# 2022–2023 Groundwater and Surface Water Monitoring Report

## Camden Gas Project

Prepared for AGL Upstream Investments Pty Ltd

October 2023

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AGL Upstream Investments Pty Ltd

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# Executive Summary

AGL Upstream Investments Pty Ltd (AGL) owns and operated the Camden Gas Project (CGP) located in the Macarthur Region, 65 kilometres (km) southwest of Sydney, NSW. The CGP produced natural gas from coal seams for the Sydney region from 2001 until August 2023 and consisted of 144 gas wells (of which, 26 were still operational as of 30 June 2023). The target coal seams are the Bulli and Balgownie Coal Seams within the Illawarra Coal Measures at depths of approximately 550–700 metres below ground level (mbgl). Following final production at the Rosalind Park Gas Plant in August 2023, the remaining gas wells are no longer producing and are being progressively plugged and abandoned.

The 2022–2023 CGP groundwater monitoring network comprises two nested monitoring sites (seven monitoring bores) targeting the alluvium near the Nepean River, and the Hawkesbury Sandstone overlying the target coal seams: Menangle Park (monitored since June 2013) and Glenlee (monitored since February 2014). Groundwater levels have been recorded at six hourly intervals and water quality data have been collected on a six monthly basis during the monitoring year. Four monitoring bores at Denham Court were monitored from 2011 to 2016 before being decommissioned at the landowners' request. The final water quality monitoring was undertaken in April 2016 and groundwater level data was available until October 2016. Denham Court was located 12 km north from the CGP and acted as a control and background monitoring location (Figure 1.1).

Surface water is monitored at one monitoring location along the Nepean River near the Menangle Park site for both surface water quality and water level. River levels are recorded at three hourly intervals, water quality data was collected on twice during the 2022–2023 monitoring year. This report presents an assessment of water level and water quality data from the groundwater monitoring network and from the Nepean River for the period up to 30 June 2023, with an emphasis on data obtained during the past 12 months.

Groundwater level in the Nepean River alluvium is shallow and shows a direct response to rainfall and flood events. Groundwater levels in each of the Hawkesbury Sandstone aquifers are shallow (approximately 8 mbgl to 15 mbgl) and follow similar trends. There is no apparent response to individual rainfall events at the Glenlee site, while a clear response to rainfall events can be observed at the Menangle Park site. Recorded groundwater levels during the 2022–2023 monitoring year were comparable to groundwater levels recorded during previous monitoring years and consistent with the climatic variations at the Menangle Park site. A stable trend in groundwater level can be observed at the deep Glenlee monitoring bore.

Groundwater sampled from the alluvium at the Menangle Park site is fresh to marginal, and generally has low dissolved metal concentrations. Groundwater sampled from the Hawkesbury Sandstone is fresh to marginal at the Menangle Park site, but during the year became brackish (instead of slightly saline) at the Glenlee site. Dissolved metal concentrations in the Hawkesbury Sandstone are generally low. Minor detections of hydrocarbons were reported at GLMB03 and MPMB02. Dissolved methane was detected at all monitoring bores except MPMB01. Toluene was observed at the Glenlee site. These are all natural occurrences. Overall, groundwater quality during the 2022–2023 monitoring year was generally comparable to that measured during previous monitoring years.

Based on available data, there are no observable impacts to groundwater levels or quality that are attributable to the CSG operations. There is no evidence of connectivity between the shallower monitored zones and the coal seams (except for the potential natural migration of gases through the Narrabeen Group strata). This corroborates the conceptual model (Parsons Brinckerhoff 2011) indicating the presence of extensive and thick claystone formations (aquitards and aquicludes) between the Hawkesbury Sandstone and coal seams restricts depressurisation and impedes the vertical flow of groundwater.

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# 1 Introduction

## 1.1 Background

AGL Upstream Investments Pty Ltd (AGL) owns and operated the Camden Gas Project (CGP) located in the Macarthur region, 65 kilometres (km) southwest of Sydney, NSW. The CGP produced natural gas from coal seams for the Sydney region from 2001 until August 2023 and consisted of 144 gas wells (of which, 26 were operational on 30 June 2023) within the Stage 1 and Stage 2 areas (Figure 1.1). The target coal seams are the Bulli and Balgownie Coal Seams within the Illawarra Coal Measures at depths of approximately 550–700 metres below ground level (mbgl). Following final production at the Rosalind Park Gas Plant in August 2023, the remaining gas wells are no longer producing and are being progressively plugged and abandoned.

EMM Consulting Pty Limited (EMM) was engaged by AGL to compile groundwater and surface water monitoring results collected between 1 July 2022 and 30 June 2023 (the 2022–2023 monitoring year) and to analyse the data and trends with reference to the CGP activities. Installation of a dedicated water monitoring network of 11 monitoring bores occurred between October 2011 and February 2014. The current groundwater monitoring network comprises seven dedicated monitoring bores in the alluvium, the Ashfield Shale, and the Hawkesbury Sandstone at two sites. The collection of groundwater level and groundwater quality data commenced in October 2011. Groundwater levels have been recorded at six-hourly intervals and, following one initial sample in November 2011, water quality data were collected on a quarterly basis between May 2013 and April 2015 and on a six-monthly basis from April 2015 onwards. In addition, one surface water monitoring location has been sampled for water quality on two occasions during the 2022–2023 monitoring year.

This report contains an evaluation of the data obtained during the 2022–2023 monitoring year, with comparison to the data obtained during the previous monitoring years (EMM 2022, 2021, 2020, 2019, 2018, 2017, and 2016; Parsons Brinckerhoff 2012, 2013a, 2014a, 2014b and 2015e).

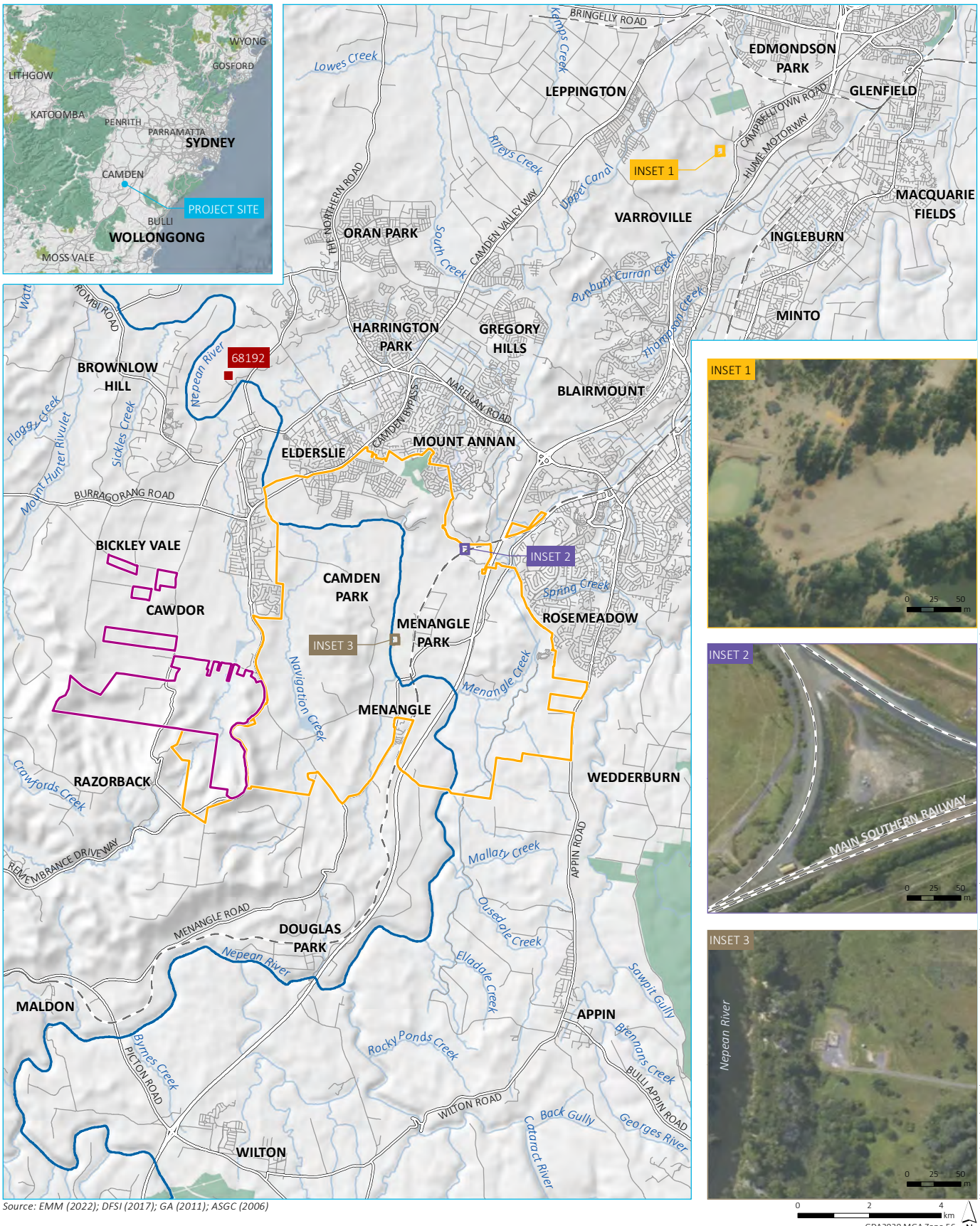
Monitoring was undertaken at two sites within the CGP during the 2022 - 2023 monitoring year: Menangle Park and Glenlee (Figure 1.1). Four monitoring bores at Denham Court (RMB01, RMB02, RMB03, RMB04) were monitored from 2011 to 2016 before being decommissioned at the landowners' request. The final water quality monitoring was undertaken in April 2016 and groundwater level data was available until October 2016. Denham Court was located 12 km from the CGP and acted as a control and background monitoring location (Figure 1.1).

The objective of the original groundwater monitoring program was to determine whether the CSG activities (primarily the local depressurisation of the deep coal seam water bearing zones) were impacting the shallow beneficial aquifers in the Hawkesbury Sandstone and alluvium of the Nepean River. The groundwater monitoring program provides water levels and water quality data and trends for each of the shallow groundwater systems of the region, in areas within (and previously in areas also distant from) the operating CGP.

## 1.2 Scope of work for the 2022–2023 monitoring program

This report presents and interprets groundwater level and groundwater quality data collected since monitoring began at each of the established sites, with emphasis on the data obtained during the 2022–2023 monitoring year. The scope of works was to:

- conduct groundwater monitoring, including six hourly groundwater level measurements and two groundwater quality sampling events (November 2022 and April 2023) testing for field parameters, major cations and anions, dissolved metals, nutrients, dissolved methane, and other hydrocarbons
- conduct surface water quality sampling events (November 2022 and April 2023) at one location (the Nepean River near the Menangle Park site as shown on Figure 1.1)
- analyse and interpret water level and water quality results with reference to the conceptual model, where relevant
- establish whether there are any observable impacts from coal seam gas (CSG) activities within the shallow aquifers.




Source: EMM (2022); DFSI (2017); GA (2011); ASGC (2006)

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KEY

- Camden Gas Project Stage 1
- Camden Gas Project Stage 2
- Nepean River
- BOM weather station
- Groundwater monitoring bore
- Decommissioned groundwater monitoring bore
- Rail line
- Major road
- Minor road
- Named watercourse
- Named waterbody
- NPWS reserve

Groundwater monitoring locations

AGL Camden Gas Project
2022-2023 Groundwater Monitoring Report
Figure 1.1

# 2 Site characterisation

## 2.1 Rainfall

The nearest Bureau of Meteorology (BoM) weather station with consistent historical climate measurements is located at Camden airport (BoM site number 68192), approximately 2.5 km northwest of the Stage 2 area (Figure 1.1). On occasions where BoM station 68192 data is unavailable data is patched from nearby stations (Queensland Government 2023). Mean temperatures at Camden airport range from 17.4°C in July to 29.7°C in January. The average annual rainfall is 789 millimetres (mm), July receives the least rain, with a mean rainfall of 39 mm, while February receives the most rain, with a mean rainfall of 104 mm (Queensland Government 2023). This is displayed in Figure 2.1.

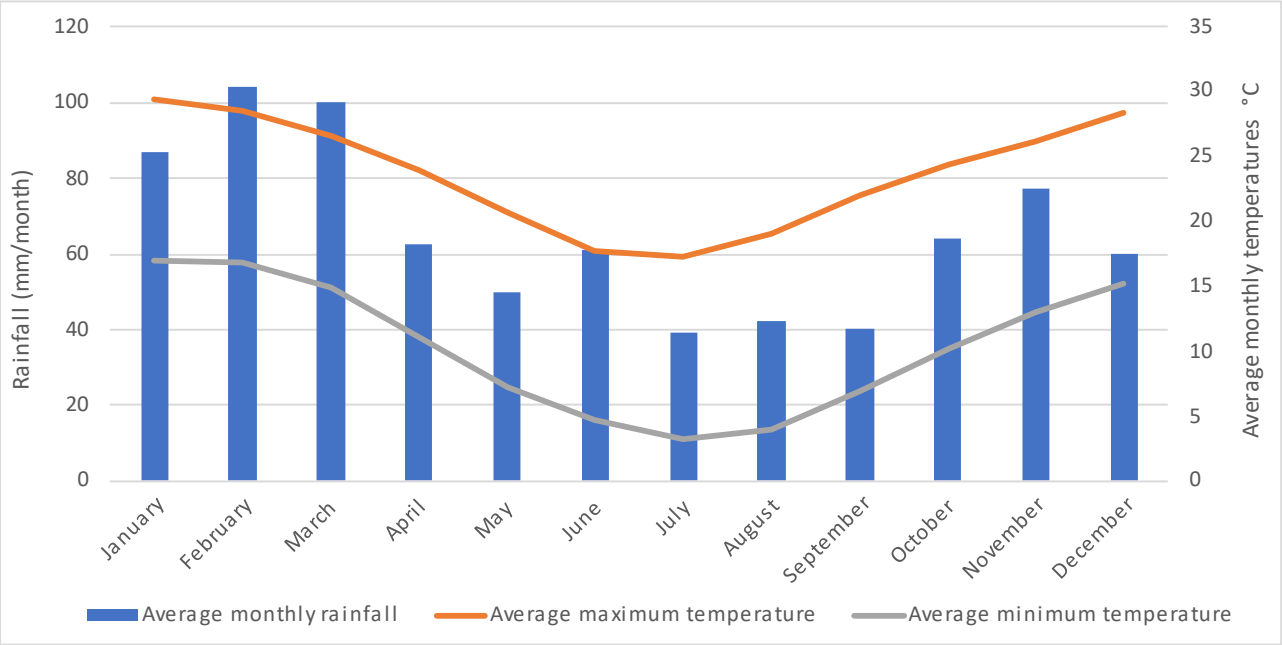



**Figure 2.1** **Average monthly temperature and rainfall at BoM station 68192 (Camden airport) from January 1971 to July 2023**

Cumulative deviation from daily rainfall mean (CDFM) rainfall for Camden airport is plotted in Figure 2.2. Long-term CDFM is generated by subtracting daily rainfall from the average daily rainfall (1971–2023) and then accumulating these residuals. Periods of below average rainfall are represented as downward trending slopes while periods of above average rainfall are represented as upward trending slopes.

The cumulative deviation plot (Figure 2.2) shows a relatively wet period between 1971 and 1992 (except for a few drought years in the early 1980s). Drier conditions then prevailed with the Millenium drought extending to 2007. A period of average rainfall followed from 2007 to 2017. 2018 and 2019 were unprecedented drought years in NSW. Since 2020, rainfall has been above the long-term average, with the cumulative deviation plot indicating a wet period.

Daily rainfall for the 2022–2023 monitoring year indicates a wet start in July 2022 followed by a drier period until October 2022. October 2022 to February 2023 was a wet period, the remainder of the monitoring year has experienced minimal rainfall.

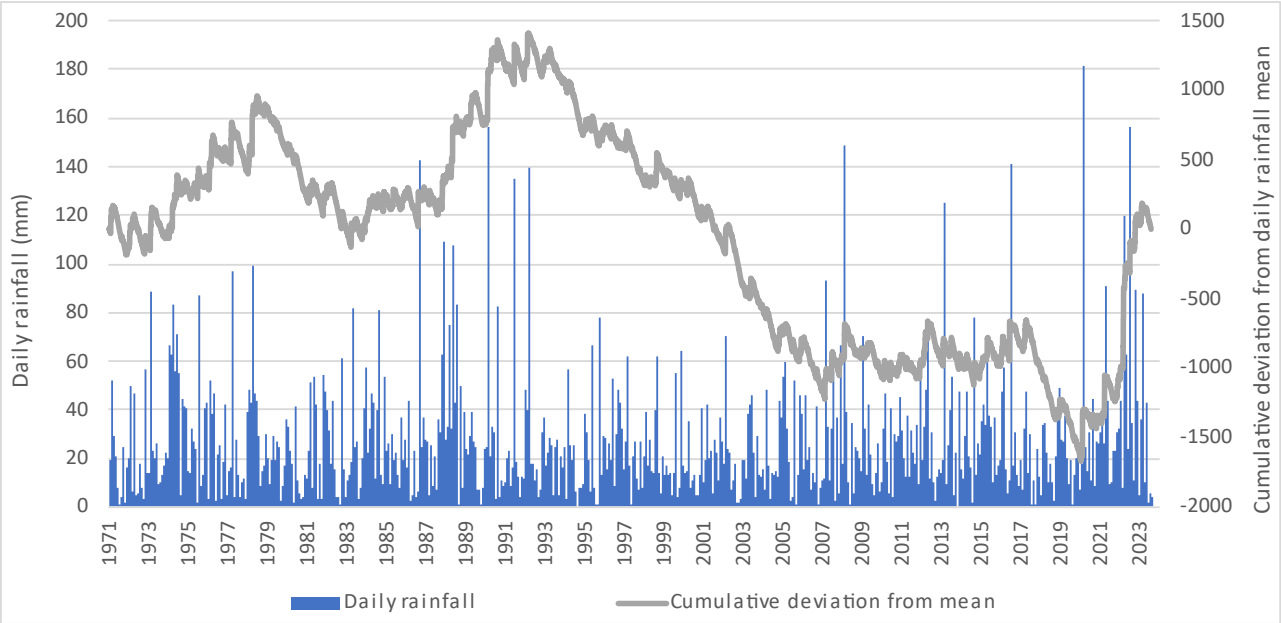



**Figure 2.2 Cumulative deviation from daily rainfall mean**

## 2.2 Surface hydrology

The CGP is located within two catchment areas: the Hawkesbury Nepean Catchment and the Sydney Metropolitan Catchment. The major surface hydrology features in the CGP are the Nepean River and its tributaries, which meander in a south to north direction within the project area; and the Georges River, which flows in a northerly direction, in the south-east of the project area.

Small farm dams are common in rural areas and provide water for stock, limited garden and irrigation purposes. Dams are replenished by rainfall and runoff, although some seepage flow through the weathered soil profiles occurs after long wet periods. Dams and seepage flows are not related to the regional groundwater systems. There are no known springs in the CGP area.

## 2.3 Geological setting

The CGP is located within the Southern Coalfield of the Sydney Geological Basin. The Basin is primarily a Permo-Triassic sedimentary rock sequence (Parkin 2002) and is underlain by undifferentiated sediments of Carboniferous and Devonian age. The stratigraphy of the CGP in the Camden-Campbelltown area is summarised in Table 2.1. The geology and structure of the CGP is shown on Figure 2.3.

The Illawarra Coal Measures is the economic sequence of interest for CSG development in the area, and consists of interbedded sandstone, shale and coal seams, with a thickness of approximately 300 m. The upper sections of the Permian Illawarra Coal Measures (Sydney Subgroup) contain the major coal seams: Bulli Coal Seam, Balgownie Coal Seam, Wongawilli Coal Seam, and Tongarra Coal Seam. The seams targeted for CSG production within the CGP are the Bulli and Balgownie coal seams, both of which are 2 m to 5 m thick within the CGP.

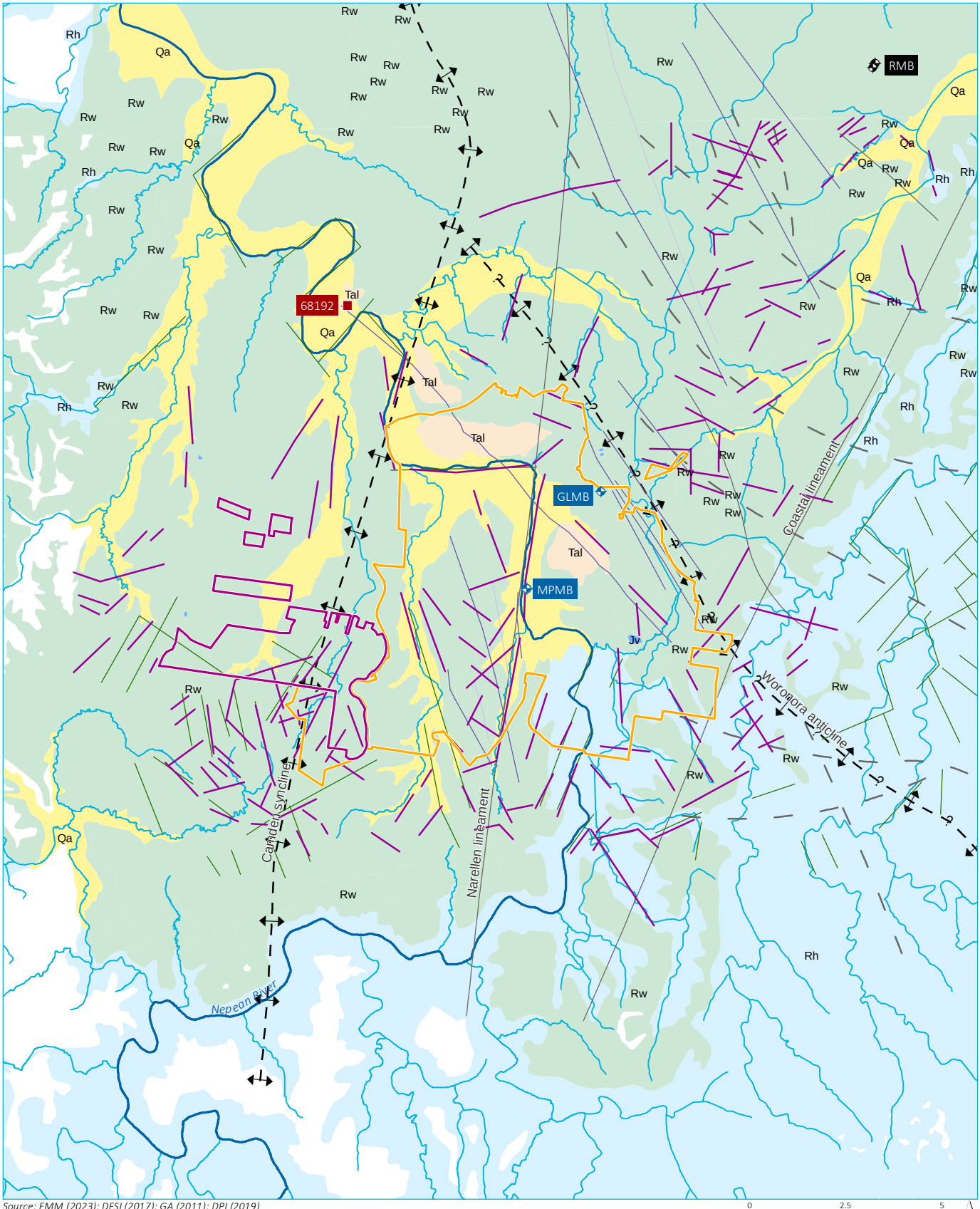
The Illawarra Coal Measures is overlain by Triassic sandstones, siltstones and claystones of the Narrabeen Group and the Hawkesbury Sandstone. Overlying the Hawkesbury Sandstone is the Triassic Wianamatta Group shales which comprise most of the surficial geology (where thin alluvial deposits are not present).

Structurally, the CGP area and surrounds are dominated by the north-northeast plunging Camden Syncline, which is a broad and gentle warp structure (Alder et al. 1991 and Bray et al. 2010). The Camden Syncline is bounded in the west and truncated in the south-west by the north-south trending Nepean Structural Zone, part of the Lapstone Structural Complex.

The CGP is relatively unaffected by major faulting apart from a set of NW-NNW trending faults associated with the Lapstone Monocline Structure (Alder et al. 1991 and Blevin et al. 2007). These faults have been identified from exploration and 2D seismic studies and they have been identified as high-angle, low to moderate displacement normal faults (Blevin et al. 2007). Many of these features intersect coal seams however very few, if any, affect the entire stratigraphic sequence and display no expression at surface.

| Period | Group | Sub-group | Formation | Description | Average thickness (m)[1] |
|---|---|---|---|---|---|
| Quaternary | | | Alluvium | Quartz and lithic 'fluvial' sand, silt and clay. | <20 |
| Tertiary | | | Alluvium | High level alluvium. | |
| Triassic | Wianamatta Group | | Bringelly Shale | Shale, carbonaceous claystone, laminate, lithic sandstone, rare coal. | 80 (top eroded) |
| | | | Minchinbury Shale | Fine to medium-grained lithic sandstone. | - |
| | | | Ashfield Shale[2] | Black to light grey shale and laminate (Bembrick et al. 1987). | - |
| | Mittagong Formation | | | Dark grey to grey alternating beds of shale laminate, siltstone and quartzose sandstone (Alder et al. 1991). | 11 |
| | Hawkesbury Sandstone | | | Massive or thickly bedded quartzose sandstone with siltstone, claystone and grey shale lenses up to several metres thick (Bowman 1974; Moffitt 2000). | 173 |
| | Narrabeen Group | Gosford Sub-group | Newport Formation | Fine-grained sandstone (less than 3 m thick) interbedded with light to dark grey, fine-grained sandstones, siltstones and minor claystones (Bowman 1974). | 35 |
| | | | Garie Formation | Cream, massive, kaolinite-rich pelletal claystone, which grades upwards to grey, slightly carbonaceous claystone containing plant fossils at the base of the Newport Formation (Moffitt 2000). | 8 |
| | | Clifton Sub-group | Bald Hill Claystone[2] | Massive chocolate coloured and cream pelletal claystones and mudstones, and occasional fine-grained channel sand units (Moffitt 2000). | 34 |
| | | | Bulgo Sandstone | Thickly bedded sandstone with intercalated siltstone and claystone bands up to 3 m thick (Moffitt 2000). | 251 |
| | | | Stanwell Park Claystone[2] | Red-green-grey shale and quartz sandstone (Moffitt 1999). | 36 |
| | | | Scarborough Sandstone | Quartz-lithic sandstone, pebbly in part (Moffitt 1999). | 20 |
| | | | Wombarra Claystone[2] | Grey shale and minor quartz-lithic sandstone (Moffitt 1999). | 32 |
| Permian | | Sydney Sub-group | Bulli Coal Seam | Coal interbedded with shale, quartz-lithic sandstone, conglomerate, chert, torbanite seams and occasionally carbonaceous mudstone (Moffitt 2000). | 4 |
| | | | Loddon Sandstone | | 12 |
| | | | Balmain Coal Member | | 24 |
| | | | Balgownie Coal Seam | | 2 |
| | | | (Remaining Sydney Subgroup) | | |
| | | Cumberland Sub-group | | | |
| | Shoalhaven Group | | | Sandstone, siltstone, shale, polymictic conglomerate, claystone; rare tuff, carbonate, evaporate. | |
| Palaeozoic | Lachlan Fold Belt | | | Intensely folded and faulted slates, phyllites, quartzite sandstones and minor limestones of Ordovician to Silurian age (Moffitt 2000). | |

*Notes:* *1. Average thickness from available well data within CGP (AGL 2013).*
*2. Aquitard or aquiclude.*




*Source: EMM (2023); DFSI (2017); GA (2011); DPI (2019)*

0 2.5 5 km

GDA 1994 MGA Zone 56

N

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Camden Gas Project Stage 1
Camden Gas Project Stage 2
Nepean River

Groundwater monitoring
Decommissioned groundwater monitoring bore
BOM weather station

Certain fault *(AGL Energy)*
Possible fault *(AGL Energy)*
Fault *(Geology 100k DPI / Mauger et al; Southern Coal Fields map)*
Interpreted Fault *(Geology 100k DPI / Mauger et al; Southern Coal Fields map)*
Syncline
Anticline
Lineament *(CSIRO 1:80,000 Landsat interpreted fracture analysis)*
Lineaments (air photo interpreted; CSIRO)

250k
Jv - Basalt, dolerite & volcanic breccia
Qa - Quaternary alluvium
Tal - High level gravels
Rw - Bringelly Shale, Minchinbury Sandstone & Ashfield Shale
Rh - Hawkesbury Sandstone

# Surface geology

AGL Camden Gas Project
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Figure 2.3

## 2.4 Hydrogeological setting

The Southern Coalfield is located within the area covered by the Water Sharing Plan for the Greater Metropolitan Region Groundwater Sources. The CGP is located across two porous rock water sources – the Sydney Basin Nepean water source to the south, and the Sydney Basin Central water source to the north (NOW 2011). These water sources are separated by the Nepean River, and each includes all the groundwater contained in the Permian and Triassic sedimentary rocks. There is no differentiation between the fresh/marginal quality groundwater contained in the Triassic aquifers and the brackish/saline groundwater contained in the deeper Permian aquifers/water bearing zones.

The recognised hydrogeological units within the CGP are shown in Table 2.2.

**Table 2.2 Hydrogeological units within the CGP area**

| Hydrogeological unit | Aquifer type |
|---|---|
| Alluvium | Unconfined aquifer |
| Ashfield Shale (Wianamatta Group) | Aquitard or unconfined/perched |
| Hawkesbury Sandstone | Unconfined/semi-confined aquifer |
| Bald Hill Claystone (Narrabeen Group) | Aquitard/aquiclude |
| Bulgo Sandstone (Narrabeen Group) | Confined aquifer |
| Stanwell Park Claystone (Narrabeen Group) | Aquitard/aquiclude |
| Scarborough Sandstone (Narrabeen Group) | Confined aquifer |
| Wombarra Claystone (Narrabeen Group) | Aquitard/aquiclude |
| Illawarra Coal Measures | Confined water bearing zones |

Alluvium occurs along the floodplain of the Nepean River and its tributaries. Alluvial deposits are generally thin, discontinuous (except along the Nepean River) and relatively permeable. The unconfined groundwater systems within the alluvium are responsive to rainfall and stream flow and form a minor beneficial groundwater system. There are also small terrace areas of Tertiary alluvium within the CGP area that contain localised groundwater systems of variable quality (Figure 2.3).

The Ashfield Shale which outcrops across the majority of the CGP is generally of low permeability and yield; however small water bearing zones are sometimes present. Water is typically brackish to saline, especially in low relief areas of western Sydney (due to the marine depositional environment of the shales) (Old 1942). Average bore yields are 1.3 litres per second (L/s) (AGL 2013).

The Hawkesbury Sandstone and Narrabeen Group form part of an extensive generally semi-confined regional groundwater system within the Sydney Basin sequence. The Hawkesbury Sandstone is more widely exploited for groundwater than the overlying and underlying formations, being of generally higher yield, better water quality and either outcropping or buried to shallow depths over the basin. Groundwater flow within the Hawkesbury Sandstone and Narrabeen Group groundwater systems at a regional scale has a major horizontal component, due to the alternation of sheet and massive facies, with some vertical leakage. The Hawkesbury Sandstone and Narrabeen Group are characterised by dual porosity. Primary porosity is connected void space between sand grains, secondary porosity is from rock defects such as joints, fractures, faults and bedding planes. Superior bore yield in the sandstone aquifers of the Hawkesbury Sandstone is often associated with secondary porosity (major fractures or a high fracture zone density). Yields of up to 40 L/s have been recorded in bores intercepting these zones within deformed areas of the Sydney Basin (McLean and Ross 2009).

Typically, within the CGP area bore yields within the Hawkesbury Sandstone rarely exceed 2 L/s (SCA 2007 and Ross 2014). The Narrabeen Group aquifer is generally not used as a water source as it is considered poorer quality and lower permeability compared to the overlying Hawkesbury Sandstone groundwater systems (Madden 2009).

Yields are highest and salinity is freshest south of the Nepean River because of proximity to recharge areas. North of the Nepean River, the groundwater within the Hawkesbury Sandstone is brackish/slightly saline. Groundwater is used for irrigation and domestic purposes to the south and immediately to the north of the Nepean River; however, further north of the river, groundwater quality is typically only suitable for stock (AGL 2013).

The coal seams present in the Illawarra Coal Measures contain both regionally and locally minor water bearing zones. Due to the greater depth of burial of the coal measures and fine-grained nature of the sedimentary rocks, the permeability is generally lower than the overlying sandstone aquifers. Recharge to the Permian water bearing zones is likely to occur where formations are outcropping, which occurs at a significant distance to the south of the CGP. Salinity of the water bearing zones is typically brackish to moderately saline.

Within the CGP, there is limited rainfall recharge to the Ashfield Shale with most rainfall generating runoff and overland flow. Some leakage through the Ashfield Shale into the Hawkesbury Sandstone is expected where there is adequate fracture spacing. It is assumed that most recharge to the sandstone aquifers occurs via lateral groundwater through-flow from upgradient areas to the south. There is insufficient data within the CGP to define local flow paths and natural discharge zones. Regionally, groundwater flow is predominantly towards the north or northeast, eventually discharging via the Georges, Parramatta or Hawkesbury River systems. Although groundwater-surface water interactions are not well defined in the area, there may be a small base flow or interflow discharge component to local stream headwaters during wet periods (Parsons Brinckerhoff 2010).

# 3 Monitoring program

## 3.1 Monitoring network

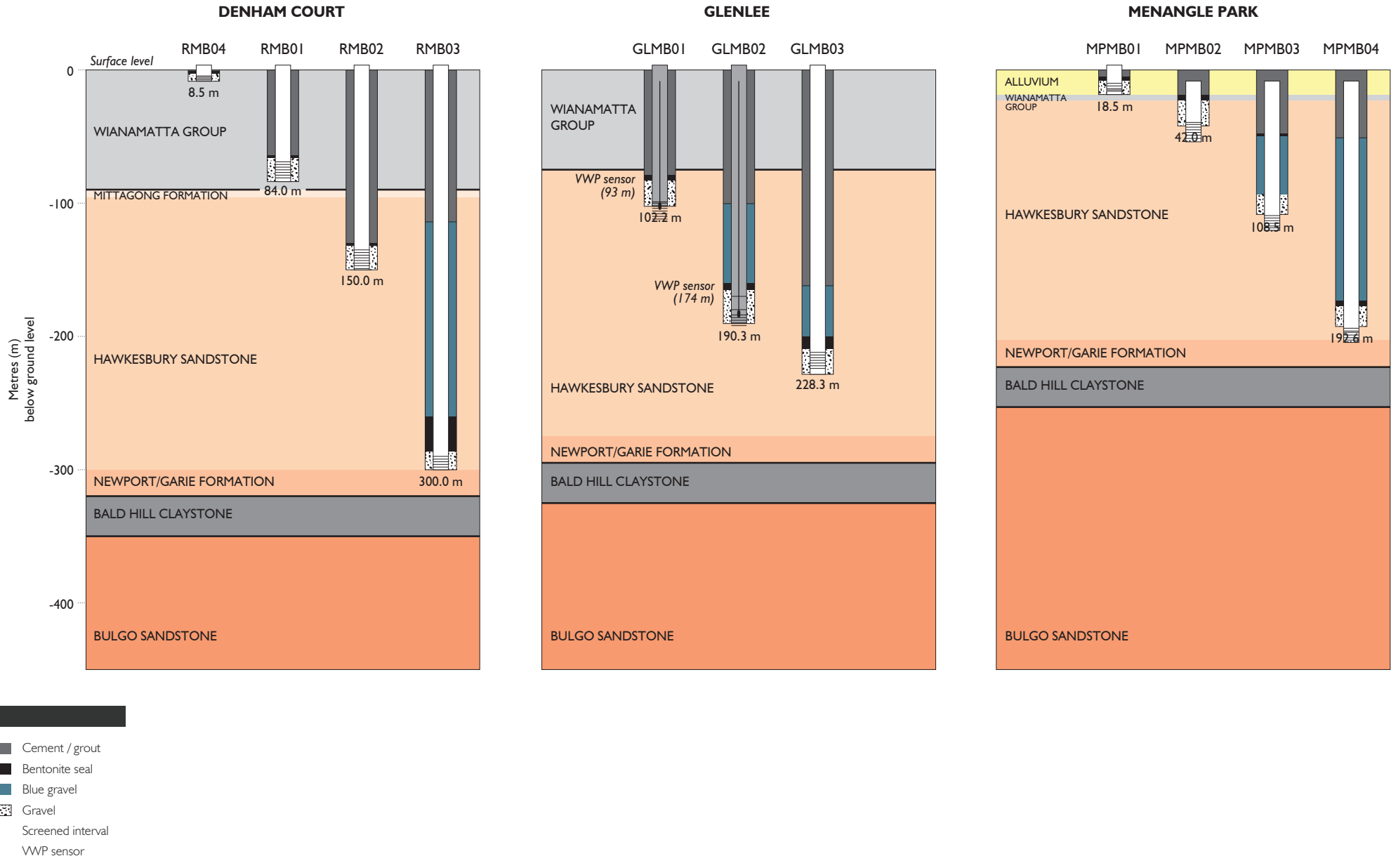
Construction details for the original 11 monitoring bores within the CGP area are presented in Table 3.1 and Figure 3.1. The current monitoring network consists of seven monitoring bores at the Menangle Park and Glenlee locations as the Denham Court monitoring bores (RMB01-04) were decommissioned in October 2016.

