Douglas PARTNERS

GROUNDED EXPERTISE

Specialist Advice on Groundwater Impact Assessment

Proposed Residential Development with Affordable Housing

16-20 Old Castle Hill Road, Castle Hill, Sydney NSW

Prepared for UPG Castle Corner Ptd Ltd

Project 235039.00

15 October 2025

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

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Groundwater Impact Assessment
Proposed Residential Development with Affordable Housing
16-20 Old Castle Hill Road, Castle Hill, Sydney NSW

1. Introduction

1.1 Purpose of this report

This specialist advice report prepared by Douglas Partners Pty Ltd (Douglas) outlines the Groundwater Impact Assessment (GIA) for a proposed residential development with affordable housing at 6-20 Old Castle Hill Road, Castle Hill, Sydney NSW (the site). The assessment was commissioned by Charbel Youseff of UPG Castle Corner Ptd Ltd (Urban) and was undertaken in accordance with Douglas' proposal 235039.00.P.002.Rev2 dated 24 July 2025.

The purpose of this GIA is to support the submission of a State Significant Development Application (SSDA), addressing the assessment requirements specified in Section 1.3. Additionally, this document aims to assist in obtaining the necessary approvals for the disposal of extracted groundwater, where applicable.

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

This GIA is based on the findings from our geotechnical investigation and monitoring (Douglas Ref. 235039.00.R.001.DftA, dated 25 September 2025) [Douglas 2025]. At the time of preparing this GIA a Preliminary/Detailed (contamination) site investigation (PSI/DSI) has not been carried out to inform the soil and / or groundwater contamination status within the site.

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

- The proposed works will intercept the groundwater table.
- Groundwater levels on site have been observed at approximately RL 106.7 m and RL 125.3 m, relative to Australian Height Datum (mAHD).
- The proposed lowest basement level has a finished floor level (FFL) of RL 112.0 mAHD.
- The basement is intended to be drained.
- The proposed method of dewatering is sump and pump.
- The extracted groundwater is proposed to be disposed of via stormwater drainage system.

This GIA is intended as a preliminary document and will be superseded by a detailed GIA that includes water treatment and discharge schematics, monitoring plans, and triggers to be implemented during construction and operation for long term dewatering.

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

1.2 Regulatory framework and guidance

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

- *Guidelines for Groundwater Protection in Australia*, National Water Quality Management Strategy (Australian Government, 2013);
- Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG, 2018);
- Minimum requirements for building site groundwater investigations and reporting (NSW DPE, 2022);
- *NSW Aquifer Interference Policy* (DPI-NSW Office of Water, 2012); and
- *NSW Aquifer Interference Policy* (NSW DPI, 2013), supplementary version.
- Groundwater assessment toolbox for Major Projects in NSW (NSW DPE, 2022);
- Guidelines for Groundwater Documentation for SSD/SSI Projects (NSW DPE, 2022);
- Minimum Groundwater Modelling Requirements for SSD/SSI Projects (NSW DPE, 2022); and
- Cumulative Groundwater Impact Assessment Approaches (NSW DPE, 2022).

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

1.3 Assessment requirements

Assessment requirements are presented in Table 1.

Table 1: Compliance table

SEARs Item	Assessment Requirement	Report Section / Response
12. Ground and Groundwater Conditions	Where required provide a Groundwater Impact Assessment in accordance with relevant Groundwater Guidelines. If the proposed development is on land identified as having high salinity or acid sulfate soil potential in an EPI provide a Salinity Management Plan or Acid Sulfate Soil Management Plan that includes appropriate management measures and strategies.	Sections 4 to 0

2. Proposed development

2.1 Proposed development and construction

Based on the drawings (Project No. 250319, dated 21 May 2025) prepared by Xavier Knight and our discussions with Charbel Youseff of Urban, it is understood that the proposed development will comprise a 40-storey residential building over 6 levels of basement. The proposed lower basement level has a finished floor level (FFL) of RL 112 mAHD and will require excavations of up to 24 m with deeper localised excavations required for the lift pits and service trenches. The proposed basement is generally set back approximately 5 metres from the site boundaries, although in some locations it extends up to the boundary lines.

2.2 Proposed dewatering and discharge methods

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

3. Site description

The site comprises 16–20 Old Castle Hill Road, Castle Hill, and is located on a northwest facing hillside. Occupying approximately 3,210 m² the site is irregular in shape and slopes generally westward. The site is bounded by Garthowen Crescent to the north, Old Castle Hill Road to the northwest, and McMullen Avenue to the southwest.

At the time of our investigation the site contained:

- No. 16 - predominantly vegetated with medium to large trees.
- No. 18 - a single-storey rendered dwelling and a fibro shed to the south.
- No. 20 - a two-storey brick dwelling with a rear pool (east).
- Small to medium sized trees and vegetation was consistent across the site.

Figure 1: Aerial image of the site

4. Hydrogeological setting

4.1 Topography and hydrology

The site is located on a northwest facing hillside that grades down toward a gully feature that naturally drains into Cattai Creek located about 2 km to the west.

4.2 Climate

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

4.3 Geology

Reference to the Sydney 1:100 000 Geological Series Sheet indicates that the site is underlain by Ashfield Shale, which overlies the Mittagong Formation and then the Hawkesbury Sandstone Formation of the Wianamatta Group

Figure 2: Geological map and site boundary

4.4 Hydrogeology and groundwater source

Based on the hydrogeological setting, the site is assumed to underlain by a groundwater system that includes minor fractured aquifers hosted by the underlying Ashfield Shale / Mittagong Formation / Hawkesbury Sandstone bedrock. These formations typically act as aquitards or aquicludes, although minor secondary permeability can occur where defects are present.

4.5 Groundwater receptors

In assessing potential impacts of dewatering on environmental receptors, those potential receptors need to be identified.

A search of the Bureau of Meteorology (BoM)'s groundwater dependent ecosystems Atlas (the GDE Atlas) indicate that there are no GDEs within a 500 m of the site.

A review of the BoM national groundwater information system (NGIS) shows five water bores are registered within 500 m of the site. A summary of the bores is presented in Table 2.

Table 2: Summary of nearby groundwater bores

Groundwater Bore Reference No.	Licence Status	Intended Purpose	Standing Water Level (m bgl)
GW021982	Surrendered	Waste Disposal	N/A
GW107575	Active	Monitoring Bore	N/A
GW109570	Active	Monitoring Bore	4.3
GW109571	Unknown	Monitoring Bore	5.0
GW109572	Unknown	Monitoring Bore	N/A

Notes: m bgl: metres below ground level

4.6 Acid sulfate soils and salinity

Reference to Department of Land and Water Conservation NSW Acid Sulfate Soil Risk Mapping indicates that the site is not within an area mapped as at risk of acid sulfate soil occurrence.

Regional mapping of salinity in Western Sydney was undertaken in 2002 by the former NSW Department of Infrastructure, Planning and Natural Resources, now the NSW Department of Climate Change, Energy, Environment and Water (DCCEEW). The map of "Salinity Potential in Western Sydney, 2002" (2003) indicates that the site is within an area of "moderate" salinity potential.

5. Investigation results

5.1 Geotechnical

A geotechnical investigation was undertaken by Douglas [Douglas 2025]. The test locations are shown in Drawing 1 (Appendix B).

The interpreted model can be summarised as follows:

Fill: sandy clay and clay fill to depths ranging from 0.1 m to 1.5 m depth; underlain by

Natural Soil: residual stiff to hard clay to depths between 4.2 m and 4.7 m; underlain by

Bedrock: siltstone and sandstone bedrock, typically fractured and very low to medium strength on first contact and improving to slightly fractured to unbroken and medium to high strength with depth.

5.2 Groundwater

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

Table 3 summarises the monitoring wells' attributes. Their location is shown on Drawing 1 (Appendix B).

Table 3: Monitoring well details

Borehole	Ground Level (mAHD)	Response Zone Interval (m bgl) [RL mAHD]	Response Zone Material	Description of fracturing
BH01	130.3	15 – 24 [115.3 – 106.3]	Siltstone/Sandstone	Slightly fractured
BH02	134.3	12 - 27 [122.3 – 107.3]	Siltstone/Sandstone	Slightly fractured
BH04	132.3	9.3 – 24.3 [123.1 – 108.1]	Siltstone/Sandstone	Fractured to slightly fractured

Notes: m bgl: metres below ground level

5.2.1 Groundwater levels

Free groundwater was not observed during auger drilling in any of the boreholes. The necessary use of water as a drilling fluid during HQ coring precluded the observation of groundwater levels during drilling.

Groundwater levels have been continuously recorded at hourly intervals since 1 September 2025 using data loggers installed in the monitoring wells. Hydrographs showing recorded levels in comparison with rainfall data over time are presented in Appendix D. Due to the relatively short monitoring period, fluctuations and trends in response to rainfall within the wells have not been clearly established.

Maximum, minimum, average and median groundwater levels recorded by the dataloggers are presented in Table 4. Note that data collected during permeability testing (i.e. purging and groundwater recharge) was omitted from the results.

Table 4: Summary of logger data

Well ID	Groundwater elevation (m AHD)			
	Lowest	Highest	Average	Median
BH01	106.7	120.0	114.3	114.3
BH02	113.1	114.6	114.4	114.3
BH04	122.3	125.3	124.9	124.9

5.2.2 Hydraulic conductivity

Rising head and packer permeability testing was undertaken within BH01, BH02 and BH04 to evaluate the mass hydraulic conductivity (or permeability) of the bedrock material. A rising head test could not be carried out within BH01 due to the relatively low levels of groundwater within the monitoring well.

The rising head test comprised removing water from the well and measuring the corresponding rise in water level at regular time intervals. The results of the rising head permeability tests are calculated using the methods proposed by Hvorslev (1951) to determine a hydraulic conductivity (k) value. The rising head test results are summarised in Table 5.

Table 5: Summary of rising head tests

Borehole	Hydraulic Conductivity, k (m/s)
BH02	1.3×10^{-8}
BH04	1.9×10^{-6}

Wireline permeability (Packer) testing is a method of calculating the permeability and hydraulic conductivity of bedrock formations surrounding a drilled borehole. A rubber packer is inflated using high pressures against the borehole walls creating a watertight seal and isolates sections of the borehole. Water is then injected under pressure directly into the area of interest. During the test, water is injected over three equally stepped increasing pressures, followed by stepping back down over the same pressures. At each pressure step, the corresponding flow rates are recorded and plotted.

A lugeon value is then calculated using the Houlsby (1976) approach based on how the bedrock behaves under the various pressures and is then converted into a hydraulic conductivity (k) (m/s).

The results of the packer testing are summarised in Table 6.

Table 6: Summary of Packer Test Results

Borehole	Packer Test Depth Interval (m) [RL mAHD]	Houlsby Lugeon Value	Estimated Hydraulic Conductivity, k (m/s)
BH01	8 - 14 [124.3 – 118.3]	8.8	1.1×10^{-6}
	14 – 20 [118.3 – 112.3]	5.2	6.8×10^{-7}
BH02	8 – 14 [126.3 – 120.3]	0.2	2.2×10^{-8}
	18 – 24 [116.3 – 110.3]	4.9	6.3×10^{-7}
BH04	6.1 – 12.1	0.4	5.2×10^{-8}

Borehole	Packer Test Depth Interval (m) [RL mAHD]	Houlsby Lugeon Value	Estimated Hydraulic Conductivity, k (m/s)
	[124.2 – 118.2]		
	12.1 – 18.1 [118.2 – 112.2]	< 0.1	2.0×10^{-9}
		Geometric Mean	1.0×10^{-7}

The results of the rising head and packer testing is consistent with ranges of values documented in the available literature for similar lithologies (e.g. Hoek & Bray 1981 and more recently Pells 2019) and previous experience with similar materials.

5.2.3 Groundwater quality

At the time of writing this report, no PSI/DSI has been carried out on the site. Groundwater quality testing was undertaken as part of this GIA. It is recommended that a PSI or DSI be completed and upon completion of that investigation, if potential contaminants of concern are identified that have not been assessed, further groundwater quality investigation may be warranted. The current results provide an indication of baseline groundwater quality at the site and inform potential disposal options and management requirements (further discussed in Section 9.4).

Groundwater samples were collected and dispatched to a NATA accredited laboratory for the analysis of metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel, and zinc), total recoverable hydrocarbons (TRH), polycyclic aromatic hydrocarbons (PAH), benzene, toluene, ethylbenzene, and xylenes (BTEX), organochlorine Pesticides (OCP), organophosphate pesticides (OPP), polychlorinated biphenyls (PCB), nutrients, dissolved oxygen, total dissolved solid, anions and cations

For the purposes this GIA, the results have been assessed against the suggested discharge criteria (refer to Section 9.4.1).

Groundwater quality results are summarised as follows:

- pH values ranged from 5.88 to 6.54, indicating slight acidic conditions and falling below the recommended discharge range of 6.0 to 8.0, as shown in Table 11 in Section 9.4.1.
- Electrical conductivity (EC) values ranged from 57 to 87.1 µS/cm, indicating freshwater.
- No non-aqueous phase liquids or oily sheens were recorded.
- The following analytes were recorded above the suggested discharge criteria:
    - Heavy metals including arsenic, cadmium, total chromium, copper, nickel and zinc;
    - Ammonia as N in BH2 only; and
    - Faecal Coliforms in BH2 was recorded at 100 cfu/100 ml

Where exceedances of guideline values were identified, appropriate treatment and disposal controls will be implemented (refer to Section 9.4.2)

Summary tables of analytical results and laboratory certificates are provided in Appendix E and Appendix F, respectively.

6. Conceptual hydrogeological model

The site is predominantly underlain by Ashfield Shale, Mittagong Formation Laminite and Hawkesbury Sandstone. The topography of the area generally grades down toward the northwest into a gully feature that extends into Cattai Creek. The groundwater levels recorded within the monitoring wells indicate that the groundwater flow is typically toward the north.

Due to the relatively short monitoring period, fluctuations and trends in response to rainfall within the wells have not been clearly established. This report should be updated upon completion of a 3-months monitoring period. The recorded groundwater levels were observed to be wholly within the bedrock profile of at least medium strength.

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

It should be noted that groundwater levels are transient and fluctuate with climatic variations and other factors (e.g. adjacent excavations, pumping). Therefore, the water levels will temporarily rise during periods of heavy or prolonged rainfall and fall during dry periods. Groundwater levels in the vicinity of the site can also be affected by nearby dewatering activities and existing drained basements.

7. Groundwater inflow assessment

7.1 Numerical modelling methodology

Seepage modelling was undertaken to assess the potential inflow rates into the proposed excavation during continuous long-term dewatering, as well as induced groundwater level changes in adjacent and surrounding areas.

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

Steady-state seepage analysis model was carried out for the long-term (post construction) inflow rates for the basement.

7.2 Model Geometry

A 3D model approximately 300 m x 350 m in area with the site located approximately in the centre was developed. The depth of the model extends to about 210 m below the BEL of the development. The model is shown below in Figure 3.

A BEL of RL 111.5 m for the basement excavation has been adopted.

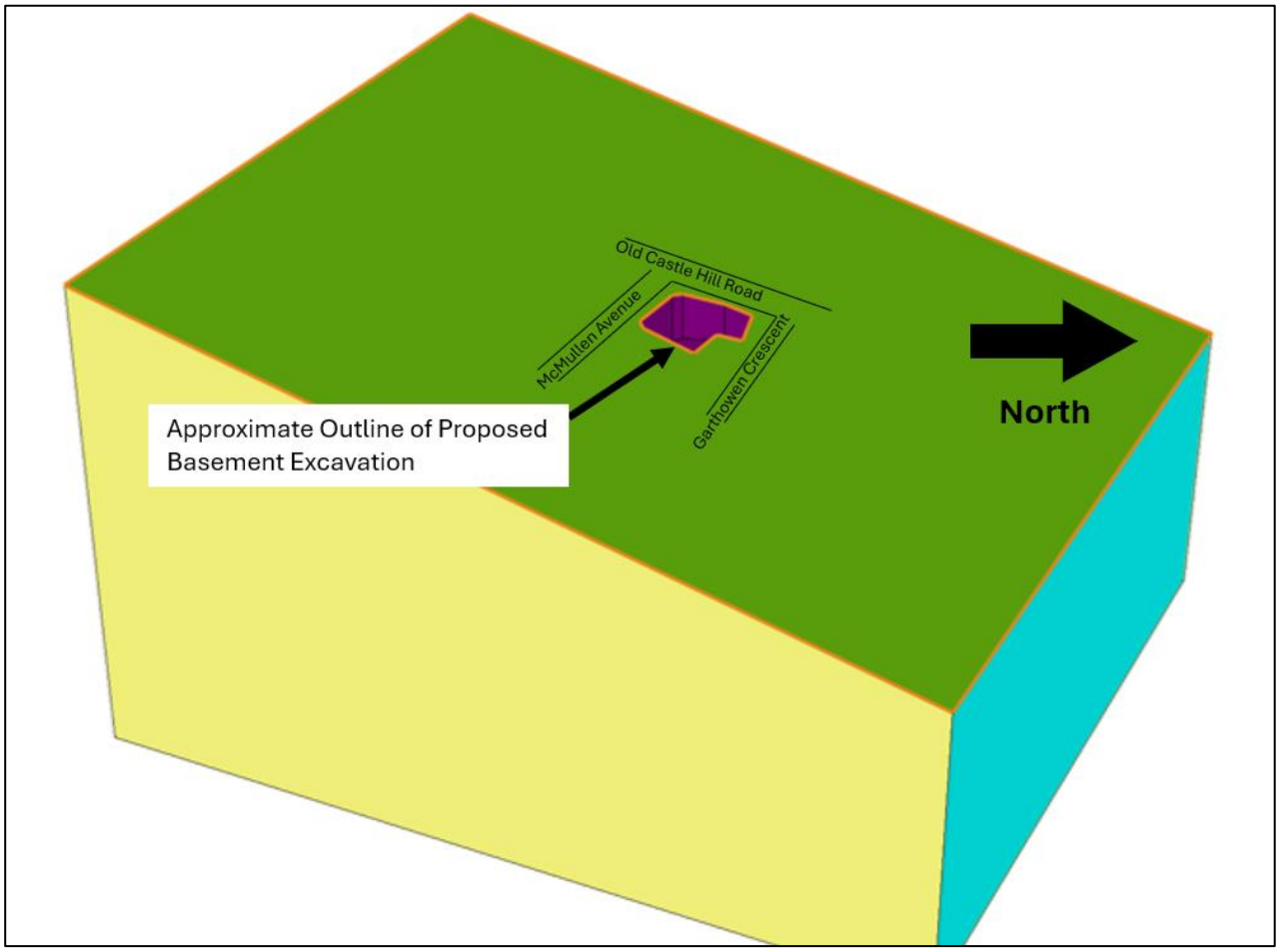

Figure 3: Model extent for 3D modelling

7.3 Model layers

A single-layer subsurface profile comprising bedrock was adopted as the groundwater was observed to be wholly within the bedrock profile. Adopted hydraulic properties (base case) based on the hydraulic conductivity testing results (Section 5.2.2) are presented in Table 7.

Table 7: Adopted hydraulic properties (base case)

Geological Unit	Saturated Kh (m/s)	Anisotropy Ratio (Kv/Kh)	Residual Water Content (%)	Saturated Volumetric Water Content (%)	Material Model Adopted
Bedrock	1×10^{-7}	0.3	7	20	Unsaturated / saturated

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

This parameter is consistent with ranges of values documented in the available literature for similar lithologies (e.g. Hoek & Bray 1981 and more recently Pells 2019) and previous experience with similar materials.

7.4 Model calibration

Groundwater total head boundary conditions have been placed along the sides of the model to simulate initial groundwater levels through the site being consistent with the maximum levels recorded during the groundwater monitoring to date.

An infiltration flux rate of 7.6 x 10^{-10} $m^3/s/m^2$, which is 2% of an average annual rainfall of 1.2 m in Sydney, was adopted to simulate infiltration and seepage from rainfall to the model surface.

The simulated initial (pre-development) groundwater contour lines through the site are shown in Figure 5;

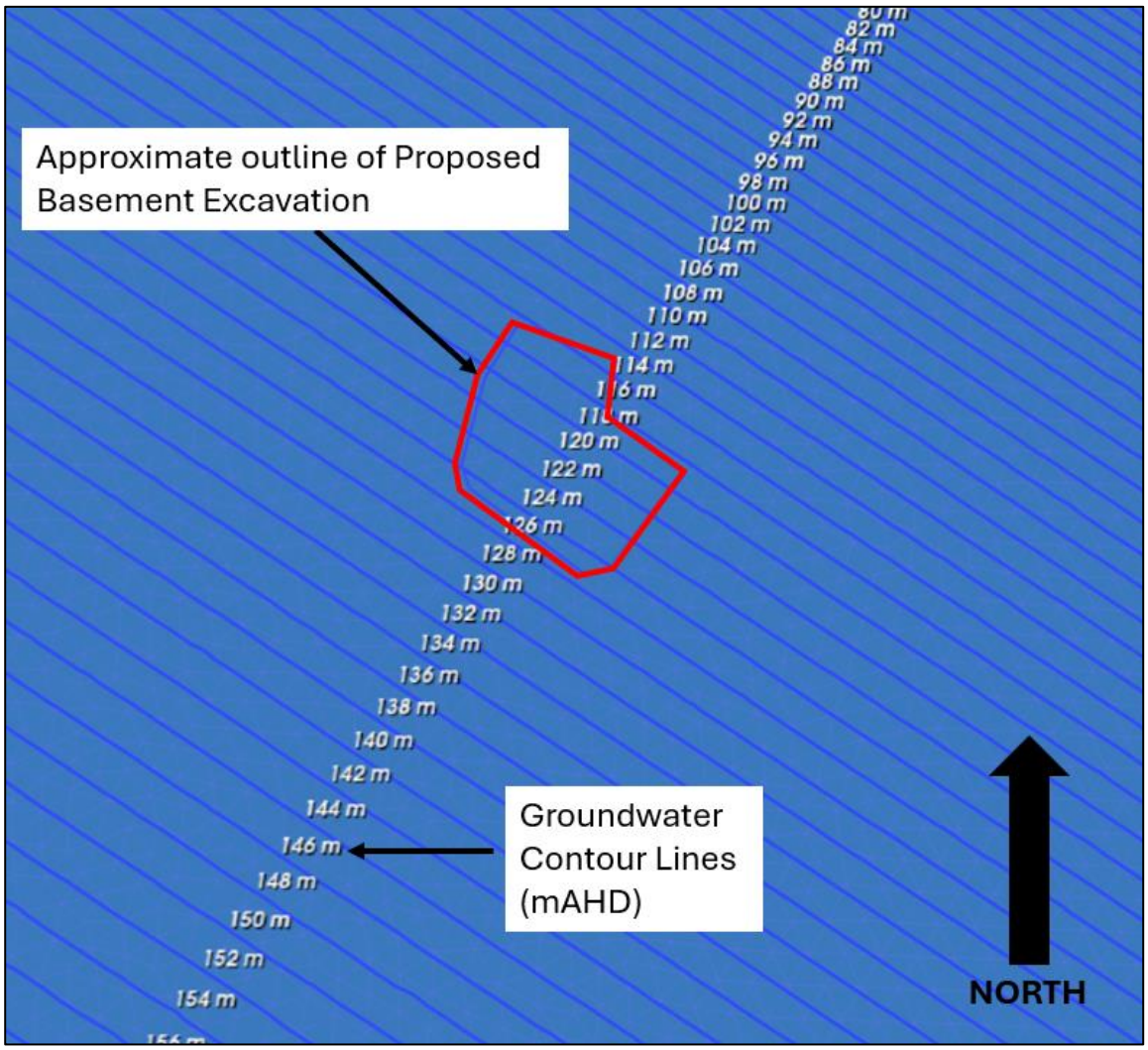

Figure 4: Initial groundwater head contours (mAHD)

A 'free flow' boundary or 'drained' boundary condition was applied to the base and the sides of the basement excavation to model a 'dry' excavation which will be required during long-term dewatering.

7.5 Sensitivity scenario

A sensitivity analyses case was carried out adopting an increased horizontal (K_h) hydraulic conductivity of 5 x 10^{-7} m/s (5 times the base case value) to assess groundwater inflows under higher hydraulic conductivity conditions.

7.6 Predicted groundwater inflow

The results from the inflow analysis are summarised in Table 8 and present the estimated annual inflow rates of groundwater into the excavation during long-term dewatering.

Table 8: Summary of groundwater inflow analysis results

Case	Inflow rate		
	(m^3 / day)	(L / min)	Annual Inflow (ML/year)
Base Case	6.2	4.3	2.3
Sensitivity Case	32.5	22.6	11.9

It should be noted that these volumes are 'estimates' of the average inflows. It is possible that localised zones of higher permeability may be present within the site, through which the rate of inflow could be significantly higher locally, and considering the subsurface heterogeneity and fractured aquifer system, a safety margin for application in the field should be considered. It should also be noted that higher pumping rates, say 2 – 3 times higher than the long term inflow rates, may be required initially until steady-state conditions are achieved.

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

7.7 Predicted groundwater drawdown and settlement

Groundwater levels immediately outside the basement excavation are expected to be drawdown to BEL and by up to approximately 2 m at a distance of 50 m (upstream) from the excavation as shown in Figure 5 below. As the basement is drained, there will be no mounding occurring. There are negligible impacts expected to surrounding properties and infrastructure from drawdown as the groundwater is contained within and flowing through the fractured bedrock profile with high deformation moduli.

