Douglas PARTNERS

GROUNDED EXPERTISE

Report on Groundwater Inflow Assessment

Proposed Residential Building

601 Pacific Highway, St Leonards NSW

Prepared for Stockland

Project 86230.01

18 March 2026

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Revision 0	Hee-Jung Yoon, Stockland
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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.

Signature	Date
Author	18 March 2026
Reviewer	18 March 2026

FS604853

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

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Executive Summary

Stockland Development (Stockland) submitted an EOI for an SSDA and concurrent rezoning proposal on 17 January 2025 through the Housing Delivery Authority Pathway (HDA). At its Briefing on 19 February 2025, the HDA recommended to the Minister that the applicant's project be declared SSD, for the reason that it sufficiently satisfied the objectives and criteria of the HDA. The project was declared as SSD in the State Significant Development Declaration Order 2025 (No 2) (26 February 2025).

A request for SEARs was lodged on the 6th of June 2025 with SEARS received on the 4th of July 2025.

This groundwater inflow assessment report has been prepared by Douglas and is submitted to the Department of Planning, Housing and Infrastructure (DPHI) in support of a State Significant Development Application (SSDA) (SSD-85848713) and concurrent rezoning proposal for a new mixed-use development at 601 Pacific Highway, St Leonards (the site).

The proposal seeks consent for the following:

- An amendment to the North Sydney Local Environmental Plan 2013 (NLEP 2013) to rezone the site from E2 Commercial Centre to MU1 Mixed Use and to amend the minimum non-residential floor space ratio development standard under Clause 4.4A from 20:1 to 1:1.
- Demolition of the existing 14 storey commercial office building that is currently on the site.
- Site excavation, remediation and other preparatory works.
- Construction and operation of a new 52 storey (RL264.50) mixed use shop top housing development, with a FSR of 20:1 (maximum GFA of 56,880m^2), comprising:
    - 538 dwellings including 508 Build-to-Sell apartments and 30 Affordable Housing apartments across a mix of apartment typologies.
    - A contribution of 5% of the residential GFA toward Affordable Housing.
    - Retail and commercial land uses at the ground and podium levels.
    - Internal and external residential amenities provided throughout the building.
    - Six levels of basement carparking, comprising a total of 300 car spaces, bicycle parking, loading bays, waste areas, plant, and back of house.
- Vehicular access to the basement via Atchison Street.
- Landscaping and Public Domain works.
- Reticulation of site services and infrastructure (electricity, telecommunication, water, and sewer connections).

This geotechnical report has been prepared to address the following relevant Secretary's Environmental Assessment Requirements (SEARs) set out in the Table 1 below.

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Table 1: Secretary's Environmental Assessment Requirements relevant to this report

SEARs	Report Reference
12. Ground and Groundwater Conditions • Assess potential impacts on soil resources and related infrastructure and riparian lands on and near the site and including soil erosion. • Where required provide a Groundwater Impact Assessment in accordance with relevant Groundwater Guidelines. If the proposed development is on land identified as having high salinity or acid sulfate soil potential in an EPI provide a Salinity Management Plan or Acid Sulfate Soil Management Plan that includes appropriate management measures and strategies.	Sections 4, and 6 to 13

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Report on Groundwater Inflow Assessment
Proposed Residential Building
601 Pacific Highway, St Leonards NSW

1. Introduction

This report prepared by Douglas Partners Pty Ltd (Douglas) presents the results of a groundwater inflow assessment undertaken for a proposed residential building at 601 Pacific Highway, St Leonards NSW (the site). The assessment was commissioned by email instructing to proceed dated 04 November 2024 from Diego Eguiguren of Stockland and was undertaken in accordance with Douglas' proposal 86230.01.P.001.Rev2 dated 17 September 2024.

Based on the supplied architectural drawings prepared by Bates Smart, it is understood that the proposed development comprises the demolition of the existing 14-storey commercial building and construction of a new 52-storey mixed-used residential building with six basement levels. The existing basement has 4 partial basement levels in a gradually spiralling arrangement with the lowest basement level understood to be at about RL 81.3 m relative to Australian Height Datum (AHD). It is proposed to deepen the existing basement by about 8.3 m to RL 73 m AHD.

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

2. Previous work

This report follows a number of previously issued Douglas reports for the project which include:

- Geotechnical Investigation Report (86230.01.R.001.Rev3, dated March 2026);
- Due Diligence Contamination Assessment (Ref.: 86230.01.R.002.Rev4, dated March 2026);
- Detailed Site Investigation (DSI) for contamination) (Ref.: 86230.03.R.002.Rev2, dated March 2026);
- Remediation Action Plan (RAP) (Ref.: 86230.03.R.001.Rev2, dated March 2026); and
- Groundwater Monitoring Memorandum (86230.01.R.003.Rev0, dated July 2025).

3. Site description

The site is located on Cammeraygal country at 601 Pacific Highway, St Leonards within North Sydney (LGA). The site is legally described as Lot 71 in DP749690 and has a total area of 2,844m^2. The site is 4.5 km north of the Sydney CBD, 3 km from the North Sydney CBD, and within proximity to the centres of St Leonards, Chatswood, and Macquarie Park. The site is located 350 metres (walking distance) from St Leonards train station and approximately 400m (walking distance) from the Crows Nest Metro station.

A site aerial and location plan is provided at Figure 1 below.

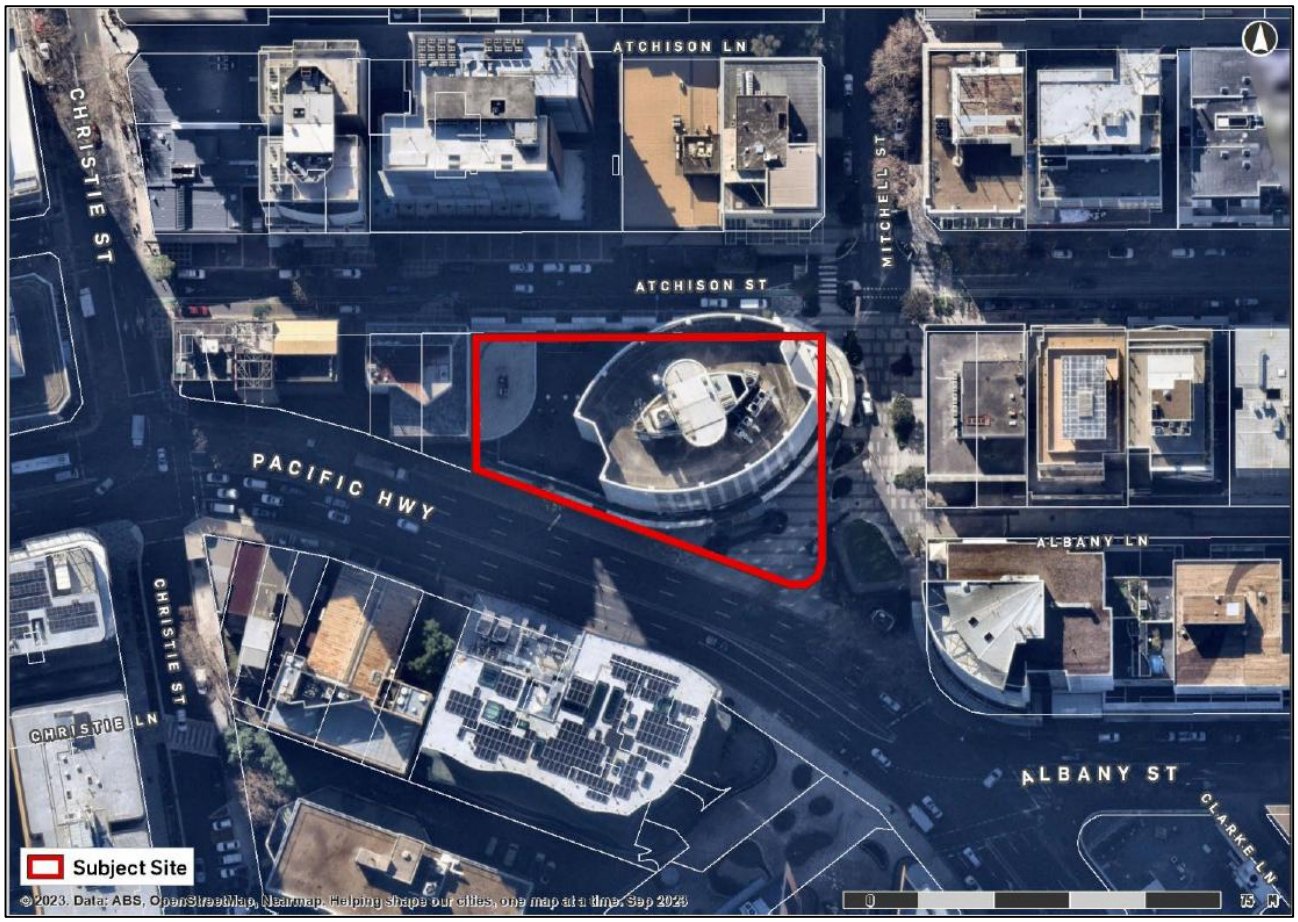

Figure 1: Site Location (provided by Urbis)

The site is bounded by a 7-storey commercial building with one level of basement carpark to the west, located at 619 Pacific Highway, and Mitchell Street to the east. Beyond Aitchson Street to the north is a 27-storey residential building understood to have a single level basement. Beyond Mitchell Street to the east is a five-storey commercial building with a basement car park.

Based on the available 'NSW 2 m Elevation Contours'; the site topography generally slopes down towards the west, with surface levels of approximately RL 93 m in the east, falling to RL 88 m in the west, relative to Australian Height Datum.

At the time of writing this report, the site is occupied by a 14-storey commercial building in the eastern portion of the site, and single level mixed-use retail in the western portion of the site, over the basement entrance. The basement levels comprise 4 partial basement levels in a gradually spiralling arrangement with the lowest basement level understood to grade from RL 82.4 m at its highest point, down to about RL 81.3 m at its lowest, measured during the initial surveying of the site. Based on the supplied existing basement drawings, it is understood that the basement retention system comprises a soldier pile wall. Shotcrete panels in the basement car park were observed and signs of minor cracking with seepage and iron staining noted.

The closest body of water to the site is Berrys Creek located approximately 750 m to the southwest, at a significantly lower elevation.

The site location is shown in Drawing 1, Appendix B.

4. Geotechnical and Hydrogeological Model

4.1 Subsurface Profile

Reference to the Sydney 1:100 000 Seamless Geology Sheet indicates that the site is underlain by the Ashfield Shale of the Wianamatta Group, described as black to dark-grey shale and laminite. Below the Ashfield Shale is the Hawkesbury Sandstone which typically comprises medium to coarse grained quartz sandstone with some shale and laminite bands or 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, ranging in thickness from about 2 m to 10 m.

Ashfield Shale is typically closely bedded and contains an orthogonal pair of steeply dipping (70° to 90°) joint sets striking NNE and ESE, spaced 0.5 m to 5 m. Randomly orientated, 30° to 45° dipping ubiquitous joints are also present. These joint sets persist through the Hawkesbury Sandstone, which is typically light to mid grey in colour and has massive and cross-bedded facies. The Hawkesbury Sandstone normally has near-horizontal bedding partings spaced from less than 1 m to well over 3 m in places.

The previous investigation, undertaken in March and April 2025, included the drilling of six boreholes (BH01-BH06). The boreholes were initiated using diacore barrel and solid flight augering to the top of weathered rock, then extended to their target depths using NMLC diamond coring. The boreholes were drilled from the existing basement level to depths of between 11 m and 15 m (BH01 – BH03, BH05 & BH06) with one borehole extended to a depth of 31.5 m (BH04).

Groundwater monitoring wells were installed in boreholes BH01, BH03, and BH06 to 14.8 m, 12.1 m, and 11.1 m, respectively.

The general subsurface profile encountered at the borehole locations may be summarised as follows:

CONCRETE - Concrete slab at all borehole locations, measured to be between 130 mm and 180 mm thick. At BH01, the concrete slab comprised two slabs of 90 mm and 130 mm, with bedding sand separating the two. Reinforcement of 8 mm diameter was noted within the concrete slabs.

FILL - Typically sandy clay and clayey sand with various proportions of igneous gravel within the shallow depths of the boreholes, with variable thickness in a range of 0.4 m to 2.4 m. The fill layer was observed to reduce in thickness in boreholes which were located in the deeper basement levels, with the thickest layer observed in BH01, and the thinnest in BH06.

SHALE BEDROCK - Generally low to medium strength, fresh, dark grey shale (Ashfield Shale) encountered in all boreholes below the fill to depths between 4.1 m and 4.8 m. The shale was typically

		slightly fractured. Frequent joints dipping 30° to 70° were observed within the shale bedrock. Sub-horizontal crushed zones with clay infill were also noted within BH02 between 3.9 m and 4.7 m depth. Very low strength bands accompanied with crushed zones and joints dipping 35° to 60° were noted in BH05 between 2.7 m and 5.3 m depth in BH05.
SANDSTONE and LAMINITE BEDROCK	-	Typically medium and medium to high strength, fresh to slightly weathered, pale grey and grey fine to medium grained sandstone and laminite (Mittagong Formation), and pale grey medium to coarse grained sandstone (Hawkesbury Sandstone) to depths of about 10.4 m and 17.0 m. Zones of very low and low strength rock were noted within the laminite bedrock at BH01 at depths of 5.0 m, 7.5 m, and 8.5 m. The rock was typically slightly fractured to unbroken. Sub-vertical joints dipping 70° to 90° were observed within BH03 between 7.2 m and 9.5 m depth.
HIGH STRENGTH SANDSTONE ROCK	-	Medium to high strength and high strength, fresh, pale grey to grey, fine to medium grained sandstone and laminite (Mittagong Formation), grading to fresh, high strength, medium to coarse grained sandstone (Hawkesbury Sandstone) to the termination depth of boreholes. A very high strength band was noted within BH01 between 14.3 m and 14.8 m depth. The high strength rock was typically unbroken. A low to medium strength, fractured zone was noted in BH04 between 26.2 m and 30.5 m depth.
POSSIBLE THRUST FAULTS	-	The low to medium strength rock and crushed zones with joints dipping 15° to 25°, observed in BH04 between 26.2 m and 30.5 m depth, were accompanied with significant loss of drilling fluid, indicating a possible presence of a thrust fault.

4.2 Groundwater

Three groundwater monitoring wells were installed during the geotechnical investigation. No groundwater seepage was noted during the augered portion of the boreholes and the necessary use of water as a drilling fluid precluded the observation of groundwater during coring.

A summary of the well construction details is presented within Table 2 below.

Table 2: Well Construction Details

BH Ref	Ground Surface Level (m AHD)	Filter Zone Depth (m)	Filter Zone Formation Material
BH01	82.4	3.0 – 14.8 m	Shale & Sandstone / Laminite
BH03	82.4	0.7 – 12.1 m	Shale & Sandstone / Laminite

BH Ref	Ground Surface Level (m AHD)	Filter Zone Depth (m)	Filter Zone Formation Material
BH06	81.3	1.5 – 11.1 m	Shale /&Sandstone / Laminite

After installation, the groundwater monitoring wells were purged of drilling fluid using a submersible pump on 9 and 10 April 2025.

Data loggers were installed in all wells between 9 April and 7 July 2025 to monitor the ground water level variations for a minimum period of three months.

A summary of the datalogger records during this reporting period is provided in Table 3.

Table 3: Summary of Datalogger Results during the Reporting Period

Borehole	Groundwater Readings (m) [*RL m AHD*]			
	Minimum	Maximum	Mean	Median
BH01	10.71 *[70.78]*	11.62 *[71.69]*	11.08 *[71.32]*	11.05 *[71.35]*
BH03	7.30 *[73.88]*	8.52 *[75.10]*	8.03 *[74.37]*	8.09 *[74.31]*
BH06	5.84 *[75.08]*	6.22 *[75.46]*	6.08 *[75.22]*	6.12 *[75.18]*

Notes: Data influenced by the permeability testing have been removed from this data set.

Manual readings of water levels were also obtained with a dip meter. A summary of the groundwater levels measured during different stages are presented in Table 4 below.

