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Report on
Supplementary Geotechnical Investigation

Proposed Commercial Development
8-10 Lee Street, Haymarket

Prepared for
Vertical First Pty Ltd

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

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1. Introduction

Douglas Partners Pty Ltd has been commissioned by Atlassian (the Applicant) to prepare this supplementary geotechnical investigation report in accordance with the technical requirements of the Secretary's Environmental Assessment Requirements (SEARs), and in support of the SSD-10405 for a commercial and hotel development above the Former Inwards Parcel Shed (Parcels Shed) at 8-10 Lee Street, Haymarket.

Specifically, this report addresses the following SEARs:

SEARs	Report Reference
18. Contamination and Remediation: '…identify geotechnical issues (including Acid Sulfate Soils) associated with the construction of the development…'	Section 11.1 "Geotechnical Issues", with advice on these and construction-related matters provided in Sections 11.2 to 11.12

The investigation was commissioned in an email by Avenor Pty Ltd (Avenor) on behalf of Vertical First Pty Ltd (Vertical), and was undertaken in accordance with a consultancy agreement and our proposal SYD190190.P.003.Rev5 dated 8 May 2020.

It is understood that the proposed development at the Site is to be divided into a 'Developer Works zone' and a 'State Works – Link Zone'. The Developer Works are proposed to include excavation for a two-level basement on the western side of Central Station (i.e. to an elevation of RL5.0 m, relative to the Australian Height Datum (AHD)) followed by construction of a multi-storey commercial tower, whereas the State Works to the west of the tower include a two-level basement to a similar elevation, with a north-south connection to proposed future, adjoining basements.

The supplementary geotechnical investigation was carried out to provide additional information on the subsurface profile and groundwater levels for the assessment of excavation conditions, and to provide information for the design of the basement excavation, shoring systems and foundations. The supplementary geotechnical investigation (completed in conjunction with a supplementary environmental investigation) included drilling boreholes, installation of standpipes with data loggers, and laboratory testing of selected soil and rock samples. Details of the field work are given in this report, together with comments relevant to design and construction practice.

2. Description of the Site

2.1 General

The Site is known as 8-10 Lee Street, Haymarket. It is an irregular-shaped allotment (refer Figure 1 below). The allotment has a small street frontage to Lee Street, however, this frontage is limited to the width of the access handle.

The Site comprises multiple parcels of land which exist at various stratums. All the lots are in the freehold ownership of Transport for NSW (TfNSW), with different leasing arrangements:

- Lot 116 in DP 1078271: YHA is currently the long-term leaseholder of the Site;
- Lot 117 in DP 1078271: This is currently in the ownership of TfNSW and the applicant is seeking the transfer of the leasehold on this land to provide for an optimised basement and servicing outcome for the Site;
- Lot 118 in DP 1078271: This is currently in the ownership of TfNSW and the applicant is seeking the transfer of the leasehold for part of the air-rights above part of this allotment to allow for an optimised building envelope for the Project. The proposal also uses a part of Lot 118 in DP 1078271 within Ambulance Avenue for Day 1 bike access, secondary pedestrian access and fire service vehicle access; and
- Lot 13 in DP 1062447: This is currently in the ownership of TfNSW, however, TOGA (who hold the lease for the Adina Hotel) have a long-term lease of this space in the lower ground area.

The Site has an area of approximately 3,764 m^2 when measured at the Upper Ground Floor level, which includes 277 m^2 of air rights that apply from RL40 m.

The Site is bounded by Ambulance Avenue to the north (also known as Lower Carriage Lane), the Adina Hotel and Upper Carriage Lane to the west, Central Station Country Platform 0 to the east, and both the Devonshire Street Pedestrian Tunnel (Devonshire Tunnel) and Henry Deane Plaza to the south.

Figure 1: Site Location and Dimensions (supplied by Urbis Pty Ltd)

2.2 Site and Surrounding Context (Supplied by Urbis Pty Ltd)

The Site is directly adjacent to the Western Wing Extension of Central Station, and forms part of the 'Western Gateway Sub-precinct' of the Central Railway Station lands. It is situated between the existing 'CountryLink' and 'Intercity' railway platforms to the east and the Adina Hotel (former Parcel Post Office) to the west.

Existing vehicle access to the Site is via Lee Street, however the Lee Street frontage of the Site is only the width of the access handle.

Current improvements on the Site include the Parcels Shed, which operated in association with the former Parcels Post Office (now the Adina Hotel). The Site is currently used as the Sydney Railway Square Youth Hostel (YHA). The Site also includes the western entryway to the Devonshire Tunnel, which runs east-west through Central Station under the existing railway lines.

The Site is situated in a well-connected location in Sydney, directly adjacent to Central Station Railway which provides rail connections across metropolitan Sydney, as well as regional and interstate connections and a direct rail link to Sydney Airport. The Site is also within close proximity to several educational institutions, and is a city fringe location which provides access to key support services.

Central Railway Station is currently undergoing rapid transformation to allow for integration of rail, metro and light rail transport infrastructure. This will elevate the role of Central Station not only for transport but also enhance opportunities for urban renewal and revitalisation of the surrounding precinct. This is one of the key drivers for the identification of the Central Station State Significant Precinct (Central SSP) and the Western Gateway Sub-precinct, to accommodate a new innovation and technology precinct.

The proximity of the Western Gateway Sub-precinct to the city, while still being located outside the core Sydney CBD, provides opportunity for it to evolve to attract technology and innovation companies. It has access to all required services while being sufficiently separate to the CBD to establish a distinct technology industry ecosystem. Its CBD fringe location will likely provide affordable commercial rents which will support 'Startups' and entrepreneurs, which are a key component of an innovation precinct.

2.3 Site Observations

The Site is divided into two areas: the 'State Works – Link Zone' to the west and the 'Developer Works Zone' to the east. With reference to Drawing 1, descriptions of the eastern and western areas of the Site are set out below. Site investigation was also carried out from within the Adina Hotel basement, however, that basement (with a floor level of RL13.4 m) does not lie within the 'site' boundaries.

- Eastern area of the Site ('Developer Works Zone'):
    - This area is occupied by the Parcels Shed, which has both Upper Ground and Lower Ground Floor levels;
    - The Upper Ground Floor level (approximate elevation of RL21.2 m) is accessed from Upper Carriage Lane, and is currently occupied by the YHA;
    - Four former rail carriages are present on the eastern side of the YHA building, mounted on steel rails which are apparently supported by rail ballast and a brick pavement. These

  carriages, modified to become dormitory rooms / accommodation, are accessed from a concrete-surfaced platform (refer Photos 1 to 4, in Appendix B);

  - The height difference between the platform and dormitory carriage rail / ballast level was measured to be 1.1 m;
  - The Lower Ground Floor level on the eastern part of the Site is accessed from Ambulance Avenue (approximate elevation of RL15.5 m), and is currently occupied by rail catering facilities operated by Gate Gourmet Rail Pty Ltd (Gate Gourmet), including food storage areas and cool rooms / freezers (refer Photo 5); and
  - The north-eastern corner of the Gate Gourmet catering facility (i.e. at Lower Ground Floor level) is connected, via a concrete-lined rail access tunnel, to a series of other subterranean rail access tunnels which pass beneath Central Station (e.g. access tunnel ‘Subway 3’).

- Central and Western area of the Site (‘State Works - Link Zone’):
  - This area includes an asphalt-surfaced, open-air, access ramp/road (i.e. Upper Carriage Lane, at approximate Upper Ground Floor level) which connects with Lee Street to the west (refer Photo 10 and 11);
  - An access corridor connects Ambulance Avenue at Lower Ground Floor level with areas of material storage and other facilities whilst Upper Carriage Lane passes above this area: the western part of the access ramp/road is assumed to be underlain by soil fill materials;
  - The open-air ramp is supported along the northern property boundary (and adjacent to the Adina Hotel property) by a brick retaining wall (refer Photos 13 and 14), through which an access portal and driveway leads southward and into the Adina Hotel’s parking basement (refer Photo 9);
  - The access corridor, aligned in an approximately north-east / south-west direction, connects Ambulance Avenue with Henry Deane Plaza (to the south). Toilet and bin room facilities were observed on the western side of the access corridor (refer Photo 7 and Photo 12);
  - A storage area / corridor, aligned in an approximately north-east / south-west direction, connecting retail operations (adjoining the Devonshire Tunnel) with the materials storage area and access corridor described above (refer Photo 6: southern end); and
  - The Adina Hotel basement is located west of the Site. Based on the provided drawing (prepared by Synman, Justin and Bialek Architects, Drawing WG.05, dated 21 March 1998), the basement floor level is at an elevation of RL13.4 m. A brick retaining wall is visible on the eastern side of the basement, together with a concrete underpin which extends below the brick wall to either just above or to below the basement floor. An outcrop of weathered, very low strength sandstone (with high strength iron-cemented bands) was observed beneath the concrete underpin at two locations within the basement, including west of the driveway from Ambulance Avenue (refer Photographs 15 to 18).

3. Project Description (Supplied by Urbis Pty Ltd)

The proposed state significant development application will facilitate the development of a new mixed-use development comprising ‘tourist and visitor accommodation’ (in the form of a ‘backpackers’) and commercial office space within the tower form. Retail, lobby and food and drink premises at the Lower Ground level and Upper Ground level.

Atlassian Central at 8-10 Lee Street will be the new gateway development at Central Station which will anchor the new ‘Technology Precinct’ proposed by the NSW Government. The new building will be purpose-built to accommodate the Atlassian Headquarters, a new TfNSW Pedestrian Link Zone, and the new Railway Square YHA backpacker’s accommodation, in addition to commercial floorspace to support technology ‘start-ups’.

The new development is to be built over the existing heritage Parcels Shed located on the western boundary of Central Station with the Adina hotel to the west. The works includes a 38-storey mixed-use tower with basement loading dock facilities accessed off Lee Street, 2-storey lobby utilising the Parcels Shed building, lower ground and upper ground retail, YHA hostel and commercial tower with staff amenities to the mid-level and roof top areas and a pedestrian Link Zone works for TfNSW.

The building design has been conceived to support the delivery of a site plan designed to connect with future developments to both the south and east, and integrate with a cohesive public realm for the broader Sydney community in accordance with NSW government strategic planning.

The tower design is a ‘demonstration project’ for Atlassian, representing their commitment to environmental sustainability and contemporary workplace settings through tower form and construction systems along with a set of emblematic outdoor workplaces stacked in the tower form.

The existing Parcels Shed will be adaptively re-used in accordance with current best practice heritage process and will form the upper level of a 2-storey entry volume that connects visually with the 2 level Link Zone. Over the roof of the Parcels Shed, a new privately owned but publicly accessible landscaped area will be created as the first part of a new upper level public realm that may extend to connect to a future Central Station concourse or future Over Station Development.

The proposed mixed-use tower directly adjoins a live rail environment to the east and public domain to the north, west and south. These works will consider these rail environments and have been designed to ensure that all TfNSW external development standards are achieved. This ensures there is no impact to the operation or safety of these TfNSW assets.

Interfaces from the overall site and especially the State works Link Zone have been designed in consultation with the adjoining stakeholders. These stakeholders include TfNSW to the north and south, Toga and the Adina Hotel operator to the west and the Dexus Fraser’s site to the south. Connections via the Link Zone, through the basements and off the proposed new Link Zone dive ramp, will be designed to enable existing and future developments to function in both the ‘Day 1 scenario’ and ‘end state’, when all developers have completed their works.

The overall project aspiration is to create a world class tech precinct with effective pedestrian links through the Atlassian site to the Central Station western forecourt to Central Walk west and adjoining stakeholder’s sites.

4. Previous Investigations

Previous investigations were completed on the eastern part of the Site by Douglas Partners Pty Ltd (Douglas Partners), in conjunction with a preliminary site investigation for contamination. The information obtained from the site investigations was presented in two reports:

- Douglas Partners Report 86767.00.R.001.Rev0, dated 26 August 2019 (Geotechnical report): and
- Douglas Partners Report 86767.01.R.001.Rev1, dated 25 September 2020 (Environmental report).

These previous investigations included six rock cored boreholes to at least 4 m below the lowest basement floor level (i.e. Boreholes BH1, BH2, BH3, BH5, BH8 and BH9) and three boreholes drilled within the soil to depths of 1.3 m - 2.4 m below the existing lower ground floor level (i.e. Boreholes BH4, BH6 and BH7). Standpipe piezometers were installed in Boreholes BH1, BH5 and BH8, with the installed pipes screened within either alluvial sand (i.e. BH1) or within the underlying very low to high strength rock. Borehole logs and core photographs from the previous investigation are reproduced within Appendix E of this report.

Groundwater permeability testing and long-term monitoring of groundwater levels in standpipes has been carried out at the Site since July 2019, with the results presented in the following monitoring reports:

- Douglas Partners Report 86767.00.R.002.Rev0 (dated 4 September 2019): Monitoring period July to August 2019;
- Douglas Partners Report 86767.00.R.003.Rev0 (dated 10 December 2019): Monitoring to 26 November 2019;
- Douglas Partners Report 86767.00.R.004.Rev0 (dated 2 March 2020): Monitoring to 19 February 2020;
- Douglas Partners Report 86767.00.R.005.Rev0 (dated 26 May 2020): Monitoring to 5 May 2020; and
- Douglas Partners Report 86767.00.R.008.Rev0 (dated 22 September 2020): Monitoring to 15 September 2020.

Rising head tests were completed within Boreholes BH5 and BH8, and falling head tests were completed within Borehole BH1. The results of these tests are included in Appendix F.

A previous geotechnical investigation carried out by Douglas Partners for a neighbouring site to the south (i.e. ‘Henry Deane Plaza’: Douglas Partners Report 27282B, dated 1999) included the drilling of a borehole near to the southern site boundary. The position of the borehole as part of that investigation is shown on Drawing 1, with the borehole information utilised to assist with the interpretation of the sub-surface profile on Drawing 2 (the borehole is denoted as ‘27282B_BH101’).

The results from boreholes completed for environmental purposes at the Site, and the geotechnical data obtained from previous investigations, has been considered in preparation of this supplementary report.

5. Geology

Reference to the Sydney 1:100 000 Geological Series Sheet (Geological Survey of NSW: Herbert, 1983) indicates that the Site is underlain by Triassic age Ashfield Shale overlying Hawkesbury Sandstone, and that the Site is located near Quaternary age alluvial sediments, including transgressive dune sands. Although not shown on the geological map, the Mittagong Formation is likely to be present at the transition between the Ashfield Shale and Hawkesbury Sandstone geological units.

The Quaternary sediments typically comprise medium to fine grained marine sand. The Ashfield Shale typically comprises black to dark grey shales and laminite. The Mittagong Formation consists of interbedded shale, laminite and fine grained quartz sandstone, and the underlying Hawkesbury Sandstone typically comprises horizontally bedded and vertically jointed, massive and cross-bedded, medium grained quartz sandstone with a few shale interbeds.

The geological map indicates the possible presence of igneous dykes near to and north of the Site, striking in a north-westerly direction. These dykes are commonly steeply dipping (often near vertical) slabs of igneous rock which intrude through the bedrock, with measured widths in the Greater Sydney Region ranging between a centimetre or less to about 6 m (Rickwood, 1985). These dykes could be associated with zones of closely spaced fractures within high strength rock. Although no evidence of dykes was found in the investigation there is a possibility that a dyke could cross the Site.

The 1:25 000 Acid Sulfate Soil Risk map for Botany Bay (Murphy, 1997) indicates that the Site does not lie within an area known for acid sulfate soils, nor does the Site occur within areas known for soil salinity issues.

Site investigations during the present study encountered alluvial and residual soils, and sandstone bedrock consistent with the Mittagong Formation and Hawkesbury Sandstone.

6. Field Work Methods

6.1 General

The field work for the supplementary geotechnical investigation was completed in conjunction with a detailed supplementary site investigation for contamination (SSI). The site works were carried out over a five-day period in April 2020 (i.e. 7-8 April, and 14-16 April), and five days in May 2020 (i.e. 16-20 May). The supplementary geotechnical and environmental investigation work included the drilling of a total of 24 boreholes at the locations shown in Drawing 1, Appendix C.

6.2 Boreholes

The areas where boreholes were drilled included:

- Eastern side of the YHA at Upper Ground Floor level: five boreholes (Boreholes BH101 to BH105, including two rock cored boreholes drilled from the concrete platform);
- Within the Gate Gourmet catering facility at Lower Ground Floor level: four boreholes (Boreholes BH106, BH113, BH114 and BH115: all for environmental testing purposes);

- Within the access corridor and storage areas, west of the Gate Gourmet facility and at Lower Ground Floor level: seven boreholes (BH107A, BH107B, BH108, BH109A, BH109B, BH116, BH117: including three rock cored boreholes);
- Within the Adina Hotel basement access driveway at Lower Ground Floor level: one borehole (Borehole BH110: for environmental testing purposes);
- Upper Carriage Lane / open-air access ramp: three boreholes (Boreholes BH111, BH112A and BH112B: including two rock cored boreholes);
- Ambulance Avenue footpath: two vertical boreholes drilled through the retaining wall's footing (Boreholes W1 and W2); and
- Within the Adina Hotel basement: two inclined boreholes drilled below an existing concrete underpin (Boreholes W3 and W4).

Following coring of concrete slabs and/or buried concrete or bricks, the following equipment was used to complete the drilling work:

- hand auger (e.g. Borehole BH101);
- hand tools / diatube (e.g. Borehole W1);
- push-tube sampling rig (e.g. Borehole BH111); and
- tracked drilling rig with 110 mm diameter spiral flight augers (e.g. BH107A).

Boreholes drilled into the underlying rock by the tracked drilling rig were cased, and then advanced into the underlying sandstone using NMLC-sized diamond core drilling equipment, to obtain 50 mm diameter, continuous samples of the rock for identification and strength testing purposes. Selected soil samples obtained during auger drilling were submitted to an analytical laboratory, with analysis of soil pH, electrical conductivity, sulfate and chloride ion concentrations.

Current boreholes drilled from the YHA (eastern) platform were taken to a maximum depth of 20 m, whereas the boreholes drilled from either the open-air ramp (Upper Carriage Lane) or from within the access corridor or storeroom were taken to a maximum depth of 15 m. Boreholes drilled to investigate the founding conditions of the brick retaining wall or its underpin ranged in depth between 1.2 m and 2.46 m.

All field work was carried out under the full-time supervision of a geotechnical engineer, engineering geologist or environmental scientist. Logging of the soil and rock materials within the boreholes was undertaken in general accordance with Australian Standard AS 1726 (2017).

Surface levels were obtained using either a laser level or interpolated from the provided site survey drawing prepared by LTS Lockley Pty Ltd (reference 50176, Rev E, dated 9 April 2020). Borehole co-ordinates were interpolated from known locations using tape measurements. The inferred accuracy of borehole surface levels is 0.1 m (in plan view), whereas the inferred accuracy of position co-ordinates is 3 m.

6.3 Standpipes

Seven new standpipe piezometers were installed into completed boreholes at the Site (i.e. Boreholes BH103, BH104, BH107A, BH107B, BH109B, BH112A, and BH112B), to measure groundwater levels, comprising screened PVC pipe with gravel backfill, a bentonite pellet seal and 'gatic' cover at ground level (refer to Borehole Logs in Appendix D for specific details).

The alternatives for the position of the screen within the standpipes were:

- Option A: within very low or low strength, fine to medium grained sandstone (interpreted to be the Mittagong Formation): Boreholes BH103, BH107A, and BH112A; and
- Option B: within the underlying medium to high strength, medium grained sandstone (interpreted to be the Hawkesbury Sandstone): Boreholes BH104, BH107B, BH109B and BH112B.

Following installation, the standpipes were flushed and subsequently pumped to remove drilling fluids. Data loggers were installed in each standpipe to collect groundwater measurements at pre-determined intervals, and the water level within each standpipe was measured by hand on multiple occasions between 23 July 2019 and 15 September 2020.

Following the drilling field work for the supplementary investigation, the following groundwater measurement, sampling and monitoring activities were completed:

- 16 April 2020: Purging of drilling water from Boreholes BH103 and BH104, and installation of data loggers. Rising head permeability tests were completed in both these boreholes;
- 24 April 2020: Measurement of water levels in three standpipes (BH1, BH103, BH104), and collection of data from loggers. Purging of water from Boreholes BH103 and BH104, followed by completion of a rising head permeability test in Borehole BH103;
- 5 May 2020: Measurement of water levels in five standpipes (BH1, BH5, BH8, BH103, and BH104), and collection of data from loggers;
- 17 May 2020: Measurement of water levels, purging of water from BH107A and BH107B, and installation of data loggers. Rising head permeability tests were completed in both these boreholes;
- 21 May 2020: Measurement of water levels, purging of water from BH109B, BH112A and BH112B, and installation of data loggers. Rising head permeability tests were successfully completed in BH109B and BH112B;
- 22 May 2020: Purging of water from BH104, followed by completion of a rising head permeability test;
- 26 May 2020: Measurement of water levels in five standpipes (BH107A, BH107B, BH109B, BH112A, and BH112B), and collection of data from loggers. Rising head permeability tests were completed in BH107A, BH107B, and BH109B;
- 5 June 2020: Measurement of water levels in eight standpipes (BH1, BH103, BH104, BH107A, BH107B, BH109B, BH112A, and BH112B), and collection of data from loggers. Falling head permeability tests were completed in BH109B, BH112A, and BH112B;
- 7 September 2020: measurement of water levels in nine standpipes (BH1, BH8, BH103, BH104, BH107A, BH107B, BH109B, BH112A, and BH112B), and collection of data from loggers; and

- 15 September 2020: measurement of the water level in one standpipe (BH5), and collection of data from the logger.

Further details of the methods and procedures employed during the site investigation are presented in the attached Notes About This Report.

7. Field Work Results

7.1 Boreholes

The detailed conditions encountered in the boreholes are presented on the borehole logs given in Appendix D, along with standard notes defining the descriptive terms and the classification methods used. Photographs of the rock core and selected photographs during the site work are included with the borehole logs.

The subsurface conditions encountered in the supplementary boreholes can be summarised as:

CONCRETE:	Single or multiple concrete slabs, with or without a brick pavement, asphalt layer, or surface ballast layer (0.15-6.3 m thick); over
FILL	Gravel, sand or clay fill to depths ranging between 4.7 m and 6.3 m on the eastern side of the YHA, or 0.0-2.2 m depth within the access corridor and Gate Gourmet (i.e. the Lower Ground Floor level).
ALLUVIAL SAND:	Loose to medium dense, alluvial sand, 0.4-1.2 m thick (Boreholes BH111, BH112A and BH112B only); over
RESIDUAL SILTY CLAY:	Soft to hard, residual silty clay, with some ironstone gravel (0.75-2.2 m thick, absent in Borehole BH102, BH105, BH107A); over
RESIDUAL SANDY CLAY:	Very stiff to hard, residual sandy clay (0.2-0.6 m thick, present in Borehole BH102, BH107A, BH107B, BH112A and BH112); over
SANDSTONE (FINE to MEDIUM):	Very low to low strength, fine to medium grained sandstone with some medium or high strength, iron-cemented bands (0.65-1.8 m thick: absent in Borehole BH109B). Numerous clay seams were encountered; over
SANDSTONE (MEDIUM):	Medium or high strength, medium grained sandstone

The fine to medium grained sandstone is interpreted to be part of the Mittagong Formation, and the underlying medium grained sandstone is interpreted to be Hawkesbury Sandstone.

Boreholes drilled to investigate the footings of the brick retaining wall along Ambulance Avenue (i.e. Boreholes W1 and W2) encountered stiff to very stiff, silty clay residual soil beneath the concrete footings, whereas the boreholes drilled beneath the concrete underpins along the western site boundary (i.e. from within the Adina Hotel basement: Boreholes W3 and W4) encountered medium to high strength fine grained sandstone with seams of clay and very low strength sandstone. The borehole logs are presented in Appendix D, with cross-sections at each retaining wall borehole location presented as Drawings W1 to W4 in Appendix C.

Surface levels and depths at which various materials were encountered in the boreholes from both previous and current investigations are summarised in Table 1.

Table 1: Borehole Surface levels and Summary of Subsurface Profile

Bore hole	Surface RL (m AHD)	Top of Alluvial soil		Top of Residual soil		Top of Very low Strength Rock		Top of Medium Strength Rock	
		Depth (m)	RL[2]	Depth (m)	RL[2]	Depth (m)	RL[2]	Depth (m)	RL[2]
BH101	20.1	*ne*	*ne*	*ne*	*ne*	*ne*	*ne*	*ne*	*ne*
BH102	20.1	*ne*	*ne*	4.7	15.4	>5.0	<15.1	>5.0	<15.1
BH103	21.2	6.3	14.9	7.0	14.2	8.5	5.7	9.2	5.0
BH104	21.2	5.0	16.2	*ne*	*ne*	7.6	13.6	9.4	11.8
BH105	20.1	*ne*	*ne*	*ne*	*ne*	6.3	13.8	>6.5	<13.6
BH106	15.5	*ne*	*ne*	0.8	14.7	>1.3	<14.2	>1.3	<14.2
BH107A	15.5	*ne*	*ne*	2.2	13.3	2.8	12.7	>3.9	<11.6
BH107B	15.5	*ne*	*ne*	2.2	13.3	2.8	12.7	4.0	11.5
BH108	15.5	*ne*	*ne*	0.2	15.3	1.1	14.4	<1.2	>13.8
BH109A	15.3	*ne*	*ne*	0.3	15.0	*ne*	*ne*	1.2	14.1
BH109B	15.3	*ne*	*ne*	0.3	15.0	*ne*	*ne*	1.2	14.1
BH110	15.3	*ne*	*ne*	*ne*	*ne*	*ne*	*ne*	*ne*	*ne*
BH111	18.7	2.0	16.7	3.2	15.5	>5.4	<13.3	>5.4	<13.3
BH112A	16.7	1.4	15.3	1.8	14.9	3.4	13.3	>4.5	<12.2
BH112B	16.8	1.4	15.4	1.8	15.0	3.4	13.4	5.1	11.7
BH113	15.5	*ne*	*ne*	0.8	14.7	>1.3	<14.2	>1.3	<14.2
BH114	15.5	*ne*	*ne*	*ne*	*ne*	*ne*	*ne*	*ne*	*ne*
BH115	15.5	*ne*	*ne*	0.9	14.6	>1.3	<14.2	>1.3	<14.2
BH116	15.5	*ne*	*ne*	0.2	15.3	>1.2	<14.3	>1.2	<14.3
BH117	15.5	*ne*	*ne*	0.3	15.2	>1.2	<14.3	>1.2	<14.3
W1	15.6	*ne*	*ne*	1.2	14.4	2.2	13.4	>2.5	<13.1
W2	15.4	*ne*	*ne*	1.0	14.4	1.1	14.3	>1.3	<14.1
W3	13.4	*ne*	*ne*	*ne*	*ne*	0.0	13.4	>1.2[3]	<12.3[3]
W4	13.4	*ne*	*ne*	*ne*	*ne*	0.9	12.6[3]	2.2[3]	11.5[3]

Bore hole	Surface RL (m AHD)	Top of Alluvial soil		Top of Residual soil		Top of Very low Strength Rock		Top of Medium Strength Rock	
		Depth (m)	RL 2	Depth (m)	RL 2	Depth (m)	RL 2	Depth (m)	RL 2
BH1	20.1	4.0	16.1	6.0	14.1	6.5	13.6	7.7	12.4
BH2	21.2	8.0	13.2	8.0	13.2	*ne*	*ne*	9.5	11.7
BH3	15.5	*ne*	*ne*	0.9	14.6	1.8	13.7	2.8	12.7
BH4	15.5	*ne*	*ne*	1.7	13.8	2.3	13.2	*ne*	*ne*
BH5	15.5	*ne*	*ne*	0.4	15.1	1.2	14.3	3.0	12.5
BH6	15.5	*ne*	*ne*	0.2	15.3	1.0	14.5	*ne*	*ne*
BH7	15.5	*ne*	*ne*	1.6	13.9	2.2	13.3	*ne*	*ne*
BH8	15.5	0.6	14.9	*ne*	*ne*	2.1	13.4	4.2	11.3
BH9	15.5	*ne*	*ne*	0.3	15.2	1.7	13.8	3.7	11.8

Notes: (1) "*ne*" indicates Not Encountered
(2) Elevation (RL) in metres AHD.
(3) Depth along the hole, elevation in metres AHD allowing for the hole inclination.

Groundwater was not observed in the boreholes during auger drilling, prior to the commencement of rotary coring. Standpipe piezometers were installed in each of the rock cored boreholes to enable groundwater observations to be made.

7.2 Standpipe Piezometers

Groundwater level observations are summarised in Table 2 and Table 3, and graphs of the groundwater levels for each data logger are presented in Appendix F (corrected for barometric pressure effects).

The graphs include rainfall record data obtained from Observatory Hill, Sydney (Bureau of Meteorology Station 066062, http://www.bom.gov.au). With the exception of Borehole BH109B, water level data affected by disturbance (such as due to rising or falling head testing) has been removed for clarity of presentation. Data is missing from short time periods from Boreholes BH103 and BH104 due to errors in placement of the logger within the borehole, or due to a very short recording interval being selected leading to the filling of the datalogger memory ahead of schedule.

As previously discussed in Douglas Partners Report 86767.00.R.004.Rev0, the water level within the alluvial sand in Borehole BH1 was measured to rise by approximately 1.4 m following four consecutive days of heavy rain (i.e. 392 mm of rainfall between 7 February and 10 February 2020: to an elevation of RL15.2 m). In contrast, water levels for piezometers screened within the underlying very low to low strength sandstone (interpreted to be the Mittagong Formation) were measured to rise by less than about 0.4 m in the same period. Water levels in piezometers screened within the underlying medium to high strength sandstone (interpreted to be the Hawkesbury Sandstone) rose / varied less than this over the same time periods (e.g. refer graphs for BH112A and BH112B in Appendix F).

Graphs of long-term groundwater level measurements from data loggers are included in Appendix F. With the exception of Borehole BH109B (very slow rate of recharge), the manual water level measurements presented in Table 2 are similar to the long-term measurements obtained from data loggers. The typical standing water levels within the sandstone on the eastern and central parts of the Site range between RL13.1 m and RL13.6 m, whereas standing water levels within the sandstone on the western part of the Site range between RL11.5 m and RL13.3 m. It is noted that the water levels are generally similar to the elevation of the Adina Hotel basement floor slab (i.e. RL13.4 m).

Table 2: Groundwater Observations (Boreholes BH1, BH5, BH8, BH103 and BH104).

Measurement Date	Standing Water Level Measurements in Boreholes									
	BH1		BH5		BH8		BH103		BH104	
	Depth (m)	RL²	Depth (m)	RL²	Depth (m)	RL²	Depth (m)	RL²	Depth (m)	RL²
23/07/2019	5.95	14.2	2.6	12.9	2.3	13.2	-	-	-	-
30/07/2019	6.1	14.0	2.4	13.1	2.3	13.2	-	-	-	-
31/07/2019	6.0	14.2	2.4	13.1	-	-	-	-	-	-
7/08/2019	6.2	14.0	-	-	-	-	-	-	-	-
14/08/2019	6.3 (dry)	<13.8 (dry)	2.4	13.1	2.3	13.2	-	-	-	-
2/09/2019	6.3 (dry)	<13.8 (dry)	-	-	-	-	-	-	-	-
26/11/2019	6.3 (dry)	<13.8 (dry)	2.4	13.1	2.3	13.2	-	-	-	-
19/02/2020	5.8	14.3	2.1	13.4	1.9	13.6	-	-	-	-
24/04/2020	6.3 (dry)	<13.8 (dry)	-	-	-	-	7.5	13.7	7.6	13.6
5/05/2020	6.3 (dry)	<13.8 (dry)	2.4	13.2	2.2	13.3	7.5	13.7	7.7	13.5
5/06/2020	6.3 (dry)	<13.8 (dry)	-	-	-	-	7.7	13.5	7.8	13.4
7/09/2020	6.3 (dry)	<13.8 (dry)	-	-	2.3	13.2	7.6	13.6	7.7	13.5
15/09/2020	-	-	2.4	13.2	-	-	-	-	-	-

Notes: (1) "-" indicates Not Measured.
(2) Elevation (RL) in metres AHD.

Table 3: Groundwater Observations (Boreholes BH107A, BH107B, BH109B, BH112A and BH112B).

Measurement Date	Standing Water Level Measurements in Boreholes									
	BH107A		BH107B		BH109B		BH112A		BH112B	
	Depth (m)	RL[2]	Depth (m)	RL[2]	Depth (m)	RL[2]	Depth (m)	RL[2]	Depth (m)	RL[2]
17/05/2020	3.2	12.3	1.8	13.7	-	-	-	-	-	-
21/05/2020	-	-	-	-	7.8[3]	7.5[3]	3.5	13.2	5.1	11.7
26/05/2020	2.1	13.4	2.6	12.9	8.2[3]	7.1[3]	3.1	13.6	5.2	11.6
5/06/2020	2.0	13.5	2.2	13.3	6.6[3]	8.7[3]	3.4	13.3	5.3	11.5
7/09/2020	2.1	13.4	2.4	13.1	2.5	12.8	3.5	13.2	5.1	11.7
15/09/2020	-	-	-	-	-	-	-	-	-	-

Notes: (1) "-" indicates Not Measured.
(2) Elevation (RL) in metres AHD.
(3) Transient water level due to slow recharge rate – refer graphs in Appendix G.

7.3 Permeability Testing

Permeability testing was completed within each standpipe, with a total of 16 tests completed between 30 July 2019 and 5 June 2020. Rising head tests were carried out in each standpipe (with the exception of BH112A), with falling head tests completed in three standpipes (i.e. BH109B, BH112A and BH112B). The permeability of the screened interval was calculated using the Hvorslev analytical method. The results of the permeability testing are presented in Appendix G.

A summary of the calculated permeability results are presented in Table 4.

Table 4: Calculated permeability results from rising or falling head tests in standpipe piezometers.

Borehole ID	Material Types within Screened Interval	Calculated Permeability (m/sec)
BH1 [1]	Sand	4.5×10^{-7} to 6.5×10^{-7}
BH5	Sandstone: fine and medium grained with clay seams in upper metre of screened interval	6.2×10^{-9}
BH8 [2]		1.0×10^{-6}
BH103 [1]	Sandstone: fine grained with extremely weathered bands, fractured	1.4×10^{-6} to 2.3×10^{-6}
BH104 [1]	Sandstone: fine to medium grained, slightly fractured then unbroken	2.3×10^{-7} to 3.5×10^{-7}
BH107A [1]	Sandstone: fine to medium grained, high strength with very low strength bands, fractured	1.4×10^{-7} to 2.0×10^{-7}
BH107B [1]	Sandstone: fine to medium grained, slightly fractured then unbroken	5.0×10^{-8} to 7.7×10^{-8}

Borehole ID	Material Types within Screened Interval	Calculated Permeability (m/sec)
BH109B	Sandstone: fine to medium grained, slightly fractured then unbroken	4.7×10^{-8}
BH112A [2]	Sandstone: fine grained with very low strength bands (core loss)	4.8×10^{-7}
BH112B [1]	Sandstone: medium grained, slightly fractured then unbroken	2.4×10^{-7} to 3.9×10^{-7}

Note: (1) Two tests carried out.
(2) Well screen includes an interval of core loss and clay seams, below the top of rock.

Typical permeability values for sand, both from DP's previous experience in the area and from published values, are usually in the range 1×10^{-4} to 1×10^{-5} m/sec. The calculated permeability values for the sand encountered in Borehole BH1 are not consistent with these values and are considered to be not representative of the permeability of the sand. Borehole BH1 was positioned near to basement walls for the YHA building, as well as adjacent to deep concrete footings founded on rock. It is considered that these factors have influenced the permeability test results for the sand layer in Borehole BH1.

A slow rate of groundwater recharge was observed for standpipes screened within high strength rock with few defects (i.e. BH109B), with water levels appearing to be similar for standpipes near to each other screened within different materials (e.g. BH107A and BH107B: screened within either the fine to medium grained sandstone or the underlying medium grained Hawkesbury Sandstone). The rapid increase in water level within the standpipe screened within the alluvial sand, and the observation of groundwater near the soil-rock interface in some boreholes (e.g. BH107A) indicates that a perched water table is probably present within the soils above rock level.

8. Laboratory Testing

Sixty-one samples selected from the better quality rock core obtained from supplementary boreholes were tested for axial point load strength index ($Is_{(50)}$). The results of the point load strength testing, presented on the borehole logs, indicate Is_{50} values of 0.1 MPa to 1.5 MPa in the fine to medium grained sandstone, and 0.3 MPa to 2.6 MPa in the medium grained sandstone, indicating rock ranging from low strength to high strength. To obtain inferred unconfined compressive strengths (UCS) from point load strength test results, a conversion factor of 18 is suggested, indicating a UCS of up to about 45 MPa for the rock encountered during the supplementary investigation.

Nine selected disturbed samples from the supplementary boreholes were tested in a NATA-accredited analytical laboratory to determine soil aggressivity (pH, electrical conductivity, sulfate and chloride ion concentrations), including one sample of alluvial sand, one sample of sand fill, two samples of silty clay fill, four samples of residual silty or sandy clay, and one sample of pulverised sandstone.

The soil aggressivity results for both the current and previous investigation are summarised in Table 5, with all the laboratory test reports included in Appendix H.

Table 5: Laboratory Test Results for Aggressivity to Buried Concrete and Steel

Sample ID	Sample Description	Elevation of Sample[1] (RL m)	pH	EC[2] (µS/cm)	Chloride (mg/kg)	Sulfate (mg/kg)
BH103, 2.9-3.0m	Fill, Silty CLAY	18.3	4.8	42	<10	51
BH103, 5.0-5.1m	Fill, Silty SAND	16.2	6.3	19	<10	20
BH104, 2.8-2.9m	Fill, Silty CLAY	18.4	4.7	68	20	52
BH104, 6.3-6.45m	Alluvial SAND	14.9	6.4	11	<10	10
BH107B, 2.4-2.5m [4]	Residual Sandy CLAY	13.1	5.9	24	<10	20
BH108, 1.05-1.2m	SANDSTONE	14.5	5.3	22	<10	10
BH112B, 2.0-2.24m	Residual Silty CLAY	14.8	5.2	40	<10	36
BH112B, 3.0-3.2m	Residual Silty CLAY	13.8	4.8	30	<10	25
BH112B, 3.2-3.44m	Residual Sandy CLAY	13.6	5.1	29	<10	25
BH1, 4.3-4.5m	Alluvial SAND	15.8	6.0	20	<10	10
BH4, 0.3-0.4m	Fill, Sandy CLAY	15.2	8.9	170	25	61
BH5, 1.1-1.2m	Residual Silty CLAY	14.4	4.9	92	29	42
BH6, 0.5-0.6m	Residual Silty CLAY	15.0	5.1	89	10	72
BH7, 0.4-0.5m	Fill, Silty SAND	15.1	8.3	120	20	42

Notes: (1) Elevation quoted is for the ‘top’ of the sample.
(2) EC = Electrical Conductivity.
(3) Analysed soil was tested as a 1:5 mixture of soil:water.
(4) Sample mislabelled on Chain of Custody as ‘BH107’.

9. Proposed Development

It is understood that the proposed development will include the dismantling of the Parcels Shed building (i.e. the YHA: to be re-built following construction of the Level 01 mega-floor/transfer deck), retention of the existing goods lift to Station platform level, removal of the carriage dormitories and rails, and excavation below the Lower Ground Floor level of the existing building for a two-level basement (to RL5.0 m), followed by construction of a multi-storey commercial tower.

Based on the provided drawings, it is understood that the proposed basement will extend close to the property boundaries to the north, east and west, and to the Devonshire Tunnel to the south. For extension of the proposed basement along the eastern boundary of the Site, the existing setback of the lower ground floor of the YHA building on this side is to be removed. The drawings indicate that a basement entry ramp is to be constructed along the northern side from Lee Street, and a connection is proposed from the second basement level to potential future basements to the south of the Site (i.e. beneath the Devonshire Tunnel).