**Table 3.1 Groundwater monitoring bore details**

| Monitoring bore | Location | Total depth [1](mbgl) | Screened depth [1](mbgl) | Lithology | Formation |
|---|---|---|---|---|---|
| RMB01[2] | Denham Court | 84.0 | 69.0–81.0 | Siltstone | Ashfield Shale |
| RMB02[2] | Denham Court | 150.0 | 135.0–147.0 | Sandstone | Hawkesbury Sandstone (upper) |
| RMB03[2] | Denham Court | 300.0 | 290.0–299.0 | Sandstone | Hawkesbury Sandstone (lower) |
| RMB04[2] | Denham Court | 8.5 | 4.5–7.5 | Clay/siltstone | Ashfield Shale (weathered) |
| MPMB01 | Menangle Park | 18.5 | 10.0–16.0 | Clay | Alluvium |
| MPMB02 | Menangle Park | 42.0 | 27.4–39.4 | Sandstone | Hawkesbury Sandstone (upper) |
| MPMB03 | Menangle Park | 108.5 | 97.0–106.0 | Sandstone | Hawkesbury Sandstone (middle) |
| MPMB04 | Menangle Park | 192.6 | 182.6–191.6 | Sandstone | Hawkesbury Sandstone (lower) |
| GLMB01[3] | Glenlee | 102.2 | 87.0–99.0[1] | Sandstone | Hawkesbury Sandstone (upper) |
| GLMB02[3] | Glenlee | 190.3 | 168.0–180.0[1] | Sandstone | Hawkesbury Sandstone (middle) |
| GLMB03 | Glenlee | 228.3 | 212.0–224.0 | Sandstone | Hawkesbury Sandstone (lower) |

Notes:

1. mbgl – metres below ground level.
2. Monitoring bores RMB01-04 were decommissioned early October 2016 and are no longer monitored.
3. Monitoring bores GLMB01 and GLMB02 were converted to vibrating wire piezometers (VWP) on 12 March 2015. The VWP sensors are installed at 93 mbgl and 174 mbgl respectively.




Nested groundwater monitoring bores at the Denham Court, Glenlee, and Menangle Park sites
Camden Gas Project
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Figure 3.1

## 3.2 Water level monitoring

Pressure transducers (Solinst Levelogger (M30) dataloggers) are suspended from a galvanised steel wire in the water column and programmed to record a groundwater level every six hours. To verify the level recorded by the dataloggers, manual measurements are recorded periodically using an electronic dip meter. The monitoring start date of the datalogger data at each monitoring bores is shown in Table 3.2.

A barometric logger installed above the water table at Menangle Park monitoring bore MPMB01 records changes in atmospheric pressure. Data from this logger are used to correct for the effects of changing barometric pressure on water level loggers in the adjacent monitoring bores.

**Table 3.2 Summary of water level monitoring locations and data collection periods**

| Monitoring locations | Monitoring period |
|---|---|
| Denham Court (RMB01, RMB02, RMB03, RMB04) | November 2011 (June 2013 for RMB04) to October 2016 |
| Menangle Park (MPMB01, MPMB02, MPMB03, MPMB04) | June 2013 to present |
| Glenlee (GLMB01, GLMB02, GLMB03) | February 2014 to March 2015 at GLMB01 and GLMB02<br>February 2014 to present at GLMB03 |

The vibrating wire piezometer (VWP) sensors at GLMB01 and GLMB02, which were installed in March 2015, are interpreted to have stabilised at lower piezometric pressure head levels compared with water levels observed in the monitoring bores prior to conversion to VWPs. The data since March 2015 is not considered to be representative of water levels in the shallow sandstone aquifers. It is possible that during the conversion of the monitoring bores to VWPs the grout did not fully penetrate the gravel pack of the former standpipe monitoring bore, creating an unnatural pressure gradient adjacent to the piezometer and bore wall. The gravel pack has a much higher hydraulic conductivity (K) (both horizontal and vertical K) than the grouted VWP sensor and the surrounding formation. In this case the higher vertical gradient in the gravel pack may be responsible for reducing horizontal pressure on the sensor hence the observed pressure difference.

Water level monitoring paused briefly at GLMB03 between October 2021 and October 2022 due to borehole clogging and the detection of elevated levels of naturally occurring hazardous gases present within the bore. The monitoring bore was reconditioned, and water levels have since stabilised.

### 3.2.1 Surface water levels

Water levels in the Nepean River are monitored by Water NSW (gauging station 212238) using automatic dataloggers close to the Menangle Park site (Figure 1.1). These water levels are included in the Menangle Park hydrograph for comparison (refer to Figure 4.1). River height is derived from automated telemetric real-time data that have been processed to remove erroneous data (WaterNSW 2023).

## 3.3 Water quality monitoring

Groundwater sampling was undertaken on 11 occasions at Denham Court (November 2011 to October 2016), 24 occasions at Menangle Park (since August 2013) and 21 occasions at Glenlee (since February 2014) with details provided in Table 3.3.

Surface water quality sampling has been undertaken on 14 occasions (since 2013) at the Nepean River beside the Menangle Park groundwater monitoring site.

Groundwater and surface water sampling was undertaken twice in the 2022–2023 monitoring year at Menangle Park, Glenlee and the Nepean River on 27 November 2022 and 4 April 2023 (with supplementary monitoring for Menangle Park, Glenlee and the Nepean River undertaken on 24 May and 27 June 2023).

Sampling of groundwater and surface water was undertaken by Parsons Brinckerhoff from October 2011 through to April 2016. Sampling from October 2016 onwards has been undertaken by EMM.

## Table 3.3 Groundwater quality program

| Sampling event | Denham Court | | | | Menangle Park | | | | Glenlee | | | Reference report |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | RMB01 | RMB02 | RMB03 | RMB04 | MPMB01 | MPMB02 | MPMB03 | MPMB04 | GLMB01 | GLMB02 | GLMB03 | |
| November 2011 | IW | ✓ | ✓ | ✓ | - | - | - | - | - | - | - | Parsons Brinckerhoff (2012) |
| May 2013 | IW | ✓ | ✓ | ✓ | - | - | - | - | - | - | - | Parsons Brinckerhoff (2013a) |
| August 2013 | IW | IW | ✓ | ✓ | ✓ | ✓ | ✓ | Blocked | - | - | - | Parsons Brinckerhoff (2013c) |
| November 2013 | ✓ | ✓ | ✓ | IW | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | Parsons Brinckerhoff (2014c) |
| February 2014 | IW | IW | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | Parsons Brinckerhoff (2014d) |
| May 2014 | IW | IW | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | Parsons Brinckerhoff (2014e) |
| August 2014 | IW | IW | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | Parsons Brinckerhoff (2014f) |
| January 2015 | IW | IW | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | Parsons Brinckerhoff (2015a) |
| April 2015 | IW | IW | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | Converted to vibrating wire piezometer (VWP) therefore no longer sampled. | | ✓ | Parsons Brinckerhoff (2015b) |
| October 2015 | ✓ | ✓ | ✓ | IW | ✓ | ✓ | ✓ | ✓ | | | ✓ | Parsons Brinckerhoff (2015d) |
| April 2016 | ✓ | ✓ | ✓ | IW | ✓ | ✓ | ✓ | ✓ | | | ✓ | Parsons Brinckerhoff (2016a) |
| October 2016 | Denham Court bore sites decommissioned in October 2016 and no longer sampled. | | | | ✓ | ✓ | ✓ | ✓ | | | ✓ | EMM (2016) |
| April 2017 | | | | | ✓ | ✓ | ✓ | ✓ | | | ✓ | EMM (2017) |
| October 2017 | | | | | ✓ | ✓ | ✓ | ✓ | | | ✓ | EMM (2017) |
| April 2018 | | | | | ✓ | ✓ | AS | AS | | | ✓ | EMM (2018) |
| October 2018 | | | | | ✓ | ✓ | ✓ | ✓ | | | ✓ | EMM (2018) |
| April 2019 | | | | | ✓ | ✓ | ✓ | ✓ | | | ✓ | EMM (2019) |
| October 2019 | | | | | ✓ | ✓ | ✓ | ✓ | | | ✓ | EMM (2019) |

## Table 3.3 Groundwater quality program

| Sampling event | Denham Court | | | | Menangle Park | | | | Glenlee | | | Reference report |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | RMB01 | RMB02 | RMB03 | RMB04 | MPMB01 | MPMB02 | MPMB03 | MPMB04 | GLMB01 | GLMB02 | GLMB03 | |
| April 2020 | | | | | ✓ | ✓ | ✓ | ✓ | | | ✓ | EMM (2020) |
| November 2020 | | | | | ✓ | ✓ | ✓ | ✓ | | | ✓ | EMM (2020) |
| April 2021 | | | | | ✓ | ✓ | ✓ | ✓ | | | ✓ | EMM (2021) |
| November 2021 | | | | | ✓ | ✓ | ✓ | ✓ | | | ✓ | EMM (2021) |
| April 2022 | | | | | ✓ | ✓ | ✓ | ✓ | | | Gas | EMM (2022a) |
| October 2022 | | | | | ✓ | ✓ | ✓ | ✓ | | | ✓ | EMM (2022b) |
| April 2023 | | | | | AS | AS | AS | AS | | | AS | EMM (2023) |

Notes:

√ = sampling occurred.

- = borehole not installed.

IW = Insufficient water to sample monitoring bore.

Blocked = MPMB04 not sampled due to blockage in monitoring bore (Parsons Brinckerhoff 2013b).

AS = Additional sampling. GLMB03, MPMB03, and MPMB04 were re-sampled on 24 April 2018 to include dissolved methane analysis. GLMB03 and MPMB01-04 were re-sampled on 24 May and 27 June 2023 for TPH, TRH, and BTEX.

Gas = GLMB03 was not sampled due to elevated levels of naturally occurring hazardous gases in this bore.

### 3.3.1 Sampling techniques

Two methods were used to obtain groundwater quality samples from the monitoring bores based on permeability of the screened formation, which was determined for each bore during hydraulic conductivity testing. In summary:

- a submersible 12 V pump is used at higher yielding bores MPMB01 and MPMB02
- a dedicated micro-purge™ low flow sampling pump was used at lower yielding monitoring bores and selected deeper bores: MPMB03, MPMB04 and GLMB03.

Where a submersible pump was used, a minimum of three well volumes was purged from the monitoring bore prior to sampling to allow a representative groundwater sample to be collected. Water quality parameters were measured during and immediately after purging to monitor water quality changes and to indicate representative groundwater suitable for sampling and analysis.

The micro-purge™ system allows groundwater to be drawn into the pump intake directly from the screened portion of the aquifer, eliminating the need to purge relatively large volumes of groundwater from these bores. Water quality parameters were monitored during the micro-purge™ pumping to ensure that a representative groundwater sample was collected.

Physicochemical parameters (pH, electrical conductivity (EC), and total dissolved solids (TDS)) were measured during and following purging using a calibrated hand-held water quality meter.

Surface water samples were taken at the riverbank using a telescopic sampler. The sample was collected from just below the water surface and approximately 1 m away from the riverbank.

### 3.3.2 Chemical analysis of water

Groundwater and surface water samples collected in the field are analysed for a broad chemical suite designed specifically to assess the chemical characteristics of the different water bearing zones at the monitoring sites. Table 3.4 details the analytical suite.

**Table 3.4 Analytical suite**

| Category | Parameters |
|---|---|
| Physicochemical parameters (measured in the field) | Electrical Conductivity (EC), pH, Total Dissolved Solids (TDS) |
| General parameters | EC, pH[1] , TDS |
| Major ions | Cations (calcium, magnesium, sodium, potassium)<br>Anions (chloride, carbonate, bicarbonate, sulphate) |
| Dissolved metals and minor/trace elements | Aluminium, antimony, arsenic, barium, beryllium, boron, bromide, bromine, cadmium, chromium, cobalt, copper, iron, lead, manganese, mercury[2], molybdenum, nickel, selenium, strontium, uranium, vanadium, zinc |
| Other analytes | Fluoride, cyanide, silica (reactive), total suspended solids (TSS) |
| Nutrients | Ammonia, nitrate, nitrite, total organic carbon (TOC), phosphorus (total and reactive) |
| Hydrocarbons | Phenol compounds, polycyclic aromatic hydrocarbons (PAH), total recoverable hydrocarbons (TRH), benzene, toluene, ethyl benzene and xylenes (BTEX) |

**Table 3.4 Analytical suite**

| Category | Parameters |
|---|---|
| Dissolved gases | Methane |

Notes: 1. Generally analysed outside of recommended holding times.

2. Included in all samples after the August 2013 sampling event.

Samples requiring laboratory analysis were analysed by Australian Laboratory Services (ALS) in Smithfield, a NATA accredited laboratory. Water samples for laboratory analysis are collected in sample bottles specified by the laboratory, with appropriate preservation where required. Samples undergoing dissolved metal analysis are filtered through 0.45 µm filters in the field prior to collection.

### 3.3.3 Quality assurance and quality control (QA/QC)

#### i Field QA/QC

The following field sampling QA/QC procedures were applied to prevent cross-contamination and preserve sample integrity:

- samples were collected in clearly labelled bottles with appropriate preservation solutions
- samples were delivered to the laboratories within the specified holding times (except for pH)
- unstable parameters were analysed in the field (physicochemical parameters).

#### ii Laboratory QA/QC

The laboratories conduct their own internal QA/QC program to assess the repeatability of the analytical procedures and instrument accuracy. These programs include analysis of laboratory sample duplicates, spike samples, certified reference standards, surrogate standards/spikes and laboratory blanks. In addition, a duplicate sample is collected in the field to assess sampling and laboratory analysis accuracy.

# 4 Groundwater levels

Hydrographs showing groundwater levels and rainfall from the start of monitoring until May 2023 (the most recent collection of data) are presented for Menangle Park in Figure 4.1 and Glenlee in Figure 4.2. The Menangle Park site is located close to the Nepean River and river levels from Water NSW gauging station 212238 have been included in the hydrograph for comparison (Figure 4.1). Individual hydrographs for each monitoring bore are included in Appendix A.

As discussed in Section 3.2, VWPs were installed at GLMB01 and GLMB02 in March 2015. It is interpreted that VWP pressure stabilised at a lower piezometric pressure head level compared with pressures observed prior to conversion to VWPs. This discrepancy was likely caused by difficulties of establishing a complete seal and, therefore, effective communication between the grouted VWP and the rock formation. The absolute pressure values post-VWP installation are not representative of formation water levels. These data are presented on individual hydrographs for each monitoring bore are in Appendix A.

The datalogger at MPMB04 malfunctioned from May 2021 to April 2022 likely because of damage caused by floods overtopping the site. The datalogger was replaced in April 2022.

## 4.1 Temporal trends

### 4.1.1 Alluvium

Groundwater level in the alluvium (MPMB01) is shallow (less than 10 mbgl) and shows a direct response to rainfall and flood events (Figure 4.1). The 2022–2023 monitoring year began with several high rainfall events but there has been very little rainfall since February 2023. This is reflected in the Nepean River level and MPMB01 water level trends.

### 4.1.2 Ashfield Shale

Monitoring of the Ashfield Shale is no longer completed as the Denham Court bores have been decommissioned. Previous results have shown that groundwater levels in the Ashfield Shale (RMB01) are typically deep (approximately 80 mbgl) and showed no apparent response to rainfall (EMM 2017).

### 4.1.3 Hawkesbury Sandstone

At the Menangle Park site, located beside the Nepean River, groundwater levels are shallow (less than 10 mbgl) (Appendix A). An obvious response to rainfall and flood events was observed in the upper and middle Hawkesbury Sandstone (monitoring bores MPMB02 and MPMB03), while a slightly subdued and delayed response is generally observed in the lower Hawkesbury Sandstone (MPMB04) (Figure 4.1). A significant increase in groundwater level was recorded in all the monitoring bores in response to the flood events of March and April 2022.

At the Glenlee site, groundwater levels are shallow (less than 15 mbgl) (Appendix A). Data recorded at GLMB03 is relatively stable ranging from 71 to 72.3 mAHD with no response to rainfall (Figure 4.2). This differs from MPMB04 which is screened across the same aquifer and shows a muted response to rainfall.

The datalogger at GLMB03 malfunctioned from October 2020 – April 2021 resulting in six months of no water level data.

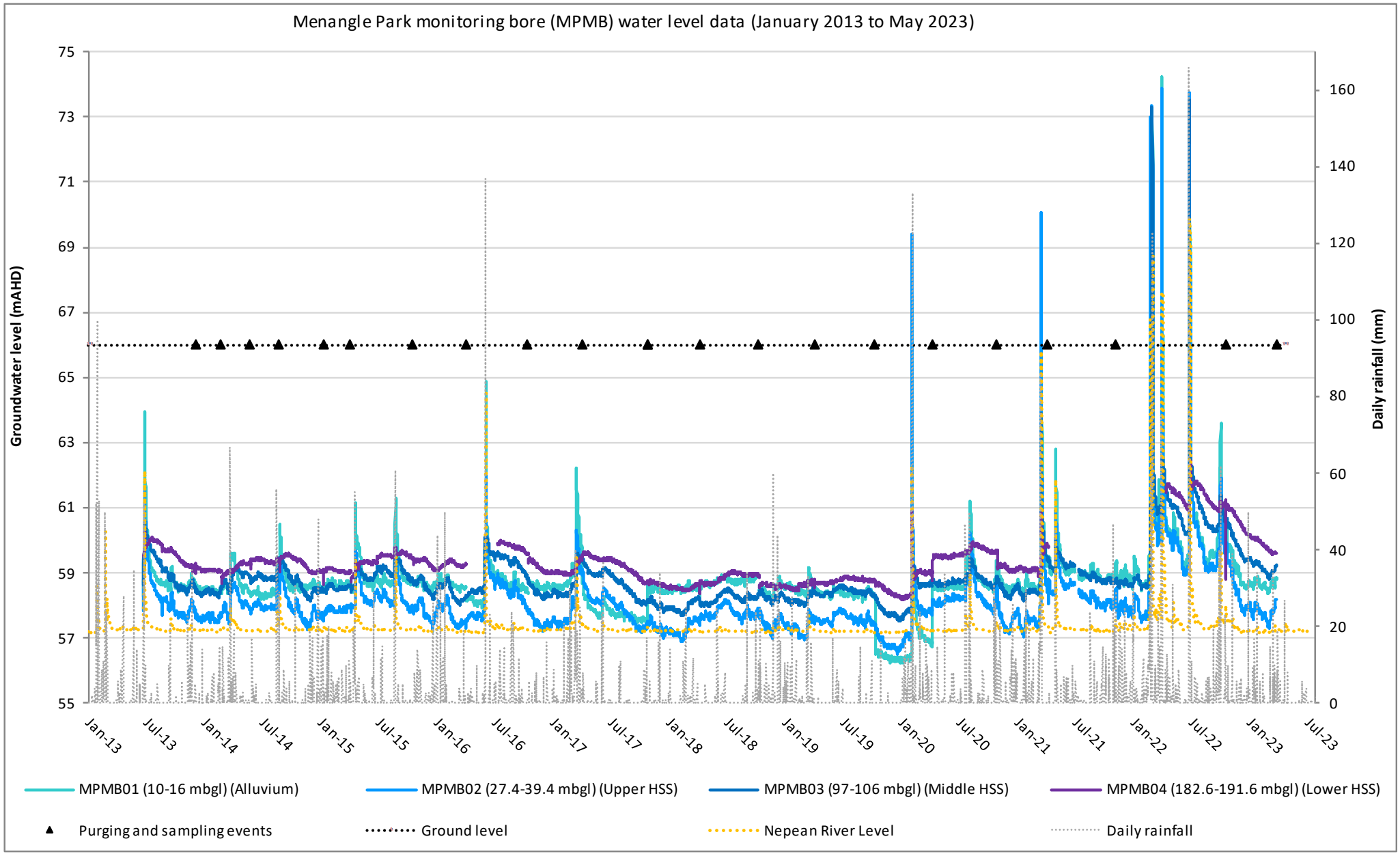



**Figure 4.1** **Groundwater levels at the Menangle Park site**

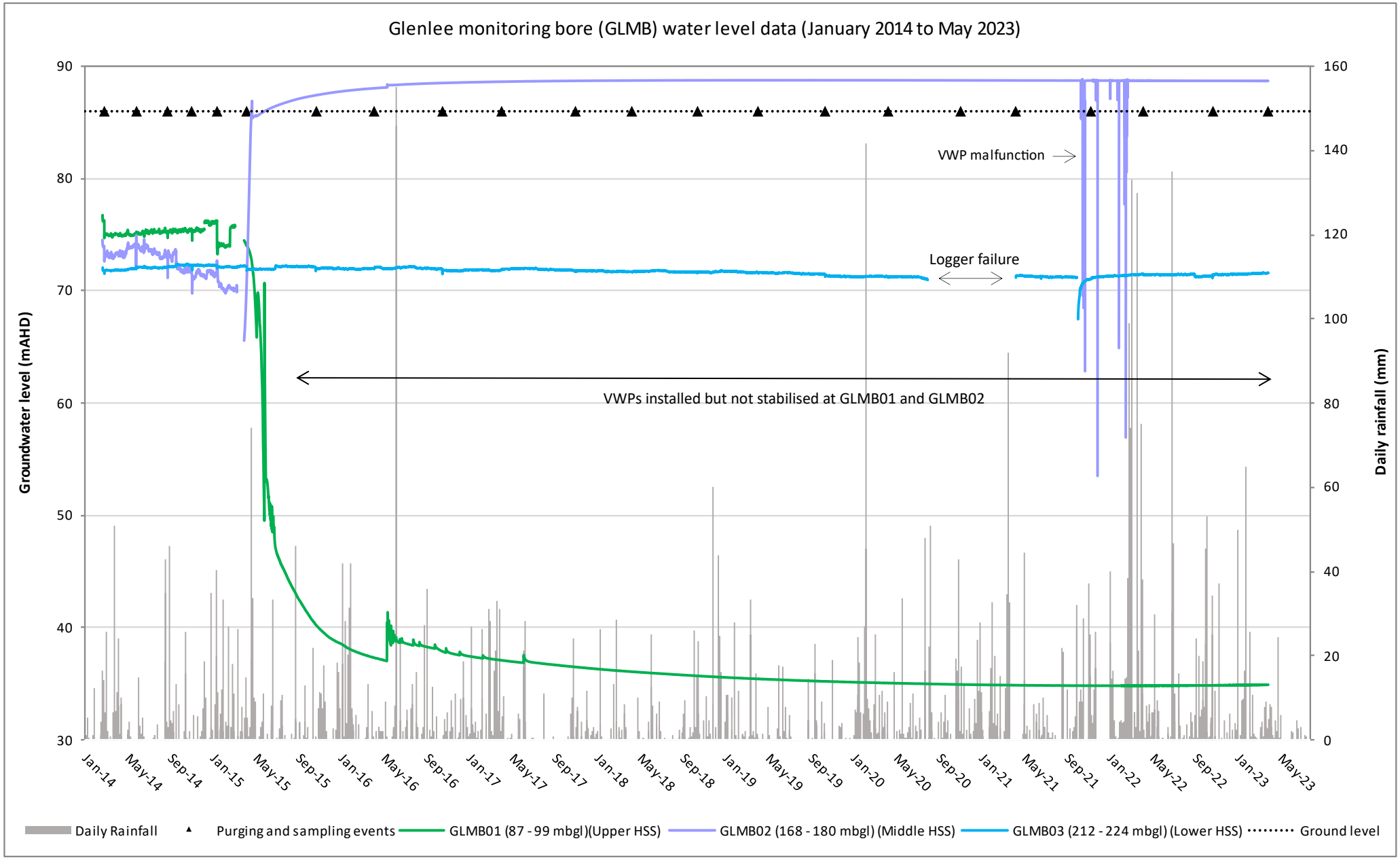



**Figure 4.2** **Groundwater levels at the Glenlee site**

## 4.2 Spatial trends in the Hawkesbury Sandstone

The conceptual model (AGL 2013) and hydrogeological setting (Section 2.4) suggest that regional groundwater flow within the Hawkesbury Sandstone is from south to north towards the incised river systems of the Sydney Basin.

The groundwater level elevations in the Hawkesbury Sandstone aquifer can be compared between the Glenlee and Menangle Park monitoring sites. Data collected at the CGP suggests that groundwater flow (in the Hawkesbury Sandstone) is more complex than the regional conceptual model. The data suggests that:

- The Nepean River in the vicinity of the Menangle Park site is a probable groundwater discharge area (as there is upward groundwater flow within the Hawkesbury Sandstone and there is no Ashfield Shale to act as a cap) although there is occasional groundwater recharge associated with flood events – shallow groundwater elevations here are between 57 mAHD and 61 mAHD and the Nepean River height is typically between 57 mAHD and 59 mAHD.

- At the Glenlee site (located north of the Menangle Park site), the deep sandstone aquifer has groundwater elevations between 71 mAHD and 73 mAHD which are higher than the deep sandstone aquifer at the Menangle Park site. The reason for this is unclear.

## 4.3 Groundwater-surface water interactions

Hydraulic connection between surface water and groundwater exists where the river is in direct contact with the underlying aquifer (Bouwer and Maddock 1997). A 'gaining' stream exists where the water table level in a connected aquifer is higher than the running level in a stream. In this situation groundwater will flow or discharge to the stream (Land and Water Australia 2007).

The Nepean River level shows a clear response to catchment rainfall and runoff (Figure 4.1). The river level is usually lower than the level in the alluvium and Hawkesbury Sandstone units, indicating the river is a gaining river at the Menangle Park site, except for short flood events, when recharge to the alluvial and shallow sandstone groundwater systems occur.

## 4.4 Vertical gradients

Vertical gradients indicate the potential for groundwater to flow vertically upward or downward at a particular location. A downward hydraulic gradient indicates a potential for downward flow from the shallower unit to the deeper unit, while an upward gradient indicates the opposite. It is noted that the actual flow direction and velocity is also governed by permeability, particularly the permeability of the confining units.

The following vertical gradient observations were made:

- There is an apparent upward hydraulic gradient at the Menangle Park site within the monitored zones of the Hawkesbury Sandstone; however, a downward gradient exists between the alluvium and the upper Hawkesbury Sandstone. The similar response to rainfall and flood events between the alluvial monitoring bore and the Hawkesbury Sandstone monitoring bores indicates connectivity between the two formations at this location, which is expected given the lack of a substantial confining layer between the formations.

- There is an apparent downward hydraulic gradient within the Hawkesbury Sandstone at the Glenlee site. This gradient is typical of these sandstone aquifers located away from the Nepean River at higher elevations.

# 5 Water quality

Groundwater and surface water sampling was undertaken twice in the 2022 - 2023 monitoring year at Menangle Park, Glenlee and the Nepean River on 27 November 2022 and 4 April 2023 (with supplementary monitoring for Menangle Park, Glenlee and the Nepean River undertaken on 24 May and 27 June 2023). These results are summarised in this chapter and are compared to previous monitoring years (EMM 2016, 2017, 2018, 2019, 2020, 2021, 2022; Parsons Brinckerhoff 2014, 2014b and 2015e).

The 2022–2023 monitoring year water quality results are presented in Appendix B and laboratory results in Appendix C.

## 5.1 Groundwater quality

### 5.1.1 Field parameters

Time series of laboratory EC and field pH for the CGP monitoring bores are presented in Figure 5.1 and Figure 5.2 respectively. It is suspected that the field pH probe used during the sampling event on 12 April 2018 was calibrated incorrectly; the measured pH values in all monitoring bores were approximately 1 unit lower than historical and most recent measurements.

Groundwater in the Hawkesbury Sandstone at the Menangle Park site in all aquifers (MPMB02-04) is classified as fresh to marginal. The fresh to marginal water quality at the Menangle Park site is likely due to the influence of rainfall recharge and connectivity with the Nepean River.

The EC recorded during the 2022–2023 monitoring year at the Menangle Park site was within the typical range compared to previous monitoring rounds.

Historically, slightly saline to moderately saline conditions were observed at the Glenlee sites GLMB01-02, while the deeper groundwater monitored in GLMB03 is better quality being mostly slightly saline. The brackish water quality observed after October 2021 is most probably the result of reconditioning of the monitoring bore where the screened interval was jetted and flushed with fresh water.

EC within the Hawkesbury Sandstone does not show a clear depth related trend at Menangle Park however, EC decreases with depth at the Glenlee site. This decrease is likely a result of saline groundwater within the Ashfield Shale migrating into the underlying sandstone aquifer because of vertical leakage.

The pH at MPMB01 in the alluvium is acidic and was measured between pH 5.2 and 5.5 during the 2022–2023 monitoring year. The pH generally increases with depth within the Hawkesbury Sandstone and is alkaline at both monitoring locations. The pH in the sandstone aquifers ranges between pH 6 and 10 for the Menangle Park sites and is more erratic at the Glenlee sites ranging between pH 7 and 11. Contamination from the grouting of the sandstone monitoring bores completed back in 2011–2012 is suspected to be contributing to the observed alkaline water quality.

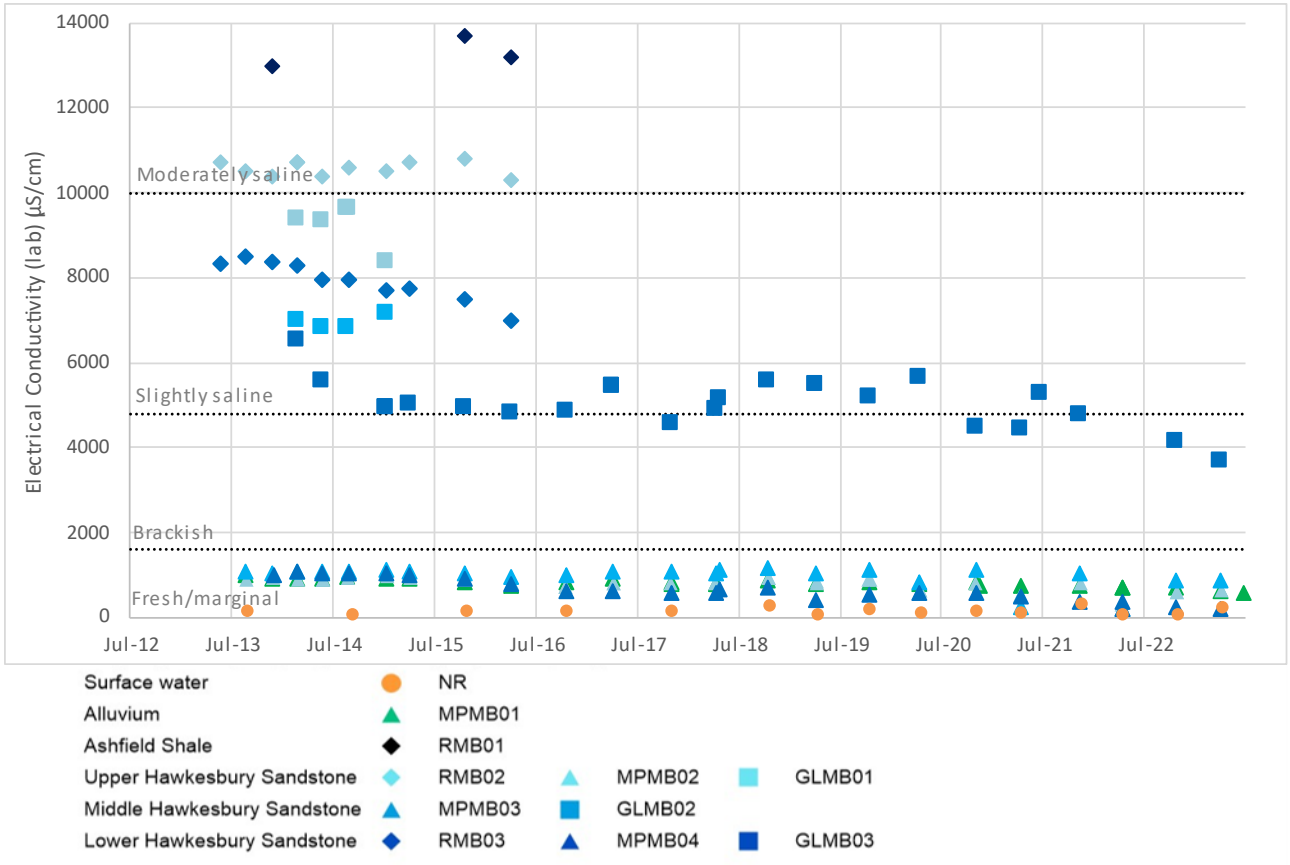



**Figure 5.1** Electrical Conductivity time series for CGP monitoring bores and Nepean River sample

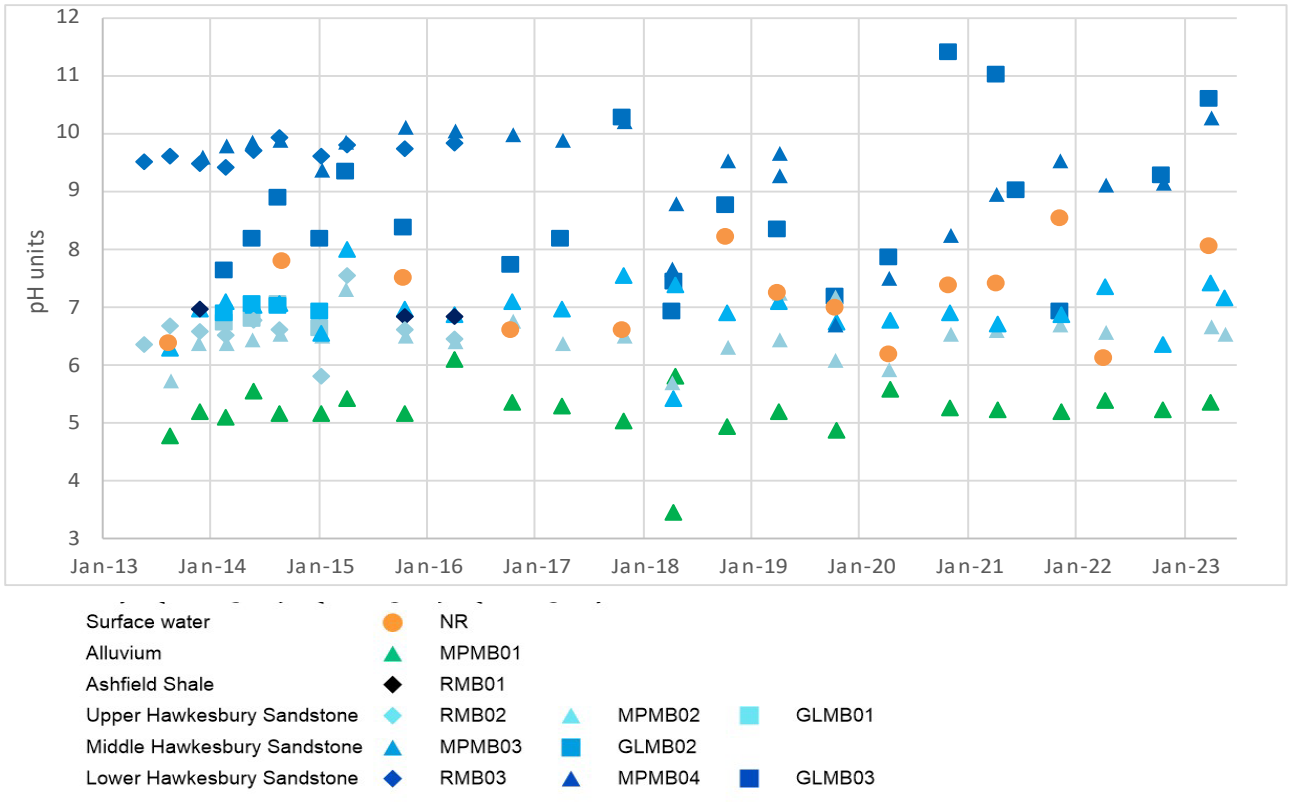


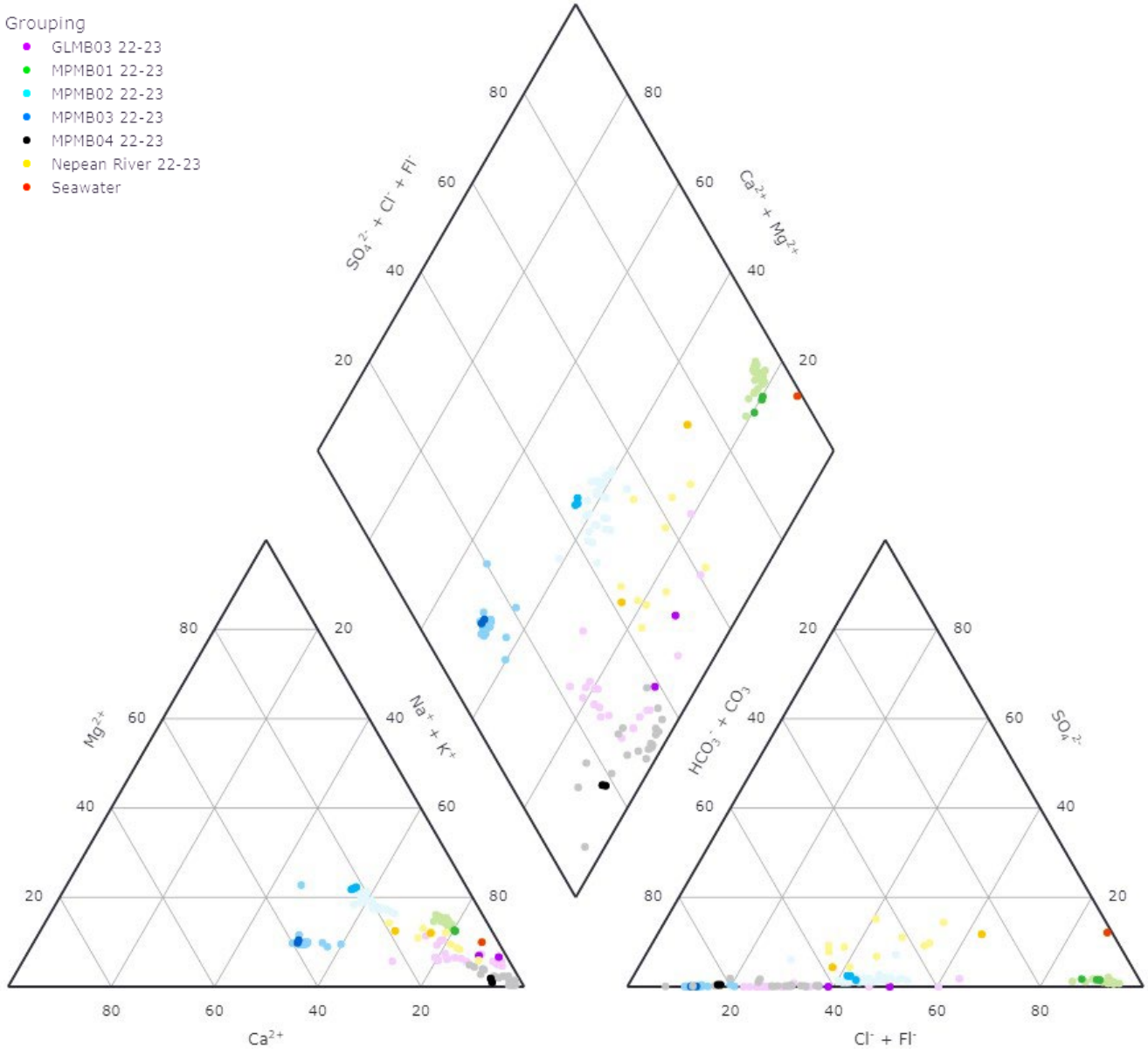

**Figure 5.2** pH time series for CGP monitoring bores and Nepean River

### 5.1.2 Major ions

The major ion characteristics of CGP monitoring bore groundwater samples are shown in a piper diagram (Figure 5.3). A piper diagram is a graphical representation of the relative concentrations of major ions in water ($Ca^{2+}$, $Mg^{2+}$, $Na^{+}$, $K^{+}$, $Cl^{-}$, $Fl^{-}$, $HCO_3^{-}$, $CO_3^{2-}$ and $SO_4^{2-}$). In the CGP monitoring bores, the most abundant ions are sodium ($Na^{+}$), chloride ($Cl^{-}$), and bicarbonate ($HCO_3^{-}$).

