



Douglas Partners

Geotechnics | Environment | Groundwater

Dewatering Management Plan

Stage 2 - Midtown
Herring Road, Macquarie Park

Prepared for
Frasers Property Ivanhoe Pty Ltd

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Integrated Practical Solutions





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Report on Dewatering Management Plan

Stage 2 - Midtown

Herring Road, Macquarie Park

1. Introduction

This report presents a dewatering management plan (DMP) prepared for Stage 2 of the Ivanhoe Estate development, also known as “Midtown” at Herring Road, Macquarie Park. The DMP was commissioned in an email dated 11 March 2022 by Chris Koukoutaris of Frasers Property Ivanhoe Pty Ltd and was undertaken in accordance with Douglas Partners' proposal 86043.06.P.008.Rev0 dated 11 March 2022.

It is understood that the proposed development at the site includes the development of three buildings, known as the C2, C3 and C4 buildings.

The aim of the DMP is to assess groundwater conditions at the site, in order to provide information to support the DA submission under the SSDA process, and to support an application for a Water Access Licence (WAL) with NRAR.

This plan includes:

- Information on baseline groundwater conditions;
- Analysis of inflow for the consolidated basements of the 3 buildings forming the Stage 2 works;
- Assessment of impacts relevant to water and soils from dewatering, including impacts on water quality and hydrology; and
- Proposed management, monitoring and remedial works during bulk excavation, to ensure that inflows and discharge do not exceed anticipated levels.

2. Proposed Development

The proposed development at the site consists of three development sites, the C2, C3 and C4 sites. The location of these sites with respect to the greater Ivanhoe site are shown in Drawing 801, in Appendix B.

The proposed developments at the sites, and the key architectural drawings, from a geotechnical perspective, that have been used in the preparation of this DMP, are summarised in Table 1.

Table 1: Summary of Proposed Stage 2 Developments and Key Architectural Drawings

Site	Proposed Work	Key Drawings
C2	Village Green and Community Centre. Low rise building with sunken, landscaped area and	Basement Plan A – Drawing A-CD-101, Rev A, dated 23/2/22 by Chrofi

Site	Proposed Work	Key Drawings
	excavation zones for swimming pool and plant rooms.	Lower Ground Plan A – Drawing-A-CD-103, Rev A, dated 23/2/22 by Chrofi
C3	High rise, mixed-use building, with three level basement.	Basement 3 – Drawing A-110-B03, Rev DA-2, dated 7/2/22 by Studio Johnson
C4	High rise, residential building, with three-level basement.	Basement 3 Plan – Drawing A-DA-2050, Rev 2, dated 17/12/21 by Cox Architecture

These drawings have been reproduced in Appendix C of this DMP.

Based on the above drawings, the proposed development is understood to require:

- For the C2 site, ground levels of approximately RL 49.5 are proposed for the Village Green, and ground floor level of the buildings. Typical floor levels of the partial basement are RL 47.1 to RL 48.1, with small areas of deeper basements (RL 45.7) for service rooms. The basement floor levels at RL 47.1 match up with the (upslope) basement levels of the neighbouring (Stage 1) C1 site development. Access between the basement areas of these adjoining buildings is proposed;
- For the C3 and C4 sites, basement floor levels of RL 40.0 and RL 37.9, respectively; and
- The extent of the proposed basements is shown, superimposed on Drawing 801 in Appendix B.

This DMP is based on the following approach to basement dewatering management:

- The adoption of dewatered excavations in the short and long-term for all the basements within the Stage 2 areas;
- The treatment and disposal to stormwater of any groundwater inflow to the basements, with stormwater disposal to flow directly into Shrimpton's Creek; and
- Excavation for the C2 basement is proposed in late 2022, and subsequent excavation of the C3 basement is proposed in late 2023.

3. Site Description

The greater Midtown site is in Macquarie Park near the corner of Epping Road and Herring Road, within the Ryde Local Government Area. The site occupies an area of approximately 8.2 hectares. The approximate location of the Stage 2 site relative to the greater Midtown area, is shown in Figure 1, and in Drawing 801, in Appendix B.

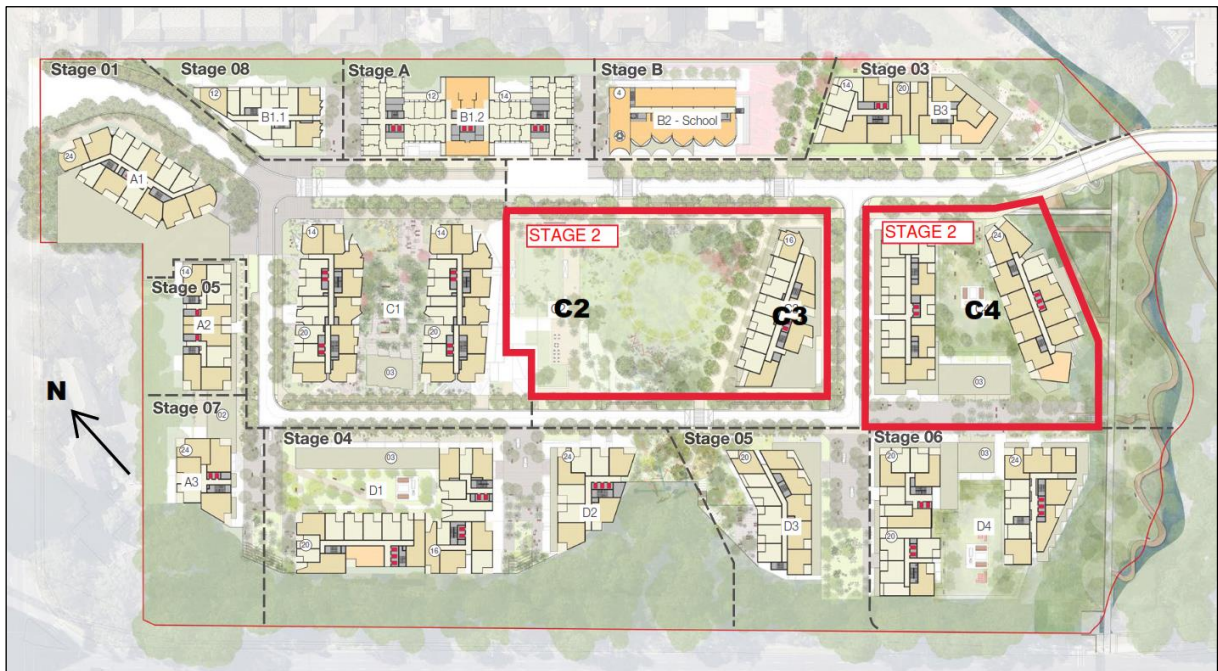


Figure 1: Location of the Stage 2 development areas (red), relative to the greater Midtown site (provided by Client).

Topographically, the Midtown site is located on a sideslope, with ground surface levels falling from approximately RL 71 near Herring Road, to approximately RL 42 at Shrimpton’s Creek, at the south-eastern boundary.

Ground surface levels within the Stage 2 area typically fall from approximately RL 54 in the C2 area to RL 44 in the C4 area, towards Shrimpton’s Creek. Local variation is also present due to temporary earthworks supporting other works at the site, including a sedimentation basin.

Reference to the Flood Impact Assessment by BMT Commercial Australia Pty Ltd dated 30 June 2021 indicates a baseline water level of RL 41.2 at Shrimpton’s Creek and estimated peak flood levels adjacent to the Stage 2 Development area of RL 44.4 to RL 44.7 (based on storms with a 5% to 1% annual exceedance probability, respectively), rising to RL 46.14 for a probable maximum flood.

4. Background Information

4.1 Previous Reporting

Multiple geotechnical investigations and groundwater monitoring observations have been undertaken at the site by DP. The baseline data informing this DMP includes the information in key documents given in Table 2.

Table 2: Key Background Reports at Midtown informing the Dewatering Management Plan

Report	Reference and Revision	Relevance
Preliminary Geotechnical Investigation of Ivanhoe Estate	86043.01.R.001.Rev1, dated 30 July 2018	Geotechnical investigation of the greater Midtown site, including bores and standpipes in the vicinity of the Stage 2 works.
Geotechnical Investigation of C2 Site	86043.06.R.001.Rev1, dated 4 August 2021	Geotechnical investigation of the C2 site within the Stage 2 area
Geotechnical Investigation of C3 Site	86043.06.R.002.Rev2, dated 4 August 2021	Geotechnical investigation of the C3 site within the Stage 2 area
Geotechnical Investigation of C4 Site	86046.06.R.003.Rev2, Dated 4 August 2021	Geotechnical investigation of the C4 site, within the Stage 2 area
Groundwater Monitoring	86043.01.R.005.Rev0 dated 30 July 2018	Groundwater monitoring of 6 bores throughout the Greater Midtown site, from November 2017 to June 2018.
Groundwater Monitoring	86043.06.R.006.Rev0 dated 4 May 2022	Groundwater monitoring of bores in the Stage 2 area from May 2021 to April 2022

The field work methods and detailed results of geotechnical investigation are provided in the relevant geotechnical reports, and reference is provided to those reports where relevant. Broadly speaking, the boreholes were drilled by auger and rotary drilling methods in the soils, then by NMLC coring in the underlying bedrock. Standpipes were installed with a gravel-packed slotted screen length, separated from inflow through overlying strata by a bentonite layer.

The locations of deep boreholes and standpipes given in the above reports are shown in Drawing 801, in Appendix B. As shown in that drawing, at the time of preparation of this report most of the groundwater monitoring standpipes have subsequently been destroyed or buried by site operations or earthworks.

The following extracts from the above reports have been appended to this report:

- Groundwater monitoring reports, and additional groundwater measurement summaries, including summaries of standpipe installation records, given in the geotechnical investigation reports have been reproduced in Appendix D of this report; and
- Permeability tests at standpipe locations are reproduced in Appendix E, based on the use of falling / rising head tests to estimate the hydraulic conductivity (k) using the Hvorslev (1951) method. The testing targeted sandstone units by installing intake screens within boreholes/wells over the area of interest.

The results of the above investigation and monitoring, including interpreted sections based on consolidated data from the various monitoring and investigation reports, are discussed further in the development of the Geotechnical and Hydrogeological Model outlined in Section 6 of this report.

4.2 Regional Mapping

Reference to the Soils Landscape Series mapping indicates that the Midtown site is largely underlain by the residual Lucas Heights soil landscape, and by the erosional Glenorie soils towards Herring Road. The Stage 2 area is mapped as residual Lucas Heights soil landscape.

Reference to the Geological mapping indicates that the Midtown site is underlain by Ashfield Shale towards Herring Road, and by the (lower unit of) Hawkesbury Sandstone in areas of lower elevation. The transitional Mittagong Formation may be present between these two units. A dyke has been identified approximately 2 km north-west of the site, oriented parallel to and near Epping Road, and potentially extending to or near the Midtown site.

The results of the various site investigations in the Stage 2 area are considered to be relatively consistent with the published mapping, with the investigation typically identifying shallow fill and residual soils, underlain by Hawkesbury Sandstone. Alluvial soils are present locally, near Shrimpton's Creek. No dyke materials were identified in the (vertical) bores.

Additional mapping for the site is considered, and discussed with specific reference to dewatering impact considerations, in Section 9 of this report.

5. Supplementary Field Work and Laboratory Testing

Groundwater sampling was carried out in general accordance with DP's standard operating procedures for the purpose of chemical laboratory testing.

Groundwater samples were collected using a low flow peristaltic pump via the micro-purge (minimal drawdown) method. The sampling method was as follows:

- Measuring of the static water level using an electronic interface probe and recording the thickness of any light aqueous phase liquid (LNAPL). It is noted that no LNAPL was encountered during the sampling;
- Decontaminating the interface probe and cable between monitoring wells by rinsing in a diluted Liquinox solution and then rinsing in demineralised water;
- Lowering the well-dedicated tubing into the well then clamping at a level approximately mid-water column;
- Setting the pump at the lowest rate possible to minimise drawdown of the water column;
- Measuring the physical parameters by continuously passing the purged water through a flow cell; and
- Following stabilisation of the field parameters, collection of samples in laboratory-prepared bottles minimising headspace within the sample bottle and capping immediately.

The general groundwater sample handling and management procedures comprised:

- Collection of 10% replicate samples for QC purposes;

- Labelling of sample containers with individual and unique identification details, including project number and sample location;
- Placing the sample jars into a cooled, insulated and sealed container for transport to the laboratory; and
- Use chain of custody documentation.

Sampling was completed from groundwater wells 109A, 111 and 118A. Sample volumes were limited at Bore 118A due to the limited depth of water in the standpipe, and the test scope was adjusted accordingly. Field work results including physical parameters were recorded on field sheets which are included in Appendix F.

The results of laboratory analysis are summarised in Table 1F in Appendix F:

The laboratory certificate of analysis together with the chain of custody and sample receipt information is provided in Appendix F.

6. Geotechnical and Hydrogeological Model

6.1 General Stratigraphy and Groundwater Levels

The geotechnical conditions identified by the investigation indicate a relatively shallow soil profile in the Stage 2 area, consisting of some fill, underlain by residual soil then by Hawkesbury Sandstone. Some alluvial soils were present beyond the Stage 2 area, closer to Shrimpton's Creek, though it is noted that the sandstone was still shallow in these areas. The geotechnical model layers at the site, based on the results of geotechnical investigation, are summarised in Table 3.

Table 3: Summary of Geotechnical Model Units in Stage 2 Area

Unit	Summary	Typical Description
1	Fill	Variable fill, including gravelly sand and apparently re-worked natural clay soils, to typical depths of 0.5 m to 1.5 m, but likely to be deeper in areas of stockpiles, earthworks and services.
2a	Alluvial Soil	Soft to firm, sandy clay, identified at Bore 10 only, beyond the eastern corner of the site, to a depth of 2.1 m.
2b	Residual Soil	Firm to very stiff sandy clay and clayey sand, with trace iron-indurated bands, often grading to hard clay and dense clayey sand (extremely weathered sandstone), absent at some locations.
3a	Sandstone – Variable	Typically very low to low strength, but with extremely weathered (soil strength) bands, medium and high strength iron-cemented bands, highly weathered, typically fractured to highly fractured sandstone.
3b	Sandstone – Low and Medium Strength	Typically medium strength, but low strength or with thick beds of low strength sandstone at some bores, and some high strength bands, highly to slightly weathered, fractured and slightly fractured sandstone.

Unit	Summary	Typical Description
3c	Sandstone – Medium and High Strength	Typically high strength, but with some thick beds of medium or medium to high strength sandstone and some very high strength bands, moderately weathered to fresh, slightly fractured to unbroken, with some fractured zones. This unit is mostly distinguished from Unit 3d by weathering.
3d	Sandstone – High Strength	Typically high strength with some very high strength bands, fresh, slightly fractured to unbroken.

The groundwater measurements at the various standpipes at the site, throughout the monitoring periods, indicate that groundwater levels are within the sandstone bedrock in the Stage 2 area, largely within Unit 3c, but occasionally in Units 3a and 3b.

The permeability of the rock mass, and therefore the flow into the excavation, is expected to be governed by the permeability and continuity of the defects within the rock. The above units are largely based on the strength of the rock and fracture spacing observed in the rock cores, and therefore are also expected to correspond to changes in permeability, with permeability decreasing from Unit 3a, to 3b, to 3c then 3d.

Interpreted geotechnical long sections through the Stage 2 area, produced for the purpose of this DMP, are included in Drawings 802 to 803. These interpreted sections show:

- A summary graphic log for the boreholes, showing the general stratigraphy with depth;
- The slotted screen length at standpipe locations, and summary water levels showing measured levels, and/or range of monitored levels at standpipe locations;
- The interpreted water table along these sections, excluding measurements that appear to represent isolated fluctuations (eg high levels shortly after drilling, with no apparent weather influence); and
- The interpreted geotechnical boundaries for the sandstone units outlined above, where those units intersect the interpreted groundwater table. The overlying soil units can be readily identified from the graphic log, are above the groundwater table and have not been labelled in the sections.

As can be seen from the sections, the groundwater table falls from approximately RL 46 at the upslope side of the Stage 2 site, near the C1 excavation for Stage 1 of the works, falling to the south and south-east towards Shrimpton's Creek, at approximately RL 41.2. Shrimpton's Creek appears to be the receiving water for the existing groundwater flow through the site. Groundwater in the depth range affected by the proposed dewatered excavation, is largely within Unit 3c sandstone. Some of the more fractured rock of Units 3a and 3b are intercepted at the eastern end of the site, however, as can be seen in Long Section B-B (Drawing 803 in Appendix B).

Groundwater level fluctuations of approximately 0.5 m to 1.0 m were typically observed at monitoring points during the monitoring period, though occasionally higher. Greater fluctuations are likely to occur over the longer term in response to climate and weather variations, and due to human influences onsite or upslope. The water levels shown in the sections are generally at the higher end of the monitored readings, for the subject bores.

6.2 Hydrogeological Characterisation

The results of the permeability tests (by falling / rising head, or 'slug' tests), as given in Appendix D of this report, were considered in conjunction with the effective screen length, material description, Rock Quality Designation (RQD) and average defect spacing, as given in the original bore logs in the investigation reports. Increasing defects in rock masses will lead to increases in permeability. A visual assessment from the borehole photos along the screen interval (as given in the investigation reports) was also completed, to check calculated permeabilities against the general rock condition. The results of the review are summarised in Table 4.

Table 4: Summary of Hydrogeological Data at Midtown

Bore	Screen Start (RL,m)	Screen Finish (RL,m)	Screened Unit	Rock Strength	Rock Weathering	Average Fracture Spacing (m)	RQD	Estimated k (m/s)
118A	46	43.9	3A	VL/LS	HW	0.35	55	7.7E-08
104A	40.3	38.3	3C	HS	MW	0.1	70	4.2E-06
106	42	38.5	3C	HS	SW/FR	>1.0	98	9.7E-08
106*	42	38.5	3C	HS	SW/FR	>1.1	99	1.5E-08
109A	41.1	37.6	3C	HS	SW/MW	0.75	93	2.8E-07
111A	40.8	37.3	3C	MS/HS	MW/SW	0.5	90	3.8E-07
115	38.9	35.4	3C	HS	MW/SW	0.4	90	1.9E-06
107	36	32.5	3D	HS	FR	1	94	1.7E-06
109	35.8	32.3	3D	HS	FR	>1	100	1.3E-07
111	37.5	34	3D	MS/HS	FR	1	95	1.7E-07
113	36.1	32.6	3D	HS	FR	>1	100	9.7E-07
114	39	32.4	3D	HS	FR	0.75	95	5.4E-07

*Note: Rising head tests

The hydraulic conductivity values in Table 4 were then plotted against RL to interpret appropriate parameters for the inflow assessment for each unit, as shown in Figure 3.

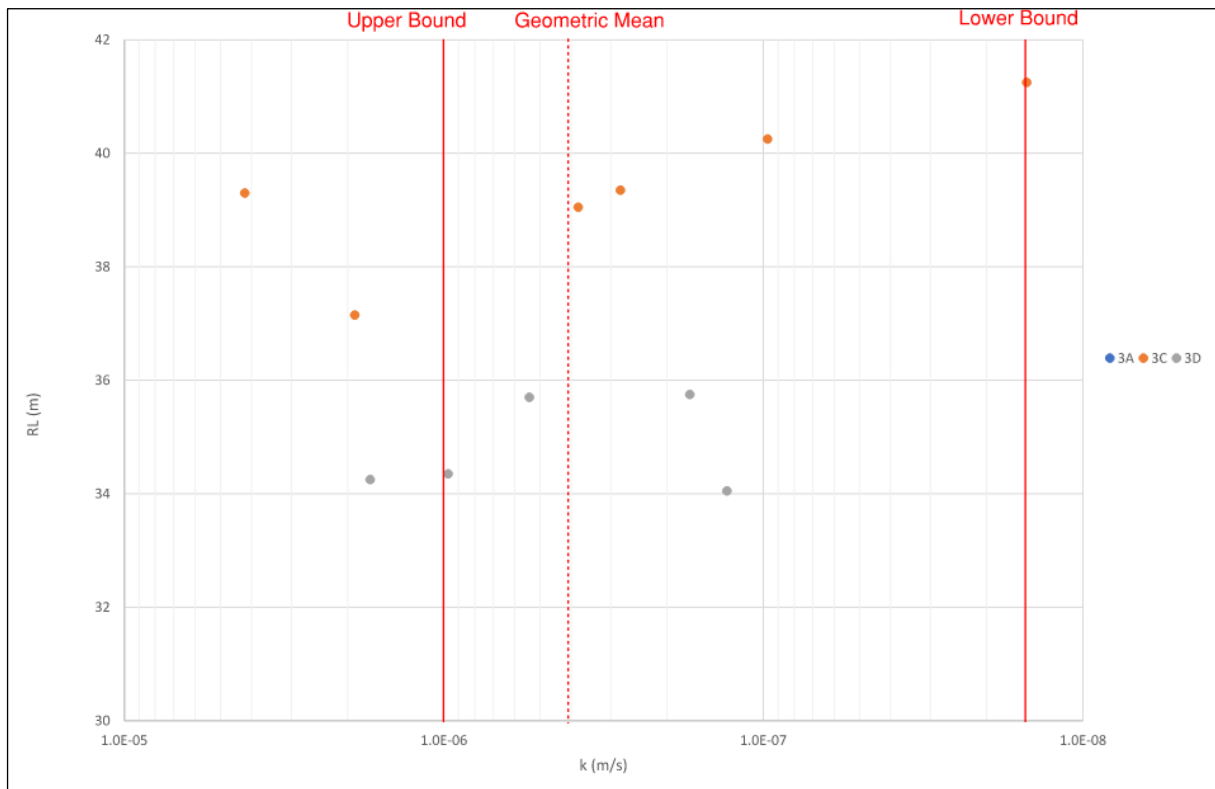


Figure 2: Hydraulic Conductivity vs RL using Midtown data (x axis log scale)

It is noted in Figure 3 that there is no noticeable variation when comparing the permeability of the in-situ testing for the 3c and 3d units, which are the primary units which will contribute to seepage and groundwater inflows. Testing on the 3a unit was in a similar order to the other sandstone units, while inconclusive testing occurred in the 3b unit. Given this, it was deemed suitable to adopt a bulk rock horizontal hydraulic conductivity (k_h) for the inflow and drawdown assessment. This was calculated by taking the geometric mean of all hydraulic conductivities for borehole screens located below the long-term water table, and represents an average permeability on a large rock mass scale. Table 5 summarises the adopted (hydraulic) conductivity values, with 'lines of best fit' indicated in Figure 3. Note that the x axis on Figure 2 is a log scale.

Table 5: Adopted hydraulic permeability for inflow assessment

Unit	Bound	k_h (m/s)	k_h (m/d)	k_v/k_h
3a, 3b, 3c and 3d	Upper	1.0E-6	0.0864	0.5
	Geometric Mean	4.0E-7	0.0346	0.5
	Lower	1.5E-8	0.0013	0.5
Fill / Residual Soil	Adopted all cases	1.0E-8	0.000864	0.5

A porosity of 0.1 was adopted for sandstone, and 0.5 for the soil unit.

7. Groundwater Modelling

7.1 Methodology

Groundwater modelling was undertaken to assess the potential inflow rates into the proposed basement during construction. The drawdown or cone of depression, likely to be induced by the excavation was also assessed.

A 2-dimensional (2D) numerical groundwater model was developed. The modelling was carried out using 2D finite element hydrogeological software SEEP/W (a component of GeoStudio 2019 R2, Version 10.1.1.18972) developed by GEOSLOPE International Ltd. Both steady-state and transient flow conditions were modelled in the analyses.

The resulting SEEP/W outputs (in m³/s/m run) are based on a two dimensional model, which assumes the basement excavations are much longer than their width. In order to convert these predictions to more realistic values for a finite basement, the following expression proposed by Kavvas et al (1992) was used to adjust the results to allow for the actual length to width ratio of the proposed basement.

$$\frac{q_0}{q} = 0.7 + 0.3 \left(1 - \frac{B}{L} \right)$$

where: q_0 is the predicted 'realistic' inflow rate
 q is the inflow rate from 2D modelling
 B is the width of the excavation
 L is the length of the excavation

7.2 Model Geometry

For the purpose of the analysis, DP selected one cross-section in the west to east direction, intersecting the C1, C3, and C4 basements footprint through the centre. The ground surrounding the proposed development was simulated as being a multi-layered numerical model to represent the subsurface conditions surrounding the site. The C2 basement was excluded from the inflow assessment, as there is very limited interception of the groundwater table (<0.5 m) in a corner of the basement, and the inflows are expected to be orders of magnitude less than the inflows to C3 and C4 (ie effectively negligible for the consolidated basement inflows).

