GROUNDED
EXPERTISE

Dewatering Management Plan

Proposed Aquatic Centre

12-16 Margaret Street, Strathfield NSW

Prepared for Meriden School

Project 204585.07

12 December 2024

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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.

GROUNDED EXPERTISE

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1. Introduction

This report prepared by Douglas Partners Pty Ltd (Douglas) presents the dewatering management plan for a proposed aquatic centre at 12-16 Margaret Street, Strathfield NSW (the site). The investigation was commissioned by email instructing to proceed dated 19 March 2024 from Devon Claremont of Meriden School and was undertaken in accordance with Douglas' proposal 204585.07.P.001.Rev2 dated 15 March 2024.

It is understood a dewatering management plan is required as a part of the State Significant Development Application (SSD-59020210) for the disposal of any incidental water (i.e., other sources of water excluding the groundwater) into Council's stormwater system during construction.

This report provides reference to recent investigations carried out within the site by Douglas. Reference has also been made to the NSW Aquifer Interference Policy (AIP) prepared by NSW Office of Water, dated September 2012 and the NSW DPE minimum requirements for groundwater investigation and reporting (NSW DPE, 2021).

This report includes an inflow and groundwater impact assessment and provides management options and screening values for any incidental water accumulating in any excavations during construction. Douglas notes that the inflow and impact assessment provided herein will be required for submission to Department of Climate Change, Energy, the Environment and Water (DCCEEW) as part of the SSD application.

2. Site description

The site is located to the south of Margaret Street, Strathfield. The overall site is a near-rectangular shaped area of approximately 2070 m^2 and is bounded by Margaret Street to the north, residential development and Santa Maria Del Monte School to the south, residential development to the east and part of Lingwood Campus (Meriden Pre School) in the west. An aerial photograph of the site (outlined in red) detailing the proposed development footprint is shown in Figure 1 below.

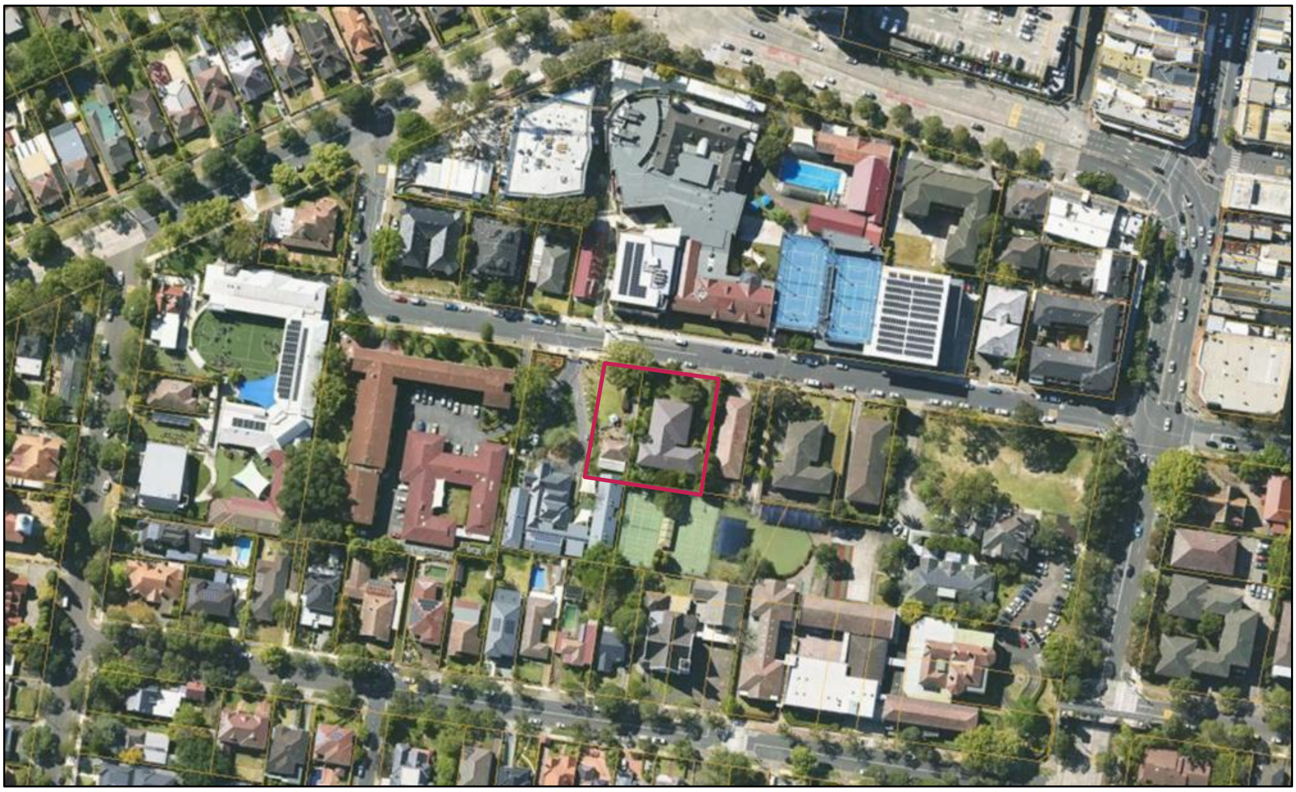

Figure 1: Aerial image of the site cadastral lots overlain

3. Hydrogeological setting

3.1 Topography

The ground surface across the site gently slopes downwards in a northerly direction, with levels typically ranging between about RL 22 and RL 20 AHD. There are several changes in slope associated with the partial basement of the existing building, within 12-14 Margaret Street.

This area appeared to follow the regional topography (sloping downwards to the north) with apparent cut and fill in the centre for the existing basement carpark and fill mound in the northern portion of the site, facing Margaret Street. The recent investigations confirmed the presence of the fill in the mound area.

3.2 Geology

Reference to the Sydney 1:100 000 Geological Series Sheet (Wilson, 1983) indicates that the site is underlain by Ashfield Shale. The Ashfield Shale typically comprises dark grey shale, laminite and siltstone which usually weathers to form a moderately deep residual clay profile. The predominantly shaley rock is typically closely bedded and contains an orthogonal pair of steeply dipping (70° to 90°) joint sets typically striking NNE and ESE and spaced at 0.5 m to 5 m. Randomly oriented, 30° to 45° dipping slickensided joints are also ubiquitous.

The results of the recent field work for the present investigation were consistent with the published geological mapping.

3.3 Hydrogeology

The geology and topography of the site suggests that the permanent groundwater table occurs within the bedrock (Ashfield Shale), predominantly in structures where secondary permeability has been enhanced (e.g., in fractures and cracks, etc).

Ephemeral seepage from perched water would be expected from along the top of bedrock and through joints and bedding planes within the rock itself. Seepage volume would be expected to be low and vary with climatic events.

3.4 Hydrology

There are no surface water bodies within or near the vicinity of the site.

3.5 Groundwater receptors

No registered groundwater bores are located within 500 m of the site. The nearest bores are for monitoring purposes. The nearest surface water body is Powells Creek, parts of which are culverted. Powells Creek is located approximately 600 m north of the site and connects to the Parramatta River at Homebush Bay. Based on the geology and topography of the site, surface and groundwater are expected to flow in a northerly direction, possibly toward Powells Creek.

A review of the Bureau of Meteorology Groundwater Dependant Ecosystems Atlas indicates that there are no aquatic, subterranean or terrestrial GDEs within 500 m of the site. The closest GDE to the site is approximately 2.6 km north which comprises a high potential for terrestrial GDE (Estuarine Mangrove Forest, vegetation).

4. Investigation results

4.1 Geotechnical

Information used to develop the conceptual groundwater model and DMP was obtained from the geotechnical investigation undertaken by Douglas at the subject site, "Report on Geotechnical investigation: Proposed Aquatic Centre, 12-16 Margaret Street, Strathfield" (Project number 204585.07.R.001.Rev0 dated July 2024).

Details of the subsurface conditions encountered are given in the borehole logs, together with notes explaining descriptive terms and classification methods used, are given in the above- mentioned geotechnical report. The test locations are shown in Drawing 1 (Appendix B).

Based on the results of the site investigation, the sequence of subsurface materials encountered at the site, in increasing depth order, is summarised below.

- FILL: typically, sandy / silty clay, varying in depths of between 0.3 m and 1.6 m with varying proportions of rootlets and gravel. Traces of slag was observed in Bore 101 and fragments of plastic was observed in Bore 104. Concrete was encountered at the surface of Bore 205 and Bore 206 to depths in the range of 0.09 m and 0.16 m.
- RESIDUAL: very stiff to hard clay to depths of between 0.3 m and 3.2 m with the lower part of this unit generally described as extremely weathered material (XWM); and

- BEDROCK: generally, very low to low strength laminite becoming medium strength below depths of between 3.0 m to 3.2 m. The laminite was typically encountered from depths of between 5.5 m and 5.9 m to the base of the boreholes. Bore 103 encountered a sheared zone between 5 m and 8 m.

4.2 Groundwater levels

No free groundwater was encountered during auger drilling through the soil profile of the boreholes. The use of water for rotary drilling and coring prevented observations of groundwater within the rock at Bore 101 to Bore 104. Some water loss was noted during rock drilling within Bore 101 at a depth of approximately 7.2 m.

The groundwater monitoring wells installed within Bores 101 to 103 were purged after installation, and the groundwater levels measured at the completion of the investigation. Bore 104 was purged of drilling fluid during NMLC coring and the groundwater level was measured, prior to commencing drilling the following day. A summary of the measured groundwater levels from this investigation are provided in Table 1.

Table 1: Summary of groundwater measurements

Bore No.	Surface RL (AHD)	Water Depth (m)		Water Level (AHD)	
		Minimum	Maximum	Minimum	Maximum
101(1)	20.7	3.8(3)	3.9(3)	16.8	16.9
102(2)	20.4	2.2(4)	2.4(4)	18.0	18.2
103(1)	19.8	3.4(3)	3.6(3)	16.2	16.4
104	21.5	3.9(5)		17.6	

Notes to Table:

(1) Well was purged and rising head test carried out on 19 April 2024

(2) Well was purged and rising head test carried out on 18 April 2024

(3) Standing water levels were measured using a data logger, following purging from 24/4/2024 to 21/6/2024

(4) Standing water levels were measured using a data logger, following purging from 30/5/2024 to 21/6/2024

(5) Standing water levels were measured on 18/4/2024 using a dip meter, following purging of drilling fluid during coring on 17/04/2024.

The standing water levels recorded at the three monitoring wells were between 2.2 m to 3.9 m below ground level, between RL 16.2 and RL 18.2. The above groundwater levels correspond to levels in rock, noting that all standpipes were screened and sealed within the bedrock. Seepage from perched groundwater is, however, expected to occur along the soil and rock interface and may also occur through fractured zones and joints in the rock. Ephemeral seepage appears to be occurring along the soil and rock interface following heavy rainfall and may also be occurring along bedding planes and within fractured zones in the rock. Seepage is likely to increase following periods of extended wet weather. It should be noted that groundwater levels are transient and water levels are likely to fluctuate following periods of extended wet weather.

4.3 Hydraulic conductivity testing

Rising head permeability tests were carried out in the wells of Bore 101 and Bore 102 on 18 April 2024 and Bore 103 on 19 April 2024. This was carried out by purging the well then measuring the rise in water level at regular time intervals using a data logger. A falling head tests was carried out in the well of Bore 102 on 30 May 2024. This was carried out by adding water to the well then measuring the fall in water level at regular time intervals using a data logger.

Permeability was analysed using Hvorslev (Hvorslev, 1951) solution for slug testing interpretation. The detailed results of the permeability tests are attached in Appendix D and a summary of the results are presented in Table 2. The detailed results of the permeability tests are attached in Appendix D.

Table 2: Interpreted permeability results

Well ID	Material Types within Screen Interval	Calculated Permeability (m/s)
BH101	Laminite (interbedded siltstone and sandstone), Fresh	7.3×10^{-9} (R)
BH102	Laminite (interbedded siltstone and sandstone), Slightly weathered to Fresh	8.2×10^{-10} (R)
		2.1×10^{-8} (F)
BH103	Laminite (interbedded siltstone and sandstone), Fresh	1.5×10^{-7} (R)
	Geometric Mean	1.2×10^{-8}

Notes to Table:

R – Rising head test

F – Falling head test

4.4 Groundwater quality

A groundwater sample was collected from within well BH101 by means of a low flow sampling pump. The sample was analysed at a NATA accredited laboratory for a suite of contaminant of potential concern (CoPC) as informed by the potential contamination sources outlined in Douglas' report on detailed site investigation (204585.08.R.001.Rev0 dated 24 May 2024). The groundwater sample was taken after stable readings were obtained for pH, conductivity, temperature, redox, turbidity and dissolved oxygen. Finalised stabilised readings are presented in Table 3.

Table 3: Groundwater quality - field parameter readings

Well ID	Temperature (°C)	Dissolved Oxygen (mg/L)	Conductivity (mS/cm)	pH	Redox (mV)
BH101	20.8	0.80	9	6.9	128

The dissolved oxygen levels indicated slightly anaerobic conditions. The pH was neutral. The electrical conductivity values are typical of fresh water. Redox potential (Eh) indicates slightly oxidising conditions. No light non-aqueous phase liquid (LNAPL) was observed whilst sampling.

