.13	0.76	10.6	7.56	194
23/04/2019	WARARM5	0.041	0.046	0.13	0.76	63.3	7.56	194
23/04/2019	WDFS1	0.026	0.027	0.16	0.71	7.5	7.56	191
23/04/2019	WDFS1+100	0.009	0.014	0.18	0.6	45	7.59	190
02/05/2019	ETAU	0.448	0.502	0.33	4.37	78.6	6.97	235
02/05/2019	ETFSL200	0.171	0.187	0.07	0.86	213.6	7.2	226
02/05/2019	ETFSL500	0.24	0.267	0.5	1.4	208.1	7.31	248
02/05/2019	CONFLU1	0.068	0.078	0.12	0.9	198.7	7.41	215
02/05/2019	WARARM5	0.024	0.03	0.14	0.51	201.1	7.3	184
02/05/2019	WDFS1	0.022	0.024	0.19	0.62	194.3	7.31	195
02/05/2019	WDFS1+100	0.01	0.016	0.18	0.5	189.9	7.4	196
06/05/2019	ETAU	0.381	0.421	<0.05	1.3	148.2	6.89	284
06/05/2019	ETFSL200	0.164	0.183	0.1	0.62	252.8	7.18	278
06/05/2019	ETFSL500	0.212	0.256	0.7	1.68	256.8	7.34	314
06/05/2019	CONFLU1	0.076	0.084	0.12	0.78	236.9	7.48	271
06/05/2019	WARARM5	0.025	0.023	0.09	0.46	254.6	7.37	238
06/05/2019	WDFS1	0.024	0.028	0.14	0.71	216.8	7.43	250
06/05/2019	WDFS1+100	0.009	0.009	0.08	0.54	259.9	7.57	246
13/05/2019	ETAU	0.452	0.488	0.08	2.71	106.4	7.15	299
13/05/2019	ETFSL200	0.171	0.208	0.06	0.93	254.6	7.48	290
13/05/2019	ETFSL500	0.261	0.273	0.29	1.74	241.2	7.57	322
13/05/2019	CONFLU1	0.057	0.063	0.07	0.88	249.5	7.61	269
13/05/2019	WARARM5	0.028	0.026	0.07	0.52	249.3	7.6	248
13/05/2019	WDFS1	0.034	0.031	0.05	0.85	243.4	7.61	260
13/05/2019	WDFS1+100	0.009	0.011	<0.05	0.58	243.9	7.71	265
20/05/2019	ETAU	0.432	0.49	<0.05	1.93	270.8	6.96	297
20/05/2019	ETFSL200	0.212	0.230	0.1	1.27	97.3	7.79	291
20/05/2019	ETFSL500	0.282	0.292	1.16	2.02	-17.1	7.63	331
20/05/2019	CONFLU1	0.076	0.092	0.1	1.12	68	7.76	286
20/05/2019	WARARM5	0.035	0.036	0.15	0.54	58.2	7.66	252
20/05/2019	WDFS1	0.027	0.028	0.2	0.72	27.9	7.43	266
20/05/2019	WDFS1+100	0.015	0.016	0.12	0.57	113.4	7.74	270
27/05/2019	ETAU	0.422	0.498	<0.05	2.26	169.8	7.02	301
27/05/2019	ETFSL200	0.240	0.239	0.11	1.06	286.4	7.45	293
27/05/2019	ETFSL500	0.292	0.276	1.14	1.92	286	7.51	334
27/05/2019	CONFLU1	0.06	0.053	0.07	0.69	151.2	7.63	271
27/05/2019	WARARM5	0.026	0.024	<0.05	0.49	278	7.47	254
27/05/2019	WDFS1	0.034	0.037	0.1	0.82	274.3	7.57	270
27/05/2019	WDFS1+100	0.013	0.013	0.06	0.52	284.6	7.76	271
05/06/2019	ETAU	0.295	0.28	0.66	2.05	127.4	7.15	228
03/06/2019	ETFSL200	0.237	0.245	0.09	1.34	84	7.63	316
03/06/2019	ETFSL500	0.325	0.339	1.31	2.4	23	7.71	358
03/06/2019	CONFLU1	0.093	0.099	0.06	0.78	54.6	7.87	308
03/06/2019	WARARM5	0.024	0.02	0.07	0.41	122.6	7.78	275
03/06/2019	WDFS1	0.056	0.057	0.39	1.68	80.4	7.78	290
03/06/2019	WDFS1+100	0.019	0.021	0.15	0.56	87.6	7.92	291

ATTACHMENT A (Continued)

Water Quality Data for Sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100

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)
11/06/2019	ETAU	0.0448	0.465	0.41	2.98	142.8	7.08	291
11/06/2019	ETFSL200	0.247	0.253	0.1	1.12	116.2	7.43	287
11/06/2019	ETFSL500	0.34	0.358	1.24	2.26	63.1	7.55	323
11/06/2019	CONFLU1	0.118	0.13	0.13	1.1	73.1	7.58	278
11/06/2019	WARARM5	0.026	0.024	0.05	0.45	82	7.55	234
11/06/2019	WDFS1	0.061	0.056	0.14	0.73	101.4	7.58	251
11/06/2019	WDFS1+100	0.035	0.03	<0.05	0.56	89.2	7.63	251
18/06/2019	ETAU	0.383	0.411	1.74	2.71	12.6	6.83	252
18/06/2019	ETFSL200	0.275	0.296	0.39	1.37	35.8	7.01	242
18/06/2019	ETFSL500	0.277	0.29	0.6	1.63	12.6	7.14	249
18/06/2019	CONFLU1	0.192	0.137	0.07	0.93	8.1	7.24	235
18/06/2019	WARARM5	0.019	0.014	<0.05	0.26	48.8	7.36	222
18/06/2019	WDFS1	0.088	0.092	0.11	0.73	3.4	7.25	229
18/06/2019	WDFS1+100	0.083	0.088	<0.05	0.71	13.9	7.26	226
25/06/2019	ETAU	0.369	0.377	2.13	3.62	-2.6	6.88	266
25/06/2019	ETFSL200	0.217	0.259	0.11	2.29	2.3	7.16	252
25/06/2019	ETFSL500	0.254	0.268	0.44	2.04	-28.1	7.22	266
25/06/2019	CONFLU1	0.076	0.09	<0.05	0.66	-7.1	7.4	246
25/06/2019	WARARM5	0.066	0.017	<0.05	0.35	4.7	7.43	236
25/06/2019	WDFS1	0.079	0.087	0.12	0.75	-9.4	7.38	241
25/06/2019	WDFS1+100	0.054	0.062	<0.05	0.64	-30.8	7.41	237
01/07/2019	ETAU	0.39	0.405	0.87	3.55	37.4	7.32	261
01/07/2019	ETFSL200	0.219	0.228	<0.05	1.47	20.7	7.21	247
01/07/2019	ETFSL500	0.275	0.372	0.85	2.78	-28.7	7.3	276
01/07/2019	CONFLU1	0.135	0.145	0.17	0.92	-10.8	7.45	250
01/07/2019	WARARM5	0.018	0.018	<0.05	0.37	5.3	7.51	226
01/07/2019	WDFS1	0.065	0.066	0.14	0.81	-13	7.39	234
01/07/2019	WDFS1+100	0.046	0.044	<0.05	0.6	-7.2	7.47	234
08/07/2019	ETAU	0.144	0.154	0.63	1.33	42.7	6.59	177
08/07/2019	ETFSL200	0.13	0.142	0.52	0.99	30.2	6.72	176
08/07/2019	ETFSL500	0.143	0.153	0.68	1.08	13	6.77	180
08/07/2019	CONFLU1	0.082	0.091	0.31	0.91	-32.7	7.01	191
08/07/2019	WARARM5	0.018	0.019	0.07	0.58	17.1	7.15	201
08/07/2019	WDFS1	0.082	0.089	0.36	0.94	1.5	6.98	190
08/07/2019	WDFS1+100	0.078	0.081	0.21	0.79	-5	7.01	188
15/07/2019	ETAU	0.268	0.266	1.11	2.05	-3.8	6.66	221
15/07/2019	ETFSL200	0.209	0.219	0.21	1.24	-4.9	6.76	218
15/07/2019	ETFSL500	0.241	0.256	0.56	1.8	-13.9	6.84	232
15/07/2019	CONFLU1	0.126	0.127	0.07	0.97	6.6	6.89	221
15/07/2019	WARARM5	0.023	0.017	<0.05	0.52	19.7	6.98	222
15/07/2019	WDFS1	0.086	0.097	0.05	0.95	15	6.9	215
15/07/2019	WDFS1+100	0.06	0.064	<0.05	0.78	-1.6	6.87	210
22/07/2019	ETAU	0.415	0.372	2.39	3.53	28.3	7.04	243
22/07/2019	ETFSL200	0.289	0.272	0.08	1.46	3.8	6.45	235
22/07/2019	ETFSL500	0.332	0.291	0.71	2.07	-38.1	6.65	254
22/07/2019	CONFLU1	0.168	0.153	0.06	0.84	10.3	6.66	233
22/07/2019	WARARM5	0.025	0.017	<0.05	0.44	9	6.66	222
22/07/2019	WDFS1	0.094	0.091	0.34	0.8	14	6.63	226
22/07/2019	WDFS1+100	0.071	0.061	0.26	0.61	-1.6	6.63	227

ATTACHMENT A (Continued)

Water Quality Data for Sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100

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)
29/07/2019	ETAU	0.348	0.363	0.22	2.06	53	6.3	315
29/07/2019	ETFSL200	0.234	0.25	0.07	1.4	56.1	6.41	311
29/07/2019	ETFSL500	0.301	0.348	1.37	2.58	-3.8	6.51	342
29/07/2019	CONFLU1	0.13	0.127	0.33	1.28	14.3	6.51	312
29/07/2019	WARARM5	0.029	0.018	0.1	0.38	36.1	6.52	291
29/07/2019	WDFS1	0.077	0.078	0.15	0.87	21.1	6.58	306
29/07/2019	WDFS1+100	0.044	0.044	0.11	0.55	13.7	6.48	302
05/08/2019	ETAU	0.387	0.371	0.72	3.36	34	6.35	323
05/08/2019	ETFSL200	0.247	0.259	0.13	1.47	16.2	6.5	317
05/08/2019	ETFSL500	0.304	0.319	1.34	2.2	-8.3	6.67	354
05/08/2019	CONFLU1	0.104	0.107	0.13	0.74	4.1	6.64	311
05/08/2019	WARARM5	0.019	0.016	0.08	0.37	1.6	6.63	291
05/08/2019	WDFS1	0.061	0.055	0.43	0.86	5.9	6.61	299
05/08/2019	WDFS1+100	0.041	0.038	0.11	0.52	32.5	6.54	305
12/08/2019	ETAU	0.405	0.402	1.42	3.6	29	6.45	292
12/08/2019	ETFSL200	0.249	0.240	0.16	1.38	69.3	6.22	287
12/08/2019	ETFSL500	0.317	0.306	1.52	2.48	13.1	6.35	314
12/08/2019	CONFLU1	0.104	0.108	0.13	0.7	32.9	6.34	283
12/08/2019	WARARM5	0.016	0.013	0.09	0.38	47.9	6.32	263
12/08/2019	WDFS1	0.052	0.052	0.1	0.58	37.6	6.26	275
12/08/2019	WDFS1+100	0.028	0.035	0.13	1.65	11.2	6.35	275
19/08/2019	ETAU	0.425	0.461	1.34	3.64	14	6.29	297
19/08/2019	ETFSL200	0.242	0.264	0.12	1.37	143	6.47	290
19/08/2019	ETFSL500	0.314	0.334	1.3	2.36	-36.1	6.65	319
19/08/2019	CONFLU1	0.106	0.116	0.08	0.71	-16.8	6.62	290
19/08/2019	WARARM5	0.016	0.016	0.08	0.31	7.7	6.43	267
19/08/2019	WDFS1	0.042	0.051	0.1	0.63	-25.6	6.64	279
19/08/2019	WDFS1+100	0.017	0.021	0.12	0.52	-0.5	6.61	279
26/08/2019	ETAU	0.434	0.498	1.56	4.11	2.7	6.93	321
26/08/2019	ETFSL200	0.249	0.267	0.28	1.32	40.1	7.16	317
26/08/2019	ETFSL500	0.297	0.345	1.28	2.66	-33.7	7.21	358
26/08/2019	CONFLU1	0.106	0.115	0.26	1.0	-29	7.36	316
26/08/2019	WARARM5	0.016	0.023	0.17	0.64	-26.1	7.32	287
26/08/2019	WDFS1	0.047	0.051	0.19	0.63	-43.4	7.39	306
26/08/2019	WDFS1+100	0.021	0.038	0.14	0.7	-12.2	7.42	304
02/09/2019	ETAU	0.394	0.427	1.55	3.69	1.2	8.48	308
02/09/2019	ETFSL200	0.233	0.225	<0.05	0.73	31.4	6.13	292
02/09/2019	ETFSL500	0.304	0.293	1.08	1.5	-24.4	6.4	326
02/09/2019	CONFLU1	0.179	0.126	<0.05	0.72	16.3	6.42	290
02/09/2019	WARARM5	0.016	0.013	<0.05	0.3	223.6	6.41	262
02/09/2019	WDFS1	0.047	0.042	<0.05	0.49	4.7	6.41	272
02/09/2019	WDFS1+100	0.026	0.028	<0.05	0.47	33.7	6.41	269
09/09/2019	ETAU	0.387	0.412	1.08	2.58	1.9	7.24	314
08/09/2019	ETFSL200	0.205	0.235	0.12	1.58	41.5	7.34	306
08/09/2019	ETFSL500	0.268	0.297	1.08	2.04	-18.2	7.52	345
08/09/2019	CONFLU1	0.082	0.093	0.1	0.82	-2	7.54	300
08/09/2019	WARARM5	0.018	0.018	0.08	0.4	44.8	7.47	255
08/09/2019	WDFS1	0.025	0.025	0.16	0.61	-55.2	7.53	273
08/09/2019	WDFS1+100	0.01	0.01	0.17	0.56	34.8	7.53	275

ATTACHMENT A (Continued)