The geological units were subdivided into layers corresponding to the main soil and rock units for the numerical model, as outlined and characterised in Section 6.2. The boundaries of the model were extended approximately 50 m from the western end of C1 basement and 20 m from the eastern end of C4 excavation. This is slightly less than the actual distance to Shrimpton's Creek from the C4 basement area (approximately 25 m), but is considered reasonable for the purpose of this assessment.

The geological units were simulated by assigning multiple materials with different hydraulic conductivities (permeabilities) to the model layers. Details of the layering are provided in Figure 3. All layers were assigned as SEEP/W saturated/unsaturated materials.

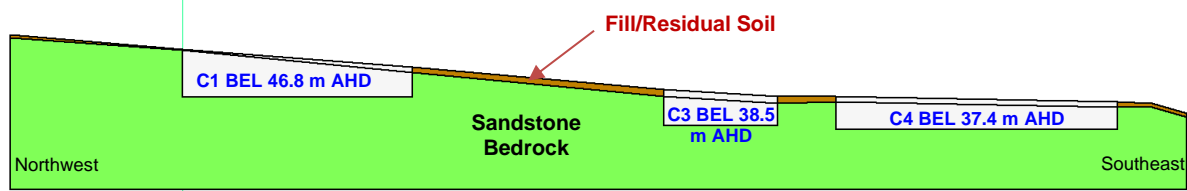


Figure 3: Model Geometry

The calculated reduction factors due to each basement shape and alignment, were obtained from the following geometries and applied to the Seep/W analysis outputs:

- C3: approximately 33 m width (average) parallel to the flow direction and 70 m length perpendicular to the flow direction, a reduction factor of 0.85 was applied.
- C4: approximately 70 m (average) width parallel to the flow direction and 82 m length perpendicular to the flow direction, a reduction factor of 0.75 was applied.

These reduction factors were used to obtain the inflow estimates in ML/year.

7.3 Basement Shoring Walls

As noted in Section 2 of this report, it is understood that a drained basement shoring excavation support scheme is proposed.

The bulk excavation levels for C1, C3, and C4 were assumed at RLs 46.8, 38.5, and 37.4 m AHD, respectively. These levels correspond to a depth of approximately 0.3 m below basement floor levels.

7.4 Groundwater Modelling Simulations

A Base Case Analysis was based on the geometric mean for sandstone bedrock permeability value. The analysis was run under transient and steady-state conditions and comprised the following:

Table 6: Groundwater Modelling Runs

Run	Scenario and Boundary Conditions
Run 1- C3 Excavation Dewatering	This considered a transient scenario to estimate the inflow and drawdown due to C3 basement excavation and construction (an assumed construction dewatering period of up to 1 year) while C1 excavation is already completed. The groundwater level at C1 was set to RL 46.8 (i.e., C1 BEL) as northwestern end boundary condition and at RL 41.2 (Shrimpton Creek) on the southeastern end of the model.
Run 2- C4 Excavation Dewatering	This considered a transient scenario to estimate the inflow and drawdown due to C4 basement excavation and construction (an assumed construction dewatering period of up to 1 year) while C1 and C3 excavations are already completed.

Run	Scenario and Boundary Conditions
	The groundwater level at C3 was set to RL 38.5 (i.e., C3 BEL) as northwestern end boundary condition and about RL 41.2 (Shrimpton Creek) on the southeastern end of the model.
Run 3 – <u>Steady-State Analysis</u>	This considered a long term steady-state scenario assuming the three drained basements of C1, C3 and C4 completely excavated to estimate the long term inflow and drawdown likely to happen as a result of the drained basements after the basements are constructed. The constant head ‘far-end’ boundary conditions were calibrated similar to Run 2-C4.

In excavation stages, the duration of the basement excavation works has been assumed to be effectively instantaneous, ie all excavation below the groundwater table is assumed to occur in one step, and not progressively over days or weeks. This results in concentrated short-term inflows after excavation, but does not affect long term volumes.

Following the base case runs, sensitivity analyses were undertaken using the upper bound and lower bound values for sandstone bedrock permeability given in Section 6.2, with no other changes to the model.

7.5 Groundwater Modelling Results

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

Simulated results of the runs for the short term (during construction) and in the long term (basements left as drained) for the base case are summarised in Table 7 to Table 9, with the inflow volumes adjusted to consider the dimensions of the basement (refer discussion in Section 7.1).

Table 7: Predictive Model Simulated Inflow Results - Run 1- C3 Excavation Dewatering

Elapsed Time	Inflow Rate – Base Case			
	m ³ / sec / m run	L / min	m ³ / day	Average ML / year
7 days	1.7 x 10 ⁻⁶	8.8	12.7	2.7
14 days	1.2 x 10 ⁻⁶	6.4	9.2	
30 days	9.8 x 10 ⁻⁷	5.2	7.5	
60 days	9.2 x 10 ⁻⁷	4.9	7.0	
90 days	9.1 x 10 ⁻⁷	4.8	6.9	
180 days	9.0 x 10 ⁻⁷	4.8	6.9	
270 days	9.0 x 10 ⁻⁷	4.8	6.9	

Elapsed Time	Inflow Rate – Base Case			
	m ³ / sec / m run	L / min	m ³ / day	Average ML / year
1 year	9.0 x 10 ⁻⁷	4.8	6.9	

Table 8: Predictive Model Simulated Inflow Results - Run 2 - C4 Excavation Dewatering

Elapsed Time	Inflow Rate – Base Case			
	m ³ / sec / m run	L / min	m ³ / day	Average ML / year
7 days	1.4 x 10 ⁻⁶	9.0	13.0	4.5
14 days	1.3 x 10 ⁻⁶	8.5	12.3	
30 days	1.3 x 10 ⁻⁶	8.5	12.2	
60 days	1.3 x 10 ⁻⁶	8.5	12.2	
90 days	1.3 x 10 ⁻⁶	8.5	12.2	
180 days	1.3 x 10 ⁻⁶	8.5	12.2	
270 days	1.3 x 10 ⁻⁶	8.5	12.2	
1 year	1.3 x 10 ⁻⁶	8.5	12.2	

Table 9: Predictive Model Simulated Inflow Results for Long Term - Run 3 – Steady-State

Basement ID	Inflow Rate – Base Case			
	m ³ / sec / m run	L / min	m ³ / day	Average ML / year
C3	5.1 x 10 ⁻⁷	2.7	3.9	1.5
C4	1.3 x 10 ⁻⁶	8.5	12.2	4.5

Sensitivity analysis results, based on the upper bound and lower bound permeabilities results given in Table 10 below.

Table 10: Sensitivity Analyses - Predictive Model Simulated 2D Inflow Results

Average Inflow Rate (ML/Year)			
Case	Basement ID	Upper Bound	Lower Bound
Average Inflow Rate during Excavation (ML/year)	C3	8.4	0.3
	C4	12.3	0.3
Long-term	C3	4.0	0.1
	C4	12.2	0.2

The following comments are given on the analysis:

- Average inflows of about 3 ML/year and 5 ML/year are expected during the basement excavation and first year of dewatering for C3 and C4; respectively
- Long-term inflows of about 2ML/year and 5 ML/year are expected for C3 and C4, respectively; **or 7 ML/year for the consolidated basements of the Stage 2 area, in the long-term.**
- Sensitivity estimates of inflow indicate long term flows of less than 1 ML/year to up to 17 ML/year for the consolidated basements of the Stage 2 areas and based on the expected construction sequence. Given the available information and availability of management options (refer Section 10), it is anticipated that if the higher inflow levels are encountered during excavation, management options will be put in place to manage them.

The inflow rate presented above is a prediction only and may vary significantly to the rate presented. The actual flow rate will only be known once the excavation is completed, and the inflow can be observed and measured. Appropriate planning should be in place to monitor and compensate for possible variations in the actual inflow rate, as discussed in Section 10.

7.6 Drawdown Estimates

The impact on the water table from dewatering of the C3 and C4 basements was estimated by subtracting the steady-state groundwater level after excavation from the initial groundwater level prior to basement excavation. The drawdown at various distances away from the basement excavation in the upstream and downstream side of the excavation in the long term for base case analysis are summarised in Table 11. Note that mounding effects are not anticipated, given the dewatered basements proposed.

Table 11: Groundwater Table Drawdown

Location	Location	Initial Water Level (RL m AHD)	Final Water Level (RL m AHD)	Drawdown (m)
Upslope (Upgradient)	Immediately Adjacent to Basement	45.0	38.5	6.5
	20 m from Basement	45.5	41.4	4.1
	50 m from Basement	46.2	44.0	2.2
Downslope (Downgradient)	Immediately Adjacent to Basement	41.7	37.4	4.3
	10 m from Basement	41.5	39.9	1.6
	20 m from Basement (Shrimptons Creek)	41.2	41.2	0.0*

Note: *The lack of drawdown at Shrimpton's Creek is reflective of the boundary conditions. Given that any groundwater take is to be treated and disposed of to Shrimpton's Creek, this is considered reasonable.

The simulation results show that drawdown of 2.2 m is anticipated 50 m upslope of the basement (still within the Midtown site), and 1.6 m is anticipated 10 m downslope of the basement. Drawdown at

Shrimpton's Creek (0 m) is determined by the boundary condition, and is considered reasonable given the return of groundwater take to Shrimpton's Creek, in the area adjacent to the Midtown area.

This analysis also indicates that some drawdown may occur around the (local) C2 excavation. Given the nominal depth into the existing groundwater at that location, this further reinforces the negligible inflows to the C2 basement, compared to the C3 and C4 basements.

8. Groundwater Quality

One round of the groundwater monitoring was completed as part of the current works from the wells within or near the Stage 2 development. Results were compared against the adopted groundwater quality criteria to provide an indication on the likely requirement for treatment of groundwater prior to disposal.

Groundwater results and the adopted screening criteria (ANZG 2018) are shown in Table 1F in Appendix F. It should be noted that the disposal criteria may vary depending on the receiving water body and / or the requirements of relevant authorities. The adopted criteria for 95% species protection for freshwater groundwater was selected based on the groundwater conditions at the site.

The results of the groundwater quality monitoring indicate that groundwater chemical concentrations are within the adopted screening criteria for all analytes tested with the exception of metals that exceeded the adopted criteria (more specifically, chromium, copper, iron, lead and zinc). Elevated iron concentrations can also be associated with discolouring of the water and may have aesthetic concerns. These elevated concentrations, particularly in sample 118 are likely associated with the high levels of total suspended solids (TSS) detected in the groundwater which would also need to be addressed. It is noted that although sample 118 had elevated suspended solids, the anion and cation concentrations were consistent with the results from the other groundwater wells. As such, the results from sample 118 are considered to be representative of the groundwater rather than surface water or perched water, although the high TSS may be influenced by sediment and not be representative of groundwater inflow.

Groundwater will require treatment and quality monitoring prior to disposal to stormwater (ie Shrimptons Creek) and noting that, based on the current results, the required quality levels should be able to be achieved through conventional industry practices. Site specific dewatering criteria from the relevant authorities would need to be confirmed prior to any groundwater disposal and ongoing monitoring undertaken as outlined in Section 10.

9. Impact Assessment

9.1 Aquifer Interference Policy

The Water Management Act (2000) includes the concept of ensuring "no more than minimal harm" for granting water access licences and approvals, and the NSW Aquifer Interference Policy (AIP, 2012) requires assessment of the potential impact of dewatering relative to the minimal impact considerations it defines (in Table 1 or Table 2 of that document), as they relate to water-dependent assets.

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.

The site is underlain by fill and residual and shallow rock that is typically slightly fractured. The rock profile on the site is of relatively low permeability with low yield, and is considered to be a “less productive groundwater source” as outlined in the AIP.

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 groundwater dependant ecosystem, high priority culturally significant site, *and* less than a 2 m decline at any water supply work; *and*; a cumulative pressure head decline of not more than 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.

The minimal consideration impacts relate to impacts on groundwater dependant ecosystems and groundwater users. The proposed excavation on the site is considered to comply with the AIP minimal consideration requirements for the following reasons;

- There are no registered groundwater users within 500 m of the site (ref Figure 4), and DP is not aware of any water sharing agreements in the area;
- DP is not aware of any groundwater dependant ecosystems in close proximity of the site. There is a moderate potential GDE more than 100 m from the site to the south at ELS Hall Park. Lane Cove River is situated 1 km from the site to the north east (ref Figure 5). These locations are considered to be too distant from the basements to be influenced by the dewatering activities, particularly given the proposed return of groundwater to Shrimpton’s Creek;
- The site and adjacent soils are outside of areas of coastal Acid Sulphate Soil mapping, and elevations are above the level of known acid sulphate soils. Therefore no change in soil or water quality due to drawdown in acid sulphate soils is anticipated;
- Groundwater testing indicates that measures to make the groundwater take suitable for disposal to stormwater (ie Shrimptons Creek), are likely to be achievable using conventional groundwater treatment methods; and
- The take of water can be easily measured during the construction period and in the long term.

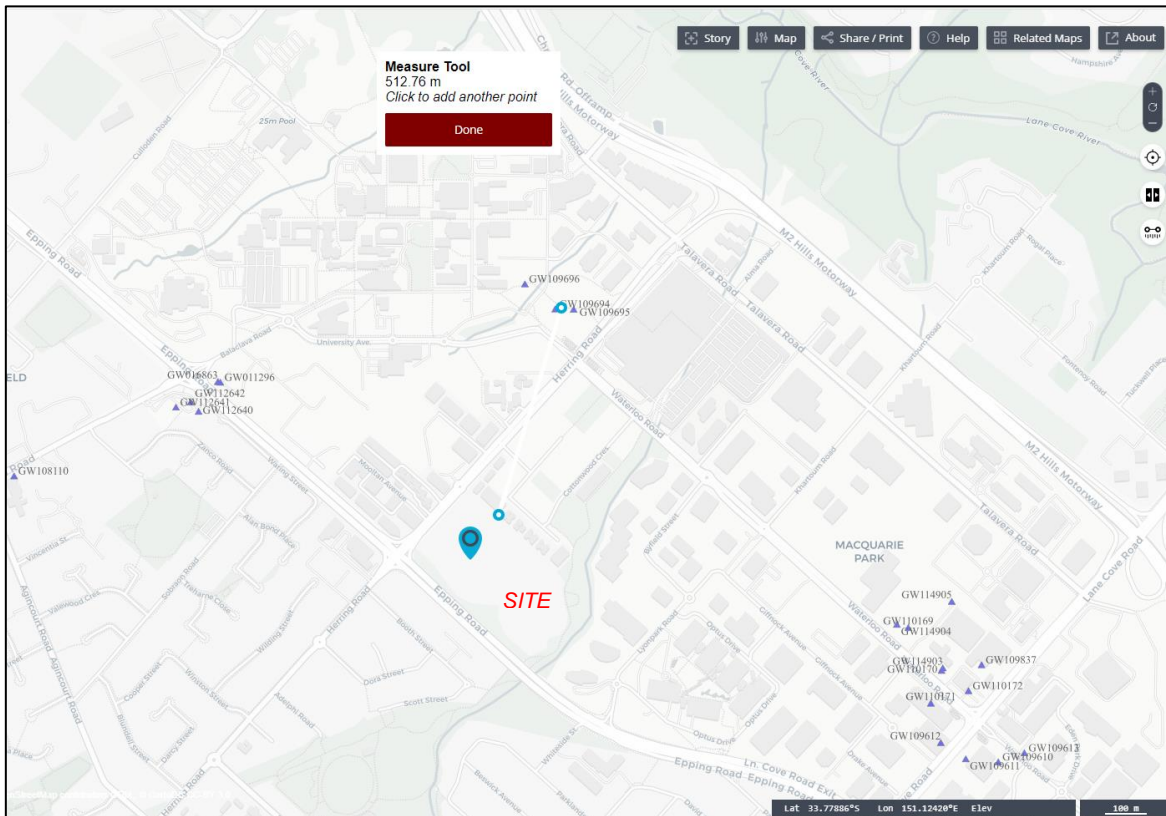


Figure 4: Map of NSW Registered Groundwater Wells (Purple Triangles)



Figure 5: Map of Groundwater Dependent Ecosystems (GDEs) Near the Site (Bureau of Meteorology (BoM): GDE Atlas online, viewed 28 April 2022.)

9.2 Summary of Assessment of Effects on Neighbouring Properties

The potential effects of dewatering on neighbouring properties and groundwater dependent ecosystems, building on the information already outlined above, is summarised in Table 12.

Table 12: Assessment of Potential Effects of Dewatering on Neighbouring Properties

Item	Comment
Proximity of Groundwater Dependent Ecosystems (GDEs)	No known groundwater dependent ecosystems in close proximity to the site. ELS Hall Park and Lane Cove River are more than 100 m and 1 km away from the site, respectively (see Figure 5)
Water Supply Losses by neighbouring groundwater users	A review of registered bores within a 500 m radius of the surrounding site was undertaken. The search identified no groundwater wells within the search area (see Figure 4). Seep/W analysis indicates drawdown of approximately 2 m at 50 m from the basement, which is still within the Midtown site.
Potential Subsidence of neighbouring structures	It is considered that the local lowering of the water levels within the rock will have no significant impact to the surrounding properties or structures. No settlement is anticipated due to groundwater drawdown in rock.
Mounding of water upgradient of structure	Significant mounding of groundwater is not expected. A drained basement would eliminate potential mounding.

10. Groundwater Management, Monitoring and Reporting

10.1 Approvals and Licensing

The proposed drained basement will be subject to DA approval. A separate approval for a water supply works is not required for a state significant development, provided approval for a drained basement is granted in the DA.

The following will then also be required:

- A water access license (WAL), nominating the subject development as the water supply work. This will need to be obtained from the Natural Resources Access Regulator (NRAR); and
- An allocation/entitlement sufficient for the proposed take. This may be obtained from a controlled allocation, or trading on the market.

Reference to the Water Sharing Plan for the Greater Metropolitan Region Groundwater Sources 2011 (accessed 2 May 2022), indicates that the site is within the Sydney Basin Central Groundwater Source.

The analysis indicates that an entitlement of 7 ML/year (ie 7 shares of entitlement) appears to be a reasonable target based on the available permeability data, and the proposed timing of the works, with excavation of the C3 and C4 basement in separate water years. Additional entitlements up to the anticipated upper bound of 17 ML/year may potentially allow greater flexibility during construction,

reduce delays, remediation and mitigation actions requirements, provided that the groundwater impacts remain within acceptable levels in both the short term and steady state condition, as measured by the monitoring program. Excess shares may then be sold on the market. Retaining a target of 7 ML/year increases the chance of remediation and control of inflow during construction being suitable for long-term targets, that may allow some or all long-term dewatering to fall within an exemption, particularly if the Stage 2 area is subdivided in the future. As noted previously these are estimates only and variation must be expected. Actual inflows will only be known at the time of excavation and dewatering.

10.2 Compliance and Mitigation Strategy

Additional measures to ensure compliance and mitigate against excessive impacts may be required if inflow volumes or groundwater impacts are found to be greater than expected.

10.2.1 Shoring and Bulk Excavation

The investigation results indicate that groundwater levels will be within sandstone, although areas of more fractured rock (eg in Units 3a and 3b) may require grouting or cut-off walls (eg by use of a secant-pile wall, or by over-excavation, installation of temporary drainage to manage short-term inflows, and installation of a more localised cut-off wall), to reduce inflows through the rock.

The design of shoring, including cut-off walls or grouting around the basement should consider the design flood levels at Shrimpton's Creek, which may result in higher than usual hydrostatic loads on these structures in the design flood event.

The flood levels indicated by the flood impact study suggest that infiltration of surface water may occur into the basement during a flood event, unless the basement retention is designed to be tanked above the sandstone and to withstand the full hydrostatic pressure. If the soils are saturated during the storm event, infiltration into the underlying bedrock may result in temporary higher inflows to the basement during these events.

It would be costly to continue to install cut-off walls to significant depth in the sandstone, particularly as shoring walls are not likely to be required once consistently medium strength rock with no adverse defects is encountered (typically Unit 3c).

For excavation below the shoring, where excessive inflows occur along particular defects, grouting or similar of the defects of concern should be considered to manage flows to acceptable levels. It is noted that these methods can be expensive and time consuming and may result in the redirection of flow rather than immediate reduction in inflow. These remediation measures should be designed and installed in accordance with the required design life, noting that temporary measures may be required to manage inflows for construction of more permanent inflow management.

Ongoing monitoring should be undertaken as excavation proceeds to allow identification of when groundwater impacts or inflows are excessive relative to the expected inflows. Excavation progress may need to be halted until the remedial actions are taken and found to be effective.

10.2.2 Detailed Excavation

The inflow arising from local excavations in sandstone below the basement floor levels will depend on local features within the rock. Grouting may be required to manage inflows, but if excessive inflow occurs, consideration could also be given to tanking local, deep structures where the structure can readily resist uplift loads (eg lift pits). For many local excavations, inflows may only be short-term (eg excavations for footings).

10.2.3 Groundwater Treatment and Disposal

The treatment and disposal of groundwater inflows to Shrimptons Creek is an important control on the impacts of the proposed dewatering. Current quality testing indicates that conventional water treatment measures can be used to manage water quality in this respect. As groundwater quality and treatment may change over time, the treatment provisions should be reviewed and revised, as required to meet the quality requirements for disposal to Shrimpton's Creek.

10.2.4 Separation of Stormwater and Groundwater Inflows

Stormwater should be effectively separated from groundwater inflows as soon as is practicable in the excavation area, to limit error in measurement of groundwater inflows and for effective treatment of groundwater. Such separation may be impractical, at least prior to the completion of excavation.

10.3 Monitoring and Reporting

Monitoring and reporting will be required to ensure that the impact of the drained basement is consistent with expectations, and that dewatering activities meet the requirements of the approvals and licenses.

Monitoring requirements are summarised in Table 13.

Table 13: Summary of Monitoring Requirements during Excavation

ID	Item	Monitoring	Requirements	Reporting*
1	Groundwater Drawdown	By monitoring of water levels in standpipes at least 3 locations around the outside of the proposed basement levels. Given the scale of the site, and potential access limitations, additional bores are likely to be required to effectively monitor drawdown. In event of damage or obstruction, replacement required within a week.	Replacement strategy. Daily records. Trigger values based on drawdown model, depend on location of monitoring wells (will depend on other site works and accessibility).	Reporting frequency based on excavation progress.
2	Groundwater Quality Sampling and Testing	Sampling and testing of water from wells and excavation, or the point of discharge. Contaminant and physical properties tested to be nominated by	pH and turbidity to be measured daily for the first week and then weekly.	

ID	Item	Monitoring	Requirements	Reporting*
		the authority accepting water but to include: Heavy Metals and PAH pH & conductivity Suspended Solids Turbidity Dissolved Oxygen Levels	Two rounds of groundwater sampling and testing initially. Subject to relatively uniform results groundwater testing to be carried out monthly or as otherwise agreed with the authority accepting the water.	
3	Groundwater inflow (or disposal) rates	Groundwater inflow to be measured in collection tanks of a pre-determined size or using a calibrated flow meter connected to the dewatering system. Excavation depths to be recorded with inflow records, until bulk excavation levels have been reached.	Daily, or once collection point is filled (whichever is more frequent), during excavation and for the first two weeks following excavation then daily. Trigger values based on approvals & entitlements	Weekly
4	Quantity of water disposed off-site (includes rainwater)	Calibrated Flowmeter connected to any pump-out system	Automatically	Weekly (Annual reporting to NRAR, but earlier if exceedance is expected)
5	(Optional) Rain Gauge measurement	In the event of high rainfall during excavation prior to construction of the basement structure and stormwater control, daily rain gauge measurements may be prudent to improve assessment of groundwater inflows from the available measurements	Daily, if recorded	As per inflow/disposal rates

Note: * Internal reporting to Principal, only. Reporting to NRAR will generally be on an annual basis for groundwater inflow (per "water year"), or as required by 'trigger levels'.