5. Conceptual hydrogeological model

The site is predominantly underlain by the Ashfield Group Shale and Laminite. The hydrogeology at the site can be characterised by the following:

- Ephemeral seepage or 'perched' groundwater, expected to occur within the fill, higher permeability layers within the natural soils (e.g., clayey sand), and along the top of rock, particularly following periods of rainfall or due to human influences such as stormwater runoff and irrigation. Some ephemeral seepage may also migrate through defects within the rock; and
- Groundwater sources at the subject site are considered to be from water flowing downslope through the laminite from areas of higher topography. These sources are expected to respond to climatic and weather variations, which would be expected to be reflected by natural fluctuations in groundwater levels.

It should be noted that groundwater levels are transient and can fluctuate over time due to seasonal and climatic factors.

It should also be noted that fractured zones (i.e., sheared zones, faulting and fragmented rock) have been encountered within the laminite at varying depths and may lead to zones of higher permeability rock than indicated by the permeability test results. Bore 103 encountered a sheared zone between the depth of 5 m and8 m but the screened zone of the well was situated below this layer and was unable to measure the permeability of this fractured zone. Notwithstanding this, the bedrock associated with the shear zone could be more open elsewhere than at this bore location which may lead to slightly increased groundwater flow.

6. Groundwater quality

The adopted groundwater site assessment criteria (SAC) were sourced from:

- NEPC *National Environment Protection (Assessment of Site Contamination) Measure 1999 (as amended 2013) [NEPM]* (NEPC, 2013), Health Screening Levels (HSL) Category A for clay at a depth of 4 to 8 m;
- ANZG *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZG, 2018). 99% Level of protection (LOP) for fresh water was adopted for bio accumulative contaminants and 95% LOP for non-bio accumulative contaminants ;
- NHMRC *Guidelines for Managing Risks In Recreational Water* (NHMRC, 2008);
- NHMRC, NRMMC *Australian Drinking Water Guidelines 6 2011, Version 3.2* (NHMRC, NRMMC, 2022); and
- ANZECC *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZECC, 2000).

All results were below the SAC, with the exception of:

- Nickel (12 mg/kg) in BH101 which exceeded the ANZG (2018) 95% LOP for freshwater aquatic ecosystems of 11 mg/kg; and
- Zinc in BH101 (9 mg/kg) and BD1/20240423 (10 mg/kg) which exceeded the ANZG (2018) 95% LOP for freshwater aquatic ecosystems of 8 mg/kg;

- Azinphos methyl was noted below the laboratory PQL but above the adopted criteria. This is not considered to be of concern given:
  - OPP were not recorded in the soil results and no potential source has been identified; and
  - concentrations for OPP in groundwater were generally low, with all concentrations below the laboratory PQL.

Based on our experience in the area, the concentrations of metals (i.e., typically copper, nickel, and zinc) in groundwater are considered likely to be attributed to the background concentrations that would be common in urban environments due to roadway run-off, stormwater and underground services and other diffuse urban impacts, and can often be regarded as background levels.

Given the generally low concentrations noted in the natural soil samples test, it is considered that the contamination in the soil has not vertically migrated into the groundwater beneath the site. Therefore, the groundwater at the site is not considered to pose an unacceptable risk in regard to the proposed development.

If any exceedances are detected before and during the course of dewatering, treatment prior to disposal may be required. Based on the current results, it is considered that the groundwater may be suitable for dewatering / discharge subject to the treatment of analytes that exceed disposal criteria and approval from the relevant authorities. It is expected that the treatment requirements for groundwater and any additional stormwater runoff can be achieved through conventional methods by the dewatering contractor.

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 2-dimensional (2D) numerical groundwater model was developed. The modelling was carried out using the 2D finite element hydrogeological software SEEP / W (a component of GeoStudio) developed by GEOSLOPE International Ltd. The transient conditions due to construction dewatering of the excavation were modelled in the analysis.

7.2 Model geometry and layers

A cross-section was selected across the proposed basement excavation. Its location is shown on Figure 2.

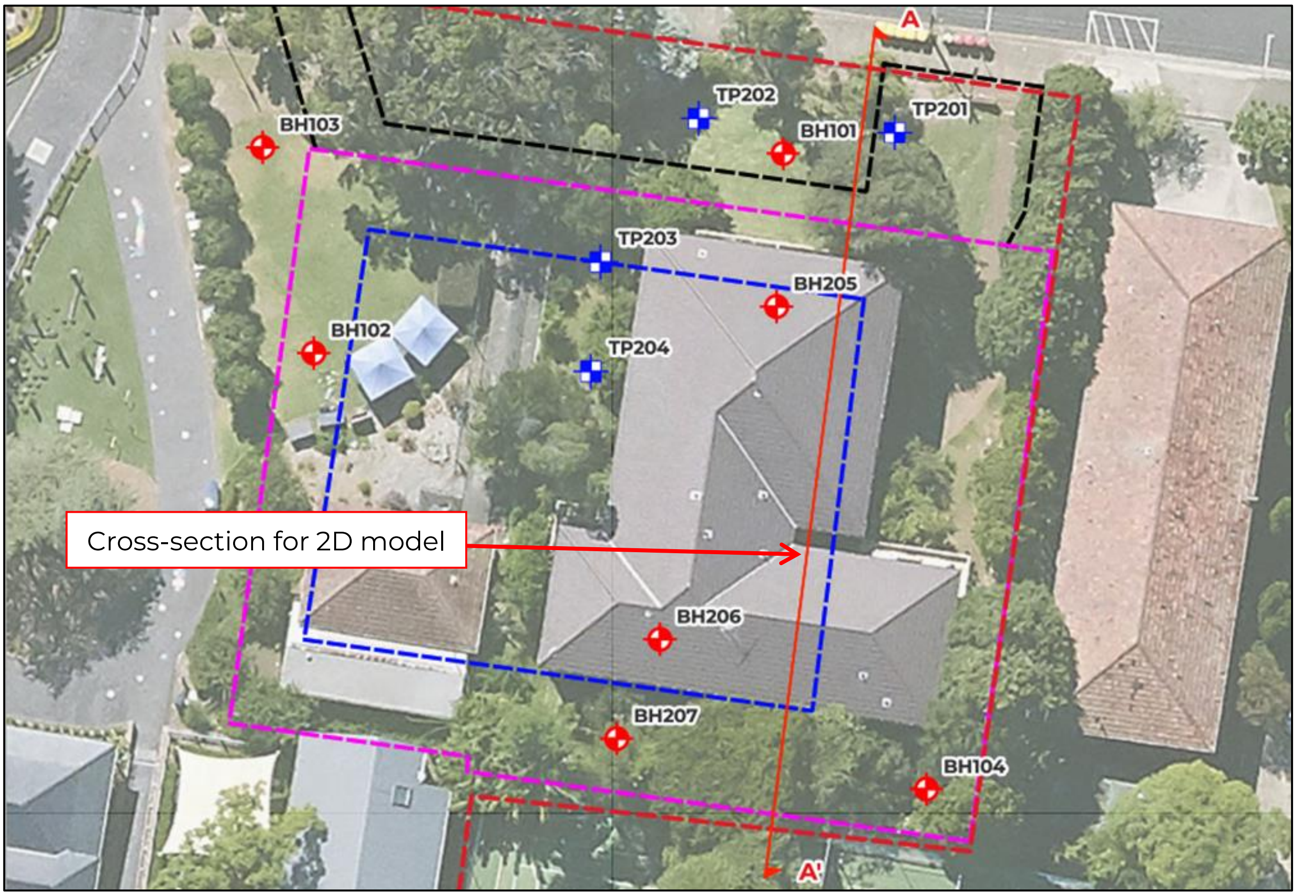

Figure 2: Cross-section for 2D modelling

The subsurface aquifer system surrounding and beneath the proposed development was simulated as a multi-layered numerical model, to represent the site subsurface conditions based on site investigation data and to allow simulation of the vertical flow components.

The hydrogeological units were simulated as two layers. Adopted hydraulic properties (base case) are presented in Table 4. Parameters were selected based on the results of the hydraulic conductivity testing (Section 4.3), ranges of values documented in the available literature for similar lithologies (e.g. Fetter 1994 and Hoek & Bray 1981) and previous experience with similar materials.

Table 4: Model layers and adopted hydraulic properties (base case)

Layer	Material	Saturated Kh (m/s)	Anisotropy ratio (Kv/Kh)	Effective porosity (%)	Material model adopted
1	Fill / Residual clay	1×10^{-7}	1.0	30	Unsaturated / saturated
2	Laminite	1.2×10^{-8}	1.0	10	Unsaturated / saturated

Notes to table:

Kh: Horizontal hydraulic conductivity

Kv: Vertical hydraulic conductivity

7.3 Initial groundwater elevation and boundary conditions

7.3.1 Initial groundwater elevation and boundary conditions

The model adopted an upstream constant head boundary at RL 23 AHD and a downstream constant head boundary at RL 11 m AHD. These boundary conditions were selected to replicate groundwater levels observed below the site.

As the proposed development is located within a residential setting with limited vegetated areas and clayey soil profile, a net rainfall infiltration rate of 1% was assigned as water influx over the ground surface.

Recharge could also possibly be occurring from anthropogenic sources, such as seepage from leaking water mains. Loss of water from the aquifer may be occurring due to extraction activities from nearby properties, together with natural discharge into water bodies. Water loss from the aquifer to the atmosphere through evapotranspiration (e.g., from vegetation at the surface, above the aquifer) is considered and combined with the effective recharge value adopted.

7.3.2 Basement design and dewatering

The proposed basement's exposed rock faces were simulated as 'Seepage Faces' in SEEP / W with zero hydraulic pressure head along the full height i.e. a drained basement. The subsoil drainage and the sump were simulated were simulated by a horizontal boundary condition of 'zero hydraulic pressure head'. The deepest proposed floor finished level (FFL) for the proposed excavation is approximately RL 14.7. Douglas has assumed the bulk excavation level will be RL 14.2. The model set-up is presented in Figure 3 below.

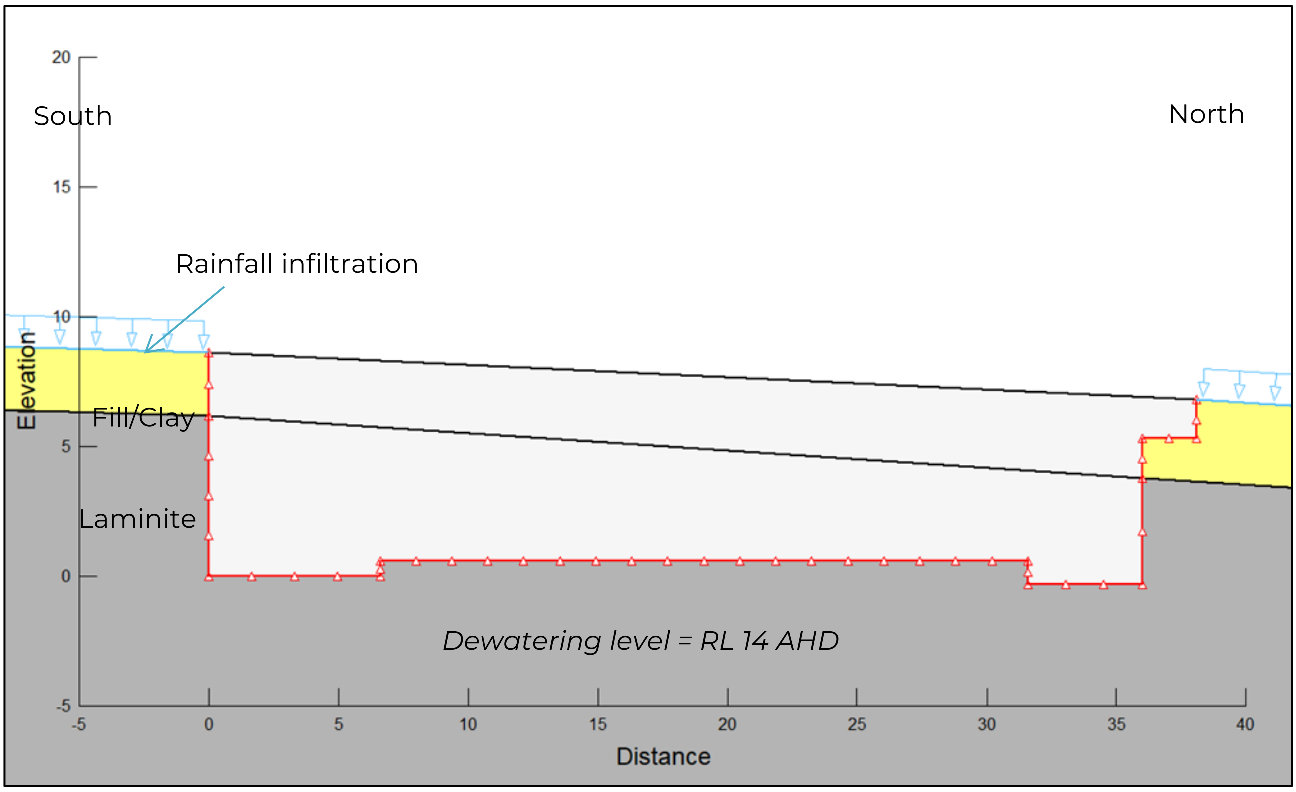

Figure 3: Model set-up

7.4 Simulation

To simulate the temporary dewatering required during construction, transient flow conditions were modelled in the analysis. For the purpose of the analysis, excavation was undertaken in a single stage (i.e., instantaneously) and the subsequent temporary dewatering period was assumed to be up to one year, subdivided into multiple time intervals.