The reduced levels of the suspended slabs for the development's Upper Ground floor, Lower Ground floor and Basement 1 levels are RL21.0 m, RL15.3 m, and RL10.3 m, respectively. The lowest basement slab (i.e. Basement 2) level is proposed at RL5.0 m. This will require excavation depths of about 17 m on the eastern boundary and about 11.5 m along the other boundaries.

10. Geotechnical Model

The field work results are summarised on seven geotechnical cross-sections in Appendix C, which show the interpreted layers of filling, alluvial and residual soil and sandstone units between selected test locations. The interpreted boundaries shown on the sections are accurate only at the test locations and layers shown diagrammatically on the drawings are inferred only. Bands of lower or higher strength rock may be present within the generalised sandstone layers. Single or multiple concrete slabs were present at the surface over most of the Site, with rail ballast encountered over concrete and bricks within the rail carriage dormitory area.

The interpreted geotechnical models for the Site are:

- Eastern part of the Site (i.e. below the eastern part of the YHA building, from Upper Ground Floor level: Refer to Drawing 2):
    - soft to firm or very loose to medium dense fill materials (clay or sand: up to 8 m thick, below the current ground surface), over
    - a discontinuous lens of very loose sand alluvium (up to 2.0 m thick), over
    - soft to hard silty clay or sandy clay residual soil (up to about 2.5 m thick), overlying
    - fine to medium grained sandstone, very low strength with high strength iron-cemented bands (0.5-1.8 m thick), and then overlying
    - medium to high strength, medium grained sandstone;
- Central and Western parts of the Site (i.e. below the western section of the YHA building and the existing asphalt-surfaced open-air ramp: refer to Drawings 3 and 5):
    - stiff or loose to dense fill materials (clay and sand: up to 2.2 m thick, decreasing in a westerly direction), over
    - a discontinuous lens of very loose to medium dense sand alluvium (up to 1.3 m thick: apparent dip to the south), over
    - very stiff to hard sandy or silty clay residual soil (up to 2.2 m thick), overlying
    - fine to medium grained sandstone (very low strength, with high strength bands: about 2 m thick), and then overlying
    - medium to high strength, medium grained sandstone;

The rock materials encountered in the boreholes at the Site (summarised in Table 6) have been classified in accordance with the system given in Pells et. al. (1998), and Bertuzzi and Pells (2002), which grades Sydney sandstone into five classes on the basis of strength and defects from Class I (high strength with virtually no defects) to Class V (very low strength sandstone). It should be noted that the profiles are accurate at the borehole locations only, and that variations must be expected away from the boreholes.

It should be noted that bands of higher strength rock can occur within rock of lower strength. To simplify the interpreted model the classes given in Table 6 are based on the lower class applicable within a depth zone.

Table 6: Summary of Material Strata Levels and Rock Classifications

Borehole ID	Top of Stratum¹									
	Class V ²		Class IV ²		Class III ²		Class II ²		Class I ²	
	Depth (m)	Level (RL)	Depth (m)	Level (RL)	Depth (m)	Level (RL)	Depth (m)	Level (RL)	Depth (m)	Level (RL)
BH103	8.5	12.7	-	-	9.2	12.1	-	<10.4	-	<10.4
BH104	7.6	13.6	-	-	-	-	9.4	11.8	14.5	6.7
BH107B	2.8	12.7	4.1	11.5	-	-	-	-	4.9	10.6
BH109B	1.1	14.2	2.0	13.3	3.0	12.3	4.2	11.1	6.5	8.8
BH112B	3.2	13.6	5.4	11.4	7.9	8.9	-	-	8.4	8.4
BH1	6.5	13.6	-	-	7.7	12.4	8.5	11.6	9.9	10.2
BH2	9.5	11.7	-	-	10.3	10.9	11.5	9.7	12.6	8.6
BH3	1.8	13.7	-	-	3.3	12.2	-	-	5.1	10.4
BH4	2.3	13.2	-	<13.2	-	<13.2	-	<13.2	-	<13.2
BH5	1.2	14.3	1.9	13.6	2.8	12.7	-	-	6.7	8.8
BH6	1.0	14.5	-	<14.5	-	<14.5	-	<14.5	-	<14.5
BH7	2.2	13.3	-	<13.3	-	<13.3	-	<13.3	-	<13.3
BH8	2.1	13.4	3.6	11.9	4.9	10.6	-	-	7.9	7.6
BH9	1.7	13.8	2.3	13.2	3.7	11.8	-	-	5.9	9.6

Notes: (1) Depths and levels shown are to the top of rock classes in boreholes, with depths in metres and elevations in m AHD.
(2) Rock classifications are based on Pells et. al (1998) and Bertuzzi and Pells (2002).
(3) '-' indicates the material was not encountered within the drilled length.

11. Comments

11.1 Geotechnical Issues

Some of the geotechnical issues that need to be considered for the proposed development are:

- Maintaining the stability and integrity of adjoining structures, services and tunnels (i.e. the Adina hotel, Central Station infrastructure, Henry Deane Plaza buildings, and the existing pedestrian tunnel and buried stormwater/sewer services adjacent to the southern site boundary);
- Excavation-induced movement adjacent to Lee Street, which is a Roads and Maritime Services (RMS) asset;
- Excavation-induced movement adjacent to the eastern site boundary, which is a Sydney Trains Rail corridor;
- Groundwater is likely to be present within the basement excavation envelope, in the form of seepage within the fill and soils, at the soil-rock interface and along rock joints and bedding planes;
- Water-tight shoring walls will need to be designed around the perimeter of the site to retain fill, alluvial and residual soils, to reduce groundwater inflow, and to control drawdown of water levels on adjacent sites;
- The shoring will need to be socketed into competent rock, which may be problematic for some shoring systems;
- Design of the shoring walls (including of anchors, props or struts) on the northern, eastern and southern boundaries will need to take into consideration the positions of future proposed basement levels and connections;
- If water-tight shoring walls (cut-off walls) are constructed into rock to reduce inflow and drawdown of water levels, then it is technically feasible to construct a drained basement, however, this will be subject to review and approval by both the City of Sydney Council (Council) and by Water NSW; and
- Alternatively, a tanked basement could be constructed to reduce the need for long term collection, possible treatment and removal of groundwater inflows. A tanked basement would need to be designed for horizontal hydrostatic pressure behind shoring walls and hydrostatic uplift of the basement floor slab.

11.2 Site Preparation

Site preparation may require the partial demolition of portions of the existing structures to facilitate access for machinery (at Lower Ground Floor level), and removal of existing equipment (e.g. industrial freezers, rail dormitory carriages). Access tracks and ramps may be required to enable machinery (e.g. piling rigs) to access the eastern part of the Site, for which it is likely that removal and replacement of loose filling materials (e.g. including sand filling or rail ballast) and construction of working platforms will be required. Subject to confirmation testing, existing concrete slabs may be suitable as working platforms for piling rigs, prior to their removal as part of the bulk excavation works. Further geotechnical advice should be sought when further details are known.

Prior to the commencement of basement excavation works, a strategy to monitor building movement during the construction period (including the Adina Hotel swimming pool) will need to be implemented.

Based on a site inspection of the Adina Hotel basement it is likely that the foundation system of this building is shallow footings (at Lower Ground Floor level) founded on the underlying sandstone, however, this will need to be confirmed at a later stage of the Project.

Installation of water-tight shoring walls around the site perimeter will be required, prior to the commencement of the basement bulk excavation works. Low-height equipment is likely to be required, if piling works are to be carried out within indoor areas.

Loose sand and soft clay filling is likely to be exposed within the upper 4-8 m of the eastern side of the excavation which is likely to pose challenges for construction vehicles with pneumatic tyres. Some rutting and surface damage should be expected, particularly if traversed following periods of prolonged rainfall. It is anticipated that tracked machines would be able to safely traverse and work upon this material while it is exposed.

If placement of fill is required, or there is a need to improve the allowable bearing capacity of the underlying site soils, additional site preparation will be required. Typical site preparation measures could include:

- Removal of loose soil to create a level surface, to a depth to be determined on a case-by-case basis by a geotechnical professional;
- Compact the exposed material, then test roll the exposed surface using at least six passes of a minimum 12-tonne roller in non-vibration mode. The final pass should be witnessed by an experienced geotechnical engineer to detect any weak zones which would require additional rectification work, as directed by the geotechnical engineer;
- If required, replacement fill material should be free of oversize particles (>100 mm) and materials which could break down or degrade, should be placed in layers of loose thickness not greater than 200 mm (dependent upon the size of compaction machinery), and compacted to a dry density ratio of at least 98% relative to Standard compaction. Moisture contents should be maintained within 2% of Standard optimum moisture content. Compaction should be increased to a dry density ratio of 100% relative to Standard compaction for the top layer of the fill material (if the replacement filling used is sand, compact to a density index of 75%);
- Moisture conditioning (i.e. drying or wetting) of the replacement fill material may be required, to enable a greater degree of compaction to be achieved; and
- All fill materials should be placed in accordance with Australian Standard AS 3798 (2007), with earthworks quality control testing undertaken to verify that the required compaction/moisture criteria are achieved.

Stabilisation of both the brick retaining wall along the northern property boundary and the Adina Hotel basement access portal will be required if these are to be retained as part of the works, such as by underpinning of the brick retaining wall and the existing concrete underpin down to medium strength rock.

Dilapidation surveys should be carried out on adjacent properties, including structures, pathways, walls or roadways within about 30 m of the proposed excavation, prior to commencement of the works. The dilapidation survey should document existing conditions and the presence of defects, and thereby allow appropriate responses should any claims arise from construction at this site. Buildings supported on shallow foundations are especially prone to the detrimental effects of settlement and vibration.

11.3 Excavation

Following completion of the site preparation works, including the installation of the shoring walls, excavation for the basement levels is expected to be required through up to about 9.5 m of soil (including clay and sand fill, alluvial sand, and residual silty and sandy clay), then through rock of varying strength, including high strength sandstone.

The fill, alluvial and residual soils should be readily excavated using conventional earthmoving equipment. Very low to low strength rock will likely require light to medium ripping. The use of heavy ripping equipment, rock hammers or rock saws will be required to excavate medium or high strength rock.

Rippability of the sandstone is critically dependent upon the spacing of bedding and vertical joints, as well as on strength. Effective removal of the medium or higher strength sandstone within the lower levels of the excavation should be achieved by heavy bulldozers ripping in conjunction with rock hammers, however, excavation contractors should make their own assessment of likely productivity depending on their equipment capabilities and operator skills. Detailed footing excavations adjacent to boundary lines can be achieved by use of rock hammers or hydraulic rotary rock saws, or milling heads. Rock saws should also be used along the site boundaries to minimise over-break.

11.4 Vibration Control

Noise and vibration will be caused by excavation and earthworks activities at the Site. The use of rock hammers will cause vibrations which, if not controlled, could possibly result in damage to nearby structures and disturbance to occupants, and it will be necessary to use appropriate methods and equipment to keep ground vibrations at adjacent buildings and structures within acceptable limits.

Based on previous experience and with reference to Australian / International Standard AS/ISO 2631.2 (2014), an initial vibration limit of 8 mm/sec vector sum peak particle velocity (VSPPV) is suggested at the foundation level of adjacent buildings, for human comfort considerations. This initial vibration limit may need to be reduced if there are vibration-sensitive buildings or equipment in the area (e.g. Sydney Trains rail signals services). It is noted that brick buildings or structures near to the proposed excavation (e.g. the Central Station buildings, and the brick retaining wall on the northern property boundary) may be founded on pad or strip footings at shallow depths, which could be affected by ground vibration. The owners of any in-ground utilities within and around the property should also be consulted with regard to allowable vibration levels.

If generation of construction vibration is a potential problem, consideration should be given to rock sawing and rock milling methods of rock excavation. A site-specific vibration monitoring trial may be required to determine vibration attenuation, once excavation plant and methods have been finalised.

11.5 Disposal of Excavated Material

Off-site disposal of excavated material will require assessment and environmental testing for re-use or classification, in accordance with *Waste Classification Guidelines* (NSW EPA, 2014), prior to disposal to an appropriately licensed landfill or receiving site. This includes fill materials and virgin excavated natural materials (VENM), such as may be removed from this site. The type and extent of testing undertaken will depend on the final use or destination of the spoil, and requirements of the receiving site.

11.6 Batter Slopes

Based upon the provided drawings, excavation up to the property boundaries is proposed. Although batters are not shown in the elevation drawings, it is likely that internal batters will be required during construction for temporary site access and driveways. Vertical excavations along the site boundaries in the fill, surficial soils and very low to low strength rock cannot be relied upon to remain stable and will require shoring.

The suggested maximum batter slopes for temporary batters of up to 3 m height above the water table, which are not subjected to surcharge loads, are presented in Table 7.

In the absence of specific geotechnical advice, where batters are required adjacent to existing buildings supported on high level footings, an additional 'set-back' distance of at least 1 m should be used. An assessment of stability using analytical techniques would be necessary for excavations deeper than 3 m, and flatter batters would usually be appropriate.

Table 7: Recommended Maximum Batter Slopes for Excavated Slopes

Excavated material	Temporary Batter	Permanent Batter
Filling	1.5H:1V	2H:1V
Residual soils	1.5H:1V	2H:1V
Extremely low to low strength sandstone	0.5H:1V	1H:1V
Medium strength sandstone (or better)	Vertical [1]	Vertical [1]

Note: (1) Must be inspected by an engineering geologist for unstable wedges, which should be cleared or rock bolted

Care should be taken where any surcharge loads are planned at the crest of batter slopes (e.g. placement of scaffolding sole boards). A slope stability analysis should be undertaken for batters subjected to surcharge loads on a case-by-case basis, following inspection and testing by a geotechnical engineer. Material stockpiles and machinery or equipment should not be stored at the crest of unsupported excavations.

Given the proximity of adjacent structures, Sydney Trains assets and the depth of excavation, shoring walls are likely to be required for the northern, eastern and southern excavation perimeter.

Excavation within medium to high strength sandstone can be cut vertically, provided the exposed faces are carefully inspected by a suitably qualified geotechnical engineer or engineering geologist as the excavation progresses.

Regular inspections of the rock face will be required during excavation (recommended at about every 1.5 m 'drop'), to determine whether there are any adversely oriented defects which require rectification works to maintain stability, such as rock bolts or anchors or installation of steel mesh-reinforced shotcrete. Based upon the quality of the medium to high strength sandstone encountered in boreholes during the investigation, it is expected that there should only be a few minor beds of very low or low strength sandstone requiring shotcrete protection.

11.7 Groundwater

11.7.1 General

Groundwater measurements from standpipe piezometers indicate that the proposed design floor level of ‘Basement 2’ (i.e. RL5.0 m) will be below the permanent groundwater table, which has been measured at an elevation of around RL13.4 m within the sandstone. Perched groundwater is also indicated to be present, at or near the soil-rock interface and also within the alluvial sand following periods of heavy rainfall.

The measurements indicate that water inflows within the sandstone bedrock appear to be controlled by rock joints. The seams and other fractures in the weathered rock may also be acting as conduits for water flow, and temporary water storage. Minimal variability in groundwater levels was observed following rainfall periods between July 2019 and September 2020.

Previous experience indicates that the groundwater from the geological units at the Site can have moderate concentrations of dissolved solids, including iron. Once the groundwater comes into contact with the atmosphere, precipitation of iron oxides is likely to occur and provision should be made for the filtering and cleaning of this precipitate from subsoil drains, sumps, pumps and other fittings over the medium to longer term.

Groundwater modelling of the proposed basement and required dewatering (refer Groundwater Modelling Report: 86767.04.R.003.Rev1, dated 30 October 2020) indicates that potential settlements induced by the dewatering will not be noticeable beneath neighbouring structures or pavements founded on fill or alluvial soils, and will be negligible for neighbouring structures founded on medium to high strength sandstone. This report has been included in Appendix I for ready reference. The results of a groundwater contamination assessment are presented in the supplementary contamination investigation report (Douglas Partners Report 86767.06.R.001.Rev1, dated 25 September 2020), and are not further discussed within this report.

11.7.2 Seepage Rates and Groundwater Drawdown

The design of the basement had targeted a groundwater drawdown in soils or extremely low strength rock at neighbouring properties (below existing water levels) of no more than 1.5 m. To achieve this, the basement construction will need to include a relatively water-tight perimeter ‘cut-off’ wall. This wall could be either socketed a minimum of 2 m into competent, slightly weathered to fresh, slightly fractured and unbroken, medium to high strength sandstone, or drilled through the medium or high strength sandstone to below the base of the excavation.

Extending the cut-off wall to below the level of the basement excavation would reduce the risk of seepage occurring through fractures in the rock in the sides of the excavation and would also further reduce the inflow to the basement. If excessive water ingress becomes an issue during excavation in the case whether the walls have been terminated above the basement design floor level, then grouting of open joints and bedding partings may be necessary and will be relatively difficult and costly to achieve.

The detailed groundwater modelling (presented in DP Report 86767.04.R.003.Rev1, Appendix I) has concluded that a drained basement is feasible for the Site, provided a perimeter water-tight cut-off wall is constructed and extended at least 2 m into the slightly fractured or unbroken sandstone. The modelling for this case indicates a long-term rate of inflow into the basement of about 2.1 ML per year, although the actual seepage into the excavation may be much less than the predicted values, depending on the fractures in the rock.

If seepage flows are to be reduced below 2 ML per year then cut-off walls could be extended below the basement floor level, as the seepage would then only be able to occur up through the medium to high strength rock below the basement floor. It will be necessary to provide under-floor drainage to safeguard against uplift pressures for a slab designed for drained conditions. This could comprise a minimum 100 mm thick, durable open graded crushed rock with subsurface drains and sumps.

Approval for a drained basement will be subject to review and approval by Council and by Water NSW. If a drained basement slab is not permitted, then a water-tight 'tanked' basement will be required for the permanent basement structure. A tanked basement would need to be designed to resist uplift forces associated with hydrostatic groundwater pressures which could be in the order of 10 m of hydraulic head.

11.7.3 Disposal

It is noted that off-site disposal of collected groundwater will need to be carried out in accordance with New South Wales Government Legislation (1997), and that water to be discharged into the natural environment should comply with the relevant guidelines (e.g. Australian and New Zealand Guidelines for Fresh and Marine Water Quality, Australian and New Zealand Environment and Conservation Council (ANZECC), Agricultural and Resource Management Council of Australia and New Zealand), and/or City of Sydney Council's local stormwater discharge conditions. It is considered that preparation of a dewatering management plan will likely be required during a later stage of the Project.

11.8 Excavation Support

11.8.1 General

Shoring will be required around the northern, eastern and southern sides of the basement excavations. As outlined above, the installation of a water-tight shoring wall will be required around the basement perimeter, socketed at least 2 m into the slightly fractured or unbroken sandstone.

11.8.2 Shoring / Retaining Walls

Shoring wall systems which could be considered include diaphragm walls and interlocking secant pile walls, as follows:

- Diaphragm walls may be used as the permanent basement wall. They are usually considered to have a reduced risk of adverse construction issues, but are relatively slow to construct and consequently more expensive. They are constructed using a large 'grab' bucket, which excavates the soil and rock in vertical panels which are supported by bentonite fluid. Each panel is then cast using concrete tremmied into the bentonite-supported excavation, with steel reinforcement cages installed prior to the concrete being tremmied. The joints between the panels are sealed with a 'waterstop', so that a completely water-tight wall is achieved; or

- Interlocking secant pile walls are typically formed by drilling alternate 'soft' grout or concrete piles and then installing 'hard' reinforced concrete piles by cutting into the previously drilled soft piles. This overlap typically ensures that piles are sealed, but some misalignment can occur even at relatively shallow depths to create minor gaps in the wall. The potential for misalignment, and therefore seepage ingress and soil loss through the wall, in deep secant pile walls is high. Drilling of piles into rock can also be problematic for secant piles, and may result in decompression or disturbance of the surrounding soils which can result in damage to adjacent buildings. The use of segmental casing through the soils would be required to avoid issues associated with decompression and hole collapse in sandy soils, and pumps may be required to remove seepage from pile excavations prior to placement of concrete.

11.8.3 Design of Excavation Support

The shoring will need to be supported by internal bracing (e.g. props or struts) or ground anchors to control deflections. It is noted that Sydney Trains do not usually allow any anchors (temporary or permanent) within their corridor, and internal bracing or props are likely to be required along the eastern and southern site boundaries (depending on the final basement configuration).

Excavation faces retained either temporarily or permanently will be subjected to earth pressures from the ground surface down to the top of medium strength rock. The values of active earth pressure coefficient (K_a) given in Table 8 may be used for a level ground surface and a 'flexible' wall which is allowed some lateral movement. 'At rest' earth pressure (K_o) values should be used where the wall movement needs to be reduced, such as next to neighbouring building footings.

Table 8: Preliminary Design Parameters for Shoring Systems

Material Description	Unit Weight (kN/m^3)	Coefficient of Active Earth Pressure (K_a)	Coefficient of Earth Pressure 'at Rest' (K_o)	Effective Cohesion (c': kPa)	Effective Friction Angle (Degrees)
Sand and clay filling, very loose or loose alluvial sand, or soft clay	18	0.35	0.6	0	28
Very stiff to hard residual clay	18	0.25	0.5	3	25
Extremely low to low strength sandstone	22	0.1	0.2	100	25
Medium strength or stronger sandstone	24	0*	0*	300	40

Note * subject to geotechnical inspection.

The design for lateral earth pressures of multiple anchored or propped walls may be based on a trapezoidal earth pressure distribution, with additional allowances made for surcharge loads from adjacent buildings, sloping ground surfaces, the rail corridor, and construction machinery. Hydrostatic pressures acting on the full height of the shoring wall should also be included in the design where adequate drainage is not provided behind its full height.

The following earth pressure magnitudes are considered appropriate, where H is the height of soil and rock to be retained (in metres):

- 4H kPa, where some lateral movement is allowed; and
- 6H kPa, where lateral movements need to be minimised (e.g. next to buildings or services).

In each case the maximum pressure generally acts over the central 60% of the wall height, reducing to zero at the top and base of the wall.

If the shoring terminates in rock above the bulk excavation level then rock bolts or anchors will be required to ensure that the toe of the shoring is not undermined by further excavation of the rock below the shoring level.

Table 9: Preliminary Passive Resistance Values

Foundation Stratum	Ultimate Passive Pressure (kPa)
Extremely low to very low strength sandstone	400
Low strength sandstone	2,000
Medium strength or stronger sandstone	4,000

A preliminary geotechnical analysis of the shoring walls has been carried out (refer DP Report 86767.04.R.001.Rev1, dated 27 August 2020). Detailed design of shoring is likely to be required when further details are known, and should be carried out using WALLAP, PLAXIS or other accepted computer analysis programs capable of modelling progressive excavation and anchoring, and predicting potential lateral movements, stresses and bending moments. PLAXIS (or similar) would be required if it is necessary to assess ground movements on surrounding properties (e.g. Lee Street and Sydney Trains Rail Corridor and Tracks), as WALLAP can only assess wall movements.

11.8.4 Ground Anchors

For estimation purposes the design of temporary ground anchors for the support of shoring systems may be carried out on the basis of the maximum bond stresses given in Table 10. The anchors should preferably have their bond length within the medium strength or stronger sandstone.

Table 10: Preliminary Bond Stresses for Rock Anchor Design

Material Description	Maximum Allowable Bond Stress (kPa)	Maximum Ultimate Bond Stress (kPa)
Very low strength sandstone	100	200
Low strength sandstone	200	400
Medium strength or stronger sandstone	500	1000

To prevent excessive lateral deformation, installation of temporary ground anchors may be required below any adjoining footings (i.e. located on or close to the site boundaries), or into the toes of shoring piles installed above the basement design floor level. Additional anchors may be required if potentially unstable blocks or wedges are observed during excavation of rock.

The parameters given in Table 10 assume that the anchor holes are clean and adequately flushed, with grouting and other installation procedures carried out carefully and in accordance with good anchoring practice. Careful installation and close supervision by a geotechnical specialist may allow increased bond stresses to be adopted during construction, subject to testing. The use of permanent anchors would require careful attention to corrosion protection. Further advice on design and specification should be sought if permanent anchors are to be employed at this site.

Ground anchors should be designed to have an appropriate free length (minimum of 3 m) and have a minimum 3 m bond length. After installation they should be proof loaded to 125% of the design working load and locked-off at no higher than 80% of the working load. Periodic checks should be carried out during the construction phase to ensure that the lock-off load is maintained and not lost due to creep effects or other causes.

It will be necessary to obtain permission from neighbouring landowners prior to installing anchors that will extend beyond the site boundaries. In addition, care should be taken to avoid damaging buried services, pipes and subsurface structures (possibly including neighbouring piled footings) during anchor installation. Anchoring should only be carried out by an experienced contractor with demonstrated experience in similar ground conditions.

Vertical anchors for uplift support could also be designed using the parameters given in Table 10. The designer should check the cone pull-out failure mechanism by assuming a 90-degree cone for both the soil and rock.

11.9 Excavation-Induced Ground Movement

11.9.1 RMS Infrastructure and Sydney Trains Rail Corridor

Lee Street is an RMS asset, and Central Station is a Sydney Trains asset. Reference should be made to RMS 2012: Geotechnical Technical Direction, which outlines requirements for excavations adjacent to RMS infrastructure, and includes the level of geotechnical investigation required, dilapidation surveying, instrumentation and monitoring during construction, trigger levels and contingency plans. Sydney Trains, RMS or other local authorities may have specific requirements, which will need to be discussed and implemented before construction commences.

A Geotechnical Impact Assessment (GIA), i.e. numerical modelling, will typically be required as part of a Development Application (imposed by both RMS and Sydney Trains). The purpose of the GIA is to assess the likely amount of excavation-induced ground movement resulting from the proposed excavation.

During construction, instrumentation (e.g. inclinometers) and survey monitoring are typically required where the excavation exceeds heights of either 3 m (for cantilevered shoring walls) or 6 m (for anchored or propped shoring walls). A geotechnical monitoring plan is likely to be required by RMS prior to construction for this site.

Depending on the setback of the basement excavation from the Sydney Trains Rail corridor, a site-specific track monitoring plan may also be required. It should be noted that this will likely involve the placement of survey markers within the rail corridor and on the nearest track, which has its own complications regarding the delays and costs associated in obtaining the necessary approvals from Sydney Trains.

11.9.2 Stress Relief

For an excavation which extends to a depth of about 7 m below the top of medium or high strength sandstone, there is likely to be some inward horizontal movement due to the effects of stress relief. It is impracticable to provide restraint for the relatively high in-situ horizontal stresses present within the Hawkesbury Sandstone. Release of these stresses due to the excavation will generally cause horizontal movement along the rock bedding surfaces and partings.

Based on monitoring experience for excavations in the Sydney region, excavation to about 10 m below the top of weathered rock may give rise to lateral movements of between 0.5 mm and 1.5 mm for every 1 m depth of excavation below the top of rock (i.e. in the order of 5 – 15 mm total movement at the centre of the face, at the top of the excavation). The stress relief movements behind the top of the excavation typically reduce by 1 mm per metre of distance back from the face.

The new building structure should be designed to allow for some stress relief movements, i.e. leaving a gap between the structure and the rock face. The differences in stress relief movements behind the top of the excavation may result in cracking of adjacent brittle buildings. It is recommended that appropriate allowance also be made for the repair of pavements and public utilities, where excavations are carried out close to structures.

Regular monitoring of survey targets along the excavation perimeter during construction, such as following each successive ‘drop’ in excavation level, should be undertaken to monitor the effects of stress relief.

11.10 Foundations

It is anticipated that the foundations for the proposed building will be constructed within a uniform founding stratum, at or below the floor level of ‘Basement 2’ (i.e. RL5.0 m). As depicted in the interpreted cross-sections (Drawings 2 to 7, Appendix C), high strength, medium grained Hawkesbury Sandstone (assessed to be mostly Class I sandstone) is expected to be exposed at this level over the floor of the basement excavation.

On this basis spread footings (i.e. pad footings) should be suitable for supporting the proposed building loads within the excavation footprint. These may be designed for the support of axial compression loads using the bearing pressures, shaft adhesions and modulus values presented in Table 11, which are based on the assumption that the excavations are clean and free of loose debris, with pile sockets free of smear and adequately roughened immediately prior to concrete placement. Shaft adhesion values for uplift (tension) may be taken as being equal to 70% of the values for compression.

If allowable bearing pressures of more than 3.5 MPa are used in design, then additional testing will be required in the form of cored boreholes and spoon testing of footings, to ensure there are no defects beneath footings. Spoon testing involves drilling a 50 mm diameter hole below the base of the footing, to a depth of 1.5 times the footing width, followed by testing to check for the presence of weak/clay bands. If weak seams are detected, then footings may need to be taken deeper to reach suitable foundation material. Alternatively, if the bearing pressures are limited to a maximum of 3.5 MPa then visual inspection of foundations during construction will be sufficient.

Table 11: Recommended Design Parameters and Moduli for Foundation Design

Foundation Stratum[1]	Allowable Parameters		Ultimate Parameters [3]		Field Elastic Modulus (MPa)
	End Bearing (MPa)	Shaft Adhesion (kPa) [2]	End Bearing (MPa)	Shaft Adhesion (kPa) [2]	
Sandstone – Class V	1.0	75	3	150	50
Sandstone – Class IV	2.0	100	6	250	100
Sandstone – Class III	3.5	350	20	800	350
Sandstone – Class II	6.0	600	60	1500	900
Sandstone – Class I	10.0	600	120	3000	2000

Notes
(1) Rock classification based on Pells et. al (1998) and Bertuzzi and Pells (2002).
(2) Shaft adhesion applicable to the design of bored piles, uncased over the rock socket length, where adequate sidewall cleanliness and roughness are achieved.
(3) Ultimate end bearing parameters mobilized at large settlements (i.e. >5% of pile diameter).

If an allowable bearing pressure of 10 MPa is used during design then 100% of the footings should be spoon tested to a depth equivalent to 1.5 times the footing width with cored boreholes in 50% of the footings drilled to 3 m below bulk excavation level. If the bearing pressure is kept at 6 MPa or less the amount of spoon testing could be reduced to 33% of the footings.

Where footings are located within the zone of influence of adjacent excavations, drawn upward at 45 degrees from the toe of the excavation (such as lift shafts or tanks), the allowable bearing pressure should be reduced by 25% and the excavation floor carefully inspected for adversely oriented joints. Alternatively, the footings may be taken deeper, below the zone of influence.

The settlement of a spread footing is dependent on the loads applied to the footing and the foundation conditions below the footing. The total settlement of a spread footing designed using the allowable parameters provided in Table 11 should be less than 1% of the footing width upon application of the design load. Differential settlements between adjacent footings may be in the order of 50% of the value of total settlement. The design of footings is usually governed by settlement criteria and performance rather than the ultimate bearing capacity or Ultimate Limit State condition.

For limit state design, selection of the geotechnical strength reduction factor (ϕ_g) in accordance with Australian piling code AS 2159 (2009) is based on a series of individual risk ratings (IRR), which are weighted on numerous factors and lead to an average risk rating (ARR). Therefore, it is recommended that an appropriate geotechnical strength reduction factor be calculated by the pile designer. Preliminary design could be based on a ϕ_g of 0.4 (i.e. no pile testing), and refined as the design progresses. Footing settlements may be calculated for assessment of the serviceability limiting state using the elastic modulus values given in Table 11.

All spread footings should be inspected by an experienced geotechnical professional to check the adequacy of the foundation material and proof drilled or spoon tested as appropriate.

11.11 Soil Aggressivity to Concrete and Steel Structures

In accordance with Australian Standard AS 2159 (2009), the results of the chemical laboratory testing indicate that:

- all of the soils tested are non-aggressive to buried steel;
- the alluvial sand (above the water table) and the sandy clay and silty sand fill materials are non-aggressive to buried concrete;
- the silty clay fill and residual soils are mildly aggressive to buried concrete; and
- the weathered sandstone (inferred to be Hawkesbury Sandstone) is mildly aggressive to buried concrete.

It is considered that the silty clay residual soils are likely to be derived from weathering of the fine to medium grained sandstone (i.e. the Mittagong Formation), and so this sandstone is also likely to be mildly aggressive to buried concrete and non-aggressive to buried steel.

11.12 Seismic Design

In accordance with the Earthquake Loading Standard, AS 1170.4 (2007), the Site has a hazard factor (z) of 0.08. Given that most of the basement excavation is in Class V rock or better and that the building is likely to be connected to the shoring, a site sub-soil class of rock (B_e) is considered appropriate, assuming that all major structural loads are carried to rock of at least extremely low to very low strength.

12. Further Geotechnical Work

It is suggested that the following further geotechnical work, to be completed at a later stage of the Project, could include:

- Preparation of a geotechnical monitoring plan (Lee Street for RMS) and track monitoring plan (eastern site boundary for Sydney Trains). Both RMS and Sydney Trains will typically require this as part of the development application;
- Instrumentation (inclinometers and survey markers) installed during construction to monitor excavation-induced movements, and to confirm that they are within the approved / tolerable limits specified in both the geotechnical monitoring plan and track monitoring plan;
- Dilapidation surveys;
- Waste Classification of all material to be excavated and transported off site; and
- Footing inspections during construction.

It is recommended that a meeting be held after the initial design has been completed to confirm that the recommendations given in this report have been interpreted correctly.

13. References

AS 1170.4:2007, *Structural design actions Part 4: Earthquake actions in Australia*, Standards Australia.

AS 1726:2017, *Geotechnical Site Investigations*, Standards Australia.

AS 2159:2009, *Piling Design and Installation*, Standards Australia.

AS 3798:2007, *Guidelines on earthworks for commercial and residential developments*", Standards Australia.

AS/ISO 2631.2: 2014, *Mechanical vibration and shock – Evaluation of human exposure to whole-body vibration – Vibration in buildings (1 Hz to 80 Hz)*, Standards Australia / International Standards Organisation.

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Herbert C. (1983), *Sydney 1:100 000 Geological Sheet 9130, 1st edition*. Geological Survey of New South Wales, Sydney.

Murphy C.L. (1997), *Acid Sulfate Soil Risk Map for Botany Bay, 2nd edition.* Department of Land and Water Conservation, New South Wales, Sydney.

NSW Environment Protection Authority (NSW EPA: 2014), *Waste Classification Guidelines*.

New South Wales Government Legislation (1997), *Protection of the Environment Operations Act 1997 No. 156* (POEO Act), https://www.legislation.nsw.gov.au/~/view/act/1997/156/full.

Pells, P.J.N., Mostyn, G., Walker, B.F. (1998), *Foundations on Sandstone and Shale in the Sydney Region*, Australian Geomechanics Journal, December 1998.

Rickwood, P.C. (1985), *Igneous intrusives in the Greater Sydney Region,* in *Engineering Geology of the Sydney Region, pages 215-308 (ed. Pells P.J.N), A.A Balkema, 1985.*

Roads and Maritime Services (2012), *RMS Geotechnical Technical Direction 2012/001*, April 2012.

14. Glossary of Key Terms

Term	Definition
Adina Hotel	2 Lee Street, Haymarket The Former Parcels Post Office The Adina Apartment Hotel Sydney Central
Atlassian Central	The Atlassian tower building (building only)
Atlassian Central development	The whole Atlassian development within the Atlassian Site including the tower and public domain works.
Atlassian Site	8 – 10 Lee Street, Haymarket
Central Sydney	Land identified as Central Sydney under the Sydney LEP 2012 and includes Sydney's Central Business District (CBD)
Central SSP	Central Station State Significant Precinct
Central Walk West	The future western pedestrian entry to the new 19 metre-wide underground concourse customers to suburban rail and Sydney Metro platforms.
Devonshire Tunnel	The pedestrian and cycle tunnel running between Chalmers Street and Lee Street
"Dexus/Frasers Site"	14-30 Lee Street Haymarket. Adjoining land immediately to the south currently comprising three 8-storey commercial buildings
Habitat Level 1	Flexibly ventilated workspace areas
Link Zone	The publicly accessible land within the Site.
Sub-precinct	Western Gateway Sub-precinct
The Project	Commercial and hotel development above the Former Inwards Parcel Shed at 8-10 Lee Street, Haymarket

15. Glossary of Abbreviations

Term	Definition
ARR	Average risk rating
ANZECC	Australian and New Zealand Environment and Conservation Council
DP	Deposited Plan
GIA	Geotechnical Impact Assessment
HBM	Hazardous building materials
IRR	Individual risk ratings

Term	Definition
kPa	Kilopascals (unit of pressure)
MPa	Megapascals (unit of pressure)
NATA	National Association of Testing Authorities, Australia
RMS	Roads and Maritime Services
RL (m AHD)	Reduced Level or Elevation in metres, relative to the Australian Height Datum
SSI	Supplementary Site Investigation for Contamination
TfNSW	Transport for New South Wales
UCS	Unconfined compressive strength
VSPPV	Vector sum peak particle velocity
VENM	Virgin excavated natural materials

16. Limitations

Douglas Partners Pty Ltd (Douglas Partners) has prepared this report for this project at 8-10 Lee Street, Haymarket, in accordance with DP's proposal SYD190190.P.003.Rev5, and acceptance received from Avenor Pty Ltd on behalf of Vertical First Pty Ltd on 7 May 2020. The work was carried out under a consultancy agreement. This report is provided for the exclusive use of Vertical First Pty Ltd or their agents, for this project only and for the purposes as described in the report. It should not be used by or be relied upon for other projects or purposes on the same or other site or by a third party. Any party so relying upon this report beyond its exclusive use and purpose as stated above, and without the express written consent of DP, does so entirely at its own risk and without recourse to Douglas Partners for any loss or damage. In preparing this report Douglas Partners has necessarily relied upon information provided by the client and/or their agents.

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

DP's advice is based upon the conditions encountered during this investigation. The accuracy of the advice provided by Douglas Partners 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.

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

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

The scope for work for this investigation included the assessment of sub-surface materials for contaminants within the Site, which is presented under separate cover. Should evidence of filling 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 filling may contain contaminants and hazardous building materials.

Asbestos has not been detected by observation or by laboratory analysis of soil samples, at the test locations sampled and analysed (refer to Douglas Partners Report 86767.03.R.001.Rev1 for further details). Building demolition materials, such as glass, brick, ceramic tile and coal, were, however, located in previous below-ground filling, and these are considered as indicative of the possible presence of hazardous building materials (HBM), including asbestos.

Although the sampling plan adopted for this investigation is considered appropriate to achieve the stated project objectives, there are necessarily parts of the Site that have not been sampled and analysed. This is either due to undetected variations in ground conditions or to budget constraints (as discussed above), or to parts of the Site being inaccessible and not available for inspection/sampling. It is therefore considered possible that HBM, including asbestos, may be present in unobserved or untested parts of the Site, between and beyond sampling locations, and hence no warranty can be given that asbestos is not present.

The contents of this report do not constitute formal design components such as are required, by the Health and Safety Legislation and Regulations, to be included in a Safety Report specifying the hazards likely to be encountered during construction and the controls required to mitigate risk. This design process requires risk assessment to be undertaken, with such assessment being dependent upon factors relating to likelihood of occurrence and consequences of damage to property and to life. This, in turn, requires project data and analysis presently beyond the knowledge and project role respectively of Douglas Partners. Douglas Partners may be able, however, to assist the client in carrying out a risk assessment of potential hazards contained in the Comments section of this report, as an extension to the current scope of works, if so requested, and provided that suitable additional information is made available to Douglas Partners. Any such risk assessment would, however, be necessarily restricted to the geotechnical / groundwater components set out in this report and to their application by the Project designers to project design, construction, maintenance and demolition.

