

# Memorandum

06 May 2020

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To David Mudd  
From James Duggleby

Subject Camden Gas Project- FY19/20 Six-monthly monitoring update – April 2020

Dear David,

This memo presents the updated hydrographs for the Menangle Park and Glenlee groundwater monitoring bores to April 2020 in Figures A.1 – A.5, and the water quality results for the April 2020 sampling event in Table A.1, including the Nepean River. Results are presented for samples taken on 15 April 2020.

Key observations for this monitoring period (October 2019 to April 2020) are:

- Groundwater levels at the Menangle Park monitoring bores decreased over the summer to the end of January 2020, to their lowest levels since monitoring began in July 2013. Significant rainfall during the cyclonic event, 7-10 February 2020, prompted a short-term increase in groundwater levels in all monitoring bores.
- Groundwater level at Glenlee monitoring bore GLMB03 shows a continuation of the slight decreasing trend observed since July 2016.
- As noted in the October 2019 monitoring update memo (EMM 2019), the vibrating wire piezometer (VWP) sensors at GLMB01 and GLMB02 stabilised at lower piezometric pressure head levels compared with pressures observed from the former standpipe monitoring bores prior to conversion to VWPs. This data is not considered representative of formation pressures, potentially due to interference from the gravel pack surrounding the piezometers. Although the absolute pressure values post-VWP installation are not representative of formation pressures, the trends in the data are and are therefore still useful.

The groundwater quality results will be analysed and discussed in the next annual monitoring report.

The results are included in the following attached figures and table:

- Figures A.1 – A.4: Individual hydrographs for the Menangle Park and Glenlee sites;
- Figures A.5: Nested hydrographs for the Menangle Park and Glenlee sites;
- Table A.1: Water quality results for April 2020.