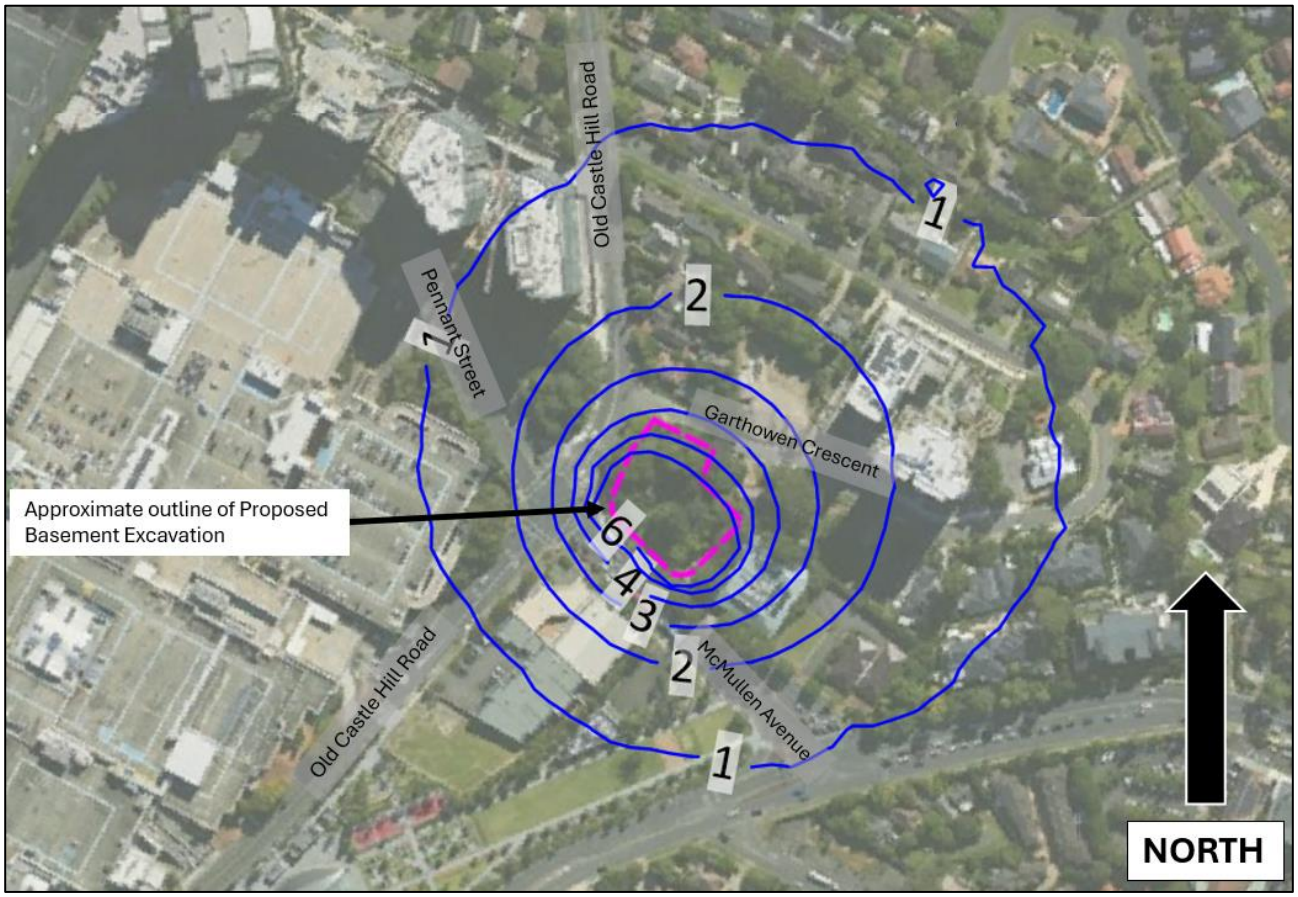

Figure 5: Groundwater drawdown contour lines during continuous dewatering (mAHD)

8. Impact assessment

8.1 Aquifer Interference Policy consideration

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

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

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

8.2 Environmental risk assessment

An assessment of the potential effects of dewatering on neighbouring properties, public infrastructure and groundwater receptors has been summarised in Table 9.

Table 9: Assessment of Potential Effects of Dewatering

Item	Comment
Impacts on potential GDEs	There are no GDEs within 500 m of the site (Section 4.5).
Water supply losses by neighbouring groundwater users	Five water bores were located within 500 m of the site (Section 4.5). Impacts at the water bores are predicted to be less than 2 m as per the AIP minimal impact considerations noting also that only 4 are possibly active and they are nominated as monitoring bores only.
Potential subsidence of neighbouring structures	Groundwater drawdown is predicted to mostly occur within the bedrock units with high deformation moduli. Therefore, risk of subsidence due to lowering of the water table is expected to be negligible.
Mounding of water upgradient of structure	As the basement is proposed to be drained, mounding of groundwater is not expected upgradient of the site.
Water quality	All analytes were within the adopted discharge criteria, with the exception of pH, faecal coliforms, arsenic, cadmium, total chromium, copper, nickel, zinc and ammonia as N. These and other common construction process contaminants will be tested and treated prior to stormwater disposal. Controls to mitigate potential contamination impacts from discharge of the extracted groundwater are provided in Section 9 and include treatment and monitoring of the extracted water prior to discharge.
ASS	<u>On-site</u> Acid Sulphate Soils (ASS) is not considered to be present on the site. As such no further on-site assessment or management is considered warranted. <u>Off-site</u> For Class 5 land, development consent is required for works within 500 metres of adjacent Class 1, 2, 3 or 4 land that is below 5 metres Australian Height Datum and by which the water table is likely to be lowered below 1 metre Australian Height Datum on adjacent Class 1, 2, 3 or 4 land. The predicted groundwater drawdown (Section 7.7) indicates that the drawdown will be in bedrock and that the drawdown level will not extend to lands below 5 m AHD. As such, no management is considered warranted for off-site ASS.
Salinity	While the site is located in an area of “moderate” salinity potential (Section 4.6), EC values from the groundwater quality testing indicate that the groundwater is fresh (Section 5.2.3) and salinity

Item	Comment
	testing from our geotechnical report (Douglas 2025) conclude that the soils are non-saline. Therefore, salinity is not considered a concern and no further assessment, or management is not required.

9. Recommended management strategy

9.1 General

Dewatering will be required during the construction of the basement and long term operation of a drained basement. This section outlines the proposed management strategy based on the preferred methodology for dewatering and disposal.

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

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

9.2 Groundwater inflow control

9.2.1 Control measures and monitoring

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

Groundwater inflow control measures may include:

- Perimeter drainage to capture and divert groundwater;
- Inflow reduction measures such as grouting.

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

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

More information on recommended monitoring is provided in Section 9.5.

9.2.2 Trigger levels

Control measures will be monitored against inflow volumes, with the trigger level being an exceedance of the predicted inflows as outlined in Section 7.6.

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

9.3 Discharge options and contingency measures

Management options for groundwater disposal are presented in Table 10.

Based on groundwater quality testing and predicted dewatering rates, Option 1 (disposal to stormwater) is considered feasible. The other two options listed in Table 10 are provided as contingency plans.

Table 10: Summary of possible management options

Management Option	Comments
Option 1: On-site treatment and disposal to stormwater.	Generally applicable where the treatment required is routine, e.g., solids removal, alum dosing and pH adjustment. Treatment of specific contaminants may require more physical space and result in higher treatment costs. Water disposed to stormwater is typically required to meet general NSW DPE requirements (NSW DPE 2021 & 2022), ANZG (2018) water quality standards for the relevant receiving water body and any associated uses (Section 9.4.1). Further requirements may be enforced depending on the specific approval documentation.
Option 2: * Disposal to the sewer under a Trade Waste Agreement with Sydney Water.	Generally, will require further negotiation and establishment of water quality criteria prior to disposal. Water quality screening levels will depend on the specific trade waste agreement with Sydney Water.
Option 3: ** Tanker off-site for disposal at a licensed liquid waste treatment facility.	May be suitable for more heavily contaminated liquids where on-site treatment is not practicable. Appropriate as a contingency strategy. Can be limited in applicability for larger volumes of water. Water quality screening levels will depend on specific requirements of the waste facility (including their Environmental Protection Licence conditions)

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

9.4 Water quality control

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

Based on the water testing discussed in Section 5.2.3 and the environmental risk assessment conducted in Section 8.2, it is likely that some form of treatment of groundwater will be required prior to discharge.

9.4.1 Discharge criteria

The discharge criteria, and rationale for the criteria are provided in Table 11 below. The adopted discharge criteria are based on the stormwater system discharging to Cattai Creek located about 2 km to the west (freshwater). The discharge criteria include levels adopted from:

- ANZG, 'Australian and New Zealand Guidelines for Fresh and Marine Water Quality 2018' (ANZG, 2018), with a 95% level of protection (LOP) for freshwater ecosystems;
- NHMRC Guidelines for Managing Risks In Recreational Water (NHMRC, 2008);
- Relevant discharge criteria of Sydney Water for stormwater disposal.

The discharge criteria are subject to the approval of the Council or other consent authority responsible for the receiving water body and stormwater network. Subject to the completion of a PSI / DSI and if additional contaminants of potential concern are identified, additional discharge criteria may be recommended.

Table 11: Summary of screening criteria (units given in µg/L unless otherwise stated)

Analyte		Freshwater DGV (95% LOP)	Recreational water guideline values	Physical Parameters
Metals	Arsenic (III / V)	24 / 13	100	-
	Cadmium	0.2	20	-
	Chromium (III / VI)	1	500	-
	Copper	1.4	20000	-
	Mercury (inorganic)	0.6	10	-
	Lead	3.4	100	-
	Nickel	11	200	-
	Zinc	8	30000 (aesthetic only)	-
	Manganese	1900	5000	-
BTEX	Benzene	950	10	-

Analyte		Freshwater DGV (95% LOP)	Recreational water guideline values	Physical Parameters
	Ethylbenzene	80	3000	-
	m-Xylene	75	6000 (total xylene)	-
	o-xylene	350	6000 (total xylene)	-
	p-Xylene	200	6000 (total xylene)	
	Toluene	180	8000	
PAH	Anthracene	0.4	-	-
	Benzo(a)pyrene	0.2	0.1	-
	Fluoranthene	1.4	-	-
	Naphthalene	16	-	-
	Phenanthrene	2	-	-
TRH	C_6-C_{10}	10 (< PQL) [a]		-
	C_{10}-C_{16}	50 (< PQL) [a]		-
	C_{16}-C_{34}	100 (< PQL) [a]		-
	C_{34}-C_{40}	100 (< PQL) [a]		-
Phenols	Phenol	320	-	-
	Pentachlorophenol	10	100	-
	2,4,6-Trichlorophenol	20	200	-
PCB	Aroclor 1242	0.6	-	-
	Aroclor 1254	0.03	-	-
OCP	Aldrin	0.001	3 (Aldrin + Dieldrin)	-
	Chlordane	0.08	20	-
	DDT	0.01	90	-
	Dieldrin	0.01	3 (Aldrin + Dieldrin)	-
	Endosulfan	0.2	200	-
	Endrin	0.02	-	-
	Heptachlor	0.09	3	-
	Methoxychlor	0.005	3000	-

Analyte		Freshwater DGV (95% LOP)	Recreational water guideline values	Physical Parameters
OPP	Chlorpyrifos	0.01	100	-
	Diazinon	0.01	40	-
	Dimethoate	0.15	70	-
	Fenitrothion	0.2	70	-
	Malathion	0.05	700	-
	Parathion	0.004	200	-
Nutrients - Dissolved	Ammonia as N	900		-
Oil and Grease		5000 (< PQL)[a]	5000 (< PQL)[a]	Nonvisible
Faecal Coliforms		100 (<PQL)[a]	100 (<PQL)[a]	-
Physical Parameters	Conductivity	-	-	125 - 2200 µs/cm [b]
	pH	-	6.5-8.5 aesthetic only)	6-8 [b] (6.5-8.5) [c]
	Dissolved Oxygen	-	>80% saturation (aesthetic only)	85-120 % saturation [b]
	Turbidity	-	-	6-50 NTU [b]
	Total Suspended Solids	-	-	< 50 mg/L [d]

Notes: PQL – laboratory practical quantification limit

a – set at the laboratory PQL, example limits given

b – given as comparative levels for lowland rivers. Typical conductivity values for coastal rivers in NSW are cited as 200-300 µs/cm

c – range of typical neutral pH conditions.

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

9.4.2 Treatment options

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

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

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

9.4.3 Proposed water quality monitoring

Water quality monitoring will be conducted in three phases, as follows:

- Baseline monitoring: conducted prior to commencement of dewatering to inform treatment requirement and disposal options;
- Treatment trial monitoring: conducted at the start up period of dewatering to assess the success of the treatment equipment prior to discharge; and
- Routine monitoring: conducted throughout the dewatering and discharge period.

The requirements for each phase are provided below.

9.4.3.1 Baseline monitoring

The purpose of the baseline monitoring is to assess the quality of the untreated groundwater to inform the required treatment prior to discharge to prevent environmental harm of the receiving water body. It is considered that the groundwater data as reported in Section 5.2.3 is sufficient to inform the baseline water quality for the project.

Sampling is to be conducted by a suitably qualified environmental consultant. Water quality sampling from groundwater wells should be conducted in accordance with Geoscience Australia's Groundwater Sampling and Analysis – A Field Guide (Geoscience Australia 2009).

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

9.4.3.2 Treatment trial monitoring

The purpose of the treatment trial and associated monitoring is to assess the success of the treatment method in treating water to meet the discharge criteria, or any modifications required to treat the water to meet the discharge criteria.

The treatment trial may operate using a batch or continuous treatment. For a batch treatment approach, the treated water can be disposed of to stormwater following confirmation it meets the discharge criteria, subject to Council approval. For a continuous treatment approach the treated water cannot be disposed of to stormwater until the treatment trial has been successfully completed. The treated groundwater may be stored on site, or dispose of via an alternative method (e.g. to a licenced liquid waste facility).

For batch based treatment, sampling events can be conducted for each batch, with a maximum of one batch of water treated a day. For continuous treatment, testing should occur every one to three days.

The treatment trial monitoring is to include testing for the analytes listed in Section 9.4.3.4.

The treatment trial is to continue until three sequential samples of treated water meet the discharge criteria.

Sampling and analysis of three samples of untreated water (over three sampling events) for all analytes in Section 9.4.3.4 is also to be conducted, either as part of the treatment trial (if suitable water available for sampling), or otherwise in the initial stage of the routine testing.

9.4.3.3 Routine monitoring

The purpose of the routine monitoring is to assess ongoing compliance with the discharge criteria. Changes in the water quality post treatment may occur due to changes in the extracted / input water quality or changes during treatment (e.g., filters nearing end of life).

The base requirements for routine monitoring are provided in Section 9.5. The sampling frequency and analytical suite should be reviewed by the Environmental Consultant during the dewatering period. Based on this review the Environmental Consultant may recommend:

- Removing some analytes, due to sufficient data being available to assess that they are not of concern;
- A reduction in the frequency of analysis of some analytes, due to sufficient data being available to show consistency in water quality;
- Analysis of additional analytes, or more frequent analysis of some or all analytes, due to variability in the results or additional risks being identified based on field observations of laboratory results.

Recommendations for reductions in the analytical programme should be approved by The Hills Shire Council prior to being implemented.

9.4.3.4 Analytes

The testing suite is summarised in Table 12 and has been adopted based on the following information:

- The requirements of DPE (2022);
- The baseline water quality data (refer to Section 5.2.3);
- The potential for spills / leaks during excavation works;
- Potential salinity impacts;
- General parameters to inform suitability of the water for discharge and changes in groundwater source.

Table 12: Proposed suite of analytes for water quality monitoring

Category	Analytes	Minimum frequency
Field parameters	pH, visible / olfactory signs of turbidity, oil / grease, chemical / noxious odours	Baseline [1] Treatment trial [1] Daily

Category	Analytes	Minimum frequency
	EC, REDOX potential (Eh), temperature, dissolved oxygen	Baseline [1] Treatment trial [1] Monthly [1]
Physical parameters	TDS, TSS	Baseline [1] Treatment trial [1] Monthly [1]
Major ions	Calcium, magnesium, sodium, potassium, chloride, sulphate and alkalinity (total, carbonate and bicarbonate)	Baseline [1] Treatment trial [1] Monthly [1]
Metals (total)	arsenic (As), cadmium (Cd), chromium (Cr), copper (Cu), lead (Pb), manganese (Mn), mercury (Hg), nickel (Ni), zinc (Zn)	Baseline [1] Treatment trial [2] Every routine sampling event [2]
Nutrients	Ammonia (NH3), nitrate (NO3), total nitrogen (N), oxidised nitrogen (N), total phosphorus (P), reactive phosphorus (P)	Baseline [1]
Nutrients	Ammonia (NH3), nitrate, and any of the nutrients of concern from baseline monitoring	Treatment trial [2] Every routine sampling event [2]
Microbiological organisms	Faecal coliforms	Baseline [1] Every routine sampling event [2]
Potential contaminants	TRH, BTEX	Baseline [1] Treatment trial [2] Every routine sampling event [2]
	PAH	Baseline [1]
	OCP, OPP, PCB, phenols	Baseline [1]

Notes:

1. Based on requirements of DPE (2022)
2. Based on available data. Sampling requirements and frequencies may be reviewed as discussed in Section 9.4.3.3

Acronyms EC: electrical conductivity | TDS: total dissolved solids | TSS: total suspended solids
TRH: total recoverable hydrocarbons | TPH: total petroleum hydrocarbons
BTEX: benzene, toluene, ethylbenzene and xylenes
PAH: polycyclic aromatic hydrocarbons

OCP: organochlorine pesticides
OPP: organophosphate pesticides
PCB: polychlorinated biphenyls

3. If subsequent PSI / DSI identifies additional contaminants of potential concern the testing programme may need to be adjusted.

9.5 Monitoring and reporting requirements

The following monitoring program and associated reporting as presented in Table 13 is to be adopted until the end of excavation and construction works on-site.

Table 13: Monitoring and reporting requirements

Item	Monitoring requirements	Methodology
Visual inspection	No visible oil and grease, sheen, significant discolouration or odours.	Daily inspections (by contractor). **HOLD POINT -** If indicators are observed, discharge must be suspended pending analytical confirmation.
Field parameter assessment	pH, daily, preferably continuously Visible / olfactory signs of turbidity, oil / grease, chemical / noxious odours: daily	• Automated measurement as part of treatment system or measure with field pH meter of treated water. • Daily observations (by contractor).
Water quality sampling and testing	Samples from treated water to assess compliance with discharge criteria (Table 11). As per analytical requirements in Section 9.4.3.4. Samples from untreated water as required to inform treatment requirements	All monitoring: • Sampling by suitably experienced environmental engineer / scientist. • Field parameters (pH, EC, turbidity) using field probes. • Chain of Custody (COC) documentation to accompany all samples. • Analysis by a NATA-accredited laboratory. Baseline and treatment trial • As per Section 9.4.3. Routine • Sampling pre-discharge (batch discharge). • Sampling twice weekly (continuous discharge). • Review and update frequency in accordance with Section 9.4.3.4.

Item	Monitoring requirements	Methodology
		HOLD POINT - If water exceeds assessment criteria (SAC), manage as per contingency strategy (Section 9.7).
Quality control sampling	Replicate sampling to verify lab result accuracy.	• Conducted during above sampling events. • Analyse at a rate of 10% of samples. • Testing suite: Metals, TRH, BTEX. • Results to be included in final dewatering completion report.
Quantity of groundwater inflows	Measurements of groundwater volumes (as per Section 9.2).	• Weekly monitoring and reporting of groundwater abstraction volumes. • Weekly reporting of volumes to the Environmental Consultant. • Results to be included in final dewatering completion report. **HOLD POINT -** If volumes exceed trigger levels or Council discharge allowance, works must be halted to minimise inflow (e.g., via grouting).
Dewatering completion report	Final documentation of the dewatering program.	Prepared by a suitably qualified consultant and to include: • Summary of contractor records (e.g. visual inspections, unexpected finds) • Full analytical and quality control results. • Records of dewatering volumes. • Commentary on compliance and any non-conformances with the GIA.

9.6 Personnel and responsibilities

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

Table 14: Personnel and Responsibilities

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

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

9.7 Contingency plan

As per Section 9.5, at any hold point if any non-conformance is encountered then the following general contingency plan will be enacted:

- Entity recording the non-conformance to notify the Site Manager / Contractor and other relevant parties (e.g. geotechnical or Environmental Consultant);
- Dewatering volumes:
  - Suspend discharge;
  - Should dewatering volumes be higher than predicted or higher than discharge limits provided by relevant authorities, suspend construction and reduce pumping rates. Options could include grouting to reduce groundwater inflows;
- Water quality discharge criteria non-conformance:
  - Review of results by Environmental Consultant to assess potential risk to environment;
  - Should water quality be deemed unsuitable for disposal, suspend dewatering and (further) treat water prior to discharge;
  - If relevant, Environmental Consultant to inspect the site / unexpected finds and collect additional water quality samples to assess issue of concern;
  - Review treatment procedures and update methodology as required to improve treatment outcomes;
  - Written advice by the Environmental Consultant that additional laboratory analytical results meet the discharge criteria and / or that recommending that continued discharge is not considered to pose an unacceptable environmental risk and / or recommending additional work (as applicable).
- Off-site tankering may be adopted to meet disposal requirements; and
- Notification to relevant regulatory authorities, as required under approvals.

10. Approvals and licensing

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

10.1 Water Access Licence (WAL) and entitlements

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

In accordance with the Water Management (General) Regulation Act 2018, extraction of water from the greater metropolitan region groundwater source for the purpose of construction dewatering are currently exempt from requiring a Water Access License (WAL) under the coastal construction of infrastructure exemption clause.

For long-term, continuous dewatering of the basement, the predicted groundwater inflows into the proposed basement in the base case are less than 3 ML per year, therefore the development is highly likely not to require a WAL as it meets exemption under Clause 21(2) of the Water Management (General) Regulation 2018. Should the monitoring of the actual inflow volume during the construction suggest it is likely to exceed 3 ML, a Water Access Licence would be required with appropriate groundwater share allocation from NRAR (1 water share per 1 ML).

Actual inflow volumes will only be known at the time of excavation and allowances for variation in the inflow rate should be made. In this regard, inflow volume records during construction when actual inflows are known should be maintained and reported to DCCEEW within 28 days of the water year finishing (i.e.. Before 28 July).

10.2 Water Supply Works Approval (WSWA)

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

10.3 Council and EPA approvals

Depending on the proposed discharge route and water quality:

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

11. Conclusion

The proposed development is expected to have a lowest basement FFL of RL 112 mAHD which will require excavations of up to 24 m below existing surface levels with deeper localised excavations required for the lift cores. The proposed building is expected to be designed as drained with groundwater discharging into the council stormwater system.

The maximum recorded groundwater levels and the geometric mean horizontal permeability values have been adopted in a 3D groundwater modelling for the proposed development. The results of the base case analysis indicate that the predicted annual inflow into the drained basement is 2.3 ML for long-term dewatering. As the predicted inflow rate (base case) is less than

3 ML per year, a WAL is unlikely to be required, unless the monitoring of the actual inflow during construction suggests otherwise.

A sensitivity case was also considered for a more conservative scenario, where the horizontal permeability value was assumed as 5 times the base-case value. The results of the sensitivity case indicates that inflows into the basement for continuous long-term dewatering could exceed 3 ML per annum with an estimated inflow of approximately 11.9 ML per year. Despite this increase of volume, the assessed impact remains within the 'Level 1 Minimal Impact Considerations' as defined by the AIP.

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

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

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

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

12. References

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

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

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

Douglas. (2025). Geotechnical investigation report.

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

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

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

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

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

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

13. Limitations

Douglas Partners Pty Ltd (Douglas) has prepared this report for this project at 16-20 Old Castle Hill Road, Castle Hill, Sydney NSW in line with Douglas' proposal dated 24 July 2025 and acceptance received from Charbel Youseff of UPG Castle Corner Ptd Ltd. The work was carried out under Douglas' Engagement Terms. This report is provided for the exclusive use of UPG Castle Corner Ptd Ltd for this project only and for the purposes as described in the report. It should not be used by or relied upon for other projects or purposes on the same or other site or by a third party. Any party so relying upon this report beyond its exclusive use and purpose as stated above, and without the express written consent of Douglas, does so entirely at its own risk and without recourse to Douglas for any loss or damage. In preparing this report Douglas has necessarily relied upon information provided by the client and/or their agents.

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

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

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

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

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

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

Appendix A

About this Report

About this Report

October 2024

Introduction

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

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

Copyright

Borehole and Test Pit Logs

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

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

Groundwater

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

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

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

Reports

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

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

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

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

About this Report

Site Anomalies

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

Information for Contractual Purposes

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

Site Inspection

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

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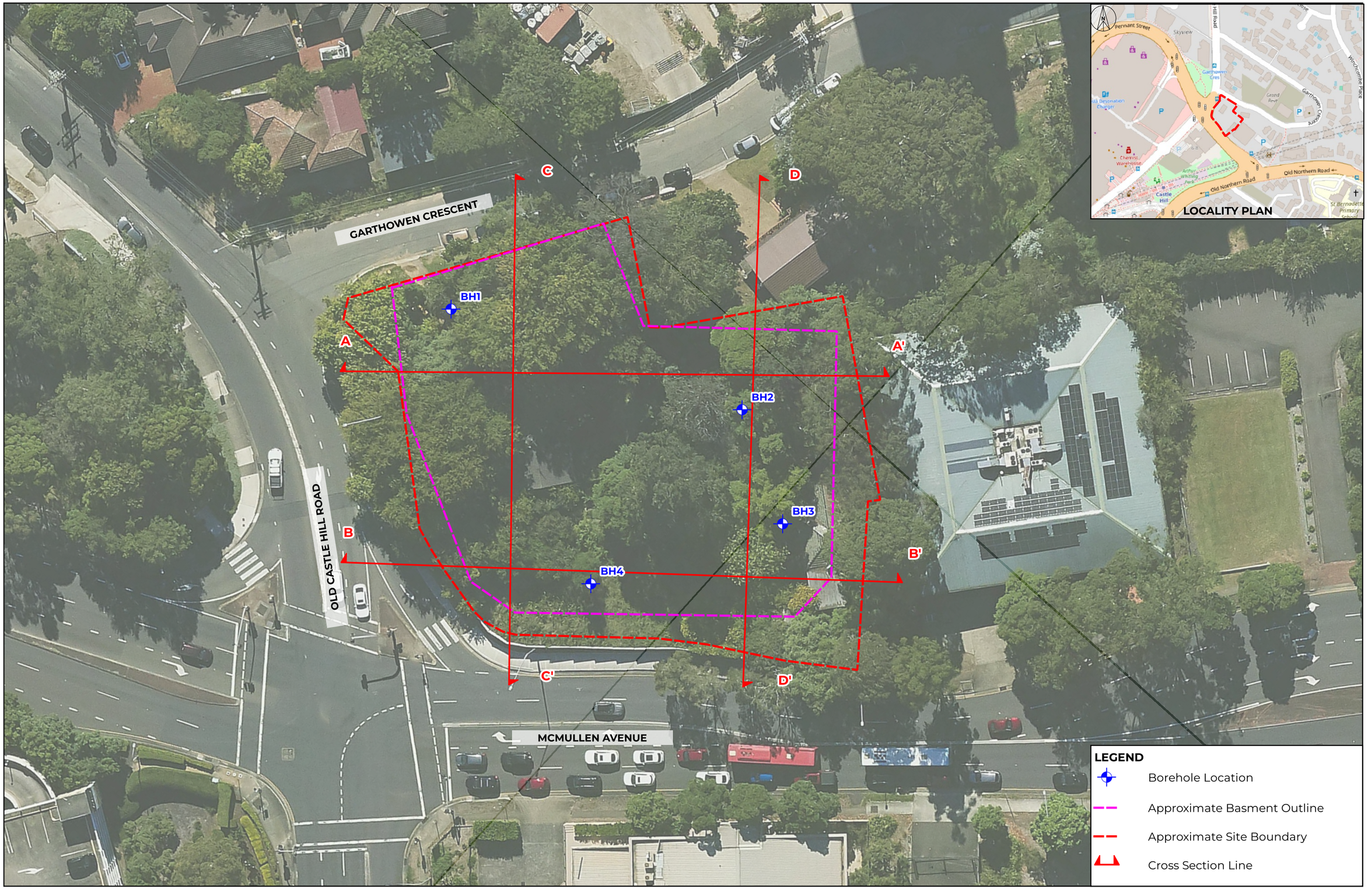
Appendix B

Drawings



REV	DESCRIPTION/COMMENT	DATE	DRAWN BY
0	Initial Issue	11.09.2025	MN

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

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

CLIENT: **UPG Castle Corner Ptd Lty**

NOTE:
1: Base map from Metromap (Dated 06.04.2025)
2: Basement outline from Studio.SC, Reference No. 20240027, Drawing No. AD-DA11_097 (Dated 21.08.2025)

COORDINATE REFERENCE SYSTEM: GDA2020 / MGA zone 56

PROJECT NAME: **Residential Development with Affordable Housing**
PROJECT ADRESS: **16-20 Old Castle Hill Road, Castle Hill**

DRAWING TITLE: **Test Location Plan**

PROJECT NO: **235039.00**
DRAWING NO: **1**
REVISION: **0**

\\dpsydnas02\Projects\235039.00 - CASTLE HILL, 16-20 Old Castle Hill Road\7.0 Drawings\7.3 QGIS\235039.00.qgz

A

A'

ELEVATION (AHD)

APPROXIMATE SITE BOUNDARY

APPROXIMATE SITE BOUNDARY

UNIT 1: FILL

BH01

BH02

UNIT 2

UNIT 3

UNIT 4

UNIT 5

UNIT 6

PROPOSED BASEMENT FFL
RL 112m

DISTANCE ALONG PROFILE (m)

LEGEND

- CH - High Plasticity CLAY
- CI - Medium Plasticity CLAY
- CL-CI - Low to Medium Plasticity CLAY
- FILL
- INTERBEDDED SILTSTONE & SANDSTONE
- SANDSTONE
- SILTSTONE

TESTS / OTHER

N - Standard penetration test value

— ? — — - Interpreted geotechnical boundary

ROCK STRENGTH

VL - Very Low
L - Low
M - Medium
H - High
VH - Very High
EH - Extremely High

SOIL CONSISTENCY

vs - Very Soft
s - Soft
f - Firm
st - Stiff
vst - Very Stiff
h - Hard

na - Not applicable
nd - No data
pc - Poorly compated
mc - Mostly compacted
wc - Well compacted

REV	DESCRIPTION/COMMENT	DATE	DRAWN BY
0	Initial Issue	12.09.2025	MN

SCALE: 0 10

Horizontal Scale 1:500
Vertical Exaggeration = 2.0

Douglas PARTNERS

OFFICE: SYDNEY

96-98 Hermitage Rd, West Ryde NSW 2114

(02) 9809 0666

CLIENT:

UPG Castle Corner Ptd Lty

NOTES
1. Subsurface conditions are accurate at the borehole locations only. Variations in subsurface conditions may occur between borehole locations. Interpreted strata boundaries are approximate and should be used as a guide only.
2. Summary logs only and should be read in conjunction with detailed logs.
3. Horizontal and vertical scales are not equal.