Douglas Partners Pty Ltd

Appendix A

About This Report

About this Report

Douglas Partners

Introduction

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

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

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

Borehole and Test Pit Logs

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

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

Groundwater

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

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

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

Reports

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

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

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

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

About this Report

Site Anomalies

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

Information for Contractual Purposes

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

Site Inspection

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

Appendix B

Site Photographs

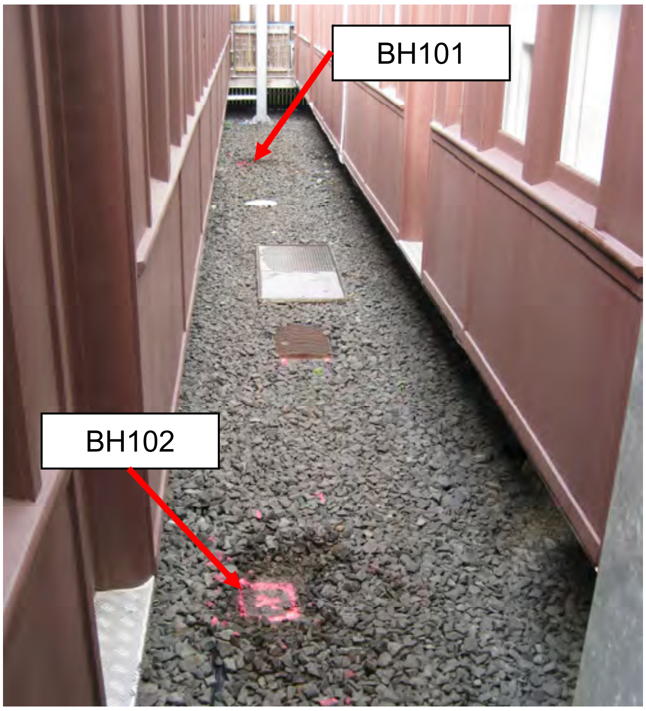


Photo 1 – View south-west between the rail dormitory carriages on the eastern side of the YHA building (Upper Ground Floor level), with the positions of environmental investigation boreholes BH101 and BH102 as shown.

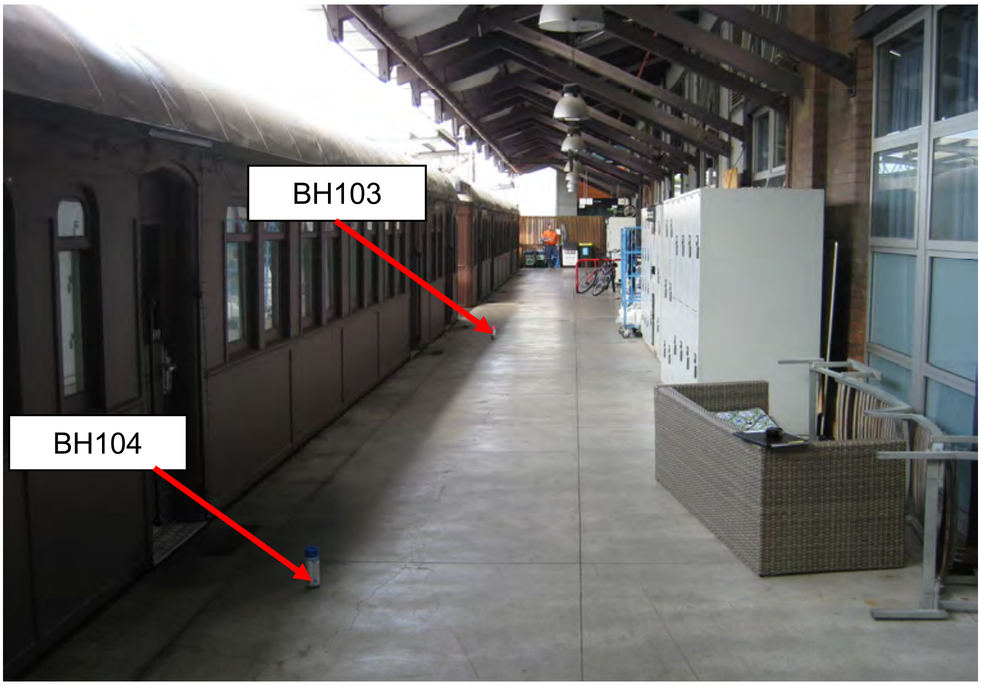


Photo 2 – View south-west along a former rail platform, on the eastern side of the YHA building (Upper Ground Floor level). The locations of boreholes BH103 and BH104 are indicated as shown.

Douglas Partners Geotechnics / Environment / Groundwater	**Site Photographs**	PROJECT: 86767.07
	Proposed Commercial Development	PLATE No: 1
	8-10 Lee Street, Haymarket	REV: 1
	CLIENT: Vertical First Pty Ltd	DATE: 23/09/2020

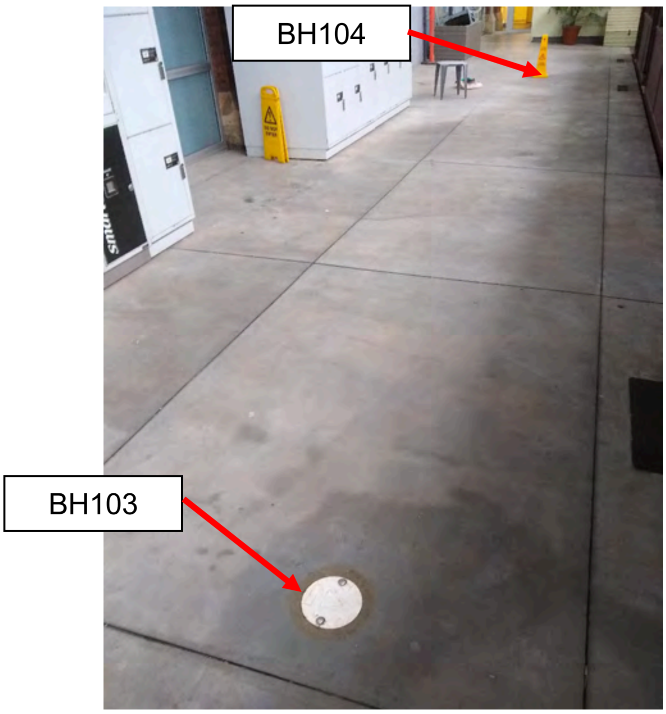


Photo 3 – View north-east along a former rail platform, on the eastern side of the YHA building (Upper Ground Floor level). The locations of boreholes BH103 and BH104 (with white lid covers) are indicated as shown.

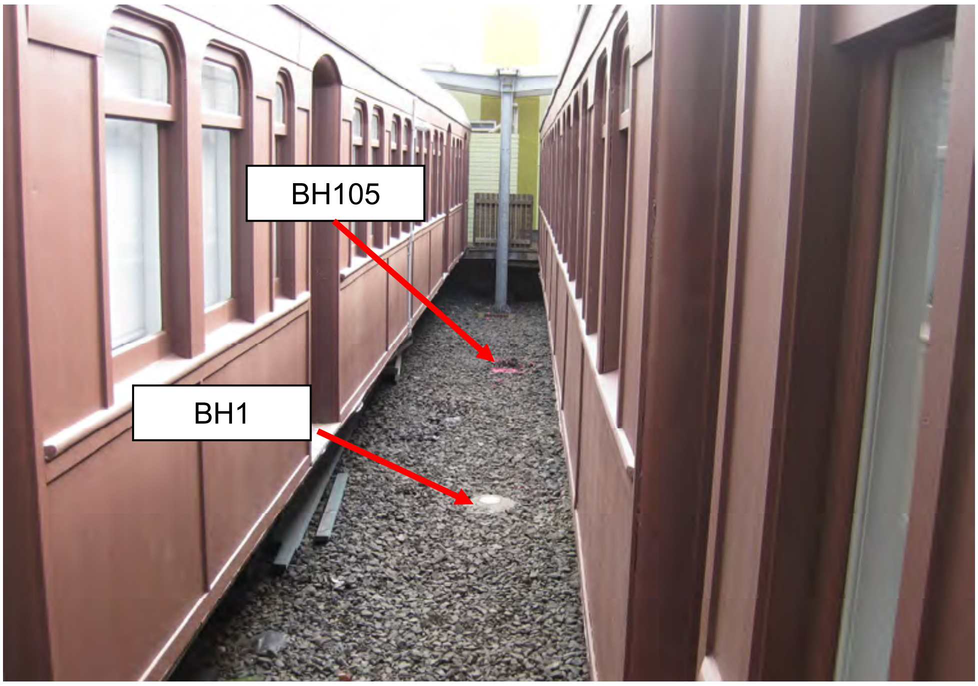


Photo 4 – View south-west between the rail dormitory carriages on the eastern side of the YHA building (Upper Ground Floor level), with the position of boreholes BH105 and BH1 (with installed standpipe) indicated as shown.

Douglas Partners
Geotechnics | Environment | Groundwater

Site Photographs

Proposed Commercial Development

8-10 Lee Street, Haymarket

CLIENT: Vertical First Pty Ltd

PROJECT: 86767.07
PLATE No: 2
REV: 1
DATE: 23/09/2020

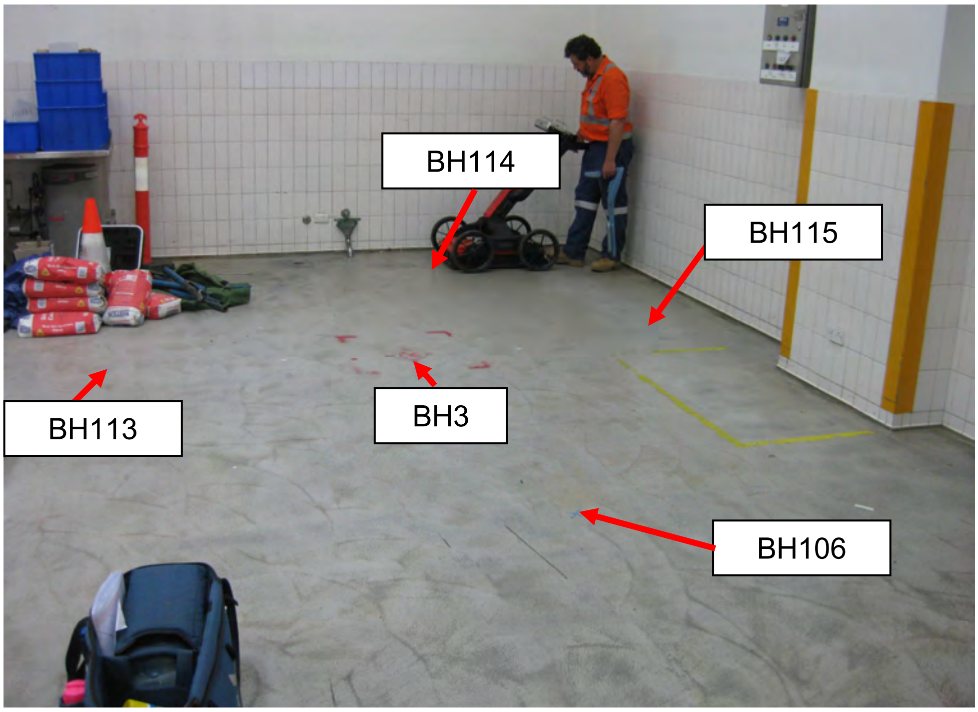


Photo 5 – View east within the Gate Gourmet Rail Catering Facility (Lower Ground Floor level). The locations of boreholes BH106, BH113, BH114 and BH115, and BH3 are indicated as shown.

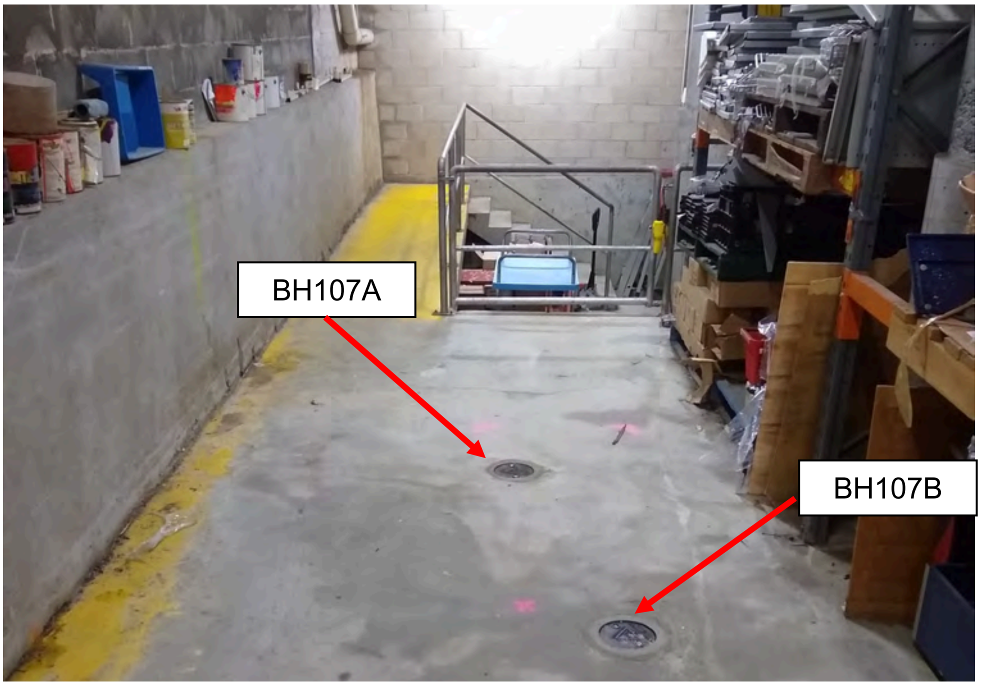


Photo 6 – View south-west within a concrete-walled storage area at the Lower Ground Floor Level. A set of steps leading down to the Henry Deane Plaza is present overhead. The position of boreholes BH107A and BH107B (with installed standpipes) are indicated as shown.

Douglas Partners Geotechnics / Environment / Groundwater	**Site Photographs** **Proposed Commercial Development** **8-10 Lee Street, Haymarket**	PROJECT: 86767.07 PLATE No: 3 REV: 1
	CLIENT: Vertical First Pty Ltd	DATE: 23/09/2020

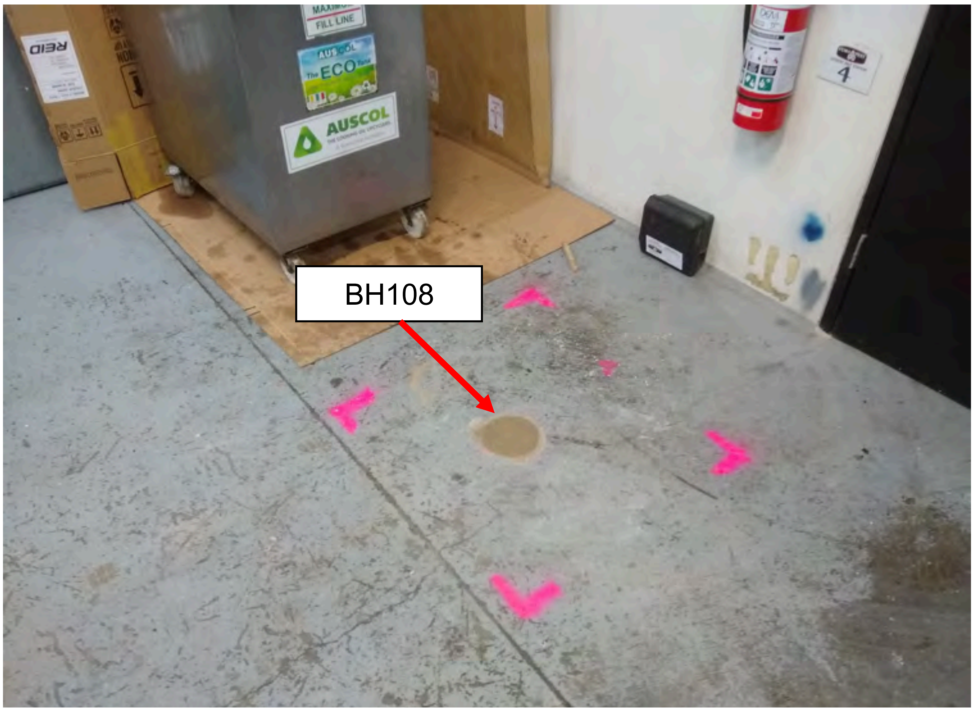


Photo 7 – View north-east within a bin room near to Ambulance Avenue, at Lower Ground Floor level. The location of borehole BH108 is indicated as shown.

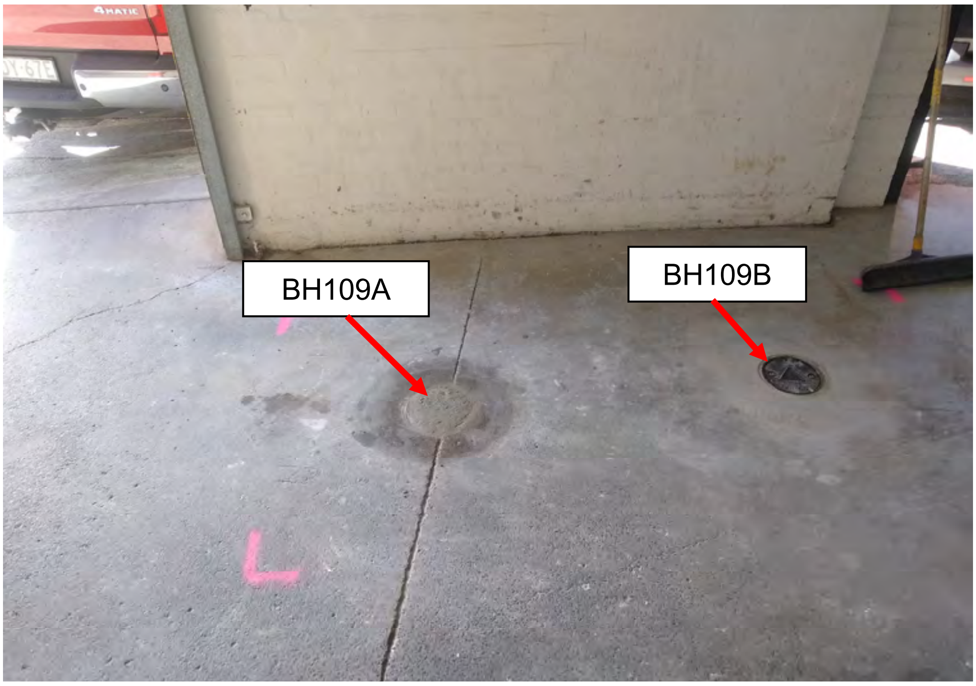


Photo 8 – View north-east at the loading dock entry from Ambulance Avenue, at Lower Ground Floor level. The locations of boreholes BH109A and BH109B (with installed standpipe) are indicated as shown.

Douglas Partners
Geotechnics / Environment / Groundwater

Site Photographs

Proposed Commercial Development

8-10 Lee Street, Haymarket

CLIENT: Vertical First Pty Ltd

PROJECT: 86767.07

PLATE No: 4

REV: 1

DATE: 23/09/2020

Photo 9 – View south-west from Ambulance Avenue, at the entrance into the Adina Hotel Basement (Lower Ground Floor level). The location of borehole BH110 is indicated as shown.

Photo 10 – View east along Upper Carriage Lane towards Central Station (Upper Ground Floor level). The location of borehole BH111 is indicated as shown.

Douglas Partners Geotechnics / Environment / Groundwater	**Site Photographs** **Proposed Commercial Development** **8-10 Lee Street, Haymarket**	PROJECT: 86767.07 PLATE No: 5 REV: 1
	CLIENT: Vertical First Pty Ltd	DATE: 23/09/2020

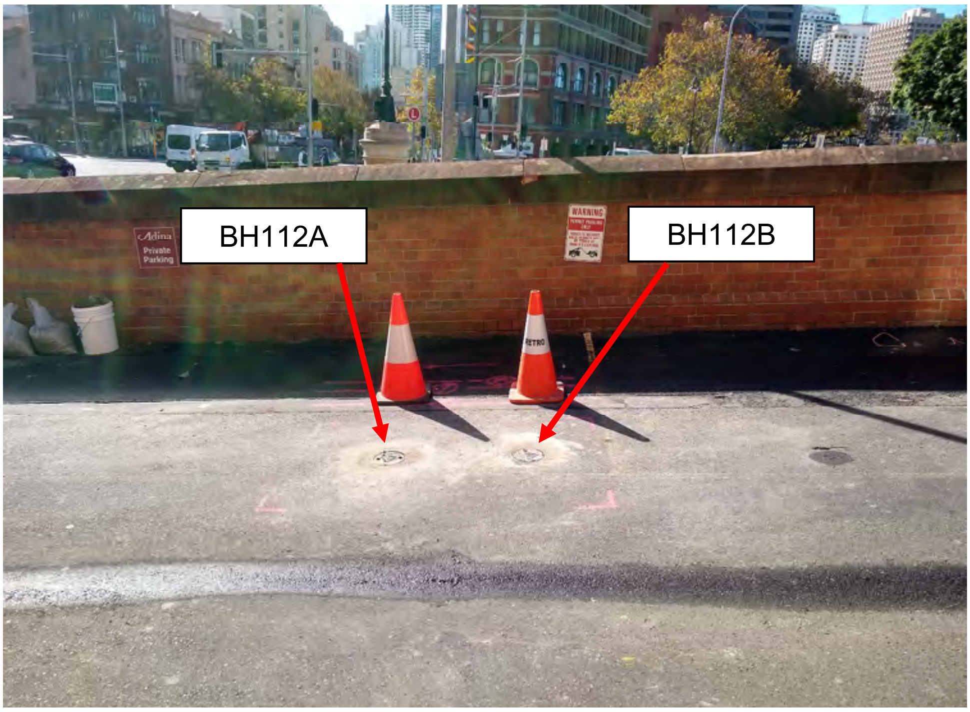


Photo 11 – View north from Upper Carriage Lane, near to the Adina Hotel boom gate (which is to the right of the field of view). The location of boreholes BH112A and BH112B (with installed standpipes) are indicated as shown.

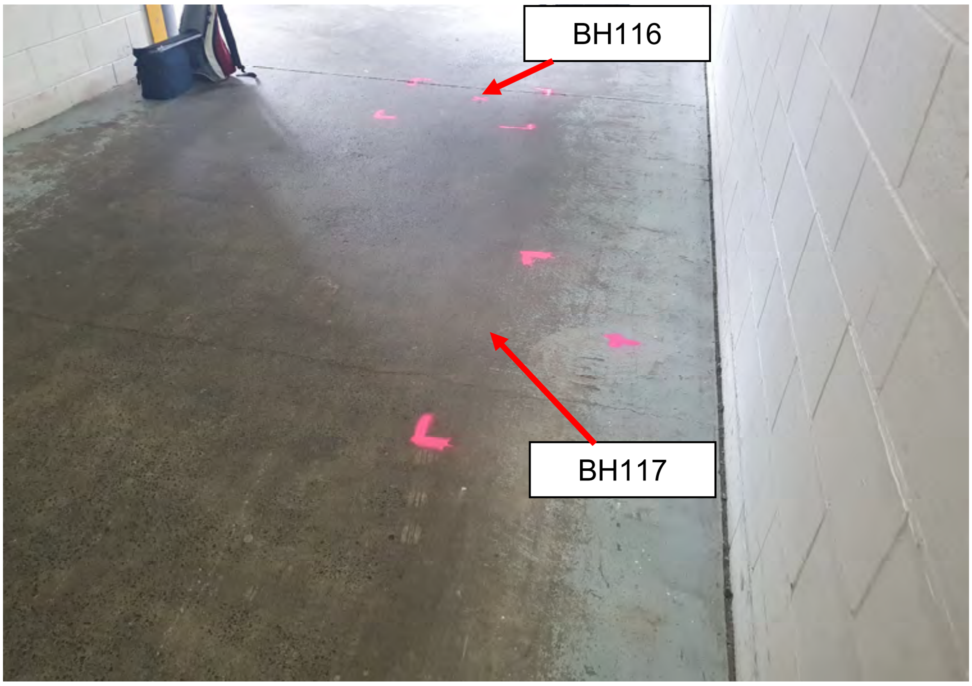


Photo 12 – View north-east near to the loading dock entry from Ambulance Avenue, at Lower Ground Floor level. The locations of boreholes BH116 and BH117are indicated as shown.

Douglas Partners Geotechnics / Environment / Groundwater	**Site Photographs** **Proposed Commercial Development** **8-10 Lee Street, Haymarket**	PROJECT: 86767.07 PLATE No: 6 REV: 1
	CLIENT: Vertical First Pty Ltd	DATE: 23/09/2020

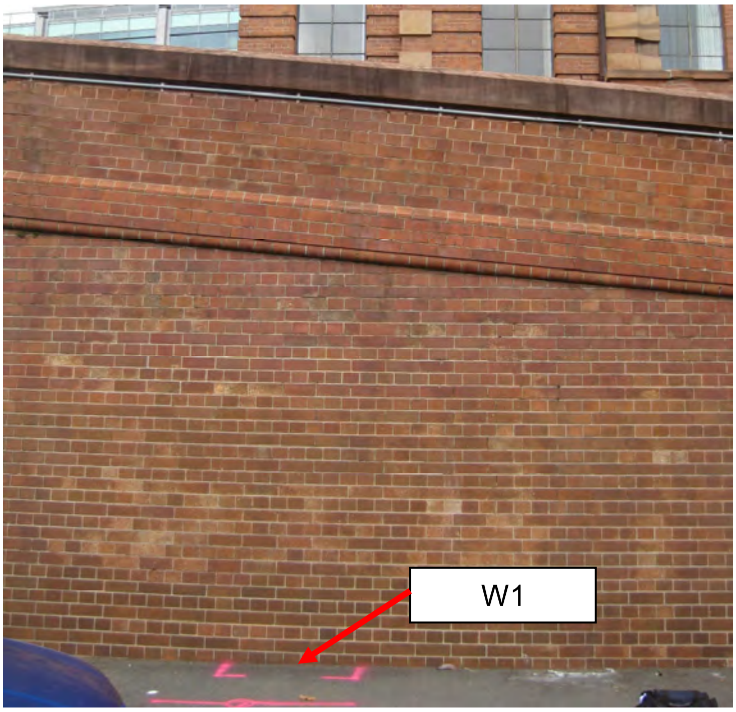


Photo 13 – View south-west from Ambulance Avenue towards the brick retaining wall and the northern site boundary (Lower Ground Floor Level). Upper Carriage Lane and the Adina Hotel are at a higher elevation and in the background. The location of borehole W1 is indicated as shown.

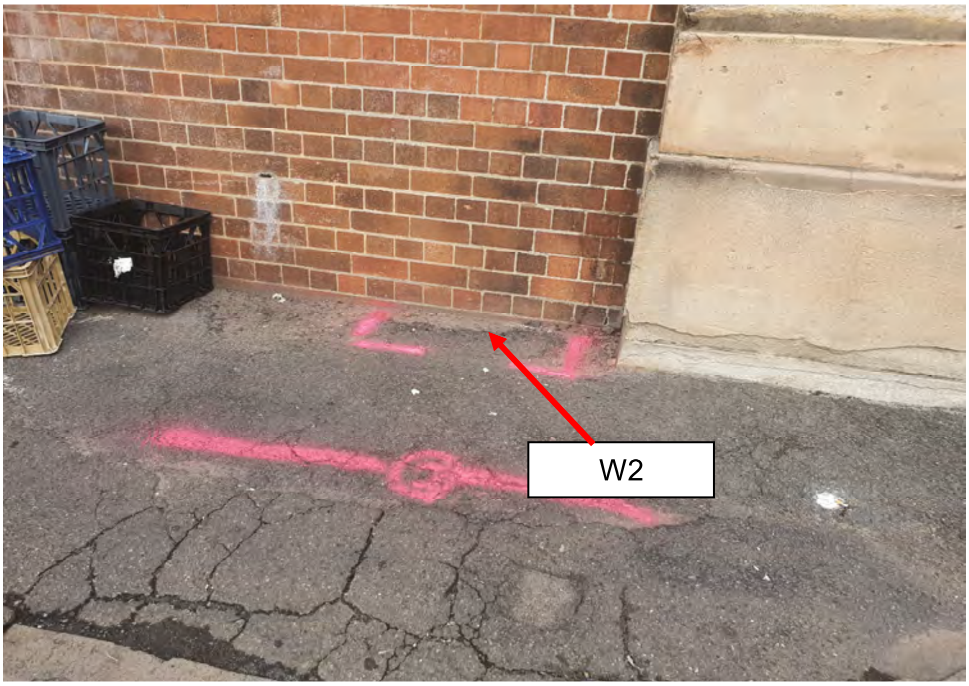


Photo 14 – View south-west from Ambulance Avenue towards the brick retaining wall and the northern site boundary (Lower Ground Floor Level), left of the entrance into the Adina Hotel basement. The location of borehole W2 is indicated as shown.

Douglas Partners Geotechnics / Environment / Groundwater	**Site Photographs** **Proposed Commercial Development** **8-10 Lee Street, Haymarket**	PROJECT: 86767.07 PLATE No: 7 REV: 1
	CLIENT: Vertical First Pty Ltd	DATE: 23/09/2020

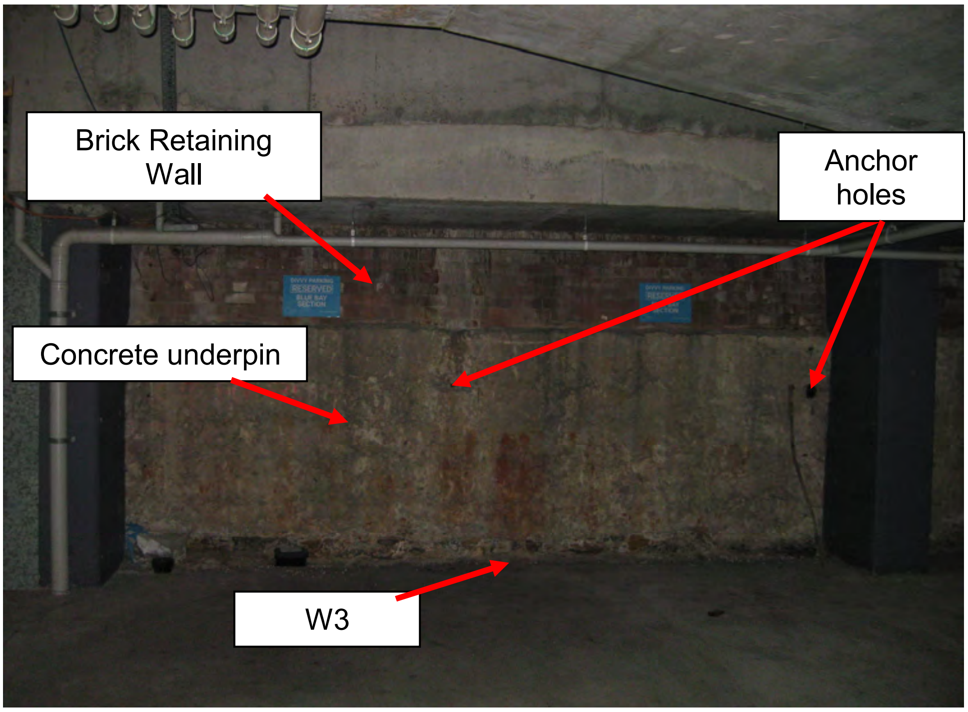


Photo 15 – View south-east within the Adina Hotel basement towards the western site boundary, the lower part of a brick retaining wall and a concrete underpin. The location of boreholes W3 and holes for former temporary anchors are indicated as shown.

Photo 16 – View south-east within the Adina Hotel basement adjacent to Borehole W3, of sandstone exposed beneath the concrete underpin and just above the level of the basement floor slab.

Douglas Partners Geotechnics / Environment / Groundwater	**Site Photographs** **Proposed Commercial Development** **8-10 Lee Street, Haymarket**	PROJECT: 86767.07 PLATE No: 8 REV: 1
	CLIENT: Vertical First Pty Ltd	DATE: 23/09/2020

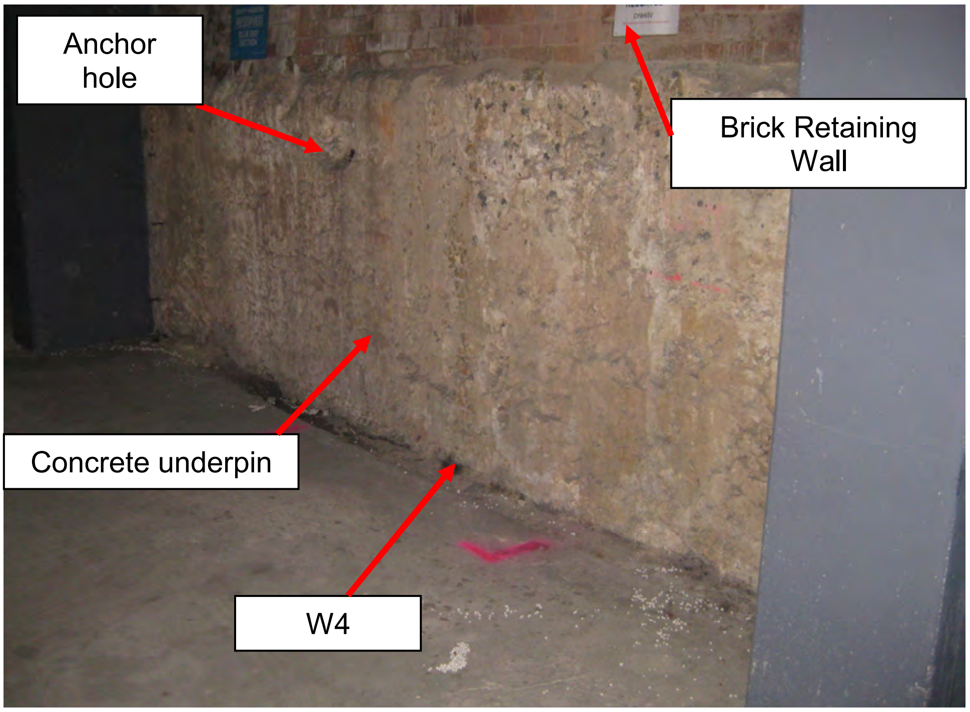


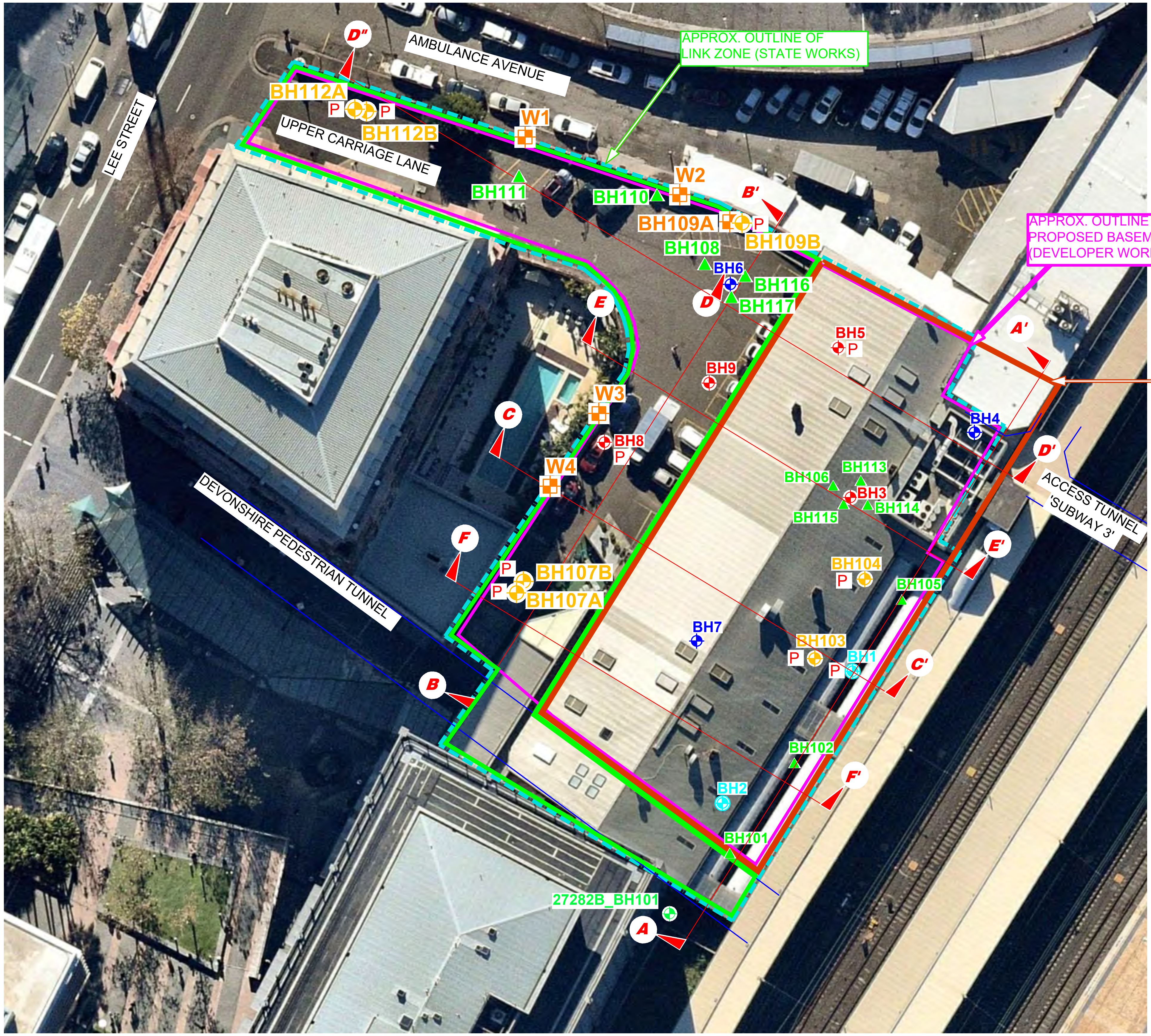
Photo 17 – View south-east within the Adina Hotel basement towards the western site boundary, the lower part of a brick retaining wall and a concrete underpin. The location of boreholes W3 and holes for former temporary anchors are indicated as shown.

Photo 18 – View north of rock exposure observed adjacent to and west of the Adina Hotel basement entry ramp, of sandstone exposed beneath a concrete underpin. Multiple iron-cemented and clayey seams are present above the concrete floor slab.

Douglas Partners Geotechnics / Environment / Groundwater	**Site Photographs**	PROJECT:	86767.07
	Proposed Commercial Development	PLATE No:	9
	8-10 Lee Street, Haymarket	REV:	1
	CLIENT: Vertical First Pty Ltd	DATE:	23/09/2020

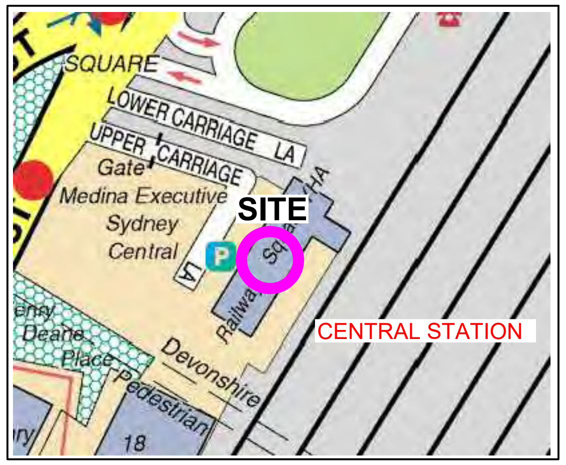
Appendix C

Drawings



NOTE:
1: Base image from Nearmap.com
(Dated 1 July 2019)
2: Test locations are approximate only and are
shown with reference to existing features.
3. Approximate Development Outlines are as
provided by Avenor Pty Ltd on 12 August 2019.