Yours sincerely

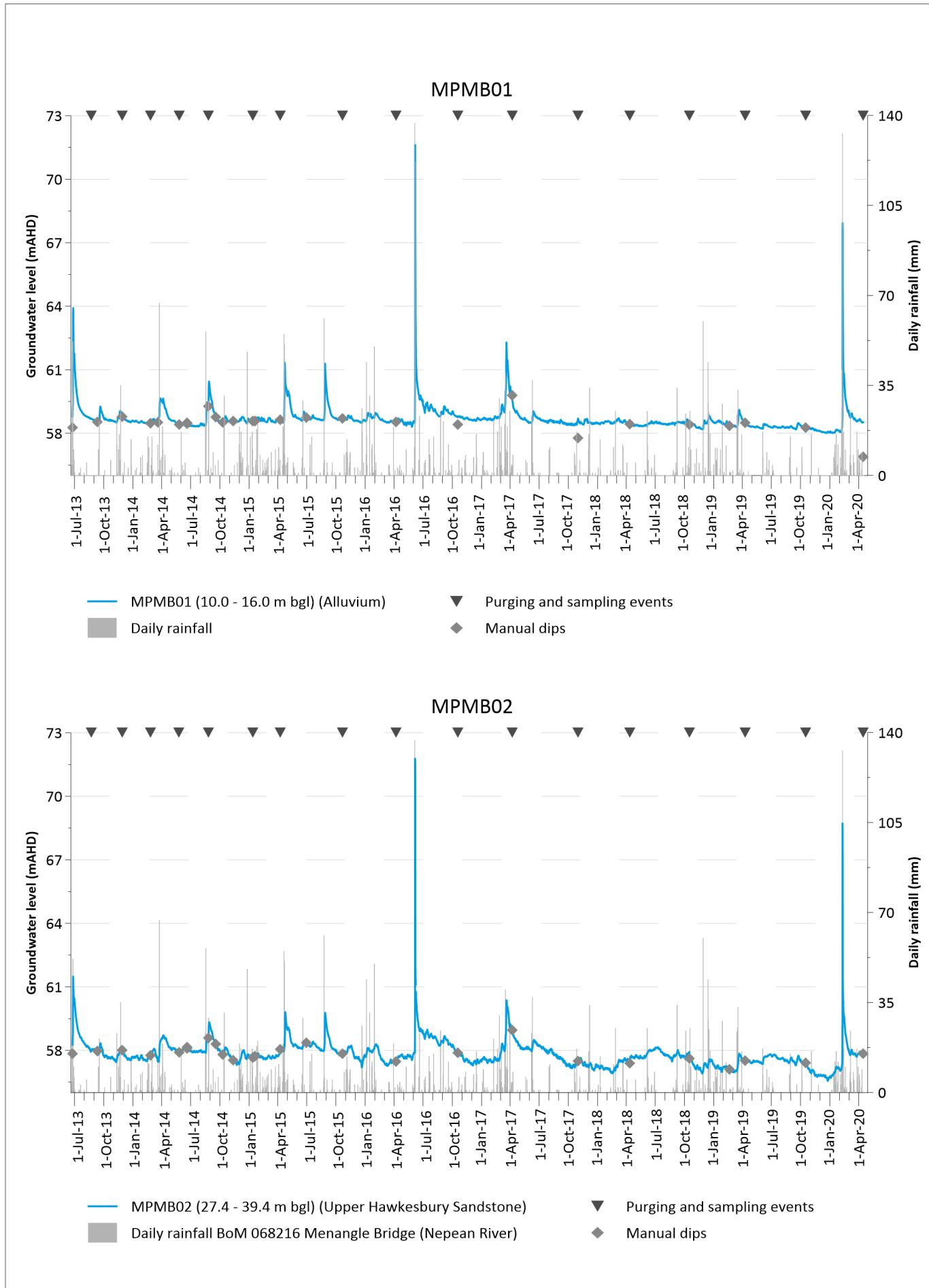


James Duttleby  
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Reviewed: BB

## Reference

EMM Consulting (EMM) 2019, *Camden Gas Project – FY19/20 Six-monthly monitoring update – October 2019*, prepared for AGL Energy Pty Ltd.