The analysis was also run under 'steady state' conditions to assess long-term groundwater inflows (i.e., assuming permanent drained basement, after construction).

7.5 Sensitivity analyses

Two sensitivity analyses were run to assess groundwater inflows under higher hydraulic conductivity and higher groundwater level conditions:

- Sensitivity 1: The hydraulic conductivity of Layer 2 (i.e., Laminite as defined in the geotechnical model) was increased to 1.5×10^{-7} m/s; and
- Sensitivity 2: The water table is 1 m higher than under base case conditions.

7.6 Groundwater modelling results

7.6.1 Predicted groundwater inflow

The inflow rates obtained from the modelling represent the estimated total rate of groundwater flowing into the excavation and the volume (per unit time) requiring extraction via the dewatering system, in order to dewater the basement during and after construction.

The estimated inflows from the analysis for the first year (i.e., during construction) and long term are summarised in:

- Table 5, for the base case scenarios as detailed in previous sections; and
- Table 6, for the sensitivity analysis.

Table 5: Simulated inflow results for baseline cases

Elapsed time	Baseline case – predicted inflow	
	L/day	Cumulated (ML)
1 day	2,438	0.00
3 days	1,431	0.01
6 days	1,208	0.01
11 days	1,093	0.02
21 days	1,000	0.03
37 days	917	0.04
67 days	832	0.07
118 days	749	0.11
207 days	658	0.17
365 days	558	0.27
Long term	L/day	ML/year
	256	0.09

Table 6: Simulated long term inflow results for sensitivity cases

Long term inflow	Sensitivity – high k		Sensitivity – higher GWL	
	L/day	ML/year	L/day	ML/year
	1,466	0.54	334	0.12

Notes to table:

k: permeability

GWL: groundwater level

The results of the groundwater inflow analysis indicate that under both baseline and sensitivity hydrogeological conditions, inflows are predicted to be low. It is noted that the precision to which the results are presented does not represent the accuracy of the predictions, the level of precision is provided to allow comparison of scenarios, the accuracy will be lower because of the inherent variability in key parameters such as hydraulic conductivity and recharge and results could range up to an order of magnitude, in which instance the flows would still be well less than 3 ML/year.

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. Accordingly, it is recommended that a 'factor of safety' of at least 2 be applied to these values for design purposes and that inflow rates be monitored during excavation and construction.

It should be noted that the simulated dewatering rates and drawdown are dependent on the dewatering scheme adopted for the site, and construction and permeability of the wall, 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.

7.6.2 Drawdown

Based on the results of the geotechnical investigation, the groundwater drawdown is expected to occur mostly within the sandstone bedrock. Due to the stiffness of the rock, settlements on adjacent structures due to the drawdown in such rock would be expected to be negligible. Similarly, drawdown on any nearby GDEs would also be negligible.

8. Potential risks associated with dewatering

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 Risk assessment

An assessment of the potential effects of dewatering on neighbouring properties and groundwater receptors has been summarised in Table 7.

Table 7: Assessment of potential impacts of dewatering

Item	Comment
Impacts on potential GDEs	There are no potential GDEs mapped within 500 m of the site. Impacts are therefore considered unlikely.
Water supply losses by neighbouring groundwater users	A review of registered bores within a 500 m radius to the surrounding site was undertaken. The search identified no groundwater bores for domestic use (Section 3.5).
Potential subsidence of neighbouring structures	Groundwater drawdown is predicted to mostly occur within the rock units. Therefore, risk of subsidence due to lowering of the water table is expected to be negligible.
Mounding of water upgradient of structure	As the basement is proposed to be drained, mounding of groundwater is not expected upgradient of the site.

9. Recommended management strategy

A drained basement (i.e., non-hydrostatic) is considered suitable for this site due to the low inflows predicted, the site geology and the site topography. Drainage measures within the basement walls and below the basement slab will be required to collect and store water inflows for periodic discharge.

This section outlines the proposed management strategy based on the preferred methodology for dewatering and disposal.

9.1 Potential treatment requirements

Contaminants identified in the well samples potentially represent the typical contaminants that will require treatment prior to disposal. Treatment strategies for these contaminants include:

- **Solids removal**, relevant screening criteria: heavy metals, TSS / TDS, turbidity, pH, conductivity i.e., to remove suspended solids, and excessive dissolved solids occurring from surface water run-off / seepage from soils. This treatment step may also include additional pH adjustment / flocculation (and final pH adjustment) which may assist in treating typical slightly elevated metals concentrations seen in urban water environments. Solids removal may also generally assist in removing any insoluble contaminants associated with fill (e.g., PAH, metals).
- **Metals removal**, relevant screen criteria: heavy metals. Treatment of solids generally may remove the bulk of metals (i.e., where present in undissolved phase); and / or,

- **Minor Petroleum Impact / Oil and Grease**, relevant screening criteria: heavy metals, TRH, BTEX, oil and grease, VOC. Although not present in the recent test results, it may be possible that run-off / infiltration and / or impacts from construction activities may result in minor amounts of petroleum impacts in the accumulating water. Typical treatment steps may include a range of technologies (i.e., phase separation, chemical filters, etc.).

Any treatment system therefore may include, but not be limited to:

- Intermediate holding / buffer tank(s);
- Sediment tank(s);
- Chemical treatment units, with pH adjustment and coagulant / flocculant additives; and
- Filtration systems with media specific for removal of dissolved heavy metals and trace quantities of petroleum / VOCs.

9.2 Groundwater inflow control

Based on the inflow assessment (Section 7), seepage inflows are expected to be minor. These flows, both in the short and long term, should be readily controllable by pumping from sumps for discharge to the surrounding ground. Given the relatively low expected inflow volumes, standard subfloor drainage systems will be sufficient to direct the seepage water into the sumps. It should be noted that seepage may temporarily increase following high rainfall events.

Appropriate planning should be in place to monitor and compensate for possible variations in the actual inflow rate. If higher inflows are encountered, grouting may be required to reduce the inflows.

9.3 Water quality control

Seepage water quality must be tested prior to discharge to the receiving environment to prevent contamination and adverse impacts during and after construction.

The recommended methodology for water quality testing is as follows:

- Collection of water samples and quality control samples from seepage water stored in the sumps;
- Measurement of general groundwater physical parameters (EC, pH and temperature) prior to sampling using a calibrated water quality meter;
- Analysis of the samples at a NATA accredited laboratory for the analytes presented in Table 8 below; and
- Review and update of this water quality testing methodology as required.

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

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

Table 8: Proposed suite of analytes for water quality monitoring

Category	Analytes
Field parameters	T, EC, pH, turbidity
Physical properties	TDS, TSS
Major ions	Calcium, magnesium, sodium, potassium, chloride, sulphate and alkalinity (total, carbonate and bicarbonate)
Metals (total and dissolved)	Arsenic, aluminium, cadmium, chromium, copper, iron, mercury, manganese, nickel, lead and zinc
Nutrients	Total nitrogen, total Kjeldahl nitrogen, nitrite, nitrate, ammonia, total phosphorus and reactive phosphorus
Organics	TRH / TPH, BTEX, PAH, oil and grease
Other	E.coli and faecal coliforms

Notes to Table:

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

Water quality results should be compared to assessment criteria for each analyte. These assessment criteria would be selected based on the initial suite of groundwater quality results and relevant guidelines and Council requirements.

9.4 Proposed water quality discharge criteria

Based on the site setting and receiving water bodies, the discharge criterion, based on the following rationale is likely to apply (to be confirmed based on Council requirements / conditions):

- The 95% level of protection (LOP) for fresh water (ANZG, 2018); and
- ANZECC (2000) default trigger values for physical parameters (freshwater NSW lowland river systems).

The screening criteria are summarized in Table G1, in Appendix G.

9.5 Monitoring and reporting requirements

The following monitoring program and associated reporting is to be adopted during initial construction and will be undertaken during excavation and construction works on-site.

Table 9: Monitoring and reporting requirements

Item	Monitoring requirements	Methodology
Visual inspection	No visible oil and grease, 'sheen' and / or no significant discolouration or odours. Inspections to be conducted from stored liquids in the intermediate flocculation tank.	Daily inspections (contractor). **HOLD POINT - If any of the visual inspection signs are noted, then any discharge will be suspended until further analytical testing is completed**.
Groundwater level monitoring	Groundwater level recording to monitor drawdown in the vicinity of the site.	Continuous groundwater level monitoring using data logger recording at six-hourly intervals in monitoring wells in the vicinity of the site. Quarterly manual groundwater level measurements in monitoring wells.
Water quality sampling and testing	Samples to be collected from both the sumps analysed for identified potential contaminants and general water parameters set out in Table 8.	Two rounds of groundwater sampling and testing initially (i.e., prior to bulk excavation). The need the specific testing based on Table 8 may be reviewed after initial testing by the environmental consultant. Thereafter, sampling will be conducted before each discharge event. Sample analysis to be done at NATA accredited laboratories. Samples will be recorded using industry standard Chain of Custody (COC) documentation, including the date, name and signature of sampler, sample ID, and transportation records to the NATA accredited laboratory. **HOLD POINT – If seepage water concentrations exceed assessment criteria, then discharge is to be halted. Contingency strategy to be adopted.** Physical parameters (temperature, pH, turbidity and electrical conductivity, oil and grease) may be monitored using suitable on-site probes / testing kits once correlations are established with analytical results. Inclusion of results in a final water quality monitoring report.

Item	Monitoring requirements	Methodology
Quality control sampling	Collection of replicate samples to verify quality of laboratory results. Testing suite to include: • Metals (dissolved); • TRH; • BTEX; and • PAH	During each sampling event. Samples will be recorded using industry standard COC documentation, including the date, sample ID, name and signature of sampler, and transportation records to the NATA accredited laboratory. Inclusion of results in a final water quality monitoring report.
Quantity of groundwater inflows	Calibrated flowmeter connected to any pump-out system.	Continuous monitoring of pump-out volumes and recording of daily volumes. **HOLD POINT - If dewatering volumes exceed the predicted inflows, construction will be halted to minimise inflows (e.g., grouting of exposed drained basement faces).** Weekly reporting of volumes to the Environmental Consultant. Inclusion of results in a final water monitoring report.
Dewatering completion report	To be prepared by a suitably qualified consultant upon completion of all dewatering works. The summary report will incorporate the above information and: • Any on-site records kept by the contractor (e.g., visual observations, any unexpected finds records, etc.); • All analytical results (i.e., each batch of water disposed) compared to the adopted assessment criteria. • Quality control testing; • Record of dewatering volumes (i.e., for each discharge event); and • Comment on any unexpected finds or non-conformances, and / or otherwise if the dewatering works have complied with this DMP.	

Notes to table:

Testing frequency, assessment criteria and analysis requirements may be reviewed in consultation with the environmental consultant based on ongoing results.

9.6 Personnel and responsibilities

Table 10 below outlines the proposed project personnel and relevant responsibilities as part of the management plan.

Table 10: Nominated personnel and responsibilities

Role	Organisation	Responsibilities
Site Manager / Contractor	TBC	Routine visual inspection. Monitoring / recording of discharge volumes. Maintaining any unexpected / contingency records.
Dewatering Contractor	TBC	Design / specification and ongoing maintenance of the dewatering system.
Geotechnical Consultant	Douglas Partners – 02 9809 0666	Groundwater level monitoring and review of disposal volumes. Assist in preparation of the dewatering completion report.
Environmental Consultant	Douglas Partners – 02 9809 0666	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.

9.7 Contingency plan

As per Table 9 (Section 9.5), at any hold point, if any non-conformance is encountered then dewatering will be suspended. The following general contingency plan will be enacted:

- Should water quality be deemed unsuitable for disposal, suspend dewatering and treat water prior to discharge to the ground;
- Should dewatering volumes be higher than predicted, suspend construction, contact geotechnical consultant and determine if undertake grouting to reduce groundwater inflows is required;
- Notify the Site Manager / Contractor and Environmental Consultant;
- Environmental Consultant to inspect the site / unexpected finds and collect additional water quality samples as advised;
- Off-site tankering may be adopted to meet disposal requirements; and
- Written confirmation by the Environmental Consultant that disposal may resume (e.g., upon receipt of laboratory results).

10. Conclusion

The geotechnical investigation identified that the site is underlain by very low to low strength laminite to medium strength moderately weathered to fresh Laminite.