0 5 10 15 20 30 40 50m
1:500 @ A3



Locality Plan

LEGEND

- ⊕ Previous geotechnical borehole (DP Project 27282B, dated 1999)
- ⊕ Environmental borehole - Lower Ground Floor (DP Report 86767.01.R.001.DftB, dated 29 August 2019)
- ⊕ Geotechnical & environmental borehole - Lower Ground Floor (DP Report 86767.00.R.001.Rev0, dated 26 August 2019)
- ⊕ Geotechnical & environmental borehole - Upper Ground Floor (DP Report 86767.00.R.001.Rev0, dated 26 August 2019)
- ▲ Environmental borehole
- ⊕ Geotechnical & environmental borehole
- ⊞ Geotechnical borehole
- P Standpipe piezometer
- A A' Geotechnical Cross Section A-A'
- — · — Approximate site boundary

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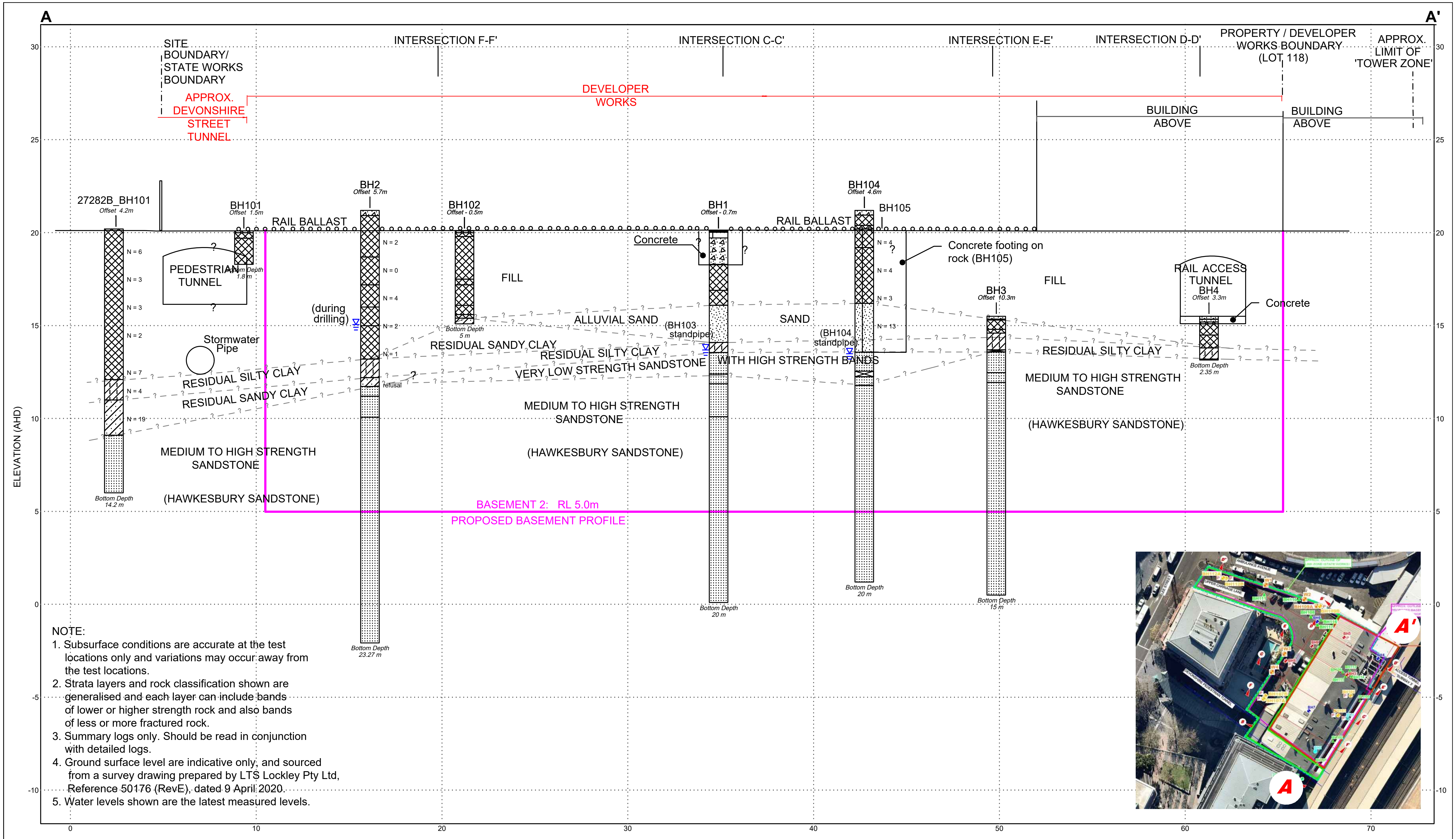
CLIENT: Vertical First Pty Ltd
OFFICE: Sydney
DRAWN BY: HDS
SCALE: 1:500 @ A3
DATE: 03.07.2020

TITLE: **Test Location Plan**
Proposed Commercial Development
8-10 Lee Street, HAYMARKET

N

PROJECT No: 86767.00
DRAWING No: 1
REVISION: 9



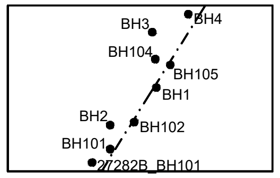
NOTE:
1. Subsurface conditions are accurate at the test locations only and variations may occur away from the test locations.
2. Strata layers and rock classification shown are generalised and each layer can include bands of lower or higher strength rock and also bands of less or more fractured rock.
3. Summary logs only. Should be read in conjunction with detailed logs.
4. Ground surface level are indicative only, and sourced from a survey drawing prepared by LTS Lockley Pty Ltd, Reference 50176 (RevE), dated 9 April 2020.
5. Water levels shown are the latest measured levels.

LEGEND

▨ Concrete	▨ Sand
▤ Bricks	▨ Silty Clay
▩ Fill	▨ Sandstone
▨ Sandy Clay	☒ Core Loss

TESTS / OTHER
N - Standard penetration test value
▽ - Water level

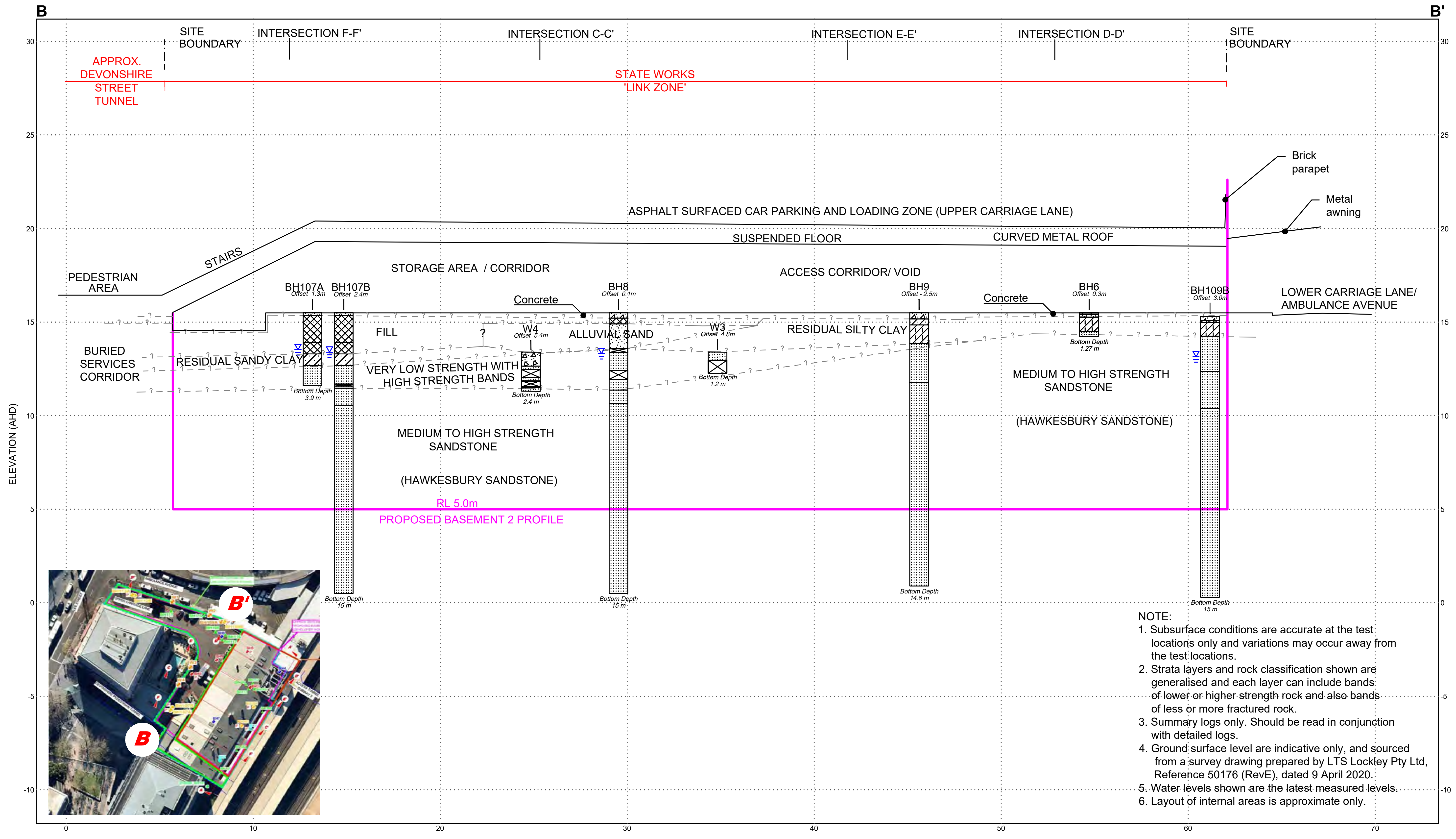
SITE MAP



0 4
Horizontal Scale (metres)
Natural Scale

Douglas Partners
Geotechnics / Environment / Groundwater

CLIENT: Vertical First Pty Ltd		TITLE: **Interpreted Geotechnical Cross-Section A-A'** **Proposed Commercial Development** **8-10 Lee Street, HAYMARKET**	PROJECT No: 86767.00
OFFICE: Sydney	DRAWN BY: HDS		DRAWING No: 2
SCALE: 1:200 (H) 1:200 (V) @ A3	DATE: 03.07.2020		REVISION: 4

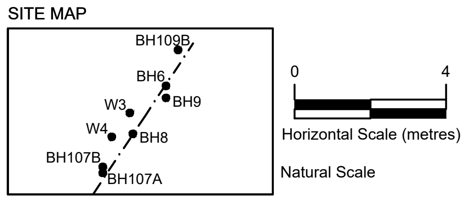


NOTE:
1. Subsurface conditions are accurate at the test locations only and variations may occur away from the test locations.
2. Strata layers and rock classification shown are generalised and each layer can include bands of lower or higher strength rock and also bands of less or more fractured rock.
3. Summary logs only. Should be read in conjunction with detailed logs.
4. Ground surface level are indicative only, and sourced from a survey drawing prepared by LTS Lockley Pty Ltd, Reference 50176 (RevE), dated 9 April 2020.
5. Water levels shown are the latest measured levels.
6. Layout of internal areas is approximate only.

LEGEND
- ☒ Core Loss
- ■ Asphaltic Concrete
- ▨ Clay
- ▦ Concrete
- ▩ Filling
- ░ Sand
- ▤ Sandstone
- ▨ Silty Clay
- ▨ Silty Clay

TESTS / OTHER
N - Standard penetration test value
▽ - Water level

SITE MAP

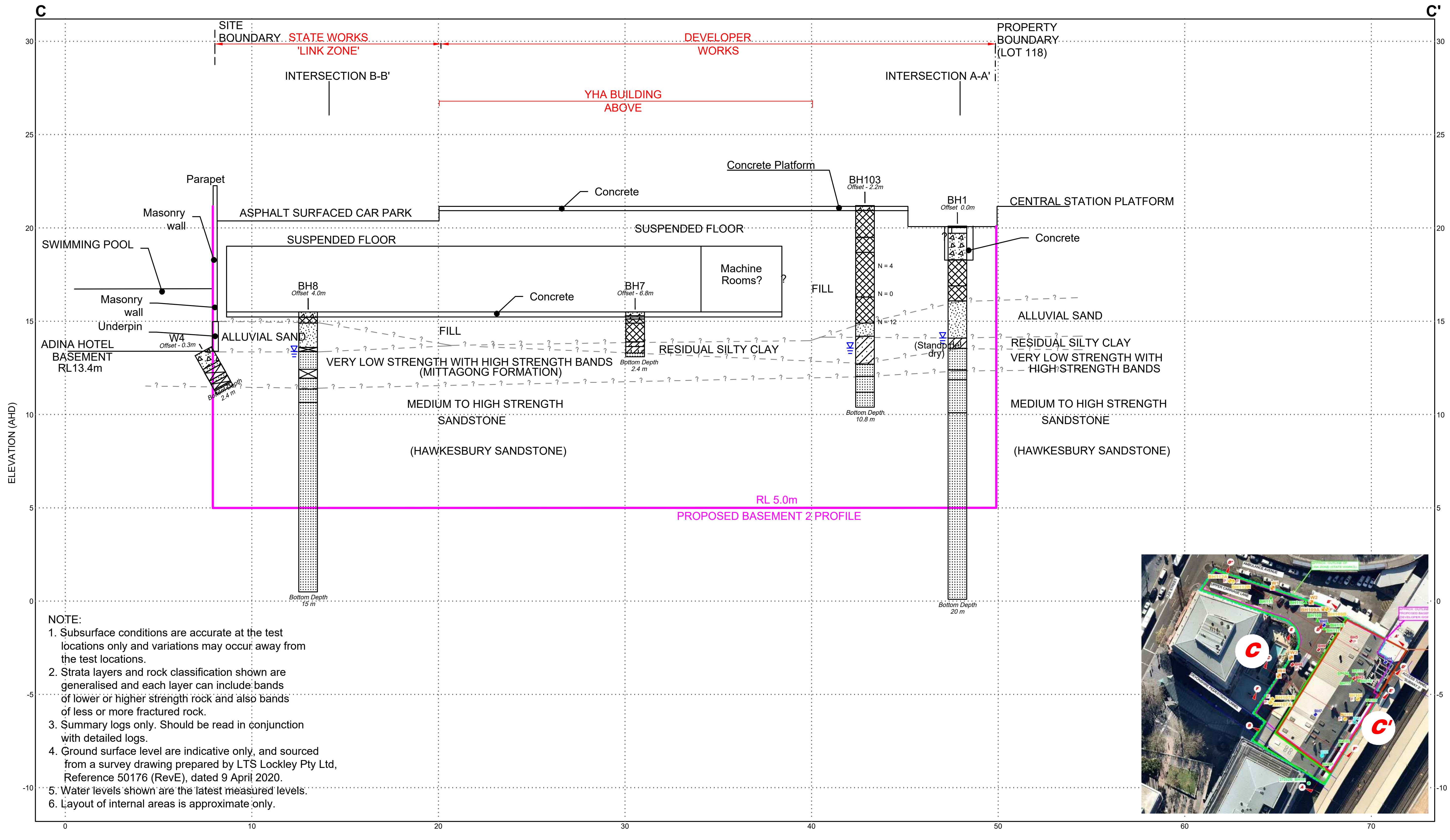


Douglas Partners
Geotechnics | Environment | Groundwater

CLIENT: Vertical First Pty Ltd
OFFICE: Sydney
DRAWN BY: HDS
SCALE: 1:200 (H) 1:200 (V) @ A3
DATE: 3.07.2020

TITLE: **Interpreted Geotechnical Cross-Section B-B'**
Proposed Commercial Development
8-10 Lee Street, HAYMARKET

PROJECT No: 86767.00
DRAWING No: 3
REVISION: 4



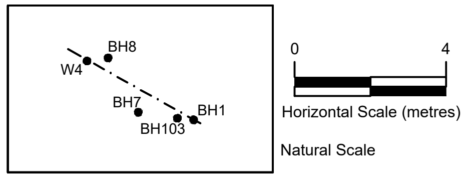
NOTE:
1. Subsurface conditions are accurate at the test locations only and variations may occur away from the test locations.
2. Strata layers and rock classification shown are generalised and each layer can include bands of lower or higher strength rock and also bands of less or more fractured rock.
3. Summary logs only. Should be read in conjunction with detailed logs.
4. Ground surface level are indicative only, and sourced from a survey drawing prepared by LTS Lockley Pty Ltd, Reference 50176 (RevE), dated 9 April 2020.
5. Water levels shown are the latest measured levels.
6. Layout of internal areas is approximate only.

LEGEND

☒ Core Loss	▨ Sand
▤ Bricks	▦ Sandstone
▨ Concrete	▨ Silty Clay
▩ Filling	▨ Sandy Clay

TESTS / OTHER
N - Standard penetration test value
▽ - Water level

SITE MAP

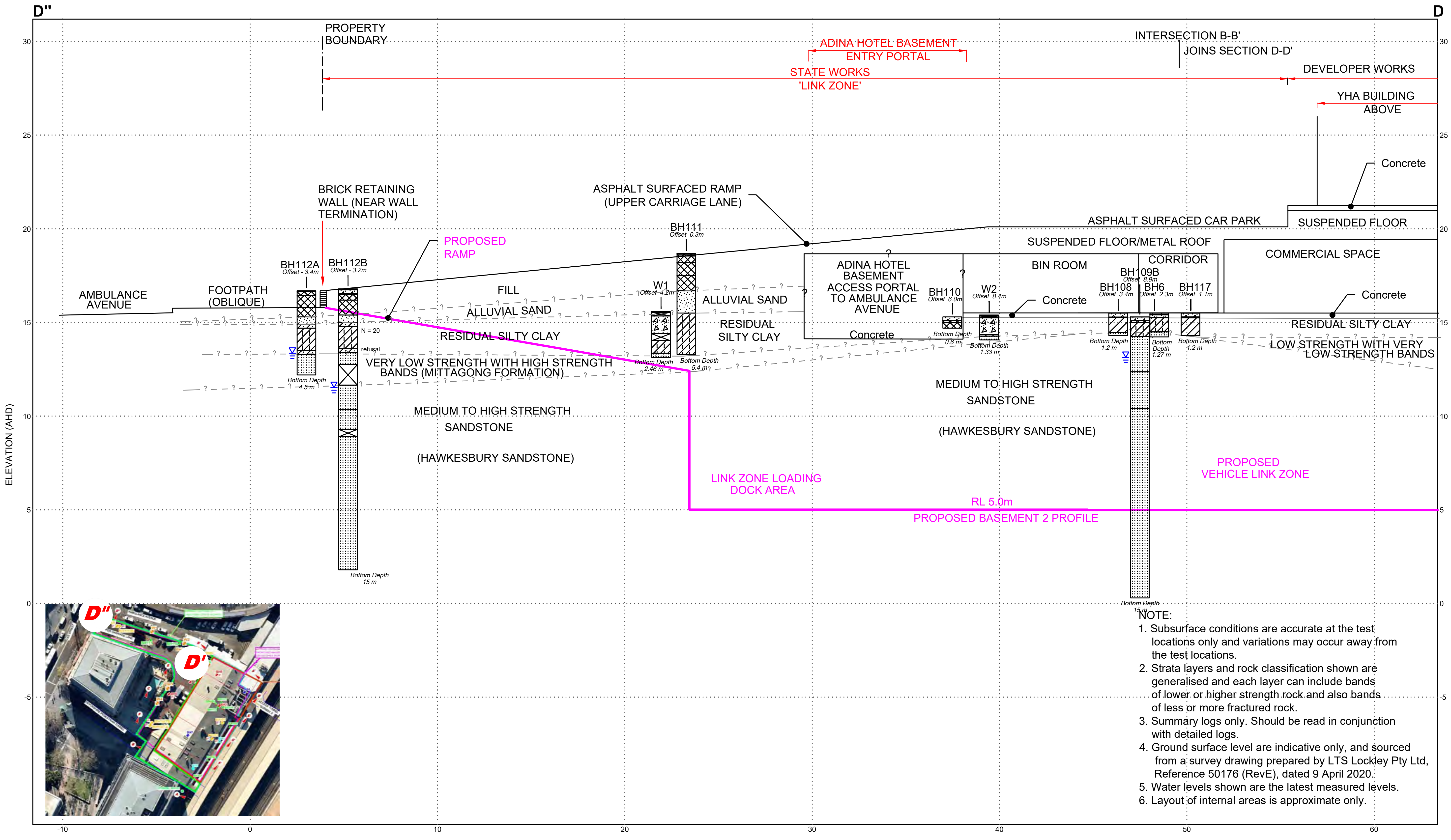


Douglas Partners
Geotechnics / Environment / Groundwater

CLIENT: Vertical First Pty Ltd
OFFICE: Sydney
DRAWN BY: HDS
SCALE: 1:200 (H) 1:200 (V) @ A3
DATE: 03.07.2020

TITLE: **Interpreted Geotechnical Cross-Section C-C'**
Proposed Commercial Development
8-10 Lee Street, HAYMARKET

PROJECT No: 86767.00
DRAWING No: 4
REVISION: 4

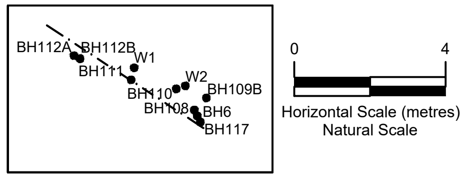


NOTE:
1. Subsurface conditions are accurate at the test locations only and variations may occur away from the test locations.
2. Strata layers and rock classification shown are generalised and each layer can include bands of lower or higher strength rock and also bands of less or more fractured rock.
3. Summary logs only. Should be read in conjunction with detailed logs.
4. Ground surface level are indicative only, and sourced from a survey drawing prepared by LTS Lockley Pty Ltd, Reference 50176 (RevE), dated 9 April 2020.
5. Water levels shown are the latest measured levels.
6. Layout of internal areas is approximate only.

LEGEND

- ☒ Core Loss
- ■ Asphaltic Concrete
- ▨ Clay
- ▦ Concrete
- ▩ Fill
- ░ Sand
- ░ Sandstone
- ▨ Sandy Clay
- ▨ Silty Clay

SITE MAP

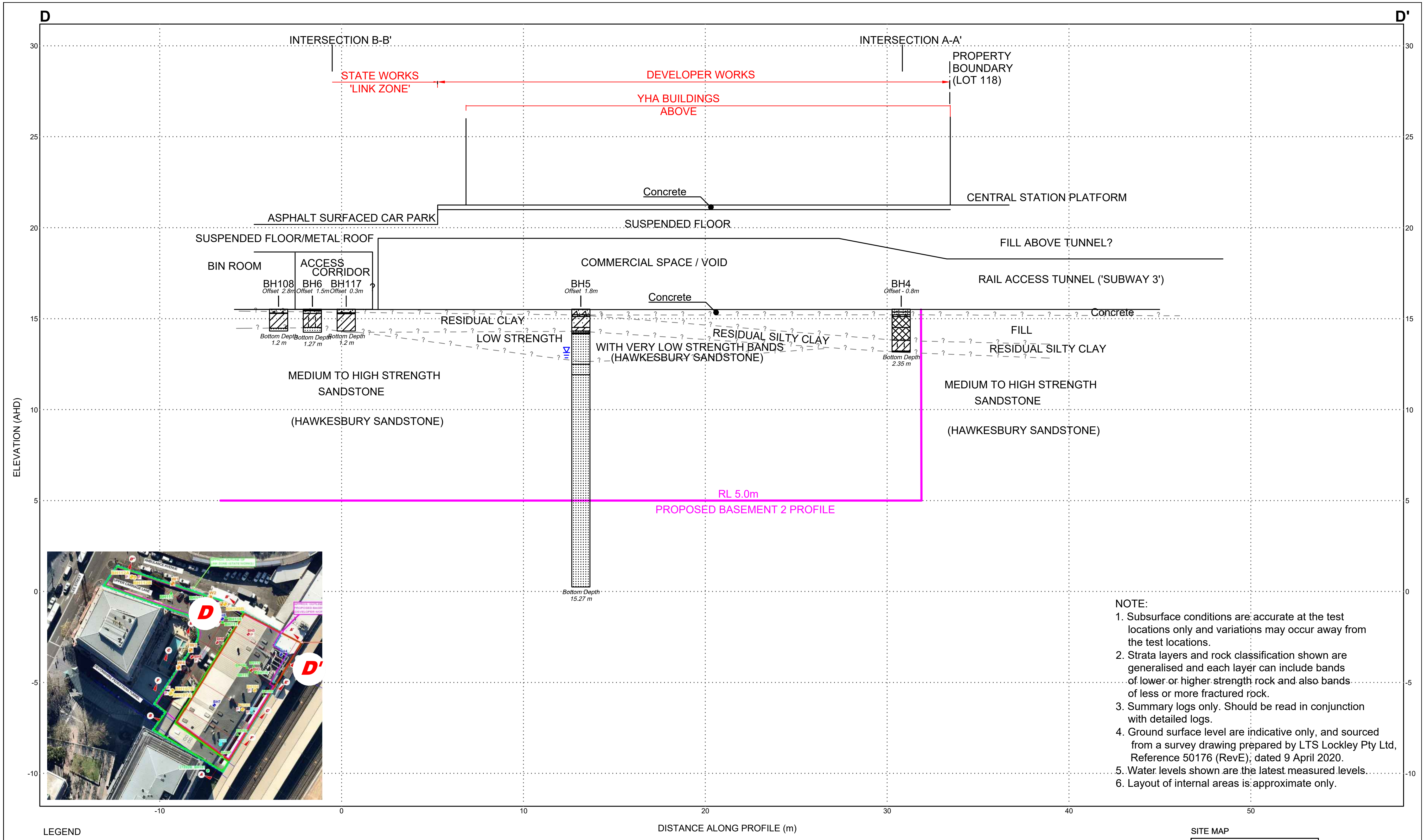


Douglas Partners
Geotechnics | Environment | Groundwater

CLIENT: Vertical First Pty Ltd		
OFFICE: Sydney	DRAWN BY: HDS/ PSCH	
SCALE: 1:200 (H) 1:200 (V) @ A3	DATE: 03.07.2020	

TITLE: **Interpreted Geotechnical Cross-Section D''-D (extended)**
Proposed Commercial Development
8-10 Lee Street, HAYMARKET

PROJECT No: 86767.00
DRAWING No: 5
REVISION: 3



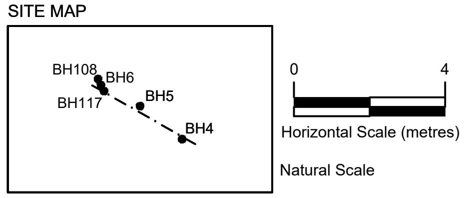
NOTE:
1. Subsurface conditions are accurate at the test locations only and variations may occur away from the test locations.
2. Strata layers and rock classification shown are generalised and each layer can include bands of lower or higher strength rock and also bands of less or more fractured rock.
3. Summary logs only. Should be read in conjunction with detailed logs.
4. Ground surface level are indicative only, and sourced from a survey drawing prepared by LTS Lockley Pty Ltd, Reference 50176 (RevE), dated 9 April 2020.
5. Water levels shown are the latest measured levels.
6. Layout of internal areas is approximate only.

LEGEND

☒	Core Loss	▒	Sandstone
■	Asphaltic Concrete	▨	Sandy Clay
▦	Concrete	▨	Silty Clay
☒	Fill	▨	Clay

TESTS / OTHER
N - Standard penetration test value
▽ - Water level

SITE MAP



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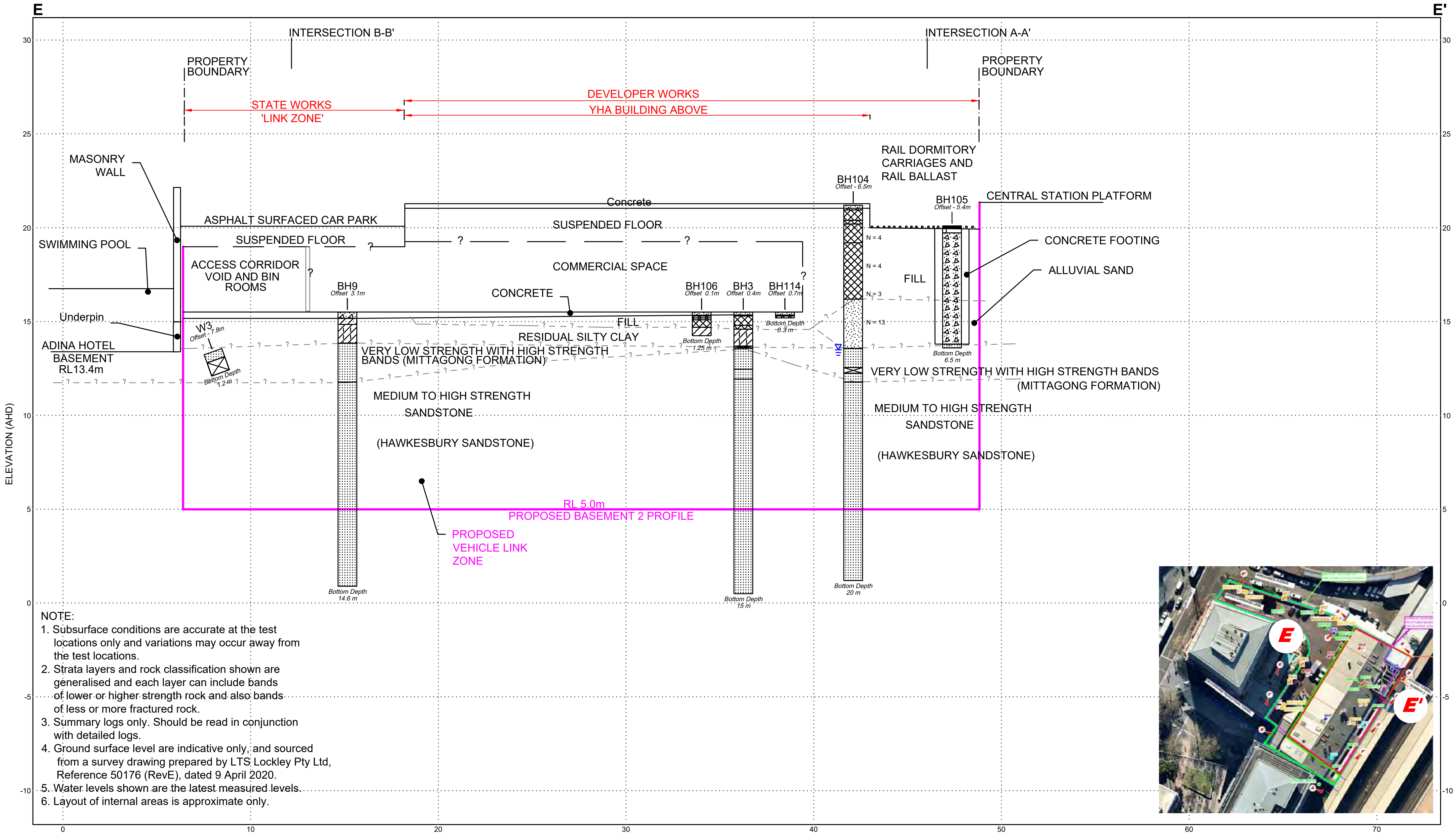
CLIENT: Vertical First Pty Ltd
OFFICE: Sydney
DRAWN BY: HDS
SCALE: 1:200 (H) 1:200 (V) @ A3
DATE: 03.07.2020

TITLE: **Interpreted Geotechnical Cross-Section D-D'**
Proposed Commercial Development
8-10 Lee Street, HAYMARKET

PROJECT No: 86767.00
DRAWING No: 5A
REVISION: 4



NOTE:

1. Subsurface conditions are accurate at the test locations only and variations may occur away from the test locations.
2. Strata layers and rock classification shown are generalised and each layer can include bands of lower or higher strength rock and also bands of less or more fractured rock.
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4. Ground surface level are indicative only, and sourced from a survey drawing prepared by LTS Lockley Pty Ltd, Reference 50176 (RevE), dated 9 April 2020.
5. Water levels shown are the latest measured levels.
6. Layout of internal areas is approximate only.

LEGEND

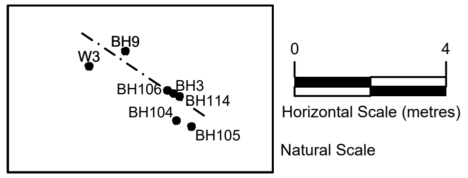
- ☒ Core Loss
- ▤ Bricks
- ▨ Clay
- ▩ Concrete
- ▩ Fill
- ░ Sand
- ░ Sandstone
- ▨ Silty Clay

TESTS / OTHER

N - Standard penetration test value

▽ - Water level

SITE MAP



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CLIENT: Vertical First Pty Ltd

OFFICE: Sydney

DRAWN BY: HDS/ PSCH

SCALE: 1:200 (H) 1:200 (V) @ A3

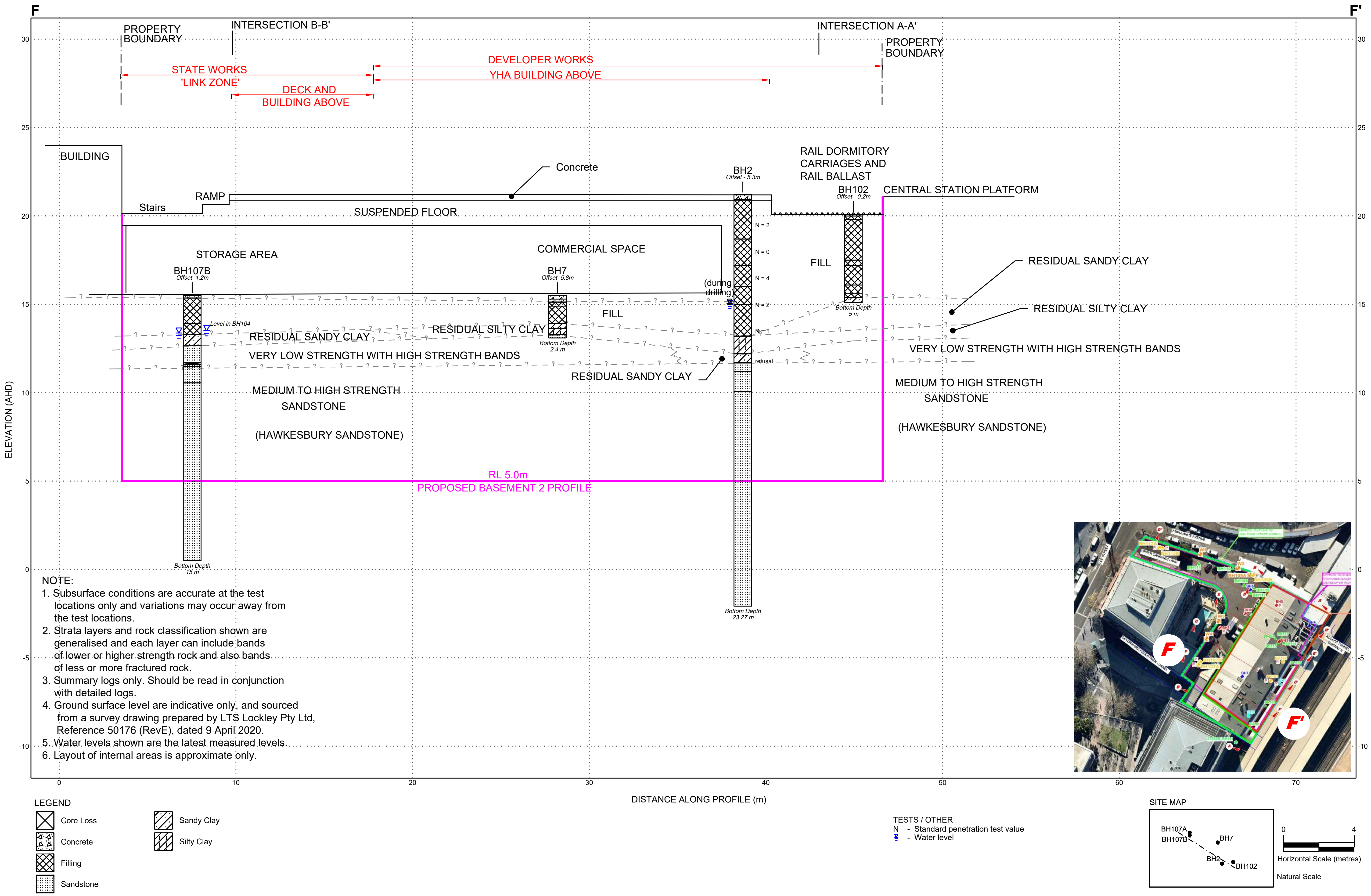
DATE: 03.07.2020

TITLE: **Interpreted Geotechnical Cross-Section E-E'**
Proposed Commercial Development
8-10 Lee Street, HAYMARKET

PROJECT No: 86767.00

DRAWING No: 6

REVISION: 3



NOTE:

1. Subsurface conditions are accurate at the test locations only and variations may occur away from the test locations.
2. Strata layers and rock classification shown are generalised and each layer can include bands of lower or higher strength rock and also bands of less or more fractured rock.
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5. Water levels shown are the latest measured levels.
6. Layout of internal areas is approximate only.