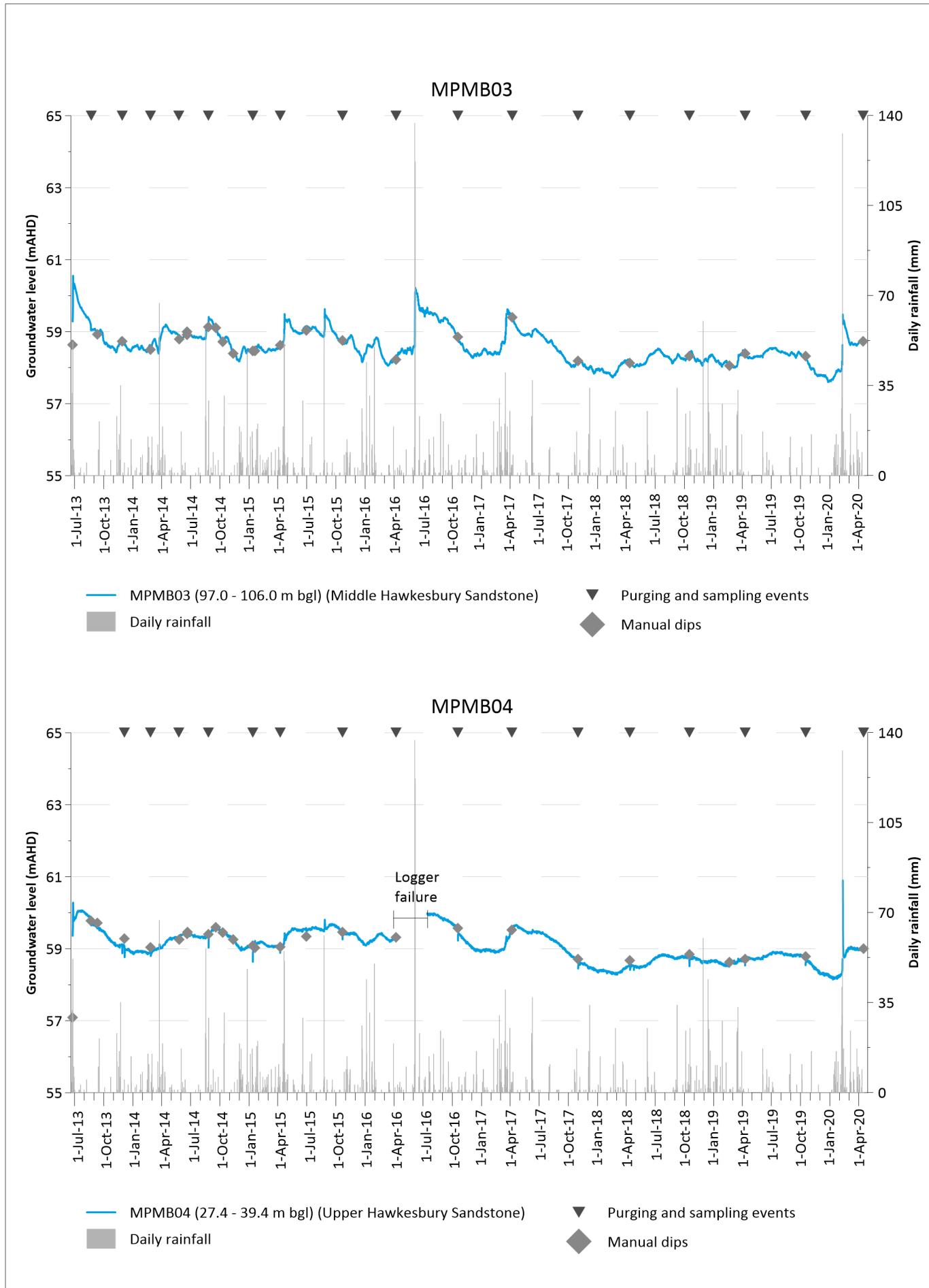


**MPMB01 and MPMB02 hydrographs**

Camden Gas Project

