

17-51223

Table 5-2 Field parameters March and October 2018

Sample ID	Date	pH	EC ($\mu\text{S/cm}$)	TDS (mg/L)	REDOX (mV)	Dissolved oxygen (mg/L)	Temperature (°C)	Comments
SE1D	20/03/18	4.90	453	-	194.4	-	22.5	Clear, low-no sediment, no odour, no sheen
	24/10/18	6.88	443	319.2	348.1	7.28	19.8	Clear, no sheen, no odour, low sediment load
GW1S	24/10/18	6.95	1057	773.50	310.4	6.69	19.2	Cloudy brown, sulfurous smell, no sheen, moderate sediment load
GW1D	24/10/18	8.83	932	676.0	327.7	2.68	19.5	Pale brown, cloudy, no odour, low sediment load, no sheen
SE3D	20/03/18	3.90	454	-	225.1	-	20.0	Clear, low-moderate sediment load, slight odour, no sheen
	25/10/18	5.86	586	416.0	271.3	6.07	20.9	*
SE4D	19/03/18	3.69	215	-	176.0	-	19.9	Cloudy white, moderate sediment load, no odour, no sheen
	24/10/18	4.92	248	180.7	356.8	6.98	19.3	*
SE5D	20/03/18	3.53	900	-	202.6	-	20.6	Clear – cloudy pale brown colour, moderate sediment load, no sheen, organic odour
	-	-	-	-	-	-	-	-
GW5S	24/10/18	5.59	1992	1456.2	412.8	2.52	19.2	Cloudy brown, high sediment load, no odour, no sheen
GW5D	-	-	-	-	-	-	-	-
SE6D	20/03/18	4.62	248	-	203.9	-	19.6	Cloudy white-yellow, moderate sediment load, no odour, no sheen
	24/10/18	5.17	278	205.4	364.6	5.97	18.8	Clear, no-low sediment load, no odour, no sheen
SE7D	20/03/18	3.98	235	-	212.8	-	20.0	Cloudy white, moderate – high sediment load, no odour, slight sheen and small bubbles on the surface
	24/10/18	5.36	269	187.9	346.4	6.84	21.2	Clear, low sediment load, no odour, no sheen
GW7S	24/10/18	8.16	190	138.5	350.8	8.32	19.4	Slightly off white/cloudy, no odour, no sheen, low sediment load
GW7D	24/10/18	10.57**	601	435.5	324.0	6.01	19.6	Brown – clear colour, low sediment load, no odour no sheen
SE8D	21/03/18	4.05	279	-	167.2	-	19.8	Clear, slight odour, low – no sediment, no sheen
	-	-	-	-	-	-	-	-
SE9D	19/03/18	3.70	315	-	171.0	-	19.6	Clear, no-low sediment, slight odour, no sheen
	24/10/18	4.14	320	234.6	399.9	4.70	19.0	Clear water, no sediment, no sheen, no odour
GW9S	24/10/18	9.70**	447	336.5	366.2	0.83	19.0	*
GW9D	24/10/18	5.20	320	234.0	394.2	3.08	19.1	Clear water, no odour, no sheen
SE10D	19/03/18	3.56	302	-	170.0	-	19.5	Clear, no-low sediment, small bubbles but no sheen on surface, no odour
	24/10/18	4.58	307	226.9	402.8	4.58	18.7	Clear, low sediment load, no odour, no sheen
CCBH1	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-
CCBH2	21/03/18	4.64	152	-	211.3	-	21.4	*
	25/10/18	5.16	151	101.4	283.7	5.91	23.2	Clear, no odour, no sheen

- denotes that the well was dry or unable to be sampled. ** denotes that no comment was noted on the field sheet at this location. *** denotes that the highly alkaline (outlier) pH value observed which is not considered representative of groundwater conditions at this location

A summary of the main observations from Table 5-2 is provided below:

- The recorded pH measurements from all of the wells sampled (shallow and deep) indicated that the groundwater was slightly acidic to slightly alkaline and ranged between a pH of 3.53 in March (SE5D) and 8.83 in October (GW1D).
- Elevated alkaline pH values were observed at GW7D (10.6) and GW9S (9.7) during the October 2018 monitoring event which [REDACTED] consider not to be representative of groundwater at these locations (based on the general groundwater conditions observed on-site). The elevated alkaline values are likely to be associated with the recent installation of these wells. The pH will be reassessed in future monitoring rounds, particularly at these locations, and is expected to stabilise closer to the anticipated range of 5 – 7 over time.
- Field EC ranged from 151 $\mu\text{S}/\text{cm}$ in October (CCBH2) to 1,992 $\mu\text{S}/\text{cm}$ in October (GW5S). This range is indicative of a 'fresh' to 'marginal' water quality across the Site. The majority of wells on-site are noted to be of 'fresh' water quality ($<1,000 \mu\text{S}/\text{cm}$). Overall, the results indicate that groundwater within the deeper wells tends to be of 'fresh' water quality and of 'marginal' water quality within a few shallow monitoring wells (e.g. GW1S and GW5S).
- TDS concentrations were highest in October at GW5S (1456.2 mg/L) and the lowest in October at CCBH2 (101.4 mg/L) which correlates with the measured EC concentrations.
- REDOX ranged from 167.2 mV in March (SE8D) to 402.8 mV in October (SE10D).
- Dissolved oxygen concentrations ranged between 0.83 mg/L in October (GW9S) to 8.32 mg/L in October (GW7S).
- A slight sheen and small bubbles were noted at SE7D in March 2018 however, overall most monitored locations reported a clear to brown colouring, no odour, a low sediment load and no sheen. Small bubbles were also observed at GW1S, SE7D and SE10D over the October 2018 monitoring period. A sulfurous odour was noted at GW1S and an organic odour was noted at SE5D in the October and March 2018 events respectively.