Water Quality Data for Sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100

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)
19/09/2019	ETAU	0.045	0.052	0.25	0.7	108.8	7.13	128
19/09/2019	ETFSL200	0.046	0.054	0.26	0.76	111.5	5.94	132
19/09/2019	ETFSL500	0.048	0.059	0.27	0.88	114	5.94	127
19/09/2019	CONFLU1	0.058	0.068	0.25	0.81	127.9	5.93	128
19/09/2019	WARARM5	0.056	0.068	0.21	0.77	118	5.93	140
19/09/2019	WDFS1	0.064	0.073	0.22	0.75	127.2	5.93	139
19/09/2019	WDFS1+100	0.062	0.069	0.2	0.68	148.8	5.81	136
23/09/2019	ETAU	0.118	0.109	0.55	0.97	73.4	6.08	197
23/09/2019	ETFSL200	0.095	0.098	0.41	0.8	40.6	6.09	194
23/09/2019	ETFSL500	0.104	0.112	0.53	1.16	29.8	6.15	200
23/09/2019	CONFLU1	0.132	0.139	0.35	1.17	36.5	6.15	198
23/09/2019	WARARM5	0.047	0.049	0.16	0.47	72.6	6.17	199
23/09/2019	WDFS1	0.074	0.075	0.25	0.63	32.7	6.15	197
23/09/2019	WDFS1+100	0.086	0.089	0.27	0.68	14.4	6.14	196
03/10/2019	ETAU	0.229	0.256	0.43	1.95	56.4	6.08	248
03/10/2019	ETFSL200	0.182	0.202	<0.05	1.19	47.2	6.14	245
03/10/2019	ETFSL500	0.168	0.227	0.32	1.6	4.1	6.28	270
03/10/2019	CONFLU1	0.121	0.125	<0.05	0.85	27.7	6.2	248
03/10/2019	WARARM5	0.051	0.056	<0.05	0.46	36.2	6.19	238
03/10/2019	WDFS1	0.094	0.109	<0.05	0.8	20.8	6.2	242
03/10/2019	WDFS1+100	0.095	0.101	<0.05	0.81	34.1	6.39	247
09/10/2019	ETAU	0.194	0.208	0.07	1.74	113.8	6.68	241
09/10/2019	ETFSL200	0.148	0.161	<0.05	1.33	63.3	6.98	245
09/10/2019	ETFSL500	0.202	0.214	0.47	1.87	9	7.16	274
09/10/2019	CONFLU1	0.184	0.143	<0.05	0.98	39.6	7.22	256
09/10/2019	WARARM5	0.054	0.053	0.07	0.46	62.2	7.15	243
09/10/2019	WDFS1	0.094	0.103	<0.05	0.91	62.2	7.2	250
09/10/2019	WDFS1+100	0.084	0.087	0.08	0.91	71.8	7.22	246
14/10/2019	ETAU	0.111	0.112	0.67	1.18	53	6.6	199
14/10/2019	ETFSL200	0.094	0.099	0.41	0.97	36.1	6.77	195
14/10/2019	ETFSL500	0.096	0.093	0.54	0.95	32.3	6.87	206
14/10/2019	CONFLU1	0.072	0.076	0.23	0.75	33.7	7.08	224
14/10/2019	WARARM5	0.035	0.036	0.05	0.33	35	7.19	248
14/10/2019	WDFS1	0.065	0.071	0.16	0.65	23.5	7.07	229
14/10/2019	WDFS1+100	0.06	0.057	0.16	0.6	-18.3	7.02	224
21/10/2019	ETAU	0.245	0.244	0.81	2.12	81.3	7.44	260
21/10/2019	ETFSL200	0.157	0.167	<0.05	1.18	108.5	7.45	262
21/10/2019	ETFSL500	0.184	0.193	0.46	1.58	43.2	7.59	282
21/10/2019	CONFLU1	0.063	0.069	<0.05	0.61	70.3	7.58	260
21/10/2019	WARARM5	0.04	0.035	0.07	0.36	79.6	7.61	260
21/10/2019	WDFS1	0.088	0.093	<0.05	0.75	40.8	7.63	262
21/10/2019	WDFS1+100	0.061	0.066	0.09	0.73	38.9	7.64	260
28/10/2019	ETAU	0.325	0.34	<0.05	2.13	173	6.61	281
28/10/2019	ETFSL200	0.206	0.228	0.06	1.31	165.1	7.31	277
28/10/2019	ETFSL500	0.251	0.262	0.88	1.74	83.3	7.1	308
28/10/2019	CONFLU1	0.113	0.118	0.19	0.89	156.2	7.45	288
28/10/2019	WARARM5	0.044	0.047	0.19	0.41	160.3	7.44	279
28/10/2019	WDFS1	0.083	0.091	0.19	0.92	151.6	7.42	286
28/10/2019	WDFS1+100	0.056	0.062	0.18	0.7	116.1	7.71	283

ATTACHMENT A (Continued)

Water Quality Data for Sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100

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)
04/11/2019	ETAU	0.379	0.39	0.41	2.29	185.3	6.81	286
04/11/2019	ETFSL200	0.211	0.242	<0.05	0.77	136.2	7.48	281
04/11/2019	ETFSL500	0.271	0.261	0.28	1.24	98.9	7.42	305
04/11/2019	CONFLU1	0.111	0.099	<0.05	0.63	122.9	7.69	275
04/11/2019	WARARM5	0.044	0.042	<0.05	0.27	131	7.78	274
04/11/2019	WDFS1	0.074	0.08	<0.05	0.59	154.4	7.62	271
04/11/2019	WDFS1+100	0.055	0.062	<0.05	0.58	90.7	7.84	272
14/11/2019	ETAU	0.362	0.374	<0.05	1.72	307.7	6.74	300
14/11/2019	ETFSL200	0.156	0.19	<0.05	0.7	172	7.39	296
14/11/2019	ETFSL500	0.244	0.26	0.36	1.58	93.1	7.24	339
14/11/2019	CONFLU1	0.04	0.046	0.16	0.7	179.6	7.78	298
14/11/2019	WARARM5	0.03	0.032	<0.05	0.39	148.3	7.6	282
14/11/2019	WDFS1	0.073	0.086	0.09	0.83	163.5	7.69	304
14/11/2019	WDFS1+100	0.015	0.023	0.15	0.59	141.1	8.51	294
18/11/2019	ETAU	0.386	0.406	<0.05	1.94	213.9	6.62	298
18/11/2019	ETFSL200	0.195	0.213	<0.05	0.05	125.4	7.47	297
18/11/2019	ETFSL500	0.23	0.253	0.22	1.43	105.6	7.44	331
18/11/2019	CONFLU1	0.049	0.053	0.15	0.66	152.1	7.82	295
18/11/2019	WARARM5	0.032	0.038	0.13	0.45	178.6	7.71	282
18/11/2019	WDFS1	0.039	0.05	0.17	0.7	154.1	7.78	295
18/11/2019	WDFS1+100	0.019	0.023	0.14	0.58	102.1	8.35	293
25/11/2019	ETAU	0.455	0.496	<0.05	1.67	227.7	6.58	300
25/11/2019	ETFSL200	0.188	0.196	<0.05	0.54	183.9	6.89	297
25/11/2019	ETFSL500	0.23	0.259	0.23	1.52	121.5	7.22	332
25/11/2019	CONFLU1	0.064	0.078	0.13	0.83	217.5	7.8	311
25/11/2019	WARARM5	0.036	0.035	0.11	0.45	205.2	7.69	292
25/11/2019	WDFS1	0.033	0.043	0.17	0.68	222.5	7.89	302
25/11/2019	WDFS1+100	0.013	0.022	0.16	0.58	170.8	8.7	302

Sustainable Minerals Institute

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St Lucia QLD 4072 Australia

Director

Professor Neville Plint

CRICOS PROVIDER NUMBER 000258

25 March 2020

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 – December 2019

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 Longwall 304 Water Management Plan (LW304 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 LW304 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 LW304 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 LW304 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 LW304 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.

Analysis conducted by Hydro Engineering & Consulting (2019) in accordance with the LW304 WMP, identified that the performance indicator for water resources reaching the Woronora Reservoir was exceeded for dissolved (i.e. filtered <0.45 µm fraction) manganese on the Eastern Tributary at site ETWQ AU in December 2019 (as there was not a similar exceedance of the trigger recorded at control site WOWQ 2 on the Woronora River). The performance indicator was not exceeded for field filtered iron or aluminium in December 2019 and therefore these parameters are not discussed in this report.

In accordance with the LW304 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*.

This assessment against the water quality subsidence impact performance measure has been prepared for December 2019 in consideration of:

- pluviograph data;
- flow data from the Eastern Tributary gauging location (GS 300078);
- groundwater level and groundwater quality results for Eastern Tributary sites up to 31 December 2019¹;
- surface water quality data at site ETWQ AU/ETAU² and sites further upstream on the Eastern Tributary up to 31 December 2019;
- surface water quality data at sites downstream of ETWQ AU/ETAU² up to 31 December 2019; 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 2018, above average rainfall has only been recorded in October 2018, November 2018, December 2018 and September 2019, with below average rainfall recorded in all other months, including December 2019 (Table 1).

Total rainfall in December 2019 was 3.6 mm, below the average rainfall at Darkes Forest (103.0 mm), with rainfall occurring on 14 December (0.5 mm rainfall), 25 December (0.5 mm rainfall) and 26 December 2019 (5.5 mm rainfall). Shallow groundwater levels correlate with the rainfall trend.

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

² Site ETAU is the same as site ETWQ AU (i.e. samples are taken at the same location). The difference between the sites relates to the time of sampling. Site ETWQ AU monitoring is conducted on the same day as sites upstream of ETWQ AU/ETAU (shown on Charts 1 to 2), while site ETAU monitoring is conducted on the same day as the sites downstream of ETWQ AU/ETAU (described in Section 3 and shown on Charts 3 to 4). From 29 January 2019, water quality sampling of all sites on the Eastern Tributary was undertaken in a single day. Future reporting will identify the data at this site as site ETWQ AU.

Table 1 Monthly Rainfall Data (mm) for PV7, January 2018 to December 2019

Month/Year	Rainfall at PV7 (mm)	Rainfall at Darkes Forest (mm) [#]	Monthly Mean Rainfall at Darkes Forest (1894-2019) (mm) [#]
January 2018	48.0	12.0	132.4
February 2018	115.5	16.6	159.6
March 2018	151.0	45.0	153.9
April 2018	32.0	21.6	126.8
May 2018	12.5	8.0	129.1
June 2018	112.0	91.8	146.6
July 2018	3.5	0.4	96.4
August 2018	12.5	15.8	89.1
September 2018	52.0	41.8	76.6
October 2018	197.0	200.8	91.9
November 2018	114.5	127.8	105.4
December 2018	120.0	91.0	103.8
January 2019	58.5	55.4	131.8
February 2019	41.0	54.2	158.7
March 2019	149.0	201.2	154.3
April 2019	35.0	46.0	126.1
May 2019	8.5	8.0	128.1
June 2019	115.5	47.4	145.8
July 2019	56.0	46.4	96.0
August 2019	53.0	58.8	88.9
September 2019	162.5	150.2	77.2
October 2019	53.0	37.4	91.5
November 2019	47.0	43.8	104.9
December 2019	6.5	3.6	103.0

[#] 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 December 2019.

2. EASTERN TRIBUTARY SURFACE WATER AND GROUNDWATER QUALITY DATA

Plots of dissolved manganese at surface water quality sites ETWQ AU, ETWQ AQ (upstream on the Eastern Tributary) and WOWQ 2 (control site) and at groundwater quality site ETGW2, are compared to rainfall at PV7 (Chart 1) and streamflow at GS 300078 (Chart 2) (Figure 1).

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.

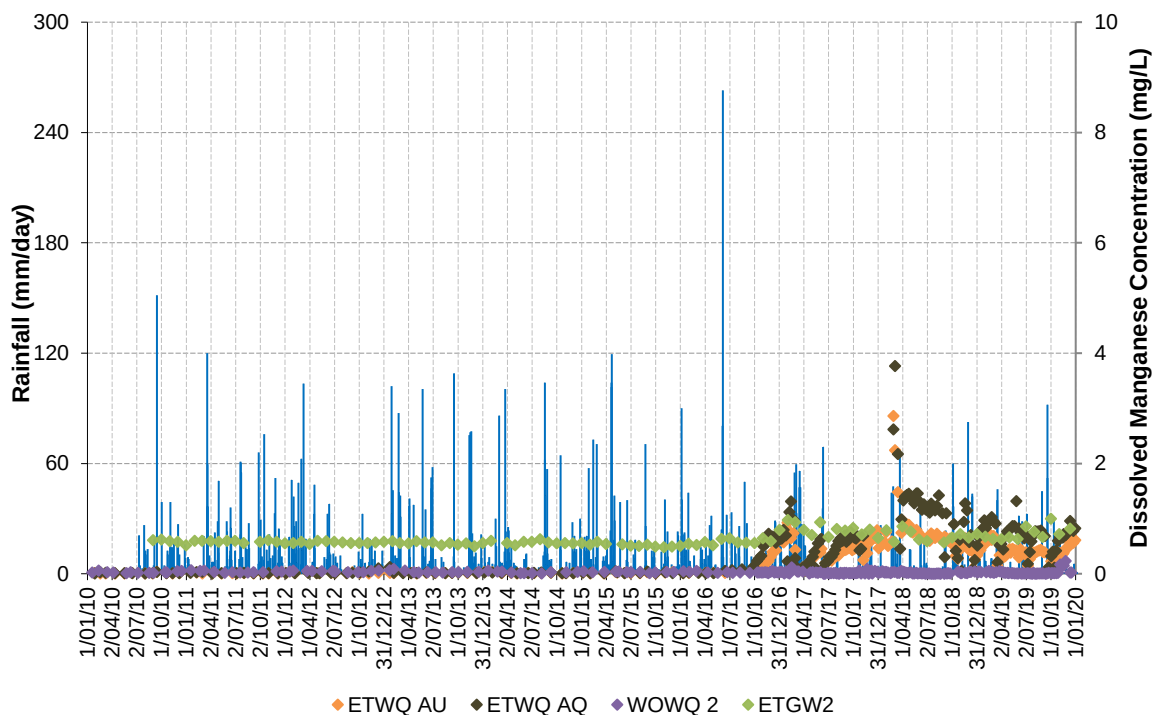


Chart 1 Dissolved Manganese Concentrations at Surface Water Quality Sites ETWQ AU, ETWQ AQ and WOWQ 2 and Groundwater Quality Site ETGW2, and Rainfall (to 31 December 2019)