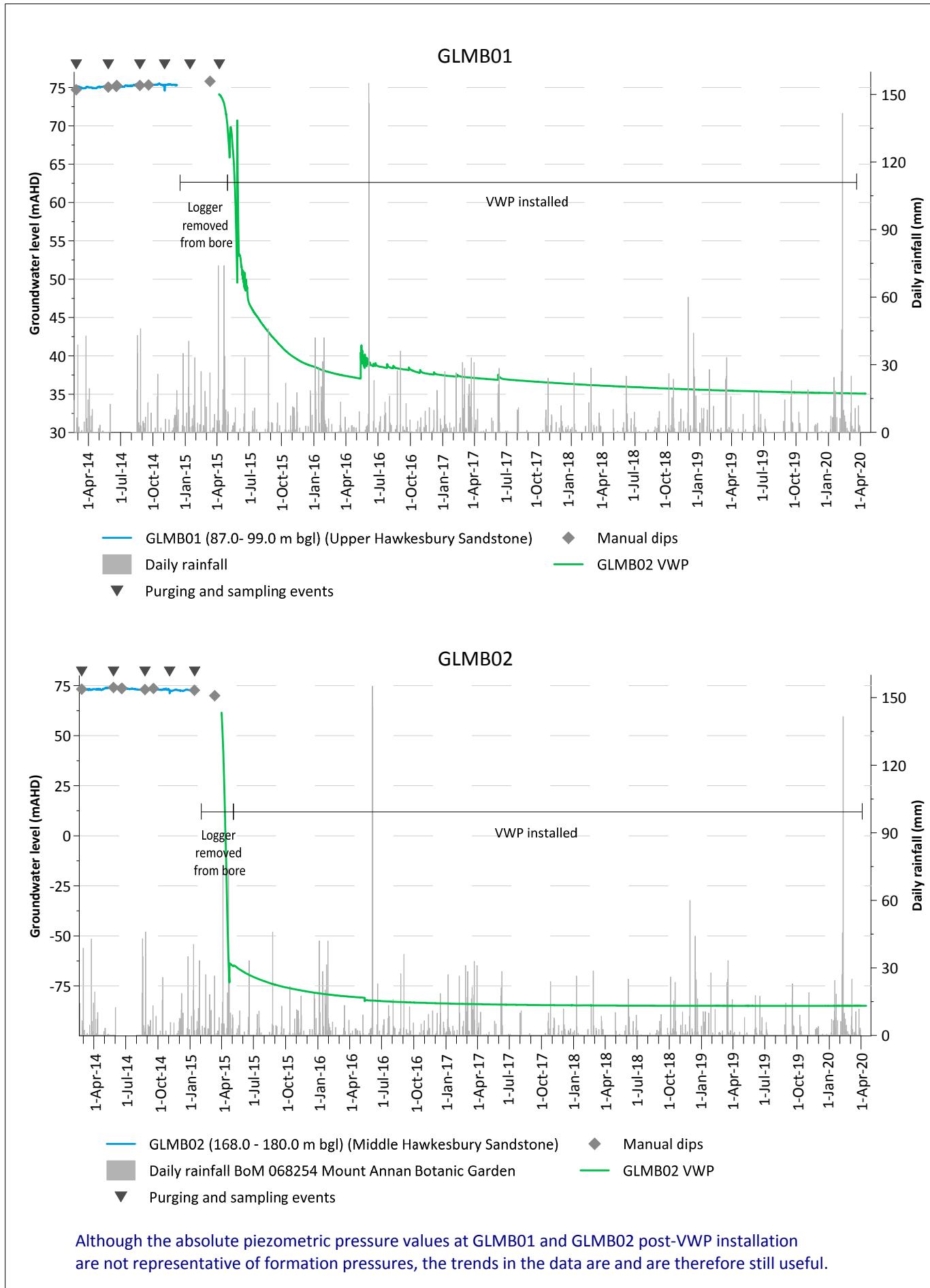
Six-monthly Monitoring Event - April 2020