5.4 Laboratory analytical results

The detailed analytical results for the March and October 2018 GMEs are presented in Appendix D – Table D. 1. Associated QA/QC results tables are also presented in Appendix D- Table D. 2 and Table D. 3. Laboratory Certificates of Analysis are included in Appendix E

Elevated results above the adopted assessment criteria are summarised in Table 5-3 and Table 5-4 below. It is noted that PAH, Phenols, PCBs, OCP or OPP compounds (monitored in the October event only as part of the annual analytical suite) were reported below the LOR, which is consistent with historical monitoring observations. There was one concentration of ethylbenzene (4 mg/L) reported marginally above the NPUG criteria (3 mg/L) at CCBH2 (in October 2018).

Concentrations of TRH (NEPM 2013 fractions) were reported above the LOR at CCBH2, GW1D, GW1S, GW5S, GW7D and SE1D. Low concentrations of PFAS were reported marginally above the LOR at GW1D, GW1S, CCBH2 GW5D, GW7D, GW9D, SE3D, SE4D, SE6D, SE7D, SE9D, SE10D and SE10S. The detections of PFAS and TRH compounds were below the adopted assessment criteria.

5.4.1 March 2018 – Assessment criteria comparison

A summary of the March 2018 GME results, against the adopted assessment criteria, are presented in Table 5-3.

Table 5-3 Laboratory results summary - March 2018

Location		Elevated result against the adopted assessment criteria (as defined in Section 3)			
Locational Context	Sample ID	Australian Drinking Water Guidelines	Fresh Waters Guidelines	Long-term Irrigation Guidelines	Non-potable Groundwater Use
Cross Gradient	SE1D	-	Cu, Fe, Ni, Zn	Fe	Fe
Down Gradient (Primary Leachate Pond)	SE3D	-	N (total)	-	-
Upgradient (Leachate Evaporation Ponds)	SE4D	-	Al, Fe	Fe	Fe
Upgradient (site)	SE5D	-	Al, Cu, Fe, Zn	Fe	Fe, Cl
Down Gradient (Crystal Pigment Cell 1)	SE6D	-	N (total)	N (total)	-
	SE7D	-	Cu, Zn	Fe	-
	SE8D	-	N (total), Al	-	-
Down Gradient (Leachate Evaporation Ponds)	SE9D	-	Al, Cu	Fe	Fe
	SE10D	-	Al	-	-
Down Gradient (site)	CCBH2	-	N (total), Cu, Zn	P (total)	-

5.4.2 October 2018 – Assessment criteria comparison

A summary of the October 2018 GME results against the adopted assessment criteria are presented in Table 5-4.

Table 5-4 Laboratory results summary - October 2018

Location		Elevated result against the adopted assessment criteria (as defined in Section 3)			
Location Context	Sample ID	Australian Drinking Water Guidelines*	Fresh Waters Guidelines	Long-term Irrigation Guidelines	Non-potable Groundwater Use
Cross-gradient	SE1D	-	Zn	-	-
	GW1S	Mn	Fe, Zn	P (total), Fe, Mn	Fe
	GW1D	-	Al, Cu, Fe, Zn	Fe	Al, Fe

Down-gradient (Primary Leachate Pond)	SE3D	-	N (total), Cu, Zn	P (total)	-
Up-gradient (Leachate Evaporation Ponds)	SE4D	-	Al, Cu, Zn	-	-
Up-gradient (site)	GW5S	Mn	N (total), P (total), Cu, Fe, Zn	Cl, P (total), Fe, Mn	Cl, NH ₃ (as N), Fe
Down-gradient (Crystal Pigment Cell 1)	SE6D	-	N (total), Cu, Zn,	N (total)	-
	SE7D	-	Cu, Fe, Zn	Fe	Fe
	GW7S	-	N (total), Al, Fe, Zn	N (total), Fe	Al, Fe
	GW7D	-	Al, Cu, Zn	P (total), Fe	Al
Down-gradient (Leachate Evaporation Ponds)	SE9D	-	Zn	-	-
	SE9S	-	P (total), Fe, Zn	P (total), Fe	Fe
	GW9S	Mn	Fe	Fe, Mn	Fe
	GW9D	Mn	Fe	Fe, Mn	Fe
	SE10S	Sum of PFHxS and PFOS*	N (total), P(total), Fe	P(total), Fe	Fe
	SE10D	-	Al, Cu	-	-
Down-gradient (site)	CCBH2	-	N (total), Cu, Fe, Zn	P (total), Fe	Fe, Ethylbenzene

*GHD notes that HEPA 2018 fresh water (95%) and health drinking water guidelines for PFAS have been adopted for the Site, discussed further in Section 6.5.

5.5 Quality assurance / quality control evaluation

5.5.1 Relative percentage difference

Table 5-5 outlines the blind duplicate and field split samples that were collected for groundwater monitoring in 2018 during both events.