A detailed groundwater management and monitoring plan should be prepared prior to commencement of work on site to identify the trigger values for the above monitoring, with due consideration of available monitoring points, entitlements and license conditions (eg metering). The expected impacts outlined in this report would provide the baseline for development of these triggers. Reporting responsibilities, including responsibilities for reporting to NRAR should form part of the monitoring plan, noting that exceedance of the expected impacts must be promptly reported to NRAR.

A long-term management plan will also need to be incorporated into the final building management strategy, to ensure that appropriate monitoring continues for the life of the building. This is expected to

include monthly water quality measurement of limited quality parameters, and monthly meter readings of discharge, with reporting to NRAR.

While not the subject of the current DA, it is anticipated that the three sites will be separated into lots in the future. As such action may allow some or all of the sites to fall under exemptions to Water Access Licences, it is suggested that the records for items 2-4 in Table 13 also be separately recorded and reported, if practical, to provide useful information to support future exemptions.

11. References

Kavvas, M., Giolas, A., & Papacharalambous, G., 1992: Drainage of Supported Excavations. Geotechnical & Geological Engineering, Vol. 10, pp. 141-157. Technical Note.

12. Limitations

Douglas Partners (DP) has prepared this report for this project at Stage 2, Midtown in accordance with DP's proposal dated 11 March 2022 and acceptance received from Chris Koukoutaris dated 11 March 2022. The work was carried out under the Consultancy Services Agreement dated 26 April 2021. This report is provided for the exclusive use of Frasers Ivanhoe 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 DP, does so entirely at its own risk and without recourse to DP for any loss or damage. In preparing this report DP 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 DP's field testing has been completed.

DP's advice is based upon the conditions encountered during investigations. The accuracy of the advice provided by DP 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. DP 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 DP. This is because this report has been written as advice and opinion rather than instructions for construction.

Douglas Partners Pty Ltd

Appendix A

About This Report

About this Report

Douglas Partners



Introduction

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

DP's 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 Conditions of Engagement 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, DP 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, DP 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, DP 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, DP 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

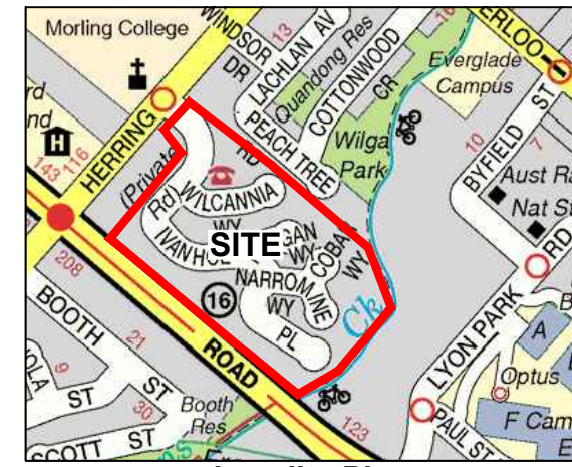
Where information obtained from this report is provided for tendering purposes, it is recommended that all information, including the written report and discussion, be made available. In circumstances where the discussion or comments section is not relevant to the contractual situation, it may be appropriate to prepare a specially edited document. DP 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.

Appendix B

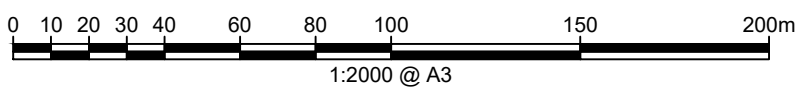
Drawings



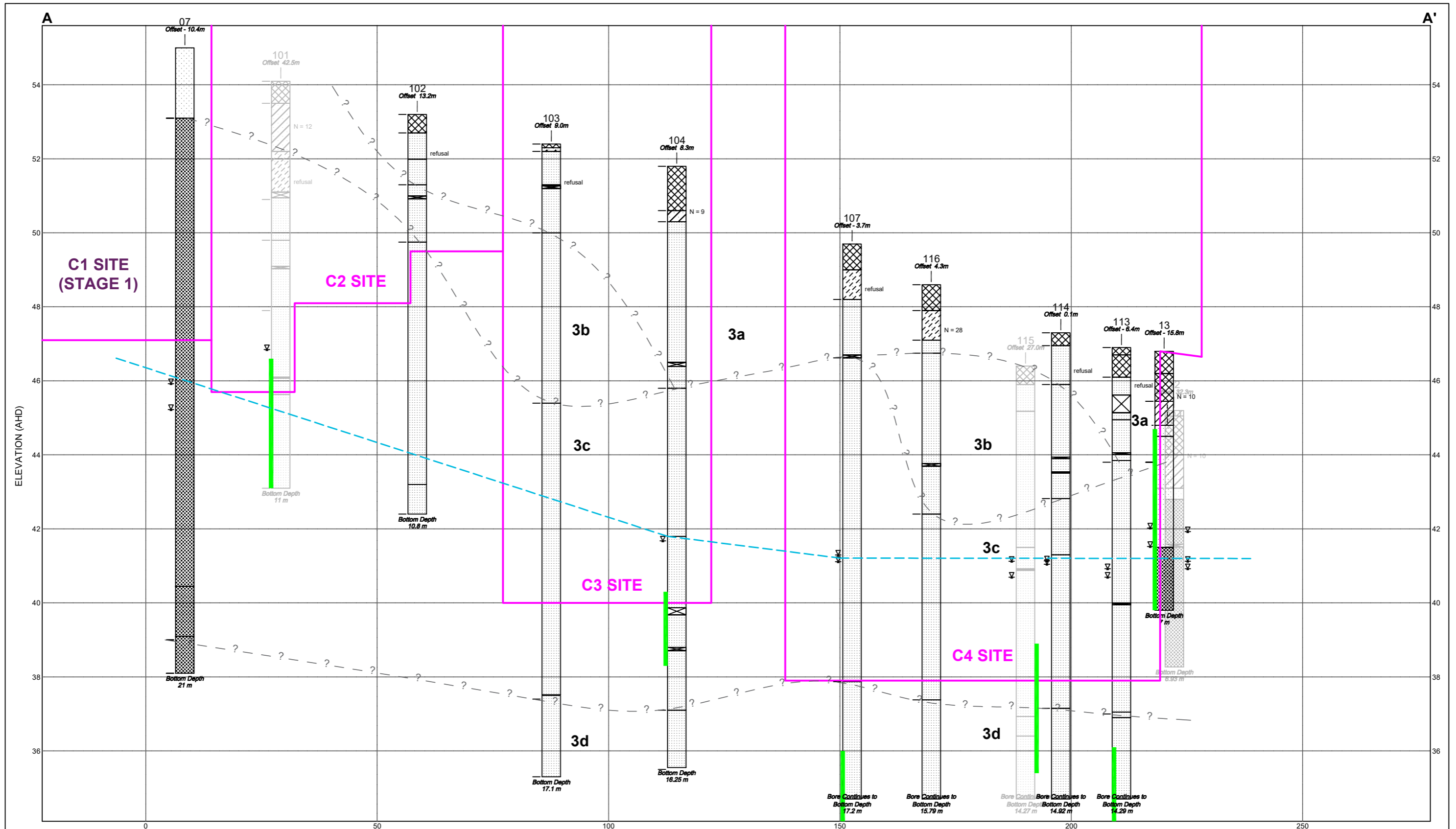
Locality Plan

- LEGEND**
- ◆ Borehole Location
 - ◆ Previous Cored Bore location
 - Standpipe Location (Current)
 - Standpipe Location (Destroyed)
 - - - Greater Midtown Site Boundary
 - - - Stage 2 Midtown Site Boundary
 - - - C2 Site - Approximate Proposed Building Footprint
 - - - C3 Site - Approximate Proposed Basement Footprint
 - - - C4 Site - Approximate Proposed Basement Footprint
 - - - Interpreted Sections (See Drawings 802 and 803)

NOTE:
1: Base image from MetroMap (Dated 09.02.2022)



	CLIENT: Frasers Property Ivanhoe		TITLE: Test Location Plan Proposed Residential Development Ivanhoe Estate, Macquarie Park		PROJECT No: 86043.06
	OFFICE: Sydney	DRAWN BY: MG			DRAWING No: 801
	SCALE: 1:2000 @ A3	DATE: 13.04.2022			REVISION: 0



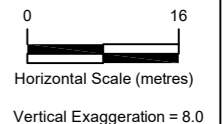
LEGEND		

NOTES:

- 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.
- Summary logs only and should be read in conjunction with detailed logs.
- Horizontal and vertical scales are not equal.
- Greyed out bore have not been included in the interpreted boundaries, but are near the section and included for comparison

TESTS / OTHER

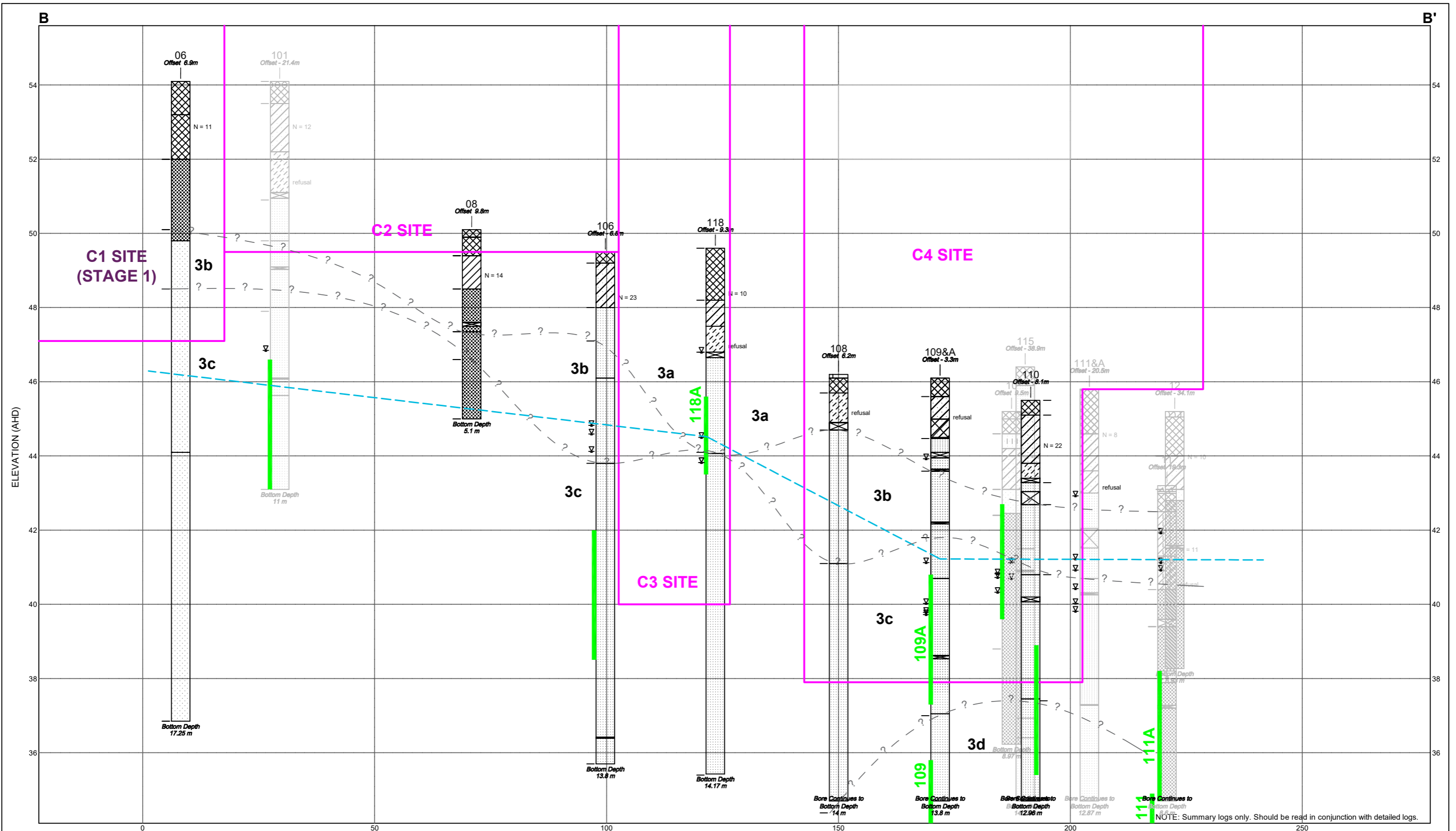
- N - Standard penetration test value
- ▽ - Water level
- - - - - Interpreted water table
- Standpipe Screen Length
- - - - - Approximate Basement/Design floor Level
- - - - - Interpreted Geotechnical Unit Boundary
- 3d - Interpreted Geotechnical Unit (only Sandstone labelled)



CLIENT: Frasers Property Ivanhoe Pty Ltd
 OFFICE: Sydney DRAWN BY: SCP
 SCALE: 1:800 (H) @ A3 DATE: 29.04.2022
 1:100 (V)

TITLE: **Interpreted Geotechnical Long Section A-A'**
Proposed Stage 2 Development
Midtown, Maquarie Park

PROJECT No: 86043.06
 DRAWING No: 802
 REVISION: 0

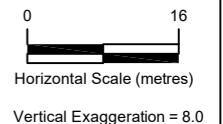


NOTE: Summary logs only. Should be read in conjunction with detailed logs.

LEGEND			

- NOTES:
- 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.
 - Summary logs only and should be read in conjunction with detailed logs.
 - Horizontal and vertical scales are not equal.
 - Greyed out bore have not been included in the interpreted boundaries, but are near the section and included for comparison

TESTS / OTHER	
N	- Standard penetration test value
	- Water level
	- Interpreted water table
	- Standpipe Screen Length
	- Approximate Basement/Design Floor Level/Boundary
	- Interpreted Geotechnical Unit Boundary
	- Interpreted Geotechnical Unit (only Sandstone labelled)



CLIENT: Frasers Property Ivanhoe Pty Ltd
 OFFICE: Sydney DRAWN BY: SCP
 SCALE: 1:800 (H) DATE: 29.04.2022
 1:100 (V) @ A3

TITLE: Interpreted Geotechnical Long Section B-B'
 Proposed Stage 2 Development
 Midtown, Maquarie Park

PROJECT No: 86043.06
 DRAWING No: 803
 REVISION: 0

Appendix C

Key Architectural Drawings



NOT FOR CONSTRUCTION



Client
Frasers Property Australia
 11268A DEVONSHIRE ST
 SURRY HILLS NSW 2010
 PH: 02 9211 2700
 ABN: 63111324353

REV	DESCRIPTION	DRAWN	DATE	REV	DESCRIPTION	DRAWN	DATE
DA2	DA Documentation		7/2022				

ALL LEVELS TO AUSTRALIAN HEIGHT DATUM.
 IT IS THE CONTRACTORS RESPONSIBILITY TO CONFIRM ALL MEASUREMENTS ON SITE PRIOR TO COMMENCEMENT OF WORK. DRAWINGS SHOULD NOT BE SCALED.
 WRITTEN DIMENSIONS ONLY SHOULD BE TAKEN FROM DRAWINGS. ALL DIMENSIONING IS TO SUBSTRATE BRICKWORK / BLOCKWORK UNLESS OTHERWISE NOTED.
 DESIGN AND DRAWINGS REMAIN COPYRIGHT OF STUDIO JOHNSTON
 NOT TO BE USED FOR CONSTRUCTION

Project
C3 Midtown MacPark
 Title
Basement 3

Job No.	2101	Rev.	
Scale	1:100 @ A1	Project	A-110- DA-2 B03
Date	7/2022	Drawn/Checked	PLJ/PJ CJ

BASEMENT BICYCLE & STORAGE SCHEDULE

Storage Type	Quantity
BASEMENT 1	
Social - 1 Bed (Vertical bicycle storage)	78
Social - 2 Bed (Horizontal bicycle storage)	62
Social - 2 Bed (Vertical bicycle storage)	16
Social - Studio (Vertical bicycle storage)	23
Social - Visitor Bicycle Parking Spaces (Hoops)	4
BASEMENT 2	
Market - 1 Bed (Vertical bicycle storage)	78
Market - 2 Bed (Horizontal bicycle storage)	24
Market - 3 Bed (Horizontal bicycle storage)	10
Market - 4 Bed (Horizontal bicycle storage)	4
Market - Visitor bicycle parking spaces (Hoops)	6
Social - 1 Bed (Vertical bicycle storage)	19
Social - 2 Bed (Horizontal bicycle storage)	17
Social - Studio (Vertical bicycle storage)	1
BASEMENT 3	
Market - 1 Bed (Vertical bicycle storage)	55
Market - 2 Bed (Horizontal bicycle storage)	24
Market - 2 Bed (Vertical bicycle storage)	44
Market - 3 Bed (Horizontal bicycle storage)	33
Total	498

PARKING SCHEDULE

PARKING TYPE	Quantity
BASEMENT 1	
5400x2400 Social Accessible (Angle)	10
5400x2400 Social Residential (Angle)	81
5400x2400 Social Residential (Parallel)	5
5400x2400 Social Visitor (Angle)	9
5400x2400 Social Visitor (Parallel)	2
Shared Space	5
BASEMENT 2	112
5400x2400 Market Accessible (Angle)	8
5400x2400 Market Residential (Angle)	97
5400x2400 Market Residential (Parallel)	6
5400x2400 Market Visitor (Angle)	7
5400x2400 Social Residential (Angle)	11
Shared Space	4
BASEMENT 3	133
5400x2400 Market Accessible (Angle)	6
5400x2400 Market Residential (Angle)	135
5400x2400 Market Residential (Parallel)	12
5400x2400 Market Visitor (Angle)	7
Shared Space	3
Grand Total (Car spaces)	396
Shared Spaces	12
Car Wash Bays	2

Basement 1	Area	5555m ²
Total spaces inc. Shared spaces	Efficiency	49 m ² /space
Basement 2	Area	5555m ²
Total spaces inc. Shared spaces	Efficiency	41 m ² /space
Basement 3	Area	5555m ²
Total spaces inc. Shared spaces	Efficiency	34 m ² /space
Total Basement area:	16665m ²	
Total Efficiency rate:	40.8m ² /space	

Legend
 Deep Soil

Cox Architecture
 Level 6, 155 Clarence Street,
 Sydney, NSW 2000, Australia
 T + 61 2 9267 9599
 F + 61 2 9264 5844
 www.coxarchitecture.com.au

Nominated Architects
 Joe Agius no. 6491
 Russel Lee no. 6367



Client
 FRASERS PROPERTY

Project No.
 220148.00

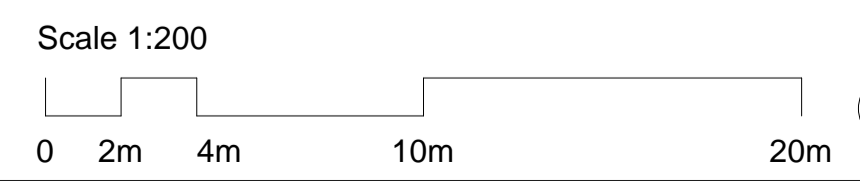
Project
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 EPPING ROAD, MACQUARIE PARK, NSW

Drawing Title
 BASEMENT 3 PLAN

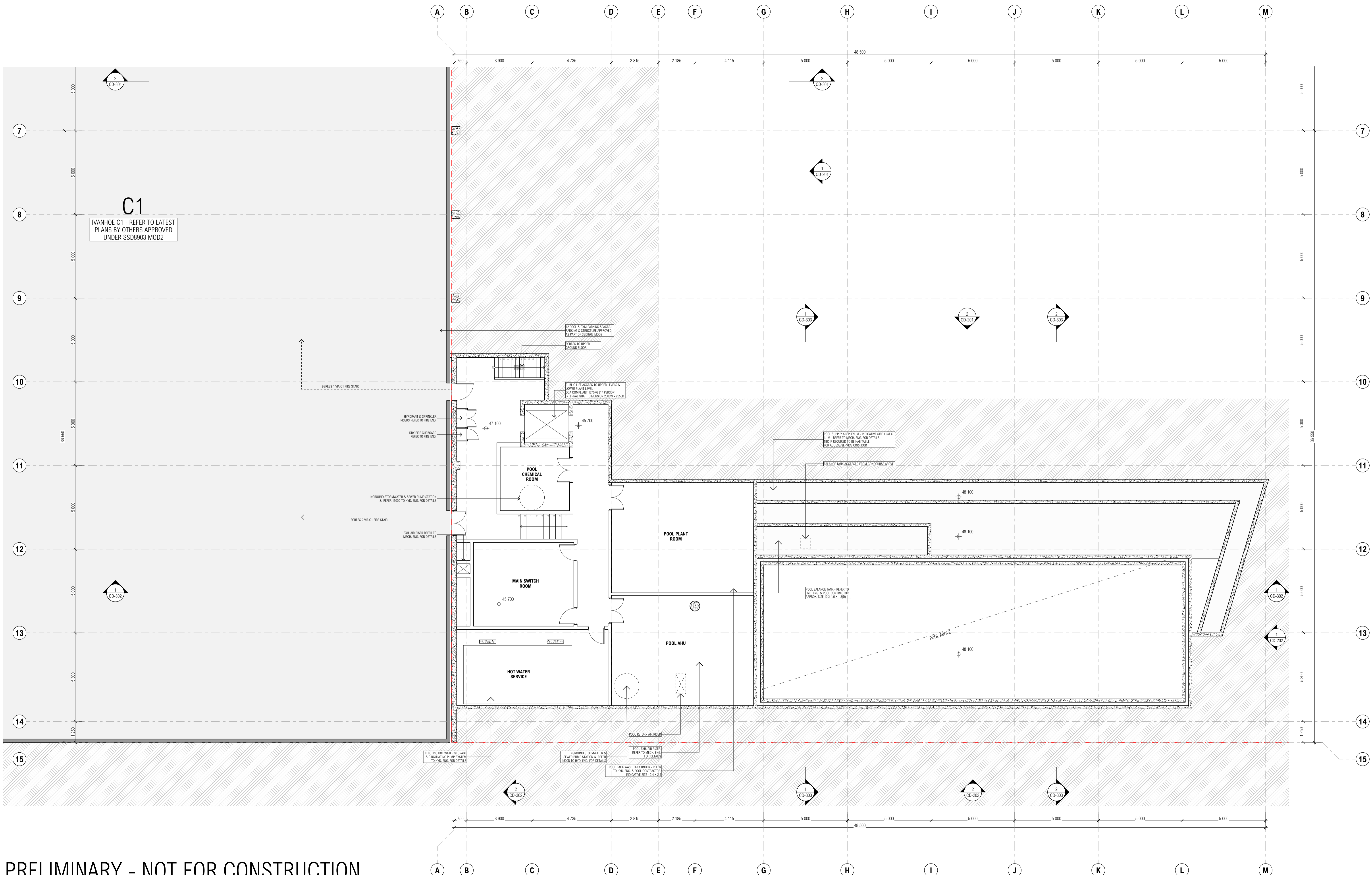
Document Control Status:
 NOT FOR CONSTRUCTION
 DEVELOPMENT APPLICATION

Project Architect: AL
Design Associates: FM / RB
Project Director: RJ
Drawing Number: A-DA-2050

Drawn: IC / DP
Scale: 1 : 200 @ A1
Date: 17.12.2021
Revision:



DA ISSUE



PRELIMINARY - NOT FOR CONSTRUCTION

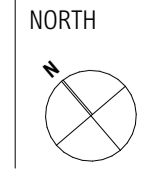
ARCHITECT
CHROFI
 3/1 THE CORSO MANLY NSW 2095 AUSTRALIA
 T +61 2 8096 8500 E info@chrofi.com
CHOI ROPHA FIGHERA P/L ACN 144 714 885 ATF CHOI ROPHA FIGHERA UNIT TRUST T/A CHROFI ABN 22 365 257 187 NOMINATED ARCHITECT JOHN CHOI 8706 TAI ROPHA 6568 STEVEN FIGHERA 0600 THIS DRAWING SHOULD BE READ IN CONJUNCTION WITH ALL RELEVANT CONTRACTS, SPECIFICATION, REPORT AND DRAWINGS. DO NOT SCALE DRAWINGS. DIMENSIONS GOVERN. VERIFY ALL DIMENSIONS ON SITE BEFORE CONSTRUCTION. COPYRIGHT OF THIS DRAWING IS VESTED IN CHROFI.