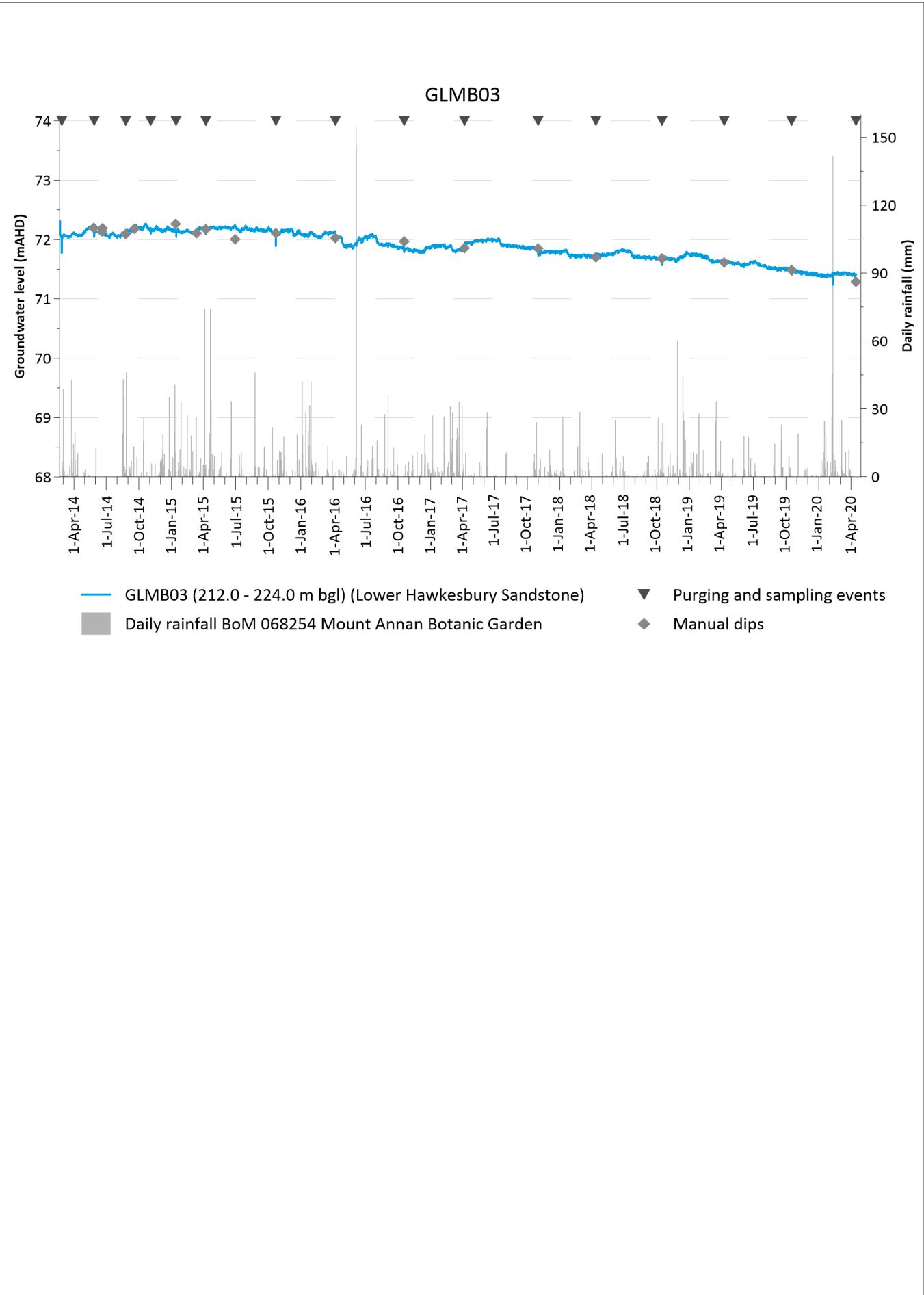
Figure A.1



**MPMB03 and MPMB04 hydrographs**

Camden Gas Project  
Six-monthly Monitoring Event - April 2020  
Figure A.2





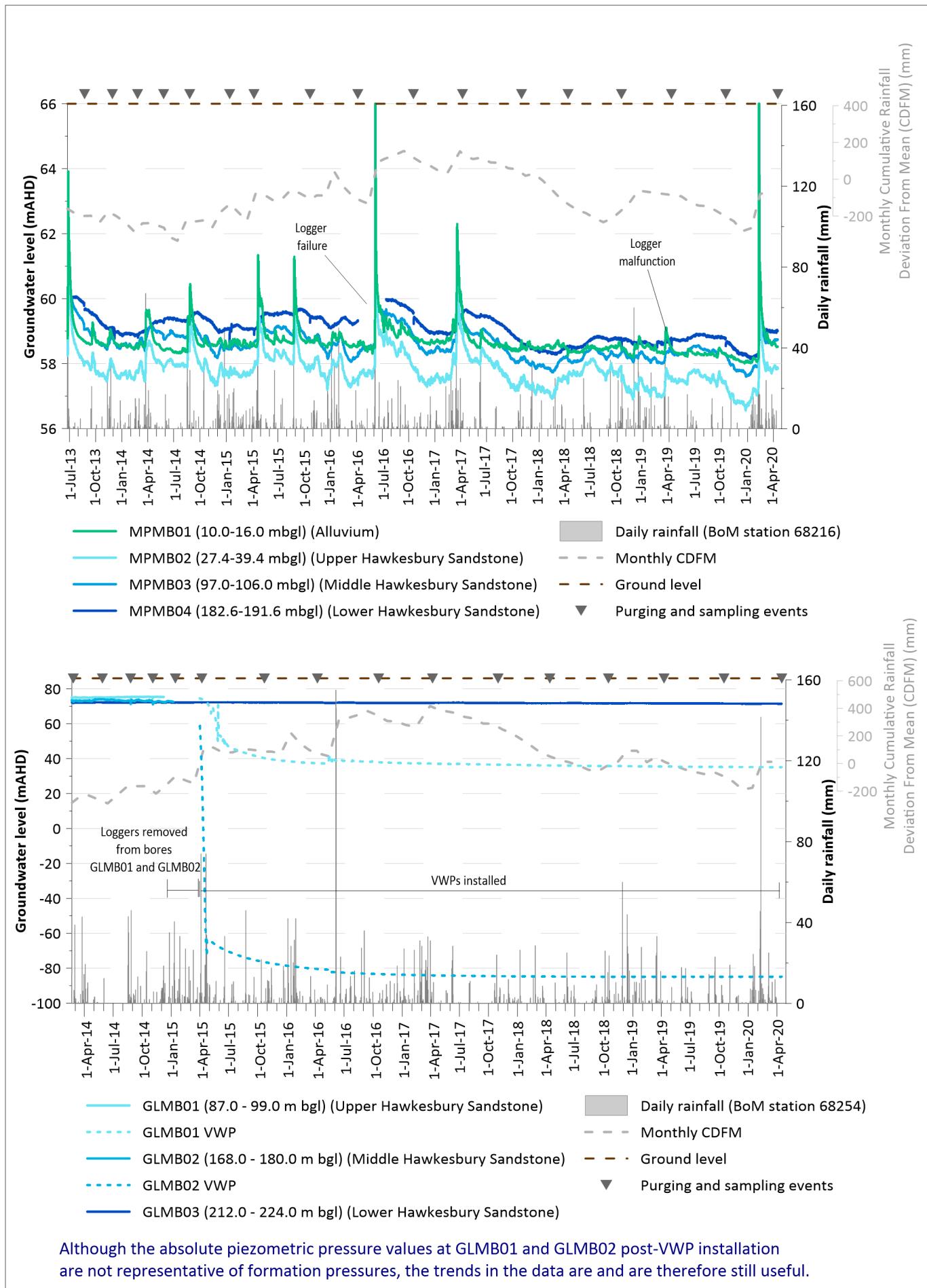


Table A.1 Water quality results six-monthly monitoring event - April 2020

Field ID	GLMB03	MPMB01	MPMB02	MPMB03	MPMB04	Nepean River
Date	15/04/2020	15/04/2020	15/04/2020	15/04/2020	15/04/2020	15/04/2020
Water level (mbTOC)	15.150	10.300	9.290	8.240	7.910	N/A
Field parameters	Units					EQL
Dissolved Oxygen	mg/L	-*	1.34	0.39	-*	7.03
pH (field)	pH units	7.84	5.57	5.92	6.78	7.5
Electrical conductivity (field)	µS/cm	4,664	702	575	795	130
Electrical conductivity (lab)	µS/cm	1	5,660	774	628	583
Temp (Field)	°C	20.9	22.8	22.7	19.4	21.3
Dissolved oxygen (field)	%	8	8.7	4.5	3	3
Total dissolved solids (field)	mg/L	-*	455	377	-*	85
Total dissolved solids (lab)	mg/L	10	3,080	428	319	450
Suspended solids	mg/L	5	<5	61	58	74
Redox (field)	mV	-	-164	66.1	-91.5	4.3
	-	-	-	-	-	-44.5
Laboratory analytes						
pH (Lab)	pH_Units	0.01	7.42	5.96	6.78	7.51
Alkalinity (Hydroxide) as CaCO <sub>3</sub>	mg/L	1	<1	<1	<1	<1
Carbonate Alkalinity-mg CaCO <sub>3</sub> /L	mg/L	1	<1	<1	<1	<1
Bicarbonate Alkalinity-mg CaCO <sub>3</sub> /L	mg/L	1	2,050	22	148	365
Alkalinity (total) as CaCO <sub>3</sub>	mg/L	1	2,050	22	148	365
Sulfate as SO <sub>4</sub> - Turbidimetric	mg/L	1	<1	4	6	<1
Chloride	mg/L	1	637	231	118	51
Calcium	mg/L	1	134	10	24	65