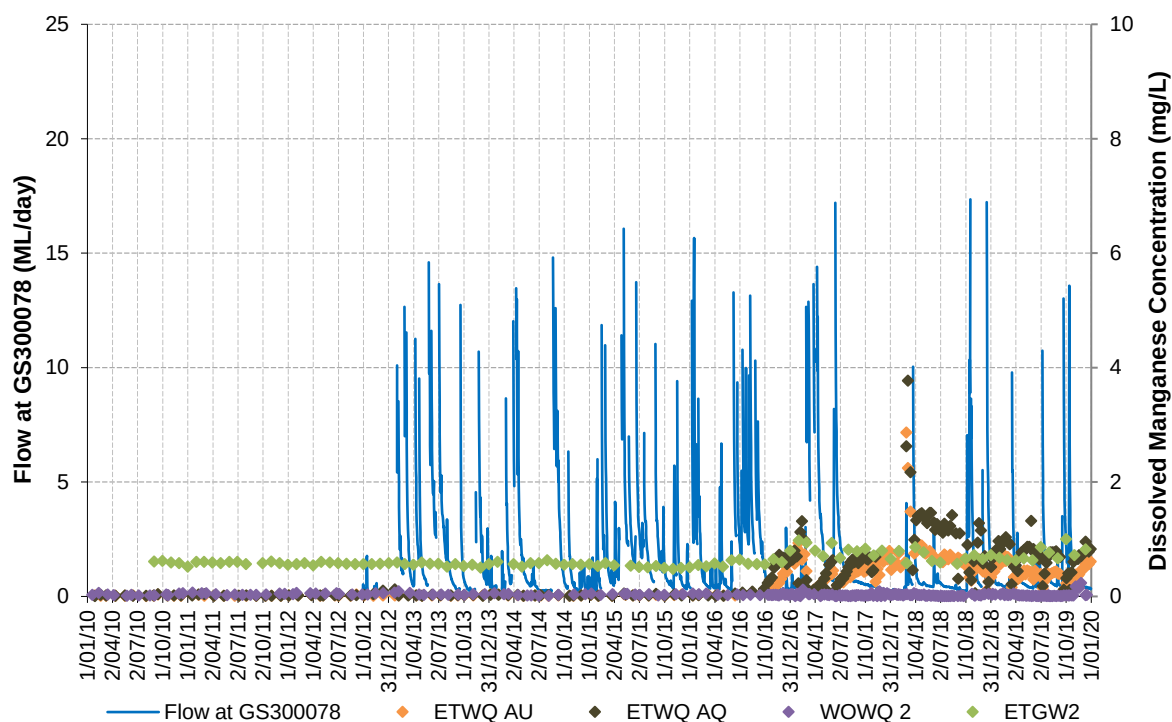
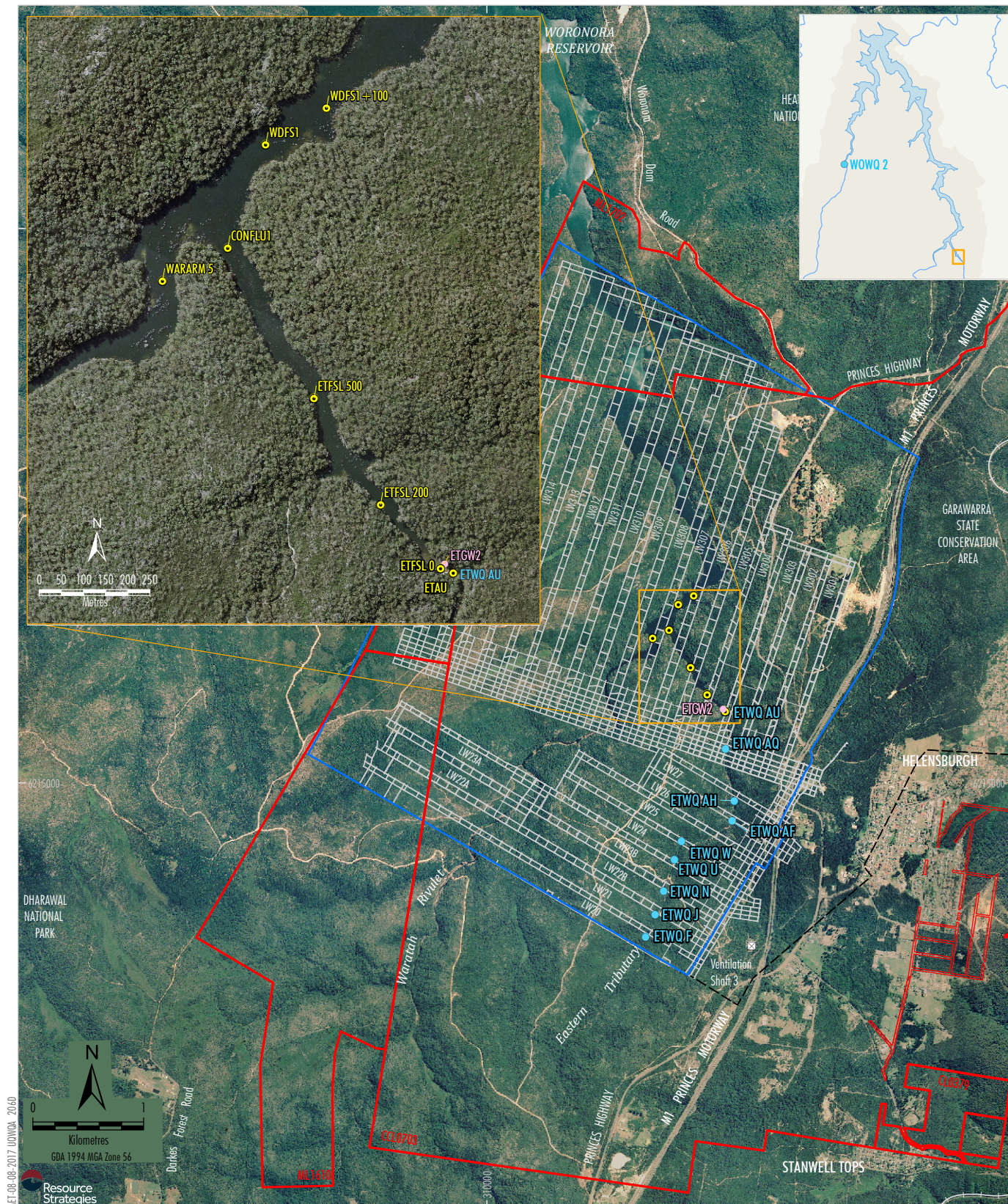


Chart 2 Dissolved Manganese Concentrations at Surface Water Quality Sites ETWQ AU, ETWQ AQ and WOWQ 2 and Groundwater Quality Site ETGW2, and Stream Flow (to 31 December 2019)



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 on Eastern Tributary
- Water Quality Site on Eastern Tributary and/or in Woronora Reservoir
- Groundwater Quality Site of Eastern Tributary

Peabody
METROPOLITAN COAL

Surface Water Quality Sampling of
Eastern Tributary Watercourse
and Woronora Reservoir

Figure 1

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. <0.1 mg/L, exist in the natural creek water. Dissolved manganese is easily diluted by freshwater flow to low levels when higher creek flows occur.

In December 2019, dissolved manganese concentrations at site ETWQ AU ranged between 0.498 mg/L and 0.609 mg/L. 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. The dilution of dissolved manganese concentrations during high flows 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. Concentrations subsequently increased, but remained notably lower than those recorded prior to the rainfall event.

Water quality parameters pertinent to the increase in manganese (dissolved-filtered <0.45 µm fraction) concentration 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 oxidizing and becomes reducing when ORP is below approximately 10 mV.

In December 2019 at site ETWQ AU:

- pH (lab measurement) was generally consistent (pH 6.50 to pH 7.61);
- EC concentrations (lab measurement) ranged between 307 µS/cm and 360 µS/cm; and
- ORP (field measurement) ranged between 46.0 mV and 204.4 mV.

3. WATER RESOURCES REACHING THE WORONORA RESERVOIR

In accordance with the LW304 WMP, site ETWQ AU on the Eastern Tributary and control site WOWQ 2 on the Woronora River are used to assess the LW304 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. 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.

Metropolitan Coal has taken a photographic record of the watercourse / waterbody at the time of sampling, estimated the width of the watercourse / water body 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 (HCPL, 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 December 2019 the Woronora Reservoir water level varied between 151.71 mAHD (on 5 December 2019) and 151.38 mAHD (on 19 December 2019) (water level decreased slightly). The position of the reservoir water level can only be determined to the closest one metre contour, accordingly, the average reservoir water level during December 2019 was approximately 3,491 m (corresponding to 152 mAHD) downstream of site ETSFL 0.

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 December 2019, the Woronora Reservoir water level was downstream of site WDFS1+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

Water quality data for filtered and total manganese for January 2018 to December 2019 at sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400 and ETFSL 500 is provided in Attachment A. As described earlier, sampling at sites ETFSL 100, ETFSL 300 and ETFSL 400 was suspended once monitoring at sites CONFLU1, WARARM5, WDFS1 and WDFS1+100 commenced on 22 November 2018³. Water quality data for filtered and total manganese since sampling commenced on 22 November 2018 at sites CONFLU1, WARARM5, WDFS1 and WDFS1+100 is also provided in Attachment A.

As described above, the Woronora Reservoir water level decreased slightly in December 2019, and was downstream of site WDFS1+100. The results for dissolved and total manganese at sites ETAU, ETFSL 200, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100 since the commencement of monitoring to the end of December 2019, are shown on Charts 3 and 4, respectively. These sites provide a profile along the arm of the Woronora Reservoir.

The filtered manganese concentrations for December 2019 ranged from 0.498 mg/L to 0.609 mg/L at site ETAU, 0.130 mg/L to 0.182 mg/L at site ETFSL 200, 0.208 mg/L to 0.286 mg/L at site ETFSL 500, 0.028 mg/L to 0.062 mg/L at site CONFLU1, 0.021 mg/L to 0.035 mg/L at site WARARM5, 0.009 mg/L to 0.021 mg/L at site WDFS1 and 0.003 mg/L to 0.012 mg/L at site WDFS1+100 (Chart 3).

Total manganese concentrations for December 2019 followed similar trends, ranging from 0.463 mg/L to 0.641 mg/L at site ETAU, 0.125 mg/L to 0.186 mg/L at site ETFSL 200, 0.207 mg/L to 0.305 mg/L at site ETFSL 500, 0.031 mg/L to 0.059 mg/L at site CONFLU1, 0.026 mg/L to 0.036 mg/L at site WARARM5, 0.022 mg/L to 0.04 mg/L at site WDFS1 and 0.013 mg/L to 0.025 mg/L at site WDFS1+100 (Chart 4).

³ Sampling at site ETAU was also temporarily suspended during this period but was resumed on 12 December 2018. Data from sampling undertaken at site ETWQ AU has been substituted for site ETAU during this period. Sampling at site ETAU was undertaken on 12 and 27 December 2018.

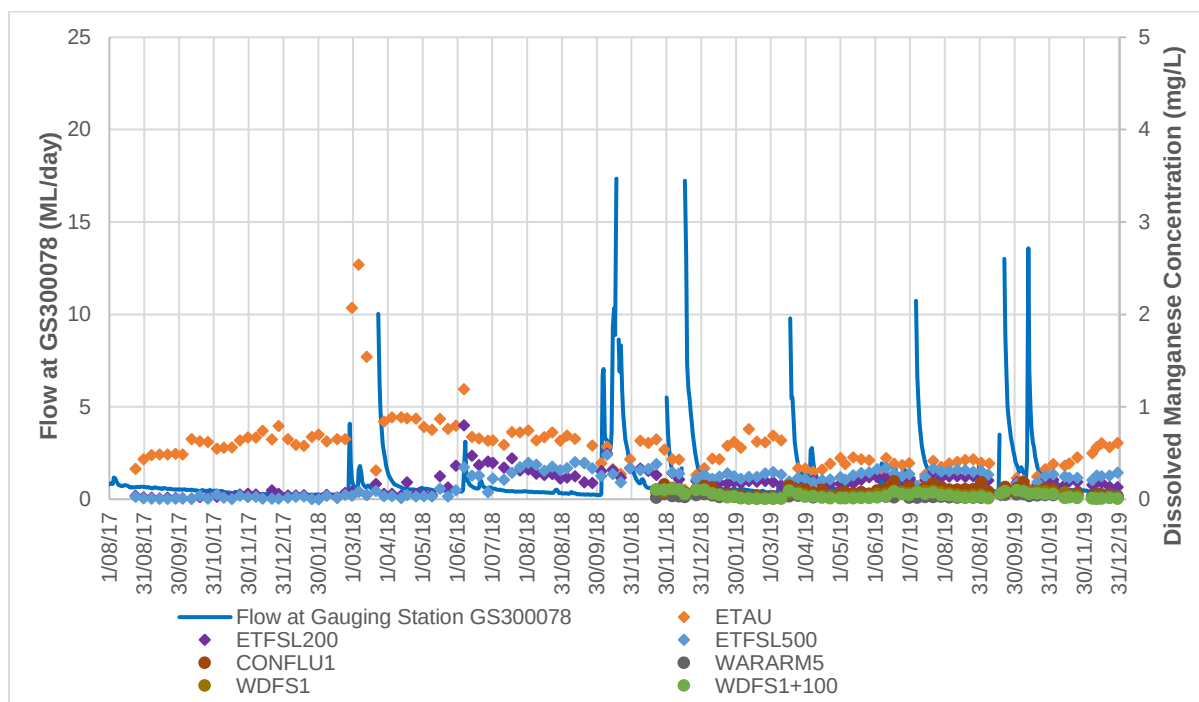


Chart 3 Dissolved Manganese Concentrations at Surface Water Quality Sites ETAU⁴, ETFSL 200, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100, and Stream Flow (August 2017 to 31 December 2019)

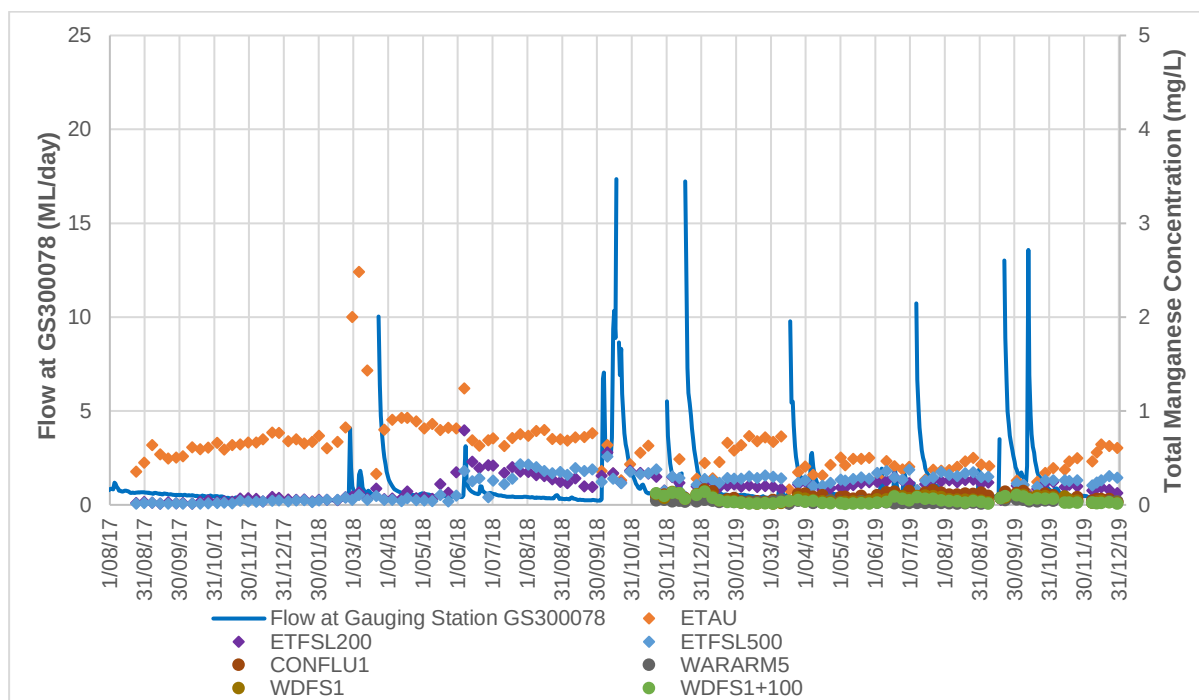


Chart 4 Total Manganese Concentrations at Surface Water Quality Sites ETAU⁵, ETFSL 200, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100, and Stream Flow (August 2017 to 31 December 2019)

⁴ Data from sampling undertaken at site ETWQ AU has been substituted for site ETAU from 22 November to 6 December 2018 and 17 December 2018. Sampling at site ETAU was undertaken on 12 and 27 December 2018.