All bores have a dominant sodium cation type. The anion type ranges from bicarbonate (MPMB03, MPMB04, and mostly GLMB03) to chloride (MPMB01). MPMB02 and the Nepean River are relatively mixed between bicarbonate and chloride anion types.

MPMB01 (alluvium) is consistently dominated by sodium chloride. Bores in the Lower Hawkesbury Sandstone (MPMB04 and GLMB03) are within their historical sodium-bicarbonate range. MPMB02 and MPMB03 are within their historical ranges of magnesium bicarbonate type and mixed composition type respectively. The Nepean River had a higher bicarbonate result in April 2023 than recorded historically.




Seawater data (Turekian 1968) included for reference.

Transparent colours illustrate historical results.

**Figure 5.3 Major ion chemistry of groundwater for CGP monitoring bores**

### 5.1.3 Dissolved metals

Concentrations of dissolved metals in groundwater for 2022–2023 monitoring year are presented in Figure 5.4. The major findings for dissolved metals for this monitoring year are as follows:

- Dissolved metal concentrations are below the limit of reporting for beryllium, uranium, antimony, cadmium, lead, selenium, and vanadium, which is historically typical.
- Dissolved metal concentrations are generally similar in the alluvium and the Hawkesbury Sandstone, with exceptions discussed below. Dissolved metal concentrations across all sites were generally comparable to the previous monitoring events (2013 to 2023).
- Consistent with previous years, dissolved arsenic is below the limit of reporting in the alluvium and Nepean River. Over the 2022–2023 monitoring year, MPMB02 recorded the highest historical level of dissolved arsenic, ranging from. 0.015 and 0.016 mg/L in October 2022 and 0.018 mg/L in April 2023. Previously, the highest level of dissolved arsenic was 0.007 mg/L which was recorded in April 2020.
- Dissolved copper peaked in October 2022 at GLMB03 and has been trending upward for two years at MPMB04. This is inconsistent with previous years where copper is typically higher in the alluvium and Nepean River than other monitoring locations.
- Consistent with previous years, dissolved aluminium is below the limit of reporting at GLMB03, MPMB02, and MPMB03, however, it's also below the limit of reporting at MPMB01 which is lower than the historical average.
- Consistent with previous years, dissolved cobalt is below the limit of reporting at GLMB03, MPMB04, and Nepean River. Dissolved cobalt at MPMB01, MPMB02, and MPMB03 is within the historical range.
- Consistent with previous years, barium and strontium is highest in GLMB03 and lowest in the Nepean River.
- Dissolved boron and mercury were below the limit of reporting at MPMB02, MPMB03, MPMB04, and the Nepean River which is historically typical. MPMB01 detected dissolved mercury in April 2023 within the historical range, however, GLMB03 recorded the highest result to date of dissolved boron and mercury in both October 2022 and April 2023.
- Dissolved chromium and manganese at MPMB02 are higher than typical but have recorded similar levels historically. However, dissolved iron was the highest recorded at MPMB02. In October 2022 dissolved iron levels at MPMB02 were 4.40 and 4.41 mg/L, which increased in April 2023 to 5.61 mg/L. Prior to the 2022–2023 monitoring year the highest dissolved iron concentration at MPMB02 was 4.23 mg/L in April 2020.

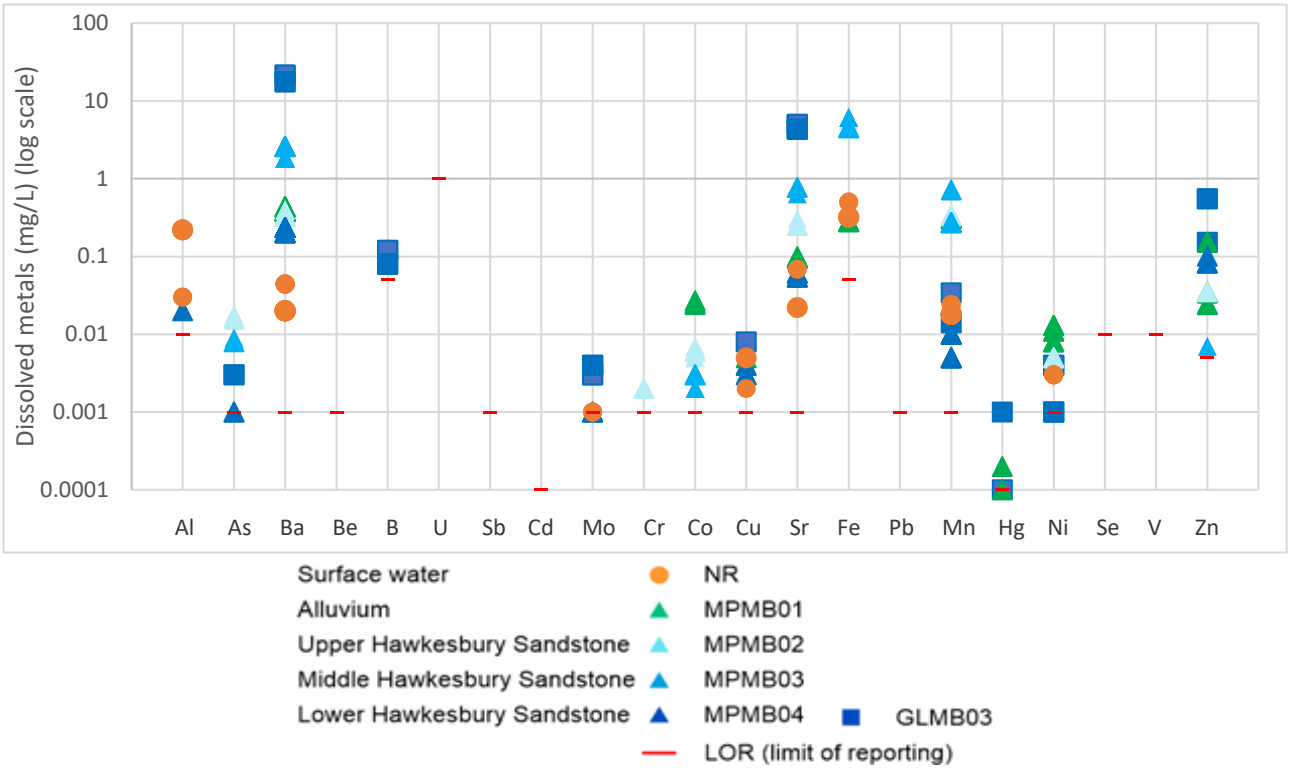
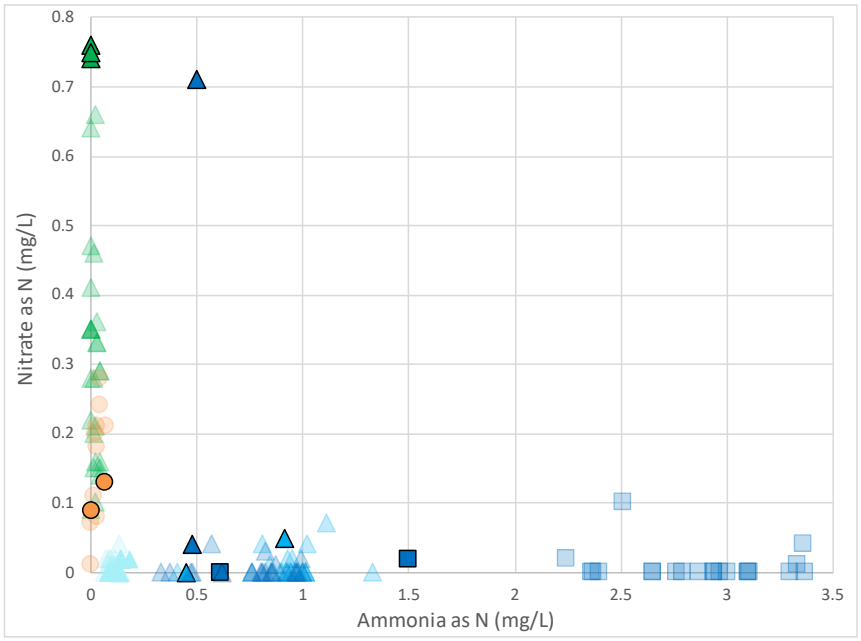



**Figure 5.4** **Dissolved metal concentrations in groundwater for CGP monitoring bores (2022–2023 monitoring year)**

### 5.1.4 Nutrients

A plot showing ammonia versus nitrate in groundwater is presented in Figure 5.5. The major findings for nutrients in the 2022–2023 monitoring year are as follows:

- The Nepean River, MPMB02, and MPMB03 were within their historical ranges of generally low ammonia and nitrate.
- MPMB01 had elevated levels of nitrate over the 2022–2023 monitoring year compared to previous years.
- MPMB04 had elevated levels of nitrate in October 2022 which returned to a slightly elevated level in April 2023.
- GLMB03 had lower levels of ammonia over the 2022–2023 monitoring year.
- Nitrite concentrations remained below the laboratory LOR at all monitoring bores and in the Nepean River.
- Reactive phosphorus concentrations were below the limit of reporting in all hydrogeological units except GLMB03 which had the highest historically recorded level of 0.2 mg/L in April 2023.
- Total organic carbon (TOC) concentrations were generally comparable between the lower, middle and upper Hawkesbury Sandstone at Menangle Park site and the Nepean River. In October 2022 GLMB03 recorded TOC concentrations five times greater than previously recorded, which reduced to double the typical concentration in April 2023. TOC was not detected in the alluvium (MPMB01), which is a consistent with previous results.




Transparent colours illustrate historical results.

| | | | |
|---|---|---|---|
| Surface water | NR | | |
| Alluvium | MPMB01 | | |
| Upper Hawkesbury Sandstone | MPMB02 | | |
| Middle Hawkesbury Sandstone | MPMB03 | | |
| Lower Hawkesbury Sandstone | MPMB04 | GLMB03 | |

**Figure 5.5 Ammonia versus nitrate concentrations in groundwater for CGP monitoring bores**

### 5.1.5 Dissolved gasses

Dissolved gases naturally occur in the Hawkesbury Sandstone aquifers (at all depths) and are likely to have migrated from the deep Illawarra Coal Measures through the Narrabeen Group strata and into the Hawkesbury Sandstone. Dissolved methane is shown to be of mostly thermogenic origin (Parsons Brinckerhoff 2014). A time series plot of dissolved methane concentrations in groundwater is presented in Figure 5.6. Major findings for dissolved gases in 2022–2023 monitoring year are as follows:

- Dissolved methane was within the historical range except for MPMB02, which was slightly elevated in May 2023 (1.83 mg/L), although this was lower than the other Hawkesbury Sandstone bores Figure 5.6.

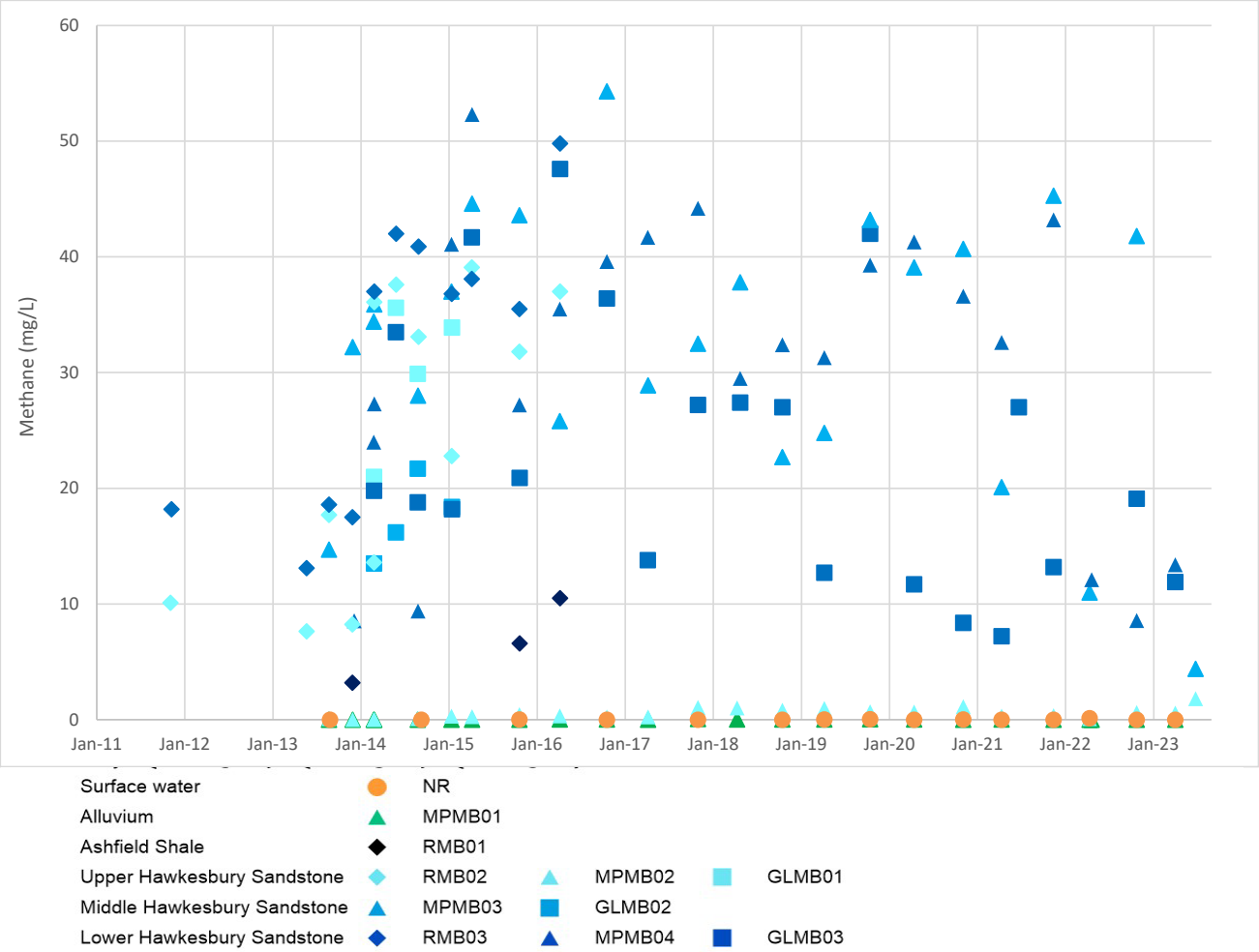



**Figure 5.6 Dissolved methane time series for CGP monitoring bores and Nepean River**

### 5.1.6 Dissolved hydrocarbons

Dissolved heavier hydrocarbons (i.e. >$C_6$) can occur naturally in groundwater, with concentrations derived from carbonaceous material in the adjacent strata (CSIRO 2011).

MPMB02, MPMB03, MPMB04, and the Nepean River did not detect any hydrocarbons (PAH, TRH, TPH), phenols, or BTEX during the 2022–2023 monitoring year which is consistent with recent historical trends (Figure 5.7).

MPMB01 detected 20 µg/L of $C_6$-$C_{10}$ TRH, in June 2023 (an additional sampling event), which has not previously been detected at this borehole (Figure 5.7. and Appendix B).

Anomalous levels of all TRH species except $C_{34}$-$C_{40}$ and $C_6$-$C_{10}$ were detected in GLMB03 in October 2022 and April 2023, which have not previously been detected. However, during the additional sampling event in June 2023, levels returned to below the limit of reporting for all analytes except $C_6$-$C_{10}$ (TRH), which is consistent with previous results.

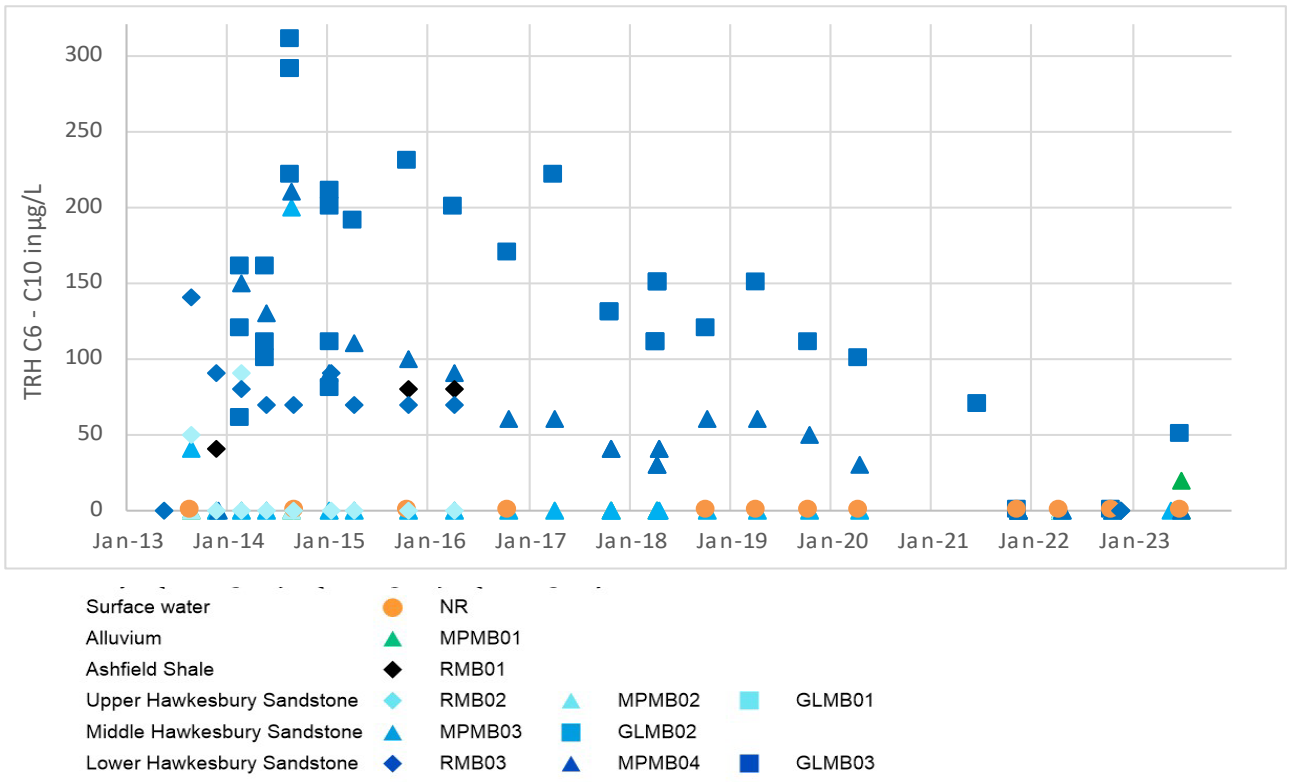



**Figure 5.7 Dissolved TRH time series for CGP monitoring bores and Nepean River**

Detections of phenols or PAH were not detected at GLMB03. Toluene (BTEX) continued to be present although at concentrations less than recent monitoring years (Figure 5.8). Toluene has occasionally been detected in other monitoring sites at similar concentrations since monitoring commenced, including the former control site (Denham Court, RMB) located at a significant distance from development activities (e.g. EMM 2016) (Figure 5.8). No other BTEX compounds (i.e. benzene, xylenes and ethyl benzene) were detected during this monitoring year at any monitoring locations.

MPMB04, which has typically had low levels of toluene in previous monitoring years, was below the limit of reporting for both monitoring events this year.

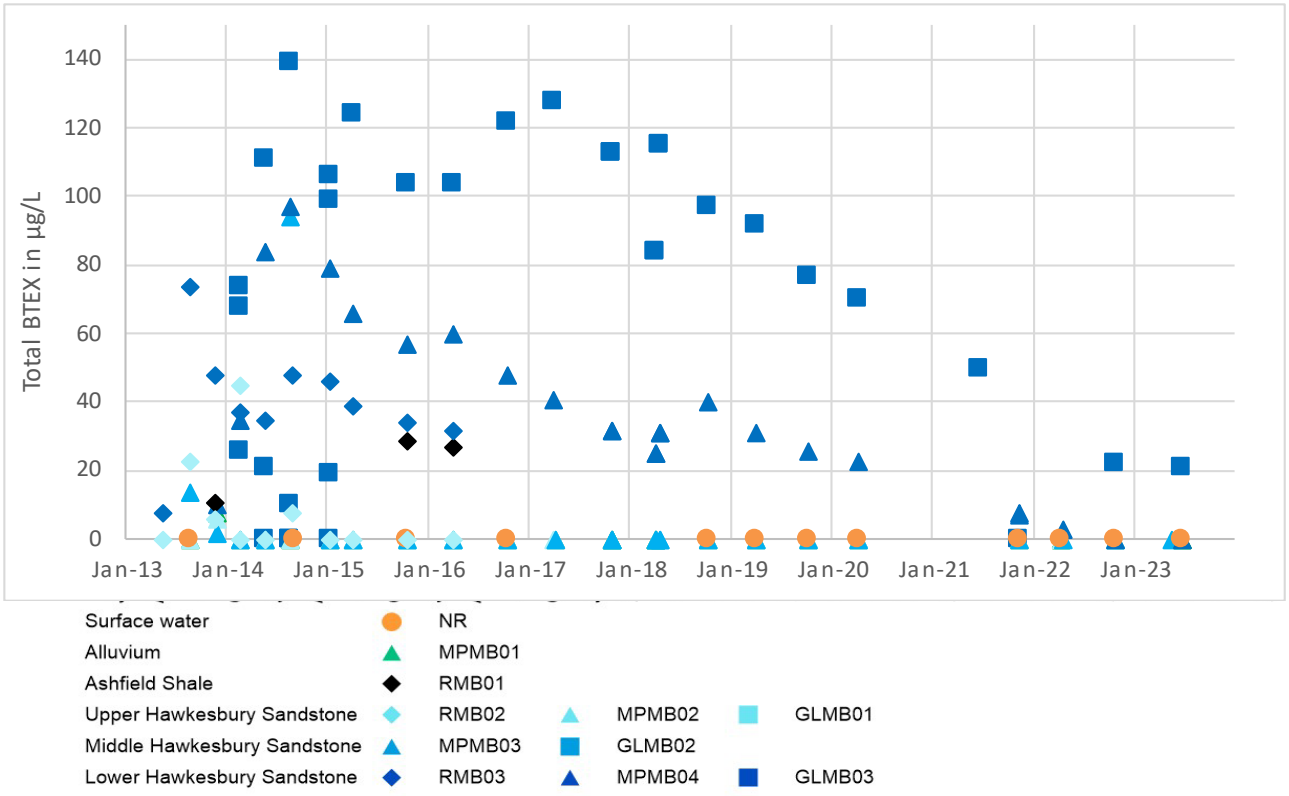



**Figure 5.8 Dissolved BTEX time series for CGP monitoring bores and Nepean River**

## 5.2 Surface water quality

Surface water quality results of the Nepean River are overall consistent with previous monitoring years. The results of the 2022–2023 monitoring year were compared to ANZECC (2000) guidelines for freshwater ecosystems (95% protection level), which are noted in Appendix B:

- Salinity is fresh, with electrical conductivity measured at 94 and 275 µS/cm in October 2022 and April 2023 respectively; and continues to be typically lower than groundwater in the alluvium (Figure 5.1).
- pH is slightly acidic in October 2022 (6.11) to slightly alkaline in April 2023 (8.02). The pH of the Nepean River is generally higher than the pH of groundwater in the alluvium (Figure 5.2). Although a pH of 8.02 in the river is high, the Nepean River recorded a pH of 8.18 in October 2018.
- Dominant major ions are sodium, chloride, and bicarbonate (Figure 5.3).

Dissolved metal concentrations in the Nepean River are typically lower than those of groundwater in the alluvium and Hawkesbury Sandstone units (Figure 5.4) and are generally below the ANZECC 2000 guideline values. However, two exceedances were recorded in October 2022 and April 2023:

- aluminium concentration of 0.22 mg/L (October 2022) exceeded the guideline value of 0.055 mg/L
- copper concentration of 0.005 mg/L and 0.002 mg/L (October 2022 and April 2023 respectively) exceeded the guideline value of 0.0014 mg/L.

Nutrient concentrations over the 2022–2023 monitoring year were low, within historical ranges, and within the ANZECC 2000 95% protection level guidelines.

Dissolved methane and heavier hydrocarbons were not detected.

# 6 Discussion and conclusions

Groundwater level data at nested monitoring bores was collected using dataloggers, identifying trends in the alluvium and Hawkesbury Sandstone aquifers. Water quality samples were collected all monitoring bore sites.

The main findings for the 2022–2023 monitoring year regarding **water levels** are:

- Menangle Park Site:
  - Groundwater levels at Menangle Park were all shallower than 10 mbgl for each monitored zone.
  - The groundwater level in the alluvium (MPMB01) showed a direct response to rainfall and floods (Figure 4.1).
  - An obvious response to rainfall and flood events was observed in the upper and middle Hawkesbury Sandstone (monitoring bores MPMB02 and MPMB03) (Figure 4.1).
  - A slightly subdued and delayed response was generally observed in the lower Hawkesbury Sandstone (MPMB04) (Figure 4.1).
- Glenlee Site:
  - Groundwater levels were less than 15 mbgl at Glenlee (GLMB03) and do not show a clear response to rainfall (Figure 4.2).
  - The pressures in the VWP installed at GLMB01 and GLMB02 (installed in 2015) stabilised at lower piezometric pressure head levels compared with pressures observed from the former standpipe monitoring bores. The measured pressures are not representative of formation water levels.
- For the regional Hawkesbury Sandstone aquifer, groundwater elevations were higher at the Glenlee site (approximately 71–75 mAHD) than the Menangle Park site (approximately 57–61 mAHD).
- Vertical gradients vary between sites. An upward gradient is evident at Menangle Park and a downward gradient is evident at the Glenlee site.
- The Nepean River elevation is usually lower than the groundwater elevation in the alluvium and Hawkesbury Sandstone units, indicating the river is a gaining stream around the Menangle Park site, except for short periods during flood events when recharge to the underlying groundwater systems occurs.
- The groundwater level data collected in the alluvium and Hawkesbury Sandstone are indicative of natural systems in long-term equilibrium with seasonal rainfall recharge responses.

No long-term groundwater level drawdown trends attributable to CSG operations (which involves depressurisation and local dewatering of the deep coal seams) have been observed in the groundwater level data at any of the monitored locations.

The main findings for the 2022–2023 monitoring year regarding **water quality** are:

- Menangle Park Site:
  - Groundwater quality in the alluvium at the Menangle Park site (MPMB01) was characterised as fresh to marginal and slightly acidic pH. Dissolved metal concentrations were typically low. Negligible dissolved hydrocarbons were detected.

- Groundwater quality in the Hawkesbury Sandstone ranged from fresh to marginal at the Menangle Park site (MPMB02, MPMB03, MPMB04).

- Dissolved arsenic, iron and methane at MPMB02 were the highest recorded during the 2022–2023 monitoring year.

- Dissolved methane was present at Menangle Park bores except MPMB01 (and the Nepean River), which is consistent to previous monitoring data. Dissolved hydrocarbons (methane) were observed to occur at the former control site (Denham Court) located significant distance from any development activities, indicating a natural source.

- No BTEX compounds were detected at the Menangle Park site.

• Glenlee Site:

- Groundwater quality in the Hawkesbury Sandstone was brackish at the Glenlee site (GLMB03). This improved salinity during the year is most probably the result of reconditioning of the monitoring bore where the screened interval was jetted and flushed with fresh water.

- pH and previously anomalous dissolved metal concentrations have returned to the general historical range at the Glenlee site during the 2022–2023 monitoring year. Dissolved copper, boron, mercury as well as reactive phosphorus, TOC, and TRH species in GLMB03 in 2022–2023 were the highest recorded while ammonia was the lowest at this location compared to previous years.

- Toluene was detected in the lower Hawkesbury Sandstone at GLMB03. This is consistent with previous monitoring data at GLMB03 and is assessed to be naturally occurring given toluene has been detected at all sites except the Nepean River, including the former control site (Denham Court) located a significant distance from the CGP gas production wells. No other BTEX compounds were detected.

- Dissolved methane was present at GLMB03, which is consistent to previous monitoring data. Dissolved hydrocarbons (methane) were observed to occur at the former control site (Denham Court) located significant distance from any development activities, indicating a natural source.

No significant change in water quality was detected during the 2022–2023 monitoring year compared to the previous monitoring years (e.g. EMM 2022 and 2021). No adverse water quality impacts attributable to CSG operations were observed at any of the monitored sites. Water quality results are not significantly different between the former control site (Denham Court) and monitoring sites located within the CGP footprint (Menangle Park and Glenlee).

To conclude, based on the available data, there are no observable impacts to groundwater levels or quality or surface water quality that are attributable to the CSG operations. There is no evidence of connectivity between the shallower monitored zones and the coal seams (except for the potential natural migration of gases through the Narrabeen Group strata) which corroborates the conceptual model developed during the Phase 1 studies (Parsons Brinckerhoff 2011). The presence of extensive and thick claystone formations (aquitards and aquicludes) between the Hawkesbury Sandstone and the targeted coal seams restricts depressurisation and impedes the vertical flow of groundwater.

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# Glossary

| | |
|---|---|
| Acidity | Base neutralising capacity. |
| Alkalinity | Acid neutralising capacity. |
| Alluvium | Unconsolidated sediments (clays, sands, gravels and other materials) deposited by flowing water. Deposits can be made by streams on river beds, floodplains, and alluvial fans. |
| Alluvial aquifer | Permeable zones that store and produce groundwater from unconsolidated alluvial sediments. Shallow alluvial aquifers are generally unconfined aquifers. |
| Ammonia | A compound of nitrogen and hydrogen (NH3) that is a common by-product of animal waste and landfills but is also found naturally in reduced environments. Ammonia readily converts to nitrate in soils and streams. |
| Anion | An ion with a negative charge – usually non-metal ions when disassociated and dissolved in water. |
| Aquatic ecosystem | The stream channel, lake or estuary bed, water, and (or) biotic communities and the habitat features that occur therein. |
| Aquiclude | An impermeable unit that acts as a barrier to the flow of groundwater from one formation to another. |
| Aquifer | Rock or sediment in a formation, group of formations, or part of a formation that is saturated and sufficiently permeable to transmit economic quantities of water. |
| Aquifer properties | The characteristics of an aquifer that determine its hydraulic behaviour and its response to abstraction. |
| Aquifer, confined | An aquifer that is overlain by low permeability strata. The hydraulic conductivity of the confining bed is significantly lower than that of the aquifer. |
| Aquifer, semi-confined | An aquifer overlain by a low-permeability layer that permits water to slowly flow through it. During pumping, recharge to the aquifer can occur across the leaky confining layer – also known as a leaky artesian or leaky confined aquifer. |
| Aquifer, unconfined | Also known as a water table aquifer. An aquifer in which there are no confining beds between the zone of saturation and the surface. The water table is the upper boundary of an unconfined aquifer. |
| Aquitard | A low permeability unit that can store groundwater and also transmit it slowly from one formation to another. Aquitards retard but do not prevent the movement of water to or from adjacent aquifers. |
| Australian Height Datum (AHD) | The reference point (very close to mean sea level) for all elevation measurements, and used for correlating depths of aquifers and water levels in bores. |
| Beneficial aquifer | An aquifer with a water resource of sufficient quality and quantity to provide either ecosystem protection, raw water for drinking water supply, and agricultural or industrial water. |
| Bore | A structure drilled below the surface to obtain water from an aquifer or series of aquifers. |
| Cation | An ion with a positive charge – usually metal ions when disassociated and dissolved in water. |
| Claystone | A non-fissile rock of sedimentary origin composed primarily of clay-sized particles (less than 0.004 mm). |

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| Coal | A sedimentary rock derived from the compaction and consolidation of vegetation or swamp deposits to form a fossilised carbonaceous rock. |
| Coal seam | A layer of coal within a sedimentary rock sequence. |
| Coal seam gas (CSG) | Coal seam gas is a form of natural gas (predominantly methane) that is extracted from coal seams. |
| Concentration | The amount or mass of a substance present in a given volume or mass of sample, usually expressed as milligram per litre (water sample) or micrograms per kilogram (sediment sample). |
| Conceptual model | A simplified and idealised representation (usually graphical) of the physical hydrogeologic setting and the hydrogeological understanding of the essential flow processes of the system. This includes the identification and description of the geologic and hydrologic framework, media type, hydraulic properties, sources and sinks, and important aquifer flow and surface-groundwater interaction processes. |
| Confining layer | Low permeability strata that may be saturated but will not allow water to move through it under natural hydraulic gradients. |
| Datalogger | A digital recording instrument that is inserted in monitoring and pumping bores to record pressure measurements and water level variations. |
| Dual permeability aquifer | An aquifer in which groundwater flow is through both the primary porosity of the rock matrix and the secondary porosity of fractures and fissures. |
| Electrical conductivity (EC) | A measure of a fluid's ability to conduct an electrical current and is an estimation of the total ions dissolved. It is often used as a measure of water salinity. |
| Facies | An assemblage or association of mineral, rock, or fossil features reflecting the environment and conditions of origin of the rock. It refers to the appearance and peculiarities that distinguish a rock unit from associated or adjacent units. |
| Fault | A fracture in rock along which there has been an observable amount of displacement. Faults are rarely single planar units; normally they occur as parallel to sub-parallel sets of planes along which movement has taken place to a greater or lesser extent. Such sets are called fault or fracture zones. |
| Groundwater | The water contained in interconnected pores or fractures located below the water table in the saturated zone. |
| Groundwater level | The water level measured in a bore; this may be at or close to the water table in unconfined aquifers, or represent the average piezometric level across the screened interval in confined aquifers. |
| Groundwater flow | The movement of water through openings in sediment and rock within the zone of saturation. |
| Groundwater system | A system that is hydrogeologically more similar than different in regard to geological province, hydraulic characteristics and water quality, and may consist of one or more geological formations. |
| Hydraulic conductivity (K) | The rate at which water of a specified density and kinematic viscosity can move through a permeable medium (notionally equivalent to the permeability of an aquifer to fresh water). |
| Hydraulic gradient | The change in total hydraulic head with a change in distance in a given direction. |

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| Hydraulic head | A specific measurement of water pressure above a datum. It is usually measured as a water surface elevation, expressed in units of length. In an aquifer, it can be calculated from the depth to water in a monitoring bore. The hydraulic head can be used to determine a hydraulic gradient between two or more points. |
| Hydrogeology | The study of the interrelationships of geologic materials and processes with water, especially groundwater. |
| Hydrology | The study of the occurrence, distribution, and chemistry of all surface waters. |
| Ion | An ion is an atom or molecule where the total number of electrons is not equal to the total number of protons, giving it a net positive or negative electrical charge. |
| Limit or reporting (LOR) | The concentration below which a particular analytical method cannot determine, with a high degree of certainty, a concentration. |
| Lithology | The study of rocks and their depositional or formational environment on a large specimen or outcrop scale. |
| Major ions | Constituents commonly present in concentrations exceeding 10 milligram per litre. Dissolved cations generally are calcium, magnesium, sodium, and potassium; the major anions are sulphate, chloride, fluoride, nitrate, and those contributing to alkalinity, most generally assumed to be bicarbonate and carbonate. |
| Methane ($CH_4$) | An odourless, colourless, flammable gas, which is the major constituent of natural gas. It is used as a fuel and is an important source of hydrogen and a wide variety of organic compounds. |
| MicroSiemens per centimetre (µS/cm) | A measure of water salinity commonly referred to as EC (see also electrical conductivity). Most commonly measured in the field with calibrated field meters. |
| Monitoring bore | A non-pumping bore, is generally of small diameter that is used to measure the elevation of the water table and/or water quality. Bores generally have a short well screen against a single aquifer through which water can enter. |
| Normal fault | Where the fault plane is vertical or dips towards the downthrow side of a fault. |
| Permeability | The property or capacity of a porous rock, sediment, clay or soil to transmit a fluid. It is a measure of the relative ease of fluid flow under unequal pressure. The hydraulic conductivity is the permeability of a material for water at the prevailing temperature. |
| Permeable material | Material that permits water to move through it at perceptible rates under the hydraulic gradients normally present. |
| Permian | The last period of the Palaeozoic era that finished approximately 252 million years before present. |
| pH | Potential of Hydrogen; the logarithm of the reciprocal of hydrogen-ion concentration in gram atoms per litre; provides a measure on a scale from 0 to 14 of the acidity or alkalinity of a solution (where 7 is neutral, greater than 7 is alkaline and less than 7 is acidic). |
| Porosity | The proportion of open space within an aquifer, comprised of intergranular space, pores, vesicles and fractures. |
| Porosity, primary | The porosity that represents the original pore openings when a rock or sediment formed. |
| Porosity, secondary | The porosity caused by fractures or weathering in a rock or sediment after it has been formed. |