Magnesium	mg/L	1	134	18	22	20
Sodium	mg/L	1	973	98	64	76
Potassium	mg/L	1	37	2	4	11
Reactive Silica	mg/L	0.05	22.9	17.2	9.85	7.92
Fluoride	mg/L	0.1	<0.1	<0.1	<0.1	<0.1
Bromide	mg/L	0.01	1.01	0.383	0.165	0.078
Cyanide Total	mg/L	0.004	<0.004	<0.004	<0.004	<0.004
Dissolved metals						
Aluminum	mg/L	0.01	0.01	0.03	0.02	0.02
Antimony	mg/L	0.001	<0.001	<0.001	<0.001	<0.001
Arsenic	mg/L	0.001	0.023	<0.001	0.007	0.008
Boron	mg/L	0.05	<0.05	<0.05	<0.05	<0.05
Barium	mg/L	0.001	24.7	0.565	0.342	1.4
Beryllium	mg/L	0.001	<0.001	<0.001	<0.001	<0.001
Bromine	mg/L	0.1	1.6	0.5	0.2	0.1
Cadmium	mg/L	0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Chromium	mg/L	0.001	<0.001	<0.001	0.002	<0.001
Cobalt	mg/L	0.001	<0.001	0.036	0.002	0.003
Copper	mg/L	0.001	0.005	0.008	<0.001	<0.001
Iron	mg/L	0.05	0.23	0.53	4.05	9
Lead	mg/L	0.001	<0.001	<0.001	<0.001	<0.001
Manganese	mg/L	0.001	0.015	0.454	0.248	1.37
Mercury	mg/L	0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Molybdenum	mg/L	0.001	<0.001	<0.001	<0.001	<0.001
Nickel	mg/L	0.001	0.003	0.019	0.007	0.003
Selenium	mg/L	0.01	<0.01	<0.01	<0.01	<0.01
Strontium	mg/L	0.001	5.78	0.118	0.294	0.617
Uranium	mg/L	0.001	<0.001	<0.001	<0.001	<0.001
Vanadium	mg/L	0.01	<0.01	<0.01	<0.01	<0.01
Zinc	mg/L	0.005	0.073	0.066	0.046	0.02
Nutrients						
Ammonia (as N)	mg/L	0.01	3	<0.01	0.12	1.33
Nitrite (as N)	mg/L	0.01	<0.01	0.01	<0.01	<0.01
Nitrate (as N)	mg/L	0.01	<0.01	0.28	<0.01	<0.01
Nitrite + Nitrate as N	mg/L	0.01	<0.01	0.29	<0.01	<0.01