⁵ Total manganese is not sampled at site ETWQ AU, and therefore results were unable to be substituted for site ETAU from 22 November to 6 December 2018 and 17 December 2018. Sampling at site ETAU was undertaken on 12 and 27 December 2018.

The Australian Drinking Water Guidelines (ADWG, 2011) are published by the National Health and Medical Research Council and updated most recently in 2018; 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 Australian Drinking Water Guideline before being supplied to the Helensburgh area as well as parts of the Sutherland Shire and northern Wollongong (WaterNSW, 2017).

The ADWG (2011) guidelines are based on total concentrations of manganese in water. The ADWG value is 0.5 mg/L total manganese for health. 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).

Water quality data for parameters pertinent to dissolved manganese for January 2018 to December 2019 at sites ETAU, ETFSL 200, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100 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 during December 2019, with sites WDFS1 and WDFS1+100 reducing by the end of the month (from 8.45 to 8.28, and 8.45 to 8.24, respectively) and sites ETAU, ETFSL200, ETFSL500, WARARM5 and CONFLU1 increasing by the end of the month (from 6.65 to 7.61, 7.50 to 8.01, 7.41 to 8.05, 7.95 to 8.13, and 8.08 to 8.12, respectively). At the end of December 2019, all sites were within the ADWG value range for pH (Attachment A).

The groundwater at ETGW2 below ETAU on 20 November 2019 was pH 6.27 and 12 December 2019 was pH 6.89, indicating that seeping groundwater was not a source of higher pH water entering the reservoir.

The pH of creek water following limited rain events may fluctuate slightly because dry iron oxyhydroxide in contact with water undergoes hydrolysis. It is possible that the higher pH water in the reservoir is linked to the limited rain events recorded at PV7 since September 2019, as both arms of the Woronora Reservoir appear to have increasing pH of water associated with a limnological process. Given the limited rain events recorded leading up to and in December 2019, the fluctuations within the creek water pH are considered to be natural. In December 2019, the pH values at all sites were within the ADWG value 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 December 2019, which has triggered 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 for December 2019, show the quality of water below ETAU fluctuated during December 2019, with the water observed to be clear at the end of December due to the rainfall event on 26 December 2019, before which the water showed mild turbidity. A slight decrease in the presence of orange-yellow coating on the bed rock surfaces of the sites was observed by the end of December 2019. The presence of orange-yellow coating on the creek sediment surface will darken with time as conversion to goethite occurs.

Water reaching the Woronora Reservoir occurs where the inflowing stream water meets the reservoir waterbody. In December 2019, the Woronora Reservoir water level was downstream of site WDFS1+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.

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

ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, WARARM5, CONFLU1, WDFS1 and
WDFS1+100

JANUARY 2018 TO DECEMBER 2019

ATTACHMENT A

Water Quality Data for Sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100

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)
4/01/2018	ETAU	0.652	0.678	<0.05	0.59	132	7.37	351
4/01/2018	ETFSL100	0.281	0.305	<0.05	0.82	125.3	7.75	337
4/01/2018	ETFSL200	0.042	0.057	<0.05	0.68	132.7	7.05	118
4/01/2018	ETFSL300	0.038	0.052	0.06	0.6	13.2	6.92	111
4/01/2018	ETFSL400	0.024	0.037	<0.05	0.47	129.9	6.96	110
4/01/2018	ETFSL500	0.016	0.036	<0.05	0.46	121.7	6.74	111
11/01/2018	ETAU	0.588	0.698	0.13	1.36	55.9	7.56	364
11/01/2018	ETFSL100	0.197	0.237	<0.05	0.55	24.3	7.88	345
11/01/2018	ETFSL200	0.041	0.053	<0.05	0.63	101	7.14	139
11/01/2018	ETFSL300	0.067	0.078	1.89	2.1	35.2	6.88	128
11/01/2018	ETFSL400	0.106	0.052	0.47	0.66	52	6.84	124
11/01/2018	ETFSL500	0.026	0.046	0.06	0.78	94.4	7.01	122
18/01/2018	ETAU	0.577	0.653	<0.05	1.15	136.4	7.67	366
18/01/2018	ETFSL100	0.211	0.22	<0.05	0.64	131.9	7.74	353
18/01/2018	ETFSL200	0.046	0.055	<0.05	0.79	131.2	7	129
18/01/2018	ETFSL300	0.058	0.057	0.06	0.84	125.5	6.94	126
18/01/2018	ETFSL400	0.038	0.048	<0.05	0.71	139.6	6.96	125
18/01/2018	ETFSL500	0.032	0.049	<0.05	0.78	121.4	6.94	123
25/01/2018	ETAU	0.674	0.668	<0.05	0.52	56.8	7.55	378
25/01/2018	ETFSL100	0.074	0.152	<0.05	0.46	-4.4	7.82	360
25/01/2018	ETFSL200	0.007	0.034	<0.05	0.41	70.6	7.16	120
25/01/2018	ETFSL300	0.005	0.035	<0.05	0.46	22.8	7.09	117
25/01/2018	ETFSL400	0.001	0.032	<0.05	0.41	55	7	118
25/01/2018	ETFSL500	0.002	0.03	<0.05	0.35	288.6	7.04	115
31/01/2018	ETAU	0.7	0.734	<0.05	0.67	82.3	7.46	374
31/01/2018	ETFSL100	0.089	0.147	<0.05	0.36	30.7	8.01	361
31/01/2018	ETFSL200	0.005	0.052	<0.05	0.57	79.1	7.28	139
31/01/2018	ETFSL300	0.002	0.049	<0.05	0.66	42.7	7.08	123
31/01/2018	ETFSL400	0.001	0.046	<0.05	0.54	92	7.05	122
31/01/2018	ETFSL500	0.001	0.044	<0.05	0.55	71	7.01	122
7/02/2018	ETAU	0.625	0.601	<0.05	0.65	106.9	7.39	374
7/02/2018	ETFSL100	0.102	0.129	<0.05	0.75	14.8	7.78	359
7/02/2018	ETFSL200	0.047	0.051	<0.05	0.48	80.4	7.04	119
7/02/2018	ETFSL300	0.049	0.059	<0.05	0.65	38.2	6.97	119
7/02/2018	ETFSL400	0.112	0.07	0.27	0.74	1	6.77	118
7/02/2018	ETFSL500	0.038	0.053	0.11	0.58	86.6	6.92	117
16/02/2018	ETAU	0.65	0.67	<0.05	0.66	158.8	7.54	380
16/02/2018	ETFSL100	0.075	0.126	<0.05	0.33	163.9	7.96	369
16/02/2018	ETFSL200	0.016	0.048	<0.05	0.6	152	7.05	128
16/02/2018	ETFSL300	0.023	0.058	<0.05	0.81	121.1	6.88	124
16/02/2018	ETFSL400	0.012	0.049	<0.05	0.54	143.2	6.83	121
16/02/2018	ETFSL500	0.019	0.054	<0.05	0.54	144.1	6.82	120
23/02/2018	ETAU	0.651	0.822	<0.05	1.72	163.6	7.21	400
23/02/2018	ETFSL100	0.12	0.2	<0.05	0.5	31.8	7.75	384
23/02/2018	ETFSL200	0.068	0.078	<0.05	0.93	55.8	6.92	140
23/02/2018	ETFSL300	0.065	0.07	0.07	0.88	55.2	6.8	136
23/02/2018	ETFSL400	0.062	0.075	<0.05	0.93	41.8	6.78	135
23/02/2018	ETFSL500	0.049	0.075	<0.05	1.07	-119.2	6.78	132

ATTACHMENT A (Continued)
Water Quality Data for Sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100

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)
1/03/2018	ETAU	2.07	2	5.96	5.69	83.1	6.32	492
1/03/2018	ETFSL100	1.78	1.72	2.41	2.7	36.7	6.31	464
1/03/2018	ETFSL200	0.08	0.087	0.08	0.83	59	6.45	133
1/03/2018	ETFSL300	0.059	0.069	0.16	0.79	43.5	6.36	127
1/03/2018	ETFSL400	0.05	0.064	0.1	1.03	32	6.35	125
1/03/2018	ETFSL500	0.036	0.051	0.08	0.65	2.3	6.38	123
7/03/2018	ETAU	2.54	2.48	7.52	7.23	168.1	6.12	514
7/03/2018	ETFSL100	2.21	2.15	4.12	4.43	158.6	6.11	479
7/03/2018	ETFSL200	0.082	0.132	0.07	0.92	166.8	6.29	147
7/03/2018	ETFSL300	0.108	0.12	<0.05	0.91	149	6.32	147
7/03/2018	ETFSL400	0.088	0.11	<0.05	0.78	161.1	6.79	142
7/03/2018	ETFSL500	0.083	0.102	0.07	0.76	154.5	6.32	138
14/03/2018	ETAU	1.54	1.43	3.72	6.68	41.4	6.58	450
14/03/2018	ETFSL100	0.907	1.08	0.55	3.58	31.6	6.95	431
14/03/2018	ETFSL200	0.047	0.066	<0.05	0.63	76	6.84	135
14/03/2018	ETFSL300	0.048	0.054	<0.05	0.56	41.4	6.83	133
14/03/2018	ETFSL400	0.064	0.055	0.06	0.61	3.3	6.86	132
14/03/2018	ETFSL500	0.047	0.052	<0.05	0.47	21.9	6.79	131
22/03/2018	ETAU	0.312	0.33	0.73	1.46	229.3	5.24	237
22/03/2018	ETFSL100	0.362	0.363	0.71	1.69	182.9	5.08	240
22/03/2018	ETFSL200	0.166	0.173	0.44	1.63	71.9	6.51	160
22/03/2018	ETFSL300	0.118	0.118	0.28	1.33	70.6	6.54	153
22/03/2018	ETFSL400	0.146	0.136	0.8	1.66	22.8	6.61	152
22/03/2018	ETFSL500	0.091	0.095	0.14	1.02	32.6	6.65	144
29/03/2018	ETAU	0.841	0.798	2.83	3.32	148	6.66	341
29/03/2018	ETFSL100	0.732	0.729	1.87	2.6	40.9	6.63	332
29/03/2018	ETFSL200	0.058	0.059	0.11	0.62	84.2	6.65	131
29/03/2018	ETFSL300	0.047	0.053	0.08	0.59	65.9	6.64	131
29/03/2018	ETFSL400	0.051	0.055	0.08	0.74	71.4	6.64	130
29/03/2018	ETFSL500	0.033	0.051	0.08	1.29	27.3	6.68	128
5/4/2018	ETAU	0.885	0.904	2.84	4.76	182.7	6.57	384
5/4/2018	ETFSL100	0.674	0.672	0.73	2.41	191.7	6.67	374
5/4/2018	ETFSL200	0.058	0.067	0.08	0.62	211.9	6.32	142
5/4/2018	ETFSL300	0.044	0.058	0.07	0.57	209.4	6.37	142
5/4/2018	ETFSL400	0.04	0.058	0.13	0.77	209.1	6.39	141
5/4/2018	ETFSL500	0.035	0.054	0.09	0.66	205.9	6.4	141
13/4/2018	ETAU	0.888	0.927	1.42	4.26	156.2	6.76	391
13/4/2018	ETFSL100	0.614	0.651	0.13	2.46	172.9	6.92	382
13/4/2018	ETFSL200	0.042	0.065	0.08	0.7	42.8	6.84	153
13/4/2018	ETFSL300	0.033	0.051	0.05	0.5	40.9	6.52	145
13/4/2018	ETFSL400	0.023	0.048	<0.05	0.59	64.1	6.6	147
13/4/2018	ETFSL500	0.014	0.04	<0.05	0.51	58.6	6.61	142
18/4/2018	ETAU	0.875	0.925	0.62	2.62	192.1	6.77	397
18/4/2018	ETFSL100	0.614	0.636	0.13	2.27	192.3	7.19	390
18/4/2018	ETFSL200	0.184	0.14	0.57	1.14	184.8	6.75	178
18/4/2018	ETFSL300	0.059	0.074	0.08	0.86	186.3	6.81	162
18/4/2018	ETFSL400	0.05	0.069	<0.05	0.64	181.3	6.76	159
18/4/2018	ETFSL500	0.044	0.071	0.07	0.76	185.5	6.76	160

ATTACHMENT A (Continued)

