
Specialist Advice

**Report on Groundwater Impact
Assessment**

Proposed Mixed Use Development

20-22 Atchison Street, St Leonards, NSW

Prepared for Setia Sydney Pty Ltd

Project 73262.05

18 September 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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Report on Groundwater Impact Assessment Proposed Mixed Use Development 20-22 Atchison Street, St Leonards, NSW

1. Introduction

This specialist advice report prepared by Douglas Partners Pty Ltd (Douglas) presents the results of a groundwater impact assessment undertaken for a proposed mixed use development at 20-22 Atchison Street, St Leonards, NSW (the site).

This report has been prepared to support a State Significant Development Application (SSDA) SSD- 87486461 for the site at 20-22 Atchison Street, St Leonards (the site).

The Minister for Planning, or their delegate, is the consent authority for the SSDA and this application is lodged with the NSW Department of Planning, Housing and Infrastructure (DPHI) for assessment.

This report has been prepared in response to the requirements contained within the Secretary's Environmental Assessment Requirements (SEARs) dated 9 July 2025 (SSD-87486461). Specifically, this report has been prepared to respond to the SEARs in Tabel 1.

Table 1: Planning Secretary's Environmental Assessment Requirements

Secretary's Environmental Assessment Requirements	Refer Report Section
12. Groundwater Impact Assessment	Section 9

Additionally, this document aims to assist in obtaining the necessary approvals for the disposal of extracted groundwater, where applicable, and the approval of a drained basement from the Department of Climate Change, Energy, the Environment and Water (DCCEEW).

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

This Groundwater Impact Assessment (GIA) is based on the findings of site-specific investigations and monitoring, including:

- Geotechnical investigation (Ref. 73262.05.R.001.Rev0, dated 15 September 2025) [Douglas GI 2025]; and
- Detailed (contamination) site investigation (Ref. 73262.06, Dated 17 September 2025) [Douglas DSI 2025].

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 between approximately RL 72.2 mAHD and RL 79.3 mAHD.

- The depth of the proposed excavation is approximately 21 m.
- The basement is intended to be drained.
- The extracted groundwater will be disposed of via stormwater.

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

2. Proposed development

2.1 Proposed development and construction

Based on the provided architectural drawings (Ref. 223107.00, dated 1 September 2025, by COX), it is understood that the lowest (fifth) basement level is designed at RL 71.85 m AHD. It is estimated that bulk excavations of up to 21 m may be required for the construction of the proposed five level basement. Deeper localised excavations will be required for the lift pit and service trenches. The proposed basement is shown to extend to the site boundaries.

It is noted that the site is partially located over the second protection reserve of Sydney Metro, with a minimum set back of about 12.1 m from the first protection reserve approximately, as shown in Figure 1 below.

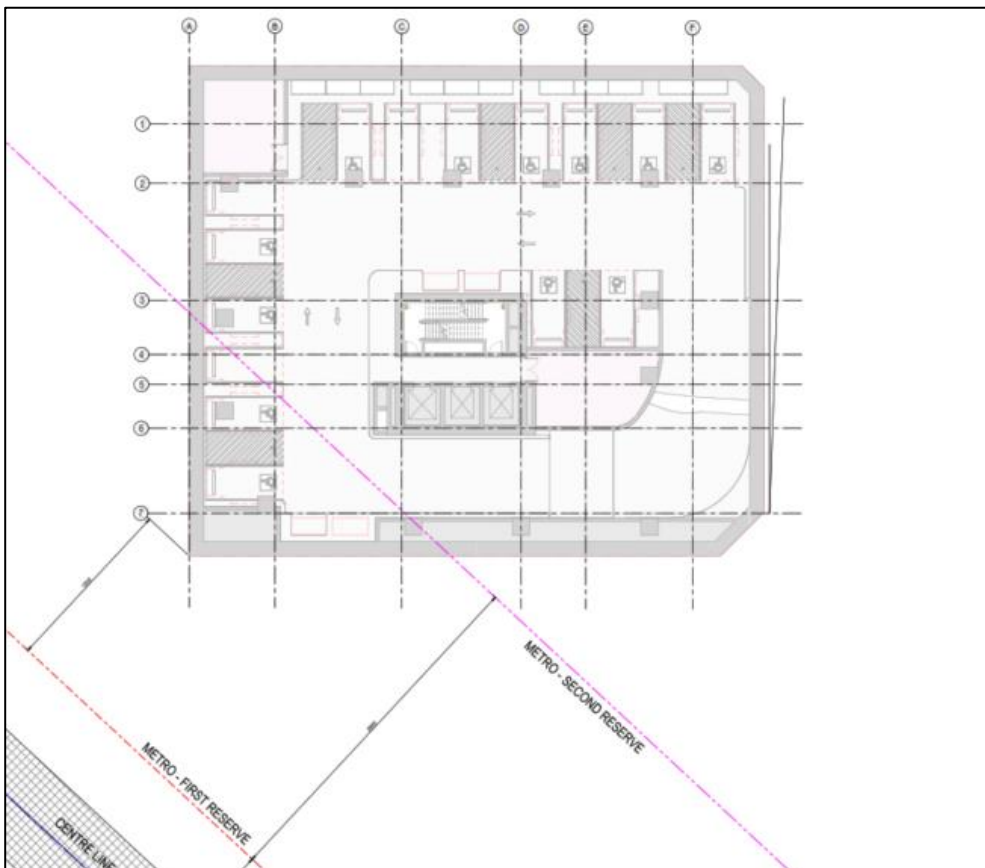


Figure 1: Approximate location of the site in relation to Sydney Metro line and protection reserves (ref: 131713_Atchison St_Metro_Tunnels - Meinhardt)

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, pending water quality testing results and relevant approvals.

3. Site description

The site occupies a strategic location in the St Leonards Crows Nest precinct and is in close proximity to the St Leonards railway station and Crows Nest Metro station and town centre.

The site is located at 20-22 Atchison Street, St Leonards. The site has a primary frontage to Atchison Street to the south, Mitchell Street to the east and Atchison Lane to the north. The site is located within the North Sydney Local Government Area (LGA) and is located approximately 4.5 km north of the Sydney CBD.

The site comprises two allotments described as Lot 1 in DP740017 and Lot 120 DP564606 with a total area of 1374.4 sqm. The site is located near the crest of a high ridgeline point, with Mitchell Street falling in elevation towards the north of the site and Atchison Street falling towards the east. The site location is outlined in Figure 2.



Figure 2: Site Location (red)

Existing development on the site includes:

- 22 Atchison Street is currently occupied by six storey commercial office building and 18-20 Atchison Street comprises a three-storey commercial building which is currently vacant. The buildings were constructed in the 1980s and have a primary frontage to Atchison Street and secondary vehicular access from Atchison Lane.
- 22 Atchison Street accommodates additional vehicular access from Mitchell Street.

Ground surface levels in the general surrounds slope from the south-eastern corner of site boundary, at approximately RL 92 m AHD to the north-western corner of site boundary, at approximately RL 88 m. The finished level of the existing lower ground carpark at the site is approximated to be between RL 87.8 m and RL 88.8 m AHD from the supplied site survey plans.

Reference to the supplied information by the client, indicates that the Sydney Metro Tunnel runs close to the southeastern corner of the site.

The closest natural water bodies to the site are Berrys Creek and Flat Rock Creek, located approximately 700 m and 950 m to the southwest and northeast of the site respectively.

4. Project Description

The application seeks development consent for an SSSA which will facilitate the redevelopment of the site for a shop top housing development using the recently introduced provisions under the Transit Oriented Development (TOD) reforms.

The project seeks consent for:

- Demolition of existing buildings on site and tree removal.
- Construction of a 40-storey shop top housing development comprising:
- Consistent Messaging Text - 20-22 Atchison Street, St Leonards.
- 4-storey mixed-use (commercial, residential and retail) podium with a retail tenancy at ground level (Atchison Street frontage).
- 36 levels of residential apartments and residential amenities within the tower.
- Landscaping and public amenities along the Mitchell Street eastern elevation at ground level.
- Consolidated vehicular and loading access from Atchison Lane.
- 5 storey basement accommodating car, bicycle and motorcycle parking, storage, plant and end of trip facilities (EOTF) for the commercial component.
- Amalgamation of Lot 1 in DP740017 and Lot 120 DP564606.
- 10% of residential floor space to be used for affordable housing via monetary contribution.
- Storage areas, utilities and service provision.

Refer to Architectural Plans prepared by Cox Architecture appended to the Environmental Impact Statement.

5. Hydrogeological setting

5.1 Topography

The site is located near the crest of a northwest facing hillside that slopes down toward a gully that naturally drains into Flat Rock Creek located 950 m away and ultimately finishes in Long Bay to the northeast.

5.2 Climate

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

5.3 Geology

Reference to the Sydney 1:100,000 Geological Series Sheet indicates that the site is underlain by the Ashfield Shale formation, typically consisting of black to dark grey shale and laminite of Triassic age. This is underlain by Hawkesbury Sandstone of the Triassic Period which typically consists of medium to coarse grained quartz sandstone with minor siltstone and laminite lenses.

The Mittagong formation is a transitional unit often found between the Ashfield Shale and Hawkesbury Sandstone and typically includes laminite and fine-grained sandstone of variable strength. Whilst not distinctly shown on the geological mapping, it is known to occur in this area.

5.4 Groundwater receptors

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

A groundwater bore search of the WaterNSW and Douglas database indicates a registered deep bore located at approximately 400 m to the north of the site (GW108224). The recorded measurements from the well in 2006, shows standing water level at 35 m, (inferred RL 39 m).

5.5 Acid sulfate soils and salinity

The 1:25,000 Acid Sulfate Soil Risk Map (1994-1998, NSW Department of Environment and Climate Change) indicates that the site is not located within an area with known potential for acid sulfate soils (ASS).

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

6. Investigation results

6.1 Geotechnical

A geotechnical investigation was undertaken by Douglas [Douglas GI 2025] which included nine boreholes (BH1 to BH9). The test locations are shown in Drawing 1 (Appendix B).

The interpreted model can be summarised as follows:

- **Fill:** Typically, granular fill, with a deeper clayey fill in BH4 and BH6; underlain by
- **Residual Soil:** Residual clay and extremely weathered siltstone in the form of silty clay, mostly hard; underlain by
- **Bedrock:** Highly to moderately weathered siltstone (Ashfield Shale), very low to low strength and fractured on first contact and increasing with depth to moderately weathered to fresh, medium to high strength and slightly fractured; underlain by

Slightly weathered to fresh, medium to high and high strength laminite, slightly fractured (Mittagong Formation); underlain by

Medium to high and high strength sandstone (Hawkesbury Sandstone), fresh, slightly fractured to unbroken.

Three monitoring wells were installed to depths between 15 m (BH2 and BH3) and 18 m (BH1) which included three data loggers for long term groundwater level monitoring within each well to comply with DCCEE minimum requirements.

6.2 Groundwater

Table 2 summarises water level measurements taken for the groundwater wells at the site between the period of 4 August and 3 September 2025 which is approximately 4 weeks.

Table 2: Current groundwater level measurements in wells

Borehole	Surface Level (m AHD)	Date Measured	Water Depth (m)	Water Level (m AHD)
BH1	88.8	4 August 2025	15.5	73.3
		11 August 2025	12.5	76.3
		28 August 2025	16.6	72.2
		3 September 2025	15.4	73.4
BH2	88.6	11 August 2025	10.0	78.6
		28 August 2025	9.3	79.3
		3 September 2025	9.4	79.2
BH3	88.8	11 August 2025	14.0	74.8
		3 September 2025	14.2	74.6

It should be noted that at the time of writing this report a groundwater monitoring period of about four weeks (with 3 data loggers) has been completed. Therefore, only the manual dip readings have been presented. After three months of groundwater monitoring data has been collected, this report will be updated.

6.2.1 Hydraulic Conductivity

Falling head hydraulic conductivity tests were carried out within all monitoring wells (BH1 to BH3). Well installation details are included on the borehole logs in Appendix C.

Hydraulic conductivity tests were analysed using Hvorslev (1951) solution for slug testing interpretation. The permeability testing results are summarised in Table 3. The measured hydraulic conductivity values are similar to typical values commonly seen within similar rock formations in Sydney (Pells et. al., 2019, Classification of Sandstones and Shales in the Sydney Region: A Forty Year Review).

Table 3: Summary of interpreted hydraulic conductivity results

Borehole	Screen Depth (m bgl)	Test Type	Material Type over Screen	Date	Hydraulic Conductivity, k (m/sec)
BH1	15 - 18	Falling Head	Laminite	05 August 25	9.7×10^{-8}
BH2	9 - 15	Falling Head	Siltstone and Sandstone	05 August 25	4.9×10^{-8}
BH3	9 - 15	Falling Head	Siltstone and Sandstone	05 August 25	1.3×10^{-7}
Geometric Mean					8.5×10^{-8}

6.2.2 Groundwater quality

Douglas has undertaken preliminary groundwater quality testing as part of the detailed site (contamination) investigation [Douglas DSI 2025]. Groundwater quality testing was undertaken for Heavy metals - As, Pb, Cd, Cr, Cu, Hg, Ni and Zn, Total Recoverable Hydrocarbons (TRH), Benzene, Toluene, Ethylbenzene, Xylene and Naphthalene (BTEXN), Polycyclic aromatic hydrocarbons (PAH), Polychlorinated biphenyls (PCB), Organochlorine pesticides (OCP), Organophosphate pesticides (OPP), per-and polyfluoroalkyl substances (PFAS) and Volatile organic compounds (VOC).

All results were below the adopted site assessment criteria (SAC), with the exception of:

- Copper in BH1 and its replicate (8 µg/L) and BH2 (2 µg/L) which exceeded the adopted SAC (1.4 µg/L);
- Nickel in BH1 and its replicate (46-48 µg/L) and BH2 (24 µg/L) which exceeded the adopted SAC (11 µg/L);
- Zinc in BH1 and its replicate (46-56 µg/L) and BH2 (79 µg/L) and BH3 (9 µg/L) which exceeded the adopted SAC (8 µg/L);

- Dieldrin (an organochlorine pesticide) in sample BH1 (0.017 µg/L) in BH1 which exceeded the SAC of 0.01 µg/L. Dieldrin was below the laboratory detection limit and SAC in BH2; and
- PFOS in sample BH1 (0.04 µg/L) which exceeded the SAC of 0.00023 µg/L. PFOS did not exceed the SAC in BH2

Note: the assessment criteria adopted for the contamination investigation are not dewatering discharge criteria. Dewatering discharge criteria (as outlined in Section 10.3.1) must consider the method of dewatering, volume of water and the discharge environment.

Low levels of TRH were detected in BH2 (F2 (>C10-C16 less Naphthalene, 180 µg/L) and BH1 (F3 (>C16-C34), 160 µg/L). Based on the concentration of volatile hydrocarbons (F1 ((C6-C10)-BTEX), BTEX, PAH and VOC) which were all below the detection limits it is not considered likely that the detected TRH is associated with petroleum hydrocarbons or other volatile compounds that present a risk of vapour intrusion into the proposed basement. Therefore, the low levels of TRH are not considered to be significant and do not require remediation or additional groundwater / vapour intrusion controls in the proposed basement.

Based on our experience in the area, the concentrations of metals in groundwater are considered likely to be attributed to the background concentrations that would be associated with the mineralogy and urban runoff.

With regards to the dieldrin (OCP) and PFOS detected in BH1 it is considered possible that the elevated concentrations may be attributed to fouling / sedimentation from surface impacts in the groundwater well in and therefore may not be related to on-site sources of contamination. Douglas also noted that:

- No dieldrin or elevated concentrations of PFOS were recorded in soils at the site;
- the proposed development will require bulk excavation for basement which would require mass soil and rock removal from the site and dewatering and therefore and likely removal of any source mass (if present); and
- the nearest likely surface water receptor is 700 to 950 m away from the site (depending on the direction of groundwater flow) and very unlikely to be impacted by groundwater from the site; and

However, testing of OCP and PFAS was limited to two of three locations during the contamination investigation. Therefore, it was recommended that a supplementary round of groundwater well development and testing be undertaken to confirm the concentrations of OCP, PFAS and TRH in groundwater and dewatering requirements for basement construction (noting the recorded concentrations indicate a potential requirement for treatment of these contaminants, and metals, prior to disposal of extracted groundwater).

7. Conceptual hydrogeological model

The site is predominantly underlain by Ashfield Shale, Mittagong Formation and Hawkesbury Sandstone. The topography of the area generally grades down toward the northwest into a gully feature that extends into Flat Rock Creek and eventually finishes in Long Bay to the northeast. The groundwater levels recorded within the monitoring wells indicate that the groundwater flow is typically toward the northwest.

The recorded groundwater levels were observed to be wholly within the bedrock profile.

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

It should be noted that groundwater levels are transient and fluctuate with climatic variations and other factors (e.g. adjacent excavations, pumping). Therefore, the water levels will temporarily rise during periods of heavy or prolonged rainfall and fall during dry periods. Groundwater levels can also be affected by the amount of pumping occurring in groundwater extraction bores in the aquifer although these have not been identified in the area.

8. Groundwater inflow assessment

8.1 Numerical modelling methodology

A 2-dimensional (2D) numerical model was developed for the proposed excavation using SEEP/W, a component of GeoStudio 2023.1.2 R2 (version 23.1.2.11) developed by GEOSLOPE International Ltd. Steady state and transient analysis were undertaken to assess the potential dewatering rates and volumes during excavations works and for a long-term drained basement.

Douglas selected a single vertical cross-section in a roughly north to south direction, intercepting the basement footprint through the centre of the excavation, as shown in Figure 3. The ground surrounding the proposed basement was simulated as being a single-layered numerical model to represent the general subsurface conditions to allow the vertical flow components to be simulated more accurately.

Bulk Excavation Level (BEL) for the model was assumed to be at RL 71.5 m AHD, which is 0.35 m below FFL of the lowest basement.

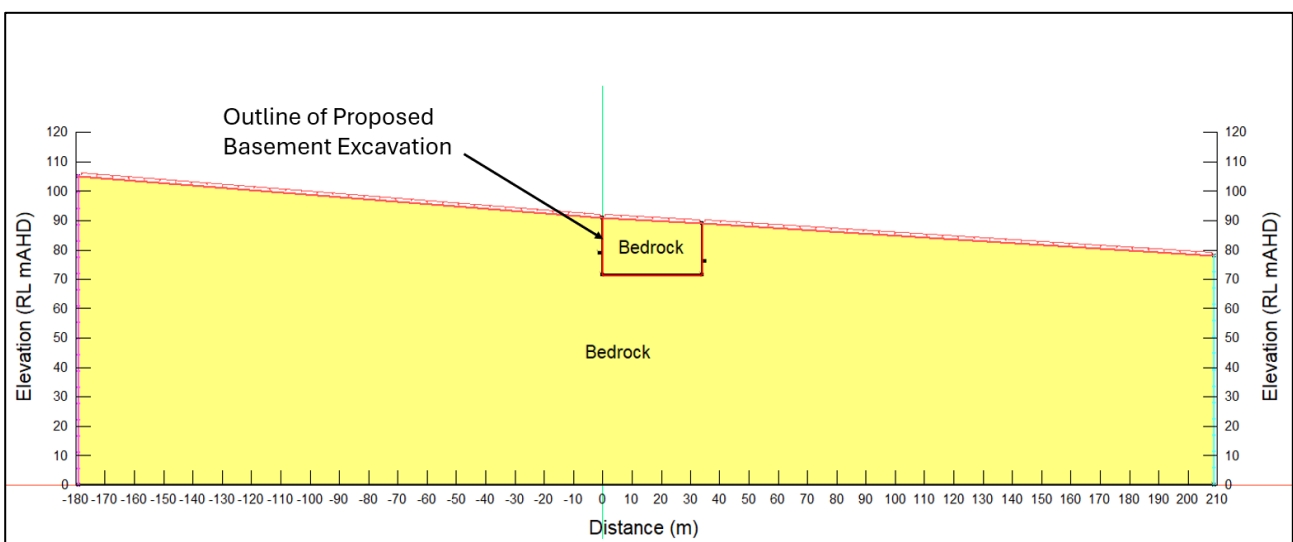


Figure 3: SeepW model of site showing layer strata and boundary conditions

As the groundwater was observed only within the bedrock profile, the surficial soils were excluded from the model and considered negligible for the purpose of this assessment. The horizontal permeability value adopted for the bedrock (Table 4) were taken as the geometric mean of the testing results for the bedrock.

8.1.1 Model layers

The hydrogeological units were simulated as a single layer. Adopted hydraulic properties (base case) are presented in Table 4. Parameters were selected based on the Geometric Mean result of the hydraulic conductivity testing (Section 6.2.1), ranges of values documented in the available literature for similar lithologies (e.g. Hoek & Bray 1981 and more recently Pells 2019) and previous experience with similar materials.

Table 4: Summary of material parameters for groundwater inflow analysis

Geological Unit	Saturated Kh (m/s)	Anisotropy Ratio (Kv/Kh)	Residual Water Content (%)	Saturated Volumetric Water Content (%)	Material Model Adopted
Bedrock	8.5×10^{-8}	0.3	7	20	Unsaturated / saturated

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

8.2 Model calibration

Groundwater levels were established in the model by setting constant head conditions at the lateral extents and applying a surface flux along the upgradient ground surface. The model was calibrated to roughly match the hydraulic gradient (effective total head) observed within the groundwater monitoring. The initial groundwater head levels prior to dewater are presented in Figure 4 below.

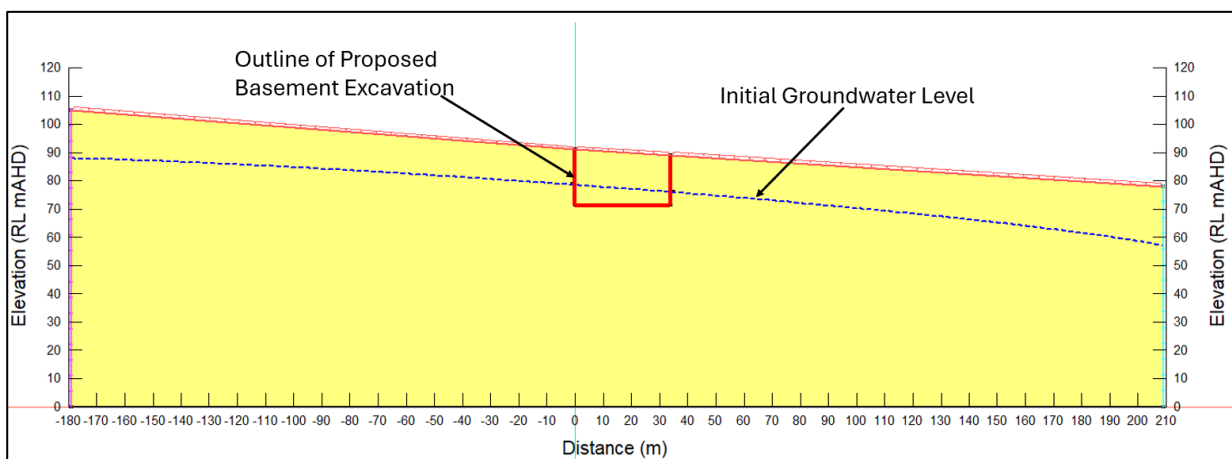


Figure 4: Simulation of initial groundwater levels prior to dewatering

An infiltration flux rate of $7.6 \times 10^{-10} \text{ m}^3/\text{s}/\text{m}^2$, which is 2% of an average annual rainfall of 1.2 m in Sydney, was adopted to simulate infiltration and seepage from rainfall and other potential sources (i.e. leaking services) to the model surface.

A 'free flow' boundary or 'drained' boundary condition were applied to the base and the sides of the basement excavation to model a 'dry' excavation which will be required during construction.

8.3 Sensitivity analysis

A sensitivity case was modelled where a horizontal permeability of the bedrock was increased to 5 times of the base case value.

8.4 Groundwater modelling results

Groundwater inflow into the excavation was assessed adopting steady-state analysis to simulate dewatering during continuous, long-term dewatering (drained basement) and assumes the excavation and dewatering to target depth is instantaneous.

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

The SEEP/W results are based on a two-dimensional model, which assumes the excavation is much longer than its width. The methods proposed by Kavvas et al (1992), shown in Equation 1, were used to adjust the 2D results to allow for the actual length to width ratio of the proposed basement. For the assessment, a width of 34 m and length of 40 m was adopted.

Equation 1

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

where: q_o is the predicted 'realistic' inflow rate

q is the inflow rate from 2D modelling

B is the width of the excavation

L is the length of the excavation

8.4.1 Predicted groundwater inflow

The results from the inflow analysis summarised in the below Table 5 present the estimated annual inflow rates of groundwater into the excavation during construction and in the long term.

Table 5: Summary of groundwater inflow analysis results

Case	Inflow rate		Annual Inflow (ML/year)
	(m ³ / day)	(L / min)	
Base Case	1.0	0.7	0.4
Sensitivity Case	6.0	4.2	2.2

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.

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.

8.5 Drawdown and Settlement

Groundwater levels immediately outside the basement excavation are expected to be drawdown to BEL and by up to approximately 3 m at a distance of 40 m (upstream) from the excavation as shown in 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.

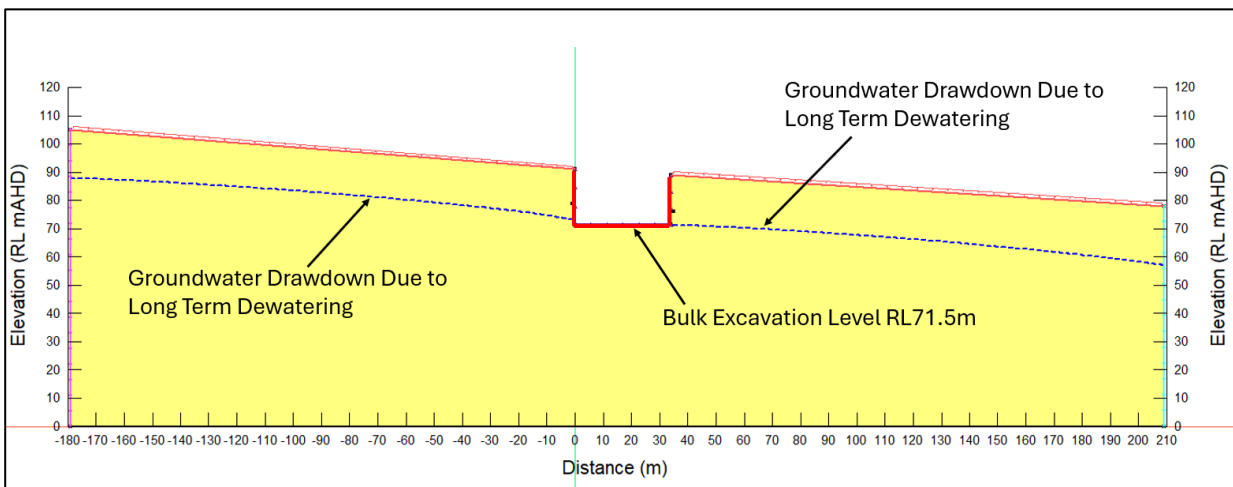


Figure 5: Simulation of excavation with drawdown

8.6 Review of hydrogeological concept model

The predicted inflows are less than 3 ML (estimates only and variation must be expected). Actual inflows will only be known at the time of excavation and dewatering. Further analysis would be required following the conclusion of long-term groundwater monitoring. The model will need to be reviewed when the excavation works commence and the actual inflows are known.

9. Impact assessment

9.1 Aquifer Interference Policy Assessment

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.

9.2 Environmental risk assessment

An assessment of the potential effects of dewatering on neighbouring properties and groundwater receptors has been summarised in Table 6.

Table 6: Assessment of potential effects of dewatering

Item	Comment
Impacts on potential GDEs	There are no GDEs within 500 m of the site (Section 5.4).
Water supply losses by neighbouring groundwater users	One water bore was located within 500 m of the site (Section 5.4). Impacts at the water bore are predicted to be less than 2 m as per the AIP minimal impact considerations.
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	Based on the available testing results (refer to Section 6.2.2), the extracted groundwater will require treatment for metals and suspended solids (via conventional methods) prior to disposal to stormwater to manage potential impact on the receiving water body. OCP (dieldrin) and PFOS were detected in one well (BH1) and low concentrations of TRH were also detected however a supplementary round

Item	Comment
	<p>of groundwater sampling is recommended to confirm if this result is truly representative of groundwater conditions or anomalous and if treatment of these contaminants is required prior to discharge.</p> <p>The site topography indicates that the natural groundwater flow may drain to either Berrys Creek, located approximately 700 m southwest of the site or Flat Rock Creek which is located 950 m to the northeast .</p> <p>Whilst the DSI indicates a history of potentially contaminating activities around the site, the potential for impact on migration of contaminated groundwater (if any) greater than 40 m from the site is expected to be negligible. Furthermore, no beneficial groundwater use or sensitive receptors have been identified within 350 m of the site.</p>
Contamination risk	<p>The contamination risk for the dewatering comprises the potential for untreated groundwater discharge into an aquatic ecosystem if not appropriately treated prior to discharge.</p> <p>Controls to mitigate potential contamination impacts from discharge of the extracted groundwater are provided in Section 10 and include treatment and monitoring of the extracted water prior to discharge.</p>
ASS	<p><u>On-site</u></p> <p>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.</p> <p><u>Off-site</u></p> <p>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.</p> <p>The predicted groundwater drawdown (Section 8.5) indicates that the drawdown will be in bedrock and that the 1 m drawdown level will not extend to lands below 5 m AHD. As such, no management is considered warranted for off-site ASS.</p>
Salinity	<p>Salinity is not a concern and thus further assessment, or management is not required.</p>

Based on the findings of this assessment, the impacts from dewatering for the proposed development are below the minimum impact requirements outlined in the AIP and therefore, the impact are considered “low to negligible”.

10. Recommended management strategy

10.1 General

Dewatering will be required during the construction of the project. 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 Sections 8 and 9, 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.

10.2 Groundwater inflow control

10.2.1 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 of joints or ground improvement;
- Groundwater level and inflow monitoring should be undertaken during construction to:
- Validate inflow predictions and performance of control measures;
- Ensure drawdown remains within acceptable limits to prevent environmental or structural impacts; and
- Implement trigger contingency responses if unexpected inflow or impacts occur.

More information on recommended monitoring is provided in Section 10.3.

10.2.2 Trigger levels

Control measures will be monitored against two key thresholds:

- Volume trigger: inflow exceeds the maximum predicted by sensitivity modelling (Section 8);
or
- Drawdown trigger: groundwater drawdown exceeds 0.5 m (beyond expected values) at any monitoring well.

If either trigger is reached, dewatering and excavation must be halted and a mitigation strategy (e.g. grouting) be implemented before work resumes or further assessment undertaken to justify the exceedance.

10.3 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 6.2.2 and the environmental risk assessment conducted in Section 9.2 it is likely that some form of treatment of groundwater will be required prior to discharge

10.3.1 Discharge criteria

The adopted discharge criteria are based on the stormwater system discharging potentially to Berrys Creek located approximately 700 m southwest or Flat Rock Creek which is located 950 m to the northeast. The stormwater layout should be reviewed to confirm if the initial discharge point is to a fresh or marine environment. At this stage it has been assumed that stormwater will discharge to a freshwater environment in Berrys Creek or Flat Rock Creek water body. 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; and
- Subject to the outcome of the supplementary groundwater testing, if PFAS is detected above the 95% LOP, HEPA PFAS National Environmental Management Plan (NEMP) Version 3.0 (HEPA 2025), with a 95% level of protection (LOP) for freshwater ecosystems.

The discharge criteria are subject to the approval of the Council or other consent authority responsible for the receiving water body and stormwater network. If the discharge location is determined to be brackish or marine environment in Parramatta River then the LOP for marine ecosystems shall be adopted.

10.3.2 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 DMP prior to construction.

10.3.3 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.

10.3.3.1 **Baseline monitoring**

It is considered that the following additional baseline water quality testing is required to inform treatment / management requirements and disposal options:

- Collection of a sample from the receiving surface water body and analysis for:
 - Hardness and pH
 - Metals, nutrients and subject to the outcome of proposed additional groundwater potentially PFAS
- Collection of untreated water samples and quality control samples from wells/sump etc;
- Measurement of general groundwater physical parameters given in Section 10.3.3.4. using a calibrated water quality meter; and
- Analysis of the samples by a NATA accredited laboratory for the analytes as indicated in Section 10.3.3.4.

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.

10.3.3.2 **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 to stormwater following confirmation that it meets the discharge criteria, subject to Council approval. For a continuous treatment approach the treated water cannot be disposed to stormwater until the treatment trial has been successfully completed. The treated groundwater may be stored on site, or disposed 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 10.3.3.4

10.3.3.3 **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 (eg, filters nearing end of life).

The base requirements for routine monitoring are provided in Section 10.3.4. 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 Council prior to being implemented.

10.3.3.4 Analytes

The testing suite in Table 7 has been adopted based on the following information:

- The requirements of DPE (2022);
- The contaminants of potential concern identified in the previous investigations;
- The baseline water quality data (refer to Section 6.2.2);
- The potential for spills / leaks during excavation works;
- General parameters to inform suitability of the water for discharge and changes in groundwater source.

Table 7: 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
	EC, REDOX potential (Eh), temperature, dissolved oxygen	Baseline ¹ Treatment trial ¹ Monthly ¹
Physical parameters	Alkalinity (total, carbonate, hydroxide bicarbonate), TDS, total hardness, TSS, total organic carbon (TOC), sodium absorption ratio (SAR)	Baseline ¹ Treatment trial ¹ Monthly ¹
Major ions	Sulfate (SO ₄), chloride (Cl), carbonates (CO ₃), bromide (Br), fluoride (F), Calcium (Ca), magnesium (Mg), sodium (Na), potassium (K) Cation/anion balance (as a percentage)	Baseline ¹ Treatment trial ¹ Monthly ¹
Metals (total)	Aluminium (Al), antimony (Sb), arsenic (As), barium (Ba), beryllium (Be), boron (B), cadmium (Cd),	Baseline ¹

Category	Analytes	Minimum frequency
	chromium (Cr), cobalt (Co), copper (Cu), iron (Fe), lead (Pb), lithium (Li), manganese (Mn), mercury (Hg), molybdenum (Mo), nickel (Ni), selenium (Se), silica (dissolved SiO ₂), silver (Ag), strontium (Sr), uranium (U), vanadium (V), zinc (Zn)	
	As, Cd, Cr, Cu, Hg, Mn, Ni, Pb, Zn, and any of the metals above which exceeded discharge criteria in baseline monitoring	Treatment trial ² Every routine sampling event ²
Metals (total and dissolved)	Ferrous iron	TBD based on outcome of baseline testing
Nutrients	Ammonia (NH ₃), nitrate (NO ₃), total nitrogen (N), oxidised nitrogen (N), total phosphorus (P), reactive phosphorus (P)	Baseline ¹
Nutrients	Nitrate, and any of the nutrients of concern from baseline monitoring	TBD based on outcome of baseline testing
Microbiological organisms	Faecal coliforms, faecal streptococci, Escherichia coli	Baseline ¹
Potential contaminants	TRH, BTEX	Baseline ¹ Treatment trial ² Every routine sampling event ²
	PAH	Baseline ¹
	OCP & PFAS subject to outcome of recommended supplementary groundwater monitoring event. If they are confirmed to not be contaminants of concern testing will not be required	TBC based on outcome of supplementary groundwater testing

Notes:

Based on requirements of DPE (2022)

Based on available data

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

VOC: volatile organic compounds

sVOC: semi-volatile organic compounds

PFAS: per- and polyfluorinated substances

10.3.4 Monitoring and Reporting Requirements

The following monitoring program and associated reporting is to be adopted until the end of excavation and construction works on-site. Groundwater level monitoring should be continued one month after construction. Groundwater level monitoring should be undertaken in a minimum of three monitoring wells during and after construction located outside of the excavation which will require the drilling and installation of new wells. Any wells damaged during construction should be replaced in a timely manner.

Table 8: 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	<ul style="list-style-type: none"> • Automated measurement as part of treatment system or measure with field pH meter of treated water. • Daily observations (by contractor).
Groundwater level monitoring	Monitor drawdown at a minimum of three wells in the vicinity of the site.	<ul style="list-style-type: none"> • Continuous groundwater level monitoring using data logger (minimum six-hourly frequency). • Quarterly manual readings. • Monitoring to continue for one month post-construction dewatering. <p>HOLD POINT - If drawdown exceeds predictions by >0.5 m, construction must be halted and contingency measures activated.</p>
Water quality sampling and testing	Samples from treated water to assess compliance with discharge criteria (Section 10.3.1) As per analytical requirements in Section 10.3.3.4.	All monitoring: <ul style="list-style-type: none"> • 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.

Item	Monitoring requirements	Methodology
	Samples from untreated water as required to inform treatment requirements	<p>Baseline and treatment trial</p> <ul style="list-style-type: none"> As per Section 10.3.3. <p>Routine</p> <ul style="list-style-type: none"> Sampling pre-discharge (batch discharge). Sampling twice weekly (continuous discharge). Review and update frequency in accordance with Section 10.3.3.4. <p>HOLD POINT - If water exceeds assessment criteria (SAC), manage as per contingency strategy (Section 6.2.2)</p>
Quality control sampling	Replicate sampling to verify lab result accuracy.	<ul style="list-style-type: none"> Conducted during above sampling events. Analyse at a rate of 10% of samples. Testing suite: Metals, TRH, BTEX. Additional analytes including PFAS and OCP subject to outcome of supplementary groundwater monitoring Results to be included in final dewatering completion report.
Quantity of groundwater inflows	Measurements of groundwater volumes (as per Section 10.2).	<ul style="list-style-type: none"> 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. <p>HOLD POINT - If volumes exceed trigger levels or Council discharge allowance, works must be halted to minimise inflow (e.g., via grouting).</p>
Dewatering completion report	Final documentation of the dewatering program.	<p>Prepared by a suitably qualified consultant and to include:</p> <ul style="list-style-type: none"> 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 DMP.

10.4 Personnel and responsibilities

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

Table 9: 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.
Environmental Consultant	Water quality sampling (analysis using NATA accredited laboratories). Interim advice for each sampling event to confirm (or otherwise) compliance with discharge requirements. Quality control sampling. Assist in preparation of the dewatering completion report.

10.5 Contingency plan

As per Section 10.4, 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 (eg 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.

11. Approvals and licensing

In accordance with the Water Management Act 2000, approval for the take of water for the purpose of long-term dewatering of a drained basement would be given when development consent for the SSDA is granted by the Environmental Planning Instrument. A separate Water Supply Works Approval (WSWA) from WaterNSW would not be required, unless this is specifically requested in the development conditions.

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 are less than 3 ML per year, therefore the development does not require a WAL as it meets exemption under Clause 21(2) of the Water Management (General) Regulation 2018.

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 (ie. Before 28 July).

12. Conclusion

The proposed development is expected to have a lowest basement at RL 71.85 m AHD which will require excavations of up to 21 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 the collected groundwater discharging into the council stormwater.

The maximum recorded groundwater levels and geometric mean horizontal permeability values have been adopted in a 2D seepage analysis for the proposed development. The results of the base case analysis indicate that the predicted annual inflows for long-term dewatering into the drained basement is 0.4 ML. As the predicted inflow rate is less than 3 ML per year, a WAL will not be required.

A sensitivity case considering more conservative conditions where horizontal permeability values are 5 x higher than those adopted in the base case was modelled. The sensitivity case results indicate that annual groundwater inflow volumes for long-term dewatering is 2.2 ML, which is also below 3 ML.

Disposal of the groundwater inflow 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 water table drawdown is predicted to be entirely within the bedrock profile with high deformation moduli, the risk of subsidence in neighbouring structures and infrastructure due to drawdown is expected to be negligible.

From a geotechnical and hydrogeological viewpoint, it is considered that a drained basement is feasible without significant impacts on surrounding groundwater systems, users and structures, and approval will be subject to review 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.

13. Limitations

Douglas Partners Pty Ltd (Douglas) has prepared this report for this project at 20-22 Atchison Street, St Leonards, NSW in line with Douglas' proposal dated 21/05/2025 and acceptance received from Peter Avramopoulos of Setia Sydney Pty Ltd. The work was carried out under Douglas' Engagement Terms. This report is provided for the exclusive use of Setia Sydney Pty Ltd for this project only and for the purposes as described in the report. It should not be used by or relied upon for other projects or purposes on the same or other site or by a third party. Any party so relying upon this report beyond its exclusive use and purpose as stated above, and without the express written consent of Douglas, does so entirely at its own risk and without recourse to Douglas for any loss or damage. In preparing this report Douglas has necessarily relied upon information provided by the client and/or their agents.

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

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

The assessment of atypical safety hazards arising from this advice is restricted to the geotechnical 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

Introduction

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

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

Copyright

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

Borehole and Test Pit Logs

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

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

Groundwater

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

- In low permeability soils groundwater may enter the hole very slowly or perhaps not at all during the time the hole is left open;
- A localised, perched water table may lead to an erroneous indication of the true water table;
- Water table levels will vary from time to time with seasons or recent weather

changes. They may not be the same at the time of construction as are indicated in the report; and

- The use of water or mud as a drilling fluid will mask any groundwater inflow. Water has to be blown out of the hole and drilling mud must first be washed out of the hole if water measurements are to be made.

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

Reports

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

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

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

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

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About this Report

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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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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)).

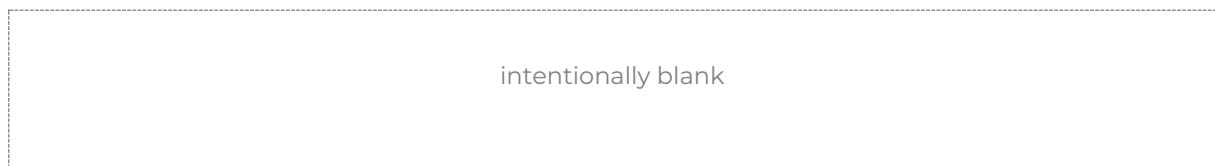
Data Integrity Codes

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.





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”.



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
	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”.

□

intentionally blank

□



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:

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

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



Rock Descriptions

Terminology
Symbols
Abbreviations

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

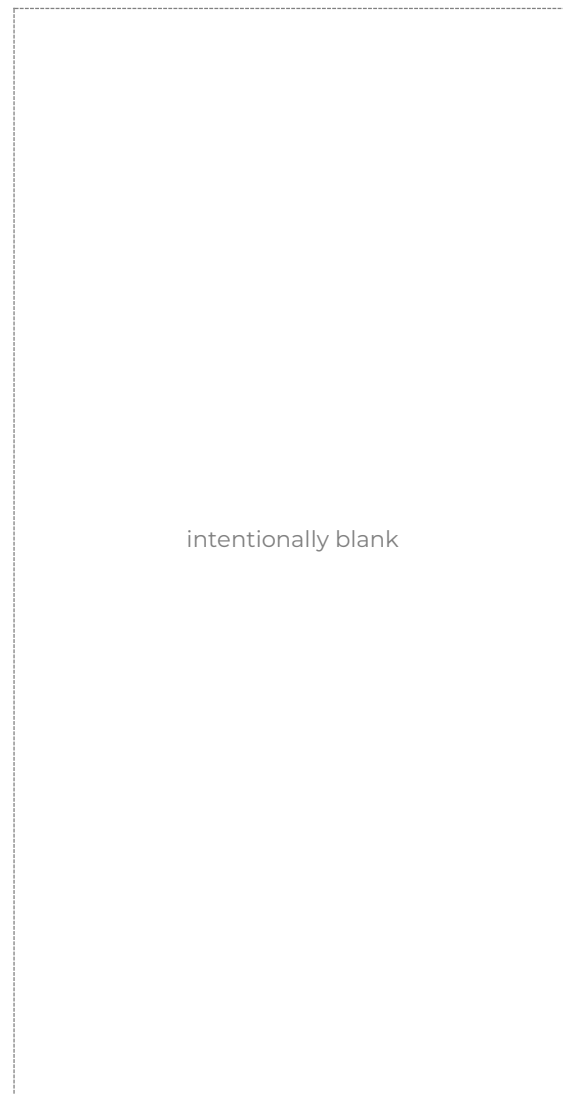
Term	Abbreviation Code
Curved	CU
Discontinuous	DIS
Irregular	IR
Planar	PR
Stepped	ST
Undulating	UN

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





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 appearing to the right of the scale, as illustrated below:

SAMPLE			DEPTH (m)	TESTING	
SAMPLE REMARKS	TYPE	INTERVAL		TEST TYPE	RESULTS AND REMARKS
	SPT		1.0 1.45	SPT	4,9,11 N=20

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(L)
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

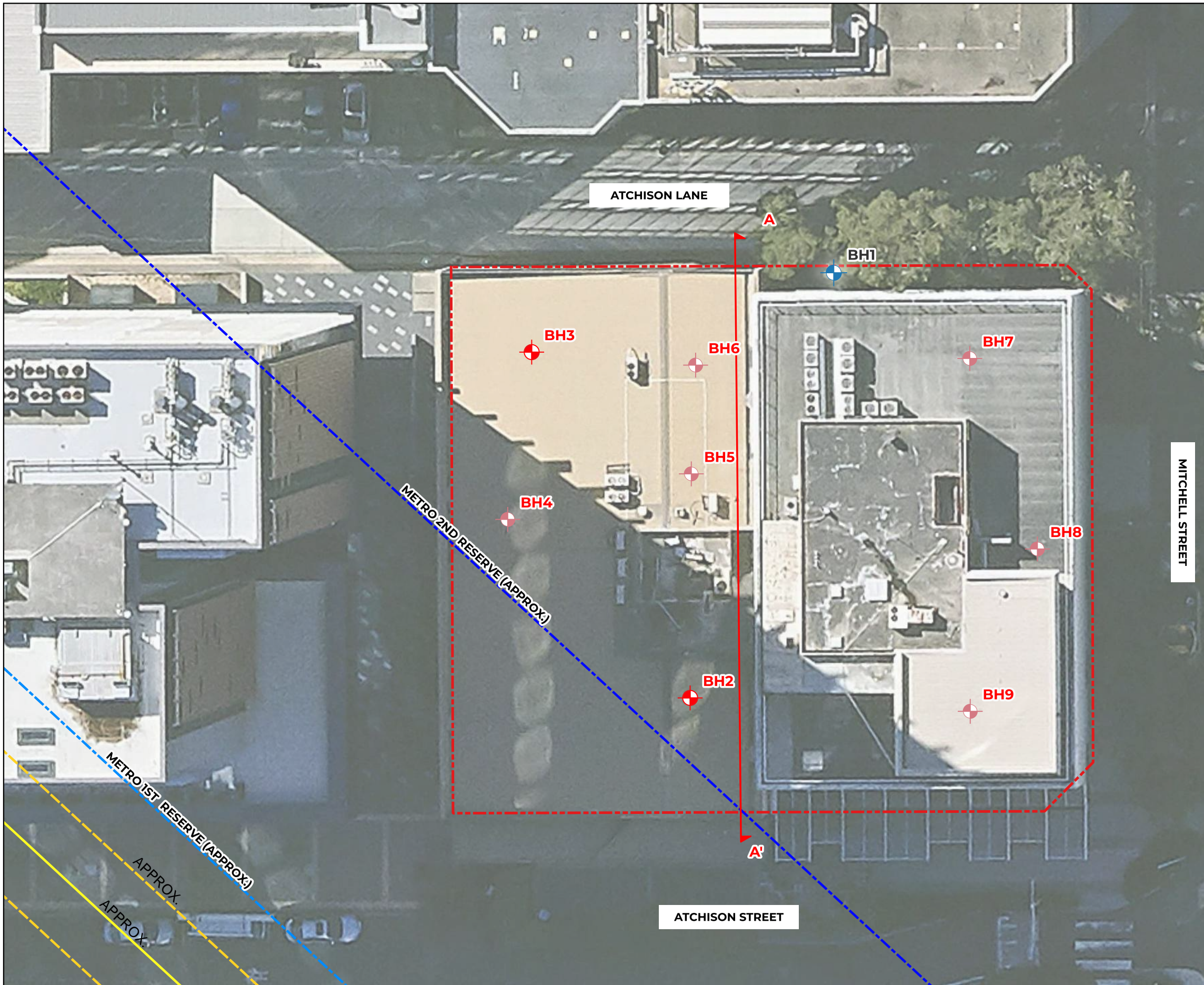
The drilling/excavation methods used to perform the investigation may be shown either in a dedicated column down the left-hand edge of the log, or stated in the log footer. In some circumstances abbreviation codes may be used.

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 □

Appendix B

Drawings



LEGEND

- Current Borehole Locations
- Shallow Borehole Location
- Borehole Location
- Previous Geotechnical Borehole (2012)
- Approximate Site Boundary
- Tunnel Extent
- Metro Tunnel Centre Line
- Cross Section Line

P:\73262.05 - ST LEONARDS, 20-22 Atchison Street\70 Drawings\7.3 QC\15\73262.05.cdg

REV	DESCRIPTION/COMMENT	DATE	DRAWN BY
0	Initial Issue	05.09.2025	MN

SCALE: 1:250 @ A3

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

CLIENT:
Setia Sydney Pty Ltd

NOTE:
1: Basemap from Metromap (Dated 13.03.2025)
2: Test locations are approximate only and were measured from existing site features

COORDINATE REFERENCE SYSTEM: GDA2020 / MGA zone 56

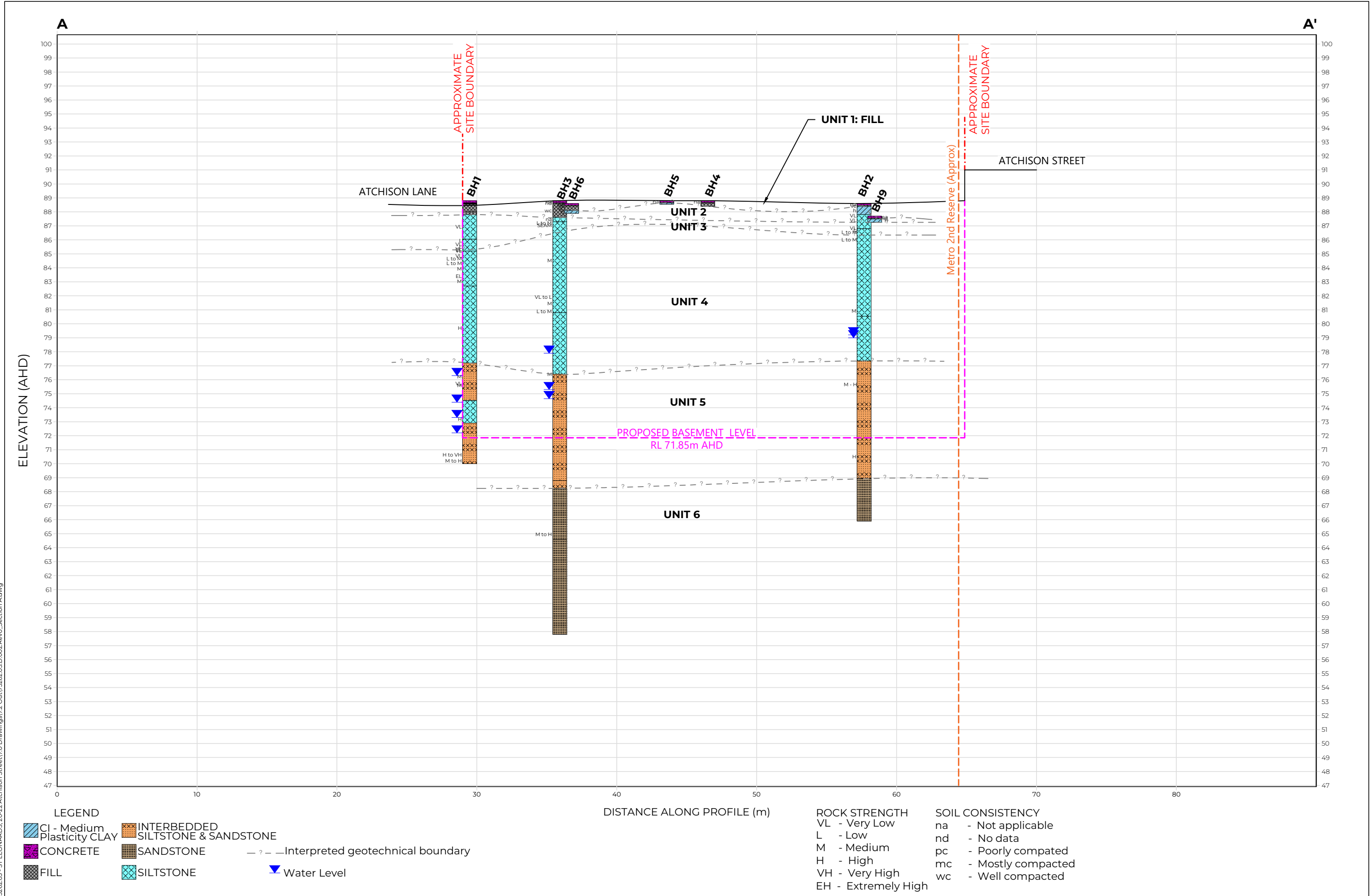
PROJECT NAME:
Proposed Mixed Use Development
PROJECT ADDRESS:
20-22 Atchison Street, St Leonards, NSW

DRAWING TITLE:
Proposed Test Location Plan

PROJECT NO:
73262.05

DRAWING NO:
1

REVISION:
0



LEGEND

CI - Medium Plasticity CLAY	INTERBEDDED SILTSTONE & SANDSTONE
CONCRETE	SANDSTONE
FILL	SILTSTONE
- ? - - Interpreted geotechnical boundary	
Water Level	

ROCK STRENGTH	SOIL CONSISTENCY
VL - Very Low	na - Not applicable
L - Low	nd - No data
M - Medium	pc - Poorly compacted
H - High	mc - Mostly compacted
VH - Very High	wc - Well compacted
EH - Extremely High	

REV	DESCRIPTION/COMMENT	DATE	DRAWN BY
0	Initial Issue	05.09.2025	MN

SCALE: Horizontal Scale 1:250
Vertical Exaggeration = 1.0

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

CLIENT:
Setia Sydney Pty Ltd

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 Mixed Use Development
PROJECT ADDRESS:
20-22 Atchison Street, St Leonards, NSW

DRAWING TITLE:
Geological Cross Section A-A'

PROJECT No:	73262.05
DRAWING No:	2
REVISION:	0

\\pspsdmnas02\Projects\73262.05 - ST LEONARDS - 20-22 Atchison Street\70 Drawings\72 Out\73262.05.D.002 Rev0_Section A.dwg

Appendix C

Borehole Logs

BOREHOLE LOG

CLIENT: Setia Sydney Pty Ltd
PROJECT: Proposed Mixed Use Development
LOCATION: 20-22 Atchison Street, St Leonards, NSW 2065

SURFACE LEVEL: 88.6 AHD
COORDINATE: E:333114.5, N:6256033.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH2
PROJECT No: 73262.05
DATE: 05/08/25 - 06/08/25
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
0.13	0.20	CONCRETE; 130mm, 6mmØ reinforcement at 100mm.		NA	NA					0.13 - 0.20	DGPS/150			
	0.80	FILL / SAND with silt: dark brown; fine to medium.								0.20 - 0.80				
	0.80	Gravelly CLAY (Cl): pale grey mottled orange-brown; medium plasticity; fine to coarse, ironstone gravel.		XWM	(H)	ND				0.80 - 1.00				
	1.00	Continued as rock log								1.00 - 22.70				
	2.00									2.00 - 3.00				
	3.00									3.00 - 4.00				
	4.00									4.00 - 5.00				
	5.00									5.00 - 6.00				
	6.00									6.00 - 7.00				
	7.00									7.00 - 8.00				
	8.00									8.00 - 9.00				
	9.00									9.00 - 10.00				
	10.00									10.00 - 11.00				
	11.00									11.00 - 12.00				
	12.00									12.00 - 13.00				
	13.00									13.00 - 14.00				
	14.00									14.00 - 15.00				
	15.00									15.00 - 16.00				
	16.00									16.00 - 17.00				
	17.00									17.00 - 18.00				
	18.00									18.00 - 19.00				
	19.00									19.00 - 20.00				
	20.00									20.00 - 21.00				
	21.00									21.00 - 22.70				

Generated with CORE-GS by Geroc - Split Soil-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: Geo 205 **OPERATOR:** Ground Test (JJ) **LOGGED:** C. S. Yip
METHOD: DT to 0.13m, then HA to 0.3m, then WB to 0.8m, then NMLC to 22.7m **CASING:** Uncased
REMARKS: Surface level from TSS Survey Drawing (210492-1).
 Coordinates estimated measurements to site features.

Refer to explanatory notes for symbol and abbreviation definitions



BOREHOLE LOG

CLIENT: Setia Sydney Pty Ltd
PROJECT: Proposed Mixed Use Development
LOCATION: 20-22 Atchison Street, St Leonards, NSW 2065

SURFACE LEVEL: 88.6 AHD
COORDINATE: E:333114.5, N:6256033.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH2
PROJECT No: 73262.05
DATE: 05/08/25 - 06/08/25
SHEET: 2 of 4

CONDITIONS ENCOUNTERED										SAMPLE			TESTING					
GROUNDWATER	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	WEATH.	DEPTH (m)	STRENGTH	RECOVERY (%)	RQD	FRAC. SPACING (m)	DEFECTS & REMARKS	SAMPLE REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS	BACKFILL	WELL PIPE
	88	Continued from soil log																
	1	SILTSTONE: grey and orange-brown, extremely weathered bands; highly fractured; with iron staining. Ashfield Shale.		HW, XW	0.80, 0.93	VL, SEAM	100	0	SEAM	1.30m: B x multiple, 0-5°, PR, SN Fe, VR, (0.80-1.80m) 1.33m: EW x3, 0°, 200-420mm; (0.80-1.85m)				1	PLT	PL(A)=0.12MPa		
	1.80	SILTSTONE: dark grey, thinly laminated to thinly bedded; with fine sandstone laminations (<5%). Ashfield Shale.		HW, MW, XW	1.17, 1.25, 1.67, 1.85, 1.95, 2.19, 2.26	VL, L, L to M, SEAM	100	0	SEAM	2.05m: B, 0-5°, PR, VNR Clay, SM, multiple; (1.85-2.24m) 2.06m: EW x4, 0-5°, 10-80mm; (1.85-2.25m) 2.37m: EW x2, 0-5°, 5-10mm; (2.34-2.39m) 2.41m: B, 0°, PR, SN Fe, VR				2	PLT	PL(A)=0.11MPa		
	3				2.94	L	100	94		2.58m: JT x3, 60-85°, PR, SN Fe, RF, or CN; (2.26-2.90m) 2.61m: B, 0°, PR, INF Clay 5mm, SM 2.77m: SZ, 0°, 20mm 2.92m: EW, 0°, 10mm 3.12m: B, 0°, PR, SN Fe, VR				3	PLT	PL(A)=0.72MPa		
	4									3.52m: JT x4, 20-80°, PR, SN Fe, VR, (3.22-3.81m) 3.69-3.74m: B x2, 0°, PR, INF Clay 5mm, SM 3.89m: JT, 50°, PR, CN, RF 4.09-4.21m: JT, 85°, PR, SN Fe, RF 4.54m: JT, 70°, PR, SN Fe, VR 4.69m: JT, 45-70°, IR, CN, VR				4	PLT	PL(A)=0.84MPa		
	5									5.16m: B x6, 0°, PR, SN Fe, VR, (4.51-5.81m) 5.26-5.28m: JT x2, 10-30°, CU, SN Fe, VR 5.32-5.37m: JT x2, 20-45°, PR, SN Fe, RF 5.54m: JT, 85°, PR, SN Fe, VR 5.78m: JT, 10°, PR, SN Fe, VR 6.02-6.12m: B x2, 0-5°, PR, SN Fe, VR				5	PLT	PL(A)=0.83MPa		
	6									6.67m: B, 0°, PR, VNR Clay, SM 6.73-6.82m: JT, 75-85°, PR, SN Fe, RF 7.41m: JT x4, 30-75°, PR, RF, (6.97-7.85m) 7.83m: EW, 0°, 10mm 7.95m: JT, 85°, PR, SN Fe, RF, (7.87-8.02m)				6	PLT	PL(A)=0.70MPa		
	7						100	100						7	PLT	PL(A)=0.77MPa		
	8	SILTSTONE: dark grey. Ashfield Shale.												8	PLT	PL(A)=0.78MPa		
	9									8.78m: JT x3, 60-85°, PR, CN, RF, (8.46-9.10m) 8.85m: B, 0°, PR, CN, RF 9.05m: B x2, 0°, PR, CN, RF, (8.85-9.24m) 9.24m: B, 0°, PR, CN, RF 9.30m: B, 0°, PR, CN, RF 9.34m: JT, 70°, PR, HE, RF				9	PLT	PL(A)=0.72MPa		
	8.06																	
	80																	
	70																	

NOTES: *Soil origin is "probable" unless otherwise stated.

PLANT: Geo 205 **OPERATOR:** Ground Test (JJ) **LOGGED:** C. S. Yip
METHOD: DT to 0.13m, then HA to 0.3m, then WB to 0.8m, then NMLC to 22.7m **CASING:** Uncased
REMARKS: Surface level from TSS Survey Drawing (210492-1). Coordinates estimated measurements to site features.



Refer to explanatory notes for symbol and abbreviation definitions

BOREHOLE LOG

CLIENT: Setia Sydney Pty Ltd
PROJECT: Proposed Mixed Use Development
LOCATION: 20-22 Atchison Street, St Leonards, NSW 2065

SURFACE LEVEL: 88.6 AHD
COORDINATE: E:333114.5, N:6256033.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH2
PROJECT No: 73262.05
DATE: 05/08/25 - 06/08/25
SHEET: 3 of 4

CONDITIONS ENCOUNTERED										SAMPLE			TESTING								
GROUNDWATER RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	SOIL STRENGTH (where encountered) SOIL MOISTURE	GRAPHIC	WEATH. RS XW LHV RHW RHW RHW FR	DEPTH (m)	STRENGTH VL L M H VH EH	RECOVERY (%)	RQD	FRACTURE SPACING (m)	DEFECTS & REMARKS	SAMPLE REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS		BACKFILL	WELL PIPE	
																	PL(A)	PL(B)			
	78	[CONT] SILTSTONE: dark grey. Ashfield Shale.						100	98		10.25m: JT, 30°, PR, INF Clay 2mm, SM 10.29-10.35m: SZ, 25°, 60mm 10.41m: JT, 75°, IR, CN, VR, (10.33-10.48m) 10.87m: JT x3, 70-80°, PR, CN, RF, (10.70-11.04m)				11	PLT	PL(A)=0.52MPa				
	11.11						M	100	98		11.09-11.19m: EW x2, 0-5°, 10-25mm 11.16m: B, 0°, PR, VNR Clay, SM				12	PLT	PL(A)=0.43MPa				
	11.25	INTERBEDDED SILTSTONE (40%) INTERLAMINATED SANDSTONE (60%): SILTSTONE: dark grey, laminated to medium bedded SANDSTONE: pale grey, fine to medium grained, thinly laminated to thinly bedded. Mittagong Formation.									11.81m: B x6, 0-5°, PR, CN, VR, (11.38-12.24m)				12	PLT	PL(A)=1.2MPa				
	12										12.29-12.38m: JT, 85°, IR, CN, VR				13	PLT	PL(A)=0.84MPa				
	12.40							100	98		12.79-12.98m: B x3, 5-15°, UN, CN, VR				13	PLT	PL(A)=1.9MPa				
	13										13.50m: B, 10°, CU, CN, VR				14	PLT	PL(A)=1.4MPa				
	13.50										13.85m: B, 15°, PR, CN, VR				14	PLT	PL(A)=1.9MPa				
	14							100	100		14.96m: B, 5°, PR, CN, RF				15	PLT	PL(A)=1.4MPa				
	15				FR						15.20m: B x2, 5-10°, PR, CN, RF				15	PLT	PL(A)=2.5MPa				
	15										15.65-15.71m: B x2, 10°, PR, VNR Clay, SM 15.78-15.82m: B x2, 5°, IR, CN, VR				16	PLT	PL(A)=1.6MPa				
	16							100	98		16.11-16.34m: B x2, 5-10°, PR, CT CBS, RF				16	PLT	PL(A)=1.9MPa				
	17										16.64m: B, 10°, IR, CN, VR 16.84m: JT, 10°, PR, CN, VR				17	PLT	PL(A)=0.66MPa				
	17						H	100	100		17.27m: B x4, 5°, PR, CN, VR, (17.06-17.48m)				17	PLT	PL(A)=3.0MPa				
	18										17.67-17.85m: B x3, 5-10°, PR, CN, RF				18	PLT	PL(A)=1.2MPa				
	18										18.19m: EW, 5°, 10mm				18	PLT	PL(A)=0.66MPa				
	19							100	100		19.06m: SZ, 5°, 8mm 19.22m: EW, 10°, 10mm 19.39m: B x2, 5°, PR, CT CBS, VR 19.49m: B, 0°, UN, INF Clay 5mm, SM				19	PLT	PL(A)=1.2MPa				
	19.67	19.67m: SANDSTONE: as below						100	100		19.68m: B, 10°, IR, VNR Clay, SM				19	PLT	PL(A)=1.2MPa				

NOTES: *Soil origin is "probable" unless otherwise stated.

PLANT: Geo 205
METHOD: DT to 0.13m, then HA to 0.3m, then WB to 0.8m, then NMLC to 22.7m
REMARKS: Surface level from TSS Survey Drawing (210492-1).
 Coordinates estimated measurements to site features.

OPERATOR: Ground Test (JJ)

LOGGED: C. S. Yip
CASING: Uncased

Refer to explanatory notes for symbol and abbreviation definitions



BOREHOLE LOG

CLIENT: Setia Sydney Pty Ltd
PROJECT: Proposed Mixed Use Development
LOCATION: 20-22 Atchison Street, St Leonards, NSW 2065

SURFACE LEVEL: 88.6 AHD
COORDINATE: E:333114.5, N:6256033.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH2
PROJECT No: 73262.05
DATE: 05/08/25 - 06/08/25
SHEET: 4 of 4

CONDITIONS ENCOUNTERED										SAMPLE			TESTING									
GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	SOIL STRENGTH (where encountered) SOIL MOISTURE	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	
																		RESULTS AND REMARKS	RESULTS AND REMARKS			
	88		SANDSTONE: pale grey, medium to coarse grained, with siltstone clasts (<2%). Hawkesbury Sandstone.						100	100												
		21	20.08m: Siltstone clast 20.45m-20.58m: Siltstone clast			FR		H									21	PLT	PL(A)=1.4MPa			
		22	21.58m-21.74m: Bed of siltstone						100	100		21.69m: B, 5°, CU, CN, VR 21.73m: B, 5°, PR, VNR Clay, SM					22	PLT	PL(A)=2.0MPa			
	66		Borehole discontinued at 22.70m depth. Target Depth Reached.																			
	65																					
	64																					
	63																					
	62																					
	61																					
	60																					
	59																					

NOTES: #Soil origin is "probable" unless otherwise stated.

PLANT: Geo 205

OPERATOR: Ground Test (JJ)

LOGGED: C. S. Yip

METHOD: DT to 0.13m, then HA to 0.3m, then WB to 0.8m, then NMLC to 22.7m

CASING: Uncased

REMARKS: Surface level from TSS Survey Drawing (210492-1).
Coordinates estimated measurements to site features.

Refer to explanatory notes for symbol and abbreviation definitions

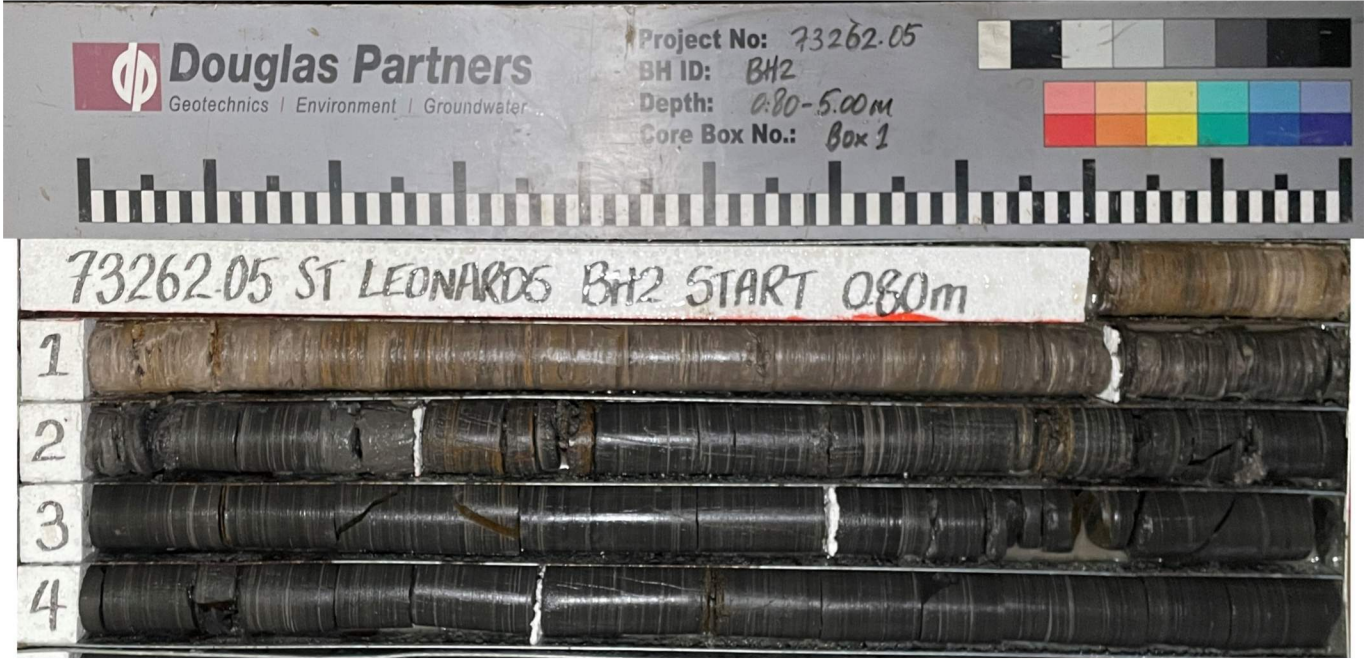


CORE PHOTO LOG

CLIENT: Setia Sydney Pty Ltd
PROJECT: Proposed Mixed Use Development
LOCATION: 20-22 Atchison Street, St Leonards, NSW 2065

SURFACE LEVEL: 88.6 AHD
COORDINATE: E:333114.5, N:6256033.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH2
PROJECT No: 73262.05
DATE: 05/08/25 - 06/08/25
SHEET: 1 of 3



0.80-5.00 m depth



5.00-10.00 m depth

CORE PHOTO LOG

CLIENT: Setia Sydney Pty Ltd
PROJECT: Proposed Mixed Use Development
LOCATION: 20-22 Atchison Street, St Leonards, NSW 2065

SURFACE LEVEL: 88.6 AHD
COORDINATE: E:333114.5, N:6256033.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH2
PROJECT No: 73262.05
DATE: 05/08/25 - 06/08/25
SHEET: 2 of 3



10.00-15.00 m depth



15.00-20.00 m depth

CORE PHOTO LOG

CLIENT: Setia Sydney Pty Ltd
PROJECT: Proposed Mixed Use Development
LOCATION: 20-22 Atchison Street, St Leonards, NSW 2065

SURFACE LEVEL: 88.6 AHD
COORDINATE: E:333114.5, N:6256033.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH2
PROJECT No: 73262.05
DATE: 05/08/25 - 06/08/25
SHEET: 3 of 3



20.00-22.70 m depth

BOREHOLE LOG

CLIENT: Setia Sydney Pty Ltd
PROJECT: Proposed Mixed Use Development
LOCATION: 20-22 Atchison Street, St Leonards, NSW 2065

SURFACE LEVEL: 88.8 AHD
COORDINATE: E:333104.5, N:6256055.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH3
PROJECT No: 73262.05
DATE: 04/08/25 - 05/08/25
SHEET: 1 of 5

CONDITIONS ENCOUNTERED						SAMPLE				TESTING AND REMARKS					
GROUNDWATER	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN (#)	CONSIS. (°)	DENSITY (°)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS	BACKFILL	WELL PIPE
	0.15	CONCRETE; 150mm, 6mmØ steel reinforcement bar at 100mm.		NA	NA	NA									
	0.20	FILL / SAND: yellow-brown; fine to medium.							A/ES	0.20 - 0.30					
		FILL / Gravelly CLAY with cobbles: dark grey; medium plasticity; fine to medium, siltstone and ironstone gravel; siltstone cobbles.		FILL	WC	w=PL			A/ES	0.30 - 0.50					
	1.20	SILTSTONE: dark grey; apparently very low strength.			NA	NA			A/ES	1.30 - 1.50					
	1.50	Continued as rock log													
	2.00														
	3.00														
	4.00														
	5.00														
	6.00														
	7.00														
	8.00														
	9.00														

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: Geo 205
METHOD: DT to 0.15m, then AD/T to 1.5m, then NMLC to 31m
REMARKS: Surface level from TSS Survey Drawing (210492-1). Coordinates estimated measurements to site features.

OPERATOR: Ground Test (JJ)

LOGGED: C. S. Yip
CASING: PVC to 1.5m

Refer to explanatory notes for symbol and abbreviation definitions



BOREHOLE LOG

CLIENT: Setia Sydney Pty Ltd
PROJECT: Proposed Mixed Use Development
LOCATION: 20-22 Atchison Street, St Leonards, NSW 2065

SURFACE LEVEL: 88.8 AHD
COORDINATE: E:333104.5, N:6256055.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH3
PROJECT No: 73262.05
DATE: 04/08/25 - 05/08/25
SHEET: 2 of 5

CONDITIONS ENCOUNTERED										SAMPLE			TESTING					
GROUNDWATER	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
	88													1	PLT	PL(A)=0.93MPa		
	87	Continued from soil log SILTSTONE: dark grey, thinly laminated; with fine sandstone laminations (10%); with orange-brown staining. Ashfield Shale.		HW	1.50	M								2	PLT	PL(A)=0.33MPa		
	86			HW	1.72		100							3	PLT	PL(A)=0.48MPa		
	85			MW	2.23									4	PLT	PL(A)=0.37MPa		
	84						100							5	PLT	PL(A)=0.37MPa		
	83													6	PLT	PL(A)=0.29MPa		
	82			SW	6.00									7	PLT	PL(A)=0.50MPa		
	81				7.00	M								8	PLT	PL(A)=0.74MPa		
	80	SILTSTONE: dark grey, bedded, 0 to 5°, <5% grey, fine to medium grained sandstone beds. Ashfield Shale.			7.70	L to M								9	PLT	PL(A)=0.76MPa		
	79			FR	8.10	M		100	98									

NOTES: #Soil origin is "probable" unless otherwise stated.

PLANT: Geo 205 **OPERATOR:** Ground Test (JJ) **LOGGED:** C. S. Yip
METHOD: DT to 0.15m, then AD/T to 1.5m, then NMLC to 31m **CASING:** PVC to 1.5m
REMARKS: Surface level from TSS Survey Drawing (210492-1). Coordinates estimated measurements to site features.



Refer to explanatory notes for symbol and abbreviation definitions

BOREHOLE LOG

CLIENT: Setia Sydney Pty Ltd
PROJECT: Proposed Mixed Use Development
LOCATION: 20-22 Atchison Street, St Leonards, NSW 2065

SURFACE LEVEL: 88.8 AHD
COORDINATE: E:333104.5, N:6256055.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH3
PROJECT No: 73262.05
DATE: 04/08/25 - 05/08/25
SHEET: 3 of 5

CONDITIONS ENCOUNTERED										SAMPLE			TESTING					
GROUNDWATER	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	WEATH.	DEPTH (m)	STRENGTH	RECOVERY (%)	RQD	FRAC. SPACING (m)	DEFECTS & REMARKS	SAMPLE REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS	BACKFILL	WELL PIPE
RL (m)																		
78	11	[CONT] SILTSTONE: dark grey, bedded, 0 to 5°, <5% grey, fine to medium grained sandstone beds. Ashfield Shale.					100	98		10.31-10.45m: JT x2, 55-60°, PR, SN Fe, VR				11	PLT	PL(A)=0.85MPa		
77	12						100	100		11.23m: JT x6, 35-70°, PR, CN, RF, (10.45-12.00m)				12	PLT	PL(A)=0.57MPa		
76	12.41	INTERLAMINATED SANDSTONE INTERBEDDED SILTSTONE (40%): SANDSTONE: pale grey, fine to medium grained, laminated, 0 to 10° SILTSTONE: dark grey, laminated to medium bedded. Mittagong Formation.					100	95		12.00-12.10m: JT, 65°, PR, CN, RF 12.15m: EW, 5°, 15mm 12.16-12.26m: SZ, 0°, 100mm 12.42m: JT, 45°, PR, CN, RF				13	PLT	PL(A)=0.78MPa		
75	13					M				13.00m: B x5, 0-5°, PR, CN, VR, (12.75-13.25m) 13.30-13.32m: EW x2, 10°, 5-10mm 13.50m: B x3, 5-10°, CU, CN, VR, (13.42-13.58m) 13.72-13.78m: B x2, 0-5°, PR, INF Clay, SM, 2-5mm				14	PLT	PL(A)=0.51MPa		
74	14						100	95		14.33m: EW, 5°, 20mm 14.48-14.58m: B x4, IR, CN, VR				15	PLT	PL(A)=1.3MPa		
73	15						100	98		15.08m: B, 5°, PR, VNR Clay, SM 15.64m: B, 5°, IR, CN, VR 15.83-15.93m: JT x2, 45-75°, PR, CN, VR				16	PLT	PL(A)=0.66MPa		
72	16.70						100	95		16.36-16.44m: JT, 60°, PR, CN, RF 16.48-16.52m: B x3, 5-10°, IR, CN, VR 16.55m: JT, 35°, PR, CN, RF 16.70m: EW, 10°, 10mm 16.72m: JT, 40°, PR, CN, VR				17	PLT	PL(A)=1.8MPa		
71	18						100	98		17.67m: EW, 10°, 5mm 17.78-17.87m: JT, 60°, PR, CN, RF				18	PLT	PL(A)=0.87MPa		
70	19						100	100		18.67m: EW, 5°, 5mm 18.88-18.95m: B x4, 0-5°, PR, CN, VR 19.48m: B, 10°, PR, CN, VR 19.61m: JT, 25°, IR, CN, RF				19	PLT	PL(A)=2.1MPa		
69															PLT	PL(A)=1.2MPa		

NOTES: *Soil origin is "probable" unless otherwise stated.

PLANT: Geo 205
METHOD: DT to 0.15m, then AD/T to 1.5m, then NMLC to 31m
REMARKS: Surface level from TSS Survey Drawing (210492-1).
 Coordinates estimated measurements to site features.

OPERATOR: Ground Test (JJ)

LOGGED: C. S. Yip
CASING: PVC to 1.5m

Refer to explanatory notes for symbol and abbreviation definitions



BOREHOLE LOG

CLIENT: Setia Sydney Pty Ltd
PROJECT: Proposed Mixed Use Development
LOCATION: 20-22 Atchison Street, St Leonards, NSW 2065

SURFACE LEVEL: 88.8 AHD
COORDINATE: E:333104.5, N:6256055.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH3
PROJECT No: 73262.05
DATE: 04/08/25 - 05/08/25
SHEET: 4 of 5

CONDITIONS ENCOUNTERED										SAMPLE			TESTING					
GROUNDWATER	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
	20.00	[CONT]. INTERLAMINATED SANDSTONE and SILTSTONE: as above.					100	100		20.07-20.10m: B x2, 0-10°, PR, CN, VR								
	20.56	SANDSTONE: grey, fine to coarse grained, bedded, 0 to 10°; trace layers with siltstone clasts up to 20mm. Hawkesbury Sandstone.					100	100		21.15m: B, 10°, PR, CT CBS, VR				21	PLT	PL(A)=1.9MPa		
	21									21.92m: CS, 15°, 10mm				22	PLT	PL(A)=1.2MPa		
	22									22.38m: B, 10°, PR, CN, VR								
	23						100	100		22.43m: JT, 20°, PR, CN, RF 22.63m: B, 10°, PR, CT CBS, RF 22.65m: EW, 20°, 5mm 22.96m: B, 5°, UN, CT CBS, VR 23.18-23.19m: B x2, 50-10°, PR, CT CBS, VR				23	PLT	PL(A)=1.1MPa		
	24									23.55m: EW, 10°, 25mm								
	24.24	SANDSTONE: pale grey, medium to coarse grained, medium bedded to thickly bedded. Hawkesbury Sandstone.					100	100		24.19m: B, 5°, PR, CT CBS, RF 24.34m: JT x2, 70-85°, PR, CN, VR				24	PLT	PL(A)=0.86MPa PL(A)=0.34MPa		
	25													25	PLT	PL(A)=0.90MPa		
	26						100	100						26	PLT	PL(A)=1.2MPa		
	27						100	100		27.04m: B, 5°, PR, CT CBS, RF				27	PLT	PL(A)=1.1MPa		
	28									28.18m: EW, 0°, 5mm				28	PLT	PL(A)=1.2MPa		
	29						100	100		28.75m: B, 15°, PR, VNR Clay, SM				29	PLT	PL(A)=0.92MPa		
	30									29.24m: B, 5°, UN, CT CBS, RF								

NOTES: #Soil origin is "probable" unless otherwise stated.

PLANT: Geo 205
METHOD: DT to 0.15m, then AD/T to 1.5m, then NMLC to 31m
REMARKS: Surface level from TSS Survey Drawing (210492-1). Coordinates estimated measurements to site features.

OPERATOR: Ground Test (JJ)

LOGGED: C. S. Yip
CASING: PVC to 1.5m

Refer to explanatory notes for symbol and abbreviation definitions



BOREHOLE LOG

CLIENT: Setia Sydney Pty Ltd
PROJECT: Proposed Mixed Use Development
LOCATION: 20-22 Atchison Street, St Leonards, NSW 2065

SURFACE LEVEL: 88.8 AHD
COORDINATE: E:333104.5, N:6256055.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH3
PROJECT No: 73262.05
DATE: 04/08/25 - 05/08/25
SHEET: 5 of 5

GROUNDWATER		CONDITIONS ENCOUNTERED										SAMPLE			TESTING					
		RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	SOIL STRENGTH (where encountered)	GRAPHIC	WEATH.	DEPTH (m)	STRENGTH	RECOVERY (%)	RQD	FRACTURE SPACING (m)	DEFECTS & REMARKS	SAMPLE REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS	BACKFILL
	58	31	[CONT] SANDSTONE: pale grey, medium to coarse grained, medium bedded to thickly bedded. Hawkesbury Sandstone.			FR			100	100		30.56m: B, 5°, PR, CN, VR								
			Borehole discontinued at 31.00m depth. Target Depth Reached.																	
	57	32																		
	56	33																		
	55	34																		
	54	35																		
	53	36																		
	52	37																		
	51	38																		
	50	39																		
	49																			

NOTES: #Soil origin is "probable" unless otherwise stated.

PLANT: Geo 205
METHOD: DT to 0.15m, then AD/T to 1.5m, then NMLC to 31m
REMARKS: Surface level from TSS Survey Drawing (210492-1). Coordinates estimated measurements to site features.

OPERATOR: Ground Test (JJ)

LOGGED: C. S. Yip
CASING: PVC to 1.5m

Refer to explanatory notes for symbol and abbreviation definitions

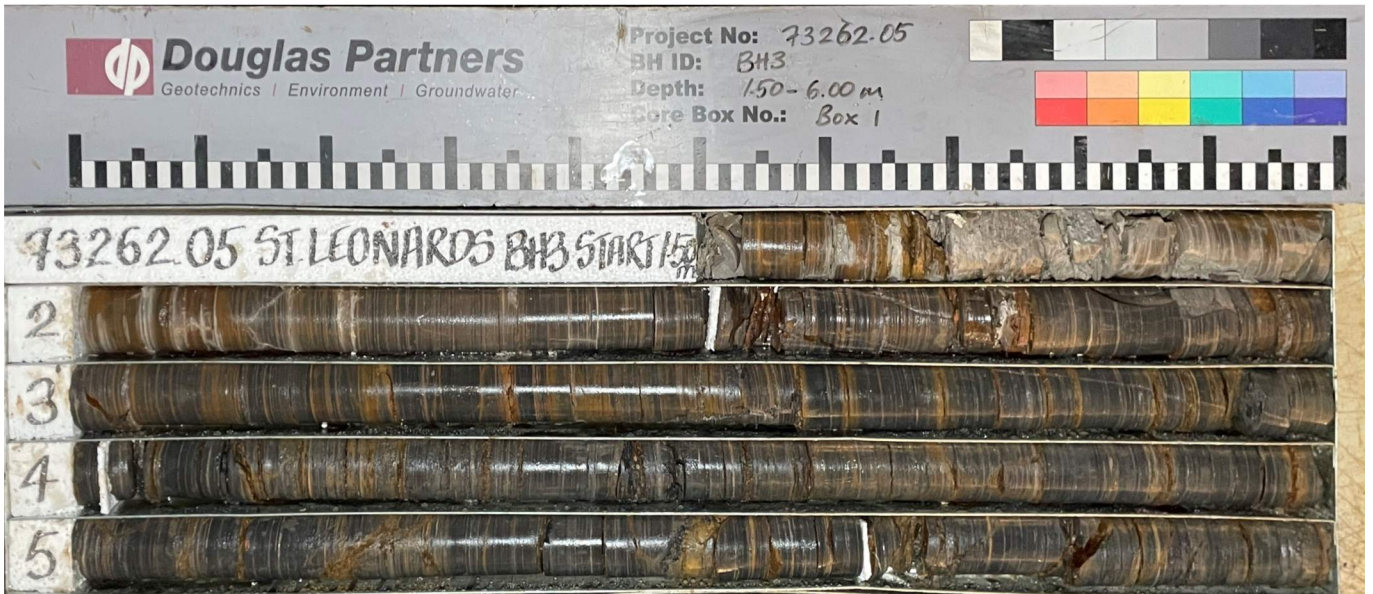


CORE PHOTO LOG

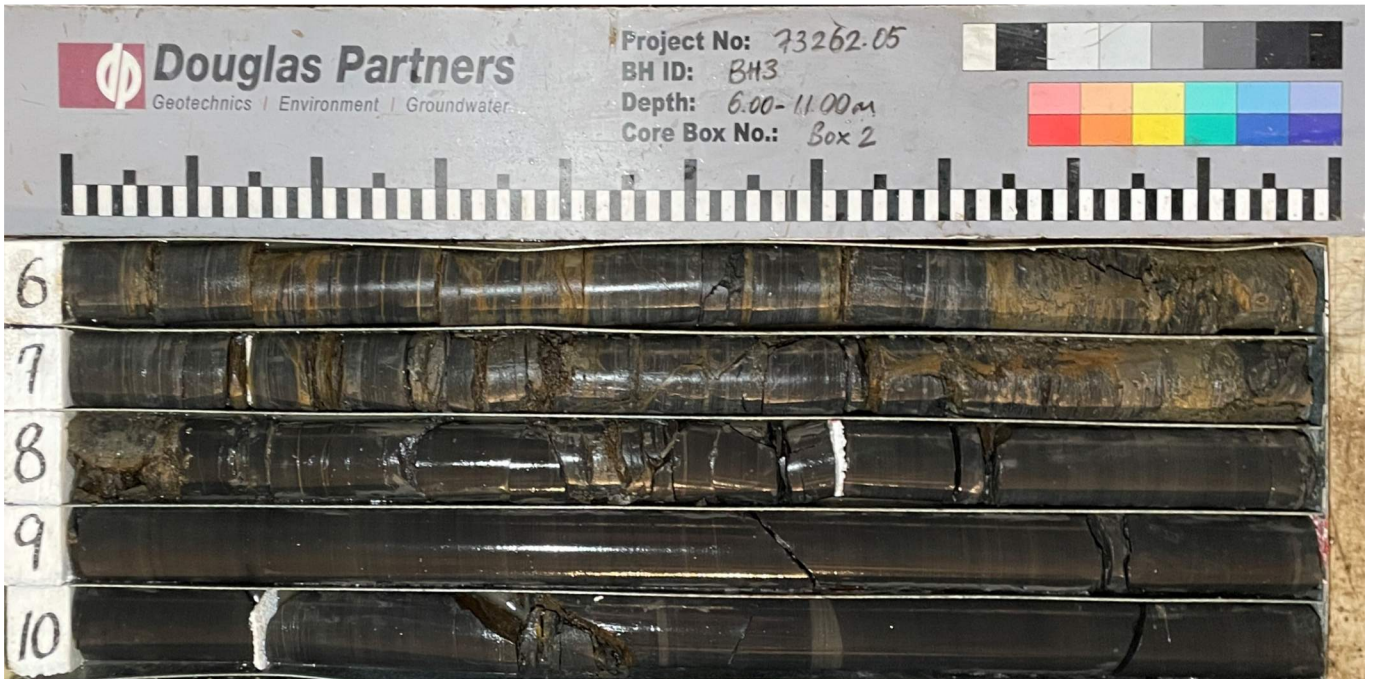
CLIENT: Setia Sydney Pty Ltd
PROJECT: Proposed Mixed Use Development
LOCATION: 20-22 Atchison Street, St Leonards, NSW 2065

SURFACE LEVEL: 88.8 AHD
COORDINATE: E:333104.5, N:6256055.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH3
PROJECT No: 73262.05
DATE: 04/08/25 - 05/08/25
SHEET: 1 of 3



1.50-6.00 m depth



6.00-11.00 m depth

CORE PHOTO LOG

CLIENT: Setia Sydney Pty Ltd
PROJECT: Proposed Mixed Use Development
LOCATION: 20-22 Atchison Street, St Leonards, NSW 2065

SURFACE LEVEL: 88.8 AHD
COORDINATE: E:333104.5, N:6256055.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH3
PROJECT No: 73262.05
DATE: 04/08/25 - 05/08/25
SHEET: 2 of 3



11.00-16.00 m depth



16.00-21.00 m depth

CORE PHOTO LOG

CLIENT: Setia Sydney Pty Ltd
PROJECT: Proposed Mixed Use Development
LOCATION: 20-22 Atchison Street, St Leonards, NSW 2065

SURFACE LEVEL: 88.8 AHD
COORDINATE: E:333104.5, N:6256055.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH3
PROJECT No: 73262.05
DATE: 04/08/25 - 05/08/25
SHEET: 3 of 3



21.00-26.00 m depth



26.00-31.00 m depth

BOREHOLE LOG

CLIENT: Setia Sydney Pty Ltd
PROJECT: Proposed Mixed Use Development
LOCATION: 20-22 Atchison Street, St Leonards, NSW 2065

SURFACE LEVEL: 88.8 AHD
COORDINATE: E:333114.6, N:6256047.3
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH5
PROJECT No: 73262.05
DATE: 05/08/25
SHEET: 1 of 1

GROUNDWATER		CONDITIONS ENCOUNTERED					SAMPLE			TESTING AND REMARKS				
		RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN (#)	CONSIS. (%)	DENSITY (%)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE
05/08/25 No Free Groundwater Observed While Augering			CONCRETE; 130mm, 6mmØ steel reinforcement bar at 100mm.		NA	NA	NA							
	0.13	0.16	FILL / SAND with silt: dark brown; fine to medium; occasional tile fragments and rootlets .		FILL	ND	M			ES		0.13		
			Gravelly CLAY (Cl): pale grey mottled orange-brown; medium plasticity; fine to coarse, siltstone and ironstone gravel; extremely weathered siltstone.		XWM	H	w<PL			A/ES		0.16		
		Borehole discontinued at 0.25m depth. Refusal on extremely weathered siltstone.									0.25			

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: Hand tools
METHOD: DT to 0.13m, then HA to 0.25m
REMARKS: Surface level from TSS Survey Drawing (210492-1). Coordinates estimated measurements to site features.

OPERATOR: (C. S. Yip)

LOGGED: C. S. Yip
CASING: Uncased

Refer to explanatory notes for symbol and abbreviation definitions



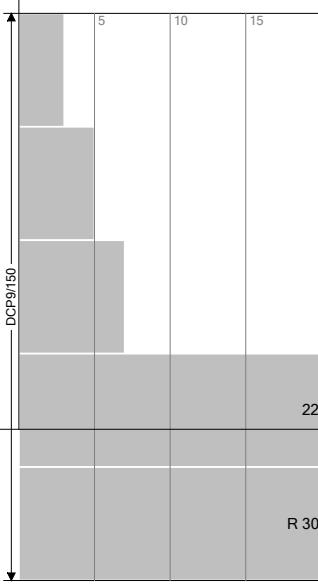
BOREHOLE LOG

CLIENT: Setia Sydney Pty Ltd
PROJECT: Proposed Mixed Use Development
LOCATION: 20-22 Atchison Street, St Leonards, NSW 2065

SURFACE LEVEL: 88.6 AHD
COORDINATE: E:333114.8, N:6256054.2
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH6
PROJECT No: 73262.05
DATE: 05/08/25
SHEET: 1 of 1

GROUNDWATER		CONDITIONS ENCOUNTERED					SAMPLE			TESTING AND REMARKS					
		RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN (#)	CONSIS. (%)	DENSITY (%)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
05/08/25 No Free Groundwater Observed While Augering	88	0.13	CONCRETE; 130mm, 6mmØ steel reinforcement bar at 100mm.		NA	NA	NA								
		0.18	FILL / SAND with silt: dark brown; fine to medium.		FILL	ND	M			ES	0.13 - 0.18				
		0.30	FILL / CLAY with gravel: pale brown; medium plasticity; fine to medium, siltstone and ironstone gravel; occasional glass fragments, steel bar.		FILL	VC	w=PL			ES	0.18 - 0.30				
		0.50	From 0.30m: With fine to coarse sand		FILL	VC	w=PL								
	88	0.50	Gravelly CLAY (Cl): pale grey mottled orange-brown; medium plasticity; fine to coarse, siltstone and ironstone gravel.		XWM	H	w<PL			ES	0.30 - 0.50				
		0.70	Borehole discontinued at 0.70m depth. Refusal on extremely weathered siltstone.												
		1.00													
		87													



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

PLANT: Hand tools
METHOD: DT to 0.13m, then HA to 0.7m
REMARKS: Surface level from TSS Survey Drawing (210492-1). Coordinates estimated measurements to site features.

OPERATOR: (C. S. Yip)

LOGGED: C. S. Yip
CASING: Uncased

Refer to explanatory notes for symbol and abbreviation definitions



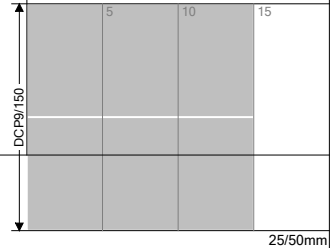
BOREHOLE LOG

CLIENT: Setia Sydney Pty Ltd
PROJECT: Proposed Mixed Use Development
LOCATION: 20-22 Atchison Street, St Leonards, NSW 2065

SURFACE LEVEL: 87.7 AHD
COORDINATE: E:333132.1, N:6256054.6
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH7
PROJECT No: 73262.05
DATE: 04/08/25
SHEET: 1 of 1

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
04/08/25 No Free Groundwater Observed While Augering		0.13	CONCRETE; 130mm, 6mmØ steel reinforcement bar at 100mm.		NA	NA	NA							
		0.25	FILL / GRAVEL: grey; medium to coarse, igneous.		FILL	ND	M			ES				
		0.40	Silty CLAY (Cl) with gravel: grey; medium plasticity; fine to medium, siltstone and ironstone gravel; extremely weathered siltstone.		XWM	H	w<PL			A/ES				
			Borehole discontinued at 0.50m depth. Refusal on extremely weathered siltstone.											



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: Hand tools
METHOD: DT to 0.13m, then HA to 0.5m
REMARKS: Surface level from TSS Survey Drawing (210492-1). Coordinates estimated measurements to site features.

OPERATOR: (C. S. Yip)

LOGGED: C. S. Yip
CASING: Uncased

Refer to explanatory notes for symbol and abbreviation definitions



BOREHOLE LOG

CLIENT: Setia Sydney Pty Ltd
PROJECT: Proposed Mixed Use Development
LOCATION: 20-22 Atchison Street, St Leonards, NSW 2065

SURFACE LEVEL: 87.7 AHD
COORDINATE: E:333136.3, N:6256042.6
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH8
PROJECT No: 73262.05
DATE: 04/08/25
SHEET: 1 of 1

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
04/08/25 No Free Groundwater Observed While Augering		0.13	CONCRETE; 130mm, 6mmØ steel reinforcement bar at 100mm.		NA	NA	NA							
		0.24	FILL / GRAVEL; medium to coarse, igneous.		FILL	ND	M			ES				
		0.30	Silty CLAY (Cl) with gravel: grey; medium plasticity; fine to medium, siltstone and ironstone gravel; extremely weathered siltstone.		XWM	VSt H	w<PL			AES				
		0.40	Borehole discontinued at 0.40m depth. Refusal on extremely weathered siltstone.											
	87													
	86	1												

DCP 9/150

	5	10	15
			22
			HB 25/70mm

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: Hand tools

OPERATOR: (C. S. Yip)

LOGGED: C. S. Yip

METHOD: DT to 0.13m, then HA to 0.4m

CASING: Uncased

REMARKS: Surface level from TSS Survey Drawing (210492-1).
Coordinates estimated measurements to site features.

Refer to explanatory notes for symbol and abbreviation definitions



BOREHOLE LOG

CLIENT: Setia Sydney Pty Ltd
PROJECT: Proposed Mixed Use Development
LOCATION: 20-22 Atchison Street, St Leonards, NSW 2065

SURFACE LEVEL: 87.7 AHD
COORDINATE: E:333132.1, N:6256032.4
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH9
PROJECT No: 73262.05
DATE: 04/08/25
SHEET: 1 of 1

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
04/08/25 No Free Groundwater Observed While Augering		0.14	CONCRETE; 140mm, 6mmØ steel reinforcement at 100mm.	[Concrete Symbol]	NA	NA	NA							
		0.20	FILL / GRAVEL: grey; medium to coarse, igneous.	[Fill Symbol]	FILL	ND	M			ES		0.14 - 0.20		
			Silty CLAY (Cl) with gravel; medium plasticity; fine to medium, siltstone and ironstone gravel; extremely weathered siltstone.	[Clay Symbol]	XWM	H	w<PL			A/ES		0.20 - 0.40		
			Borehole discontinued at 0.45m depth. Refusal on extremely weathered siltstone.											HB 30/110mm
	87													
		1												
	86													

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: Hand tools
METHOD: DT to 0.13m, then HA to 0.45m
REMARKS: Surface level from TSS Survey Drawing (210492-1).
 Coordinates estimated measurements to site features.

OPERATOR: (C. S. Yip)

LOGGED: C. S. Yip
CASING: Uncased

Refer to explanatory notes for symbol and abbreviation definitions



Appendix D

Laboratory Results

Table I3: Summary of Results of Groundwater Analysis

		Metals - Dissolved								TRH				BTEX						PAH									
		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	Acenaphthene	Acenaphthylene	Anthracene	Benzo(a)anthracene	Naphthalene	Benzo(a)pyrene (BaP)	Benzo(b,k)fluoranthene	Benzo(g,h,i)perylene	Chrysene	
	PQL	1	0.1	1	1	1	0.05	1	1	10	50	100	100	1	1	1	1	2	1	0.1	0.1	0.1	0.1	1	0.1	0.2	0.1	0.1	
ANZG (2018) 95% LOP Fresh		13	0.2	1	1.4	3.4	0.06	11	8					950	180	80	350	75				0.01		16	0.1				
HEPA (2020) 99% LOP Fresh																													
NEPC (2013) HSL 2-4m										6,000	NL			5,000	NL	NL			NL					NL					
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	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
BH1	27/08/25	<1	0.1	<1	8	<1	<0.05	46	46	<10	<50	160	<100	<1	<1	<1	<1	<2	<1	<0.1	<0.1	<0.1	<0.1	<1	<0.1	<0.2	<0.1	<0.1	
BD/20250827	27/08/25	<1	0.1	<1	8	<1	<0.05	48	56	<10	<50	<100	<100	<1	<1	<1	<1	<2	<1	-	-	-	-	<1	-	-	-	-	
BH2	27/08/25	<1	<0.1	<1	2	<1	<0.05	24	79	<10	180	<100	<100	<1	<1	<1	<1	<2	<1	<0.1	<0.1	<0.1	<0.1	<1	<0.1	<0.2	<0.1	<0.1	
BH3	27/08/25	<1	<0.1	<1	<1	<1	<0.05	11	9	<10	<50	<100	<100	<1	<1	<1	<1	<2	<1	<0.1	<0.1	<0.1	<0.1	<1	<0.1	<0.2	<0.1	<0.1	

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: 99% level of protection adopted for bioaccumulative chemicals]

HEPA (2018) PFAS National Environmental Management Plan, Version 2 99% level of protection for Fresh water aquatic ecosystems

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.

Table I3: Summary of Results of Groundwater Analysis

		OCP																											
		Dibenz(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	Endosulfan II	Endosulfan Sulphate	Endrin	Endrin Aldehyde	Heptachlor	Heptachlor Epoxide	Hexachlorobenzene	Methoxychlor	alpha-BHC	beta-BHC	delta-BHC	
	PQL	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	0.002	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	
ANZG (2018) 95% LOP Fresh			1			0.6				0.006		0.001	0.01							0.01		0.01		0.1	0.005				
HEPA (2020) 99% LOP Fresh																													
NEPC (2013) HSL 2-4m																													
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	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	
BH1	27/08/25	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.001	<0.001	<0.001	<0.001	0.017	0.017	<0.001	<0.001	<0.002	<0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
BD/20250827	27/08/25	-	-	-	-	-	-	<1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
BH2	27/08/25	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
BH3	27/08/25	<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	<0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	

Notes:

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

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

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HEPA (2018) PFAS National Environmental Management Plan, Version 2 99% level of protection for Fresh water aquatic ecosystems

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

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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.

Table I3: Summary of Results of Groundwater Analysis

		OPP																			PCB									
		Lindane	Sum of detected OCP	Azinphos methyl (Cuthion)	Bromophos-ethyl	Chlorpyrifos	Chlorpyrifos-methyl	Diazinon	Dichlorvos	Dimethoate	Ethion	Remel (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	Arochlor 1260	Sum of detected PCB		
	PQL	0.001	0.001	0.02	0.05	0.009	0.05	0.01	0.05	0.1	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		
ANZG (2018) 95% LOP Fresh		0.2		0.02		0.00004		0.01		0.15			0.2		0.05	0.004												0.3	0.01	
HEPA (2020) 99% LOP Fresh																														
NEPC (2013) HSL 2-4m																														
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	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	
BH1	27/08/25	<0.001	0.017	<0.02	<0.05	<0.009	<0.05	<0.01	<0.05	<0.1	<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	<0.01	<0.01
BD/20250827	27/08/25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH2	27/08/25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
BH3	27/08/25	<0.001	<0.001	<0.02	<0.05	<0.009	<0.05	<0.01	<0.05	<0.1	<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	<0.01	

Notes:

- No criterion / not defined / not tested / not applicable
 - * QA/QC replicate of sample listed directly below the primary sample
 - NL Not limiting
 - PQL Practical quantitation limit
- Shaded cell is exceedance of guideline value
- Where one or more guideline value is exceeded, the cell is shaded to the colour of the highest guideline value exceeded
- ANZG (2018) Australian and New Zealand Guidelines for Fresh and Marine Water Quality, 95% level of protection of species for Fresh aquatic ecosystems [NB: 99% level of protection adopted for bioaccumulative chemicals]
- HEPA (2018) PFAS National Environmental Management Plan, Version 2 99% level of protection for Fresh water aquatic ecosystems
- 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.

Table I3: Summary of Results of Groundwater Analysis

		1,1,1,2-tetrachloroethane	1,1,1-trichloroethane	1,1,2,2-tetrachloroethane	tetrachloroethene	1,1,2-trichloroethane	1,1,2-trichloroethylene	1,1-dichloroethane	1,1-Dichloroethene	1,1-dichloropropene	1,2,3-trichlorobenzene	1,2,3-trichloropropane	1,2,4-trichlorobenzene	1,2,4-trimethylbenzene	1,2-dibromo-3-chloropropane	1,2-dichlorobenzene	1,2-dichloroethane	1,2-dichloropropane	1,3,5-trimethylbenzene	1,3-dichlorobenzene	1,3-dichloropropane	1,4-dichlorobenzene	2,2-dichloropropane	2-chlorotoluene	4-chlorotoluene	4-isopropyl toluene	Bromobenzene
	PQL	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
ANZG (2018) 95% LOP Fresh			270	400	70	6,500	330		700		3		85			160	1,900	900		260	1,100	60					
HEPA (2020) 99% LOP Fresh																											
NEPC (2013) HSL 2-4m																											
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	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
BH1	27/08/25	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
BD/20250827	27/08/25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH2	27/08/25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH3	27/08/25	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1

Notes:

- No criterion / not defined / not tested / not applicable
- * QA/QC replicate of sample listed directly below the primary sample
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 ANZG (2018) Ammonia DGV is pH and temperature dependant. DGV for a pH of 8 provided in table.

Table I3: Summary of Results of Groundwater Analysis

		VOC (excluding BTEX)																										
		Bromochloromethane	Bromodichloromethane	Bromoform	carbon tetrachloride	Chloroethane	Vinyl Chloride	Chloroform	Chloromethane	cis-1,2-dichloroethene	cis-1,3-dichloropropene	isopropylbenzene (cumene)	Cyclohexane	dibromochloromethane	Dibromomethane	Dichlorodifluoroethane	1,2-dibromoethane	hexachlorobutadiene	Bromomethane	Monochlorobenzene	n-butyl benzene	n-propyl benzene	sec-butyl benzene	Styrene (vinylbenzene)	Tert-butyl benzene	trans-1,2-dichloroethene	trans-1,3-dichloropropene	
	PQL	1	1	1	1	10	10	1	10	1	1	1	1	1	1	10	1	1	10	1	1	1	1	1	1	1	1	1
ANZG (2018) 95% LOP Fresh					240		100	770				30								55								
HEPA (2020) 99% LOP Fresh																												
NEPC (2013) HSL 2-4m																												
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	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
BH1	27/08/25	<1	<1	<1	<1	<10	<10	<1	<10	<1	<1	<1	<1	<1	<1	<10	<1	<1	<10	<1	<1	<1	<1	<1	<1	<1	<1	<1
BD/20250827	27/08/25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
BH2	27/08/25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
BH3	27/08/25	<1	<1	<1	<1	<10	<10	<1	<10	<1	<1	<1	<1	<1	<1	<10	<1	<1	<10	<1	<1	<1	<1	<1	<1	<1	<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: 99% level of protection adopted for bioaccumulative chemicals]
- HEPA (2018) PFAS National Environmental Management Plan, Version 2 99% level of protection for Fresh water aquatic ecosystems
- 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+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.

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				PFAS							Other	
		Trichlorofluoromethane	Sum of detected VOC	PFOS	PFOA	PFHxS	Perfluorobutanesulfonic acid	6:2 FTS	8:2 FTS	Sum of detected PFAS	Disulfoton	Mevinphos
	PQL	10	1	0.0002	0.0002	0.0002	0.0004	0.0004	0.0004	0.0002	0.05	0.05
ANZG (2018) 95% LOP Fresh												
HEPA (2020) 99% LOP Fresh				0.00023	19							
NEPC (2013) HSL 2-4m												
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
BH1	27/08/25	<10	<1	0.04	0.082	0.27	0.2	0.0004	<0.0004	0.59	<0.05	<0.05
BD/20250827	27/08/25	-	-	-	-	-	-	-	-	-	-	-
BH2	27/08/25	-	-	-	-	-	-	-	-	-	-	-
BH3	27/08/25	<10	<1	0.0002	<0.0002	<0.0002	<0.0004	<0.0004	<0.0004	0.0002	<0.05	<0.05

Notes:

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