Total phosphorus	mg/L	0.01	0.02	0.02	0.06	0.1
Reactive phosphorus (as P)	mg/L	0.01	0.05	<0.01	<0.01	<0.01
Total Organic Carbon	mg/L	1	15	2	4	12
54		6				
Dissolved gases						
Methane	mg/L	0.01	11.7	0.036	0.679	39.1
Ethane	mg/L	0.01	<0.01	<0.01	<0.01	<0.01
Ethene	mg/L	0.01	0.067	<0.01	<0.01	<0.01
Propane	mg/L	0.01	<0.01	<0.01	<0.01	<0.01
Propene	mg/L	0.01	0.016	<0.01	<0.01	<0.01
Butene	mg/L	0.01	<0.01	<0.01	<0.01	<0.01
Butane	mg/L	0.01	<0.01	<0.01	<0.01	<0.01
Phenolic compounds						
Phenol	µg/L	1	<1.0	<1.0	<1.0	<1.0
2-chlorophenol	µg/L	1	<1.0	<1.0	<1.0	<1.0
2-methylphenol	µg/L	1	<1.0	<1.0	<1.0	<1.0
3,4,4-methylphenol	µg/L	2	<2.0	<2.0	<2.0	<2.0
2-nitrophenol	µg/L	1	<1.0	<1.0	<1.0	<1.0
2,4-dimethylphenol	µg/L	1	<1.0	<1.0	<1.0	<1.0
2,4-dichlorophenol	µg/L	1	<1.0	<1.0	<1.0	<1.0
2,6-dichlorophenol	µg/L	1	<1.0	<1.0	<1.0	<1.0
4-chloro-3-methylphenol	µg/L	1	<1.0	<1.0	<1.0	<1.0
2,4,6-trichlorophenol	µg/L	1	<1.0	<1.0	<1.0	<1.0
2,4,5-trichlorophenol	µg/L	1	<1.0	<1.0	<1.0	<1.0
Pentachlorophenol	µg/L	2	<2.0	<2.0	<2.0	<2.0
Polyyclic aromatic hydrocarbons						
Acenaphthene	µg/L	1	<1.0	<1.0	<1.0	<1.0
Acenaphthylene	µg/L	1	<1.0	<1.0	<1.0	<1.0
Fluorene	µg/L	1	<1.0	<1.0	<1.0	<1.0
Phenanthere	µg/L	1	<1.0	<1.0	<1.0	<1.0
Anthracene	µg/L	1	<1.0	<1.0	<1.0	<1.0
Fluoranthene	µg/L	1	<1.0	<1.0	<1.0	<1.0
Pyrene	µg/L	1	<1.0	<1.0	<1.0	<1.0
Benz(a)anthracene	µg/L	1	<1.0	<1.0	<1.0	<1.0
Chrysene	µg/L	1	<1.0	<1.0	<1.0	<1.0