Water Quality Data for Sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100

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)
26/4/2018	ETAU	0.871	0.887	3.01	4.32	7.2	7.02	1040
26/4/2018	ETFSL100	0.587	0.631	0.1	2.06	9.6	7.42	409
26/4/2018	ETFSL200	0.059	0.071	0.08	0.69	45.1	7.01	159
26/4/2018	ETFSL300	0.043	0.055	<0.05	0.54	2.5	6.96	159
26/4/2018	ETFSL400	0.04	0.055	<0.05	0.54	36	6.97	155
26/4/2018	ETFSL500	0.03	0.05	0.05	0.51	94.3	6.96	152
3/5/2018	ETAU	0.781	0.813	2.38	2.38	76.9	6.9	362
3/5/2018	ETFSL100	0.58	0.611	0.18	3.02	20	7.47	358
3/5/2018	ETFSL200	0.056	0.081	0.07	0.78	43.5	7.01	142
3/5/2018	ETFSL300	0.053	0.059	0.13	0.55	5.3	7.02	136
3/5/2018	ETFSL400	0.044	0.052	0.06	0.45	55.3	7	132
3/5/2018	ETFSL500	0.034	0.044	0.07	0.68	60.7	7.01	128
10/5/2018	ETAU	0.752	0.86	4.66	4.66	176.7	6.75	388
10/5/2018	ETFSL100	0.553	0.628	0.06	4.58	191.5	7.19	384
10/5/2018	ETFSL200	0.044	0.061	<0.05	0.89	187.4	6.64	129
10/5/2018	ETFSL300	0.042	0.051	0.08	0.56	180.2	6.67	131
10/5/2018	ETFSL400	0.051	0.056	0.1	0.5	170.7	6.71	133
10/5/2018	ETFSL500	0.032	0.04	0.08	0.45	164	6.68	124
17/5/2018	ETAU	0.868	0.795	3.32	3.32	160	6.78	383
17/5/2018	ETFSL100	0.634	0.605	<0.05	2.66	178.5	7.12	375
17/5/2018	ETFSL200	0.249	0.22	0.25	1.87	178.5	6.85	246
17/5/2018	ETFSL300	0.176	0.178	0.12	1.57	175.8	6.84	230
17/5/2018	ETFSL400	0.146	0.14	0.1	1.32	179.3	6.78	202
17/5/2018	ETFSL500	0.113	0.102	0.12	1.36	179.6	6.65	176
24/5/2018	ETAU	0.763	0.795	3.22	3.22	192.8	7.22	381
24/5/2018	ETFSL100	0.563	0.63	<0.05	4.36	194.2	7.12	375
24/5/2018	ETFSL200	0.128	0.128	0.58	1.03	189.4	6.95	158
24/5/2018	ETFSL300	0.04	0.053	0.05	0.62	102.2	6.78	125
24/5/2018	ETFSL400	0.037	0.043	0.07	0.39	184.9	6.72	145
24/5/2018	ETFSL500	0.031	0.037	<0.05	0.33	185.2	6.76	120
31/5/2018	ETAU	0.797	0.812	3.74	3.74	193.3	7.22	378
31/5/2018	ETFSL100	0.626	0.598	<0.05	2.57	197.5	7.12	375
31/5/2018	ETFSL200	0.362	0.344	0.48	2.18	187.7	7.18	260
31/5/2018	ETFSL300	0.177	0.171	0.24	1.44	185.8	7.18	188
31/5/2018	ETFSL400	0.178	0.162	0.67	1.86	179.9	7.19	184
31/5/2018	ETFSL500	0.098	0.096	0.11	0.89	176	7.12	154
7/6/2018	ETAU	1.19	1.24	3.12	4.03	188.4	6.8	361
7/6/2018	ETFSL100	0.889	0.942	1.43	2.91	185.7	7.19	342
7/6/2018	ETFSL200	0.8	0.792	1.29	3.2	189.2	7.17	327
7/6/2018	ETFSL300	0.625	0.67	0.9	3.42	178.7	7.16	304
7/6/2018	ETFSL400	0.402	0.442	0.06	4.24	182.9	7.25	271
7/6/2018	ETFSL500	0.347	0.358	0.35	3.74	183.4	7.27	268
14/6/2018	ETAU	0.674	0.686	2.1	3.89	99.8	6.94	314
14/6/2018	ETFSL100	0.34	0.539	0.26	2.33	73.3	7.27	309
14/6/2018	ETFSL200	0.47	0.459	0.72	2.12	178.9	7.09	300
14/6/2018	ETFSL300	0.377	0.37	0.26	2.25	167.8	7.12	264
14/6/2018	ETFSL400	0.292	0.288	0.08	2.17	192.4	7.15	228
14/6/2018	ETFSL500	0.255	0.251	0.08	1.94	203.5	7.04	201

ATTACHMENT A (Continued)
Water Quality Data for Sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100

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)
20/6/2018	ETAU	0.657	0.628	3.62	5.4	188.3	6.72	337
20/6/2018	ETFSL100	0.457	0.468	0.9	3.16	19	6.9	324
20/6/2018	ETFSL200	0.371	0.39	0.72	2.4	191.4	6.95	320
20/6/2018	ETFSL300	0.384	0.377	0.34	2.42	190.5	6.98	322
20/6/2018	ETFSL400	0.331	0.333	<0.05	2.84	191.2	7	312
20/6/2018	ETFSL500	0.256	0.28	<0.05	2.67	184.8	7.01	273
28/6/2018	ETAU	0.634	0.687	4.08	7	185.8	6.6	328
28/6/2018	ETFSL100	0.501	0.559	1.04	3.95	188.8	7.02	329
28/6/2018	ETFSL200	0.409	0.422	1.45	3.94	187.2	6.82	306
28/6/2018	ETFSL300	0.176	0.207	<0.05	1.95	199.7	6.77	190
28/6/2018	ETFSL400	0.108	0.111	<0.05	1.04	198.5	6.67	128
28/6/2018	ETFSL500	0.075	0.079	0.05	0.79	179.7	6.61	118
2/7/2018	ETAU	0.637	0.706	3.29	6.24	39.9	7.05	352
2/7/2018	ETFSL100	0.519	0.558	0.97	4.38	191	7.31	351
2/7/2018	ETFSL200	0.395	0.416	0.86	2.28	191.4	7.34	344
2/7/2018	ETFSL300	0.391	0.426	1.19	3.57	193.9	7.25	342
2/7/2018	ETFSL400	0.327	0.349	0.15	3.82	195.4	7.22	311
2/7/2018	ETFSL500	0.226	0.258	0.06	2.37	194.2	7.15	252
12/7/2018	ETAU	0.587	0.626	1.11	2.33	456.6	7.31	370
12/7/2018	ETFSL100	0.501	0.492	0.63	1.6	163.5	7.59	367
12/7/2018	ETFSL200	0.342	0.338	0.73	1.42	160.3	7.5	355
12/7/2018	ETFSL300	0.324	0.373	1.16	2.87	154.8	7.49	361
12/7/2018	ETFSL400	0.338	0.353	0.44	3.85	1596	7.55	356
12/7/2018	ETFSL500	0.212	0.218	<0.05	2.45	158.3	7.37	259
19/7/2018	ETAU	0.726	0.712	0.63	3.5	177	7	377
19/7/2018	ETFSL100	0.576	0.565	0.11	3.01	202.8	7.37	371
19/7/2018	ETFSL200	0.444	0.4	0.36	2.35	200.6	7.24	360
19/7/2018	ETFSL300	0.462	0.402	1.11	3.68	202	7.21	372
19/7/2018	ETFSL400	0.431	0.374	0.57	3.48	203.3	7.33	384
19/7/2018	ETFSL500	0.288	0.279	<0.05	3.33	203.6	7.21	330
26/7/2018	ETAU	0.725	0.753	4.1	6.53	-5.9	6.59	364
26/7/2018	ETFSL100	0.522	0.566	0.19	2.89	10.8	6.78	356
26/7/2018	ETFSL200	0.31	0.353	0.29	1.73	9.8	6.79	351
26/7/2018	ETFSL300	0.35	0.35	1.59	2.55	-0.3	6.71	353
26/7/2018	ETFSL400	0.375	0.397	1.92	3.56	-12.3	6.75	370
26/7/2018	ETFSL500	0.346	0.431	<0.05	3.13	107.8	6.88	378
02/8/2018	ETAU	0.744	0.733	0.44	2.96	54.8	6.53	366
02/8/2018	ETFSL100	0.526	0.544	0.09	2.48	325	6.57	359
02/8/2018	ETFSL200	0.321	0.350	0.39	1.44	265.1	6.51	352
02/8/2018	ETFSL300	0.337	0.348	1.79	2.59	263.4	6.39	355
02/8/2018	ETFSL400	0.398	0.420	3.38	4.5	251.8	6.59	397
02/8/2018	ETFSL500	0.395	0.429	1.14	3.44	236.4	6.8	386
09/8/2018	ETAU	0.637	0.785	2.11	5.08	257.2	6.73	367
09/8/2018	ETFSL100	0.538	0.644	0.18	5.24	256.6	6.92	363
09/8/2018	ETFSL200	0.276	0.316	0.20	1.56	248.6	6.86	355
09/8/2018	ETFSL300	0.285	0.306	1.68	2.50	233.3	6.75	355
09/8/2018	ETFSL400	0.375	0.416	5.43	6.97	254.2	6.99	436
09/8/2018	ETFSL500	0.373	0.401	3.02	4.50	253.7	6.9	390

ATTACHMENT A (Continued)
Water Quality Data for Sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100

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)
16/8/2018	ETAU	0.672	0.797	1.53	3.99	250.1	6.71	365
16/8/2018	ETFSL100	0.491	0.584	0.08	2.32	264.8	7.16	362
16/8/2018	ETFSL200	0.263	0.304	0.1	1.17	265.4	7.13	353
16/8/2018	ETFSL300	0.249	0.298	1.02	1.98	267.4	6.96	349
16/8/2018	ETFSL400	0.336	0.351	3.57	4.23	260.7	7.12	405
16/8/2018	ETFSL500	0.309	0.358	1.69	3.18	261.3	6.98	386
23/8/2018	ETAU	0.724	0.701	0.92	3.12	266.4	7.03	358
23/8/2018	ETFSL100	0.489	0.505	0.07	2.26	271.7	6.97	351
23/8/2018	ETFSL200	0.274	0.270	0.1	1.01	267.1	7.11	344
23/8/2018	ETFSL300	0.227	0.273	0.83	1.83	265.6	7.04	341
23/8/2018	ETFSL400	0.267	0.279	2.11	2.50	261.8	7.05	365
23/8/2018	ETFSL500	0.352	0.337	2.34	3.41	258.1	7.23	382
30/8/2018	ETAU	0.632	0.696	<0.05	2.52	99.5	7.97	368
30/8/2018	ETFSL100	0.440	0.491	<0.05	2.09	77	7.73	354
30/8/2018	ETFSL200	0.225	0.243	0.06	0.85	23.2	7.85	350
30/8/2018	ETFSL300	0.236	0.248	0.96	1.70	256.2	7.78	345
30/8/2018	ETFSL400	0.327	0.343	3.30	4.50	252.5	8.20	399
30/8/2018	ETFSL500	0.316	0.350	2.05	3.65	228.1	8.18	387
05/9/2018	ETAU	0.688	0.683	0.66	4.54	25.2	7.44	363
05/9/2018	ETFSL100	0.476	0.483	<0.05	2.06	53.5	7.77	350
05/9/2018	ETFSL200	0.234	0.23	0.09	0.98	12.5	7.71	340
05/9/2018	ETFSL300	0.259	0.238	1.08	1.71	-12.5	7.57	333
05/9/2018	ETFSL400	0.367	0.371	4.53	5.96	-42.4	7.65	404
05/9/2018	ETFSL500	0.336	0.318	2.52	3.73	1.5	7.69	372
12/9/2018	ETAU	0.653	0.719	<0.05	3.72	178.2	7.05	360
12/9/2018	ETFSL100	0.461	0.521	<0.05	2.72	71.7	7.54	356
12/9/2018	ETFSL200	0.25	0.28	<0.05	0.96	20.1	7.49	346
12/9/2018	ETFSL300	0.3	0.301	0.41	1.73	3.1	7.38	345
12/9/2018	ETFSL400	0.389	0.34	2.15	2.77	-62.7	7.39	359
12/9/2018	ETFSL500	0.401	0.39	1.04	3.87	-17.4	7.43	381
20/9/2018	ETAU	0.392	0.721	1.14	2.49	272.4	7.11	362
20/9/2018	ETFSL100	0.179	0.467	<0.05	1.88	272.4	7.18	350
20/9/2018	ETFSL200	0.182	0.194	0.63	0.7	25.2	7.17	341
20/9/2018	ETFSL300	0.227	0.233	0.63	1.5	-11.9	7.08	337
20/9/2018	ETFSL400	0.386	0.356	2.66	5.39	-34.2	7.21	397
20/9/2018	ETFSL500	0.394	0.358	1.1	3.15	25.4	7.25	371
27/9/2018	ETAU	0.58	0.763	<0.05	2.24	234	7.33	400
27/9/2018	ETFSL100	0.434	0.493	<0.05	1.54	268.1	7.64	392
27/9/2018	ETFSL200	0.178	0.188	<0.05	0.61	272.8	7.55	381
27/9/2018	ETFSL300	0.231	0.239	0.4	1.6	270.8	7.33	377
27/9/2018	ETFSL400	0.331	0.325	1.49	3.55	263.1	7.41	400
27/9/2018	ETFSL500	0.335	0.375	0.83	3.46	266.8	7.67	416
05/10/2018	ETAU	0.39	0.359	2.14	3.49	274.6	7.28	250
05/10/2018	ETFSL100	0.297	0.686	0.32	12	271	7.57	286
05/10/2018	ETFSL200	0.305	0.308	0.29	2.72	269.7	7.67	295
05/10/2018	ETFSL300	0.272	0.305	0.32	2.72	267.7	7.66	291
05/10/2018	ETFSL400	0.364	0.299	0.63	2.95	259.8	7.73	294
05/10/2018	ETFSL500	0.251	0.245	0.36	2.11	242.9	7.58	271

ATTACHMENT A (Continued)