PROJECT NAME:

Proposed Residential Development with Affordable Housing

PROJECT ADDRESS:

16-20 Old Castle Hill Road, Castle Hill

DRAWING TITLE:

Geological Cross Section A-A'

PROJECT No: **235039.00**

DRAWING No: **2**

REVISION: **0**

P:\235039.00 - CASTLE HILL 16-20 Old Castle Hill Road\7.0 Drawings\7.2 Out\235039.00.D.002-5.Rev0_Cross Sections.dwg

B

B'

ELEVATION (AHD)

APPROXIMATE SITE BOUNDARY

APPROXIMATE SITE BOUNDARY

BH04

BH03

UNIT 1: FILL

UNIT 2

UNIT 3

UNIT 4

UNIT 5

UNIT 6

PROPOSED BASEMENT FFL
RL 112m

pc
h
N=42
h
N=30
VL - L
M
H
M / H
H
VH
H

pc
st - vst
N=28
h
h
VL
SEAM
VL
M
VL
h
M - H
VH
H

148 147 146 145 144 143 142 141 140 139 138 137 136 135 134 133 132 131 130 129 128 127 126 125 124 123 122 121 120 119 118 117 116 115 114 113 112 111 110 109 108 107 106 105 104 103 102 101 100 99 98 97 96

0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170

DISTANCE ALONG PROFILE (m)

LEGEND

- CH - High Plasticity CLAY
- CL-CI - Low to Medium Plasticity CLAY
- CI - Medium Plasticity CLAY
- FILL
- SANDSTONE
- Silty CLAY
- INTERBEDDED SILTSTONE & SANDSTONE
- SILTSTONE

TESTS / OTHER

N - Standard penetration test value

— ? — — - Interpreted geotechnical boundary

ROCK STRENGTH

VL - Very Low
L - Low
M - Medium
H - High
VH - Very High
EH - Extremely High

SOIL CONSISTENCY

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s - Soft
f - Firm
st - Stiff
vst - Very Stiff
h - Hard

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nd - No data
pc - Poorly compated
mc - Mostly compacted
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REV	DESCRIPTION/COMMENT	DATE	DRAWN BY
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SCALE: 0 10

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CLIENT:

UPG Castle Corner Ptd Lty

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2. Summary logs only and should be read in conjunction with detailed logs.
3. Horizontal and vertical scales are not equal.

PROJECT NAME:

Proposed Residential Development with Affordable Housing

PROJECT ADDRESS:

16-20 Old Castle Hill Road, Castle Hill

DRAWING TITLE:

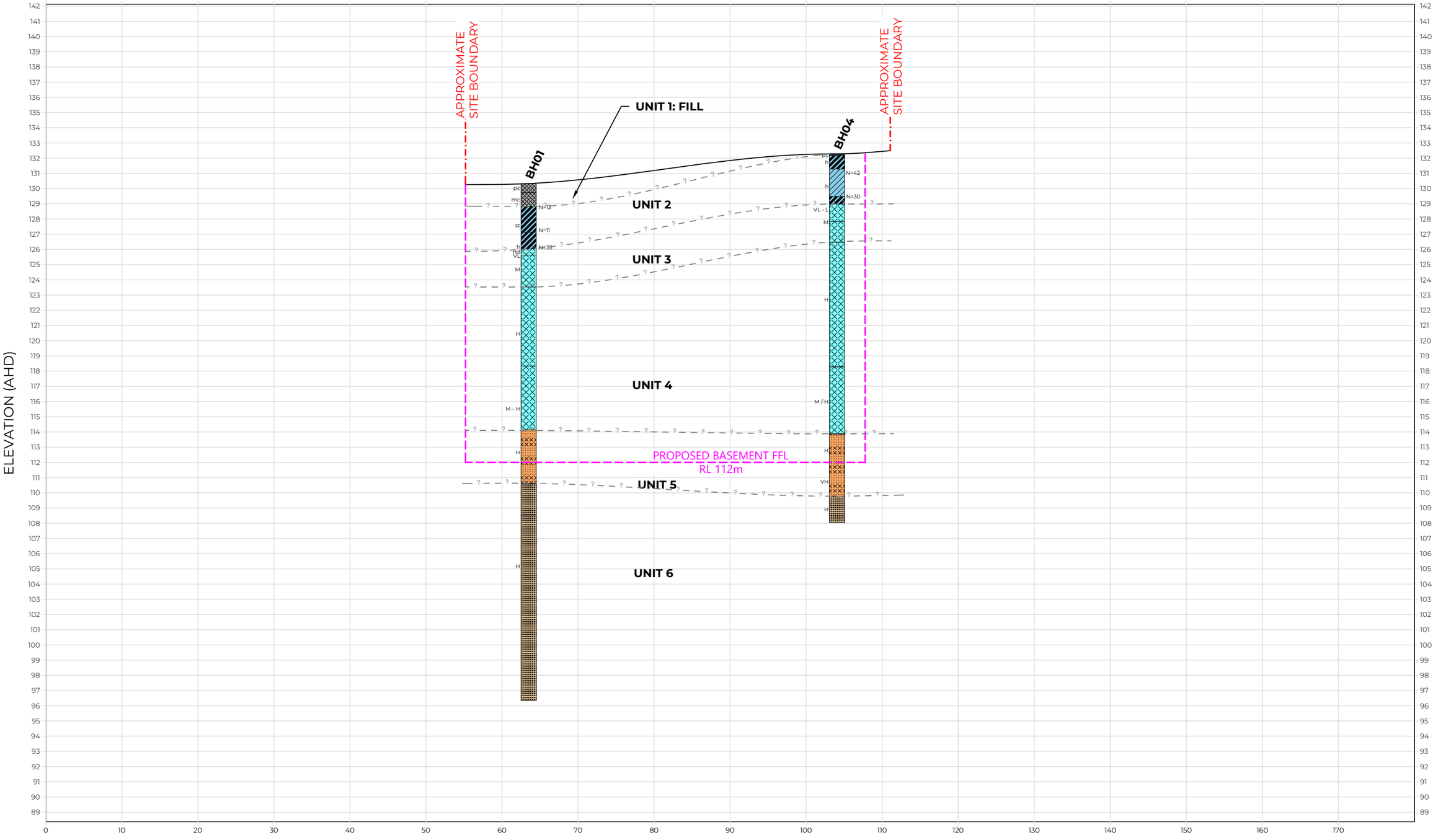
Geological Cross Section D-D'

PROJECT No: **235039.00**

DRAWING No: **3**

REVISION: **0**

P:\235039.00 - CASTLE HILL 16-20 Old Castle Hill Road\7.0 Drawings\7.2 Out\235039.00.D.002-5.Rev0_Cross Sections.dwg



LEGEND

- CH - High Plasticity CLAY
- FILL
- SILTSTONE
- Silty CLAY
- INTERBEDDED SILTSTONE & SANDSTONE
- CL-CI - Low to Medium Plasticity CLAY
- SANDSTONE

TESTS / OTHER

N - Standard penetration test value

— ? — — - Interpreted geotechnical boundary

ROCK STRENGTH

VL - Very Low
L - Low
M - Medium
H - High
VH - Very High
EH - Extremely High

SOIL CONSISTENCY

vs - Very Soft
s - Soft
f - Firm
st - Stiff
vst - Very Stiff
h - Hard

na - Not applicable
nd - No data
pc - Poorly compated
mc - Mostly compacted
wc - Well compacted

REV	DESCRIPTION/COMMENT	DATE	DRAWN BY
0	Initial Issue	12.09.2025	MN

SCALE: 0 10

Horizontal Scale 1:500
Vertical Exaggeration = 2.0

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

CLIENT:
UPG Castle Corner Ptd Lty

NOTES
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PROJECT NAME:
Proposed Residential Development with Affordable Housing

PROJECT ADDRESS:
16-20 Old Castle Hill Road, Castle Hill

DRAWING TITLE:
Geological Cross Section C-C'

PROJECT No: **235039.00**
DRAWING No: **4**
REVISION: **0**

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D

D'

ELEVATION (AHD)

APPROXIMATE SITE BOUNDARY

APPROXIMATE SITE BOUNDARY

UNIT 1: FILL

BH02

BH03

UNIT 2

UNIT 3

UNIT 4

UNIT 5

UNIT 6

PROPOSED BASEMENT FFL
RL 112m

pc
st
N=39
h
N=43
SOft
VL
L
M
M / H
H
VH
H
pc
st - vst
N=28
h
SEAM
VL
SEAM
VL
M
VL
M
H
M - H
VH
H
H

148 147 146 145 144 143 142 141 140 139 138 137 136 135 134 133 132 131 130 129 128 127 126 125 124 123 122 121 120 119 118 117 116 115 114 113 112 111 110 109 108 107 106 105 104 103 102 101 100 99 98 97 96

0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170

DISTANCE ALONG PROFILE (m)

LEGEND

- CH - High Plasticity CLAY
- CI - Medium Plasticity CLAY
- CL-CI - Low to Medium Plasticity CLAY
- FILL
- INTERBEDDED SILTSTONE & SANDSTONE
- SANDSTONE
- SILTSTONE

TESTS / OTHER

N - Standard penetration test value

— ? — — - Interpreted geotechnical boundary

ROCK STRENGTH

VL - Very Low
L - Low
M - Medium
H - High
VH - Very High
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SOIL CONSISTENCY

vs - Very Soft
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REV	DESCRIPTION/COMMENT	DATE	DRAWN BY
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Horizontal Scale 1:500
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PROJECT NAME:

Proposed Residential Development with Affordable Housing

PROJECT ADDRESS:

16-20 Old Castle Hill Road, Castle Hill

DRAWING TITLE:

Geological Cross Section D-D'

PROJECT No: **235039.00**

DRAWING No: **5**

REVISION: **0**

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Appendix C

Borehole Logs (BH01, BH02, BH03 and BH04

Terminology, Symbols and Abbreviations

November 2023

Introduction to Terminology, Symbols and Abbreviations

Douglas Partners' reports, investigation logs, and other correspondence may use terminology which has quantitative or qualitative connotations. To remove ambiguity or uncertainty surrounding the use of such terms, the following sets of notes pages may be attached Douglas Partners' reports, depending on the work performed and conditions encountered:

- Soil Descriptions;
- Rock Descriptions; and
- Sampling, insitu testing, and drilling methodologies

In addition to these pages, the following notes generally apply to most documents.

Abbreviation Codes

Site conditions may also be presented in a number of different formats, such as investigation logs, field mapping, or as a written summary. In some of these formats textual or symbolic terminology may be presented using textual abbreviation codes or graphic symbols, and, where commonly used, these are listed alongside the terminology definition. For ease of identification in these note pages, textual codes are presented in these notes in the following style XW. Code usage conforms with the following guidelines:

- Textual codes are case insensitive, although herein they are generally presented in upper case; and
- Textual codes are contextual (i.e. the same or similar combinations of characters may be used in different contexts with different meanings (for example `PL` is used for plastic limit in the context of soil moisture condition, as well as in `PL(A)` for point load test result in the testing results column)).

Data Integrity Codes

Subsurface investigation data recorded by Douglas Partners is generally managed in a highly structured database environment, where records "span" between a top and bottom depth interval. Depth interval "gaps" between records are considered to introduce ambiguity, and, where appropriate, our practice guidelines may require contiguous data sets. Recording meaningful data is not always appropriate (for example assigning a "strength" to a concrete pavement) and the following codes may be used to maintain contiguity in such circumstances.

Term	Description	Abbreviation Code
Core loss	No core recovery	KL
Unknown	Information was not available to allow classification of the property. For example, when auguring in loose, saturated sand auger cuttings may not be returned.	UK
No data	Information required to allow classification of the property was not available. For example if drilling is commenced from the base of a hole predrilled by others	ND
Not Applicable	Derivation of the properties not appropriate or beyond the scope of the investigation. For example providing a description of the strength of a concrete pavement	NA

Graphic Symbols

Douglas Partners' logs contain a "graphic" column which provides a pictorial representation of the basic composition of the material. The symbols used are directly representing the material name stated in the adjacent "Description of Strata" column, and as such no specific graphic symbology legend has been provided in these notes.

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Soil Descriptions

Terminology
Symbols
Abbreviations

March 2024

Introduction

All materials which are not considered to be "in-situ rock" are described in general accordance with the soil description model of AS 1726-2017 Part 6.1.3, and can be broken down into the following description structure:

The "classification" comprises a two character "group symbol" providing a general summary of dominant soil characteristics. The "name" summarises the particle sizes within the soil which most influence its behaviour. The detailed description presents more information about composition, condition, structure, and origin of the soil.

Classification, naming and description of soils require the relative proportion of particles of different sizes within the whole soil mixture to be considered.

Particle size designation and Behaviour Model

Solid particles within a soil are differentiated on the basis of size.

The engineering behaviour properties of a soil can subsequently be modelled to be either "fine grained" (also known as "cohesive" behaviour) or "coarse grained" ("non cohesive" behaviour), depending on the relative proportion of fine or coarse fractions in the soil mixture.

Particle Size Designation	Particle Size (mm)	Behaviour Model	
		Behaviour	Approximate Dry Mass
Boulder	>200	Excluded from particle behaviour model as "oversize"	
Cobble	63 - 200		
Gravel[1]	2.36 - 63	Coarse	>65%
Sand[1]	0.075 - 2.36		
Silt	0.002 - 0.075	Fine	>35%
Clay	<0.002		

[1] – refer grain size subdivision descriptions below

The behaviour model boundaries defined above are not precise, and the material behaviour should be assumed from the name given to the material (which considers the particle fraction which dominates the behaviour, refer "component proportions" below), rather than strict observance of the proportions of particle sizes. For example, if a material is named a "Sandy CLAY", this is indicative that the material exhibits fine grained behaviour, even if the dry mass of coarse grained material may exceed 65%.

Component proportions

The relative proportion of the dry mass of each particle size fraction is assessed to be a "primary", "secondary", or "minor" component of the soil mixture, depending on its influence over the soil behaviour.

Component Proportion Designation	Definition[1]	Relative Proportion	
		In Fine Grained Soil	In Coarse Grained Soil
Primary	The component (particle size designation, refer above) which dominates the engineering behaviour of the soil	The clay/silt component with the greater proportion	The sand/gravel component with the greater proportion
Secondary	Any component which is not the primary, but is significant to the engineering properties of the soil	Any component with greater than 30% proportion	Any granular component with greater than 30%; or Any fine component with greater than 12%
Minor[2]	Present in the soil, but not significant to its engineering properties	All other components	All other components

[1] As defined in AS1726-2017 6.1.4.4

[2] In the detailed material description, minor components are split into two further sub-categories. Refer "identification of minor components" below.

Composite Materials

In certain situations, a lithology description may describe more than one material, for example, collectively describing a layer of interbedded sand and clay. In such a scenario, the two materials would be described independently, with the names preceded or followed by a statement describing the arrangement by which the materials co-exist. For example, "INTERBEDDED Silty CLAY AND SAND".

Soil Descriptions

Classification

The soil classification comprises a two character group symbol. The first character identifies the primary component. The second character identifies either the grading or presence of fines in a coarse grained soil, or the plasticity in a fine grained soil. Refer AS1726-2017 6.1.6 for further clarification.

Soil Name

For most soils, the name is derived with the primary component included as the noun (in upper case), preceded by any secondary components stated in an adjective form. In this way, the soil name also describes the general composition and indicates the dominant behaviour of the material.

Component [1]	Prominence in Soil Name
Primary	Noun (eg "CLAY")
Secondary	Adjective modifier (eg "Sandy")
Minor	No influence

[1] – for determination of component proportions, refer component proportions on previous page

For materials which cannot be disaggregated, or which are not comprised of rock or mineral fragments, the names "ORGANIC MATTER" or "ARTIFICIAL MATERIAL" may be used, in accordance with AS1726-2017 Table 14.

Commercial or colloquial names are not used for the soil name where a component derived name is possible (for example "Gravelly SAND" rather than "CRACKER DUST").

Materials of "fill" or "topsoil" origin are generally assigned a name derived from the primary/secondary component (where appropriate). In log descriptions this is preceded by uppercase "FILL" or "TOPSOIL". Origin uncertainty is indicated in the description by the characters (?), with the degree of uncertainty described (using the terms "probably" or "possibly" in the origin column, or at the end of the description).

Identification of minor components

Minor components are identified in the soil description immediately following the soil name. The minor component fraction is usually preceded with a term indicating the relative proportion of the component.

Minor Component Proportion Term	Relative Proportion	
	In Fine Grained Soil	In Coarse Grained Soil
With	All fractions: 15-30%	Clay/silt: 5-12% sand/gravel: 15-30%
Trace	All fractions: 0-15%	Clay/silt: 0-5% sand/gravel: 0-15%

The terms "with" and "trace" generally apply only to gravel or fine particle fractions. Where cobbles/boulders are encountered in minor proportions (generally less than about 12%) the term "occasional" may be used. This term describes the sporadic distribution of the material within the confines of the investigation excavation only, and there may be considerable variation in proportion over a wider area which is difficult to factually characterise due to the relative size of the particles and the investigation methods.

Soil Composition

Plasticity

Descriptive Term	Laboratory liquid limit range	
	Silt	Clay
Non-plastic materials	Not applicable	Not applicable
Low plasticity	≤50	≤35
Medium plasticity	Not applicable	>35 and ≤50
High plasticity	>50	>50

Note, Plasticity descriptions generally describe the plasticity behaviour of the whole of the fine grained soil, not individual fine grained fractions.

Grain Size

Type		Particle size (mm)
Gravel	Coarse	19 - 63
	Medium	6.7 - 19
	Fine	2.36 – 6.7
Sand	Coarse	0.6 - 2.36
	Medium	0.21 - 0.6
	Fine	0.075 - 0.21

Grading

Grading Term	Particle size (mm)
Well	A good representation of all particle sizes
Poorly	An excess or deficiency of particular sizes within the specified range
Uniformly	Essentially of one size
Gap	A deficiency of a particular size or size range within the total range

Note, AS1726-2017 provides terminology for additional attributes not listed here.

Soil Condition

Moisture

The moisture condition of soils is assessed relative to the plastic limit for fine grained soils, while for coarse grained soils it is assessed based on the appearance and feel of the material. The moisture condition of a material is considered to be independent of stratigraphy (although commonly these are related), and this data is presented in its own column on logs.

Applicability	Term	Tactile Assessment	Abbreviation code
Fine	Dry of plastic limit	Hard and friable or powdery	w<PL
	Near plastic limit	Can be moulded	w=PL
	Wet of plastic limit	Water residue remains on hands when handling	w>PL
	Near liquid limit	"oozes" when agitated	w=LL
	Wet of liquid limit	"oozes"	w>LL
Coarse	Dry	Non-cohesive and free running	D
	Moist	Feels cool, darkened in colour, particles may stick together	M
	Wet	Feels cool, darkened in colour, particles may stick together, free water forms when handling	W

The abbreviation code NDF, meaning "not-assessable due to drilling fluid use" may also be used.

Note, observations relating to free ground water or drilling fluids are provided independent of soil moisture condition.

Consistency/Density/Compaction/Cementation/Extremely Weathered Material

These concepts give an indication of how the material may respond to applied forces (when considered in conjunction with other attributes of the soil). This behaviour can vary independent of the composition of the material, and on logs these are described in an independent column and are generally mutually exclusive (i.e it is inappropriate to describe both consistency and compaction at the same time). The method by which the behaviour is described depends on the behaviour model and other characteristics of the soil as follows:

- In fine grained soils, the "consistency" describes the ease with which the soil can be remoulded, and is generally correlated against the materials undrained shear strength;
- In granular materials, the relative density describes how tightly packed the particles are, and is generally correlated against the density index;
- In anthropogenically modified materials, the compaction of the material is described qualitatively;
- In cemented soils (both natural and anthropogenic), the cemented "strength" is described qualitatively, relative to the difficulty with which the material is disaggregated; and
- In soils of extremely weathered material origin, the engineering behaviour may be governed by relic rock features, and expected behaviour needs to be assessed based the overall material description.

Quantitative engineering performance of these materials may be determined by laboratory testing or estimated by correlated field tests (for example penetration or shear vane testing). In some cases, performance may be assessed by tactile or other subjective methods, in which case investigation logs will show the estimated value enclosed in round brackets, for example (VS).

Consistency (fine grained soils)

Consistency Term	Tactile Assessment	Undrained Shear Strength (kPa)	Abbreviation Code
Very soft	Extrudes between fingers when squeezed	<12	VS
Soft	Mouldable with light finger pressure	>12 - ≤25	S
Firm	Mouldable with strong finger pressure	>25 - ≤50	F
Stiff	Cannot be moulded by fingers	>50 - ≤100	St
Very stiff	Indented by thumbnail	>100 - ≤200	VSt
Hard	Indented by thumbnail with difficulty	>200	H
Friable	Easily crumbled or broken into small pieces by hand	-	Fr

Relative Density (coarse grained soils)

Relative Density Term	Density Index	Abbreviation Code
Very loose	<15	VL
Loose	>15 - ≤35	L
Medium dense	>35 - ≤65	MD
Dense	>65 - ≤85	D
Very dense	>85	VD

Note, tactile assessment of relative density is difficult, and generally requires penetration testing, hence a tactile assessment guide is not provided.

Compaction (anthropogenically modified soil)

Compaction Term	Abbreviation Code
Well compacted	WC
Poorly compacted	PC
Moderately compacted	MC
Variably compacted	VC

Cementation (natural and anthropogenic)

Cementation Term	Abbreviation Code
Moderately cemented	MOD
Weakly cemented	WEK

Extremely Weathered Material

AS1726-2017 considers weathered material to be soil if the unconfined compressive strength is less than 0.6 MPa (i.e. less than very low strength rock). These materials may be identified as "extremely weathered material" in reports and by the abbreviation code XWM on log sheets. This identification is not correlated to any specific qualitative or quantitative behaviour, and the engineering properties of this material must therefore be assessed according to engineering principles with reference to any relic rock structure, fabric, or texture described in the description.

Soil Origin

Term	Description	Abbreviation Code
Residual	Derived from in-situ weathering of the underlying rock	RS
Extremely weathered material	Formed from in-situ weathering of geological formations. Has strength of less than 'very low' as per as1726 but retains the structure or fabric of the parent rock.	XWM
Alluvial	Deposited by streams and rivers	ALV
Fluvial	Deposited by channel fill and overbank (natural levee, crevasse splay or flood basin)	FLV
Estuarine	Deposited in coastal estuaries	EST
Marine	Deposited in a marine environment	MAR
Lacustrine	Deposited in freshwater lakes	LAC
Aeolian	Carried and deposited by wind	AEO
Colluvial	Soil and rock debris transported down slopes by gravity	COL
Slopewash	Thin layers of soil and rock debris gradually and slowly deposited by gravity and possibly water	SW
Topsoil	Mantle of surface soil, often with high levels of organic material	TOP
Fill	Any material which has been moved by man	FILL
Littoral	Deposited on the lake or seashore	LIT
Unidentifiable	Not able to be identified	UID

Cobbles and Boulders

The presence of particles considered to be "oversize" may be described using one of the following strategies:

- Oversize encountered in a minor proportion (when considered relative to the wider area) are noted in the soil description; or
- Where a significant proportion of oversize is encountered, the cobbles/boulders are described independent of the soil description, in a similar manner to composite soils (described above) but qualified with "MIXTURE OF".

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Rock Strength

Rock strength is defined by the unconfined compressive strength, and it refers to the strength of the rock substance and not the strength of the overall rock mass, which may be considerably weaker due to defects.

The Point Load Strength Index $I_{s(50)}$ is commonly used to provide an estimate of the rock strength and site specific correlations should be developed to allow UCS values to be determined. The point load strength test procedure is described by Australian Standard AS4133.4.1-2007. The terms used to describe rock strength are as follows:

Strength Term	Unconfined Compressive Strength (MPa)	Point Load Index[1] $I_{s(50)}$ MPa	Abbreviation Code
Very low	0.6 - 2	0.03 - 0.1	VL
Low	2 - 6	0.1 - 0.3	L
Medium	6 - 20	0.3 - 1.0	M
High	20 - 60	1 - 3	H
Very high	60 - 200	3 - 10	VH
Extremely high	>200	>10	EH

[1] Rock strength classification is based on UCS. The UCS to $I_{s(50)}$ ratio varies significantly for different rock types and specific ratios may be required for each site. The point load Index ranges shown above are as suggested in AS1726 and should not be relied upon without supporting evidence.

The following abbreviation codes are used for soil layers or seams of material "within rock" but for which the equivalent UCS strength is less than 0.6 MPa.