Table 4: Summary of Manual Groundwater Measurement Results (Year 2025)

Borehole	Measured Groundwater Depth (m) and RL [*m AHD*]		
	9 April *	17 April *	7 July
BH01	11.0 *[71.4]*	10.83 *[71.6]*	11.12 *[71.3]*
BH03	9.0 *[73.4]*	6.73 *[75.7]*	8.17 *[74.2]*
BH06	*N.D*	3.40 *[77.9]*	6.13 *[75.2]*

Note: * Measurement may be influenced by purging and permeability testing completed 09/04/25 and 17/04/25
N.D – No data

The groundwater measurements obtained from the dataloggers from 9 April to 7 July 2025 (the reporting period), together with a plot of daily rainfall records obtained from Weather Station No. 066011 and No. 66214 (Ref.: Bureau of Meteorology Station. http://www.bom.gov.au) included within Appendix C.

BOM data indicates that the total rainfall recorded in the reporting period was 380 mm, with a maximum daily rainfall of 73 mm on 2 July 2025.

Review of the datalogger results suggest that the rainfall in the reporting period did not result in a pronounced response in the measured groundwater levels.

Based on the recorded levels, the groundwater flow direction is expected to be towards the southwest with a gradient of about 0.09.

4.3 Permeability Testing

Falling head permeability tests were carried out in three boreholes to evaluate the hydraulic conductivity of the rock mass encountered in the boreholes. The test involves adding water and measuring the changes in water level in the well at regular time intervals using the dataloggers. The results of the permeability tests using Hvorslev's (1951) method are summarised in Table 5 below. Results sheets are provided in Appendix C.

Table 5: Results of Permeability Testing

Test Location	Screened Depth (m)	Test Method	Material	Hydraulic Conductivity (m/sec)
BH01	3.0 – 14.8	Falling Head	Shale & Sandstone/ Laminite	2.3×10^{-7}
BH03	0.5 – 12.1	Falling Head	Shale & Sandstone / Laminite	4.3×10^{-9}
BH03	0.5 – 12.1	Falling Head	Shale & Sandstone / Laminite	5.6×10^{-9}
BH06	1.5 – 11.1	Falling Head	Shale & Sandstone / Laminite	2.8×10^{-7}

The results of the permeability testing undertaken during the investigation for BH03, are up to approximately two orders of magnitude lower than some of the results from nearby previous investigations for "weathered sandstone". However, these values are consistent with the typical expected values for permeability in high strength, unfractured rock (Pells 2019).

4.4 Surface Waters, Groundwater Dependent Ecosystems, Groundwater Extraction Bores and EPA Notified Sites

The surface water sources in the vicinity of the site include the Lane Cover River which is located about 80 m below and 1.4 km southwest of the site. No other surface water sources are mapped within 1 km of the site.

Reference to the Australian Bureau of Meteorology GDE Atlas indicates that there are no mapped groundwater dependant ecosystems (GDEs) in proximity to the site. The nearest being a coastal sandstone gully about 1.1 km to the northeast of the site.

One extraction bore is noted about 420 m north-northeast of the site with a recorded standing water level of RL 35 m. The bore is located in an area about 20 m lower than the subject site, with a surface level of approximately RL 72 AHD.

One EPA registered site associated with a Telstra Data Centre is located approximately 650 m northwest of the subject site. No other EPA registered sites are noted within 1 km of the site. This site is included within the EPA List of Contaminated Sites (List of notified sites (nsw.gov.au), dated July 2025). Reference to this list indicates that the site has been assessed by the EPA and is classified as "Regulation under CLM Act not required". Give this classification, the presence of known plumes of significant contamination are considered unlikely. In addition, the site is noted to be positioned downstream and well below the subject site and the proposed basement level and would be expected to have no impact.

5. Proposed Development

It is understood that the proposed development comprises the demolition of the existing 14-storey commercial building and construction of a new 52-storey mixed-use residential building with six basement levels. The sixth level basement FFL is understood to be RL 73 m AHD, with a bulk excavation level of RL 72.6. m, requiring additional excavation of up to 8 m depth.

The proposed basement excavation is expected to extend up to about 6-7 m below the measured groundwater levels in some locations.

6. Groundwater Modelling

6.1 Methodology

Numerical modelling was undertaken to assess the potential inflow rates into the proposed basement during construction and in the long-term (if the basement is constructed as fully drained). The extent of drawdown likely to be induced by the drained basement was also assessed.

A 2-dimensional (2D) numerical groundwater model was developed for the site. The modelling was carried out using the 2D finite element hydrogeological software SEEP/W, developed by GEOSLOPE International Ltd. Transient flow conditions were modelled over a 1-year period to assess inflow rates during construction and steady state flow conditions were modelled to assess long term inflow rates for drained basement construction.

6.2 Model Geometry

For the purpose of the analysis, Douglas selected a long section along an east-westerly alignment, approximately through the centre of the basement footprint, approximately parallel to the longer basement edge adjacent to Atchison Steet. Details of the general existing and proposed basement shapes and orientation were adapted from the provided Bates Smart drawings (Drawing Ref.: 10B6, Revision P5, dated 02 March 2026).

The subsurface materials were subdivided into four layers corresponding to the soil and rock units. The aquifer boundaries of the model were extended approximately 75 m from the north and south basement boundaries.

The approximate alignment of the section is indicated on Figure 2 below. The general model section is shown in Figure 3 below.

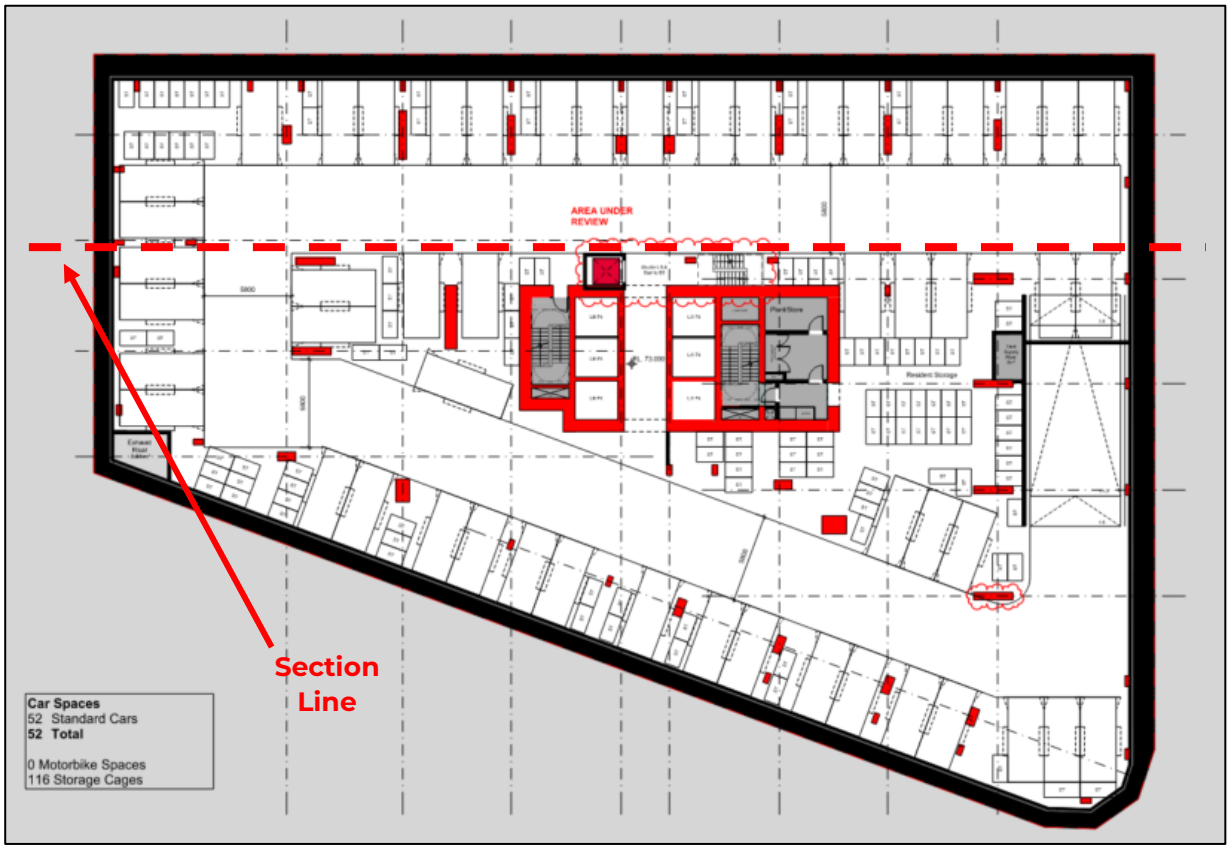

Figure 2: Extract from Bates Smart Drawing with approximate section lines

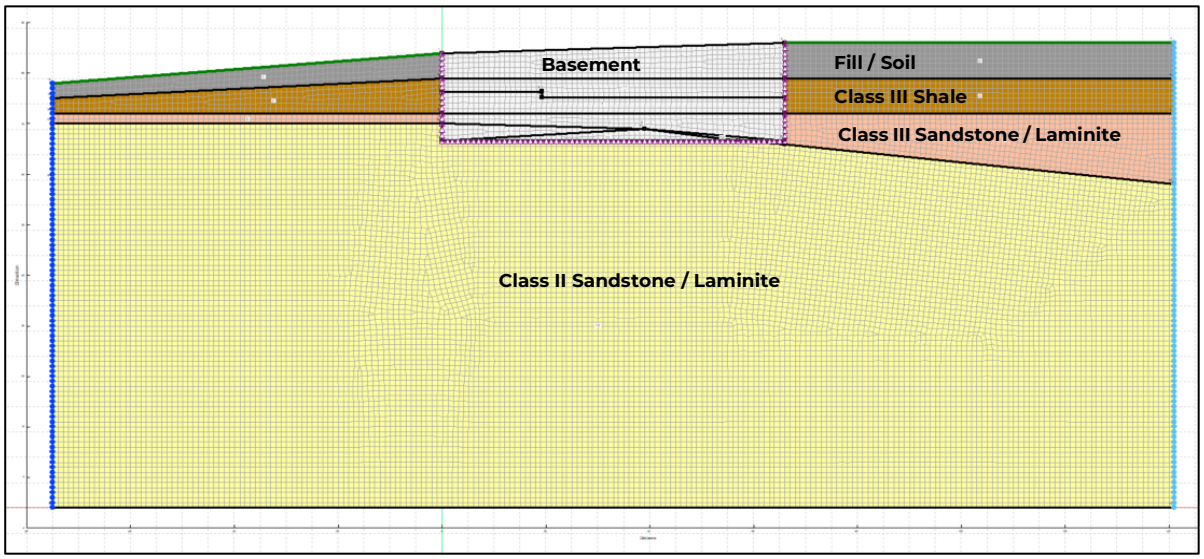

Figure 3: General Model Section

The constant head 'far-end' boundary conditions were selected to generate a similar hydraulic gradient as measured and to match the median hydraulic heads measured in monitoring wells.

Hydraulic parameters required for the multi-layer model include horizontal (K_h) and vertical (K_v) hydraulic conductivities, as well as volumetric water content curves, for each material.

The hydraulic conductivity assigned to the soil was estimated based on literature and Douglas' experience with similar materials in Sydney.

A hydraulic conductivity value assigned to the rock formation was selected based on geometric mean of in-situ permeability testing undertaken on the site for the sandstone / laminite and experience with similar materials. This is considered moderately conservative based on Douglas' experience with other similar developments in this material.

The hydraulic conductivity of the rock unit will vary with changes in the secondary structural features (defects), such as joints, bedding planes, faults, etc. along which groundwater will flow. Changes in the clay or silt content within defect apertures, as well as the orientation and interconnection of defects, will cause changes in the rock mass permeability. Given that the structure of Mittagong Formation commonly contains intersecting horizontal bedding planes and subvertical or steeply dipping joint/fault features which control the rock mass permeability, ratios of vertical and horizontal hydraulic conductivity (k_v / k_h) between 0.3 and 0.6 in the rock have been considered in the model.

The properties adopted in the model are summarised in Table 6 below.

Table 6: Summary of Material Parameters

Material	Saturated Horizontal Hydraulic Conductivity, Khs (m/sec)	Material Model Adopted	Assumed Saturated Volumetric Water Content	Assumed Residual Volumetric Water Content
Fill / Soil	1×10^{-8}	Unsaturated / saturated	0.15	0.05
Class III Shale	1×10^{-7}	Unsaturated / saturated	0.15	0.1
Class III & II Sandstone / Laminite	3.5×10^{-8}	Unsaturated / saturated	0.2	0.1

The hydraulic conductivity curves for unsaturated material types were estimated using the Van Genuchten formulae, included as a built-in function in SEEP/W.

6.3 Basement Shoring and Dewatering

It is understood that the proposed basement is intended to be fully drained, both during construction and in the long term. It has been assumed in the model that any seepage into the basement will be collected in perimeter sumps and pumped out of the basement.

The proposed excavation faces (presumably soldier shoring piles with shotcrete infill panels over strip drains pinned to the excavation face), have been modelled as potential seepage faces over the full height of the proposed excavation.

There are known permanently drained basements at nearby sites, with deeper basement levels. These basements are expected to continue to draw groundwater towards them, resulting in a reduction of inflow into the subject basement. However, for the simplicity, none of the nearby basements is modelled and therefore the assessment is likely conservative.

6.4 Groundwater Modelling Simulations

The model was run under transient conditions to assess the dewatering flow rates during construction, and under steady-state conditions to assess the long-term dewatering flow rates required for a drained basement, and the effect on the water table in the long term.

A number of sensitivity cases were analysed in addition to the base case. The details of the base and sensitivity cases are summarised below:

- Base Case – Material properties as detailed within Table 6.
- Sensitivity 1 – Arithmetic mean of in-situ permeability testing (1.3×10^{-7} m/s) applied to the Class II &III Sandstone and Laminite Units.
- Sensitivity 2 - Highest in-situ permeability test result (3.8×10^{-7} m/s) applied to the Class II &III Sandstone and Laminite Units.

In addition, each of the above cases were analysed for a general sensitivity case in which the observed groundwater level was elevated by 1 m.

7. Modelling Results

7.1 Groundwater Inflow

Groundwater inflow into the excavation along seepage face boundaries on the excavation faces, and along the basement floor, was evaluated using a mesh cross-section through the elements adjacent to the excavation. The predicted 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 (sump-and-pump) in order to dewater the basement excavation during construction and in the long-term. The simulated results are summarised in Table 7 below.

Table 7: Summary of Inflow Modelling Results

Case	Kh/Kv Ratio	Groundwater	Predicted Inflow (ML/year)	
			Transient	Steady State
Base Case	**0.3**	**Observed**	0.5	0.4
Base Case	**0.3**	**+1m**	0.6	0.5
Base Case	**0.6**	**Observed**	0.6	0.5
Base Case	**0.6**	**+1m**	0.8	0.6

Case	Kh/Kv Ratio	Groundwater	Predicted Inflow (ML/year)	
			Transient	Steady State
Sensitivity 1	0.3	Observed	1.3	1.1
Sensitivity 1	0.3	+1m	1.6	1.4
Sensitivity 1	0.6	Observed	1.7	1.4
Sensitivity 1	0.6	+1m	2.0	1.7
Sensitivity 2	0.3	Observed	2.6	2.4
Sensitivity 2	0.3	+1m	3.1	2.8
Sensitivity 2	0.6	Observed	3.2	2.9
Sensitivity 2	0.6	+1m	3.9	3.5

The unit width flows have been multiplied by the width of the overall excavation as well as the half the length of the sides of the excavation. This is considered an overall conservative assumption as flows in the sides of the excavation are expected to be less due to the reduced background groundwater level along the sides.

The SEEP/W results are based on a two-dimensional model, which assumes the excavation is much longer than it's width. In order to convert these predictions to more realistic values, the expression proposed by Kavvadas et al (1992) was used to adjust the results to allow for the length to width ratio of the proposed basement. Based on this a shape factor of 0.7 was adopted and has been applied to the results presented within Table 7.

The results of the SEEP/W analyses were checked using established simplified analytical methods for calculating flow rates into excavations. Predicted inflow rates are very sensitive to the clay content in defect apertures and the degree of fracturing in the bedrock. The estimates provided are based on available information and typical conditions encountered during the investigation, however the actual seepage rate will only be known once excavation is complete and may vary significantly to the predicted value. Flows can also be expected to vary temporally in response to rainfall conditions, with higher flows following rainfall events and reduced flows in dry periods. It is recommended that appropriate allowance and redundancy be included in the design and planning for changes in inflow rates. Where higher inflow occurs along fractured zones grouting could be used to reduce the permeability and inflow, if required.

7.2 **Drawdown and Settlement**

The magnitudes of the potential changes to the groundwater levels resulting from the construction of a drained basement (drawdown) were estimated by subtracting the predicted long-term groundwater levels from the original groundwater levels. The maximum estimated drawdowns at various distances from the north and south excavation faces are summarised Table 8 and Table 9 below.

Table 8: Estimated Drawdown at East Excavation Face

Location	Original Water Level (m AHD)	Final Water Level (m AHD)	Drawdown (m)
Immediately adjacent to basement	79.6	72.6	7
20 m away from basement	81.1	78.8	2.3

Table 9: Estimated Drawdown at West Excavation Face

Location	Original Water Level (m AHD)	Final Water Level (m AHD)	Drawdown (m)
Immediately adjacent to basement	73.4	70.7	2.7
20 m away from basement	71.3	69.4	1.9

The groundwater drawdown is expected to occur within the sandstone/laminite bedrock only. Settlements induced by drawdown in the bedrock are expected to be negligible due to the high deformation moduli of these bedrocks.

8. Aquifer Interference Policy Consideration

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

The site is underlain by rock that is typically fractured to unbroken with some highly fractured zones. The soil and rock profile at the site is of relatively low permeability with potentially low yield and is considered to be a 'less productive groundwater source' as outlined in the AIP.

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

- less than or equal to 10% cumulative variation in water table 40 m from any high priority groundwater dependent ecosystem (GDE), high priority culturally significant site, or less than a 2 m decline at any water supply work;
- a cumulative pressure head decline of not 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.

The Lane Cover River which is located about 80 m below and 1.4 km southwest of the site. No other surface water sources are mapped within 1 km of the site.

There are no mapped groundwater dependant ecosystems (GDEs) in proximity to the site. The nearest being a coastal sandstone gully about 1.1 km to the northeast of the site.

One extraction bore is noted about 420 m north-northeast of the site with a recorded standing water level of RL 35 m. The bore is located in an area about 20 m lower than the subject site, with a surface level of approximately RL 72 AHD and will not be impacted.

Given the distance from the subject site to the nearest surface water source and registered groundwater extraction well, as well as the absence of GDEs in the vicinity of the site, it is considered unlikely that the impact of the proposed development will exceed "the minimum impact consideration" outlines by the AIP and is therefore compliant.

9. Groundwater Quality

Reference to the Due Diligence Contamination Assessment (86230.01.R.002.Rev4, dated March 2026) completed by Doulas for the site, indicates that, overall, there was no gross groundwater contamination reported during the investigation except for elevated concentrations of chromium, copper, lead, nickel and zinc which are commonly found in urban areas of Sydney. Concentrations of Bromodichloromethane and Dibromodichloromethane were also detected.

Elevated concentrations of some nutrients, anions and cations were also reported for the analysed samples. Whilst these do not constitute contaminants, they will need to be considered for dewatering purposes and it is considered likely that some form of pre-treatment will be required to reduce these concentrations prior to disposal of water collected through the dewatering system.

Reference should be made to the Due Diligence Contamination Assessment report for details of the testing carried out.

10. Groundwater Disposal and Council Requirements

All collected groundwater requiring disposal will need to be tested against the requirements of the receiving authority. For example, disposal to stormwater will require Council approval and be subject to their water quality requirements for discharge to stormwater.

Ongoing monitoring of groundwater quality will be required to check that the groundwater quality complies with the nominated criteria for disposal. Suggested monitoring and reporting requirements are given in Section 12.

Where groundwater does not comply with the nominated requirements some form of groundwater treatment will be required prior to disposal. The treatment system will be determined and adjusted based on the groundwater test results prior to disposal and may include a combination of the following:

- Use of settlement tanks with addition of a flocculation agent to control heavy metals;
- Use of carbon filters to control hydrocarbons; and
- Use of specialist treatment systems to control heavy metals and hydrocarbons.

11. Potential Effects on Neighbouring Properties

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

Table 10: Assessment of Potential Effects of Dewatering

Item	Comment
Proximity of Groundwater Dependent Ecosystems (GDEs)	No GDEs mapped within 500 m of the site
Water supply losses by neighbouring groundwater users	A review of registered bores within a 500 m radius of the surrounding site was undertaken. The search identified one extraction bore about 420 m north-northeast of the site. Given the predominant groundwater flow direction is to the southwest and the identified well is at a considerably lower elevation than the proposed basement, impact of this will is considered unlikely at this distance.
Potential subsidence of neighbouring structures	Subsidence of bedrocks due to drawdown is considered unlikely due to their high deformation moduli.
Proximity to Contaminated Sites	An EPA registered sites associated with a Telstra Data Centre is located approximately 650 m northwest of the subject site. The site has been assessed by the EPA and is classified as “Regulation under CLM Act not required”. Give this classification, the presence of known plumes of significant contamination are considered unlikely. In addition, the site is noted to be positioned downstream and well below the subject site and the proposed basement level and would be expected to have no impact.

12. Monitoring and Reporting

The following monitoring and associated reporting is suggested during initial construction and should be undertaken during excavation and construction works on-site.

Table 11: Monitoring and Reporting requirements

Item	Monitoring	Monitoring Frequency	Reporting
Assess effect of excavation on groundwater	Monitoring of groundwater levels in three monitoring wells outside the excavation footprint, during and following completion of construction. The locations will be subject to access and approvals and will be determined prior to construction. Existing wells could be used where possible. This	Daily for the first two weeks then weekly. This can be relaxed to monthly once steady groundwater levels are established, during construction	Weekly then monthly during construction

Item	Monitoring	Monitoring Frequency	Reporting
	requirement could be deleted if approved by NRAR given low risk.		
Groundwater Quality Sampling and Testing	Sampling and testing of water from wells and the excavation, or at the point of discharge. Contaminant and physical properties tested to be nominated by the authority accepting water but to include: • Heavy Metals and PAH; • pH & conductivity; • Suspended Solids; • Turbidity; and • Dissolved Oxygen Levels.	pH and turbidity to be measured daily for the first week and then weekly. Two rounds of groundwater sampling and testing initially. Subject to relatively uniform results groundwater testing to be carried out fortnightly or as otherwise agreed with the authority accepting the water.	
Groundwater inflow rates	Groundwater inflow to be measured in collection tanks, of a pre-determined size or using a calibrated flow meter connected to the dewatering system.	Twice daily, or once collection point is filled (whichever is more frequent), for the first two weeks. After steady groundwater inflow rates are established then daily.	Weekly
Quantity of water disposed off-site (includes rainwater)	Calibrated Flowmeter connected to any pump-out system	Automatically	Weekly

13. Conclusion

The geotechnical investigation on the site has identified fill to shallow depths, overlying Ashfield Shale, Mittagong Formation Laminite and Hawkesbury Sandstone bedrock. Groundwater has been recorded in monitoring wells at the site, at elevations between RL 77.9 m AHD and RL 70.8 m AHD, within the bedrock with a gradient generally towards the west.

The proposed basement excavation is expected to extend up to about 6-7 m below the measured groundwater levels in some locations. Some of the groundwater is likely associated with perched seepage along the rock surface and through fractures in the rock as opposed to permanent or regional groundwater table.

Groundwater modelling has been undertaken which predicts that annual groundwater inflow rates of between 0.5 ML/year and 0.8 ML/year during the first year of construction and between 0.4 ML/year and 0.6 ML/year in the long term may be expected for a drained basement construction. This prediction is an estimate based on the information available; actual flow rates may vary from these and will only be known once the excavation is complete and inflow rates can be measured.

Given that the predicted inflow is less than 3 ML/year, for SSDA, it is expected that a Water Access License will not be required from Natural Resources Access Regulator (NRAR). If the actual inflows are greater than 3 ML/year this will require a Water Access Licence and appropriate groundwater share allocation from NRAR (1 water share per 1 ML) for the long-term drainage of the basement.

From a geotechnical point of view, it is considered that a drained basement is feasible without any significant impact to surrounding properties. Most deep basements in the St Leonards area, including nearby and recent deep basements, are constructed as drained basements and Douglas is not aware of any significant issues with groundwater inflow in the area for these basements. In addition, the use of a drained basement is not considered likely to influence any GDEs or groundwater extraction bores in accordance with the AIP minimal impact considerations. Construction of a drained basement will be subject to review and approval from Council and relevant authorities.

14. References

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

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

Pells, P. M. (2019). Classification of Sandstones and Shales in the Sydney Region: A Forty Rear Review. *Austalian Geomechanics,* , Volume 54, 29-55.

15. Limitations

Douglas Partners Pty Ltd (Douglas) has prepared this report for this project at 601 Pacific Highway, St Leonards NSW in line with Douglas' proposal dated 17/09/2024 and acceptance received from Diego Eguiguren of Stockland dated 19/11/2024. The work was carried out under contract No. CW96547 dated 15/11/2024. This report is provided for the exclusive use of Stockland for this project only and for the purposes as described in the report. It should not be used by or relied upon for other projects or purposes on the same or other site or by a third party. Any party so relying upon this report beyond its exclusive use and purpose as stated above, and without the express written consent of Douglas, does so entirely at its own risk and without recourse to Douglas for any loss or damage. In preparing this report Douglas has necessarily relied upon information provided by the client and/or their agents.

The results provided in the report are indicative of the sub-surface conditions on the site only at the specific sampling and/or testing locations, and then only to the depths investigated and at the time the work was carried out. Sub-surface conditions can change abruptly due to variable

geological processes and also as a result of human influences. Such changes may occur after Douglas' field testing has been completed.

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

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

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

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

The scope of work for this report did not include the assessment of surface or sub-surface materials or groundwater for contaminants, within or adjacent to the site. Should evidence of fill of unknown origin be noted in the report, and in particular the presence of building demolition materials, it should be recognised that there may be some risk that such fill may contain contaminants and hazardous building materials.

Appendix A

About this Report

About this Report

October 2024

Introduction

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

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

Copyright

Borehole and Test Pit Logs

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

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

Groundwater

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

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

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

Reports

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

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

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

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

About this Report

Site Anomalies

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

Information for Contractual Purposes

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

Site Inspection

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

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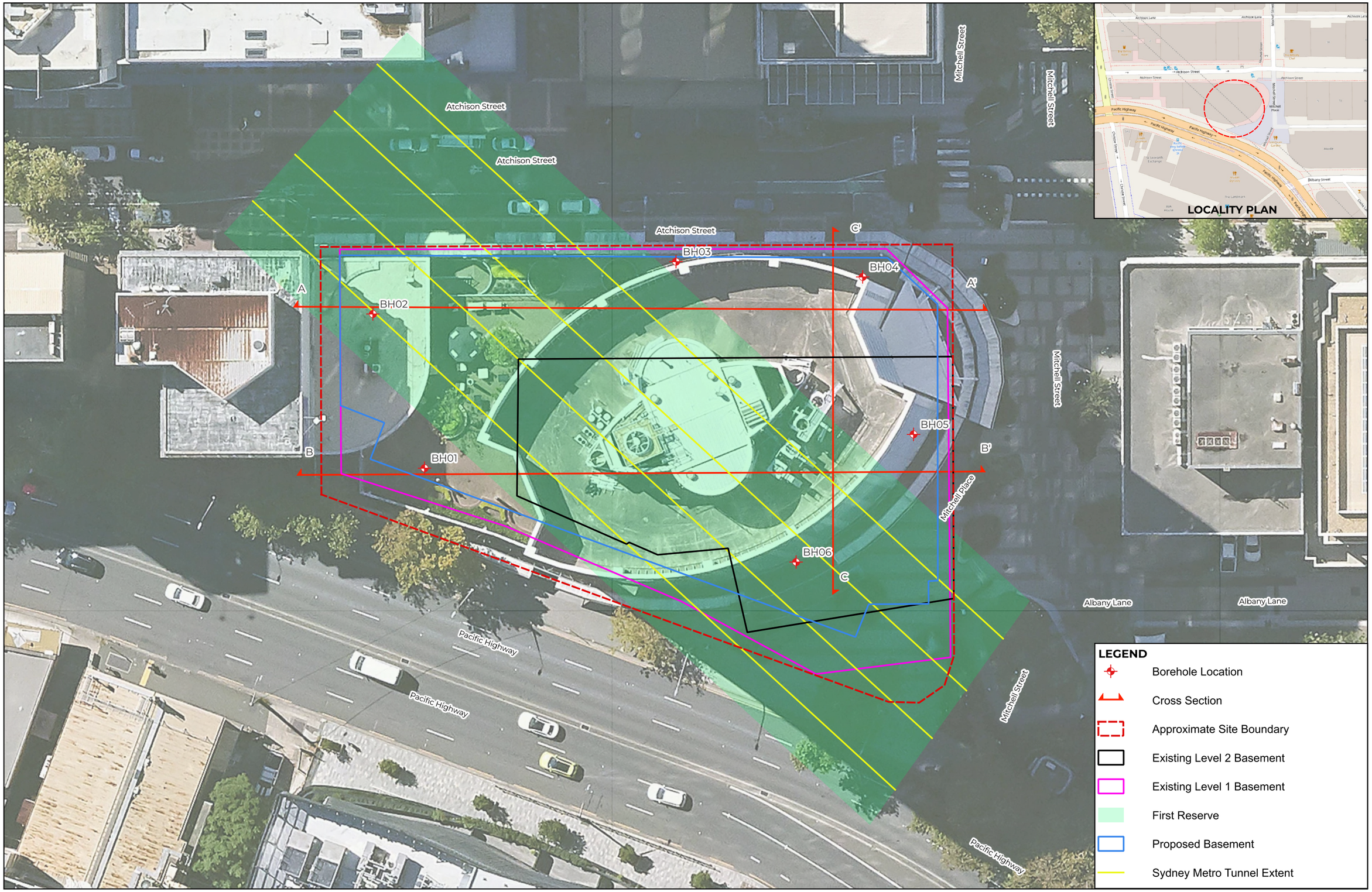
Appendix B

Drawings



REV	DESCRIPTION/COMMENT	DATE	DRAWN BY
0	INITIAL ISSUE	15.04.2025	EC

SCALE: 0 4 8 12 16 20 m
1:400 @ A3

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

CLIENT:
Stockland Commercial Property

NOTE:
1: Basemap from Metromap (Dated 13.03.2025)

COORDINATE REFERENCE SYSTEM: GDA2020 / MGA zone 56

PROJECT NAME:
Proposed Commercial Building

PROJECT ADDRESS:
601 Pacific Highway, St Leonards

DRAWING TITLE:
Test Location Plan

PROJECT NO: **86230.01**

DRAWING NO: **1**

REVISION: **0**

Appendix C

Groundwater Data

Terminology, Symbols and Abbreviations

November 2023

Introduction to Terminology, Symbols and Abbreviations

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

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

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

Abbreviation Codes

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

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

Data Integrity Codes

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

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

Graphic Symbols

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

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Soil Descriptions

Terminology
Symbols
Abbreviations

March 2024

Introduction

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

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

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

Particle size designation and Behaviour Model

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

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

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

[1] – refer grain size subdivision descriptions below

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

Component proportions

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

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

[1] As defined in AS1726-2017 6.1.4.4

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

Composite Materials

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

Soil Descriptions

Classification

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

Soil Name

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

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

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

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

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

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

Identification of minor components

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

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

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

Soil Composition

Plasticity

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

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

Grain Size

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

Grading

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

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

Soil Condition

Moisture

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

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

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

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

Consistency/Density/Compaction/Cementation/Extremely Weathered Material

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

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

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

Consistency (fine grained soils)

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

Relative Density (coarse grained soils)

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

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

Compaction (anthropogenically modified soil)

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

Cementation (natural and anthropogenic)

Cementation Term	Abbreviation Code
Moderately cemented	MOD
Weakly cemented	WEK

Extremely Weathered Material

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

Soil Origin

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

Cobbles and Boulders

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

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

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Rock Strength

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

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

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

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

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

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

Degree of Weathering

The degree of weathering of rock is classified as follows:

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

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

Degree of Alteration

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

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

Degree of Fracturing

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

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

Rock Quality Designation

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

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

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

Stratification Spacing

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

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

Defect Descriptions

Defect Type

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

Rock Defect Orientation

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

Rock Defect Coating

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

Rock Defect Infill

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

Rock Defect Shape/Planarity

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

Rock Defect Roughness

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

Defect Orientation

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

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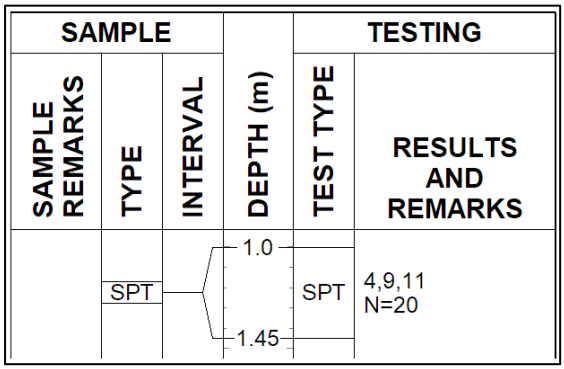
Sampling, Testing and Excavation Methodology

Terminology
Symbols
Abbreviations

October 2024

Sampling and Testing

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



Sampling

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

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

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

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

Field and Laboratory Testing

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

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

Field and laboratory testing (continued)

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

Groundwater Observations

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

Drilling or Excavation Methods/Tools

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

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

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

Douglas PARTNERS

BOREHOLE LOG

CLIENT: Stockland Commercial Property
PROJECT: Proposed Commencial Building
LOCATION: 601 Pacific Highway, St Leonards, NSW 2065

SURFACE LEVEL: 82.4 AHD
COORDINATE: E:333081.1, N:6255981.1
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH01
PROJECT No: 86230.01
DATE: 25/03/25
SHEET: 1 of 3

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(#)	CONSIS.(*) / DENSITY.(*)	MOISTURE	REMARKS	SAMPLE TYPE	SAMPLE INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS	BACKFILL	WELL PIPE
25/03/25 No free groundwater observed whilst augering	82	0.25	CONCRETE; reinforcement 8mm, 2 slabs 130mm thick and 90mm thick (low), second slab has no reinforcement observable, 10mm blinding sand separating slabs.		FILL	NA	NA		D	0.40	0.25			Bentonite	
		0.35	FILL / GRAVEL: dark grey; fine to medium, angular, igneous.						D	0.50					
	81	1	FILL / CLAY trace sand: dark grey; low to medium plasticity; fine sand.		FILL	PC	w<PL		D	0.90 1.00	1				
		2	2.00m: poor compaction						D	1.40 1.50	2				
	80	2.60	Continued as rock log						D	1.90 2.00	3				
	79	3									4				
	78	4									5				
	77	5									6				
	76	6									7				
	75	7									8				
	74	8									9				
	73	9													

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

PLANT: DTS 700
METHOD: DT to 0.25m, AD/T to 2.6m, NMLC to 14.80m
REMARKS: Unable to perform SPTs due to height restriction

OPERATOR: Terratest

LOGGED: JDS
CASING: HWT to 2m

Refer to explanatory notes for symbol and abbreviation definitions

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

BOREHOLE LOG

CLIENT: Stockland Commercial Property
PROJECT: Proposed Commencial Building
LOCATION: 601 Pacific Highway, St Leonards, NSW 2065

SURFACE LEVEL: 82.4 AHD
COORDINATE: E:333081.1, N:6255981.1
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH01
PROJECT No: 86230.01
DATE: 25/03/25
SHEET: 2 of 3

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	WEATH.	DEPTH (m)	STRENGTH	RECOVERY (%)	RQD	FRACTURE SPACING (m)	DEFECTS & REMARKS	SAMPLE REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS	BACKFILL	WELL PIPE
25/03/25 No free groundwater observed whilst augering	82	0	Continued from soil log												0				
	81	1													1				
	80	2													2				
		2.60	SILTSTONE: dark grey, indistinct bedding; (horizontal). Ashfield Shale.			2.60		100	100						3	PLT	PL(A)=0.62MPa		
	79	3						100	100		2.87m: JT, 70°, PR, CN, SM 3.23m: JT, 70°, PR, CN, SM,				3	PLT	PL(A)=0.78MPa		
							M				3.00m: Very minimal water loss					PLT	PL(A)=0.65MPa		
	78	4						100	100		3.72m: JT, 70°, PR, CN, SM,				4	PLT	PL(A)=0.62MPa		
		4.54	SANDSTONE: grey, fine to medium grained, indistinct bedding; siltstone ~5 - 10%. Mittagong Formation.		FR						4.09m: JT, 30°, PR, CN, SM,					PLT	PL(A)=0.98MPa		
	77	5				5.00	L	100	100		4.70m: Water loss ~20%				5	PLT	PL(A)=0.28MPa		
						5.60					5.70m: Water loss ~30-40%					PLT	PL(A)=1.1MPa		
	76	6					H	95	100						6	PLT	PL(A)=1.2MPa		
		6.65																	
		6.70				6.70												Gravel	
	75	7					H	100	90		7.30m: Water loss 80-100% recovering to ~40%				7	PLT	PL(A)=1.1MPa		
						7.65					7.55-7.65m: B, 5°, PR, CN, RF, x3								
	74	8			FR		H	100	93		8.03m: B, 10°, PR, CN, RF 8.25m: B, 10°, PR, CN, RF 8.40m: B, 10°, PR, CN, RF				8	PLT	PL(A)=1.6MPa		
						8.60 8.65					8.62-8.70m: B, 0°, PR, RF, x4								
	73	9					M	100	100		8.90m: Water loss 60-90% 9.10m: Water loss ~10-20%				9	PLT	PL(A)=0.73MPa		
								100	100										

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

PLANT: DTS 700
METHOD: DT to 0.25m, AD/T to 2.6m, NMLC to 14.80m
REMARKS: Unable to perform SPTs due to height restriction

OPERATOR: Terratest

LOGGED: JDS
CASING: HWT to 2m

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

Refer to explanatory notes for symbol and abbreviation definitions

Douglas PARTNERS

BOREHOLE LOG

CLIENT: Stockland Commercial Property
PROJECT: Proposed Commencial Building
LOCATION: 601 Pacific Highway, St Leonards, NSW 2065

SURFACE LEVEL: 82.4 AHD
COORDINATE: E:333081.1, N:6255981.1
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH01
PROJECT No: 86230.01
DATE: 25/03/25
SHEET: 3 of 3

CONDITIONS ENCOUNTERED														SAMPLE				TESTING			
GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	WEATH.	DEPTH (m)	STRENGTH	RECOVERY (%)	RQD	FRACTURE SPACING (m)	DEFECTS & REMARKS	SAMPLE REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS	BACKFILL	WELL PIPE
	72	11					M	100	100						11	PLT	PL(A)=0.76MPa		
	71					11.50		100	100		10.80m: Water loss ~20-30%					PLT	PL(A)=0.74MPa		
		12.00	SANDSTONE: grey, medium to coarse grained, indistinct bedding. Hawkesbury Sandstone.		FR						11.90m: JT, 90°, PR, SN Fe, RF 12.05m: JT, 90°, PR, CN, RF 12.23m: JT, 50°, PR, CN, RF				12			Gravel	
	70	12					H	100	100		12.60m: B, 5°, PR, INF M, RF					PLT	PL(A)=1.1MPa		
	69	13													13	PLT	PL(A)=1.1MPa		
	68	14				14.20 14.25	H - VH	100	100		14.26m: CS 50mm				14	PLT	PL(A)=3.1MPa		
	67	15	Borehole discontinued at 14.80m depth. Target depth reached.								14.71m: B, 10°, PR, SN Fe, RF								
	66	16																	
	65	17																	
	64	18																	
	63	19																	

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

PLANT: DTS 700
METHOD: DT to 0.25m, AD/T to 2.6m, NMLC to 14.80m
REMARKS: Unable to perform SPTs due to height restriction

OPERATOR: Terratest

LOGGED: JDS
CASING: HWT to 2m

Refer to explanatory notes for symbol and abbreviation definitions

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

CORE PHOTO LOG

CLIENT: Stockland Commercial Property
PROJECT: Proposed Commencial Building
LOCATION: 601 Pacific Highway, St Leonards, NSW 2065

SURFACE LEVEL: 82.4 AHD
COORDINATE: E:333081.1, N:6255981.1
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH01
PROJECT No: 86230.01
DATE: 25/03/25
SHEET: 1 of 2

2.60-7.00 m depth

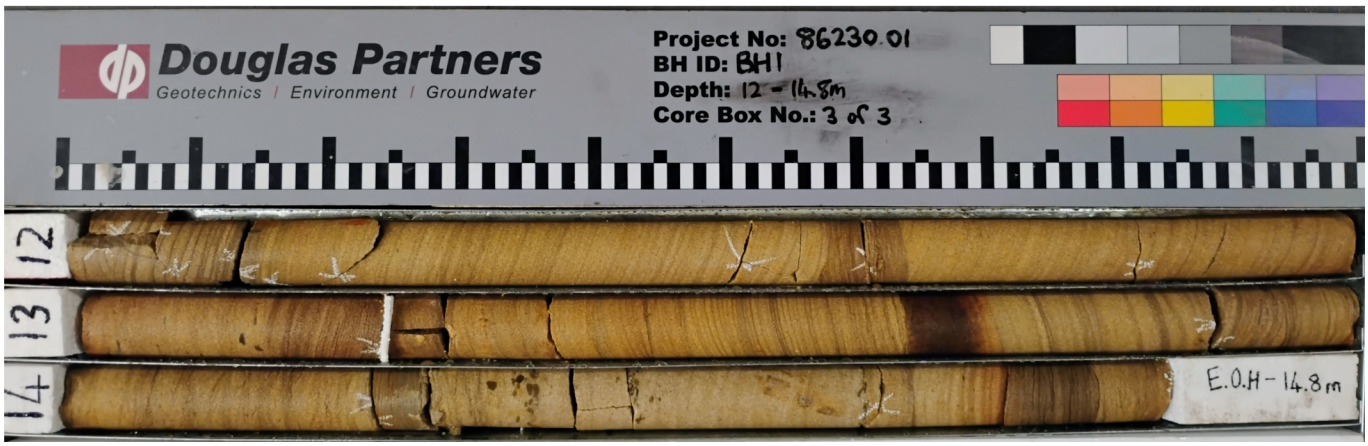
7.00-12.00 m depth

CORE PHOTO LOG

CLIENT: Stockland Commercial Property
PROJECT: Proposed Commencial Building
LOCATION: 601 Pacific Highway, St Leonards, NSW 2065

SURFACE LEVEL: 82.4 AHD
COORDINATE: E:333081.1, N:6255981.1
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH01
PROJECT No: 86230.01
DATE: 25/03/25
SHEET: 2 of 2



12.00-14.80 m depth

BOREHOLE LOG

CLIENT: Stockland Commercial Property
PROJECT: Proposed Commencial Building
LOCATION: 601 Pacific Highway, St Leonards, NSW 2065

SURFACE LEVEL: 82.4 AHD
COORDINATE: E:333075.4, N:6255998.3
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH02
PROJECT No: 86230.01
DATE: 28/03/25
SHEET: 1 of 3

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
28/03/25 No free groundwater observed whilst augering	82	0.18	CONCRETE; 2 layers reinforcement 8mm and 4mm.			NA	NA				0		
		0.40	FILL / Gravelly SAND with clay: brownish-grey; fine to medium; medium, sub-angular, igneous gravel.		FILL	ND	M						
					FILL		D						
		0.90	FILL / Clayey SAND trace gravel: dark grey; fine to medium; low to medium plasticity clay; fine to medium, angular, igneous gravel.		FILL		w<PL						
	81	1.10	FILL / CLAY trace sand trace gravel: dark grey; low to medium plasticity.								1		
			Continued as rock log										
	80	2									2		
	79	3									3		
	78	4									4		
	77	5									5		
	76	6									6		
	75	7									7		
	74	8									8		
	73	9									9		

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

PLANT: DTS 700
METHOD: DT to 0.13m, AD/T to 1.10m, NMLC to 14.10m
REMARKS:

OPERATOR: Terratest

LOGGED: JDS
CASING: HWT to 1m

Refer to explanatory notes for symbol and abbreviation definitions

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

BOREHOLE LOG

CLIENT: Stockland Commercial Property
PROJECT: Proposed Commencial Building
LOCATION: 601 Pacific Highway, St Leonards, NSW 2065

SURFACE LEVEL: 82.4 AHD
COORDINATE: E:333075.4, N:6255998.3
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH02
PROJECT No: 86230.01
DATE: 28/03/25
SHEET: 2 of 3

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

GROUNDWATER: 28/03/25 No free groundwater observed whilst augering

RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	WEATH.	DEPTH (m)	STRENGTH	RECOVERY (%)	RQD	FRACTURE SPACING (m)	DEFECTS & REMARKS	SAMPLE REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS	BACKFILL	WELL PIPE
82	0	Continued from soil log												0				
	1	SILTSTONE: dark grey, indistinct bedding, 0 to 10°. Ashfield Shale.		FR	1.10	L	100	100		1.33m: JT, 40°, PR, CN, SM				1	PLT	PL(A)=0.12MPa		
81					2.00		100	100							PLT	PL(A)=0.14MPa		
	2													2	PLT	PL(A)=0.32MPa		
80	2.50									2.50m - 3.60m: Water loss <10%								
	2.63				2.63					2.80m: JT, 50°, PR, CN, SM					PLT	PL(A)=0.60MPa		
	3						88	100		3.27m: JT, 45°, PR, CN, SM				3	PLT	PL(A)=0.66MPa		
79				FR		M												
	4									3.90m: CZ, 0°, PR, Clay, SM, ~5mm				4	PLT	PL(A)=0.87MPa		
78							100	100		4.25m: CZ, 0°, PR, Clay, SM, ~5mm					PLT	PL(A)=0.54MPa		
	4.72									4.62-4.67m: CZ, 5°, PR, Clay								
	5	SANDSTONE: grey, fine and medium grained; with siltstone laminations and bedding. Mittagong Formation.		SW	4.70									5	PLT	PL(A)=0.48MPa		
77		5.50m-5.80m: rip up clasts			5.30										PLT	PL(A)=0.37MPa		
	6				6.00		100	100						6				
76						H									PLT	PL(A)=1.2MPa		
	7			FR			100	100						7				
75					7.60	M									PLT	PL(A)=1.3MPa		
	8				8.05									8				
74										8.56m: CZ, 20mm					PLT	PL(A)=1.4MPa		
	9					H	100	100						9				
73															PLT	PL(A)=1.1MPa		
							100	100										

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

PLANT: DTS 700
METHOD: DT to 0.13m, AD/T to 1.10m, NMLC to 14.10m
REMARKS:

OPERATOR: Terratest

LOGGED: JDS
CASING: HWT to 1m

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

Refer to explanatory notes for symbol and abbreviation definitions

Douglas PARTNERS

BOREHOLE LOG

CLIENT: Stockland Commercial Property
PROJECT: Proposed Commencial Building
LOCATION: 601 Pacific Highway, St Leonards, NSW 2065

SURFACE LEVEL: 82.4 AHD
COORDINATE: E:333075.4, N:6255998.3
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH02
PROJECT No: 86230.01
DATE: 28/03/25
SHEET: 3 of 3

CONDITIONS ENCOUNTERED														SAMPLE				TESTING			
GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	WEATH. (PS, XW, HW, DW, MW, SW, 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
	72	10	[CONT] SANDSTONE: grey, fine and medium grained; with siltstone laminations and bedding. Mittagong Formation.		FR	10.00	M	100	100		10.60m CZ, 20mm				10	PLT	PL(A)=0.49MPa		
	71	11				10.40					11.10m - 14.10m: Water loss <10%				11	PLT	PL(A)=1.4MPa		
	70	12					H	100	100						12	PLT	PL(A)=1.8MPa		
	69	13						87	87		13.38m B, 0°, PR, INF Clay 10mm, RF				13	PLT	PL(A)=1.1MPa		
		13.37	SANDSTONE: pale grey, medium to coarse grained; cross-bedded 0-10 degreess. Hawkesbury Sandstone.												14				
	68	13.90	Borehole discontinued at 14.10m depth. Target depth reached.																
	67	15																	
	66	16																	
	65	17																	
	64	18																	
	63	19																	

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

PLANT: DTS 700
METHOD: DT to 0.13m, AD/T to 1.10m, NMLC to 14.10m
REMARKS:

OPERATOR: Terratest

LOGGED: JDS
CASING: HWT to 1m

Refer to explanatory notes for symbol and abbreviation definitions

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

CORE PHOTO LOG

CLIENT: Stockland Commercial Property
PROJECT: Proposed Commencial Building
LOCATION: 601 Pacific Highway, St Leonards, NSW 2065

SURFACE LEVEL: 82.4 AHD
COORDINATE: E:333075.4, N:6255998.3
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH02
PROJECT No: 86230.01
DATE: 28/03/25
SHEET: 1 of 2

1.10-5.00 m depth

5.00-10.00 m depth

CORE PHOTO LOG

CLIENT: Stockland Commercial Property
PROJECT: Proposed Commencial Building
LOCATION: 601 Pacific Highway, St Leonards, NSW 2065

SURFACE LEVEL: 82.4 AHD
COORDINATE: E:333075.4, N:6255998.3
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH02
PROJECT No: 86230.01
DATE: 28/03/25
SHEET: 2 of 2

10.00-14.10 m depth

BOREHOLE LOG

CLIENT: Stockland Commercial Property
PROJECT: Proposed Commencial Building
LOCATION: 601 Pacific Highway, St Leonards, NSW 2065

SURFACE LEVEL: 82.4 AHD
COORDINATE: E:333109.1, N:6256004.1
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH03
PROJECT No: 86230.01
DATE: 01/04/25
SHEET: 1 of 3

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN[#]	CONSIS.[*] / DENSITY.[*]	MOISTURE	REMARKS	SAMPLE TYPE	SAMPLE INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS	BACKFILL	WELL PIPE
01/04/25 No free groundwater observed whilst augering	82	0.15	CONCRETE; 150mm thick.			NA			D	0.15 to 0.20	0.15			Bentonite	
		0.25	FILL / Gravelly SAND: yellow and grey; medium; fine to coarse, igneous, concrete gravel.		FILL	ND	w<PL		D	0.40 to 0.50	0.20				
		0.70	FILL / Sandy CLAY trace gravel: dark grey; low to medium plasticity; fine to coarse sand; fine gravel; shale.		FILL						0.50				
	81	1	Continued as rock log								1				
	80	2									2				
	79	3									3				
	78	4									4				
	77	5									5			Sand	
	76	6									6				
	75	7									7				
	74	8									8				
	73	9									9				

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

PLANT: DTS 700
METHOD: DT to 0.15m, AD/T to 0.70m, NMLC to 12.10m
REMARKS:

OPERATOR: Terratest

LOGGED: JDS
CASING: HWT to 0.5m

Refer to explanatory notes for symbol and abbreviation definitions

BOREHOLE LOG

CLIENT: Stockland Commercial Property
PROJECT: Proposed Commencial Building
LOCATION: 601 Pacific Highway, St Leonards, NSW 2065

SURFACE LEVEL: 82.4 AHD
COORDINATE: E:333109.1, N:6256004.1
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH03
PROJECT No: 86230.01
DATE: 01/04/25
SHEET: 2 of 3

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	WEATH.	DEPTH (m)	STRENGTH	RECOVERY (%)	RQD	FRACTURE SPACING (m)	DEFECTS & REMARKS	SAMPLE REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS	BACKFILL	WELL PIPE
01/04/25 No free groundwater observed whilst augering	82	0	Continued from soil log												0			Bentonite	
	81	1	SILTSTONE: dark grey, indistinct bedding, 0 to 10°. Ashfield Shale.		SW	0.70 1.00	VL L M H VH EH	100	100		0.75m: JT, 35°, PR, SN Fe 0.92m: JT, 85°, PR, SN Fe 0.70m - 1.80m: Water loss <10% 1.39m: JT, 70°, PR, CN, SM				1	PLT	PL(A)=1.3MPa		
	80	2						100	100						2	PLT	PL(A)=0.80MPa		
																PLT	PL(A)=0.61MPa		
	79	3						100	100		2.80m: JT, 40°, PR, CN, SM				3	PLT	PL(A)=0.91MPa		
											3.30m - 4.00m: Water loss ~10%					PLT	PL(A)=0.70MPa		
	78	4					M H	100	100		4.13-4.15m: CZ, 0°, PR, SN Clay 4.25m: JT, 80°, PR, CN, SM				4	PLT	PL(A)=0.67MPa		
		4.80														PLT	PL(A)=0.86MPa		
	77	5	SANDSTONE: grey and pale grey, fine to medium grained, distinct, laminated; siltstone laminations and bedding 0 to 10 degrees. Mittagong Formation.		FR			100	100						5	PLT	PL(A)=1.1MPa	Sand	
	76	6									6.08m: B, ~5°, PR, CN, RF 6.49m: JT, 15°, PR, CN, RF				6	PLT	PL(A)=0.77MPa		
	75	7				7.00	H	100	90		7.28m: B, 10°, PR, RF 7.30m: B, 5°, PR, HE 7.35m: B, 50°, PR Clay 6 mm 7.41m: B, ~20°, UN, RF 7.50m: JT, 70°, PR, HE 7.62m: JT, 85°, UN, HE 7.75m: JT, 20°, UN, Clay, ~5mm				7	PLT	PL(A)=2.4MPa		
	74	8						100	100		8.46m: B, 5°, ST, Clay, ~2 mm 8.79m: JT, 70°, PR, CN, RF				8	PLT	PL(A)=1.5MPa		
	73	9				9.40	M	100	84		9.45m: JT, 80-90°, CU, Clay, 1-3mm 9.60m: B, ~50°, PR, Clay, PO, 1-2mm				9	PLT	PL(A)=0.37MPa		

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

PLANT: DTS 700
METHOD: DT to 0.15m, AD/T to 0.70m, NMLC to 12.10m
REMARKS:

OPERATOR: Terratest

LOGGED: JDS
CASING: HWT to 0.5m

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

Refer to explanatory notes for symbol and abbreviation definitions

Douglas PARTNERS

BOREHOLE LOG

CLIENT: Stockland Commercial Property
PROJECT: Proposed Commencial Building
LOCATION: 601 Pacific Highway, St Leonards, NSW 2065

SURFACE LEVEL: 82.4 AHD
COORDINATE: E:333109.1, N:6256004.1
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH03
PROJECT No: 86230.01
DATE: 01/04/25
SHEET: 3 of 3

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	WEATH. (DW: PS, XW, HW, MW, SW, FR)	DEPTH (m)	STRENGTH (VL, L, M, H, VH, EH)	RECOVERY (%)	RQD	FRACTURE SPACING (m) (0.03, 0.06, 0.20, 0.60, >2.00)	DEFECTS & REMARKS	SAMPLE REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS	BACKFILL	WELL PIPE
	72	11	[CONT] SANDSTONE: grey and pale grey, fine to medium grained, distinct, laminated; siltstone laminations and bedding 0 to 10 degrees. Mittagong Formation.		FR		M	100	84						11	PLT	PL(A)=0.92MPa	Sand	
	71							100	100		11.55m: JT, 40°, PR, VNR Clay, RF 11.63m: CS, 30mm					PLT	PL(A)=0.84MPa		
		12									12.06m: JT, 80°, PR, CN, SM				12				
	70		Borehole discontinued at 12.10m depth. Target depth reached.																
		13																	
	69																		
		14																	
	68																		
		15																	
	67																		
		16																	
	66																		
		17																	
	65																		
		18																	
	64																		
		19																	
	63																		

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

PLANT: DTS 700
METHOD: DT to 0.15m, AD/T to 0.70m, NMLC to 12.10m
REMARKS:

OPERATOR: Terratest

LOGGED: JDS
CASING: HWT to 0.5m

Refer to explanatory notes for symbol and abbreviation definitions

Douglas PARTNERS

CORE PHOTO LOG

CLIENT: Stockland Commercial Property
PROJECT: Proposed Commencial Building
LOCATION: 601 Pacific Highway, St Leonards, NSW 2065

SURFACE LEVEL: 82.4 AHD
COORDINATE: E:333109.1, N:6256004.1
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH03
PROJECT No: 86230.01
DATE: 01/04/25
SHEET: 1 of 2

0.70-5.00 m depth

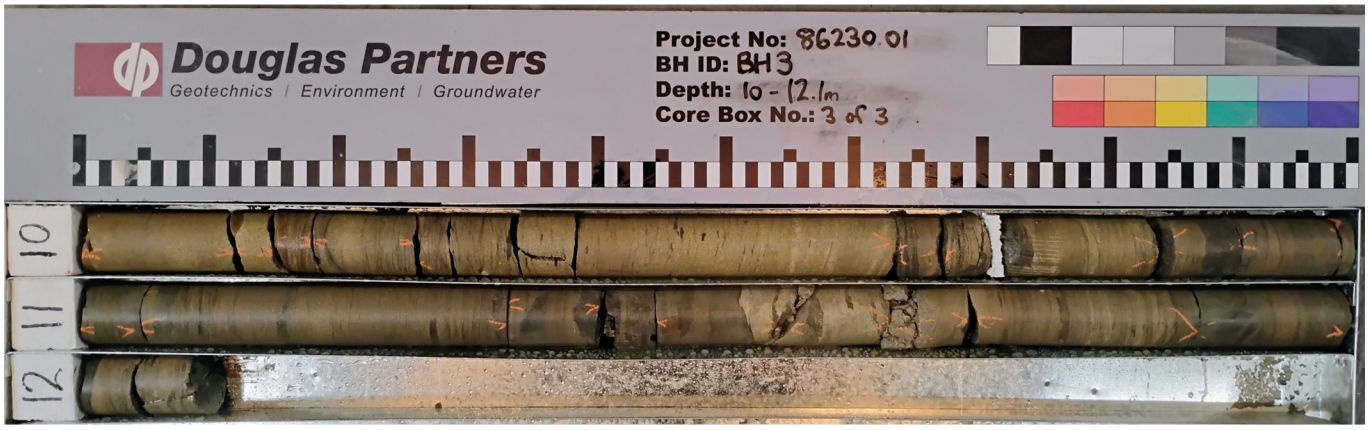
5.00-10.00 m depth

CORE PHOTO LOG

CLIENT: Stockland Commercial Property
PROJECT: Proposed Commencial Building
LOCATION: 601 Pacific Highway, St Leonards, NSW 2065

SURFACE LEVEL: 82.4 AHD
COORDINATE: E:333109.1, N:6256004.1
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH03
PROJECT No: 86230.01
DATE: 01/04/25
SHEET: 2 of 2



10.00-12.10 m depth

BOREHOLE LOG

CLIENT: Stockland Commercial Property
PROJECT: Proposed Commencial Building
LOCATION: 601 Pacific Highway, St Leonards, NSW 2065

SURFACE LEVEL: 82.4 AHD
COORDINATE: E:333129.9, N:6256002.4
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH04
PROJECT No: 86230.01
DATE: 03/04/25 - 07/04/25
SHEET: 1 of 5

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
07/04/25 Water level measured at 25.2m BGL.	82	0.15	CONCRETE; 150mm thick; one layer bidirectional reinforcement (SL82).		FILL	NA	NA		D	0.15 - 0.20	0.15		
		0.23	FILL / SAND: grey; medium.		FILL	ND	M		D	0.40 - 0.50	0.20		
		0.60	FILL / Sandy GRAVEL: dark grey; fine to medium, sub-angular, igneous; fine to coarse sand.				M / W				0.40		
		1	Continued as rock log								0.50		
	81	1									1		
		2									2		
	80	3									3		
	79	4									4		
	78	5									5		
	77	6									6		
	76	7									7		
	75	8									8		
	74	9									9		
	73												

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: DTS 700
OPERATOR: Terratest
LOGGED: JDS
METHOD: DT (200mm) to 0.15m, AD/T to 0.60m, NMLC to 31.50m
CASING: HW to 0.5m
REMARKS:

Refer to explanatory notes for symbol and abbreviation definitions

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

BOREHOLE LOG

CLIENT: Stockland Commercial Property
PROJECT: Proposed Commencial Building
LOCATION: 601 Pacific Highway, St Leonards, NSW 2065

SURFACE LEVEL: 82.4 AHD
COORDINATE: E:333129.9, N:6256002.4
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH04
PROJECT No: 86230.01
DATE: 03/04/25 - 07/04/25
SHEET: 2 of 5

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	WEATH.	DEPTH (m)	STRENGTH	RECOVERY (%)	RQD	FRACTURE SPACING (m)	DEFECTS & REMARKS	SAMPLE REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS	BACKFILL	WELL PIPE
07/04/25 Water level measured at 25.2m BGL.	82	0	Continued from soil log												0	PLT	PL(A)=1.1MPa		
			SILTSTONE: dark grey, indistinct bedding, 0 to 10°. Ashfield Shale.			0.60		100	100										
	81	1													1	PLT	PL(A)=1.0MPa		
											1.71m: JT, 70°, PR, CN, SM								
											1.91m: JT, 50°, PR, CN, SM					PLT	PL(A)=1.2MPa		
	80	2					H	100	100						2	PLT	PL(A)=0.68MPa		
											2.86m: JT, 60°, PR, CN, SM					PLT	PL(A)=0.75MPa		
		3													3	PLT	PL(A)=1.3MPa		
	79					3.40		100	100										
							M				3.79m: JT, 80°, PR, CN, SM					PLT	PL(A)=0.56MPa		
		4									3.70m: Water loss 10-20%				4	PLT	PL(A)=0.22MPa		
		4.15				4.10	L				4.15m: JT, ~70°, PR, CN, RF								
	78		SANDSTONE: grey and pale grey, fine to medium grained, distinct, bedded; siltstone laminae ~5-15%. Mittagong Formation.			4.20		100	100		4.20m: Water loss <10%					PLT	PL(A)=0.85MPa		
		5													5				
	77				FR											PLT	PL(A)=1.2MPa		
		6					H	100	100						6				
	76										6.70m - 8.20m: Water loss 10%					PLT	PL(A)=1.7MPa		
		7													7				
	75					7.50	L	100	99		7.60m: JT, 70°, CU, CN, RF								
						7.90	M				7.66m: B, 0°, PR, RF 7.68m: B, 0°, PR, RF					PLT	PL(A)=0.13MPa		
		8				8.10									8	PLT	PL(A)=2.2MPa		
	74						H												
											8.72-8.92m: B, 0-10°, PR, RF, 7x								
		9				9.00		100	87						9				
	73						M				9.00-9.70m: JT, 85°, CU, CN, RF								
						9.90		100	100							PLT	PL(A)=0.73MPa		

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

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

PLANT: DTS 700
OPERATOR: Terratest
LOGGED: JDS
METHOD: DT (200mm) to 0.15m, AD/T to 0.60m, NMLC to 31.50m
CASING: HW to 0.5m
REMARKS:

Refer to explanatory notes for symbol and abbreviation definitions

Douglas PARTNERS

BOREHOLE LOG

CLIENT: Stockland Commercial Property
PROJECT: Proposed Commencial Building
LOCATION: 601 Pacific Highway, St Leonards, NSW 2065

SURFACE LEVEL: 82.4 AHD
COORDINATE: E:333129.9, N:6256002.4
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH04
PROJECT No: 86230.01
DATE: 03/04/25 - 07/04/25
SHEET: 3 of 5

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	WEATH.	DEPTH (m)	STRENGTH	RECOVERY (%)	RQD	FRACTURE SPACING (m)	DEFECTS & REMARKS	SAMPLE REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS	BACKFILL	WELL PIPE
	72	10.00	SANDSTONE: grey, pale grey, and pale brown, fine to medium grained, distinct bedding, 0 to 10°; siltstone laminae ~5-15%. Mittagong Formation.					100	100						11	PLT	PL(A)=1.1MPa		
	71	11						100	100						12	PLT	PL(A)=0.99MPa		
	70	12						100	100						13	PLT	PL(A)=0.83MPa		
	69	13 13.05	SANDSTONE: pale grey and pale brown, medium to coarse grained; cross-bedded. Hawkesbury Sandstone.				M - H	100	100						14	PLT	PL(A)=0.89MPa		
	68	14	From 14.30m: pale grey					100	100		13.81m: B, 5-10°, PR, VNR Clay, RF				15	PLT	PL(A)=0.80MPa		
	67	15	15.00m-15.65m: 50% carbonaceous laminations		FR			100	92		15.54m: B, 0°, PR, VNR Clay, RF 15.67m: B, 10°, PR, VNR, RF				16	PLT	PL(A)=0.73MPa		
	66	16						100	100						17	PLT	PL(A)=1.1MPa		
	65	17				17.00		100	100						18	PLT	PL(A)=1.3MPa		
	64	18					H	100	100						19	PLT	PL(A)=1.0MPa		
	63	19						100	100		19.57m: B, 10°, PR, RF, iron clay 19.80m: Water loss ~20%					PLT	PL(A)=1.1MPa		

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

PLANT: DTS 700
OPERATOR: Terratest
LOGGED: JDS
METHOD: DT (200mm) to 0.15m, AD/T to 0.60m, NMLC to 31.50m
CASING: HW to 0.5m
REMARKS:

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

Refer to explanatory notes for symbol and abbreviation definitions

Douglas PARTNERS

BOREHOLE LOG

CLIENT: Stockland Commercial Property
PROJECT: Proposed Commencial Building
LOCATION: 601 Pacific Highway, St Leonards, NSW 2065

SURFACE LEVEL: 82.4 AHD
COORDINATE: E:333129.9, N:6256002.4
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH04
PROJECT No: 86230.01
DATE: 03/04/25 - 07/04/25
SHEET: 4 of 5

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	WEATH.	DEPTH (m)	STRENGTH	RECOVERY (%)	RQD	FRACTURE SPACING (m)	DEFECTS & REMARKS	SAMPLE REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS	BACKFILL	WELL PIPE
	62	20	[CONT] SANDSTONE: pale grey and pale brown, medium to coarse grained; cross-bedded. Hawkesbury Sandstone.					100	100		20.77m: CS, 10mm				20	PLT	PL(A)=1.0MPa		
	61	21									21.20m: B, ~5°, PR, Clay 2mm, RF				21	PLT	PL(A)=1.3MPa		
											21.40m: Water loss ~10%								
	60	22						100	100						22	PLT	PL(A)=1.1MPa		
	59	23					H	100	100						23	PLT	PL(A)=1.6MPa		
	58	24						100	100						24	PLT	PL(A)=1.5MPa		
	57	25			FR			100	100						25	PLT	PL(A)=1.7MPa		
	56	26				26.50	L	100	92		26.12m: JT, 90°, UN, CN, RF 26.20m: B, 5-10°, PR, Clay, RF, 3-4mm 26.26m: B, 0°, PR, Clay, RF, 1-2mm 26.57m: B, 15°, PR, Clay 1mm, RF 26.70m: B, 0°, PR, Clay 5mm, RF 26.75m: B, 0°, PR, Clay, RF, 1-2mm				26	PLT	PL(A)=0.34MPa		
	55	27				26.90					26.00m - 27.40m: Water loss 25%				27	PLT	PL(A)=0.59MPa		
	54	28					M	100	90		27.75m: CS, 10°, PR, Clay 40mm, RF 28.08m: CS, Clay 15mm 28.20m: JT, 20°, PR, Clay 4mm, RF 28.25m: B, 0°, PR, Clay, RF, 2-4mm				28	PLT	PL(A)=0.32MPa		
	53	29				29.50	M	100	76		28.70m: JT, 15°, PR, Clay 4mm, RF 28.94m: JT, 20°, PR, VNR Clay, RF 29.04-29.30m: B, 5°, PR, VNR, RF 29.36m: JT, 70°, PR, CN, RF 29.40m: JT, 15°, PR, VNR, RF 29.57-29.67m: CZ, 10°, PR 29.82m: JT, 5°, UN, VNR				29	PLT	PL(A)=0.43MPa		
																PLT	PL(A)=0.29MPa		

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

PLANT: DTS 700
METHOD: DT (200mm) to 0.15m, AD/T to 0.60m, NMLC to 31.50m
REMARKS:

OPERATOR: Terratest

LOGGED: JDS
CASING: HW to 0.5m

Refer to explanatory notes for symbol and abbreviation definitions

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

BOREHOLE LOG

CLIENT: Stockland Commercial Property
PROJECT: Proposed Commencial Building
LOCATION: 601 Pacific Highway, St Leonards, NSW 2065

SURFACE LEVEL: 82.4 AHD
COORDINATE: E:333129.9, N:6256002.4
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH04
PROJECT No: 86230.01
DATE: 03/04/25 - 07/04/25
SHEET: 5 of 5

CONDITIONS ENCOUNTERED													SAMPLE				TESTING			
GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	WEATH. (PS, XW, HW, DW, MW, SW, FR)	DEPTH (m)	STRENGTH (VL, L, M, H, VH, EH)	RECOVERY (%)	RQD	FRACTURE SPACING (m) (0.06, 0.20, 0.60, 2.00)	DEFECTS & REMARKS	SAMPLE REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS	BACKFILL	WELL PIPE
	52	30	[CONT] SANDSTONE: pale grey and pale brown, medium to coarse grained; cross-bedded. Hawkesbury Sandstone.		FR	30.00	H	100	90		Clay, RF, 29.92m: JT, 25°, PR, Clay 6mm, RF 29.98m: JT, 15°, PR, Clay, RF, ~2mm 30.10m: Water loss 25% 30.29m: B, 5°, PR, Clay, RF, 2-4mm 30.34-30.39m: B, ~10°, UN, Clay, RF, 4-6mm 30.45m: B, 15°, UN, Clay, RF, ~2mm 30.48m: B, 10°, PR, Clay, RF, ~3mm				31	PLT	PL(A)=0.95MPa PL(A)=1.2MPa		
	51	31	Borehole discontinued at 31.50m depth.																	
	50	32																		
	49	33																		
	48	34																		
	47	35																		
	46	36																		
	45	37																		
	44	38																		
	43	39																		

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

PLANT: DTS 700
OPERATOR: Terratest
LOGGED: JDS
METHOD: DT (200mm) to 0.15m, AD/T to 0.60m, NMLC to 31.50m
CASING: HW to 0.5m
REMARKS:

Refer to explanatory notes for symbol and abbreviation definitions

Douglas PARTNERS

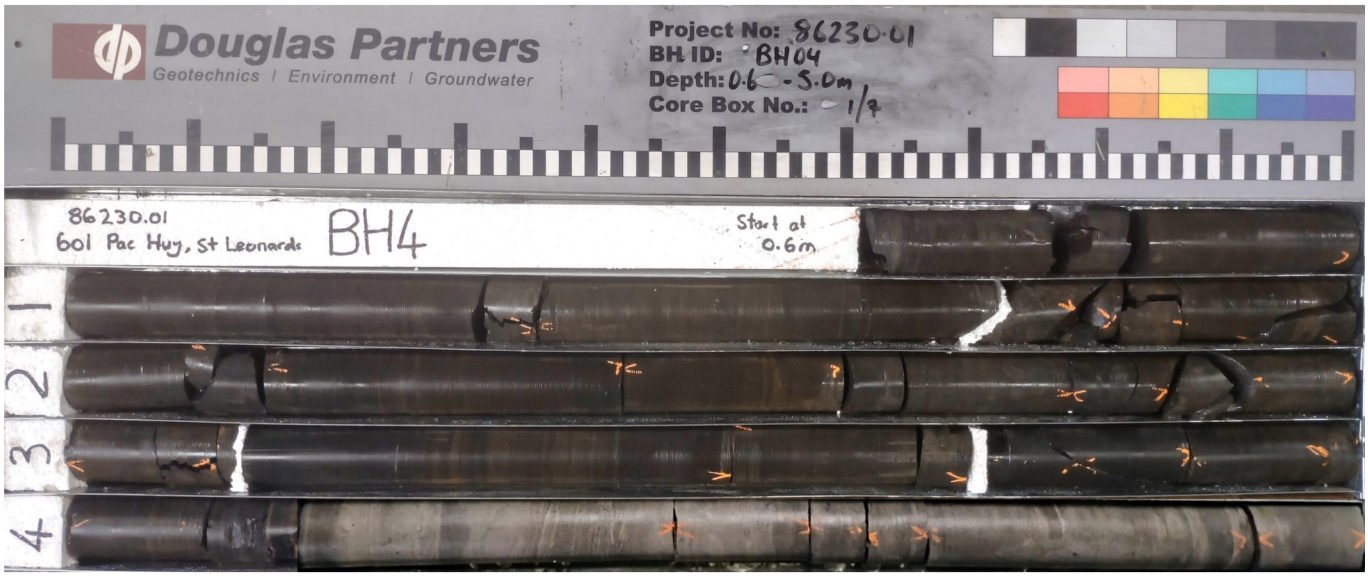
Generated with CORE-GS by Geroc - Split Soil-Rock Log

CORE PHOTO LOG

CLIENT: Stockland Commercial Property
PROJECT: Proposed Commencial Building
LOCATION: 601 Pacific Highway, St Leonards, NSW 2065

SURFACE LEVEL: 82.4 AHD
COORDINATE: E:333129.9, N:6256002.4
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH04
PROJECT No: 86230.01
DATE: 03/04/25 - 07/04/25
SHEET: 1 of 4



0.60-5.00 m depth

5.00-10.00 m depth

CORE PHOTO LOG

CLIENT: Stockland Commercial Property
PROJECT: Proposed Commencial Building
LOCATION: 601 Pacific Highway, St Leonards, NSW 2065

SURFACE LEVEL: 82.4 AHD
COORDINATE: E:333129.9, N:6256002.4
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH04
PROJECT No: 86230.01
DATE: 03/04/25 - 07/04/25
SHEET: 2 of 4

10.00-15.00 m depth

15.00-20.00 m depth

CORE PHOTO LOG

CLIENT: Stockland Commercial Property
PROJECT: Proposed Commencial Building
LOCATION: 601 Pacific Highway, St Leonards, NSW 2065

SURFACE LEVEL: 82.4 AHD
COORDINATE: E:333129.9, N:6256002.4
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH04
PROJECT No: 86230.01
DATE: 03/04/25 - 07/04/25
SHEET: 3 of 4

20.00-25.00 m depth

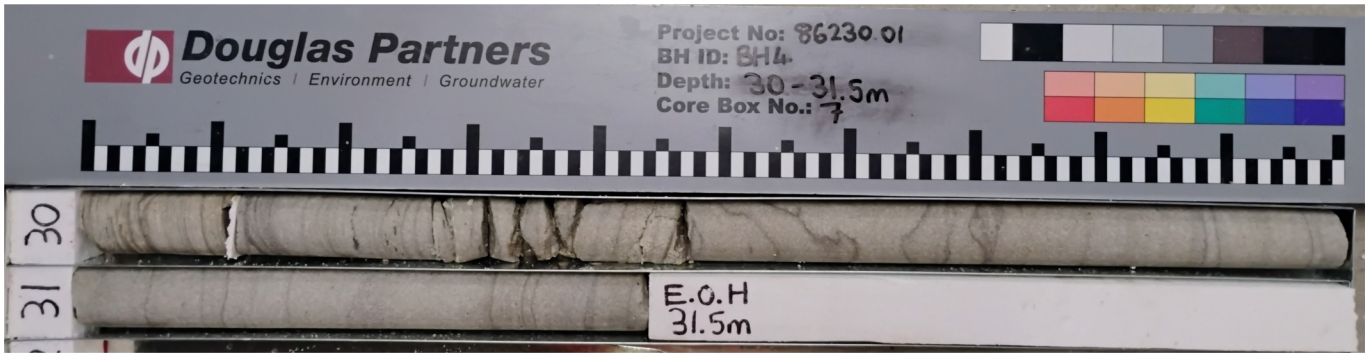
25.00-30.00 m depth

CORE PHOTO LOG

CLIENT: Stockland Commercial Property
PROJECT: Proposed Commencial Building
LOCATION: 601 Pacific Highway, St Leonards, NSW 2065

SURFACE LEVEL: 82.4 AHD
COORDINATE: E:333129.9, N:6256002.4
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH04
PROJECT No: 86230.01
DATE: 03/04/25 - 07/04/25
SHEET: 4 of 4



30.00-31.50 m depth

BOREHOLE LOG

CLIENT: Stockland Commercial Property
PROJECT: Proposed Commencial Building
LOCATION: 601 Pacific Highway, St Leonards, NSW 2065

SURFACE LEVEL: 82.2 AHD
COORDINATE: E:333135.6, N:6255984.9
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH05
PROJECT No: 86230.01
DATE: 08/04/25
SHEET: 1 of 3

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
08/04/25 No free groundwater observed whilst augering	82	0.15	CONCRETE; 150mm thick; one layer reinforcement 8mm (SL82).			NA	NA		D		0.15 0.20		
		0.25			FILL								
		0.30	FILL / SAND: yellow-grey; medium.						D		0.40 0.50		
			FILL / GRAVEL: grey; fine to medium, sub-angular, igneous.		FILL	ND	M						
	81	1 1.10	FILL / Sandy CLAY trace gravel: grey; low to medium plasticity; fine sand; fine, angular, siltstone gravel; trace PVC fragments.						D		0.90 1.00		
			Continued as rock log										
	80	2									2		
	79	3									3		
	78	4									4		
	77	5									5		
	76	6									6		
	75	7									7		
	74	8									8		
	73	9									9		

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

PLANT: DTS 700
METHOD: DT (200mm) to 0.15m, AD/T to 1.10m, NMLC to 14.60m
REMARKS:

OPERATOR: Terratest

LOGGED: JDS
CASING: HWT to 1m

Refer to explanatory notes for symbol and abbreviation definitions

BOREHOLE LOG

CLIENT: Stockland Commercial Property
PROJECT: Proposed Commencial Building
LOCATION: 601 Pacific Highway, St Leonards, NSW 2065

SURFACE LEVEL: 82.2 AHD
COORDINATE: E:333135.6, N:6255984.9
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH05
PROJECT No: 86230.01
DATE: 08/04/25
SHEET: 2 of 3

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	WEATH.	DEPTH (m)	STRENGTH	RECOVERY (%)	RQD	FRACTURE SPACING (m)	DEFECTS & REMARKS	SAMPLE REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS	BACKFILL	WELL PIPE
08/04/25 No free groundwater observed whilst augering	82	1	Continued from soil log			1.10									1				
	81	1.25	SILTSTONE: dark grey, indistinct bedding, 0 to 10°. Ashfield Shale.			1.25	M	81	81		1.50m: JT, 90°, CU, CN, RF 1.80m: JT, 70°, PR, VNR M, SM, 1.90m - 3.00m: Water loss ~10%				2	PLT	PL(A)=0.77MPa		
	80	2				2.20	VL	100	80		2.06m: JT, 70°, PR, CN, SM 2.15m: JT, 70°, PR, CN, SM 2.20-2.30m: CZ, M					PLT	PL(A)=1.5MPa		
						2.30	M - H									PLT	PL(A)=2.3MPa		
	79	3				3.43	VL	100	60		2.76m: JT, 50-60°, PR, VNR M, SM 2.83m: JT, 50-60°, PR, VNR M, SM 2.88m: JT, 50-60°, PR, VNR M, SM 3.05-3.10m: CZ, M 3.12m: JT, 70°, PR, CN, SM 3.36m: B, PR, M, SM, 3.43-3.65m: CZ, M, 3.75-3.78m: CZ, M,				3	PLT	PL(A)=0.35MPa		
						3.65	L - M									PLT	PL(A)=0.16MPa		
						3.90	VL									PLT	PL(A)=0.66MPa		
	78	4				4.00	L - M				3.90-4.00m: CZ, 6°, M 4.30m: B, 90°, PR, VNR M, SM, 4.30m - 5.90m: Water loss <10%				4	PLT	PL(A)=0.39MPa		
						4.71					4.45m: JT, 35°, PR, VNR M, SM 4.53m: B, 0°, PR, M, SM, 1-2mm 4.67m: B, PR, M, SM, ~2mm 4.71m: B, PR, M, SM, ~2mm					PLT	PL(A)=0.13MPa		
	77	4.75	SANDSTONE: grey and pale grey, fine to medium grained, distinct, bedded; with siltstone laminations and bedding ~5%. Mittagong Formation.	FR		4.74		100	86		4.74m: B, PR, M, SM, ~2mm 4.77m: B, PR, M, SM, ~2mm 5.90m - 7.50m: Water loss ~10%				5	PLT	PL(A)=1.0MPa		
	76	6									6.30m: JT, 70°, PR, CN, RF				6				
								100	100		6.56m: JT, 70°, PR, CN, RF 6.60m: B, 0°, PR, SM 6.82m: JT, 70°, PR, CN, RF 6.94m: B, 10°, PR, SM					PLT	PL(A)=0.69MPa		
	75	7					M - H				7.40m: B, 10°, PR, SM				7	PLT	PL(A)=1.4MPa		
	74	8						100	100						8	PLT	PL(A)=1.6MPa		
	73	9						100	100		9.23m: B, 5°, PR, SM				9	PLT	PL(A)=0.90MPa		

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

PLANT: DTS 700
METHOD: DT (200mm) to 0.15m, AD/T to 1.10m, NMLC to 14.60m
REMARKS:

OPERATOR: Terratest

LOGGED: JDS
CASING: HWT to 1m

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

Refer to explanatory notes for symbol and abbreviation definitions

Douglas PARTNERS

BOREHOLE LOG

CLIENT: Stockland Commercial Property
PROJECT: Proposed Commencial Building
LOCATION: 601 Pacific Highway, St Leonards, NSW 2065

SURFACE LEVEL: 82.2 AHD
COORDINATE: E:333135.6, N:6255984.9
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH05
PROJECT No: 86230.01
DATE: 08/04/25
SHEET: 3 of 3

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	WEATH.	DEPTH (m)	STRENGTH	RECOVERY (%)	RQD	FRACTURE SPACING (m)	DEFECTS & REMARKS	SAMPLE REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS	BACKFILL	WELL PIPE
	72	11	[CONT] SANDSTONE: grey and pale grey, fine to medium grained, distinct, bedded; with siltstone laminations and bedding ~5%. Mittagong Formation.		FR	12.20	M	100	100		10.30m: No drilling muds, water loss ~20%				11	PLT	PL(A)=1.9MPa		
	71							100	92		10.55-1059m: CZ, INF Clay 6mm, 10.66m: B, 15°, PR, Clay 10mm, SM					PLT	PL(A)=0.95MPa		
	70	12									11.57m: B, 10°, PR, M, SM				12				
	69	13				13.20	M	100	100						13	PLT	PL(A)=0.40MPa		
	68	14					H	100	95		13.40m: B, 5°, PR, Clay 1mm, SM 13.45m: JT, 80°, ST, CN, RF				14	PLT	PL(A)=1.0MPa		
	67	15	Borehole discontinued at 14.60m depth. Target depth reached.								14.55m: B, PR, Clay 11mm					PLT	PL(A)=1.1MPa		
	66	16																	
	65	17																	
	64	18																	
	63	19																	

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

PLANT: DTS 700
METHOD: DT (200mm) to 0.15m, AD/T to 1.10m, NMLC to 14.60m
REMARKS:

OPERATOR: Terratest

LOGGED: JDS
CASING: HWT to 1m

Refer to explanatory notes for symbol and abbreviation definitions

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

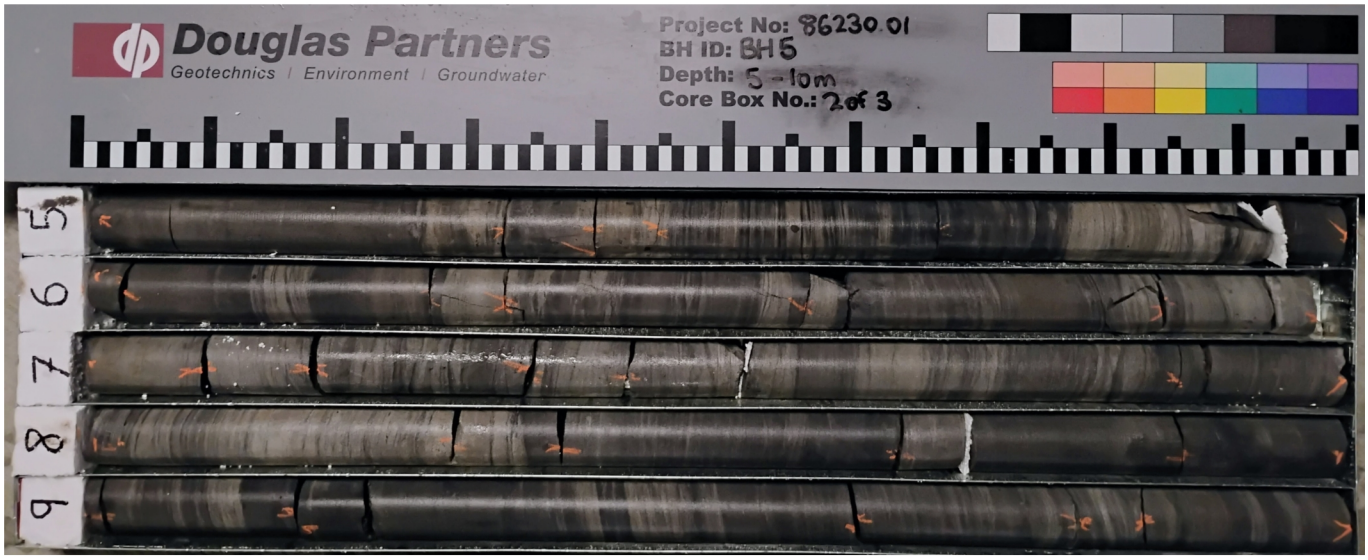
CORE PHOTO LOG

CLIENT: Stockland Commercial Property
PROJECT: Proposed Commencial Building
LOCATION: 601 Pacific Highway, St Leonards, NSW 2065

SURFACE LEVEL: 82.2 AHD
COORDINATE: E:333135.6, N:6255984.9
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH05
PROJECT No: 86230.01
DATE: 08/04/25
SHEET: 1 of 2

1.10-5.00 m depth



5.00-10.00 m depth

CORE PHOTO LOG

CLIENT: Stockland Commercial Property
PROJECT: Proposed Commencial Building
LOCATION: 601 Pacific Highway, St Leonards, NSW 2065

SURFACE LEVEL: 82.2 AHD
COORDINATE: E:333135.6, N:6255984.9
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH05
PROJECT No: 86230.01
DATE: 08/04/25
SHEET: 2 of 2

10.00-14.60 m depth

BOREHOLE LOG

CLIENT: Stockland Commercial Property
PROJECT: Proposed Commencial Building
LOCATION: 601 Pacific Highway, St Leonards, NSW 2065

SURFACE LEVEL: 81.3 AHD
COORDINATE: E:333122.5, N:6255970.7
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH06
PROJECT No: 86230.01
DATE: 08/04/25
SHEET: 1 of 3

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
08/04/25 No free groundwater observed whilst augering	81	0.15	CONCRETE; 150m thick; one layer reinforcement (SL82).			NA	NA				0.15				
		0.25	FILL / SAND: grey-brown; medium.		FILL	ND	M		D		0.25				
		0.50	FILL / Sandy CLAY with gravel: dark grey; low to medium plasticity; fine to coarse sand; fine, siltstone gravel.		FILL		w=PL		D		0.40				
		0.65	SILTSTONE: dark grey. Ashfield Shale.								0.50				
	80	1	Continued as rock log								1			Bentonite	
	79	2									2				
	78	3									3				
	77	4									4				
	76	5									5				
	75	6									6			Sand	
	74	7									7				
	73	8									8				
	72	9									9				

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

PLANT: DTS 700
OPERATOR: Terratest
LOGGED: JDS
METHOD: DT (200mm) to 0.15m, AD/T to 0.50m, WB to 0.65m, NMLC to 11.05m
CASING: HWT to 0.5m
REMARKS:

Refer to explanatory notes for symbol and abbreviation definitions

Douglas PARTNERS

BOREHOLE LOG

CLIENT: Stockland Commercial Property
PROJECT: Proposed Commencial Building
LOCATION: 601 Pacific Highway, St Leonards, NSW 2065

SURFACE LEVEL: 81.3 AHD
COORDINATE: E:333122.5, N:6255970.7
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH06
PROJECT No: 86230.01
DATE: 08/04/25
SHEET: 2 of 3

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	WEATH.	DEPTH (m)	STRENGTH	RECOVERY (%)	RQD	FRACTURE SPACING (m)	DEFECTS & REMARKS	SAMPLE REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS	BACKFILL	WELL PIPE
08/04/25 No free groundwater observed whilst augering	81	0	Continued from soil log												0				
	80	1	SILTSTONE: dark grey, indistinct bedding, 0 to 10°. Ashfield Shale.			0.65		100	76		0.85m: B, 0°, PR, 1mm, SM, fines 1.15m: JT, 30°, PR, VNR, SM, fines 1.33m: JT, 30°, PR, VNR, SM, fines 1.35m: JT, 70°, PR, CN, SM 1.42m: CZ, 40mm 1.70m: Water loss <10%. no drilling mud added.				1	PLT	PL(A)=0.94MPa	Bentonite	
																PLT	PL(A)=1.8MPa		
	79	2					M	100	100						2	PLT	PL(A)=0.72MPa		
																PLT	PL(A)=0.95MPa		
	78	3						100	95		3.00m: CZ, 40mm				3	PLT	PL(A)=0.80MPa		
																PLT	PL(A)=0.75MPa		
											3.75m: CZ, 20mm 3.98m: CZ, 20mm					PLT	PL(A)=0.88MPa		
	77	4	4.05 SANDSTONE: grey and pale grey, fine to medium grained, indistinct bedding, 0 to 10°; siltstone laminations and bedding. Mittagong Formation.												4	PLT	PL(A)=0.70MPa		
						4.50		100	100							PLT	PL(A)=0.93MPa		
	76	5			FR										5	PLT	PL(A)=1.0MPa	Sand	
								100	93		6.21m: CZ, 20mm 6.31m: CZ, 20mm					PLT	PL(A)=2.0MPa		
	75	6					H								6				
																PLT	PL(A)=2.3MPa		
	74	7						100	100						7	PLT	PL(A)=1.4MPa		
	73	8													8				
								100	91							PLT	PL(A)=1.5MPa		
	72	9													9				

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

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

PLANT: DTS 700
OPERATOR: Terratest
LOGGED: JDS
METHOD: DT (200mm) to 0.15m, AD/T to 0.50m, WB to 0.65m, NMLC to 11.05m
CASING: HWT to 0.5m
REMARKS:

Refer to explanatory notes for symbol and abbreviation definitions

Douglas PARTNERS

BOREHOLE LOG

CLIENT: Stockland Commercial Property
PROJECT: Proposed Commencial Building
LOCATION: 601 Pacific Highway, St Leonards, NSW 2065

SURFACE LEVEL: 81.3 AHD
COORDINATE: E:333122.5, N:6255970.7
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH06
PROJECT No: 86230.01
DATE: 08/04/25
SHEET: 3 of 3

CONDITIONS ENCOUNTERED														SAMPLE				TESTING			
GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	WEATH. (PS, XW, DW, HW, MW, SW, 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
	71	11	[CONT] SANDSTONE: grey and pale grey, fine to medium grained, indistinct bedding, 0 to 10°; siltstone laminations and bedding. Mittagong Formation.		FR		H	100	91		9.97m: CZ, 80mm 10.10m: B, 10°, PR, Clay 10mm, RF				11	PLT	PL(A)=1.3MPa	Sand	
								100	100										
	70	12	Borehole discontinued at 11.05m depth. Target depth reached.																
	69	13																	
	68	14																	
	67	15																	
	66	16																	
	65	17																	
	64	18																	
	63	19																	
	62																		

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

PLANT: DTS 700
OPERATOR: Terratest
LOGGED: JDS
METHOD: DT (200mm) to 0.15m, AD/T to 0.50m, WB to 0.65m, NMLC to 11.05m
CASING: HWT to 0.5m
REMARKS:

Refer to explanatory notes for symbol and abbreviation definitions

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

CORE PHOTO LOG

CLIENT: Stockland Commercial Property
PROJECT: Proposed Commencial Building
LOCATION: 601 Pacific Highway, St Leonards, NSW 2065

SURFACE LEVEL: 81.3 AHD
COORDINATE: E:333122.5, N:6255970.7
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH06
PROJECT No: 86230.01
DATE: 08/04/25
SHEET: 1 of 1

0.50-5.00 m depth

5.00-11.05 m depth

Douglas PARTNERS

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

Permeability Testing - Falling Head Test Report

Client:	Stockland Developments Pty Ltd	Project No:	86230.01
Project:	Proposed Residential Development	Test date:	17-Apr-25
Location:	601 Pacific Highway, St Leonards	Tested by:	ZW

Test Location

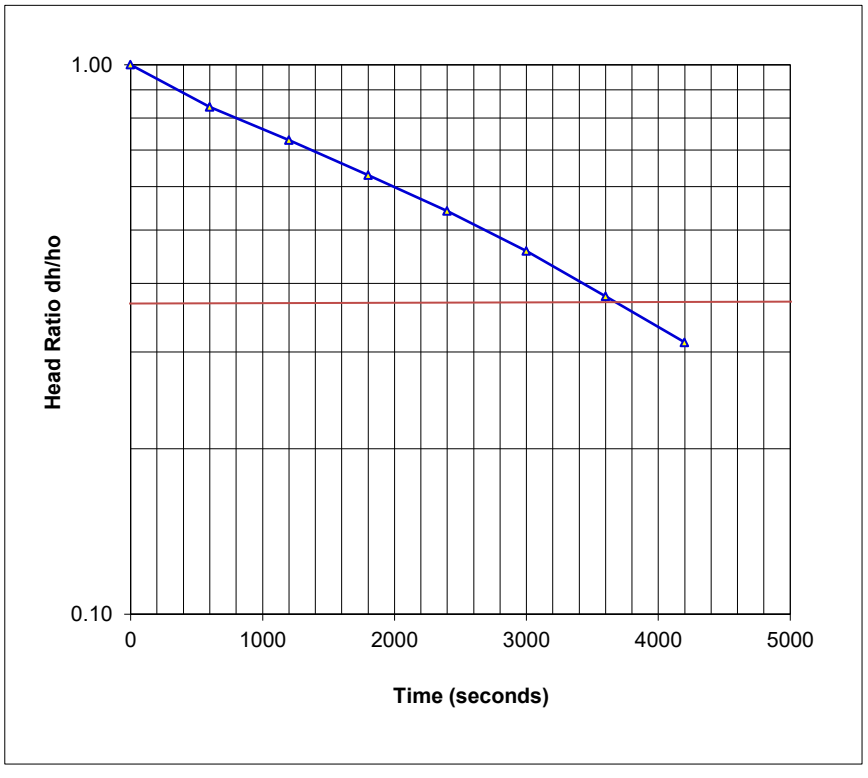
Description:	Falling Head Test (Case 2)	**Test No.**	BH01	
Material type:	Siltstone & Sandstone	Easting:	333081.1	m
		Northing	6255981.1	m
		Surface Level:	82.4	m AHD

Details of Well Installation

Effective diameter (2re)	76	mm	Depth to water before test	10.8	m
borehole diameter (2R)	76	mm	Depth to water at start of test	8.4	m
Effective Length of well screen (Le)	4.0	m	Depth of top of PVC standpipe	3.0	m
			Depth of base of PVC standpipe	14.8	m

Test Results

Time (sec)	Depth (m)	Change in Head δH (m)	δH/Ho
0.00	8.40	2.40	1.000
600.00	8.79	2.01	0.838
1200.00	9.05	1.75	0.729
1800.00	9.29	1.51	0.629
2400.00	9.50	1.30	0.542
3000.00	9.70	1.10	0.458
3600.00	9.89	0.91	0.379
4200.00	10.05	0.75	0.313



To = 60.0 mins
3600 secs

Theory: Falling Head Permeability calculated using equation by Hvorslev

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

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

Hydraulic Conductivity

k =	**2.3E-07**	m/sec
=	**0.020**	m/day

Douglas Partners
Geotechnics / Environment / Groundwater

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

Permeability Testing - Falling Head Test Report

Client:	Stockland Developments Pty Ltd	Project No:	86230.01
Project:	Proposed Residential Development	Test date:	10-Apr-25
Location:	601 Pacific Highway, St Leonards	Tested by:	JDS

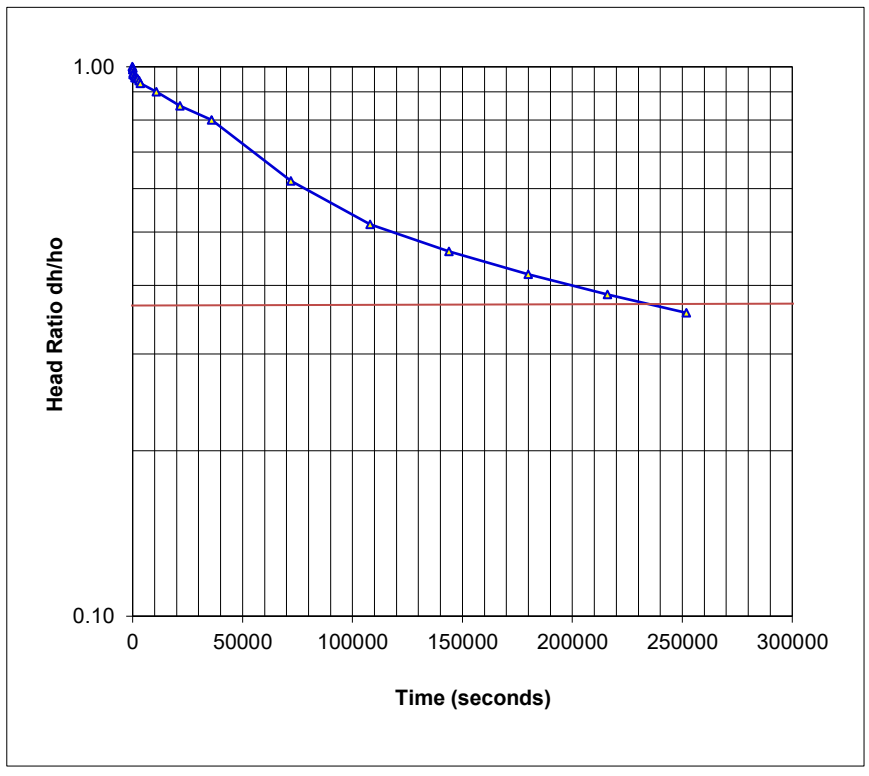
Test Location		**Test No.**	BH3	
Description:	Falling Head Test (Case 2)	Easting:	333109.1	m
Material type:	Siltstone & Sandstone	Northing	6256004.1	m
		Surface Level:	82.4	m AHD

Details of Well Installation

Effective diameter (2re)	76	mm	Depth to water before test	9	m
borehole diameter (2R)	76	mm	Depth to water at start of test	0.5	m
Effective Length of well screen (Le)	3.1	m	Depth of top of PVC standpipe	0.5	m
			Depth of base of PVC standpipe	12.1	m

Test Results

Time (sec)	Depth (m)	Change in Head δH (m)	δH/Ho
0.00	0.50	8.50	1.000
60.00	0.53	8.47	0.996
120.00	0.54	8.46	0.995
180.00	0.61	8.39	0.987
240.00	0.72	8.28	0.974
300.00	0.77	8.23	0.968
900.00	0.82	8.18	0.962
1200.00	0.88	8.12	0.955
1800.00	0.89	8.11	0.954
2400.00	0.92	8.08	0.951
3000.00	0.98	8.02	0.944
3600.00	1.07	7.93	0.933
10800.00	1.35	7.65	0.900
21600.00	1.79	7.21	0.848
36000.00	2.20	6.80	0.800
72000.00	3.73	5.27	0.620
108000.00	4.61	4.39	0.516
144000.00	5.08	3.92	0.461
180000.00	5.44	3.56	0.419
216000.00	5.73	3.27	0.385
252000.00	5.97	3.03	0.356



To = 4000 mins
240000 secs

Theory: Falling Head Permeability calculated using equation by Hvorslev

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

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

Hydraulic Conductivity	**k =**	**4.3E-09**	m/sec
	=	**0.0004**	m/day

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

Permeability Testing - Falling Head Test Report

Client:	Stockland Developments Pty Ltd	Project No:	86230.01
Project:	Proposed Residential Development	Test date:	17-Apr-25
Location:	601 Pacific Highway, St Leonards	Tested by:	ZW

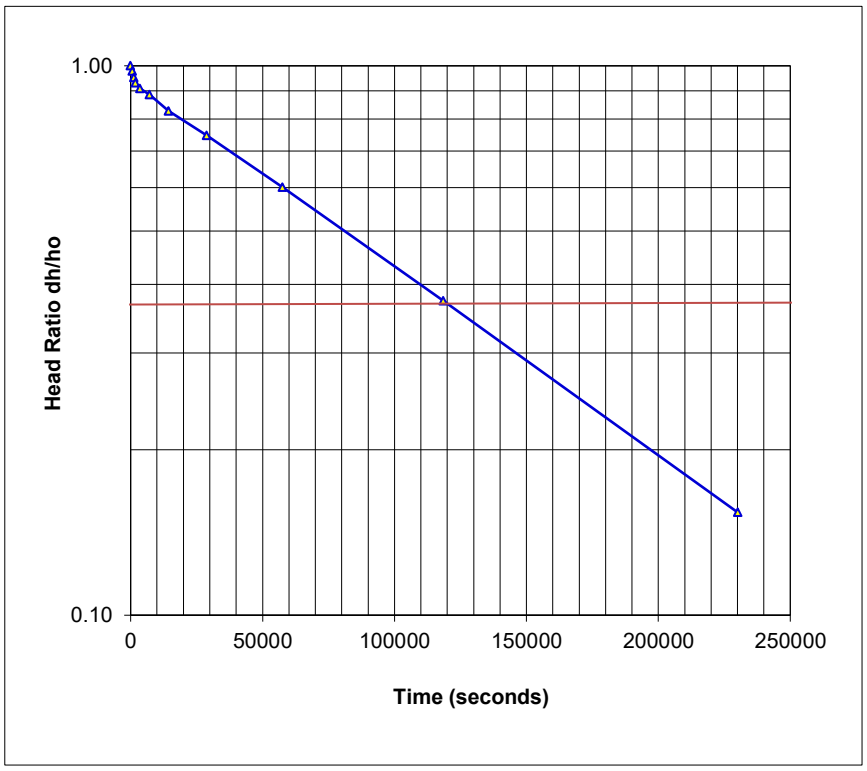
Test Location		**Test No.**	BH3	
Description:	Falling Head Test (Case 2)	Easting:	333109.1	m
Material type:	Siltstone & Sandstone	Northing	6256004.1	m
		Surface Level:	82.4	m AHD

Details of Well Installation

Effective diameter (2re)	76	mm	Depth to water before test	6.73	m
borehole diameter (2R)	76	mm	Depth to water at start of test	4	m
Effective Length of well screen (Le)	5.4	m	Depth of top of PVC standpipe	0.5	m
			Depth of base of PVC standpipe	12.1	m

Test Results

Time (sec)	Depth (m)	Change in Head δH (m)	δH/Ho
0.00	4.00	2.73	1.000
600.00	4.06	2.67	0.978
1200.00	4.13	2.60	0.952
1800.00	4.19	2.54	0.930
3600.00	4.25	2.48	0.908
7200.00	4.31	2.42	0.886
14400.00	4.47	2.26	0.828
28800.00	4.69	2.04	0.747
57600.00	5.09	1.64	0.601
118500.00	5.71	1.02	0.374
230100.00	6.31	0.42	0.154



To = 1975 mins
118500 secs

Theory: Falling Head Permeability calculated using equation by Hvorslev

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

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

Hydraulic Conductivity	**k =**	**5.6E-09**	m/sec
	=	**0.0005**	m/day

Douglas Partners
Geotechnics / Environment / Groundwater

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Permeability Testing - Falling Head Test Report

Client:	Stockland Developments Pty Ltd	Project No:	86230.01
Project:	Proposed Residential Development	Test date:	17-Apr-25
Location:	601 Pacific Highway, St Leonards	Tested by:	ZW

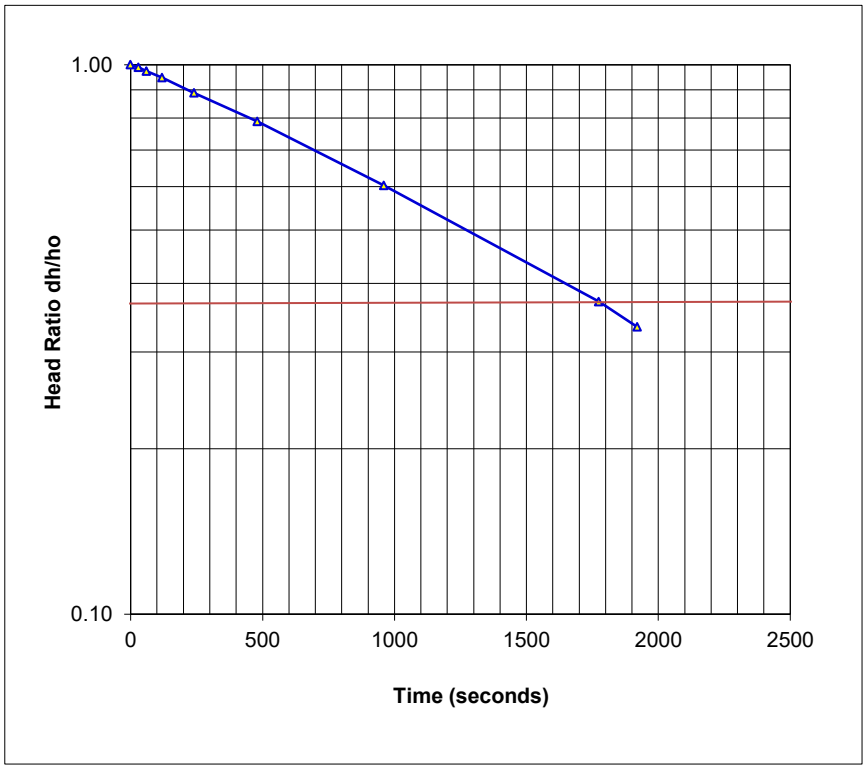
Test Location		**Test No.**	BH06	
Description:	Falling Head Test (Case 2)	Easting:	333122.5	m
Material type:	Siltstone & Sandstone	Northing	6255970.7	m
		Surface Level:	81.3	m AHD

Details of Well Installation

Effective diameter (2re)	76	mm	Depth to water before test	3.4	m
borehole diameter (2R)	76	mm	Depth to water at start of test	1.51	m
Effective Length of well screen (Le)	7.7	m	Depth of top of PVC standpipe	1.5	m
			Depth of base of PVC standpipe	11.1	m

Test Results

Time (sec)	Depth (m)	Change in Head δH (m)	δH/Ho
0.00	1.51	1.89	1.000
30.00	1.53	1.87	0.989
60.00	1.56	1.84	0.974
120.00	1.61	1.79	0.947
240.00	1.72	1.68	0.889
480.00	1.91	1.49	0.788
960.00	2.26	1.14	0.603
1775.00	2.7	0.70	0.370
1920.00	2.77	0.63	0.333



To = 29.6 mins
1775 secs

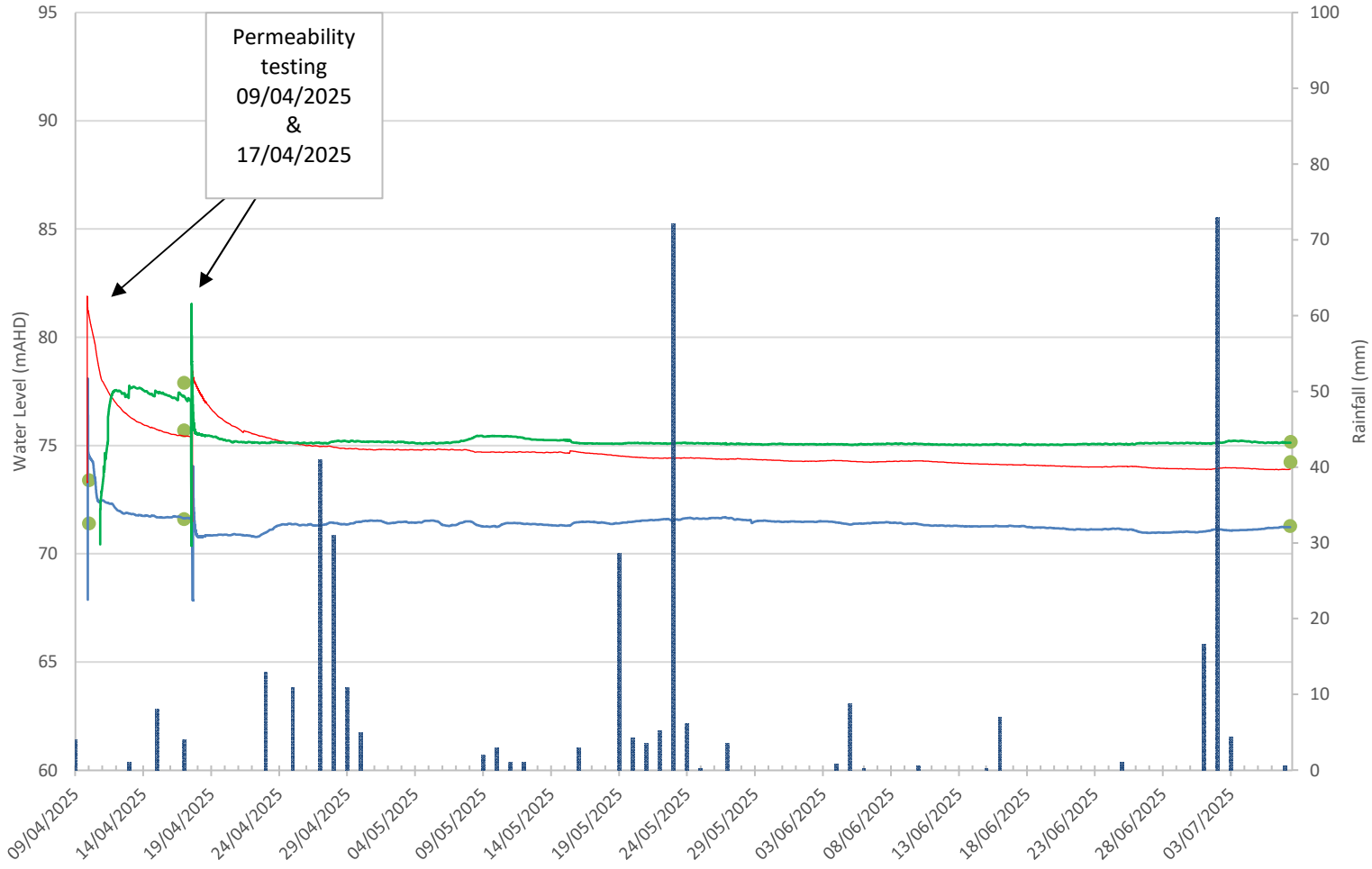
Theory: Falling Head Permeability calculated using equation by Hvorslev

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

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

Hydraulic Conductivity **k =** **2.8E-07** m/sec
= **0.024** m/day

Groundwater Level Monitoring Summary



Note: Reading Interval = 1 hour

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- Manual Levels
- Water Level BH01
- Water Level BH03
- Water Level BH06
- Rainfall data (ST: 066011)

Date:	From	Drawn:
08/07/2025	09/04/2025	AG
	To	Checked:
	07/07/2025	STE