CLIENT
FRASERS PROPERTY
 LANDSCAPE ARCHITECT
MCGREGOR COXALL

REV	DATE	ISSUE	REV	DATE	ISSUE
A	23/2/22	PRELIMINARY GA ISSUE			

PROJECT IVANHOE VILLAGE GREEN & COMMUNITY CENTRE 1 IVANHOE PLACE, MACQUARIE PARK NSW 2113					
PROJECT NUMBER	PLOT DATE	DRAWN	CHECKED	SHEET SCALE	SHEET SIZE
2041	23/2/22	LH	HR	1:100	A1

DRAWING TITLE BASEMENT PLAN A	
DRAWING NUMBER	REVISION
A-CD-101	A



Appendix D

Groundwater Monitoring Reports

Frasers Property Ivanhoe Pty Ltd
Level 2, 1C Homebush Bay Drive
Rhodes NSW 2138

Project 86043.01
30 July 2018
R.005.Rev0
SCP:cm

Attention: Mr Chris Koukoutaris

Email: Chris.Koukoutaris@frasersproperty.com.au

Dear Chris Koukoutaris

Groundwater Monitoring
Proposed Residential Development
Ivanhoe Estate, Macquarie Park

This letter provides a summary of groundwater monitoring results at Ivanhoe Estate for the period 14 November 2017 to 22 June 2018, and brief comments.

Douglas Partners Pty Ltd (DP) installed six groundwater monitors (data-loggers) in monitoring wells at Bores 01, 05, 07, 10, 12 and 13 in November 2017, during geotechnical investigations at the site. The bore locations are shown in the attached Drawing GW1, and reference should be made to DP Report 86043.01.R.001.Rev1 for the detailed methods and results of the geotechnical investigation, and details of standpipe construction. The standpipes were purged of groundwater prior to the installation of groundwater monitors.

During the monitoring period, the dataloggers were inspected on a regular basis for intermediate uploads and maintenance. The dataloggers were generally removed from the boreholes on 22 June 2018, except at Bore 05, where the datalogger was removed in early March 2018 due to demolition works in the area. Surface damage to the standpipe was also observed at Bore 01 during the site visit of March 2018, with more severe damage noted in June 2018.

The attached figures show the water levels at well locations from 14 November 2017 to 22 June 2018, together with daily rainfall measurements from the Bureau of Meteorology. Rainfall measurements are those measured at Macquarie Park (Willandra Village) from 1 November 2017 to 30 June 2018.

The results of groundwater levels are summarised in the following table.

Table 1: Summary of Groundwater Monitoring Measurements

Bore	Ground Surface Level (RL)	Range of Groundwater Depths (m)	Range of Groundwater Levels (RL)	Typical Groundwater Levels (RL)	Comment
01	67.5	17.3 - 18.2	49.3 - 50.2	49.3 - 50.0	Outlier readings in June 2018
05	59.2	12.5 - 12.9	46.3 - 46.7	46.3 - 46.7	
07	59.1	13.2 - 13.9	45.2 - 45.8	45.2 - 45.8	
10	45.2	4.4 - 4.9	40.3 - 40.8	40.3 - 40.8	
12	45.2	3.3 - 4.3	40.8 - 41.8	40.8 - 41.2	Responsive to rainfall events
13	46.8	4.8 - 5.3	41.2 - 42.0	41.2 - 42.0	

The following comments are made with regards to the groundwater readings obtained at the site:

- Groundwater levels at the site generally fell slightly during the course of the monitoring period, with typical fluctuations of 0.5 m to 1.0 m.
- Groundwater levels generally showed no significant response to rainfall events, with the exception of groundwater levels at Bore 12.
- At Bore 01, unusual readings were obtained in June 2018 following rainfall. It is considered likely that this is due to the surficial damage observed at the standpipe, with dislodgement of the standpipe cover possibly resulting in surface water inflow to the standpipe.
- At Bore 12, elevated groundwater readings followed some rainfall events, with water levels rising by up to 0.6 m, then rapidly dissipating to more typical groundwater levels. The standpipe construction at this location includes a bentonite seal down to sandstone. Presuming that the seal has performed adequately, the cause of the elevated water levels may be due to local ground conditions (eg groundwater infiltration through joints or bedding planes in the sandstone) and its proximity to the creek and/or the adjacent stormwater drains.
- Reference to the borehole logs in DP Report 86043.01.R.001.Rev1 indicates that the above groundwater levels correspond to levels within the sandstone bedrock.

The limitations of the associated geotechnical investigation report, DP Report 86043.01.R.001.Rev1 apply to this letter report.

Please contact the undersigned if you have any questions on this matter.

Yours faithfully

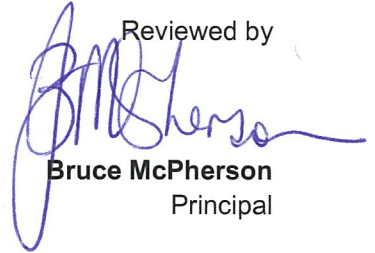
Douglas Partners Pty Ltd



Sally Peacock
Geotechnical Engineer

Attachments: About this Report
 Drawing GW1
 Figures 1 to 6

Reviewed by



Bruce McPherson
Principal

About this Report

Douglas Partners



Introduction

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

DP's 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 Conditions of Engagement 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, DP 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, DP 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, DP will be pleased to assist with investigations or advice to resolve the matter.

About this Report

Site Anomalies

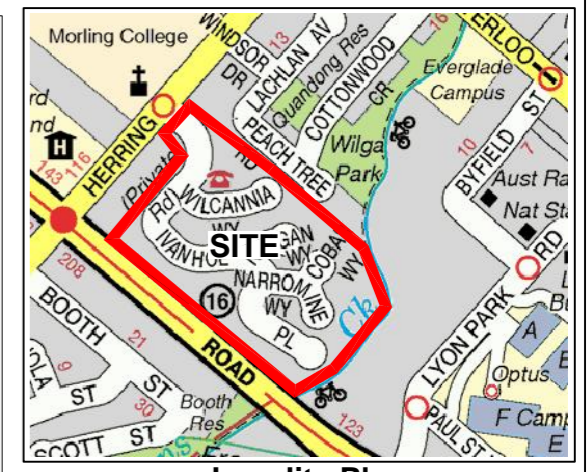
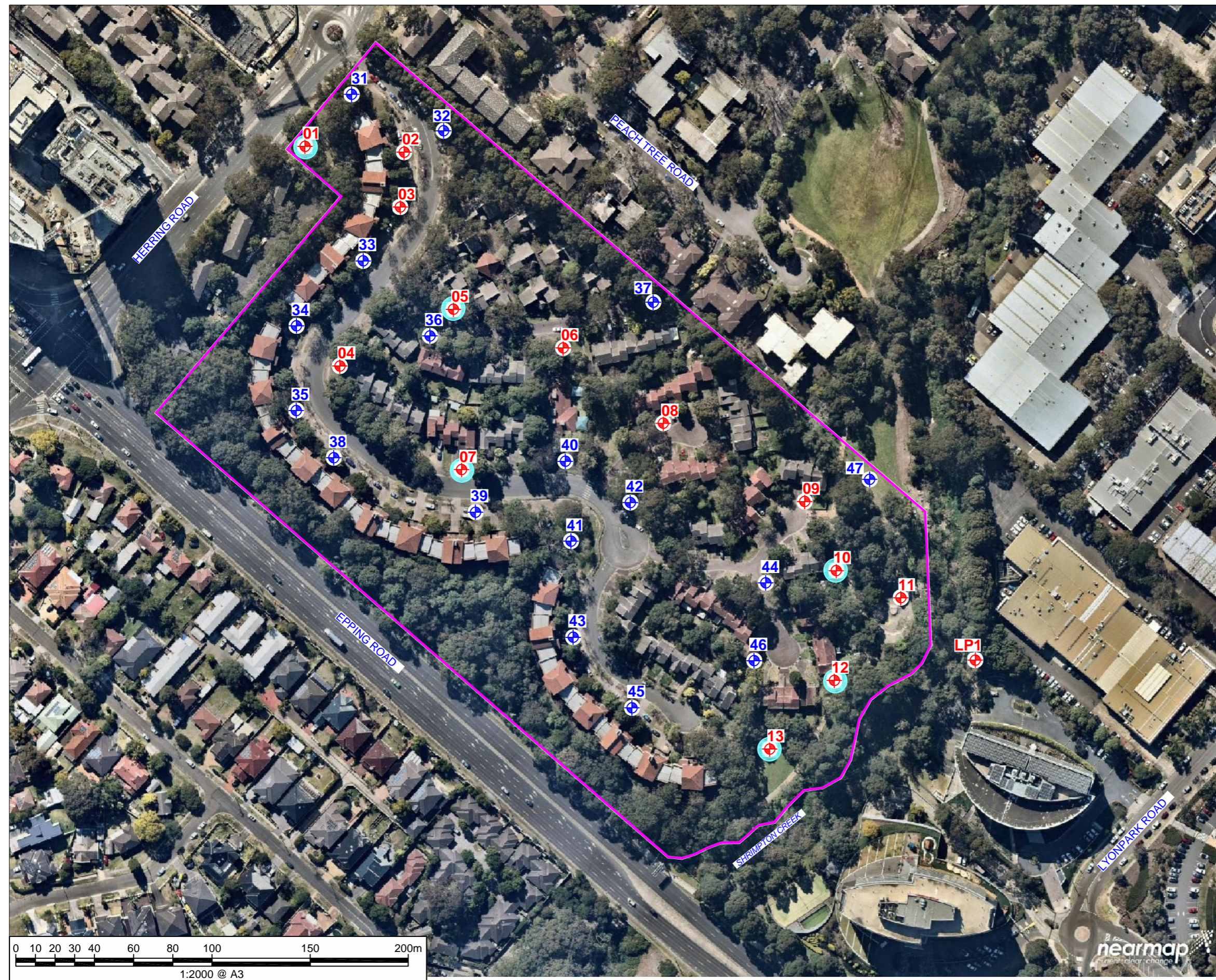
In the event that conditions encountered on site during construction appear to vary from those which were expected from the information contained in the report, DP requests that it be immediately notified. Most problems are much more readily resolved when conditions are exposed rather than at some later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



Locality Plan

NOTE:
 1: Base image from Nearmap.com (Dated 19.10.2017)
 2: Test locations are approximate only and are shown with reference to existing features.

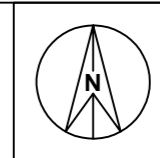
LEGEND

- ◆ Cored bore location
- ◆ Shallow bore location
- Standpipe location
- Site boundary



CLIENT: Frasers Property Ivanhoe
 OFFICE: Sydney DRAWN BY: PSCH
 SCALE: 1:2000 @ A3 DATE: 04.07.2018

TITLE: **Test Location Plan**
Proposed Residential Development
Ivanhoe Estate, MACQUARIE PARK