The proposed FFL of the basement is approximately at RL 14.7. Its excavation is therefore expected to intersect the water table.

Groundwater modelling undertaken for the project predicts that groundwater inflow rates during construction will be low (probably about 0.3 ML/year). It is estimated to be approximately 0.1 ML per year for a drained basement in the long term but potentially reaching flows of up to an equivalent of 0.5 ML per year at times. This prediction is an estimate based on the information available; actual flow rates may vary from these and will only be known once the excavation is complete and inflow rates can be measured.

Given that the predicted temporary and long-term inflow is less than 3 ML/year, and the purpose of dewatering is for construction and ongoing drainage, the proposed excavation is expected to be eligible for a Water Access Licence exemption, subject to the ongoing measurement and reporting required to claim the exemption.

From a geotechnical point of view, it is considered that drained basements are feasible without any significant impact to surrounding properties. In addition, the use of a drained basement is not considered likely to influence any GDEs or groundwater supply works in accordance with the AIP minimal impact considerations.

Construction of a drained basement will be subject to review and approval from Council and relevant authorities.

11. References

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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.

Hvorslev, M. J. (1951). *Time Lag and Soil Permeability in Groundwater Observations*. Bulleton No 36, Vicksburg, Mississippi: Waterways Experiment Station, Corps of Engineers, US Army.

LandCom. (2004). *Managing Urban Stormwater: Soils and Construction, Volume 1 ("Blue Book")*. 4th Edition, March 2004: LandCom, New South Wales Government.

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

Wilson, G. M. (1983). *Sydney 1:100,000 Geology Sheet*. NSW, Australia: NSW Department of Mines.

12. Limitations

Douglas Partners Pty Ltd (Douglas) has prepared this report for this project at 12-16 Margaret Street, Strathfield NSW in line with Douglas' proposal 204585.07.P.001.Rev2 dated 15 March 2024 and acceptance received from Kelsie Tuck of CTPG on behalf of Meriden School dated 19 March 2024. The work was carried out under Douglas' Engagement Terms. This report is provided for the exclusive use of Meriden School 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 and 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.

Appendix A

About this report

About this Report

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

This report is the property of Douglas Partners Pty Ltd. The report may only be used for the purpose for which it was commissioned and in accordance with the Engagement Terms for the commission supplied at the time of proposal. Unauthorised use of this report in any form whatsoever is prohibited.

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.

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	Prelim Draft	24.05.2024	MN

SCALE: 0 5 10 15 20 m — 1:400 @ A3

Douglas PARTNERS

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

CLIENT: **Meriden School**

NOTE:
1: Basemap from Metromap (Dated 25.03.2024)
2: Proposed outlines from Bates Smart Architects Pty Ltd, Project No. S12808, Drawing No's CONS03.002&3 Revision A (Dated 09.05.2024)

COORDINATE REFERENCE SYSTEM: GDA2020 / MGA zone 56

PROJECT NAME: **Proposed Aquatic Centre**

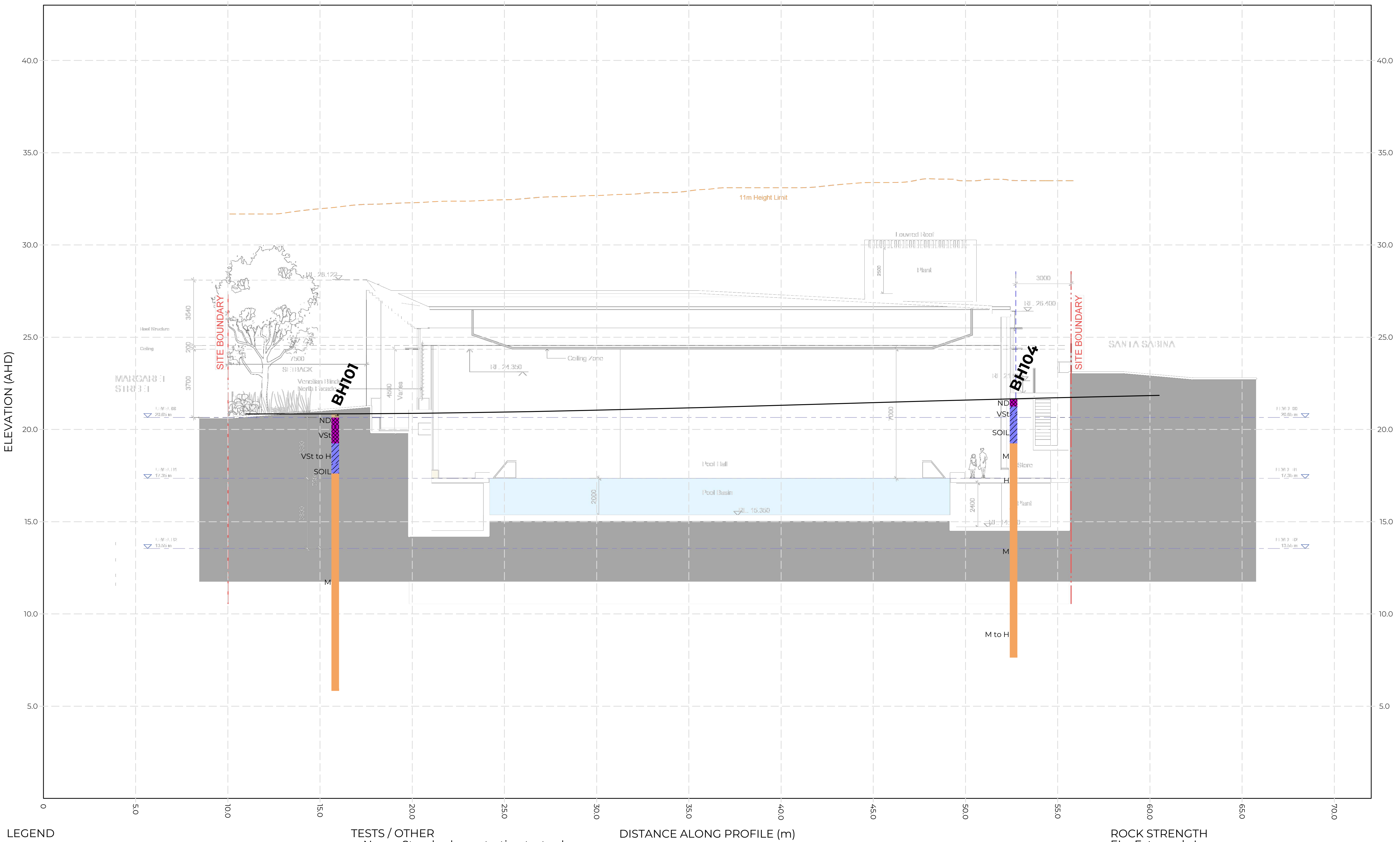
PROJECT ADRESS: **12-16 Margaret Street, Strathfield**

DRAWING TITLE: **TEST LOCATION PLAN**

PROJECT NO: **204585.07**

DRAWING NO: **1**

REVISION: **0**



LEGEND

- CI - Medium Plasticity CLAY
- CI-CH - Medium to High Plasticity CLAY
- FILL
- Laminite
- TOPSOIL

TESTS / OTHER

- N - Standard penetration test value
- — ? — — - Interpreted geotechnical boundary

ROCK STRENGTH

- EL - Extremely Low
- VL - Very Low
- L - Low
- M - Medium
- H - High

REV	DESCRIPTION/COMMENT	DATE	DRAWN BY
0	Prelim Draft	24.05.2024	MN/EC

SCALE: 0 — 4
Horizontal Scale 1:200 @A3
Vertical Exaggeration = 1.0

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

CLIENT:
Meriden School

NOTES
1. Subsurface conditions are accurate at the borehole locations only. Variations in subsurface conditions may occur between borehole locations. Interpreted strata boundaries are approximate and should be used as a guide only.
2. Summary logs only and should be read in conjunction with detailed logs.
3. Horizontal and vertical scales are not equal.
4. Base section drawing from Bates Smart Architects Pty Ltd, Project No. S12808, Drawing No. DA10.001 Revision C (Dated 30.09.2024)

PROJECT NAME:
Proposed Aquatic Centre

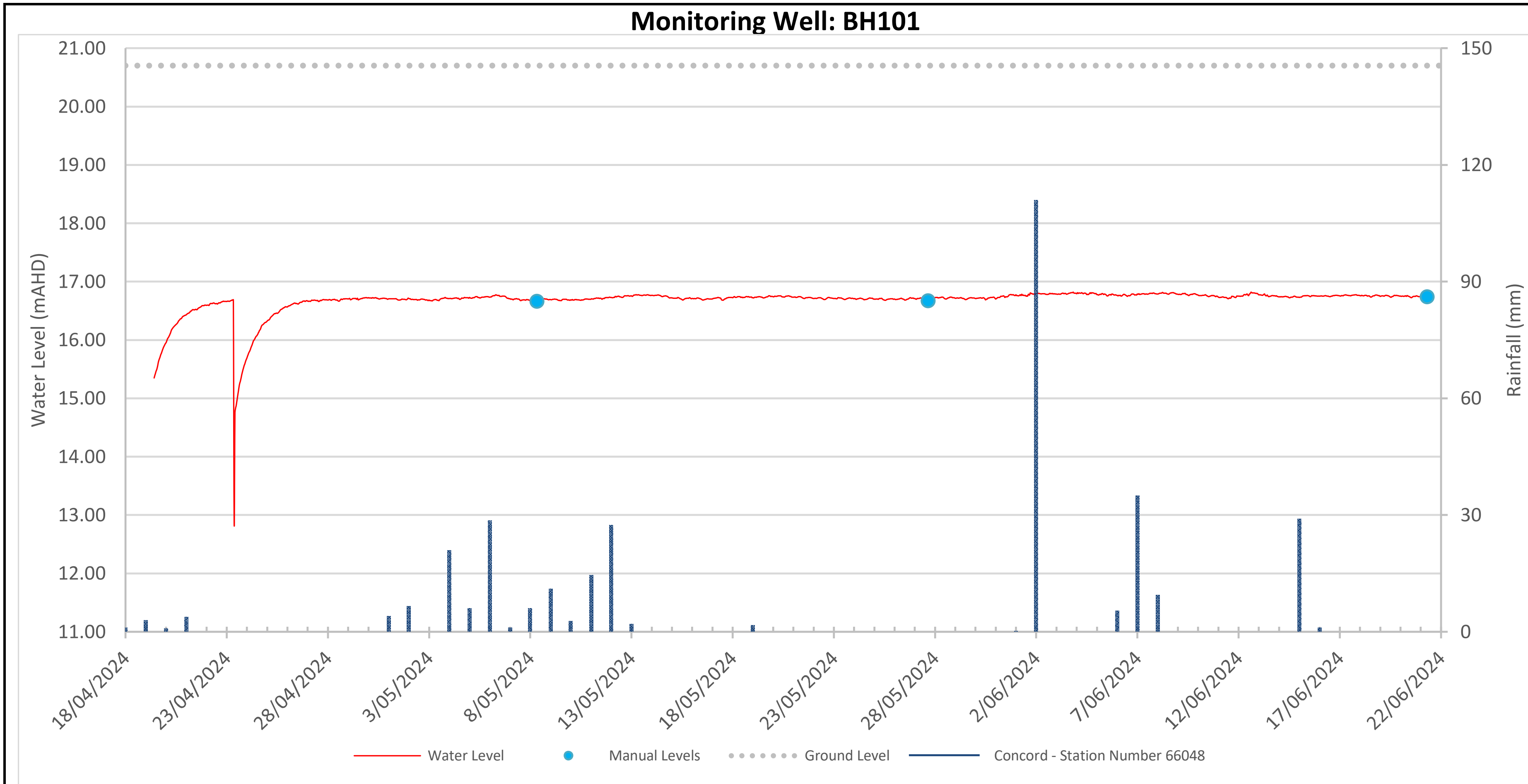
PROJECT ADDRESS:
12-16 Margaret Street, Strathfield

DRAWING TITLE:
GEOLOGICAL CROSS SECTION A-A'

PROJECT No: **204585.07**
DRAWING No: **2**
REVISION: **0**

Appendix C

Hydrographs

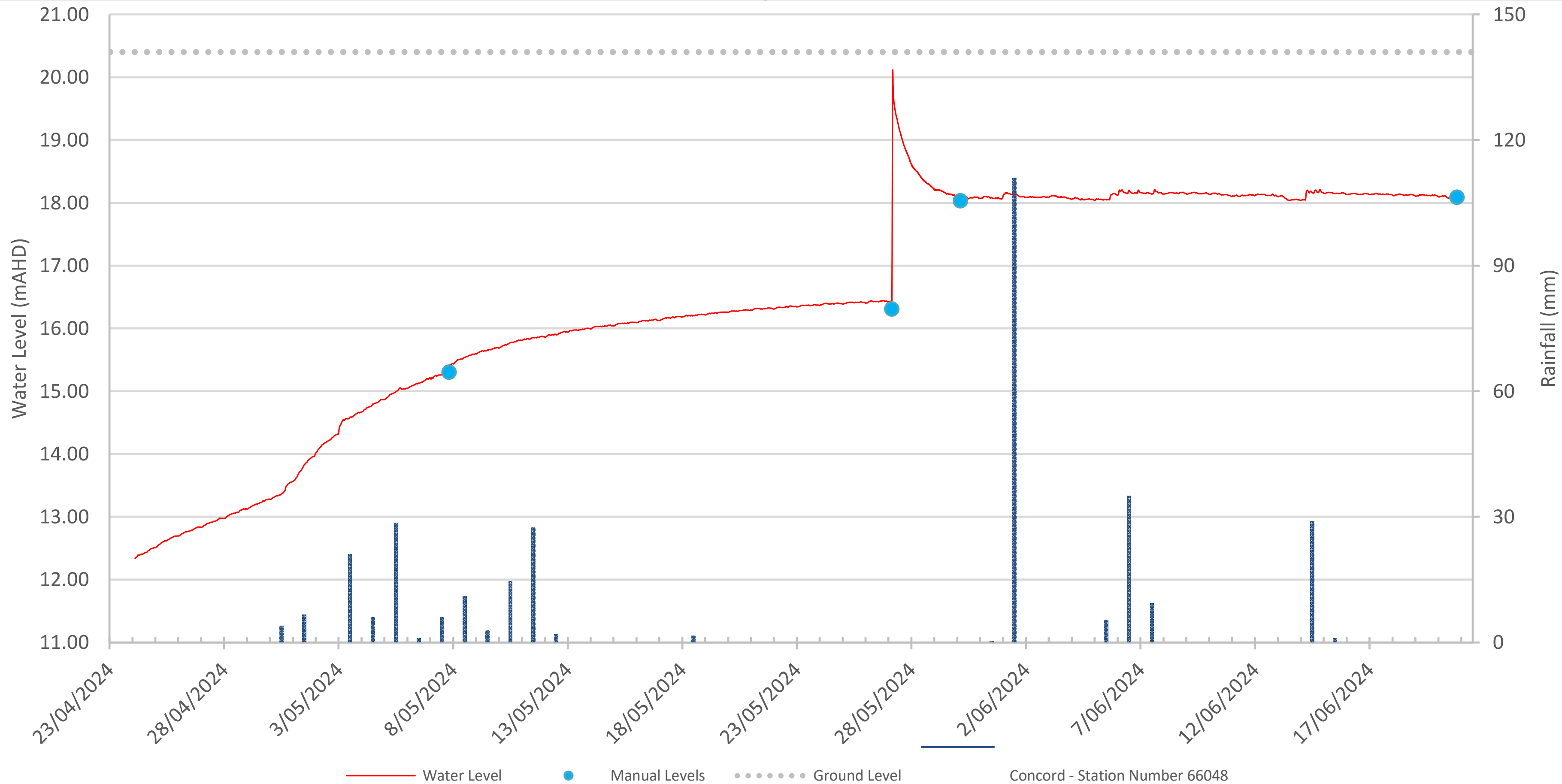


Note: Reading Interval = 10 minutes

Douglas PARTNERS

From	19/04/2024	Drawn:	JDB
To	21/06/2024	Date:	21/06/2024

Monitoring Well: BH102

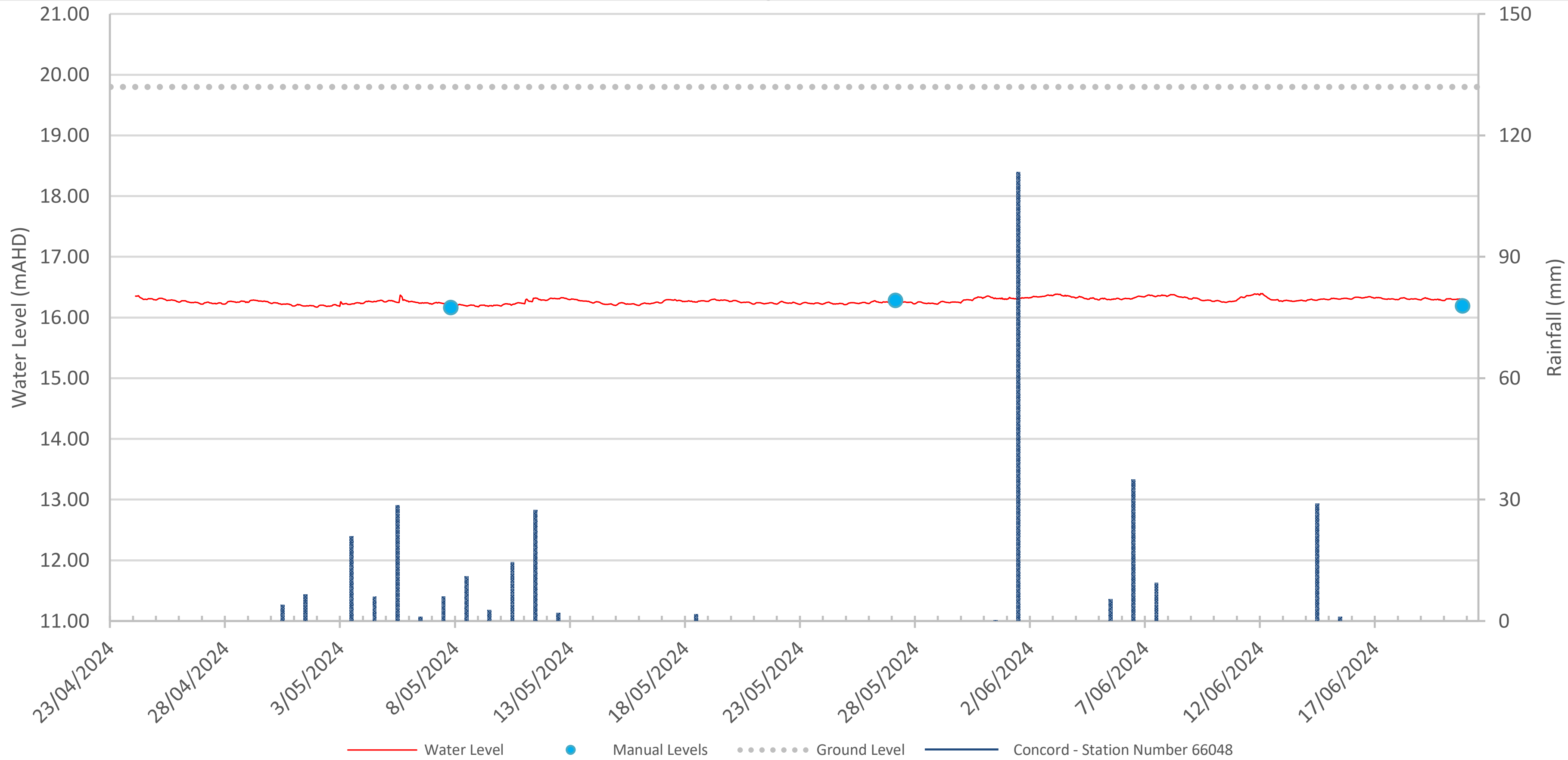


Note: Reading Interval = 10 minutes

Douglas PARTNERS

From	24/04/2024	**Drawn:**	JDB
To	21/06/2024	**Date:**	21/06/2024

Monitoring Well: BH103



Note: Reading Interval = 10 minutes

Douglas PARTNERS

From	24/04/2024	**Drawn:**	JDB
To	21/06/2024	**Date:**	21/06/2024

Appendix D

Hydraulic conductivity results

Permeability Testing - Falling Head Test Report

Client:	Meriden School	Project No:	204585.07
Project:	Proposed Aquatic Centre	Test date:	30-May-24
Location:	12-16 Magaret Street, Strathfield	Tested by:	JDB

Test Location

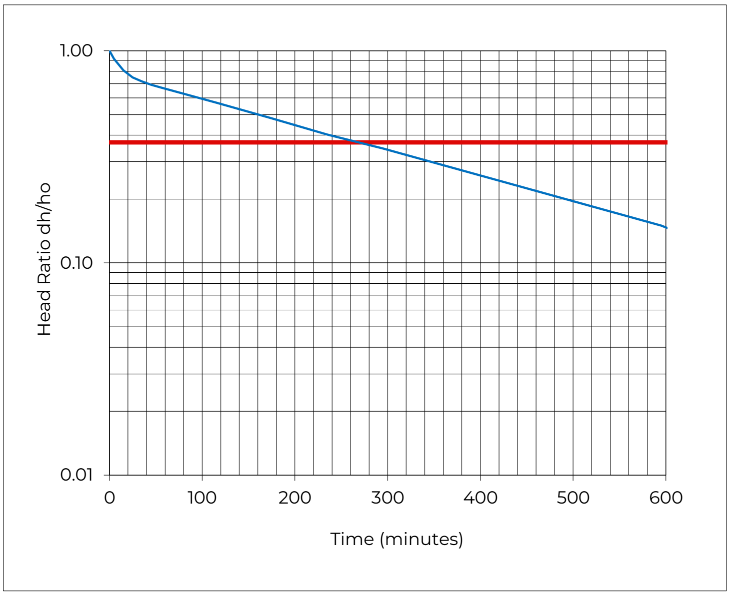
Description:	Standpipe in borehole	**Test No.**	BH102	
Material type:	Laminite	Easting:	323484.2	m
		Northing	6250098.2	m
		Surface Level:	20.4	m AHD

Details of Well Installation

Effective diameter (2re)	50	mm	Depth to water before test	4.1	m
borehole diameter (2R)	76	mm	Depth to water at start of test	0.00	m
Effective Length of well screen (Le)	4.78	m	Depth of top of gravel pack	5.00	m
			Depth of base of gravel pack	12.00	m

Test Results

Time (min)	Depth (m)	Change in Head dH (m)	dH/Ho
0.0	2.00	2.10	1.043
0	6.11	2.01	1.000
5	5.94	1.84	0.915
15	5.73	1.63	0.809
25	5.61	1.51	0.749
35	5.55	1.45	0.718
45	5.49	1.39	0.691
55	5.45	1.35	0.671
115	5.25	1.15	0.570
175	5.07	0.97	0.480
235	4.91	0.81	0.403
295	4.80	0.70	0.346
595	4.40	0.30	0.150
900	4.19	0.09	0.045



To = 250.0 mins
15000 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 =**	**2.1E-08**	m/sec
	=	**1.8E-03**	m/day

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ABN 75 053 980 117
www.douglaspartners.com.au

Permeability Testing - Rising Head Test Report

Client:	Meriden School	Project No:	204585.07
Project:	Proposed Aquatic Centre	Test date:	18-Apr-24
Location:	12-16 Magaret Street, Strathfield	Tested by:	YG

Test Location | **Test No.** BH101

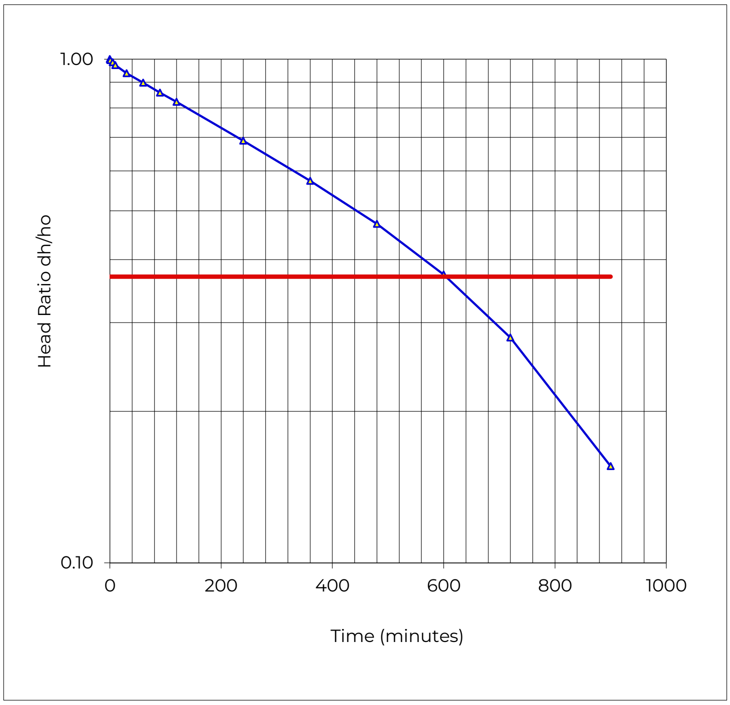
Description: Standpipe in borehole | Easting: 323512.4 m
Material type: Laminite | Northing 6250110.2 m
Surface Level: 20.7 m AHD

Details of Well Installation

Effective diameter (2re)	50	mm
borehole diameter (2R)	76	mm
Effective Length of well screen (Le)	6	m
Depth to water before test	5.25	m
Depth to water at start of test	7.50	m
Depth of top of gravel pack	5.00	m
Depth of base of gravel pack	12.00	m

Test Results

Time (min)	Depth (m)	Change in Head dH (m)	dH/Ho
0.0	7.5	2.25	1.000
1.0	7.49	2.24	0.996
5.0	7.47	2.22	0.987
10.0	7.44	2.19	0.973
30.0	7.36	2.11	0.938
60.0	7.27	2.02	0.898
90.0	7.18	1.93	0.858
120.0	7.10	1.85	0.822
240.0	6.80	1.55	0.689
360.0	6.54	1.29	0.573
480.0	6.31	1.06	0.471
600.0	6.09	0.84	0.373
720.0	5.88	0.63	0.280
900.0	5.60	0.35	0.156



To = 600.0 mins
36000 secs

Theory: Falling Head Permeability calculated using equation by Hvorslev

k = [r² 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 = **7.3E-09** m/sec
= **6.3E-04** m/day

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ABN 75 053 980 117
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Permeability Testing - Rising Head Test Report

Client:	Meriden School	Project No:	204585.07
Project:	Proposed Aquatic Centre	Test date:	18-Apr-24
Location:	12-16 Magaret Street, Strathfield	Tested by:	YG

Test Location

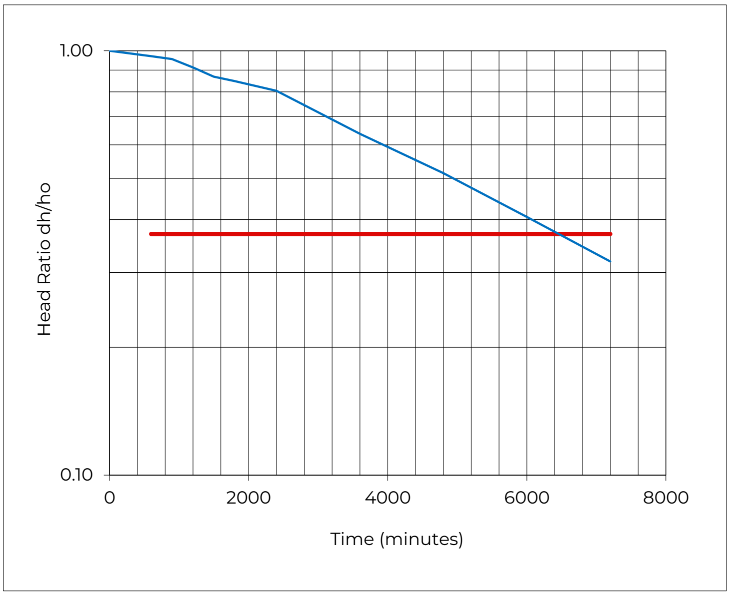
Description:	Standpipe in borehole	Test No.	BH102	
Material type:	Laminite	Easting:	323484.2	m
		Northing	6250098.2	m
		Surface Level:	20.4	m AHD

Details of Well Installation

Effective diameter (2re)	50	mm	Depth to water before test	7.22	m
borehole diameter (2R)	76	mm	Depth to water at start of test	8.60	m
Effective Length of well screen (Le)	4.78	m	Depth of top of gravel pack	5.00	m
			Depth of base of gravel pack	12.00	m

Test Results

Time (min)	Depth (m)	Change in Head dH (m)	dH/Ho
0.0	8.60	1.38	1.000
600	8.56	1.34	0.971
900	8.54	1.32	0.957
1200	8.48	1.26	0.913
1500	8.42	1.20	0.870
1800	8.39	1.17	0.848
2400	8.33	1.11	0.804
3600	8.10	0.88	0.638
4800	7.93	0.71	0.514
6000	7.78	0.56	0.406
7200	7.66	0.44	0.319



To = 6400.0 mins
4E+05 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 =**	**8.2E-10**	m/sec
	=	**7.1E-05**	m/day

Douglas Partners Pty Ltd
ABN 75 053 980 117
www.douglaspartners.com.au

Permeability Testing - Rising Head Test Report

Client:	Meriden School	Project No:	204585.07
Project:	Proposed Aquatic Centre	Test date:	19-Apr-24
Location:	12-16 Magaret Street, Strathfield	Tested by:	YG

Test Location | **Test No.** BH103

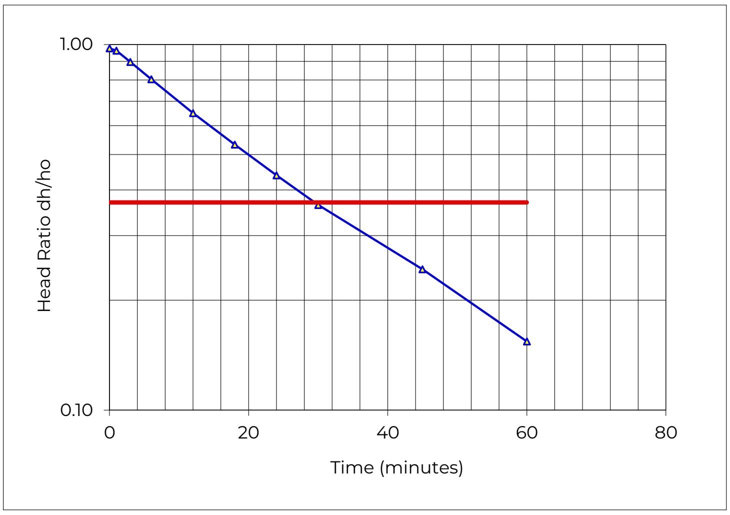
Description:	Standpipe in borehole	Easting:	323481.2	m
Material type:	Laminite	Northing	6250110.6	m
		Surface Level:	19.8	m AHD

Details of Well Installation

Effective diameter (2re)	50	mm	Depth to water before test	3.26	m
borehole diameter (2R)	76	mm	Depth to water at start of test	5.40	m
Effective Length of well screen (Le)	6	m	Depth of top of gravel pack	7.50	m
			Depth of base of gravel pack	15.00	m

Test Results

Time (min)	Depth (m)	Change in Head dH (m)	dH/Ho
0.0	5.35	2.09	0.977
1.0	5.32	2.06	0.963
3.0	5.18	1.92	0.897
6.0	4.98	1.72	0.804
12.0	4.65	1.39	0.650
18.0	4.40	1.14	0.533
24.0	4.20	0.94	0.439
30.0	4.04	0.78	0.364
45.0	3.78	0.52	0.243
60.0	3.59	0.33	0.154



To = 29.0 mins
1740 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 = 1.5E-07** m/sec
= 1.3E-02 m/day

Appendix E

Summary of laboratory results for water analysis

Douglas PARTNERS

Table E1: Summary of Laboratory Results – TRH, BTEX, PAH, OCP, OPP, PCB

				NHMRC (2018) ADWG Health	ANZG (2018) 95% LOP	NEPC (2013) HSL 4-8m	NHMRC (2012) Recreation		
Sample ID								BH101	BD1/20240423
Sample Date		PQL	Units					23/04/24	23/04/24
Metals - Dissolved	Total Arsenic	1	µg/L	10	13		100	**7**	**6**
	Cadmium	0.1	µg/L	2	0.2		20	<0.1	<0.1
	Total Chromium	1	µg/L		1			<1	<1
	Copper	1	µg/L	2,000	1.4		20,000	**1**	<1
	Lead	1	µg/L	10	3.4		100	<1	<1
	Mercury (inorganic)	0.05	µg/L	1	0.06		10	<0.05	<0.05
	Nickel	1	µg/L	20	11		200	**12**	**11**
	Zinc	1	µg/L		8			**9**	**10**
TRH	F1 ((C6-C10)-BTEX)	10	µg/L			NL		<10	-
	F2 (>C10-C16 less Naphthalene)	50	µg/L			NL		<50	-
	F3 (>C16-C34)	100	µg/L					<100	-
	F4 (>C34-C40)	100	µg/L					<100	-
BTEX	Benzene	1	µg/L	1	950	NL	10	<1	-
	Toluene	1	µg/L	800	180	NL	8,000	<1	-
	Ethylbenzene	1	µg/L	300	80	NL	3,000	<1	-
	o-Xylene	1	µg/L		350			<1	-
	m+p-Xylene	2	µg/L		75			<2	-
	Total Xylenes	1	µg/L	600		NL	6,000	<1	-
PAH	Acenaphthene	0.01	µg/L					<0.01	<0.01
	Acenaphthylene	0.01	µg/L					<0.01	<0.01
	Anthracene	0.01	µg/L		0.01			<0.01	<0.01
	Benzo(a)anthracene	0.01	µg/L					<0.01	<0.05
	Naphthalene	1	µg/L		16	NL		<1	<0.02
	Benzo(a)pyrene (B(a)P)	0.01	µg/L	0.01	0.1		0.1	<0.01	<0.01
	Benzo(b,j+k)fluoranthene	0.02	µg/L					<0.02	<0.02
	Benzo(g,h,i)perylene	0.01	µg/L					<0.01	<0.01
	Chrysene	0.01	µg/L					<0.01	<0.05
	Dibenzo(a,h)anthracene	0.01	µg/L					<0.01	<0.01
	Fluoranthene	0.01	µg/L		1			<0.01	<0.01
	Fluorene	0.01	µg/L					<0.01	**0.02**
	Indeno(1,2,3-c,d)pyrene	0.01	µg/L					<0.01	<0.01
	Phenanthrene	0.01	µg/L		0.6			<0.01	**0.04**
	Pyrene	0.01	µg/L					<0.01	<0.01
	Sum of detected PAH	0.01	µg/L					<0.01	**0.06**
OCP	DDE	0.001	µg/L					<0.001	-
	DDT	0.001	µg/L	9	0.006		90	<0.001	-
	DDD	0.001	µg/L					<0.001	-
	Aldrin	0.001	µg/L		0.001			<0.001	-
	Dieldrin	0.001	µg/L		0.01			<0.001	-
	Aldrin + Dieldrin (calculated)	0.001	µg/L	0.3			3	<0.001	-
	alpha-chlordane	0.001	µg/L					<0.001	-
	gamma-Chlordane	0.001	µg/L					<0.001	-
	Endosulfan I	0.002	µg/L					<0.002	-
	Endosulfan II	0.002	µg/L					<0.002	-
	Endosulfan Sulphate	0.001	µg/L					<0.001	-
	Endrin	0.001	µg/L		0.01			<0.001	-
	Endrin Aldehyde	0.001	µg/L					<0.001	-
	Heptachlor	0.001	µg/L	0.3	0.01		3	<0.001	-
	Heptachlor Epoxide	0.001	µg/L					<0.001	-
	Hexachlorobenzene	0.001	µg/L		0.1			<0.001	-
	Methoxychlor	0.001	µg/L		0.005			<0.001	-
	alpha-BHC	0.001	µg/L					<0.001	-
	beta-BHC	0.001	µg/L					<0.001	-
	delta-BHC	0.001	µg/L					<0.001	-
	Lindane	0.001	µg/L	10	0.2		100	<0.001	-
	Sum of detected OCP	0.001	µg/L					<0.001	-

OPP	Azinphos methyl (Guthion)	0.2	µg/L	30	0.02		300	<0.2	-
	Bromophos-ethyl	0.05	µg/L	10			100	<0.05	-
	Chlorpyriphos	0.009	µg/L	10	0.00004		100	<0.009	-
	Chlorpyriphos-methyl	0.05	µg/L					<0.05	-
	Diazinon	0.01	µg/L	4	0.01		40	<0.01	-
	Dichlorvos	0.05	µg/L	5			50	<0.05	-
	Dimethoate	0.1	µg/L	7	0.15		70	<0.1	-
	Ethion	0.05	µg/L	4			40	<0.05	-
	Ronnel (fenchlorphos)	0.05	µg/L					<0.05	-
	Fenitrothion	0.05	µg/L	7	0.2		70	<0.05	-
	Fenthion	0.05	µg/L	7			70	<0.05	-
	Malathion	0.05	µg/L	70	0.05		700	<0.05	-
	Parathion	0.004	µg/L	20	0.004		200	<0.004	-
	Parathion-methyl	0.05	µg/L	0.7			7	<0.05	-
	Methidathion	0.05	µg/L	6			60	<0.05	-
	Fenamiphos	0.05	µg/L	0.5			5	<0.05	-
	Sum of detected OPP	0.004	µg/L					<0.004	-
PCB	Arochlor 1016	0.01	µg/L					<0.01	-
	Arochlor 1221	0.01	µg/L					<0.01	-
	Arochlor 1232	0.01	µg/L					<0.01	-
	Arochlor 1242	0.01	µg/L		0.3			<0.01	-
	Arochlor 1248	0.01	µg/L					<0.01	-
	Arochlor 1254	0.01	µg/L		0.01			<0.01	-
	Aroclor 1260	0.01	µg/L					<0.01	-
	Sum of detected PCB	0.01	µg/L					<0.01	-

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

Shaded cell is exceedance of guideline value

Where one or more guideline value is exceeded, the cell is shaded to the colour of the highest guideline value exceeded

NEPC (2013) National Environment Protection (Assessment of Site Contamination) Measure 1999 (as amended 2013), health screening level Clay 4-8m

ANZG (2018) Australian and New Zealand Guidelines for Fresh and Marine Water Quality, 95% level of protection of species for Fresh aquatic ecosystems [NB: 99% level of protection adopted for bioaccumulative chemicals]

NHMRC (2018) Australian Drinking Water Guidelines 6 2011, drinking water aesthetic-based criteria

NHMRC (2008) Guidelines for Managing Risk in Recreational Water

ANZG (2018) Australian and New Zealand Guidelines for Fresh and Marine Water Quality, orange text is 'unknown' level of protection

Underlining of ANZG (2018) criteria indicates a criteria with an 'unknown' level of protection.