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| Quaternary | The most recent geological period extending from approximately 2.6 million years ago to the present day. |
| Quality assurance | Evaluation of quality-control data to allow quantitative determination of the quality of chemical data collected during a study. Techniques used to collect, process, and analyse water samples are evaluated. |
| Recharge | The process which replenishes groundwater, usually by rainfall infiltrating from the ground surface to the water table and by river water reaching the water table or exposed aquifers. The addition of water to an aquifer. |
| Recharge area | A geographic area that directly receives infiltrated water from surface and in which there are downward components of hydraulic head in the aquifer. Recharge generally moves downward from the water table into the deeper parts of an aquifer then moves laterally and vertically to recharge other parts of the aquifer or deeper aquifer zones. |
| Salinity | The concentration of dissolved salts in water, usually expressed in EC units or milligrams of total dissolved solids per litre (mg/L TDS). |
| Salinity classification | Fresh water quality – water with a salinity <800 µS/cm.<br>Marginal water quality – water that is more saline than freshwater and generally waters between 800 and 1,600 µS/cm.<br>Brackish quality – water that is more saline than freshwater and generally waters between 1,600 and 4,800 µS/cm.<br>Slightly saline quality – water that is more saline than brackish water and generally waters with a salinity between 4,800 and 10,000 µS/cm.<br>Moderately saline quality – water that is more saline than slightly saline water and generally waters between 10,000 and 20,000 µS/cm.<br>Saline quality – water that is almost as saline as seawater and generally waters with a salinity greater than 20,000 µS/cm.<br>Seawater quality – water that is generally around 55,000 µS/cm.<br>(Australian Water Resources Council 1988) |
| Sandstone | Sandstone is a sedimentary rock composed mainly of sand-sized minerals or rock grains (predominantly quartz). |
| Screen | A type of bore lining or casing of special construction, with apertures designed to permit the flow of water into a bore while preventing the entry of aquifer or filter pack material. |
| Sedimentary rock aquifer | These occur in consolidated sediments such as porous sandstones and conglomerates, in which water is stored in the intergranular pores, and limestone, in which water is stored in solution cavities and joints. These aquifers are generally located in sedimentary basins that are continuous over large areas and may be tens or hundreds of metres thick. In terms of quantity, they contain the largest volumes of groundwater. |
| Shale | A laminated sedimentary rock in which the constituent particles are predominantly of clay size. |
| Siltstone | A fine-grained rock of sedimentary origin composed mainly of silt-sized particles (0.004 to 0.06 mm). |
| Standing water level (SWL) | The height to which groundwater rises in a bore after it is drilled and completed, and after a period of pumping when levels return to natural atmospheric or confined pressure levels. |
| Stratigraphy | The depositional order of sedimentary rocks in layers. |

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| Surface water-groundwater interaction | This occurs in two ways: (1) streams gain water from groundwater through the streambed when the elevation of the water table adjacent to the streambed is greater than the water level in the stream; and (2) streams lose water to groundwater through streambeds when the elevation of the water table is lower than the water level in the stream. |
| Tertiary | Geologic time at the beginning of the Cainozoic era, 65 to 2.6 million years ago, after the Cretaceous and before the Quaternary. |
| Total Dissolved Solids (TDS) | A measure of the salinity of water, usually expressed in milligrams per litre (mg/L). See also EC. |
| Water quality | Term used to describe the chemical, physical, and biological characteristics of water, usually in respect to its suitability for a particular purpose. |
| Water quality data | Chemical, biological, and physical measurements or observations of the characteristics of surface and ground waters, atmospheric deposition, potable water, treated effluents, and waste water and of the immediate environment in which the water exists. |
| Well | Pertaining to a gas exploration well or gas production well. |

# Abbreviations

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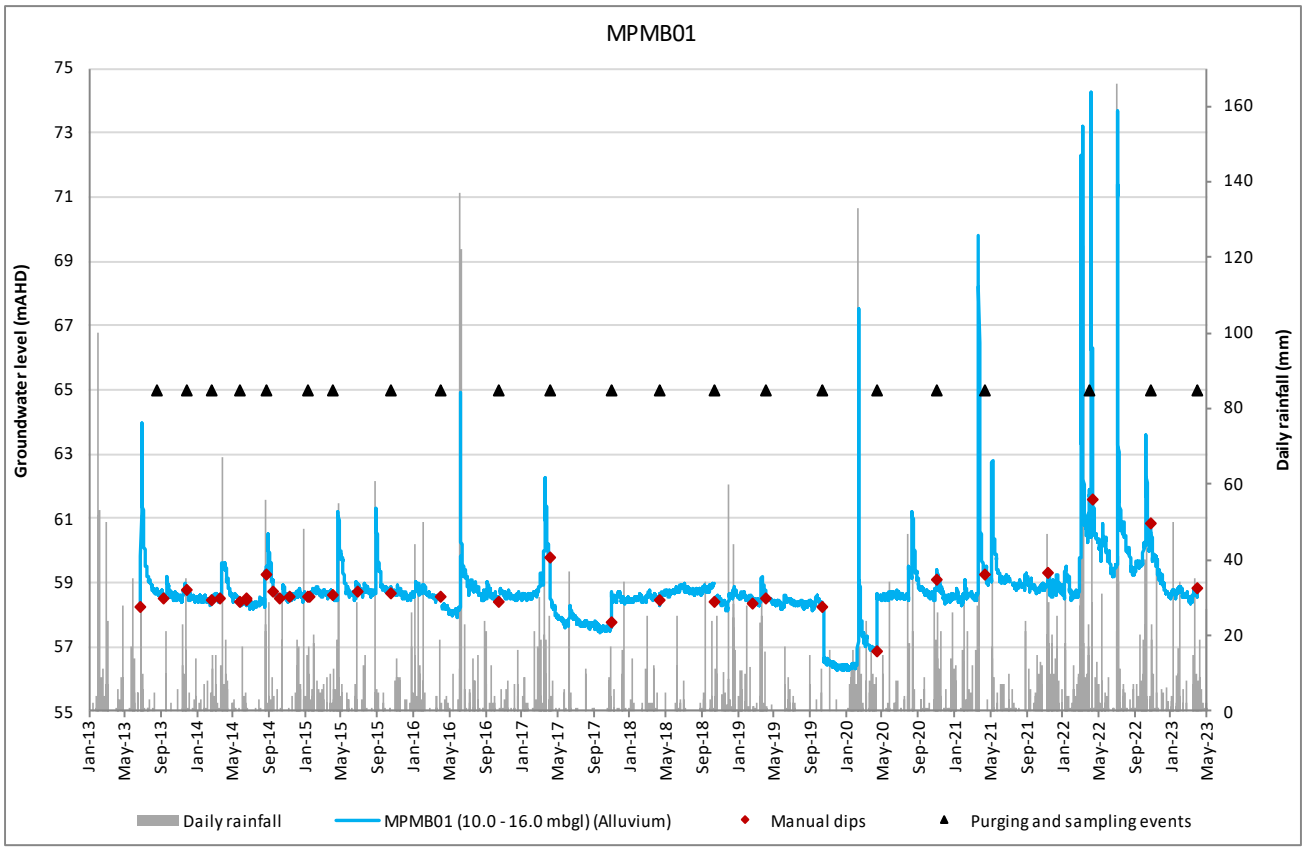
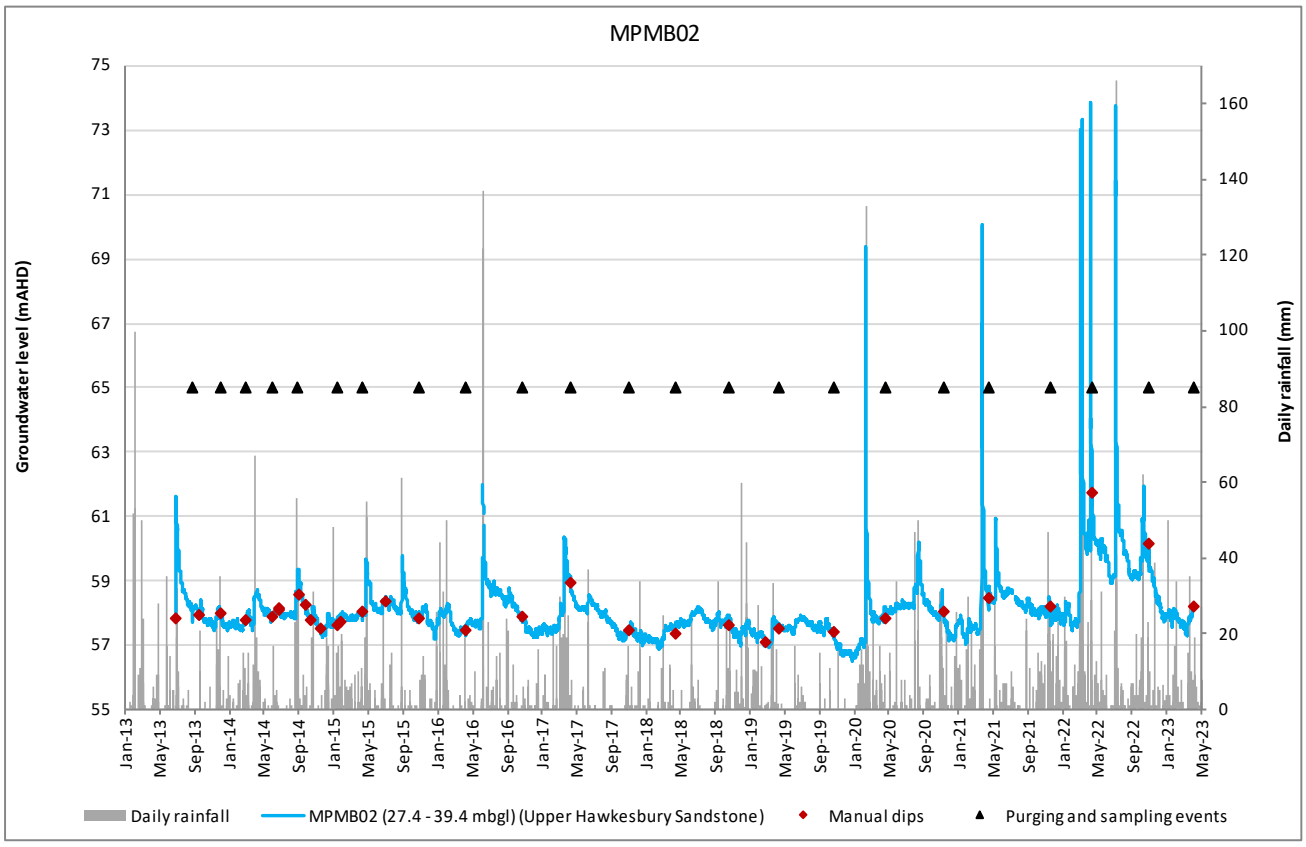
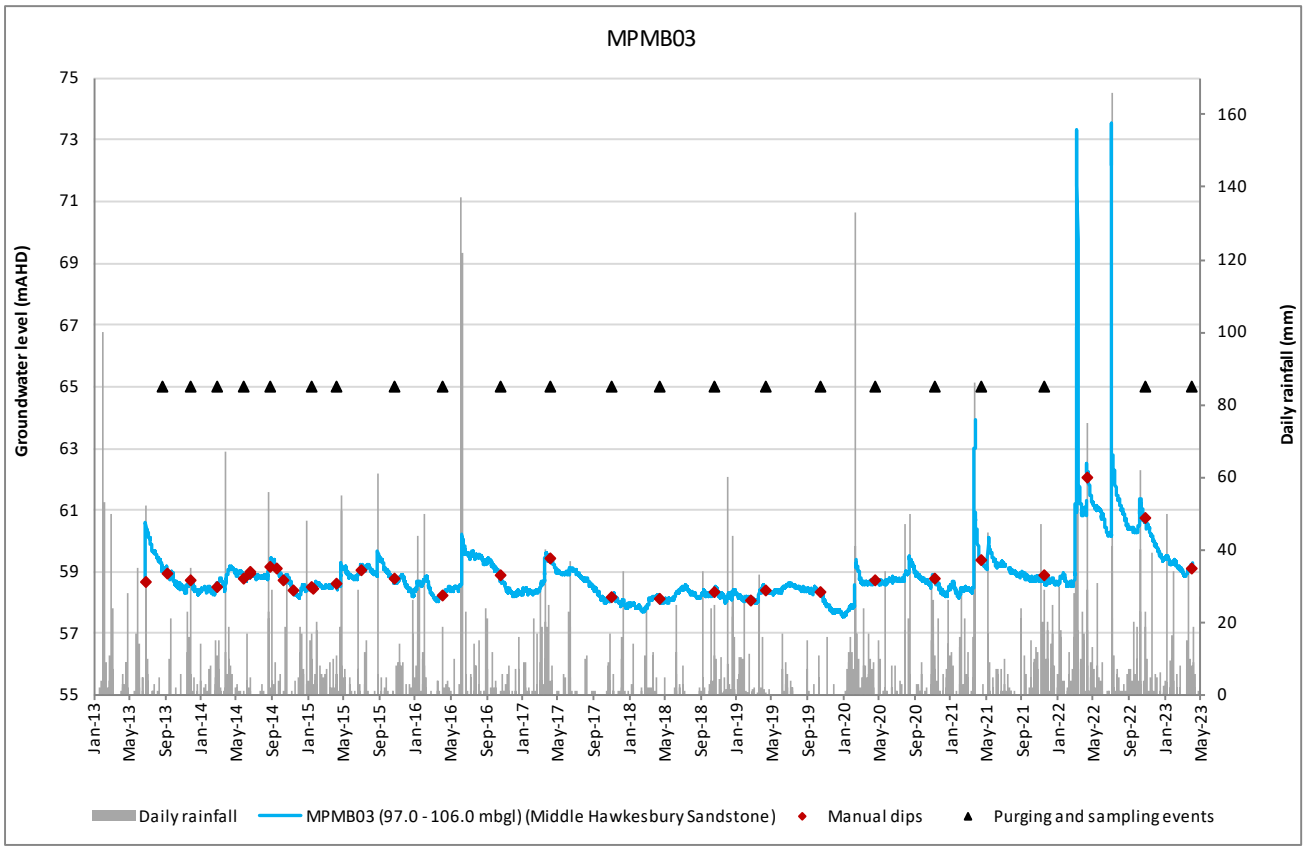
| AGL | AGL Upstream Investments Pty Ltd |
| BoM | Bureau of Meteorology |
| BTEX | Benzene, toluene, ethyl benzene and xylenes |
| CDFM | Cumulative deviation from mean |
| CGP | Camden Gas Project |
| CSG | Coal seam gas |
| EC | Electrical conductivity |
| LOR | Limit of reporting |
| PAH | Polycyclic aromatic hydrocarbons |
| SCA | Sydney Catchment Authority |
| TDS | Total dissolved solids |
| TPH | Total petroleum hydrocarbons |
| TRH | Total recoverable hydrocarbons |
| VWP | Vibrating wire piezometer |
| °C | degrees Celsius |
| L/s | litres per second |
| m | metres |
| mAHD | metres Australian Height Datum |
| mbgl | metres below ground level |
| mg/L<br>mg/L | milligrams per litre |
| µg/L | micrograms per litre |
| µS/cm | microSiemens per centimetre |

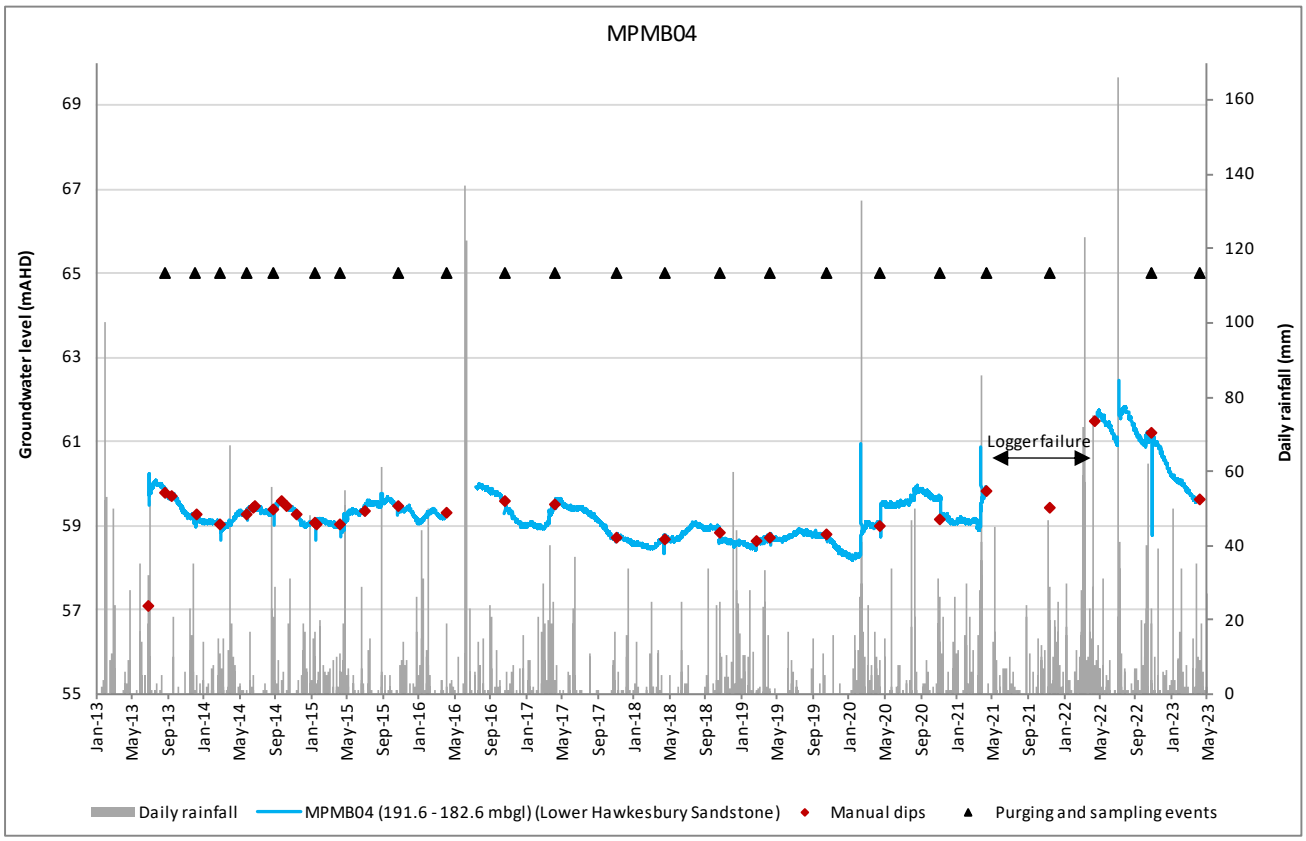
# Appendix A
## Groundwater hydrographs

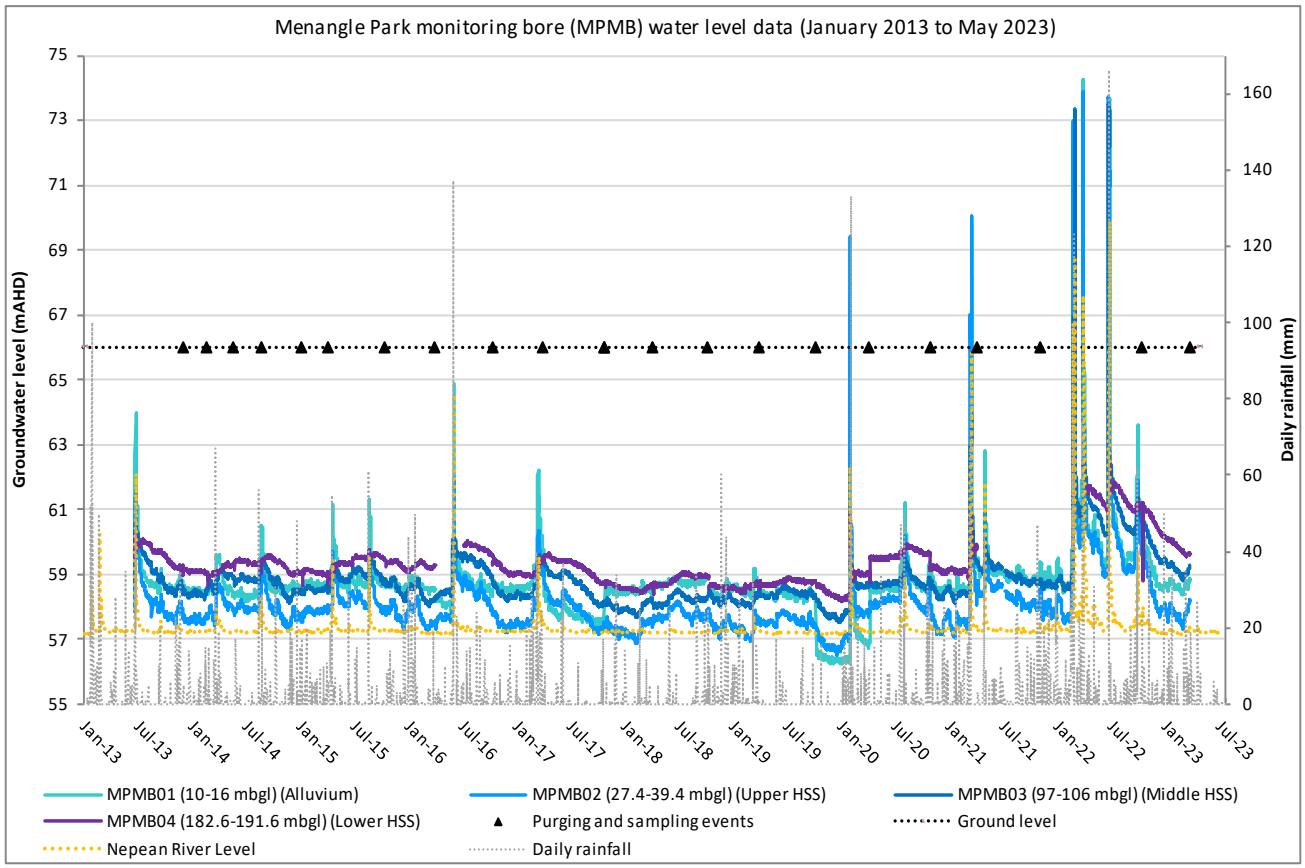
EMM
creating opportunities

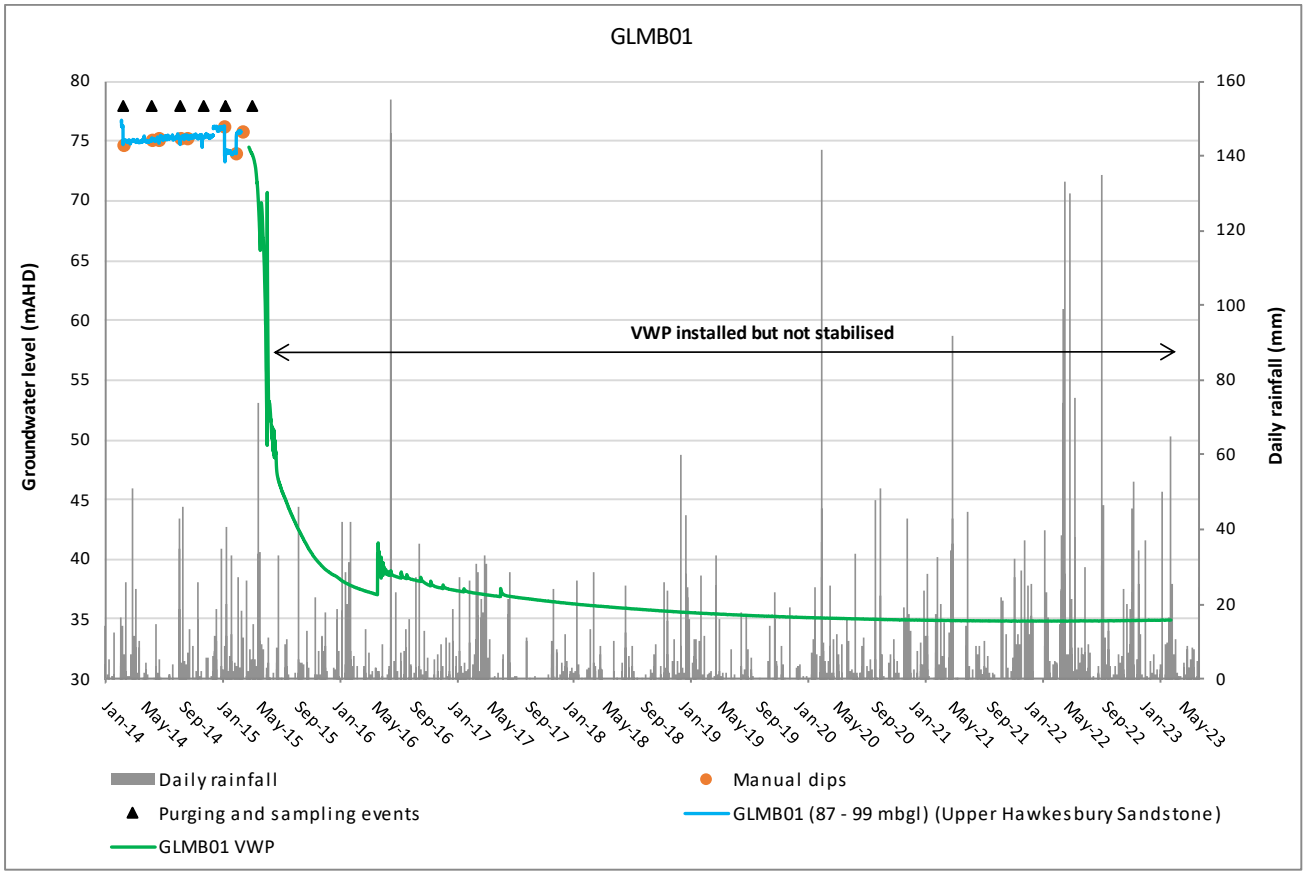

MPMB01
Groundwater level (mAHD)
Daily rainfall (mm)
75
73
71
69
67
65
63
61
59
57
55
160
140
120
100
80
60
40
20
0
Jan-13
May-13
Sep-13
Jan-14
May-14
Sep-14
Jan-15
May-15
Sep-15
Jan-16
May-16
Sep-16
Jan-17
May-17
Sep-17
Jan-18
May-18
Sep-18
Jan-19
May-19
Sep-19
Jan-20
May-20
Sep-20
Jan-21
May-21
Sep-21
Jan-22
May-22
Sep-22
Jan-23
May-23
Daily rainfall
MPMB01 (10.0 - 16.0 mbgl) (Alluvium)
Manual dips
Purging and sampling events

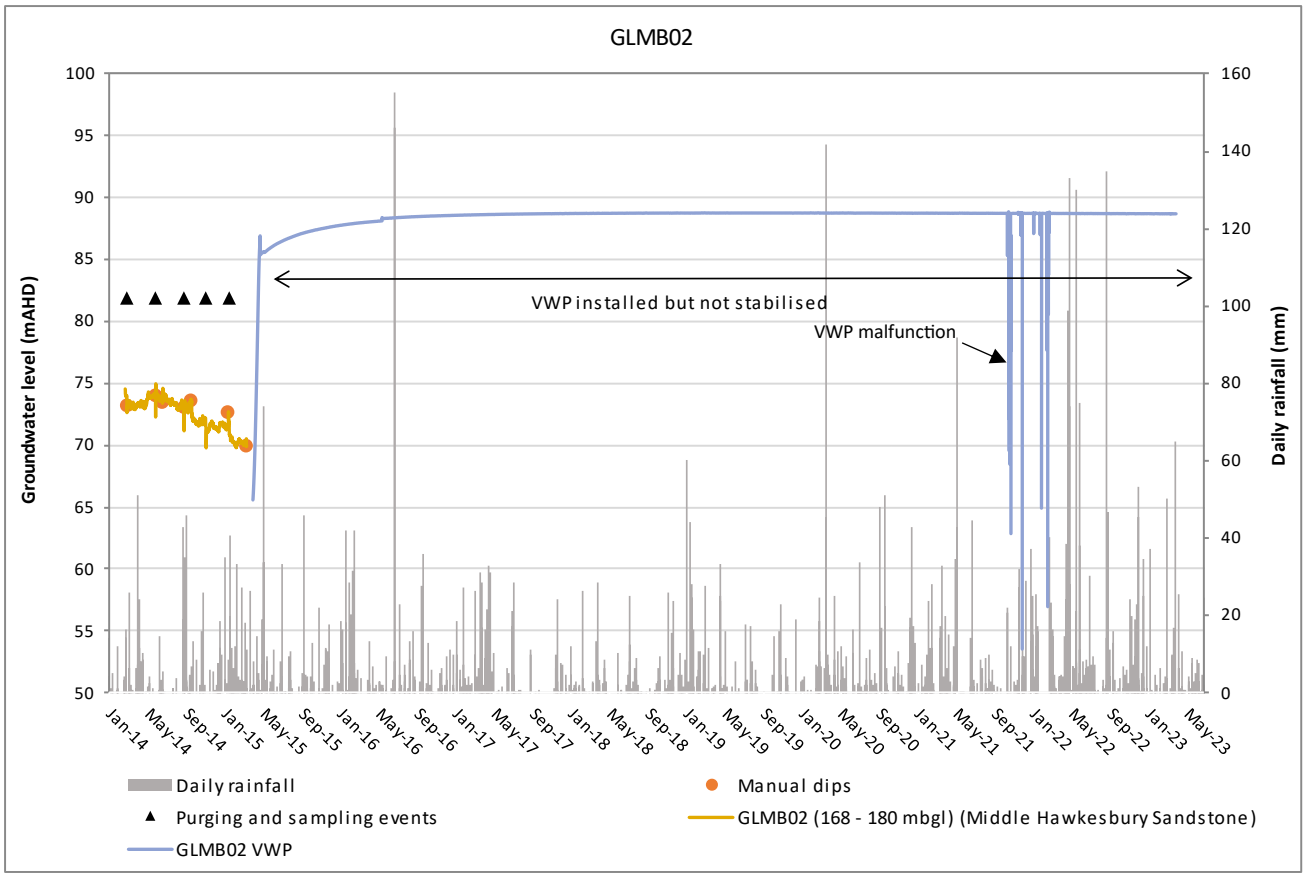

MPMB02
Groundwater level (mAHD)
Daily rainfall (mm)
75
73
71
69
67
65
63
61
59
57
55
160
140
120
100
80
60
40
20
0
Jan-13
May-13
Sep-13
Jan-14
May-14
Sep-14
Jan-15
May-15
Sep-15
Jan-16
May-16
Sep-16
Jan-17
May-17
Sep-17
Jan-18
May-18
Sep-18
Jan-19
May-19
Sep-19
Jan-20
May-20
Sep-20
Jan-21
May-21
Sep-21
Jan-22
May-22
Sep-22
Jan-23
May-23
Daily rainfall
MPMB02 (27.4 - 39.4 mbgl) (Upper Hawkesbury Sandstone)
Manual dips
Purging and sampling events

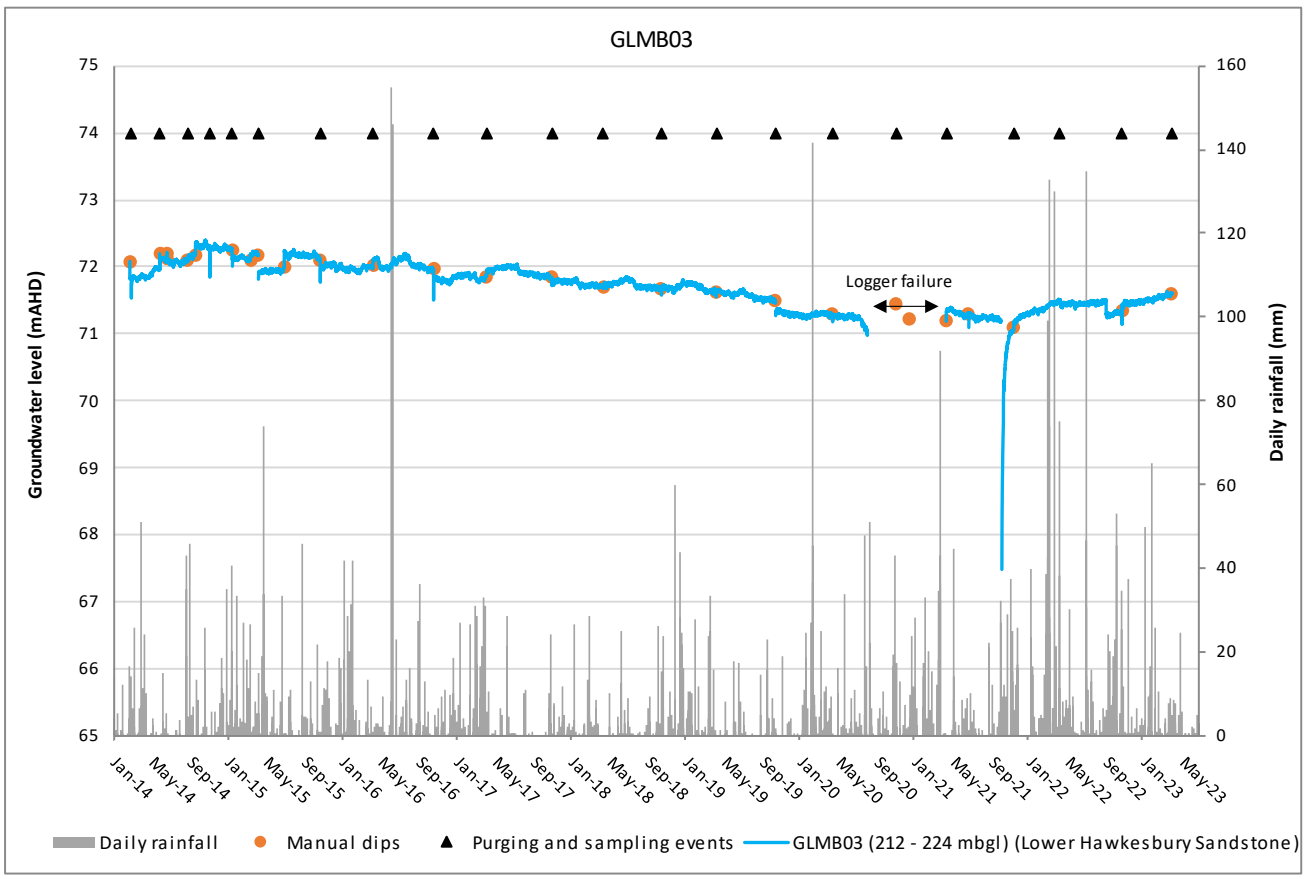

MPMB03
Groundwater level (mAHD)
Daily rainfall (mm)
75
73
71
69
67
65
63
61
59
57
55
160
140
120
100
80
60
40
20
0
Jan-13
May-13
Sep-13
Jan-14
May-14
Sep-14
Jan-15
May-15
Sep-15
Jan-16
May-16
Sep-16
Jan-17
May-17
Sep-17
Jan-18
May-18
Sep-18
Jan-19
May-19
Sep-19
Jan-20
May-20
Sep-20
Jan-21
May-21
Sep-21
Jan-22
May-22
Sep-22
Jan-23
May-23
Daily rainfall
MPMB03 (97.0 - 106.0 mbgl) (Middle Hawkesbury Sandstone)
Manual dips
Purging and sampling events

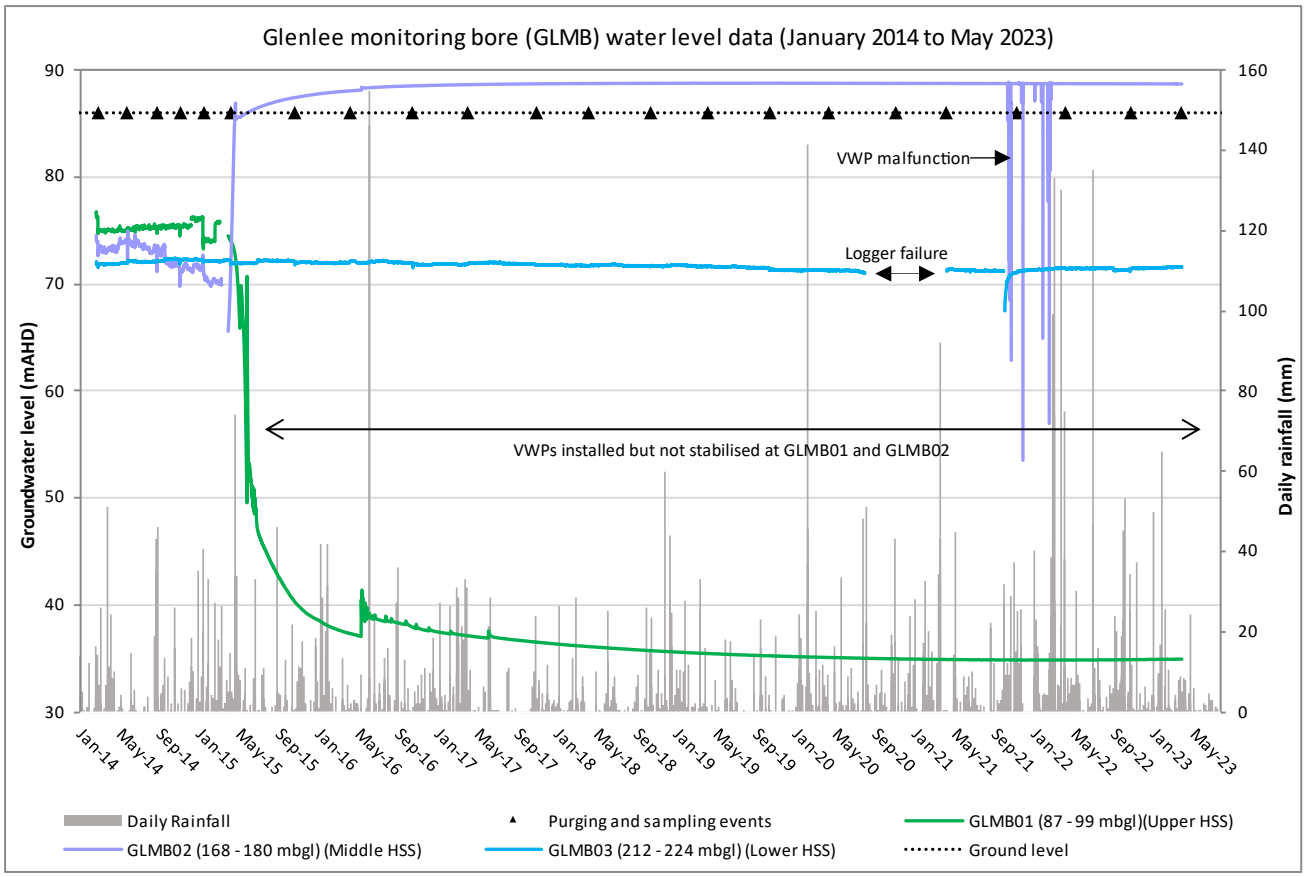

MPMB04
Groundwater level (mAHD)
Daily rainfall (mm)
69
67
65
63
61
59
57
55
160
140
120
100
80
60
40
20
0
Logger failure
Jan-13
May-13
Sep-13
Jan-14
May-14
Sep-14
Jan-15
May-15
Sep-15
Jan-16
May-16
Sep-16
Jan-17
May-17
Sep-17
Jan-18
May-18
Sep-18
Jan-19
May-19
Sep-19
Jan-20
May-20
Sep-20
Jan-21
May-21
Sep-21
Jan-22
May-22
Sep-22
Jan-23
May-23
Daily rainfall
MPMB04 (191.6 - 182.6 mbgl) (Lower Hawkesbury Sandstone)
Manual dips
Purging and sampling events