PROJECT No: 86043.01
 DRAWING No: GW1
 REVISION: 0

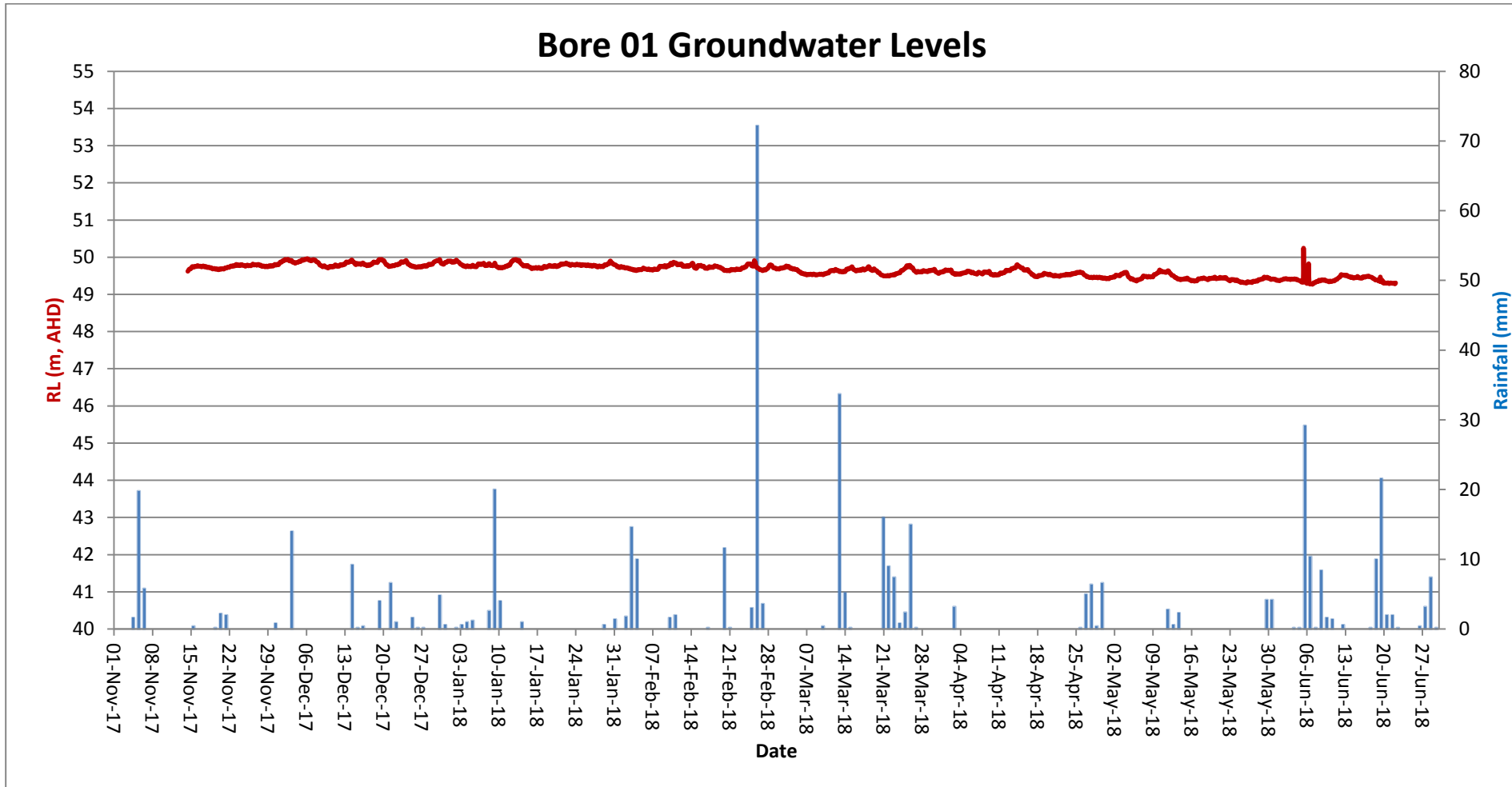


Figure 1: Groundwater Monitoring Results at Bore 01

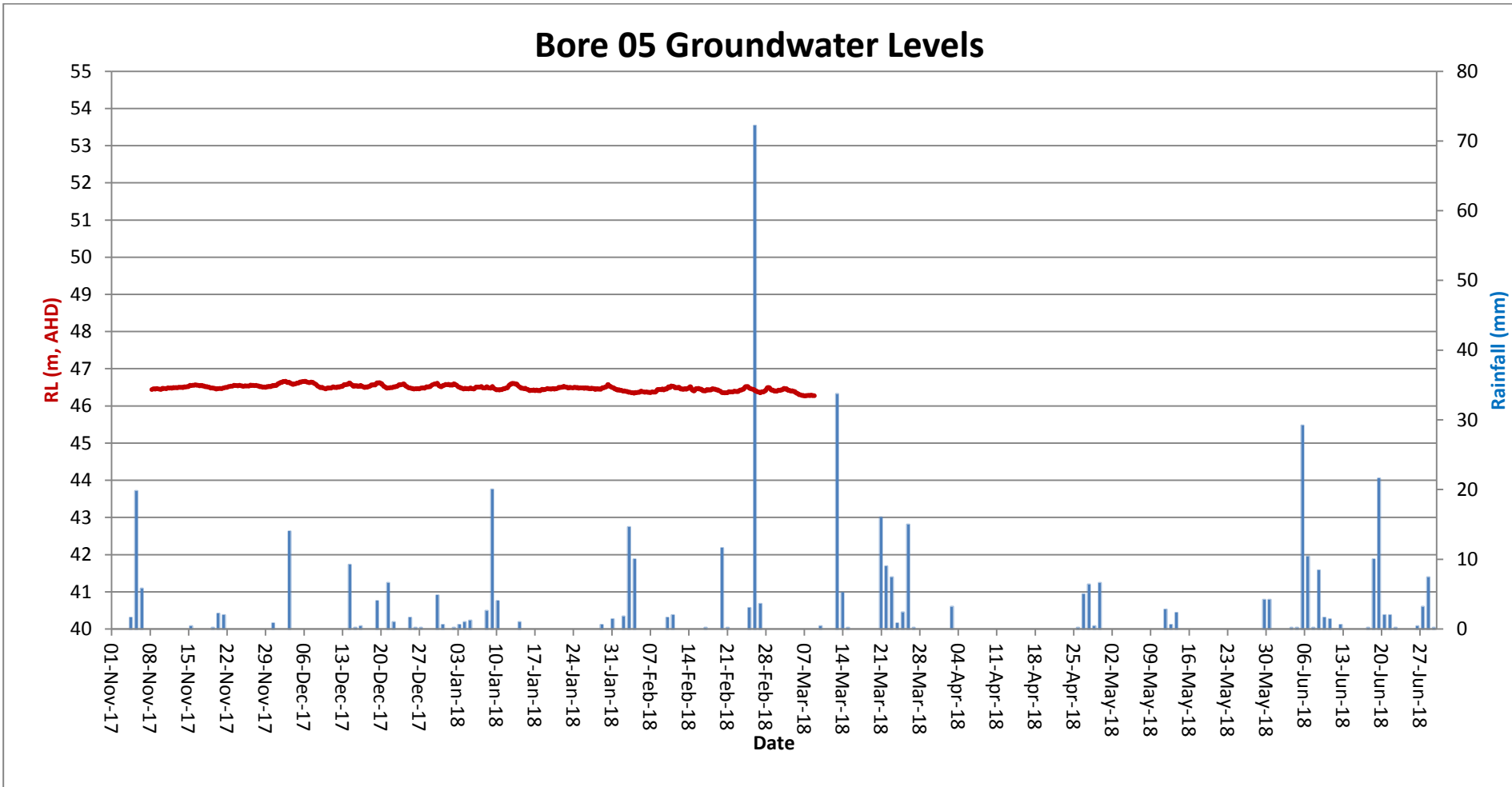


Figure 2: Groundwater Monitoring Results at Bore 05

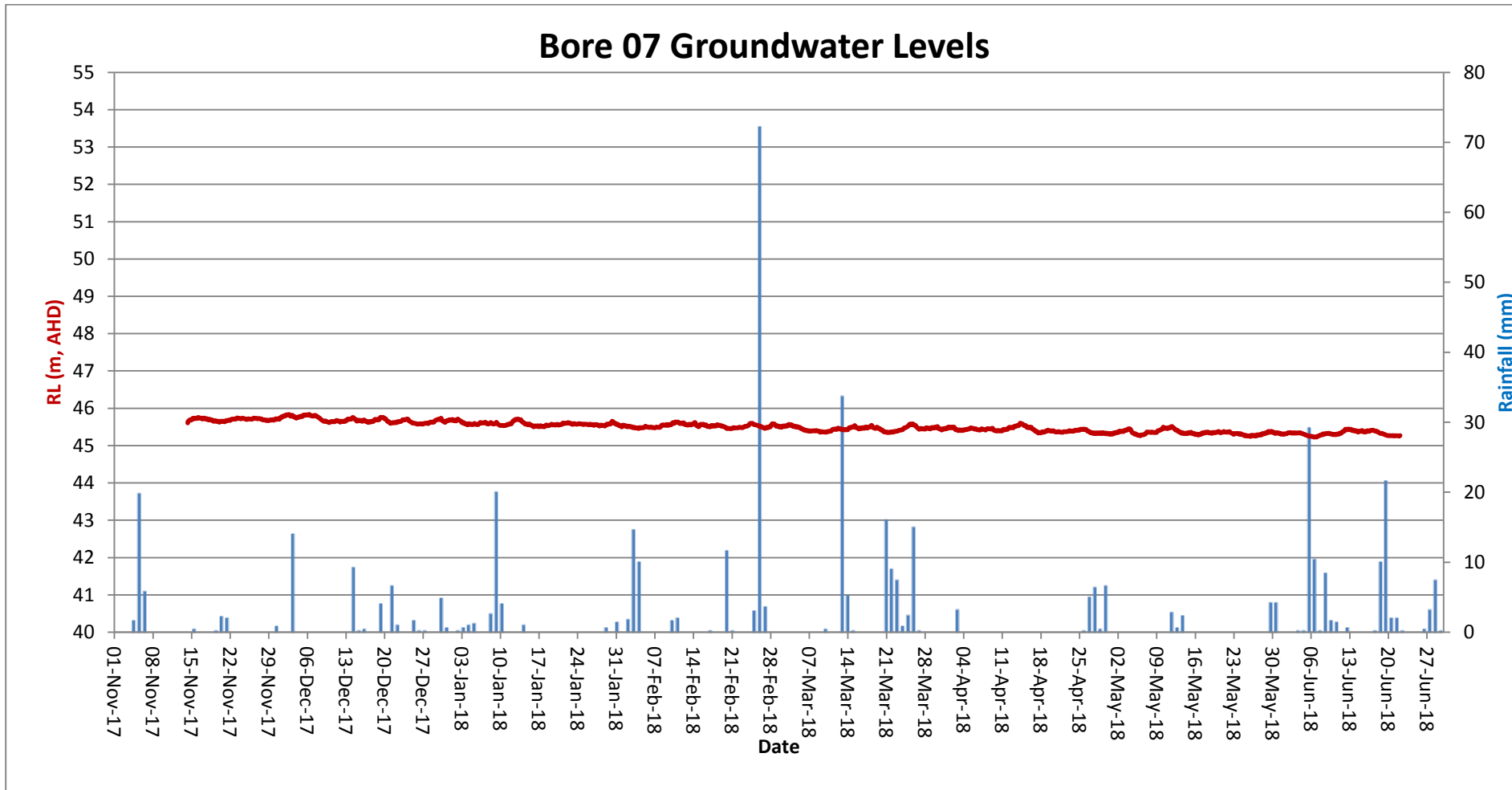


Figure 3: Groundwater Monitoring Results at Bore 07

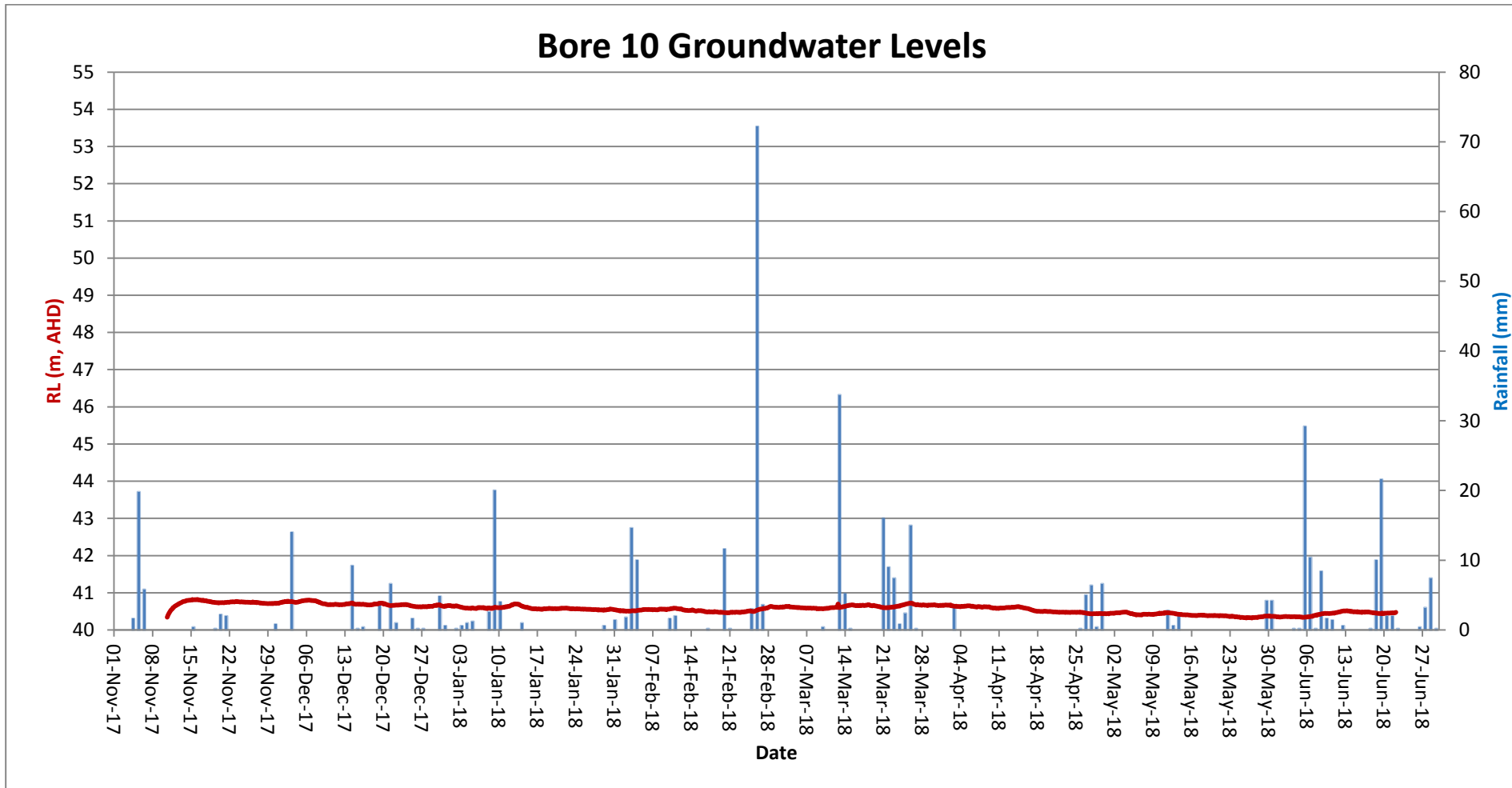


Figure 4: Groundwater Monitoring Results at Bore 10

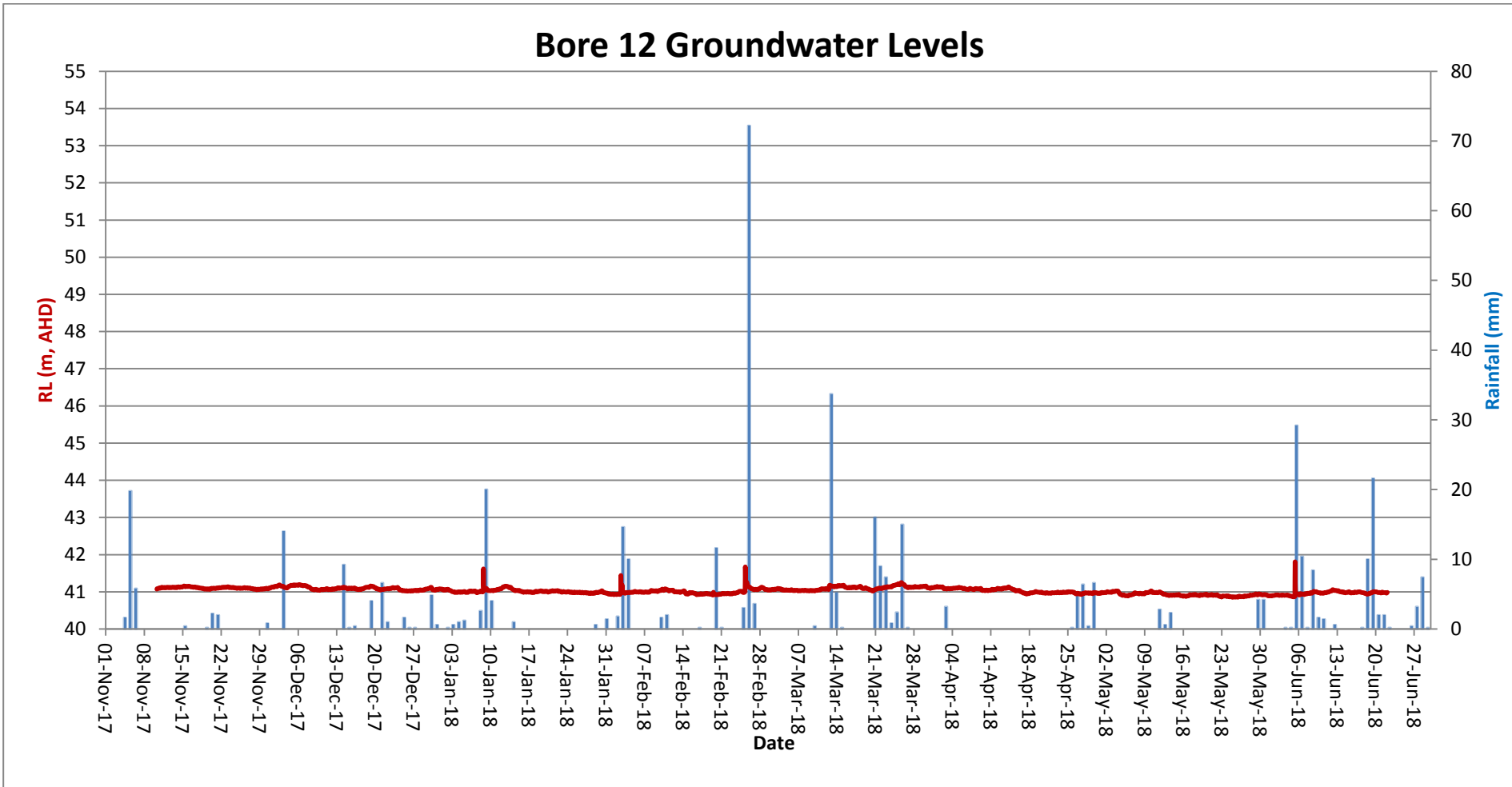


Figure 5: Groundwater Monitoring Results at Bore 12

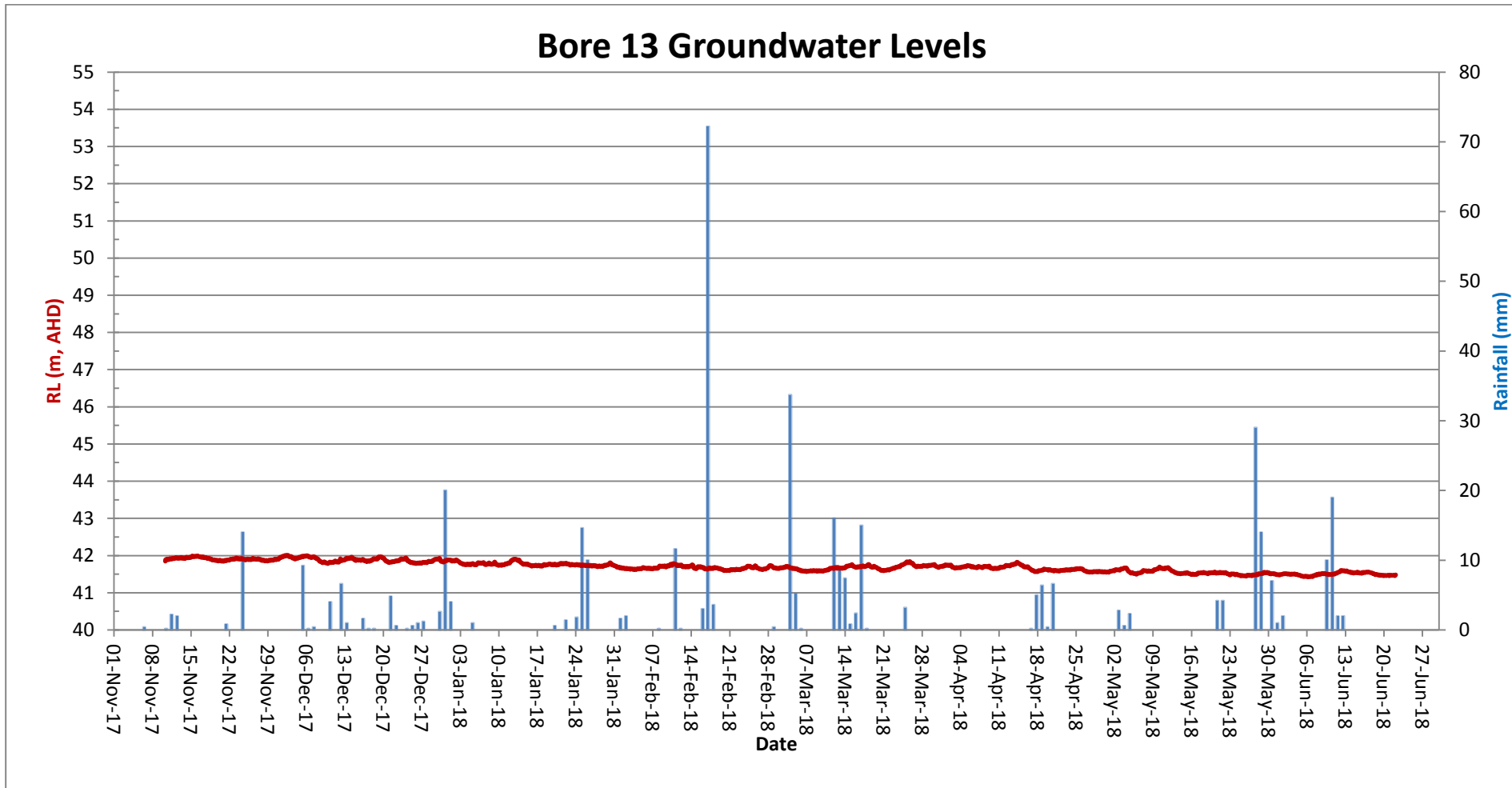


Figure 6: Groundwater Monitoring Results at Bore 13

Appendix D - Summary of Groundwater Measurements - Midtown, Macquarie Park

Groundwater level measurements at standpipes in the vicinity of the Stage 2 development area of the Midtown site are summarised in Table D1, below, together with reference to the reports which provide the relevant logs. Standpipe construction details are summarised in Table D2.

Table D1 – Summary of Groundwater Measurements – Stage 2 Midtown, Macquarie Park

Test Location	Ground Surface RL	Depth to Water (m)	Water Level (RL)	Comment	Gravel Interval (m)	Status	Original Report(s)
07	59.1	13.2-13.9	45.2-45.8	Monitoring Period November 2017-June 2018	1.2-21.0	Destroyed	86043.01.R.005.Rev0; 86043.01.R.001.Rev1
10	45.2	4.4-4.9	40.3-40.8	Monitoring Period November 2017-June 2018	2.6-5.6	Missing	86043.01.R.005.Rev0; 86043.01.R.001.Rev1
12	45.2	3.3-4.3	40.8-41.8	Monitoring Period November 2017-June 2018; Responsive to rainfall events	2.3-6.93	Missing	86043.01.R.005.Rev0; 86043.01.R.001.Rev1
13	46.8	4.8-5.3	41.2-42.0	Monitoring Period November 2017-June 2018	1.8-7.0	Missing	86043.01.R.005.Rev0; 86043.01.R.001.Rev1
101	54.1	7.28	46.8	11/05/2021	7.5-11.0	Intact	86043.06.R.001
103	52.4	-	-	No reading obtained before destruction	11.5-15.0	Destroyed	86043.06.R.002
104A	51.7	10.15	41.55	28/05/21	11.5-13.5	Intact	86043.06.R.002
106	49.5	4.93-4.98	44.5-44.6	11&28/05/2021	7.5-11.0	Intact	86043.06.R.002
107	49.7	8.43-8.61	41.1-41.3	28/04/2021 (8.61m), 28/5/21 (8.43m)	13.7-17.2	Intact	86043.06.R.003
109	46.1	6.34-6.4	39.7-39.8	28/04/2021 (6.4m), 28/5/21 (6.34m)	10.3-13.8	Intact	86043.06.R.003
109A	46.1	2.2-6.1	40.0-43.9	17/5/21 (2.2m), 28/5/21 (6.1m); Nested well	5.0-8.5	Intact	86043.06.R.003
111	45.8	4.9-6.0	39.8-40.9	28/4/21 (6.0m), 17/5/21 (4.9m), 27/5/21 (5.95m)	8.3-11.8	Intact	86043.06.R.003
111A	45.8	2.9-5.54	40.3-42.9	17/5/21 (2.9m), 27/5/21 (5.54m); Nested well	5.0-8.5	Intact	86043.06.R.003
113	46.9	6.23-6.0	40.7-40.9	28/04/2021 (6.23m), 27/5/21 (6.0m)	10.8-14.29	Intact	86043.06.R.003

Continued on next page

Table D1 – Summary of Groundwater Measurements – Stage 2 Midtown, Macquarie Park (continued)

Test Location	Ground Surface RL	Depth to Water (m)	Water Level (RL)	Comment	Gravel Interval (m)	Status	Original Report(s)
114	47.3	6.28-6.19	41.0-41.1	28/04/2021 (6.28m), 28/5/21 (6.19m)	8.3-14.92	Intact	86043.06.R.003
114A	47.3	4.06	43.2	28/5/21; Nested well	1.5-4.5	Intact	86043.06.R.003
115	46.4	5.3-5.73	40.7-41.1	17/5/21 (5.3m), 27/5/21 (5.73m);	7.5-11.0	Intact	86043.06.R.003
118A	50.0	5.38	44.6	28/5/21	4.0-6.1	Intact	86043.06.R.002

Table D2 – Summary of Well Construction – Stage 2 Midtown, Macquarie Park

Bore	101	103	104A	106	107	109	109A
Ground Level	54.1	52.4	51.7	49.5	49.7	46.1	46.1
Backfill	0-7.0	0-11.0	0-10.5	0-7.0	0-13.2	0-9.5	0-4.5
Bento	7.0-7.5	11.0-11.5	10.5-11.5	7.0-7.5	13.2-13.7	9.5-10.3	4.5-5.0
Gravel	7.5-11.0	11.5-15.0	11.5-13.5	7.5-11.0	13.7-17.2	10.3-13.8	5.0-8.5
Blank PVC	0-8.0	0-12.0	0-12.0	0-8.0	0-14.2	0-10.8	0-5.5
Slotted PVC	8.0-11.0	12.0-15.0	12.0-13.5	8.0-11.0	14.2-17.2	10.8-13.8	5.5-8.5

Bore	111	111A	113	114	114A	115	118A
Ground Level	45.8	45.8	46.9	47.3	47.3	46.4	50
Backfill	0-7.5	0-4.5	0-10.3	0-7.8	0-0.5	0-7.0	0-3.0
Bento	7.5-8.3	4.5-5.0	10.3-10.8	7.8-8.3	0.5-1.5	7.0-7.5	3.0-4.0
Gravel	8.3-11.8	5.0-8.5	10.8-14.29	8.3-14.92	1.5-4.5	7.5-11.0	4.0-6.1
Blank PVC	0-8.8	0-5.5	0-11.29	0-8.92	0-2.0	0-8.0	0.0-4.5
Slotted PVC	8.8-11.8	5.5-8.5	11.29-14.29	14.92-8.92	2.0-4.5	8.0-11.0	4.5-6.1

Frasers Property Ivanhoe Pty Ltd
Level 2, 1C Homebush Bay Drive
Rhodes NSW 2138

Project 86043.06
4 May 2022
R.006.Rev0
SCP

Attention: Mr Chris Koukoutaris

Email: Chris.Koukoutaris@frasersproperty.com.au

Dear Chris

Groundwater Monitoring
Stage 2 - Midtown
Herring Road, Macquarie Park

1. Introduction

This letter provides a summary of groundwater monitoring results following investigation of Stage 2 of Ivanhoe Estate for the period 28 May 2021 to 20 April 2022, and brief comments.

The groundwater monitoring follows previous groundwater monitoring at the Greater Ivanhoe Estate area, encompassing the Stage 2 area, and undertaken from 14 November 2017 to 22 June 2018. The results of that monitoring were previously reported in DP memo 86043.01.R.005.Rev0, dated 30 July 2018. Attempts to re-locate those standpipes in March and April 2021 were unsuccessful, and given the site works that had occurred at that time, those standpipes are presumed to be destroyed.

2. Groundwater Monitoring

Douglas Partners Pty Ltd (DP) installed four groundwater monitors (data-loggers) in monitoring wells at Bores 106, 111A and 114 on 28 May 2021, and Bore 118A on 3 June 2021, following geotechnical investigation at the site. A further two groundwater monitors (data-loggers) were installed at Bores 109A and 111 on 21 March 2022.

The bore locations are shown in the attached Drawing 101, and reference should be made to DP Reports 86043.06.R.001 to R.003 for the detailed methods and results of the geotechnical investigation, and details of standpipe construction. The standpipes were purged of groundwater following the completion of drilling.

During the monitoring period, the dataloggers were periodically inspected for intermediate uploads and maintenance. Unfortunately, several of the data-loggers were buried or destroyed during site works following installation. While repeated attempts were made to re-locate the standpipes, and to excavate materials that obstructed or buried standpipes, the data-loggers (and final monitoring data) were

generally lost. Only the data-logger at Bore 118A remained operational for the full intended monitoring period.

The attached figures show the measurements of water levels at well locations from 17 June 2021 to 20 April 2022, where available from data-logger records, together with daily rainfall measurements from the Bureau of Meteorology. Rainfall measurements are those measured at Macquarie Park (Willandra Village) for the relevant time interval.

The results are summarised in the following Table 1.

Table 1: Summary of Groundwater Monitoring Measurements at Data-logger Locations

Bore	Ground Surface Level (RL)	Manual Measured groundwater depths (m)*	Monitoring Period	Range of Groundwater Depths (m)*	Range of Groundwater Levels (RL)*	Comment
106	49.5	4.9 (11/5/21 – after drilling) 5.0 (28/5/21)	28 May 2021-31 August 2021	4.7 – 5.4	44.2 – 44.8	Buried/destroyed after August 2021
109A	46.1	2.2 (17/5/21 – after drilling) 6.1 (28/5/21) 5.0 (21/3/22)	-	5.0 – 6.1	40.0 – 41.1	Buried/destroyed after 21 March 2022 prior to first datalogger upload
111	45.8	6.0 (28/4/21 – after drilling) 4.9 (17/5/21) 6.0 (27/5/21) 4.6 (21/3/22)	-	4.6 – 6.0	39.8 – 41.2	Buried/destroyed after 21 March 2022 prior to first datalogger upload
111A	45.8	2.9 (17/5/21 – after drilling) 5.5 (27/5/21)	28 May 2021 – 31 August 2021	5.4 – 5.8	40.0 – 40.4	Buried/destroyed after August 2021
114	47.3	6.3 (28/4/21 – after drilling) 6.2 (28/5/21)		6.2 – 6.3	41.0 – 41.1	Buried/destroyed after 28 May 2021, prior to first datalogger upload
118A	50.0	5.4 (28/5/21 – after drilling)	3 June 2021 – 20 April 2022	5.1 – 5.8**	44.2 – 45.0**	Datalogger retrieved on 20 April 2022

Note: *Manual measurements of groundwater depth exclude manual check measurements during the monitoring period. Values given in italics show readings that are considered to be inconsistent with subsequent data. While standpipes were purged and allowed to recharge prior to measurement, the italicised results are considered to be influenced by the drilling process, and the readings have been excluded from the other groundwater depth and level summary columns.

**At BH118A a brief water pressure increase during high rainfall on 22/2/22, and low water level from sampling on 21/3/22 were excluded from the ranges, due to suspected surface infiltration and artificial influences, respectively.

Additional manual measurements of groundwater at additional standpipes during the Stage 2 investigation (April to May 2021), but not subject to further monitoring, have been previously reported in the relevant geotechnical investigation reports – DP Reports 86043.06.R.001 to 003, dated August 2021.

3. Comment on Groundwater Results

The following comments are made with regards to the groundwater readings obtained at the site:

- Groundwater levels at the site apparently fell slightly during the monitoring period to September 2021 at Bores 106 and 111A (after which no further monitoring data was obtained) and to December 2021 at Bore 118A, where monitoring continued. At Bore 118A, groundwater levels subsequently rose to RL 45.0, showing a 0.9 m variation in groundwater levels during the monitoring period. This is likely due to the wet conditions experienced during those months, with monthly climate summaries for Sydney by the Bureau of Meteorology noting that rainfall was generally above average in December 2021 and January 2022, and well above average in February 2022 and March 2022. The highest water levels at the end of the monitoring period were still within 0.5 m of the early monitoring readings;
- While monitoring at Bores 109A and 111 were unsuccessful due to destroyed or buried standpipes, the manual readings taken at these locations suggest similar variations in groundwater levels (of 1.1 m to 1.4 m) between May 2021 and March 2022; and
- Reference to the relevant borehole logs in DP Reports 86043.06.R.001 to 003 indicates that the above groundwater levels are all within the sandstone bedrock.

The limitations of the associated geotechnical investigation reports, DP Report 86043.01.R.001 to 003 apply to this letter report.

Please contact the undersigned if you have any questions on this matter.

Yours faithfully
Douglas Partners Pty Ltd


Sally Peacock
Senior Associate

Reviewed by


pp **Scott Easton**
Principal

Attachments: About this Report
 Drawing GW1
 Figures 1 to 3

About this Report

Douglas Partners



Introduction

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

DP's 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.

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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, DP 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, DP 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, DP will be pleased to assist with investigations or advice to resolve the matter.