Scenario	Abbreviation Code
The material encountered has an equivalent UCS strength of less than 0.6 MPa, and therefore is considered to be soil (as per Note 1 of Table 20 of AS 1726-2017). The properties of the material encountered over this interval are described in the "Description of Strata" and soil properties columns.	SOIL
The material encountered has an equivalent UCS strength of less than 0.6 MPa, and therefore is considered to be soil (as per Note 1 of Table 20 of AS 1726-2017). The prominence of the material is such that it can be considered to be a seam (as defined in Table 22 of AS1726-2017) and the properties of the material are described in the defect column.	SEAM

Degree of Weathering

The degree of weathering of rock is classified as follows:

Weathering Term	Description	Abbreviation Code
Residual Soil[1]	Material is weathered to such an extent that it has soil properties. Mass structure and material texture and fabric of original rock are no longer visible, but the soil has not been significantly transported.	RS
Extremely weathered[1]	Material is weathered to such an extent that it has soil properties. Mass structure and material texture and fabric of original rock are still visible	XW
Highly weathered	The whole of the rock material is discoloured, usually by iron staining or bleaching to the extent that the colour of the original rock is not recognisable. Rock strength is significantly changed by weathering. Some primary minerals have weathered to clay minerals. Porosity may be increased by leaching or may be decreased due to deposition of weathering products in pores.	HW
Moderately weathered	The whole of the rock material is discoloured, usually by iron staining or bleaching to the extent that the colour of the original rock is not recognisable but shows little or no change of strength from fresh rock.	MW
Slightly weathered	Rock is partially discoloured with staining or bleaching along joints but shows little or no change of strength from fresh rock.	SW
Fresh	No signs of decomposition or staining.	FR
Note: If HW and MW cannot be differentiated use DW (see below)		
Distinctly weathered	Rock strength usually changed by weathering. The rock may be highly discoloured, usually by iron staining. Porosity may be increased by leaching or may be decreased due to deposition of weathered products in pores.	DW

[1] The parent rock type, of which the residual/extremely weathered material is a derivative, will be stated in the description (where discernible).

Degree of Alteration

The degree of alteration of the rock material (physical or chemical changes caused by hot gasses or liquids at depth) is classified as follows:

Term	Description	Abbreviation Code
Extremely altered	Material is altered to such an extent that it has soil properties. Mass structure and material texture and fabric of original rock are still visible.	XA
Highly altered	The whole of the rock material is discoloured, usually by staining or bleaching to the extent that the colour of the original rock is not recognisable. Rock strength is changed by alteration. Some primary minerals are altered to clay minerals. Porosity may be increased by leaching or may be decreased due to precipitation of secondary materials in pores.	HA
Moderately altered	The whole of the rock material is discoloured, usually by staining or bleaching to the extent that the colour of the original rock is not recognisable but shows little or no change of strength from fresh rock.	MA
Slightly altered	Rock is slightly discoloured but shows little or no change of strength from fresh rock	SA
Note: If HA and MA cannot be differentiated use DA (see below)		
Distinctly altered	Rock strength usually changed by alteration. The rock may be highly discoloured, usually by staining or bleaching. Porosity may be increased by leaching or may be decreased due to precipitation of secondary minerals in pores.	DA

Degree of Fracturing

The following descriptive classification apply to the spacing of natural occurring fractures in the rock mass. It includes bedding plane partings, joints and other defects, but excludes drilling breaks. These terms are generally not required on investigation logs where fracture spacing is presented as a histogram, and where used are presented in an unabbreviated format.

Term	Description
Fragmented	Fragments of <20 mm
Highly Fractured	Core lengths of 20-40 mm with occasional fragments
Fractured	Core lengths of 30-100 mm with occasional shorter and longer sections
Slightly Fractured	Core lengths of 300 mm or longer with occasional sections of 100-300 mm
Unbroken	Core contains very few fractures

Rock Quality Designation

The quality of the cored rock can be measured using the Rock Quality Designation (RQD) index, defined as:

$$\text{RQD \%} = \frac{\text{cumulative length of 'sound' core sections > 100 mm long}}{\text{total drilled length of section being assessed}}$$

where 'sound' rock is assessed to be rock of low strength or stronger. The RQD applies only to natural fractures. If the core is broken by drilling or handling (i.e., drilling breaks) then the broken pieces are fitted back together and are not included in the calculation of RQD.

Stratification Spacing

These terms may be used to describe the spacing of bedding partings in sedimentary rocks. Where used, these terms are generally presented in an unabbreviated format

Term	Separation of Stratification Planes
Thinly laminated	< 6 mm
Laminated	6 mm to 20 mm
Very thinly bedded	20 mm to 60 mm
Thinly bedded	60 mm to 0.2 m
Medium bedded	0.2 m to 0.6 m
Thickly bedded	0.6 m to 2 m
Very thickly bedded	> 2 m

Defect Descriptions

Defect Type

Term	Abbreviation Code
Bedding plane	B
Cleavage	CL
Crushed seam	CS
Crushed zone	CZ
Drilling break	DB
Decomposed seam	DS
Drill lift	DL
Extremely Weathered seam	EW
Fault	F
Fracture	FC
Fragmented	FG
Handling break	HB
Infilled seam	IS
Joint	JT
Lamination	LAM
Shear seam	SS
Shear zone	SZ
Vein	VN
Mechanical break	MB
Parting	P
Sheared Surface	S

Rock Defect Orientation

Term	Abbreviation Code
Horizontal	H
Vertical	V
Sub-horizontal	SH
Sub-vertical	SV

Rock Defect Coating

Term	Abbreviation Code
Clean	CN
Coating	CT
Healed	HE
Infilled	INF
Stained	SN
Tight	TI
Veneer	VNR

Rock Defect Infill

Term	Abbreviation Code
Calcite	CA
Carbonaceous	CBS
Clay	CLAY
Iron oxide	FE
Manganese	MN
Pyrite	Py
Secondary material	MS
Silt	M
Quartz	Qz
Unidentified material	MU

Rock Defect Shape/Planarity

Term	Abbreviation Code
Curved	CU
Discontinuous	DIS
Irregular	IR
Planar	PR
Stepped	ST
Undulating	UN

Rock Defect Roughness

Term	Abbreviation Code
Polished	PO
Rough	RF
Smooth	SM
Slickensided	SL
Very rough	VR

Defect Orientation

The inclination of defects is always measured from the perpendicular to the core axis.

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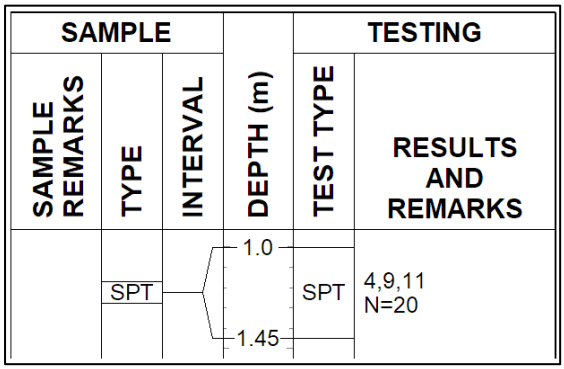
Sampling, Testing and Excavation Methodology

Terminology
Symbols
Abbreviations

October 2024

Sampling and Testing

A record of samples retained, and field testing performed is usually shown on a Douglas Partners' log with samples appearing to the left of a depth scale, and selected field and laboratory testing (including results, where relevant) appearing to the right of the scale, as illustrated below:



Sampling

The type or intended purpose for which a sample was taken is indicated by the following abbreviation codes.

Sample Type	Code
Auger sample	A
Acid Sulfate sample	ASS
Bulk sample	B
Core sample	C
Disturbed sample	D
Environmental sample	ES
Driven Tube sample	DT
Gas sample	G
Piston sample	P
Sample from SPT test	SPT
Undisturbed tube sample	U[1]
Water sample	W
Material Sample	MT
Core sample for unconfined compressive strength testing	UCS

[1] – numeric suffixes indicate tube diameter/width in mm

The above codes only indicate that a sample was retained, and not that testing was scheduled or performed.

Field and Laboratory Testing

A record that field and laboratory testing was performed is indicated by the following abbreviation codes.

Test Type	Code
Pocket penetrometer (kPa)	PP
Photo ionisation detector (ppm)	PID
Standard Penetration Test x/y =x blows for y mm penetration HB = hammer bouncing HW = fell under weight of hammer	SPT
Shear vane (kPa)	V
Unconfined compressive strength, (MPa)	UCS

Field and laboratory testing (continued)

Test Type	Code
Point load test, (MPa), axial (A), diametric (D), irregular (I)	PLT(_)
Dynamic cone penetrometer, followed by blow count penetration increment in mm (cone tip, generally in accordance with AS1289.6.3.2)	DCP9/150
Perth sand penetrometer, followed by blow count penetration increment in mm (flat tip, generally in accordance with AS1289.6.3.3)	PSP/150

Groundwater Observations

▷	seepage/inflow
▽	standing or observed water level
NFGWO	no free groundwater observed
OBS	observations obscured by drilling fluids

Drilling or Excavation Methods/Tools

The drilling/excavation methods used to perform the investigation may be shown either in a dedicated column down the left-hand edge of the log, or stated in the log footer. In some circumstances abbreviation codes may be used.

Method	Abbreviation Code
Direct Push	DP
Solid flight auger. Suffixes: /T = tungsten carbide tip, /V = v-shaped tip	AD[1]
Air Track	AT
Diatube	DT[1]
Hand auger	HA[1]
Hand tools (unspecified)	HAND
Existing exposure	X
Hollow flight auger	HSA[1]
HQ coring	HQ3
HMLC series coring	HMLC
NMLC series coring	NMLC
NQ coring	NQ3
PQ coring	PQ3
Predrilled	PD
Push tube	PT[1]
Ripping tyne/ripper	R
Rock roller	RR[1]
Rock breaker/hydraulic hammer	EH
Sonic drilling	SON[1]
Mud/blade bucket	MB[1]
Toothed bucket	TB[1]
Vibrocore	VC[1]
Vacuum excavation	VE
Wash bore (unspecified bit type)	WB[1]

[1] – numeric suffixes indicate tool diameter/width in mm

Douglas PARTNERS

BOREHOLE LOG

CLIENT: UPG Castle Corner Ptd Lty
PROJECT: Proposed Residential Development with Affordable Housing
LOCATION: 16-20 Old Castle Hill Road, Castle Hill, Sydney, NSW 2154

SURFACE LEVEL: 130.3 AHD
COORDINATE: E:315564.1, N:6266019.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH01
PROJECT No: 235039.00
DATE: 19/08/25 - 20/08/25
SHEET: 1 of 5

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(#)	CONSIS.(*) / DENSITY.(*)	MOISTURE	REMARKS	SAMPLE TYPE	SAMPLE INTERVAL	DEPTH (m)	TESTING AND REMARKS: TEST TYPE	RESULTS AND REMARKS	BACKFILL	WELL PIPE
19/08/25 No Free Groundwater Observed Whilst Augering	130	0.60	FILL / Sandy CLAY trace gravel: pale grey and grey-brown; low to medium plasticity; fine sand.		FILL	(PC)			A A	0.10 0.20 0.40 0.50					
	129	1.50	FILL / CLAY trace silt trace gravel: pale grey-brown; low to medium plasticity; ironstone gravel.		FILL	(MC)	M		A U50	0.90 1.00 1.40		PP	500kPa		
	128	3.20	CLAY (CH): pale grey; high plasticity.		RS	St	w=PL		SPT A U50 A SPT	1.90 2.00 2.50 2.90 3.00 3.35		SPT PP SPT	4,5,8 N=13 200kPa 2,4,7 N=11		
	127	4.30	CLAY (CH): mottled red-brown and pale grey; high plasticity.		RS	H			SPT	4.00 4.45		SPT	6,15,20 N=35		
	126	4.70	SILTSTONE: grey-brown; distinctly weathered; very low strength. Ashfield Shale.			ND	NA								
			Continued as rock log												

NOTES: (#) Soil origin is "probable" unless otherwise stated. (*) Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: Comacchio Geo 305
METHOD: AD/T to 4m, then WB to 4.7m, then HQ3 to 34m
REMARKS:

OPERATOR: Ground Test (LC)

LOGGED: S. Islam
CASING: HW to 4.7m

Refer to explanatory notes for symbol and abbreviation definitions

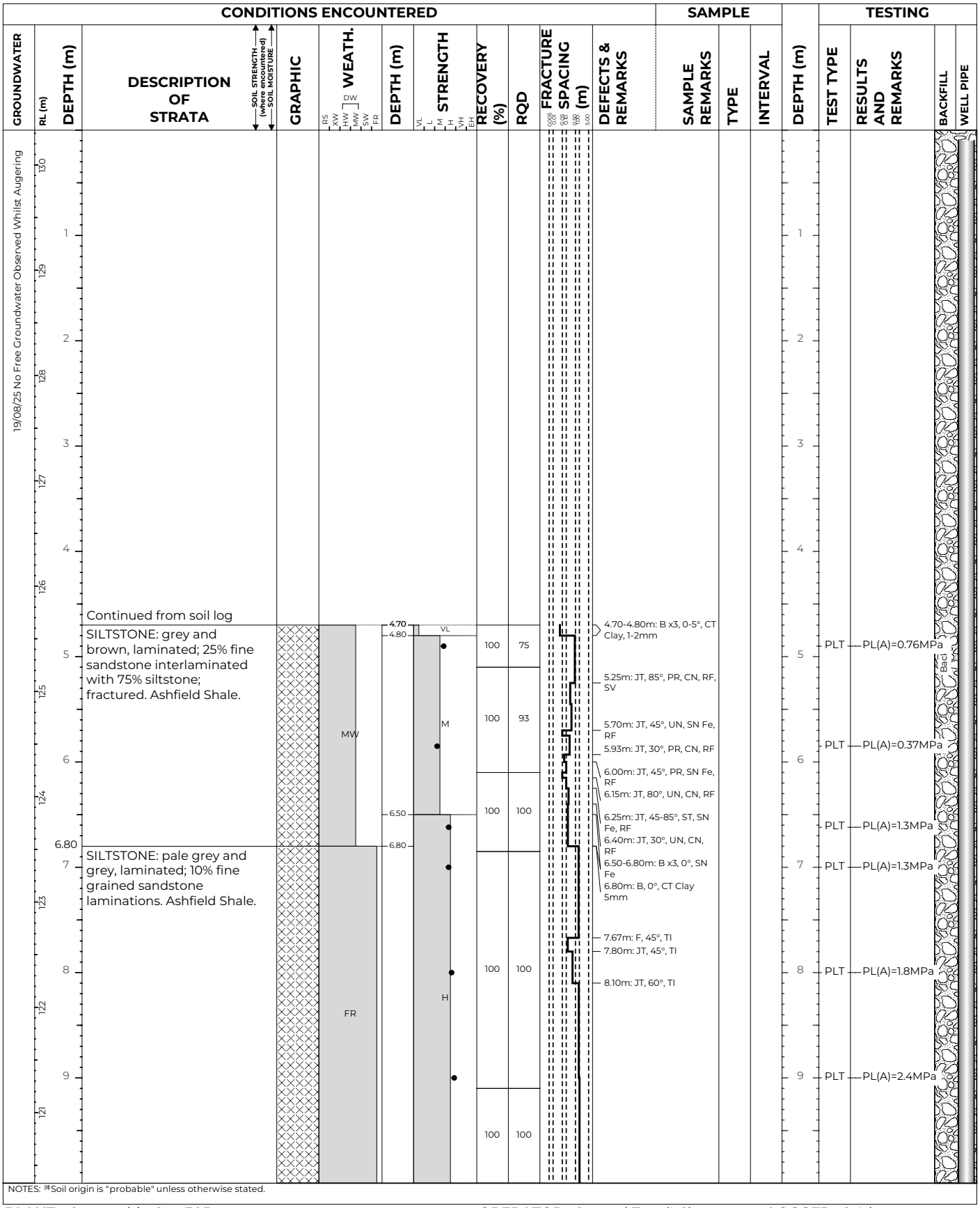
Generated with CORE-GS by Geroc - Split Soil-Rock Log

BOREHOLE LOG

CLIENT: UPG Castle Corner Ptd Lty
PROJECT: Proposed Residential Development with Affordable Housing
LOCATION: 16-20 Old Castle Hill Road, Castle Hill, Sydney, NSW 2154

SURFACE LEVEL: 130.3 AHD
COORDINATE: E:315564.1, N:6266019.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH01
PROJECT No: 235039.00
DATE: 19/08/25 - 20/08/25
SHEET: 2 of 5



NOTES: [a] Soil origin is "probable" unless otherwise stated.

PLANT: Comacchio Geo 305
METHOD: AD/T to 4m, then WB to 4.7m, then HQ3 to 34m
REMARKS:

OPERATOR: Ground Test (LC)

LOGGED: S. Islam
CASING: HW to 4.7m

Refer to explanatory notes for symbol and abbreviation definitions

Douglas PARTNERS

BOREHOLE LOG

CLIENT: UPG Castle Corner Ptd Lty
PROJECT: Proposed Residential Development with Affordable Housing
LOCATION: 16-20 Old Castle Hill Road, Castle Hill, Sydney, NSW 2154

SURFACE LEVEL: 130.3 AHD
COORDINATE: E:315564.1, N:6266019.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH01
PROJECT No: 235039.00
DATE: 19/08/25 - 20/08/25
SHEET: 3 of 5

CONDITIONS ENCOUNTERED | **SAMPLE** | **TESTING**

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA (SOIL STRENGTH (where encountered) / SOIL MOISTURE)	GRAPHIC	WEATH. (DW: XW, HW, MW, SW, FR)	DEPTH (m)	STRENGTH (VL, L, M, H, VH, EH)	RECOVERY (%)	RQD	FRACTURE SPACING (m) (0.03, 0.06, 0.20, 0.60, >0.60)	DEFECTS & REMARKS	SAMPLE REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS	BACKFILL	WELL PIPE
	120	11	[CONT] SILTSTONE: pale grey and grey, laminated; 10% fine grained sandstone laminations. Ashfield Shale.					100	100		10.02m: JT, 50°, PR, CN, SM				11	PLT	PL(A)=1.8MPa	Backfill	
	119						H				11.75-11.85m: JT, 70°, PR, CN, SM					PLT	PL(A)=2.3MPa		
		12.00									12.10m: JT, 80°, UN, CN, RF				12	PLT	PL(A)=1.1MPa		
	118		SHALE: grey; trace fine sandstone laminations. Ashfield Shale.																
		13						100	100						13	PLT	PL(A)=2.2MPa	Bentonite	
	117					13.30					13.25m: JT, 45-70°, CU, TI								
											13.35m: JT, 45-80°								
											13.52m: JT, 60°, UN, CN, RF								
		14													14	PLT	PL(A)=0.83MPa		
	116						M	100	100		14.52m: JT, 45°, PR, CN, SM								
		15			FR		H								15	PLT	PL(A)=0.97MPa		
	115										15.30m: JT, 45°, PR, CN, SM								
											15.85m: JT, 85°, PR, CN, SM								
		16													16				
		16.20	INTERBEDDED SILTSTONE AND SANDSTONE: SILTSTONE: grey and pale grey; 50% interbedded and laminated with 50% siltstone SANDSTONE: fine grained. Mittagong Formation.			16.30													
	114	17						100	100						17	PLT	PL(A)=1.6MPa	Gravel	
	113															PLT	PL(A)=1.6MPa		
		18					H				18.10-18.13m: DS				18	PLT	PL(A)=2.1MPa		
	112																		
		19						100	100						19	PLT	PL(A)=2.0MPa		
	111																		
		19.70									19.70-19.73m: FG, 0°, 30mm					PLT	PL(A)=2.2MPa		

NOTES: [a] Soil origin is "probable" unless otherwise stated.

Generated with CORE-GS by Geroc - Split Soil-Rock Log

PLANT: Comacchio Geo 305
METHOD: AD/T to 4m, then WB to 4.7m, then HQ3 to 34m
REMARKS:

OPERATOR: Ground Test (LC)

LOGGED: S. Islam
CASING: HW to 4.7m

Douglas PARTNERS

BOREHOLE LOG

CLIENT: UPG Castle Corner Ptd Lty
PROJECT: Proposed Residential Development with Affordable Housing
LOCATION: 16-20 Old Castle Hill Road, Castle Hill, Sydney, NSW 2154

SURFACE LEVEL: 130.3 AHD
COORDINATE: E:315564.1, N:6266019.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH01
PROJECT No: 235039.00
DATE: 19/08/25 - 20/08/25
SHEET: 4 of 5

CONDITIONS ENCOUNTERED | **SAMPLE** | **TESTING**

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA (SOIL STRENGTH (where encountered) / SOIL MOISTURE)	GRAPHIC	WEATH. (PS, XW, DW, HW, MW, SW, FR)	DEPTH (m)	STRENGTH (VL, L, M, H, VH, EH)	RECOVERY (%)	RQD	FRACTURE SPACING (m) (<0.06, 0.06-0.2, 0.2-0.6, 0.6-2, >2)	DEFECTS & REMARKS	SAMPLE REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS	BACKFILL	WELL PIPE
	110	21	SANDSTONE: fine grained, laminated; 20% siltstone laminations; cross bedded. Mittagong Formation.													21	PLT	PL(A)=2.0MPa	Gravel	
	109							100	100			20.80m: B, 0°, CT Clay 5mm								
		21.80										21.80m: B, 10°, PR, VNR Clay								
	108	22	SANDSTONE: medium to coarse grained, 10 to 20°; cross bedded. Hawkesbury Sandstone.													22	PLT	PL(A)=1.1MPa		
		23														23	PLT	PL(A)=1.2MPa		
	107							100	100			23.75m: B, 15°, PR, VNR Clay								
		24														24	PLT	PL(A)=1.2MPa		
	106																		Bentonite	
		25			FR		H									25	PLT	PL(A)=1.4MPa		
	105																			
		26														26	PLT	PL(A)=1.2MPa		
	104							100	100			26.60m: B, 10°, CT CBS 1mm								
		27														27	PLT	PL(A)=1.3MPa	Backfill	
	103																			
		28														28	PLT	PL(A)=1.3MPa		
	102																			
		29														29	PLT	PL(A)=1.5MPa		
	101							100	100			29.50m: B, 0°, 5mm, siltstone fragments								
																	PLT	PL(A)=1.7MPa		

NOTES: [a] Soil origin is "probable" unless otherwise stated.

PLANT: Comacchio Geo 305
METHOD: AD/T to 4m, then WB to 4.7m, then HQ3 to 34m
REMARKS:

OPERATOR: Ground Test (LC)

LOGGED: S. Islam
CASING: HW to 4.7m

Generated with CORE-GS by Geroc - Split Soil-Rock Log

Refer to explanatory notes for symbol and abbreviation definitions

Douglas PARTNERS

BOREHOLE LOG

CLIENT: UPG Castle Corner Ptd Lty
PROJECT: Proposed Residential Development with Affordable Housing
LOCATION: 16-20 Old Castle Hill Road, Castle Hill, Sydney, NSW 2154

SURFACE LEVEL: 130.3 AHD
COORDINATE: E:315564.1, N:6266019.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH01
PROJECT No: 235039.00
DATE: 19/08/25 - 20/08/25
SHEET: 5 of 5

CONDITIONS ENCOUNTERED														SAMPLE				TESTING			
GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA (SOIL STRENGTH (where encountered) / SOIL MOISTURE)	GRAPHIC	WEATH. (PS, XW, DW [HW, MW], SW, FR)	DEPTH (m)	STRENGTH (VL, L, M, H, VH, EH)	RECOVERY (%)	RQD	FRACTURE SPACING (m) (0.03, 0.06, 0.20, 0.60, >0.60)	DEFECTS & REMARKS	SAMPLE REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS	BACKFILL	WELL PIPE
	100	30	[CONT] SANDSTONE: medium to coarse grained, 10 to 20°; cross bedded. Hawkesbury Sandstone.					100	100						30				
	99	31													31	PLT	PL(A)=1.1MPa		
	98	32			FR		H	100	100						32	PLT	PL(A)=1.4MPa	Backfill	
	97	33									33.20m: B, 35°, PR, VNR Clay, RF, TI				33	PLT	PL(A)=1.8MPa		
	96	34	Borehole discontinued at 34.00m depth. Target depth reached.																
	95	35																	
	94	36																	
	93	37																	
	92	38																	
	91	39																	

NOTES: [a] Soil origin is "probable" unless otherwise stated.