Water Quality Data for Sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100

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)
10/10/2018	ETAU	0.569	0.635	1.8	2.68	266.6	6.59	308
10/10/2018	ETFSL100	0.571	0.602	1.62	2.25	267.5	6.66	304
10/10/2018	ETFSL200	0.494	0.558	1.07	1.88	269.6	6.78	302
10/10/2018	ETFSL300	0.492	0.49	1.05	1.42	269.6	6.81	303
10/10/2018	ETFSL400	0.479	0.503	2.3	3.04	267.3	7.07	334
10/10/2018	ETFSL500	0.48	0.512	1.36	2	266.7	6.98	308
15/10/2018	ETAU	0.325	0.333	0.9	1.33	285.6	6.35	269
15/10/2018	ETFSL100	0.298	0.302	0.69	1.2	278.5	6.36	259
15/10/2018	ETFSL200	0.316	0.336	0.66	1.9	276.9	6.37	262
15/10/2018	ETFSL300	0.286	0.298	0.57	1.41	279.5	6.39	259
15/10/2018	ETFSL400	0.276	0.3	0.6	1.38	279.9	6.56	266
15/10/2018	ETFSL500	0.273	0.279	0.63	1.18	263	7.71	267
22/10/2018	ETAU	0.274	0.259	0.76	1.26	276.9	6.52	281
22/10/2018	ETFSL100	0.25	0.244	0.56	1.13	270.7	6.57	278
22/10/2018	ETFSL200	0.235	0.233	0.41	1.01	270.4	6.53	275
22/10/2018	ETFSL300	0.236	0.228	0.42	1	269	6.58	275
22/10/2018	ETFSL400	0.304	0.263	1.8	2.51	264.8	7.01	321
22/10/2018	ETFSL500	0.184	0.229	0.26	1.19	258.5	6.74	279
30/10/2018	ETAU	0.432	0.431	1.79	2.55	15.1	6.65	290
30/10/2018	ETFSL100	0.376	0.39	0.76	1.78	-0.4	6.91	286
30/10/2018	ETFSL200	0.336	0.363	0.37	1.47	3.8	6.92	285
30/10/2018	ETFSL300	0.341	0.35	0.39	1.32	7.6	6.99	291
30/10/2018	ETFSL400	0.36	0.364	1.58	3.1	-77.3	7.09	329
30/10/2018	ETFSL500	0.34	0.351	0.5	1.63	-4.2	7.05	296
08/11/2018	ETAU	0.635	0.553	0.76	3.15	23.3	7.07	307
08/11/2018	ETFSL100	0.429	0.433	0.14	1.59	12.9	7.35	307
08/11/2018	ETFSL200	0.333	0.34	0.06	1	20	7.31	303
08/11/2018	ETFSL300	0.333	0.329	0.06	1.1	5.4	7.32	304
08/11/2018	ETFSL400	0.431	0.403	5.31	5.49	247.1	7.47	385
08/11/2018	ETFSL500	0.315	0.325	0.37	1.54	248.4	7.30	310
15/11/2018	ETAU	0.609	0.628	0.53	2.04	264.1	7.09	334
15/11/2018	ETFSL100	0.399	0.414	<0.05	1.6	172.9	7.32	328
15/11/2018	ETFSL200	0.308	0.331	<0.05	1.34	272	7.31	325
15/11/2018	ETFSL300	0.321	0.298	0.08	1.15	271	7.28	324
15/11/2018	ETFSL400	0.396	0.383	1.44	4.72	262.5	7.35	373
15/11/2018	ETFSL500	0.328	0.336	0.24	1.76	267.3	7.38	345
19/11/2018	ETWQ AU	0.647	- ⁶	0.08	2.42	259.1	7.22	345
22/11/2018	ETFSL200	0.264	0.298	<0.05	0.82	30.9	7.29	355
22/11/2018	ETFSL500	0.38	0.376	0.67	1.88	-3.3	7.50	373
22/11/2018	CONFLU1	0.085	0.088	0.12	0.9	-1.1	7.51	307
22/11/2018	WARARM5	0.018	0.046	0.25	1	54.6	7.57	297
22/11/2018	WDFS1	0.105	0.114	0.12	1.15	40.1	7.53	307
22/11/2018	WDFS1+100	0.103	0.119	0.1	1.06	26	7.55	306

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

ATTACHMENT A (Continued)

Water Quality Data for Sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100

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)
26/11/2018	ETWQ AU	0.538	- ⁶	<0.05	1.36	83.8	7.11	354
29/11/2018	ETFSL200	0.139	0.15	0.54	1.2	36.1	7.07	195
29/11/2018	ETFSL500	0.167	0.147	0.3	1.19	30.1	6.94	195
29/11/2018	CONFLU1	0.158	0.108	0.27	1.18	29.5	7.19	200
29/11/2018	WARARM5	0.055	0.052	0.18	0.92	66.7	7.5	206
29/11/2018	WDFS1	0.082	0.074	0.18	0.21	36.7	7.8	206
29/11/2018	WDFS1+100	0.103	0.094	0.19	1	38.4	7.36	200
4/12/2018	ETWQ AU	0.433	- ⁶	1.65	2.36	30.6	7	266
6/12/2018	ETFSL200	0.283	0.295	0.26	1.04	242.7	6.97	260
6/12/2018	ETFSL500	0.29	0.3	0.62	1.47	249.5	7.23	270
6/12/2018	CONFLU1	0.112	0.114	0.12	1.13	243.8	7.24	243
6/12/2018	WARARM5	0.034	0.035	<0.05	0.75	250.1	7.29	238
6/12/2018	WDFS1	0.122	0.134	0.07	1.12	241.4	7.29	246
6/12/2018	WDFS1+100	0.109	0.126	<0.05	0.99	251.1	7.3	245
12/12/2018	ETAU	0.428	0.484	1.49	3.33	-	6.86	269
12/12/2018	ETFSL200	0.215	0.232	<0.05	0.42	255.3	7.4	245
12/12/2018	ETFSL500	0.276	0.284	0.27	0.89	251.9	7.41	262
12/12/2018	CONFLU1	0.081	0.091	0.45	0.8	17.9	7.39	219
12/12/2018	WARARM5	0.03	0.042	<0.05	0.58	236.4	7.53	214
12/12/2018	WDFS1	0.108	0.121	0.41	1.09	27.5	7.44	225
12/12/2018	WDFS1+100	0.105	0.12	<0.05	0.99	42.3	7.24	243
17/12/2018	ETWQ AU	0.102	- ⁶	0.18	0.75	280.3	6.50	152
17/12/2018	ETFSL200	0.076	0.084	0.17	0.7	274.8	6.76	152
17/12/2018	ETFSL500	0.087	0.086	0.19	0.76	274.8	6.56	150
17/12/2018	CONFLU1	0.068	0.068	0.16	0.78	270.9	6.64	152
17/12/2018	WARARM5	0.023	0.032	0.08	0.54	257.5	6.77	156
17/12/2018	WDFS1	0.069	0.062	0.15	0.75	273	6.67	153
17/12/2018	WDFS1+100	0.055	0.063	0.12	0.71	278.4	6.71	154
27/12/2018	ETAU	0.263	0.277	0.61	1.81	24.3	6.72	217
27/12/2018	ETFSL200	0.196	0.194	0.09	0.93	30.6	7.11	216
27/12/2018	ETFSL500	0.219	0.213	0.3	1.37	-6.9	7.13	224
27/12/2018	CONFLU1	0.071	0.075	<0.05	0.86	21.4	7.15	208
27/12/2018	WARARM5	0.045	0.036	<0.05	0.48	3.4	7.3	206
27/12/2018	WDFS1	0.108	0.11	0.06	0.99	24.9	7.12	210
27/12/2018	WDFS1+100	0.101	0.105	<0.05	0.93	37.4	7.13	210
3/01/2019	ETWQ AU	0.335	0.443	<0.05	1.57	110.1	7.35	300
3/01/2019	ETFSL200	0.159	0.226	<0.05	0.63	113.1	7.63	290
3/01/2019	ETFSL500	0.265	0.274	0.12	1.32	11.5	7.5	302
3/01/2019	CONFLU1	0.143	0.16	<0.05	1.21	4.8	7.29	270
3/01/2019	WARARM5	0.055	0.054	<0.05	0.64	56.4	7.46	256
3/01/2019	WDFS1	0.106	0.14	<0.05	1.27	72	7.45	265
3/01/2019	WDFS1+100	0.101	0.138	<0.05	1.16	56.2	7.42	263
10/01/2019	ETWQ AU	0.438	0.282	<0.05	1.41	244.1	6.92	268
10/01/2019	ETFSL200	0.216	0.246	<0.05	0.62	26.8	8.03	279
10/01/2019	ETFSL500	0.22	0.262	<0.05	1.18	-9.3	7.64	300
10/01/2019	CONFLU1	0.129	0.141	<0.05	1.11	-33.7	7.55	269
10/01/2019	WARARM5	0.042	0.041	<0.05	0.6	90.3	7.62	252
10/01/2019	WDFS1	0.061	0.087	<0.05	0.92	22.1	7.59	242
10/01/2019	WDFS1+100	0.061	0.074	<0.05	0.97	6.9	7.58	240

ATTACHMENT A (Continued)

Water Quality Data for Sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100

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)
16/01/2019	ETWQ AU	0.433	0.454	<0.05	1.86	171.1	6.75	282
16/01/2019	ETFSL200	0.18	0.189	<0.05	0.4	258.4	7.67	275
16/01/2019	ETFSL500	0.244	0.233	0.38	1	262.4	7.65	303
16/01/2019	CONFLU1	0.058	0.049	0.12	0.86	261.2	7.68	249
16/01/2019	WARARM5	0.025	0.028	0.11	0.52	268.1	7.82	242
16/01/2019	WDFS1	0.046	0.044	0.16	0.92	263.5	7.76	256
16/01/2019	WDFS1+100	0.047	0.044	0.19	0.94	259.2	7.79	260
23/01/2019	ETWQ AU	0.579	0.661	<0.05	2.09	184.3	6.78	292
23/01/2019	ETFSL200	0.171	0.204	<0.05	0.38	96.8	7.65	286
23/01/2019	ETFSL500	0.28	0.284	0.2	1.62	-11.1	7.65	316
23/01/2019	CONFLU1	0.052	0.056	<0.05	1.11	5.6	7.7	264
23/01/2019	WARARM5	0.043	0.036	<0.05	0.74	-38.4	7.7	253
23/01/2019	WDFS1	0.032	0.042	<0.05	1.08	19.6	7.77	266
23/01/2019	WDFS1+100	0.02	0.029	<0.05	0.92	-16.6	7.83	266
29/01/2019	ETAU	0.62	0.578	0.07	1.52	66.8	6.7	294
29/01/2019	ETFSL200	0.19	0.216	<0.05	0.44	36.2	7.23	282
29/01/2019	ETFSL500	0.249	0.279	<0.05	1.48	12.1	7.34	310
29/01/2019	CONFLU1	0.048	0.07	<0.05	1.05	-20.8	7.54	282
29/01/2019	WARARM5	0.031	0.028	<0.05	0.54	49.5	7.34	251
29/01/2019	WDFS1	0.027	0.038	<0.05	0.96	29.7	7.49	260
29/01/2019	WDFS1+100	0.03	0.03	<0.05	0.91	9.9	7.49	260
4/02/2019	ETAU	0.559	0.635	<0.05	1.04	51.1	6.8	283
4/02/2019	ETFSL200	0.173	0.191	<0.05	0.34	9.1	7.26	275
4/02/2019	ETFSL500	0.221	0.276	0.31	1.7	-18.6	7.35	302
4/02/2019	CONFLU1	0.043	0.036	0.16	0.85	-51.7	7.55	252
4/02/2019	WARARM5	0.023	0.029	0.19	0.74	139.1	7.58	240
4/02/2019	WDFS1	0.012	0.021	0.27	0.8	73.2	7.71	252
4/02/2019	WDFS1+100	0.01	0.02	0.29	0.74	50	7.71	255
11/02/2019	ETAU	0.757	0.731	<0.05	1.5	261.4	6.86	288
11/02/2019	ETFSL200	0.197	0.206	<0.05	0.36	6.8	7.21	280
11/02/2019	ETFSL500	0.243	0.302	0.5	1.86	-33.9	7.3	306
11/02/2019	CONFLU1	0.023	0.033	0.24	0.94	-96.7	7.48	255
11/02/2019	WARARM5	0.019	0.026	0.24	0.66	53.5	7.46	243
11/02/2019	WDFS1	0.011	0.018	0.31	0.98	-26	7.62	259
11/02/2019	WDFS1+100	0.005	0.013	0.3	0.83	64.5	7.62	258
18/02/2019	ETAU	0.624	0.675	0.17	1.51	51.8	6.91	303
18/02/2019	ETFSL200	0.189	0.19	0.19	0.36	12.8	7.27	296
18/02/2019	ETFSL500	0.243	0.284	0.23	1.77	-15.6	7.86	277
18/02/2019	CONFLU1	0.041	0.035	0.13	0.9	6.6	7.73	291
18/02/2019	WARARM5	0.022	0.024	0.19	0.64	64.1	7.46	262
18/02/2019	WDFS1	0.007	0.012	0.31	0.78	26.7	7.83	279
18/02/2019	WDFS1+100	0.006	0.011	0.24	0.64	23.3	7.84	279
25/02/2019	ETAU	0.616	0.719	<0.05	0.93	273.1	7.19	283
25/02/2019	ETFSL200	0.198	0.199	<0.05	0.54	270.5	7.06	271
25/02/2019	ETFSL500	0.281	0.312	1.72	2.11	270.6	7.3	307
25/02/2019	CONFLU1	0.022	0.027	0.06	0.86	274.6	7.37	247
25/02/2019	WARARM5	0.014	0.023	<0.05	0.53	264.2	7.4	238
25/02/2019	WDFS1	0.009	0.017	<0.05	0.79	272.6	7.55	248
25/02/2019	WDFS1+100	0.004	0.014	0.05	0.92	264.9	7.6	246

ATTACHMENT A (Continued)