About this Report

Site Anomalies

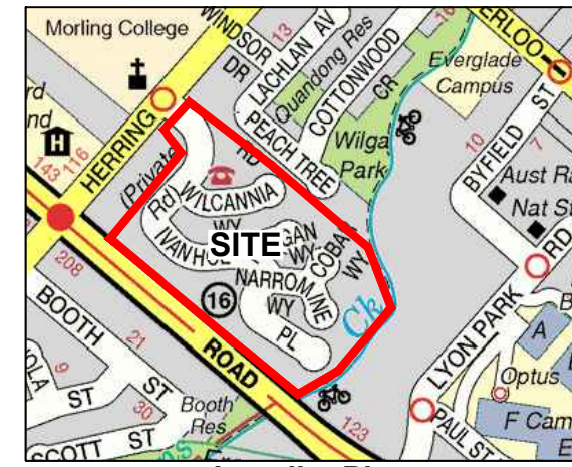
In the event that conditions encountered on site during construction appear to vary from those which were expected from the information contained in the report, DP requests that it be immediately notified. Most problems are much more readily resolved when conditions are exposed rather than at some later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



Locality Plan

- LEGEND**
- ◆ Borehole Location
 - ◆ Previous Cored Bore location
 - Standpipe Location (Current)
 - Standpipe Location (Destroyed)
 - - - Site Boundary

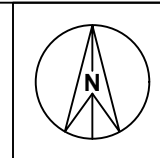
NOTE:
1: Base image from MetroMap (Dated 09.02.2022)



Douglas Partners
Geotechnics | Environment | Groundwater

CLIENT: Frasers Property Ivanhoe	
OFFICE: Sydney	DRAWN BY: MG
SCALE: 1:2000 @ A3	DATE: 28.04.2022

TITLE: **Standpipe Location Plan**
Proposed Residential Development
Ivanhoe Estate, Macquarie Park



PROJECT No:	86043.06
DRAWING No:	GW1
REVISION:	0

Groundwater Monitoring BH106



Figure 1: Groundwater Monitoring Results at Bore 106

Groundwater Monitoring BH111A

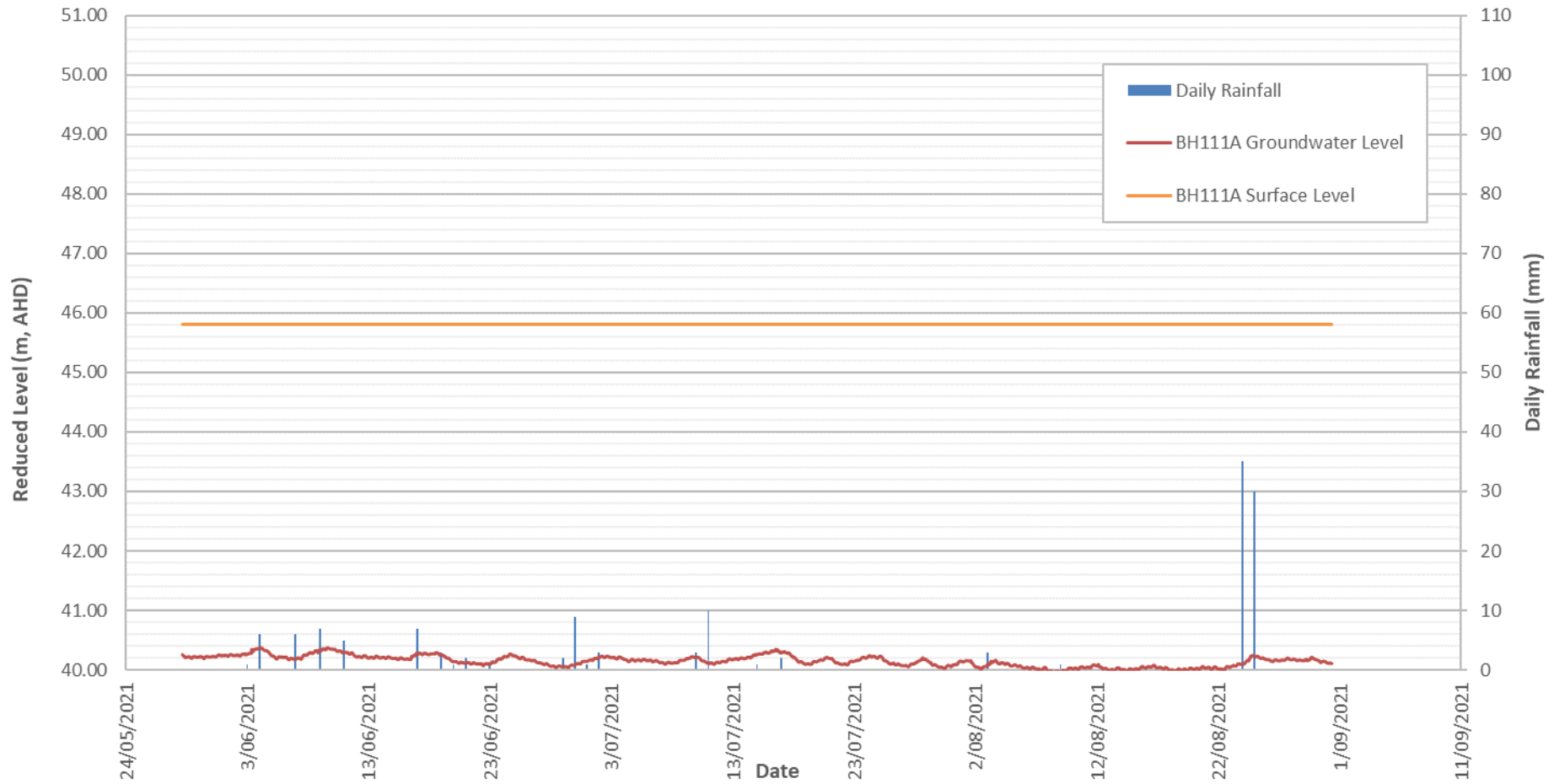


Figure 2: Groundwater Monitoring Results at Bore 111A

Groundwater Monitoring BH118A

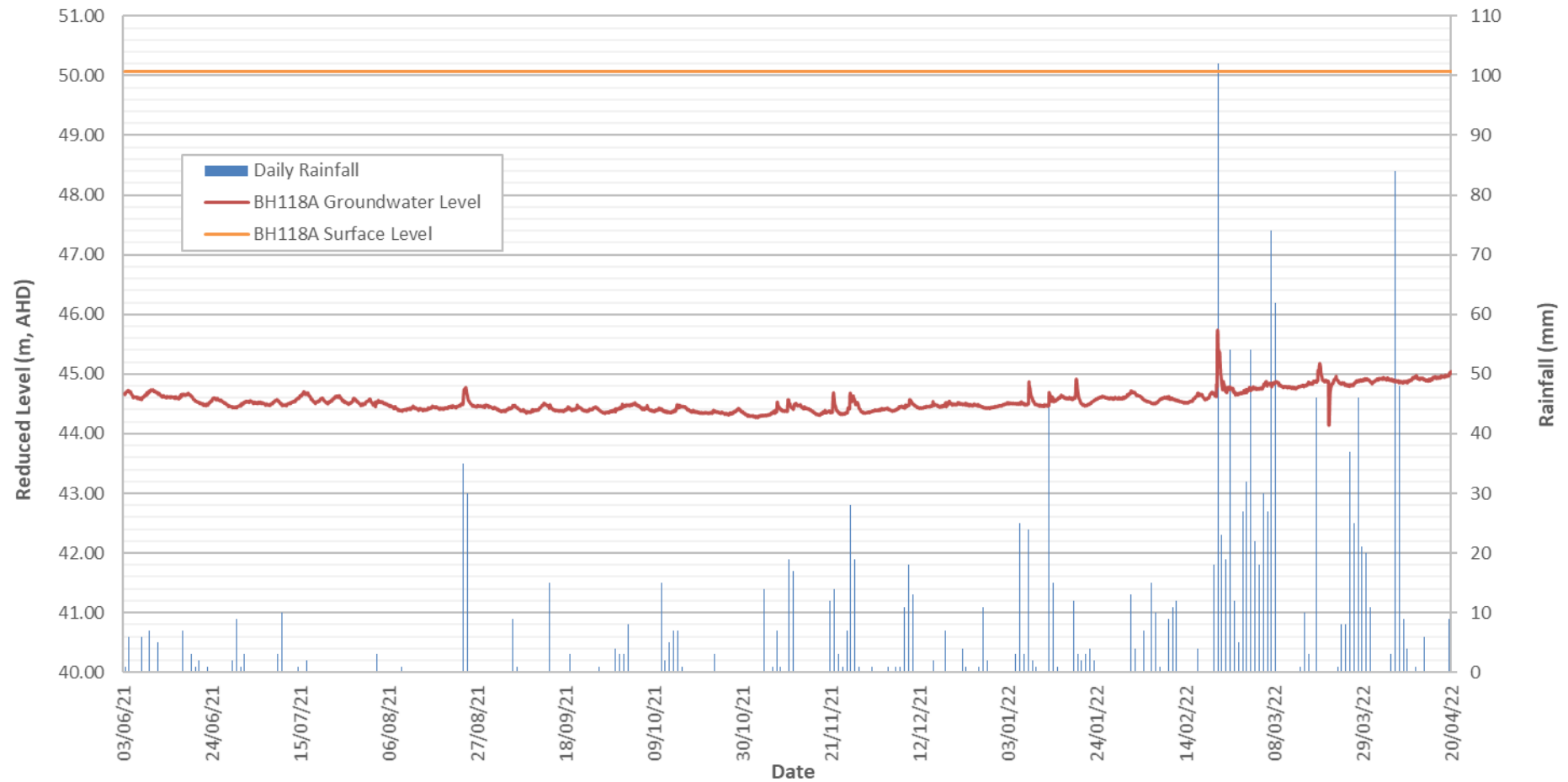


Figure 3: Groundwater Monitoring Results at Bore 118A

Appendix E

Results of Permeability Tests

Appendix F

Laboratory Testing



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 291444

Client Details

Client	Douglas Partners Pty Ltd
Attention	Sally Peacock
Address	96 Hermitage Rd, West Ryde, NSW, 2114

Sample Details

Your Reference	86043.06, Macquarie Park
Number of Samples	4 Water
Date samples received	21/03/2022
Date completed instructions received	21/03/2022

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 28/03/2022

Date of Issue 28/03/2022

NATA Accreditation Number 2901. This document shall not be reproduced except in full.

Accredited for compliance with ISO/IEC 17025 - Testing. **Tests not covered by NATA are denoted with ***

Results Approved By

Diego Bigolin, Inorganics Supervisor
Dragana Tomas, Senior Chemist
Hannah Nguyen, Metals Supervisor
Josh Williams, Organics and LC Supervisor
Liam Timmins, Chemist
Nick Sarlamis, Assistant Operation Manager

Authorised By

Nancy Zhang, Laboratory Manager

VOCs in water				
Our Reference		291444-1	291444-2	291444-3
Your Reference	UNITS	109A	111	118A
Date Sampled		21/03/2022	21/03/2022	21/03/2022
Type of sample		Water	Water	Water
Date extracted	-	22/03/2022	22/03/2022	22/03/2022
Date analysed	-	23/03/2022	23/03/2022	23/03/2022
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	<1	<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		291444-1	291444-2	291444-3
Your Reference	UNITS	109A	111	118A
Date Sampled		21/03/2022	21/03/2022	21/03/2022
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	%	100	100	100
Surrogate toluene-d8	%	96	97	96
Surrogate 4-BFB	%	99	102	100

vTRH(C6-C10)/BTEXN in Water					
Our Reference		291444-1	291444-2	291444-3	291444-4
Your Reference	UNITS	109A	111	118A	BD1/20220321
Date Sampled		21/03/2022	21/03/2022	21/03/2022	21/03/2022
Type of sample		Water	Water	Water	Water
Date extracted	-	22/03/2022	22/03/2022	22/03/2022	22/03/2022
Date analysed	-	23/03/2022	23/03/2022	23/03/2022	23/03/2022
TRH C ₆ - C ₉	µg/L	<10	<10	<10	<10
TRH C ₆ - C ₁₀	µg/L	<10	<10	<10	<10
TRH C ₆ - C ₁₀ less BTEX (F1)	µg/L	<10	<10	<10	<10
Benzene	µg/L	<1	<1	<1	<1
Toluene	µg/L	<1	<1	<1	<1
Ethylbenzene	µg/L	<1	<1	<1	<1
m+p-xylene	µg/L	<2	<2	<2	<2
o-xylene	µg/L	<1	<1	<1	<1
Naphthalene	µg/L	<1	<1	<1	<1
Surrogate Dibromofluoromethane	%	100	100	100	99
Surrogate toluene-d8	%	96	97	96	95
Surrogate 4-BFB	%	99	102	100	100

svTRH (C10-C40) in Water					
Our Reference		291444-1	291444-2	291444-3	291444-4
Your Reference	UNITS	109A	111	118A	BD1/20220321
Date Sampled		21/03/2022	21/03/2022	21/03/2022	21/03/2022
Type of sample		Water	Water	Water	Water
Date extracted	-	24/03/2022	24/03/2022	24/03/2022	24/03/2022
Date analysed	-	24/03/2022	24/03/2022	24/03/2022	25/03/2022
TRH C ₁₀ - C ₁₄	µg/L	<50	<50	<50	<50
TRH C ₁₅ - C ₂₈	µg/L	<100	<100	<100	<100
TRH C ₂₉ - C ₃₆	µg/L	<100	<100	<100	<100
Total +ve TRH (C10-C36)	µg/L	<50	<50	<50	<50
TRH >C ₁₀ - C ₁₆	µg/L	<50	<50	<50	<50
TRH >C ₁₀ - C ₁₆ less Naphthalene (F2)	µg/L	<50	<50	<50	<50
TRH >C ₁₆ - C ₃₄	µg/L	<100	<100	<100	<100
TRH >C ₃₄ - C ₄₀	µg/L	<100	<100	<100	<100
Total +ve TRH (>C10-C40)	µg/L	<50	<50	<50	<50
Surrogate o-Terphenyl	%	91	88	108	98

PAHs in Water - Low Level					
Our Reference		291444-1	291444-2	291444-3	291444-4
Your Reference	UNITS	109A	111	118A	BD1/20220321
Date Sampled		21/03/2022	21/03/2022	21/03/2022	21/03/2022
Type of sample		Water	Water	Water	Water
Date extracted	-	24/03/2022	24/03/2022	24/03/2022	24/03/2022
Date analysed	-	24/03/2022	24/03/2022	24/03/2022	25/03/2022
Naphthalene	µg/L	<0.2	<0.2	<0.2	<0.2
Acenaphthylene	µg/L	<0.1	<0.1	<0.1	<0.1
Acenaphthene	µg/L	<0.1	<0.1	<0.1	<0.1
Fluorene	µg/L	<0.1	<0.1	<0.1	<0.1
Phenanthrene	µg/L	<0.1	<0.1	<0.1	<0.1
Anthracene	µg/L	<0.1	<0.1	<0.1	<0.1
Fluoranthene	µg/L	<0.1	<0.1	<0.1	<0.1
Pyrene	µg/L	<0.1	<0.1	<0.1	<0.1
Benzo(a)anthracene	µg/L	<0.1	<0.1	<0.1	<0.1
Chrysene	µg/L	<0.1	<0.1	<0.1	<0.1
Benzo(b,j+k)fluoranthene	µg/L	<0.2	<0.2	<0.2	<0.2
Benzo(a)pyrene	µg/L	<0.1	<0.1	<0.1	<0.1
Indeno(1,2,3-c,d)pyrene	µg/L	<0.1	<0.1	<0.1	<0.1
Dibenzo(a,h)anthracene	µg/L	<0.1	<0.1	<0.1	<0.1
Benzo(g,h,i)perylene	µg/L	<0.1	<0.1	<0.1	<0.1
Benzo(a)pyrene TEQ	µg/L	<0.5	<0.5	<0.5	<0.5
Total +ve PAH's	µg/L	<0.1	<0.1	<0.1	<0.1
Surrogate <i>p</i> -Terphenyl-d14	%	89	79	64	93

OCPs in Water - Trace Level			
Our Reference		291444-1	291444-2
Your Reference	UNITS	109A	111
Date Sampled		21/03/2022	21/03/2022
Type of sample		Water	Water
Date extracted	-	24/03/2022	24/03/2022
Date analysed	-	24/03/2022	24/03/2022
alpha-BHC	µg/L	<0.001	<0.001
HCB	µg/L	<0.001	<0.001
beta-BHC	µg/L	<0.001	<0.001
gamma-BHC	µg/L	<0.001	<0.001
Heptachlor	µg/L	<0.001	<0.001
delta-BHC	µg/L	<0.001	<0.001
Aldrin	µg/L	<0.001	<0.001
Heptachlor Epoxide	µg/L	<0.001	<0.001
gamma-Chlordane	µg/L	<0.001	<0.001
alpha-Chlordane	µg/L	<0.001	<0.001
Endosulfan I	µg/L	<0.002	<0.002
pp-DDE	µg/L	<0.001	<0.001
Dieldrin	µg/L	<0.001	<0.001
Endrin	µg/L	<0.001	<0.001
Endosulfan II	µg/L	<0.002	<0.002
pp-DDD	µg/L	<0.001	<0.001
Endrin Aldehyde	µg/L	<0.001	<0.001
pp-DDT	µg/L	<0.001	<0.001
Endosulfan Sulphate	µg/L	<0.001	<0.001
Methoxychlor	µg/L	<0.001	<0.001
Surrogate TCMX	%	78	86

OP in water Trace ANZECCF/ADWG			
Our Reference		291444-1	291444-2
Your Reference	UNITS	109A	111
Date Sampled		21/03/2022	21/03/2022
Type of sample		Water	Water
Date extracted	-	24/03/2022	24/03/2022
Date analysed	-	24/03/2022	24/03/2022
Dichlorovos	µg/L	<0.2	<0.2
Dimethoate	µg/L	<0.15	<0.15
Diazinon	µg/L	<0.01	<0.01
Chlorpyrifos-methyl	µg/L	<0.2	<0.2
Methyl Parathion	µg/L	<0.2	<0.2
Ronnel	µg/L	<0.2	<0.2
Fenitrothion	µg/L	<0.2	<0.2
Malathion	µg/L	<0.05	<0.05
Chlorpyrifos	µg/L	<0.009	<0.009
Parathion	µg/L	<0.004	<0.004
Bromophos ethyl	µg/L	<0.2	<0.2
Ethion	µg/L	<0.2	<0.2
Azinphos-methyl (Guthion)	µg/L	<0.02	<0.02
Surrogate TCMX	%	78	76

PCBs in Water - Trace Level			
Our Reference		291444-1	291444-2
Your Reference	UNITS	109A	111
Date Sampled		21/03/2022	21/03/2022
Type of sample		Water	Water
Date extracted	-	24/03/2022	24/03/2022
Date analysed	-	24/03/2022	24/03/2022
Aroclor 1016	µg/L	<0.01	<0.01
Aroclor 1221	µg/L	<0.01	<0.01
Aroclor 1232	µg/L	<0.01	<0.01
Aroclor 1242	µg/L	<0.01	<0.01
Aroclor 1248	µg/L	<0.01	<0.01
Aroclor 1254	µg/L	<0.01	<0.01
Aroclor 1260	µg/L	<0.01	<0.01
Surrogate TCMX	%	78	76

Organochlorine Pesticides in Water		
Our Reference		291444-3
Your Reference	UNITS	118A
Date Sampled		21/03/2022
Type of sample		Water
Date extracted	-	24/03/2022
Date analysed	-	24/03/2022
alpha-BHC	µg/L	<0.2
HCB	µg/L	<0.2
beta-BHC	µg/L	<0.2
gamma-BHC	µg/L	<0.2
Heptachlor	µg/L	<0.2
delta-BHC	µg/L	<0.2
Aldrin	µg/L	<0.2
Heptachlor Epoxide	µg/L	<0.2
gamma-Chlordane	µg/L	<0.2
alpha-Chlordane	µg/L	<0.2
Endosulfan I	µg/L	<0.2
pp-DDE	µg/L	<0.2
Dieldrin	µg/L	<0.2
Endrin	µg/L	<0.2
Endosulfan II	µg/L	<0.2
pp-DDD	µg/L	<0.2
Endrin Aldehyde	µg/L	<0.2
pp-DDT	µg/L	<0.2
Endosulfan Sulphate	µg/L	<0.2
Methoxychlor	µg/L	<0.2
Surrogate TCMX	%	65

OP Pesticides in Water		
Our Reference		291444-3
Your Reference	UNITS	118A
Date Sampled		21/03/2022
Type of sample		Water
Date extracted	-	24/03/2022
Date analysed	-	24/03/2022
Dichlorvos	µg/L	<0.2
Dimethoate	µg/L	<0.2
Diazinon	µg/L	<0.2
Chlorpyrifos-methyl	µg/L	<0.2
Ronnel	µg/L	<0.2
Fenitrothion	µg/L	<0.2
Malathion	µg/L	<0.2
Chlorpyrifos	µg/L	<0.2
Parathion	µg/L	<0.2
Bromophos ethyl	µg/L	<0.2
Ethion	µg/L	<0.2
Azinphos-methyl (Guthion)	µg/L	<0.2
Surrogate TCMX	%	65

PCBs in Water		
Our Reference		291444-3
Your Reference	UNITS	118A
Date Sampled		21/03/2022
Type of sample		Water
Date extracted	-	24/03/2022
Date analysed	-	24/03/2022
Aroclor 1016	µg/L	<2
Aroclor 1221	µg/L	<2
Aroclor 1232	µg/L	<2
Aroclor 1242	µg/L	<2
Aroclor 1248	µg/L	<2
Aroclor 1254	µg/L	<2
Aroclor 1260	µg/L	<2
Surrogate TCMX	%	65

HM in water - dissolved					
Our Reference		291444-1	291444-2	291444-3	291444-4
Your Reference	UNITS	109A	111	118A	BD1/20220321
Date Sampled		21/03/2022	21/03/2022	21/03/2022	21/03/2022
Type of sample		Water	Water	Water	Water
Date prepared	-	24/03/2022	24/03/2022	24/03/2022	24/03/2022
Date analysed	-	24/03/2022	24/03/2022	24/03/2022	24/03/2022
Arsenic-Dissolved	µg/L	<1	<1	<1	<1
Cadmium-Dissolved	µg/L	<0.1	<0.1	<0.1	<0.1
Chromium-Dissolved	µg/L	<1	<1	<1	<1
Copper-Dissolved	µg/L	2	<1	35	2
Lead-Dissolved	µg/L	4	<1	<1	4
Mercury-Dissolved	µg/L	<0.05	<0.05	<0.05	<0.05
Nickel-Dissolved	µg/L	2	2	3	2
Zinc-Dissolved	µg/L	16	26	22	16
Iron-Dissolved	µg/L	220	730	1,300	250

HM in water - total				
Our Reference		291444-1	291444-2	291444-3
Your Reference	UNITS	109A	111	118A
Date Sampled		21/03/2022	21/03/2022	21/03/2022
Type of sample		Water	Water	Water
Date prepared	-	24/03/2022	24/03/2022	24/03/2022
Date analysed	-	24/03/2022	24/03/2022	24/03/2022
Arsenic-Total	µg/L	<1	<1	6
Cadmium-Total	µg/L	<0.1	<0.1	0.2
Chromium-Total	µg/L	1	4	58
Copper-Total	µg/L	3	6	69
Lead-Total	µg/L	5	6	70
Mercury-Total	µg/L	<0.05	<0.05	0.08
Nickel-Total	µg/L	3	4	19
Zinc-Total	µg/L	19	48	230
Iron-Total	µg/L	500	2,700	44,000

Ion Balance				
Our Reference		291444-1	291444-2	291444-3
Your Reference	UNITS	109A	111	118A
Date Sampled		21/03/2022	21/03/2022	21/03/2022
Type of sample		Water	Water	Water
Date prepared	-	21/03/2022	21/03/2022	21/03/2022
Date analysed	-	21/03/2022	21/03/2022	21/03/2022
Calcium - Dissolved	mg/L	6.0	27	28
Potassium - Dissolved	mg/L	0.7	1	3
Sodium - Dissolved	mg/L	93	74	67
Magnesium - Dissolved	mg/L	7.9	5.0	2
Hardness	mgCaCO ₃ /L	47	88	80
Hydroxide Alkalinity (OH ⁻) as CaCO ₃	mg/L	<5	<5	<5
Bicarbonate Alkalinity as CaCO ₃	mg/L	<5	65	120
Carbonate Alkalinity as CaCO ₃	mg/L	<5	<5	<5
Total Alkalinity as CaCO ₃	mg/L	<5	65	120
Sulphate, SO ₄	mg/L	170	64	95
Chloride, Cl	mg/L	120	110	48
Ionic Balance	%	-15	-5.0	-11

Miscellaneous Inorganics				
Our Reference		291444-1	291444-2	291444-3
Your Reference	UNITS	109A	111	118A
Date Sampled		21/03/2022	21/03/2022	21/03/2022
Type of sample		Water	Water	Water
Date prepared	-	23/03/2022	23/03/2022	23/03/2022
Date analysed	-	23/03/2022	23/03/2022	23/03/2022
Total Suspended Solids	mg/L	76	300	95,000
Total Dissolved Solids (grav)	mg/L	300	320	420
Oil & Grease (LLE)	mg/L	<5	<5	[NA]
Ferric Iron (by calculation)	mg/L	<0.05	0.21	<0.05
Ferrous Iron	mg/L	0.24	0.52	1.3