ANZG (2018) DGV adopted for most conservative species of following analytes: DGV for xylene (m) adopted for xylene (m+p); DGV for CrVI adopted for total chromium; DGV for AsV adopted for total arsenic

ANZG (2018) DGV adopted for aluminium in freshwater is for receiving waters with pH >6.5. For receiving waters with pH <6.5 suitability of the more conservative, low reliability DGV of unknown LOP should be considered

ANZG (2018) Ammonia DGV is pH and temperature dependant. DGV for a pH of 8 provided in table.

Appendix F

Laboratory test results

Envirolab Services Pty Ltd
ABN 37 112 535 645
12 Ashley St Chatswood NSW 2067
ph 02 9910 6200   fax 02 9910 6201
customerservice@envirolab.com.au
www.envirolab.com.au

CERTIFICATE OF ANALYSIS 350131

Client Details

Client	Douglas Partners Pty Ltd
Attention	Joel James-Hall
Address	96 Hermitage Rd, West Ryde, NSW, 2114

Sample Details

Your Reference	**204585.08 Strathfield**
Number of Samples	4 Water
Date samples received	30/04/2024
Date completed instructions received	30/04/2024

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	07/05/2024
Date of Issue	07/05/2024

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Results Approved By
Diego Bigolin, Inorganics Supervisor
Dragana Tomas, Senior Chemist
Liam Timmins, Organics Supervisor
Loren Bardwell, Development Chemist
Timothy Toll, Senior Chemist

Authorised By
Nancy Zhang, Laboratory Manager

vTRH(C6-C10)/BTEXN in Water				
Our Reference		350131-1	350131-3	350131-4
Your Reference	UNITS	BH101	TS	TB
Date Sampled		23/04/2024	23/04/2024	23/04/2024
Type of sample		Water	Water	Water
Date extracted	-	06/05/2024	06/05/2024	06/05/2024
Date analysed	-	07/05/2024	07/05/2024	07/05/2024
TRH C_6 - C_9	µg/L	<10	[NA]	[NA]
TRH C_6 - C_{10}	µg/L	<10	[NA]	[NA]
TRH C_6 - C_{10} less BTEX (F1)	µg/L	<10	[NA]	[NA]
Benzene	µg/L	<1	105%	<1
Toluene	µg/L	<1	106%	<1
Ethylbenzene	µg/L	<1	115%	<1
m+p-xylene	µg/L	<2	106%	<2
o-xylene	µg/L	<1	106%	<1
Naphthalene	µg/L	<1	[NA]	[NA]
Surrogate Dibromofluoromethane	%	100	101	99
Surrogate Toluene-d8	%	101	101	100
Surrogate 4-Bromofluorobenzene	%	98	100	99

svTRH (C10-C40) in Water		
Our Reference		350131-1
Your Reference	UNITS	BH101
Date Sampled		23/04/2024
Type of sample		Water
Date extracted	-	03/05/2024
Date analysed	-	04/05/2024
TRH C_{10} - C_{14}	µg/L	<50
TRH C_{15} - C_{28}	µg/L	<100
TRH C_{29} - C_{36}	µg/L	<100
Total +ve TRH (C10-C36)	µg/L	<50
TRH >C_{10} - C_{16}	µg/L	<50
TRH >C_{10} - C_{16} less Naphthalene (F2)	µg/L	<50
TRH >C_{16} - C_{34}	µg/L	<100
TRH >C_{34} - C_{40}	µg/L	<100
Total +ve TRH (>C10-C40)	µg/L	<50
Surrogate o-Terphenyl	%	84

PAHs in Water - Trace Level			
Our Reference		350131-1	350131-2
Your Reference	UNITS	BH101	BD1/20240423
Date Sampled		23/04/2024	23/04/2024
Type of sample		Water	Water
Date extracted	-	03/05/2024	03/05/2024
Date analysed	-	06/05/2024	06/05/2024
Naphthalene	µg/L	<0.02	<0.02
Acenaphthylene	µg/L	<0.01	<0.01
Acenaphthene	µg/L	<0.01	<0.01
Fluorene	µg/L	<0.01	0.02
Phenanthrene	µg/L	<0.01	0.04
Anthracene	µg/L	<0.01	<0.01
Fluoranthene	µg/L	<0.01	<0.01
Pyrene	µg/L	<0.01	<0.01
Benzo(a)anthracene	µg/L	<0.01	<0.05
Chrysene	µg/L	<0.01	<0.05
Benzo(b,j+k)fluoranthene	µg/L	<0.02	<0.02
Benzo(a)pyrene	µg/L	<0.01	<0.01
Dibenzo(a,h)anthracene	µg/L	<0.01	<0.01
Indeno(1,2,3-c,d)pyrene	µg/L	<0.01	<0.01
Benzo(g,h,i)perylene	µg/L	<0.01	<0.01
Benzo(a)pyrene TEQ	µg/L	<0.05	<0.05
Total +ve PAH's	µg/L	NIL (+)VE	0.060
Surrogate p-Terphenyl-d14	%	89	85

OCPs in Water - Trace Level		
Our Reference		350131-1
Your Reference	UNITS	BH101
Date Sampled		23/04/2024
Type of sample		Water
Date extracted	-	03/05/2024
Date analysed	-	06/05/2024
alpha-BHC	µg/L	<0.001
HCB	µg/L	<0.001
beta-BHC	µg/L	<0.001
gamma-BHC	µg/L	<0.001
Heptachlor	µg/L	<0.001
delta-BHC	µg/L	<0.001
Aldrin	µg/L	<0.001
Heptachlor Epoxide	µg/L	<0.001
gamma-Chlordane	µg/L	<0.001
alpha-Chlordane	µg/L	<0.001
Endosulfan I	µg/L	<0.002
pp-DDE	µg/L	<0.001
Dieldrin	µg/L	<0.001
Endrin	µg/L	<0.001
Endosulfan II	µg/L	<0.002
pp-DDD	µg/L	<0.001
Endrin Aldehyde	µg/L	<0.001
pp-DDT	µg/L	<0.001
Endosulfan Sulphate	µg/L	<0.001
Methoxychlor	µg/L	<0.001
Surrogate 4-Chloro-3-NBTF	%	69

OP in water LL ANZECCF/ADWG		
Our Reference		350131-1
Your Reference	UNITS	BH101
Date Sampled		23/04/2024
Type of sample		Water
Date extracted	-	03/05/2024
Date analysed	-	06/05/2024
Dichlorvos	µg/L	<0.05
Mevinphos	µg/L	<0.05
Phorate	µg/L	<0.05
Dimethoate	µg/L	<0.1
Diazinon	µg/L	<0.01
Disulfoton	µg/L	<0.05
Chlorpyriphos-methyl	µg/L	<0.05
Parathion-Methyl	µg/L	<0.05
Ronnel	µg/L	<0.05
Fenitrothion	µg/L	<0.05
Malathion	µg/L	<0.05
Chlorpyriphos	µg/L	<0.009
Fenthion	µg/L	<0.05
Parathion	µg/L	<0.004
Bromophos ethyl	µg/L	<0.05
Methidathion	µg/L	<0.05
Fenamiphos	µg/L	<0.05
Ethion	µg/L	<0.05
Phosalone	µg/L	<0.05
Azinphos-methyl (Guthion)	µg/L	<0.2
Coumaphos	µg/L	<0.05
Surrogate 4-Chloro-3-NBTF	%	69

PCBs in Water - Trace Level		
Our Reference		350131-1
Your Reference	UNITS	BH101
Date Sampled		23/04/2024
Type of sample		Water
Date extracted	-	03/05/2024
Date analysed	-	06/05/2024
Aroclor 1016	µg/L	<0.01
Aroclor 1221	µg/L	<0.01
Aroclor 1232	µg/L	<0.01
Aroclor 1242	µg/L	<0.01
Aroclor 1248	µg/L	<0.01
Aroclor 1254	µg/L	<0.01
Aroclor 1260	µg/L	<0.01
Surrogate TCMX	%	80

Total Phenolics in Water		
Our Reference		350131-1
Your Reference	UNITS	BH101
Date Sampled		23/04/2024
Type of sample		Water
Date extracted	-	03/05/2024
Date analysed	-	03/05/2024
Total Phenolics (as Phenol)	mg/L	<0.05

HM in water - dissolved			
Our Reference		350131-1	350131-2
Your Reference	UNITS	BH101	BD1/20240423
Date Sampled		23/04/2024	23/04/2024
Type of sample		Water	Water
Date prepared	-	02/05/2024	02/05/2024
Date analysed	-	02/05/2024	02/05/2024
Arsenic-Dissolved	µg/L	7	6
Cadmium-Dissolved	µg/L	<0.1	<0.1
Chromium-Dissolved	µg/L	<1	<1
Copper-Dissolved	µg/L	1	<1
Lead-Dissolved	µg/L	<1	<1
Mercury-Dissolved	µg/L	<0.05	<0.05
Nickel-Dissolved	µg/L	12	11
Zinc-Dissolved	µg/L	9	10

Method ID	Methodology Summary
Inorg-031	Total Phenolics by segmented flow analyser (in line distillation with colourimetric finish). Solids are extracted in a caustic media prior to analysis.
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.
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.
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.

QUALITY CONTROL: vTRH(C6-C10)/BTEXN in Water					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W3	[NT]
Date extracted	-			06/05/2024	[NT]	[NT]	[NT]	[NT]	06/05/2024	[NT]
Date analysed	-			07/05/2024	[NT]	[NT]	[NT]	[NT]	07/05/2024	[NT]
TRH C_6 - C_9	µg/L	10	Org-023	<10	[NT]	[NT]	[NT]	[NT]	95	[NT]
TRH C_6 - C_{10}	µg/L	10	Org-023	<10	[NT]	[NT]	[NT]	[NT]	95	[NT]
Benzene	µg/L	1	Org-023	<1	[NT]	[NT]	[NT]	[NT]	96	[NT]
Toluene	µg/L	1	Org-023	<1	[NT]	[NT]	[NT]	[NT]	94	[NT]
Ethylbenzene	µg/L	1	Org-023	<1	[NT]	[NT]	[NT]	[NT]	97	[NT]
m+p-xylene	µg/L	2	Org-023	<2	[NT]	[NT]	[NT]	[NT]	94	[NT]
o-xylene	µg/L	1	Org-023	<1	[NT]	[NT]	[NT]	[NT]	93	[NT]
Naphthalene	µg/L	1	Org-023	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Surrogate Dibromofluoromethane	%		Org-023	107	[NT]	[NT]	[NT]	[NT]	100	[NT]
Surrogate Toluene-d8	%		Org-023	99	[NT]	[NT]	[NT]	[NT]	100	[NT]
Surrogate 4-Bromofluorobenzene	%		Org-023	101	[NT]	[NT]	[NT]	[NT]	102	[NT]

QUALITY CONTROL: svTRH (C10-C40) in Water					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W2	[NT]
Date extracted	-			03/05/2024	[NT]	[NT]	[NT]	[NT]	03/05/2024	[NT]
Date analysed	-			04/05/2024	[NT]	[NT]	[NT]	[NT]	04/05/2024	[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]	112	[NT]
TRH C_{29} - C_{36}	µg/L	100	Org-020	<100	[NT]	[NT]	[NT]	[NT]	114	[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]	112	[NT]
TRH >C_{34} - C_{40}	µg/L	100	Org-020	<100	[NT]	[NT]	[NT]	[NT]	114	[NT]
Surrogate o-Terphenyl	%		Org-020	93	[NT]	[NT]	[NT]	[NT]	105	[NT]

QUALITY CONTROL: PAHs in Water - Trace Level					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W2	[NT]
Date extracted	-			03/05/2024	[NT]	[NT]	[NT]	[NT]	03/05/2024	[NT]
Date analysed	-			06/05/2024	[NT]	[NT]	[NT]	[NT]	06/05/2024	[NT]
Naphthalene	µg/L	0.02	Org-022/025	[NT]	[NT]	[NT]	[NT]	[NT]	98	[NT]
Acenaphthene	µg/L	0.01	Org-022/025	[NT]	[NT]	[NT]	[NT]	[NT]	96	[NT]
Fluorene	µg/L	0.01	Org-022/025	[NT]	[NT]	[NT]	[NT]	[NT]	98	[NT]
Phenanthrene	µg/L	0.01	Org-022/025	[NT]	[NT]	[NT]	[NT]	[NT]	89	[NT]
Fluoranthene	µg/L	0.01	Org-022/025	[NT]	[NT]	[NT]	[NT]	[NT]	94	[NT]
Pyrene	µg/L	0.01	Org-022/025	[NT]	[NT]	[NT]	[NT]	[NT]	98	[NT]
Chrysene	µg/L	0.01	Org-022/025	[NT]	[NT]	[NT]	[NT]	[NT]	80	[NT]
Benzo(a)pyrene	µg/L	0.01	Org-022/025	[NT]	[NT]	[NT]	[NT]	[NT]	87	[NT]
Surrogate p-Terphenyl-d14	%		Org-022/025	81	[NT]	[NT]	[NT]	[NT]	87	[NT]