PLANT: Comacchio Geo 305
METHOD: AD/T to 4m, then WB to 4.7m, then HQ3 to 34m
REMARKS:

OPERATOR: Ground Test (LC)

LOGGED: S. Islam
CASING: HW to 4.7m

Refer to explanatory notes for symbol and abbreviation definitions

Generated with CORE-GS by Geroc - Split Soil-Rock Log

Douglas PARTNERS

CORE PHOTO LOG

CLIENT: UPG Castle Corner Ptd Lty
PROJECT: Proposed Residential Development with Affordable Housing
LOCATION: 16-20 Old Castle Hill Road, Castle Hill, Sydney, NSW 2154

SURFACE LEVEL: 130.3 AHD
COORDINATE: E:315564.1, N:6266019.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH01
PROJECT No: 235039.00
DATE: 19/08/25 - 20/08/25
SHEET: 1 of 4

4.70-8.00 m depth

8.00-12.00 m depth

Douglas PARTNERS

CORE PHOTO LOG

CLIENT: UPG Castle Corner Ptd Lty
PROJECT: Proposed Residential Development with Affordable Housing
LOCATION: 16-20 Old Castle Hill Road, Castle Hill, Sydney, NSW 2154

SURFACE LEVEL: 130.3 AHD
COORDINATE: E:315564.1, N:6266019.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH01
PROJECT No: 235039.00
DATE: 19/08/25 - 20/08/25
SHEET: 2 of 4

12.00-16.00 m depth

16.00-20.00 m depth

CORE PHOTO LOG

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LOCATION: 16-20 Old Castle Hill Road, Castle Hill, Sydney, NSW 2154

SURFACE LEVEL: 130.3 AHD
COORDINATE: E:315564.1, N:6266019.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH01
PROJECT No: 235039.00
DATE: 19/08/25 - 20/08/25
SHEET: 3 of 4

20.00-24.00 m depth

24.00-28.00 m depth

Douglas PARTNERS

CORE PHOTO LOG

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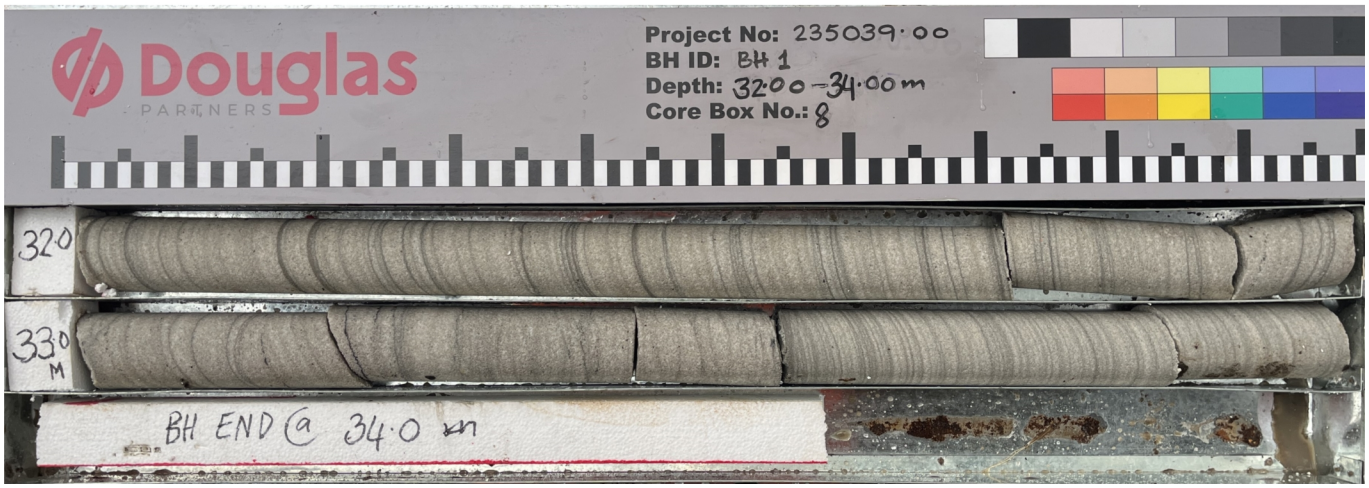
LOCATION: 16-20 Old Castle Hill Road, Castle Hill, Sydney, NSW 2154

SURFACE LEVEL: 130.3 AHD
COORDINATE: E:315564.1, N:6266019.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH01
PROJECT No: 235039.00
DATE: 19/08/25 - 20/08/25
SHEET: 4 of 4

28.00-32.00 m depth



32.00-34.00 m depth

BOREHOLE LOG

CLIENT: UPG Castle Corner Ptd Lty
PROJECT: Proposed Residential Development with Affordable Housing
LOCATION: 16-20 Old Castle Hill Road, Castle Hill, Sydney, NSW 2154

SURFACE LEVEL: 134.3 AHD
COORDINATE: E:315580.9, N:6265979.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH02
PROJECT No: 235039.00
DATE: 26/08/25
SHEET: 1 of 4

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(#)	CONSIS.(*)	DENSITY.(*)	MOISTURE	REMARKS	SAMPLE TYPE	SAMPLE INTERVAL	DEPTH (m)	TESTING AND REMARKS: TEST TYPE	TESTING AND REMARKS: RESULTS AND REMARKS	BACKFILL	WELL PIPE
26/08/25 No Free Groundwater Observed Whilst Augering	134	0.40	FILL / Sandy CLAY: grey-brown; medium plasticity; fine sand; trace of concrete bricks and tree roots.		FILL	(PC)		M		A	0.10–0.20	0.10				
			CLAY (CH): red-brown and pale grey; high plasticity.		RS	St		w=PL		A	0.40–0.50	0.40	PP	180kPa		
										U50		0.50				
		1								A	0.90–1.00	0.90				
	133	1.20	CLAY (CI) trace gravel: pale grey-brown; medium plasticity; ironstone gravel.		RS					SPT		1.00	SPT	5,15,24 N=39		
												1.45				
		2.00	CLAY (CL-CI): pale grey and brown; low to medium plasticity; ironstone bands; extremely weathered shale / siltstone.		RS		H	w<PL		A	1.90–2.00	1.90				
												2.00				
												2.50				
										SPT		2.95	SPT	8,18,25 N=43		
	131	3.35	Continued as rock log													
	130	4										4				
	129	5										5			Backfill	
	128	6										6				
	127	7										7				
	126	8										8				
	125	9										9				

NOTES: (#) Soil origin is "probable" unless otherwise stated. (*)Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: Comacchio Geo 305
METHOD: AD/T to 2.5m, then WB to 3.35m, then HQ3 to 27m
REMARKS:

OPERATOR: Ground Test (LC)

LOGGED: S. Islam
CASING: HW to 3.3m

Refer to explanatory notes for symbol and abbreviation definitions

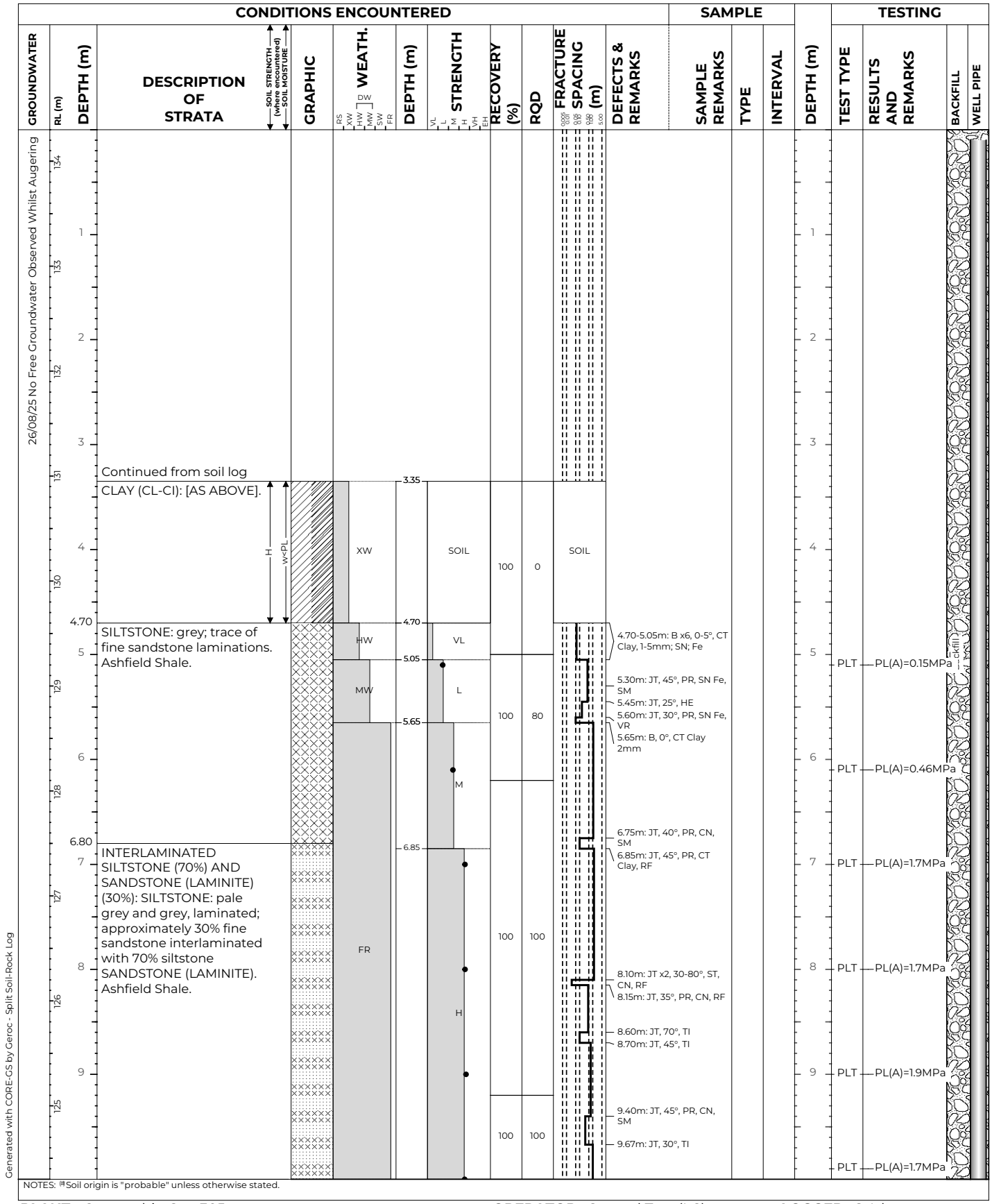
Generated with CORE-GS by Geroc - Split Soil-Rock Log

BOREHOLE LOG

CLIENT: UPG Castle Corner Ptd Lty
PROJECT: Proposed Residential Development with Affordable Housing
LOCATION: 16-20 Old Castle Hill Road, Castle Hill, Sydney, NSW 2154

SURFACE LEVEL: 134.3 AHD
COORDINATE: E:315580.9, N:6265979.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH02
PROJECT No: 235039.00
DATE: 26/08/25
SHEET: 2 of 4



NOTES: [a] Soil origin is "probable" unless otherwise stated.

PLANT: Comacchio Geo 305
METHOD: AD/T to 2.5m, then WB to 3.35m, then HQ3 to 27m
REMARKS:

OPERATOR: Ground Test (LC)

LOGGED: S. Islam
CASING: HW to 3.3m

Refer to explanatory notes for symbol and abbreviation definitions

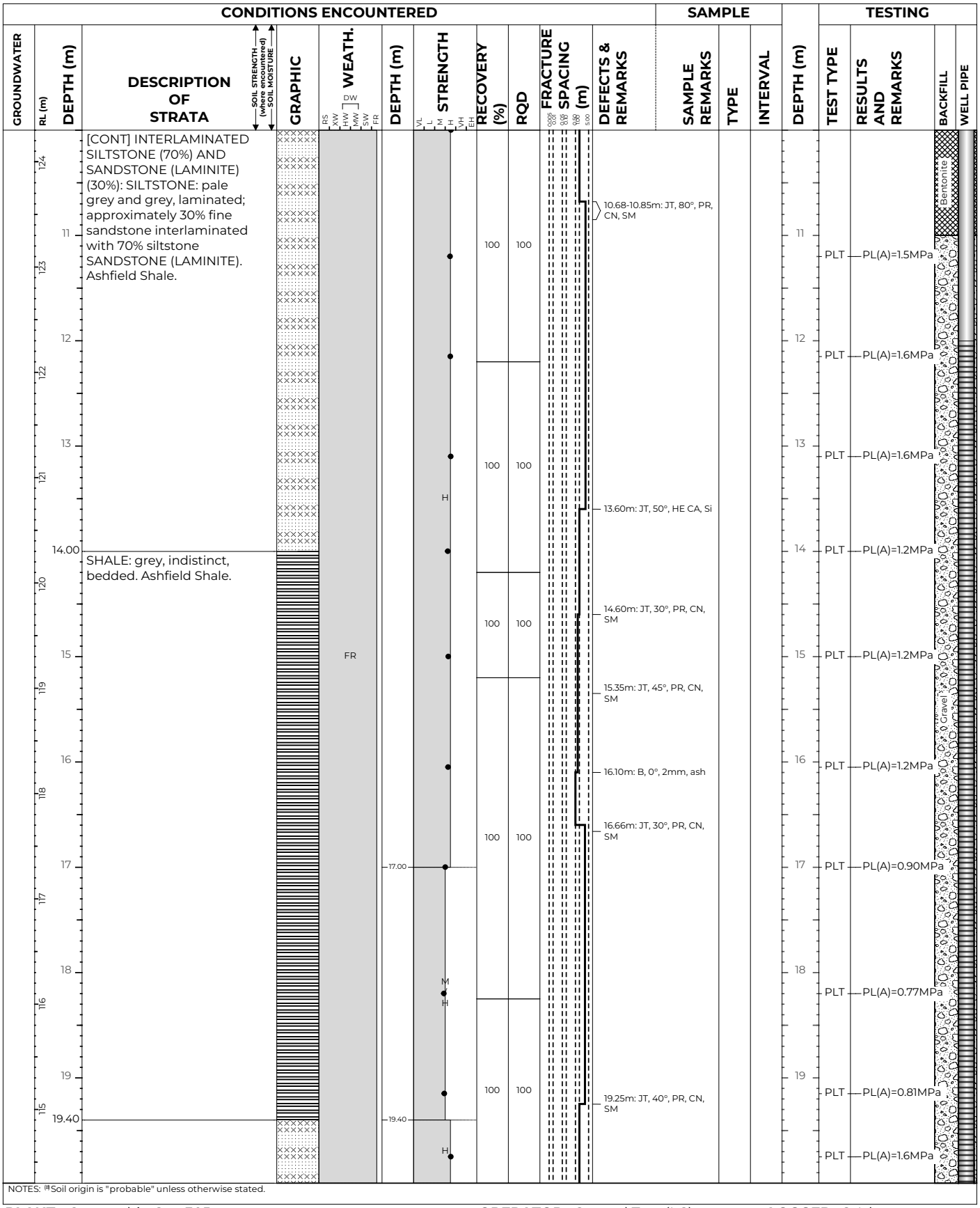
Douglas PARTNERS

BOREHOLE LOG

CLIENT: UPG Castle Corner Ptd Lty
PROJECT: Proposed Residential Development with Affordable Housing
LOCATION: 16-20 Old Castle Hill Road, Castle Hill, Sydney, NSW 2154

SURFACE LEVEL: 134.3 AHD
COORDINATE: E:315580.9, N:6265979.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH02
PROJECT No: 235039.00
DATE: 26/08/25
SHEET: 3 of 4



NOTES: [a] Soil origin is "probable" unless otherwise stated.

Generated with CORE-GS by Geroc - Split Soil-Rock Log

PLANT: Comacchio Geo 305
METHOD: AD/T to 2.5m, then WB to 3.35m, then HQ3 to 27m
REMARKS:

OPERATOR: Ground Test (LC)

LOGGED: S. Islam
CASING: HW to 3.3m

Douglas PARTNERS

BOREHOLE LOG

CLIENT: UPG Castle Corner Ptd Lty
PROJECT: Proposed Residential Development with Affordable Housing
LOCATION: 16-20 Old Castle Hill Road, Castle Hill, Sydney, NSW 2154

SURFACE LEVEL: 134.3 AHD
COORDINATE: E:315580.9, N:6265979.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH02
PROJECT No: 235039.00
DATE: 26/08/25
SHEET: 4 of 4

CONDITIONS ENCOUNTERED | **SAMPLE** | **TESTING**

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	WEATH.	DEPTH (m)	STRENGTH	RECOVERY (%)	RQD	FRACTURE SPACING (m)	DEFECTS & REMARKS	SAMPLE REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS	BACKFILL	WELL PIPE
	114	21	INTERBEDDED SANDSTONE AND SILTSTONE: pale grey and grey; interbedded and laminated; approximately 60% fine grained sandstone interbedded / laminated with 40% siltstone. Mittagong Formation.				H	100	100		20.25m: JT, 25°, PR, CN, SM				21	PLT	PL(A)=2.7MPa	Gravel	
	113															PLT	PL(A)=0.96MPa		
	112	22													22	PLT	PL(A)=2.5MPa		
								100	100										
	111	23			FR	22.85	VH								23	PLT	PL(A)=3.1MPa		
		24.00	SANDSTONE: pale grey, medium to coarse grained; trace of carbonaceous laminations; cross bedded (10°-25°). Hawkesbury Sandstone.			24.00					23.70-23.83m: JT, 70-80°, CU, CN, RF				24	PLT	PL(A)=1.3MPa		
	110	25					H	100	100						25	PLT	PL(A)=1.9MPa		
	109																		
	108	26													26	PLT	PL(A)=2.1MPa		
	107	27	Borehole discontinued at 27.00m depth. Target depth reached.																
	106	28																	
	105	29																	

NOTES: [a] Soil origin is "probable" unless otherwise stated.

PLANT: Comacchio Geo 305
METHOD: AD/T to 2.5m, then WB to 3.35m, then HQ3 to 27m
REMARKS:

OPERATOR: Ground Test (LC)

LOGGED: S. Islam
CASING: HW to 3.3m

Refer to explanatory notes for symbol and abbreviation definitions

Generated with CORE-GS by Geroc - Split Soil-Rock Log

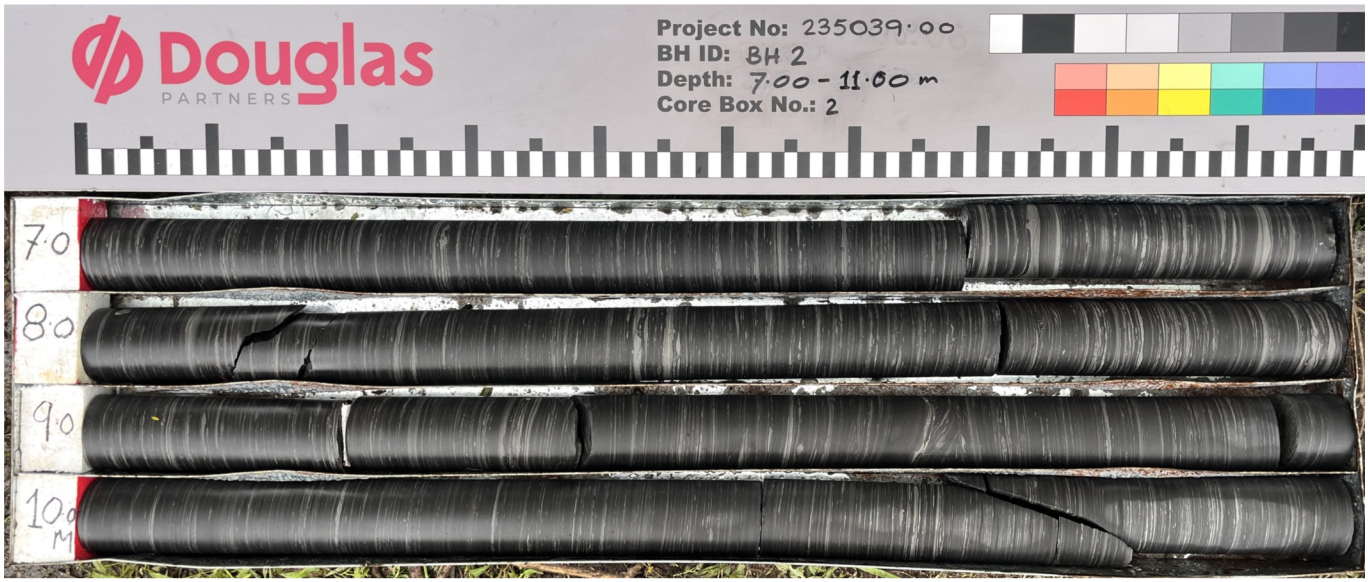
CORE PHOTO LOG

CLIENT: UPG Castle Corner Ptd Lty
PROJECT: Proposed Residential Development with Affordable Housing
LOCATION: 16-20 Old Castle Hill Road, Castle Hill, Sydney, NSW 2154

SURFACE LEVEL: 134.3 AHD
COORDINATE: E:315580.9, N:6265979.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH02
PROJECT No: 235039.00
DATE: 26/08/25
SHEET: 1 of 3

3.35-7.00 m depth



7.00-11.00 m depth

Douglas PARTNERS

CORE PHOTO LOG

CLIENT: UPG Castle Corner Ptd Lty
PROJECT: Proposed Residential Development with Affordable Housing
LOCATION: 16-20 Old Castle Hill Road, Castle Hill, Sydney, NSW 2154

SURFACE LEVEL: 134.3 AHD
COORDINATE: E:315580.9, N:6265979.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH02
PROJECT No: 235039.00
DATE: 26/08/25
SHEET: 2 of 3

11.00-15.00 m depth

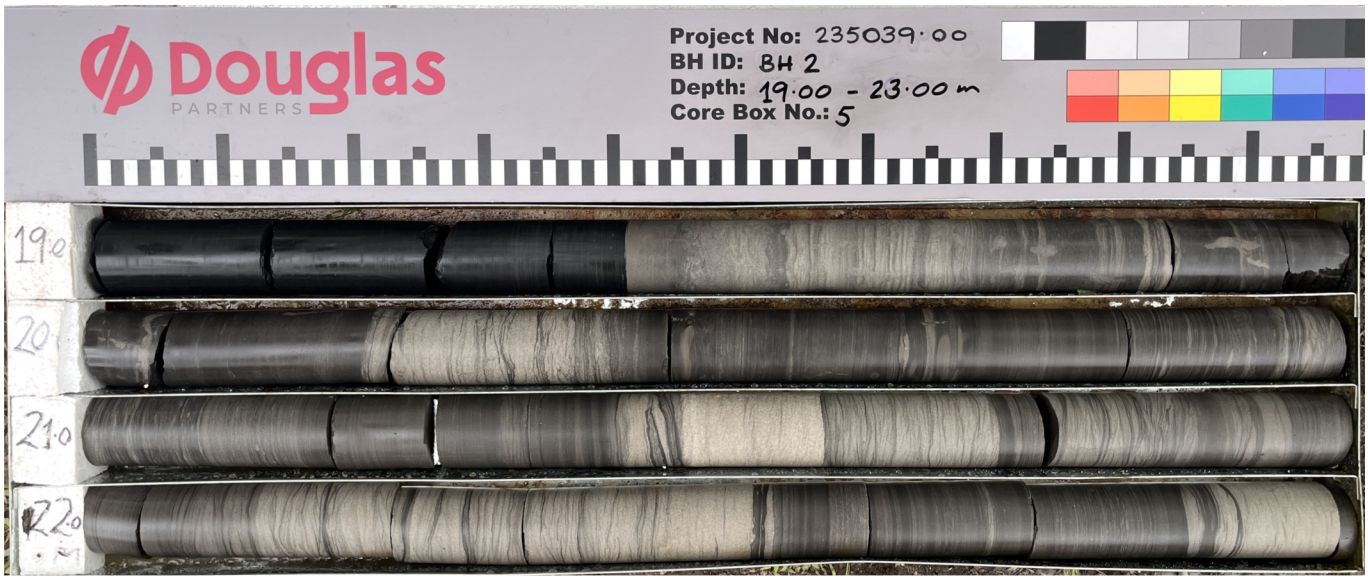
15.00-19.00 m depth

CORE PHOTO LOG

CLIENT: UPG Castle Corner Ptd Lty
PROJECT: Proposed Residential Development with Affordable Housing
LOCATION: 16-20 Old Castle Hill Road, Castle Hill, Sydney, NSW 2154

SURFACE LEVEL: 134.3 AHD
COORDINATE: E:315580.9, N:6265979.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH02
PROJECT No: 235039.00
DATE: 26/08/25
SHEET: 3 of 3



19.00-23.00 m depth

23.00-27.00 m depth

Douglas PARTNERS

BOREHOLE LOG

CLIENT: UPG Castle Corner Ptd Lty
PROJECT: Proposed Residential Development with Affordable Housing
LOCATION: 16-20 Old Castle Hill Road, Castle Hill, Sydney, NSW 2154

SURFACE LEVEL: 135.5 AHD
COORDINATE: E:315572.8, N:6265964.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH03
PROJECT No: 235039.00
DATE: 22/08/25 - 25/08/25
SHEET: 1 of 4

CONDITIONS ENCOUNTERED								SAMPLE			TESTING AND REMARKS	
GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN[#]	CONSIS.[*] / DENSITY.[*]	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
22/08/25 No Free Groundwater Observed Whilst Augering	135	0.10	FILL / GRAVEL; fine to medium, sub-angular to rounded, river gravel.		FILL				A	0.10–0.20	0.10		
			FILL / Silty CLAY trace sand trace gravel: grey to dark grey; fine sand; fine to medium, igneous gravel.		FILL	(PC)	M		A	0.40–0.50	0.20		
		0.70									0.40		
	134	1	CLAY (CH): pale grey and brown; high plasticity.		RS	St - VSt	w=PL		A	0.90–1.00	0.50		
									U50		0.90		
											1.00		
											1.40	PP	320kPa
		2							SPT		1.50	SPT	7,11,17 N=28
	133	2.65	CLAY (CI) with gravel: pale grey-brown; medium plasticity; ironstone gravel; Extremely weathered siltstone.		RS	H	w<PL				1.95		
		3							SPT		2.50	SPT	7,25,25/50 R
		3.30	CLAY (CL-CI) with gravel: pale grey and brown; low to medium plasticity; ironstone gravel; Extremely weathered siltstone.		RS						2.85		
	132	3.60	Continued as rock log								3		
		4									4		
	131												
		5									5		
	130												
		6									6		
	129												
		7									7		
	128												
		8									8		
	127												
		9									9		
	126												

NOTES: [#] Soil origin is "probable" unless otherwise stated. [*] Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: Comacchio Geo 305
METHOD: AD/T to 2.5m, then WB to 3.6m, then HQ3 to 29m
REMARKS:

OPERATOR: Ground Test (LC)

LOGGED: S. Islam
CASING: HW to 3m

Refer to explanatory notes for symbol and abbreviation definitions

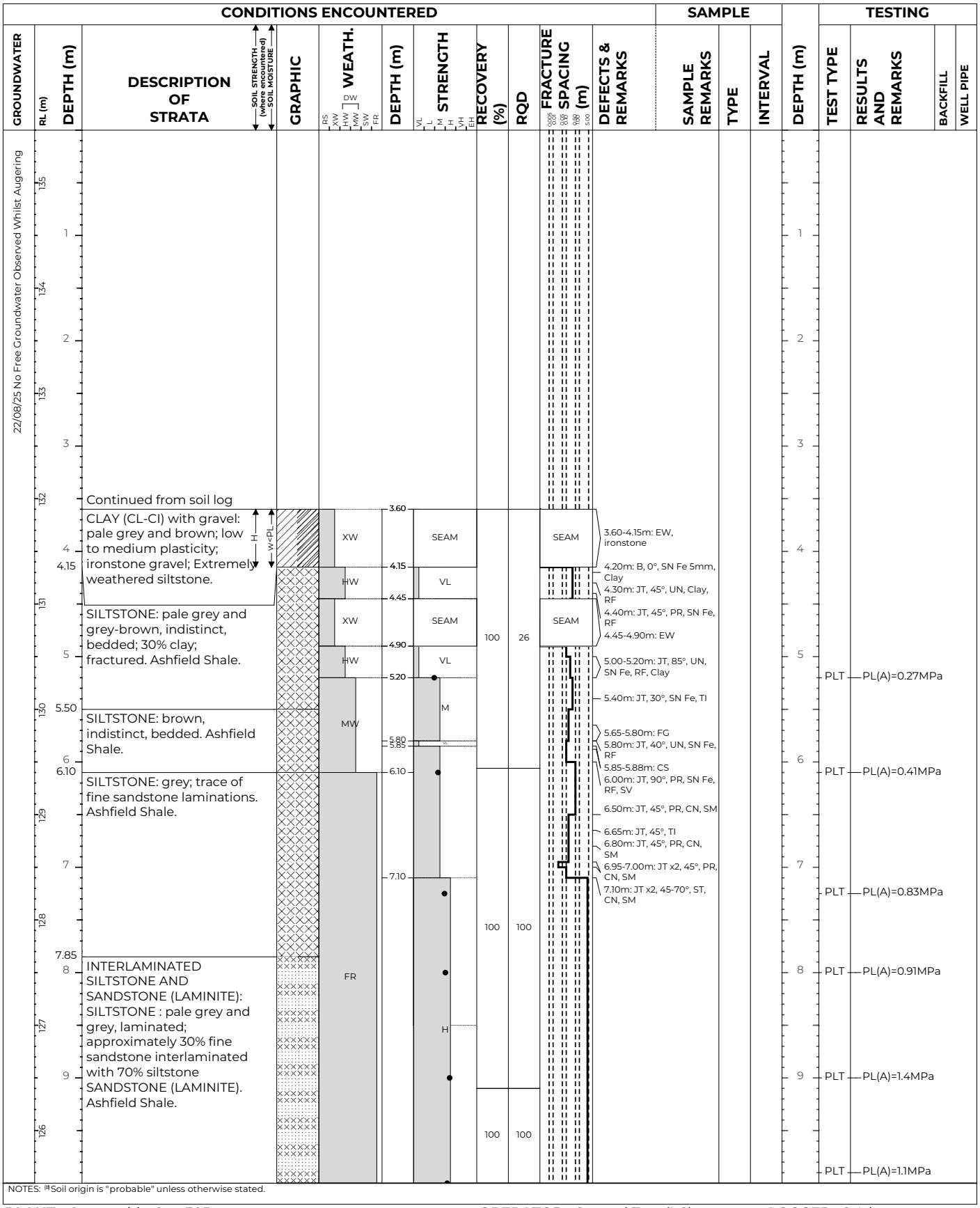
Douglas PARTNERS

BOREHOLE LOG

CLIENT: UPG Castle Corner Ptd Lty
PROJECT: Proposed Residential Development with Affordable Housing
LOCATION: 16-20 Old Castle Hill Road, Castle Hill, Sydney, NSW 2154

SURFACE LEVEL: 135.5 AHD
COORDINATE: E:315572.8, N:6265964.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH03
PROJECT No: 235039.00
DATE: 22/08/25 - 25/08/25
SHEET: 2 of 4



NOTES: [a] Soil origin is "probable" unless otherwise stated.

PLANT: Comacchio Geo 305
METHOD: AD/T to 2.5m, then WB to 3.6m, then HQ3 to 29m
REMARKS:

OPERATOR: Ground Test (LC)

LOGGED: S. Islam
CASING: HW to 3m

Refer to explanatory notes for symbol and abbreviation definitions

Douglas PARTNERS

BOREHOLE LOG

CLIENT: UPG Castle Corner Ptd Lty
PROJECT: Proposed Residential Development with Affordable Housing
LOCATION: 16-20 Old Castle Hill Road, Castle Hill, Sydney, NSW 2154

SURFACE LEVEL: 135.5 AHD
COORDINATE: E:315572.8, N:6265964.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH03
PROJECT No: 235039.00
DATE: 22/08/25 - 25/08/25
SHEET: 3 of 4

CONDITIONS ENCOUNTERED | **SAMPLE** | **TESTING**

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	WEATH.	DEPTH (m)	STRENGTH	RECOVERY (%)	RQD	FRACTURE SPACING (m)	DEFECTS & REMARKS	SAMPLE REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS	BACKFILL	WELL PIPE
	125		[CONT] INTERLAMINATED SILTSTONE AND SANDSTONE (LAMINITE): SILTSTONE : pale grey and grey, laminated; approximately 30% fine sandstone interlaminated with 70% siltstone SANDSTONE (LAMINITE). Ashfield Shale.																
	124	11						100	100						11	PLT	PL(A)=1.5MPa		
	123	12													12	PLT	PL(A)=1.2MPa		
	122	13.00	SILTSTONE: grey; trace of fine sandstone laminations (approximately 10%). Ashfield Shale.				H	100	100						13	PLT	PL(A)=1.3MPa		
	121	14													14	PLT	PL(A)=1.1MPa		
	120	15			FR										15	PLT	PL(A)=2.2MPa		
	119	16									15.40-15.48m: F, 45°, HE				16	PLT	PL(A)=2.1MPa		
	118	16.50	SHALE: grey, indistinct, bedded. Ashfield Shale.					100	100						17	PLT	PL(A)=1.1MPa		
	117	17				17.30					17.45m: JT, 80°, PR, Py, SM, (17.32-17.60mm)				18	PLT	PL(A)=0.84MPa		
	116	18					M-H								19	PLT	PL(A)=1.1MPa		
		19						100	95		19.10m: JT, 50°, PR, CN, SM					PLT	PL(A)=0.89MPa		
											19.85-19.98m: JT, 75°, PR,								

NOTES: [a] Soil origin is "probable" unless otherwise stated.

PLANT: Comacchio Geo 305
METHOD: AD/T to 2.5m, then WB to 3.6m, then HQ3 to 29m
REMARKS:

OPERATOR: Ground Test (LC)

LOGGED: S. Islam
CASING: HW to 3m

Refer to explanatory notes for symbol and abbreviation definitions

Generated with CORE-GS by Geroc - Split Soil-Rock Log

BOREHOLE LOG

CLIENT: UPG Castle Corner Ptd Lty
PROJECT: Proposed Residential Development with Affordable Housing
LOCATION: 16-20 Old Castle Hill Road, Castle Hill, Sydney, NSW 2154

SURFACE LEVEL: 135.5 AHD
COORDINATE: E:315572.8, N:6265964.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH03
PROJECT No: 235039.00
DATE: 22/08/25 - 25/08/25
SHEET: 4 of 4

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	WEATH.	DEPTH (m)	STRENGTH	RECOVERY (%)	RQD	FRACTURE SPACING (m)	DEFECTS & REMARKS	SAMPLE REMARKS	SAMPLE TYPE	SAMPLE INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS	BACKFILL	WELL PIPE
	115	21	[CONT] SHALE: grey, indistinct, bedded. Ashfield Shale.				M - H	100	95		CN, SM 20.40-20.55m: JT x2, 45-70°, SL, SM, FG, 20mm, SZ 20.70-20.75m: JT, 45°, SL, SM, FG, 50mm, SZ				21	PLT	PL(A)=3.1MPa		
	114	21.05	INTERBEDDED SANDSTONE AND SILTSTONE: pale grey and grey; interbedded / laminated; approximately 50% fine sandstone interbedded with 50% siltstone. Mittagong Formation.			21.05	VH												
	113	22				22.00		100	100						22	PLT	PL(A)=1.9MPa		
	112	23													23	PLT	PL(A)=2.2MPa		
	111	24			FR										24	PLT	PL(A)=1.9MPa		
	110	25					H	100	100						25	PLT	PL(A)=2.0MPa		
	109	25.75	SANDSTONE: pale grey, medium to coarse grained, 10 to 25°; cross bedded; trace siltstone laminations. Hawkesbury Sandstone.												26	PLT	PL(A)=1.1MPa		
	108	27									27.25m: B, 0°, 10mm, siltstone 27.58m: B, 0°, 15mm, siltstone				27	PLT	PL(A)=1.2MPa		
	107	28						100	100						28	PLT	PL(A)=1.3MPa		
	106	29	Borehole discontinued at 29.00m depth. Target depth reached.																

NOTES: [a] Soil origin is "probable" unless otherwise stated.

PLANT: Comacchio Geo 305
METHOD: AD/T to 2.5m, then WB to 3.6m, then HQ3 to 29m
REMARKS:

OPERATOR: Ground Test (LC)

LOGGED: S. Islam
CASING: HW to 3m

Refer to explanatory notes for symbol and abbreviation definitions

Generated with CORE-GS by Geroc - Split Soil-Rock Log

CORE PHOTO LOG

CLIENT: UPG Castle Corner Ptd Lty
PROJECT: Proposed Residential Development with Affordable Housing
LOCATION: 16-20 Old Castle Hill Road, Castle Hill, Sydney, NSW 2154

SURFACE LEVEL: 135.5 AHD
COORDINATE: E:315572.8, N:6265964.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH03
PROJECT No: 235039.00
DATE: 22/08/25 - 25/08/25
SHEET: 1 of 4

3.60-7.00 m depth

7.00-11.00 m depth

Douglas PARTNERS

CORE PHOTO LOG

CLIENT: UPG Castle Corner Ptd Lty
PROJECT: Proposed Residential Development with Affordable Housing
LOCATION: 16-20 Old Castle Hill Road, Castle Hill, Sydney, NSW 2154

SURFACE LEVEL: 135.5 AHD
COORDINATE: E:315572.8, N:6265964.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH03
PROJECT No: 235039.00
DATE: 22/08/25 - 25/08/25
SHEET: 2 of 4

11.00-15.00 m depth

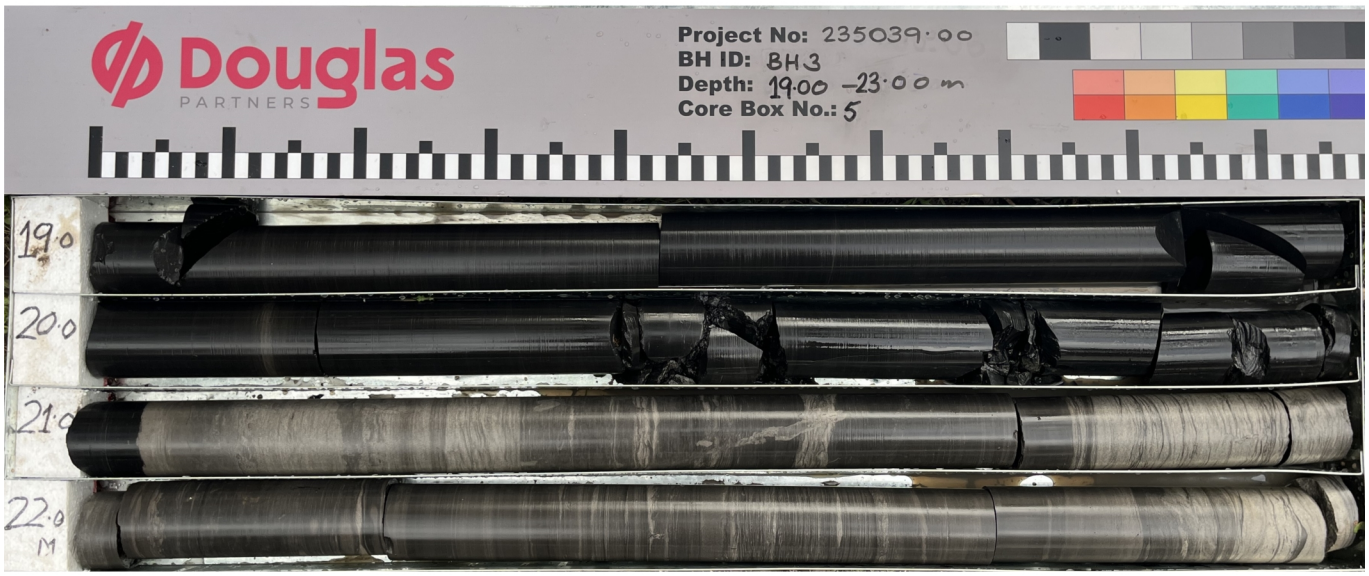
15.00-19.00 m depth

CORE PHOTO LOG

CLIENT: UPG Castle Corner Ptd Lty
PROJECT: Proposed Residential Development with Affordable Housing
LOCATION: 16-20 Old Castle Hill Road, Castle Hill, Sydney, NSW 2154

SURFACE LEVEL: 135.5 AHD
COORDINATE: E:315572.8, N:6265964.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH03
PROJECT No: 235039.00
DATE: 22/08/25 - 25/08/25
SHEET: 3 of 4



19.00-23.00 m depth

23.00-27.00 m depth

Douglas PARTNERS

CORE PHOTO LOG

CLIENT: UPG Castle Corner Ptd Lty
PROJECT: Proposed Residential Development with Affordable Housing
LOCATION: 16-20 Old Castle Hill Road, Castle Hill, Sydney, NSW 2154

SURFACE LEVEL: 135.5 AHD
COORDINATE: E:315572.8, N:6265964.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH03
PROJECT No: 235039.00
DATE: 22/08/25 - 25/08/25
SHEET: 4 of 4

27.00-29.00 m depth

BOREHOLE LOG

CLIENT: UPG Castle Corner Ptd Lty
PROJECT: Proposed Residential Development with Affordable Housing
LOCATION: 16-20 Old Castle Hill Road, Castle Hill, Sydney, NSW 2154

SURFACE LEVEL: 132.3 AHD
COORDINATE: E:315548.7, N:6265978.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH04
PROJECT No: 235039.00
DATE: 27/08/25 - 28/08/25
SHEET: 1 of 4

CONDITIONS ENCOUNTERED								SAMPLE				TESTING AND REMARKS			
GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN[#]	CONSIS.[*] DENSITY.[*]	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS	BACKFILL	WELL PIPE
					TOP	(PC)	M								
27/08/25 No Free Groundwater Observed Whilst Augering	132	0.10	TOPSOIL / Silty CLAY: grey and dark grey; trace of tiles fragments and root fibres.						A		0.10 0.20				
			CLAY (CH): brown then pale grey-brown; high plasticity.		RS	H	w=PL		A U50		0.40 0.50 0.80	PP	>600kPa		
	131	1.00	CLAY (CL-CI) trace gravel: pale brown; low to medium plasticity; ironstone gravel.		RS	H	w<PL		A SPT		0.90 1.00 1.45	SPT	15,18,24 N=42		
	130	2							A		1.90 2.00				
		2.80	CLAY (CH) with siltstone: pale grey and red-brown; high plasticity; trace of iron cemented siltstone bands.		RS		w=PL		SPT		2.50 2.95	SPT	7,12,18 N=30		
	129	3.30	Continued as rock log												
	128	4									4			Backfill	
	127	5									5				
	126	6									6			Bentonite	
	125	7									7			Gravel	
	124	8									8				
	123	9									9				

NOTES: [#] Soil origin is "probable" unless otherwise stated. [*] Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: Comacchio Geo 305
OPERATOR: Ground Test (LC)
LOGGED: S. Islam
METHOD: AD/T to 2.5m, then WB to 3.3m, then HQ3 to 24.25m
CASING: HW to 3.3m
REMARKS:

Refer to explanatory notes for symbol and abbreviation definitions

Douglas PARTNERS

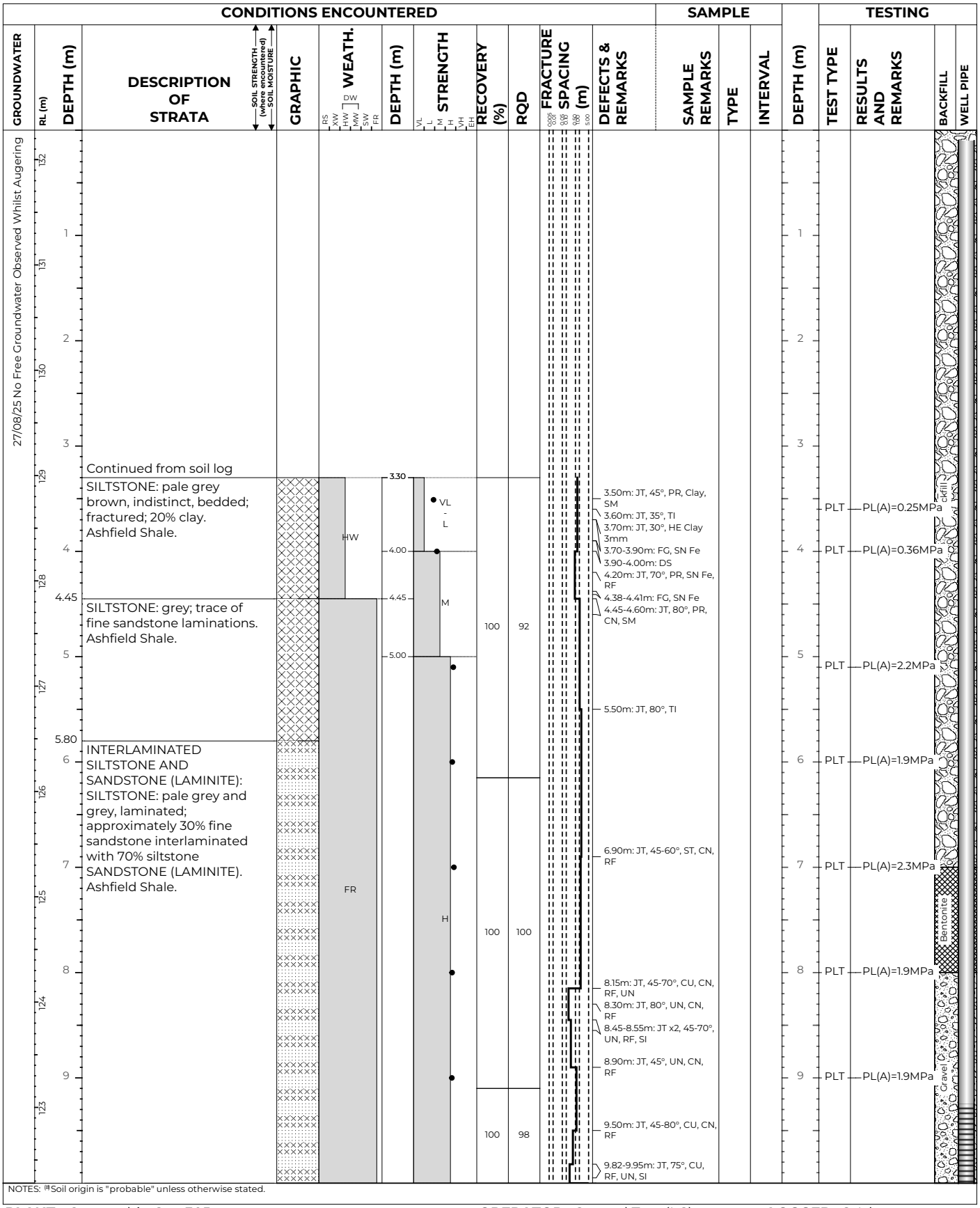
Generated with CORE-GS by Geroc - Split Soil-Rock Log

BOREHOLE LOG

CLIENT: UPG Castle Corner Ptd Lty
PROJECT: Proposed Residential Development with Affordable Housing
LOCATION: 16-20 Old Castle Hill Road, Castle Hill, Sydney, NSW 2154

SURFACE LEVEL: 132.3 AHD
COORDINATE: E:315548.7, N:6265978.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH04
PROJECT No: 235039.00
DATE: 27/08/25 - 28/08/25
SHEET: 2 of 4



NOTES: [a] Soil origin is "probable" unless otherwise stated.

PLANT: Comacchio Geo 305
METHOD: AD/T to 2.5m, then WB to 3.3m, then HQ3 to 24.25m
REMARKS:

OPERATOR: Ground Test (LC)

LOGGED: S. Islam
CASING: HW to 3.3m

Refer to explanatory notes for symbol and abbreviation definitions

Douglas PARTNERS

BOREHOLE LOG

CLIENT: UPG Castle Corner Ptd Lty
PROJECT: Proposed Residential Development with Affordable Housing
LOCATION: 16-20 Old Castle Hill Road, Castle Hill, Sydney, NSW 2154

SURFACE LEVEL: 132.3 AHD
COORDINATE: E:315548.7, N:6265978.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH04
PROJECT No: 235039.00
DATE: 27/08/25 - 28/08/25
SHEET: 3 of 4

CONDITIONS ENCOUNTERED | **SAMPLE** | **TESTING**

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	WEATH.	DEPTH (m)	STRENGTH	RECOVERY (%)	RQD	FRACTURE SPACING (m)	DEFECTS & REMARKS	SAMPLE REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS	BACKFILL	WELL PIPE
	122		[CONT] INTERLAMINATED SILTSTONE AND SANDSTONE (LAMINITE): SILTSTONE: pale grey and grey, laminated; approximately 30% fine sandstone interlaminated with 70% siltstone SANDSTONE (LAMINITE). Ashfield Shale.								10.00m: JT, 45°, PR, RF, SI					PLT	PL(A)=1.8MPa		
	121	11						100	98						11	PLT	PL(A)=1.6MPa		
	120	12					H								12	PLT	PL(A)=1.5MPa		
	119	13						100	100						13	PLT	PL(A)=2.0MPa		
		14.00	SHALE: grey, indistinct, bedded. Ashfield Shale.			14.20					14.22m: JT, 45°, PR, CN, SM				14	PLT	PL(A)=2.8MPa		
	118				FR														
	117	15													15	PLT	PL(A)=0.95MPa	vel	
	116	16					M to H				16.00m: JT, 45°, CN, SL, SM				16	PLT	PL(A)=1.2MPa		
								100	97		16.80m: JT, 80°, PR, CN, SM, TI								
	115	17									17.08m: JT, 45°, PR, CN, SM				17	PLT	PL(A)=1.3MPa		
											17.18-17.23m: JT, 45-70°, CU, CN, SM								
											17.25m: JT, 30°, PR, CN, SM								
	114	18									17.80m: JT, 80°, PR, CN, SM				18	PLT	PL(A)=0.77MPa		
		18.40	INTERBEDDED SANDSTONE AND SILTSTONE: SANDSTONE: pale grey and grey; interbedded / laminated; 50% fine sandstone interbedded / laminated with 50% siltstone SILTSTONE. Mittagong Formation.			18.40													
	113	19					H	100	100						19	PLT	PL(A)=1.9MPa		

NOTES: [a] Soil origin is "probable" unless otherwise stated.

Generated with CORE-GS by Geroc - Split Soil-Rock Log

PLANT: Comacchio Geo 305
METHOD: AD/T to 2.5m, then WB to 3.3m, then HQ3 to 24.25m
REMARKS:

OPERATOR: Ground Test (LC)

LOGGED: S. Islam
CASING: HW to 3.3m

Douglas PARTNERS

BOREHOLE LOG

CLIENT: UPG Castle Corner Ptd Lty
PROJECT: Proposed Residential Development with Affordable Housing
LOCATION: 16-20 Old Castle Hill Road, Castle Hill, Sydney, NSW 2154

SURFACE LEVEL: 132.3 AHD
COORDINATE: E:315548.7, N:6265978.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH04
PROJECT No: 235039.00
DATE: 27/08/25 - 28/08/25
SHEET: 4 of 4

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	WEATH.	DEPTH (m)	STRENGTH	RECOVERY (%)	RQD	FRACTURE SPACING (m)	DEFECTS & REMARKS	SAMPLE REMARKS	SAMPLE TYPE	SAMPLE INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS	BACKFILL	WELL PIPE
	112		[CONT] INTERBEDDED SANDSTONE AND SILTSTONE: SANDSTONE: pale grey and grey; interbedded / laminated; 50% fine sandstone interbedded / laminated with 50% siltstone SILTSTONE. Mittagong Formation.				H												
		21				20.60		100	100						21	PLT	PL(A)=2.6MPa		
	111						VH				21.42m: F, 45°, TI					PLT	PL(A)=3.5MPa		
		22			FR										22	PLT	PL(A)=3.4MPa	Gravel	
	110	22.50	SANDSTONE: pale grey, medium to coarse grained, 10 to 25°; cross bedded; trace of siltstone laminations . Hawkesbury Sandstone.			22.50					22.25m: JT, 45°, PR, CN, RF 22.40m: JT, 25°, PR, 40mm, SM, FG 22.65m: JT, 75°, PR, CN, RF								
		23					H	100	100						23	PLT	PL(A)=1.0MPa		
	109																		
		24													24	PLT	PL(A)=1.7MPa		
	108		Borehole discontinued at 24.25m depth. Target depth reached.																
		25																	
	107																		
		26																	
	106																		
		27																	
	105																		
		28																	
	104																		
		29																	
	103																		

NOTES: [a] Soil origin is "probable" unless otherwise stated.

PLANT: Comacchio Geo 305
METHOD: AD/T to 2.5m, then WB to 3.3m, then HQ3 to 24.25m
REMARKS:

OPERATOR: Ground Test (LC)

LOGGED: S. Islam
CASING: HW to 3.3m

Refer to explanatory notes for symbol and abbreviation definitions

Generated with CORE-GS by Geroc - Split Soil-Rock Log

CORE PHOTO LOG

CLIENT: UPG Castle Corner Ptd Lty
PROJECT: Proposed Residential Development with Affordable Housing
LOCATION: 16-20 Old Castle Hill Road, Castle Hill, Sydney, NSW 2154

SURFACE LEVEL: 132.3 AHD
COORDINATE: E:315548.7, N:6265978.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH04
PROJECT No: 235039.00
DATE: 27/08/25 - 28/08/25
SHEET: 1 of 3

3.30-7.00 m depth

7.00-11.00 m depth

Douglas PARTNERS

CORE PHOTO LOG

CLIENT: UPG Castle Corner Ptd Lty
PROJECT: Proposed Residential Development with Affordable Housing
LOCATION: 16-20 Old Castle Hill Road, Castle Hill, Sydney, NSW 2154

SURFACE LEVEL: 132.3 AHD
COORDINATE: E:315548.7, N:6265978.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH04
PROJECT No: 235039.00
DATE: 27/08/25 - 28/08/25
SHEET: 2 of 3

11.00-15.00 m depth

15.00-19.00 m depth

Douglas PARTNERS

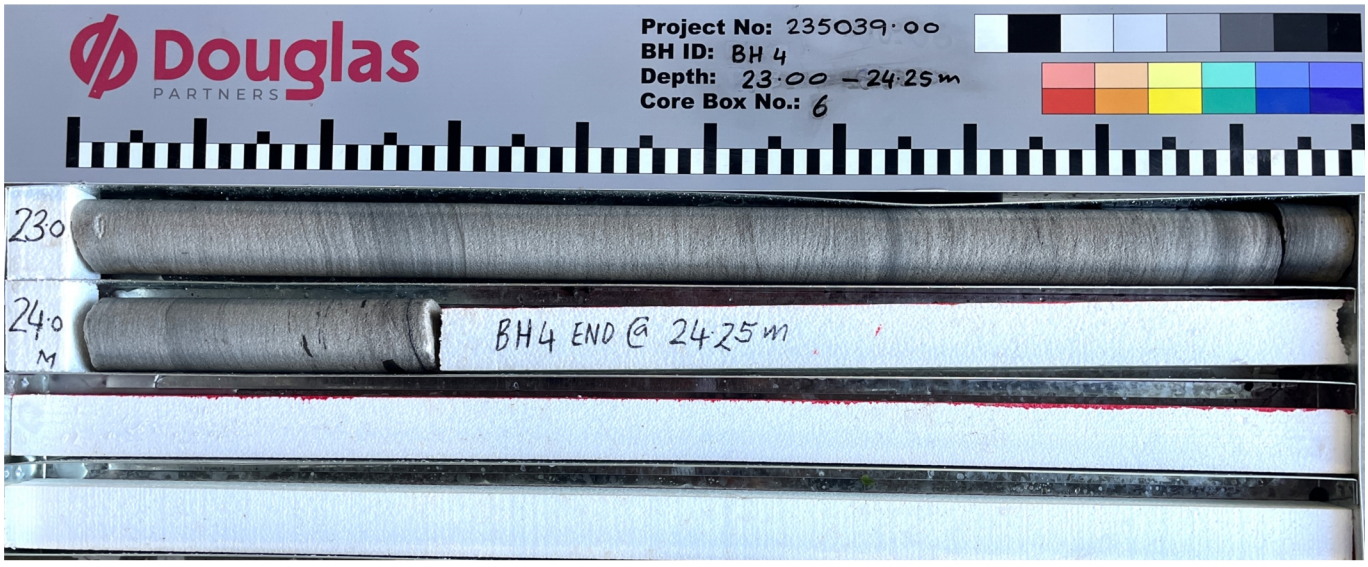
CORE PHOTO LOG

CLIENT: UPG Castle Corner Ptd Lty
PROJECT: Proposed Residential Development with Affordable Housing
LOCATION: 16-20 Old Castle Hill Road, Castle Hill, Sydney, NSW 2154

SURFACE LEVEL: 132.3 AHD
COORDINATE: E:315548.7, N:6265978.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH04
PROJECT No: 235039.00
DATE: 27/08/25 - 28/08/25
SHEET: 3 of 3

19.00-23.00 m depth



23.00-24.25 m depth

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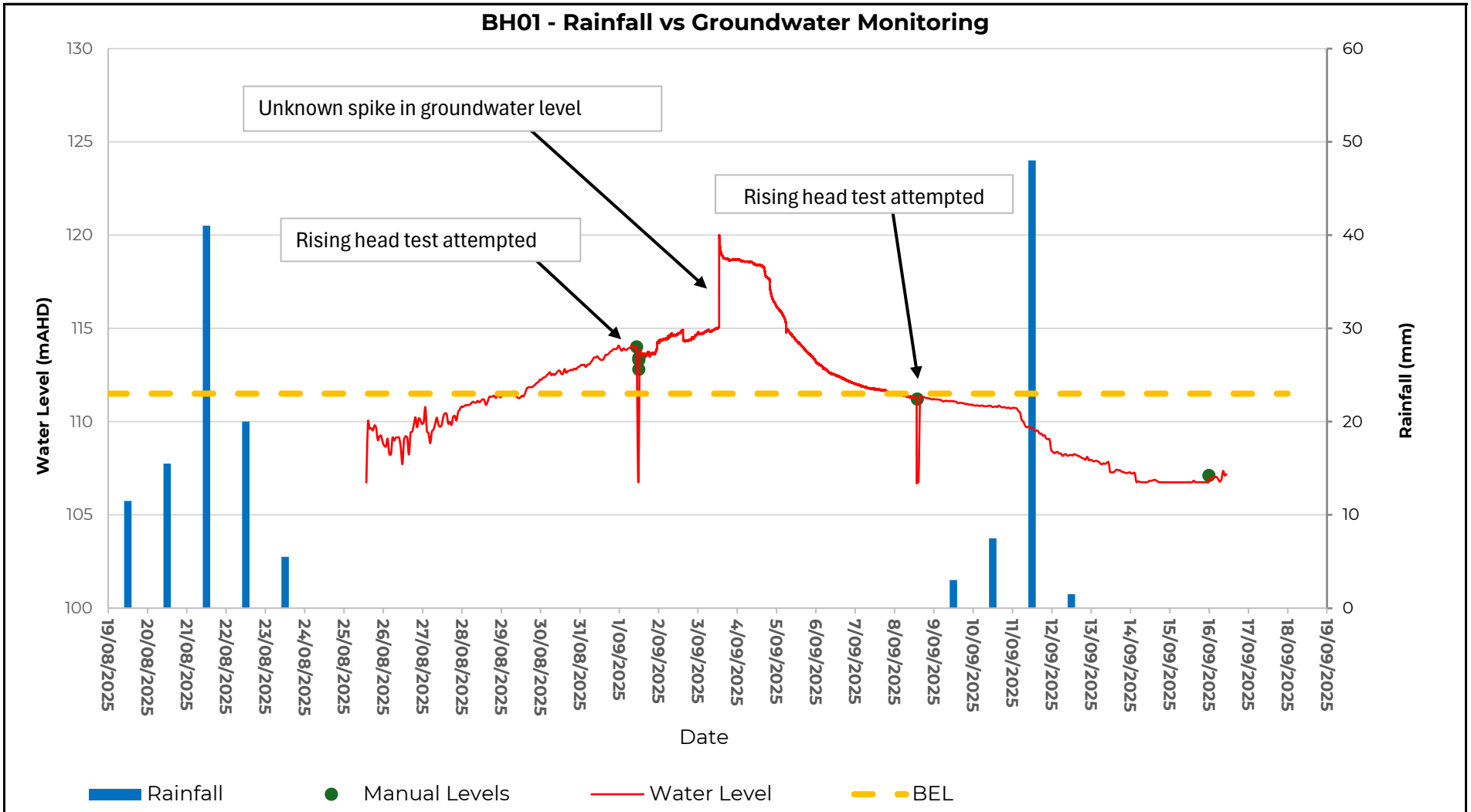
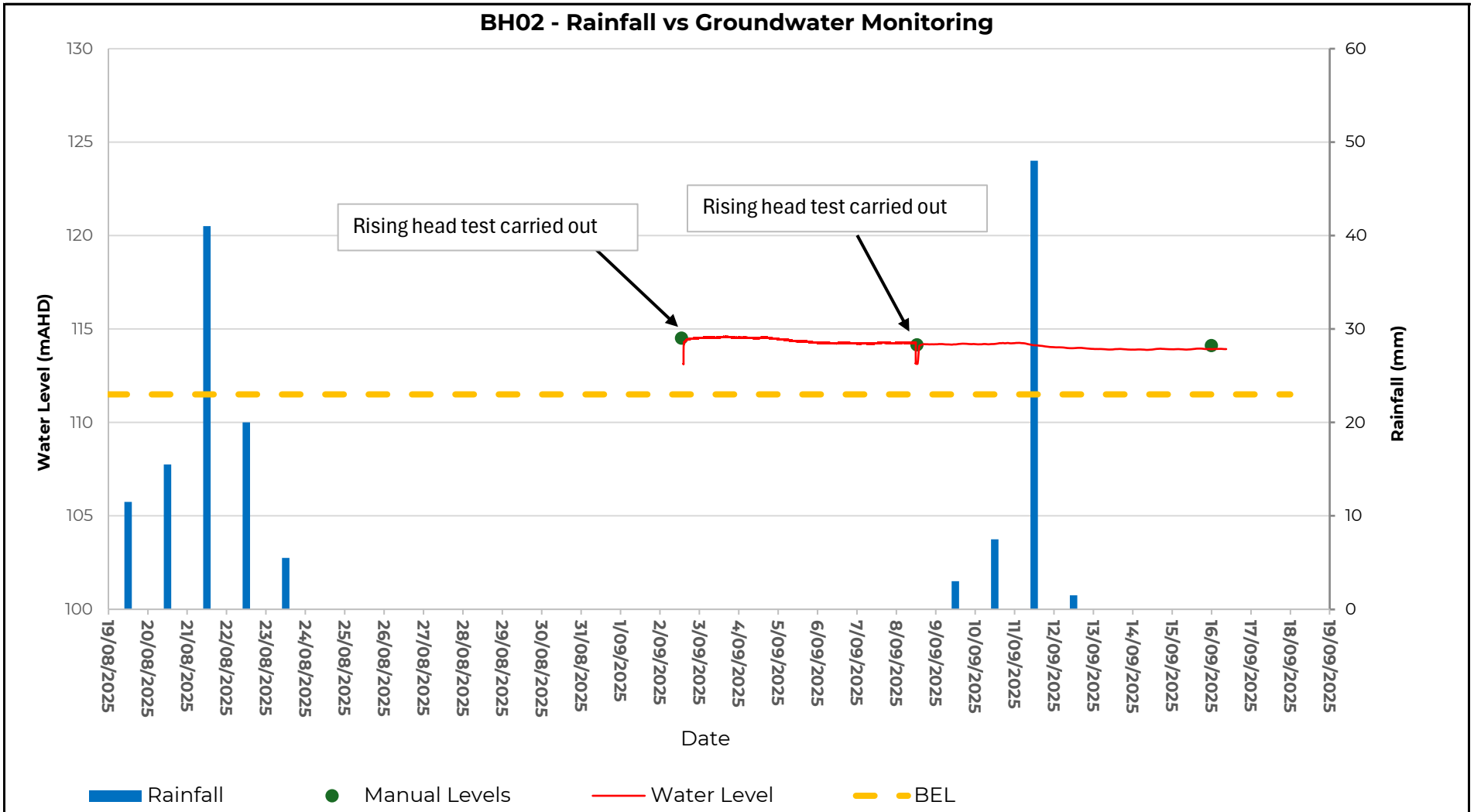
Appendix D

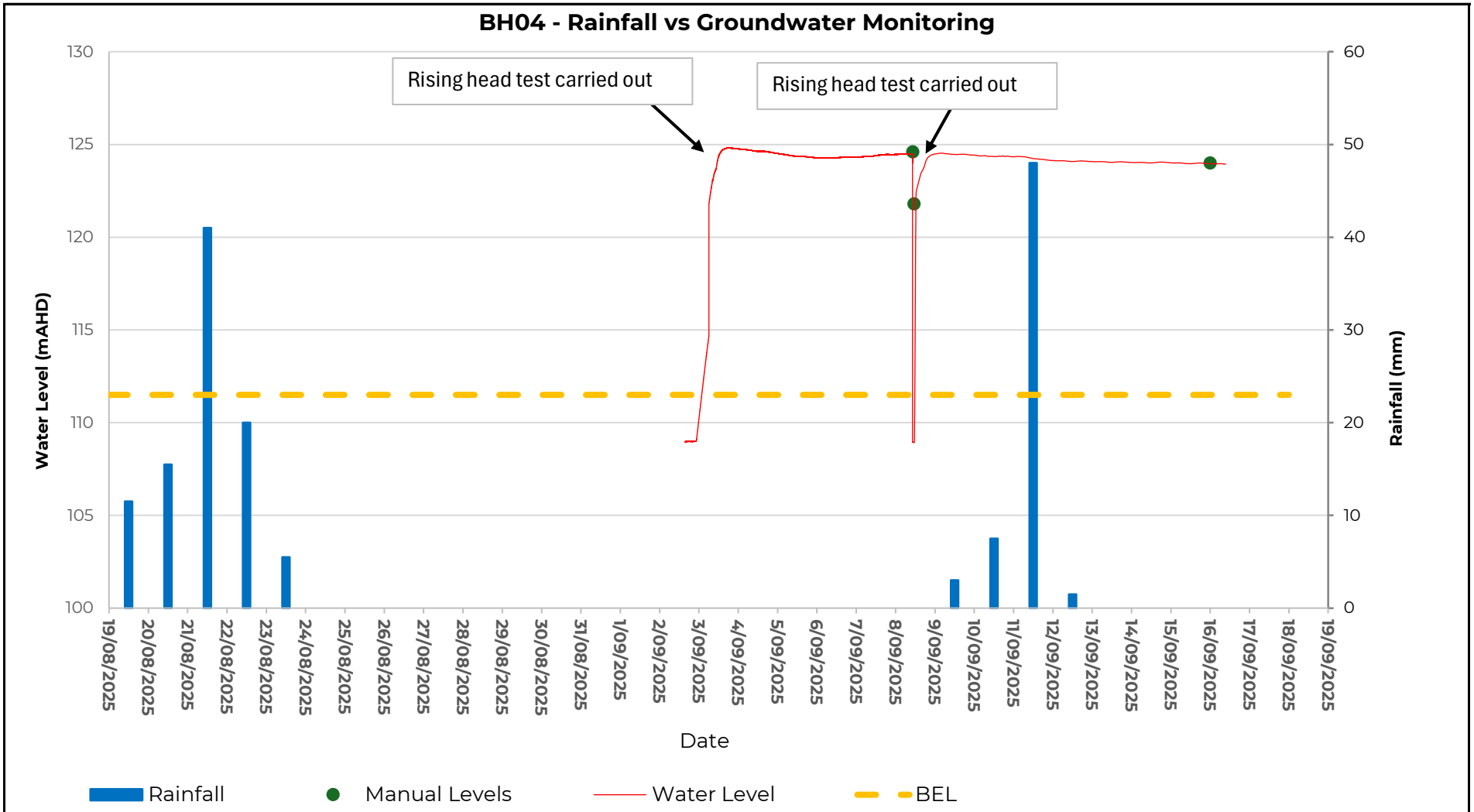
Hydrographs



Douglas PARTNERS GROUNDED EXPERTISE	**Client**	UPG Castle Corner Pty Ltd	**Borehole:**
	Project	Proposed Residential Development with Affordable Housing	BH01
	Location	16 - 20 Castle Hill Road, Castle Hill, Sydney, NSW 2154	**Project:** 235039.00



Douglas PARTNERS GROUNDED EXPERTISE	**Client**	UPG Castle Corner Pty Ltd	**Borehole:**
	Project	Proposed Residential Development with Affordable Housing	BH02
	Location	16 - 20 Castle Hill Road, Castle Hill, Sydney, NSW 2154	**Project:** 235039.00



Douglas PARTNERS GROUNDED EXPERTISE	**Client**	UPG Castle Corner Pty Ltd	**Borehole:**
	Project	Proposed Residential Development with Affordable Housing	BH04
	Location	16 - 20 Castle Hill Road, Castle Hill, Sydney, NSW 2154	**Project:** 235039.00

Appendix E

Water Quality Summary Table

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Table 1: Summary of Laboratory Results – TRH, BTEX, PAH, OCP, OPP, PCB, Nutrients, Physical Parameters, Anions & Cations

		Metals - Dissolved								TRH				BTEX					
		Total Arsenic	Cadmium	Total Chromium	Copper	Lead	Mercury (inorganic)	Nickel	Zinc	F1 ((C6-C10) BTEX)	F2 (>C10-C16 less Naphthalene)	F3 (>C16-C34)	F4 (>C34-C40)	Benzene	Toluene	Ethylbenzene	o-Xylene	m+p-Xylene	Total Xylenes
	PQL	1	0.1	1	1	1	0.05	1	1	10	50	100	100	1	1	1	1	2	1
NHMRC (2012) Recreation		100	20		20,000	50	10	200						10	8,000	3,000			6,000
ANZG (2018) 95% LOP Fresh		13	0.2	1	1.4	3.4	**0.6**	11	8					950	180	80	350	75	
Sample ID	Sample Date	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
BH1	08/09/25	**2**	**0.8**	**1**	<1	<1	<0.05	**8**	**12**	<10	<50	<100	<100	<1	<1	<1	<1	<2	<1
BH2	08/09/25	**5**	<0.1	**2**	**9**	<1	<0.05	**12**	**49**	<10	<50	<100	<100	<1	<1	<1	<1	<2	<1
BH4	08/09/25	**17**	<0.1	**3**	**21**	**1**	<0.05	**51**	**220**	<10	<50	<100	<100	<1	<1	<1	<1	<2	<1
BD1/20250908	08/09/25	**17**	<0.1	**3**	**24**	**1**	<0.05	**54**	**220**	<10	<50	<100	<100	<1	<1	<1	<1	<2	<1

Notes:

- No criterion / not defined / not tested / not applicable
* QA/QC replicate of sample listed directly below the primary sample
NL Not limiting
PQL Practical quantitation limit
Shaded cell is exceedance of guideline value
Where one or more guideline value is exceeded, the cell is shaded to the colour of the highest guideline value exceeded
ANZG (2018) Australian and New Zealand Guidelines for Fresh and Marine Water Quality, 95% level of protection of species for Fresh aquatic ecosystems [NB: 95% level of protection adopted for bioaccumulative chemicals]
NHMRC (2008) Guidelines for Managing Risk in Recreational Water
ANZG (2018) Australian and New Zealand Guidelines for Fresh and Marine Water Quality, orange text is 'unknown' level of protection
Underlining of ANZG (2018) criteria indicates a criteria with an 'unknown' level of protection.
ANZG (2018) DGV adopted for most conservative species of following analytes: DGV for xylene (m) adopted for xylene (m+p); DGV for CrVI adopted for total chromium; DGV for AsV adopted for total arsenic
ANZG (2018) DGV adopted for aluminium in freshwater is for receiving waters with pH >6.5. For receiving waters with pH <6.5 suitability of the more conservative, low reliability DGV of unknown LOP should be considered
ANZG (2018) Ammonia DGV is pH and temperature dependant. DGV for a pH of 8 provided in table.

PAH																								
Acenaphthene	Acenaphthylene	Anthracene	Benzo(a)anthracene	Naphthalene	Benzo(a)pyrene (B[a]P)	Benzo(b,j+k)fluoranthene	Benzo(g,h,i)perylene	Chrysene	Dibenzo(a,h)anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-c,d)pyrene	Phenanthrene	Pyrene	Sum of detected PAH	DDE	DDT	DDD	Aldrin	Dieldrin	Aldrin + Dieldrin (calculated)	alpha-chlordane	gamma-Chlordane	Endosulfan I
0.1	0.1	0.1	0.1	1	0.1	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.002
					0.1												90				3			
		0.4		16	**0.2**					**1.4**			**2**				**0.01**		**0.001**	**0.01**				
µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
<0.1	<0.1	<0.1	<0.1	<1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.002
<0.1	<0.1	<0.1	<0.1	<1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	-	-	-	-	-	-	-	-
<0.1	<0.1	<0.1	<0.1	<1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	-	-	-	-	-	-	-	-
<0.1	<0.1	<0.1	<0.1	<1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	-	-	-	-	-	-	-	-

OCP																			
Endosulfan II	Endosulfan Sulphate	Endrin	Endrin Aldehyde	Heptachlor	Heptachlor Epoxide	Hexachlorobenzene	Methoxychlor	alpha-BHC	beta-BHC	delta-BHC	Lindane	Sum of detected OCP	Azinphos methyl (Guthion)	Bromophos-ethyl	Chlorpyriphos	Chlorpyriphos-methyl	Diazinon	Dichlorvos	Dimethoate
0.002	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.02	0.05	0.009	0.05	0.01	0.05	0.1
				3							100		300	100	100		40	50	70
		0.02		**0.09**		0.1	**0.005**				0.2		0.02		**0.01**		0.01		0.15
µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
<0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.02	<0.05	<0.009	<0.05	<0.01	<0.05	<0.1
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

OPP										PCB							
Ethion	Ronnel (fenchlorphos)	Fenitrothion	Fenthion	Malathion	Parathion	Parathion-methyl	Methidathion	Fenamiphos	Sum of detected OPP	Arochlor 1016	Arochlor 1221	Arochlor 1232	Arochlor 1242	Arochlor 1248	Arochlor 1254	Aroclor 1260	Sum of detected PCB
0.05	0.05	0.05	0.05	0.05	0.004	0.05	0.05	0.05	0.004	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
40		70	70	700	200	7	60	5									
		0.2		0.05	0.004								**0.6**		**0.03**		
µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
<0.05	<0.05	<0.05	<0.05	<0.05	<0.004	<0.05	<0.05	<0.05	<0.004	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Nutrients								Physical Parameters		Microbiologica	Anions & Cations						Anions & Cations - Dissolved			
Nitrogen	Ammonia as N	TKN in water	Nitrate as N	Nitrite as N	NOx as N	Organic Nitrogen as N	Phosphorous	Dissolved oxygen	Total dissolved solids	Faecal Coliforms	Bicarbonate Alkalinity as CaCO3	Chloride	Hydroxide Alkalinity (OH-) as CaCO3	Ionic Balance	Sulphate	Total Alkalinity as CaCO3	Calcium	Magnesium	Potassium	Sodium
100	5	100	5	5	5	200	50	100	5,000	100	5,000	1000	5,000		1000	5,000	500	500	500	500
			113,000	9,000																
	900		1,100																	
µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	CFU/100mL	µg/L	µg/L	µg/L	mg/kg	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
400	**300**	**400**	<5	<5	<5	<200	**60**	**6,800**	**3,800,000**	<1000	**760,000**	**1,500,000**	<5000	**-40000**	**170,000**	**760,000**	**56,000**	**140,000**	**35,000**	**940,000**
1,200	**1,100**	**1,200**	<5	<5	<5	<200	<50	-	**6,200,000**	**100**	**890,000**	**2,600,000**	<5000	**-30000**	**230,000**	**890,000**	**120,000**	**210,000**	**45,000**	**1,500,000**
700	**650**	**700**	<5	<5	<5	<200	**1,500**	-	**5,800,000**	<1000	**720,000**	**2,700,000**	<5000	**-100000**	**240,000**	**720,000**	**73,000**	**140,000**	**47,000**	**1,400,000**
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table QA2: Trip Blank Results - Water Sampling

Sample ID	Sample Date	Media Being Sampled	Sample Type	Units	TRH	BTEX						PAH		Lab Report No
					F1 ((C6-C10)-BTEX)	Benzene	Toluene	Ethylbenzene	o-Xylene	m+p-Xylene	Total Xylenes	Naphthalene	Sum of detected PAH	
TB	08/09/25	Water	Water	µg/L	<10	<1	<1	<1	<1	<2	<1	<1	<1	390304

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Table QA3: Trip Spike Results – Water Sampling (% Recovery)

Sample ID	Sample Date	Media Being Sampled	Sample Type	Benzene	Toluene	Ethylbenzene	o-Xylene	m+p-Xylene	Lab Report No
TS	08/09/25	Water	Water	90	90	91	92	97	390304

Table QA1: Relative Percentage Difference Results – Water Sampling

Lab Report No	Sample ID	Sample Date	Sample Type	Units	Metals - Dissolved								TRH				
					Total Arsenic	Cadmium	Total Chromium	Copper	Lead	Mercury (inorganic)	Nickel	Zinc	F1 ((C6-C10)-BTEX)	F2 (>C10-C16 less Naphthalene)	F3 (>C16-C34)	F4 (>C34-C40)	Benzene
390304	BH4	08/09/25	Water	µg/L	**17**	<0.1	**3**	**21**	**1**	<0.05	**51**	**220**	<10	<50	<100	<100	<1
390304	BD1/20250908	08/09/25	Water	µg/L	**17**	<0.1	**3**	**24**	**1**	<0.05	**54**	**220**	<10	<50	<100	<100	<1
		Difference		µg/L	0	0	0	3	0	0	3	0	0	0	0	0	0
		RPD		%	0%	0%	0%	13%	0%	0%	6%	0%	0%	0%	0%	0%	0%

BTEX					PAH														
Toluene	Ethylbenzene	o-Xylene	m+ p-Xylene	Total Xylenes	Acenaphthene	Acenaphthylene	Anthracene	Benzo(a)anthracene	Naphthalene	Benzo(a)pyrene (B(a)P)	Benzo(b,j+k)fluoranthene	Benzo(g,h,i)perylene	Chysene	Dibenzo(a,h)anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-c,d)pyrene	Phenanthrene	Pyrene	Sum of detected PAH
<1	<1	<1	<2	<1	<0.1	<0.1	<0.1	<0.1	<1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
<1	<1	<1	<2	<1	<0.1	<0.1	<0.1	<0.1	<1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

Appendix F

Laboratory Reports

Envirolab Services Pty Ltd
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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 390304

Client Details

Client	Douglas Partners Pty Ltd
Attention	Warren Smith
Address	96 Hermitage Rd, West Ryde, NSW, 2114

Sample Details

Your Reference	**235039.00, Sydney**
Number of Samples	6 Water
Date samples received	08/09/2025
Date completed instructions received	08/09/2025

Analysis Details

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

Samples were analysed as received from the client unless as indicated below in the method summaries. Results relate specifically to the samples as received.

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

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

Report Details

Date results requested by	15/09/2025
Date of Issue	15/09/2025

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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
Nancy Zhang, Laboratory Manager, Sydney
Priya Samarawickrama, Senior Chemist
Tabitha Roberts, Senior Chemist

Authorised By
Nancy Zhang, Laboratory Manager

vTRH(C6-C10)/BTEXN in Water						
Our Reference		390304-1	390304-2	390304-3	390304-4	390304-5
Your Reference	UNITS	BH1	BH2	BH4	BD1/20250908	TS
Date Sampled		08/09/2025	08/09/2025	08/09/2025	08/09/2025	08/09/2025
Type of sample		Water	Water	Water	Water	Water
Date extracted	-	11/09/2025	11/09/2025	11/09/2025	11/09/2025	11/09/2025
Date analysed	-	12/09/2025	12/09/2025	12/09/2025	12/09/2025	12/09/2025
TRH C_6 - C_9	µg/L	<10	<10	<10	<10	[NA]
TRH C_6 - C_{10}	µg/L	<10	<10	<10	<10	[NA]
TRH C_6 - C_{10} less BTEX (F1)	µg/L	<10	<10	<10	<10	[NA]
Benzene	µg/L	<1	<1	<1	<1	90%
Toluene	µg/L	<1	<1	<1	<1	90%
Ethylbenzene	µg/L	<1	<1	<1	<1	91%
m+p-xylene	µg/L	<2	<2	<2	<2	97%
o-xylene	µg/L	<1	<1	<1	<1	92%
Naphthalene	µg/L	<1	<1	<1	<1	[NA]
Surrogate Dibromofluoromethane	%	102	101	106	102	98
Surrogate Toluene-d8	%	98	98	100	98	97
Surrogate 4-Bromofluorobenzene	%	93	92	92	90	99

vTRH(C6-C10)/BTEXN in Water		
Our Reference		390304-6
Your Reference	UNITS	TB
Date Sampled		08/09/2025
Type of sample		Water
Date extracted	-	11/09/2025
Date analysed	-	12/09/2025
TRH C_6 - C_9	µg/L	<10
TRH C_6 - C_{10}	µg/L	<10
TRH C_6 - C_{10} less BTEX (F1)	µg/L	<10
Benzene	µg/L	<1
Toluene	µg/L	<1
Ethylbenzene	µg/L	<1
m+p-xylene	µg/L	<2
o-xylene	µg/L	<1
Naphthalene	µg/L	<1
Surrogate Dibromofluoromethane	%	101
Surrogate Toluene-d8	%	100
Surrogate 4-Bromofluorobenzene	%	91

svTRH (C10-C40) in Water					
Our Reference	UNITS	390304-1	390304-2	390304-3	390304-4
Your Reference		BH1	BH2	BH4	BD1/20250908
Date Sampled		08/09/2025	08/09/2025	08/09/2025	08/09/2025
Type of sample		Water	Water	Water	Water
Date extracted	-	09/09/2025	09/09/2025	09/09/2025	09/09/2025
Date analysed	-	09/09/2025	09/09/2025	09/09/2025	09/09/2025
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	%	97	108	73	94

PAHs in Water					
Our Reference		390304-1	390304-2	390304-3	390304-4
Your Reference	UNITS	BH1	BH2	BH4	BD1/20250908
Date Sampled		08/09/2025	08/09/2025	08/09/2025	08/09/2025
Type of sample		Water	Water	Water	Water
Date extracted	-	09/09/2025	09/09/2025	09/09/2025	09/09/2025
Date analysed	-	12/09/2025	10/09/2025	10/09/2025	10/09/2025
Naphthalene	µg/L	<0.1	<0.1	<0.1	<0.1
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 p-Terphenyl-d14	%	92	94	66	94

Total Phenolics in Water					
Our Reference		390304-1	390304-2	390304-3	390304-4
Your Reference	UNITS	BH1	BH2	BH4	BD1/20250908
Date Sampled		08/09/2025	08/09/2025	08/09/2025	08/09/2025
Type of sample		Water	Water	Water	Water
Date extracted	-	12/09/2025	12/09/2025	12/09/2025	12/09/2025
Date analysed	-	12/09/2025	12/09/2025	12/09/2025	12/09/2025
Total Phenolics (as Phenol)	mg/L	<0.05	<0.05	<0.05	<0.05

OCPs in Water - Trace Level		
Our Reference	UNITS	390304-1
Your Reference		BH1
Date Sampled		08/09/2025
Type of sample		Water
Date extracted	-	09/09/2025
Date analysed	-	12/09/2025
alpha-BHC	µg/L	<0.001
HCB	µg/L	<0.001
beta-BHC	µg/L	<0.001
gamma-BHC	µg/L	<0.001
Heptachlor	µg/L	<0.001
delta-BHC	µg/L	<0.001
Aldrin	µg/L	<0.001
Heptachlor Epoxide	µg/L	<0.001
gamma-Chlordane	µg/L	<0.001
alpha-Chlordane	µg/L	<0.001
Endosulfan I	µg/L	<0.002
pp-DDE	µg/L	<0.001
Dieldrin	µg/L	<0.001
Endrin	µg/L	<0.001
Endosulfan II	µg/L	<0.002
pp-DDD	µg/L	<0.001
Endrin Aldehyde	µg/L	<0.001
pp-DDT	µg/L	<0.001
Endosulfan Sulphate	µg/L	<0.001
Methoxychlor	µg/L	<0.001
Surrogate 4-Chloro-3-NBTF	%	84

OP in water LL ANZECCF/ADWG		
Our Reference		390304-1
Your Reference	UNITS	BH1
Date Sampled		08/09/2025
Type of sample		Water
Date extracted	-	09/09/2025
Date analysed	-	12/09/2025
Dichlorvos	µg/L	<0.05
Mevinphos	µg/L	<0.05
Phorate	µg/L	<0.05
Dimethoate	µg/L	<0.1
Diazinon	µg/L	<0.01
Disulfoton	µg/L	<0.05
Chlorpyriphos-methyl	µg/L	<0.05
Parathion-Methyl	µg/L	<0.05
Ronnel	µg/L	<0.05
Fenitrothion	µg/L	<0.05
Malathion	µg/L	<0.05
Chlorpyriphos	µg/L	<0.009
Fenthion	µg/L	<0.05
Parathion	µg/L	<0.004
Bromophos ethyl	µg/L	<0.05
Methidathion	µg/L	<0.05
Fenamiphos	µg/L	<0.05
Ethion	µg/L	<0.05
Phosalone	µg/L	<0.05
Azinphos-methyl (Guthion)	µg/L	<0.02
Coumaphos	µg/L	<0.05
Surrogate 4-Chloro-3-NBTF	%	84

PCBs in Water - Trace Level		
Our Reference		390304-1
Your Reference	UNITS	BH1
Date Sampled		08/09/2025
Type of sample		Water
Date extracted	-	09/09/2025
Date analysed	-	12/09/2025
Aroclor 1016	µg/L	<0.01
Aroclor 1221	µg/L	<0.01
Aroclor 1232	µg/L	<0.01
Aroclor 1242	µg/L	<0.01
Aroclor 1248	µg/L	<0.01
Aroclor 1254	µg/L	<0.01
Aroclor 1260	µg/L	<0.01
Surrogate 2-Fluorobiphenyl	%	81

HM in water - dissolved					
Our Reference	UNITS	390304-1	390304-2	390304-3	390304-4
Your Reference		BH1	BH2	BH4	BD1/20250908
Date Sampled		08/09/2025	08/09/2025	08/09/2025	08/09/2025
Type of sample		Water	Water	Water	Water
Date prepared	-	09/09/2025	09/09/2025	09/09/2025	09/09/2025
Date analysed	-	09/09/2025	09/09/2025	09/09/2025	09/09/2025
Arsenic-Dissolved	µg/L	2	5	17	17
Cadmium-Dissolved	µg/L	0.8	<0.1	<0.1	<0.1
Chromium-Dissolved	µg/L	1	2	3	3
Copper-Dissolved	µg/L	<1	9	21	24
Lead-Dissolved	µg/L	<1	<1	1	1
Mercury-Dissolved	µg/L	<0.05	<0.05	<0.05	<0.05
Nickel-Dissolved	µg/L	8	12	51	54
Zinc-Dissolved	µg/L	12	49	220	220

Metals in Waters - Acid extractable				
Our Reference		390304-1	390304-2	390304-3
Your Reference	UNITS	BH1	BH2	BH4
Date Sampled		08/09/2025	08/09/2025	08/09/2025
Type of sample		Water	Water	Water
Date prepared	-	09/09/2025	09/09/2025	09/09/2025
Date analysed	-	09/09/2025	09/09/2025	09/09/2025
Phosphorus - Total	mg/L	0.06	<0.05	1.5

Miscellaneous Inorganics				
Our Reference	UNITS	390304-1	390304-2	390304-3
Your Reference		BH1	BH2	BH4
Date Sampled		08/09/2025	08/09/2025	08/09/2025
Type of sample		Water	Water	Water
Date prepared	-	08/09/2025	08/09/2025	08/09/2025
Date analysed	-	08/09/2025	08/09/2025	08/09/2025
pH	pH Units	6.9	[NA]	[NA]
Electrical Conductivity	µS/cm	6,800	[NA]	[NA]
Total Dissolved Solids (grav)	mg/L	3,800	6,200	5,800
Total Suspended Solids	mg/L	18	41	420
Ammonia as N in water	mg/L	0.30	1.1	0.65
Nitrate as N in water	mg/L	<0.005	<0.005	<0.005
Nitrite as N in water	mg/L	<0.005	<0.005	<0.005
Total Nitrogen in water	mg/L	0.4	1.2	0.7
TKN in water	mg/L	0.4	1.2	0.7
Organic Nitrogen as N	mg/L	<0.2	<0.2	<0.2
NOx as N in water	mg/L	<0.005	<0.005	<0.005
Phosphate as P in water	mg/L	0.02	0.02	0.03
Dissolved Oxygen*	mg/L	6.8	[NA]	[NA]

Ion Balance				
Our Reference		390304-1	390304-2	390304-3
Your Reference	UNITS	BH1	BH2	BH4
Date Sampled		08/09/2025	08/09/2025	08/09/2025
Type of sample		Water	Water	Water
Date prepared	-	08/09/2025	08/09/2025	08/09/2025
Date analysed	-	08/09/2025	08/09/2025	08/09/2025
Calcium - Dissolved	mg/L	56	120	73
Potassium - Dissolved	mg/L	35	45	47
Sodium - Dissolved	mg/L	940	1,500	1,400
Magnesium - Dissolved	mg/L	140	210	140
Hardness (calc) equivalent $CaCO_3$	mg/L	710	1,200	760
Hydroxide Alkalinity (OH^-) as $CaCO_3$	mg/L	<5	<5	<5
Bicarbonate Alkalinity as $CaCO_3$	mg/L	760	890	720
Carbonate Alkalinity as $CaCO_3$	mg/L	<5	<5	<5
Total Alkalinity as $CaCO_3$	mg/L	760	890	720
Sulphate, SO4	mg/L	170	230	240
Chloride, Cl	mg/L	1,500	2,600	2,700
Ionic Balance	%	-4.0	-3.0	-10

Microbiological Testing				
Our Reference	UNITS	390304-1	390304-2	390304-3
Your Reference		BH1	BH2	BH4
Date Sampled		08/09/2025	08/09/2025	08/09/2025
Type of sample		Water	Water	Water
Date of testing	-	09/09/2025	09/09/2025	09/09/2025
Faecal Coliforms	cfu/100mL	<1000	100	<1000

Method ID	Methodology Summary
Ext-008	Subcontracted to Sonic Food & Water Testing. NATA Accreditation No. 4034.
Inorg-001	pH - Measured using pH meter and electrode. Please note that the results for water analyses are indicative only, as analysis outside of the APHA storage times.
Inorg-002	Conductivity and Salinity - measured using a conductivity cell.
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. NOTE: Where the EC of the sample is <100µS/cm, the TDS will typically be below 70mg/L (as the sample is very likely to be at least drinking water quality). Therefore to ensure data quality for TDS, the TDS is typically calculated as per the equation below:- TDS = EC * 0.6
Inorg-019	Suspended Solids - determined gravimetricially by filtration of the sample. The samples are dried at 104+/-5°C.
Inorg-031	Total Phenolics by segmented flow analyser (in line distillation with colourimetric finish). Solids are extracted in a caustic media prior to analysis.
Inorg-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-055	Nitrate - determined colourimetrically. Waters samples are filtered on receipt prior to analysis. Soils are analysed following a water extraction.
Inorg-055	Nitrite - determined colourimetrically based on APHA latest edition NO2- B. Waters samples are filtered on receipt prior to analysis. Soils are analysed following a water extraction.
Inorg-055/062/127	Total Nitrogen - Calculation sum of TKN and oxidised Nitrogen. Alternatively analysed by combustion and chemiluminescence.
Inorg-057	Ammonia - determined colourimetrically, based on APHA latest edition 4500-NH3 F. Waters samples are filtered on receipt prior to analysis. Soils are analysed following a KCl extraction.
Inorg-060	Phosphate determined colourimetrically based on EPA365.1 and APHA latest edition 4500 P E. Waters samples are filtered on receipt prior to analysis. Soils are analysed following a water extraction.
Inorg-062	TKN - determined colourimetrically based on APHA latest edition 4500 Norg. Alternatively, TKN can be derived from calculation (Total N - NOx).
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.
Inorg-112	Dissolved Oxygen using membrane electrode. Note this analysis should ideally be carried out immediately after sampling.

Method ID	Methodology Summary
Metals-020	Determination of various metals/elements by ICP-AES. Total Phosphate determined stochiometrically from Phosphorus (assumed to be present as Phosphate). Where salts (oxides, chlorides etc.) are calculated from the element concentration stoichiometrically there is no guarantee that the salt form is completely soluble in the acids used in the preparation. Submission of low masses of sample e.g. for dust samples, may result in raised PQLs. Where molecular anion forms are calculated from an element (e.g. SO4 from S or PO4 from P stoichiometrically), the assumption is that the element is only present in that molecular anion form.
Metals-021	Determination of Mercury by Cold Vapour AAS.
Metals-022	Determination of various metals by ICP-MS. Please note for Bromine and Iodine, any forms of these elements that are present are included together in the one result reported for each of these two elements. Where salts (oxides, chlorides etc.) are calculated from the element concentration stoichiometrically there is no guarantee that the salt form is completely soluble in the acids used in the preparation.
Org-020	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-FID. F2 = (>C10-C16)-Naphthalene as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater (HSLs Tables 1A (3, 4)). Note Naphthalene is determined from the VOC analysis.
Org-021/022/025	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC-ECD and/or GC-MS/GC-MSMS.
Org-021/022/025	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC-ECD and/or GC-MS/GC-MSMS. Note, the Total +ve PCBs PQL is reflective of the lowest individual PQL and is therefore" Total +ve PCBs" is simply a sum of the positive individual PCBs.
Org-022/025	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-MS/GC-MSMS.
Org-022/025	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC-MS/GC-MSMS. Note, the Total +ve reported DDD+DDE+DDT PQL is reflective of the lowest individual PQL and is therefore simply a sum of the positive individually report DDD+DDE+DDT.
Org-022/025	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-MS/GC-MSMS. Benzo(a)pyrene TEQ as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater - 2013.
Org-023	Water samples are analysed directly by purge and trap GC-MS.
Org-023	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS. Water samples are analysed directly by purge and trap GC-MS. F1 = (C6-C10)-BTEX as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater.

QUALITY CONTROL: vTRH(C6-C10)/BTEXN in Water					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W3	[NT]
Date extracted	-			11/09/2025	1	11/09/2025	12/09/2025		11/09/2025	[NT]
Date analysed	-			12/09/2025	1	12/09/2025	15/09/2025		12/09/2025	[NT]
TRH C_6 - C_9	µg/L	10	Org-023	<10	1	<10	<10	0	98	[NT]
TRH C_6 - C_{10}	µg/L	10	Org-023	<10	1	<10	<10	0	98	[NT]
Benzene	µg/L	1	Org-023	<1	1	<1	<1	0	99	[NT]
Toluene	µg/L	1	Org-023	<1	1	<1	<1	0	95	[NT]
Ethylbenzene	µg/L	1	Org-023	<1	1	<1	<1	0	97	[NT]
m+p-xylene	µg/L	2	Org-023	<2	1	<2	<2	0	100	[NT]
o-xylene	µg/L	1	Org-023	<1	1	<1	<1	0	101	[NT]
Naphthalene	µg/L	1	Org-023	<1	1	<1	<1	0	[NT]	[NT]
Surrogate Dibromofluoromethane	%		Org-023	98	1	102	101	1	96	[NT]
Surrogate Toluene-d8	%		Org-023	99	1	98	98	0	99	[NT]
Surrogate 4-Bromofluorobenzene	%		Org-023	94	1	93	92	1	108	[NT]

QUALITY CONTROL: svTRH (C10-C40) in Water						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	390304-3
Date extracted	-			09/09/2025	2	09/09/2025	09/09/2025		09/09/2025	09/09/2025
Date analysed	-			09/09/2025	2	09/09/2025	09/09/2025		09/09/2025	09/09/2025
TRH C_{10} - C_{14}	µg/L	50	Org-020	<50	2	<50	<50	0	106	103
TRH C_{15} - C_{28}	µg/L	100	Org-020	<100	2	<100	<100	0	111	114
TRH C_{29} - C_{36}	µg/L	100	Org-020	<100	2	<100	<100	0	114	97
TRH >C_{10} - C_{16}	µg/L	50	Org-020	<50	2	<50	<50	0	106	103
TRH >C_{16} - C_{34}	µg/L	100	Org-020	<100	2	<100	<100	0	111	114
TRH >C_{34} - C_{40}	µg/L	100	Org-020	<100	2	<100	<100	0	114	97
Surrogate o-Terphenyl	%		Org-020	96	2	108	87	22	87	111

QUALITY CONTROL: PAHs in Water						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W3	390304-3
Date extracted	-			09/09/2025	2	09/09/2025	09/09/2025		09/09/2025	09/09/2025
Date analysed	-			12/09/2025	2	10/09/2025	10/09/2025		10/09/2025	10/09/2025
Naphthalene	µg/L	0.1	Org-022/025	<0.1	2	<0.1	<0.1	0	84	100
Acenaphthylene	µg/L	0.1	Org-022/025	<0.1	2	<0.1	<0.1	0	[NT]	[NT]
Acenaphthene	µg/L	0.1	Org-022/025	<0.1	2	<0.1	<0.1	0	82	89
Fluorene	µg/L	0.1	Org-022/025	<0.1	2	<0.1	<0.1	0	85	91
Phenanthrene	µg/L	0.1	Org-022/025	<0.1	2	<0.1	<0.1	0	89	95
Anthracene	µg/L	0.1	Org-022/025	<0.1	2	<0.1	<0.1	0	[NT]	[NT]
Fluoranthene	µg/L	0.1	Org-022/025	<0.1	2	<0.1	<0.1	0	89	99
Pyrene	µg/L	0.1	Org-022/025	<0.1	2	<0.1	<0.1	0	96	106
Benzo(a)anthracene	µg/L	0.1	Org-022/025	<0.1	2	<0.1	<0.1	0	[NT]	[NT]
Chrysene	µg/L	0.1	Org-022/025	<0.1	2	<0.1	<0.1	0	75	81
Benzo(b,j+k)fluoranthene	µg/L	0.2	Org-022/025	<0.2	2	<0.2	<0.2	0	[NT]	[NT]
Benzo(a)pyrene	µg/L	0.1	Org-022/025	<0.1	2	<0.1	<0.1	0	100	111
Indeno(1,2,3-c,d)pyrene	µg/L	0.1	Org-022/025	<0.1	2	<0.1	<0.1	0	[NT]	[NT]
Dibenzo(a,h)anthracene	µg/L	0.1	Org-022/025	<0.1	2	<0.1	<0.1	0	[NT]	[NT]
Benzo(g,h,i)perylene	µg/L	0.1	Org-022/025	<0.1	2	<0.1	<0.1	0	[NT]	[NT]
Surrogate p-Terphenyl-d14	%		Org-022/025	88	2	94	90	4	87	102

QUALITY CONTROL: Total Phenolics in Water						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	390304-2
Date extracted	-			12/09/2025	1	12/09/2025	12/09/2025		12/09/2025	12/09/2025
Date analysed	-			12/09/2025	1	12/09/2025	12/09/2025		12/09/2025	12/09/2025
Total Phenolics (as Phenol)	mg/L	0.05	Inorg-031	<0.05	1	<0.05	<0.05	0	96	95

QUALITY CONTROL: OCPs in Water - Trace Level					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date extracted	-			09/09/2025	[NT]	[NT]	[NT]	[NT]	09/09/2025	[NT]
Date analysed	-			12/09/2025	[NT]	[NT]	[NT]	[NT]	12/09/2025	[NT]
alpha-BHC	µg/L	0.001	Org-022/025	<0.001	[NT]	[NT]	[NT]	[NT]	88	[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]	88	[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]	87	[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]	88	[NT]
Heptachlor Epoxide	µg/L	0.001	Org-022/025	<0.001	[NT]	[NT]	[NT]	[NT]	94	[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]	83	[NT]
Dieldrin	µg/L	0.001	Org-022/025	<0.001	[NT]	[NT]	[NT]	[NT]	93	[NT]
Endrin	µg/L	0.001	Org-022/025	<0.001	[NT]	[NT]	[NT]	[NT]	90	[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]	99	[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]	[NT]	[NT]
Endosulfan Sulphate	µg/L	0.001	Org-022/025	<0.001	[NT]	[NT]	[NT]	[NT]	87	[NT]
Methoxychlor	µg/L	0.001	Org-022/025	<0.001	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Surrogate 4-Chloro-3-NBTF	%		Org-022/025	75	[NT]	[NT]	[NT]	[NT]	75	[NT]

QUALITY CONTROL: OP in water LL ANZECCF/ADWG					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date extracted	-			09/09/2025	[NT]	[NT]	[NT]	[NT]	09/09/2025	[NT]
Date analysed	-			12/09/2025	[NT]	[NT]	[NT]	[NT]	12/09/2025	[NT]
Dichlorvos	µg/L	0.05	Org-022/025	<0.05	[NT]	[NT]	[NT]	[NT]	104	[NT]
Mevinphos	µg/L	0.05	Org-022/025	<0.05	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Phorate	µg/L	0.05	Org-022/025	<0.05	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Dimethoate	µg/L	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Diazinon	µg/L	0.01	Org-022/025	<0.01	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Disulfoton	µg/L	0.05	Org-022/025	<0.05	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Chlorpyriphos-methyl	µg/L	0.05	Org-022/025	<0.05	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Parathion-Methyl	µg/L	0.05	Org-022/025	<0.05	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Ronnel	µg/L	0.05	Org-022/025	<0.05	[NT]	[NT]	[NT]	[NT]	97	[NT]
Fenitrothion	µg/L	0.05	Org-022/025	<0.05	[NT]	[NT]	[NT]	[NT]	109	[NT]
Malathion	µg/L	0.05	Org-022/025	<0.05	[NT]	[NT]	[NT]	[NT]	114	[NT]
Chlorpyriphos	µg/L	0.009	Org-022/025	<0.009	[NT]	[NT]	[NT]	[NT]	103	[NT]
Fenthion	µg/L	0.05	Org-022/025	<0.05	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Parathion	µg/L	0.004	Org-022/025	<0.004	[NT]	[NT]	[NT]	[NT]	101	[NT]
Bromophos ethyl	µg/L	0.05	Org-022/025	<0.05	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Methidathion	µg/L	0.05	Org-022/025	<0.05	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Fenamiphos	µg/L	0.05	Org-022/025	<0.05	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Ethion	µg/L	0.05	Org-022/025	<0.05	[NT]	[NT]	[NT]	[NT]	107	[NT]
Phosalone	µg/L	0.05	Org-022/025	<0.05	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Azinphos-methyl (Guthion)	µg/L	0.02	Org-022/025	<0.02	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Coumaphos	µg/L	0.05	Org-022/025	<0.05	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Surrogate 4-Chloro-3-NBTF	%		Org-022/025	75	[NT]	[NT]	[NT]	[NT]	75	[NT]

QUALITY CONTROL: PCBs in Water - Trace Level					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date extracted	-			09/09/2025	[NT]	[NT]	[NT]	[NT]	09/09/2025	[NT]
Date analysed	-			12/09/2025	[NT]	[NT]	[NT]	[NT]	12/09/2025	[NT]
Aroclor 1016	µg/L	0.01	Org-021/022/025	<0.01	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Aroclor 1221	µg/L	0.01	Org-021/022/025	<0.01	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Aroclor 1232	µg/L	0.01	Org-021/022/025	<0.01	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Aroclor 1242	µg/L	0.01	Org-021/022/025	<0.01	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Aroclor 1248	µg/L	0.01	Org-021/022/025	<0.01	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Aroclor 1254	µg/L	0.01	Org-021/022/025	<0.01	[NT]	[NT]	[NT]	[NT]	89	[NT]
Aroclor 1260	µg/L	0.01	Org-021/022/025	<0.01	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Surrogate 2-Fluorobiphenyl	%		Org-021/022/025	70	[NT]	[NT]	[NT]	[NT]	74	[NT]

QUALITY CONTROL: HM in water - dissolved						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W3	390304-2
Date prepared	-			09/09/2025	1	09/09/2025	09/09/2025		09/09/2025	09/09/2025
Date analysed	-			09/09/2025	1	09/09/2025	09/09/2025		09/09/2025	09/09/2025
Arsenic-Dissolved	µg/L	1	Metals-022	<1	1	2	2	0	96	108
Cadmium-Dissolved	µg/L	0.1	Metals-022	<0.1	1	0.8	0.7	13	96	97
Chromium-Dissolved	µg/L	1	Metals-022	<1	1	1	1	0	94	110
Copper-Dissolved	µg/L	1	Metals-022	<1	1	<1	<1	0	96	103
Lead-Dissolved	µg/L	1	Metals-022	<1	1	<1	<1	0	102	94
Mercury-Dissolved	µg/L	0.05	Metals-021	<0.05	1	<0.05	<0.05	0	98	98
Nickel-Dissolved	µg/L	1	Metals-022	<1	1	8	9	12	95	104
Zinc-Dissolved	µg/L	1	Metals-022	<1	1	12	13	8	96	101

QUALITY CONTROL: Metals in Waters - Acid extractable						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date prepared	-			09/09/2025	1	09/09/2025	09/09/2025		09/09/2025	[NT]
Date analysed	-			09/09/2025	1	09/09/2025	09/09/2025		09/09/2025	[NT]
Phosphorus - Total	mg/L	0.05	Metals-020	<0.05	1	0.06	0.05	18	94	[NT]

QUALITY CONTROL: Miscellaneous Inorganics						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date prepared	-			08/09/2025	1	08/09/2025	08/09/2025		08/09/2025	[NT]
Date analysed	-			08/09/2025	1	08/09/2025	08/09/2025		08/09/2025	[NT]
pH	pH Units		Inorg-001	[NT]	1	6.9	[NT]		100	[NT]
Electrical Conductivity	µS/cm	1	Inorg-002	<1	1	6800	[NT]		101	[NT]
Total Dissolved Solids (grav)	mg/L	5	Inorg-018	<5	1	3800	3800	0	100	[NT]
Total Suspended Solids	mg/L	5	Inorg-019	<5	1	18	[NT]		96	[NT]
Ammonia as N in water	mg/L	0.005	Inorg-057	<0.005	1	0.30	[NT]		103	[NT]
Nitrate as N in water	mg/L	0.005	Inorg-055	<0.005	1	<0.005	[NT]		100	[NT]
Nitrite as N in water	mg/L	0.005	Inorg-055	<0.005	1	<0.005	[NT]		103	[NT]
Total Nitrogen in water	mg/L	0.1	Inorg-055/062/127	<0.1	1	0.4	[NT]		87	[NT]
TKN in water	mg/L	0.1	Inorg-062	<0.1	1	0.4	[NT]		[NT]	[NT]
Organic Nitrogen as N	mg/L	0.2	Inorg-055/062/127	<0.2	1	<0.2	[NT]		[NT]	[NT]
NOx as N in water	mg/L	0.005	Inorg-055	<0.005	1	<0.005	[NT]		100	[NT]
Phosphate as P in water	mg/L	0.005	Inorg-060	<0.005	1	0.02	[NT]		111	[NT]
Dissolved Oxygen*	mg/L	0.1	Inorg-112	<0.1	1	6.8	[NT]		[NT]	[NT]

QUALITY CONTROL: Miscellaneous Inorganics						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-			[NT]	2	08/09/2025	08/09/2025		[NT]	[NT]
Date analysed	-			[NT]	2	08/09/2025	08/09/2025		[NT]	[NT]
Total Dissolved Solids (grav)	mg/L	5	Inorg-018	[NT]	2	6200	[NT]		[NT]	[NT]
Total Suspended Solids	mg/L	5	Inorg-019	[NT]	2	41	[NT]		[NT]	[NT]
Ammonia as N in water	mg/L	0.005	Inorg-057	[NT]	2	1.1	[NT]		[NT]	[NT]
Nitrate as N in water	mg/L	0.005	Inorg-055	[NT]	2	<0.005	[NT]		[NT]	[NT]
Nitrite as N in water	mg/L	0.005	Inorg-055	[NT]	2	<0.005	[NT]		[NT]	[NT]
Total Nitrogen in water	mg/L	0.1	Inorg-055/062/127	[NT]	2	1.2	1.2	0	[NT]	[NT]
TKN in water	mg/L	0.1	Inorg-062	[NT]	2	1.2	[NT]		[NT]	[NT]
Organic Nitrogen as N	mg/L	0.2	Inorg-055/062/127	[NT]	2	<0.2	[NT]		[NT]	[NT]
NOx as N in water	mg/L	0.005	Inorg-055	[NT]	2	<0.005	[NT]		[NT]	[NT]
Phosphate as P in water	mg/L	0.005	Inorg-060	[NT]	2	0.02	[NT]		[NT]	[NT]

QUALITY CONTROL: Ion Balance						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date prepared	-			08/09/2025	1	08/09/2025	08/09/2025		08/09/2025	[NT]
Date analysed	-			08/09/2025	1	08/09/2025	08/09/2025		08/09/2025	[NT]
Calcium - Dissolved	mg/L	0.5	Metals-020	<0.5	1	56	55	2	91	[NT]
Potassium - Dissolved	mg/L	0.5	Metals-020	<0.5	1	35	34	3	100	[NT]
Sodium - Dissolved	mg/L	0.5	Metals-020	<0.5	1	940	940	0	81	[NT]
Magnesium - Dissolved	mg/L	0.5	Metals-020	<0.5	1	140	130	7	93	[NT]
Hardness (calc) equivalent $CaCO_3$	mg/L	3	Metals-020	[NT]	1	710	690	3	[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	760	[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	760	[NT]		107	[NT]
Sulphate, SO4	mg/L	1	Inorg-081	<1	1	170	[NT]		99	[NT]
Chloride, Cl	mg/L	1	Inorg-081	<1	1	1500	[NT]		89	[NT]
Ionic Balance	%		Inorg-040	[NT]	1	-4.0	[NT]		[NT]	[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.

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.

Air volumes are typically provided by customers (often as flow rate(s) and sampling time(s) and/or simply volumes) sampled or exposure times (determines 'volume' passive badges are exposed to)). Hence in such circumstances the volume measurement is inevitably not covered by Envirolab's NATA accreditation. An exception may occur where Envirolab Newcastle does the sampling where accreditation exists for certain types of sampling and hence volume determination(s). Note air volumes are often used to determine concentrations for dust and/or analyses on filters, sorbents and in impingers. For canister sampling, the air volume is covered by Envirolab's NATA accreditation.

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.

For Dust Deposit Gauge (DDG) analysis the sampling, sampling period and funnel exposure area do not fall under Envirolab's NATA accreditation (unless the Newcastle laboratory where responsible for the sampling), hence the annotation on the DDG units of reporting.

Urine Analysis - The BEI values listed are taken from the 2022 edition of "TLVs and BEIs Threshold Limits" by ACGIH.

Report Comments

Total metals: no unfiltered, preserved sample was received, therefore analysis was conducted from the unpreserved sample bottle.
Note: there is a possibility some elements may be underestimated.

Micro analysed by Sonic, report no W2520309.