Water Quality Data for Sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100

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)
04/03/2019	ETAU	0.688	0.67	<0.05	0.13	104.3	6.74	306
04/03/2019	ETFSL200	0.185	0.193	0.12	0.48	259.3	7.18	294
04/03/2019	ETFSL500	0.295	0.298	0.76	2.02	271.1	7.33	334
04/03/2019	CONFLU1	0.032	0.049	0.12	1.71	277.1	7.56	274
04/03/2019	WARARM5	0.025	0.031	0.12	1.02	277.7	7.44	248
04/03/2019	WDFS1	0.006	0.013	0.13	0.81	273.6	7.75	271
04/03/2019	WDFS1+100	0.005	0.011	0.21	0.71	249.3	7.58	270
11/03/2019	ETAU	0.638	0.726	0.08	0.94		6.87	322
11/03/2019	ETFSL200	0.152	0.170	0.06	0.38	227.4	7.24	310
11/03/2019	ETFSL500	0.266	0.28	0.5	1.91	219.5	7.43	347
11/03/2019	CONFLU1	0.024	0.03	0.23	0.96	228.5	7.53	289
11/03/2019	WARARM5	0.018	0.052	0.19	0.71	202.5	7.53	269
11/03/2019	WDFS1	0.01	0.018	0.26	0.8	219.7	7.07	276
11/03/2019	WDFS1+100	0.006	0.027	0.22	1.45	215.9	7.82	289
18/03/2019	ETAU	0.153	0.16	0.84	1.21	239	6.77	175
18/03/2019	ETFSL200	0.187	<0.01	0.5	0.204	237.9	6.62	180
18/03/2019	ETFSL500	0.193	<0.01	0.63	0.197	230.4	6.7	184
18/03/2019	CONFLU1	0.146	0.02	0.5	0.156	50.3	6.72	172
18/03/2019	WARARM5	0.032	<0.01	0.3	0.034	49.3	6.67	153
18/03/2019	WDFS1	0.071	0.04	0.44	0.073	21.4	6.67	159
18/03/2019	WDFS1+100	0.094	0.04	0.42	0.099	57.1	6.61	158
26/03/2019	ETAU	0.335	0.347	0.46	1.91	29.3	6.74	230
26/03/2019	ETFSL200	0.205	0.217	<0.05	1.04	23.5	6.96	224
26/03/2019	ETFSL500	0.233	0.234	0.5	1.39	227	6.99	239
26/03/2019	CONFLU1	0.095	0.114	<0.05	0.8	237.9	7.02	206
26/03/2019	WARARM5	0.039	0.041	<0.05	0.45	241.4	6.92	195
26/03/2019	WDFS1	0.073	0.076	<0.05	0.65	236.4	7.02	200
26/03/2019	WDFS1+100	0.054	0.049	<0.05	0.64	241.1	7.03	199
01/04/2019	ETAU	0.332	0.407	<0.05	1.51	160	7.3	256
01/04/2019	ETFSL200	0.184	0.248	<0.05	0.78	-1.8	7.68	248
01/04/2019	ETFSL500	0.222	0.261	0.47	1.14	-4.8	7.64	263
01/04/2019	CONFLU1	0.103	0.116	0.17	0.92	9	7.68	232
01/04/2019	WARARM5	0.034	0.037	0.1	0.42	36.8	7.71	207
01/04/2019	WDFS1	0.051	0.061	0.18	0.64	0.8	7.67	221
01/04/2019	WDFS1+100	0.027	0.031	0.14	0.56	43.5	7.73	219
08/04/2019	ETAU	0.298	0.319	0.64	1.89	35.8	6.86	225
08/04/2019	ETFSL200	0.200	0.198	0.12	0.96	273.8	7.09	212
08/04/2019	ETFSL500	0.184	0.2	0.34	1.34	264	7.25	220
08/04/2019	CONFLU1	0.073	0.082	0.14	0.77	238.9	7.54	212
08/04/2019	WARARM5	0.02	0.018	0.06	0.35	252.5	7.6	204
08/04/2019	WDFS1	0.039	0.05	0.11	0.7	236.9	7.56	205
08/04/2019	WDFS1+100	0.03	0.038	0.08	0.58	242.3	7.61	205
16/04/2019	ETAU	0.321	0.31	<0.05	1.31	259.8	7.17	240
16/04/2019	ETFSL200	0.156	0.154	<0.05	0.64	83.9	7.48	233
16/04/2019	ETFSL500	0.207	0.204	0.53	1.25	11.4	7.65	262
16/04/2019	CONFLU1	0.099	0.1	0.06	0.73	3.8	7.69	235
16/04/2019	WARARM5	0.024	0.021	0.21	0.34	21.6	7.62	207
16/04/2019	WDFS1	0.035	0.035	0.13	0.62	0.9	7.6	215
16/04/2019	WDFS1+100	0.017	0.017	0.14	0.48	4.6	7.67	214

ATTACHMENT A (Continued)

Water Quality Data for Sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100

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)
23/04/2019	ETAU	0.384	0.425	<0.05	1.82	262.5	7.54	224
23/04/2019	ETFSL200	0.162	0.174	0.08	0.77	73.9	7.31	218
23/04/2019	ETFSL500	0.214	0.232	0.24	1.4	8.8	7.64	240
23/04/2019	CONFLU1	0.041	0.046	0.13	0.76	10.6	7.56	194
23/04/2019	WARARM5	0.041	0.046	0.13	0.76	63.3	7.56	194
23/04/2019	WDFS1	0.026	0.027	0.16	0.71	7.5	7.56	191
23/04/2019	WDFS1+100	0.009	0.014	0.18	0.6	45	7.59	190
02/05/2019	ETAU	0.448	0.502	0.33	4.37	78.6	6.97	235
02/05/2019	ETFSL200	0.171	0.187	0.07	0.86	213.6	7.2	226
02/05/2019	ETFSL500	0.24	0.267	0.5	1.4	208.1	7.31	248
02/05/2019	CONFLU1	0.068	0.078	0.12	0.9	198.7	7.41	215
02/05/2019	WARARM5	0.024	0.03	0.14	0.51	201.1	7.3	184
02/05/2019	WDFS1	0.022	0.024	0.19	0.62	194.3	7.31	195
02/05/2019	WDFS1+100	0.01	0.016	0.18	0.5	189.9	7.4	196
06/05/2019	ETAU	0.381	0.421	<0.05	1.3	148.2	6.89	284
06/05/2019	ETFSL200	0.164	0.183	0.1	0.62	252.8	7.18	278
06/05/2019	ETFSL500	0.212	0.256	0.7	1.68	256.8	7.34	314
06/05/2019	CONFLU1	0.076	0.084	0.12	0.78	236.9	7.48	271
06/05/2019	WARARM5	0.025	0.023	0.09	0.46	254.6	7.37	238
06/05/2019	WDFS1	0.024	0.028	0.14	0.71	216.8	7.43	250
06/05/2019	WDFS1+100	0.009	0.009	0.08	0.54	259.9	7.57	246
13/05/2019	ETAU	0.452	0.488	0.08	2.71	106.4	7.15	299
13/05/2019	ETFSL200	0.171	0.208	0.06	0.93	254.6	7.48	290
13/05/2019	ETFSL500	0.261	0.273	0.29	1.74	241.2	7.57	322
13/05/2019	CONFLU1	0.057	0.063	0.07	0.88	249.5	7.61	269
13/05/2019	WARARM5	0.028	0.026	0.07	0.52	249.3	7.6	248
13/05/2019	WDFS1	0.034	0.031	0.05	0.85	243.4	7.61	260
13/05/2019	WDFS1+100	0.009	0.011	<0.05	0.58	243.9	7.71	265
20/05/2019	ETAU	0.432	0.49	<0.05	1.93	270.8	6.96	297
20/05/2019	ETFSL200	0.212	0.230	0.1	1.27	97.3	7.79	291
20/05/2019	ETFSL500	0.282	0.292	1.16	2.02	-17.1	7.63	331
20/05/2019	CONFLU1	0.076	0.092	0.1	1.12	68	7.76	286
20/05/2019	WARARM5	0.035	0.036	0.15	0.54	58.2	7.66	252
20/05/2019	WDFS1	0.027	0.028	0.2	0.72	27.9	7.43	266
20/05/2019	WDFS1+100	0.015	0.016	0.12	0.57	113.4	7.74	270
27/05/2019	ETAU	0.422	0.498	<0.05	2.26	169.8	7.02	301
27/05/2019	ETFSL200	0.240	0.239	0.11	1.06	286.4	7.45	293
27/05/2019	ETFSL500	0.292	0.276	1.14	1.92	286	7.51	334
27/05/2019	CONFLU1	0.06	0.053	0.07	0.69	151.2	7.63	271
27/05/2019	WARARM5	0.026	0.024	<0.05	0.49	278	7.47	254
27/05/2019	WDFS1	0.034	0.037	0.1	0.82	274.3	7.57	270
27/05/2019	WDFS1+100	0.013	0.013	0.06	0.52	284.6	7.76	271
05/06/2019	ETAU	0.295	0.28	0.66	2.05	127.4	7.15	228
03/06/2019	ETFSL200	0.237	0.245	0.09	1.34	84	7.63	316
03/06/2019	ETFSL500	0.325	0.339	1.31	2.4	23	7.71	358
03/06/2019	CONFLU1	0.093	0.099	0.06	0.78	54.6	7.87	308
03/06/2019	WARARM5	0.024	0.02	0.07	0.41	122.6	7.78	275
03/06/2019	WDFS1	0.056	0.057	0.39	1.68	80.4	7.78	290
03/06/2019	WDFS1+100	0.019	0.021	0.15	0.56	87.6	7.92	291

ATTACHMENT A (Continued)

Water Quality Data for Sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100

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)
11/06/2019	ETAU	0.0448	0.465	0.41	2.98	142.8	7.08	291
11/06/2019	ETFSL200	0.247	0.253	0.1	1.12	116.2	7.43	287
11/06/2019	ETFSL500	0.34	0.358	1.24	2.26	63.1	7.55	323
11/06/2019	CONFLU1	0.118	0.13	0.13	1.1	73.1	7.58	278
11/06/2019	WARARM5	0.026	0.024	0.05	0.45	82	7.55	234
11/06/2019	WDFS1	0.061	0.056	0.14	0.73	101.4	7.58	251
11/06/2019	WDFS1+100	0.035	0.03	<0.05	0.56	89.2	7.63	251
18/06/2019	ETAU	0.383	0.411	1.74	2.71	12.6	6.83	252
18/06/2019	ETFSL200	0.275	0.296	0.39	1.37	35.8	7.01	242
18/06/2019	ETFSL500	0.277	0.29	0.6	1.63	12.6	7.14	249
18/06/2019	CONFLU1	0.192	0.137	0.07	0.93	8.1	7.24	235
18/06/2019	WARARM5	0.019	0.014	<0.05	0.26	48.8	7.36	222
18/06/2019	WDFS1	0.088	0.092	0.11	0.73	3.4	7.25	229
18/06/2019	WDFS1+100	0.083	0.088	<0.05	0.71	13.9	7.26	226
25/06/2019	ETAU	0.369	0.377	2.13	3.62	-2.6	6.88	266
25/06/2019	ETFSL200	0.217	0.259	0.11	2.29	2.3	7.16	252
25/06/2019	ETFSL500	0.254	0.268	0.44	2.04	-28.1	7.22	266
25/06/2019	CONFLU1	0.076	0.09	<0.05	0.66	-7.1	7.4	246
25/06/2019	WARARM5	0.066	0.017	<0.05	0.35	4.7	7.43	236
25/06/2019	WDFS1	0.079	0.087	0.12	0.75	-9.4	7.38	241
25/06/2019	WDFS1+100	0.054	0.062	<0.05	0.64	-30.8	7.41	237
01/07/2019	ETAU	0.39	0.405	0.87	3.55	37.4	7.32	261
01/07/2019	ETFSL200	0.219	0.228	<0.05	1.47	20.7	7.21	247
01/07/2019	ETFSL500	0.275	0.372	0.85	2.78	-28.7	7.3	276
01/07/2019	CONFLU1	0.135	0.145	0.17	0.92	-10.8	7.45	250
01/07/2019	WARARM5	0.018	0.018	<0.05	0.37	5.3	7.51	226
01/07/2019	WDFS1	0.065	0.066	0.14	0.81	-13	7.39	234
01/07/2019	WDFS1+100	0.046	0.044	<0.05	0.6	-7.2	7.47	234
08/07/2019	ETAU	0.144	0.154	0.63	1.33	42.7	6.59	177
08/07/2019	ETFSL200	0.13	0.142	0.52	0.99	30.2	6.72	176
08/07/2019	ETFSL500	0.143	0.153	0.68	1.08	13	6.77	180
08/07/2019	CONFLU1	0.082	0.091	0.31	0.91	-32.7	7.01	191
08/07/2019	WARARM5	0.018	0.019	0.07	0.58	17.1	7.15	201
08/07/2019	WDFS1	0.082	0.089	0.36	0.94	1.5	6.98	190
08/07/2019	WDFS1+100	0.078	0.081	0.21	0.79	-5	7.01	188
15/07/2019	ETAU	0.268	0.266	1.11	2.05	-3.8	6.66	221
15/07/2019	ETFSL200	0.209	0.219	0.21	1.24	-4.9	6.76	218
15/07/2019	ETFSL500	0.241	0.256	0.56	1.8	-13.9	6.84	232
15/07/2019	CONFLU1	0.126	0.127	0.07	0.97	6.6	6.89	221
15/07/2019	WARARM5	0.023	0.017	<0.05	0.52	19.7	6.98	222
15/07/2019	WDFS1	0.086	0.097	0.05	0.95	15	6.9	215
15/07/2019	WDFS1+100	0.06	0.064	<0.05	0.78	-1.6	6.87	210
22/07/2019	ETAU	0.415	0.372	2.39	3.53	28.3	7.04	243
22/07/2019	ETFSL200	0.289	0.272	0.08	1.46	3.8	6.45	235
22/07/2019	ETFSL500	0.332	0.291	0.71	2.07	-38.1	6.65	254
22/07/2019	CONFLU1	0.168	0.153	0.06	0.84	10.3	6.66	233
22/07/2019	WARARM5	0.025	0.017	<0.05	0.44	9	6.66	222
22/07/2019	WDFS1	0.094	0.091	0.34	0.8	14	6.63	226
22/07/2019	WDFS1+100	0.071	0.061	0.26	0.61	-1.6	6.63	227

ATTACHMENT A (Continued)