Method ID	Methodology Summary
Inorg-003	Oil & Grease - determine gravimetrically following extraction with Hexane, in accordance with APHA latest edition, 5520-B.
Inorg-006	Alkalinity - determined titrimetrically in accordance with APHA latest edition, 2320-B.
Inorg-018	Total Dissolved Solids - determined gravimetrically. The solids are dried at 180+/-10°C.
Inorg-019	Suspended Solids - determined gravimetrically by filtration of the sample. The samples are dried at 104+/-5°C.
Inorg-040	The concentrations of the major ions (mg/L) are converted to milliequivalents and summed. The ionic balance should be within +/- 15% ie total anions = total cations +/-15%.
Inorg-076	Ferrous Iron is determined colourimetrically by discrete analyser. Waters samples are filtered on receipt prior to analysis.
Inorg-081	Anions - a range of Anions are determined by Ion Chromatography, in accordance with APHA latest edition, 4110-B. Waters samples are filtered on receipt prior to analysis. Alternatively determined by colourimetry/turbidity using Discrete Analyser.
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.
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	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC-ECD.
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: VOCs in water				Duplicate				Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date extracted	-			22/03/2022	[NT]	[NT]	[NT]	[NT]	22/03/2022	[NT]
Date analysed	-			23/03/2022	[NT]	[NT]	[NT]	[NT]	23/03/2022	[NT]
Dichlorodifluoromethane	µg/L	10	Org-023	<10	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Chloromethane	µg/L	10	Org-023	<10	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Vinyl Chloride	µg/L	10	Org-023	<10	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Bromomethane	µg/L	10	Org-023	<10	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Chloroethane	µg/L	10	Org-023	<10	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Trichlorofluoromethane	µg/L	10	Org-023	<10	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
1,1-Dichloroethene	µg/L	1	Org-023	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Trans-1,2-dichloroethene	µg/L	1	Org-023	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
1,1-dichloroethane	µg/L	1	Org-023	<1	[NT]	[NT]	[NT]	[NT]	83	[NT]
Cis-1,2-dichloroethene	µg/L	1	Org-023	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Bromochloromethane	µg/L	1	Org-023	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Chloroform	µg/L	1	Org-023	<1	[NT]	[NT]	[NT]	[NT]	100	[NT]
2,2-dichloropropane	µg/L	1	Org-023	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
1,2-dichloroethane	µg/L	1	Org-023	<1	[NT]	[NT]	[NT]	[NT]	92	[NT]
1,1,1-trichloroethane	µg/L	1	Org-023	<1	[NT]	[NT]	[NT]	[NT]	88	[NT]
1,1-dichloropropene	µg/L	1	Org-023	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Cyclohexane	µg/L	1	Org-023	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Carbon tetrachloride	µg/L	1	Org-023	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Benzene	µg/L	1	Org-023	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Dibromomethane	µg/L	1	Org-023	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
1,2-dichloropropane	µg/L	1	Org-023	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Trichloroethene	µg/L	1	Org-023	<1	[NT]	[NT]	[NT]	[NT]	83	[NT]
Bromodichloromethane	µg/L	1	Org-023	<1	[NT]	[NT]	[NT]	[NT]	80	[NT]
trans-1,3-dichloropropene	µg/L	1	Org-023	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
cis-1,3-dichloropropene	µg/L	1	Org-023	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
1,1,2-trichloroethane	µg/L	1	Org-023	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Toluene	µg/L	1	Org-023	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
1,3-dichloropropane	µg/L	1	Org-023	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Dibromochloromethane	µg/L	1	Org-023	<1	[NT]	[NT]	[NT]	[NT]	72	[NT]
1,2-dibromoethane	µg/L	1	Org-023	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Tetrachloroethene	µg/L	1	Org-023	<1	[NT]	[NT]	[NT]	[NT]	91	[NT]
1,1,1,2-tetrachloroethane	µg/L	1	Org-023	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Chlorobenzene	µg/L	1	Org-023	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Ethylbenzene	µg/L	1	Org-023	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Bromoform	µg/L	1	Org-023	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
m+p-xylene	µg/L	2	Org-023	<2	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Styrene	µg/L	1	Org-023	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
1,1,2,2-tetrachloroethane	µg/L	1	Org-023	<1	[NT]	[NT]	[NT]	[NT]	[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	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
1,2,3-trichloropropane	µg/L	1	Org-023	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Isopropylbenzene	µg/L	1	Org-023	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Bromobenzene	µg/L	1	Org-023	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
n-propyl benzene	µg/L	1	Org-023	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
2-chlorotoluene	µg/L	1	Org-023	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
4-chlorotoluene	µg/L	1	Org-023	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
1,3,5-trimethyl benzene	µg/L	1	Org-023	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Tert-butyl benzene	µg/L	1	Org-023	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
1,2,4-trimethyl benzene	µg/L	1	Org-023	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
1,3-dichlorobenzene	µg/L	1	Org-023	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Sec-butyl benzene	µg/L	1	Org-023	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
1,4-dichlorobenzene	µg/L	1	Org-023	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
4-isopropyl toluene	µg/L	1	Org-023	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
1,2-dichlorobenzene	µg/L	1	Org-023	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
n-butyl benzene	µg/L	1	Org-023	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
1,2-dibromo-3-chloropropane	µg/L	1	Org-023	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
1,2,4-trichlorobenzene	µg/L	1	Org-023	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Hexachlorobutadiene	µg/L	1	Org-023	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
1,2,3-trichlorobenzene	µg/L	1	Org-023	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Surrogate Dibromofluoromethane	%		Org-023	99	[NT]	[NT]	[NT]	[NT]	104	[NT]
Surrogate toluene-d8	%		Org-023	96	[NT]	[NT]	[NT]	[NT]	99	[NT]
Surrogate 4-BFB	%		Org-023	99	[NT]	[NT]	[NT]	[NT]	96	[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	-			22/03/2022	[NT]	[NT]	[NT]	[NT]	22/03/2022	[NT]
Date analysed	-			23/03/2022	[NT]	[NT]	[NT]	[NT]	23/03/2022	[NT]
TRH C ₆ - C ₉	µg/L	10	Org-023	<10	[NT]	[NT]	[NT]	[NT]	91	[NT]
TRH C ₆ - C ₁₀	µg/L	10	Org-023	<10	[NT]	[NT]	[NT]	[NT]	91	[NT]
Benzene	µg/L	1	Org-023	<1	[NT]	[NT]	[NT]	[NT]	87	[NT]
Toluene	µg/L	1	Org-023	<1	[NT]	[NT]	[NT]	[NT]	86	[NT]
Ethylbenzene	µg/L	1	Org-023	<1	[NT]	[NT]	[NT]	[NT]	93	[NT]
m+p-xylene	µg/L	2	Org-023	<2	[NT]	[NT]	[NT]	[NT]	95	[NT]
o-xylene	µg/L	1	Org-023	<1	[NT]	[NT]	[NT]	[NT]	90	[NT]
Naphthalene	µg/L	1	Org-023	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Surrogate Dibromofluoromethane	%		Org-023	99	[NT]	[NT]	[NT]	[NT]	104	[NT]
Surrogate toluene-d8	%		Org-023	96	[NT]	[NT]	[NT]	[NT]	99	[NT]
Surrogate 4-BFB	%		Org-023	99	[NT]	[NT]	[NT]	[NT]	96	[NT]

Client Reference: 86043.06, Macquarie Park

QUALITY CONTROL: svTRH (C10-C40) in Water					Duplicate			Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W3	[NT]
Date extracted	-			24/03/2022	[NT]	[NT]	[NT]	[NT]	24/03/2022	[NT]
Date analysed	-			24/03/2022	[NT]	[NT]	[NT]	[NT]	24/03/2022	[NT]
TRH C ₁₀ - C ₁₄	µg/L	50	Org-020	<50	[NT]	[NT]	[NT]	[NT]	101	[NT]
TRH C ₁₅ - C ₂₈	µg/L	100	Org-020	<100	[NT]	[NT]	[NT]	[NT]	100	[NT]
TRH C ₂₉ - C ₃₆	µg/L	100	Org-020	<100	[NT]	[NT]	[NT]	[NT]	109	[NT]
TRH >C ₁₀ - C ₁₆	µg/L	50	Org-020	<50	[NT]	[NT]	[NT]	[NT]	101	[NT]
TRH >C ₁₆ - C ₃₄	µg/L	100	Org-020	<100	[NT]	[NT]	[NT]	[NT]	100	[NT]
TRH >C ₃₄ - C ₄₀	µg/L	100	Org-020	<100	[NT]	[NT]	[NT]	[NT]	109	[NT]
Surrogate o-Terphenyl	%		Org-020	121	[NT]	[NT]	[NT]	[NT]	98	[NT]

QUALITY CONTROL: PAHs in Water - Low Level					Duplicate			Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date extracted	-			24/03/2022	[NT]	[NT]	[NT]	[NT]	24/03/2022	[NT]
Date analysed	-			25/03/2022	[NT]	[NT]	[NT]	[NT]	25/03/2022	[NT]
Naphthalene	µg/L	0.2	Org-022/025	<0.2	[NT]	[NT]	[NT]	[NT]	113	[NT]
Acenaphthylene	µg/L	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Acenaphthene	µg/L	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	113	[NT]
Fluorene	µg/L	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	109	[NT]
Phenanthrene	µg/L	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	124	[NT]
Anthracene	µg/L	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Fluoranthene	µg/L	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	114	[NT]
Pyrene	µg/L	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	117	[NT]
Benzo(a)anthracene	µg/L	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Chrysene	µg/L	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	85	[NT]
Benzo(b,j+k)fluoranthene	µg/L	0.2	Org-022/025	<0.2	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Benzo(a)pyrene	µg/L	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	124	[NT]
Indeno(1,2,3-c,d)pyrene	µg/L	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Dibenzo(a,h)anthracene	µg/L	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Benzo(g,h,i)perylene	µg/L	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Surrogate p-Terphenyl-d14	%		Org-022/025	91	[NT]	[NT]	[NT]	[NT]	93	[NT]

QUALITY CONTROL: OCPs in Water - Trace Level				Duplicate				Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	
Date extracted	-			24/03/2022	[NT]	[NT]	[NT]	[NT]	24/03/2022	[NT]
Date analysed	-			24/03/2022	[NT]	[NT]	[NT]	[NT]	24/03/2022	[NT]
alpha-BHC	µg/L	0.001	Org-022/025	<0.001	[NT]	[NT]	[NT]	[NT]	102	[NT]
HCB	µg/L	0.001	Org-022/025	<0.001	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
beta-BHC	µg/L	0.001	Org-022/025	<0.001	[NT]	[NT]	[NT]	[NT]	113	[NT]
gamma-BHC	µg/L	0.001	Org-022/025	<0.001	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Heptachlor	µg/L	0.001	Org-022/025	<0.001	[NT]	[NT]	[NT]	[NT]	102	[NT]
delta-BHC	µg/L	0.001	Org-022/025	<0.001	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Aldrin	µg/L	0.001	Org-022/025	<0.001	[NT]	[NT]	[NT]	[NT]	107	[NT]
Heptachlor Epoxide	µg/L	0.001	Org-022/025	<0.001	[NT]	[NT]	[NT]	[NT]	111	[NT]
gamma-Chlordane	µg/L	0.001	Org-022/025	<0.001	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
alpha-Chlordane	µg/L	0.001	Org-022/025	<0.001	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Endosulfan I	µg/L	0.002	Org-022/025	<0.002	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
pp-DDE	µg/L	0.001	Org-022/025	<0.001	[NT]	[NT]	[NT]	[NT]	106	[NT]
Dieldrin	µg/L	0.001	Org-022/025	<0.001	[NT]	[NT]	[NT]	[NT]	116	[NT]
Endrin	µg/L	0.001	Org-022/025	<0.001	[NT]	[NT]	[NT]	[NT]	64	[NT]
Endosulfan II	µg/L	0.002	Org-022/025	<0.002	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
pp-DDD	µg/L	0.001	Org-022/025	<0.001	[NT]	[NT]	[NT]	[NT]	108	[NT]
Endrin Aldehyde	µg/L	0.001	Org-022/025	<0.001	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
pp-DDT	µg/L	0.001	Org-022/025	<0.001	[NT]	[NT]	[NT]	[NT]	108	[NT]
Endosulfan Sulphate	µg/L	0.001	Org-022/025	<0.001	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Methoxychlor	µg/L	0.001	Org-022/025	<0.001	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Surrogate TCMX	%		Org-022/025	86	[NT]	[NT]	[NT]	[NT]	89	[NT]

Client Reference: 86043.06, Macquarie Park

QUALITY CONTROL: OP in water Trace ANZECCF/ADWG					Duplicate			Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	
Date extracted	-			24/03/2022	[NT]	[NT]	[NT]	[NT]	24/03/2022	[NT]
Date analysed	-			25/03/2022	[NT]	[NT]	[NT]	[NT]	24/03/2022	[NT]
Dichlorovos	µg/L	0.2	Org-022/025	<0.2	[NT]	[NT]	[NT]	[NT]	75	[NT]
Dimethoate	µg/L	0.15	Org-022/025	<0.15	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Diazinon	µg/L	0.01	Org-022/025	<0.01	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Chlorpyriphos-methyl	µg/L	0.2	Org-022/025	<0.2	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Methyl Parathion	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]	113	[NT]
Fenitrothion	µg/L	0.2	Org-022/025	<0.2	[NT]	[NT]	[NT]	[NT]	83	[NT]
Malathion	µg/L	0.05	Org-022/025	<0.05	[NT]	[NT]	[NT]	[NT]	113	[NT]
Chlorpyriphos	µg/L	0.009	Org-022/025	<0.009	[NT]	[NT]	[NT]	[NT]	113	[NT]
Parathion	µg/L	0.004	Org-022/025	<0.004	[NT]	[NT]	[NT]	[NT]	96	[NT]
Bromophos ethyl	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]	91	[NT]
Azinphos-methyl (Guthion)	µg/L	0.02	Org-022/025	<0.02	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Surrogate TCMX	%		Org-022/025	86	[NT]	[NT]	[NT]	[NT]	89	[NT]

Client Reference: 86043.06, Macquarie Park

QUALITY CONTROL: PCBs in Water - Trace Level					Duplicate			Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	
Date extracted	-			24/03/2022	[NT]	[NT]	[NT]	[NT]	24/03/2022	[NT]
Date analysed	-			25/03/2022	[NT]	[NT]	[NT]	[NT]	24/03/2022	[NT]
Aroclor 1016	µg/L	0.01	Org-021	<0.01	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Aroclor 1221	µg/L	0.01	Org-021	<0.01	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Aroclor 1232	µg/L	0.01	Org-021	<0.01	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Aroclor 1242	µg/L	0.01	Org-021	<0.01	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Aroclor 1248	µg/L	0.01	Org-021	<0.01	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Aroclor 1254	µg/L	0.01	Org-021	<0.01	[NT]	[NT]	[NT]	[NT]	108	[NT]
Aroclor 1260	µg/L	0.01	Org-021	<0.01	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Surrogate TCMX	%		Org-021	86	[NT]	[NT]	[NT]	[NT]	89	[NT]

QUALITY CONTROL: Organochlorine Pesticides in Water				Duplicate				Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W3	[NT]
Date extracted	-			24/03/2022	[NT]	[NT]	[NT]	[NT]	24/03/2022	[NT]
Date analysed	-			24/03/2022	[NT]	[NT]	[NT]	[NT]	24/03/2022	[NT]
alpha-BHC	µg/L	0.2	Org-022/025	<0.2	[NT]	[NT]	[NT]	[NT]	102	[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]	114	[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]	103	[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]	109	[NT]
Heptachlor Epoxide	µg/L	0.2	Org-022/025	<0.2	[NT]	[NT]	[NT]	[NT]	112	[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]	107	[NT]
Dieldrin	µg/L	0.2	Org-022/025	<0.2	[NT]	[NT]	[NT]	[NT]	114	[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]	108	[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]	108	[NT]
Methoxychlor	µg/L	0.2	Org-022/025	<0.2	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Surrogate TCMX	%		Org-022/025	86	[NT]	[NT]	[NT]	[NT]	89	[NT]

Client Reference: 86043.06, Macquarie Park

QUALITY CONTROL: OP Pesticides in Water				Duplicate				Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W3	[NT]
Date extracted	-			24/03/2022	[NT]	[NT]	[NT]	[NT]	24/03/2022	[NT]
Date analysed	-			24/03/2022	[NT]	[NT]	[NT]	[NT]	24/03/2022	[NT]
Dichlorvos	µg/L	0.2	Org-022/025	<0.2	[NT]	[NT]	[NT]	[NT]	91	[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]
Chlorpyrifos-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]	112	[NT]
Fenitrothion	µg/L	0.2	Org-022/025	<0.2	[NT]	[NT]	[NT]	[NT]	85	[NT]
Malathion	µg/L	0.2	Org-022/025	<0.2	[NT]	[NT]	[NT]	[NT]	110	[NT]
Chlorpyrifos	µg/L	0.2	Org-022/025	<0.2	[NT]	[NT]	[NT]	[NT]	112	[NT]
Parathion	µg/L	0.2	Org-022/025	<0.2	[NT]	[NT]	[NT]	[NT]	93	[NT]
Bromophos ethyl	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]	92	[NT]
Azinphos-methyl (Guthion)	µg/L	0.2	Org-022/025	<0.2	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Surrogate TCMX	%		Org-022/025	86	[NT]	[NT]	[NT]	[NT]	89	[NT]

Client Reference: 86043.06, Macquarie Park

QUALITY CONTROL: PCBs in Water					Duplicate			Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W3	[NT]
Date extracted	-			24/03/2022	[NT]	[NT]	[NT]	[NT]	24/03/2022	[NT]
Date analysed	-			24/03/2022	[NT]	[NT]	[NT]	[NT]	24/03/2022	[NT]
Aroclor 1016	µg/L	2	Org-021	<2	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Aroclor 1221	µg/L	2	Org-021	<2	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Aroclor 1232	µg/L	2	Org-021	<2	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Aroclor 1242	µg/L	2	Org-021	<2	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Aroclor 1248	µg/L	2	Org-021	<2	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Aroclor 1254	µg/L	2	Org-021	<2	[NT]	[NT]	[NT]	[NT]	108	[NT]
Aroclor 1260	µg/L	2	Org-021	<2	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Surrogate TCMX	%		Org-021	86	[NT]	[NT]	[NT]	[NT]	89	[NT]

QUALITY CONTROL: HM in water - dissolved				Duplicate				Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W2	[NT]
Date prepared	-			24/03/2022	1	24/03/2022	24/03/2022		24/03/2022	[NT]
Date analysed	-			24/03/2022	1	24/03/2022	24/03/2022		24/03/2022	[NT]
Arsenic-Dissolved	µg/L	1	Metals-022	<1	1	<1	<1	0	97	[NT]
Cadmium-Dissolved	µg/L	0.1	Metals-022	<0.1	1	<0.1	<0.1	0	99	[NT]
Chromium-Dissolved	µg/L	1	Metals-022	<1	1	<1	<1	0	97	[NT]
Copper-Dissolved	µg/L	1	Metals-022	<1	1	2	2	0	98	[NT]
Lead-Dissolved	µg/L	1	Metals-022	<1	1	4	4	0	100	[NT]
Mercury-Dissolved	µg/L	0.05	Metals-021	<0.05	1	<0.05	[NT]		114	[NT]
Nickel-Dissolved	µg/L	1	Metals-022	<1	1	2	2	0	99	[NT]
Zinc-Dissolved	µg/L	1	Metals-022	<1	1	16	16	0	98	[NT]
Iron-Dissolved	µg/L	10	Metals-022	<10	1	220	230	4	97	[NT]

Client Reference: 86043.06, Macquarie Park

QUALITY CONTROL: HM in water - total				Duplicate				Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W2	[NT]
Date prepared	-			24/03/2022	1	24/03/2022	24/03/2022		24/03/2022	[NT]
Date analysed	-			24/03/2022	1	24/03/2022	24/03/2022		24/03/2022	[NT]
Arsenic-Total	µg/L	1	Metals-022	<1	1	<1	[NT]		98	[NT]
Cadmium-Total	µg/L	0.1	Metals-022	<0.1	1	<0.1	[NT]		99	[NT]
Chromium-Total	µg/L	1	Metals-022	<1	1	1	[NT]		98	[NT]
Copper-Total	µg/L	1	Metals-022	<1	1	3	[NT]		98	[NT]
Lead-Total	µg/L	1	Metals-022	<1	1	5	[NT]		104	[NT]
Mercury-Total	µg/L	0.05	Metals-021	<0.05	1	<0.05	<0.05	0	114	[NT]
Nickel-Total	µg/L	1	Metals-022	<1	1	3	[NT]		99	[NT]
Zinc-Total	µg/L	1	Metals-022	<1	1	19	[NT]		97	[NT]
Iron-Total	µg/L	10	Metals-022	<10	1	500	[NT]		101	[NT]

Client Reference: 86043.06, Macquarie Park

QUALITY CONTROL: Ion Balance				Duplicate				Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	291444-2
Date prepared	-			21/03/2022	1	21/03/2022	21/03/2022		21/03/2022	21/03/2022
Date analysed	-			21/03/2022	1	21/03/2022	21/03/2022		21/03/2022	21/03/2022
Calcium - Dissolved	mg/L	0.5	Metals-020	<0.5	1	6.0	6.0	0	90	86
Potassium - Dissolved	mg/L	0.5	Metals-020	<0.5	1	0.7	0.6	15	92	92
Sodium - Dissolved	mg/L	0.5	Metals-020	<0.5	1	93	90	3	105	79
Magnesium - Dissolved	mg/L	0.5	Metals-020	<0.5	1	7.9	7.8	1	88	87
Hardness	mgCaCO ₃ /L	3		<3	1	47	47	0	[NT]	[NT]
Hydroxide Alkalinity (OH ⁻) as CaCO ₃	mg/L	5	Inorg-006	<5	1	<5	[NT]		[NT]	[NT]
Bicarbonate Alkalinity as CaCO ₃	mg/L	5	Inorg-006	<5	1	<5	[NT]		[NT]	[NT]
Carbonate Alkalinity as CaCO ₃	mg/L	5	Inorg-006	<5	1	<5	[NT]		[NT]	[NT]
Total Alkalinity as CaCO ₃	mg/L	5	Inorg-006	<5	1	<5	[NT]		100	[NT]
Sulphate, SO ₄	mg/L	1	Inorg-081	<1	1	170	180	6	98	#
Chloride, Cl	mg/L	1	Inorg-081	<1	1	120	120	0	102	#
Ionic Balance	%		Inorg-040	[NT]	1	-15	[NT]		[NT]	[NT]

Client Reference: 86043.06, Macquarie Park

QUALITY CONTROL: Miscellaneous Inorganics					Duplicate			Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date prepared	-			23/03/2022	[NT]	[NT]	[NT]	[NT]	23/03/2022	[NT]
Date analysed	-			23/03/2022	[NT]	[NT]	[NT]	[NT]	23/03/2022	[NT]
Total Suspended Solids	mg/L	5	Inorg-019	<5	[NT]	[NT]	[NT]	[NT]	87	[NT]
Total Dissolved Solids (grav)	mg/L	5	Inorg-018	<5	[NT]	[NT]	[NT]	[NT]	101	[NT]
Oil & Grease (LLE)	mg/L	5	Inorg-003	<5	[NT]	[NT]	[NT]	[NT]	97	[NT]
Ferric Iron (by calculation)	mg/L	0.05		<0.05	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Ferrous Iron	mg/L	0.05	Inorg-076	<0.05	[NT]	[NT]	[NT]	[NT]	106	[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.

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

ION_BALANCE:# Percent recovery is not applicable due to the high concentration of the analyte/s in the sample/s. However an acceptable recovery was obtained for the LCS.

SAMPLE RECEIPT ADVICE

Client Details

Client	Douglas Partners Pty Ltd
Attention	Sally Peacock

Sample Login Details

Your reference	86043.06, Macquarie Park
Envirolab Reference	291444
Date Sample Received	21/03/2022
Date Instructions Received	21/03/2022
Date Results Expected to be Reported	28/03/2022

Sample Condition

Samples received in appropriate condition for analysis	Yes
No. of Samples Provided	4 Water
Turnaround Time Requested	Standard
Temperature on Receipt (°C)	17
Cooling Method	Ice
Sampling Date Provided	YES

Comments

118A - not enough for Oil & Grease

Please direct any queries to:

Aileen Hie

Phone: 02 9910 6200
Fax: 02 9910 6201
Email: ahie@envirolab.com.au

Jacinta Hurst

Phone: 02 9910 6200
Fax: 02 9910 6201
Email: jhurst@envirolab.com.au

Analysis Underway, details on the following page:



Sample ID	VOCs in water	vTRH(C6-C10)/BTEXN in Water	svTRH (C10-C40) in Water	PAHs in Water - Low Level	OCPs in Water - Trace Level	OP in water Trace ANZECC/ADWG	PCBs in Water - Trace Level	Organochlorine Pesticides in Water	OP Pesticides in Water	PCBs in Water	HM in water - dissolved	HM in water - total	Calcium - Dissolved	Potassium - Dissolved	Sodium - Dissolved	Magnesium - Dissolved	Hardness	Hydroxide Alkalinity (OH-) as CaCO3	Bicarbonate Alkalinity as CaCO3	Carbonate Alkalinity as CaCO3	Total Alkalinity as CaCO3	Sulphate, SO4	Chloride, Cl	Ionic Balance	Total Suspended Solids	Total Dissolved Solids(grav)	Oil & Grease (LLE)	Ferric Iron (by calculation)	Ferrous Iron
109A	✓	✓	✓	✓	✓	✓	✓				✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
111	✓	✓	✓	✓	✓	✓	✓				✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
118A	✓	✓	✓	✓				✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	
BD1/20220321		✓	✓	✓							✓																		

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.