Menangle Park monitoring bore (MPMB) water level data (January 2013 to May 2023)
Groundwater level (mAHD)
Daily rainfall (mm)
MPMB01 (10-16 mbgl) (Alluvium)
MPMB02 (27.4-39.4 mbgl) (Upper HSS)
MPMB03 (97-106 mbgl) (Middle HSS)
MPMB04 (182.6-191.6 mbgl) (Lower HSS)
Purging and sampling events
Ground level
Nepean River Level
Daily rainfall


GLMB01
Groundwater level (mAHD)
Daily rainfall (mm)
VWP installed but not stabilised
Daily rainfall
Manual dips
Purging and sampling events
GLMB01 (87 - 99 mbgl) (Upper Hawkesbury Sandstone)
GLMB01 VWP


GLMB02
Groundwater level (mAHD)
Daily rainfall (mm)
VWP installed but not stabilised
VWP malfunction
Daily rainfall
Manual dips
Purging and sampling events
GLMB02 (168 - 180 mbgl) (Middle Hawkesbury Sandstone)
GLMB02 VWP


GLMB03
Groundwater level (mAHD)
Daily rainfall (mm)
Logger failure
Daily rainfall
Manual dips
Purging and sampling events
GLMB03 (212 - 224 mbgl) (Lower Hawkesbury Sandstone)


Glenlee monitoring bore (GLMB) water level data (January 2014 to May 2023)
Groundwater level (mAHD)
Daily rainfall (mm)
90
80
70
60
50
40
30
160
140
120
100
80
60
40
20
0
VWP malfunction
Logger failure
VWPs installed but not stabilised at GLMB01 and GLMB02
Jan-14
May-14
Sep-14
Jan-15
May-15
Sep-15
Jan-16
May-16
Sep-16
Jan-17
May-17
Sep-17
Jan-18
May-18
Sep-18
Jan-19
May-19
Sep-19
Jan-20
May-20
Sep-20
Jan-21
May-21
Sep-21
Jan-22
May-22
Sep-22
Jan-23
May-23
Daily Rainfall
Purging and sampling events
GLMB01 (87 - 99 mbgl)(Upper HSS)
GLMB02 (168 - 180 mbgl) (Middle HSS)
GLMB03 (212 - 224 mbgl) (Lower HSS)
Ground level

# Appendix B

## Water quality summary table

EMM
creating opportunities

| | | | Location Code | GLMB03 | GLMB03 | GLMB03 | MPMB01 | MPMB01 | MPMB01 (QA) | MPMB01 | MPMB01 (QA) | MPMB02 | MPMB02 (QA1) | MPMB02 | MPMB02 | MPMB03 | MPMB03 | MPMB03 | MPMB04 | MPMB04 | MPMB04 | Nepean River | Nepean River | Nepean River | Trip Blank |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Date | 27 Oct 2022 | 04 Apr 2023 | 27 Jun 2023 | 26 Oct 2022 | 04 Apr 2023 | 04 Apr 2023 | 27 Jun 2023 | 27 Jun 2023 | 26 Oct 2022 | 26 Oct 2022 | 04 Apr 2023 | 24 May 2023 | 26 Oct 2022 | 04 Apr 2023 | 24 May 2023 | 26 Oct 2022 | 04 Apr 2023 | 27 Jun 2023 | 26 Oct 2022 | 04 Apr 2023 | 27 Jun 2023 | 21 Oct 2022 |
| | | | Water level (mbgl) | 14.54 | 14.84 | | 5.79 | 8.37 | 8.37 | | | 6.50 | 6.50 | 8.93 | 9.11 | 5.70 | 7.85 | 7.84 | 4.98 | 7.29 | | - | | | - |
| | Unit | EQL | | | | | | | | | | | | | | | | | | | | | | | |
| **Field parameters** | | | | | | | | | | | | | | | | | | | | | | | | | |
| pH (field) | pH units | | | 9.25 | 10.57 | | 5.22 | 5.35 | 5.35 | | | 6.38 | 6.38 | 6.67 | 6.55 | 6.37 | 7.42 | 7.15 | 9.15 | 10.26 | | 6.11 | 8.02 | - | - |
| Electrical Conductivity (field) | µS/cm | | | 4158 | 3634 | | 677 | 541 | 541 | | | 675 | 675 | 587 | 468.1 | 672 | 824 | 185 | 194.7 | 208.1 | | 139.9 | 245 | - | - |
| Total dissolved solids (TDS) | mg/L | | | 2704 | | | 436 | | | | | 432 | 432 | | 345.2 | 496 | | 135.2 | 139 | | | 91 | | | |
| **Physical parameters (lab)** | | | | | | | | | | | | | | | | | | | | | | | | | |
| TSS | mg/L | 5 | | <5 | 8 | - | 17 | 10 | 5 | - | - | 70 | 80 | <5 | - | 170 | 23 | - | 50 | 16 | | 10 | 15 | - | - |
| TDS | mg/L | 10 | | 2,960 | 2340 | - | 366 | 338 | 326 | - | - | 306 | 308 | 354 | | 474 | 482 | - | 129 | 134 | | 68 | 158 | - | - |
| Electrical Conductivity (Lab) | µS/cm | 1 | | 4,140 | 3700 | - | 707 | 606 | 594 | - | - | 594 | 600 | 631 | - | 880 | 878 | - | 236 | 220 | | 94 | 275 | - | - |
| pH (Lab) | - | 0.01 | | 8.8 | 9.88 | - | 6.63 | 6.01 | 6.01 | - | - | 7.35 | 7.43 | 6.89 | | 7.84 | 7.79 | | 8.62 | 8.83 | | 6 | 6.81 | - | - |
| **Major ions** | | | | | | | | | | | | | | | | | | | | | | | | | |
| Calcium (filtered) | mg/L | 1 | | 49 | 15 | - | 8 | 8 | 8 | - | - | 22 | 22 | 28 | - | 70 | 83 | - | 3 | 3 | | 3 | 7 | - | - |
| Magnesium (filtered) | mg/L | 1 | | 64 | 63 | - | 14 | 14 | 14 | - | - | 22 | 23 | 27 | - | 19 | 21 | - | 1 | <1 | | 2 | 7 | - | - |
| Sodium (filtered) | mg/L | 1 | | 781 | 837 | - | 89 | 88 | 88 | - | - | 53 | 55 | 65 | - | 83 | 97 | - | 46 | 45 | | 10 | 40 | - | - |
| Potassium (filtered) | mg/L | 1 | | 31 | 33 | - | 1 | 1 | 2 | - | - | 3 | 3 | 4 | - | 10 | 12 | - | 4 | 4 | | 1 | 4 | - | - |
| Chloride | mg/L | 1 | | 772 | 690 | - | 208 | 183 | 170 | - | - | 103 | 103 | 116 | | 57 | 64 | - | 20 | 19 | | 16 | 43 | - | - |
| Alkalinity (Bicarbonate as $CaCO_3$) | mg/L | 1 | | 722 | 491 | - | 26 | 15 | 15 | - | - | 139 | 136 | 146 | | 406 | 416 | - | 78 | 69 | | 6 | 66 | - | - |
| Alkalinity (Carbonate as $CaCO_3$) | mg/L | 1 | | 24 | 592 | - | <1 | <1 | <1 | - | - | <1 | <1 | <1 | | <1 | <1 | - | 18 | 19 | | <1 | <1 | - | - |
| Alkalinity (Hydroxide) as $CaCO_3$ | mg/L | 1 | | <1 | <1 | - | <1 | <1 | <1 | - | - | <1 | <1 | <1 | | <1 | <1 | - | <1 | <1 | | <1 | <1 | - | - |
| Alkalinity (total) as $CaCO_3$ | mg/L | 1 | | 745 | 1080 | - | 26 | 15 | 15 | - | - | 139 | 136 | 146 | | 406 | 416 | - | 96 | 88 | | 6 | 66 | - | - |
| Sulfate as $SO_4$ - Turbidimetric (filtered) | mg/L | 1 | | <1 | <1 | - | 4 | 3 | 3 | - | - | 6 | 6 | 4 | | <1 | <1 | - | <1 | <1 | | 3 | 5 | - | - |
| **Nutrients** | | | | | | | | | | | | | | | | | | | | | | | | | |
| Ammonia as N | mg/L | 0.01 | | 0.61 | 1.5 | - | <0.01 | <0.01 | <0.01 | - | - | 0.18 | 0.13 | 0.14 | - | 0.45 | 0.91 | - | 0.5 | 0.48 | | 0.06 | <0.01 | - | - |
| Nitrite + Nitrate as N | mg/L | 0.01 | | <0.01 | 0.02 | - | 0.76 | 0.74 | 0.75 | - | - | 0.02 | <0.01 | 0.02 | - | <0.01 | 0.05 | - | 0.71 | 0.04 | | 0.13 | 0.09 | - | - |
| 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 | <0.01 | | <0.01 | <0.01 | - | - |
| Nitrate (as N) | mg/L | 0.01 | | <0.01 | 0.02 | - | 0.76 | 0.74 | 0.75 | - | - | 0.02 | <0.01 | 0.02 | - | <0.01 | 0.05 | - | 0.71 | 0.04 | | 0.13 | 0.09 | - | - |
| Phosphate total (as P) | mg/L | 0.01 | | 0.51 | 0.18 | - | 0.03 | 0.8 | 0.96 | - | - | 0.08 | 0.05 | 0.07 | - | 0.09 | 0.11 | - | 0.03 | 0.02 | | 0.03 | 0.04 | - | - |
| Reactive Phosphorus as P | mg/L | 0.01 | | 0.02 | 0.2 | - | <0.01 | <0.01 | <0.01 | - | - | <0.01 | <0.01 | <0.01 | - | <0.01 | <0.01 | - | <0.01 | <0.01 | | <0.01 | <0.01 | - | - |
| TOC | mg/L | 1 | | 439 | 90 | - | <1 | <1 | <1 | - | - | 2 | 2 | <1 | - | 5 | 5 | - | 6 | 6 | | 5 | 5 | - | - |
| **Other** | | | | | | | | | | | | | | | | | | | | | | | | | - |
| Cyanide Total | mg/L | 0.004 | | <0.010 | <0.004 | - | <0.004 | <0.004 | <0.004 | - | - | <0.004 | <0.004 | <0.004 | - | <0.004 | <0.004 | - | <0.004 | <0.004 | | <0.004 | <0.004 | - | - |
| Fluoride | mg/L | 0.1 | | 0.1 | <0.1 | - | <0.1 | <0.1 | <0.1 | - | - | 0.1 | 0.1 | 0.1 | - | <0.1 | 0.1 | - | 0.2 | 0.2 | | <0.1 | <0.1 | - | - |
| Bromide | mg/L | 0.01 | | 1.49 | 1.7 | - | 0.37 | 0.371 | 0.401 | - | - | 0.199 | 0.206 | 0.245 | - | 0.144 | <0.01 | - | 0.076 | 0.07 | | 0.041 | 0.117 | - | - |
| Bromine (filtered) | mg/L | 0.1 | | 2 | 1.9 | - | 0.3 | 0.5 | 0.4 | - | - | 0.2 | 0.2 | 0.3 | - | <0.1 | 0.1 | - | <0.1 | <0.1 | | <0.1 | 0.2 | - | - |
| Reactive Silica | mg/L | 0.05 | | 4.8 | 4.31 | - | 16.6 | 17.4 | 17.6 | - | - | 9.52 | 9.29 | 10.8 | - | 8.16 | 9.22 | - | 3.21 | 3.63 | | 4.14 | 2.03 | - | - |
| **Metals** | | | | | | | | | | | | | | | | | | | | | | | | | - |
| Aluminium (filtered) | mg/L | 0.01 | | <0.01 | <0.01 | - | <0.01 | <0.01 | <0.01 | - | - | <0.01 | <0.01 | <0.01 | - | <0.01 | <0.01 | - | 0.02 | <0.01 | | 0.22 | 0.03 | - | - |
| Antimony (filtered) | 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 | <0.001 | | <0.001 | <0.001 | - | - |
| Arsenic (filtered) | mg/L | 0.001 | | 0.003 | 0.003 | - | <0.001 | <0.001 | <0.001 | - | - | 0.016 | 0.015 | 0.018 | - | 0.009 | 0.008 | - | 0.001 | 0.001 | | <0.001 | <0.001 | - | - |
| Barium (filtered) | mg/L | 0.001 | | 21.4 | 17.6 | - | 0.433 | 0.385 | 0.38 | - | - | 0.328 | 0.325 | 0.394 | - | 1.84 | 2.58 | - | 0.235 | 0.202 | | 0.02 | 0.044 | - | - |
| Beryllium (filtered) | 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 | <0.001 | | <0.001 | <0.001 | - | - |
| Boron (filtered) | mg/L | 0.05 | | 0.12 | 0.08 | - | <0.05 | <0.05 | <0.05 | - | - | <0.05 | <0.05 | <0.05 | - | <0.05 | <0.05 | - | <0.05 | <0.05 | | <0.05 | <0.05 | - | - |
| Cadmium (filtered) | 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 | <0.0001 | | <0.0001 | <0.0001 | - | - |
| Chromium (III+VI) (filtered) | mg/L | 0.001 | | <0.001 | <0.001 | - | <0.001 | <0.001 | <0.001 | - | - | 0.002 | <0.001 | <0.001 | - | <0.001 | <0.001 | - | <0.001 | <0.001 | | <0.001 | <0.001 | - | - |
| Cobalt (filtered) | mg/L | 0.001 | | <0.001 | <0.001 | - | 0.027 | 0.025 | 0.024 | - | - | 0.006 | 0.007 | 0.005 | - | 0.002 | 0.003 | - | <0.001 | <0.001 | | <0.001 | <0.001 | - | - |
| Copper (filtered) | mg/L | 0.001 | | 0.008 | <0.001 | - | 0.005 | 0.003 | 0.004 | - | - | <0.001 | <0.001 | <0.001 | - | <0.001 | <0.001 | - | 0.003 | 0.004 | | 0.005 | 0.002 | - | - |
| Iron (filtered) | mg/L | 0.05 | | <0.05 | <0.05 | - | <0.05 | 0.28 | 0.28 | - | - | 4.41 | 4.4 | 5.61 | - | 6.13 | 4.51 | - | <0.05 | <0.05 | | 0.32 | 0.5 | - | - |
| Lead (filtered) | 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 | <0.001 | | <0.001 | <0.001 | - | - |
| Manganese (filtered) | mg/L | 0.001 | | 0.034 | 0.014 | - | 0.32 | 0.306 | 0.308 | - | - | 0.335 | 0.342 | 0.32 | - | 0.716 | 0.271 | - | 0.01 | 0.005 | | 0.018 | 0.024 | - | - |
| Mercury (filtered) | mg/L | 0.0001 | | 0.0001 | 0.001 | - | <0.0001 | 0.0001 | 0.0002 | - | - | <0.0001 | <0.0001 | <0.0001 | - | <0.0001 | <0.0001 | - | <0.0001 | <0.0001 | | <0.0001 | <0.0001 | - | - |
| Molybdenum (filtered) | mg/L | 0.001 | | 0.003 | 0.004 | - | <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 (filtered) | mg/L | 0.001 | | 0.004 | 0.001 | - | 0.008 | 0.011 | 0.013 | - | - | 0.005 | 0.005 | 0.004 | - | <0.001 | <0.001 | - | <0.001 | <0.001 | - | <0.001 | 0.003 | - | - |
| Selenium (filtered) | 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 | <0.01 | | <0.01 | <0.01 | - | - |
| Strontium (filtered) | mg/L | 0.001 | | 4.98 | 4.31 | - | 0.095 | 0.1 | 0.097 | - | - | 0.25 | 0.252 | 0.304 | - | 0.635 | 0.776 | - | 0.061 | 0.054 | | 0.022 | 0.068 | - | - |
| Uranium (filtered) | 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 | <0.001 | | <0.001 | <0.001 | - | - |
| Vanadium (filtered) | 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 | <0.01 | | <0.01 | <0.01 | - | - |
| Zinc (filtered) | mg/L | 0.005 | | 0.549 | 0.152 | - | 0.024 | 0.034 | 0.035 | - | - | <0.005 | <0.005 | 0.007 | - | <0.005 | <0.005 | - | 0.082 | 0.101 | | <0.005 | <0.005 | - | - |
| **Dissolved gases** | | | | | | | | | | | | | | | | | | | | | | | | | - |
| Methane | mg/L | 0.01 | | 19.1 | 11.9 | - | 0.013 | <0.01 | <0.01 | - | - | 0.616 | 0.586 | - | 1.83 | 41.8 | - | 4.4 | 8.57 | 13.4 | | <0.01 | <0.01 | - | - |
| **BTEX** | | | | | | | | | | | | | | | | | | | | | | | | | |
| Benzene | µg/L | 1 | | <1 | - | <1 | <1 | - | - | <1 | <1 | <1 | <1 | - | <1 | <1 | - | <1 | <1 | | <1 | <1 | | <1 | <1 |
| Ethylbenzene | µg/L | 2 | | <2 | - | <2 | <2 | - | - | <2 | <2 | <2 | <2 | - | <2 | <2 | - | <2 | <2 | | <2 | <2 | | <2 | <2 |
| Toluene | µg/L | 2 | | 22 | - | 21 | <2 | - | - | <2 | <2 | <2 | <2 | - | <2 | <2 | - | <2 | <2 | | <2 | <2 | | <2 | <2 |
| Total BTEX | µg/L | 1 | | 22 | - | 21 | <1 | - | - | <1 | <1 | <1 | <1 | - | <1 | <1 | - | <1 | <1 | | <1 | <1 | | <1 | <1 |
| Xylene (m & p) | µg/L | 2 | | <2 | - | <2 | <2 | - | - | <2 | <2 | <2 | <2 | - | <2 | <2 | - | <2 | <2 | | <2 | <2 | | <2 | <2 |
| Xylene (o) | µg/L | 2 | | <2 | - | <2 | <2 | - | - | <2 | <2 | <2 | <2 | - | <2 | <2 | - | <2 | <2 | | <2 | <2 | | <2 | <2 |
| Xylene Total | µg/L | 2 | | <2 | - | <2 | <2 | - | - | <2 | <2 | <2 | <2 | - | <2 | <2 | - | <2 | <2 | | <2 | <2 | | <2 | <2 |
| Naphthalene (VOC) | mg/L | 0.005 | | <0.005 | - | <0.005 | <0.005 | - | - | <0.005 | <0.005 | <0.005 | <0.005 | - | <0.005 | <0.005 | - | <0.005 | <0.005 | | <0.005 | <0.005 | | <0.005 | <0.005 |
| **Phenols** | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2,4,5-Trichlorophenol | µg/L | 1 | | <1.0 | <1.0 | - | <1.0 | <1.0 | <1.0 | - | - | <1.0 | <1.0 | <1.0 | - | <1.0 | <1.0 | - | <1.0 | <1.0 | | <1.0 | <1.0 | - | - |
| 2,4,6-Trichlorophenol | µg/L | 1 | | <1.0 | <1.0 | - | <1.0 | <1.0 | <1.0 | - | - | <1.0 | <1.0 | <1.0 | - | <1.0 | <1.0 | - | <1.0 | <1.0 | | <1.0 | <1.0 | - | - |
| 2,4-Dichlorophenol | µg/L | 1 | | <1.0 | <1.0 | - | <1.0 | <1.0 | <1.0 | - | - | <1.0 | <1.0 | <1.0 | - | <1.0 | <1.0 | - | <1.0 | <1.0 | | <1.0 | <1.0 | - | - |
| 2,4-Dimethylphenol | µg/L | 1 | | <1.0 | <1.0 | - | <1.0 | <1.0 | <1.0 | - | - | <1.0 | <1.0 | <1.0 | - | <1.0 | <1.0 | - | <1.0 | <1.0 | | <1.0 | <1.0 | - | - |
| 2,6-Dichlorophenol | µg/L | 1 | | <1.0 | <1.0 | - | <1.0 | <1.0 | <1.0 | - | - | <1.0 | <1.0 | <1.0 | - | <1.0 | <1.0 | - | <1.0 | <1.0 | | <1.0 | <1.0 | - | - |
| 2-Chlorophenol | µg/L | 1 | | <1.0 | <1.0 | - | <1.0 | <1.0 | <1.0 | - | - | <1.0 | <1.0 | <1.0 | - | <1.0 | <1.0 | - | <1.0 | <1.0 | | <1.0 | <1.0 | - | - |
| 2-Nitrophenol | µg/L | 1 | | <1.0 | <1.0 | - | <1.0 | <1.0 | <1.0 | - | - | <1.0 | <1.0 | <1.0 | - | <1.0 | <1.0 | - | <1.0 | <1.0 | - | <1.0 | <1.0 | - | - |
| 2-Methylphenol | µg/L | 1 | | <1.0 | <1.0 | - | <1.0 | <1.0 | <1.0 | - | - | <1.0 | <1.0 | <1.0 | - | <1.0 | <1.0 | - | <1.0 | <1.0 | | <1.0 | <1.0 | - | - |
| 3&4-Methylphenol (m&p-cresol) | µg/L | 2 | | <2.0 | <2.0 | - | <2.0 | <2.0 | <2.0 | - | - | <2.0 | <2.0 | <2.0 | - | <2.0 | <2.0 | - | <2.0 | <2.0 | | <2.0 | <2.0 | - | - |
| Pentachlorophenol | µg/L | 2 | | <2.0 | <2.0 | - | <2.0 | <2.0 | <2.0 | - | - | <2.0 | <2.0 | <2.0 | - | <2.0 | <2.0 | - | <2.0 | <2.0 | | <2.0 | <2.0 | - | - |
| 4-chloro-3-methylphenol | µg/L | 1 | | <1.0 | <1.0 | - | <1.0 | <1.0 | <1.0 | - | - | <1.0 | <1.0 | <1.0 | - | <1.0 | <1.0 | - | <1.0 | <1.0 | | <1.0 | <1.0 | - | - |
| Phenol | µg/L | 1 | | <1.0 | <1.0 | - | <1.0 | <1.0 | <1.0 | - | - | <1.0 | <1.0 | <1.0 | - | <1.0 | <1.0 | - | <1.0 | <1.0 | | <1.0 | <1.0 | - | - |
| **TRH** | | | | | | | | | | | | | | | | | | | | | | | | | |
| C10-C16 | µg/L | 100 | | 100 | <100 | <100 | <100 | <100 | <100 | <100 | <100 | <100 | <100 | - | <100 | <100 | <100 | <100 | <100 | <100 | <100 | <100 | <100 | <100 | - |
| C10-C16 (F2 minus Naphthalene) | µg/L | 100 | | 100 | <100 | <100 | <100 | <100 | <100 | <100 | <100 | <100 | <100 | - | <100 | <100 | <100 | <100 | <100 | <100 | <100 | <100 | <100 | <100 | - |
| C10-C40 (Sum of total) | µg/L | 100 | | 460 | 740 | <100 | <100 | <100 | <100 | <100 | <100 | <100 | <100 | - | <100 | <100 | <100 | <100 | <100 | <100 | <100 | <100 | <100 | <100 | - |
| C16-C34 | µg/L | 100 | | 360 | 740 | <100 | <100 | <100 | <100 | <100 | <100 | <100 | <100 | - | <100 | <100 | <100 | <100 | <100 | <100 | <100 | <100 | <100 | <100 | - |
| C34-C40 | µg/L | 100 | | <100 | <100 | <100 | <100 | <100 | <100 | <100 | <100 | <100 | <100 | - | <100 | <100 | <100 | <100 | <100 | <100 | <100 | <100 | <100 | <100 | - |
| C6-C10 | µg/L | 20 | | <20 | - | 50 | <20 | - | - | <20 | 20 | <20 | <20 | - | <20 | <20 | - | <20 | <20 | - | <20 | <20 | - | <20 | <20 |
| C6-C10 (F1 minus BTEX) | µg/L | 20 | | <20 | | 30 | <20 | | | <20 | 20 | <20 | <20 | | <20 | <20 | | <20 | <20 | | <20 | <20 | | <20 | <20 |
| **PAH** | | | | | | | | | | | | | | | | | | | | | | | | | |

| | | Location Code | GLMB03 | GLMB03 | GLMB03 | MPMB01 | MPMB01 | MPMB01 (QA) | MPMB01 | MPMB01 (QA) | MPMB02 | MPMB02 (QA1) | MPMB02 | MPMB02 | MPMB03 | MPMB03 | MPMB03 | MPMB04 | MPMB04 | MPMB04 | Nepean River | Nepean River | Nepean River | Trip Blank |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Date | 27 Oct 2022 | 04 Apr 2023 | 27 Jun 2023 | 26 Oct 2022 | 04 Apr 2023 | 04 Apr 2023 | 27 Jun 2023 | 27 Jun 2023 | 26 Oct 2022 | 26 Oct 2022 | 04 Apr 2023 | 24 May 2023 | 26 Oct 2022 | 04 Apr 2023 | 24 May 2023 | 26 Oct 2022 | 04 Apr 2023 | 27 Jun 2023 | 26 Oct 2022 | 04 Apr 2023 | 27 Jun 2023 | 21 Oct 2022 |
| | | Water level (mbgl) | 14.54 | 14.84 | | 5.79 | 8.37 | 8.37 | | | 6.50 | 6.50 | 8.93 | 9.11 | 5.70 | 7.85 | 7.84 | 4.98 | 7.29 | | | | | |
| | Unit | EQL | | | | | | | | | | | | | | | | | | | | | | |
| Naphthalene | µg/L | 1 | <1.0 | <1.0 | - | <1.0 | <1.0 | <1.0 | - | - | <1.0 | <1.0 | <1.0 | - | <1.0 | <1.0 | - | <1.0 | <1.0 | - | <1.0 | <1.0 | - | - |
| Acenaphthene | µg/L | 1 | <1.0 | <1.0 | - | <1.0 | <1.0 | <1.0 | - | - | <1.0 | <1.0 | <1.0 | - | <1.0 | <1.0 | - | <1.0 | <1.0 | - | <1.0 | <1.0 | - | - |
| Acenaphthylene | µg/L | 1 | <1.0 | <1.0 | - | <1.0 | <1.0 | <1.0 | - | - | <1.0 | <1.0 | <1.0 | - | <1.0 | <1.0 | - | <1.0 | <1.0 | - | <1.0 | <1.0 | - | - |
| Anthracene | µg/L | 1 | <1.0 | <1.0 | - | <1.0 | <1.0 | <1.0 | - | - | <1.0 | <1.0 | <1.0 | - | <1.0 | <1.0 | - | <1.0 | <1.0 | - | <1.0 | <1.0 | - | - |
| Benz(a)anthracene | µg/L | 1 | <1.0 | <1.0 | - | <1.0 | <1.0 | <1.0 | - | - | <1.0 | <1.0 | <1.0 | - | <1.0 | <1.0 | - | <1.0 | <1.0 | - | <1.0 | <1.0 | - | - |
| Benzo(a) pyrene | µg/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 | <0.5 | - | <0.5 | <0.5 | - | - |
| Benzo(a)pyrene TEQ calc (Zero) | µg/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 | <0.5 | - | <0.5 | <0.5 | - | - |
| Benzo(b+j)fluoranthene | µg/L | 1 | <1.0 | <1.0 | - | <1.0 | <1.0 | <1.0 | - | - | <1.0 | <1.0 | <1.0 | - | <1.0 | <1.0 | - | <1.0 | <1.0 | - | <1.0 | <1.0 | - | - |
| Benzo(g,h,i)perylene | µg/L | 1 | <1.0 | <1.0 | - | <1.0 | <1.0 | <1.0 | - | - | <1.0 | <1.0 | <1.0 | - | <1.0 | <1.0 | - | <1.0 | <1.0 | - | <1.0 | <1.0 | - | - |
| Benzo(k)fluoranthene | µg/L | 1 | <1.0 | <1.0 | - | <1.0 | <1.0 | <1.0 | - | - | <1.0 | <1.0 | <1.0 | - | <1.0 | <1.0 | - | <1.0 | <1.0 | - | <1.0 | <1.0 | - | - |
| Chrysene | µg/L | 1 | <1.0 | <1.0 | - | <1.0 | <1.0 | <1.0 | - | - | <1.0 | <1.0 | <1.0 | - | <1.0 | <1.0 | - | <1.0 | <1.0 | - | <1.0 | <1.0 | - | - |
| Dibenz(a,h)anthracene | µg/L | 1 | <1.0 | <1.0 | - | <1.0 | <1.0 | <1.0 | - | - | <1.0 | <1.0 | <1.0 | - | <1.0 | <1.0 | - | <1.0 | <1.0 | - | <1.0 | <1.0 | - | - |
| Fluoranthene | µg/L | 1 | <1.0 | <1.0 | - | <1.0 | <1.0 | <1.0 | - | - | <1.0 | <1.0 | <1.0 | - | <1.0 | <1.0 | - | <1.0 | <1.0 | - | <1.0 | <1.0 | - | - |
| Fluorene | µg/L | 1 | <1.0 | <1.0 | - | <1.0 | <1.0 | <1.0 | - | - | <1.0 | <1.0 | <1.0 | - | <1.0 | <1.0 | - | <1.0 | <1.0 | - | <1.0 | <1.0 | - | - |
| PAHs (Sum of total) | µg/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 | <0.5 | - | <0.5 | <0.5 | - | - |
| Indeno(1,2,3-c,d)pyrene | µg/L | 1 | <1.0 | <1.0 | - | <1.0 | <1.0 | <1.0 | - | - | <1.0 | <1.0 | <1.0 | - | <1.0 | <1.0 | - | <1.0 | <1.0 | - | <1.0 | <1.0 | - | - |
| Phenanthrene | µg/L | 1 | <1.0 | <1.0 | - | <1.0 | <1.0 | <1.0 | - | - | <1.0 | <1.0 | <1.0 | - | <1.0 | <1.0 | - | <1.0 | <1.0 | - | <1.0 | <1.0 | - | - |
| Pyrene | µg/L | 1 | <1.0 | <1.0 | - | <1.0 | <1.0 | <1.0 | - | - | <1.0 | <1.0 | <1.0 | - | <1.0 | <1.0 | - | <1.0 | <1.0 | - | <1.0 | <1.0 | - | - |
| **TPH** | | | | | | | | | | | | | | | | | | | | | | | | |
| +C10-C36 (Sum of total) | µg/L | 50 | 430 | 800 | <50 | <50 | <50 | <50 | <50 | <50 | <50 | <50 | - | <50 | <50 | <50 | <50 | <50 | <50 | <50 | <50 | <50 | <50 | - |
| C15-C28 | µg/L | 100 | 360 | 590 | <100 | <100 | <100 | <100 | <100 | <100 | <100 | <100 | - | <100 | <100 | <100 | <100 | <100 | <100 | <100 | <100 | <100 | <100 | - |
| C10-C14 | µg/L | 50 | 70 | <50 | <50 | <50 | <50 | <50 | <50 | <50 | <50 | <50 | - | <50 | <50 | <50 | <50 | <50 | <50 | <50 | <50 | <50 | <50 | - |
| C29-C36 | µg/L | 50 | <50 | 210 | <50 | <50 | <50 | <50 | <50 | <50 | <50 | <50 | - | <50 | <50 | <50 | <50 | <50 | <50 | <50 | <50 | <50 | <50 | - |
| C6-C9 | µg/L | 20 | <20 | - | 50 | <20 | - | - | <20 | 20 | <20 | <20 | - | <20 | <20 | - | <20 | <20 | - | <20 | <20 | - | <20 | <20 |

# Appendix C
## Laboratory Reports

EMM
creating opportunities

ALS Environmental

# CERTIFICATE OF ANALYSIS

| | | | |
|---|---|---|---|
| **Work Order** | : **ES2238520** | Page | : 1 of 13 |
| Client | : **EMM CONSULTING PTY LTD** | Laboratory | : Environmental Division Sydney |
| Contact | : MS KAITLYN BRODIE | Contact | : Cez Bautista |
| Address | : Ground Floor Suite 1 20 Chandos Street St Leonards NSW NSW 2065 | Address | : 277-289 Woodpark Road Smithfield NSW Australia 2164 |
| Telephone | : 02 9493 9500 | Telephone | : +61-2-8784 8555 |
| Project | : AGL Camden Gas Project E220575 | Date Samples Received | : 26-Oct-2022 17:00 |
| Order number | : ---- | Date Analysis Commenced | : 26-Oct-2022 |
| C-O-C number | : ---- | Issue Date | : 03-Nov-2022 20:35 |
| Sampler | : Claire Corthier, KAITLYN BRODIE | | |
| Site | : ---- | | |
| Quote number | : SY/416/16 - AGL Camden Planned Event | | |
| No. of samples received | : 7 | | |
| No. of samples analysed | : 6 | | |

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

**Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.**

## *Signatories*

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

| *Signatories* | *Position* | *Accreditation Category* |
|---|---|---|
| Ankit Joshi | Senior Chemist - Inorganics | Sydney Inorganics, Smithfield, NSW |
| Edwandy Fadjar | Organic Coordinator | Sydney Organics, Smithfield, NSW |

## General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contract for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- EP075 (SIM): Where reported, Benzo(a)pyrene Toxicity Equivalent Quotient (TEQ) per the NEPM (2013) is the sum total of the concentration of the eight carcinogenic PAHs multiplied by their Toxicity Equivalence Factor (TEF) relative to Benzo(a)pyrene. TEF values are provided in brackets as follows: Benz(a)anthracene (0.1), Chrysene (0.01), Benzo(b+j) & Benzo(k)fluoranthene (0.1), Benzo(a)pyrene (1.0), Indeno(1.2.3.cd)pyrene (0.1), Dibenz(a.h)anthracene (1.0), Benzo(g.h.i)perylene (0.01). Less than LOR results for 'TEQ Zero' are treated as zero.
- EP080: Where reported, Total Xylenes is the sum of the reported concentrations of m&p-Xylene and o-Xylene at or above the LOR.
- EP075(SIM): Where reported, Total Cresol is the sum of the reported concentrations of 2-Methylphenol and 3- & 4-Methylphenol at or above the LOR.
- As per QWI – EN55-3 Data Interpreting Procedures, Ionic balances are typically calculated using Major Anions - Chloride, Alkalinity and Sulfate; and Major Cations - Calcium, Magnesium, Potassium and Sodium. Where applicable and dependent upon sample matrix, the Ionic Balance may also include the additional contribution of Ammonia, Dissolved Metals by ICPMS and H+ to the Cations and Nitrate, SiO2 and Fluoride to the Anions.
- EG020: Bromine quantification may be unreliable due to its low solubility in acid, leading to variable volatility during measurement by ICPMS.
- EG035: Poor matrix spike recovery was obtained for Mercury on sample ES2237930 # 1. Confirmed by re-analysis.
- EP075(SIM): Surrogate recovery bias low due to sample matrix interferences.
- EN055: Ionic Balance out of acceptable limits for sample ES2238520-#001 due to analytes not quantified in this report.
- Sodium Adsorption Ratio (where reported): Where results for Na, Ca or Mg are <LOR, a concentration at half the reported LOR is incorporated into the SAR calculation. This represents a conservative approach for Na relative to the assumption that <LOR = zero concentration and a conservative approach for Ca & Mg relative to the assumption that <LOR is equivalent to the LOR concentration.

## Analytical Results

| Sub-Matrix: WATER (Matrix: WATER) | | | Sample ID | MPMB01 | MPMB02 | MPMB03 | MPMB04 | NR |
|---|---|---|---|---|---|---|---|---|
| | | | Sampling date / time | [26-Oct-2022] | [26-Oct-2022] | [26-Oct-2022] | [26-Oct-2022] | [26-Oct-2022] |
| Compound | CAS Number | LOR | Unit | ES2238520-001 | ES2238520-002 | ES2238520-003 | ES2238520-004 | ES2238520-005 |
| | | | | Result | Result | Result | Result | Result |
| **EA005P: pH by PC Titrator** | | | | | | | | |
| pH Value | ---- | 0.01 | pH Unit | 6.63 | 7.35 | 7.84 | 8.62 | 6.00 |
| **EA010P: Conductivity by PC Titrator** | | | | | | | | |
| Electrical Conductivity @ 25°C | ---- | 1 | µS/cm | 707 | 594 | 880 | 236 | 94 |
| **EA015: Total Dissolved Solids dried at 180 ± 5 °C** | | | | | | | | |
| Total Dissolved Solids @180°C | ---- | 10 | mg/L | 366 | 306 | 474 | 129 | 68 |
| **EA025: Total Suspended Solids dried at 104 ± 2°C** | | | | | | | | |
| Suspended Solids (SS) | ---- | 5 | mg/L | 17 | 70 | 170 | 50 | 10 |
| **ED037P: Alkalinity by PC Titrator** | | | | | | | | |
| Hydroxide Alkalinity as CaCO3 | DMO-210-001 | 1 | mg/L | <1 | <1 | <1 | <1 | <1 |
| Carbonate Alkalinity as CaCO3 | 3812-32-6 | 1 | mg/L | <1 | <1 | <1 | 18 | <1 |
| Bicarbonate Alkalinity as CaCO3 | 71-52-3 | 1 | mg/L | 26 | 139 | 406 | 78 | 6 |
| Total Alkalinity as CaCO3 | ---- | 1 | mg/L | 26 | 139 | 406 | 96 | 6 |
| **ED041G: Sulfate (Turbidimetric) as SO4 2- by DA** | | | | | | | | |
| Sulfate as SO4 - Turbidimetric | 14808-79-8 | 1 | mg/L | 4 | 6 | <1 | <1 | 3 |
| **ED045G: Chloride by Discrete Analyser** | | | | | | | | |
| Chloride | 16887-00-6 | 1 | mg/L | 208 | 103 | 57 | 20 | 16 |
| **ED093F: Dissolved Major Cations** | | | | | | | | |
| Calcium | 7440-70-2 | 1 | mg/L | 8 | 22 | 70 | 3 | 3 |
| Magnesium | 7439-95-4 | 1 | mg/L | 14 | 22 | 19 | 1 | 2 |
| Sodium | 7440-23-5 | 1 | mg/L | 89 | 53 | 83 | 46 | 10 |
| Potassium | 7440-09-7 | 1 | mg/L | 1 | 3 | 10 | 4 | 1 |
| **EG020F: Dissolved Metals by ICP-MS** | | | | | | | | |
| Aluminium | 7429-90-5 | 0.01 | mg/L | <0.01 | <0.01 | <0.01 | 0.02 | 0.22 |
| Antimony | 7440-36-0 | 0.001 | mg/L | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 |
| Arsenic | 7440-38-2 | 0.001 | mg/L | <0.001 | 0.016 | 0.009 | 0.001 | <0.001 |
| Boron | 7440-42-8 | 0.05 | mg/L | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 |
| Barium | 7440-39-3 | 0.001 | mg/L | 0.433 | 0.328 | 1.84 | 0.235 | 0.020 |
| Beryllium | 7440-41-7 | 0.001 | mg/L | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 |
| Cadmium | 7440-43-9 | 0.0001 | mg/L | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 |
| Cobalt | 7440-48-4 | 0.001 | mg/L | 0.027 | 0.006 | 0.002 | <0.001 | <0.001 |
| Chromium | 7440-47-3 | 0.001 | mg/L | <0.001 | 0.002 | <0.001 | <0.001 | <0.001 |
| Copper | 7440-50-8 | 0.001 | mg/L | 0.005 | <0.001 | <0.001 | 0.003 | 0.005 |
| Manganese | 7439-96-5 | 0.001 | mg/L | 0.320 | 0.335 | 0.716 | 0.010 | 0.018 |
| Nickel | 7440-02-0 | 0.001 | mg/L | 0.008 | 0.005 | <0.001 | <0.001 | <0.001 |

## Analytical Results

| Sub-Matrix: WATER (Matrix: WATER) | | | Sample ID | MPMB01 | MPMB02 | MPMB03 | MPMB04 | NR |
|---|---|---|---|---|---|---|---|---|
| | | | Sampling date / time | [26-Oct-2022] | [26-Oct-2022] | [26-Oct-2022] | [26-Oct-2022] | [26-Oct-2022] |
| Compound | CAS Number | LOR | Unit | ES2238520-001 | ES2238520-002 | ES2238520-003 | ES2238520-004 | ES2238520-005 |
| | | | | Result | Result | Result | Result | Result |
| **EG020F: Dissolved Metals by ICP-MS - Continued** | | | | | | | | |
| Lead | 7439-92-1 | 0.001 | mg/L | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 |
| Selenium | 7782-49-2 | 0.01 | mg/L | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Vanadium | 7440-62-2 | 0.01 | mg/L | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Zinc | 7440-66-6 | 0.005 | mg/L | **0.024** | <0.005 | <0.005 | **0.082** | <0.005 |
| Molybdenum | 7439-98-7 | 0.001 | mg/L | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 |
| Strontium | 7440-24-6 | 0.001 | mg/L | **0.095** | **0.250** | **0.635** | **0.061** | **0.022** |
| Uranium | 7440-61-1 | 0.001 | mg/L | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 |
| Iron | 7439-89-6 | 0.05 | mg/L | <0.05 | **4.41** | **6.13** | <0.05 | **0.32** |
| Bromine | 7726-95-6 | 0.1 | mg/L | **0.3** | **0.2** | <0.1 | <0.1 | <0.1 |
| **EG035F: Dissolved Mercury by FIMS** | | | | | | | | |
| Mercury | 7439-97-6 | 0.0001 | mg/L | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 |
| **EG052G: Silica by Discrete Analyser** | | | | | | | | |
| Reactive Silica | ---- | 0.05 | mg/L | **16.6** | **9.52** | **8.16** | **3.21** | **4.14** |
| **EK026SF: Total CN by Segmented Flow Analyser** | | | | | | | | |
| Total Cyanide | 57-12-5 | 0.004 | mg/L | <0.004 | <0.004 | <0.004 | <0.004 | <0.004 |
| **EK040P: Fluoride by PC Titrator** | | | | | | | | |
| Fluoride | 16984-48-8 | 0.1 | mg/L | <0.1 | **0.1** | <0.1 | **0.2** | <0.1 |
| **EK055G: Ammonia as N by Discrete Analyser** | | | | | | | | |
| Ammonia as N | 7664-41-7 | 0.01 | mg/L | <0.01 | **0.18** | **0.45** | **0.50** | **0.06** |
| **EK057G: Nitrite as N by Discrete Analyser** | | | | | | | | |
| Nitrite as N | 14797-65-0 | 0.01 | mg/L | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| **EK058G: Nitrate as N by Discrete Analyser** | | | | | | | | |
| Nitrate as N | 14797-55-8 | 0.01 | mg/L | **0.76** | **0.02** | <0.01 | **0.71** | **0.13** |
| **EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser** | | | | | | | | |
| Nitrite + Nitrate as N | ---- | 0.01 | mg/L | **0.76** | **0.02** | <0.01 | **0.71** | **0.13** |
| **EK067G: Total Phosphorus as P by Discrete Analyser** | | | | | | | | |
| Total Phosphorus as P | ---- | 0.01 | mg/L | **0.03** | **0.08** | **0.09** | **0.03** | **0.03** |
| **EK071G: Reactive Phosphorus as P by discrete analyser** | | | | | | | | |
| Reactive Phosphorus as P | 14265-44-2 | 0.01 | mg/L | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| **EN055: Ionic Balance** | | | | | | | | |
| ø Total Anions | ---- | 0.01 | meq/L | **6.47** | **5.81** | **9.72** | **2.48** | **0.63** |
| ø Total Cations | ---- | 0.01 | meq/L | **5.45** | **5.29** | **8.92** | **2.34** | **0.77** |
| ø Ionic Balance | ---- | 0.01 | % | **8.57** | **4.66** | **4.27** | **----** | **----** |

## Analytical Results

| Sub-Matrix: WATER (Matrix: WATER) | | | Sample ID | MPMB01 | MPMB02 | MPMB03 | MPMB04 | NR |
|---|---|---|---|---|---|---|---|---|
| | | | Sampling date / time | [26-Oct-2022] | [26-Oct-2022] | [26-Oct-2022] | [26-Oct-2022] | [26-Oct-2022] |
| Compound | CAS Number | LOR | Unit | ES2238520-001 | ES2238520-002 | ES2238520-003 | ES2238520-004 | ES2238520-005 |
| | | | | Result | Result | Result | Result | Result |
| **EP005: Total Organic Carbon (TOC)** | | | | | | | | |
| Total Organic Carbon | ---- | 1 | mg/L | <1 | 2 | 5 | 6 | 5 |
| **EP033: C1 - C4 Hydrocarbon Gases** | | | | | | | | |
| Methane | 74-82-8 | 10 | µg/L | 13 | 616 | 41800 | 8570 | <10 |
| Ethene | 74-85-1 | 10 | µg/L | <10 | <10 | <10 | <10 | <10 |
| Ethane | 74-84-0 | 10 | µg/L | <10 | <10 | <10 | <10 | <10 |
| Propene | 115-07-1 | 10 | µg/L | <10 | <10 | <10 | <10 | <10 |
| Propane | 74-98-6 | 10 | µg/L | <10 | <10 | <10 | <10 | <10 |
| Butene | 25167-67-3 | 10 | µg/L | <10 | <10 | <10 | <10 | <10 |
| Butane | 106-97-8 | 10 | µg/L | <10 | <10 | <10 | <10 | <10 |
| **EP075(SIM)A: Phenolic Compounds** | | | | | | | | |
| Phenol | 108-95-2 | 1.0 | µg/L | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 |
| 2-Chlorophenol | 95-57-8 | 1.0 | µg/L | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 |
| 2-Methylphenol | 95-48-7 | 1.0 | µg/L | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 |
| 3- & 4-Methylphenol | 1319-77-3 | 2.0 | µg/L | <2.0 | <2.0 | <2.0 | <2.0 | <2.0 |
| 2-Nitrophenol | 88-75-5 | 1.0 | µg/L | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 |
| 2.4-Dimethylphenol | 105-67-9 | 1.0 | µg/L | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 |
| 2.4-Dichlorophenol | 120-83-2 | 1.0 | µg/L | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 |
| 2.6-Dichlorophenol | 87-65-0 | 1.0 | µg/L | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 |
| 4-Chloro-3-methylphenol | 59-50-7 | 1.0 | µg/L | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 |
| 2.4.6-Trichlorophenol | 88-06-2 | 1.0 | µg/L | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 |
| 2.4.5-Trichlorophenol | 95-95-4 | 1.0 | µg/L | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 |
| Pentachlorophenol | 87-86-5 | 2.0 | µg/L | <2.0 | <2.0 | <2.0 | <2.0 | <2.0 |
| **EP075(SIM)B: Polynuclear Aromatic Hydrocarbons** | | | | | | | | |
| Naphthalene | 91-20-3 | 1.0 | µg/L | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 |
| Acenaphthylene | 208-96-8 | 1.0 | µg/L | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 |
| Acenaphthene | 83-32-9 | 1.0 | µg/L | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 |
| Fluorene | 86-73-7 | 1.0 | µg/L | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 |
| Phenanthrene | 85-01-8 | 1.0 | µg/L | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 |
| Anthracene | 120-12-7 | 1.0 | µg/L | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 |
| Fluoranthene | 206-44-0 | 1.0 | µg/L | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 |
| Pyrene | 129-00-0 | 1.0 | µg/L | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 |
| Benz(a)anthracene | 56-55-3 | 1.0 | µg/L | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 |
| Chrysene | 218-01-9 | 1.0 | µg/L | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 |
| Benzo(b+j)fluoranthene | 205-99-2 205-82-3 | 1.0 | µg/L | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 |

## Analytical Results

| Sub-Matrix: WATER (Matrix: WATER) | | | Sample ID | MPMB01 | MPMB02 | MPMB03 | MPMB04 | NR |
|---|---|---|---|---|---|---|---|---|
| | | | Sampling date / time | [26-Oct-2022] | [26-Oct-2022] | [26-Oct-2022] | [26-Oct-2022] | [26-Oct-2022] |
| Compound | CAS Number | LOR | Unit | ES2238520-001 | ES2238520-002 | ES2238520-003 | ES2238520-004 | ES2238520-005 |
| | | | | Result | Result | Result | Result | Result |
| **EP075(SIM)B: Polynuclear Aromatic Hydrocarbons - Continued** | | | | | | | | |
| Benzo(k)fluoranthene | 207-08-9 | 1.0 | µg/L | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 |
| Benzo(a)pyrene | 50-32-8 | 0.5 | µg/L | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 |
| Indeno(1.2.3.cd)pyrene | 193-39-5 | 1.0 | µg/L | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 |
| Dibenz(a.h)anthracene | 53-70-3 | 1.0 | µg/L | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 |
| Benzo(g.h.i)perylene | 191-24-2 | 1.0 | µg/L | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 |
| ^ Sum of polycyclic aromatic hydrocarbons | ---- | 0.5 | µg/L | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 |
| ^ Benzo(a)pyrene TEQ (zero) | ---- | 0.5 | µg/L | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 |
| **EP080/071: Total Petroleum Hydrocarbons** | | | | | | | | |
| C6 - C9 Fraction | ---- | 20 | µg/L | <20 | <20 | <20 | <20 | <20 |
| C10 - C14 Fraction | ---- | 50 | µg/L | <50 | <50 | <50 | <50 | <50 |
| C15 - C28 Fraction | ---- | 100 | µg/L | <100 | <100 | <100 | <100 | <100 |
| C29 - C36 Fraction | ---- | 50 | µg/L | <50 | <50 | <50 | <50 | <50 |
| ^ C10 - C36 Fraction (sum) | ---- | 50 | µg/L | <50 | <50 | <50 | <50 | <50 |
| **EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions** | | | | | | | | |
| C6 - C10 Fraction | C6_C10 | 20 | µg/L | <20 | <20 | <20 | <20 | <20 |
| ^ C6 - C10 Fraction minus BTEX (F1) | C6_C10-BTEX | 20 | µg/L | <20 | <20 | <20 | <20 | <20 |
| >C10 - C16 Fraction | ---- | 100 | µg/L | <100 | <100 | <100 | <100 | <100 |
| >C16 - C34 Fraction | ---- | 100 | µg/L | <100 | <100 | <100 | <100 | <100 |
| >C34 - C40 Fraction | ---- | 100 | µg/L | <100 | <100 | <100 | <100 | <100 |
| ^ >C10 - C40 Fraction (sum) | ---- | 100 | µg/L | <100 | <100 | <100 | <100 | <100 |
| ^ >C10 - C16 Fraction minus Naphthalene (F2) | ---- | 100 | µg/L | <100 | <100 | <100 | <100 | <100 |
| **EP080: BTEXN** | | | | | | | | |
| Benzene | 71-43-2 | 1 | µg/L | <1 | <1 | <1 | <1 | <1 |
| Toluene | 108-88-3 | 2 | µg/L | <2 | <2 | <2 | <2 | <2 |
| Ethylbenzene | 100-41-4 | 2 | µg/L | <2 | <2 | <2 | <2 | <2 |
| meta- & para-Xylene | 108-38-3 106-42-3 | 2 | µg/L | <2 | <2 | <2 | <2 | <2 |
| ortho-Xylene | 95-47-6 | 2 | µg/L | <2 | <2 | <2 | <2 | <2 |
| ^ Total Xylenes | ---- | 2 | µg/L | <2 | <2 | <2 | <2 | <2 |
| ^ Sum of BTEX | ---- | 1 | µg/L | <1 | <1 | <1 | <1 | <1 |
| Naphthalene | 91-20-3 | 5 | µg/L | <5 | <5 | <5 | <5 | <5 |
| **ED009: Anions** | | | | | | | | |
| Bromide | 24959-67-9 | 0.010 | mg/L | **0.370** | **0.199** | **0.144** | **0.076** | **0.041** |

## Analytical Results

| Sub-Matrix: WATER (Matrix: WATER) | | | | Sample ID | MPMB01 | MPMB02 | MPMB03 | MPMB04 | NR |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Sampling date / time | [26-Oct-2022] | [26-Oct-2022] | [26-Oct-2022] | [26-Oct-2022] | [26-Oct-2022] |
| Compound | CAS Number | LOR | Unit | | ES2238520-001 | ES2238520-002 | ES2238520-003 | ES2238520-004 | ES2238520-005 |
| | | | | | Result | Result | Result | Result | Result |
| **EP075(SIM)S: Phenolic Compound Surrogates** | | | | | | | | | |
| Phenol-d6 | 13127-88-3 | 1.0 | % | | 23.9 | 31.0 | 34.8 | 29.8 | 40.1 |
| 2-Chlorophenol-D4 | 93951-73-6 | 1.0 | % | | 51.4 | 60.9 | 58.3 | 27.9 | 79.4 |
| 2.4.6-Tribromophenol | 118-79-6 | 1.0 | % | | 51.6 | 56.3 | 59.7 | 13.3 | 62.6 |
| **EP075(SIM)T: PAH Surrogates** | | | | | | | | | |
| 2-Fluorobiphenyl | 321-60-8 | 1.0 | % | | 58.2 | 67.0 | 67.4 | 71.1 | 73.7 |
| Anthracene-d10 | 1719-06-8 | 1.0 | % | | 68.0 | 76.8 | 80.5 | 78.3 | 82.9 |
| 4-Terphenyl-d14 | 1718-51-0 | 1.0 | % | | 85.2 | 90.1 | 103 | 88.3 | 48.8 |
| **EP080S: TPH(V)/BTEX Surrogates** | | | | | | | | | |
| 1.2-Dichloroethane-D4 | 17060-07-0 | 2 | % | | 106 | 90.2 | 104 | 107 | 108 |
| Toluene-D8 | 2037-26-5 | 2 | % | | 97.3 | 79.3 | 91.7 | 93.8 | 98.9 |
| 4-Bromofluorobenzene | 460-00-4 | 2 | % | | 91.8 | 77.1 | 88.8 | 90.5 | 93.4 |

## Analytical Results

| Sub-Matrix: WATER (Matrix: WATER) | | | Sample ID | QA1 | ---- | ---- | ---- | ---- |
|---|---|---|---|---|---|---|---|---|
| | | | Sampling date / time | 26-Oct-2022 00:00 | ---- | ---- | ---- | ---- |
| Compound | CAS Number | LOR | Unit | ES2238520-006 | -------- | -------- | -------- | -------- |
| | | | | Result | ---- | ---- | ---- | ---- |
| **EA005P: pH by PC Titrator** | | | | | | | | |
| **pH Value** | ---- | 0.01 | pH Unit | **7.43** | ---- | ---- | ---- | ---- |
| **EA010P: Conductivity by PC Titrator** | | | | | | | | |
| **Electrical Conductivity @ 25°C** | ---- | 1 | µS/cm | **600** | ---- | ---- | ---- | ---- |
| **EA015: Total Dissolved Solids dried at 180 ± 5 °C** | | | | | | | | |
| **Total Dissolved Solids @180°C** | ---- | 10 | mg/L | **308** | ---- | ---- | ---- | ---- |
| **EA025: Total Suspended Solids dried at 104 ± 2°C** | | | | | | | | |
| **Suspended Solids (SS)** | ---- | 5 | mg/L | **80** | ---- | ---- | ---- | ---- |
| **ED037P: Alkalinity by PC Titrator** | | | | | | | | |
| **Hydroxide Alkalinity as CaCO3** | DMO-210-001 | 1 | mg/L | <1 | ---- | ---- | ---- | ---- |
| **Carbonate Alkalinity as CaCO3** | 3812-32-6 | 1 | mg/L | <1 | ---- | ---- | ---- | ---- |
| **Bicarbonate Alkalinity as CaCO3** | 71-52-3 | 1 | mg/L | **136** | ---- | ---- | ---- | ---- |
| **Total Alkalinity as CaCO3** | ---- | 1 | mg/L | **136** | ---- | ---- | ---- | ---- |
| **ED041G: Sulfate (Turbidimetric) as SO4 2- by DA** | | | | | | | | |
| **Sulfate as SO4 - Turbidimetric** | 14808-79-8 | 1 | mg/L | **6** | ---- | ---- | ---- | ---- |
| **ED045G: Chloride by Discrete Analyser** | | | | | | | | |
| **Chloride** | 16887-00-6 | 1 | mg/L | **103** | ---- | ---- | ---- | ---- |
| **ED093F: Dissolved Major Cations** | | | | | | | | |
| **Calcium** | 7440-70-2 | 1 | mg/L | **22** | ---- | ---- | ---- | ---- |
| **Magnesium** | 7439-95-4 | 1 | mg/L | **23** | ---- | ---- | ---- | ---- |
| **Sodium** | 7440-23-5 | 1 | mg/L | **55** | ---- | ---- | ---- | ---- |
| **Potassium** | 7440-09-7 | 1 | mg/L | **3** | ---- | ---- | ---- | ---- |
| **EG020F: Dissolved Metals by ICP-MS** | | | | | | | | |
| **Aluminium** | 7429-90-5 | 0.01 | mg/L | <0.01 | ---- | ---- | ---- | ---- |
| **Antimony** | 7440-36-0 | 0.001 | mg/L | <0.001 | ---- | ---- | ---- | ---- |
| **Arsenic** | 7440-38-2 | 0.001 | mg/L | **0.015** | ---- | ---- | ---- | ---- |
| **Boron** | 7440-42-8 | 0.05 | mg/L | <0.05 | ---- | ---- | ---- | ---- |
| **Barium** | 7440-39-3 | 0.001 | mg/L | **0.325** | ---- | ---- | ---- | ---- |
| **Beryllium** | 7440-41-7 | 0.001 | mg/L | <0.001 | ---- | ---- | ---- | ---- |
| **Cadmium** | 7440-43-9 | 0.0001 | mg/L | <0.0001 | ---- | ---- | ---- | ---- |
| **Cobalt** | 7440-48-4 | 0.001 | mg/L | **0.007** | ---- | ---- | ---- | ---- |
| **Chromium** | 7440-47-3 | 0.001 | mg/L | <0.001 | ---- | ---- | ---- | ---- |
| **Copper** | 7440-50-8 | 0.001 | mg/L | <0.001 | ---- | ---- | ---- | ---- |
| **Manganese** | 7439-96-5 | 0.001 | mg/L | **0.342** | ---- | ---- | ---- | ---- |
| **Nickel** | 7440-02-0 | 0.001 | mg/L | **0.005** | ---- | ---- | ---- | ---- |

## Analytical Results

| Sub-Matrix: WATER (Matrix: WATER) | | | | Sample ID | QA1 | ---- | ---- | ---- | ---- |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Sampling date / time | 26-Oct-2022 00:00 | ---- | ---- | ---- | ---- |
| Compound | CAS Number | LOR | Unit | | ES2238520-006 | -------- | -------- | -------- | -------- |
| | | | | | Result | ---- | ---- | ---- | ---- |
| **EG020F: Dissolved Metals by ICP-MS - Continued** | | | | | | | | | |
| **Lead** | 7439-92-1 | 0.001 | mg/L | | <0.001 | ---- | ---- | ---- | ---- |
| **Selenium** | 7782-49-2 | 0.01 | mg/L | | <0.01 | ---- | ---- | ---- | ---- |
| **Vanadium** | 7440-62-2 | 0.01 | mg/L | | <0.01 | ---- | ---- | ---- | ---- |
| **Zinc** | 7440-66-6 | 0.005 | mg/L | | <0.005 | ---- | ---- | ---- | ---- |
| **Molybdenum** | 7439-98-7 | 0.001 | mg/L | | <0.001 | ---- | ---- | ---- | ---- |
| **Strontium** | 7440-24-6 | 0.001 | mg/L | | **0.252** | ---- | ---- | ---- | ---- |
| **Uranium** | 7440-61-1 | 0.001 | mg/L | | <0.001 | ---- | ---- | ---- | ---- |
| **Iron** | 7439-89-6 | 0.05 | mg/L | | **4.40** | ---- | ---- | ---- | ---- |
| **Bromine** | 7726-95-6 | 0.1 | mg/L | | **0.2** | ---- | ---- | ---- | ---- |
| **EG035F: Dissolved Mercury by FIMS** | | | | | | | | | |
| **Mercury** | 7439-97-6 | 0.0001 | mg/L | | <0.0001 | ---- | ---- | ---- | ---- |
| **EG052G: Silica by Discrete Analyser** | | | | | | | | | |
| **Reactive Silica** | ---- | 0.05 | mg/L | | **9.29** | ---- | ---- | ---- | ---- |
| **EK026SF: Total CN by Segmented Flow Analyser** | | | | | | | | | |
| **Total Cyanide** | 57-12-5 | 0.004 | mg/L | | <0.004 | ---- | ---- | ---- | ---- |
| **EK040P: Fluoride by PC Titrator** | | | | | | | | | |
| **Fluoride** | 16984-48-8 | 0.1 | mg/L | | **0.1** | ---- | ---- | ---- | ---- |
| **EK055G: Ammonia as N by Discrete Analyser** | | | | | | | | | |
| **Ammonia as N** | 7664-41-7 | 0.01 | mg/L | | **0.13** | ---- | ---- | ---- | ---- |
| **EK057G: Nitrite as N by Discrete Analyser** | | | | | | | | | |
| **Nitrite as N** | 14797-65-0 | 0.01 | mg/L | | <0.01 | ---- | ---- | ---- | ---- |
| **EK058G: Nitrate as N by Discrete Analyser** | | | | | | | | | |
| **Nitrate as N** | 14797-55-8 | 0.01 | mg/L | | <0.01 | ---- | ---- | ---- | ---- |
| **EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser** | | | | | | | | | |
| **Nitrite + Nitrate as N** | ---- | 0.01 | mg/L | | <0.01 | ---- | ---- | ---- | ---- |
| **EK067G: Total Phosphorus as P by Discrete Analyser** | | | | | | | | | |
| **Total Phosphorus as P** | ---- | 0.01 | mg/L | | **0.05** | ---- | ---- | ---- | ---- |
| **EK071G: Reactive Phosphorus as P by discrete analyser** | | | | | | | | | |
| **Reactive Phosphorus as P** | 14265-44-2 | 0.01 | mg/L | | <0.01 | ---- | ---- | ---- | ---- |
| **EN055: Ionic Balance** | | | | | | | | | |
| **ø Total Anions** | ---- | 0.01 | meq/L | | **5.75** | ---- | ---- | ---- | ---- |
| **ø Total Cations** | ---- | 0.01 | meq/L | | **5.46** | ---- | ---- | ---- | ---- |
| **ø Ionic Balance** | ---- | 0.01 | % | | **2.57** | ---- | ---- | ---- | ---- |

## Analytical Results

| Sub-Matrix: WATER (Matrix: WATER) | | | Sample ID | QA1 | ---- | ---- | ---- | ---- |
|---|---|---|---|---|---|---|---|---|
| | | | Sampling date / time | 26-Oct-2022 00:00 | ---- | ---- | ---- | ---- |
| Compound | CAS Number | LOR | Unit | ES2238520-006 | -------- | -------- | -------- | -------- |
| | | | | Result | ---- | ---- | ---- | ---- |
| **EP005: Total Organic Carbon (TOC)** | | | | | | | | |
| **Total Organic Carbon** | ---- | 1 | mg/L | **2** | ---- | ---- | ---- | ---- |
| **EP033: C1 - C4 Hydrocarbon Gases** | | | | | | | | |
| **Methane** | 74-82-8 | 10 | µg/L | **586** | ---- | ---- | ---- | ---- |
| **Ethene** | 74-85-1 | 10 | µg/L | <10 | ---- | ---- | ---- | ---- |
| **Ethane** | 74-84-0 | 10 | µg/L | <10 | ---- | ---- | ---- | ---- |
| **Propene** | 115-07-1 | 10 | µg/L | <10 | ---- | ---- | ---- | ---- |
| **Propane** | 74-98-6 | 10 | µg/L | <10 | ---- | ---- | ---- | ---- |
| **Butene** | 25167-67-3 | 10 | µg/L | <10 | ---- | ---- | ---- | ---- |
| **Butane** | 106-97-8 | 10 | µg/L | <10 | ---- | ---- | ---- | ---- |
| **EP075(SIM)A: Phenolic Compounds** | | | | | | | | |
| **Phenol** | 108-95-2 | 1.0 | µg/L | <1.0 | ---- | ---- | ---- | ---- |
| **2-Chlorophenol** | 95-57-8 | 1.0 | µg/L | <1.0 | ---- | ---- | ---- | ---- |
| **2-Methylphenol** | 95-48-7 | 1.0 | µg/L | <1.0 | ---- | ---- | ---- | ---- |
| **3- & 4-Methylphenol** | 1319-77-3 | 2.0 | µg/L | <2.0 | ---- | ---- | ---- | ---- |
| **2-Nitrophenol** | 88-75-5 | 1.0 | µg/L | <1.0 | ---- | ---- | ---- | ---- |
| **2.4-Dimethylphenol** | 105-67-9 | 1.0 | µg/L | <1.0 | ---- | ---- | ---- | ---- |
| **2.4-Dichlorophenol** | 120-83-2 | 1.0 | µg/L | <1.0 | ---- | ---- | ---- | ---- |
| **2.6-Dichlorophenol** | 87-65-0 | 1.0 | µg/L | <1.0 | ---- | ---- | ---- | ---- |
| **4-Chloro-3-methylphenol** | 59-50-7 | 1.0 | µg/L | <1.0 | ---- | ---- | ---- | ---- |
| **2.4.6-Trichlorophenol** | 88-06-2 | 1.0 | µg/L | <1.0 | ---- | ---- | ---- | ---- |
| **2.4.5-Trichlorophenol** | 95-95-4 | 1.0 | µg/L | <1.0 | ---- | ---- | ---- | ---- |
| **Pentachlorophenol** | 87-86-5 | 2.0 | µg/L | <2.0 | ---- | ---- | ---- | ---- |
| **EP075(SIM)B: Polynuclear Aromatic Hydrocarbons** | | | | | | | | |
| **Naphthalene** | 91-20-3 | 1.0 | µg/L | <1.0 | ---- | ---- | ---- | ---- |
| **Acenaphthylene** | 208-96-8 | 1.0 | µg/L | <1.0 | ---- | ---- | ---- | ---- |
| **Acenaphthene** | 83-32-9 | 1.0 | µg/L | <1.0 | ---- | ---- | ---- | ---- |
| **Fluorene** | 86-73-7 | 1.0 | µg/L | <1.0 | ---- | ---- | ---- | ---- |
| **Phenanthrene** | 85-01-8 | 1.0 | µg/L | <1.0 | ---- | ---- | ---- | ---- |
| **Anthracene** | 120-12-7 | 1.0 | µg/L | <1.0 | ---- | ---- | ---- | ---- |
| **Fluoranthene** | 206-44-0 | 1.0 | µg/L | <1.0 | ---- | ---- | ---- | ---- |
| **Pyrene** | 129-00-0 | 1.0 | µg/L | <1.0 | ---- | ---- | ---- | ---- |
| **Benz(a)anthracene** | 56-55-3 | 1.0 | µg/L | <1.0 | ---- | ---- | ---- | ---- |
| **Chrysene** | 218-01-9 | 1.0 | µg/L | <1.0 | ---- | ---- | ---- | ---- |
| **Benzo(b+j)fluoranthene** | 205-99-2 205-82-3 | 1.0 | µg/L | <1.0 | ---- | ---- | ---- | ---- |

## Analytical Results

| Sub-Matrix: WATER (Matrix: WATER) | | | | Sample ID | QA1 | ---- | ---- | ---- | ---- |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Sampling date / time | 26-Oct-2022 00:00 | ---- | ---- | ---- | ---- |
| Compound | CAS Number | LOR | Unit | | ES2238520-006 | -------- | -------- | -------- | -------- |
| | | | | | Result | ---- | ---- | ---- | ---- |
| **EP075(SIM)B: Polynuclear Aromatic Hydrocarbons - Continued** | | | | | | | | | |
| Benzo(k)fluoranthene | 207-08-9 | 1.0 | µg/L | | <1.0 | ---- | ---- | ---- | ---- |
| Benzo(a)pyrene | 50-32-8 | 0.5 | µg/L | | <0.5 | ---- | ---- | ---- | ---- |
| Indeno(1.2.3.cd)pyrene | 193-39-5 | 1.0 | µg/L | | <1.0 | ---- | ---- | ---- | ---- |
| Dibenz(a.h)anthracene | 53-70-3 | 1.0 | µg/L | | <1.0 | ---- | ---- | ---- | ---- |
| Benzo(g.h.i)perylene | 191-24-2 | 1.0 | µg/L | | <1.0 | ---- | ---- | ---- | ---- |
| ^ Sum of polycyclic aromatic hydrocarbons | ---- | 0.5 | µg/L | | <0.5 | ---- | ---- | ---- | ---- |
| ^ Benzo(a)pyrene TEQ (zero) | ---- | 0.5 | µg/L | | <0.5 | ---- | ---- | ---- | ---- |
| **EP080/071: Total Petroleum Hydrocarbons** | | | | | | | | | |
| C6 - C9 Fraction | ---- | 20 | µg/L | | <20 | ---- | ---- | ---- | ---- |
| C10 - C14 Fraction | ---- | 50 | µg/L | | <50 | ---- | ---- | ---- | ---- |
| C15 - C28 Fraction | ---- | 100 | µg/L | | <100 | ---- | ---- | ---- | ---- |
| C29 - C36 Fraction | ---- | 50 | µg/L | | <50 | ---- | ---- | ---- | ---- |
| ^ C10 - C36 Fraction (sum) | ---- | 50 | µg/L | | <50 | ---- | ---- | ---- | ---- |
| **EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions** | | | | | | | | | |
| C6 - C10 Fraction | C6_C10 | 20 | µg/L | | <20 | ---- | ---- | ---- | ---- |
| ^ C6 - C10 Fraction minus BTEX (F1) | C6_C10-BTEX | 20 | µg/L | | <20 | ---- | ---- | ---- | ---- |
| >C10 - C16 Fraction | ---- | 100 | µg/L | | <100 | ---- | ---- | ---- | ---- |
| >C16 - C34 Fraction | ---- | 100 | µg/L | | <100 | ---- | ---- | ---- | ---- |
| >C34 - C40 Fraction | ---- | 100 | µg/L | | <100 | ---- | ---- | ---- | ---- |
| ^ >C10 - C40 Fraction (sum) | ---- | 100 | µg/L | | <100 | ---- | ---- | ---- | ---- |
| ^ >C10 - C16 Fraction minus Naphthalene (F2) | ---- | 100 | µg/L | | <100 | ---- | ---- | ---- | ---- |
| **EP080: BTEXN** | | | | | | | | | |
| Benzene | 71-43-2 | 1 | µg/L | | <1 | ---- | ---- | ---- | ---- |
| Toluene | 108-88-3 | 2 | µg/L | | <2 | ---- | ---- | ---- | ---- |
| Ethylbenzene | 100-41-4 | 2 | µg/L | | <2 | ---- | ---- | ---- | ---- |
| meta- & para-Xylene | 108-38-3 106-42-3 | 2 | µg/L | | <2 | ---- | ---- | ---- | ---- |
| ortho-Xylene | 95-47-6 | 2 | µg/L | | <2 | ---- | ---- | ---- | ---- |
| ^ Total Xylenes | ---- | 2 | µg/L | | <2 | ---- | ---- | ---- | ---- |
| ^ Sum of BTEX | ---- | 1 | µg/L | | <1 | ---- | ---- | ---- | ---- |
| Naphthalene | 91-20-3 | 5 | µg/L | | <5 | ---- | ---- | ---- | ---- |
| **ED009: Anions** | | | | | | | | | |
| Bromide | 24959-67-9 | 0.010 | mg/L | | **0.206** | ---- | ---- | ---- | ---- |

## Analytical Results

| Sub-Matrix: WATER (Matrix: WATER) | | | | Sample ID | QA1 | ---- | ---- | ---- | ---- |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Sampling date / time | 26-Oct-2022 00:00 | ---- | ---- | ---- | ---- |
| Compound | CAS Number | LOR | Unit | | ES2238520-006 | -------- | -------- | -------- | -------- |
| | | | | | Result | ---- | ---- | ---- | ---- |
| **EP075(SIM)S: Phenolic Compound Surrogates** | | | | | | | | | |
| **Phenol-d6** | 13127-88-3 | 1.0 | % | | **28.4** | ---- | ---- | ---- | ---- |
| **2-Chlorophenol-D4** | 93951-73-6 | 1.0 | % | | **59.9** | ---- | ---- | ---- | ---- |
| **2.4.6-Tribromophenol** | 118-79-6 | 1.0 | % | | **65.6** | ---- | ---- | ---- | ---- |
| **EP075(SIM)T: PAH Surrogates** | | | | | | | | | |
| **2-Fluorobiphenyl** | 321-60-8 | 1.0 | % | | **73.6** | ---- | ---- | ---- | ---- |
| **Anthracene-d10** | 1719-06-8 | 1.0 | % | | **74.8** | ---- | ---- | ---- | ---- |
| **4-Terphenyl-d14** | 1718-51-0 | 1.0 | % | | **98.0** | ---- | ---- | ---- | ---- |
| **EP080S: TPH(V)/BTEX Surrogates** | | | | | | | | | |
| **1.2-Dichloroethane-D4** | 17060-07-0 | 2 | % | | **110** | ---- | ---- | ---- | ---- |
| **Toluene-D8** | 2037-26-5 | 2 | % | | **100** | ---- | ---- | ---- | ---- |
| **4-Bromofluorobenzene** | 460-00-4 | 2 | % | | **96.4** | ---- | ---- | ---- | ---- |

## Surrogate Control Limits

Sub-Matrix: **WATER**

| Compound | CAS Number | Recovery Limits (%) Low | Recovery Limits (%) High |
|---|---|---|---|
| **EP075(SIM)S: Phenolic Compound Surrogates** | | | |
| **Phenol-d6** | 13127-88-3 | 10 | 44 |
| **2-Chlorophenol-D4** | 93951-73-6 | 14 | 94 |
| **2.4.6-Tribromophenol** | 118-79-6 | 17 | 125 |
| **EP075(SIM)T: PAH Surrogates** | | | |
| **2-Fluorobiphenyl** | 321-60-8 | 20 | 104 |
| **Anthracene-d10** | 1719-06-8 | 27 | 113 |
| **4-Terphenyl-d14** | 1718-51-0 | 32 | 112 |
| **EP080S: TPH(V)/BTEX Surrogates** | | | |
| **1.2-Dichloroethane-D4** | 17060-07-0 | 71 | 137 |
| **Toluene-D8** | 2037-26-5 | 79 | 131 |
| **4-Bromofluorobenzene** | 460-00-4 | 70 | 128 |

ALS Environmental

# CERTIFICATE OF ANALYSIS

| | | | |
|---|---|---|---|
| **Work Order** | : **ES2238636** | Page | : 1 of 8 |
| Client | : **EMM CONSULTING PTY LTD** | Laboratory | : Environmental Division Sydney |
| Contact | : MS KAITLYN BRODIE | Contact | : Cez Bautista |
| Address | : Ground Floor Suite 1 20 Chandos Street St Leonards NSW NSW 2065 | Address | : 277-289 Woodpark Road Smithfield NSW Australia 2164 |
| Telephone | : 02 9493 9500 | Telephone | : +61-2-8784 8555 |
| Project | : AGL Camden Gas Project E220575 | Date Samples Received | : 27-Oct-2022 13:45 |
| Order number | : ---- | Date Analysis Commenced | : 27-Oct-2022 |
| C-O-C number | : ---- | Issue Date | : 09-Nov-2022 14:53 |
| Sampler | : Claire Corthier, KAITLYN BRODIE | | |
| Site | : ---- | | |
| Quote number | : SY/416/16 - AGL Camden Planned Event | | |
| No. of samples received | : 3 | | |
| No. of samples analysed | : 3 | | |

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

**Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.**

## *Signatories*

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

| *Signatories* | *Position* | *Accreditation Category* |
|---|---|---|
| Ankit Joshi | Senior Chemist - Inorganics | Sydney Inorganics, Smithfield, NSW |
| Edwandy Fadjar | Organic Coordinator | Sydney Organics, Smithfield, NSW |

## General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contract for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- Ek026SF: LOR raised for total CN samples 1( result confirmed by re-analyse in Mel) due to sample matrix.
- EP075 (SIM): Where reported, Benzo(a)pyrene Toxicity Equivalent Quotient (TEQ) per the NEPM (2013) is the sum total of the concentration of the eight carcinogenic PAHs multiplied by their Toxicity Equivalence Factor (TEF) relative to Benzo(a)pyrene. TEF values are provided in brackets as follows: Benz(a)anthracene (0.1), Chrysene (0.01), Benzo(b+j) & Benzo(k)fluoranthene (0.1), Benzo(a)pyrene (1.0), Indeno(1.2.3.cd)pyrene (0.1), Dibenz(a.h)anthracene (1.0), Benzo(g.h.i)perylene (0.01). Less than LOR results for 'TEQ Zero' are treated as zero.
- EP080: Where reported, Total Xylenes is the sum of the reported concentrations of m&p-Xylene and o-Xylene at or above the LOR.
- EP075(SIM): Where reported, Total Cresol is the sum of the reported concentrations of 2-Methylphenol and 3- & 4-Methylphenol at or above the LOR.
- As per QWI – EN55-3 Data Interpreting Procedures, Ionic balances are typically calculated using Major Anions - Chloride, Alkalinity and Sulfate; and Major Cations - Calcium, Magnesium, Potassium and Sodium. Where applicable and dependent upon sample matrix, the Ionic Balance may also include the additional contribution of Ammonia, Dissolved Metals by ICPMS and H+ to the Cations and Nitrate, SiO2 and Fluoride to the Anions.
- EG020: Bromine quantification may be unreliable due to its low solubility in acid, leading to variable volatility during measurement by ICPMS.
- EG035: Poor matrix spike recovery was obtained for Mercury on sample ES2237930 # 1. Confirmed by re-analysis.
- EG035: Positive Mercury result ES2238636 #1 has been confirmed by reanalysis.
- EP080: Sample TRIP SPIKE contains volatile compounds spiked into the sample containers prior to dispatch from the laboratory. BTEXN compounds spiked at 20 ug/L.
- Sodium Adsorption Ratio (where reported): Where results for Na, Ca or Mg are <LOR, a concentration at half the reported LOR is incorporated into the SAR calculation. This represents a conservative approach for Na relative to the assumption that <LOR = zero concentration and a conservative approach for Ca & Mg relative to the assumption that <LOR is equivalent to the LOR concentration.

## Analytical Results

| Sub-Matrix: WATER (Matrix: WATER) | | | Sample ID | GLMB03 | TB | Trip spike | ---- | ---- |
|---|---|---|---|---|---|---|---|---|
| | | | Sampling date / time | 27-Oct-2022 11:30 | 21-Oct-2022 00:00 | 21-Oct-2022 00:00 | ---- | ---- |
| Compound | CAS Number | LOR | Unit | ES2238636-001 | ES2238636-002 | ES2238636-003 | -------- | -------- |
| | | | | Result | Result | Result | ---- | ---- |
| **EA005P: pH by PC Titrator** | | | | | | | | |
| pH Value | ---- | 0.01 | pH Unit | **8.80** | ---- | ---- | ---- | ---- |
| **EA010P: Conductivity by PC Titrator** | | | | | | | | |
| Electrical Conductivity @ 25°C | ---- | 1 | µS/cm | **4140** | ---- | ---- | ---- | ---- |
| **EA015: Total Dissolved Solids dried at 180 ± 5 °C** | | | | | | | | |
| Total Dissolved Solids @180°C | ---- | 10 | mg/L | **2960** | ---- | ---- | ---- | ---- |
| **EA025: Total Suspended Solids dried at 104 ± 2°C** | | | | | | | | |
| Suspended Solids (SS) | ---- | 5 | mg/L | <5 | ---- | ---- | ---- | ---- |
| **ED037P: Alkalinity by PC Titrator** | | | | | | | | |
| Hydroxide Alkalinity as CaCO3 | DMO-210-001 | 1 | mg/L | <1 | ---- | ---- | ---- | ---- |
| Carbonate Alkalinity as CaCO3 | 3812-32-6 | 1 | mg/L | **24** | ---- | ---- | ---- | ---- |
| Bicarbonate Alkalinity as CaCO3 | 71-52-3 | 1 | mg/L | **722** | ---- | ---- | ---- | ---- |
| Total Alkalinity as CaCO3 | ---- | 1 | mg/L | **745** | ---- | ---- | ---- | ---- |
| **ED041G: Sulfate (Turbidimetric) as SO4 2- by DA** | | | | | | | | |
| Sulfate as SO4 - Turbidimetric | 14808-79-8 | 1 | mg/L | <1 | ---- | ---- | ---- | ---- |
| **ED045G: Chloride by Discrete Analyser** | | | | | | | | |
| Chloride | 16887-00-6 | 1 | mg/L | **772** | ---- | ---- | ---- | ---- |
| **ED093F: Dissolved Major Cations** | | | | | | | | |
| Calcium | 7440-70-2 | 1 | mg/L | **49** | ---- | ---- | ---- | ---- |
| Magnesium | 7439-95-4 | 1 | mg/L | **64** | ---- | ---- | ---- | ---- |
| Sodium | 7440-23-5 | 1 | mg/L | **781** | ---- | ---- | ---- | ---- |
| Potassium | 7440-09-7 | 1 | mg/L | **31** | ---- | ---- | ---- | ---- |
| **EG020F: Dissolved Metals by ICP-MS** | | | | | | | | |
| Aluminium | 7429-90-5 | 0.01 | mg/L | <0.01 | ---- | ---- | ---- | ---- |
| Antimony | 7440-36-0 | 0.001 | mg/L | <0.001 | ---- | ---- | ---- | ---- |
| Arsenic | 7440-38-2 | 0.001 | mg/L | **0.003** | ---- | ---- | ---- | ---- |
| Boron | 7440-42-8 | 0.05 | mg/L | **0.12** | ---- | ---- | ---- | ---- |
| Barium | 7440-39-3 | 0.001 | mg/L | **21.4** | ---- | ---- | ---- | ---- |
| Beryllium | 7440-41-7 | 0.001 | mg/L | <0.001 | ---- | ---- | ---- | ---- |
| Cadmium | 7440-43-9 | 0.0001 | mg/L | <0.0001 | ---- | ---- | ---- | ---- |
| Cobalt | 7440-48-4 | 0.001 | mg/L | <0.001 | ---- | ---- | ---- | ---- |
| Chromium | 7440-47-3 | 0.001 | mg/L | <0.001 | ---- | ---- | ---- | ---- |
| Copper | 7440-50-8 | 0.001 | mg/L | **0.008** | ---- | ---- | ---- | ---- |
| Manganese | 7439-96-5 | 0.001 | mg/L | **0.034** | ---- | ---- | ---- | ---- |
| Nickel | 7440-02-0 | 0.001 | mg/L | **0.004** | ---- | ---- | ---- | ---- |

## Analytical Results

| Sub-Matrix: WATER (Matrix: WATER) | | | Sample ID | GLMB03 | TB | Trip spike | ---- | ---- |
|---|---|---|---|---|---|---|---|---|
| | | | Sampling date / time | 27-Oct-2022 11:30 | 21-Oct-2022 00:00 | 21-Oct-2022 00:00 | ---- | ---- |
| Compound | CAS Number | LOR | Unit | ES2238636-001 | ES2238636-002 | ES2238636-003 | -------- | -------- |
| | | | | Result | Result | Result | ---- | ---- |
| **EG020F: Dissolved Metals by ICP-MS - Continued** | | | | | | | | |
| Lead | 7439-92-1 | 0.001 | mg/L | <0.001 | ---- | ---- | ---- | ---- |
| Selenium | 7782-49-2 | 0.01 | mg/L | <0.01 | ---- | ---- | ---- | ---- |
| Vanadium | 7440-62-2 | 0.01 | mg/L | <0.01 | ---- | ---- | ---- | ---- |
| Zinc | 7440-66-6 | 0.005 | mg/L | **0.549** | ---- | ---- | ---- | ---- |
| Molybdenum | 7439-98-7 | 0.001 | mg/L | **0.003** | ---- | ---- | ---- | ---- |
| Strontium | 7440-24-6 | 0.001 | mg/L | **4.98** | ---- | ---- | ---- | ---- |
| Uranium | 7440-61-1 | 0.001 | mg/L | <0.001 | ---- | ---- | ---- | ---- |
| Iron | 7439-89-6 | 0.05 | mg/L | <0.05 | ---- | ---- | ---- | ---- |
| Bromine | 7726-95-6 | 0.1 | mg/L | **1.7** | ---- | ---- | ---- | ---- |
| **EG035F: Dissolved Mercury by FIMS** | | | | | | | | |
| Mercury | 7439-97-6 | 0.0001 | mg/L | **0.0001** | ---- | ---- | ---- | ---- |
| **EG052G: Silica by Discrete Analyser** | | | | | | | | |
| Reactive Silica | ---- | 0.05 | mg/L | **4.80** | ---- | ---- | ---- | ---- |
| **EK026SF: Total CN by Segmented Flow Analyser** | | | | | | | | |
| Total Cyanide | 57-12-5 | 0.004 | mg/L | <0.010 | ---- | ---- | ---- | ---- |
| **EK040P: Fluoride by PC Titrator** | | | | | | | | |
| Fluoride | 16984-48-8 | 0.1 | mg/L | **0.1** | ---- | ---- | ---- | ---- |
| **EK055G: Ammonia as N by Discrete Analyser** | | | | | | | | |
| Ammonia as N | 7664-41-7 | 0.01 | mg/L | **0.61** | ---- | ---- | ---- | ---- |
| **EK057G: Nitrite as N by Discrete Analyser** | | | | | | | | |
| Nitrite as N | 14797-65-0 | 0.01 | mg/L | <0.01 | ---- | ---- | ---- | ---- |
| **EK058G: Nitrate as N by Discrete Analyser** | | | | | | | | |
| Nitrate as N | 14797-55-8 | 0.01 | mg/L | <0.01 | ---- | ---- | ---- | ---- |
| **EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser** | | | | | | | | |
| Nitrite + Nitrate as N | ---- | 0.01 | mg/L | <0.01 | ---- | ---- | ---- | ---- |
| **EK067G: Total Phosphorus as P by Discrete Analyser** | | | | | | | | |
| Total Phosphorus as P | ---- | 0.01 | mg/L | **0.51** | ---- | ---- | ---- | ---- |
| **EK071G: Reactive Phosphorus as P by discrete analyser** | | | | | | | | |
| Reactive Phosphorus as P | 14265-44-2 | 0.01 | mg/L | **0.02** | ---- | ---- | ---- | ---- |
| **EN055: Ionic Balance** | | | | | | | | |
| ø Total Anions | ---- | 0.01 | meq/L | **36.7** | ---- | ---- | ---- | ---- |
| ø Total Cations | ---- | 0.01 | meq/L | **42.5** | ---- | ---- | ---- | ---- |
| ø Ionic Balance | ---- | 0.01 | % | **7.35** | ---- | ---- | ---- | ---- |

## Analytical Results

| Sub-Matrix: WATER (Matrix: WATER) | | | Sample ID | GLMB03 | TB | Trip spike | ---- | ---- |
|---|---|---|---|---|---|---|---|---|
| | | | Sampling date / time | 27-Oct-2022 11:30 | 21-Oct-2022 00:00 | 21-Oct-2022 00:00 | ---- | ---- |
| Compound | CAS Number | LOR | Unit | ES2238636-001 | ES2238636-002 | ES2238636-003 | -------- | -------- |
| | | | | Result | Result | Result | ---- | ---- |
| **EP005: Total Organic Carbon (TOC)** | | | | | | | | |
| **Total Organic Carbon** | ---- | 1 | mg/L | **439** | ---- | ---- | ---- | ---- |
| **EP033: C1 - C4 Hydrocarbon Gases** | | | | | | | | |
| **Methane** | 74-82-8 | 10 | µg/L | **19100** | ---- | ---- | ---- | ---- |
| **Ethene** | 74-85-1 | 10 | µg/L | <10 | ---- | ---- | ---- | ---- |
| **Ethane** | 74-84-0 | 10 | µg/L | **234** | ---- | ---- | ---- | ---- |
| **Propene** | 115-07-1 | 10 | µg/L | <10 | ---- | ---- | ---- | ---- |
| **Propane** | 74-98-6 | 10 | µg/L | **18** | ---- | ---- | ---- | ---- |
| **Butene** | 25167-67-3 | 10 | µg/L | <10 | ---- | ---- | ---- | ---- |
| **Butane** | 106-97-8 | 10 | µg/L | <10 | ---- | ---- | ---- | ---- |
| **EP075(SIM)A: Phenolic Compounds** | | | | | | | | |
| **Phenol** | 108-95-2 | 1.0 | µg/L | <1.0 | ---- | ---- | ---- | ---- |
| **2-Chlorophenol** | 95-57-8 | 1.0 | µg/L | <1.0 | ---- | ---- | ---- | ---- |
| **2-Methylphenol** | 95-48-7 | 1.0 | µg/L | <1.0 | ---- | ---- | ---- | ---- |
| **3- & 4-Methylphenol** | 1319-77-3 | 2.0 | µg/L | <2.0 | ---- | ---- | ---- | ---- |
| **2-Nitrophenol** | 88-75-5 | 1.0 | µg/L | <1.0 | ---- | ---- | ---- | ---- |
| **2.4-Dimethylphenol** | 105-67-9 | 1.0 | µg/L | <1.0 | ---- | ---- | ---- | ---- |
| **2.4-Dichlorophenol** | 120-83-2 | 1.0 | µg/L | <1.0 | ---- | ---- | ---- | ---- |
| **2.6-Dichlorophenol** | 87-65-0 | 1.0 | µg/L | <1.0 | ---- | ---- | ---- | ---- |
| **4-Chloro-3-methylphenol** | 59-50-7 | 1.0 | µg/L | <1.0 | ---- | ---- | ---- | ---- |
| **2.4.6-Trichlorophenol** | 88-06-2 | 1.0 | µg/L | <1.0 | ---- | ---- | ---- | ---- |
| **2.4.5-Trichlorophenol** | 95-95-4 | 1.0 | µg/L | <1.0 | ---- | ---- | ---- | ---- |
| **Pentachlorophenol** | 87-86-5 | 2.0 | µg/L | <2.0 | ---- | ---- | ---- | ---- |
| **EP075(SIM)B: Polynuclear Aromatic Hydrocarbons** | | | | | | | | |
| **Naphthalene** | 91-20-3 | 1.0 | µg/L | <1.0 | ---- | ---- | ---- | ---- |
| **Acenaphthylene** | 208-96-8 | 1.0 | µg/L | <1.0 | ---- | ---- | ---- | ---- |
| **Acenaphthene** | 83-32-9 | 1.0 | µg/L | <1.0 | ---- | ---- | ---- | ---- |
| **Fluorene** | 86-73-7 | 1.0 | µg/L | <1.0 | ---- | ---- | ---- | ---- |
| **Phenanthrene** | 85-01-8 | 1.0 | µg/L | <1.0 | ---- | ---- | ---- | ---- |
| **Anthracene** | 120-12-7 | 1.0 | µg/L | <1.0 | ---- | ---- | ---- | ---- |
| **Fluoranthene** | 206-44-0 | 1.0 | µg/L | <1.0 | ---- | ---- | ---- | ---- |
| **Pyrene** | 129-00-0 | 1.0 | µg/L | <1.0 | ---- | ---- | ---- | ---- |
| **Benz(a)anthracene** | 56-55-3 | 1.0 | µg/L | <1.0 | ---- | ---- | ---- | ---- |
| **Chrysene** | 218-01-9 | 1.0 | µg/L | <1.0 | ---- | ---- | ---- | ---- |
| **Benzo(b+j)fluoranthene** | 205-99-2 205-82-3 | 1.0 | µg/L | <1.0 | ---- | ---- | ---- | ---- |

## Analytical Results

| Sub-Matrix: WATER (Matrix: WATER) | | | Sample ID | GLMB03 | TB | Trip spike | ---- | ---- |
|---|---|---|---|---|---|---|---|---|
| | | | Sampling date / time | 27-Oct-2022 11:30 | 21-Oct-2022 00:00 | 21-Oct-2022 00:00 | ---- | ---- |
| Compound | CAS Number | LOR | Unit | ES2238636-001 | ES2238636-002 | ES2238636-003 | -------- | -------- |
| | | | | Result | Result | Result | ---- | ---- |
| **EP075(SIM)B: Polynuclear Aromatic Hydrocarbons - Continued** | | | | | | | | |
| Benzo(k)fluoranthene | 207-08-9 | 1.0 | µg/L | <1.0 | ---- | ---- | ---- | ---- |
| Benzo(a)pyrene | 50-32-8 | 0.5 | µg/L | <0.5 | ---- | ---- | ---- | ---- |
| Indeno(1.2.3.cd)pyrene | 193-39-5 | 1.0 | µg/L | <1.0 | ---- | ---- | ---- | ---- |
| Dibenz(a.h)anthracene | 53-70-3 | 1.0 | µg/L | <1.0 | ---- | ---- | ---- | ---- |
| Benzo(g.h.i)perylene | 191-24-2 | 1.0 | µg/L | <1.0 | ---- | ---- | ---- | ---- |
| ^ Sum of polycyclic aromatic hydrocarbons | ---- | 0.5 | µg/L | <0.5 | ---- | ---- | ---- | ---- |
| ^ Benzo(a)pyrene TEQ (zero) | ---- | 0.5 | µg/L | <0.5 | ---- | ---- | ---- | ---- |
| **EP080/071: Total Petroleum Hydrocarbons** | | | | | | | | |
| C6 - C9 Fraction | ---- | 20 | µg/L | <20 | <20 | ---- | ---- | ---- |
| C10 - C14 Fraction | ---- | 50 | µg/L | **70** | ---- | ---- | ---- | ---- |
| C15 - C28 Fraction | ---- | 100 | µg/L | **360** | ---- | ---- | ---- | ---- |
| C29 - C36 Fraction | ---- | 50 | µg/L | <50 | ---- | ---- | ---- | ---- |
| ^ C10 - C36 Fraction (sum) | ---- | 50 | µg/L | **430** | ---- | ---- | ---- | ---- |
| **EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions** | | | | | | | | |
| C6 - C10 Fraction | C6_C10 | 20 | µg/L | <20 | <20 | ---- | ---- | ---- |
| ^ C6 - C10 Fraction minus BTEX (F1) | C6_C10-BTEX | 20 | µg/L | <20 | <20 | ---- | ---- | ---- |
| >C10 - C16 Fraction | ---- | 100 | µg/L | **100** | ---- | ---- | ---- | ---- |
| >C16 - C34 Fraction | ---- | 100 | µg/L | **360** | ---- | ---- | ---- | ---- |
| >C34 - C40 Fraction | ---- | 100 | µg/L | <100 | ---- | ---- | ---- | ---- |
| ^ >C10 - C40 Fraction (sum) | ---- | 100 | µg/L | **460** | ---- | ---- | ---- | ---- |
| ^ >C10 - C16 Fraction minus Naphthalene (F2) | ---- | 100 | µg/L | **100** | ---- | ---- | ---- | ---- |
| **EP080: BTEXN** | | | | | | | | |
| Benzene | 71-43-2 | 1 | µg/L | <1 | <1 | **15** | ---- | ---- |
| Toluene | 108-88-3 | 2 | µg/L | **22** | <2 | **14** | ---- | ---- |
| Ethylbenzene | 100-41-4 | 2 | µg/L | <2 | <2 | **16** | ---- | ---- |
| meta- & para-Xylene | 108-38-3 106-42-3 | 2 | µg/L | <2 | <2 | **15** | ---- | ---- |
| ortho-Xylene | 95-47-6 | 2 | µg/L | <2 | <2 | **14** | ---- | ---- |
| ^ Total Xylenes | ---- | 2 | µg/L | <2 | <2 | **29** | ---- | ---- |
| ^ Sum of BTEX | ---- | 1 | µg/L | **22** | <1 | **74** | ---- | ---- |
| Naphthalene | 91-20-3 | 5 | µg/L | <5 | <5 | **17** | ---- | ---- |
| **ED009: Anions** | | | | | | | | |
| Bromide | 24959-67-9 | 0.010 | mg/L | **1.49** | ---- | ---- | ---- | ---- |

## Analytical Results

| Sub-Matrix: WATER (Matrix: WATER) | | | | Sample ID | GLMB03 | TB | Trip spike | ---- | ---- |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Sampling date / time | 27-Oct-2022 11:30 | 21-Oct-2022 00:00 | 21-Oct-2022 00:00 | ---- | ---- |
| Compound | CAS Number | LOR | Unit | | ES2238636-001 | ES2238636-002 | ES2238636-003 | -------- | -------- |
| | | | | | Result | Result | Result | ---- | ---- |
| **EP075(SIM)S: Phenolic Compound Surrogates** | | | | | | | | | |
| **Phenol-d6** | 13127-88-3 | 1.0 | % | | **23.0** | ---- | ---- | ---- | ---- |
| **2-Chlorophenol-D4** | 93951-73-6 | 1.0 | % | | **40.6** | ---- | ---- | ---- | ---- |
| **2.4.6-Tribromophenol** | 118-79-6 | 1.0 | % | | **81.7** | ---- | ---- | ---- | ---- |
| **EP075(SIM)T: PAH Surrogates** | | | | | | | | | |
| **2-Fluorobiphenyl** | 321-60-8 | 1.0 | % | | **64.8** | ---- | ---- | ---- | ---- |
| **Anthracene-d10** | 1719-06-8 | 1.0 | % | | **75.4** | ---- | ---- | ---- | ---- |
| **4-Terphenyl-d14** | 1718-51-0 | 1.0 | % | | **72.5** | ---- | ---- | ---- | ---- |
| **EP080S: TPH(V)/BTEX Surrogates** | | | | | | | | | |
| **1.2-Dichloroethane-D4** | 17060-07-0 | 2 | % | | **93.3** | **102** | **97.7** | ---- | ---- |
| **Toluene-D8** | 2037-26-5 | 2 | % | | **103** | **118** | **114** | ---- | ---- |
| **4-Bromofluorobenzene** | 460-00-4 | 2 | % | | **91.9** | **102** | **99.9** | ---- | ---- |

## Surrogate Control Limits

Sub-Matrix: **WATER**

| Compound | CAS Number | Recovery Limits (%) Low | High |
|---|---|---|---|
| **EP075(SIM)S: Phenolic Compound Surrogates** | | | |
| **Phenol-d6** | 13127-88-3 | 10 | 44 |
| **2-Chlorophenol-D4** | 93951-73-6 | 14 | 94 |
| **2.4.6-Tribromophenol** | 118-79-6 | 17 | 125 |
| **EP075(SIM)T: PAH Surrogates** | | | |
| **2-Fluorobiphenyl** | 321-60-8 | 20 | 104 |
| **Anthracene-d10** | 1719-06-8 | 27 | 113 |
| **4-Terphenyl-d14** | 1718-51-0 | 32 | 112 |
| **EP080S: TPH(V)/BTEX Surrogates** | | | |
| **1.2-Dichloroethane-D4** | 17060-07-0 | 71 | 137 |
| **Toluene-D8** | 2037-26-5 | 79 | 131 |
| **4-Bromofluorobenzene** | 460-00-4 | 70 | 128 |

# CERTIFICATE OF ANALYSIS

| | | | |
|---|---|---|---|
| **Work Order** | : **ES2311396** | Page | : 1 of 12 |
| Client | : **EMM CONSULTING PTY LTD** | Laboratory | : Environmental Division Sydney |
| Contact | : MS KAITLYN BRODIE | Contact | : Customer Services ES |
| Address | : Ground Floor Suite 1 20 Chandos Street St Leonards NSW NSW 2065 | Address | : 277-289 Woodpark Road Smithfield NSW Australia 2164 |
| Telephone | : 02 9493 9500 | Telephone | : +61-2-8784 8555 |
| Project | : AGL, Camden Gas Project E220575 | Date Samples Received | : 05-Apr-2023 11:25 |
| Order number | : ---- | Date Analysis Commenced | : 05-Apr-2023 |
| C-O-C number | : ---- | Issue Date | : 13-Apr-2023 18:00 |
| Sampler | : CLAIRE CORTHIER, KAITLYN BRODIE | | |
| Site | : ---- | | |
| Quote number | : SY/416/16 - AGL Camden Planned Event | | |
| No. of samples received | : 9 | | |
| No. of samples analysed | : 9 | | |

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

**Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.**

## *Signatories*

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

| *Signatories* | *Position* | *Accreditation Category* |
|---|---|---|
| Ankit Joshi | Senior Chemist - Inorganics | Sydney Inorganics, Smithfield, NSW |
| Edwandy Fadjar | Organic Coordinator | Sydney Organics, Smithfield, NSW |
| Sanjeshni Jyoti | Senior Chemist Volatiles | Sydney Organics, Smithfield, NSW |
| Wisam Marassa | Inorganics Coordinator | Sydney Inorganics, Smithfield, NSW |

## General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contract for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- EP075 (SIM): Where reported, Benzo(a)pyrene Toxicity Equivalent Quotient (TEQ) per the NEPM (2013) is the sum total of the concentration of the eight carcinogenic PAHs multiplied by their Toxicity Equivalence Factor (TEF) relative to Benzo(a)pyrene. TEF values are provided in brackets as follows: Benz(a)anthracene (0.1), Chrysene (0.01), Benzo(b+j) & Benzo(k)fluoranthene (0.1), Benzo(a)pyrene (1.0), Indeno(1.2.3.cd)pyrene (0.1), Dibenz(a.h)anthracene (1.0), Benzo(g.h.i)perylene (0.01). Less than LOR results for 'TEQ Zero' are treated as zero.
- EP080: Where reported, Total Xylenes is the sum of the reported concentrations of m&p-Xylene and o-Xylene at or above the LOR.
- EP075(SIM): Where reported, Total Cresol is the sum of the reported concentrations of 2-Methylphenol and 3- & 4-Methylphenol at or above the LOR.
- As per QWI – EN55-3 Data Interpreting Procedures, Ionic balances are typically calculated using Major Anions - Chloride, Alkalinity and Sulfate; and Major Cations - Calcium, Magnesium, Potassium and Sodium. Where applicable and dependent upon sample matrix, the Ionic Balance may also include the additional contribution of Ammonia, Dissolved Metals by ICPMS and H+ to the Cations and Nitrate, SiO2 and Fluoride to the Anions.
- EG035: Poor matrix spike recovery was obtained for Mercury on sample ES2310974 #5. Confirmed by re-analysis.
- EG020: ‘Bromine’ quantification may be unreliable due to its low solubility in acid, leading to variable volatility during measurement by ICPMS.
- EG035: Positive Mercury results ES2311396 #1, #2 and #7 have been confirmed by reanalysis.
- EK071G: It has been noted that Reactive P is greater than Total P on sample 1, however this difference is within the limits of experimental variation.
- EP075(SIM): Particular samples phenolic surrogate low due to matrix interferences.
- EP080: Sample TRIP SPIKE contains volatile compounds spiked into the sample containers prior to dispatch from the laboratory. BTEXN compounds spiked at 20 ug/L.
- Sodium Adsorption Ratio (where reported): Where results for Na, Ca or Mg are <LOR, a concentration at half the reported LOR is incorporated into the SAR calculation. This represents a conservative approach for Na relative to the assumption that <LOR = zero concentration and a conservative approach for Ca & Mg relative to the assumption that <LOR is equivalent to the LOR concentration.

## Analytical Results

| Sub-Matrix: WATER (Matrix: WATER) | | | Sample ID | GLMB03 | MPMB01 | MPMB02 | MPMB03 | MPMB04 |
|---|---|---|---|---|---|---|---|---|
| | | | Sampling date / time | [04-Apr-2023] | [04-Apr-2023] | [04-Apr-2023] | [04-Apr-2023] | [04-Apr-2023] |
| Compound | CAS Number | LOR | Unit | ES2311396-001 | ES2311396-002 | ES2311396-003 | ES2311396-004 | ES2311396-005 |
| | | | | Result | Result | Result | Result | Result |
| **EA005P: pH by PC Titrator** | | | | | | | | |
| pH Value | ---- | 0.01 | pH Unit | **9.88** | **6.01** | **6.89** | **7.79** | **8.83** |
| **EA010P: Conductivity by PC Titrator** | | | | | | | | |
| Electrical Conductivity @ 25°C | ---- | 1 | µS/cm | **3700** | **606** | **631** | **878** | **220** |
| **EA015: Total Dissolved Solids dried at 180 ± 5 °C** | | | | | | | | |
| Total Dissolved Solids @180°C | ---- | 10 | mg/L | **2340** | **338** | **354** | **482** | **134** |
| **EA025: Total Suspended Solids dried at 104 ± 2°C** | | | | | | | | |
| Suspended Solids (SS) | ---- | 5 | mg/L | **8** | **10** | <5 | **23** | **16** |
| **ED037P: Alkalinity by PC Titrator** | | | | | | | | |
| Hydroxide Alkalinity as CaCO3 | DMO-210-001 | 1 | mg/L | <1 | <1 | <1 | <1 | <1 |
| Carbonate Alkalinity as CaCO3 | 3812-32-6 | 1 | mg/L | **592** | <1 | <1 | <1 | **19** |
| Bicarbonate Alkalinity as CaCO3 | 71-52-3 | 1 | mg/L | **491** | **15** | **146** | **416** | **69** |
| Total Alkalinity as CaCO3 | ---- | 1 | mg/L | **1080** | **15** | **146** | **416** | **88** |
| **ED041G: Sulfate (Turbidimetric) as SO4 2- by DA** | | | | | | | | |
| Sulfate as SO4 - Turbidimetric | 14808-79-8 | 1 | mg/L | <1 | **3** | **4** | <1 | <1 |
| **ED045G: Chloride by Discrete Analyser** | | | | | | | | |
| Chloride | 16887-00-6 | 1 | mg/L | **690** | **183** | **116** | **64** | **19** |
| **ED093F: Dissolved Major Cations** | | | | | | | | |
| Calcium | 7440-70-2 | 1 | mg/L | **15** | **8** | **28** | **83** | **3** |
| Magnesium | 7439-95-4 | 1 | mg/L | **63** | **14** | **27** | **21** | <1 |
| Sodium | 7440-23-5 | 1 | mg/L | **837** | **88** | **65** | **97** | **45** |
| Potassium | 7440-09-7 | 1 | mg/L | **33** | **1** | **4** | **12** | **4** |
| **EG020F: Dissolved Metals by ICP-MS** | | | | | | | | |
| Aluminium | 7429-90-5 | 0.01 | mg/L | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Antimony | 7440-36-0 | 0.001 | mg/L | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 |
| Arsenic | 7440-38-2 | 0.001 | mg/L | **0.003** | <0.001 | **0.018** | **0.008** | **0.001** |
| Boron | 7440-42-8 | 0.05 | mg/L | **0.08** | <0.05 | <0.05 | <0.05 | <0.05 |
| Barium | 7440-39-3 | 0.001 | mg/L | **17.6** | **0.385** | **0.394** | **2.58** | **0.202** |
| Beryllium | 7440-41-7 | 0.001 | mg/L | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 |
| Cadmium | 7440-43-9 | 0.0001 | mg/L | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 |
| Cobalt | 7440-48-4 | 0.001 | mg/L | <0.001 | **0.025** | **0.005** | **0.003** | <0.001 |
| Chromium | 7440-47-3 | 0.001 | mg/L | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 |
| Copper | 7440-50-8 | 0.001 | mg/L | <0.001 | **0.003** | <0.001 | <0.001 | **0.004** |
| Manganese | 7439-96-5 | 0.001 | mg/L | **0.014** | **0.306** | **0.320** | **0.271** | **0.005** |

## Analytical Results

| Sub-Matrix: WATER (Matrix: WATER) | | | Sample ID | GLMB03 | MPMB01 | MPMB02 | MPMB03 | MPMB04 |
|---|---|---|---|---|---|---|---|---|
| | | | Sampling date / time | [04-Apr-2023] | [04-Apr-2023] | [04-Apr-2023] | [04-Apr-2023] | [04-Apr-2023] |
| Compound | CAS Number | LOR | Unit | ES2311396-001 | ES2311396-002 | ES2311396-003 | ES2311396-004 | ES2311396-005 |
| | | | | Result | Result | Result | Result | Result |
| **EG020F: Dissolved Metals by ICP-MS - Continued** | | | | | | | | |
| Nickel | 7440-02-0 | 0.001 | mg/L | **0.001** | **0.011** | **0.004** | <0.001 | <0.001 |
| Lead | 7439-92-1 | 0.001 | mg/L | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 |
| Selenium | 7782-49-2 | 0.01 | mg/L | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Vanadium | 7440-62-2 | 0.01 | mg/L | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Zinc | 7440-66-6 | 0.005 | mg/L | **0.152** | **0.034** | **0.007** | <0.005 | **0.101** |
| Molybdenum | 7439-98-7 | 0.001 | mg/L | **0.004** | <0.001 | <0.001 | <0.001 | **0.001** |
| Strontium | 7440-24-6 | 0.001 | mg/L | **4.31** | **0.100** | **0.304** | **0.776** | **0.054** |
| Uranium | 7440-61-1 | 0.001 | mg/L | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 |
| Iron | 7439-89-6 | 0.05 | mg/L | <0.05 | **0.28** | **5.61** | **4.51** | <0.05 |
| Bromine | 7726-95-6 | 0.1 | mg/L | **1.9** | **0.5** | **0.3** | **0.1** | <0.1 |
| **EG035F: Dissolved Mercury by FIMS** | | | | | | | | |
| Mercury | 7439-97-6 | 0.0001 | mg/L | **0.0010** | **0.0001** | <0.0001 | <0.0001 | <0.0001 |
| **EG052G: Silica by Discrete Analyser** | | | | | | | | |
| Reactive Silica | ---- | 0.05 | mg/L | **4.31** | **17.4** | **10.8** | **9.22** | **3.63** |
| **EK026SF: Total CN by Segmented Flow Analyser** | | | | | | | | |
| Total Cyanide | 57-12-5 | 0.004 | mg/L | <0.004 | <0.004 | <0.004 | <0.004 | <0.004 |
| **EK040P: Fluoride by PC Titrator** | | | | | | | | |
| Fluoride | 16984-48-8 | 0.1 | mg/L | <0.1 | <0.1 | **0.1** | **0.1** | **0.2** |
| **EK055G: Ammonia as N by Discrete Analyser** | | | | | | | | |
| Ammonia as N | 7664-41-7 | 0.01 | mg/L | **1.50** | <0.01 | **0.14** | **0.91** | **0.48** |
| **EK057G: Nitrite as N by Discrete Analyser** | | | | | | | | |
| Nitrite as N | 14797-65-0 | 0.01 | mg/L | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| **EK058G: Nitrate as N by Discrete Analyser** | | | | | | | | |
| Nitrate as N | 14797-55-8 | 0.01 | mg/L | **0.02** | **0.74** | **0.02** | **0.05** | **0.04** |
| **EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser** | | | | | | | | |
| Nitrite + Nitrate as N | ---- | 0.01 | mg/L | **0.02** | **0.74** | **0.02** | **0.05** | **0.04** |
| **EK067G: Total Phosphorus as P by Discrete Analyser** | | | | | | | | |
| Total Phosphorus as P | ---- | 0.01 | mg/L | **0.18** | **0.80** | **0.07** | **0.11** | **0.02** |
| **EK071G: Reactive Phosphorus as P by discrete analyser** | | | | | | | | |
| Reactive Phosphorus as P | 14265-44-2 | 0.01 | mg/L | **0.20** | <0.01 | <0.01 | <0.01 | <0.01 |
| **EN055: Ionic Balance** | | | | | | | | |
| ø Total Anions | ---- | 0.01 | meq/L | **41.0** | **5.52** | **6.27** | **10.1** | **2.29** |
| ø Total Cations | ---- | 0.01 | meq/L | **43.2** | **5.40** | **6.55** | **10.4** | **2.21** |

## Analytical Results

| Sub-Matrix: WATER (Matrix: WATER) | | | Sample ID | GLMB03 | MPMB01 | MPMB02 | MPMB03 | MPMB04 |
|---|---|---|---|---|---|---|---|---|
| | | | Sampling date / time | [04-Apr-2023] | [04-Apr-2023] | [04-Apr-2023] | [04-Apr-2023] | [04-Apr-2023] |
| Compound | CAS Number | LOR | Unit | ES2311396-001 | ES2311396-002 | ES2311396-003 | ES2311396-004 | ES2311396-005 |
| | | | | Result | Result | Result | Result | Result |
| **EN055: Ionic Balance - Continued** | | | | | | | | |
| ø Ionic Balance | ---- | 0.01 | % | **2.54** | **1.09** | **2.16** | **1.36** | **----** |
| **EP005: Total Organic Carbon (TOC)** | | | | | | | | |
| Total Organic Carbon | ---- | 1 | mg/L | **90** | <1 | <1 | **5** | **6** |
| **EP033: C1 - C4 Hydrocarbon Gases** | | | | | | | | |
| Methane | 74-82-8 | 10 | µg/L | **11900** | <10 | **----** | **----** | **13400** |
| Ethene | 74-85-1 | 10 | µg/L | <10 | <10 | **----** | **----** | <10 |
| Ethane | 74-84-0 | 10 | µg/L | **162** | <10 | **----** | **----** | <10 |
| Propene | 115-07-1 | 10 | µg/L | <10 | <10 | **----** | **----** | <10 |
| Propane | 74-98-6 | 10 | µg/L | **14** | <10 | **----** | **----** | <10 |
| Butene | 25167-67-3 | 10 | µg/L | <10 | <10 | **----** | **----** | <10 |
| Butane | 106-97-8 | 10 | µg/L | <10 | <10 | **----** | **----** | <10 |
| **EP075(SIM)A: Phenolic Compounds** | | | | | | | | |
| Phenol | 108-95-2 | 1.0 | µg/L | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 |
| 2-Chlorophenol | 95-57-8 | 1.0 | µg/L | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 |
| 2-Methylphenol | 95-48-7 | 1.0 | µg/L | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 |
| 3- & 4-Methylphenol | 1319-77-3 | 2.0 | µg/L | <2.0 | <2.0 | <2.0 | <2.0 | <2.0 |
| 2-Nitrophenol | 88-75-5 | 1.0 | µg/L | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 |
| 2.4-Dimethylphenol | 105-67-9 | 1.0 | µg/L | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 |
| 2.4-Dichlorophenol | 120-83-2 | 1.0 | µg/L | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 |
| 2.6-Dichlorophenol | 87-65-0 | 1.0 | µg/L | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 |
| 4-Chloro-3-methylphenol | 59-50-7 | 1.0 | µg/L | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 |
| 2.4.6-Trichlorophenol | 88-06-2 | 1.0 | µg/L | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 |
| 2.4.5-Trichlorophenol | 95-95-4 | 1.0 | µg/L | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 |
| Pentachlorophenol | 87-86-5 | 2.0 | µg/L | <2.0 | <2.0 | <2.0 | <2.0 | <2.0 |
| **EP075(SIM)B: Polynuclear Aromatic Hydrocarbons** | | | | | | | | |
| Naphthalene | 91-20-3 | 1.0 | µg/L | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 |
| Acenaphthylene | 208-96-8 | 1.0 | µg/L | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 |
| Acenaphthene | 83-32-9 | 1.0 | µg/L | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 |
| Fluorene | 86-73-7 | 1.0 | µg/L | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 |
| Phenanthrene | 85-01-8 | 1.0 | µg/L | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 |
| Anthracene | 120-12-7 | 1.0 | µg/L | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 |
| Fluoranthene | 206-44-0 | 1.0 | µg/L | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 |
| Pyrene | 129-00-0 | 1.0 | µg/L | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 |
| Benz(a)anthracene | 56-55-3 | 1.0 | µg/L | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 |

## Analytical Results

| Sub-Matrix: WATER (Matrix: WATER) | | | | Sample ID | GLMB03 | MPMB01 | MPMB02 | MPMB03 | MPMB04 |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Sampling date / time | [04-Apr-2023] | [04-Apr-2023] | [04-Apr-2023] | [04-Apr-2023] | [04-Apr-2023] |
| Compound | CAS Number | LOR | Unit | | ES2311396-001 | ES2311396-002 | ES2311396-003 | ES2311396-004 | ES2311396-005 |
| | | | | | Result | Result | Result | Result | Result |
| **EP075(SIM)B: Polynuclear Aromatic Hydrocarbons - Continued** | | | | | | | | | |
| Chrysene | 218-01-9 | 1.0 | µg/L | | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 |
| Benzo(b+j)fluoranthene | 205-99-2 205-82-3 | 1.0 | µg/L | | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 |
| Benzo(k)fluoranthene | 207-08-9 | 1.0 | µg/L | | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 |
| Benzo(a)pyrene | 50-32-8 | 0.5 | µg/L | | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 |
| Indeno(1.2.3.cd)pyrene | 193-39-5 | 1.0 | µg/L | | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 |
| Dibenz(a.h)anthracene | 53-70-3 | 1.0 | µg/L | | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 |
| Benzo(g.h.i)perylene | 191-24-2 | 1.0 | µg/L | | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 |
| ^ Sum of polycyclic aromatic hydrocarbons | ---- | 0.5 | µg/L | | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 |
| ^ Benzo(a)pyrene TEQ (zero) | ---- | 0.5 | µg/L | | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 |
| **EP080/071: Total Petroleum Hydrocarbons** | | | | | | | | | |
| C10 - C14 Fraction | ---- | 50 | µg/L | | <50 | <50 | ---- | <50 | <50 |
| C15 - C28 Fraction | ---- | 100 | µg/L | | **590** | <100 | ---- | <100 | <100 |
| C29 - C36 Fraction | ---- | 50 | µg/L | | **210** | <50 | ---- | <50 | <50 |
| ^ C10 - C36 Fraction (sum) | ---- | 50 | µg/L | | **800** | <50 | ---- | <50 | <50 |
| **EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions** | | | | | | | | | |
| >C10 - C16 Fraction | ---- | 100 | µg/L | | <100 | <100 | ---- | <100 | <100 |
| >C16 - C34 Fraction | ---- | 100 | µg/L | | **740** | <100 | ---- | <100 | <100 |
| >C34 - C40 Fraction | ---- | 100 | µg/L | | <100 | <100 | ---- | <100 | <100 |
| ^ >C10 - C40 Fraction (sum) | ---- | 100 | µg/L | | **740** | <100 | ---- | <100 | <100 |
| ^ >C10 - C16 Fraction minus Naphthalene (F2) | ---- | 100 | µg/L | | <100 | <100 | ---- | <100 | <100 |
| **ED009: Anions** | | | | | | | | | |
| Bromide | 24959-67-9 | 0.010 | mg/L | | **1.70** | **0.371** | **0.245** | <0.010 | **0.070** |
| **EP075(SIM)S: Phenolic Compound Surrogates** | | | | | | | | | |
| Phenol-d6 | 13127-88-3 | 1.0 | % | | **19.1** | **28.6** | **30.4** | **25.5** | **17.7** |
| 2-Chlorophenol-D4 | 93951-73-6 | 1.0 | % | | **17.4** | **53.9** | **55.2** | **47.8** | **17.3** |
| 2.4.6-Tribromophenol | 118-79-6 | 1.0 | % | | **11.6** | **59.5** | **66.4** | **60.5** | **11.6** |
| **EP075(SIM)T: PAH Surrogates** | | | | | | | | | |
| 2-Fluorobiphenyl | 321-60-8 | 1.0 | % | | **64.2** | **58.7** | **56.5** | **50.0** | **51.3** |
| Anthracene-d10 | 1719-06-8 | 1.0 | % | | **76.8** | **74.1** | **76.0** | **68.3** | **67.1** |
| 4-Terphenyl-d14 | 1718-51-0 | 1.0 | % | | **75.0** | **68.6** | **72.8** | **64.1** | **62.2** |

## Analytical Results

| Sub-Matrix: WATER (Matrix: WATER) | | | Sample ID | NR | QA1 | TB | Trip Spike | ---- |
|---|---|---|---|---|---|---|---|---|
| | | | Sampling date / time | [04-Apr-2023] | 04-Apr-2023 00:00 | 30-Mar-2023 00:00 | 30-Mar-2023 00:00 | ---- |
| Compound | CAS Number | LOR | Unit | ES2311396-006 | ES2311396-007 | ES2311396-008 | ES2311396-009 | -------- |
| | | | | Result | Result | Result | Result | ---- |
| **EA005P: pH by PC Titrator** | | | | | | | | |
| pH Value | ---- | 0.01 | pH Unit | **6.81** | **6.01** | ---- | ---- | ---- |
| **EA010P: Conductivity by PC Titrator** | | | | | | | | |
| Electrical Conductivity @ 25°C | ---- | 1 | µS/cm | **275** | **594** | ---- | ---- | ---- |
| **EA015: Total Dissolved Solids dried at 180 ± 5 °C** | | | | | | | | |
| Total Dissolved Solids @180°C | ---- | 10 | mg/L | **158** | **326** | ---- | ---- | ---- |
| **EA025: Total Suspended Solids dried at 104 ± 2°C** | | | | | | | | |
| Suspended Solids (SS) | ---- | 5 | mg/L | **15** | **5** | ---- | ---- | ---- |
| **ED037P: Alkalinity by PC Titrator** | | | | | | | | |
| Hydroxide Alkalinity as CaCO3 | DMO-210-001 | 1 | mg/L | <1 | <1 | ---- | ---- | ---- |
| Carbonate Alkalinity as CaCO3 | 3812-32-6 | 1 | mg/L | <1 | <1 | ---- | ---- | ---- |
| Bicarbonate Alkalinity as CaCO3 | 71-52-3 | 1 | mg/L | **66** | **15** | ---- | ---- | ---- |
| Total Alkalinity as CaCO3 | ---- | 1 | mg/L | **66** | **15** | ---- | ---- | ---- |
| **ED041G: Sulfate (Turbidimetric) as SO4 2- by DA** | | | | | | | | |
| Sulfate as SO4 - Turbidimetric | 14808-79-8 | 1 | mg/L | **5** | **3** | ---- | ---- | ---- |
| **ED045G: Chloride by Discrete Analyser** | | | | | | | | |
| Chloride | 16887-00-6 | 1 | mg/L | **43** | **170** | ---- | ---- | ---- |
| **ED093F: Dissolved Major Cations** | | | | | | | | |
| Calcium | 7440-70-2 | 1 | mg/L | **7** | **8** | ---- | ---- | ---- |
| Magnesium | 7439-95-4 | 1 | mg/L | **7** | **14** | ---- | ---- | ---- |
| Sodium | 7440-23-5 | 1 | mg/L | **40** | **88** | ---- | ---- | ---- |
| Potassium | 7440-09-7 | 1 | mg/L | **4** | **2** | ---- | ---- | ---- |
| **EG020F: Dissolved Metals by ICP-MS** | | | | | | | | |
| Aluminium | 7429-90-5 | 0.01 | mg/L | **0.03** | <0.01 | ---- | ---- | ---- |
| Antimony | 7440-36-0 | 0.001 | mg/L | <0.001 | <0.001 | ---- | ---- | ---- |
| Arsenic | 7440-38-2 | 0.001 | mg/L | <0.001 | <0.001 | ---- | ---- | ---- |
| Boron | 7440-42-8 | 0.05 | mg/L | <0.05 | <0.05 | ---- | ---- | ---- |
| Barium | 7440-39-3 | 0.001 | mg/L | **0.044** | **0.380** | ---- | ---- | ---- |
| Beryllium | 7440-41-7 | 0.001 | mg/L | <0.001 | <0.001 | ---- | ---- | ---- |
| Cadmium | 7440-43-9 | 0.0001 | mg/L | <0.0001 | <0.0001 | ---- | ---- | ---- |
| Cobalt | 7440-48-4 | 0.001 | mg/L | <0.001 | **0.024** | ---- | ---- | ---- |
| Chromium | 7440-47-3 | 0.001 | mg/L | <0.001 | <0.001 | ---- | ---- | ---- |
| Copper | 7440-50-8 | 0.001 | mg/L | **0.002** | **0.004** | ---- | ---- | ---- |
| Manganese | 7439-96-5 | 0.001 | mg/L | **0.024** | **0.308** | ---- | ---- | ---- |

## Analytical Results

| Sub-Matrix: WATER (Matrix: WATER) | | | Sample ID | NR | QA1 | TB | Trip Spike | ---- |
|---|---|---|---|---|---|---|---|---|
| | | | Sampling date / time | [04-Apr-2023] | 04-Apr-2023 00:00 | 30-Mar-2023 00:00 | 30-Mar-2023 00:00 | ---- |
| Compound | CAS Number | LOR | Unit | ES2311396-006 | ES2311396-007 | ES2311396-008 | ES2311396-009 | -------- |
| | | | | Result | Result | Result | Result | ---- |
| **EG020F: Dissolved Metals by ICP-MS - Continued** | | | | | | | | |
| Nickel | 7440-02-0 | 0.001 | mg/L | **0.003** | **0.013** | ---- | ---- | ---- |
| Lead | 7439-92-1 | 0.001 | mg/L | <0.001 | <0.001 | ---- | ---- | ---- |
| Selenium | 7782-49-2 | 0.01 | mg/L | <0.01 | <0.01 | ---- | ---- | ---- |
| Vanadium | 7440-62-2 | 0.01 | mg/L | <0.01 | <0.01 | ---- | ---- | ---- |
| Zinc | 7440-66-6 | 0.005 | mg/L | <0.005 | **0.035** | ---- | ---- | ---- |
| Molybdenum | 7439-98-7 | 0.001 | mg/L | **0.001** | <0.001 | ---- | ---- | ---- |
| Strontium | 7440-24-6 | 0.001 | mg/L | **0.068** | **0.097** | ---- | ---- | ---- |
| Uranium | 7440-61-1 | 0.001 | mg/L | <0.001 | <0.001 | ---- | ---- | ---- |
| Iron | 7439-89-6 | 0.05 | mg/L | **0.50** | **0.28** | ---- | ---- | ---- |
| Bromine | 7726-95-6 | 0.1 | mg/L | **0.2** | **0.4** | ---- | ---- | ---- |
| **EG035F: Dissolved Mercury by FIMS** | | | | | | | | |
| Mercury | 7439-97-6 | 0.0001 | mg/L | <0.0001 | **0.0002** | ---- | ---- | ---- |
| **EG052G: Silica by Discrete Analyser** | | | | | | | | |
| Reactive Silica | ---- | 0.05 | mg/L | **2.03** | **17.6** | ---- | ---- | ---- |
| **EK026SF: Total CN by Segmented Flow Analyser** | | | | | | | | |
| Total Cyanide | 57-12-5 | 0.004 | mg/L | <0.004 | <0.004 | ---- | ---- | ---- |
| **EK040P: Fluoride by PC Titrator** | | | | | | | | |
| Fluoride | 16984-48-8 | 0.1 | mg/L | <0.1 | <0.1 | ---- | ---- | ---- |
| **EK055G: Ammonia as N by Discrete Analyser** | | | | | | | | |
| Ammonia as N | 7664-41-7 | 0.01 | mg/L | <0.01 | <0.01 | ---- | ---- | ---- |
| **EK057G: Nitrite as N by Discrete Analyser** | | | | | | | | |
| Nitrite as N | 14797-65-0 | 0.01 | mg/L | <0.01 | <0.01 | ---- | ---- | ---- |
| **EK058G: Nitrate as N by Discrete Analyser** | | | | | | | | |
| Nitrate as N | 14797-55-8 | 0.01 | mg/L | **0.09** | **0.75** | ---- | ---- | ---- |
| **EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser** | | | | | | | | |
| Nitrite + Nitrate as N | ---- | 0.01 | mg/L | **0.09** | **0.75** | ---- | ---- | ---- |
| **EK067G: Total Phosphorus as P by Discrete Analyser** | | | | | | | | |
| Total Phosphorus as P | ---- | 0.01 | mg/L | **0.04** | **0.96** | ---- | ---- | ---- |
| **EK071G: Reactive Phosphorus as P by discrete analyser** | | | | | | | | |
| Reactive Phosphorus as P | 14265-44-2 | 0.01 | mg/L | <0.01 | <0.01 | ---- | ---- | ---- |
| **EN055: Ionic Balance** | | | | | | | | |
| ø Total Anions | ---- | 0.01 | meq/L | **2.64** | **5.16** | ---- | ---- | ---- |
| ø Total Cations | ---- | 0.01 | meq/L | **2.77** | **5.43** | ---- | ---- | ---- |

## Analytical Results

| Sub-Matrix: WATER (Matrix: WATER) | | | Sample ID | NR | QA1 | TB | Trip Spike | ---- |
|---|---|---|---|---|---|---|---|---|
| | | | Sampling date / time | [04-Apr-2023] | 04-Apr-2023 00:00 | 30-Mar-2023 00:00 | 30-Mar-2023 00:00 | ---- |
| Compound | CAS Number | LOR | Unit | ES2311396-006 | ES2311396-007 | ES2311396-008 | ES2311396-009 | -------- |
| | | | | Result | Result | Result | Result | ---- |
| **EN055: Ionic Balance - Continued** | | | | | | | | |
| ø Ionic Balance | ---- | 0.01 | % | **----** | **2.58** | ---- | ---- | ---- |
| **EP005: Total Organic Carbon (TOC)** | | | | | | | | |
| Total Organic Carbon | ---- | 1 | mg/L | **5** | <1 | ---- | ---- | ---- |
| **EP033: C1 - C4 Hydrocarbon Gases** | | | | | | | | |
| Methane | 74-82-8 | 10 | µg/L | <10 | <10 | ---- | ---- | ---- |
| Ethene | 74-85-1 | 10 | µg/L | <10 | <10 | ---- | ---- | ---- |
| Ethane | 74-84-0 | 10 | µg/L | <10 | <10 | ---- | ---- | ---- |
| Propene | 115-07-1 | 10 | µg/L | <10 | <10 | ---- | ---- | ---- |
| Propane | 74-98-6 | 10 | µg/L | <10 | <10 | ---- | ---- | ---- |
| Butene | 25167-67-3 | 10 | µg/L | <10 | <10 | ---- | ---- | ---- |
| Butane | 106-97-8 | 10 | µg/L | <10 | <10 | ---- | ---- | ---- |
| **EP075(SIM)A: Phenolic Compounds** | | | | | | | | |
| Phenol | 108-95-2 | 1.0 | µg/L | <1.0 | <1.0 | ---- | ---- | ---- |
| 2-Chlorophenol | 95-57-8 | 1.0 | µg/L | <1.0 | <1.0 | ---- | ---- | ---- |
| 2-Methylphenol | 95-48-7 | 1.0 | µg/L | <1.0 | <1.0 | ---- | ---- | ---- |
| 3- & 4-Methylphenol | 1319-77-3 | 2.0 | µg/L | <2.0 | <2.0 | ---- | ---- | ---- |
| 2-Nitrophenol | 88-75-5 | 1.0 | µg/L | <1.0 | <1.0 | ---- | ---- | ---- |
| 2.4-Dimethylphenol | 105-67-9 | 1.0 | µg/L | <1.0 | <1.0 | ---- | ---- | ---- |
| 2.4-Dichlorophenol | 120-83-2 | 1.0 | µg/L | <1.0 | <1.0 | ---- | ---- | ---- |
| 2.6-Dichlorophenol | 87-65-0 | 1.0 | µg/L | <1.0 | <1.0 | ---- | ---- | ---- |
| 4-Chloro-3-methylphenol | 59-50-7 | 1.0 | µg/L | <1.0 | <1.0 | ---- | ---- | ---- |
| 2.4.6-Trichlorophenol | 88-06-2 | 1.0 | µg/L | <1.0 | <1.0 | ---- | ---- | ---- |
| 2.4.5-Trichlorophenol | 95-95-4 | 1.0 | µg/L | <1.0 | <1.0 | ---- | ---- | ---- |
| Pentachlorophenol | 87-86-5 | 2.0 | µg/L | <2.0 | <2.0 | ---- | ---- | ---- |
| **EP075(SIM)B: Polynuclear Aromatic Hydrocarbons** | | | | | | | | |
| Naphthalene | 91-20-3 | 1.0 | µg/L | <1.0 | <1.0 | ---- | ---- | ---- |
| Acenaphthylene | 208-96-8 | 1.0 | µg/L | <1.0 | <1.0 | ---- | ---- | ---- |
| Acenaphthene | 83-32-9 | 1.0 | µg/L | <1.0 | <1.0 | ---- | ---- | ---- |
| Fluorene | 86-73-7 | 1.0 | µg/L | <1.0 | <1.0 | ---- | ---- | ---- |
| Phenanthrene | 85-01-8 | 1.0 | µg/L | <1.0 | <1.0 | ---- | ---- | ---- |
| Anthracene | 120-12-7 | 1.0 | µg/L | <1.0 | <1.0 | ---- | ---- | ---- |
| Fluoranthene | 206-44-0 | 1.0 | µg/L | <1.0 | <1.0 | ---- | ---- | ---- |
| Pyrene | 129-00-0 | 1.0 | µg/L | <1.0 | <1.0 | ---- | ---- | ---- |
| Benz(a)anthracene | 56-55-3 | 1.0 | µg/L | <1.0 | <1.0 | ---- | ---- | ---- |

## Analytical Results

| Sub-Matrix: WATER (Matrix: WATER) | | | | Sample ID | NR | QA1 | TB | Trip Spike | ---- |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Sampling date / time | [04-Apr-2023] | 04-Apr-2023 00:00 | 30-Mar-2023 00:00 | 30-Mar-2023 00:00 | ---- |
| Compound | CAS Number | LOR | Unit | | ES2311396-006 | ES2311396-007 | ES2311396-008 | ES2311396-009 | -------- |
| | | | | | Result | Result | Result | Result | ---- |
| **EP075(SIM)B: Polynuclear Aromatic Hydrocarbons - Continued** | | | | | | | | | |
| Chrysene | 218-01-9 | 1.0 | µg/L | | <1.0 | <1.0 | ---- | ---- | ---- |
| Benzo(b+j)fluoranthene | 205-99-2 205-82-3 | 1.0 | µg/L | | <1.0 | <1.0 | ---- | ---- | ---- |
| Benzo(k)fluoranthene | 207-08-9 | 1.0 | µg/L | | <1.0 | <1.0 | ---- | ---- | ---- |
| Benzo(a)pyrene | 50-32-8 | 0.5 | µg/L | | <0.5 | <0.5 | ---- | ---- | ---- |
| Indeno(1.2.3.cd)pyrene | 193-39-5 | 1.0 | µg/L | | <1.0 | <1.0 | ---- | ---- | ---- |
| Dibenz(a.h)anthracene | 53-70-3 | 1.0 | µg/L | | <1.0 | <1.0 | ---- | ---- | ---- |
| Benzo(g.h.i)perylene | 191-24-2 | 1.0 | µg/L | | <1.0 | <1.0 | ---- | ---- | ---- |
| ^ Sum of polycyclic aromatic hydrocarbons | ---- | 0.5 | µg/L | | <0.5 | <0.5 | ---- | ---- | ---- |
| ^ Benzo(a)pyrene TEQ (zero) | ---- | 0.5 | µg/L | | <0.5 | <0.5 | ---- | ---- | ---- |
| **EP080/071: Total Petroleum Hydrocarbons** | | | | | | | | | |
| C6 - C9 Fraction | ---- | 20 | µg/L | | ---- | ---- | <20 | ---- | ---- |
| C10 - C14 Fraction | ---- | 50 | µg/L | | <50 | <50 | ---- | ---- | ---- |
| C15 - C28 Fraction | ---- | 100 | µg/L | | <100 | <100 | ---- | ---- | ---- |
| C29 - C36 Fraction | ---- | 50 | µg/L | | <50 | <50 | ---- | ---- | ---- |
| ^ C10 - C36 Fraction (sum) | ---- | 50 | µg/L | | <50 | <50 | ---- | ---- | ---- |
| **EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions** | | | | | | | | | |
| C6 - C10 Fraction | C6_C10 | 20 | µg/L | | ---- | ---- | <20 | ---- | ---- |
| ^ C6 - C10 Fraction minus BTEX (F1) | C6_C10-BTEX | 20 | µg/L | | ---- | ---- | <20 | ---- | ---- |
| >C10 - C16 Fraction | ---- | 100 | µg/L | | <100 | <100 | ---- | ---- | ---- |
| >C16 - C34 Fraction | ---- | 100 | µg/L | | <100 | <100 | ---- | ---- | ---- |
| >C34 - C40 Fraction | ---- | 100 | µg/L | | <100 | <100 | ---- | ---- | ---- |
| ^ >C10 - C40 Fraction (sum) | ---- | 100 | µg/L | | <100 | <100 | ---- | ---- | ---- |
| ^ >C10 - C16 Fraction minus Naphthalene (F2) | ---- | 100 | µg/L | | <100 | <100 | ---- | ---- | ---- |
| **EP080: BTEXN** | | | | | | | | | |
| Benzene | 71-43-2 | 1 | µg/L | | ---- | ---- | <1 | **14** | ---- |
| Toluene | 108-88-3 | 2 | µg/L | | ---- | ---- | <2 | **15** | ---- |
| Ethylbenzene | 100-41-4 | 2 | µg/L | | ---- | ---- | <2 | **15** | ---- |
| meta- & para-Xylene | 108-38-3 106-42-3 | 2 | µg/L | | ---- | ---- | <2 | **15** | ---- |
| ortho-Xylene | 95-47-6 | 2 | µg/L | | ---- | ---- | <2 | **16** | ---- |
| ^ Total Xylenes | ---- | 2 | µg/L | | ---- | ---- | <2 | **31** | ---- |
| ^ Sum of BTEX | ---- | 1 | µg/L | | ---- | ---- | <1 | **75** | ---- |
| Naphthalene | 91-20-3 | 5 | µg/L | | ---- | ---- | <5 | **19** | ---- |

## Analytical Results

| Sub-Matrix: WATER (Matrix: WATER) | | | | Sample ID | NR | QA1 | TB | Trip Spike | ---- |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Sampling date / time | [04-Apr-2023] | 04-Apr-2023 00:00 | 30-Mar-2023 00:00 | 30-Mar-2023 00:00 | ---- |
| Compound | CAS Number | LOR | Unit | | ES2311396-006 | ES2311396-007 | ES2311396-008 | ES2311396-009 | -------- |
| | | | | | Result | Result | Result | Result | ---- |
| **ED009: Anions** | | | | | | | | | |
| **Bromide** | 24959-67-9 | 0.010 | mg/L | | **0.117** | **0.401** | **----** | **----** | **----** |
| **EP075(SIM)S: Phenolic Compound Surrogates** | | | | | | | | | |
| **Phenol-d6** | 13127-88-3 | 1.0 | % | | **28.0** | **27.7** | **----** | **----** | **----** |
| **2-Chlorophenol-D4** | 93951-73-6 | 1.0 | % | | **50.7** | **50.2** | **----** | **----** | **----** |
| **2.4.6-Tribromophenol** | 118-79-6 | 1.0 | % | | **59.4** | **61.8** | **----** | **----** | **----** |
| **EP075(SIM)T: PAH Surrogates** | | | | | | | | | |
| **2-Fluorobiphenyl** | 321-60-8 | 1.0 | % | | **58.0** | **52.4** | **----** | **----** | **----** |
| **Anthracene-d10** | 1719-06-8 | 1.0 | % | | **71.8** | **72.7** | **----** | **----** | **----** |
| **4-Terphenyl-d14** | 1718-51-0 | 1.0 | % | | **76.3** | **76.2** | **----** | **----** | **----** |
| **EP080S: TPH(V)/BTEX Surrogates** | | | | | | | | | |
| **1.2-Dichloroethane-D4** | 17060-07-0 | 2 | % | | **----** | **----** | **89.1** | **89.1** | **----** |
| **Toluene-D8** | 2037-26-5 | 2 | % | | **----** | **----** | **95.7** | **94.6** | **----** |
| **4-Bromofluorobenzene** | 460-00-4 | 2 | % | | **----** | **----** | **101** | **97.1** | **----** |

## Surrogate Control Limits

| Sub-Matrix: WATER | | Recovery Limits (%) | |
|---|---|---|---|
| Compound | CAS Number | Low | High |
| **EP075(SIM)S: Phenolic Compound Surrogates** | | | |
| Phenol-d6 | 13127-88-3 | 10 | 44 |
| 2-Chlorophenol-D4 | 93951-73-6 | 14 | 94 |
| 2.4.6-Tribromophenol | 118-79-6 | 17 | 125 |
| **EP075(SIM)T: PAH Surrogates** | | | |
| 2-Fluorobiphenyl | 321-60-8 | 20 | 104 |
| Anthracene-d10 | 1719-06-8 | 27 | 113 |
| 4-Terphenyl-d14 | 1718-51-0 | 32 | 112 |
| **EP080S: TPH(V)/BTEX Surrogates** | | | |
| 1.2-Dichloroethane-D4 | 17060-07-0 | 72 | 143 |
| Toluene-D8 | 2037-26-5 | 75 | 131 |
| 4-Bromofluorobenzene | 460-00-4 | 73 | 137 |

# CERTIFICATE OF ANALYSIS

| | | | |
|---|---|---|---|
| **Work Order** | : **ES2317268** | Page | : 1 of 4 |
| Client | : **EMM CONSULTING PTY LTD** | Laboratory | : Environmental Division Sydney |
| Contact | : MS KAITLYN BRODIE | Contact | : Customer Services ES |
| Address | : Ground Floor Suite 1 20 Chandos Street St Leonards NSW NSW 2065 | Address | : 277-289 Woodpark Road Smithfield NSW Australia 2164 |
| Telephone | : 02 9493 9500 | Telephone | : +61-2-8784 8555 |
| Project | : AGL Camden Gas Project E220575 | Date Samples Received | : 24-May-2023 12:20 |
| Order number | : ---- | Date Analysis Commenced | : 26-May-2023 |
| C-O-C number | : ---- | Issue Date | : 30-May-2023 16:09 |
| Sampler | : KAITLYN BRODIE | | |
| Site | : ---- | | |
| Quote number | : EN/112/21 | | |
| No. of samples received | : 2 | | |
| No. of samples analysed | : 2 | | |

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

**Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.**

## *Signatories*

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

| *Signatories* | *Position* | *Accreditation Category* |
|---|---|---|
| Edwandy Fadjar | Organic Coordinator | Sydney Organics, Smithfield, NSW |

## General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contract for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- EP080: Where reported, Total Xylenes is the sum of the reported concentrations of m&p-Xylene and o-Xylene at or above the LOR.

## Analytical Results

| Sub-Matrix: WATER (Matrix: WATER) | | | Sample ID | MPMB02 | MPMB03 | ---- | ---- | ---- |
|---|---|---|---|---|---|---|---|---|
| | | | Sampling date / time | 24-May-2023 10:30 | 24-May-2023 11:00 | ---- | ---- | ---- |
| Compound | CAS Number | LOR | Unit | ES2317268-001 | ES2317268-002 | -------- | -------- | -------- |
| | | | | Result | Result | ---- | ---- | ---- |
| **EP033: C1 - C4 Hydrocarbon Gases** | | | | | | | | |
| **Methane** | 74-82-8 | 10 | µg/L | **1830** | **4400** | ---- | ---- | ---- |
| **Ethene** | 74-85-1 | 10 | µg/L | <10 | <10 | ---- | ---- | ---- |
| **Ethane** | 74-84-0 | 10 | µg/L | <10 | <10 | ---- | ---- | ---- |
| **EP080/071: Total Petroleum Hydrocarbons** | | | | | | | | |
| **C6 - C9 Fraction** | ---- | 20 | µg/L | <20 | <20 | ---- | ---- | ---- |
| **C10 - C14 Fraction** | ---- | 50 | µg/L | <50 | <50 | ---- | ---- | ---- |
| **C15 - C28 Fraction** | ---- | 100 | µg/L | <100 | <100 | ---- | ---- | ---- |
| **C29 - C36 Fraction** | ---- | 50 | µg/L | <50 | <50 | ---- | ---- | ---- |
| ^ **C10 - C36 Fraction (sum)** | ---- | 50 | µg/L | <50 | <50 | ---- | ---- | ---- |
| **EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions** | | | | | | | | |
| **C6 - C10 Fraction** | C6_C10 | 20 | µg/L | <20 | <20 | ---- | ---- | ---- |
| ^ **C6 - C10 Fraction minus BTEX (F1)** | C6_C10-BTEX | 20 | µg/L | <20 | <20 | ---- | ---- | ---- |
| **>C10 - C16 Fraction** | ---- | 100 | µg/L | <100 | <100 | ---- | ---- | ---- |
| **>C16 - C34 Fraction** | ---- | 100 | µg/L | <100 | <100 | ---- | ---- | ---- |
| **>C34 - C40 Fraction** | ---- | 100 | µg/L | <100 | <100 | ---- | ---- | ---- |
| ^ **>C10 - C40 Fraction (sum)** | ---- | 100 | µg/L | <100 | <100 | ---- | ---- | ---- |
| ^ **>C10 - C16 Fraction minus Naphthalene (F2)** | ---- | 100 | µg/L | <100 | <100 | ---- | ---- | ---- |
| **EP080: BTEXN** | | | | | | | | |
| **Benzene** | 71-43-2 | 1 | µg/L | <1 | <1 | ---- | ---- | ---- |
| **Toluene** | 108-88-3 | 2 | µg/L | <2 | <2 | ---- | ---- | ---- |
| **Ethylbenzene** | 100-41-4 | 2 | µg/L | <2 | <2 | ---- | ---- | ---- |
| **meta- & para-Xylene** | 108-38-3 106-42-3 | 2 | µg/L | <2 | <2 | ---- | ---- | ---- |
| **ortho-Xylene** | 95-47-6 | 2 | µg/L | <2 | <2 | ---- | ---- | ---- |
| ^ **Total Xylenes** | ---- | 2 | µg/L | <2 | <2 | ---- | ---- | ---- |
| ^ **Sum of BTEX** | ---- | 1 | µg/L | <1 | <1 | ---- | ---- | ---- |
| **Naphthalene** | 91-20-3 | 5 | µg/L | <5 | <5 | ---- | ---- | ---- |
| **EP080S: TPH(V)/BTEX Surrogates** | | | | | | | | |
| **1.2-Dichloroethane-D4** | 17060-07-0 | 2 | % | **102** | **123** | ---- | ---- | ---- |
| **Toluene-D8** | 2037-26-5 | 2 | % | **101** | **104** | ---- | ---- | ---- |
| **4-Bromofluorobenzene** | 460-00-4 | 2 | % | **112** | **122** | ---- | ---- | ---- |

## Surrogate Control Limits

Sub-Matrix: **WATER**

| Compound | CAS Number | Recovery Limits (%) Low | Recovery Limits (%) High |
|---|---|---|---|
| **EP080S: TPH(V)/BTEX Surrogates** | | | |
| **1.2-Dichloroethane-D4** | 17060-07-0 | 72 | 143 |
| **Toluene-D8** | 2037-26-5 | 75 | 131 |
| **4-Bromofluorobenzene** | 460-00-4 | 73 | 137 |

# CERTIFICATE OF ANALYSIS

| | | | |
|---|---|---|---|
| **Work Order** | : **ES2321338** | Page | : 1 of 4 |
| Client | : **EMM CONSULTING PTY LTD** | Laboratory | : Environmental Division Sydney |
| Contact | : MS KAITLYN BRODIE | Contact | : Sepan Mahamad |
| Address | : Ground Floor Suite 1 20 Chandos Street St Leonards NSW NSW 2065 | Address | : 277-289 Woodpark Road Smithfield NSW Australia 2164 |
| Telephone | : 02 9493 9500 | Telephone | : +61 2 8784 8555 |
| Project | : AGL Camden Gas Project E220575 | Date Samples Received | : 27-Jun-2023 11:45 |
| Order number | : ---- | Date Analysis Commenced | : 28-Jun-2023 |
| C-O-C number | : ---- | Issue Date | : 03-Jul-2023 20:12 |
| Sampler | : KAITLYN BRODIE | | |
| Site | : ---- | | |
| Quote number | : EN/112/21 | | |
| No. of samples received | : 5 | | |
| No. of samples analysed | : 5 | | |

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

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- Analytical Results
- Surrogate Control Limits

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| *Signatories* | *Position* | *Accreditation Category* |
|---|---|---|
| Edwandy Fadjar | Organic Coordinator | Sydney Organics, Smithfield, NSW |

## General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

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Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

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Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contract for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- EP080: Where reported, Total Xylenes is the sum of the reported concentrations of m&p-Xylene and o-Xylene at or above the LOR.

## Analytical Results

| Sub-Matrix: WATER (Matrix: WATER) | | | Sample ID | MPMB01 | MPMB04 | GLMB03 | Nepean River | QA1 |
|---|---|---|---|---|---|---|---|---|
| | | | Sampling date / time | 27-Jun-2023 09:15 | 27-Jun-2023 09:40 | 27-Jun-2023 08:30 | 27-Jun-2023 07:45 | 27-Jun-2023 00:00 |
| Compound | CAS Number | LOR | Unit | ES2321338-001 | ES2321338-002 | ES2321338-003 | ES2321338-004 | ES2321338-005 |
| | | | | Result | Result | Result | Result | Result |
| **EP080/071: Total Petroleum Hydrocarbons** | | | | | | | | |
| C6 - C9 Fraction | ---- | 20 | µg/L | <20 | <20 | **50** | <20 | **20** |
| C10 - C14 Fraction | ---- | 50 | µg/L | <50 | <50 | <50 | <50 | <50 |
| C15 - C28 Fraction | ---- | 100 | µg/L | <100 | <100 | <100 | <100 | <100 |
| C29 - C36 Fraction | ---- | 50 | µg/L | <50 | <50 | <50 | <50 | <50 |
| ^ C10 - C36 Fraction (sum) | ---- | 50 | µg/L | <50 | <50 | <50 | <50 | <50 |
| **EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions** | | | | | | | | |
| C6 - C10 Fraction | C6_C10 | 20 | µg/L | <20 | <20 | **50** | <20 | **20** |
| ^ C6 - C10 Fraction minus BTEX (F1) | C6_C10-BTEX | 20 | µg/L | <20 | <20 | **30** | <20 | **20** |
| >C10 - C16 Fraction | ---- | 100 | µg/L | <100 | <100 | <100 | <100 | <100 |
| >C16 - C34 Fraction | ---- | 100 | µg/L | <100 | <100 | <100 | <100 | <100 |
| >C34 - C40 Fraction | ---- | 100 | µg/L | <100 | <100 | <100 | <100 | <100 |
| ^ >C10 - C40 Fraction (sum) | ---- | 100 | µg/L | <100 | <100 | <100 | <100 | <100 |
| ^ >C10 - C16 Fraction minus Naphthalene (F2) | ---- | 100 | µg/L | <100 | <100 | <100 | <100 | <100 |
| **EP080: BTEXN** | | | | | | | | |
| Benzene | 71-43-2 | 1 | µg/L | <1 | <1 | <1 | <1 | <1 |
| Toluene | 108-88-3 | 2 | µg/L | <2 | <2 | **21** | <2 | <2 |
| Ethylbenzene | 100-41-4 | 2 | µg/L | <2 | <2 | <2 | <2 | <2 |
| meta- & para-Xylene | 108-38-3 106-42-3 | 2 | µg/L | <2 | <2 | <2 | <2 | <2 |
| ortho-Xylene | 95-47-6 | 2 | µg/L | <2 | <2 | <2 | <2 | <2 |
| ^ Total Xylenes | ---- | 2 | µg/L | <2 | <2 | <2 | <2 | <2 |
| ^ Sum of BTEX | ---- | 1 | µg/L | <1 | <1 | **21** | <1 | <1 |
| Naphthalene | 91-20-3 | 5 | µg/L | <5 | <5 | <5 | <5 | <5 |
| **EP080S: TPH(V)/BTEX Surrogates** | | | | | | | | |
| 1.2-Dichloroethane-D4 | 17060-07-0 | 2 | % | **98.8** | **124** | **97.0** | **104** | **79.3** |
| Toluene-D8 | 2037-26-5 | 2 | % | **84.9** | **105** | **93.4** | **104** | **106** |
| 4-Bromofluorobenzene | 460-00-4 | 2 | % | **98.1** | **104** | **102** | **107** | **100.0** |

## Surrogate Control Limits

| Sub-Matrix: **WATER** | | Recovery Limits (%) | |
|---|---|---|---|
| *Compound* | *CAS Number* | *Low* | *High* |
| **EP080S: TPH(V)/BTEX Surrogates** | | | |
| **1.2-Dichloroethane-D4** | 17060-07-0 | 72 | 143 |
| **Toluene-D8** | 2037-26-5 | 75 | 131 |
| **4-Bromofluorobenzene** | 460-00-4 | 73 | 137 |

## Australia

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