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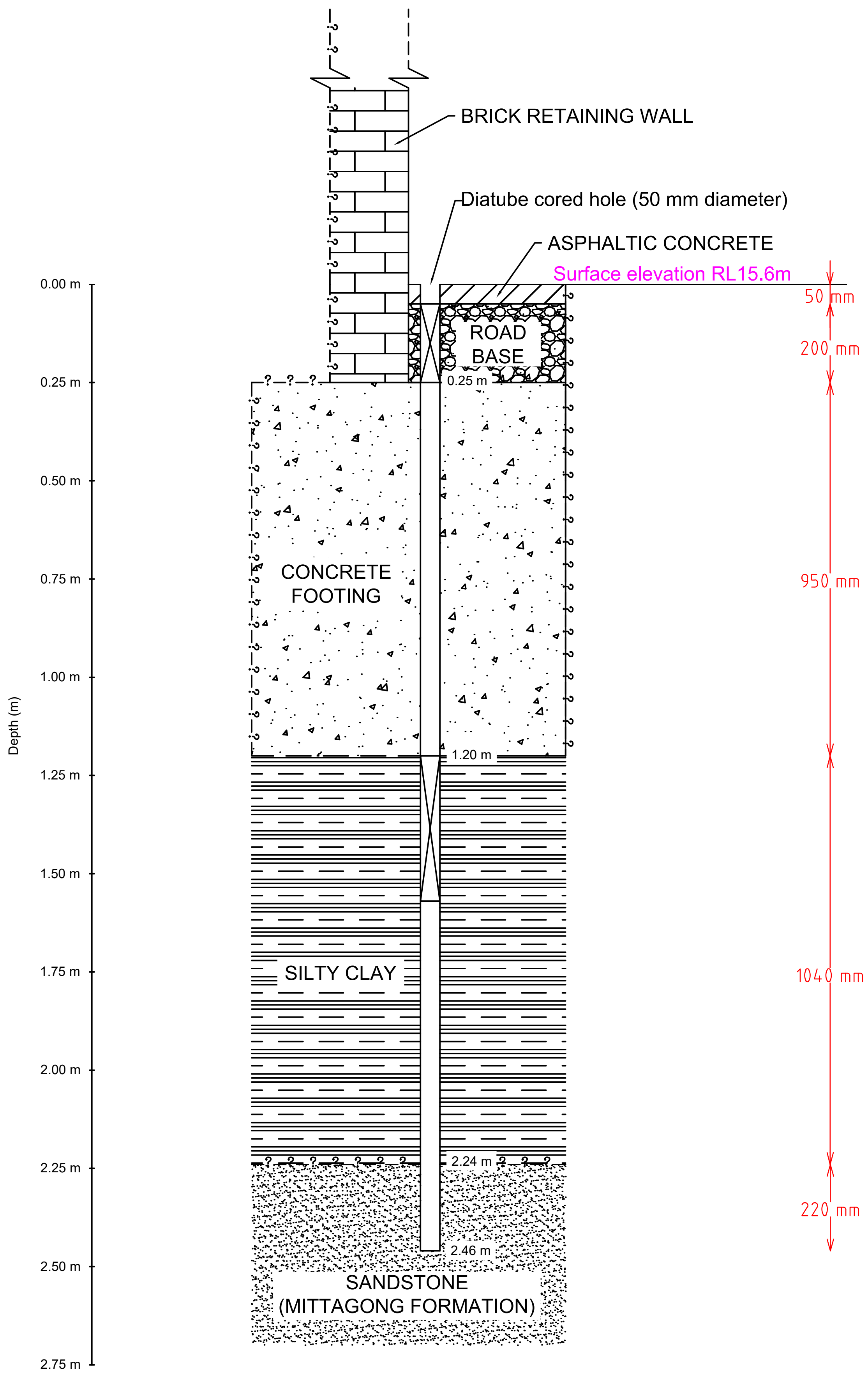
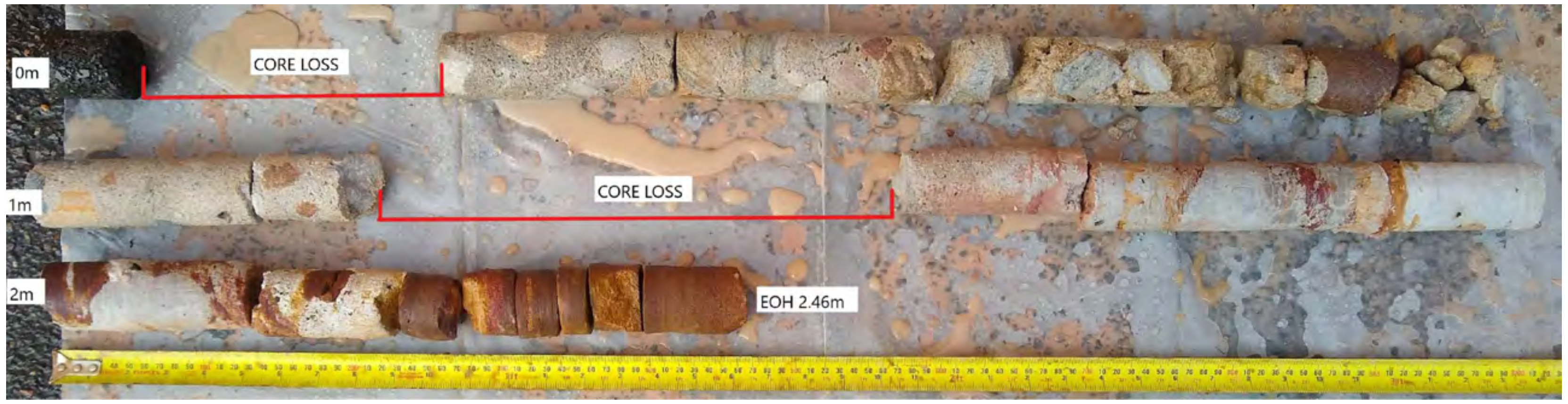
CLIENT: Vertical First Pty Ltd
OFFICE: Sydney
DRAWN BY: HDS
SCALE: 1:200 (H) 1:200 (V) @ A3
DATE: 03.07.2020

TITLE: **Interpreted Geotechnical Cross-Section F-F'**
Proposed Commercial Development
8-10 Lee Street, HAYMARKET

PROJECT No: 86767.00
DRAWING No: 7
REVISION: 3

SECTION W1-W1'





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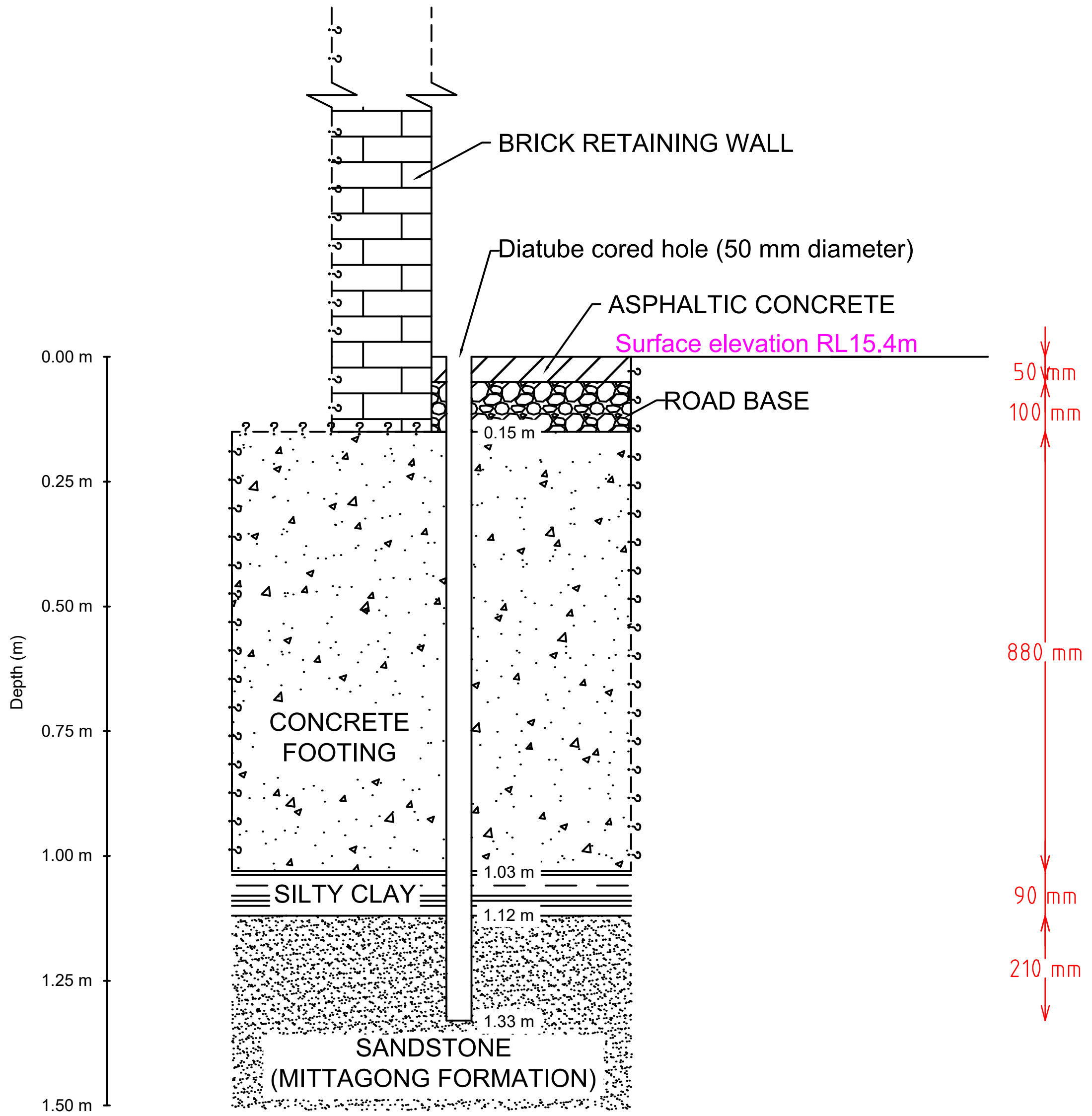
CLIENT: Vertical First Pty Ltd
OFFICE: Sydney
DRAWN BY: JDB
SCALE: 1:15 @ A3
DATE: 15.6.2020

TITLE: **W1 Cross Section**
Proposed Commercial Development
8-10 Lee Street, Haymarket

PROJECT No: 86767.00
DRAWING No: W1
REVISION: 0

SECTION W2-W2'



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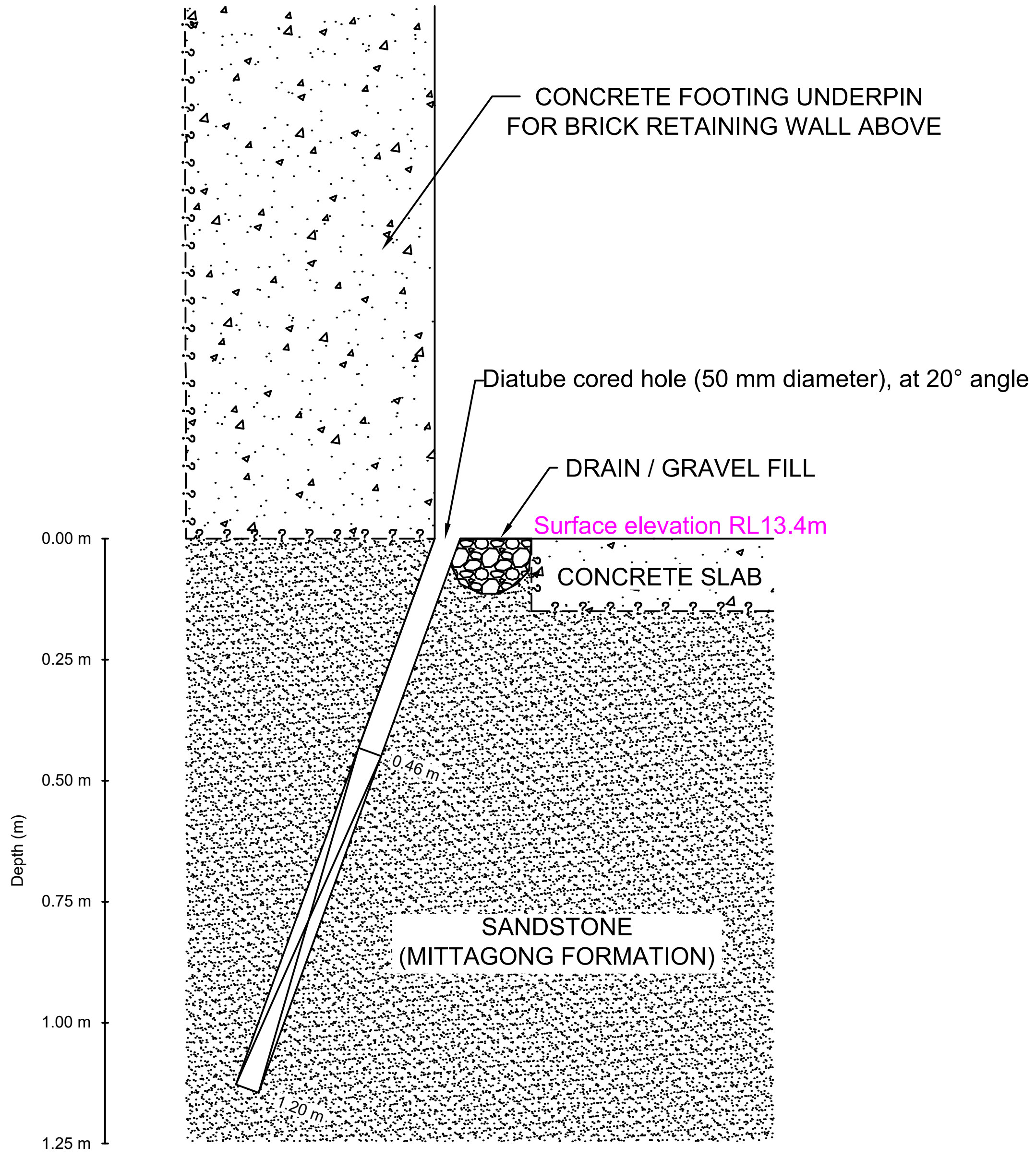
CLIENT: Vertical First Pty Ltd
OFFICE: Sydney
DRAWN BY: JDB
SCALE: 1:15 @ A3
DATE: 15.6.2020

TITLE: **W1 Cross Section**
Proposed Commercial Development
8-10 Lee Street, Haymarket

PROJECT No: 86767.00
DRAWING No: W2
REVISION: 0

SECTION W3-W3'



Note: Depth measurements are along the length of the hole.

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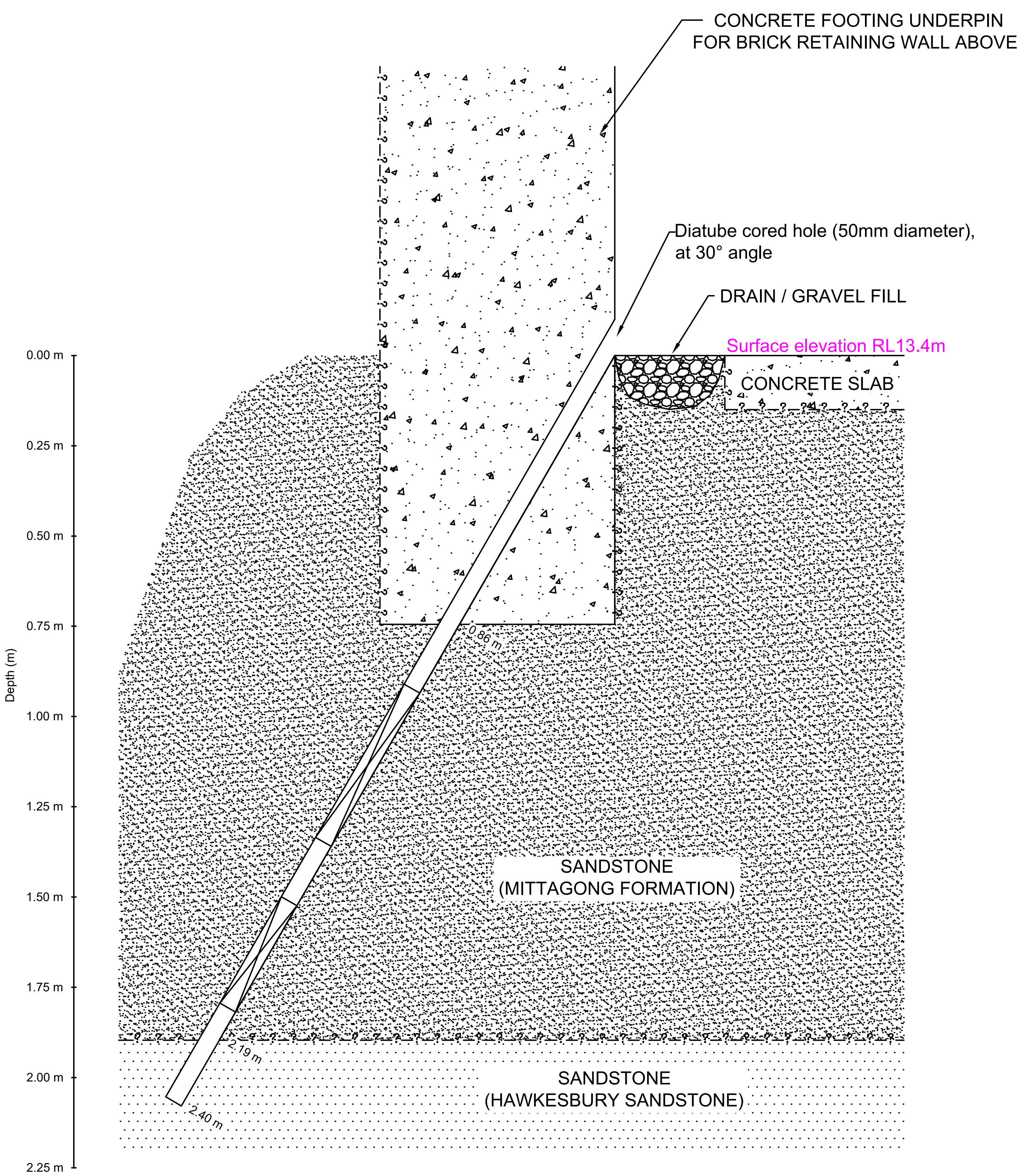
CLIENT: Vertical First Pty Ltd
OFFICE: Sydney
DRAWN BY: JDB
SCALE: 1:15 @ A3
DATE: 15.6.2020

TITLE: **W3 Cross Section**
Proposed Commercial Development
8-10 Lee Street, Haymarket

PROJECT No: 86767.00
DRAWING No: W3
REVISION: 0

SECTION W4-W4'



Note: Depth measurements are along the length of the hole.

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CLIENT: Vertical First Pty Ltd
OFFICE: Sydney
DRAWN BY: JDB
SCALE: 1:15 @ A3
DATE: 15.6.2020

TITLE: **W4 Cross Section**
Proposed Commercial Development
8-10 Lee Street, Haymarket

PROJECT No: 86767.00
DRAWING No: W4
REVISION: 0

Appendix D

Field Work Results

Sampling Methods

Sampling

Sampling is carried out during drilling or test pitting to allow engineering examination (and laboratory testing where required) of the soil or rock.

Disturbed samples taken during drilling provide information on colour, type, inclusions and, depending upon the degree of disturbance, some information on strength and structure.

Undisturbed samples are taken by pushing a thin-walled sample tube into the soil and withdrawing it to obtain a sample of the soil in a relatively undisturbed state. Such samples yield information on structure and strength, and are necessary for laboratory determination of shear strength and compressibility. Undisturbed sampling is generally effective only in cohesive soils.

Test Pits

Test pits are usually excavated with a backhoe or an excavator, allowing close examination of the in-situ soil if it is safe to enter into the pit. The depth of excavation is limited to about 3 m for a backhoe and up to 6 m for a large excavator. A potential disadvantage of this investigation method is the larger area of disturbance to the site.

Large Diameter Augers

Boreholes can be drilled using a rotating plate or short spiral auger, generally 300 mm or larger in diameter commonly mounted on a standard piling rig. The cuttings are returned to the surface at intervals (generally not more than 0.5 m) and are disturbed but usually unchanged in moisture content. Identification of soil strata is generally much more reliable than with continuous spiral flight augers, and is usually supplemented by occasional undisturbed tube samples.

Continuous Spiral Flight Augers

The borehole is advanced using 90-115 mm diameter continuous spiral flight augers which are withdrawn at intervals to allow sampling or in-situ testing. This is a relatively economical means of drilling in clays and sands above the water table. Samples are returned to the surface, or may be collected after withdrawal of the auger flights, but they are disturbed and may be mixed with soils from the sides of the hole. Information from the drilling (as distinct from specific sampling by SPTs or undisturbed samples) is of relatively low reliability, due to the remoulding, possible mixing or softening of samples by groundwater.

Non-core Rotary Drilling

The borehole is advanced using a rotary bit, with water or drilling mud being pumped down the drill rods and returned up the annulus, carrying the drill cuttings. Only major changes in stratification can be determined from the cuttings, together with some information from the rate of penetration. Where drilling mud is used this can mask the cuttings and reliable identification is only possible from separate sampling such as SPTs.

Continuous Core Drilling

A continuous core sample can be obtained using a diamond tipped core barrel, usually with a 50 mm internal diameter. Provided full core recovery is achieved (which is not always possible in weak rocks and granular soils), this technique provides a very reliable method of investigation.

Standard Penetration Tests

Standard penetration tests (SPT) are used as a means of estimating the density or strength of soils and also of obtaining a relatively undisturbed sample. The test procedure is described in Australian Standard 1289, Methods of Testing Soils for Engineering Purposes - Test 6.3.1.

The test is carried out in a borehole by driving a 50 mm diameter split sample tube under the impact of a 63 kg hammer with a free fall of 760 mm. It is normal for the tube to be driven in three successive 150 mm increments and the 'N' value is taken as the number of blows for the last 300 mm. In dense sands, very hard clays or weak rock, the full 450 mm penetration may not be practicable and the test is discontinued.

The test results are reported in the following form.

- In the case where full penetration is obtained with successive blow counts for each 150 mm of, say, 4, 6 and 7 as:

  4,6,7
  N=13

- In the case where the test is discontinued before the full penetration depth, say after 15 blows for the first 150 mm and 30 blows for the next 40 mm as:

  15, 30/40 mm

The results of the SPT tests can be related empirically to the engineering properties of the soils.

Dynamic Cone Penetrometer Tests / Perth Sand Penetrometer Tests

Dynamic penetrometer tests (DCP or PSP) are carried out by driving a steel rod into the ground using a standard weight of hammer falling a specified distance. As the rod penetrates the soil the number of blows required to penetrate each successive 150 mm depth are recorded. Normally there is a depth limitation of 1.2 m, but this may be extended in certain conditions by the use of extension rods. Two types of penetrometer are commonly used.

- Perth sand penetrometer - a 16 mm diameter flat ended rod is driven using a 9 kg hammer dropping 600 mm (AS 1289, Test 6.3.3). This test was developed for testing the density of sands and is mainly used in granular soils and filling.
- Cone penetrometer - a 16 mm diameter rod with a 20 mm diameter cone end is driven using a 9 kg hammer dropping 510 mm (AS 1289, Test 6.3.2). This test was developed initially for pavement subgrade investigations, and correlations of the test results with California Bearing Ratio have been published by various road authorities.

Soil Descriptions

Description and Classification Methods

The methods of description and classification of soils and rocks used in this report are based on Australian Standard AS 1726-1993, Geotechnical Site Investigations Code. In general, the descriptions include strength or density, colour, structure, soil or rock type and inclusions.

Soil Types

Soil types are described according to the predominant particle size, qualified by the grading of other particles present:

Type	Particle size (mm)
Boulder	>200
Cobble	63 - 200
Gravel	2.36 - 63
Sand	0.075 - 2.36
Silt	0.002 - 0.075
Clay	<0.002

The sand and gravel sizes can be further subdivided as follows:

Type	Particle size (mm)
Coarse gravel	20 - 63
Medium gravel	6 - 20
Fine gravel	2.36 - 6
Coarse sand	0.6 - 2.36
Medium sand	0.2 - 0.6
Fine sand	0.075 - 0.2

The proportions of secondary constituents of soils are described as:

Term	Proportion	Example
And	Specify	Clay (60%) and Sand (40%)
Adjective	20 - 35%	Sandy Clay
Slightly	12 - 20%	Slightly Sandy Clay
With some	5 - 12%	Clay with some sand
With a trace of	0 - 5%	Clay with a trace of sand

Definitions of grading terms used are:

- Well graded - a good representation of all particle sizes
- Poorly graded - an excess or deficiency of particular sizes within the specified range
- Uniformly graded - an excess of a particular particle size
- Gap graded - a deficiency of a particular particle size with the range

Cohesive Soils

Cohesive soils, such as clays, are classified on the basis of undrained shear strength. The strength may be measured by laboratory testing, or estimated by field tests or engineering examination. The strength terms are defined as follows:

Description	Abbreviation	Undrained shear strength (kPa)
Very soft	vs	<12
Soft	s	12 - 25
Firm	f	25 - 50
Stiff	st	50 - 100
Very stiff	vst	100 - 200
Hard	h	>200

Cohesionless Soils

Cohesionless soils, such as clean sands, are classified on the basis of relative density, generally from the results of standard penetration tests (SPT), cone penetration tests (CPT) or dynamic penetrometers (PSP). The relative density terms are given below:

Relative Density	Abbreviation	SPT N value	CPT qc value (MPa)
Very loose	vl	<4	<2
Loose	l	4 - 10	2 -5
Medium dense	md	10 - 30	5 - 15
Dense	d	30 - 50	15 - 25
Very dense	vd	>50	>25

Soil Descriptions

Soil Origin

It is often difficult to accurately determine the origin of a soil. Soils can generally be classified as:

- Residual soil - derived from in-situ weathering of the underlying rock;
- Transported soils - formed somewhere else and transported by nature to the site; or
- Filling - moved by man.

Transported soils may be further subdivided into:

- Alluvium - river deposits
- Lacustrine - lake deposits
- Aeolian - wind deposits
- Littoral - beach deposits
- Estuarine - tidal river deposits
- Talus - scree or coarse colluvium
- Slopewash or Colluvium - transported downslope by gravity assisted by water. Often includes angular rock fragments and boulders.

Rock Strength

Rock strength is defined by the Point Load Strength Index ($Is_{(50)}$) and 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 test procedure is described by Australian Standard 4133.4.1 - 2007. The terms used to describe rock strength are as follows:

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

* Assumes a ratio of 20:1 for UCS to $Is_{(50).}$ It should be noted that the UCS to $Is_{(50)}$ ratio varies significantly for different rock types and specific ratios should be determined for each site.

Degree of Weathering

The degree of weathering of rock is classified as follows:

Term	Abbreviation	Description
Extremely weathered	EW	Rock substance has soil properties, i.e. it can be remoulded and classified as a soil but the texture of the original rock is still evident.
Highly weathered	HW	Limonite staining or bleaching affects whole of rock substance and other signs of decomposition are evident. Porosity and strength may be altered as a result of iron leaching or deposition. Colour and strength of original fresh rock is not recognisable
Moderately weathered	MW	Staining and discolouration of rock substance has taken place
Slightly weathered	SW	Rock substance is slightly discoloured but shows little or no change of strength from fresh rock
Fresh stained	Fs	Rock substance unaffected by weathering but staining visible along defects
Fresh	Fr	No signs of decomposition or staining

Degree of Fracturing

The following classification applies to the spacing of natural fractures in diamond drill cores. It includes bedding plane partings, joints and other defects, but excludes drilling breaks.

Term	Description
Fragmented	Fragments of <20 mm
Highly Fractured	Core lengths of 20-40 mm with some fragments
Fractured	Core lengths of 40-200 mm with some shorter and longer sections
Slightly Fractured	Core lengths of 200-1000 mm with some shorter and longer sections
Unbroken	Core lengths mostly > 1000 mm

Rock Descriptions

Rock Quality Designation

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

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

where 'sound' rock is assessed to be rock of low strength or better. 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

For sedimentary rocks the following terms may be used to describe the spacing of bedding partings:

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

Symbols & Abbreviations

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Introduction

These notes summarise abbreviations commonly used on borehole logs and test pit reports.

Drilling or Excavation Methods

C	Core drilling
R	Rotary drilling
SFA	Spiral flight augers
NMLC	Diamond core - 52 mm dia
NQ	Diamond core - 47 mm dia
HQ	Diamond core - 63 mm dia
PQ	Diamond core - 81 mm dia

Water

▷	Water seep
▽	Water level

Sampling and Testing

A	Auger sample
B	Bulk sample
D	Disturbed sample
E	Environmental sample
U_{50}	Undisturbed tube sample (50mm)
W	Water sample
pp	Pocket penetrometer (kPa)
PID	Photo ionisation detector
PL	Point load strength Is(50) MPa
S	Standard Penetration Test
V	Shear vane (kPa)

Description of Defects in Rock

The abbreviated descriptions of the defects should be in the following order: Depth, Type, Orientation, Coating, Shape, Roughness and Other. Drilling and handling breaks are not usually included on the logs.

Defect Type

B	Bedding plane
Cs	Clay seam
Cv	Cleavage
Cz	Crushed zone
Ds	Decomposed seam
F	Fault
J	Joint
Lam	Lamination
Pt	Parting
Sz	Sheared Zone
V	Vein

Orientation

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

h	horizontal
v	vertical
sh	sub-horizontal
sv	sub-vertical

Coating or Infilling Term

cln	clean
co	coating
he	healed
inf	infilled
stn	stained
ti	tight
vn	veneer

Coating Descriptor

ca	calcite
cbs	carbonaceous
cly	clay
fe	iron oxide
mn	manganese
slt	silty

Shape

cu	curved
ir	irregular
pl	planar
st	stepped
un	undulating

Roughness

po	polished
ro	rough
sl	slickensided
sm	smooth
vr	very rough

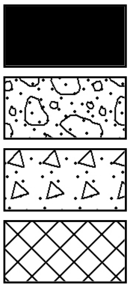
Other

fg	fragmented
bnd	band
qtz	quartz

Symbols & Abbreviations

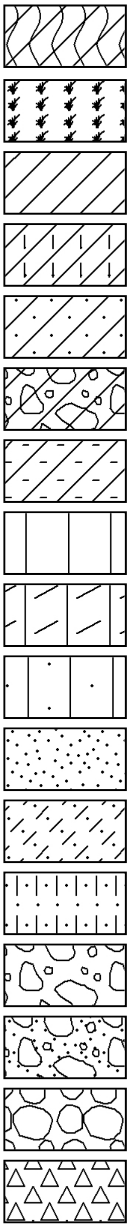
Graphic Symbols for Soil and Rock

General



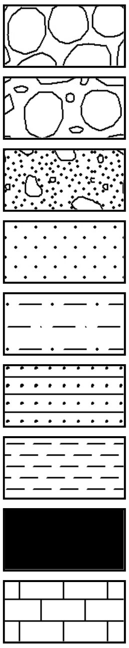
Asphalt
Road base
Concrete
Filling

Soils



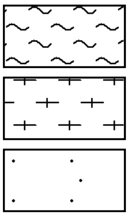
Topsoil
Peat
Clay
Silty clay
Sandy clay
Gravelly clay
Shaly clay
Silt
Clayey silt
Sandy silt
Sand
Clayey sand
Silty sand
Gravel
Sandy gravel
Cobbles, boulders
Talus

Sedimentary Rocks



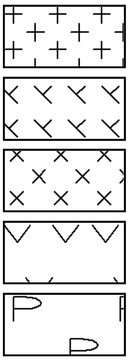
Boulder conglomerate
Conglomerate
Conglomeratic sandstone
Sandstone
Siltstone
Laminite
Mudstone, claystone, shale
Coal
Limestone

Metamorphic Rocks



Slate, phyllite, schist
Gneiss
Quartzite

Igneous Rocks



Granite
Dolerite, basalt, andesite
Dacite, epidote
Tuff, breccia
Porphyry

BOREHOLE LOG

CLIENT: Vertical First Pty Ltd
PROJECT: Proposed Commercial Development
LOCATION: 8-10 Lee Street, Haymarket

SURFACE LEVEL: 20.1 AHD
EASTING: 333968
NORTHING: 6249242
DIP/AZIMUTH: 90°/--

BORE No: BH101
PROJECT No: 86767.03
DATE: 8/4/2020
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Sampling & In Situ Testing: Depth	Sampling & In Situ Testing: Sample	Sampling & In Situ Testing: Results & Comments	Water	VWP Construction Details
		FILL/BALLAST							
20	0.1	FILL/Silty CLAY: medium plasticity, pale brown and grey, with fine angular sandstone gravel, trace brick and organic fragments, w~PL, generally in a loose condition		A	0.1 0.2		PID=2.9 ppm		
	0.4	FILL/SAND and GRAVEL: fine to medium sand, pale grey, fine to coarse angular sandstone cobbles, gravel and bricks, moist, generally in a dense condition		A	0.5 0.6		PID=1.8 ppm		
				A	0.9 1.0		PID=1.2 ppm		
19	1								1
				A	1.4 1.5		PID=3.3 ppm		
	1.8	Bore discontinued at 1.8m - Target depth reached							
18	2								2
17	3								3
16	4								4

RIG: Hand Tools **DRILLER:** Tightsite **LOGGED:** NB **CASING:** Uncased
TYPE OF BORING: Hand auger and crowbar to 1.8m
WATER OBSERVATIONS: No free groundwater observed
REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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Photo D1 – View within borehole BH101, showing the sand and gravel fill encountered at shallow depth below the rail ballast / ground surface level between the rail carriage dormitories.

Photo D2 – View of fill obtained from Borehole BH101.

Douglas Partners Geotechnics / Environment / Groundwater	**Borehole Photographs**	PROJECT: 86867.00
	Proposed Commercial Development	PLATE No: D1
	8-10 Lee Street, Haymarket	REV: 0
	CLIENT: Vertical First Pty Ltd	DATE: 13/05/2020

BOREHOLE LOG

CLIENT: Vertical First Pty Ltd
PROJECT: Proposed Commercial Development
LOCATION: 8-10 Lee Street, Haymarket

SURFACE LEVEL: 20.1 AHD
EASTING: 333976
NORTHING: 6249251
DIP/AZIMUTH: 90°/--

BORE No: BH102
PROJECT No: 86767.03
DATE: 8/4/2020
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	VWP Construction Details
				Type	Depth	Sample	Results & Comments		
		FILL/BALLAST							
20	0.1	FILL/Silty GRAVEL: fine to medium, dark grey, trace sand and clay, moist, generally in a loose condition		A	0.1 0.2		PID=1.1 ppm		
	0.3	FILL/SAND: fine to medium, pale yellow brown and grey, with silt, trace clay lenses, moist, generally in a loose condition		A	0.5 0.6		PID=1.6 ppm		
19	1			A	1.0 1.1		PID=2 ppm		1
				A	1.5 1.6		PID=1.1 ppm		
18	2			A	2.0 2.1		PID=1.7 ppm		2
				A	2.4 2.5		PID=2.4 ppm		
	2.6	FILL/SAND: fine to medium, pale grey, trace silt, moist, generally in a loose condition							
17	2.9 3	FILL/Silty CLAY: medium plasticity, orange, pale yellow and black, trace sand and gravel, with ash, w>PL, generally in a stiff condition		A	3.1 3.2		PID=1.4 ppm		3
		Below 3.5m: grading to dark grey and black, with fine to medium sand and angular gravel		A	3.5 3.6		PID=4.1 ppm		
16	4 4.0	FILL/Sandy GRAVEL: fine to medium gravel, dark grey and black, fine to coarse sand, trace ash, moist, generally in a medium dense condition		A	4.0 4.1		PID=3 ppm		4
	4.5	FILL/Silty CLAY: high plasticity, orange, pale yellow and pale grey, trace ash, w<PL, generally in a firm condition		A	4.5 4.6		PID=2.2 ppm		
	4.7	Sandy CLAY CH: high plasticity, pale grey, w<PL, appears firm, residual		A	4.7 4.8		PID=1.7 ppm		
				A	4.9 5.0		PID=1.1 ppm		
	5.0	Bore discontinued at 5.0m Target depth reached							

RIG: Hand Tools **DRILLER:** NB **LOGGED:** NB **CASING:** Uncased

TYPE OF BORING: Hand Auger to 5m

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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Geotechnics / Environment / Groundwater

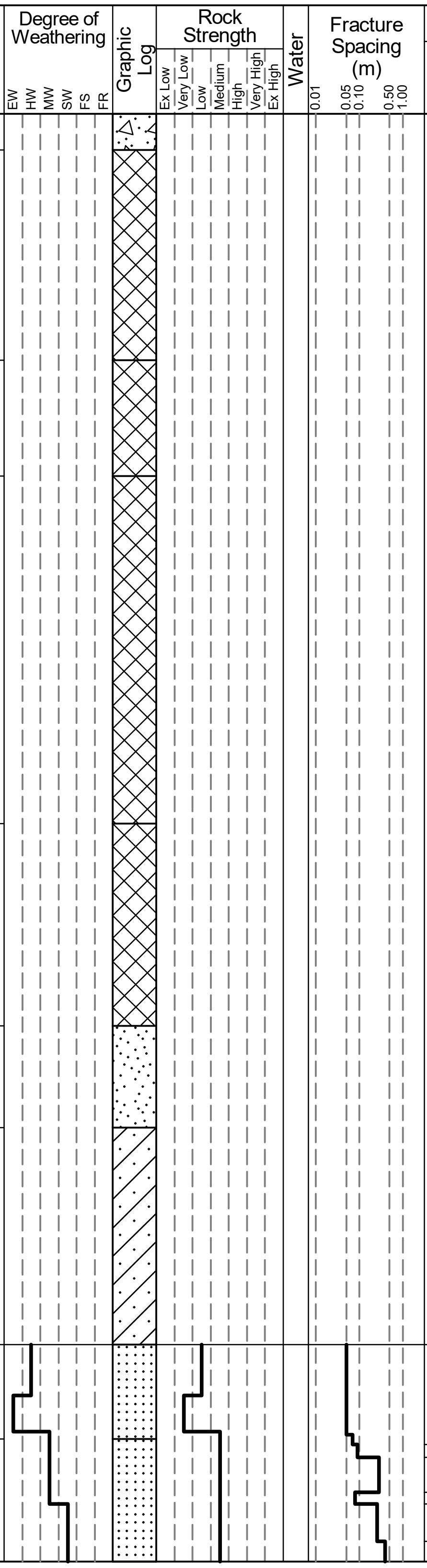
BOREHOLE LOG

CLIENT: Vertical First Pty Ltd
PROJECT: Proposed Commercial Development
LOCATION: 8-10 Lee Street, Haymarket

SURFACE LEVEL: 21.2 AHD
EASTING: 333978
NORTHING: 6249263
DIP/AZIMUTH: 90°/--

BORE No: BH103
PROJECT No: 86767.00
DATE: 15 - 16/4/2020
SHEET 1 OF 2

Depth (m)	Description of Strata	Discontinuities B - Bedding J - Joint S - Shear F - Fault	Type	Core Rec. %	RQD %	Test Results & Comments
0.0	FILL/ CONCRETE					
0.25	FILL/ SAND: fine to medium, pale brown, trace silt, moist, generally in a very loose condition		A A A			PID=3 PID=1.3
1.7	FILL/ Silty CLAY: low plasticity, pale grey-orange and dark grey, with angular sandstone, shale, ironstone gravel, w>PL, generally in a stiff to very stiff condition		A			
2.5	FILL/ Silty CLAY: low to medium plasticity, red brown, w<PL, generally in a firm condition		A A S S			PID=2.4 2,2,2 N = 4 1,0,0 N = 0
4.9	FILL/ Silty SAND: fine to coarse, dark grey and brown, trace fine gravel, moist, generally in a very loose condition		A S			PID=0 3,5,7 N = 12
6.3	SAND SP: fine to medium, pale grey, moist, medium dense, alluvial					
7.0	Sandy CLAY CI-CH: medium to high plasticity, dark red-orange, w>PL, very stiff, residual		A			2,6,14 N = 20
8.5	SANDSTONE: fine grained, dark brown, pale grey and orange-grey, highly weathered with extremely weathered bands, low strength with very low strength bands, fractured, Mittagong Formation	8.5m-8.85m: fractured 8.85m: Ds 250mm 9.12m: Ds 10mm 9.19m: Ds 20mm	C	100	0	
9.15	SANDSTONE: refer following page	9.28m: J90°, st, ro, fe stn 9.52m: B0°, pl, ro, fe co 9.6m: Ds 20mm	C	100	100	
10.0						



RIG: XC 100 **DRILLER:** Terratest **LOGGED:** NB **CASING:** HQ to 8.5m

TYPE OF BORING: Diatube to 0.25m, Hand tools to 2.6m, SFA (TC-bit) to 8.5m, NMLC to 10.8m

WATER OBSERVATIONS: No free groundwater observed during drilling

REMARKS: Standpipe installed: 0-8.5m Blank PVC pipe, 8.5-9.3m Slotted PVC pipe, End cap at 9.3m, Backfill 0-7.5m, Bentonite 7.5-8.5m, Sand filter 8.5-9.3m, Bentonite 9.3-10.8m, Gatic cover at surface. Hole pre-drilled 8 April 2020 to 2.6m depth