QUALITY CONTROL: OCPs in Water - Trace Level					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date extracted	-			03/05/2024	[NT]	[NT]	[NT]	[NT]	03/05/2024	[NT]
Date analysed	-			06/05/2024	[NT]	[NT]	[NT]	[NT]	06/05/2024	[NT]
alpha-BHC	µg/L	0.001	Org-022/025	[NT]	[NT]	[NT]	[NT]	[NT]	85	[NT]
beta-BHC	µg/L	0.001	Org-022/025	[NT]	[NT]	[NT]	[NT]	[NT]	131	[NT]
Heptachlor	µg/L	0.001	Org-022/025	[NT]	[NT]	[NT]	[NT]	[NT]	103	[NT]
Aldrin	µg/L	0.001	Org-022/025	[NT]	[NT]	[NT]	[NT]	[NT]	87	[NT]
Heptachlor Epoxide	µg/L	0.001	Org-022/025	[NT]	[NT]	[NT]	[NT]	[NT]	130	[NT]
pp-DDE	µg/L	0.001	Org-022/025	[NT]	[NT]	[NT]	[NT]	[NT]	100	[NT]
Dieldrin	µg/L	0.001	Org-022/025	[NT]	[NT]	[NT]	[NT]	[NT]	67	[NT]
Endrin	µg/L	0.001	Org-022/025	[NT]	[NT]	[NT]	[NT]	[NT]	121	[NT]
pp-DDD	µg/L	0.001	Org-022/025	[NT]	[NT]	[NT]	[NT]	[NT]	83	[NT]
Endosulfan Sulphate	µg/L	0.001	Org-022/025	[NT]	[NT]	[NT]	[NT]	[NT]	88	[NT]
Surrogate 4-Chloro-3-NBTF	%		Org-022/025	89	[NT]	[NT]	[NT]	[NT]	73	[NT]

QUALITY CONTROL: OP in water LL ANZECCF/ADWG					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date extracted	-			03/05/2024	[NT]	[NT]	[NT]	[NT]	03/05/2024	[NT]
Date analysed	-			06/05/2024	[NT]	[NT]	[NT]	[NT]	06/05/2024	[NT]
Dichlorvos	µg/L	0.05	Org-022/025	[NT]	[NT]	[NT]	[NT]	[NT]	119	[NT]
Ronnel	µg/L	0.05	Org-022/025	[NT]	[NT]	[NT]	[NT]	[NT]	112	[NT]
Fenitrothion	µg/L	0.05	Org-022/025	[NT]	[NT]	[NT]	[NT]	[NT]	91	[NT]
Malathion	µg/L	0.05	Org-022/025	[NT]	[NT]	[NT]	[NT]	[NT]	130	[NT]
Chlorpyriphos	µg/L	0.009	Org-022/025	[NT]	[NT]	[NT]	[NT]	[NT]	103	[NT]
Parathion	µg/L	0.004	Org-022/025	[NT]	[NT]	[NT]	[NT]	[NT]	85	[NT]
Ethion	µg/L	0.05	Org-022/025	[NT]	[NT]	[NT]	[NT]	[NT]	91	[NT]
Surrogate 4-Chloro-3-NBTF	%		Org-022/025	89	[NT]	[NT]	[NT]	[NT]	73	[NT]

QUALITY CONTROL: PCBs in Water - Trace Level					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date extracted	-			03/05/2024	[NT]	[NT]	[NT]	[NT]	03/05/2024	[NT]
Date analysed	-			06/05/2024	[NT]	[NT]	[NT]	[NT]	06/05/2024	[NT]
Aroclor 1254	µg/L	0.01	Org-021/022/025	[NT]	[NT]	[NT]	[NT]	[NT]	73	[NT]
Surrogate TCMX	%		Org-021/022/025	83	[NT]	[NT]	[NT]	[NT]	75	[NT]

QUALITY CONTROL: Total Phenolics in Water					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W2	[NT]
Date extracted	-			03/05/2024	1	03/05/2024	03/05/2024		03/05/2024	[NT]
Date analysed	-			03/05/2024	1	03/05/2024	03/05/2024		03/05/2024	[NT]
Total Phenolics (as Phenol)	mg/L	0.05	Inorg-031	<0.05	1	<0.05	<0.05	0	101	[NT]

QUALITY CONTROL: HM in water - dissolved					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W5	[NT]
Date prepared	-			02/05/2024	[NT]	[NT]	[NT]	[NT]	02/05/2024	[NT]
Date analysed	-			02/05/2024	[NT]	[NT]	[NT]	[NT]	02/05/2024	[NT]
Arsenic-Dissolved	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	95	[NT]
Cadmium-Dissolved	µg/L	0.1	Metals-022	<0.1	[NT]	[NT]	[NT]	[NT]	91	[NT]
Chromium-Dissolved	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	82	[NT]
Copper-Dissolved	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	85	[NT]
Lead-Dissolved	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	98	[NT]
Mercury-Dissolved	µg/L	0.05	Metals-021	<0.05	[NT]	[NT]	[NT]	[NT]	102	[NT]
Nickel-Dissolved	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	87	[NT]
Zinc-Dissolved	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	86	[NT]

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

PAHs in Water - Trace Level - The PQL has been raised due to interferences from analytes (other than those being tested) in sample/s 350131-2.

LOC 30/4/24 0926

Douglas PARTNERS

CHAIN OF CUSTODY DESPATCH SHEET

Project No: 204585.08	**Suburb:** Strathfield		**To:** Envirolab Services
Project Manager: Joel James-Hall	**Order Number:**	**Sampler:**	12 Ashley St, Chatswood NSW 2067
Email: joel.james-hall@douglaspartners.com.au; johann.chalache@douglaspartners.com.au			**Attn:** Sample Receipt
Turnaround time: ☑ Standard ☐ 72 hour ☐ 48 hour ☐ 24 hour ☐ Same day			(02) 9910 6200 samplereceipt@envirolab.con
Prior Storage: ☑ Fridge ☐ Freezer ☑ Esky ☐ Shelf	**Do samples contain 'potential' HBM?** ☑ No ☐ Yes (If YES, handle, transport, store in accordance with FPM HAZID)		

Lab ID	Sample ID: Location / Other ID	Depth From	Depth To	Date Sampled	Sample Type (S - soil, W - water, M - Material)	Container Type (G - glass, P - plastic)	Combo 8 (dissolved)	Metals, PAH (dissolved)	BTEX									Notes/ Preservation/ Additional Requirements
1	BH101			23/04/24	W	G/P	x											Low level PAH, Trace OCP, OPP, PCB
2	BD1/20240423			23/04/24	W	G/P		x										Low level PAH
3	TS			23/04/24	W	G			x									
4	TB			23/04/24	W	G			x									

Envirolab Services
12 Ashley St
Chatswood NSW 2067
Ph: (02) 9910 6200
Job No: 350131
Date Received: 30/4/24
Time Received: 1610
Received By: JN
Temp: Cool/Ambient
Cooling: Ice/Icepack
Security: Intact/Broken/None

Metals to analyse: HM8 (As, Cd, Cr, Cu, Pb, Hg, Ni, Zn)		**LAB RECEIPT**
Number of samples in container:	**Transported to laboratory by:**	**Lab Ref. No:** 350131
Send results to: Douglas Partners Pty Ltd		**Received by:** 30/4/24, 1610
Address: 96 Hermitage Road, West Ryde NSW 2114	**Phone:** (02) 9809 0666	**Date & Time:** ELS SYD
Relinquished by: JBC	**Date:** **Signed:**	**Signed:**

Envirolab Services Pty Ltd
ABN 37 112 535 645
12 Ashley St Chatswood NSW 2067
ph 02 9910 6200 fax 02 9910 6201
customerservice@envirolab.com.au
www.envirolab.com.au

SAMPLE RECEIPT ADVICE

Client Details	
Client	Douglas Partners Pty Ltd
Attention	Joel James-Hall

Sample Login Details	
Your reference	204585.08 Strathfield
Envirolab Reference	350131
Date Sample Received	30/04/2024
Date Instructions Received	30/04/2024
Date Results Expected to be Reported	07/05/2024

Sample Condition	
Samples received in appropriate condition for analysis	Yes
No. of Samples Provided	4 Water
Turnaround Time Requested	Standard
Temperature on Receipt (°C)	14
Cooling Method	Ice Pack
Sampling Date Provided	YES

Comments
Nil

Please direct any queries to:

Aileen Hie	Jacinta Hurst
Phone: 02 9910 6200	**Phone: 02 9910 6200**
Fax: 02 9910 6201	**Fax: 02 9910 6201**
Email: ahie@envirolab.com.au	**Email: jhurst@envirolab.com.au**

Analysis Underway, details on the following page:

Envirolab Services Pty Ltd
ABN 37 112 535 645
12 Ashley St Chatswood NSW 2067
ph 02 9910 6200 fax 02 9910 6201
customerservice@envirolab.com.au
www.envirolab.com.au

Sample ID	vTRH(C6-C10)/BTEXN in Water	svTRH (C10-C40) in Water	PAHs in Water - Trace Level	OCPs in Water - Trace Level	OP in water LL ANZECCF/ADWG	PCBs in Water - Trace Level	Total Phenolicsin Water	HM in water - dissolved
BH101	✓	✓	✓	✓	✓	✓	✓	✓
BD1/20240423			✓					✓
TS	✓							
TB	✓							

The '✓' indicates the testing you have requested. **THIS IS NOT A REPORT OF THE RESULTS.**

Additional Info
Sample storage - Waters are routinely disposed of approximately 1 month and soils approximately 2 months from receipt.
Requests for longer term sample storage must be received in writing.
Please contact the laboratory immediately if observed settled sediment present in water samples is to be included in the extraction and/or analysis (exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, Total Recoverable metals and PFAS analysis where solids are included by default.
TAT for Micro is dependent on incubation. This varies from 3 to 6 days.

Appendix G

Summary of screening criteria

The adopted groundwater site assessment criteria (SAC) were sourced from:

- ANZG *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZG, 2018). 99% Level of protection (LOP) for fresh water was adopted for bio accumulative contaminants and 95% LOP for non-bio accumulative contaminants; and
- ANZECC *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZECC, 2000).

Table G1: Summary screening criteria (units given in µg/L unless otherwise stated)

Analyte		Freshwater (95% LOP)	Physical parameters
Metals	Arsenic (III / V)	24 / 13	-
	Cadmium	0.2	-
	Chromium (III / VI)	1	-
	Copper	1.4	-
	Mercury (inorganic)	0.06	-
	Lead	3.4	-
	Nickel	11	-
	Zinc	8	-
TRH	C_6-C_{10}	10 (< PQL) [d]	-
	C_{10}-C_{16}	50 (< PQL) [d]	-
	C_{16}-C_{34}	100 (< PQL) [d]	-
	C_{34}-C_{40}	100 (< PQL) [d]	-
Oil and Grease		5000 (< PQL)[d]	No visible
BTEX	Benzene	950 [a]	-
	Toluene	180	-
	Ethylbenzene	80	-
	Xylenes (m-, o- & p-)	75 / 350 / 200	-
PAH	Anthracene	0.01 [a]	-
	Benzo(a)pyrene	0.1 [a]	-
	Fluoranthene	1 [a]	-
	Naphthalene	50	-
	Phenanthrene	0.6 [a]	-
PCB	Aroclor 1254 (as a preliminary screen)	0.01	-
OCP	Aldrin [a]	0.001	-

Analyte		Freshwater (95% LOP)	Physical parameters
	(as a preliminary screen)		
OPP	Chlopyrifos [a] (as a preliminary screen)	0.01	-
Phenols	Pentachlorophenol [a] (as a preliminary screen)	11	-
PFAS	PFOS	0.00023 [a]	-
	PFOA	19 [a]	-
VOC	All VOC	< PQL [e]	-
Nutrients	Ammonia as N	900	-
	Nitrate as N	-	-
	Nitrite as N	-	-
Physical Parameters	Conductivity	-	125 – 2200 µs/cm [f]
	pH	-	6-8 [f] (6.5-8.5) [h]
	Dissolved Oxygen	-	85-120 % saturation [f]
	Turbidity	-	6-50 NTU [f]
	Total Suspended Solids	-	< 50 mg/L [g]

Notes to Table:

PQL – laboratory practical quantification limit

a – 99% LOP adopted due to bioaccumulating nature of the contaminant or as otherwise recommended as per ANZG (2018)

b – unknown LOP

c – aesthetic criteria only

d – set at the laboratory PQL, example limits given

e- as an initial screen given the exhaustive list of VOC

f – given as comparative levels for lowland rivers. Typical conductivity values for coastal rivers in NSW are cited as 200-300 µs/cm (ANZECC, 2000).

g – typical levels based on experience with previous council disposal requirements

h – range of typical neutral pH conditions.