Upper South Creek

Advanced Water Recycling Centre and Pipelines

Groundwater Monitoring Report

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Revisions and Distribution

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Revisions

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Date	Rev	Remarks	Section	Prepared By	Reviewed By & Approved By
03/04/2024	1	Initial version for review	All	D. O'Brien	R. Maxwell
11/05/2024	2	Response to SW/ER comments	All	R. Maxwell	A. Harrington

Glossary and Abbreviations

Abbreviation	Term	Definition
AWRC	Advanced Recycling Water Centre	Proposed centre for treatment of the wastewater prior to reuse applications or discharge, which includes liquids treatment, advanced water treatment, solids treatment, odour treatment, and residuals management
AHD	Australian Height Datum	A common reference level used in Australia which is approximately equivalent to the height above sea level in metres.
-	Brine Pipeline	A pipeline to transport brine (salty/concentrated wastewater). Brine water is a byproduct of reverse osmosis in the wastewater treatment process.
DMP	Dewatering Management Plan	A DMP is generally developed as a sub-plan under an overarching Construction Environmental Management Plan to document the management procedures and controls to mitigate potential environmental impacts associated with dewatering activities during construction.
EC	Electrical Conductivity	The ability of a material to conduct an electric current. In groundwater studies, electrical conductivity is used as an indicator of water quality, as it relates to the concentration of charged particles in water. Electrical conductivity provides an indication of the amount of total dissolved solids and the amount of salts in the water. Typically measured in µS/cm.
EIS	Environmental Impact Statement	An Environmental Impact Statement is a publicly available document that provides technical information on a project, including a summary of the environmental setting, its environmental impacts and mitigation measures, and is used to inform development consent decisions
-	Hydraulic Conductivity	The measure of how easily water can pass through a porous material. High values indicate permeable material through which water can pass easily and low values indicate a less permeable material. Hydraulic conductivity is dependent upon the intrinsic permeability of the material, the degree of saturation and the fluid properties (i.e. density and viscosity).
HSU	Hydrostratigraphic unit	A general grouping of geologic materials that form a distinct hydrogeological unit with respect to the flow and behaviour of groundwater.
LOR	Limit of reporting	The smallest concentration of a chemical that can be reported by the laboratory using the adopted analytical methodology. Also commonly referred to as the Estimated Quantitation Limit (EQL) or detection limit.
TOC	Top of Casing	Refers to the top of the groundwater monitoring well casing. This is used as a consistent datum from which groundwater levels are measured against. Surveyed elevation of the top of casing is also measured for each monitoring well, to enable groundwater level measurements to be converted to m AHD.
-	Treated water pipeline	The pipelines that will convey the highly treated water to the receiving environment. The pipelines will transport water from the AWRC to the discharge points at the Nepean and Warragamba Rivers. These pipelines will range in size from about 0.6 m to 1.5 m in diameter and will generally consist of steel, glass reinforced plastic and polyethylene pipe materials.
USC	Upper South Creek	The catchment in which the AWRC will be located. South Creek discharges to the Nepean River which flows directly into the Hawkesbury River and then discharges out to the Pacific Ocean
WQO	Water Quality Objectives	Water Quality Objectives are long-term goals for water quality management. They are measures, levels or narrative statements of indicators of water quality that protect EVs. They define what the water quality should be to protect the EVs—after consideration of the socio-economic assessment of protecting the water quality.

1 Background

The Upper South Creek Advanced Water Recycling Centre and Pipelines project (the project) has been proposed to support the population growth and economic development of the Western Sydney Aerotropolis Growth Area (WSAGA or Aerotropolis), South West Growth Area (SWGA) and the new Western Sydney International Airport. The project will provide wastewater services to Western Sydney to produce high-quality treated water for non-drinking reuse and for release to local waterways.

The project will comprise the following components:

- A new Advanced Water Recycling Centre (AWRC) to collect wastewater from businesses and homes and treat it, producing high-quality treated water, renewable energy and biosolids for beneficial reuse
- A new green space area around the AWRC, adjacent to South Creek and Kemps Creek, to support the ongoing development of a green spine through Western Sydney
- New infrastructure from the AWRC to South Creek, to release excess treated water during significant wet weather events, estimated to occur about 3 – 14 days each year
- A new treated water pipeline from the AWRC to Nepean River at Wallacia Weir, to release high-quality treated water to the river during normal weather conditions
- A new brine pipeline from the AWRC connecting into Sydney Water's existing wastewater system to transport brine to the Malabar Wastewater Treatment Plan
- A range of ancillary infrastructure

2 Purpose

The purpose and scope of the Groundwater Monitoring Program (Appendix F of the Surface Water and Groundwater CEMP Sub-plan) is to monitor the effectiveness of mitigation measures applied during the construction phase of the AWRC site as it relates to the groundwater resources. This program is based on baseline studies developed for the Upper South Creek Advanced Water Recycling Centre Environmental Impact Statement (EIS) dated September 2021. Construction works at AWRC commenced on the 28th of August 2023.