Benz(k)fluoranthene	µg/L	1	<1.0	<1.0	<1.0	<1.0
Benz(b,j)fluoranthene	µg/L	1	<1.0	<1.0	<1.0	<1.0
Benz(a) pyrene	µg/L	0.5	<0.5	<0.5	<0.5	<0.5
Benz(a)pyrene TEQ calc (Zero)	µg/L	0.5	<0.5	<0.5	<0.5	<0.5
Indeno(1,2,3-d)pyrene	µg/L	1	<1.0	<1.0	<1.0	<1.0
Dibenz(a,h)anthracene	µg/L	1	<1.0	<1.0	<1.0	<1.0
Benz(g,h)perylene	µg/L	1	<1.0	<1.0	<1.0	<1.0
PAHs (Sum of total)	µg/L	0.5	<0.5	<0.5	<0.5	<0.5
Total petroleum hydrocarbons						
C6 - C9 Fraction	µg/L	20	100	<20	<20	30
C10 - C14 Fraction	µg/L	50	<50	<50	<50	<50
C15 - C28 Fraction	µg/L	100	<100	<100	<100	<100
C29 - C36 Fraction	µg/L	50	<50	<50	<50	<50
TPH+C10 - C36 (Sum of total)	µg/L	50	<50	<50	<50	<50
Total recoverable hydrocarbons						
C6-C10 fraction	µg/L	20	100	<20	<20	30
C6 - C10 fraction minus BTEX	µg/L	20	30	<20	<20	<20
C10 - C16 fraction	µg/L	100	<100	<100	<100	<100
TRB-C10-C16 less Naphthalene (F2)	µg/L	100	<100	<100	<100	<100
C16 - C34 fraction	µg/L	100	<100	<100	<100	<100
C34 - C40 fraction	µg/L	100	<100	<100	<100	<100
C10 - C40 fraction (Sum)	µg/L	100	<100	<100	<100	<100
Aromatic hydrocarbons						
Benzene	µg/L	1	<1	<1	<1	<1
Toluene	µg/L	2	70	<2	<2	23
Ethylbenzene	µg/L	2	<2	<2	<2	<2
Xylene (m & p)	µg/L	2	<2	<2	<2	<2
Xylene (o)	µg/L	2	<2	<2	<2	<2
Xylene Total	µg/L	2	<2	<2	<2	<2
Total BTEX	µg/L	1	70	<1	<1	23
Naphthalene	µg/L	1	<5	<5	<5	<5

Note: mbgl - metres below Top of Casing; EQL - laboratory estimated quantitation limit; \*Instrument error during sampling; reading not verified.