Water Quality Data for Sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100

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)
29/07/2019	ETAU	0.348	0.363	0.22	2.06	53	6.3	315
29/07/2019	ETFSL200	0.234	0.25	0.07	1.4	56.1	6.41	311
29/07/2019	ETFSL500	0.301	0.348	1.37	2.58	-3.8	6.51	342
29/07/2019	CONFLU1	0.13	0.127	0.33	1.28	14.3	6.51	312
29/07/2019	WARARM5	0.029	0.018	0.1	0.38	36.1	6.52	291
29/07/2019	WDFS1	0.077	0.078	0.15	0.87	21.1	6.58	306
29/07/2019	WDFS1+100	0.044	0.044	0.11	0.55	13.7	6.48	302
05/08/2019	ETAU	0.387	0.371	0.72	3.36	34	6.35	323
05/08/2019	ETFSL200	0.247	0.259	0.13	1.47	16.2	6.5	317
05/08/2019	ETFSL500	0.304	0.319	1.34	2.2	-8.3	6.67	354
05/08/2019	CONFLU1	0.104	0.107	0.13	0.74	4.1	6.64	311
05/08/2019	WARARM5	0.019	0.016	0.08	0.37	1.6	6.63	291
05/08/2019	WDFS1	0.061	0.055	0.43	0.86	5.9	6.61	299
05/08/2019	WDFS1+100	0.041	0.038	0.11	0.52	32.5	6.54	305
12/08/2019	ETAU	0.405	0.402	1.42	3.6	29	6.45	292
12/08/2019	ETFSL200	0.249	0.240	0.16	1.38	69.3	6.22	287
12/08/2019	ETFSL500	0.317	0.306	1.52	2.48	13.1	6.35	314
12/08/2019	CONFLU1	0.104	0.108	0.13	0.7	32.9	6.34	283
12/08/2019	WARARM5	0.016	0.013	0.09	0.38	47.9	6.32	263
12/08/2019	WDFS1	0.052	0.052	0.1	0.58	37.6	6.26	275
12/08/2019	WDFS1+100	0.028	0.035	0.13	1.65	11.2	6.35	275
19/08/2019	ETAU	0.425	0.461	1.34	3.64	14	6.29	297
19/08/2019	ETFSL200	0.242	0.264	0.12	1.37	143	6.47	290
19/08/2019	ETFSL500	0.314	0.334	1.3	2.36	-36.1	6.65	319
19/08/2019	CONFLU1	0.106	0.116	0.08	0.71	-16.8	6.62	290
19/08/2019	WARARM5	0.016	0.016	0.08	0.31	7.7	6.43	267
19/08/2019	WDFS1	0.042	0.051	0.1	0.63	-25.6	6.64	279
19/08/2019	WDFS1+100	0.017	0.021	0.12	0.52	-0.5	6.61	279
26/08/2019	ETAU	0.434	0.498	1.56	4.11	2.7	6.93	321
26/08/2019	ETFSL200	0.249	0.267	0.28	1.32	40.1	7.16	317
26/08/2019	ETFSL500	0.297	0.345	1.28	2.66	-33.7	7.21	358
26/08/2019	CONFLU1	0.106	0.115	0.26	1.0	-29	7.36	316
26/08/2019	WARARM5	0.016	0.023	0.17	0.64	-26.1	7.32	287
26/08/2019	WDFS1	0.047	0.051	0.19	0.63	-43.4	7.39	306
26/08/2019	WDFS1+100	0.021	0.038	0.14	0.7	-12.2	7.42	304
02/09/2019	ETAU	0.394	0.427	1.55	3.69	1.2	8.48	308
02/09/2019	ETFSL200	0.233	0.225	<0.05	0.73	31.4	6.13	292
02/09/2019	ETFSL500	0.304	0.293	1.08	1.5	-24.4	6.4	326
02/09/2019	CONFLU1	0.179	0.126	<0.05	0.72	16.3	6.42	290
02/09/2019	WARARM5	0.016	0.013	<0.05	0.3	223.6	6.41	262
02/09/2019	WDFS1	0.047	0.042	<0.05	0.49	4.7	6.41	272
02/09/2019	WDFS1+100	0.026	0.028	<0.05	0.47	33.7	6.41	269
09/09/2019	ETAU	0.387	0.412	1.08	2.58	1.9	7.24	314
08/09/2019	ETFSL200	0.205	0.235	0.12	1.58	41.5	7.34	306
08/09/2019	ETFSL500	0.268	0.297	1.08	2.04	-18.2	7.52	345
08/09/2019	CONFLU1	0.082	0.093	0.1	0.82	-2	7.54	300
08/09/2019	WARARM5	0.018	0.018	0.08	0.4	44.8	7.47	255
08/09/2019	WDFS1	0.025	0.025	0.16	0.61	-55.2	7.53	273
08/09/2019	WDFS1+100	0.01	0.01	0.17	0.56	34.8	7.53	275

ATTACHMENT A (Continued)

Water Quality Data for Sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100

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)
19/09/2019	ETAU	0.045	0.052	0.25	0.7	108.8	7.13	128
19/09/2019	ETFSL200	0.046	0.054	0.26	0.76	111.5	5.94	132
19/09/2019	ETFSL500	0.048	0.059	0.27	0.88	114	5.94	127
19/09/2019	CONFLU1	0.058	0.068	0.25	0.81	127.9	5.93	128
19/09/2019	WARARM5	0.056	0.068	0.21	0.77	118	5.93	140
19/09/2019	WDFS1	0.064	0.073	0.22	0.75	127.2	5.93	139
19/09/2019	WDFS1+100	0.062	0.069	0.2	0.68	148.8	5.81	136
23/09/2019	ETAU	0.118	0.109	0.55	0.97	73.4	6.08	197
23/09/2019	ETFSL200	0.095	0.098	0.41	0.8	40.6	6.09	194
23/09/2019	ETFSL500	0.104	0.112	0.53	1.16	29.8	6.15	200
23/09/2019	CONFLU1	0.132	0.139	0.35	1.17	36.5	6.15	198
23/09/2019	WARARM5	0.047	0.049	0.16	0.47	72.6	6.17	199
23/09/2019	WDFS1	0.074	0.075	0.25	0.63	32.7	6.15	197
23/09/2019	WDFS1+100	0.086	0.089	0.27	0.68	14.4	6.14	196
03/10/2019	ETAU	0.229	0.256	0.43	1.95	56.4	6.08	248
03/10/2019	ETFSL200	0.182	0.202	<0.05	1.19	47.2	6.14	245
03/10/2019	ETFSL500	0.168	0.227	0.32	1.6	4.1	6.28	270
03/10/2019	CONFLU1	0.121	0.125	<0.05	0.85	27.7	6.2	248
03/10/2019	WARARM5	0.051	0.056	<0.05	0.46	36.2	6.19	238
03/10/2019	WDFS1	0.094	0.109	<0.05	0.8	20.8	6.2	242
03/10/2019	WDFS1+100	0.095	0.101	<0.05	0.81	34.1	6.39	247
09/10/2019	ETAU	0.194	0.208	0.07	1.74	113.8	6.68	241
09/10/2019	ETFSL200	0.148	0.161	<0.05	1.33	63.3	6.98	245
09/10/2019	ETFSL500	0.202	0.214	0.47	1.87	9	7.16	274
09/10/2019	CONFLU1	0.184	0.143	<0.05	0.98	39.6	7.22	256
09/10/2019	WARARM5	0.054	0.053	0.07	0.46	62.2	7.15	243
09/10/2019	WDFS1	0.094	0.103	<0.05	0.91	62.2	7.2	250
09/10/2019	WDFS1+100	0.084	0.087	0.08	0.91	71.8	7.22	246
14/10/2019	ETAU	0.111	0.112	0.67	1.18	53	6.6	199
14/10/2019	ETFSL200	0.094	0.099	0.41	0.97	36.1	6.77	195
14/10/2019	ETFSL500	0.096	0.093	0.54	0.95	32.3	6.87	206
14/10/2019	CONFLU1	0.072	0.076	0.23	0.75	33.7	7.08	224
14/10/2019	WARARM5	0.035	0.036	0.05	0.33	35	7.19	248
14/10/2019	WDFS1	0.065	0.071	0.16	0.65	23.5	7.07	229
14/10/2019	WDFS1+100	0.06	0.057	0.16	0.6	-18.3	7.02	224
21/10/2019	ETAU	0.245	0.244	0.81	2.12	81.3	7.44	260
21/10/2019	ETFSL200	0.157	0.167	<0.05	1.18	108.5	7.45	262
21/10/2019	ETFSL500	0.184	0.193	0.46	1.58	43.2	7.59	282
21/10/2019	CONFLU1	0.063	0.069	<0.05	0.61	70.3	7.58	260
21/10/2019	WARARM5	0.04	0.035	0.07	0.36	79.6	7.61	260
21/10/2019	WDFS1	0.088	0.093	<0.05	0.75	40.8	7.63	262
21/10/2019	WDFS1+100	0.061	0.066	0.09	0.73	38.9	7.64	260
28/10/2019	ETAU	0.325	0.34	<0.05	2.13	173	6.61	281
28/10/2019	ETFSL200	0.206	0.228	0.06	1.31	165.1	7.31	277
28/10/2019	ETFSL500	0.251	0.262	0.88	1.74	83.3	7.1	308
28/10/2019	CONFLU1	0.113	0.118	0.19	0.89	156.2	7.45	288
28/10/2019	WARARM5	0.044	0.047	0.19	0.41	160.3	7.44	279
28/10/2019	WDFS1	0.083	0.091	0.19	0.92	151.6	7.42	286
28/10/2019	WDFS1+100	0.056	0.062	0.18	0.7	116.1	7.71	283

ATTACHMENT A (Continued)

Water Quality Data for Sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100

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)
04/11/2019	ETAU	0.379	0.39	0.41	2.29	185.3	6.81	286
04/11/2019	ETFSL200	0.211	0.242	<0.05	0.77	136.2	7.48	281
04/11/2019	ETFSL500	0.271	0.261	0.28	1.24	98.9	7.42	305
04/11/2019	CONFLU1	0.111	0.099	<0.05	0.63	122.9	7.69	275
04/11/2019	WARARM5	0.044	0.042	<0.05	0.27	131	7.78	274
04/11/2019	WDFS1	0.074	0.08	<0.05	0.59	154.4	7.62	271
04/11/2019	WDFS1+100	0.055	0.062	<0.05	0.58	90.7	7.84	272
14/11/2019	ETAU	0.362	0.374	<0.05	1.72	307.7	6.74	300
14/11/2019	ETFSL200	0.156	0.19	<0.05	0.7	172	7.39	296
14/11/2019	ETFSL500	0.244	0.26	0.36	1.58	93.1	7.24	339
14/11/2019	CONFLU1	0.04	0.046	0.16	0.7	179.6	7.78	298
14/11/2019	WARARM5	0.03	0.032	<0.05	0.39	148.3	7.6	282
14/11/2019	WDFS1	0.073	0.086	0.09	0.83	163.5	7.69	304
14/11/2019	WDFS1+100	0.015	0.023	0.15	0.59	141.1	8.51	294
18/11/2019	ETAU	0.386	0.406	<0.05	1.94	213.9	6.62	298
18/11/2019	ETFSL200	0.195	0.213	<0.05	0.05	125.4	7.47	297
18/11/2019	ETFSL500	0.23	0.253	0.22	1.43	105.6	7.44	331
18/11/2019	CONFLU1	0.049	0.053	0.15	0.66	152.1	7.82	295
18/11/2019	WARARM5	0.032	0.038	0.13	0.45	178.6	7.71	282
18/11/2019	WDFS1	0.039	0.05	0.17	0.7	154.1	7.78	295
18/11/2019	WDFS1+100	0.019	0.023	0.14	0.58	102.1	8.35	293
25/11/2019	ETAU	0.455	0.496	<0.05	1.67	227.7	6.58	300
25/11/2019	ETFSL200	0.188	0.196	<0.05	0.54	183.9	6.89	297
25/11/2019	ETFSL500	0.23	0.259	0.23	1.52	121.5	7.22	332
25/11/2019	CONFLU1	0.064	0.078	0.13	0.83	217.5	7.8	311
25/11/2019	WARARM5	0.036	0.035	0.11	0.45	205.2	7.69	292
25/11/2019	WDFS1	0.033	0.043	0.17	0.68	222.5	7.89	302
25/11/2019	WDFS1+100	0.013	0.022	0.16	0.58	170.8	8.7	302
08/12/2019	ETAU	0.498	0.463	0.08	0.76	204.4	6.65	308
08/12/2019	ETFSL200	0.156	0.152	<0.05	0.34	129.6	7.5	302
08/12/2019	ETFSL500	0.208	0.207	0.08	1.5	39.6	7.41	341
08/12/2019	CONFLU1	0.029	0.041	0.06	0.68	162.6	8.08	303
08/12/2019	WARARM5	0.021	0.026	0.2	0.49	103.8	7.95	286
08/12/2019	WDFS1	0.009	0.023	0.07	0.56	152.4	8.45	302
08/12/2019	WDFS1+100	0.009	0.023	0.07	0.56	130.8	8.45	302
12/12/2019	ETAU	0.564	0.558	0.06	1.26	68.2	7.22	348
12/12/2019	ETFSL200	0.182	0.177	<0.05	0.3	98	7.82	399
12/12/2019	ETFSL500	0.256	0.235	0.07	1.76	8.6	7.81	343
12/12/2019	CONFLU1	0.062	0.059	0.15	0.83	67.7	8.07	356
12/12/2019	WARARM5	0.031	0.029	<0.05	0.47	57.8	8.03	328
12/12/2019	WDFS1	0.018	0.029	<0.05	0.66	53.4	8.14	348
12/12/2019	WDFS1+100	0.003	0.015	<0.05	0.41	36.9	9.07	298
16/12/2019	ETAU	0.606	0.641	0.17	1.37	46	6.58	328
16/12/2019	ETFSL200	0.181	0.186	<0.05	0.44		7.36	318
16/12/2019	ETFSL500	0.25	0.261	0.22	1.61	4.2	7.3	366
16/12/2019	CONFLU1	0.051	0.058	0.13	0.95	46.4	7.99	332
16/12/2019	WARARM5	0.035	0.036	0.19	0.6	44.9	7.69	305
16/12/2019	WDFS1	0.018	0.04	0.17	0.8	9.4	8.49	325
16/12/2019	WDFS1+100	0.006	0.018	0.15	0.51	-16.4	8.83	318

ATTACHMENT A (Continued)

Water Quality Data for Sites ETAU, ETFSL 100, ETFSL 200, ETFSL 300, ETFSL 400, ETFSL 500, CONFLU1, WARARM5, WDFS1 and WDFS1+100

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)
23/12/2019	ETAU	0.564	0.624	<0.05	0.52	91.4	6.5	360
23/12/2019	ETFSL200	0.136	0.157	<0.05	0.26	95.8	7.18	349
23/12/2019	ETFSL500	0.255	0.305	0.33	1.86	6.8	7.1	409
23/12/2019	CONFLU1	0.05	0.058	0.13	0.91	36.2	7.44	367
23/12/2019	WARARM5	0.031	0.034	0.2	0.61	56.1	7.37	337
23/12/2019	WDFS1	0.021	0.03	0.21	0.79	64.8	7.64	364
23/12/2019	WDFS1+100	0.012	0.025	0.16	0.75	-50.4	8.42	364
30/12/2019	ETAU	0.609	0.606	<0.05	0.66	68	7.61	307
30/12/2019	ETFSL200	0.13	0.125	0.06	0.25	39.7	8.01	318
30/12/2019	ETFSL500	0.286	0.287	0.57	1.67	-20.7	8.05	362
30/12/2019	CONFLU1	0.028	0.031	0.13	0.63	53.4	8.12	311
30/12/2019	WARARM5	0.033	0.036	<0.05	0.59	30.7	8.13	305
30/12/2019	WDFS1	0.009	0.022	0.15	0.54	35.1	8.24	324
30/12/2019	WDFS1+100	0.008	0.013	0.08	0.36	19.9	8.28	326