As specified in Section 7.3 of the Groundwater Monitoring Program (GWMoP), this Groundwater Monitoring Report (GMR, or this 'report') will be produced every six months, in accordance with the Ministers Conditions of Approval (MCoA) C18. This report presents the findings for the reporting period of August 2023 to February 2024. The report will capture the following details:

- The location and description on monitoring undertaken.
- A summary of groundwater data collected within the monitoring period
- Summary and analysis of any measurements exceeding the project acceptable ranges.

3 Construction Update

Construction activities undertaken across the AWRC site during the reporting period are provided below. It's noted that there were no works undertaken which required extraction or interaction with groundwater

- Site Establishment
- Clearing and Grubbing
- Bulk Earthworks
- Structure Construction Works including:
  - Piling Works
  - Steel fixing
  - Installation of structural elements
  - FRP Works
- Concrete pours.

4 Groundwater Quality Monitoring

4.1 Monitoring Network

During the reporting period, groundwater quality monitoring was carried out at the locations specified in Table 4-1 at the AWRC. These monitoring locations are also presented in Figure 4-1.

Table 4 - 1: Groundwater Quality Monitoring Locations

Monitoring Well ID	Easting	Northing	Location Description	Screened Material Description	Targeted Hydrostratigraphic Unit
AWRC_ MW01	293922.34	6251905.16	North of the AWRC site, mid-way between South Creek and Kemps Creek	Claystone, sandstone, coal.	Upper Wianamatta Group (weathered/fractured Bringelly Shale)
AWRC_MW03D	294412.94	6251662.78	Well pairing east of the AWRC site, towards Kemps Creek (deeper well).	Claystone, sandstone.	Upper Wianamatta Group (weathered/fractured Bringelly Shale)
AWRC_MW03S	294412.37	6251662.41	Well pairing east of the AWRC site, towards Kemps Creek (shallower well)	Clayey sand, clayey sandy gravel, silty clay.	Unconsolidated Quaternary alluvium and residual / regolith soils
AWRC_MW04	293791.88	6251518.90	Adjacent to the western boundary of the AWRC site.	Gravelly sandy clay, sandy silty clay	Unconsolidated Quaternary alluvium and residual / regolith soils
AWRC_MW04D	293791.88	6251518.90	Adjacent to the western boundary of the AWRC site.	Siltstone, sandstone	Upper Wianamatta Group (weathered/fractured Bringelly Shale)
AWRC_MW05D	293469.19	6251417.88	Well pairing west of the AWRC site, towards South Creek (deeper well).	Claystone	Upper Wianamatta Group (weathered/fractured Bringelly Shale)
AWRC_MW05S	293468.17	6251417.73	Well pairing west of the AWRC site, towards South Creek (shallower well).	Sandy clay, clayey gravel, sandy gravelly clay.	Unconsolidated Quaternary alluvium and residual / regolith soils
AWRC_ MW06	293727.84	6251197.57	Adjacent to the south-western boundary of the AWRC site.	Sandy clay, sandy gravelly clay, gravelly clay	Unconsolidated Quaternary alluvium and residual / regolith soils
AWRC_MW07D[1]	293922.78	6251154.83	Well pairing in the southern portion of the AWRC site (deeper well).	Claystone, sandstone, coal.	Upper Wianamatta Group (weathered/fractured Bringelly Shale)
AWRC_MW07S	293922.97	6251154.16	Well pairing in the southern portion of the AWRC site (shallower well).	Clayey sandy gravel	Unconsolidated Quaternary alluvium and residual / regolith soils
AWRC_MW08D	293737.44	3748301.91	Adjacent to the western boundary of the AWRC site.	Siltstone, sandstone	Upper Wianamatta Group (weathered/fractured Bringelly Shale)
AWRC_MW08S	293737.44	3748301.91	Adjacent to the western boundary of the AWRC site.	Sandy clay	Upper Wianamatta Group (weathered/fractured Bringelly Shale)

[1] MW07D and MW07S were decommissioned following groundwater quality monitoring carried out during September 2023