Groundwater (GW) Field Sheet

Project and Bore Installation Details						
Project Name / Site Location	MACQUARIE PARK, Ivanhoe Estate			Project Number	86043.06	
Well Construction Details	Well ID	111	Drilling Method	NMLC	Hole Diameter (m)	0.075
	Well Depth (m bgl)		Screened (m bgl)	8.8-11.8	Stick Up (m)	0
Survey Information	Easting		Northing		Elevation RL	
GW Level During Drilling		m bgl				
Contaminants/Comments						

Well Development Details					
Date / Time / Weather Conditions				Purged By	
Purge Method / Equipment					
Product observed / Thickness		mm	Confirmed with Bailer? (Y / N)		
GW Level (pre-purge)		m bgl	Observed Well Depth		m bgl
Height of Water Column (H)		m bgl	Estimated Bore Volume*		L
GW Level (post-purge)		m bgl	Total Volume Purged**		L
Appearance/Comments					

Sampling Details						
Date / Time / Weather Conditions	21/3/22 1:00pm sunny, partly cloudy			Sampled By	L/AN	
Sampling Method / Equipment	Peristaltic pump, WQM, bailer & line, 12V battery, water inlet pipe					
WQM Model	TPS FCT90		WQM Calibration Date	21/3/22		
Product observed / Thickness	0	mm	Confirmed with Bailer? (Y / N)	Y		
GW Level (pre-micropurge)	4.56	m bgl	Observed Well Depth	11.25	m bgl	
Height of Water Column	6.69	m bgl	Estimated Bore Volume*	~ 39	L	
GW Level (post sample)	6.45	m bgl	Total Volume of Micro-Purged	4-5	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%
1:24pm		26.6	2.07	602	5.31	133	
1:25pm		23.1	1.87	626	5.44	126	
1:26pm		21.2	1.64	633	5.48	122	
1:27pm		20.8	1.57	628	5.45	119	
1:28pm		20.6	1.45	627	5.46	117	
1:29pm		20.5	1.38	626	5.46	116	115
1:30pm							
1:31pm							
1:32pm							
1:33pm							
1:34pm							
1:35pm							
1:36pm							
1:37pm							
1:38pm							

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,	middle of column.			
Sample Observations (e.g. colour, sediment, sheen, odour)	clear					
Sample ID	111					
QAQC Samples	Replicate	—	Triplicate	—	Other	—
Sample Containers	Amber glass	2	Plastic	2	PFAS (no teflon)	—
Quantity / Preservation / Filtration	Metals (F/UF) (HNO3)	2	Phenols/COD/NH3 (H2SO4)	1	Vials (HCl)	4
	Ferrous/Ferric Iron (HCl)	1	Cyanides/Chromium (NaOH)	—	Other	—
Comments						

*Estimated Well Volume = H * F	Std. Drilling Diameter (m)	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

Groundwater (GW) Field Sheet

Project and Bore Installation Details						
Project Name / Site Location			Project Number			
Well Construction Details	Well ID	109A	Drilling Method	Rotary	Hole Diameter (m) [†]	0.119
	Well Depth (m bgl)	8.5	Screened (m bgl)	5.5-8.5	Stick Up (m)	0
Survey Information	Easting		Northing		Elevation RL	
GW Level During Drilling	m bgl					
Contaminants/Comments						

Well Development Details			
Date / Time / Weather Conditions		Purged By	
Purge Method / Equipment			
Product observed / Thickness	mm	Confirmed with Bailer? (Y/N)	
GW Level (pre-purge)	m bgl	Observed Well Depth	m bgl
Height of Water Column (H)	m bgl	Estimated Bore Volume*	L
GW Level (post-purge)	m bgl	Total Volume Purged**	L
Appearance/Comments			

Sampling Details			
Date / Time / Weather Conditions		Sampled By	
Sampling Method / Equipment		12V battery	
WQM Model	TPS FLT-90	WQM Calibration Date	
Product observed / Thickness	mm	Confirmed with Bailer? (Y/N)	
GW Level (pre-micropurge)	4.96	Observed Well Depth	8.20
Height of Water Column	3.24	Estimated Bore Volume*	~16
GW Level (post sample)	6.33	Total Volume of Micro-Purged	9-10

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%
12:14pm		26.0	1.79	612	7.39	114	
12:15pm		22.4	1.77	634	7.51	116	
12:16pm		21.8	1.00	642	7.61	109	
12:17pm		21.7	0.91	641	7.69	106	
12:18pm		21.0	0.83	645	7.21	105	
12:19pm		20.9	0.69	645	6.50	104	
12:20pm		20.8	0.67	652	6.18	102	
12:21pm		20.7	0.56	646	6.71	104	306
12:22pm		20.6	0.55	651	7.24	101	257
12:23pm		20.5	0.55	651	7.30	101	305
12:24pm		20.5	0.50	633	7.92	99	267
12:25pm		20.5	0.46	616	8.10	98	251
12:26pm		20.5	0.43	596	8.14	97	235

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)	6.5-7	m bgl,	mid col.		
Sample Observations (e.g. colour, sediment, sheen, odour)	clear				
Sample ID	109A				
QAQC Samples	Replicate	BD1/2020321	Triplicate		Other
Sample Containers	Amber glass	2	Plastic	2	PFAS (no teflon)
Quantity / Preservation / Filtration	Metals (F/UF) (HNO3)	2	Phenols/COD/NH3 (H2SO4)	1	Vials (HCl)
	Ferrous/Ferric Iron (HCl)	1	Cyanides/Chromium (NaOH)	1	Other
Comments					

*Estimated Well Volume = H * F	Std. Drilling Diameter (m) [†]	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

Sample ID	109A	BD1/20220321	111	118A
LocCode	109A	109A	111	118A
WellCode				
Sample Date	21/03/2022	21/03/2022	21/03/2022	21/03/2022
Lab_Report_Number	291444	291444	291444	291444
Matrix_Type	WATER	WATER	WATER	WATER
ANZG (2018) Freshwater 95% LOSP Toxicant DGVs*				

Chem_Group	ChemName	Units	PQL					
Ion Balance	Carbonate Alkalinity as CaCO3	mg/L	5		<5	-	<5	<5
PAHs in Water - Low Level	Benzo(a)pyrene TEQ	µg/L	0.5		<0.5	<0.5	<0.5	<0.5
	Benzo(b,j+k)fluoranthene	µg/L	0.2		<0.2	<0.2	<0.2	<0.2
	Total +ve PAHs	µg/L	0.1		<0.1	<0.1	<0.1	<0.1
Inorganics	Alkalinity (Hydroxide) as CaCO3	mg/L	5		<5	-	<5	<5
	Alkalinity (total) as CaCO3	mg/L	5		<5	-	65	120
	Alkalinity (Bicarbonate as CaCO3)	mg/L	5		<5	-	65	120
	Chloride	mg/L	1		120	-	110	48
	Ferrous Iron	mg/L	0.05		0.24	-	0.52	1.3
	Ionic Balance	%			-15	-	-5	-11
	Sodium (Filtered)	mg/L	0.5		93	-	74	67
	Sulphate	mg/L	1		170	-	64	95
	TDS	mg/L	5		300	-	320	420
	TSS	mg/L	5		76	-	300	95,000
Metals	Arsenic	mg/L	0.001	0.024	<0.001	-	<0.001	0.006
	Arsenic (Filtered)	mg/L	0.001	0.024	<0.001	<0.001	<0.001	<0.001
	Cadmium	mg/L	0.0001	0.0004	<0.0001	-	<0.0001	0.0002
	Cadmium (Filtered)	mg/L	0.0001	0.0002	<0.0001	<0.0001	<0.0001	<0.0001
	Calcium (Filtered)	mg/L	0.5		6	-	27	28
	Chromium (III+VI)	mg/L	0.001	0.0068	0.001	-	0.004	0.058
	Chromium (III+VI) (Filtered)	mg/L	0.001	0.0068	<0.001	<0.001	<0.001	<0.001
	Copper	mg/L	0.001	0.0014	0.003	-	0.006	0.069
	Copper (Filtered)	mg/L	0.001	0.0014	0.002	0.002	<0.001	0.035
	Ferric Iron	mg/L	0.05		<0.05	-	0.21	<0.05
	Iron	mg/L	0.01		0.5	-	2.7	44
	Iron (Filtered)	mg/L	0.01		0.22	0.25	0.73	1.3
	Lead	mg/L	0.001	0.0103	0.005	-	0.006	0.07
	Lead (Filtered)	mg/L	0.001	0.0103	0.004	0.004	<0.001	<0.001
	Magnesium (Filtered)	mg/L	0.5		7.9	-	5	2
	Mercury	mg/L	0.00005	0.0006	<0.00005	-	<0.00005	0.00008
	Mercury (Filtered)	mg/L	0.00005	0.0006	<0.00005	<0.00005	<0.00005	<0.00005
	Nickel	mg/L	0.001	0.0232	0.003	-	0.004	0.019
	Nickel (Filtered)	mg/L	0.001	0.0232	0.002	0.002	0.002	0.003
	Potassium (Filtered)	mg/L	0.5		0.7	-	1	3
Zinc	mg/L	0.001	0.0168	0.019	-	0.048	0.23	
Zinc (Filtered)	mg/L	0.001	0.0168	0.016	0.016	0.026	0.022	
TPH	C10-C16	mg/L	0.05		<0.05	<0.05	<0.05	<0.05
	C16-C34	mg/L	0.1		<0.1	<0.1	<0.1	<0.1
	C34-C40	mg/L	0.1		<0.1	<0.1	<0.1	<0.1
	Oil and Grease	mg/L	5		<5	-	<5	-
	F2-NAPHTHALENE	mg/L	0.05		<0.05	<0.05	<0.05	<0.05
	C6 - C9	mg/L	0.01		<0.01	<0.01	<0.01	<0.01
	C10 - C14	mg/L	0.05		<0.05	<0.05	<0.05	<0.05
	C15 - C28	mg/L	0.1		<0.1	<0.1	<0.1	<0.1
	C29-C36	mg/L	0.1		<0.1	<0.1	<0.1	<0.1
	+C10 - C36 (Sum of total)	mg/L	0.05		<0.05	<0.05	<0.05	<0.05
	C10 - C40 (Sum of total)	mg/L	0.05		<0.05	<0.05	<0.05	<0.05
	C6-C10 less BTEX (F1)	mg/L	0.01		<0.01	<0.01	<0.01	<0.01
	C6-C10	mg/L	0.01		<0.01	<0.01	<0.01	<0.01
	BTEX	Benzene	mg/L	0.001	0.95	<0.001	<0.001	<0.001
Ethylbenzene		mg/L	0.001	0.08	<0.001	<0.001	<0.001	<0.001
Toluene		mg/L	0.001	0.18	<0.001	<0.001	<0.001	<0.001
Xylene (m & p)		mg/L	0.002		<0.002	<0.002	<0.002	<0.002
Xylene (o)		mg/L	0.001	0.35	<0.001	<0.001	<0.001	<0.001
MAH	1,2,4-trimethylbenzene	mg/L	0.001		<0.001	-	<0.001	<0.001
	1,3,5-trimethylbenzene	mg/L	0.001		<0.001	-	<0.001	<0.001
	Isopropylbenzene	mg/L	0.001	0.03	<0.001	-	<0.001	<0.001
	n-butylbenzene	mg/L	0.001		<0.001	-	<0.001	<0.001
	n-propylbenzene	mg/L	0.001		<0.001	-	<0.001	<0.001
	p-isopropyltoluene	mg/L	0.001		<0.001	-	<0.001	<0.001
	sec-butylbenzene	mg/L	0.001		<0.001	-	<0.001	<0.001
	Styrene	mg/L	0.001		<0.001	-	<0.001	<0.001
	tert-butylbenzene	mg/L	0.001		<0.001	-	<0.001	<0.001
Chlorinated Hydrocarbons	1,1,1,2-tetrachloroethane	mg/L	0.001		<0.001	-	<0.001	<0.001
	1,1,1-trichloroethane	mg/L	0.001	0.27	<0.001	-	<0.001	<0.001
	1,1,2,2-tetrachloroethane	mg/L	0.001	0.4	<0.001	-	<0.001	<0.001
	1,1,2-trichloroethane	mg/L	0.001	6.5	<0.001	-	<0.001	<0.001
	1,1-dichloroethane	mg/L	0.001		<0.001	-	<0.001	<0.001
	1,1-dichloroethene	mg/L	0.001	0.7	<0.001	-	<0.001	<0.001
	1,1-dichloropropene	mg/L	0.001		<0.001	-	<0.001	<0.001
	1,2,3-trichloropropane	mg/L	0.001		<0.001	-	<0.001	<0.001
	1,2-dibromo-3-chloropropane	mg/L	0.001		<0.001	-	<0.001	<0.001
	1,2-dichloroethane	mg/L	0.001	1.9	<0.001	-	<0.001	<0.001
	1,2-dichloropropane	mg/L	0.001	0.9	<0.001	-	<0.001	<0.001
	1,3-dichloropropane	mg/L	0.001	1.1	<0.001	-	<0.001	<0.001
	2,2-dichloropropane	mg/L	0.001		<0.001	-	<0.001	<0.001
	Bromochloromethane	mg/L	0.001		<0.001	-	<0.001	<0.001
	Bromodichloromethane	mg/L	0.001		<0.001	-	<0.001	<0.001
	Bromoform	mg/L	0.001		<0.001	-	<0.001	<0.001
	Carbon tetrachloride	mg/L	0.001	0.24	<0.001	-	<0.001	<0.001
	Chlorodibromomethane	mg/L	0.001		<0.001	-	<0.001	<0.001
	Chloroethane	mg/L	0.01		<0.01	-	<0.01	<0.01
	Chloroform	mg/L	0.001	0.77	<0.001	-	<0.001	<0.001
	Chloromethane	mg/L	0.01		<0.01	-	<0.01	<0.01
	cis-1,2-dichloroethene	mg/L	0.001		<0.001	-	<0.001	<0.001

Sample ID	109A	BD1/20220321	111	118A
LocCode	109A	109A	111	118A
WellCode				
Sample Date	21/03/2022	21/03/2022	21/03/2022	21/03/2022
Lab_Report_Number	291444	291444	291444	291444
Matrix_Type	WATER	WATER	WATER	WATER
ANZG (2018) Freshwater 95% LOSP Toxicant DGVs*				

Chem_Group	ChemName	Units	PQL					
	cis-1,3-dichloropropene	mg/L	0.001		<0.001	-	<0.001	<0.001
	Dibromomethane	mg/L	0.001		<0.001	-	<0.001	<0.001
	Hexachlorobutadiene	mg/L	0.001		<0.001	-	<0.001	<0.001
	Trichloroethene	mg/L	0.001	0.33	<0.001	-	<0.001	<0.001
	Tetrachloroethene	mg/L	0.001	0.07	<0.001	-	<0.001	<0.001
	trans-1,2-dichloroethene	mg/L	0.001		<0.001	-	<0.001	<0.001
	trans-1,3-dichloropropene	mg/L	0.001		<0.001	-	<0.001	<0.001
	Vinyl chloride	mg/L	0.01	0.1	<0.01	-	<0.01	<0.01
Halogenated Hydrocarbons	1,2-dibromoethane	mg/L	0.001		<0.001	-	<0.001	<0.001
	Bromomethane	mg/L	0.01		<0.01	-	<0.01	<0.01
	Dichlorodifluoromethane	mg/L	0.01		<0.01	-	<0.01	<0.01
	Trichlorofluoromethane	mg/L	0.01		<0.01	-	<0.01	<0.01
Halogenated Benzenes	1,2,3-trichlorobenzene	mg/L	0.001	0.01	<0.001	-	<0.001	<0.001
	1,2,4-trichlorobenzene	mg/L	0.001	0.17	<0.001	-	<0.001	<0.001
	1,2-dichlorobenzene	mg/L	0.001	0.16	<0.001	-	<0.001	<0.001
	1,3-dichlorobenzene	mg/L	0.001	0.26	<0.001	-	<0.001	<0.001
	1,4-dichlorobenzene	mg/L	0.001	0.06	<0.001	-	<0.001	<0.001
	2-chlorotoluene	mg/L	0.001		<0.001	-	<0.001	<0.001
	4-chlorotoluene	mg/L	0.001		<0.001	-	<0.001	<0.001
	Bromobenzene	mg/L	0.001		<0.001	-	<0.001	<0.001
	Chlorobenzene	mg/L	0.001	0.055	<0.001	-	<0.001	<0.001
	Hexachlorobenzene	mg/L	0.000001	0.0001	<0.000001	-	<0.000001	<0.0002
Solvents	Cyclohexane	mg/L	0.001		<0.001	-	<0.001	<0.001
PAH/Phenols	Acenaphthene	mg/L	0.0001		<0.0001	<0.0001	<0.0001	<0.0001
	Acenaphthylene	mg/L	0.0001		<0.0001	<0.0001	<0.0001	<0.0001
	Anthracene	mg/L	0.0001	0.0004	<0.0001	<0.0001	<0.0001	<0.0001
	Benz(a)anthracene	mg/L	0.0001		<0.0001	<0.0001	<0.0001	<0.0001
	Benzo(a) pyrene	mg/L	0.0001	0.0002	<0.0001	<0.0001	<0.0001	<0.0001
	Benzo(g,h,i)perylene	mg/L	0.0001		<0.0001	<0.0001	<0.0001	<0.0001
	Chrysene	mg/L	0.0001		<0.0001	<0.0001	<0.0001	<0.0001
	Dibenz(a,h)anthracene	mg/L	0.0001		<0.0001	<0.0001	<0.0001	<0.0001
	Fluoranthene	mg/L	0.0001	0.0014	<0.0001	<0.0001	<0.0001	<0.0001
	Fluorene	mg/L	0.0001		<0.0001	<0.0001	<0.0001	<0.0001
	Indeno(1,2,3-c,d)pyrene	mg/L	0.0001		<0.0001	<0.0001	<0.0001	<0.0001
	Naphthalene	mg/L	0.0002	0.016	<0.0002	<0.0002	<0.0002	<0.0002
	Phenanthrene	mg/L	0.0001	0.002	<0.0001	<0.0001	<0.0001	<0.0001
	Pyrene	mg/L	0.0001		<0.0001	<0.0001	<0.0001	<0.0001
Polychlorinated Biphenyls	Arochlor 1016	mg/L	0.00001		<0.00001	-	<0.00001	<0.002
	Arochlor 1221	mg/L	0.00001		<0.00001	-	<0.00001	<0.002
	Arochlor 1232	mg/L	0.00001		<0.00001	-	<0.00001	<0.002
	Arochlor 1242	mg/L	0.00001	0.0006	<0.00001	-	<0.00001	<0.002
	Arochlor 1248	mg/L	0.00001		<0.00001	-	<0.00001	<0.002
	Arochlor 1254	mg/L	0.00001	0.00003	<0.00001	-	<0.00001	<0.002
	Arochlor 1260	mg/L	0.00001		<0.00001	-	<0.00001	<0.002
Organochlorine Pesticides	4,4-DDE	mg/L	0.000001		<0.000001	-	<0.000001	<0.0002
	a-BHC	mg/L	0.000001		<0.000001	-	<0.000001	<0.0002
	Aldrin	mg/L	0.000001		<0.000001	-	<0.000001	<0.0002
	b-BHC	mg/L	0.000001		<0.000001	-	<0.000001	<0.0002
	Chlordane (cis)	mg/L	0.000001		<0.000001	-	<0.000001	<0.0002
	Chlordane (trans)	mg/L	0.000001		<0.000001	-	<0.000001	<0.0002
	d-BHC	mg/L	0.000001		<0.000001	-	<0.000001	<0.0002
	DDD	mg/L	0.000001		<0.000001	-	<0.000001	<0.0002
	DDT	mg/L	0.000001	0.00001	<0.000001	-	<0.000001	<0.0002
	Dieldrin	mg/L	0.000001		<0.000001	-	<0.000001	<0.0002
	Endosulfan I	mg/L	0.000002		<0.000002	-	<0.000002	<0.0002
	Endosulfan II	mg/L	0.000002		<0.000002	-	<0.000002	<0.0002
	Endosulfan sulphate	mg/L	0.000001		<0.000001	-	<0.000001	<0.0002
	Endrin	mg/L	0.000001	0.00002	<0.000001	-	<0.000001	<0.0002
	Endrin aldehyde	mg/L	0.000001		<0.000001	-	<0.000001	<0.0002
	g-BHC (Lindane)	mg/L	0.000001	0.0002	<0.000001	-	<0.000001	<0.0002
	Heptachlor	mg/L	0.000001	0.00009	<0.000001	-	<0.000001	<0.0002
	Heptachlor epoxide	mg/L	0.000001		<0.000001	-	<0.000001	<0.0002
	Methoxychlor	mg/L	0.000001		<0.000001	-	<0.000001	<0.0002
Organophosphorous Pesticides	Azinophos methyl	mg/L	0.00002	0.00002	<0.00002	-	<0.00002	<0.0002
	Bromophos-ethyl	mg/L	0.0002		<0.0002	-	<0.0002	<0.0002
	Chlorpyrifos	mg/L	0.000009	0.00001	<0.000009	-	<0.000009	<0.0002
	Chlorpyrifos-methyl	mg/L	0.0002		<0.0002	-	<0.0002	<0.0002
	Diazinon	mg/L	0.00001	0.00001	<0.00001	-	<0.00001	<0.0002
	Dichlorvos	mg/L	0.0002		<0.0002	-	<0.0002	<0.0002
	Dimethoate	mg/L	0.00015	0.00015	<0.00015	-	<0.00015	<0.0002
	Ethion	mg/L	0.0002		<0.0002	-	<0.0002	<0.0002
	Fenitrothion	mg/L	0.0002	0.0002	<0.0002	-	<0.0002	<0.0002
	Malathion	mg/L	0.00005	0.00005	<0.00005	-	<0.00005	<0.0002
	Methyl parathion	mg/L	0.0002		<0.0002	-	<0.0002	-
	Ronnel	mg/L	0.0002		<0.0002	-	<0.0002	<0.0002
Pesticides	Parathion	mg/L	0.000004	0.000004	<0.000004	-	<0.000004	<0.0002

Notes:

a. Criteria for cadmium, chromium, lead, nickel and zinc were hardness adjusted for a hardness of 72 mg/kg of CaCO₃

* Where criteria was not available, either a lower or unknown reliability criteria was applied, or the laboratory PQL was used as an initial screen

TPS FLT90 CALIBRATION RECORD

Serial Number: 474853
 DP Identification No. WQM NO. 2

Project: MACQUARIE PARK, Ivanhoe
 Project Number: 86043.06

PARAMETER	STANDARD	PRE CALIBRATION READING		POST CALIBRATION READING	
Temperature	* 23.0 - 24.0	25.0	degrees C	24.0	degrees C
pH	10.02	9.94	pH units	10.03	pH units
	7.01	7.13	pH units	7.00	pH units
	4	3.92	pH units	4.00	pH units
Conductivity	0.0** uS/cm	—	µS/cm	—	µS/cm
	2.76 mS/cm	2.67	mS/cm	2.759	mS/cm
	12.88 mS/cm	13.04	mS/cm	12.65	mS/cm
TDS	0.0** ppm	—	ppm	—	ppm
	36.0 ppk	—	ppk	—	ppk
Dissolved Oxygen	0.0% sat	—	ppm		
		-1.3	%	102.9	%
	100.0***% sat	—	ppm		
			%		%
Turbidity	0*** NTU	—	NTU	—	NTU
	90 NTU	90.3	NTU	90.0	NTU
ORP #	240 mV		mV	-	mV

Calibrated by: LT

Date: 21/3/22

* use NATA certified reference thermometer from soils clean lab

** air

*** distilled water

factory calibrated – do a bump test

NOTES: