Douglas PARTNERS

GROUNDED EXPERTISE

Groundwater Impact Assessment

Proposed Mixed-Use Development

164-194 William Street, Woolloomooloo NSW

Prepared for William Street Residential Pty Ltd

Project 208700.01

23 July 2025

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The undersigned, on behalf of Douglas Partners Pty Ltd, confirm that this document and all attached drawings, logs and test results have been checked and reviewed for errors, omissions and inaccuracies.

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Douglas Partners acknowledges Australia's First Peoples as the Traditional Owners of the Land and Sea on which we operate. We pay our respects to Elders past and present and to all Aboriginal and Torres Strait Islander peoples across the many communities in which we live, visit and work. We recognise and respect their ongoing cultural and spiritual connection to Country.

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Groundwater Impact Assessment
Proposed Mixed-Use Development
164-194 William Street, Woolloomooloo NSW

1. Introduction

1.1 Purpose of this report

This report prepared by Douglas Partners Pty Ltd (Douglas) outlines the groundwater impact assessment (GIA) for a proposed Mixed-Use Development at 164 - 194 William Street, Woolloomooloo NSW. The work was undertaken in accordance with Douglas' proposal 208700.01.P.001.Rev1 dated 12 July 2024.

The purpose of this GIA is to support the submission of a State Significant Development Application (SSDA), addressing the assessment requirements specified in Section 1.3. Additionally, this document aims to assist in obtaining the necessary approvals for the disposal of extracted groundwater, where applicable, and the approval of a drained basement through an application for a Water Supply Works Approval (WSA) with Department of Climate Change, Energy, the Environment and Water (DCCEEW).

A brief overview of the development is provided in Section 2. The site location is shown on Drawing 1, Appendix A.

This GIA is based on the findings of site-specific investigations and monitoring, including:

- Geotechnical investigation (Douglas, 2024); and
- Detailed (contamination) site investigation (DSI) (Douglas, 2023).

The following key information is relevant to the preparation of this GIA:

- The proposed works will intercept the groundwater table;
- Groundwater levels on site have been observed at approximately RL 7.6 m to 13 m AHD;
- The Bulk Excavation Level (BEL) of the proposed basement is approximately RL 2.5 m;
- The basement is intended to be drained; and
- The extracted groundwater will be disposed of via stormwater.

This GIA includes water treatment and discharge schematics, monitoring plans, and triggers to be implemented during construction.

This report must be read in conjunction with all appendices including the notes provided in Appendix B.

1.2 Regulatory framework and guidance

The following key guidelines and documents were consulted in preparation of this report:

- Groundwater assessment toolbox for Major Projects in NSW (NSW DPE, 2022);

- Guidelines for Groundwater Documentation for SSD/SSI Projects (NSW DPE, 2022);
- Minimum Groundwater Modelling Requirements for SSD/SSI Projects (NSW DPE, 2022); and
- Cumulative Groundwater Impact Assessment Approaches (NSW DPE, 2022).

Additional regulatory requirements may also apply, including WaterNSW approvals for water take and disposal (see Section 9), and local council or EPA conditions depending on the nature and location of discharge.

1.3 Conditions of approval

Conditions of approval are presented in Table 1.

Table 1: Compliance table

SEARs Item	Assessment Requirement	Report Section
12. Ground and groundwater conditions	Where required provide a Groundwater Impact Assessment in accordance with relevant Groundwater Guidelines.	Sections 4 to 11
	If the proposed development is on land identified as having high salinity or acid sulfate soil potential in an EPI provide a Salinity Management Plan or Acid Sulfate Soil Management Plan that includes appropriate management measures and strategies	Sections 4.8 and 8.2.

2. Proposed development

2.1 Proposed development and construction

It is understood that the proposed development of the site includes the construction of a multi-storey, mixed-use building over four levels of basement. Excavations to achieve the Basement 04 Finished Floor Level (FFL) of RL 3.0 m will require excavation between around 12 m to 14.8 m below existing surface levels with localised deeper excavations for the lift cores. While it is not yet known how long the construction period will be for the basement excavation, we have anticipated a period of 12 months. The site is shown on Drawing 1, Appendix A.

2.2 Proposed dewatering and discharge methods

We expect that dewatering of the site will be achievable via conventional sumps and pumps and is expected to be redirected and discharged into council stormwater drains.

3. Site description

The site of the proposed redevelopment at 164-194 William Street, Woolloomooloo has an approximately rectangular shaped footprint covering approximately 6,402 m^2. The ground surface levels fall towards the north-north-west at a grade of about 14%. The site is bounded by Forbes Street to the west, William Street to the south and Dowling Street to the east. Along the northern boundary, the site is bounded by Judge Lane on the western half and a residential

property on the eastern half. The Cross City Tunnel, which is considered to be drained, is located to the south of the site.

The site is currently occupied by a medium-rise office building in the south-western quadrant, a low-rise office building in the south-eastern quadrant, a low-rise workshop building in the north-eastern quadrant and an at-grade carpark in the north-western quadrant.

Figure 1: Aerial image of the site highlighted with red boundary

4. Hydrogeological setting

4.1 Topography

The site is located on a north west facing hillside sloping down into a natural gully feature that eventually drains into Sydney Harbour located around 500 m to the north. Surface levels across the site generally grade down to the north from around RL 18 m to 14 m.

4.2 Climate

Generally subtropical climate, characterized by mild winters and hot, humid summers. The average annual rainfall is approximately 1.2 m.

4.3 Geology

The Geological Survey of NSW Seamless Geology Web Map indicates that the site is underlain by Hawkesbury Sandstone of the Triassic Period that typically comprises medium to coarse-grained quartz sandstone with minor shale and laminite lenses.

The Geological Survey of NSW 1:100 000 Geological Series Sheet 9130 for Sydney (see Figure 2) indicates that the Woolloomooloo Fault Zone, which has an approximate north-easterly alignment, is located approximately 40 m north-west of the site.

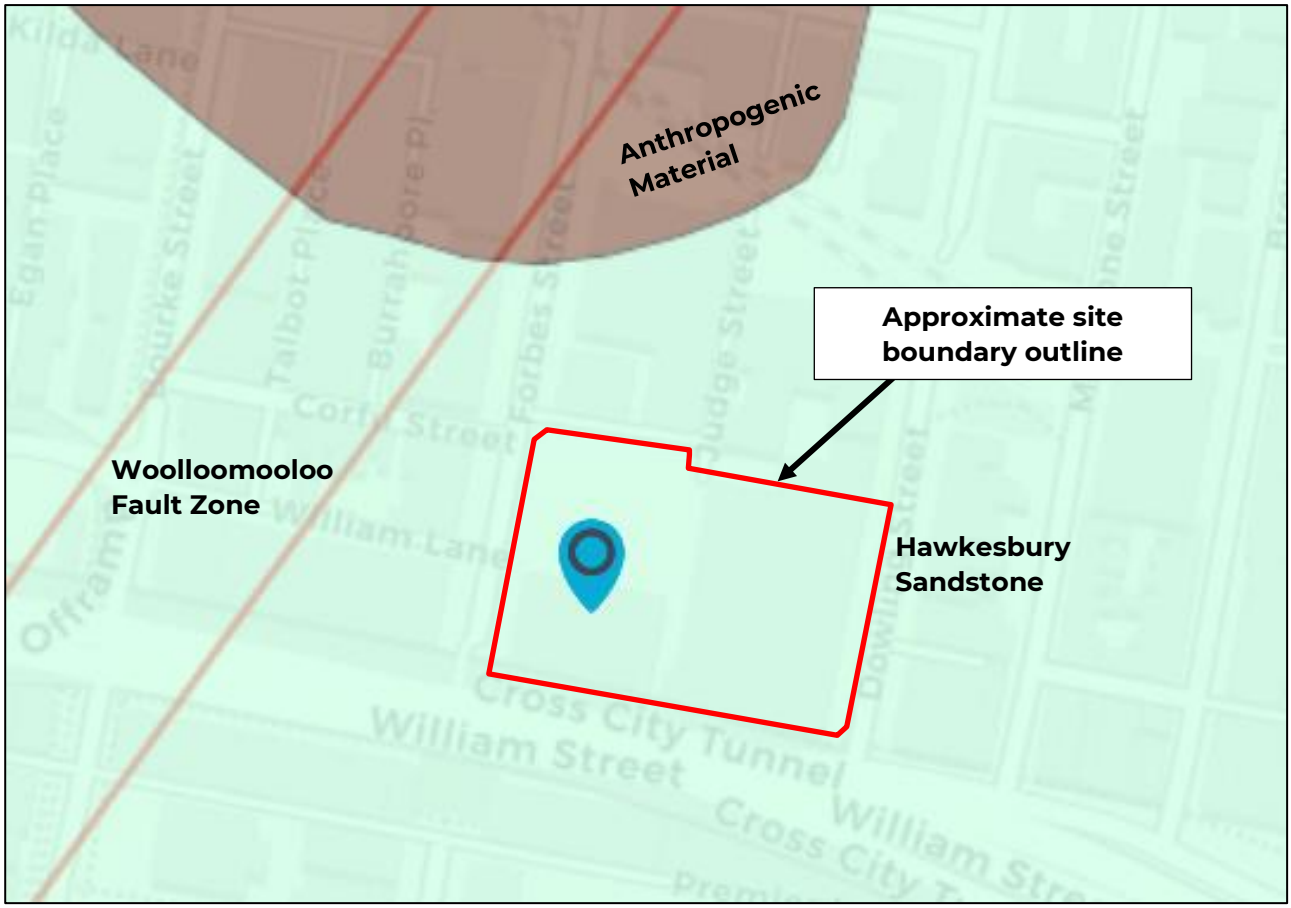

Figure 2: Geological map and site boundary

4.4 Hydrogeology and groundwater source

Based on the hydrogeological setting, the site is assumed to be underlain by the following groundwater systems:

- Aquitard within the clayey soil profile where perched groundwater could be present; and
- Minor fractured aquifers hosted by the underlying Hawkesbury Sandstone bedrock. This rock formation typically acts as aquitards or aquicludes, although minor secondary permeability can occur where defects are present.

4.5 Hydrology

Sydney Harbour is located approximately 500 m to the north of the site.

4.6 Groundwater receptors

A search of the Bureau of Meteorology (BoM)'s groundwater dependent ecosystems Atlas (the GDE Atlas) has been undertaken to identify mapped GDEs within 500 m of the site. No GDE were identified within the search radius.

A review of the BoM national groundwater information system (NGIS) shows there are no water bores are registered within 500 m of the site.

4.7 Previous contamination reports

Douglas undertook a Detailed Site (contamination) Investigation (DSI) in late 2021 (Douglas, 2025 DSI) which involved 12 boreholes and a soil sampling and analytical programme. Pertinent findings relevant to this GIA are summarised herein.

Based on a review of historical records, land uses on surrounding sites include dry cleaners, auto repair sites and motor garages and engineers. Based on observed site features and anecdotal information, two underground storage tanks (USTs) were previously in operation at the site.

All reported concentrations of contaminants in the tested soil samples from the previous due diligence contamination investigation (DDGI) (four boreholes undertaken in 2021) and DSI were below the adopted site assessment criteria (SAC) with the exception of the following:

- Polycyclic aromatic hydrocarbons (PAH) including benzo(a)pyrene in soil samples; and
- Total recoverable hydrocarbons (TRH).

The elevated concentrations reported were considered likely to be associated with the nature of the fill and possible residual impacts from the decommissioned USTs.

In this regard, the identified potential sources of contamination and their respective contaminants of potential concern (CoPC) which may impact groundwater quality can be summarized as follows:

- Fill imported and uncontrolled fill material and demolition / deterioration of previous structures, leaching and/or vertical migration of contaminants into groundwater.
  - CoPC include heavy metals, TRH, BTEX, PAH, OCP, OPP, PCB and phenols.
- Former USTs and associated pipework and bowsers.
  - CoPC include lead, TRH, BTEX, PAH, and volatile organic compounds (VOC).
- Current and past site uses: potential for soil and groundwater to be impacted by practices associated with motor related industries (e.g., car manufacturing, panel beating, motor garages, vehicle cleaning, refuelling and painting, etc.), and other potential commercial / industrial activities such as the manufacturing of batteries, paints and varnish, furniture, slot machines, electrician and builder supplies.
  - COPC include heavy metals, TRH, BTEX, PAH, OCP, OPP, PCB, VOC, phenols.

- Adjacent site uses: The large number of motor related services in the surrounds such as service stations, motor garages and dry cleaners, the long history of other commercial/industrial works in the area including a dry cleaner upgradient of the site (at the intersection adjacent and upgradient of the site - within 20 m (18-20 m southeast, and 20 m east of the site) and general maintenance / redevelopment of public roads which surround the site.
    - COPC include heavy metals, TRH, BTEX, PAH, OCP, OPP, PCB, VOC, phenols.

All groundwater can be treated prior to being pumped off site if it is contaminated.

4.8 Acid sulfate soils and salinity

The site was reviewed for the potential presence of acid sulfate soils (ASS) and salinity risks based on regional mapping, soil classification and available site investigation data.

Reference to Department of Land and Water Conservation NSW Acid Sulphate Soil Risk Mapping indicates that the site is not within an area mapped as at risk of acid sulphate soil occurrence. The closest area to the site where data is available is classified as a X2 Disturbed Zone area, located about 100 m north down the slope. Sheet 022 of the Sydney LEP 2012's Department of Planning and Environment Acid Sulphate Soil Maps, identifies the site as being a Class 5 area, defined as an area that does not have acid sulphate soil but is within 500 m of adjacent land that has acid sulphate soils.

Neither the DSI and geotechnical investigation identified alluvial soils on the site, and the permanent groundwater was recorded in the rock profile. As such ASS is not considered to be present on the site, and no further on-site assessment or management is considered warranted.

The NSW Salinity Potential map from the NSW Department of Infrastructure, Planning and Natural Resources does not indicate the site has any salinity potential. No further assessment or management of salinity is considered necessary.

5. Investigation results

5.1 Geotechnical

A geotechnical investigation was undertaken by Douglas in September 2024 [Reference 208700.01.R.001.Rev1 dated June 2025]. The test locations are shown in Drawing 1 (Appendix A).

The interpreted model can be summarised as follows:

- **Fill**: Generally, asphaltic concrete or concrete slab underlain by gravel or sandy gravel to depths of 0.2 m to 1.1 m within the basements (BH201, BH203 and BH204);
- **Soil**: Soil comprising sandy clay, clay and silty clay to 4.3 m depth was observed in BH202;
- **Bedrock**: Below the fill in BH201, BH203 and BH204 and the clays in BH202 encountered Hawkesbury Sandstone of initially low to medium strength generally increasing to medium to high strength with depth.

5.2 Groundwater

Three groundwater wells were installed within the site. Groundwater results are summarised in subsequent sections.

Table 2 summarises the monitoring wells' attributes. Their location is shown on Drawing 1 (Appendix A).

Table 2: Monitoring well details

Well ID	Installation date	Surface (m AHD)	Filter Zone (m bgl)	Screened lithology
BH201	16 July 2024	17.2	7.5 to 15.8 (RL 9.7 to 1.4)	Sandstone and Laminite
BH202	17 July 2024	14.5	5.7 to 15.10 (RL 8.8 to -0.6)	
BH203	19 July 2024	15.2	5.2 to 15.05 (RL 10.0 to 0.15)	

Notes: m bgl: metres below ground level

5.2.1 Groundwater levels

No free groundwater was observed during auger drilling (maximum auger drilling depth to 4.2 m below ground level within BH202). The use of water for rotary drilling and coring prevented observation of groundwater during drilling within the rock.

Groundwater levels have been continuously recorded at hourly (or less for testing to capture groundwater recharge) intervals since 1 August 2024 using data loggers installed in the monitoring wells. Hydrographs showing recorded levels in comparison with rainfall data over time are presented in Appendix C.

The hydrographs indicate that the groundwater levels generally respond to rainfall events.

A summary of the maximum, minimum, average, and median groundwater levels recorded by the dataloggers are presented in Table 3.

Table 3: Summary of logger data

Well ID	Groundwater elevation (m AHD)			
	Lowest	Highest	Average	Median
BH201	7.6	8.7	7.9	7.7
BH202	10.8	11.9	11.3	11.3
BH203	12.6	13.0	12.8	12.8

Notes: m bgl: metres below ground level

5.2.2 Hydraulic conductivity

Rising head hydraulic conductivity tests were carried out within the monitoring wells on 1 August 2024. The tests were undertaken by pumping and removing a volume of water from the monitoring wells to lower the water level and measuring the subsequent recovery rate.

Hydraulic conductivity tests were analysed using the Hvorslev (1951) solution for slug testing interpretation. Results are presented in Table 4. The detailed results of the tests are attached in Appendix D.

Table 4: Interpreted hydraulic conductivity results

Well ID	Filter Zone (m bgl)	Screened lithology	Hydraulic conductivity (m/s)
BH201	7.5 to 15.8 (RL 9.7 to 1.4)	Sandstone and Laminite	1.3×10^{-8}
BH202	5.7 to 15.10 (RL 8.8 to -0.6)		4.0×10^{-8}
BH203	5.2 to 15.05 (RL 10.0 to 0.15)		6.3×10^{-8}
		Geometric mean	3.2×10^{-8}

5.2.3 Groundwater quality

Groundwater samples were obtained on 7 August 2024 by a Douglas environmental scientist. The groundwater sampling records are included in Appendix F. The measured groundwater field parameters are summarised under Table 5, below.

Table 5: Groundwater Testing Results

Well ID	Temperature (°C)	Dissolved Oxygen (mg/L)	Electrical Conductivity (uS/cm)	pH	Redox (mV)
BH201	16.7	2.3	111	5.2	-490
BH202	22.0	6.3	378	4.9	198
BH203	18.2	6.8	295	4.8	191

The groundwater conditions are considered generally characteristic of a fractured sandstone aquifer.

Collected groundwater samples were analysed at a National Association of Testing Authorities (NATA) accredited laboratory for the following analytes based on the contaminants of concern as identified in the PSI and per the requirements of Sydney Water:

- Total and dissolved heavy metals (As, Cd, Cr, Cu, Pb, Hg, Ni and Zn);
- Total recoverable hydrocarbons (TRH);

- Monocyclic aromatic hydrocarbons (i.e. benzene, toluene, ethylbenzene and xylene | BTEX);
- Volatile organic compounds (VOC);
- Organochloride pesticides (OCP);
- Organophosphate pesticides (OPP);
- Polychlorinated biphenyls (PCB);
- Per and polyfluoroalkyl substances (PFAS); and
- Nutrients (nitrogen based compounds).

The groundwater analytical results have been screened against the adopted water quality acceptance criteria (refer to Section 9.3.3). As indicated on Table C1 in Appendix C all analytes were within the adopted screening levels with the exception of the following:

- Total and dissolved copper, lead and zinc exceeded the adopted Default Guideline Value (DGV) for 95% level of species protection (LOP); and
- Concentrations of perfluorooctanesulfonic acid (PFOS) was within the within the 95% LOP interim marine DGV. It is noted that the results were above for 99% LOP, however this is expected to be consistent with ambient concentrations in the region.

It is noted that trace concentrations (below the adopted water quality acceptance criteria) of naphthalene, and chloroform were detected in groundwater.

It is further noted that trace concentrations of total recoverable hydrocarbons (TRH) were reported in groundwater. Given only one groundwater monitoring event has been conducted, the significance of these results with respect to off-site disposal is not well characterised. The TRH may be associated with minor seepage and/or residual drilling fluid within the groundwater wells, or could be representative of the groundwater quality which will be encountered throughout dewatering.

6. Conceptual hydrogeological model

The site is predominantly underlain by Hawkesbury Sandstone. While the topography of the area predominately grades down toward the northwest into a gully feature that extends into the Sydney Harbour, the groundwater levels recorded within the monitoring wells indicate that the groundwater flow is typically toward the south-southwest. This is likely to be due to the presence of nearby tunnels such as the Cross City Tunnel located to the south which are known to be drained and will generally have an impact on the local groundwater flow directions and the groundwater levels within the site. The initial groundwater contour lines simulating the flow to the south within the site is shown in Figure 4.

The groundwater monitoring wells have recorded minor fluctuations and trends in response to rainfall events. The recorded groundwater levels were observed to be wholly within the bedrock profile.

The aquifer has been identified as unconfined where groundwater sources flowing into the subject site are considered to originate from rain and surface water infiltration. Over time, these water sources permeate to the natural groundwater that has been observed to be within the bedrock profile.

It should be noted that groundwater levels are transient and fluctuate with climatic variations and other factors (e.g. adjacent excavations, pumping). Therefore, the water levels will temporarily rise during periods of heavy or prolonged rainfall and fall during dry periods. Groundwater levels can also be affected by the amount of pumping occurring in groundwater extraction bores in the aquifer.

7. Groundwater inflow assessment

7.1 Numerical modelling methodology

Seepage modelling was undertaken to assess the potential inflow rates into the proposed excavation during and after construction, as well as induced groundwater level changes in adjacent and surrounding areas.

A 3-dimensional (3D) numerical groundwater model was developed. The modelling was carried out using the finite element hydrogeological software SEEP3D (version 2023.1.2) (a component of GeoStudio) developed by GEOSLOPE International Ltd.

The seepage analysis methodology comprised the following:

- A steady-state seepage analysis model for the long-term (post construction) inflow rates for the basement;
- A transient seepage analysis to predict inflow rates during the first year of construction that assumes the basement excavation will be excavated instantly. As staged excavation of the basement will likely occur, it is expected that the transient analysis will capture higher-than-expected flow rates and pumping volumes to be carried out in reality;
- A 3D model approximately 700 m x 700 m in area with the site located approximately in the centre. The depth of the model extends to 52.5 m below the BEL of the development. The model is shown below in Figure 3;
- A BEL of RL 2.5 m for the basement excavation has been adopted;
- A single-layer subsurface profile of sandstone bedrock was adopted as the groundwater was observed to be wholly within the bedrock profile. For the base case, a 'moderately conservative case' horizontal permeability (k_h) of 3.2×10^{-8} m/s was adopted for sandstone bedrock based on the geometric mean of the hydraulic conductivity testing results (Section 5.2.2). This parameter is consistent with ranges of values documented in the available literature for similar lithologies (e.g. Hoek & Bray 1981 and more recently Pells 2019) and previous experience with similar materials;
- A vertical to horizontal ratio of 0.1 has been adopted for the base case;
- Groundwater total head boundary conditions have been placed along the sides of the model to simulate initial groundwater levels through the site being consistent with the maximum results of the groundwater monitoring. The initial groundwater contour lines through the site are shown in Figure 5; and
- A 'free flow' boundary or 'drained' boundary condition (i.e. 0 m^3/sec flow) was applied to the base and the sides of the basement excavation to model a 'dry' excavation which will be required during construction.

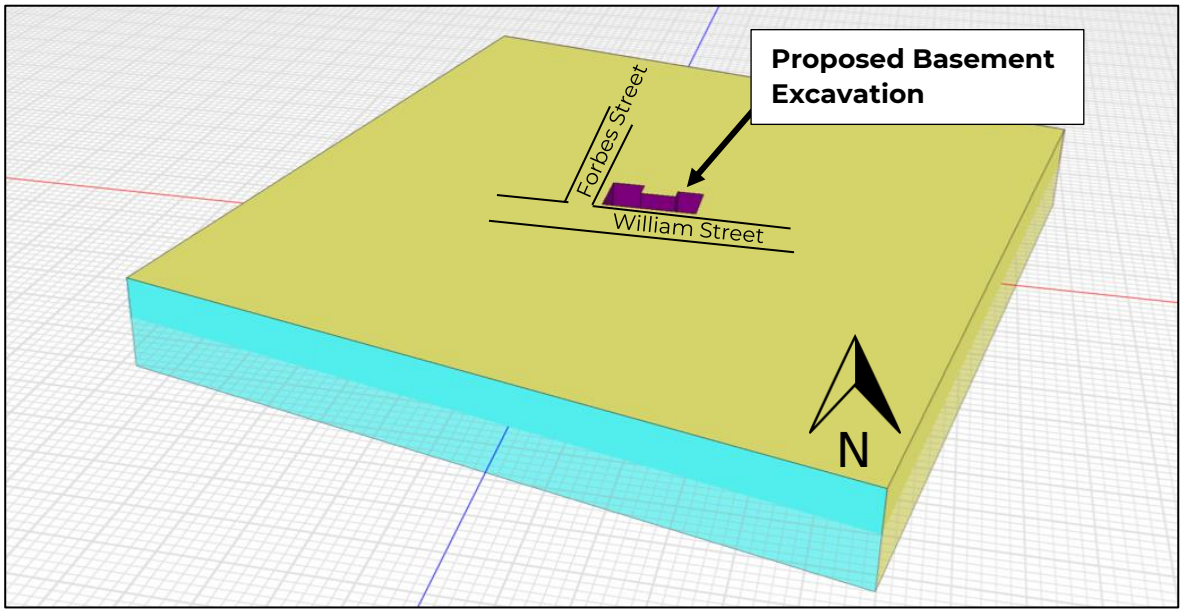

Figure 3: Model extent for 3D modelling

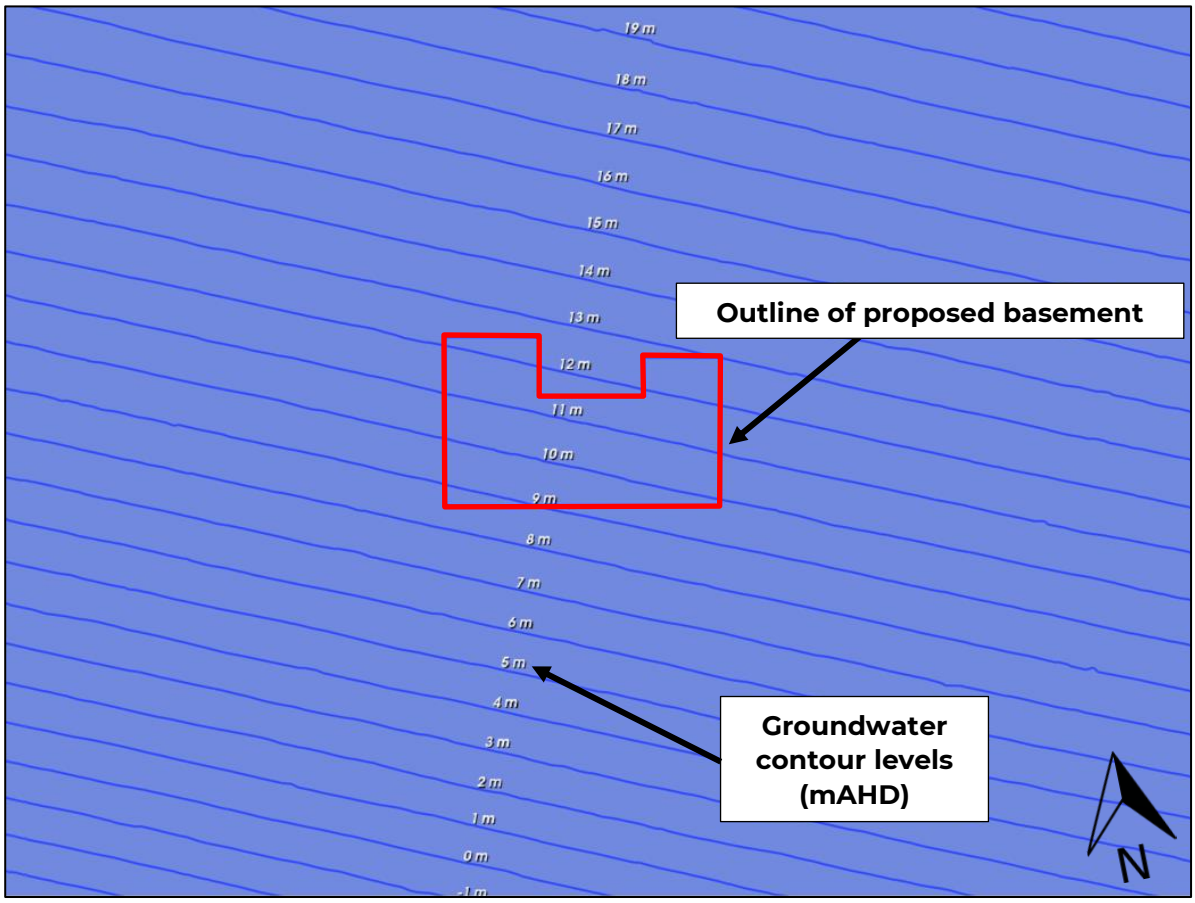

Figure 4: Initial groundwater contour lines (mAHD)

7.1.1 Model layers

As the groundwater is wholly within the bedrock profile, only one layer was modelled. Adopted hydraulic properties are presented in Table 6. Parameters were selected based on the results of the hydraulic conductivity testing (Section 5.2.2), ranges of values documented in the available literature for similar lithologies (e.g. Hoek & Bray 1981 and more recently Pells 2019) and previous experience with similar materials.

Table 6: Model layers and adopted hydraulic properties (base case)

Case	Material	Saturated Kh (m/s)	Anisotropy Ratio (Kv/Kh)	Residual Water Content (%)	Material Model Adopted
1	Sandstone	3.2×10^{-8}	0.1	2	Unsaturated / saturated

Notes: Kh: Horizontal hydraulic conductivity
Kv: Vertical hydraulic conductivity

7.2 Sensitivity scenarios

Two sensitivity cases were analysed with the following parameters:

- Case 1 – Base case with higher (5 x) the vertical to horizontal rate of 0.5 and
- Case 2 – Higher (5 x) horizontal permeability of 1.6×10^{-7} m/s.

7.2.1 Predicted groundwater inflow

The model assumes excavation and dewatering to target depth is instantaneous, resulting in substantial predicted inflows during the first days of construction. In reality, dewatering will start before excavation commences to gradually lower the water table to the desired level.

Table 7: Simulated Groundwater Inflow Rates for Base Case

Elapsed Time (day)	Dewatering Inflow Rate		
	Volume (m^3 / day)	Inflow rate (L / min)	Cumulative Inflow (ML)
3	7.1	5.0	0.0
6	6.7	4.7	0.0
11	6.4	4.4	0.1
21	6.0	4.2	0.1
37	5.7	4.0	0.2
67	5.4	3.8	0.4
118	5.1	3.6	0.7
207	4.8	3.3	1.1

Elapsed Time (day)	Dewatering Inflow Rate		
	Volume (m^3 / day)	Inflow rate (L / min)	Cumulative Inflow (ML)
365	4.4	3.1	1.8
Post-construction	1.0	0.7	0.4

Table 8: Simulated Groundwater Inflow Rates for Sensitivity Case 1

Elapsed Time (day)	Dewatering Inflow Rate		
	Volume (m^3 / day)	Inflow rate (L / min)	Cumulative Inflow (ML)
3	13.0	9.1	0.0
6	12.5	8.7	0.1
11	12.1	8.4	0.1
21	11.6	8.0	0.3
37	11.1	7.7	0.4
67	10.4	7.2	0.7
118	9.4	6.5	1.2
207	8.3	5.8	2.0
365	7.2	5.0	3.1
Post-construction	2.1	1.5	0.8

Table 9: Simulated Groundwater Inflow Rate for Sensitivity Case 2

Elapsed Time (day)	Dewatering Inflow Rate		
	Volume (m^3 / day)	Inflow rate (L / min)	Cumulative Inflow (ML)
3	30.9	21.5	0.1
6	29.0	20.2	0.2
11	27.4	19.0	0.3
21	25.7	17.8	0.6
37	23.9	16.6	1.0
67	21.9	15.2	1.6
118	19.7	13.7	2.6
207	17.6	12.2	4.2
365	15.8	11.0	6.7
Post-construction	8.2	5.7	3.0

It should be noted that these volumes are 'estimates' of the average inflows. It is possible that localised zones of higher permeability may be present within the site, through which the rate of inflow could be significantly higher, and considering the subsurface heterogeneity and fractured aquifer system, a safety margin for application in the field should be considered.

Also, simulated dewatering rates and drawdown are dependent on the dewatering scheme adopted for the site, and construction design (e.g., shoring walls), as included in the numerical models. If the depth of basement level and dewatering systems were to change then the currently predicted dewatering rates may change, in which case further modelling would be required.

7.2.2 Predicted groundwater drawdown and settlement

The drawdown contours are produced by subtracting the predicted water levels from the initial calibrated groundwater levels. The predicted drawdown during construction of the proposed drained basement is illustrated in Figure 6 (under base case conditions). The drawdown contours are the compounding effect of dewatering at the project site and the adjacent basements. The model results indicate that the 4 m predicted drawdown contour may extend up to 30 m from the site boundaries.

Any predicted drawdown will occur within the rock profile. Neighbouring structures and pavements are therefore not expected to experience noticeable dewatering-induced settlement, due to the significant deformation modulus of sandstone bedrock.

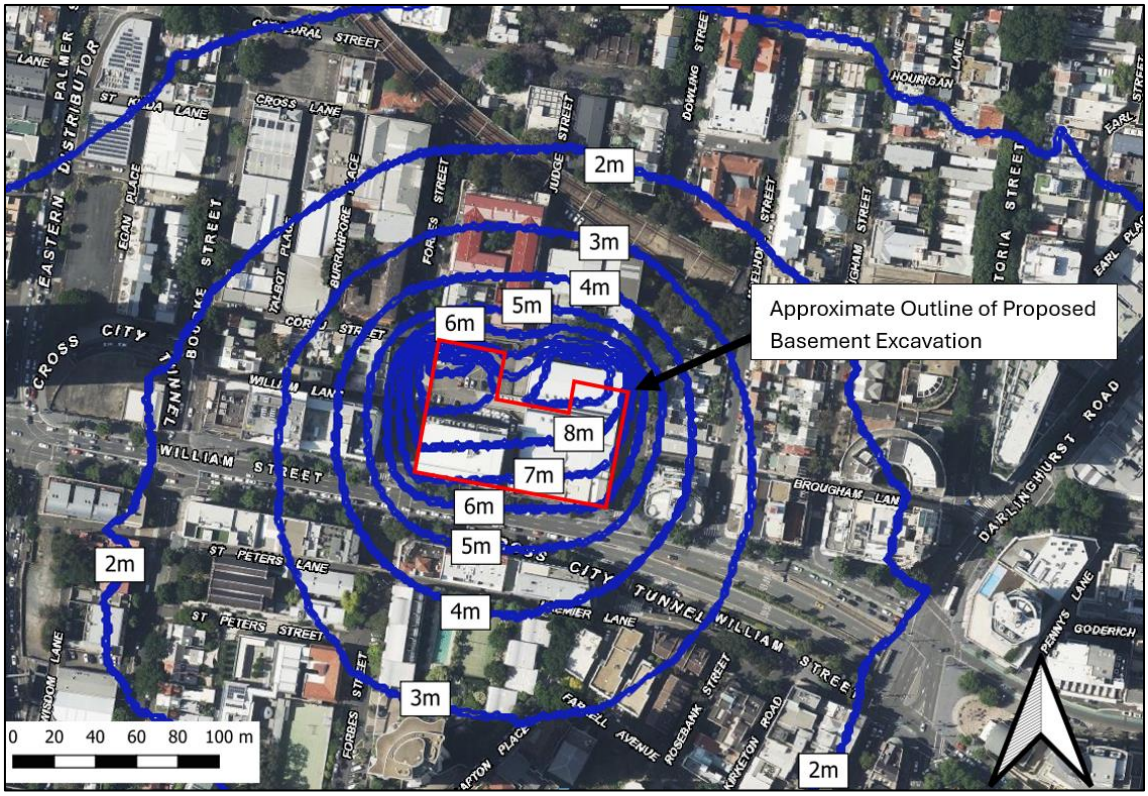

Figure 5: Groundwater contour drawdown lines on completion of basement excavation and during continuous dewatering (mAHD)

8. Impact assessment

8.1 Aquifer Interference Policy consideration

The NSW Aquifer Interference Policy (AIP) indicates that the term "aquifer" is commonly understood to mean a groundwater system that is sufficiently permeable to allow water to move within it, and which can yield productive volumes of groundwater. A groundwater system is defined as any type of saturated geological formation that can yield low or high volumes of water. However, for the purpose of the AIP, the term aquifer has the same meaning as groundwater system and includes low yielding and saline systems.

Table 1 in Section 3.2.1 of the AIP outlines minimal impact considerations. The AIP indicates that "if predicted impacts are less than the Level 1 minimal impact considerations, then these impacts will be considered as acceptable". The following minimal impact considerations are outlined for less productive porous and fractured rock groundwater sources:

- Less than or equal to 10% cumulative variation in water table 40 m from any high priority GDE or high priority culturally significant site;
- A cumulative pressure head decline of no more than a 2 m at any water supply work; and
- Any change in groundwater quality should not lower the beneficial use category of the groundwater source beyond 40 m from the activity.

8.2 Environmental risk assessment

An assessment of the potential effects of dewatering on neighbouring properties and groundwater receptors has been summarised in Table 10.

Table 10: Assessment of Potential Effects of Dewatering

Item	Comment
Impacts on potential GDEs	There are no GDEs within 500 m of the site (Section 3.3). Drawdown impacts are predicted to be insignificant at this distance from the site.
Water supply losses by neighbouring groundwater users	There are no registered water supply bores within 500 m of the site (Section 4.6). Drawdown impacts are predicted to be insignificant at this distance from the site.
Potential subsidence of neighbouring structures	Groundwater drawdown is predicted to mostly occur within the rock units with high deformation moduli. Therefore, risk of subsidence due to lowering of the water table is expected to be minimal.
Mounding of water upgradient of structure	As the basement is proposed to be drained, mounding of groundwater is not expected upgradient of the site.
Water quality	Based on the available testing results (refer to Section 5.2.3) the extracted groundwater will require treatment prior to disposal to stormwater to manage potential impact on the receiving water body.

Item	Comment
	The site topography indicates that the natural groundwater flow direction is likely to have been to the north, whilst the recorded groundwater levels indicate that groundwater may currently flow to the south-southwest, possibly draining to the Cross City Tunnel. Whilst the DSI indicates a history of potentially contaminating activities around the site, the potential for impact on migration of contaminated groundwater (if any) greater than 40 m from the site is expected to be negligible relative to the impact of the Cross City Tunnel. Furthermore no beneficial groundwater use or sensitive receptors have been identified within 500 m of the site.
Contamination risk	The contamination risk for the dewatering comprises the potential for discharge of contaminated groundwater into aquatic ecosystem if not appropriately treated prior to discharge.
ASS	<u>On-site</u> Refer to Section 4.8. Acid Sulphate Soils (ASS) is not considered to be present on the site. As such no further on-site assessment or management is considered warranted. <u>Off-site</u> For Class 5 land, development consent is required works within 500 metres of adjacent Class 1, 2, 3 or 4 land that is below 5 metres Australian Height Datum and by which the watertable is likely to be lowered below 1 metre Australian Height Datum on adjacent Class 1, 2, 3 or 4 land. The predicted groundwater drawdown (Section 7.2.2) indicates that the drawdown will be in bedrock and that the 1 m drawdown level will not extend to lands below 5 m AHD. As such no management is considered warranted for off-site ASS.
Salinity	Refer to Section 4.8. No further assessment or management of salinity is considered necessary.

9. Recommended management strategy

9.1 General

Continuous dewatering will be required during construction and on completion of the drained basement. This section outlines the proposed management strategy based on the preferred methodology for dewatering and disposal.

The proposed dewatering and discharge approach is outlined in Section 2.2 and forms the basis of the groundwater inflow assessment and impact assessment given in Section 7 and 8, respectively.

Appropriate management strategies will be required during construction and operation, to ensure that the impact and inflows arising from dewatering remain within the expected values.

9.2 Groundwater inflow control

9.2.1 Control measures and monitoring

Effective management and monitoring of groundwater inflow should be undertaken to support safe excavation, minimise impacts and satisfy the regulatory requirements. The proposed control measures will be selected based on site-specific hydrogeological conditions, construction methodology and relevant guidelines, and will be detailed in construction drawings and specifications.

Groundwater inflow control measures may include:

- Perimeter drainage to capture and divert groundwater; and
- Inflow reduction measures. Such as grouting or ground improvement.

Groundwater level and inflow monitoring should be undertaken during construction to:

- Validate inflow predictions and performance of control measures;
- Ensure drawdown remains within acceptable limits to prevent environmental or structural impacts; and
- Implement trigger contingency responses if unexpected inflow or impacts occur.

More information on recommended monitoring is provided in Section 9.4.

9.2.2 Trigger levels

Control measures will be monitored against two key thresholds:

- Volume trigger: inflow exceeds the maximum predicted by sensitivity modelling (Section 7); or
- Drawdown trigger: groundwater drawdown exceeds RL 0.5 m at any monitoring well.

If either trigger is reached, dewatering and excavation must be halted and a mitigation strategy (e.g., grouting) be implemented before work resumes.

9.3 Water quality control

Groundwater inflows would require disposal. As outlined in Section 2.2, the preferred disposal option is discharge to the stormwater, subject to approval from relevant authorities, and appropriate testing and treatment as described in subsequent sections.

9.3.1 Proposed testing

Groundwater quality must be tested prior to discharge to prevent contamination of the receiving water body.

The recommended methodology for water quality testing is as follows:

- Collection of water samples and quality control samples from the inlet and outlet of the treatment system;
- Measurement of general groundwater physical parameters (EC, pH and temperature) using a calibrated water quality meter;
- Analysis of the samples by a NATA accredited laboratory for the analytes presented in Table 11 below; and
- Review and update of the parameters being tested and this water quality testing methodology as required. The testing regime will only be reduced with the approval of City of Sydney Council.

Water quality sampling should be conducted in accordance with Geoscience Australia's Groundwater Sampling and Analysis – A Field Guide (Geoscience Australia 2009).

Quality assurance / quality control (QA/QC) procedures should be used to establish accurate, reliable and precise results. QA/QC procedures should include: calibration of equipment, analyses of samples within holding times, keeping samples chilled and wearing gloves during sampling.

Table 11: Proposed suite of analytes for water quality monitoring

Category	Analytes
Field parameters	Temperature, EC, pH, turbidity
Physical properties	TDS, TSS
Metals (total)	Arsenic, aluminium, cadmium, chromium, copper, mercury, manganese, nickel, lead and zinc
Organics	TRH or TPH, BTEX, naphthalene (all events) VOC, OCP, OPP, PCB (during commissioning, and then monthly if no exceedances of WQAC recorded, otherwise continue monitoring for all events)
Other	PFAS (trace level) (during commissioning, and then monthly if no exceedances of WQAC recorded, otherwise continue monitoring for all events)

Notes: EC: electrical conductivity | TDS: total dissolved solids | TSS: total suspended solids
TRH: total recoverable hydrocarbons | TPH: total petroleum hydrocarbons
BTEX: benzene, toluene, ethylbenzene and xylenes
PAH: polycyclic aromatic hydrocarbons
VOC: volatile organic compounds
PFAS: per- and polyfluorinated substances

9.3.2 Discharge options and contingency measures

Management options for groundwater disposal are presented in Table 12.

Based on groundwater quality testing and predicted dewatering rates, Option 1 (disposal to stormwater) is considered feasible. The other two options listed in Table 12 are provided as contingency plans.

Table 12: Summary of possible management options

Management Option	Comments
Option 1: On-site treatment (if required) and disposal to stormwater.	Generally applicable where the treatment required is routine, e.g., solids removal, alum dosing and pH adjustment. Treatment of specific contaminants may require more physical space and result in higher treatment costs. Stormwater disposed water is typically required to meet general NSW DPE requirements (NSW DPE 2021 & 2022), ANZG (2018) water quality standards for the relevant receiving water body and any associated uses (Section 9.3.3). Further requirements may be enforced depending on the specific approval documentation.
Option 2: * Disposal to the sewer under a Trade Waste Agreement with Sydney Water.	Generally, will require further negotiation and establishment of water quality criteria prior to disposal. Water quality screening levels will depend on the specific trade waste agreement with Sydney Water.
Option 3: ** Tanker off-site for disposal at an aqueous treatment plant by a suitably licenced contractor.	May be suitable for more heavily contaminated liquids where on-site treatment is not practicable. Appropriate as a contingency strategy. Can be limited in applicability for larger volumes of water. Water quality screening levels will depend on specific requirements of the contractor.

Notes: * Sydney Water has a general policy of only issuing a trade waste agreement for disposal of water from excavations where all other options have been exhausted.
** Off-site disposal of water by a tanker is generally only considered suitable in cases where periodic / batch disposal of groundwater is required (e.g., ephemeral water sources / rainfall / minor seepage only). Where continuous discharge is anticipated, this option is not feasible from an economic and / or environmental (i.e., emissions) perspective given the requirement to transport large volumes via truck at distance. It may be considered as a contingency strategy if any notable contamination which may be outside the operating capacity of the on-site treatment system is identified prior to disposal.

9.3.3 Water quality acceptance criteria

Groundwater quality results should be assessed against water quality acceptance criteria (WQAC) for each analyte prior to disposal. The WQAC should be chosen based on the receiving receptor's water quality, relevant guidelines and Council's requirements.

In line with Sydney City Council's stormwater system and WaterNSW's requirements, the following assessment criteria are recommended as a screening level for disposal to stormwater:

- ANZG, '*Australian and New Zealand Guidelines for Fresh and Marine Water Quality 2018*' (ANZG, 2018);
- ANZECC, '*Australian Water Quality Guidelines 2000*', Tables 3.3.2 to 3.3.3 Default trigger values for physical and chemical stressors in south-east Australia for slightly disturbed ecosystems (ANZECC, 2000);
- HEPA *PFAS National Environmental Management Plan (NEMP)* (HEPA, 2025); and
- NSW DPE (2021) requirements.

For stormwater disposal in urban setting, the recommended SAC are the 95% level of protection (LOP) for non-bioaccumulating contaminants, and the 99% LOP for bioaccumulating contaminants for freshwater ecosystems. In regards to PFAS the 95% LOP is to be adopted based on ambient levels of PFAS in the region, and expected water quality of the receiving water body.

In relation to TRH (and discussed in Section 4.7), WQAC have been developed, as provided in Appendix E. However the laboratory practical quantitation limit (PQL) and visual and olfactory indicators such as oily sheens and hydrocarbon odours should be adopted as a screening criterion. The adopted treatment technology should be suitable for this purpose. Where minor detections are recorded, further assessment of the risk may be conducted by the Environmental Consultant to assess the significance of the results with respect to the WQAC.

The WQAC are outlined in Appendix E.

9.3.4 Treatment options

Potential treatment options for managing groundwater quality prior to discharge may include:

- Sediment control: Settling tanks or flocculation to reduce turbidity and suspended solids.
- pH adjustment: Dosing with lime or acid to achieve acceptable discharge pH.
- Hydrocarbon removal: Use of oil-water separators and activated carbon filters.
- PFAS: Activated carbon filters (if required).
- Metals removal: Filtration or chemical precipitation, if metal concentrations exceed guidelines.

The treatment system will be designed by the dewatering contractor based on construction specifications, groundwater quality results and the WQACs. A detailed treatment schematic will be provided in the detailed groundwater plan prior to construction.

9.4 Monitoring and reporting requirements

The following monitoring program and associated reporting is to be adopted until the end of excavation and construction works on-site. Groundwater level monitoring should be continued one month after construction.

Monitoring should be undertaken in a minimum of three monitoring wells. It is recommended that the existing monitoring wells used for the groundwater investigation be used during and after construction. Any wells damaged during construction should be replaced in a timely manner.

Table 13: Monitoring and reporting requirements

Item	Monitoring requirements	Methodology
Visual inspection	No visible oil and grease, sheen, significant discolouration or odours.	Daily inspections (by contractor). **HOLD POINT -** If indicators are observed, discharge must be suspended pending analytical confirmation.

Item	Monitoring requirements	Methodology
Groundwater level monitoring	Monitor drawdown at a minimum of three wells in the vicinity of the site.	• Continuous groundwater level monitoring using data logger (minimum six-hourly frequency). • Quarterly manual readings. • Monitoring to continue for one month post-construction dewatering. **HOLD POINT -** If drawdown exceeds predictions by >2 m, construction must be halted and contingency measures activated.
Water quality sampling and testing	Sampling of treated water to assess compliance with the WQAC. Additional sampling at dewatering points sumps to be collected as required to inform treatment requirements	**Frequency** Commissioning of treatment equipment: • Treated water: every second day of treatment until all parameters meet WQAC. • Untreated water: at least three sampling events, either during initial commissioning and / or first three events once discharge has commenced. Following commissioning: • Treated water: Weekly (for continuous discharge) or prior to each discharge event (batch based treatment and discharge). • Untreated water: as required to inform treatment. **Monitoring** • Parameters for measurement as per Section 9.3.3. • Sampling and measurement of field parameters by the Environmental Consultant. • Laboratory analysis by a NATA-accredited laboratory. • Chain of Custody (COC) documentation to accompany all samples. • Results to be included in final dewatering completion report. **HOLD POINT -** If water WQAC, Environmental Consultant must review and assess risk. Where potentially unacceptable risk identified

Item	Monitoring requirements	Methodology
		discharge must be halted and managed per contingency strategy.
Quality control sampling	Replicate sampling to verify lab result accuracy.	• Conducted on 10% of samples. • Testing suite: total metals, TRH, BTEX, naphthalene. • COC documentation to accompany all samples. • Results to be included in final dewatering completion report.
Quantity of groundwater inflows	Measurements of groundwater volumes (as per Section 9.2).	• Weekly monitoring and reporting of groundwater abstraction volumes. • Results to be included in final dewatering completion report. **HOLD POINT -** If volumes exceed trigger levels or Council discharge allowance, works must be halted to minimise inflow (e.g., via grouting).
Dewatering completion report	Final documentation of the dewatering program.	Prepared by a suitably qualified consultant and to include: • Summary of contractor records (e.g. visual inspections, unexpected finds) • Full analytical and quality control results. • Records of dewatering volumes. • Commentary on compliance and any non-conformances with the GIA.

Notes: Testing frequency, assessment criteria and analysis requirements may be reviewed in consultation with the Environmental Consultant based on ongoing results.

9.5 Personnel and responsibilities

Table 14 below outlines the proposed project personnel and relevant responsibilities as part of the management plan.

Table 14: Personnel and Responsibilities

Role	Responsibilities
Site Manager / Contractor	Routine visual inspection. Monitoring / recording of dewatering / discharge volumes. Maintaining any unexpected / contingency records.
Dewatering Contractor	Design / specification and ongoing maintenance of the dewatering system.
Geotechnical Consultant	Groundwater level monitoring and review of disposal volumes.

Role	Responsibilities
	Assist in preparation of the dewatering completion report.
Environmental Consultant	Water quality sampling (analysis using NATA accredited laboratories). Interim advice for each sampling event to confirm (or otherwise) compliance with discharge requirements. Quality control sampling. Assist in preparation of the dewatering completion report.

9.6 Contingency plan

As per Section 9.3.4, at any hold point if any non-conformance is encountered then dewatering will be suspended. The following general contingency plan will be enacted:

- Communication of any identified issues of concern between the Site Manager / Contractor, Geotechnical Consultant and Environmental Consultant as required to address the issue;
- Should dewatering volumes be higher than predicted or higher than discharge limits provided by relevant authorities, suspend construction and reduce pumping rates. Options could include grouting to reduce groundwater inflows;
- Should water quality be deemed unsuitable for disposal, suspend dewatering and treat water prior to discharge;
- Environmental Consultant to inspect the site / unexpected finds and collect additional water quality samples as required (to be determined by the Environmental Consultant);
- Off-site tankering may be adopted to meet disposal requirements; and
- Written confirmation by the Environmental Consultant that water quality meets the WQAC (e.g. upon receipt of laboratory results), to support approval to recommence discharge.

10. Approvals and licensing

This section outlines the approvals, licences and other authorisations required for the proposed dewatering activities, consistent with the *Water Management Act 2000*, WaterNSW requirements, and any relevant local council or EPA obligations.

10.1 Water Access Licence (WAL) and entitlements

Dewatering of groundwater for construction purposes constitutes an aquifer interference activity under the *Water Management Act 2000* and may require a Water Access Licence (WAL) and appropriate water entitlement units (share and extraction components), depending on the water source and proposed take.

As the predicted groundwater inflows into the proposed basement is less than 3 ML per year, the development does not require a WAL as it meets exemption under Clause 21(2) of the Water Management (General) Regulation 2018.

10.2 Water Supply Works Approval (WSWA)

As the project is for an SSDA it is exempt from a water supply work approval (WSWA, under the *Water Management Act 2000*). The exemption is typically granted through the DCCEEW for SSDA projects.

10.3 Council and EPA approvals

Depending on the proposed discharge route and water quality:

- Discharge to stormwater: Council approval may be required. Acceptance criteria typically align with ANZG guidelines and site-specific conditions – refer to Section 9.3
- Discharge off-site: A licensed contractor must be engaged, and records of transport and disposal must be maintained – refer to Section 9.3.

11. Conclusion

The proposed development is expected to have a basement BEL of RL 2.5 m which will require excavations of between 12 m and 14.8 m below existing surface levels with deeper localised excavations required for the lift cores. The proposed building is expected to be designed as drained with groundwater discharging into the council stormwater.

The maximum recorded groundwater levels and highest horizontal permeability values have been adopted to model and carry out a 3D seepage analysis for the proposed development. The results of the baseline analysis indicate that the predicted annual inflows into the drained basement is 0.4 ML. The cumulative inflow for the 12-month construction dewatering period has been estimated to be in the order of 1.8 ML, using the baseline modelling scenario. Based on our experience in other deep excavations nearby within shale and sandstone bedrock, the actual seepage into the excavation could be lower than these predicted values, due to the low volumes of water stored within joints and other defects in the rock. As the predicted inflow rate is less than 3 ML per year, a WAL will not be required.

Sensitivity cases considering very conservative conditions were modelled. Both sensitivity cases indicate that groundwater inflow rates during a 12-month construction period were greater than 3 ML. Where horizontal permeability values are 5 x higher than calculated (Case 2) were adopted, the results indicate that inflows into the basement post construction could be 3 ML under adverse conditions.

Disposal of the groundwater seepage should be managed appropriately with the relevant authorities, and will require treatment of the groundwater prior to disposal, which is typical. Ongoing monitoring of groundwater quality will be required during discharge periods to confirm compliance with the water quality acceptance criteria.

As any drawdown is predicted to be within the rock profile, the risk of subsidence in neighbouring structures is expected to be negligible.

From a hydrogeological viewpoint, it is considered that a drained basement is feasible without significant impacts on surrounding groundwater systems or property, subject to review and approval from DCCEEW and other relevant authorities.

It should be noted that if there are changes to surrounding basements or water levels are found to be higher than assumed, there may be an increase in groundwater inflows which should be considered for basement design.

12. References

ANZECC. (2000). *Australian and New Zealand Guidelines for Fresh and Marine Water Quality.* Australia New Zealand Environment Conservation Council.

ANZG. (2018). *Australian and New Zealand Guidelines for Fresh and Marine Water Quality.* Canberra, ACT: Australian and New Zealand Governments and Australian state and territory governments.

Australian Government (2013). *Guidelines for Groundwater Protection in Australia – National Water Quality Management Strategy.* Department of Agriculture, Water and the Environment, Canberra.

Classification of sandstones and shales in the Sydney region: a forty year review (2019)

Douglas. (2025 GI). Geotechnical investigation report.

Douglas. (2025 DSI). Detailed (contamination) investigation report.

Geoscience Australia. (2009). *Groundwater Sampling and Analysis - A Field Guide.* Commonwealth of Australia.

NSW DPE. (2021). *Minimum requirements for building site groundwater investigations and reporting.*

NSW DPI – Office of Water. (2012). *NSW Aquifer Interference Policy.*

NSW DPI – Water. (2013). *Aquifer Interference Policy: NSW Policy for Managing the Impacts of Groundwater Extraction.*

WaterNSW. Fact Sheet – *Construction dewatering – Information for councils and applicants.*

WaterNSW. Fact Sheet – *Construction dewatering – General terms of approval.*

13. Limitations

Douglas Partners Pty Ltd (Douglas) has prepared this report for this project at 164-194 William Street, Woolloomooloo NSW in line with Douglas' proposal dated 12 July 2024 and acceptance received from John Fitzgerald of William Street Residential Pty Ltd dated 5 February 2025. The work was carried out under Douglas' Engagement Terms. This report is provided for the exclusive use of William Street Residential Pty Ltd for this project only and for the purposes as described in the report. It should not be used by or relied upon for other projects or purposes on the same or other site or by a third party. Any party so relying upon this report beyond its exclusive use and purpose as stated above, and without the express written consent of Douglas, does so entirely at its own risk and without recourse to Douglas for any loss or damage. In preparing this report Douglas has necessarily relied upon information provided by the client and/or their agents.

The results provided in the report are indicative of the sub-surface conditions on the site only at the specific sampling and/or testing locations, and then only to the depths investigated and at the time the work was carried out. Sub-surface conditions can change abruptly due to variable geological processes and also as a result of human influences. Such changes may occur after Douglas' field testing has been completed.

Douglas' advice is based upon the conditions encountered during this investigation. The accuracy of the advice provided by Douglas in this report may be affected by undetected variations in ground conditions across the site between and beyond the sampling and/or testing locations. The advice may also be limited by budget constraints imposed by others or by site accessibility.

The assessment of atypical safety hazards arising from this advice is restricted to the (geotechnical / environmental / groundwater) components set out in this report and based on known project conditions and stated design advice and assumptions. While some recommendations for safe controls may be provided, detailed 'safety in design' assessment is outside the current scope of this report and requires additional project data and assessment.

This report must be read in conjunction with all of the attached and should be kept in its entirety without separation of individual pages or sections. Douglas cannot be held responsible for interpretations or conclusions made by others unless they are supported by an expressed statement, interpretation, outcome or conclusion stated in this report.

This report, or sections from this report, should not be used as part of a specification for a project, without review and agreement by Douglas. This is because this report has been written as advice and opinion rather than instructions for construction.

This report provides specialist advice only and no part of it is considered a Regulated Design under the Design and Building Practitioner Act 2020 (NSW).

Appendix A

About this Report

About this Report

October 2024

Introduction

These notes have been provided to amplify Douglas' report in regard to classification methods, field procedures and the comments section. Not all are necessarily relevant to all reports.

Douglas' reports are based on information gained from limited subsurface excavations and sampling, supplemented by knowledge of local geology and experience. For this reason, they must be regarded as interpretive rather than factual documents, limited to some extent by the scope of information on which they rely.

Copyright

Borehole and Test Pit Logs

The borehole and test pit logs presented in this report are an engineering and/or geological interpretation of the subsurface conditions, and their reliability will depend to some extent on frequency of sampling and the method of drilling or excavation. Ideally, continuous undisturbed sampling or core drilling will provide the most reliable assessment, but this is not always practicable or possible to justify on economic grounds. In any case the boreholes and test pits represent only a very small sample of the total subsurface profile.

Interpretation of the information and its application to design and construction should therefore take into account the spacing of boreholes or pits, the frequency of sampling, and the possibility of other than 'straight line' variations between the test locations.

Groundwater

Where groundwater levels are measured in boreholes there are several potential problems, namely:

- In low permeability soils groundwater may enter the hole very slowly or perhaps not at all during the time the hole is left open;
- A localised, perched water table may lead to an erroneous indication of the true water table;
- Water table levels will vary from time to time with seasons or recent weather changes. They may not be the same at the time of construction as are indicated in the report; and
- The use of water or mud as a drilling fluid will mask any groundwater inflow. Water has to be blown out of the hole and drilling mud must first be washed out of the hole if water measurements are to be made.

More reliable measurements can be made by installing standpipes which are read at intervals over several days, or perhaps weeks for low permeability soils. Piezometers, sealed in a particular stratum, may be advisable in low permeability soils or where there may be interference from a perched water table.

Reports

The report has been prepared by qualified personnel, is based on the information obtained from field and laboratory testing, and has been undertaken to current engineering standards of interpretation and analysis. Where the report has been prepared for a specific design proposal, the information and interpretation may not be relevant if the design proposal is changed. If this happens, Douglas will be pleased to review the report and the sufficiency of the investigation work.

Every care is taken with the report as it relates to interpretation of subsurface conditions, discussion of geotechnical and environmental aspects, and recommendations or suggestions for design and construction. However, Douglas cannot always anticipate or assume responsibility for:

- Unexpected variations in ground conditions. The potential for this will depend partly on borehole or pit spacing and sampling frequency;
- Changes in policy or interpretations of policy by statutory authorities; or
- The actions of contractors responding to commercial pressures.

If these occur, Douglas will be pleased to assist with investigations or advice to resolve the matter.

About this Report

Site Anomalies

In the event that conditions encountered on site during construction appear to vary from those which were expected from the information contained in the report, Douglas requests that it be immediately notified. Most problems are much more readily resolved when conditions are exposed rather than at some later stage, well after the event.

Information for Contractual Purposes

Where information obtained from this report is provided for tendering purposes, it is recommended that all information, including the written report and discussion, be made available. In circumstances where the discussion or comments section is not relevant to the contractual situation, it may be appropriate to prepare a specially edited document. Douglas would be pleased to assist in this regard and/or to make additional report copies available for contract purposes at a nominal charge.

Site Inspection

The company will always be pleased to provide engineering inspection services for geotechnical and environmental aspects of work to which this report is related. This could range from a site visit to confirm that conditions exposed are as expected, to full time engineering presence on site.

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Appendix B

Drawings

REV	DESCRIPTION/COMMENT	DATE	DRAWN BY
0	INITIAL ISSUE	06.09.2024	EC

SCALE: 0 5 10 15 20 25 m
1:500 @ A3

Douglas PARTNERS
OFFICE: SYDNEY
96-98 Hermitage Rd, West Ryde NSW 2114
(02)9809 0666

CLIENT:
William Street Nominee Pty Ltd

NOTE:
1: Basemap from Metromap (Dated 26.06.2024)

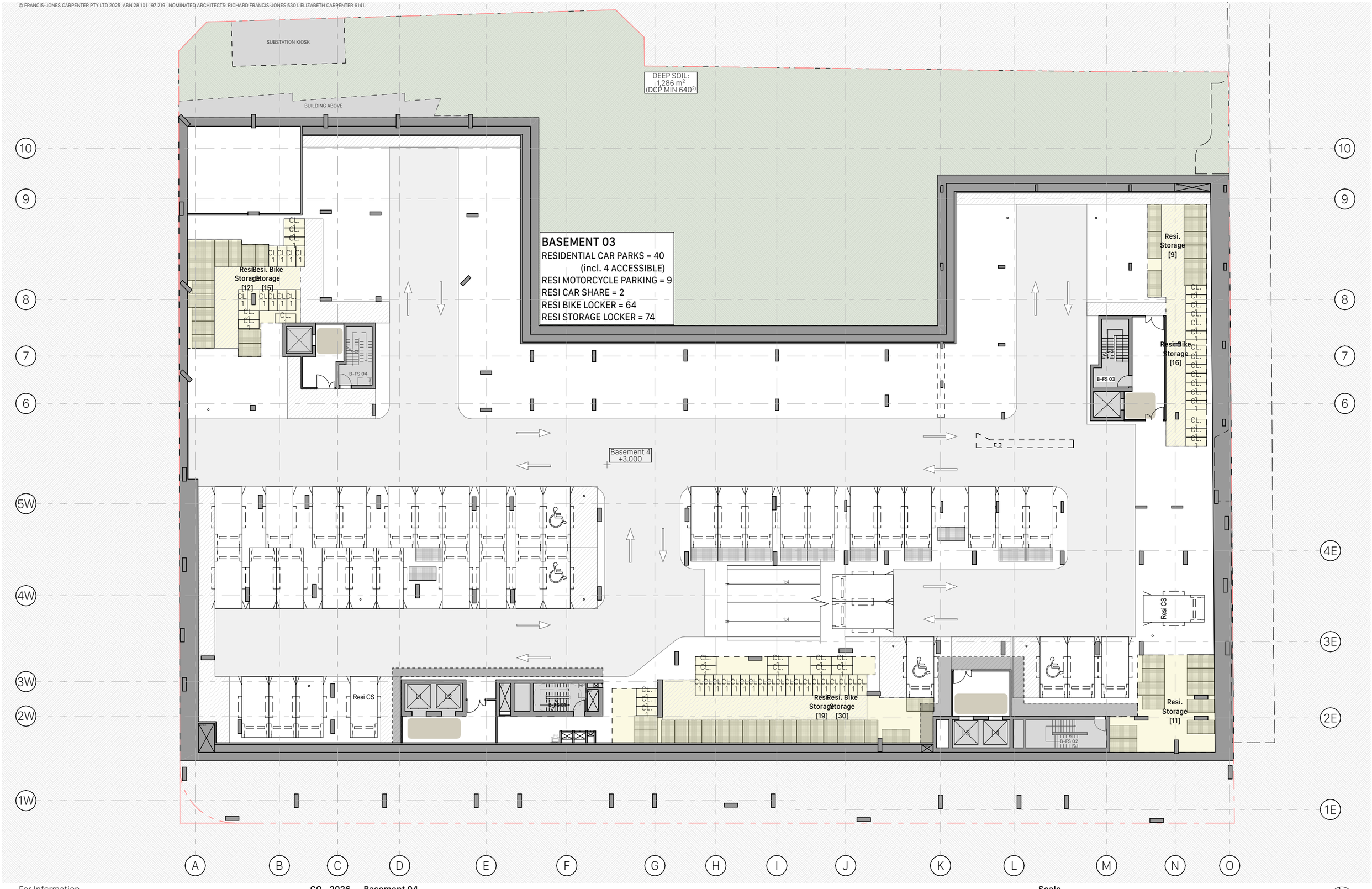
COORDINATE REFERENCE SYSTEM: GDA2020 / MGA zone 56

PROJECT NAME:
Proposed Mixed-Use Development

PROJECT ADDRESS:
164-194 William Street, Woolloomooloo

DRAWING TITLE:
Test Location Plan

PROJECT NO: **208700.01**
DRAWING NO: **1**
REVISION: **0**



For Information
1/5/2025

CO - 2026 — Basement 04
Rebel Property, HSN Property Group and Phoenix Property Investors — 164-172 and 174-194 William St

Scale
1:300 @ A3

fjcstudio
formerly fjmtstudio

Appendix C

Hydrographs

Douglas PARTNERS

Groundwater (GW) Field Sheet

Project and Bore Installation Details						
Project Name / Site Location	Woolloomooloo				Project Number	208700.01
Well Construction Details	Well ID BH201		Drilling Method		Hole Diameter (m)	
	Well Depth (m bgl)		Screened (m bgl)		Stick Up (m)	
Survey Information	Easting		Northing		Elevation RL	
GW Level During Drilling		m bgl				
Contaminants/Comments						

Well Development Details					
Date / Time / Weather Conditions	11/8/24 12pm			Purged By	EB
Purge Method / Equipment	Twister + HDPE				
Product observed / Thickness	—	mm	Confirmed with Bailer? (Y / N)		
GW Level (pre-purge)	9.17	m bgl	Observed Well Depth	16.33	m bgl
Height of Water Column (H)	7.16	m bgl	Estimated Bore Volume*		L
GW Level (post-purge)	dry	m bgl	Total Volume Purged**		L
Appearance/Comments					

Sampling Details					
Date / Time / Weather Conditions	sunny, 7/8, 8am			Sampled By	JC
Sampling Method / Equipment	peristaltic pump				
WQM Model	YSI		WQM Calibration Date	6/8/24	
Product observed / Thickness	—	mm	Confirmed with Bailer? (Y / N)		
GW Level (pre-micropurge)	9.45	m bgl	Observed Well Depth	16.4	m bgl
Height of Water Column	6.95	m bgl	Estimated Bore Volume*	~17.4	L
GW Level (post sample)	10.0	m bgl	Total Volume of Micro-Purged		L

Water Quality Parameters

Time	Cumulative Volume (L)	Temp (°C)	DO (mg/L)#	EC (µS or mS/cm)	pH	Redox (mV)	Turbidity^
Stabilisation Target (3 readings)		0.2	+/- 10%	+/- 5%	+/- 0.1	+/- 10 mV	+/- 10%
8:15	1	16.5	113.8	2.1	5.00	31.8	
8:17	1.5	16.5	112.0	2.0	5.07		
8:20	2	16.7	112.3	2.3	5.18	-125.9	
8:22	2.5	16.7	111.2	2.3	5.18	-140.0	

Notes: # Considered stabilised if three DO values are less than 0.5 mg/L ^ Considered stabilised if three Turbidity values are less than 5 NTU

Sample Details							
Sampling Depth (rationale)	10.0	m bgl,	upper mid water column				
Sample Observations (e.g. colour, sediment, sheen, odour)	cloudy with slight yellow tinge, no odour, no sheen						
Sample ID							
QAQC Samples	Replicate		Triplicate		Other		
Sample Containers Quantity / Preservation / Filtration	Amber glass		Plastic		PFAS (no teflon)		
	Metals (F/UF) (HNO3)		Phenols/COD/NH3 (H2SO4)		Vials (HCl)		
	Ferrous/Ferric Iron (HCl)		Cyanides/Chromium (NaOH)		Other		
Comments							

*Estimated Well Volume = H * F	Std. Drilling Diameter	NMLC (0.075)	HQ (0.096)	PQ (0.1226)	SFA (0.125)	HFA (0.194)
**Purge Target: min. 3 well volumes	Factor (F):	2.8	3.7	5.2	5.4	11.1

Douglas PARTNERS

Groundwater (GW) Field Sheet

Project and Bore Installation Details						
Project Name / Site Location	Woolloomooloo				Project Number	208700.01
Well Construction Details	Well ID	BH202	Drilling Method		Hole Diameter (m)	
	Well Depth (m bgl)		Screened (m bgl)		Stick Up (m)	
Survey Information	Easting		Northing		Elevation RL	
GW Level During Drilling		m bgl				
Contaminants/Comments						

Well Development Details					
Date / Time / Weather Conditions	1/8/24 12 pm			Purged By	EB
Purge Method / Equipment	Twister + HDPE				
Product observed / Thickness		mm	Confirmed with Bailer? (Y / N)		
GW Level (pre-purge)	3.12	m bgl	Observed Well Depth	15.06	m bgl
Height of Water Column (H)	11.94	m bgl	Estimated Bore Volume*		L
GW Level (post-purge)	dry	m bgl	Total Volume Purged**		L
Appearance/Comments					

Sampling Details					
Date / Time / Weather Conditions	7/8, 7am, sunny			Sampled By	JC
Sampling Method / Equipment	peristaltic pump				
WQM Model	YSI		WQM Calibration Date	6/8/24	
Product observed / Thickness		mm	Confirmed with Bailer? (Y) N)		
GW Level (pre-micropurge)	3.28	m bgl	Observed Well Depth	15.2	m bgl
Height of Water Column	11.92	m bgl	Estimated Bore Volume*	~30	L
GW Level (post sample)	4.4	m bgl	Total Volume of Micro-Purged		L

Water Quality Parameters

Time	Cumulative Volume (L)	Temp (°C)	DO (mg/L)#	EC (µS or mS/cm)	pH	Redox (mV)	Turbidity^
Stabilisation Target (3 readings)		0.2	+/- 10%	+/- 5%	+/- 0.1	+/- 10 mV	+/- 10%
7:50		18.2	15.7	353.9	4.94	198	~~390.2~~
7:52		21.4	7.0	368.9	4.96	197.4	394.8
7:54		22.1	5.0	375.4	4.93	197.5	400.1
7:56		22.2	5.7	381	4.90	197.6	404.8
		22.0	6.3	378.7	4.89	197.6	
Notes:	# Considered stabilised if three DO values are less than 0.5 mg/L			^ Considered stabilised if three Turbidity values are less than 5 NTU			

Sample Details							
Sampling Depth (rationale)	8	m bgl,	mid WC / screen				
Sample Observations (e.g. colour, sediment, sheen, odour)	clear, no odour, no sheen						
Sample ID							
QAQC Samples	Replicate		Triplicate		Other		
Sample Containers Quantity / Preservation / Filtration	Amber glass		Plastic		PFAS (no teflon)		
	Metals (F/UF) (HNO3)		Phenols/COD/NH3 (H2SO4)		Vials (HCl)		
	Ferrous/Ferric Iron (HCl)		Cyanides/Chromium (NaOH)		Other		
Comments							

*Estimated Well Volume = H * F	Std. Drilling Diameter	NMLC (0.075)	HQ (0.096)	PQ (0.1226)	SFA (0.125)	HFA (0.194)
**Purge Target: min. 3 well volumes	Factor (F):	2.8	3.7	5.2	5.4	11.1

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Groundwater (GW) Field Sheet

Project and Bore Installation Details						
Project Name / Site Location	Woolloomooloo				Project Number	208700.01
Well Construction Details	Well ID BH203		Drilling Method		Hole Diameter (m)~	
	Well Depth (m bgl)		Screened (m bgl)		Stick Up (m)	
Survey Information	Easting		Northing		Elevation RL	
GW Level During Drilling		m bgl				
Contaminants/Comments						

Well Development Details					
Date / Time / Weather Conditions	1/8/24 2:15pm			Purged By	EB
Purge Method / Equipment	Twister + HDPE				
Product observed / Thickness	—	mm	Confirmed with Bailer? (Y / N)		
GW Level (pre-purge)	2.51	m bgl	Observed Well Depth	15.05	m bgl
Height of Water Column (H)	12.54	m bgl	Estimated Bore Volume*		L
GW Level (post-purge)	dry	m bgl	Total Volume Purged**		L
Appearance/Comments					

Sampling Details					
Date / Time / Weather Conditions	9am 7/8 sunny			Sampled By	JC
Sampling Method / Equipment	peristaltic pump				
WQM Model	YSI		WQM Calibration Date	6/8/24	
Product observed / Thickness	—	mm	Confirmed with Bailer? (Y / N)		
GW Level (pre-micropurge)	2.55	m bgl	Observed Well Depth	12.2	m bgl
Height of Water Column	9.65	m bgl	Estimated Bore Volume*	~25	L
GW Level (post sample)	2.75	m bgl	Total Volume of Micro-Purged		L

Water Quality Parameters

Time	Cumulative Volume (L)	Temp (°C)	DO (mg/L)#	EC (µS or mS/cm)	pH	Redox (mV)	Turbidity^
Stabilisation Target (3 readings)		0.2	+/- 10%	+/- 5%	+/- 0.1	+/- 10 mV	+/- 10%
9:45	1	18.0	14.4	309.8	4.79	190.4	
9:47	1.5	18.0	9.2	303.1	4.78	190.5	
9:50	2	18.2	7.0	297.1	4.78	190.5	
9:52	2.5	18.2	6.8	295.9	4.80	190.7	

Notes: # Considered stabilised if three DO values are less than 0.5 mg/L ^ Considered stabilised if three Turbidity values are less than 5 NTU

Sample Details							
Sampling Depth (rationale)	8	m bgl,	mid WC / screen				
Sample Observations (e.g. colour, sediment, sheen, odour)	clear, no odour, no sheen						
Sample ID							
QAQC Samples	Replicate		Triplicate		Other		
Sample Containers Quantity / Preservation / Filtration	Amber glass		Plastic		PFAS (no teflon)		
	Metals (F/UF) (HNO3)		Phenols/COD/NH3 (H2SO4)		Vials (HCl)		
	Ferrous/Ferric Iron (HCl)		Cyanides/Chromium (NaOH)		Other		
Comments							

*Estimated Well Volume = H * F	Std. Drilling Diameter	NMLC (0.075)	HQ (0.096)	PQ (0.1226)	SFA (0.125)	HFA (0.194)
**Purge Target: min. 3 well volumes	Factor (F):	2.8	3.7	5.2	5.4	11.1

Calibration & Service Report
Water Quality Meter

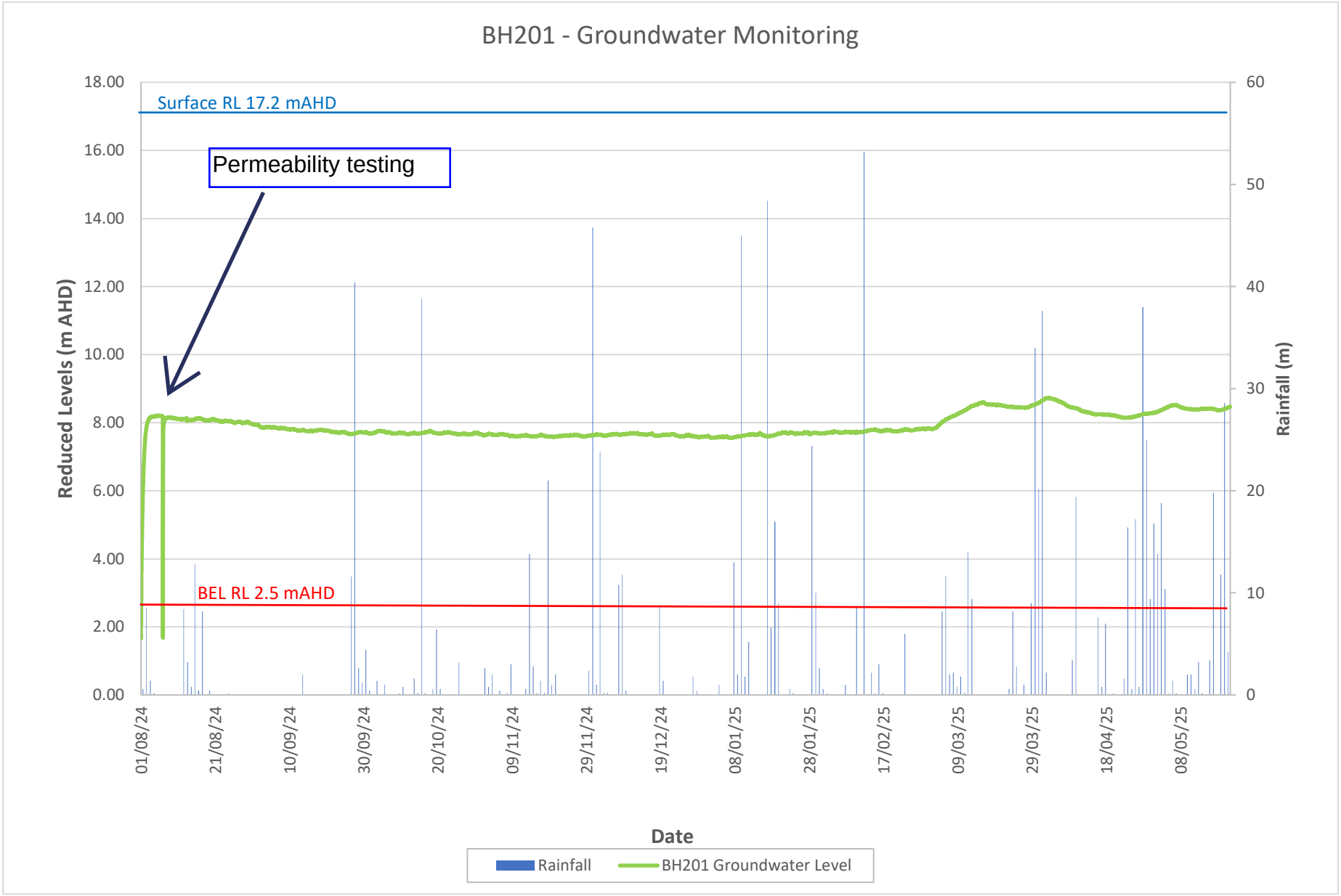
Company:	Active Environmental Solutions Hire	Manufacturer:	YSI	Serial #:	18K102295
Address:	Unit 16, 191 Parramatta Road AUBURN NSW 2144	Instrument/Model:	WQM Professional Plus w/ Quatro Cable	Cable Length:	1m
Phone:	02 9716 5966 | Fax: 02 9716 5988	Client Company:		Client Email:	
Email:	hire@aesoultions.com.au	Client Name:		Client Phone:	

Item	Test	Pass	Comments
Battery	2 x Alkaline C-cells	✓	Voltage reading above 2.9V
	Battery Saver	✓	Automatically turns off after 60 minutes if not used
Connections	Condition	✓	Good, clean
Cable	Condition	✓	Clean, no tears
Display	Operation	✓	
Firmware	Version	✓	4.0.0
Keypad	Operational	✓	
Display	Screen	✓	
Unit	Condition, seals and O-rings	✓	
Monitor housing	Condition	✓	
pH			
Condition		✓	Good, clean
pH millivolts for pH7 calibration range 0 mV ± 50 mV		✓	
pH 4 mV range + 165 to + 180 from 7 buffer mV value		✓	
pH slope		✓	55 to 60 mV/pH; ideal 59mV
Response time < 90 seconds		✓	
Calibrated and conforms to manufacturer's specifications		✓	
ORP			
Condition		✓	Good, clean
Response time < 90 seconds		✓	
within ± 80mv of reference Zobell Reading		✓	
Calibrated and conforms to manufacturer's specifications		✓	Variance range ± 20mV
Conductivity			
Condition		✓	Good, clean
Temperature		✓	°C
Conductivity cell constant 5.0 ± 1.0 in GLP file		✓	
A clean sensor reads less than 3 uS/cm in dry air		✓	
Calibrated and conforms to manufacturer's specifications		✓	µs/cm
Dissolved Oxygen			
Condition		✓	Good, clean
DO sensor in use		✓	Polarographic
1.25 mil PE membrane (yellow membrane):		✓	
DO Sensor Value		✓	(min 4.31 uA - max 8.00 uA) Avg 6.15 uA
Calibrated and conforms to manufacturer's specifications		✓	ppm

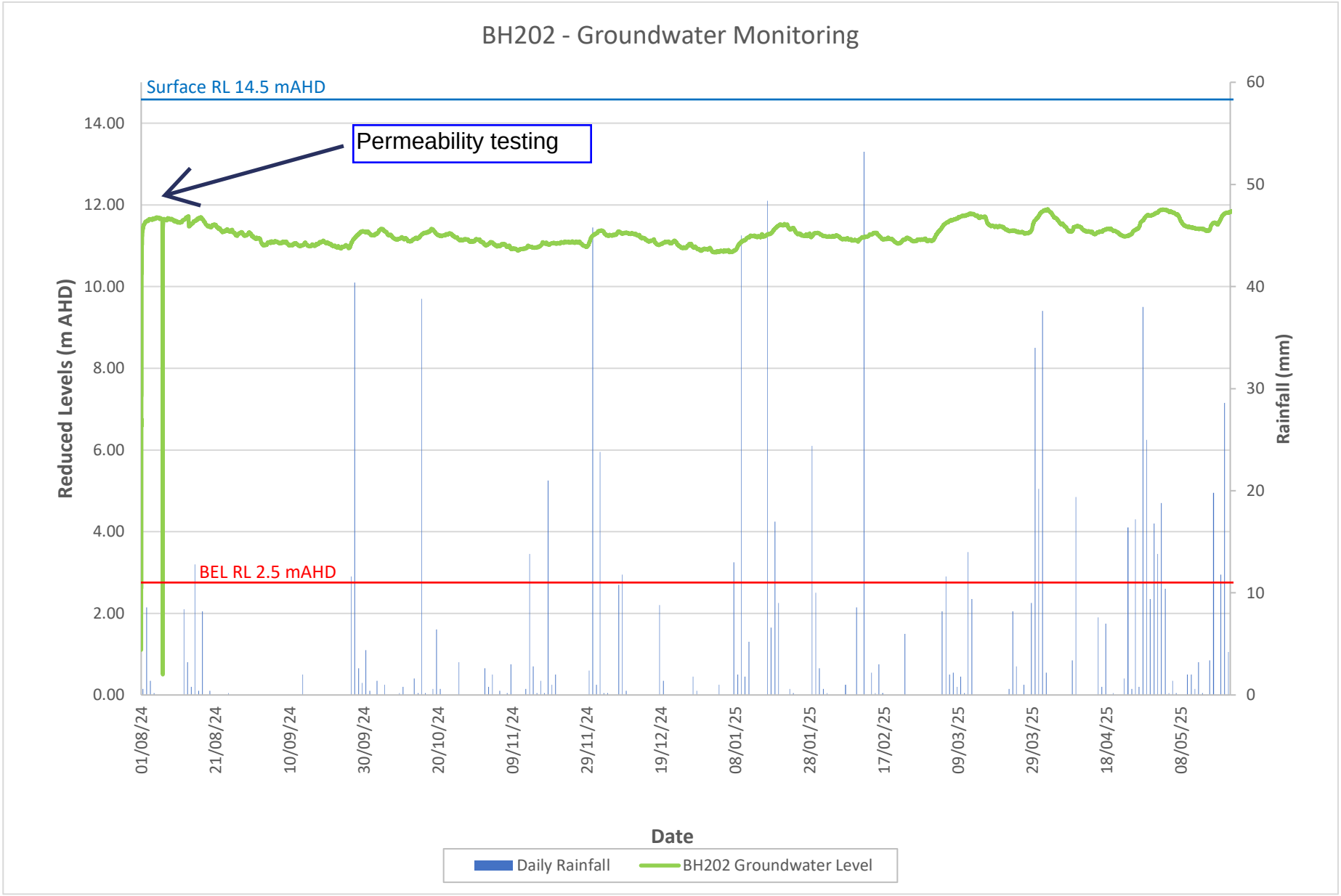
				Instrument Readings		
Parameter	Standards	Reference	Calibration Point	Before	After	Units
Temperature	Center 370 Thermometer	Room Temp.	20.1	N/A	20.1	°C
pH	pH 4.00	378644	4.00	4.2	4.0	pH
pH	pH 7.00	378645	7.00	6.98	7.0	pH
Specific Conductivity	2760 µs/cm at 25°C	378284	2760	2751	2763	µs/cm
ORP (Ref. check only)	Zobell Solutions	367761	244.2	229.2	244.2	mV
Zero Dissolved Oxygen	NaSO3 in distilled water	-	0.0	0.7	0.00	%
100% Dissolved Oxygen	100% Air Saturation	Fresh Air	100.0	120	101	%

Calibrated By: Jason Cheng

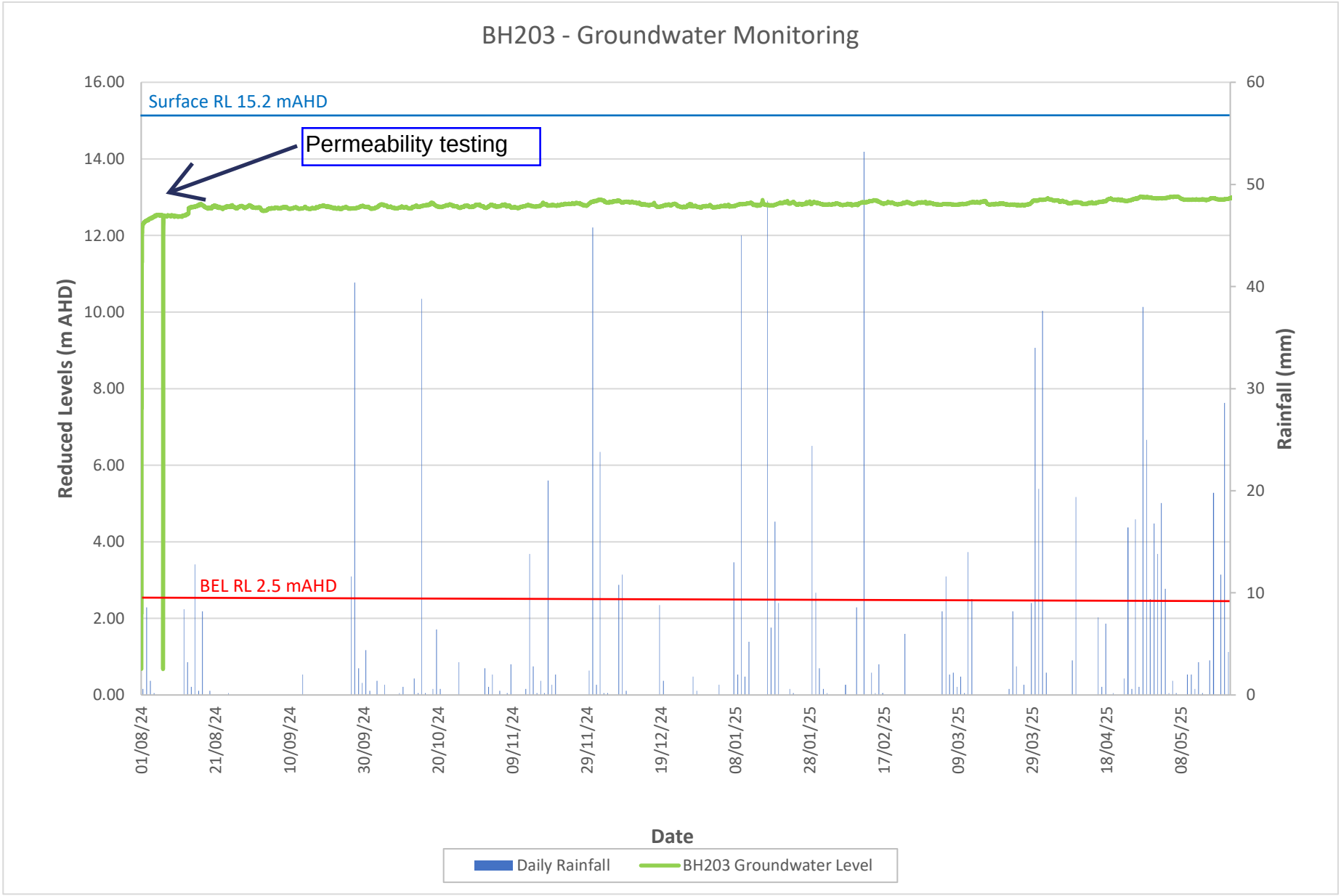
Calibration Date: 05/08/2024 Calibration Due: 01/02/2025



Groundwater monitoring Summary



Groundwater monitoring Summary



Groundwater monitoring Summary

Douglas Partners
Geotechnics / Environment / Groundwater

Table C1: Summary of Laboratory Analytical Results - Groundwater

			Metals								Metals - Dissolved								
			Total Arsenic	Cadmium	Total Chromium	Copper	Lead	Mercury (inorganic)	Nickel	Zinc	Total Arsenic	Cadmium	Total Chromium	Copper	Lead	Mercury (inorganic)	Nickel	Zinc	TRH C10 - C14
Practical Quantitation Limit (PQL)			1	0.1	1	1	1	0.05	1	1	1	0.1	1	1	1	0.05	1	1	50
ANZG (2018) Marinewater DGV 95% LOP			13	5.5	7.7 | 0.14	1.3	4.4	0.4	70	8		5.5	7.7 | 0.14	1.3	4.4	0.4	70	8	
HEPA (2025) Interim marinewater DGV 99% LOP																			
HEPA (2025) Interim marinewater DGV 95% LOP																			
Sample ID	Depth (m bgl)	Sample Date	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
BH201	10	7/08/2024	<1	<0.1	**2**	**5**	**4**	<0.05	**10**	**55**	<1	<0.1	<1	**2**	<1	<0.05	**8**	**37**	**330**
BH202	8	7/08/2024	**1**	**0.4**	**2**	**33**	**99**	<0.05	**18**	**140**	<1	**0.4**	**1**	**25**	**66**	<0.05	**15**	**120**	**69**
BH203	8	7/08/2024	<1	**0.8**	**1**	**60**	**85**	<0.05	**36**	**450**	<1	**0.7**	**1**	**52**	**59**	<0.05	**32**	**390**	**55**

Notes:

- No criterion / not defined / not tested / not applicable
* QA/QC replicate of sample listed directly below the primary sample
NL Not limiting
PQL Practical quantitation limit

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Table C1: Summary of Laboratory Analyt

			TRH								BTEX	VOC	
			TRH C15 - C28	TRH C29 - C36	Total +ve TRH (C10-C36)	TRH >C10 - C16	TRH >C10 - C16less Naphthalene (F2)	TRH >C16 - C34	TRH >C34 - C40	Total +ve TRH (>C10-C40)	Total +ve Xylenes	Chloroform	All other VOCs
Practical Quantitation Limit (PQL)			100	100	50	50	50	100	100	50		1	1
ANZG (2018) Marinewater DGV 95% LOP												770	
HEPA (2025) Interim marinewater DGV 99% LOP													
HEPA (2025) Interim marinewater DGV 95% LOP													
Sample ID	Depth (m bgl)	Sample Date	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
BH201	10	7/08/2024	<100	<100	**330**	**340**	**340**	<100	<100	**340**	<1	**8**	< PQL
BH202	8	7/08/2024	<100	<100	**70**	**62**	**62**	**120**	<100	**180**	<1	<1	< PQL
BH203	8	7/08/2024	<100	<100	**60**	**56**	**56**	**140**	<100	**190**	<1	<1	< PQL

Notes:

- No criterion / not defined / not tes
* QA/QC replicate of sample listed
NL Not limiting
PQL Practical quantitation limit

Appendix D

Hydraulic Testing Results

Douglas Partners Pty Ltd
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www.douglaspartners.com.au

Permeability Testing - Rising or Falling Head Test Report

Client:	Rebel Property	Project No:	208700.01
Project:	Proposed Mixed-Use Development	Test date:	1-Aug-24
Location:	164-194 Wiliam Street, Woolloomooloo	Tested by:	ECB

Test Location

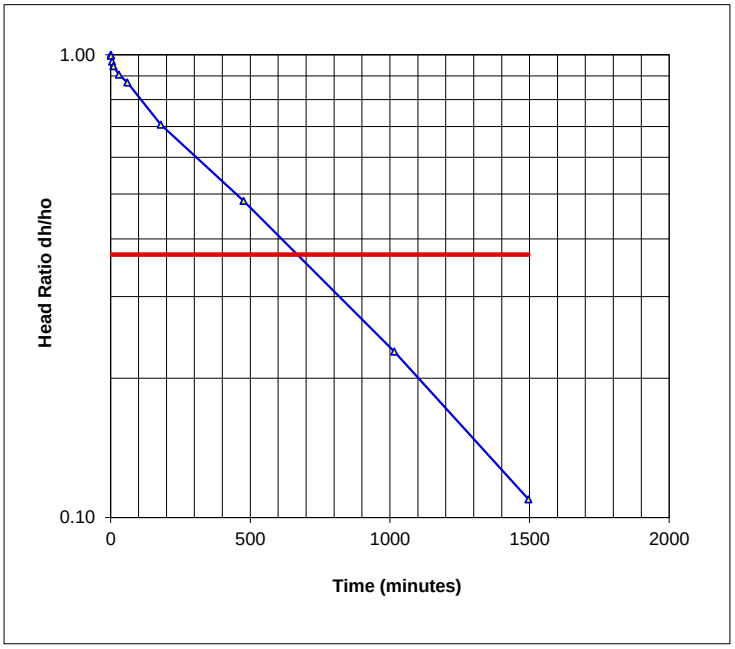
Description:	Standpipe in borehole	**Test No.**	BH201	
Material type:	Sandstone	Easting:	335315.5	m
		Northing	6250324.7	m
		Surface Level:	17.2	m AHD

Details of Well Installation

Effective diameter (2re)	76	mm	Depth to water before test	9.17	m
borehole diameter (2R)	76	mm	Depth to water at start of test	15.56	m
Effective Length of well screen (Le)	6.8	m	Depth of top of PVC standpipe	8.40	m
			Depth of base of PVC standpipe	15.90	m

Test Results

Time (min)	Depth (m)	Change in Head dH (m)	dH/Ho
0	15.56	6.39	1.000
1	15.53	6.36	0.995
5	15.35	6.18	0.967
10	15.21	6.04	0.945
30	14.96	5.79	0.906
60	14.74	5.57	0.872
180	13.68	4.51	0.706
476	12.26	3.09	0.484
1016	10.63	1.46	0.228
1496	9.87	0.70	0.110



To = 716.4 mins
42985 secs

Theory: Falling Head Permeability calculated using equation by Hvorslev

$k = [r^2 \ln(Le/R)]/2Le\ To$

where r = radius of casing
R = radius of well screen
Le = length of well screen
To = time taken to rise or fall to 37% of initial change

Hydraulic Conductivity **k =** **1.3E-08** m/sec
= **0.001** m/day

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Permeability Testing - Rising or Falling Head Test Report

Client:	Rebel Property	Project No:	208700.01
Project:	Proposed Mixed-Use Development	Test date:	1-Aug-24
Location:	164-194 Wiliam Street, Woolloomooloo	Tested by:	ECB

Test Location

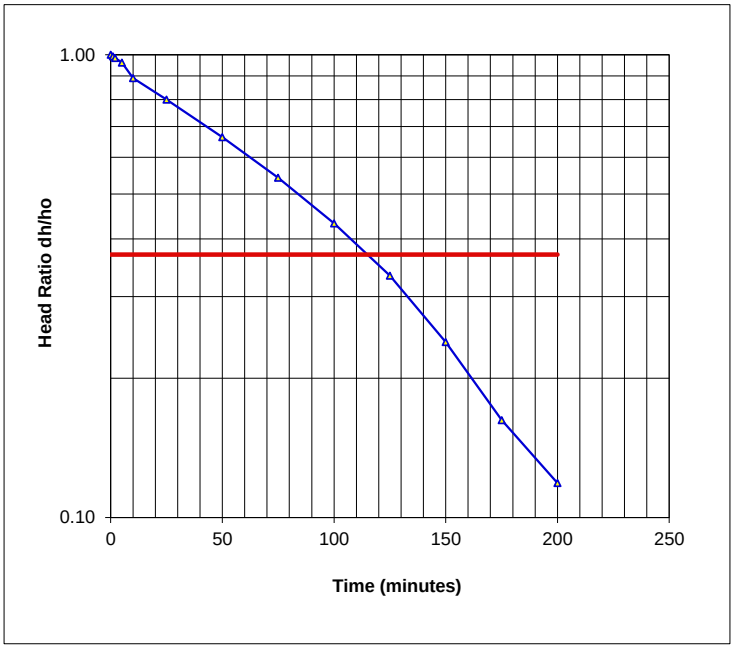
Description:	Standpipe in borehole	**Test No.**	BH202	
Material type:	Sandstone	Easting:	335326	m
		Northing	6250373	m
		Surface Level:	14.5	m AHD

Details of Well Installation

Effective diameter (2re)	50	mm	Depth to water before test	3.12	m
borehole diameter (2R)	76	mm	Depth to water at start of test	13.65	m
Effective Length of well screen (Le)	9	m	Depth of top of PVC standpipe	6.00	m
			Depth of base of PVC standpipe	15.00	m

Test Results

Time (min)	Depth (m)	Change in Head dH (m)	dH/Ho
0	13.65	10.53	1.000
1	13.57	10.45	0.992
2	13.48	10.36	0.984
5	13.24	10.12	0.961
10	12.5	9.38	0.891
25	11.54	8.42	0.800
50	10.11	6.99	0.664
75	8.83	5.71	0.542
100	7.67	4.55	0.432
125	6.63	3.51	0.333
150	5.64	2.52	0.239
175	4.83	1.71	0.162
200	4.37	1.25	0.119



To = 80 mins
4800 secs

Theory: Falling Head Permeability calculated using equation by Hvorslev

$k = [r^2 \ln(Le/R)]/2Le\ To$

where r = radius of casing
R = radius of well screen
Le = length of well screen
To = time taken to rise or fall to 37% of initial change

Hydraulic Conductivity **k = 4.0E-08** m/sec
= 0.003 m/day

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Permeability Testing - Rising or Falling Head Test Report

Client:	Rebel Property	Project No:	208700.01
Project:	Proposed Mixed-Use Development	Test date:	1-Aug-24
Location:	164-194 Wiliam Street, Woolloomooloo	Tested by:	ECB

Test Location

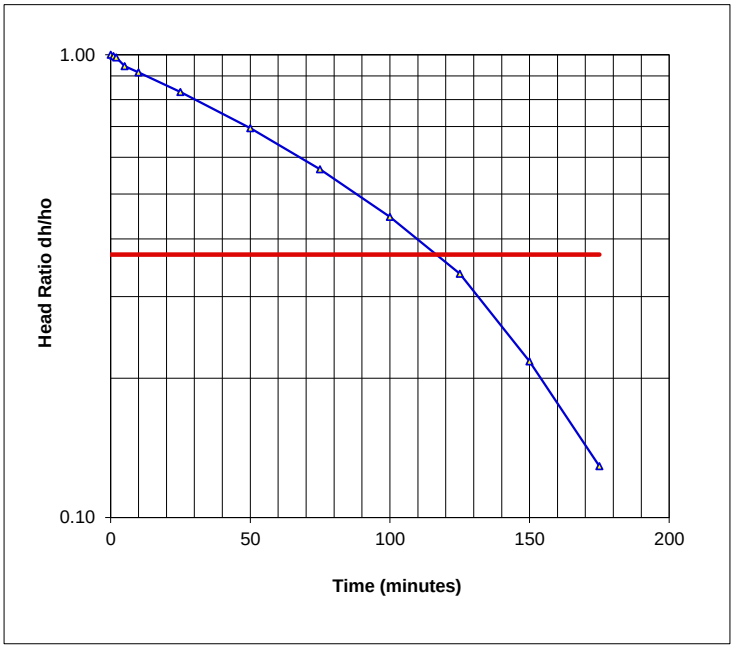
Description:	Standpipe in borehole	**Test No.**	BH203	
Material type:	Sandstone	Easting:	335391	m
		Northing	6250361	m
		Surface Level:	15.2	m AHD

Details of Well Installation

Effective diameter (2re)	50	mm	Depth to water before test	2.51	m
borehole diameter (2R)	76	mm	Depth to water at start of test	14.05	m
Effective Length of well screen (Le)	9	m	Depth of top of PVC standpipe	6.05	m
			Depth of base of PVC standpipe	15.05	m

Test Results

Time (min)	Depth (m)	Change in Head dH (m)	dH/Ho
0	14.05	11.54	1.000
1	13.97	11.46	0.993
2	13.9	11.39	0.987
5	13.42	10.91	0.945
10	13.08	10.57	0.916
25	12.1	9.59	0.831
50	10.52	8.01	0.694
75	9.04	6.53	0.566
100	7.66	5.15	0.446
125	6.39	3.88	0.336
150	5.02	2.51	0.218
175	4.0	1.49	0.129



To = 50 mins
3000 secs

Theory: Falling Head Permeability calculated using equation by Hvorslev

$k = [r^2 \ln(Le/R)]/2Le\ To$

where r = radius of casing
R = radius of well screen
Le = length of well screen
To = time taken to rise or fall to 37% of initial change

Hydraulic Conductivity **k = 6.3E-08** m/sec
= 0.005 m/day

Appendix E

Water Quality Acceptance Criteria

•

1. Water Quality Acceptance Criteria (WQAC)

The WQAC for the protection of aquatic ecosystems derived from ANZG (2018) are in Table 1.

Table 1: Groundwater investigation levels for protection of aquatic ecosystems (µg/L)

Contaminant	Marine DGV 95% LOP	Notes
Metals / metalloids		
Arsenic	24 / 13	Levels provided for As III / As IV respectively as adopted from freshwater criteria in absence of marine criteria. Unknown reliability.
Cadmium	0.7	99% LOP adopted as recommended due to potential for bioaccumulation. Very high reliability.
Chromium (VI)	4.4	Chromium VI levels adopted as initial screen for total chromium. Very high reliability.
Copper	1.3	Very high reliability.
Cyanide	4	Very low reliability.
Lead	4.4	Low reliability.
Manganese	80	Unknown reliability and LOP.
Mercury (inorganic)	0.1	99% LOP adopted as recommended due to potential for bioaccumulation. Very high reliability.
Nickel	7	99% LOP adopted as recommended to protect key species from chronic toxicity. Very high reliability.
Zinc	8	Very high reliability.
BTEX		
Benzene	500	99% LOP adopted as recommended to protect key species from chronic toxicity. Moderate reliability.
Ethylbenzene	80	Unknown reliability.
m-Xylene	75	Unknown reliability.
o-xylene	350	Adopted from freshwater criteria for in absence of marine criteria. Unknown reliability.
p-Xylene	200	Adopted from freshwater criteria for in absence of marine criteria. Unknown reliability.
Toluene	180	Unknown reliability.
PAH		

Anthracene	0.01	99% LOP adopted as recommended due to potential for bioaccumulation. Unknown reliability.
Benzo(a)pyrene	0.1	99% LOP adopted as recommended due to potential for bioaccumulation. Unknown reliability.
Fluoranthene	1	99% LOP adopted as recommended due to potential for bioaccumulation. Unknown reliability.
Naphthalene	50	99% LOP adopted as recommended to protect key species from chronic toxicity. Moderate reliability.
Phenanthrene	0.6	99% LOP adopted as recommended due to potential for bioaccumulation. Unknown reliability.
Phenols		
Phenol	400	Moderate reliability.
Pentachlorophenol	11	99% LOP adopted as recommended due to potential for bioaccumulation. Moderate reliability.
OCP		
Aldrin	0.003	Unknown reliability and LOP.
Chlordane	0.001	Unknown reliability and LOP.
DDT	0.0004	Unknown reliability and LOP.
Dieldrin	0.01	Freshwater criteria adopted in absence of marine criteria. Unknown reliability and LOP.
Endosulfan	0.005	99% LOP adopted as recommended due to potential for bioaccumulation. Moderate reliability.
Endrin	0.004	99% LOP adopted as recommended due to potential for bioaccumulation. Moderate reliability.
Heptachlor	0.0004	Unknown reliability and LOP.
Methoxychlor	0.004	Unknown reliability and LOP.
OPP		
Chlorpyrifos	0.009	Low reliability.
Diazinon	0.01	Freshwater criteria adopted in absence of marine criteria. Unknown reliability.
Dimethoate	0.15	Freshwater criteria adopted in absence of marine criteria. Unknown reliability.
Fenitrothion	0.001	Unknown reliability and LOP.
Malathion	0.05	Freshwater criteria adopted in absence of marine criteria. Unknown reliability.
Parathion	0.004	Freshwater criteria adopted in absence of marine criteria. Unknown reliability.

PCB		
Aroclor 1242	0.3	Adopted from freshwater criteria for in absence of marine criteria. 99% LOP adopted as recommended due to potential for bioaccumulation. Unknown reliability.
Aroclor 1254	0.01	Adopted from freshwater criteria for in absence of marine criteria. 99% LOP adopted as recommended due to potential for bioaccumulation. Unknown reliability.
VOC		
Tetrachloroethene (PCE)	70	Unknown reliability.
Trichloroethene (TCE)	330	Unknown reliability.
cis-1,2-dichloroethene (DCE)	700	Unknown reliability.
Chloroethene (vinyl chloride / VC)	100	Unknown reliability.
Tetrachloromethane (carbon tetrachloride / CT)	240	Unknown reliability.
Trichloromethane (chloroform / TCM)	370	99% LOP adopted as recommended to protect key species from chronic toxicity. Unknown reliability.
Inorganics		
Ammonia	910	At a receiving body pH of 8. Note: ammonia toxicity is pH and temperature dependent. Very high reliability.

Notes: 95% LOP for non-bioaccumulative contaminants
99% LOP for bioaccumulative contaminants

The WQAC for PFAS, derived from HEPA (2025) are included in Table 2 below.

Table 2: Groundwater investigation levels for protection of aquatic ecosystems (µg/L)

Contaminant / LOP	Interim marine water DGV
PFOS 95% LOP	0.13
PFOA 95% LOP	220

The WQAC for TPH, derived from Aus Government (1997) are included in Table 3 below.

Table 3: WQAC for marine ecosystems (µg/L)

Contaminant	Discharge Criteria
TPH C_6-C_9	150
TPH >C_6	300

The WQAC for physical parameters are included in Table 4 below, and have been developed with reference to ANZECC (2000) background conditions for estuaries (Tables 3.3.2 and 3.3.3).

Table 4: Typical water parameter values for estuaries in NSW

Parameters	Discharge Criteria
pH	7-8.5
Total suspended solids (TSS)	< 50 mg/L

2. References

ANZECC. (2000). *Australian and New Zealand Guidelines for Fresh and Marine Water Quality*. Australia and New Zealand Environment and Conservation Council.

ANZG. (2018). *Australian and New Zealand Guidelines for Fresh and Marine Water Quality*. Canberra, ACT: Australian and New Zealand Governments and Australian state and territory governments.

AUS Government. (1997). *Airports (Environment Protection) Regulations*. Canberra: Office of Legislative Drafting, Attorney-General's Department.

CRC CARE. (2011). *Health screening levels for petroleum hydrocarbons in soil and groundwater*. Parts 1 to 3, Technical Report No. 10: Cooperative Research Centre for Contamination Assessment and Remediation of the Environment.

HEPA. (2025). *PFAS National Environmental Management Plan (NEMP)*. Version 3.0: Heads of EPAs Australia and New Zealand.

NEPC. (2013). *National Environment Protection (Assessment of Site Contamination) Measure 1999 (as amended 2013) [NEPM]*. Australian Government Publishing Services Canberra: National Environment Protection Council.

NHMRC. (2008). *Guidelines for Managing Risks In Recreational Water*.

NHMRC. (2019). *Guidance on Per and Polyfluoroalkyl (PFAS) in Recreational Water*. National Health and Medical Research Council.

NHMRC, NRMMC. (2022). *Australian Drinking Water Guidelines 6 2011, Version 3.7*. Canberra: National Health and Medical Research Council, National Resource Management Ministerial Council.

Warne, M., Batley, G., van Dam, R., Chapman, J., Fox, D., Hickey, C., & Stauber, J. (2018). *Revised Method for Deriving Australian and New Zealand Water Quality Guideline Values for Toxicants*. Canberra: Australian Government Department of Agriculture and Water Resources.

Appendix F

Laboratory Reports

Envirolab Services Pty Ltd
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CERTIFICATE OF ANALYSIS 358685

Client Details

Client	Douglas Partners Pty Ltd
Attention	Peter Hunt
Address	96 Hermitage Rd, West Ryde, NSW, 2114

Sample Details

Your Reference	**208700.01 Woolloomooloo**
Number of Samples	3 Water
Date samples received	08/08/2024
Date completed instructions received	08/08/2024

Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.

Samples were analysed as received from the client. Results relate specifically to the samples as received.

Results are reported on a dry weight basis for solids and on an as received basis for other matrices.

Please refer to the last page of this report for any comments relating to the results.

Report Details

Date results requested by	15/08/2024
Date of Issue	15/08/2024

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Results Approved By
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Dragana Tomas, Senior Chemist
Giovanni Agosti, Group Technical Manager
Jenny He, Senior Chemist
Liam Timmins, Organics Supervisor
Timothy Toll, Senior Chemist

Authorised By
Nancy Zhang, Laboratory Manager

VOCs in water				
Our Reference	UNITS	358685-1	358685-2	358685-3
Your Reference		BH201	BH202	BH203
Date Sampled		07/08/2024	07/08/2024	07/08/2024
Type of sample		Water	Water	Water
Date Extracted	-	09/08/2024	09/08/2024	09/08/2024
Date Analysed	-	09/08/2024	09/08/2024	09/08/2024
Dichlorodifluoromethane	µg/L	<10	<10	<10
Chloromethane	µg/L	<10	<10	<10
Vinyl Chloride	µg/L	<10	<10	<10
Bromomethane	µg/L	<10	<10	<10
Chloroethane	µg/L	<10	<10	<10
Trichlorofluoromethane	µg/L	<10	<10	<10
1,1-Dichloroethene	µg/L	<1	<1	<1
Trans-1,2-dichloroethene	µg/L	<1	<1	<1
1,1-dichloroethane	µg/L	<1	<1	<1
Cis-1,2-dichloroethene	µg/L	<1	<1	<1
Bromochloromethane	µg/L	<1	<1	<1
Chloroform	µg/L	8	<1	<1
2,2-dichloropropane	µg/L	<1	<1	<1
1,2-dichloroethane	µg/L	<1	<1	<1
1,1,1-trichloroethane	µg/L	<1	<1	<1
1,1-dichloropropene	µg/L	<1	<1	<1
Cyclohexane	µg/L	<1	<1	<1
Carbon tetrachloride	µg/L	<1	<1	<1
Benzene	µg/L	<1	<1	<1
Dibromomethane	µg/L	<1	<1	<1
1,2-dichloropropane	µg/L	<1	<1	<1
Trichloroethene	µg/L	<1	<1	<1
Bromodichloromethane	µg/L	<1	<1	<1
trans-1,3-dichloropropene	µg/L	<1	<1	<1
cis-1,3-dichloropropene	µg/L	<1	<1	<1
1,1,2-trichloroethane	µg/L	<1	<1	<1
Toluene	µg/L	<1	<1	<1
1,3-dichloropropane	µg/L	<1	<1	<1
Dibromochloromethane	µg/L	<1	<1	<1
1,2-dibromoethane	µg/L	<1	<1	<1
Tetrachloroethene	µg/L	<1	<1	<1
1,1,1,2-tetrachloroethane	µg/L	<1	<1	<1
Chlorobenzene	µg/L	<1	<1	<1
Ethylbenzene	µg/L	<1	<1	<1

VOCs in water				
Our Reference	UNITS	358685-1	358685-2	358685-3
Your Reference		BH201	BH202	BH203
Date Sampled		07/08/2024	07/08/2024	07/08/2024
Type of sample		Water	Water	Water
Bromoform	µg/L	<1	<1	<1
m+p-xylene	µg/L	<2	<2	<2
Styrene	µg/L	<1	<1	<1
1,1,2,2-tetrachloroethane	µg/L	<1	<1	<1
o-xylene	µg/L	<1	<1	<1
1,2,3-trichloropropane	µg/L	<1	<1	<1
Isopropylbenzene	µg/L	<1	<1	<1
Bromobenzene	µg/L	<1	<1	<1
n-propyl benzene	µg/L	<1	<1	<1
2-chlorotoluene	µg/L	<1	<1	<1
4-chlorotoluene	µg/L	<1	<1	<1
1,3,5-trimethyl benzene	µg/L	<1	<1	<1
Tert-butyl benzene	µg/L	<1	<1	<1
1,2,4-trimethyl benzene	µg/L	<1	<1	<1
1,3-dichlorobenzene	µg/L	<1	<1	<1
Sec-butyl benzene	µg/L	<1	<1	<1
1,4-dichlorobenzene	µg/L	<1	<1	<1
4-isopropyl toluene	µg/L	<1	<1	<1
1,2-dichlorobenzene	µg/L	<1	<1	<1
n-butyl benzene	µg/L	<1	<1	<1
1,2-dibromo-3-chloropropane	µg/L	<1	<1	<1
1,2,4-trichlorobenzene	µg/L	<1	<1	<1
Hexachlorobutadiene	µg/L	<1	<1	<1
1,2,3-trichlorobenzene	µg/L	<1	<1	<1
Surrogate Dibromofluoromethane	%	101	99	100
Surrogate Toluene-d8	%	107	115	89
Surrogate 4-Bromofluorobenzene	%	98	92	98

vTRH(C6-C10)/BTEXN in Water				
Our Reference	UNITS	358685-1	358685-2	358685-3
Your Reference		BH201	BH202	BH203
Date Sampled		07/08/2024	07/08/2024	07/08/2024
Type of sample		Water	Water	Water
Date extracted	-	09/08/2024	09/08/2024	09/08/2024
Date analysed	-	09/08/2024	09/08/2024	09/08/2024
TRH C_6 - C_9	µg/L	<10	<10	<10
TRH C_6 - C_{10}	µg/L	<10	<10	<10
TRH C_6 - C_{10} less BTEX (F1)	µg/L	<10	<10	<10
Benzene	µg/L	<1	<1	<1
Toluene	µg/L	<1	<1	<1
Ethylbenzene	µg/L	<1	<1	<1
m+p-xylene	µg/L	<2	<2	<2
o-xylene	µg/L	<1	<1	<1
Naphthalene	µg/L	<1	<1	<1
Surrogate Dibromofluoromethane	%	101	99	100
Surrogate Toluene-d8	%	107	115	89
Surrogate 4-Bromofluorobenzene	%	98	92	98

svTRH (C10-C40) in Water				
Our Reference	UNITS	358685-1	358685-2	358685-3
Your Reference		BH201	BH202	BH203
Date Sampled		07/08/2024	07/08/2024	07/08/2024
Type of sample		Water	Water	Water
Date extracted	-	09/08/2024	09/08/2024	09/08/2024
Date analysed	-	11/08/2024	11/08/2024	11/08/2024
TRH C_{10} - C_{14}	µg/L	330	69	55
TRH C_{15} - C_{28}	µg/L	<100	<100	<100
TRH C_{29} - C_{36}	µg/L	<100	<100	<100
Total +ve TRH (C10-C36)	µg/L	330	70	60
TRH >C_{10} - C_{16}	µg/L	340	62	56
TRH >C_{10} - C_{16} less Naphthalene (F2)	µg/L	340	62	56
TRH >C_{16} - C_{34}	µg/L	<100	120	140
TRH >C_{34} - C_{40}	µg/L	<100	<100	<100
Total +ve TRH (>C10-C40)	µg/L	340	180	190
Surrogate o-Terphenyl	%	114	75	103

PAHs in Water - Trace Level				
Our Reference	UNITS	358685-1	358685-2	358685-3
Your Reference		BH201	BH202	BH203
Date Sampled		07/08/2024	07/08/2024	07/08/2024
Type of sample		Water	Water	Water
Date extracted	-	09/08/2024	09/08/2024	09/08/2024
Date analysed	-	14/08/2024	14/08/2024	14/08/2024
Naphthalene	µg/L	0.04	0.2	0.04
Acenaphthylene	µg/L	<0.01	<0.01	<0.01
Acenaphthene	µg/L	<0.01	<0.01	<0.01
Fluorene	µg/L	<0.01	<0.01	<0.01
Phenanthrene	µg/L	<0.01	<0.01	<0.01
Anthracene	µg/L	<0.01	<0.01	<0.01
Fluoranthene	µg/L	<0.01	<0.01	<0.01
Pyrene	µg/L	<0.01	<0.01	<0.01
Benzo(a)anthracene	µg/L	<0.01	<0.01	<0.01
Chrysene	µg/L	<0.01	<0.01	<0.01
Benzo(b,j+k)fluoranthene	µg/L	<0.02	<0.02	<0.02
Benzo(a)pyrene	µg/L	<0.01	<0.01	<0.01
Dibenzo(a,h)anthracene	µg/L	<0.01	<0.01	<0.01
Indeno(1,2,3-c,d)pyrene	µg/L	<0.01	<0.01	<0.01
Benzo(g,h,i)perylene	µg/L	<0.01	<0.01	<0.01
Benzo(a)pyrene TEQ	µg/L	<0.05	<0.05	<0.05
Total +ve PAH's	µg/L	0.040	0.19	0.040
Surrogate p-Terphenyl-d14	%	84	61	81

Organochlorine Pesticides in Water				
Our Reference	UNITS	358685-1	358685-2	358685-3
Your Reference		BH201	BH202	BH203
Date Sampled		07/08/2024	07/08/2024	07/08/2024
Type of sample		Water	Water	Water
Date extracted	-	09/08/2024	09/08/2024	09/08/2024
Date analysed	-	14/08/2024	14/08/2024	14/08/2024
alpha-BHC	µg/L	<0.2	<0.2	<0.2
HCB	µg/L	<0.2	<0.2	<0.2
beta-BHC	µg/L	<0.2	<0.2	<0.2
gamma-BHC	µg/L	<0.2	<0.2	<0.2
Heptachlor	µg/L	<0.2	<0.2	<0.2
delta-BHC	µg/L	<0.2	<0.2	<0.2
Aldrin	µg/L	<0.2	<0.2	<0.2
Heptachlor Epoxide	µg/L	<0.2	<0.2	<0.2
gamma-Chlordane	µg/L	<0.2	<0.2	<0.2
alpha-Chlordane	µg/L	<0.2	<0.2	<0.2
Endosulfan I	µg/L	<0.2	<0.2	<0.2
pp-DDE	µg/L	<0.2	<0.2	<0.2
Dieldrin	µg/L	<0.2	<0.2	<0.2
Endrin	µg/L	<0.2	<0.2	<0.2
Endosulfan II	µg/L	<0.2	<0.2	<0.2
pp-DDD	µg/L	<0.2	<0.2	<0.2
Endrin Aldehyde	µg/L	<0.2	<0.2	<0.2
pp-DDT	µg/L	<0.2	<0.2	<0.2
Endosulfan Sulphate	µg/L	<0.2	<0.2	<0.2
Methoxychlor	µg/L	<0.2	<0.2	<0.2
Mirex	ug/L	<0.2	<0.2	<0.2
Surrogate 4-Chloro-3-NBTF	%	85	71	83

OP Pesticides in Water				
Our Reference	UNITS	358685-1	358685-2	358685-3
Your Reference		BH201	BH202	BH203
Date Sampled		07/08/2024	07/08/2024	07/08/2024
Type of sample		Water	Water	Water
Date extracted	-	09/08/2024	09/08/2024	09/08/2024
Date analysed	-	14/08/2024	14/08/2024	14/08/2024
Dichlorvos	µg/L	<0.2	<0.2	<0.2
Mevinphos	µg/L	<0.2	<0.2	<0.2
Phorate	µg/L	<0.2	<0.2	<0.2
Dimethoate	µg/L	<0.2	<0.2	<0.2
Diazinon	µg/L	<0.2	<0.2	<0.2
Disulfoton	µg/L	<0.2	<0.2	<0.2
Chlorpyriphos-methyl	µg/L	<0.2	<0.2	<0.2
Parathion-Methyl	µg/L	<0.2	<0.2	<0.2
Ronnel	µg/L	<0.2	<0.2	<0.2
Fenitrothion	µg/L	<0.2	<0.2	<0.2
Malathion	µg/L	<0.2	<0.2	<0.2
Chlorpyriphos	µg/L	<0.2	<0.2	<0.2
Fenthion	µg/L	<0.2	<0.2	<0.2
Parathion	µg/L	<0.2	<0.2	<0.2
Bromophos ethyl	µg/L	<0.2	<0.2	<0.2
Methidathion	µg/L	<0.2	<0.2	<0.2
Fenamiphos	µg/L	<0.2	<0.2	<0.2
Ethion	µg/L	<0.2	<0.2	<0.2
Phosalone	µg/L	<0.2	<0.2	<0.2
Azinphos-methyl (Guthion)	µg/L	<0.2	<0.2	<0.2
Coumaphos	µg/L	<0.2	<0.2	<0.2
Surrogate 4-Chloro-3-NBTF	%	85	71	83

PCBs in Water				
Our Reference		358685-1	358685-2	358685-3
Your Reference	UNITS	BH201	BH202	BH203
Date Sampled		07/08/2024	07/08/2024	07/08/2024
Type of sample		Water	Water	Water
Date extracted	-	09/08/2024	09/08/2024	09/08/2024
Date analysed	-	14/08/2024	14/08/2024	14/08/2024
Aroclor 1016	µg/L	<2	<2	<2
Aroclor 1221	µg/L	<2	<2	<2
Aroclor 1232	µg/L	<2	<2	<2
Aroclor 1242	µg/L	<2	<2	<2
Aroclor 1248	µg/L	<2	<2	<2
Aroclor 1254	µg/L	<2	<2	<2
Aroclor 1260	µg/L	<2	<2	<2
Surrogate 2-Fluorobiphenyl	%	86	69	83

Total Phenolics in Water				
Our Reference		358685-1	358685-2	358685-3
Your Reference	UNITS	BH201	BH202	BH203
Date Sampled		07/08/2024	07/08/2024	07/08/2024
Type of sample		Water	Water	Water
Date extracted	-	09/08/2024	09/08/2024	09/08/2024
Date analysed	-	09/08/2024	09/08/2024	09/08/2024
Total Phenolics (as Phenol)	mg/L	<0.05	<0.05	<0.05

HM in water - dissolved				
Our Reference	UNITS	358685-1	358685-2	358685-3
Your Reference		BH201	BH202	BH203
Date Sampled		07/08/2024	07/08/2024	07/08/2024
Type of sample		Water	Water	Water
Date prepared	-	12/08/2024	12/08/2024	12/08/2024
Date analysed	-	12/08/2024	12/08/2024	12/08/2024
Arsenic-Dissolved	µg/L	<1	<1	<1
Cadmium-Dissolved	µg/L	<0.1	0.4	0.7
Chromium-Dissolved	µg/L	<1	1	1
Copper-Dissolved	µg/L	2	25	52
Lead-Dissolved	µg/L	<1	66	59
Mercury-Dissolved	µg/L	<0.05	<0.05	<0.05
Nickel-Dissolved	µg/L	8	15	32
Zinc-Dissolved	µg/L	37	120	390

HM in water - total				
Our Reference		358685-1	358685-2	358685-3
Your Reference	UNITS	BH201	BH202	BH203
Date Sampled		07/08/2024	07/08/2024	07/08/2024
Type of sample		Water	Water	Water
Date prepared	-	12/08/2024	12/08/2024	12/08/2024
Date analysed	-	12/08/2024	12/08/2024	12/08/2024
Arsenic-Total	µg/L	<1	1	<1
Cadmium-Total	µg/L	<0.1	0.4	0.8
Chromium-Total	µg/L	2	2	1
Copper-Total	µg/L	5	33	60
Lead-Total	µg/L	4	99	85
Mercury-Total	µg/L	<0.05	<0.05	<0.05
Nickel-Total	µg/L	10	18	36
Zinc-Total	µg/L	55	140	450

Miscellaneous Inorganics				
Our Reference	UNITS	358685-1	358685-2	358685-3
Your Reference		BH201	BH202	BH203
Date Sampled		07/08/2024	07/08/2024	07/08/2024
Type of sample		Water	Water	Water
Date prepared	-	08/08/2024	08/08/2024	08/08/2024
Date analysed	-	08/08/2024	08/08/2024	08/08/2024
pH	pH Units	6.0	5.2	5.0
Total Phosphorus	mg/L	0.01	0.01	0.01
Ammonia as N in water	mg/L	<0.005	0.27	0.023
Nitrate as N in water	mg/L	0.008	0.32	5.0
Nitrite as N in water	mg/L	<0.005	0.006	0.033
NOx as N in water	mg/L	0.01	0.3	5.0
Phosphate as P in water	mg/L	<0.005	<0.005	<0.005
TKN in water	mg/L	0.4	0.3	0.2
Organic Nitrogen as N	mg/L	0.4	<0.2	<0.2

Cations in water Dissolved				
Our Reference		358685-1	358685-2	358685-3
Your Reference	UNITS	BH201	BH202	BH203
Date Sampled		07/08/2024	07/08/2024	07/08/2024
Type of sample		Water	Water	Water
Date digested	-	12/08/2024	12/08/2024	12/08/2024
Date analysed	-	12/08/2024	12/08/2024	12/08/2024
Sodium - Dissolved	mg/L	65	40	32
Potassium - Dissolved	mg/L	3	6.1	7.3
Calcium - Dissolved	mg/L	36	3	5.4
Magnesium - Dissolved	mg/L	20	6.1	3

PFAS in Water TRACE Short				
Our Reference	UNITS	358685-1	358685-2	358685-3
Your Reference		BH201	BH202	BH203
Date Sampled		07/08/2024	07/08/2024	07/08/2024
Type of sample		Water	Water	Water
Date prepared	-	12/08/2024	12/08/2024	12/08/2024
Date analysed	-	12/08/2024	12/08/2024	12/08/2024
Perfluorohexanesulfonic acid - PFHxS	µg/L	0.0020	0.0099	0.016
Perfluorooctanesulfonic acid PFOS	µg/L	<0.0002	0.0027	0.012
Perfluorooctanoic acid PFOA	µg/L	0.0009	0.0046	0.015
6:2 FTS	µg/L	0.0075	0.064	0.068
8:2 FTS	µg/L	<0.0004	<0.0004	<0.0004
Surrogate $^{13}C_8$ *PFOS*	%	95	103	98
Surrogate $^{13}C_2$ *PFOA*	%	107	106	107
Extracted ISTD $^{18}O_2$ *PFHxS*	%	84	94	87
Extracted ISTD $^{13}C_4$ *PFOS*	%	71	81	80
Extracted ISTD $^{13}C_4$ *PFOA*	%	86	94	86
Extracted ISTD $^{13}C_2$ *6:2FTS*	%	180	153	152
Extracted ISTD $^{13}C_2$ *8:2FTS*	%	151	161	182
Total Positive PFHxS & PFOS	µg/L	0.002	0.013	0.028
Total Positive PFOS & PFOA	µg/L	0.0009	0.0074	0.026
Total Positive PFAS	µg/L	0.010	0.081	0.11

Method ID	Methodology Summary
Inorg-001	pH - Measured using pH meter and electrode. Please note that the results for water analyses are indicative only, as analysis outside of the APHA storage times.
Inorg-031	Total Phenolics by segmented flow analyser (in line distillation with colourimetric finish). Solids are extracted in a caustic media prior to analysis.
Inorg-055	Nitrate - determined colourimetrically. Waters samples are filtered on receipt prior to analysis. Soils are analysed following a water extraction.
Inorg-055	Nitrite - determined colourimetrically based on APHA latest edition NO2- B. Waters samples are filtered on receipt prior to analysis. Soils are analysed following a water extraction.
Inorg-055/062/127	Total Nitrogen - Calculation sum of TKN and oxidised Nitrogen. Alternatively analysed by combustion and chemiluminescence.
Inorg-057	Ammonia - determined colourimetrically, based on APHA latest edition 4500-NH3 F. Waters samples are filtered on receipt prior to analysis. Soils are analysed following a KCl extraction.
Inorg-060	Phosphate determined colourimetrically based on EPA365.1 and APHA latest edition 4500 P E. Waters samples are filtered on receipt prior to analysis. Soils are analysed following a water extraction.
Inorg-060	Total Phosphorus determined after persulphate digestion followed by colourimetric analysis.
Inorg-062	TKN - determined colourimetrically based on APHA latest edition 4500 Norg. Alternatively, TKN can be derived from calculation (Total N - NOx).
Metals-020	Determination of various metals by ICP-AES.
Metals-021	Determination of Mercury by Cold Vapour AAS.
Metals-022	Determination of various metals by ICP-MS. Please note for Bromine and Iodine, any forms of these elements that are present are included together in the one result reported for each of these two elements. Salt forms (e.g. FeO, PbO, ZnO) are determined stoichiometrically from the base metal concentration.
Org-020	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-FID. F2 = (>C10-C16)-Naphthalene as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater (HSLs Tables 1A (3, 4)). Note Naphthalene is determined from the VOC analysis.
Org-021/022/025	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC-ECD and/or GC-MS/GC-MSMS. Note, the Total +ve PCBs PQL is reflective of the lowest individual PQL and is therefore" Total +ve PCBs" is simply a sum of the positive individual PCBs.
Org-022/025	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-MS/GC-MSMS.
Org-022/025	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-MS/GC-MSMS. Benzo(a)pyrene TEQ as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater - 2013.
Org-023	Water samples are analysed directly by purge and trap GC-MS.

Method ID	Methodology Summary
Org-023	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS. Water samples are analysed directly by purge and trap GC-MS. F1 = (C6-C10)-BTEX as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater.
Org-029	Soil samples are extracted with basified Methanol. Waters and soil extracts are directly injected and/or concentrated/extracted using SPE. TCLPs/ASLP leachates are centrifuged, the supernatant is then analysed (including amendment with solvent) - as per the option in AS4439.3. Analysis is undertaken with LC-MS/MS. PFAS results include the sum of branched and linear isomers where applicable. Please note that PFAS results are corrected for Extracted Internal Standards (QSM 5.4 Table B-15 terminology), which are mass labelled analytes added prior to sample preparation to assess matrix effects and verify processing of the sample. PFAS analytes without a commercially available mass labelled analogue are corrected vs a closely eluting mass labelled PFAS compound. Surrogates are also reported, in this context they are mass labelled PFAS compounds added prior to extraction but are used as monitoring compounds only (not used for result correction). Envicarb (or similar) is used discretionally to remove interfering matrix components. Please contact the laboratory if estimates of Measurement Uncertainty are required as per WA DER.

QUALITY CONTROL: VOCs in water						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date Extracted	-			09/08/2024	1	09/08/2024	12/08/2024		09/08/2024	[NT]
Date Analysed	-			09/08/2024	1	09/08/2024	12/08/2024		09/08/2024	[NT]
Dichlorodifluoromethane	µg/L	10	Org-023	<10	1	<10	<10	0	[NT]	[NT]
Chloromethane	µg/L	10	Org-023	<10	1	<10	<10	0	[NT]	[NT]
Vinyl Chloride	µg/L	10	Org-023	<10	1	<10	<10	0	[NT]	[NT]
Bromomethane	µg/L	10	Org-023	<10	1	<10	<10	0	[NT]	[NT]
Chloroethane	µg/L	10	Org-023	<10	1	<10	<10	0	[NT]	[NT]
Trichlorofluoromethane	µg/L	10	Org-023	<10	1	<10	<10	0	[NT]	[NT]
1,1-Dichloroethene	µg/L	1	Org-023	<1	1	<1	<1	0	[NT]	[NT]
Trans-1,2-dichloroethene	µg/L	1	Org-023	<1	1	<1	<1	0	[NT]	[NT]
1,1-dichloroethane	µg/L	1	Org-023	<1	1	<1	<1	0	102	[NT]
Cis-1,2-dichloroethene	µg/L	1	Org-023	<1	1	<1	<1	0	[NT]	[NT]
Bromochloromethane	µg/L	1	Org-023	<1	1	<1	<1	0	[NT]	[NT]
Chloroform	µg/L	1	Org-023	<1	1	8	8	0	104	[NT]
2,2-dichloropropane	µg/L	1	Org-023	<1	1	<1	<1	0	[NT]	[NT]
1,2-dichloroethane	µg/L	1	Org-023	<1	1	<1	<1	0	101	[NT]
1,1,1-trichloroethane	µg/L	1	Org-023	<1	1	<1	<1	0	112	[NT]
1,1-dichloropropene	µg/L	1	Org-023	<1	1	<1	<1	0	[NT]	[NT]
Cyclohexane	µg/L	1	Org-023	<1	1	<1	<1	0	[NT]	[NT]
Carbon tetrachloride	µg/L	1	Org-023	<1	1	<1	<1	0	[NT]	[NT]
Benzene	µg/L	1	Org-023	<1	1	<1	<1	0	102	[NT]
Dibromomethane	µg/L	1	Org-023	<1	1	<1	<1	0	[NT]	[NT]
1,2-dichloropropane	µg/L	1	Org-023	<1	1	<1	<1	0	[NT]	[NT]
Trichloroethene	µg/L	1	Org-023	<1	1	<1	<1	0	96	[NT]
Bromodichloromethane	µg/L	1	Org-023	<1	1	<1	<1	0	112	[NT]
trans-1,3-dichloropropene	µg/L	1	Org-023	<1	1	<1	<1	0	[NT]	[NT]
cis-1,3-dichloropropene	µg/L	1	Org-023	<1	1	<1	<1	0	[NT]	[NT]
1,1,2-trichloroethane	µg/L	1	Org-023	<1	1	<1	<1	0	[NT]	[NT]
Toluene	µg/L	1	Org-023	<1	1	<1	<1	0	109	[NT]
1,3-dichloropropane	µg/L	1	Org-023	<1	1	<1	<1	0	[NT]	[NT]
Dibromochloromethane	µg/L	1	Org-023	<1	1	<1	<1	0	119	[NT]
1,2-dibromoethane	µg/L	1	Org-023	<1	1	<1	<1	0	[NT]	[NT]
Tetrachloroethene	µg/L	1	Org-023	<1	1	<1	<1	0	115	[NT]
1,1,1,2-tetrachloroethane	µg/L	1	Org-023	<1	1	<1	<1	0	[NT]	[NT]
Chlorobenzene	µg/L	1	Org-023	<1	1	<1	<1	0	[NT]	[NT]
Ethylbenzene	µg/L	1	Org-023	<1	1	<1	<1	0	105	[NT]
Bromoform	µg/L	1	Org-023	<1	1	<1	<1	0	[NT]	[NT]
m+p-xylene	µg/L	2	Org-023	<2	1	<2	<2	0	107	[NT]
Styrene	µg/L	1	Org-023	<1	1	<1	<1	0	[NT]	[NT]
1,1,2,2-tetrachloroethane	µg/L	1	Org-023	<1	1	<1	<1	0	[NT]	[NT]

QUALITY CONTROL: VOCs in water						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
o-xylene	µg/L	1	Org-023	<1	1	<1	<1	0	106	[NT]
1,2,3-trichloropropane	µg/L	1	Org-023	<1	1	<1	<1	0	[NT]	[NT]
Isopropylbenzene	µg/L	1	Org-023	<1	1	<1	<1	0	[NT]	[NT]
Bromobenzene	µg/L	1	Org-023	<1	1	<1	<1	0	[NT]	[NT]
n-propyl benzene	µg/L	1	Org-023	<1	1	<1	<1	0	[NT]	[NT]
2-chlorotoluene	µg/L	1	Org-023	<1	1	<1	<1	0	[NT]	[NT]
4-chlorotoluene	µg/L	1	Org-023	<1	1	<1	<1	0	[NT]	[NT]
1,3,5-trimethyl benzene	µg/L	1	Org-023	<1	1	<1	<1	0	[NT]	[NT]
Tert-butyl benzene	µg/L	1	Org-023	<1	1	<1	<1	0	[NT]	[NT]
1,2,4-trimethyl benzene	µg/L	1	Org-023	<1	1	<1	<1	0	[NT]	[NT]
1,3-dichlorobenzene	µg/L	1	Org-023	<1	1	<1	<1	0	[NT]	[NT]
Sec-butyl benzene	µg/L	1	Org-023	<1	1	<1	<1	0	[NT]	[NT]
1,4-dichlorobenzene	µg/L	1	Org-023	<1	1	<1	<1	0	[NT]	[NT]
4-isopropyl toluene	µg/L	1	Org-023	<1	1	<1	<1	0	[NT]	[NT]
1,2-dichlorobenzene	µg/L	1	Org-023	<1	1	<1	<1	0	[NT]	[NT]
n-butyl benzene	µg/L	1	Org-023	<1	1	<1	<1	0	[NT]	[NT]
1,2-dibromo-3-chloropropane	µg/L	1	Org-023	<1	1	<1	<1	0	[NT]	[NT]
1,2,4-trichlorobenzene	µg/L	1	Org-023	<1	1	<1	<1	0	[NT]	[NT]
Hexachlorobutadiene	µg/L	1	Org-023	<1	1	<1	<1	0	[NT]	[NT]
1,2,3-trichlorobenzene	µg/L	1	Org-023	<1	1	<1	<1	0	[NT]	[NT]
Surrogate Dibromofluoromethane	%		Org-023	92	1	101	97	4	104	[NT]
Surrogate Toluene-d8	%		Org-023	98	1	107	98	9	104	[NT]
Surrogate 4-Bromofluorobenzene	%		Org-023	86	1	98	96	2	107	[NT]

QUALITY CONTROL: vTRH(C6-C10)/BTEXN in Water						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date extracted	-			09/08/2024	1	09/08/2024	12/08/2024		09/08/2024	[NT]
Date analysed	-			09/08/2024	1	09/08/2024	12/08/2024		09/08/2024	[NT]
TRH C_6 - C_9	µg/L	10	Org-023	<10	1	<10	<10	0	106	[NT]
TRH C_6 - C_{10}	µg/L	10	Org-023	<10	1	<10	<10	0	106	[NT]
Benzene	µg/L	1	Org-023	<1	1	<1	<1	0	102	[NT]
Toluene	µg/L	1	Org-023	<1	1	<1	<1	0	109	[NT]
Ethylbenzene	µg/L	1	Org-023	<1	1	<1	<1	0	105	[NT]
m+p-xylene	µg/L	2	Org-023	<2	1	<2	<2	0	107	[NT]
o-xylene	µg/L	1	Org-023	<1	1	<1	<1	0	106	[NT]
Naphthalene	µg/L	1	Org-023	<1	1	<1	<1	0	[NT]	[NT]
Surrogate Dibromofluoromethane	%		Org-023	92	1	101	97	4	104	[NT]
Surrogate Toluene-d8	%		Org-023	98	1	107	98	9	104	[NT]
Surrogate 4-Bromofluorobenzene	%		Org-023	86	1	98	96	2	107	[NT]

QUALITY CONTROL: svTRH (C10-C40) in Water						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W3	[NT]
Date extracted	-			09/08/2024	[NT]	[NT]	[NT]	[NT]	09/08/2024	[NT]
Date analysed	-			11/08/2024	[NT]	[NT]	[NT]	[NT]	11/08/2024	[NT]
TRH C_{10} - C_{14}	µg/L	50	Org-020	<50	[NT]	[NT]	[NT]	[NT]	118	[NT]
TRH C_{15} - C_{28}	µg/L	100	Org-020	<100	[NT]	[NT]	[NT]	[NT]	108	[NT]
TRH C_{29} - C_{36}	µg/L	100	Org-020	<100	[NT]	[NT]	[NT]	[NT]	100	[NT]
TRH >C_{10} - C_{16}	µg/L	50	Org-020	<50	[NT]	[NT]	[NT]	[NT]	118	[NT]
TRH >C_{16} - C_{34}	µg/L	100	Org-020	<100	[NT]	[NT]	[NT]	[NT]	108	[NT]
TRH >C_{34} - C_{40}	µg/L	100	Org-020	<100	[NT]	[NT]	[NT]	[NT]	100	[NT]
Surrogate o-Terphenyl	%		Org-020	101	[NT]	[NT]	[NT]	[NT]	118	[NT]

QUALITY CONTROL: PAHs in Water - Trace Level						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date extracted	-			09/08/2024	[NT]	[NT]	[NT]	[NT]	09/08/2024	[NT]
Date analysed	-			14/08/2024	[NT]	[NT]	[NT]	[NT]	14/08/2024	[NT]
Naphthalene	µg/L	0.02	Org-022/025	<0.02	[NT]	[NT]	[NT]	[NT]	82	[NT]
Acenaphthylene	µg/L	0.01	Org-022/025	<0.01	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Acenaphthene	µg/L	0.01	Org-022/025	<0.01	[NT]	[NT]	[NT]	[NT]	84	[NT]
Fluorene	µg/L	0.01	Org-022/025	<0.01	[NT]	[NT]	[NT]	[NT]	84	[NT]
Phenanthrene	µg/L	0.01	Org-022/025	<0.01	[NT]	[NT]	[NT]	[NT]	82	[NT]
Anthracene	µg/L	0.01	Org-022/025	<0.01	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Fluoranthene	µg/L	0.01	Org-022/025	<0.01	[NT]	[NT]	[NT]	[NT]	82	[NT]
Pyrene	µg/L	0.01	Org-022/025	<0.01	[NT]	[NT]	[NT]	[NT]	80	[NT]
Benzo(a)anthracene	µg/L	0.01	Org-022/025	<0.01	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Chrysene	µg/L	0.01	Org-022/025	<0.01	[NT]	[NT]	[NT]	[NT]	74	[NT]
Benzo(b,j+k)fluoranthene	µg/L	0.02	Org-022/025	<0.02	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Benzo(a)pyrene	µg/L	0.01	Org-022/025	<0.01	[NT]	[NT]	[NT]	[NT]	82	[NT]
Dibenzo(a,h)anthracene	µg/L	0.01	Org-022/025	<0.01	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Indeno(1,2,3-c,d)pyrene	µg/L	0.01	Org-022/025	<0.01	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Benzo(g,h,i)perylene	µg/L	0.01	Org-022/025	<0.01	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Surrogate p-Terphenyl-d14	%		Org-022/025	72	[NT]	[NT]	[NT]	[NT]	86	[NT]

QUALITY CONTROL: Organochlorine Pesticides in Water					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date extracted	-			09/08/2024	[NT]	[NT]	[NT]	[NT]	09/08/2024	[NT]
Date analysed	-			14/08/2024	[NT]	[NT]	[NT]	[NT]	14/08/2024	[NT]
alpha-BHC	µg/L	0.2	Org-022/025	<0.2	[NT]	[NT]	[NT]	[NT]	82	[NT]
HCB	µg/L	0.2	Org-022/025	<0.2	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
beta-BHC	µg/L	0.2	Org-022/025	<0.2	[NT]	[NT]	[NT]	[NT]	78	[NT]
gamma-BHC	µg/L	0.2	Org-022/025	<0.2	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Heptachlor	µg/L	0.2	Org-022/025	<0.2	[NT]	[NT]	[NT]	[NT]	68	[NT]
delta-BHC	µg/L	0.2	Org-022/025	<0.2	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Aldrin	µg/L	0.2	Org-022/025	<0.2	[NT]	[NT]	[NT]	[NT]	80	[NT]
Heptachlor Epoxide	µg/L	0.2	Org-022/025	<0.2	[NT]	[NT]	[NT]	[NT]	84	[NT]
gamma-Chlordane	µg/L	0.2	Org-022/025	<0.2	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
alpha-Chlordane	µg/L	0.2	Org-022/025	<0.2	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Endosulfan I	µg/L	0.2	Org-022/025	<0.2	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
pp-DDE	µg/L	0.2	Org-022/025	<0.2	[NT]	[NT]	[NT]	[NT]	74	[NT]
Dieldrin	µg/L	0.2	Org-022/025	<0.2	[NT]	[NT]	[NT]	[NT]	78	[NT]
Endrin	µg/L	0.2	Org-022/025	<0.2	[NT]	[NT]	[NT]	[NT]	62	[NT]
Endosulfan II	µg/L	0.2	Org-022/025	<0.2	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
pp-DDD	µg/L	0.2	Org-022/025	<0.2	[NT]	[NT]	[NT]	[NT]	74	[NT]
Endrin Aldehyde	µg/L	0.2	Org-022/025	<0.2	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
pp-DDT	µg/L	0.2	Org-022/025	<0.2	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Endosulfan Sulphate	µg/L	0.2	Org-022/025	<0.2	[NT]	[NT]	[NT]	[NT]	66	[NT]
Methoxychlor	µg/L	0.2	Org-022/025	<0.2	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Mirex	ug/L	0.2	Org-022/025	<0.2	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Surrogate 4-Chloro-3-NBTF	%		Org-022/025	75	[NT]	[NT]	[NT]	[NT]	90	[NT]

QUALITY CONTROL: OP Pesticides in Water						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date extracted	-			09/08/2024	[NT]	[NT]	[NT]	[NT]	09/08/2024	[NT]
Date analysed	-			14/08/2024	[NT]	[NT]	[NT]	[NT]	14/08/2024	[NT]
Dichlorvos	µg/L	0.2	Org-022/025	<0.2	[NT]	[NT]	[NT]	[NT]	96	[NT]
Mevinphos	µg/L	0.2	Org-022/025	<0.2	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Phorate	µg/L	0.2	Org-022/025	<0.2	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Dimethoate	µg/L	0.2	Org-022/025	<0.2	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Diazinon	µg/L	0.2	Org-022/025	<0.2	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Disulfoton	µg/L	0.2	Org-022/025	<0.2	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Chlorpyriphos-methyl	µg/L	0.2	Org-022/025	<0.2	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Parathion-Methyl	µg/L	0.2	Org-022/025	<0.2	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Ronnel	µg/L	0.2	Org-022/025	<0.2	[NT]	[NT]	[NT]	[NT]	74	[NT]
Fenitrothion	µg/L	0.2	Org-022/025	<0.2	[NT]	[NT]	[NT]	[NT]	68	[NT]
Malathion	µg/L	0.2	Org-022/025	<0.2	[NT]	[NT]	[NT]	[NT]	86	[NT]
Chlorpyriphos	µg/L	0.2	Org-022/025	<0.2	[NT]	[NT]	[NT]	[NT]	72	[NT]
Fenthion	µg/L	0.2	Org-022/025	<0.2	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Parathion	µg/L	0.2	Org-022/025	<0.2	[NT]	[NT]	[NT]	[NT]	66	[NT]
Bromophos ethyl	µg/L	0.2	Org-022/025	<0.2	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Methidathion	µg/L	0.2	Org-022/025	<0.2	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Fenamiphos	µg/L	0.2	Org-022/025	<0.2	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Ethion	µg/L	0.2	Org-022/025	<0.2	[NT]	[NT]	[NT]	[NT]	84	[NT]
Phosalone	µg/L	0.2	Org-022/025	<0.2	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Azinphos-methyl (Guthion)	µg/L	0.2	Org-022/025	<0.2	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Coumaphos	µg/L	0.2	Org-022/025	<0.2	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Surrogate 4-Chloro-3-NBTF	%		Org-022/025	75	[NT]	[NT]	[NT]	[NT]	90	[NT]

QUALITY CONTROL: PCBs in Water						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date extracted	-			09/08/2024	[NT]	[NT]	[NT]	[NT]	09/08/2024	[NT]
Date analysed	-			14/08/2024	[NT]	[NT]	[NT]	[NT]	14/08/2024	[NT]
Aroclor 1016	µg/L	2	Org-021/022/025	<2	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Aroclor 1221	µg/L	2	Org-021/022/025	<2	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Aroclor 1232	µg/L	2	Org-021/022/025	<2	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Aroclor 1242	µg/L	2	Org-021/022/025	<2	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Aroclor 1248	µg/L	2	Org-021/022/025	<2	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Aroclor 1254	µg/L	2	Org-021/022/025	<2	[NT]	[NT]	[NT]	[NT]	81	[NT]
Aroclor 1260	µg/L	2	Org-021/022/025	<2	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Surrogate 2-Fluorobiphenyl	%		Org-021/022/025	76	[NT]	[NT]	[NT]	[NT]	85	[NT]

QUALITY CONTROL: Total Phenolics in Water					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date extracted	-			09/08/2024	[NT]	[NT]	[NT]	[NT]	09/08/2024	[NT]
Date analysed	-			09/08/2024	[NT]	[NT]	[NT]	[NT]	09/08/2024	[NT]
Total Phenolics (as Phenol)	mg/L	0.05	Inorg-031	<0.05	[NT]	[NT]	[NT]	[NT]	102	[NT]

QUALITY CONTROL: HM in water - dissolved						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W5	[NT]
Date prepared	-			12/08/2024	1	12/08/2024	12/08/2024		12/08/2024	[NT]
Date analysed	-			12/08/2024	1	12/08/2024	12/08/2024		12/08/2024	[NT]
Arsenic-Dissolved	µg/L	1	Metals-022	<1	1	<1	[NT]		92	[NT]
Cadmium-Dissolved	µg/L	0.1	Metals-022	<0.1	1	<0.1	[NT]		97	[NT]
Chromium-Dissolved	µg/L	1	Metals-022	<1	1	<1	[NT]		101	[NT]
Copper-Dissolved	µg/L	1	Metals-022	<1	1	2	[NT]		101	[NT]
Lead-Dissolved	µg/L	1	Metals-022	<1	1	<1	[NT]		105	[NT]
Mercury-Dissolved	µg/L	0.05	Metals-021	<0.05	1	<0.05	<0.05	0	116	[NT]
Nickel-Dissolved	µg/L	1	Metals-022	<1	1	8	[NT]		101	[NT]
Zinc-Dissolved	µg/L	1	Metals-022	<1	1	37	[NT]		92	[NT]

QUALITY CONTROL: HM in water - dissolved						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-			[NT]	2	12/08/2024	12/08/2024		[NT]	[NT]
Date analysed	-			[NT]	2	12/08/2024	12/08/2024		[NT]	[NT]
Arsenic-Dissolved	µg/L	1	Metals-022	[NT]	2	<1	<1	0	[NT]	[NT]
Cadmium-Dissolved	µg/L	0.1	Metals-022	[NT]	2	0.4	0.4	0	[NT]	[NT]
Chromium-Dissolved	µg/L	1	Metals-022	[NT]	2	1	1	0	[NT]	[NT]
Copper-Dissolved	µg/L	1	Metals-022	[NT]	2	25	25	0	[NT]	[NT]
Lead-Dissolved	µg/L	1	Metals-022	[NT]	2	66	65	2	[NT]	[NT]
Mercury-Dissolved	µg/L	0.05	Metals-021	[NT]	2	<0.05	[NT]		[NT]	[NT]
Nickel-Dissolved	µg/L	1	Metals-022	[NT]	2	15	15	0	[NT]	[NT]
Zinc-Dissolved	µg/L	1	Metals-022	[NT]	2	120	120	0	[NT]	[NT]

QUALITY CONTROL: HM in water - total						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date prepared	-			12/08/2024	1	12/08/2024	12/08/2024		12/08/2024	[NT]
Date analysed	-			12/08/2024	1	12/08/2024	12/08/2024		12/08/2024	[NT]
Arsenic-Total	µg/L	1	Metals-022	<1	1	<1	[NT]		96	[NT]
Cadmium-Total	µg/L	0.1	Metals-022	<0.1	1	<0.1	[NT]		100	[NT]
Chromium-Total	µg/L	1	Metals-022	<1	1	2	[NT]		102	[NT]
Copper-Total	µg/L	1	Metals-022	<1	1	5	[NT]		103	[NT]
Lead-Total	µg/L	1	Metals-022	<1	1	4	[NT]		104	[NT]
Mercury-Total	µg/L	0.05	Metals-021	<0.05	1	<0.05	<0.05	0	120	[NT]
Nickel-Total	µg/L	1	Metals-022	<1	1	10	[NT]		103	[NT]
Zinc-Total	µg/L	1	Metals-022	<1	1	55	[NT]		98	[NT]

QUALITY CONTROL: Miscellaneous Inorganics						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	358685-2
Date prepared	-			08/08/2024	1	08/08/2024	08/08/2024		08/08/2024	08/08/2024
Date analysed	-			08/08/2024	1	08/08/2024	08/08/2024		08/08/2024	08/08/2024
pH	pH Units		Inorg-001	[NT]	1	6.0	5.9	2	97	[NT]
Total Phosphorus	mg/L	0.01	Inorg-060	<0.01	1	0.01	0.01	0	107	108
Ammonia as N in water	mg/L	0.005	Inorg-057	<0.005	1	<0.005	<0.005	0	86	88
Nitrate as N in water	mg/L	0.005	Inorg-055	<0.005	1	0.008	0.008	0	98	87
Nitrite as N in water	mg/L	0.005	Inorg-055	<0.005	1	<0.005	<0.005	0	103	97
NOx as N in water	mg/L	0.005	Inorg-055	<0.005	1	0.01	0.009	11	98	87
Phosphate as P in water	mg/L	0.005	Inorg-060	<0.005	1	<0.005	<0.005	0	109	91
TKN in water	mg/L	0.1	Inorg-062	<0.1	1	0.4	[NT]		91	89
Organic Nitrogen as N	mg/L	0.2	Inorg-055/062/127	<0.2	1	0.4	[NT]		[NT]	[NT]

QUALITY CONTROL: Cations in water Dissolved						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date digested	-			12/08/2024	[NT]	[NT]	[NT]	[NT]	12/08/2024	[NT]
Date analysed	-			12/08/2024	[NT]	[NT]	[NT]	[NT]	12/08/2024	[NT]
Sodium - Dissolved	mg/L	0.5	Metals-020	<0.5	[NT]	[NT]	[NT]	[NT]	95	[NT]
Potassium - Dissolved	mg/L	0.5	Metals-020	<0.5	[NT]	[NT]	[NT]	[NT]	100	[NT]
Calcium - Dissolved	mg/L	0.5	Metals-020	<0.5	[NT]	[NT]	[NT]	[NT]	94	[NT]
Magnesium - Dissolved	mg/L	0.5	Metals-020	<0.5	[NT]	[NT]	[NT]	[NT]	91	[NT]

QUALITY CONTROL: PFAS in Water TRACE Short						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	358685-2
Date prepared	-			12/08/2024	1	12/08/2024	12/08/2024		12/08/2024	12/08/2024
Date analysed	-			12/08/2024	1	12/08/2024	12/08/2024		12/08/2024	12/08/2024
Perfluorohexanesulfonic acid - PFHxS	µg/L	0.0002	Org-029	<0.0002	1	0.0020	0.0022	10	101	98
Perfluorooctanesulfonic acid PFOS	µg/L	0.0002	Org-029	<0.0002	1	<0.0002	0.0003	40	98	97
Perfluorooctanoic acid PFOA	µg/L	0.0002	Org-029	<0.0002	1	0.0009	0.0009	0	99	100
6:2 FTS	µg/L	0.0004	Org-029	<0.0004	1	0.0075	0.0099	28	107	91
8:2 FTS	µg/L	0.0004	Org-029	<0.0004	1	<0.0004	<0.0004	0	92	101
Surrogate $^{13}C_8$ *PFOS*	%		Org-029	105	1	95	106	11	103	102
Surrogate $^{13}C_2$ *PFOA*	%		Org-029	104	1	107	108	1	103	102
Extracted ISTD $^{18}O_2$ *PFHxS*	%		Org-029	88	1	84	89	6	78	90
Extracted ISTD $^{13}C_4$ *PFOS*	%		Org-029	72	1	71	70	1	67	75
Extracted ISTD $^{13}C_4$ *PFOA*	%		Org-029	87	1	86	89	3	77	89
Extracted ISTD $^{13}C_2$ *6:2FTS*	%		Org-029	116	1	180	187	4	107	149
Extracted ISTD $^{13}C_2$ *8:2FTS*	%		Org-029	112	1	151	173	14	113	145

Result Definitions

NT	Not tested
NA	Test not required
INS	Insufficient sample for this test
PQL	Practical Quantitation Limit
<	Less than
>	Greater than
RPD	Relative Percent Difference
LCS	Laboratory Control Sample
NS	Not specified
NEPM	National Environmental Protection Measure
NR	Not Reported

Quality Control Definitions

Blank	This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.
Duplicate	This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.
Matrix Spike	A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.
LCS (Laboratory Control Sample)	This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.
Surrogate Spike	Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

Australian Drinking Water Guidelines recommend that Thermotolerant Coliform, Faecal Enterococci, & E.Coli levels are less than 1cfu/100mL. The recommended maximums are taken from "Australian Drinking Water Guidelines", published by NHMRC & ARMC 2011.

The recommended maximums for analytes in urine are taken from “2018 TLVs and BEIs”, as published by ACGIH (where available). Limit provided for Nickel is a precautionary guideline as per Position Paper prepared by AIOH Exposure Standards Committee, 2016.

Guideline limits for Rinse Water Quality reported as per analytical requirements and specifications of AS 4187, Amdt 2 2019, Table 7.2

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.

Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.

Spikes for Physical and Aggregate Tests are not applicable.

For VOCs in water samples, three vials are required for duplicate or spike analysis.

Duplicates: >10xPQL - RPD acceptance criteria will vary depending on the analytes and the analytical techniques but is typically in the range 20%-50% – see ELN-P05 QA/QC tables for details; <10xPQL - RPD are higher as the results approach PQL and the estimated measurement uncertainty will statistically increase.

Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals (not SPOCAS); 60-140% for organics/SPOCAS (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

In circumstances where no duplicate and/or sample spike has been reported at 1 in 10 and/or 1 in 20 samples respectively, the sample volume submitted was insufficient in order to satisfy laboratory QA/QC protocols.

When samples are received where certain analytes are outside of recommended technical holding times (THTs), the analysis has proceeded. Where analytes are on the verge of breaching THTs, every effort will be made to analyse within the THT or as soon as practicable.

Where sampling dates are not provided, Envirolab are not in a position to comment on the validity of the analysis where recommended technical holding times may have been breached.

Where matrix spike recoveries fall below the lower limit of the acceptance criteria (e.g. for non-labile or standard Organics <60%), positive result(s) in the parent sample will subsequently have a higher than typical estimated uncertainty (MU estimates supplied on request) and in these circumstances the sample result is likely biased significantly low.

Measurement Uncertainty estimates are available for most tests upon request.

Analysis of aqueous samples typically involves the extraction/digestion and/or analysis of the liquid phase only (i.e. NOT any settled sediment phase but inclusive of suspended particles if present), unless stipulated on the Envirolab COC and/or by correspondence. Notable exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, total recoverable metals and PFAS where solids are included by default.

Samples for Microbiological analysis (not Amoeba forms) received outside of the 2-8°C temperature range do not meet the ideal cooling conditions as stated in AS2031-2012.

Report Comments

For PFAS Extracted Internal Standards denoted with # or outside the 50-150% acceptance range, the respective target analyte results may be unaffected, in other circumstances the PQL has been raised to accommodate the outlier(s).