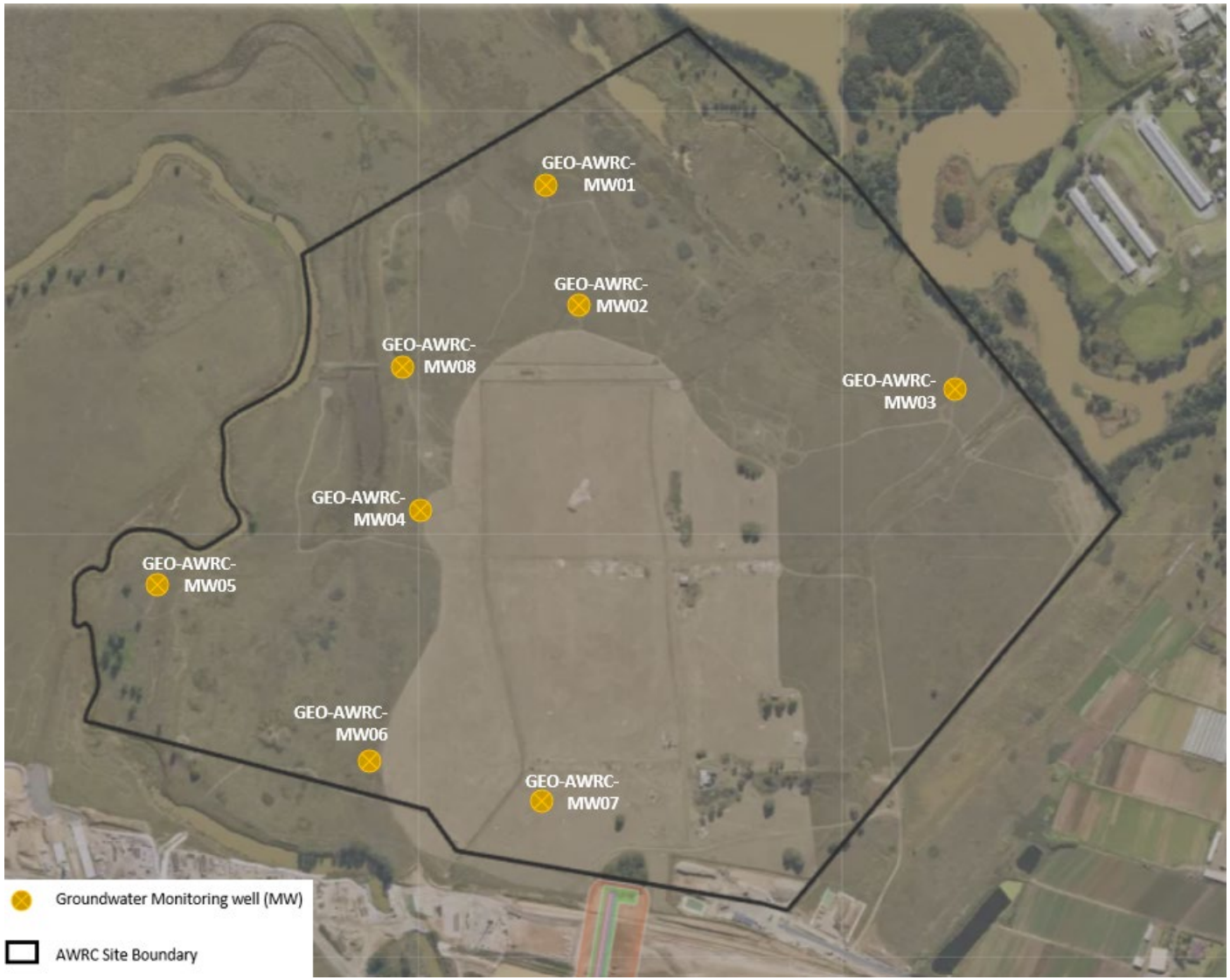


Figure 4 - 1 Groundwater Monitoring Location Map

4.2 Monitored Parameters

Measurements of the following groundwater parameters were taken during the reporting period at each groundwater monitoring location (Section 4.1) using a calibrated water quality meter and interface probe.

- Depth to water (mbTOC);
- Presence/absence of Light Non-Aqueous Phase Liquid (LNAPL) and thickness if present (mbTOC);
- Water Temperature (°C);
- pH;
- Electrical Conductivity (µS/cm);
- Dissolved Oxygen (%);
- Redox Potential;
- Visual and olfactory indicators (colour, turbidity, odour, sheen, discolouration, free phase liquids, foaming waters);
- Evidence of stressed or dead flora and / or fauna (for example, fish kills) in downstream receiving environments.

Representative groundwater samples were obtained and submitted to a NATA laboratory for analysis of the following parameters.

- Total dissolved solids (TDS).
- Total suspended solids (TSS).
- Nutrients (including ammonia, nitrate, nitrite, total nitrogen and total phosphorous).
- Major ions (chloride, sulfate, sodium, potassium, magnesium, calcium, carbonate and bicarbonate); and
- Dissolved heavy metals (As, Cd, Cr, Cu, Pb, Hg, Ni and Zn) and polycyclic aromatic hydrocarbons (PAHs).

4.3 Monitoring events and timing

Routine groundwater quality monitoring has been completed quarterly throughout the reporting period and upon commencement of construction at the AWRC in accordance with Section 5.4.3 of the GWMoP. Quarterly monitoring was undertaken in September 2023 and December 2023.

Routine water level gauging has been undertaken at groundwater monitoring wells MW04 and MW08 via nested piezometers which continuously log groundwater levels.

There were no incidents or events which occurred during the reporting period with the potential to impact groundwater quality therefore event triggered sampling was not required.

No Project trigger value or acceptable range reporting was undertaken during the reporting period. While there were some exceedances noted, these were not attributable to the Project as detailed in Section 6.

5 Groundwater Monitoring Results

5.1 September 2023

Groundwater monitoring was carried out on the 18th and 19th of September 2023 by Matt Lemcke – Hydrogeologist and Environmental Scientist from Environment and Natural Resource Solutions (ENRS). Field sampling monitoring results are provided in Table 5-1 while laboratory results are provided in Table 5-2. Monitoring wells which have Bringelly Shale project acceptable ranges are highlighted in brown while monitoring wells with alluvial/residual soil project acceptable ranges are unhighlighted. Exceedances of acceptable ranges are highlighted red in Tables 5-1 and 5-2.

Table 5 – 1: Field sampling monitoring results for September 2023

Parameter	Project Acceptable Range		Unit	MW1	MW3-D	MW3-S	MW4	MW4-D	MW5-S	MW5-D	MW7-D	MW7-S	MW8-S	MW8-D	MW6
	Alluvial/Residual Soils	Bringelly Shale													
Depth to Water	32.76	32.77	mAHD	34.45	37.22	36.79	35.99	34.80	34.01	34.07	35.83	38.35	35.21	35.35	36.19
Electrical Conductivity	117.3 – 25974	195.6 – 20241	us/cm	21400	21300	22900	17700	21900	1560	20500	21400	23400	20500	18700	321
Dissolved Oxygen	1.4 – 8.38	0.65 – 6.32	mg/L	0	0	0	11	0.18	0	0	0.67	0.06	3	0	0
pH	5.74 – 8.04	6.42 – 7.83	-	6.68	6.78	5.99	6.66	6.6	6.61	6.57	6.16	5.66	5.72	6.63	5.94
ORP (Redox Potential)	-	-	mV	-34	-47	126	-18	-26	182	-57	495	494	56	-21	246
Temperature	-	-	^{0}C	17.7	17.5	15.7	19.7	20.24	15.4	17.8	17.4	16.5	18.8	20.7	14.5
Light Non-Aqueous Phase Liquid	-	-	Presence/absence	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent

Field sampling carried out during September 2023 identified that groundwater monitoring results were largely within the Project acceptable range for each parameter. Some exceedances were identified in several monitoring locations for electrical conductivity, dissolved oxygen and pH. Analysis of these exceedances are provided in Section 6.

Table 5-2: Laboratory groundwater monitoring results for September 2023

Parameter	Project Acceptable Range		Unit	MW1	MW3-D	MW3-S	MW4	MW4-D	MW5-S	MW5-D	MW7-D	MW7-S	MW8-S	MW8-D	MW6
	Alluvial /Residual Soils	Bringelly Shale													
Total Dissolved Solids (TDS)	59 - 18500	182 – 17100	mg/L	15000	13200	13500	10400	14900	898	13300	12500	13500	12000	11700	212
Total Suspended Solids (TSS)	0 - 50	0 - 50	mg/L	<5	<5	15	429	9	24	8	10	<5	9	41	<5
Ammonia as N	<0.48	<3.3	mg/L	1.88	1.96	0.13	0.64	3.88	<0.01	3.56	0.18	0.02	0.16	4.07	<0.01
Nitrate as N	-	-	mg/L	<0.01	<0.01	0.02	0.02	<0.01	0.04	<0.01	0.3	0.06	<0.01	<0.01	0.1
Nitrite as N	-	-	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Total Nitrogen as N	<11	<11.8	mg/L	1.8	1.9	0.2	2.4	3.8	<0.1	3.6	0.6	0.2	0.2	4.2	0.1
Total Phosphorus as P	<2.15	<0.29	mg/L	<0.01	0.02	0.02	0.35	<0.01	0.02	<0.01	<0.01	<0.01	<0.01	0.02	0.02
Chloride	-	-	mg/L	7320	6760	7040	6390	7740	459	7240	6690	7560	7500	6720	71
Sulfate	-	-	mg/L	332	<1	478	314	11	6	<10	383	378	326	<10	16
Calcium	-	-	mg/L	377	307	112	182	577	38	698	114	55	106	556	<1
Magnesium	-	-	mg/L	550	460	451	394	475	34	615	452	503	477	439	1
Sodium	-	-	mg/L	3320	3390	3820	2850	3260	204	2580	3540	3920	3390	2710	63
Potassium	-	-	mg/L	20	18	4	11	39	<1	37	6	2	3	39	<1
Carbonate Alkalinity as CaCO3	-	-	mg/L	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1

Parameter	Project Acceptable Range		Unit	MW1	MW3-D	MW3-S	MW4	MW4-D	MW5-S	MW5-D	MW7-D	MW7-S	MW8-S	MW8-D	MW6
	Alluvial /Residual Soils	Bringelly Shale													
Bicarbonate Alkalinity as CaCO3	-	-	mg/L	581	733	167	238	583	99	699	193	65	106	590	32
Arsenic	<0.005	<0.015	mg/L	<0.001	<0.001	<0.001	0.003	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.002	<0.001
Cadmium	<0.0013	<0.0001	mg/L	<0.0001	<0.0001	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0003	<0.0001	<0.0001	<0.0001
Chromium	<0.022	<0.01	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Copper	<0.021	<0.01	mg/L	<0.001	<0.001	<0.001	0.001	<0.001	<0.001	<0.001	0.002	0.001	<0.001	<0.001	<0.001
Lead	<0.016	<0.014	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Nickel	<0.032	<0.028	mg/L	<0.001	<0.001	0.006	0.023	0.005	<0.001	<0.001	0.044	0.027	0.051	0.014	<0.001
Zinc	<0.471	<0.18	mg/L	<0.005	0.008	0.005	0.018	0.021	<0.005	0.041	0.04	0.027	0.019	0.039	<0.005
Mercury	<0.0001	<0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Polycyclic aromatic hydrocarbons (PAHs)	<0.5	<0.5	ug/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5

Laboratory samples for monitoring undertaken in September 2023 identified that groundwater monitoring results were largely within the Project acceptable range for each parameter. Some exceedances were identified in several monitoring locations for TSS, ammonia, cadmium and Nickel. Analysis of these exceedances is provided in Section 6.

5.2 December 2023

Groundwater monitoring was carried out on the 14th December 2023 by Matt Lemcke – Hydrogeologist and Environmental Scientist from ENRS. Field sampling monitoring results are provided in Table 5-3 while laboratory results are provided in Table 5-4. Monitoring wells which have Bringelly Shale project acceptable ranges are highlighted in brown while monitoring wells with alluvial/residual soil project acceptable ranges are unhighlighted. Exceedances of acceptable ranges are highlighted red in Tables 5-3 and 5-4. It's noted that monitoring wells MW7D and MW7S were decommissioned prior to this monitoring event and therefore monitoring data was not obtained in December 2023.

Table 5–3: Field Sampling Results for December 2023

Parameter	Project Acceptable Range		Unit	MW1	MW3-D	MW3-S	MW4	MW4-D	MW5-S	MW5-D	MW8-S	MW8-D	MW6
	Alluvial/Residual Soils	Bringelly Shale											
Depth to Water	32.76	32.77	mAHD	34.12	37.09	36.55	35.815	34.39	33.86	33.84	35.16	35.57	35.33
Electrical Conductivity	117.3 – 25974	195.6 – 20241	us/cm	21800	21100	22600	19900	21900	1590	20800	21000	18900	395
Dissolved Oxygen	1.4 – 8.38	0.65 – 6.32	mg/L	0	0	0	2.6	0	0	0	0	0	0.63
pH	5.74 – 8.04	6.42 – 7.83	-	6.75	6.81	6.01	6.54	6.6	6.71	6.61	5.71	6.64	5.85
ORP (Redox Potential)	-	-	mV	-53	-46	96	43	-41	121	-16	26	-56	223
Temperature	-	-	^{0}C	17.5	17.8	22.6	19.4	19.4	17.9	19.4	19.3	22.4	17.9
Light Non-Aqueous Phase Liquid	-	-	Presence/absence	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent

Field sampling carried out during December 2023 identified that groundwater monitoring results were largely within the Project acceptable range for each parameter. Some exceedances were identified in several monitoring locations for electrical conductivity, dissolved oxygen and pH. Analysis of these exceedances are provided in Section 6.