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

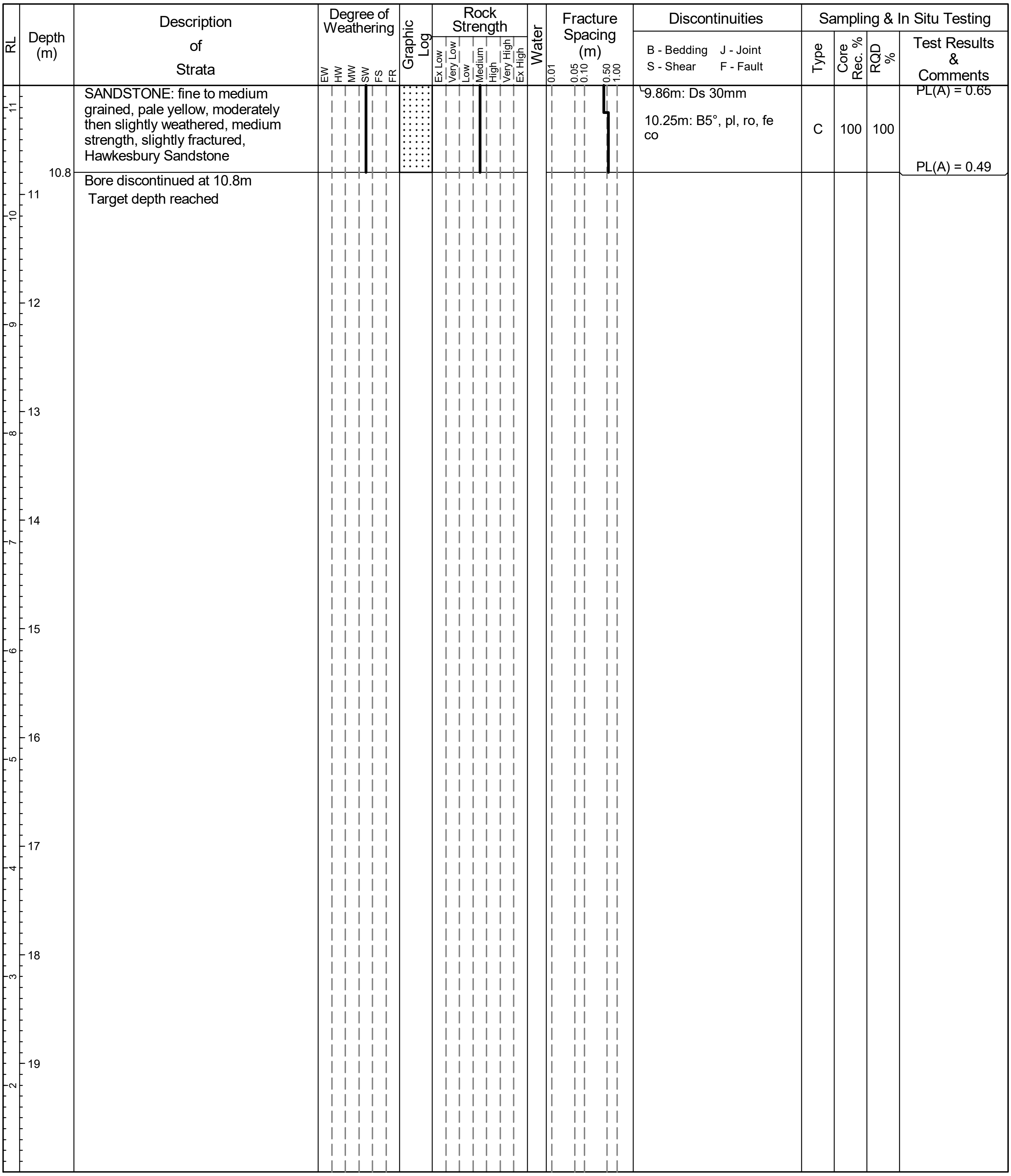
Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Vertical First Pty Ltd
PROJECT: Proposed Commercial Development
LOCATION: 8-10 Lee Street, Haymarket

SURFACE LEVEL: 21.2 AHD
EASTING: 333978
NORTHING: 6249263
DIP/AZIMUTH: 90°/--

BORE No: BH103
PROJECT No: 86767.00
DATE: 15 - 16/4/2020
SHEET 2 OF 2



Depth (m)	Description of Strata	Discontinuities B - Bedding J - Joint S - Shear F - Fault	Type	Core Rec. %	RQD %	Test Results & Comments
	SANDSTONE: fine to medium grained, pale yellow, moderately then slightly weathered, medium strength, slightly fractured, Hawkesbury Sandstone	9.86m: Ds 30mm 10.25m: B5°, pl, ro, fe co	C	100	100	PL(A) = 0.65 PL(A) = 0.49
10.8	Bore discontinued at 10.8m Target depth reached					

RIG: XC 100 **DRILLER:** Terratest **LOGGED:** NB **CASING:** HQ to 8.5m

TYPE OF BORING: Diatube to 0.25m, Hand tools to 2.6m, SFA (TC-bit) to 8.5m, NMLC to 10.8m

WATER OBSERVATIONS: No free groundwater observed during drilling

REMARKS: Standpipe installed: 0-8.5m Blank PVC pipe, 8.5-9.3m Slotted PVC pipe, End cap at 9.3m, Backfill 0-7.5m, Bentonite 7.5-8.5m, Sand filter 8.5-9.3m, Bentonite 9.3-10.8m, Gatic cover at surface. Hole pre-drilled 8 April 2020 to 2.6m depth

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BORE: 103 PROJECT: HAYMARKET APRIL 2020

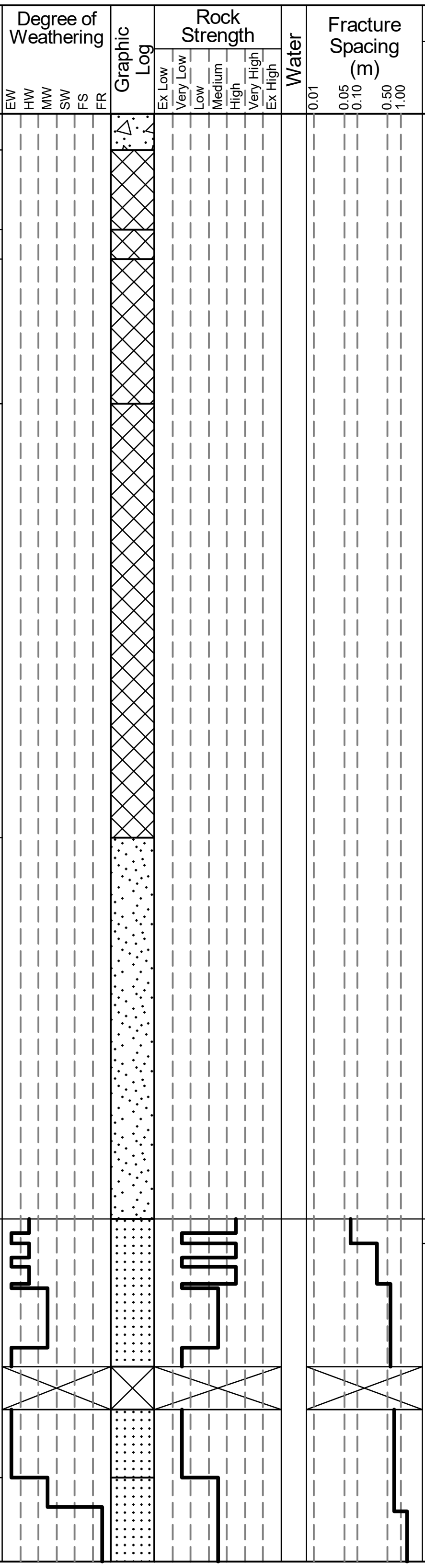
8.5-10.8m

BOREHOLE LOG

CLIENT: Vertical First Pty Ltd
PROJECT: Proposed Commercial Development
LOCATION: 8-10 Lee Street, Haymarket

SURFACE LEVEL: 21.2 AHD
EASTING: 333983
NORTHING: 6249272
DIP/AZIMUTH: 90°/--

BORE No: BH104
PROJECT No: 86767.00
DATE: 14 - 15/4/2020
SHEET 1 OF 2



RL	Depth (m)	Description of Strata	Discontinuities B - Bedding J - Joint S - Shear F - Fault	Type	Core Rec. %	RQD %	Test Results & Comments
21		FILL/ CONCRETE					
	0.25	FILL/ SAND: fine to medium, pale brown, trace silt, moist, generally in a very loose condition		A			PID=0.8
	0.8	FILL/ Silty CLAY: medium plasticity, pale orange, trace fine sand, w>PL, generally in a stiff condition		A			PID=1.2
1	1.0	FILL/ Silty CLAY: low plasticity, pale grey-orange and dark grey, with angular sandstone, shale and ironstone gravel, w>PL, generally in a soft to firm condition		A			PID=5.7
20				A*			PID=0
				S			2,2,2 N = 4
2	2.0	FILL/ Silty CLAY: medium plasticity, red-brown mottled orange, trace fine sand and gravel, w<PL, generally in a soft to firm condition					
19				A			PID=0
3 / 18				S			1,2,2 N = 4
4 / 17				S			2,1,2 N = 3
		Below 4.8m: trace ash and medium sand					
5	5.0	SAND SP: dark yellow-orange, 10% non plastic fines, moist, medium dense, alluvial					
16 / 6 / 15				S			3,5,8 N = 13
7 / 14							
	7.63	SANDSTONE: fine grained, dark brown, pale grey and orange-grey, highly then moderately weathered with extremely weathered bands, high and medium strength with very low strength bands, fractured, Mittagong Formation	7.73m: Ds 70mm 7.8m: Ds 40mm 8.08m: Ds 30mm	C	100	60	PL(A) = 0.84
8 / 13			8.65m: CORE LOSS: 300mm				
9 / 12	8.95			C	80	50	
	9.42	SANDSTONE: refer following page	9.65m: Ds 10mm				

RIG: XC 100 **DRILLER:** Terratest **LOGGED:** NB **CASING:** HQ to 7.63m

TYPE OF BORING: Diatube to 0.25m, Hand tools to 1.1m, SFA (TC-bit) to 7.63m, NMLC to 20m

WATER OBSERVATIONS: No free groundwater observed during drilling

REMARKS: Standpipe installed: 0-14.0m Blank PVC pipe, 14.0-20m Slotted PVC pipe, End cap at 20m, Backfill 0.1-6.5m, Bentonite 6.5-13.5m, Sand filter 13.5-20m, Gatic cover at surface. Hole pre-drilled 8 April 2020 to 1.1m depth. *BD2/140420 replicate: 1.4-1.5m

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

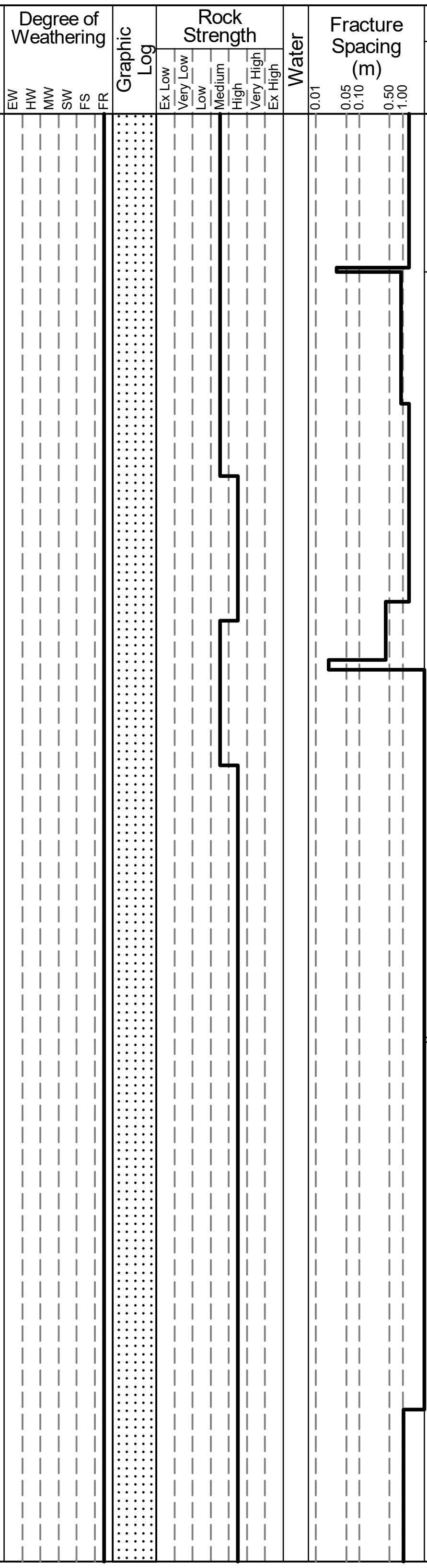
Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Vertical First Pty Ltd
PROJECT: Proposed Commercial Development
LOCATION: 8-10 Lee Street, Haymarket

SURFACE LEVEL: 21.2 AHD
EASTING: 333983
NORTHING: 6249272
DIP/AZIMUTH: 90°/--

BORE No: BH104
PROJECT No: 86767.00
DATE: 14 - 15/4/2020
SHEET 2 OF 2



RL	Depth (m)	Description of Strata	Discontinuities B - Bedding J - Joint S - Shear F - Fault	Type	Core Rec. %	RQD %	Test Results & Comments
11		SANDSTONE: fine to medium grained, pale grey with grey bands, fresh, medium and high strength, slightly fractured then unbroken, Hawkesbury Sandstone					PL(A) = 0.77
				C	100	100	PL(A) = 0.95
10	11		11.06m: Cs 2mm 11.09m: Cs 2mm				
9	12		12m: Cs 4mm	C	100	100	PL(A) = 0.94 PL(A) = 1.2
8	13		13.37m: J60°, pl, he 13.77m-13.84m: B5° (x3), st, ro, cbs co	C	100	95	PL(A) = 0.66
7	14	Between 14.52m-14.58m: band of dark grey siltstone					
6	15			C	100	100	PL(A) = 1.5 PL(A) = 1.2
5	16		>>				
4	17			C	100	100	PL(A) = 1.3
3	18			C	100	100	PL(A) = 1.3
2	19		18.95m: Cs 2mm				PL(A) = 2.6
	20.0	Bore discontinued at 20.0m Target depth reached		C	100	100	PL(A) = 1

RIG: XC 100 **DRILLER:** Terratest **LOGGED:** NB **CASING:** HQ to 7.63m

TYPE OF BORING: Diatube to 0.25m, Hand tools to 1.1m, SFA (TC-bit) to 7.63m, NMLC to 20m

WATER OBSERVATIONS: No free groundwater observed during drilling

REMARKS: Standpipe installed: 0-14.0m Blank PVC pipe, 14.0-20m Slotted PVC pipe, End cap at 20m, Backfill 0.1-6.5m, Bentonite 6.5-13.5m, Sand filter 13.5-20m, Gatic cover at surface. Hole pre-drilled 8 April 2020 to 1.1m depth. *BD2/140420 replicate: 1.4-1.5m

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BORE: 104 PROJECT: HAYMARKET APRIL 2020

7.63-12.0m

BORE: 104 PROJECT: HAYMARKET APRIL 2020

12.0-17.0m

BORE: 104 PROJECT: HAYMARKET APRIL 2020

17-20.0m

BOREHOLE LOG

CLIENT: Vertical First Pty Ltd
PROJECT: Proposed Commercial Development
LOCATION: 8-10 Lee Street, Haymarket

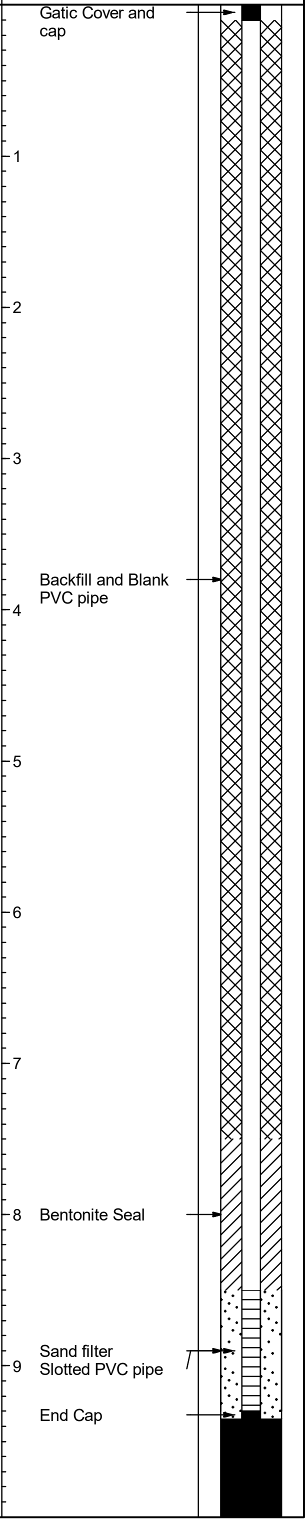
SURFACE LEVEL: 21.2 AHD
EASTING: 333978
NORTHING: 6249263
DIP/AZIMUTH: 90°/--

BORE No: BH103
PROJECT No: 86767.00
DATE: 15 - 16/4/2020
SHEET 1 OF 2

Depth (m)	Description of Strata
0.0	FILL/ CONCRETE
0.25	FILL/ SAND: fine to medium, pale brown, trace silt, moist, generally in a very loose condition
1.7	FILL/ Silty CLAY: low plasticity, pale grey-orange and dark grey, with angular sandstone, shale, ironstone gravel, w>PL, generally in a stiff to very stiff condition
2.5	FILL/ Silty CLAY: low to medium plasticity, red brown, w<PL, generally in a firm condition
4.9	FILL/ Silty SAND: fine to coarse, dark grey and brown, trace fine gravel, moist, generally in a very loose condition
6.3	SAND SP: fine to medium, pale grey, moist, medium dense, alluvial
7.0	Sandy CLAY CI-CH: medium to high plasticity, dark red-orange, w>PL, very stiff, residual
8.5	SANDSTONE: fine grained, dark brown, pale grey and orange-grey, highly weathered with extremely weathered bands, low strength with very low strength bands, fractured, Mittagong Formation
9.15	SANDSTONE: refer following page
10.0	

Type	Depth	Results & Comments
A	0.25 0.4	PID=3
A	1.0 1.1	
A	1.5 1.6	PID=1.3
A	2.0 2.1	
A	2.5 2.6	PID=2.4
A	2.9 3.0	
S	3.0 3.45	2,2,2 N = 4
S	4.5 4.95	1,0,0 N = 0
A	5.0 5.1	PID=0
S	6.0 6.45	3,5,7 N = 12
A	7.5 7.95	2,6,14 N = 20
C	8.5 9.18	
C	9.18	

Well Construction Details



RIG: XC 100 **DRILLER:** Terratest **LOGGED:** NB **CASING:** HQ to 8.5m

TYPE OF BORING: Diatube to 0.25m, Hand tools to 2.6m, SFA (TC-bit) to 8.5m, NMLC to 10.8m

WATER OBSERVATIONS: No free groundwater observed during drilling

REMARKS: Standpipe installed: 0-8.5m Blank PVC pipe, 8.5-9.3m Slotted PVC pipe, End cap at 9.3m, Backfill 0-7.5m, Bentonite 7.5-8.5m, Sand filter 8.5-9.3m, Bentonite 9.3-10.8m, Gatic cover at surface. Hole pre-drilled 8 April 2020 to 2.6m depth

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Vertical First Pty Ltd
PROJECT: Proposed Commercial Development
LOCATION: 8-10 Lee Street, Haymarket

SURFACE LEVEL: 21.2 AHD
EASTING: 333978
NORTHING: 6249263
DIP/AZIMUTH: 90°/--

BORE No: BH103
PROJECT No: 86767.00
DATE: 15 - 16/4/2020
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Sampling & In Situ Testing: Depth	Sampling & In Situ Testing: Sample	Sampling & In Situ Testing: Results & Comments	Water	Well Construction Details
		SANDSTONE: fine to medium grained, pale yellow, moderately then slightly weathered, medium strength, slightly fractured, Hawkesbury Sandstone		C	9.96 10.75		PL(A) = 0.65 PL(A) = 0.49		Bentonite plug
	10.8	Bore discontinued at 10.8m Target depth reached			10.8				

RIG: XC 100 **DRILLER:** Terratest **LOGGED:** NB **CASING:** HQ to 8.5m

TYPE OF BORING: Diatube to 0.25m, Hand tools to 2.6m, SFA (TC-bit) to 8.5m, NMLC to 10.8m

WATER OBSERVATIONS: No free groundwater observed during drilling

REMARKS: Standpipe installed: 0-8.5m Blank PVC pipe, 8.5-9.3m Slotted PVC pipe, End cap at 9.3m, Backfill 0-7.5m, Bentonite 7.5-8.5m, Sand filter 8.5-9.3m, Bentonite 9.3-10.8m, Gatic cover at surface. Hole pre-drilled 8 April 2020 to 2.6m depth

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

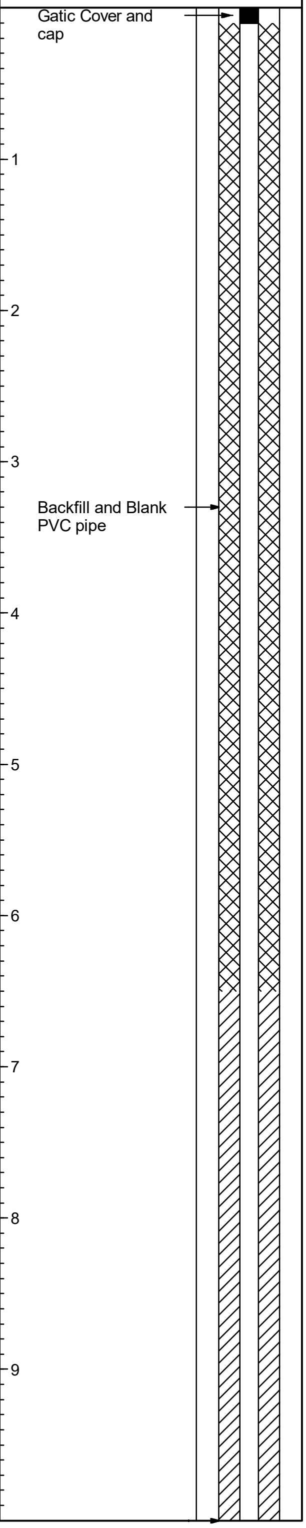
BOREHOLE LOG

CLIENT: Vertical First Pty Ltd
PROJECT: Proposed Commercial Development
LOCATION: 8-10 Lee Street, Haymarket

SURFACE LEVEL: 21.2 AHD
EASTING: 333983
NORTHING: 6249272
DIP/AZIMUTH: 90°/--

BORE No: BH104
PROJECT No: 86767.00
DATE: 14 - 15/4/2020
SHEET 1 OF 2

Depth (m)	Description of Strata	Type	Depth	Sample	Results & Comments	Water
	FILL/ CONCRETE					
0.25	FILL/ SAND: fine to medium, pale brown, trace silt, moist, generally in a very loose condition	A	0.25 0.4		PID=0.8	
0.8	FILL/ Silty CLAY: medium plasticity, pale orange, trace fine sand, w>PL, generally in a stiff condition	A	0.8 0.9		PID=1.2	
1.0	FILL/ Silty CLAY: low plasticity, pale grey-orange and dark grey, with angular sandstone, shale and ironstone gravel, w>PL, generally in a soft to firm condition	A	1.0 1.1		PID=5.7	
		A*	1.4 1.5		PID=0	
		S	1.5 1.95		2,2,2 N = 4	
2.0	FILL/ Silty CLAY: medium plasticity, red-brown mottled orange, trace fine sand and gravel, w<PL, generally in a soft to firm condition	A	2.8 2.9		PID=0	
		S	3.0 3.45		1,2,2 N = 4	
	Below 4.8m: trace ash and medium sand	S	4.5 4.95		2,1,2 N = 3	
5.0	SAND SP: dark yellow-orange, 10% non plastic fines, moist, medium dense, alluvial	S	6.0 6.45		3,5,8 N = 13	
7.63	SANDSTONE: fine grained, dark brown, pale grey and orange-grey, highly then moderately weathered with extremely weathered bands, high and medium strength with very low strength bands, fractured, Mittagong Formation	C	7.63 8.24 8.65		PL(A) = 0.84	
8.95		C				
9.42	SANDSTONE: refer following page					



RIG: XC 100 **DRILLER:** Terratest **LOGGED:** NB **CASING:** HQ to 7.63m
TYPE OF BORING: Diatube to 0.25m, Hand tools to 1.1m, SFA (TC-bit) to 7.63m, NMLC to 20m
WATER OBSERVATIONS: No free groundwater observed during drilling
REMARKS: Standpipe installed: 0-14.0m Blank PVC pipe, 14.0-20m Slotted PVC pipe, End cap at 20m, Backfill 0.1-6.5m, Bentonite 6.5-13.5m, Sand filter 13.5-20m, Gatic cover at surface. Hole pre-drilled 8 April 2020 to 1.1m depth. *BD2/140420 replicate: 1.4-1.5m

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

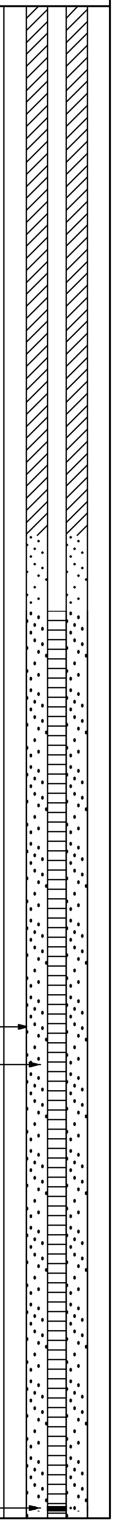
BOREHOLE LOG

CLIENT: Vertical First Pty Ltd
PROJECT: Proposed Commercial Development
LOCATION: 8-10 Lee Street, Haymarket

SURFACE LEVEL: 21.2 AHD
EASTING: 333983
NORTHING: 6249272
DIP/AZIMUTH: 90°/--

BORE No: BH104
PROJECT No: 86767.00
DATE: 14 - 15/4/2020
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
		SANDSTONE: fine to medium grained, pale grey with grey bands, fresh, medium and high strength, slightly fractured then unbroken, Hawkesbury Sandstone			9.96		PL(A) = 0.77		Bentonite Seal
				C	10.1				
11									
	11				10.96		PL(A) = 0.95		11
10									
				C	11.65				
	12				11.96		PL(A) = 0.94		12
9									
	13				12.96		PL(A) = 1.2		13
8				C	13.2				
	14				13.96		PL(A) = 0.66		14
7									
		Between 14.52m-14.58m: band of dark grey siltstone							
				C	14.69				
	15				14.96		PL(A) = 1.5		15
6									
	16				15.96		PL(A) = 1.2		16
5				C	16.23				
									Sand filter
	17				16.96		PL(A) = 1.3		17 Slotted PVC pipe
4									
				C	17.61				
	18				17.96		PL(A) = 1.3		18
3									
	19				18.96		PL(A) = 2.6		19
2				C	19.23				
		Bore discontinued at 20.0m			19.9		PL(A) = 1		
	20.0	Target depth reached							End cap



RIG: XC 100 **DRILLER:** Terratest **LOGGED:** NB **CASING:** HQ to 7.63m

TYPE OF BORING: Diatube to 0.25m, Hand tools to 1.1m, SFA (TC-bit) to 7.63m, NMLC to 20m

WATER OBSERVATIONS: No free groundwater observed during drilling

REMARKS: Standpipe installed: 0-14.0m Blank PVC pipe, 14.0-20m Slotted PVC pipe, End cap at 20m, Backfill 0.1-6.5m, Bentonite 6.5-13.5m, Sand filter 13.5-20m, Gatic cover at surface. Hole pre-drilled 8 April 2020 to 1.1m depth. *BD2/140420 replicate: 1.4-1.5m

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Vertical First Pty Ltd
PROJECT: Proposed Commercial Development
LOCATION: 8-10 Lee Street, Haymarket

SURFACE LEVEL: 20.1 AHD
EASTING: 333988
NORTHING: 6249270
DIP/AZIMUTH: 90°/--

BORE No: BH105
PROJECT No: 86767.03
DATE: 7/4/2020
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Sampling & In Situ Testing: Type	Sampling & In Situ Testing: Depth	Sampling & In Situ Testing: Sample	Sampling & In Situ Testing: Results & Comments	Water	VWP Construction Details
20	0.05	FILL/BALLAST	A	0.05 0.1		PID=2.5 ppm		
	0.1	FILL/Silty CLAY: medium plasticity, dark grey, with angular gravel and organic matter and fragments of plastic, w~PL, generally in a firm condition						
	0.37	BRICK PAVEMENT						
		CONCRETE: grey, orange and yellow-brown, with inclusions of sub-angular to sub-rounded, high strength sandstone						
19	1							1
18	2							2
17	3							3
16	4							4

RIG: Proline
DRILLER: Tightsite
LOGGED: NB
CASING: HW to 3.1m
TYPE OF BORING: Diatube to 3.1m, NMLC to 6.5m
WATER OBSERVATIONS: No free groundwater observed
REMARKS: * Field replicate BD1/070420 taken from 0.05-0.1m

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Vertical First Pty Ltd
PROJECT: Proposed Commercial Development
LOCATION: 8-10 Lee Street, Haymarket

SURFACE LEVEL: 20.1 AHD
EASTING: 333988
NORTHING: 6249270
DIP/AZIMUTH: 90°/--

BORE No: BH105
PROJECT No: 86767.03
DATE: 7/4/2020
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	VWP Construction Details
15 14	6 6.3	CONCRETE: grey, orange and yellow-brown, with inclusions of sub-angular to sub-rounded, high strength sandstone *(continued)*							6
	6.5	SANDSTONE: fine to medium grained, pale yellow, highly weathered, medium to high strength, Mittagong Formation							
13 12 11	7 8 9	Bore discontinued at 6.5m - Target depth reached							7 8 9

RIG: Proline **DRILLER:** Tightsite **LOGGED:** NB **CASING:** HW to 3.1m

TYPE OF BORING: Diatube to 3.1m, NMLC to 6.5m

WATER OBSERVATIONS: No free groundwater observed

REMARKS: * Field replicate BD1/070420 taken from 0.05-0.1m

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
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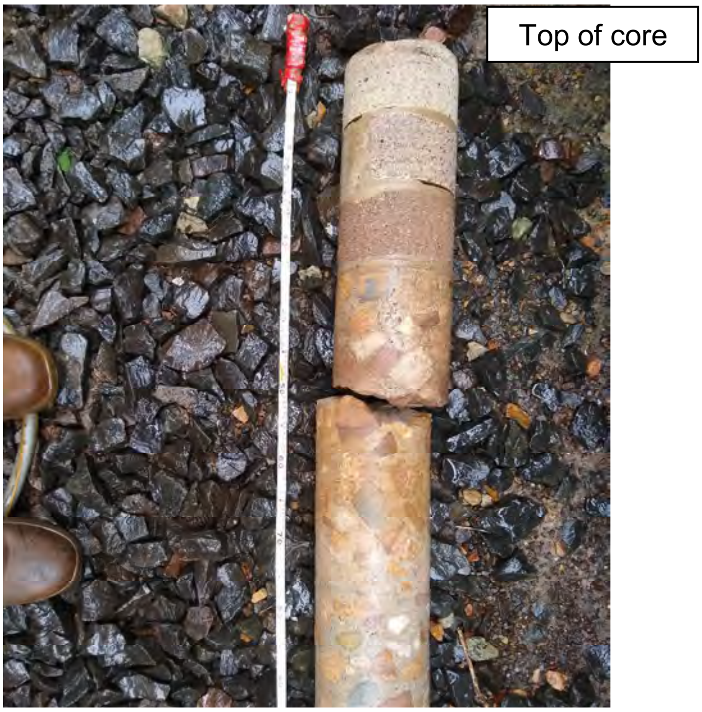


Photo D3 – View of concrete core from Borehole BH105 (below 0.1 m depth), showing a brick pavement mortared onto concrete with high strength sandstone inclusions (cyclopean concrete).

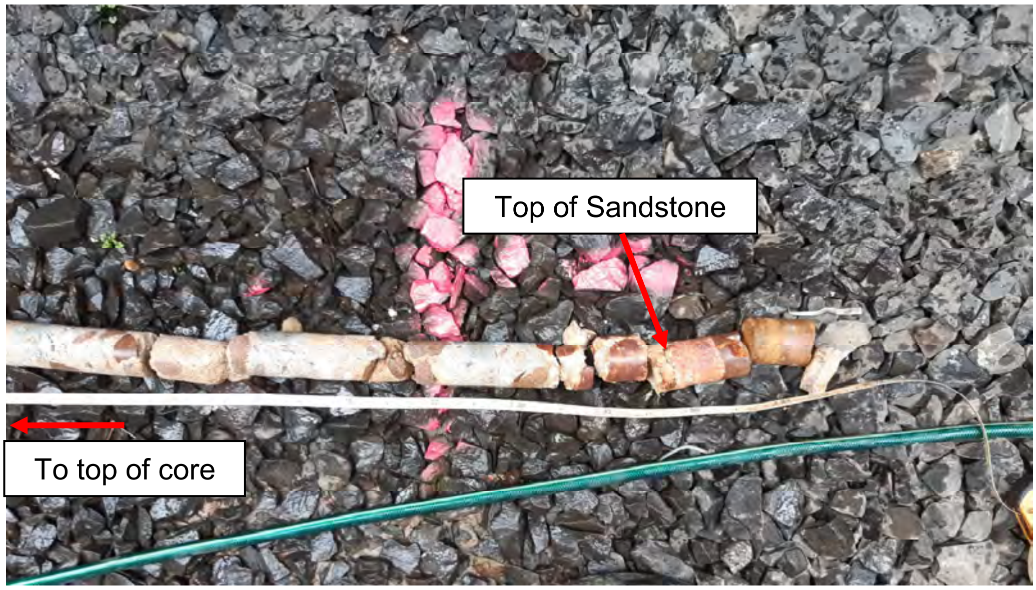


Photo D4 – View of concrete core from Borehole BH105 (below about 5.6 m depth), showing concrete with high strength sandstone inclusions (cyclopean concrete) overlying weathered fine to medium grained sandstone.

Douglas Partners Geotechnics / Environment / Groundwater	**Borehole Photographs**	PROJECT: 86867.00
	Proposed Commercial Development	PLATE No: D2
	8-10 Lee Street, Haymarket	REV: 0
	CLIENT: Vertical First Pty Ltd	DATE: 13/05/2020

BOREHOLE LOG

CLIENT: Vertical First Pty Ltd
PROJECT: Proposed Commercial Development
LOCATION: 8-10 Lee Street, Haymarket

SURFACE LEVEL: 15.5 AHD
EASTING: 333980
NORTHING: 6249282
DIP/AZIMUTH: 90°/--

BORE No: BH106
PROJECT No: 86767.03
DATE: 7/4/2020
SHEET 1 OF 1

Depth (m)	Description of Strata
	CONCRETE: grey, 2-10mm igneous aggregate
0.16	
0.2	FILL/SAND: fine to coarse, pale brown, trace seashells, moist
0.3	FILL/CLAY: medium plasticity, brown, red and grey, with fine to coarse sand, trace fine to medium gravel, fine to medium igneous rail ballast, seashells and coal, w~PL
0.4	FILL/SAND: fine to coarse, dark brown, with igneous rail ballast, trace coal, dry, hydrocarbon odour
0.8	FILL/CLAY: medium plasticity, pale grey, red and brown, trace fine to medium gravel, w~PL Below 0.5m: apparently in a stiff condition At 0.6m: tile fragment
1.25	CLAY CI-CH: medium to high plasticity, pale grey mottled red, trace fine to medium ironstone gravel, w<PL to w~PL, apparently very stiff, residual Below 1.1m: w<PL
	Bore discontinued at 1.25m - Target depth reached

Type	Depth	Sample	Results & Comments
E	0.16		
E	0.2		PID=2 ppm
E	0.3		PID=1 ppm
E	0.4		PID=1 ppm
	0.5		
E	0.9		PID=1 ppm
	1.0		
E	1.15		PID<1 ppm
	1.25		

RIG: Hand Tools **DRILLER:** AS/AMS **LOGGED:** AS **CASING:** Uncased
TYPE OF BORING: Diatube to 0.16m, Hand auger to 1.25m
WATER OBSERVATIONS: No free groundwater observed
REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

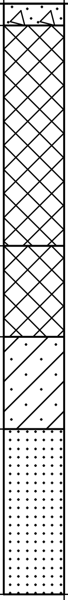
BOREHOLE LOG

CLIENT: Vertical First Pty Ltd
PROJECT: Proposed Commercial Development
LOCATION: 8-10 Lee Street, Haymarket

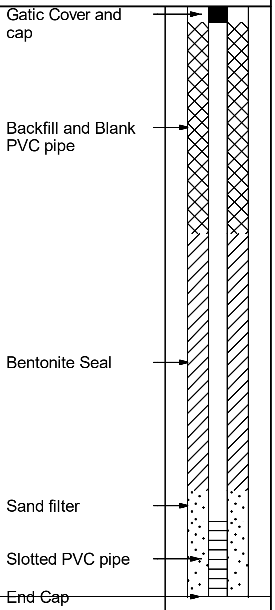
SURFACE LEVEL: 15.5 AHD
EASTING: 333945
NORTHING: 6249270
DIP/AZIMUTH: 90°/--

BORE No: BH107A
PROJECT No: 86767.00
DATE: 17/5/2020
SHEET 1 OF 1

Depth (m)	Description of Strata	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water
0.14	CONCRETE: grey, angular to subangular aggregate to 15mm, negligible voids, 9 mm steel reinforcement at 0.08 m depth					
1.6	FILL/ Sandy CLAY: low to medium plasticity, dark red and brown, fine to medium, with angular igneous and sandstone gravel, trace silt, w<PL, generally in a stiff condition Below 1.0m: grading to medium plasticity, dark grey, trace sandstone gravel, w~PL					
2.2	FILL/ Silty CLAY: medium to high plasticity, pale grey-yellow, with fine to medium sand, w~PL, generally in a stiff condition					▼ 05-06-20
2.81	Sandy CLAY CL: low to medium plasticity, pale yellow, fine to medium, w~PL, apparently stiff to very stiff, residual Below 2.6m: yellow-brown					
3.9	SANDSTONE: fine to medium grained, pale grey and red-brown, high strength with very low then low strength bands, highly weathered, fractured, Mittagong Formation					
	Bore discontinued at 3.9m - Target depth reached					



Well Construction Details



RIG: Miniprobe **DRILLER:** Terratest **LOGGED:** NB **CASING:** NA

TYPE OF BORING: SFA (TC-bit) to 3.9m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Standpipe installed: 0-3.4m Blank PVC pipe, 3.4-3.9m Slotted PVC pipe, End cap at 3.9m, Sand backfill 0-1.5m, Bentonite 1.5-3.2m, Sand filter 3.2-3.9m, Gatic cover at surface.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

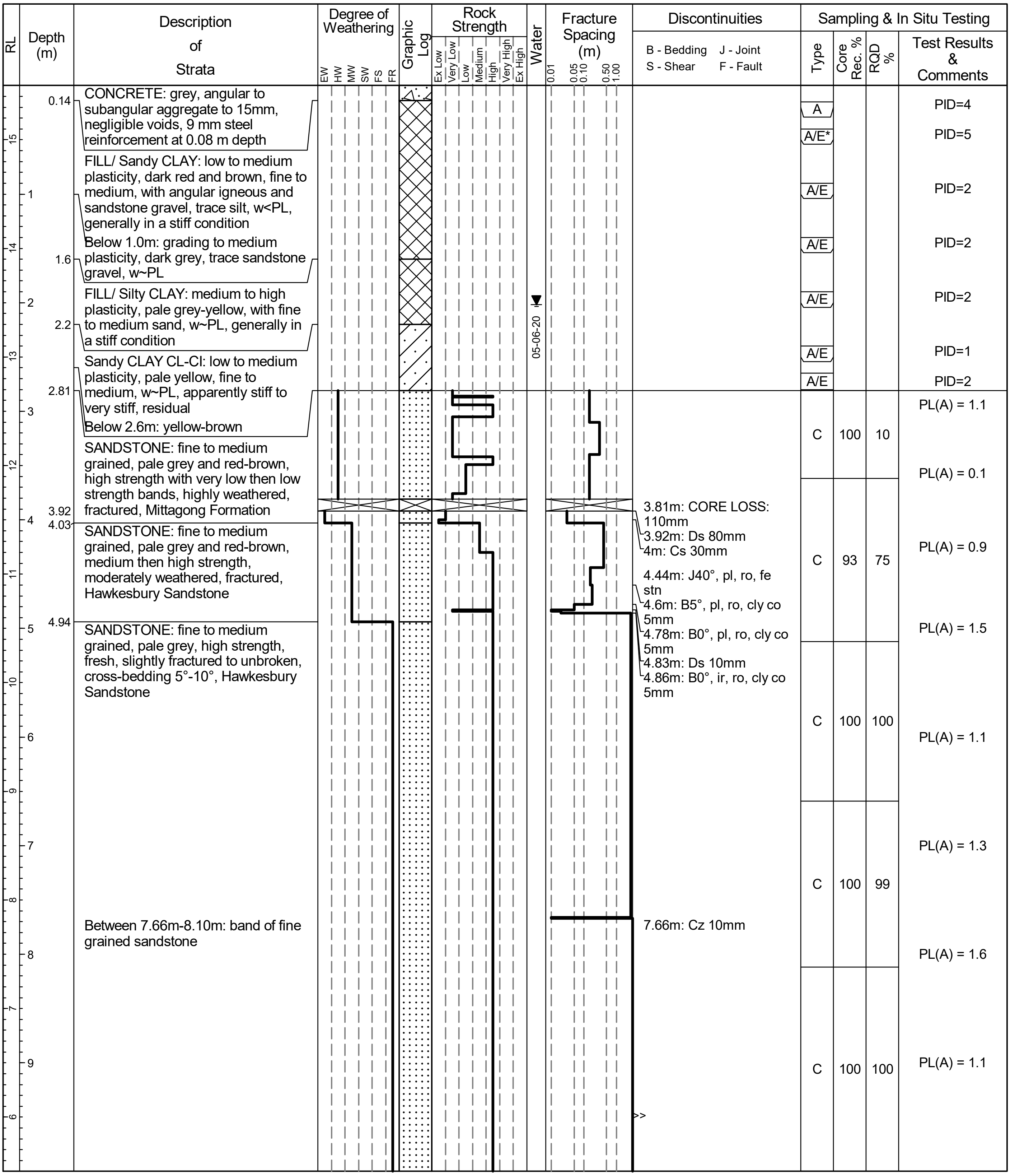
Douglas Partners
Geotechnics | Environment | Groundwater