Table 5-4: Laboratory groundwater monitoring results for December 2023

Parameter	Project Acceptable Range		Unit	MW1	MW3-D	MW3-S	MW4	MW4-D	MW5-S	MW5-D	MW8-S	MW8-D	MW6
	Alluvial /Residual Soils	Bringelly Shale											
Total Dissolved Solids (TDS)	59 - 18500	182 – 17100	mg/L	15900	13900	15700	13100	17200	850	16300	13800	14500	225
Total Suspended Solids (TSS)	0 - 50	0 - 50	mg/L	<5	<5	7	24	26	28	12	6	229	10
Ammonia as N	<0.48	<3.3	mg/L	1.81	1.9	0.11	0.57	4.88	0.02	3.52	0.13	4.26	0.05
Nitrate as N	-	-	mg/L	<0.01	0.01	0.03	<0.01	0.02	0.04	<0.01	<0.01	<0.01	0.03
Nitrite as N	-	-	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Total Nitrogen as N	<11	<11.8	mg/L	1.7	1.8	0.3	0.7	4.4	0.2	3.2	0.3	4.1	0.1
Total Phosphorus as P	<2.15	<0.29	mg/L	0.01	<0.01	0.02	0.03	0.02	0.02	0.02	0.02	0.03	<0.01
Chloride	-	-	mg/L	6990	7060	7260	6400	7540	423	7040	6890	6490	85
Sulfate	-	-	mg/L	341	<1	522	297	<1	6	<1	292	2	21
Calcium	-	-	mg/L	366	298	112	197	649	39	710	105	555	<1
Magnesium	-	-	mg/L	559	465	458	460	467	34	662	483	449	2
Sodium	-	-	mg/L	3380	3470	3920	3230	3200	215	2650	3420	2790	80
Potassium	-	-	mg/L	20	18	4	11	44	<1	36	3	38	<1
Carbonate Alkalinity as CaCO3	-	-	mg/L	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1

Parameter	Project Acceptable Range		Unit	MW1	MW3-D	MW3-S	MW4	MW4-D	MW5-S	MW5-D	MW8-S	MW8-D	MW6
	Alluvial /Residual Soils	Bringelly Shale											
Bicarbonate Alkalinity as CaCO3	-	-	mg/L	575	727	172	222	553	106	712	102	587	31
Arsenic	<0.005	<0.015	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.002	<0.001
Cadmium	<0.0013	<0.0001	mg/L	<0.0001	<0.0001	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	<0.0001	<0.0001
Chromium	<0.022	<0.01	mg/L	<0.001	<0.001	<0.001	0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Copper	<0.021	<0.01	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Lead	<0.016	<0.014	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Nickel	<0.032	<0.028	mg/L	0.003	<0.001	0.006	0.026	0.005	<0.001	<0.001	0.05	0.016	<0.001
Zinc	<0.471	<0.18	mg/L	<0.005	0.009	0.006	0.045	0.032	<0.005	0.041	0.028	0.039	0.005
Mercury	<0.0001	<0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Polycyclic aromatic hydrocarbons (PAHs)	<0.5	<0.5	ug/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5

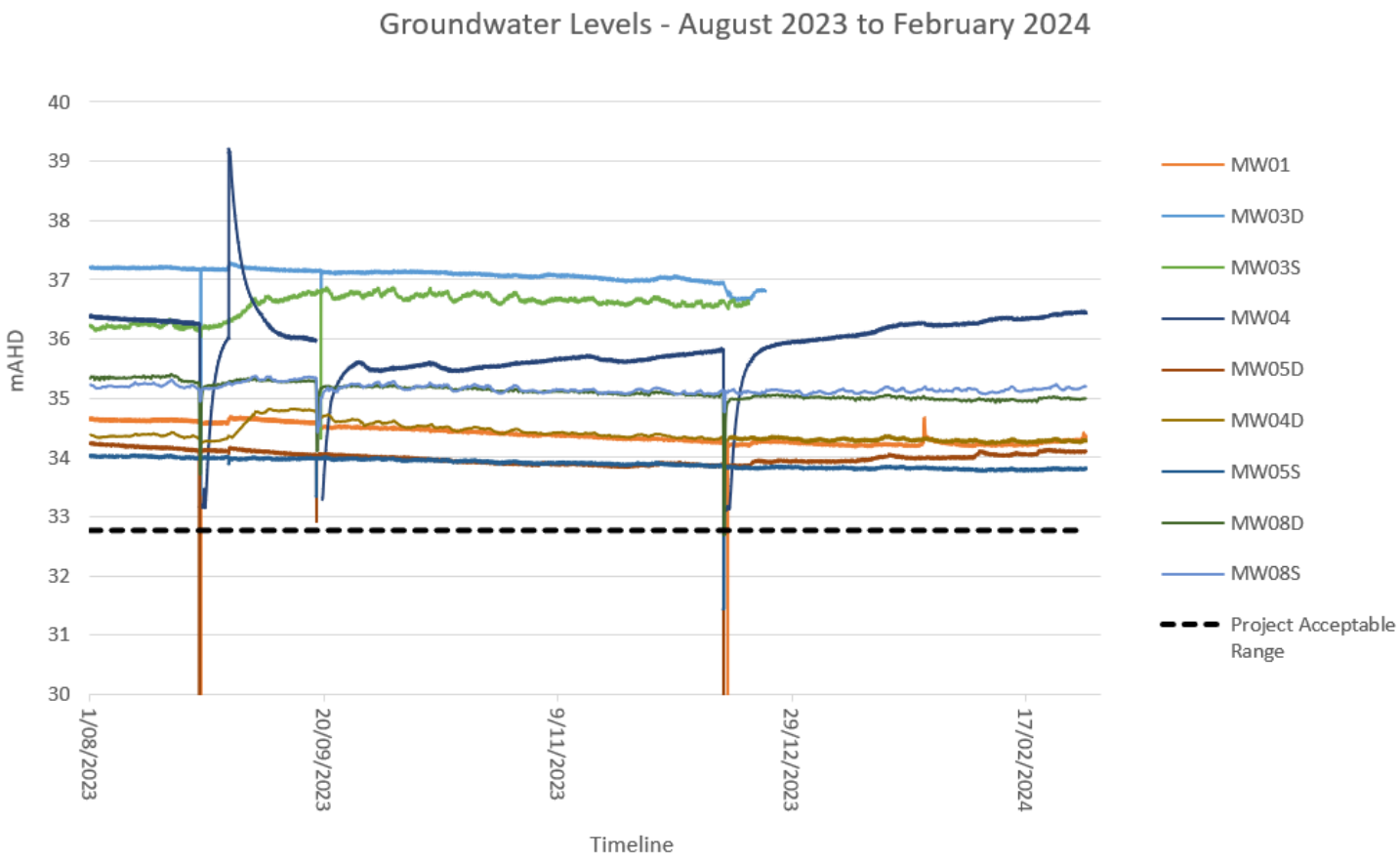
Laboratory samples for monitoring undertaken in December 2023 identified that groundwater monitoring results were largely within the Project acceptable range for each parameter. Some exceedances were identified in several monitoring locations for TSS, TDS, ammonia and nickel. Analysis of these exceedances is provided in Section 6.

5.3 Groundwater levels

Figure 5-1 below provides the groundwater level/hydrograph data for each relevant groundwater monitoring well between August 2023 and February 2024. Groundwater levels are monitored by nested piezometers. In accordance with the SWGCSP, nested piezometers are required in MW04 and MW08 however some additional monitoring has been undertaken throughout the monitoring period.

As shown below, there were two occasions where groundwater levels were recorded below the project acceptable range however this occurred during onsite groundwater monitoring events where purging of the groundwater wells was undertaken. This does not reflect actual groundwater levels. MW04 observed a spike in groundwater levels in mid-august however this was a result of an influx of surface water into the monitoring well following a significant rainfall event and therefore does not reflect actual groundwater levels.

Figure 5-1 – groundwater level data between August 2023 and February 2024



6 Discussion of exceedances

Exceedances of project acceptable ranges were observed during the reporting period for electrical conductivity, dissolved oxygen, pH, total suspended solids, total dissolved solids, some heavy metals and ammonia. An analysis and review of the exceedances was undertaken by ENRS which is summarised below.

- **Electrical conductivity (EC)** – EC for the reporting period was measured at values between 321 µS/cm (MW6 September 2023) and 23400 µS/cm (MW7-S September 2023). It is noted that some monitoring locations measured values above the project acceptable range for Bringelly Shale. Baseline groundwater monitoring data collected prior to the commencement of construction (pre-August 2023) also identified exceedances of the EC project acceptable range at several monitoring locations.
- **Dissolved oxygen (DO)** – DO for the reporting period was measured at values between 0mg/L (several locations and dates) and 11mg/L saturation (MW4 September 2023). While groundwaters are generally depleted in DO, the multiple measurements of 0mg/L were caused by insufficient flow rates and volumes able to be collected from the groundwater well which are required to avoid depletion of DO during the testing process. Construction works undertaken during the reporting period would not have an impact on groundwater DO levels. Baseline groundwater monitoring data collected prior to the commencement of construction (pre-August 2023) also identified exceedances of the DO project acceptable ranges at several monitoring locations.
- **pH** – pH for the reporting period was measured at values between 5.66 (MW7-S September 2023) and 6.81 (MW3-D December 2023). A total of four exceedances were observed in Bringelly Shale and Alluvial/Residual Soils monitoring wells, all of which were outside the lower limit of the project acceptable range. Baseline groundwater monitoring data collected prior to the commencement of construction (pre-August 2023) also identified exceedances of the pH project acceptable ranges at several monitoring locations.
- **Total dissolved solids (TDS)** – TDS for the reporting period was measured at values between 212 mg/L (MW6 September 2023) and 21800 µS/cm (MW4-D December 2023). A single exceedance of the upper project acceptance range at MW4-D was measured in December 2023. of the project acceptable range was recorded at MW4-D in December 2023. Baseline groundwater monitoring data collected prior to the commencement of construction (pre-August 2023) also identified exceedances of the TDC project acceptable ranges at several monitoring locations.
- **Total suspended solids (TSS)** – TSS for the reporting period was measured at values between the laboratory limit of reporting (LOR) and 429 mg/L (MW4 December 2023). Two exceedances of the upper project acceptance range were measured in MW4 in September, and MW8-D in December 2023. Baseline groundwater monitoring data collected prior to the commencement of construction (pre-August 2023) also identified exceedances of the TSS project acceptable ranges at several monitoring locations.
- **Heavy metals** – Review of heavy metals results for the reporting period generally reports concentrations within the project acceptance range with exception of cadmium and nickel which had three exceedances of the project acceptable range. Baseline groundwater monitoring data collected prior to the commencement of construction (pre-August 2023) also identified exceedances of the cadmium and nickel project acceptable ranges at several monitoring locations.
- **Ammonia –** Ammonia for the reporting period was measured at values between the LOR (<0.01 mg/L) and 4.88 mg/L (MW4-D December 2023). Six exceedances of the upper project acceptance range were measured in at several monitoring locations in September and December 2023. Baseline groundwater monitoring data collected prior to the commencement of construction (pre-August 2023) also identified exceedances of the ammonia project acceptable ranges at several monitoring locations.
- **Groundwater levels** – There were two occasions where groundwater levels at several monitoring locations were recorded below the project acceptable range however this occurred during onsite groundwater monitoring events where purging of the groundwater wells was undertaken. This does not reflect actual groundwater levels. MW04 observed a spike in groundwater levels in mid-august however this was a result of an influx of surface water into the monitoring well following a significant rainfall event and therefore does not reflect actual groundwater levels.

Following identification of the above exceedances, an investigation was undertaken in accordance with Section 5.5 of the GWMoP which concluded that the they were not attributed to or caused by the Project for the following reasons.

- As detailed above, baseline groundwater monitoring undertaken throughout 2023 prior to the commencement of construction (pre-August 2023) identified exceedances of project acceptable ranges for various parameters, including all of those listed above i.e. EC, DO, pH, TDS, TSS, heavy metals and ammonia.
- No excavations undertaken to date have encountered saturated media associated with groundwater. There has been no extraction, abstraction, groundwater dewatering, injection or any other interaction with groundwater to date at the AWRC.

- Construction activities have not reported any release of contamination or spill of a magnitude with the potential to cause groundwater contamination including those parameters which exceeded the project acceptable ranges.

Further to the above, it's noted that the project acceptable ranges were determined based on the limited groundwater monitoring events undertaken during the Project EIS between 31st August 2021 and 14th March 2022. The GWMoP identifies this deficiency and states that once a more robust baseline dataset has been collected, the project acceptable range should be revised. As eight data points have now been collected, the project acceptable ranges should be updated to more accurately reflect baseline values, and assess any potential impacts from construction. Project acceptable ranges will be developed based on temporal acquisition of data and formulation of 90th percentile of each parameter in accordance with national guidance (ANZG 2018).