BOREHOLE LOG

CLIENT: Vertical First Pty Ltd
PROJECT: Proposed Commercial Development
LOCATION: 8-10 Lee Street, Haymarket

SURFACE LEVEL: 15.5 AHD
EASTING: 333945
NORTHING: 6249272
DIP/AZIMUTH: 90°/--

BORE No: BH107B
PROJECT No: 86767.00
DATE: 16/5/2020
SHEET 1 OF 2



Depth (m)	Description of Strata
0.14	CONCRETE: grey, angular to subangular aggregate to 15mm, negligible voids, 9 mm steel reinforcement at 0.08 m depth
1.6	FILL/ Sandy CLAY: low to medium plasticity, dark red and brown, fine to medium, with angular igneous and sandstone gravel, trace silt, w<PL, generally in a stiff condition Below 1.0m: grading to medium plasticity, dark grey, trace sandstone gravel, w~PL
2.2	FILL/ Silty CLAY: medium to high plasticity, pale grey-yellow, with fine to medium sand, w~PL, generally in a stiff condition
2.81	Sandy CLAY CL-CI: low to medium plasticity, pale yellow, fine to medium, w~PL, apparently stiff to very stiff, residual Below 2.6m: yellow-brown
3.92	SANDSTONE: fine to medium grained, pale grey and red-brown, high strength with very low then low strength bands, highly weathered, fractured, Mittagong Formation
4.03	
4.94	SANDSTONE: fine to medium grained, pale grey and red-brown, medium then high strength, moderately weathered, fractured, Hawkesbury Sandstone
	SANDSTONE: fine to medium grained, pale grey, high strength, fresh, slightly fractured to unbroken, cross-bedding 5°-10°, Hawkesbury Sandstone Between 7.66m-8.10m: band of fine grained sandstone

Discontinuities

B - Bedding J - Joint
S - Shear F - Fault

3.81m: CORE LOSS: 110mm
3.92m: Ds 80mm
4m: Cs 30mm
4.44m: J40°, pl, ro, fe stn
4.6m: B5°, pl, ro, cly co 5mm
4.78m: B0°, pl, ro, cly co 5mm
4.83m: Ds 10mm
4.86m: B0°, ir, ro, cly co 5mm
7.66m: Cz 10mm

Sampling & In Situ Testing

Type	Core Rec. %	RQD %	Test Results & Comments
A			PID=4
A/E*			PID=5
A/E			PID=2
A/E			PID=2
A/E			PID=2
A/E			PID=1
A/E			PID=2
C	100	10	PL(A) = 1.1 PL(A) = 0.1
C	93	75	PL(A) = 0.9 PL(A) = 1.5
C	100	100	PL(A) = 1.1
C	100	99	PL(A) = 1.3 PL(A) = 1.6
C	100	100	PL(A) = 1.1

RIG: XC **DRILLER:** Terratest **LOGGED:** KR **CASING:** HWT to 2.8m

TYPE OF BORING: Diatube (200 mm) to 0.14m, SFA (TC-bit) to 2.81m, NMLC coring to 15.0m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: *BD1/20200516 taken at 0.4-0.5m. Standpipe installed: 0-5.5m Blank PVC pipe, 5.5-11.0m Slotted PVC pipe, End cap at 11.0m, Sand backfill 0-2.3m, Bentonite 2.3-5.0m, Sand filter 5.0-11.0m, Bentonite 11.0-12.0m, Backfill 12.0-15.0m, Gatic cover at surface.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Vertical First Pty Ltd
PROJECT: Proposed Commercial Development
LOCATION: 8-10 Lee Street, Haymarket

SURFACE LEVEL: 15.5 AHD
EASTING: 333945
NORTHING: 6249272
DIP/AZIMUTH: 90°/--

BORE No: BH107B
PROJECT No: 86767.00
DATE: 16/5/2020
SHEET 2 OF 2

Depth (m)	Description of Strata	Discontinuities (B - Bedding, J - Joint, S - Shear, F - Fault)	Type	Core Rec. %	RQD %	Test Results & Comments
	SANDSTONE: fine to medium grained, pale grey, high strength, fresh, slightly fractured to unbroken, cross-bedding 5°-10°, Hawkesbury Sandstone *(continued)*		C	100	100	PL(A) = 1.3
11						PL(A) = 1.1
		11.3m: B0°, pl, ro, cbs co	C	100	100	
12						PL(A) = 1.1
	Between 12.60m-13.78m: band of fine grained sandstone					
13						PL(A) = 1
		13.74m: B5°, pl, ro, cly co 5mm				
14						PL(A) = 1.2
			C	100	100	
15.0	Bore discontinued at 15.0m - Target depth reached					

RIG: XC **DRILLER:** Terratest **LOGGED:** KR **CASING:** HWT to 2.8m

TYPE OF BORING: Diatube (200 mm) to 0.14m, SFA (TC-bit) to 2.81m, NMLC coring to 15.0m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: *BD1/20200516 taken at 0.4-0.5m. Standpipe installed: 0-5.5m Blank PVC pipe, 5.5-11.0m Slotted PVC pipe, End cap at 11.0m, Sand backfill 0-2.3m, Bentonite 2.3-5.0m, Sand filter 5.0-11.0m, Bentonite 11.0-12.0m, Backfill 12.0-15.0m, Gatic cover at surface.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BORE: 107B PROJECT: HAYMARKET MAY 2020

2.81 – 7.0 m

BORE: 107B PROJECT: HAYMARKET MAY 2020

7.0 – 12.0 m

BORE: 107B PROJECT: HAYMARKET MAY 2020

12.0 – 15.0 m

BOREHOLE LOG

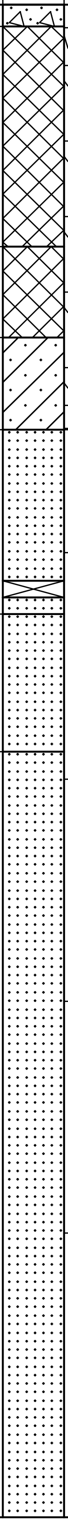
CLIENT: Vertical First Pty Ltd
PROJECT: Proposed Commercial Development
LOCATION: 8-10 Lee Street, Haymarket

SURFACE LEVEL: 15.5 AHD
EASTING: 333945
NORTHING: 6249272
DIP/AZIMUTH: 90°/--

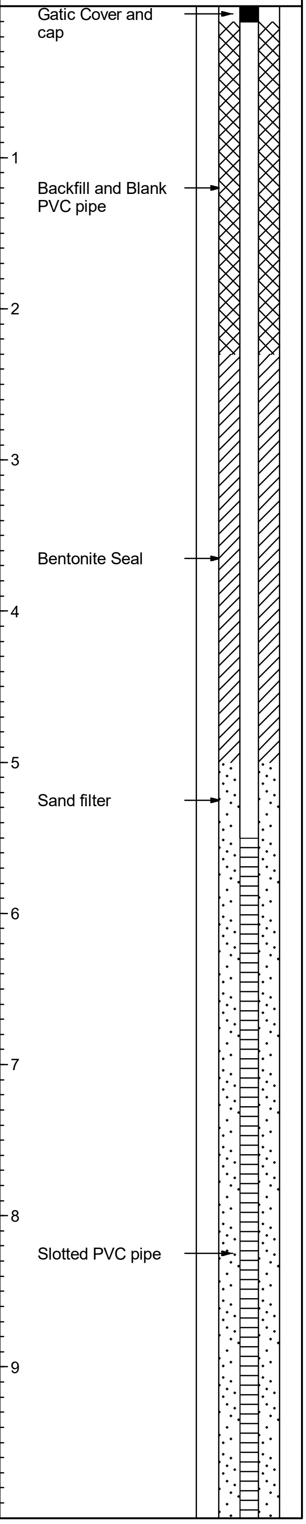
BORE No: BH107B
PROJECT No: 86767.00
DATE: 16/5/2020
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Type	Depth	Sample	Results & Comments	Water
	0.14	CONCRETE: grey, angular to subangular aggregate to 15mm, negligible voids, 9 mm steel reinforcement at 0.08 m depth	A	0.15 0.2		PID=4	
15		FILL/ Sandy CLAY: low to medium plasticity, dark red and brown, fine to medium, with angular igneous and sandstone gravel, trace silt, w<PL, generally in a stiff condition	A/E*	0.4 0.5		PID=5	
	1	Below 1.0m: grading to medium plasticity, dark grey, trace sandstone gravel, w~PL	A/E	0.9 1.0		PID=2	
14			A/E	1.4 1.5		PID=2	
	1.6 2	FILL/ Silty CLAY: medium to high plasticity, pale grey-yellow, with fine to medium sand, w~PL, generally in a stiff condition	A/E	1.9 2.0		PID=2	05-06-20
13	2.2	Sandy CLAY CL-CI: low to medium plasticity, pale yellow, fine to medium, w~PL, apparently stiff to very stiff, residual	A/E	2.4 2.5		PID=1	
		Below 2.6m: yellow-brown	A/E	2.65 2.8		PID=2	
	2.81 3	SANDSTONE: fine to medium grained, pale grey and red-brown, high strength with very low then low strength bands, highly weathered, fractured, Mittagong Formation	C	2.81 2.94		PL(A) = 1.1	
12				3.57 3.62		PL(A) = 0.1	
	3.92 4 4.03	SANDSTONE: fine to medium grained, pale grey and red-brown, medium then high strength, moderately weathered, fractured, Hawkesbury Sandstone	C	4.25		PL(A) = 0.9	
11							
	4.94 5	SANDSTONE: fine to medium grained, pale grey, high strength, fresh, slightly fractured to unbroken, cross-bedding 5°-10°, Hawkesbury Sandstone		5.0 5.12		PL(A) = 1.5	
10			C				
	6			6.0		PL(A) = 1.1	
9				6.59			
	7			7.0		PL(A) = 1.3	
8			C				
		Between 7.66m-8.10m: band of fine grained sandstone					
	8			8.0 8.12		PL(A) = 1.6	
7							
	9		C	9.0		PL(A) = 1.1	
6							
				10.0		PL(A) = 1.3	

Graphic Log



Well Construction Details



RIG: XC **DRILLER:** Terratest **LOGGED:** KR **CASING:** HWT to 2.8m

TYPE OF BORING: Diatube (200 mm) to 0.14m, SFA (TC-bit) to 2.81m, NMLC coring to 15.0m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: *BD1/20200516 taken at 0.4-0.5m. Standpipe installed: 0-5.5m Blank PVC pipe, 5.5-11.0m Slotted PVC pipe, End cap at 11.0m, Sand backfill 0-2.3m, Bentonite 2.3-5.0m, Sand filter 5.0-11.0m, Bentonite 11.0-12.0m, Backfill 12.0-15.0m, Gatic cover at surface.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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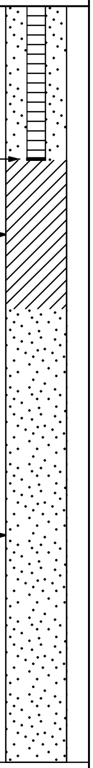
BOREHOLE LOG

CLIENT: Vertical First Pty Ltd
PROJECT: Proposed Commercial Development
LOCATION: 8-10 Lee Street, Haymarket

SURFACE LEVEL: 15.5 AHD
EASTING: 333945
NORTHING: 6249272
DIP/AZIMUTH: 90°/--

BORE No: BH107B
PROJECT No: 86767.00
DATE: 16/5/2020
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
5		SANDSTONE: fine to medium grained, pale grey, high strength, fresh, slightly fractured to unbroken, cross-bedding 5°-10°, Hawkesbury Sandstone *(continued)*		C					
	11				11.02 11.07		PL(A) = 1.1		11 End Cap
4									Bentonite Seal
	12				12.0		PL(A) = 1.1		12
3		Between 12.60m-13.78m: band of fine grained sandstone		C					
	13				13.03		PL(A) = 1		13
2									Sand Back Fill
	14				14.0 14.08		PL(A) = 1.2		14
1				C					
	15 15.0	Bore discontinued at 15.0m - Target depth reached			15.0				15
0									
	16								16
-1									
	17								17
-2									
	18								18
-3									
	19								19
-4									

RIG: XC **DRILLER:** Terratest **LOGGED:** KR **CASING:** HWT to 2.8m

TYPE OF BORING: Diatube (200 mm) to 0.14m, SFA (TC-bit) to 2.81m, NMLC coring to 15.0m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: *BD1/20200516 taken at 0.4-0.5m. Standpipe installed: 0-5.5m Blank PVC pipe, 5.5-11.0m Slotted PVC pipe, End cap at 11.0m, Sand backfill 0-2.3m, Bentonite 2.3-5.0m, Sand filter 5.0-11.0m, Bentonite 11.0-12.0m, Backfill 12.0-15.0m, Gatic cover at surface.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Vertical First Pty Ltd
PROJECT: Proposed Commercial Development
LOCATION: 8-10 Lee Street, Haymarket

SURFACE LEVEL: 15.5 AHD
EASTING: 333966
NORTHING: 6249307
DIP/AZIMUTH: 90°/--

BORE No: BH108
PROJECT No: 86767.03
DATE: 17/5/2020
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Sampling & In Situ Testing: Depth	Sampling & In Situ Testing: Sample	Sampling & In Situ Testing: Results & Comments	Water	VWP Construction Details
	0.21	CONCRETE: grey, 2-10mm igneous aggregate							
	0.23	FILL/Sandy CLAY: low plasticity, dark brown, fine to medium sand, w~PL		E	0.23 0.25		PID=2 ppm		
	1.05	CLAY CI: medium plasticity, pale grey mottled pale brown and red, w~PL, residual Below 0.6m: trace fine to medium ironstone gravel		E	0.6 0.8		PID=2 ppm		
	1.2	SANDSTONE: fine to medium grained, pale grey, highly weathered, very low strength, with clay and ironstone bands, Hawkesbury Sandstone		E	1.05 1.2		PID=2 ppm		
		Bore discontinued at 1.2m - Target depth reached. Auger refusal							

RIG: Miniprobe **DRILLER:** Terratest **LOGGED:** AS **CASING:** Uncased
TYPE OF BORING: Pushtube to 1.2m
WATER OBSERVATIONS: No free groundwater observed
REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Vertical First Pty Ltd
PROJECT: Proposed Commercial Development
LOCATION: 8-10 Lee Street, Haymarket

SURFACE LEVEL: 15.3 AHD
EASTING: 333968
NORTHING: 6249312
DIP/AZIMUTH: 90°/--

BORE No: BH109A
PROJECT No: 86767.00
DATE: 19/5/2020
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	VWP Construction Details
	0.2	CONCRETE: grey, angular to subangular aggregate to 15mm, negligible voids, no reinforcement steel observed							
	0.3	FILL/ GRAVEL: coarse, black, angular igneous gravel bonded by bitumen, dry, generally in a dense condition							
	1.05	Silty CLAY CI: medium plasticity, pale orange, w<PL, apparently stiff to very stiff, residual (possibly extremely weathered Ashfield Shale)							
	1.15	SANDSTONE: fine to medium grained, pale grey and dark orange, highly weathered, medium strength, Hawkesbury Sandstone							
		Bore discontinued at 1.15m - Refusal to TC-bit auger							

RIG: Miniprobe **DRILLER:** Terratest **LOGGED:** NB **CASING:** NA

TYPE OF BORING: SFA (TC-bit) to 1.15m

WATER OBSERVATIONS: No free groundwater observed whilst drilling

REMARKS: Surface level taken from survey drawing provided

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

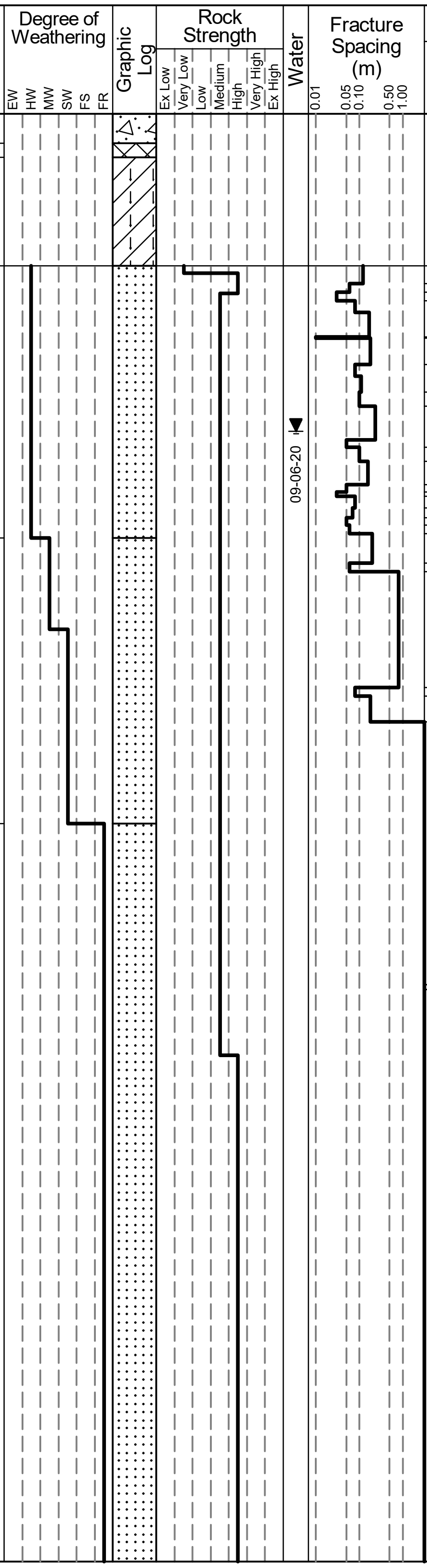
BOREHOLE LOG

CLIENT: Vertical First Pty Ltd
PROJECT: Proposed Commercial Development
LOCATION: 8-10 Lee Street, Haymarket

SURFACE LEVEL: 15.3 AHD
EASTING: 333970
NORTHING: 6249311
DIP/AZIMUTH: 90°/--

BORE No: BH109B
PROJECT No: 86767.00
DATE: 17/5/2020
SHEET 1 OF 2

Depth (m)	Description of Strata
0.2	CONCRETE: grey, angular to subangular aggregate to 15mm, negligible voids, no reinforcement steel observed
0.3	FILL/ GRAVEL: coarse, black, angular igneous gravel bonded by bitumen, dry, generally in a dense condition
1.05	Silty CLAY CI: medium plasticity, pale orange, w<PL, apparently stiff to very stiff, residual (possibly extremely weathered Mittagong Formation)
	SANDSTONE: fine to medium grained, pale grey and dark orange, highly weathered, medium strength, fractured, Hawkesbury Sandstone
2.93	SANDSTONE: fine to coarse grained, pale grey and pale yellow, moderately weathered then slightly weathered, medium strength, slightly fractured, cross-bedding 5°-10°, Hawkesbury Sandstone
4.9	SANDSTONE: fine to coarse grained, pale grey, fresh, medium then high strength, slightly fractured then unbroken, cross-bedding 5°-10°, Hawkesbury Sandstone



Discontinuities

B - Bedding J - Joint
S - Shear F - Fault

1.05m: Ds 50mm
1.17m: B0°, un, ro, fe co
1.23m-1.25m: B0° (x3), pl, ro, fe stn
1.29m & 1.37m: B0°, pl, ro, fe stn
1.54m: Ds 10mm
1.55m: J80°, pl, ro, op
1.73m & 1.81m: B0°, pl, ro, fe co
1.92m: Cs 5mm
2.02m & 2.25m: J60°, pl, he
2.3m: Cs 10mm
2.4m-2.45m: B0° (x3), un, ro, fe co
2.56m: Ds 20mm
2.61m: B2°, un, ro, fe co
2.64m: B0°, un, ro, fe co
2.72m: Ds 10mm
2.79m: Ds 5mm
2.84m: Ds 2mm
2.9m: B2°, pl, ro, fe co
3.1m: Cs 2mm
3.16m: B0°, pl, ro, fe co
3.96m: Ds 20mm
4.02m: J45°, pl, ro, fe co
4.2m: Ds 20mm
\>>
7.86m - 7.89m: Cs 2mm (x2)

Sampling & In Situ Testing

Type	Core Rec. %	RQD %	Test Results & Comments
A/E			PID<1
A/E			PID<1
C	100	20	PL(A) = 1.8
C	100	40	PL(A) = 0.7
C	100	90	PL(A) = 0.5 PL(A) = 0.7
C	100	100	PL(A) = 0.9 PL(A) = 1
C	100	100	PL(A) = 0.7 PL(A) = 1.2
C	100	100	
C	100	100	PL(A) = 1.8 PL(A) = 1.9
C	100	100	

RIG: XC **DRILLER:** Terratest **LOGGED:** NB **CASING:** HWT to 1.05m

TYPE OF BORING: Diatube (200mm) to 0.2m, SFA (TC-bit) to 1.05m, NMLC coring to 15m

WATER OBSERVATIONS: No free groundwater observed whilst drilling

REMARKS: Standpipe installed: 0-6.0m Blank PVC pipe, 6.0-11.6m Slotted PVC pipe, End cap at 11.6m, Sand backfill 0-1.05m, Bentonite 1.05-5.2m, Sand filter 5.2-11.6m, Bentonite 11.6-13.0m, Backfill 13.0-15.0m, Gatic cover at surface. Surface level taken from survey

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Vertical First Pty Ltd
PROJECT: Proposed Commercial Development
LOCATION: 8-10 Lee Street, Haymarket

SURFACE LEVEL: 15.3 AHD
EASTING: 333970
NORTHING: 6249311
DIP/AZIMUTH: 90°/--

BORE No: BH109B
PROJECT No: 86767.00
DATE: 17/5/2020
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering EW HW MW SW FS FR	Graphic Log	Rock Strength Ex Low, Very Low, Low, Medium, High, Very High, Ex High	Water	Fracture Spacing (m) 0.01 0.05 0.10 0.50 1.00	Discontinuities B - Bedding J - Joint S - Shear F - Fault	Type	Core Rec. %	RQD %	Test Results & Comments
5		SANDSTONE: fine to coarse grained, pale grey, fresh, medium then high strength, slightly fractured then unbroken, cross-bedding 5°-10°, Hawkesbury Sandstone *(continued)*							C	100	100	PL(A) = 1.4
4	11							>>	C	100	100	PL(A) = 1.8
3	12											PL(A) = 1.2
2	13								C	100	100	PL(A) = 1.4
1	14							14.6m: Ds 10mm 14.62m: J45°, st, he	C	100	100	PL(A) = 1.3
0	15 15.0	Bore discontinued at 15.0m - Target depth reached										
-1	16											
-2	17											
-3	18											
-4	19											

RIG: XC **DRILLER:** Terratest **LOGGED:** NB **CASING:** HWT to 1.05m

TYPE OF BORING: Diatube (200mm) to 0.2m, SFA (TC-bit) to 1.05m, NMLC coring to 15m

WATER OBSERVATIONS: No free groundwater observed whilst drilling

REMARKS: Standpipe installed: 0-6.0m Blank PVC pipe, 6.0-11.6m Slotted PVC pipe, End cap at 11.6m, Sand backfill 0-1.05m, Bentonite 1.05-5.2m, Sand filter 5.2-11.6m, Bentonite 11.6-13.0m, Backfill 13.0-15.0m, Gatic cover at surface. Surface level taken from survey

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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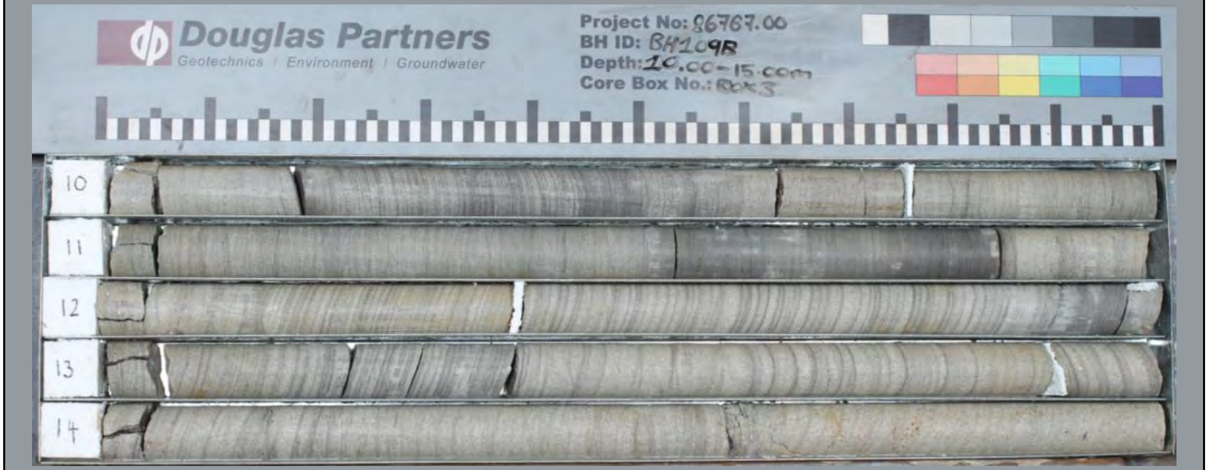
BORE: 109B PROJECT: HAYMARKET MAY 2020

1.05 – 5.0 m

BORE: 109B PROJECT: HAYMARKET MAY 2020

5.0 – 10.0 m

BORE: 109B PROJECT: HAYMARKET MAY 2020



10.0 – 15.0 m

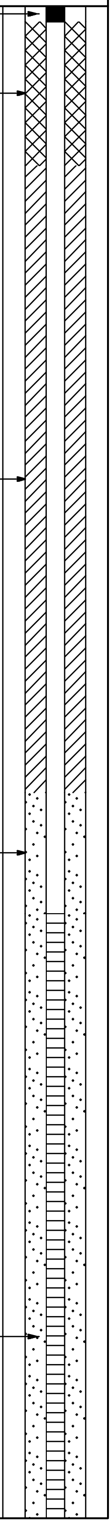
BOREHOLE LOG

CLIENT: Vertical First Pty Ltd
PROJECT: Proposed Commercial Development
LOCATION: 8-10 Lee Street, Haymarket

SURFACE LEVEL: 15.3 AHD
EASTING: 333970
NORTHING: 6249311
DIP/AZIMUTH: 90°/--

BORE No: BH109B
PROJECT No: 86767.00
DATE: 17/5/2020
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Type	Depth	Sample	Results & Comments	Water	Well Construction Details
15	0.2	CONCRETE: grey, angular to subangular aggregate to 15mm, negligible voids, no reinforcement steel observed						Gatic Cover and cap
	0.3	FILL/ GRAVEL: coarse, black, angular igneous gravel bonded by bitumen, dry, generally in a dense condition	A/E	0.4 0.5		PID<1		Backfill and Blank PVC pipe
14	1.05	Silty CLAY CI: medium plasticity, pale orange, w<PL, apparently stiff to very stiff, residual (possibly extremely weathered Mittagong Formation)	A/E	0.9 1.05		PID<1		
		SANDSTONE: fine to medium grained, pale grey and dark orange, highly weathered, medium strength, fractured, Hawkesbury Sandstone	C	1.16 1.65		PL(A) = 1.8		
13			C	2.11		PL(A) = 0.7	▼ 09-06-20	
12	2.93	SANDSTONE: fine to coarse grained, pale grey and pale yellow, moderately weathered then slightly weathered, medium strength, slightly fractured, cross-bedding 5°-10°, Hawkesbury Sandstone		3.1 3.11		PL(A) = 0.5		Bentonite Seal
11			C	3.92 4.65		PL(A) = 0.7		
10	4.9	SANDSTONE: fine to coarse grained, pale grey, fresh, medium then high strength, slightly fractured then unbroken, cross-bedding 5°-10°, Hawkesbury Sandstone	C	4.93 5.04		PL(A) = 0.9 PL(A) = 1		Sand filter
9				6.0		PL(A) = 0.7		
8			C	7.0 7.4		PL(A) = 1.2		
			C	7.75				
7			C	8.0		PL(A) = 1.8		Slotted PVC pipe
6				9.0 9.25		PL(A) = 1.9		
			C	10.0		PL(A) = 1.4		



RIG: XC **DRILLER:** Terratest **LOGGED:** NB **CASING:** HWT to 1.05m
TYPE OF BORING: Diatube (200mm) to 0.2m, SFA (TC-bit) to 1.05m, NMLC coring to 15m
WATER OBSERVATIONS: No free groundwater observed whilst drilling
REMARKS: Standpipe installed: 0-6.0m Blank PVC pipe, 6.0-11.6m Slotted PVC pipe, End cap at 11.6m, Sand backfill 0-1.05m, Bentonite 1.05-5.2m, Sand filter 5.2-11.6m, Bentonite 11.6-13.0m, Backfill 13.0-15.0m, Gatic cover at surface. Surface level taken from survey

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

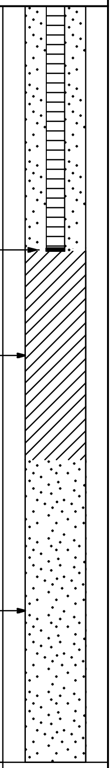
BOREHOLE LOG

CLIENT: Vertical First Pty Ltd
PROJECT: Proposed Commercial Development
LOCATION: 8-10 Lee Street, Haymarket

SURFACE LEVEL: 15.3 AHD
EASTING: 333970
NORTHING: 6249311
DIP/AZIMUTH: 90°/--

BORE No: BH109B
PROJECT No: 86767.00
DATE: 17/5/2020
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
5		SANDSTONE: fine to coarse grained, pale grey, fresh, medium then high strength, slightly fractured then unbroken, cross-bedding 5°-10°, Hawkesbury Sandstone *(continued)*		C					
					10.73				
	11				11.0		PL(A) = 1.8		11
4				C					End Cap
	12				12.0		PL(A) = 1.2		12
3									Bentonite Seal
					12.38				
	13				13.0		PL(A) = 1.4		13
2				C					
					13.88				
	14				14.0		PL(A) = 1.3		14 Sand Back Fill
1				C					
	15 15.0	Bore discontinued at 15.0m - Target depth reached			15.0				15
0									
	16								16
-1									
	17								17
-2									
	18								18
-3									
	19								19
-4									



RIG: XC **DRILLER:** Terratest **LOGGED:** NB **CASING:** HWT to 1.05m

TYPE OF BORING: Diatube (200mm) to 0.2m, SFA (TC-bit) to 1.05m, NMLC coring to 15m

WATER OBSERVATIONS: No free groundwater observed whilst drilling

REMARKS: Standpipe installed: 0-6.0m Blank PVC pipe, 6.0-11.6m Slotted PVC pipe, End cap at 11.6m, Sand backfill 0-1.05m, Bentonite 1.05-5.2m, Sand filter 5.2-11.6m, Bentonite 11.6-13.0m, Backfill 13.0-15.0m, Gatic cover at surface. Surface level taken from survey

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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BOREHOLE LOG

CLIENT: Vertical First Pty Ltd
PROJECT: Proposed Commercial Development
LOCATION: 8-10 Lee Street, Haymarket

SURFACE LEVEL: 15.3 AHD
EASTING: 333960
NORTHING: 6249314
DIP/AZIMUTH: 90°/--

BORE No: BH110
PROJECT No: 86767.00
DATE: 20/5/2020
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Sampling & In Situ Testing: Depth	Sampling & In Situ Testing: Sample	Sampling & In Situ Testing: Results & Comments	Water	VWP Construction Details
		CONCRETE: grey, angular to subangular aggregate to 15mm, negligible voids, no reinforcement	△						
	0.2	FILL/ SAND: fine to coarse, pale orange, moist, generally in a medium dense condition	▨	A	0.2 0.3		PID<1		
	0.3	FILL/ Silty CLAY: medium to high plasticity, pale grey mottled orange, with fine to coarse sand and brick, concrete and asphalt fragments, w<PL, generally in a stiff condition	▨	A	0.5 0.6		PID<1		
	0.6	Bore discontinued at 0.6m - Termination on brick and concrete fragments							

RIG: Hand tools **DRILLER:** Nick Ruha/NB **LOGGED:** NB **CASING:** NA

TYPE OF BORING: Diatube (100mm) to 0.2m, then hand auger

WATER OBSERVATIONS: No free groundwater observed whilst drilling

REMARKS: Surface level taken from survey drawing provided

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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BOREHOLE LOG

CLIENT: Vertical First Pty Ltd
PROJECT: Proposed Commercial Development
LOCATION: 8-10 Lee Street, Haymarket

SURFACE LEVEL: 18.7 AHD
EASTING: 333945
NORTHING: 6249317
DIP/AZIMUTH: 90°/--

BORE No: BH111
PROJECT No: 86767.00
DATE: 19/5/2020
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	VWP Construction Details
	0.05	ASPHALTIC CONCRETE							
	0.15	FILL/ ROADBASE: fine to coarse, dark grey, angular igneous gravel, fine to coarse sand, dry, generally in a dense condition							
		FILL/ SAND: fine to coarse, pale grey and brown, moist, generally in a loose to medium dense condition		U/E	0.4 0.5		PID<1		
	0.5	FILL/ Silty CLAY: low to medium plasticity, dark grey and brown, w<PL, generally in a stiff condition Below 0.6m, grading to sandy clay, pale orange and dark orange, fine to medium sand		U/E	1.1 1.2		PID<1		
	1.2	FILL/ SAND: fine to medium, dark brown and grey, trace silt, moist, generally in a medium dense to dense condition		U/E	1.3 1.4		PID<1		
	2.0	SAND SP: fine to medium, pale grey, moist, apparently loose, alluvial		U/E	2.0 2.1		PID<1		
		Below 2.4m: grading to pale orange		U/E*	3.0 3.1		PID<1		
	3.2	Silty CLAY CI: medium plasticity, pale orange mottled dark red, with ironstone gravel, w<PL, apparently stiff to very stiff, residual (possibly extremely weathered Mittagong Formation)		U/E	4.0 4.1		PID<1		
		Below 4.4m: grading to pale grey							

RIG: Geoprobe **DRILLER:** Terratest **LOGGED:** NB **CASING:** NA
TYPE OF BORING: Push tube to 5.4m
WATER OBSERVATIONS: No free groundwater observed whilst drilling
REMARKS: *BD1/190520NB taken at 3-3.1m. Surface level taken from survey drawing provided

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Vertical First Pty Ltd
PROJECT: Proposed Commercial Development
LOCATION: 8-10 Lee Street, Haymarket

SURFACE LEVEL: 18.7 AHD
EASTING: 333945
NORTHING: 6249317
DIP/AZIMUTH: 90°/--

BORE No: BH111
PROJECT No: 86767.00
DATE: 19/5/2020
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	VWP Construction Details
				Type	Depth	Sample	Results & Comments		
		Silty CLAY CI: medium plasticity, pale orange mottled dark red, with ironstone gravel, w<PL, apparently stiff to very stiff, residual (possibly extremely weathered Mittagong Formation) *(continued)*	▨						
	5.4	Bore discontinued at 5.4m - Target depth reached							
13									
	6								6
12									
	7								7
11									
	8								8
10									
	9								9
9									

RIG: Geoprobe **DRILLER:** Terratest **LOGGED:** NB **CASING:** NA
TYPE OF BORING: Push tube to 5.4m
WATER OBSERVATIONS: No free groundwater observed whilst drilling
REMARKS: *BD1/190520NB taken at 3-3.1m. Surface level taken from survey drawing provided

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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Top of hole

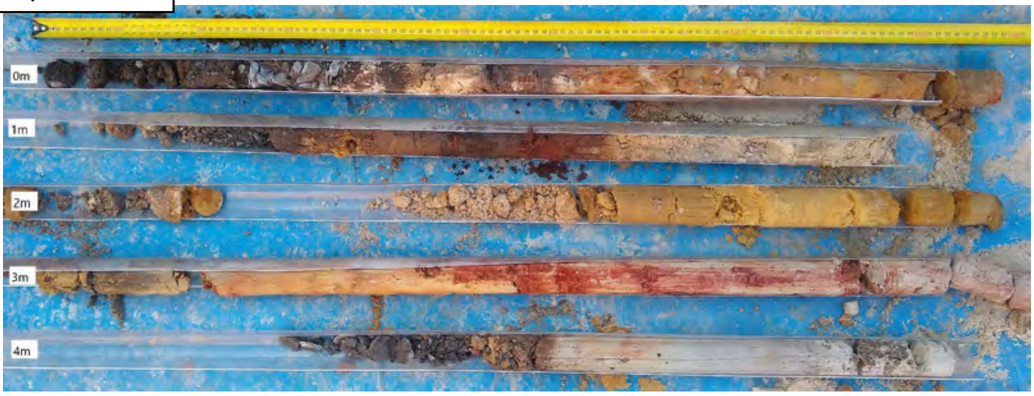

Photo D1 – View of samples obtained from Borehole BH111.

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Borehole Photographs **Proposed Commercial Development** **8-10 Lee Street, Haymarket**	PROJECT: 86867.00 PLATE No: D1 REV: 0
CLIENT: Vertical First Pty Ltd	DATE: 15/06/2020

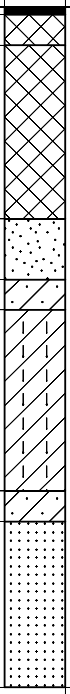
BOREHOLE LOG

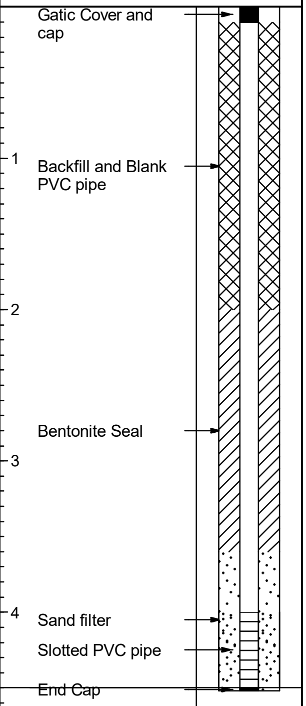
CLIENT: Vertical First Pty Ltd
PROJECT: Proposed Commercial Development
LOCATION: 8-10 Lee Street, Haymarket

SURFACE LEVEL: 16.7 AHD
EASTING: 333926
NORTHING: 6249325
DIP/AZIMUTH: 90°/--

BORE No: BH112A
PROJECT No: 86767.00
DATE: 19/5/2020
SHEET 1 OF 1

Depth (m)	Description of Strata	Water
0.05	ASPHALTIC CONCRETE	
0.25	FILL/ ROADBASE: fine to coarse, dark grey, angular igneous gravel, fine to coarse sand, dry, generally in a dense condition	
	FILL/ SAND: fine to medium, dark grey-brown, moist, generally in a loose condition	
1.4	SAND SP: fine to medium, pale orange, moist, apparently medium dense, alluvial	
1.8	Sandy CLAY CI: medium plasticity, pale grey and pale orange, fine sand, w<PL, apparently stiff, alluvial	
2.0	Silty CLAY CI-CH: medium to high plasticity, pale grey mottled dark red-orange and yellow, with ironstone gravel, w<PL, very stiff, residual (possibly extremely weathered Mittagong Formation)	
3.2	Sandy CLAY CL: low plasticity, dark red and pale grey, fine sand, w<PL, hard, residual (extremely weathered Mittagong Formation)	▼ 05-06-20
3.4	SANDSTONE: fine grained, dark brown and pale grey orange, highly weathered, medium strength, Mittagong Formation	
4.5	Bore discontinued at 4.5m - Target depth reached	





RIG: Geoprobe **DRILLER:** Terratest **LOGGED:** NB **CASING:** NA

TYPE OF BORING: SFA (TC-bit) to 4.5m

WATER OBSERVATIONS: No free groundwater observed whilst drilling

REMARKS: Standpipe installed: 0-4.0m Blank PVC pipe, 4.0-4.5m Slotted PVC pipe, End cap at 4.5m, Sand backfill 0-2.0m, Bentonite 2.0-3.6m, Sand filter 3.6-4.5m, Gatic cover at surface. Surface level taken from survey drawing provided

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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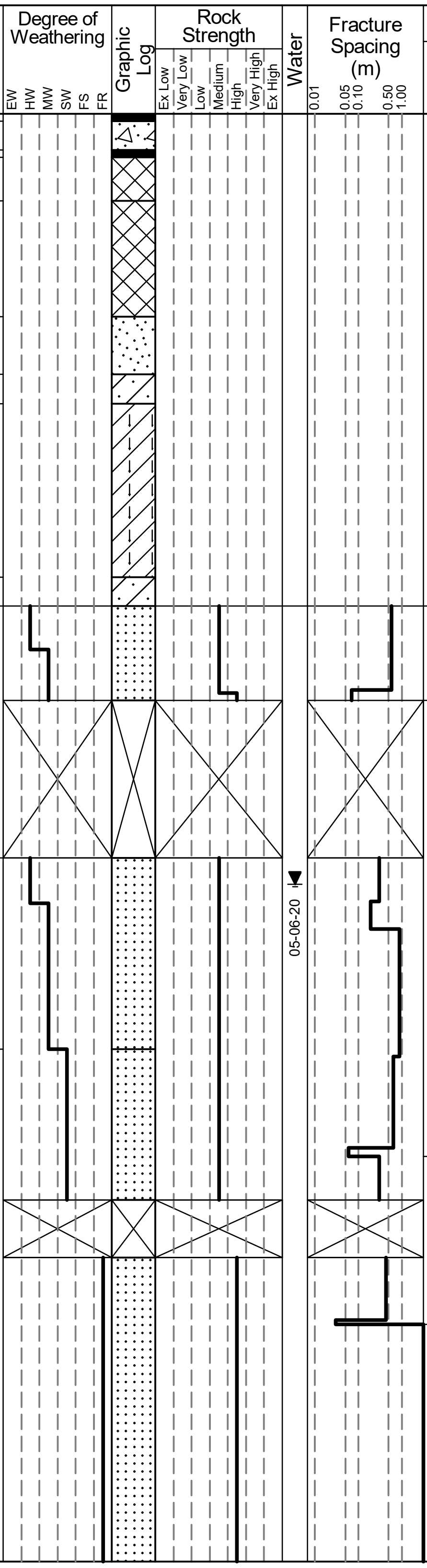
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Vertical First Pty Ltd
PROJECT: Proposed Commercial Development
LOCATION: 8-10 Lee Street, Haymarket

SURFACE LEVEL: 16.8 AHD
EASTING: 333928
NORTHING: 6249324
DIP/AZIMUTH: 90°/--

BORE No: BH112B
PROJECT No: 86767.00
DATE: 18/5/2020
SHEET 1 OF 2



RL	Depth (m)	Description of Strata	Discontinuities B - Bedding J - Joint S - Shear F - Fault	Type	Core Rec. %	RQD %	Test Results & Comments
	0.05	ASPHALTIC CONCRETE					
	0.25	CONCRETE					
	0.3	ASPHALTIC CONCRETE		A/E			PID<1
16	0.6	FILL/ SANDSTONE: possible sandstone block		A/E			PID<1
	1	FILL/ SAND: fine to medium, dark grey-brown, moist, generally in a loose condition					
15	1.4	SAND SP: fine to medium, pale orange, moist, apparently medium dense, alluvial		A/E A/E			PID<1 PID<1
	1.8	Sandy CLAY CI: medium plasticity, pale grey and pale orange, fine sand, w<PL, apparently stiff, alluvial					
14	2 2.0	Silty CLAY CI-CH: medium to high plasticity, pale grey mottled dark red-orange and yellow, with ironstone gravel, w<PL, very stiff, residual (possible extremely weathered Ashfield Shale)		S			6,9,11 N = 20
	3 3.2			S			2,8,20/140 refusal
13	3.4	Sandy CLAY CL: low plasticity, dark red and pale grey, fine sand, w<PL, hard, residual (extremely weathered Mittagong Formation)					PL(A) = 0.4
12	4	SANDSTONE: fine grained, dark brown and pale grey-orange, highly weathered then moderately weathered, medium and high strength, fractured, Mittagong Formation	3.98m: B2°, pl, ro, fe stn 4.05m: CORE LOSS: 1090mm	C	60	0	PL(A) = 1.5
11	5 5.14	SANDSTONE: fine to coarse grained, pale orange, highly weathered then moderately weathered, medium strength, fractured to slightly fractured, cross-bedding 10°-20°, Hawkesbury Sandstone	5.44m: Cs 2mm 5.63m: J20°, pl, ro, fe stn				PL(A) = 0.5
10	6 6.46	SANDSTONE: fine to coarse grained, pale grey, trace dark grey siltstone bands, slightly weathered then fresh, high strength, slightly fractured, cross-bedding 0°-10°, Hawkesbury Sandstone	6.51m: Cs 10mm				PL(A) = 0.3
9	7		7.14m: B0°, pl, ro, fe stn 7.2m: J20°, pl, ro, cly co 7.5m: CORE LOSS: 400mm	C	84	72	PL(A) = 0.5
8	7.9 8	Between 8.02m-9.83m, cross-bedding 10°-20°	8.33m: J30°, pl, ro, cln 8.36m: B10°, pl, ro, cly co 2mm				PL(A) = 1.1
7	9			C	100	100	PL(A) = 2.1

RIG: Geoprobe **DRILLER:** Terratest **LOGGED:** NB **CASING:** HWT to 3.4m

TYPE OF BORING: Diatube (200mm) to 0.6m, Hand Auger to 2m, SFA (TC-bit) to 3.4m, HQ coring to 15m

WATER OBSERVATIONS: No free groundwater observed whilst drilling

REMARKS: Rapid drilling between 4.1-4.9m & 7.5-8.0m. 20% water loss at 9m. Standpipe installed: 0-6.0m Blank PVC pipe, 6.0-12.0m Slotted PVC pipe, End cap 12.0m, Sand backfill 0-2.5m, Bentonite 2.5-5.5m, Sand filter 5.5-12.5m, Bentonite 12.5-13.0m, Backfill 13-15m

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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BOREHOLE LOG

CLIENT: Vertical First Pty Ltd
PROJECT: Proposed Commercial Development
LOCATION: 8-10 Lee Street, Haymarket

SURFACE LEVEL: 16.8 AHD
EASTING: 333928
NORTHING: 6249324
DIP/AZIMUTH: 90°/--

BORE No: BH112B
PROJECT No: 86767.00
DATE: 18/5/2020
SHEET 2 OF 2

Depth (m)	Description of Strata	Discontinuities (B - Bedding, J - Joint, S - Shear, F - Fault)	Type	Core Rec. %	RQD %	Test Results & Comments
	SANDSTONE: as above					PL(A) = 1.2
11			C	100	100	PL(A) = 1.5
		11.79m: J70°, pl, he				
12						PL(A) = 1.3
13						PL(A) = 1.3
			C	100	100	
14		14.14m: Fragmented 10mm				PL(A) = 1.5
15.0	Bore discontinued at 15.0m - Target depth reached					

RIG: Geoprobe **DRILLER:** Terratest **LOGGED:** NB **CASING:** HWT to 3.4m

TYPE OF BORING: Diatube (200mm) to 0.6m, Hand Auger to 2m, SFA (TC-bit) to 3.4m, HQ coring to 15m

WATER OBSERVATIONS: No free groundwater observed whilst drilling

REMARKS: Rapid drilling between 4.1-4.9m & 7.5-8.0m. 20% water loss at 9m. Standpipe installed: 0-6.0m Blank PVC pipe, 6.0-12.0m Slotted PVC pipe, End cap 12.0m, Sand backfill 0-2.5m, Bentonite 2.5-5.5m, Sand filter 5.5-12.5m, Bentonite 12.5-13.0m, Backfill 13-15m

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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BORE: 112B PROJECT: HAYMARKET MAY 2020

3.40 – 7.0 m

BORE: 112B PROJECT: HAYMARKET MAY 2020

7.0 – 11.0 m

BORE: 112B PROJECT: HAYMARKET MAY 2020

11.0 – 15.0 m

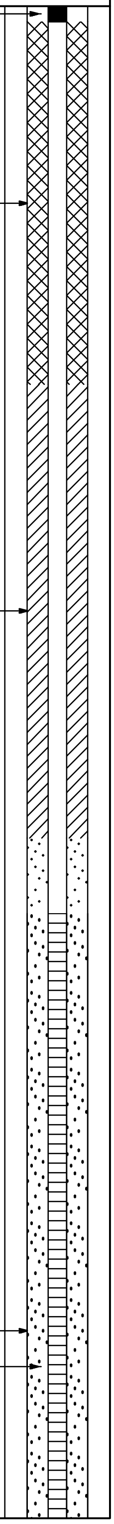
BOREHOLE LOG

CLIENT: Vertical First Pty Ltd
PROJECT: Proposed Commercial Development
LOCATION: 8-10 Lee Street, Haymarket

SURFACE LEVEL: 16.8 AHD
EASTING: 333928
NORTHING: 6249324
DIP/AZIMUTH: 90°/--

BORE No: BH112B
PROJECT No: 86767.00
DATE: 18/5/2020
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Type	Depth	Results & Comments	Water	Well Construction Details
	0.05	ASPHALTIC CONCRETE					Gatic Cover and cap
	0.25	CONCRETE		0.3			
	0.3	ASPHALTIC CONCRETE	A/E		PID<1		
	0.6	FILL/ SANDSTONE: possible sandstone block	A/E	0.6 0.7	PID<1		
16	1	FILL/ SAND: fine to medium, dark grey-brown, moist, generally in a loose condition					1
	1.4	SAND SP: fine to medium, pale orange, moist, apparently medium dense, alluvial	A/E	1.4 1.5	PID<1		Backfill and Blank PVC pipe
15			A/E	1.6 1.7	PID<1		
	1.8	Sandy CLAY CI: medium plasticity, pale grey and pale orange, fine sand, w<PL, apparently stiff, alluvial		2.0			2
	2.0	Silty CLAY CI-CH: medium to high plasticity, pale grey mottled dark red-orange and yellow, with ironstone gravel, w<PL, very stiff, residual (possible extremely weathered Ashfield Shale)	S	2.45	6,9,11 N = 20		
14	3			3.0			3
	3.2	Sandy CLAY CL: low plasticity, dark red and pale grey, fine sand, w<PL, hard, residual (extremely weathered Mittagong Formation)	S	3.4	2,8,20/140 refusal		
	3.4	SANDSTONE: fine grained, dark brown and pale grey-orange, highly weathered then moderately weathered, medium and high strength, fractured, Mittagong Formation		3.44 3.68	PL(A) = 0.4		
13	4			4.02	PL(A) = 1.5		4 Bentonite Seal
12	5		C				5
	5.14	SANDSTONE: fine to coarse grained, pale orange, highly weathered then moderately weathered, medium strength, fractured to slightly fractured, cross-bedding 10°-20°, Hawkesbury Sandstone		5.35	PL(A) = 0.5	▼ 05-06-20	
11	6			6.1 6.34	PL(A) = 0.3		6
	6.46	SANDSTONE: fine to coarse grained, pale grey, trace dark grey siltstone bands, slightly weathered then fresh, high strength, slightly fractured, cross-bedding 0°-10°, Hawkesbury Sandstone					
10	7		C	7.15	PL(A) = 0.5		7
9	7.9						
	8	Between 8.02m-9.83m, cross-bedding 10°-20°		8.09	PL(A) = 1.1		8 Sand filter
8	9			9.09 9.1	PL(A) = 2.1		9 Slotted PVC pipe
7			C				



RIG: Geoprobe **DRILLER:** Terratest **LOGGED:** NB **CASING:** HWT to 3.4m
TYPE OF BORING: Diatube (200mm) to 0.6m, Hand Auger to 2m, SFA (TC-bit) to 3.4m, HQ coring to 15m
WATER OBSERVATIONS: No free groundwater observed whilst drilling
REMARKS: Rapid drilling between 4.1-4.9m & 7.5-8.0m. 20% water loss at 9m. Standpipe installed: 0-6.0m Blank PVC pipe, 6.0-12.0m Slotted PVC pipe, End cap 12.0m, Sand backfill 0-2.5m, Bentonite 2.5-5.5m, Sand filter 5.5-12.5m, Bentonite 12.5-13.0m, Backfill 13-15m

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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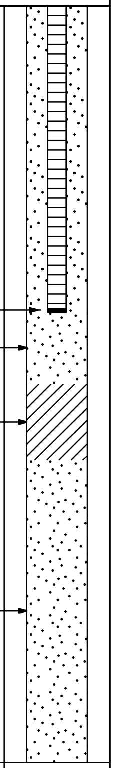
BOREHOLE LOG

CLIENT: Vertical First Pty Ltd
PROJECT: Proposed Commercial Development
LOCATION: 8-10 Lee Street, Haymarket

SURFACE LEVEL: 16.8 AHD
EASTING: 333928
NORTHING: 6249324
DIP/AZIMUTH: 90°/--

BORE No: BH112B
PROJECT No: 86767.00
DATE: 18/5/2020
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Type	Depth	Sample	Results & Comments	Water	Well Construction Details
		SANDSTONE: as above		10.12		PL(A) = 1.2		
6	11		C	11.04		PL(A) = 1.5		11
5	12			12.1		PL(A) = 1.3		12 End Cap Sand Back Fill
4								Bentonite Seal
	13		C	13.0		PL(A) = 1.3		13
3	14			14.0		PL(A) = 1.5		14 Sand Back Fill
2	15 15.0	Bore discontinued at 15.0m - Target depth reached		15.0				15
1	16							16
0	17							17
-1	18							18
-2	19							19
-3								



RIG: Geoprobe **DRILLER:** Terratest **LOGGED:** NB **CASING:** HWT to 3.4m

TYPE OF BORING: Diatube (200mm) to 0.6m, Hand Auger to 2m, SFA (TC-bit) to 3.4m, HQ coring to 15m

WATER OBSERVATIONS: No free groundwater observed whilst drilling

REMARKS: Rapid drilling between 4.1-4.9m & 7.5-8.0m. 20% water loss at 9m. Standpipe installed: 0-6.0m Blank PVC pipe, 6.0-12.0m Slotted PVC pipe, End cap 12.0m, Sand backfill 0-2.5m, Bentonite 2.5-5.5m, Sand filter 5.5-12.5m, Bentonite 12.5-13.0m, Backfill 13-15m

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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BOREHOLE LOG

CLIENT: Vertical First Pty Ltd
PROJECT: Proposed Commercial Development
LOCATION: 8-10 Lee Street, Haymarket

SURFACE LEVEL: 15.5 AHD
EASTING: 333983
NORTHING: 6249283
DIP/AZIMUTH: 90°/--

BORE No: BH113
PROJECT No: 86767.03
DATE: 7/4/2020
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	VWP Construction Details
				Type	Depth	Sample	Results & Comments		
		CONCRETE: grey, 2-10mm igneous aggregate							
	0.15	FILL/SAND: fine to coarse, pale brown and brown, trace fine to medium igneous rail ballast, trace coal, moist		E*	0.15 0.25		PID=9 ppm		
	0.4	FILL/CLAY: medium plasticity, red and pale grey, trace medium gravel, w~PL		E	0.4 0.5		PID=1 ppm		
	0.8	CLAY CI: medium plasticity, pale grey mottled red, trace fine to medium ironstone gravel, w<PL to w~PL, apparently very stiff, residual		E	0.9 1.0		PID=2 ppm		
				E	1.2 1.3		PID=8 ppm		
	1.3	Bore discontinued at 1.3m - Target depth reached							

RIG: Hand Tools **DRILLER:** AS/AMS **LOGGED:** AS **CASING:** Uncased
TYPE OF BORING: Diatube to 0.15m, Hand auger to 1.3m
WATER OBSERVATIONS: No free groundwater observed
REMARKS: * Field replicate BD2/20200407 taken from 0.15-0.25m

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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BOREHOLE LOG

CLIENT: Vertical First Pty Ltd
PROJECT: Proposed Commercial Development
LOCATION: 8-10 Lee Street, Haymarket

SURFACE LEVEL: 15.5 AHD
EASTING: 333984
NORTHING: 6249280
DIP/AZIMUTH: 90°/--

BORE No: BH114
PROJECT No: 86767.03
DATE: 7/4/2020
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	VWP Construction Details
		CONCRETE: grey, 2-10mm igneous aggregate	∆						
	0.15	FILL/SAND: fine to coarse, pale brown and brown, trace fine gravel and coal, moist	▨	E	0.15 0.2		PID=10 ppm		
	0.2	FILL/CLAY: medium plasticity, brown, pale grey and red, with fine to coarse sand, trace fine gravel, igneous rail ballast, plastic and coal, w~PL, hydrocarbon odour	▨	E	0.2 0.3				
	0.3	Bore discontinued at 0.3m - Refusal on ballast							

RIG: Hand Tools **DRILLER:** AS/AMS **LOGGED:** AS **CASING:** Uncased
TYPE OF BORING: Diatube to 0.15m, Hand auger to 0.3m
WATER OBSERVATIONS: No free groundwater observed
REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Vertical First Pty Ltd
PROJECT: Proposed Commercial Development
LOCATION: 8-10 Lee Street, Haymarket

SURFACE LEVEL: 15.5 AHD
EASTING: 333981
NORTHING: 6249280
DIP/AZIMUTH: 90°/--

BORE No: BH115
PROJECT No: 86767.03
DATE: 7/4/2020
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	VWP Construction Details
		CONCRETE: grey, 2-10mm igneous aggregate							
	0.17	FILL/SAND: fine to coarse, pale brown, moist		E	0.17 0.23		PID<1 ppm		
	0.23	FILL/CLAY: medium plasticity, red and pale grey, with fine to coarse sand and fine gravel, trace fine to coarse igneous rail ballast and coal, w~PL		E*	0.23 0.3		PID=5 ppm		
15		Below 0.5m: low plasticity, with fine to coarse ironstone gravel		E	0.5 0.6		PID=1 ppm		
	0.85	CLAY CI-CH: medium to high plasticity, pale grey mottled red, trace fine gravel, w<PL to w~PL, apparently very stiff, residual		E	0.9 1.0		PID=4 ppm		
		Below 1.2m: pale grey, w<PL		E	1.2 1.3		PID=1 ppm		
	1.3	Bore discontinued at 1.3m - Target depth reached							

RIG: Hand Tools **DRILLER:** AS/AMS **LOGGED:** AS **CASING:** Uncased

TYPE OF BORING: Diatube to 0.17m, Hand auger to 1.3m

WATER OBSERVATIONS: No free groundwater observed

REMARKS: * Field replicate BD1/20200407 taken from 0.23-0.3m

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Vertical First Pty Ltd
PROJECT: Proposed Commercial Development
LOCATION: 8-10 Lee Street, Haymarket

SURFACE LEVEL: 15.5 AHD
EASTING: 333970
NORTHING: 6249305
DIP/AZIMUTH: 90°/--

BORE No: BH116
PROJECT No: 86767.03
DATE: 17/5/2020
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	VWP Construction Details
				Type	Depth	Sample	Results & Comments		
		CONCRETE: grey, 2-10mm igneous aggregate							
	0.22	CLAY CI: medium plasticity, pale grey mottled pale brown and red, w<PL to w~PL, residual		E	0.22 0.35		PID=2 ppm		
				E*	0.5 0.7		PID=2 ppm		
		Below 0.7m: trace fine to medium ironstone gravel							
		Below 1.0m: with medium ironstone gravel		E	1.0 1.2		PID=2 ppm		
	1.2	Bore discontinued at 1.2m - Target depth reached							

RIG: Miniprobe **DRILLER:** Terratest **LOGGED:** AS **CASING:** Uncased
TYPE OF BORING: Pushtube to 1.2m
WATER OBSERVATIONS: No free groundwater observed
REMARKS: * Field replicate BD1/20200517 taken from 0.5-0.7m

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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BOREHOLE LOG

CLIENT: Vertical First Pty Ltd
PROJECT: Proposed Commercial Development
LOCATION: 8-10 Lee Street, Haymarket

SURFACE LEVEL: 15.5 AHD
EASTING: 333968
NORTHING: 6249303
DIP/AZIMUTH: 90°/--

BORE No: BH117
PROJECT No: 86767.03
DATE: 17/5/2020
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	VWP Construction Details
		CONCRETE: grey, 2-10mm igneous aggregate							
	0.2 0.25	FILL/Sandy CLAY: low plasticity, dark brown, fine to medium sand, with medium igneous rail ballast, w~PL, hydrocarbon odour		E	0.2 0.25		PID=3 ppm		
15		CLAY CI: medium plasticity, pale grey mottled pale brown and red, w~PL, residual		E*	0.6 0.8		PID=2 ppm		
	1	Below 0.9m: pale grey mottled pale brown, w<PL		E	1.0 1.2		PID=2 ppm		1
	1.2	Below 1.15m: with medium sand							
14		Bore discontinued at 1.2m - Target depth reached							
	2								2
13									
	3								3
12									
	4								4
11									

RIG: Miniprobe **DRILLER:** Terratest **LOGGED:** AS **CASING:** Uncased
TYPE OF BORING: Pushtube to 1.2m
WATER OBSERVATIONS: No free groundwater observed
REMARKS: * Field replicate BD2/20200517 taken from 0.6-0.8m

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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BOREHOLE LOG

CLIENT: Vertical First Pty Ltd
PROJECT: Proposed Commercial Development
LOCATION: 8-10 Lee Street, Haymarket

SURFACE LEVEL: 15.6 AHD
EASTING: 333946
NORTHING: 6249321
DIP/AZIMUTH: 90°/--

BORE No: W1
PROJECT No: 86767.00
DATE: 20/5/2020
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing Type	Depth	Sample	Results & Comments	Water	Well Construction Details
	0.05	ASPHALTIC CONCRETE	■	C	0.0				
	0.25	FILL/ ROADBASE: fine to coarse, dark grey, angular igneous gravel, fine to coarse sand, dry, generally in a dense condition	☒						
		CONCRETE: grey, with medium to coarse sub-rounded fragments of high strength sandstone, trace voids to 0.65m, abudant voids between 0.65m and 0.85m	▨	C	0.25 0.3		PL(A) = 1.6		
15				C	0.6				
	1								1
	1.2	Silty CLAY CI: medium plasticity, pale grey mottled dark red, w<PL, apparently stiff to very stiff, relict rock texture between 1.73-1.91m, residual (possibly extremely weathered Ashfield Shale)	☒	C	1.15				
14	1.57		▨	C	1.57				
					1.9		pp <200		
	2	Below 2.0m, with irregular iron-cemented pockets and bands		C	2.0				2
	2.24	SANDSTONE: fine grained, orange-brown, iron-cemented, highly weathered, high strength, fractured, Mittagong formation	⁚		2.4		PL(A) = 1.5		
	2.46	Bore discontinued at 2.46m - Target depth reached			2.46				
13									
	3								3
12									
	4								4
11									

RIG: Hand Drill **DRILLER:** Nick Ruha **LOGGED:** NB **CASING:** NA
TYPE OF BORING: Diatube (50mm) to 2.46m
WATER OBSERVATIONS: No free groundwater observed whilst drilling
REMARKS: Surface level taken from survey drawing provided

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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Photo W1 – View of core obtained from Borehole W1. Core losses were encountered above and below the retaining wall concrete footing.

Douglas Partners Geotechnics / Environment / Groundwater	**Borehole Photographs**	PROJECT:	86867.00
	Proposed Commercial Development	PLATE No:	W1
	8-10 Lee Street, Haymarket	REV:	0
	CLIENT: Vertical First Pty Ltd	DATE:	15/06/2020

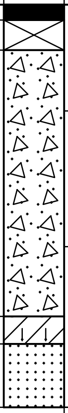
BOREHOLE LOG

CLIENT: Vertical First Pty Ltd
PROJECT: Proposed Commercial Development
LOCATION: 8-10 Lee Street, Haymarket

SURFACE LEVEL: 15.4 AHD
EASTING: 333963
NORTHING: 6249315
DIP/AZIMUTH: 90°/--

BORE No: W2
PROJECT No: 86767.00
DATE: 20/5/2020
SHEET 1 OF 1

Depth (m)	Description of Strata
0.05	ASPHALTIC CONCRETE
0.15	FILL/ ROADBASE: fine to coarse, dark grey, angular igneous gravel, fine to coarse sand, dry, generally in a dense condition
	CONCRETE: grey, with medium to coarse sub-rounded fragments of high strength sandstone, trace voids
1.03	
1.12	Silty CLAY CI: medium plasticity, pale grey mottled dark red, w<PL, apparently stiff to very stiff, residual (possibly extremely weathered Ashfield Shale)
1.33	SANDSTONE: fine grained, orange-brown and pale grey, iron-cemented and with thin clay bands, highly weathered, high strength, fractured, Mittagong formation
	Bore discontinued at 1.33m - Target depth reached



Sampling & In Situ Testing

Type	Depth	Sample	Results & Comments
C	0.0		
	0.35		
C	0.55		PL(A) = 1.6
	0.8		
C	1.15		PL(A) = 1.5
	1.33		

RIG: Hand Drill **DRILLER:** Nick Ruha **LOGGED:** NB **CASING:** NA
TYPE OF BORING: Diatube (50mm) to 1.33m
WATER OBSERVATIONS: No free groundwater observed whilst drilling
REMARKS: Surface level taken from survey drawing provided

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Photo W2 – View of core obtained from Borehole W2.

Douglas Partners Geotechnics / Environment / Groundwater	**Borehole Photographs** **Proposed Commercial Development** **8-10 Lee Street, Haymarket**	PROJECT: 86867.00 PLATE No: W2 REV: 0
	CLIENT: Vertical First Pty Ltd	DATE: 15/06/2020

BOREHOLE LOG

CLIENT: Vertical First Pty Ltd
PROJECT: Proposed Commercial Development
LOCATION: 8-10 Lee Street, Haymarket

SURFACE LEVEL: 13.4 AHD
EASTING: 333954
NORTHING: 6249290
DIP/AZIMUTH: 70°/135°

BORE No: W3
PROJECT No: 86767.00
DATE: 20/5/2020
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Well Construction Details
				Type	Depth	Sample	Results & Comments		
		SANDSTONE: fine grained, orange-brown and pale grey, iron-cemented and with thin clay bands, highly weathered, medium to high strength, fragmented, Mittagong formation	▨	C	0.0				
13			☒		0.46				
	1			C					
	1.2	Bore discontinued at 1.2m - Target depth reached			1.2				
12									
	2								
11									
	3								
10									
	4								
9									

RIG: Hand Drill **DRILLER:** Nick Ruha **LOGGED:** NB **CASING:** NA

TYPE OF BORING: Diatube (50mm) to 1.2m

WATER OBSERVATIONS: No free groundwater observed whilst drilling

REMARKS: Surface level taken from architectural drawing provided, Synman Justin Bialek Architects Pty Ltd, Lower Ground Floor plan, Drawing WD05 (Rev E) dated 21 May 1998. Borehole azimuth relative to Grid North

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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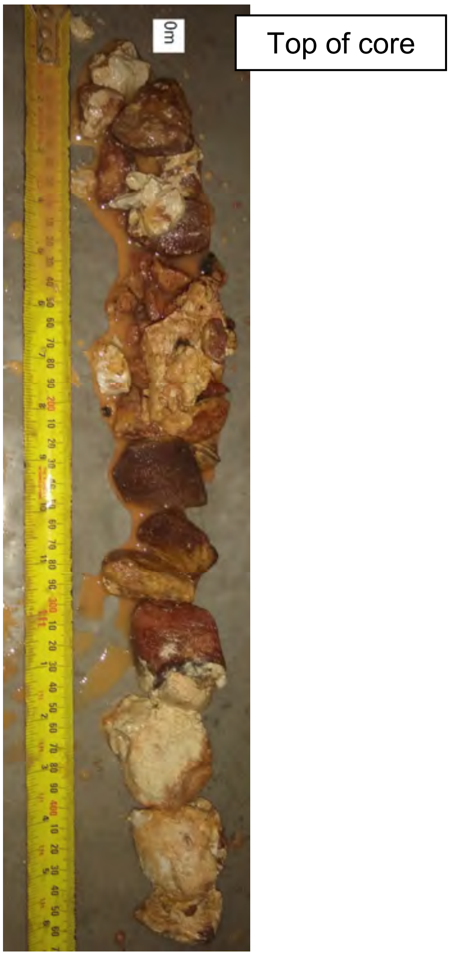

Photo W3 – View of core obtained from Borehole W3. Weathered sandstone was encountered from the start of the borehole.

Douglas Partners Geotechnics / Environment / Groundwater	**Borehole Photographs** **Proposed Commercial Development** **8-10 Lee Street, Haymarket**	PROJECT: 86867.00 PLATE No: W3 REV: 0
	CLIENT: Vertical First Pty Ltd	DATE: 15/06/2020

BOREHOLE LOG

CLIENT: Vertical First Pty Ltd
PROJECT: Proposed Commercial Development
LOCATION: 8-10 Lee Street, Haymarket

SURFACE LEVEL: 13.4 AHD
EASTING: 333948
NORTHING: 6249282
DIP/AZIMUTH: 60°/135°

BORE No: W4
PROJECT No: 86767.00
DATE: 20/5/2020
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
		CONCRETE: grey, with fine to coarse sub-rounded and sub-angular fragments of high strength sandstone, trace voids			0.0				
				C	0.22		PL(A) = 1.5		
					0.4				
				C					
	0.86	SANDSTONE: fine grained, orange-brown, highly weathered, medium to high strength, fractured, Mittagong formation							
					0.9				
				C					
					1.5				
	1.57								
				C	1.7		PL(A) = 0.29		
					2.0				
	2.12								
	2.19	SANDSTONE: fine to coarse grained, pale orange, highly weathered, medium to high strength, fractured, Hawkesbury sandstone		C	2.2		PL(A) = 0.99		
	2.4	Bore discontinued at 2.4m - Target depth reached			2.4				

RIG: Hand Drill **DRILLER:** Nick Ruha **LOGGED:** NB **CASING:** NA

TYPE OF BORING: Diatube (50mm) to 2.4m

WATER OBSERVATIONS: No free groundwater observed whilst drilling

REMARKS: Surface level taken from architectural drawing provided, Synman Justin Bialek Architects Pty Ltd, Lower Ground Floor plan, Drawing WD05 (Rev E) dated 21 May 1998. Borehole azimuth relative to Grid North

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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Top of core

Photo W4 – View of core obtained from Borehole W4.

Douglas Partners Geotechnics / Environment / Groundwater	**Borehole Photographs** **Proposed Commercial Development** **8-10 Lee Street, Haymarket**	PROJECT:	86867.00
		PLATE No:	W4
		REV:	0
	CLIENT: Vertical First Pty Ltd	DATE:	15/06/2020

Appendix E

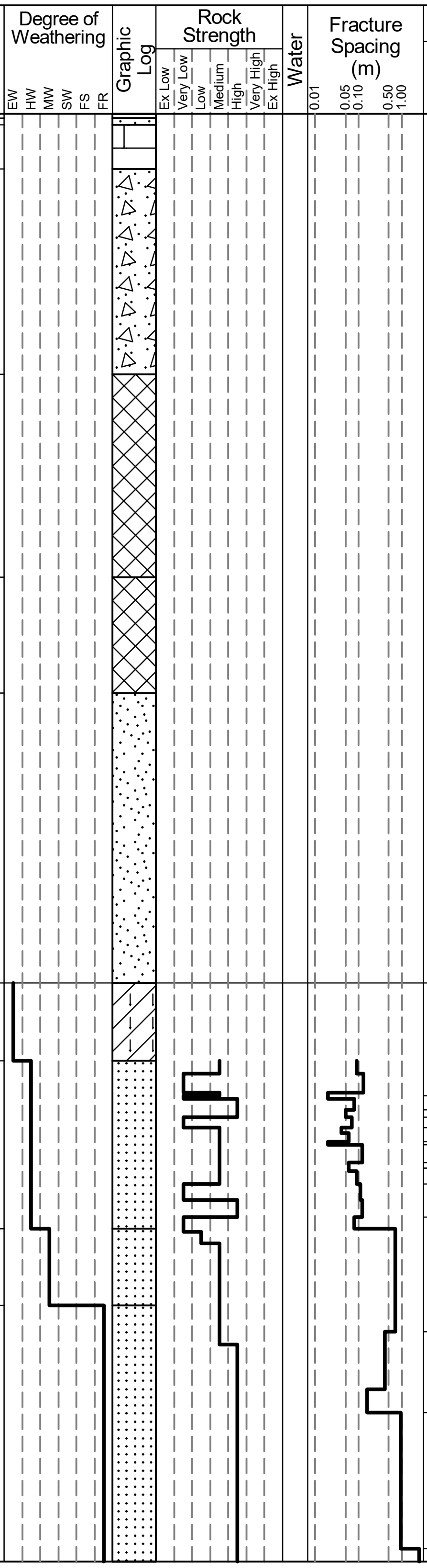
Previous Investigation Field Work Results

BOREHOLE LOG

CLIENT: Atlassian Pty Ltd
PROJECT: Proposed Commercial Development
LOCATION: 8-10 Lee Street, Haymarket

SURFACE LEVEL: 20.1 AHD
EASTING: 333983.4
NORTHING: 6249262.5
DIP/AZIMUTH: 90°/--

BORE No: BH1
PROJECT No: 86767.00
DATE: 10 - 12/7/2019
SHEET 1 OF 2



RL	Depth (m)	Description of Strata	Discontinuities B - Bedding J - Joint S - Shear F - Fault	Type	Core Rec. %	RQD %	Test Results & Comments
20	0.03 0.075	BALLAST (BLUE METAL), PLASTIC					
	0.38	CONCRETE					
		BRICK PAVEMENT					
19	1	CONCRETE At 1.3m: interface with lower concrete slab					
18	1.8 2	FILL/Sandy CLAY: low plasticity, grey mottled red-brown, fine grained sand, trace ironstone bands, slag and ash, w<PL, apparently in a very soft condition		E E			PID<1 PID<1
17	3	Below 3.0m: with ash and slag, trace glass, brick and ceramic tile fragments		E			PID<1
	3.2	FILL/SAND: fine to medium grained sand, dark brown to black, moist, apparently in a very loose condition		E E			PID<1 PID<1
16	4.0 4	SAND SP: fine to medium grained sand, orange brown, moist, very loose, alluvial soil Below 4.3m: grading to pale yellow-grey		E			PID<1
15	5						
14	6.0 6	Silty CLAY CI-CH: medium to high plasticity, orange, red and pale grey, with fine to medium grained sand, with relict rock texture, w<PL, residual soil					
13	6.54 7	SANDSTONE: medium grained, orange-red, medium strength with very low strength bands, highly weathered, fractured, Mittagong Formation	6.63m: B 0°, pl, ro, fe 6.63 to 6.76m: Ds 120mm 6.78 to 6.8m: Ds 20mm 6.88m: B 2°, un, ro, fe 6.93 to 7.0m: Ds 70mm 7.0 to 7.09m: J 90°, un, ro 7.1m: B 0°, pl, ro 7.12m: B 30°, pl, ro, fe 7.24m: B 20°, st, ro 7.28 to 7.38m: J 85°, st, ro, he 7.39 to 7.5m: Ds 110mm 7.62 to 7.7m: Ds 80mm	C	100	10	PL(A) = 0.97
12	7.7 8	SANDSTONE: medium grained, brown and pale yellow, medium to high strength, moderately weathered, slightly fractured, Hawkesbury Sandstone	8.41m: B 0°, pl, ro, fe	C	100	95	PL(A) = 0.15 PL(A) = 0.52
11	8.23 9	SANDSTONE: medium grained, pale grey, high strength, fresh, slightly fractured, cross bedding 5°-10°, Hawkesbury Sandstone	8.81 to 8.84m: (x4) B 5°, pl, ro 8.97m: B 0°, un, ro, 2mm cly	C	100	100	
	10.0						PL(A) = 1.3

RIG: Proline **DRILLER:** Tightsite **LOGGED:** WFY/NB **CASING:** HW to 6.44m

TYPE OF BORING: Diacore 0-1.3m; Hand auger 1.3m-5.0m; NMLC coring 5.0-20.0m

WATER OBSERVATIONS: No groundwater observed during auger drilling

REMARKS: Groundwater well installed: 20-7.2m backfilled with sand, 7.2-6.3m bentonite, 6.3-4.3m screened PVC with sand backfill, 4.3-4.2m blank PVC with sand backfill, 4.2-0.2m blank PVC with bentonite backfill, 0.2-0m sand, gatic cover at surface

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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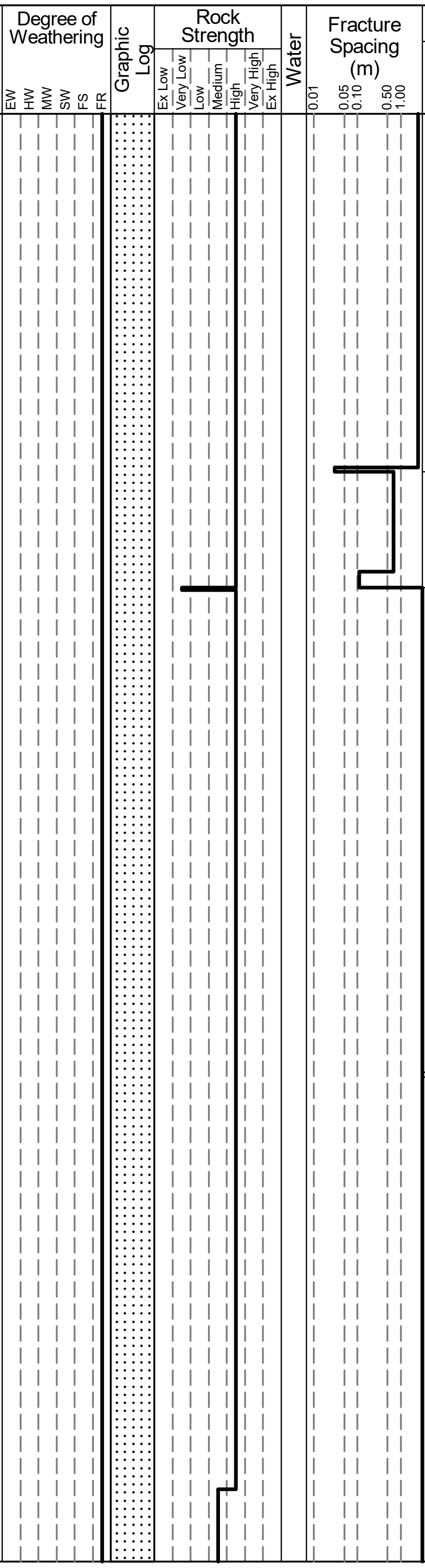
BOREHOLE LOG

CLIENT: Atlassian Pty Ltd
PROJECT: Proposed Commercial Development
LOCATION: 8-10 Lee Street, Haymarket

SURFACE LEVEL: 20.1 AHD
EASTING: 333983.4
NORTHING: 6249262.5
DIP/AZIMUTH: 90°/--

BORE No: BH1
PROJECT No: 86767.00
DATE: 10 - 12/7/2019
SHEET 2 OF 2



RL	Depth (m)	Description of Strata	Discontinuities (B - Bedding, J - Joint, S - Shear, F - Fault)	Type	Core Rec. %	RQD %	Test Results & Comments
10		SANDSTONE: medium grained, pale grey, high strength, fresh, unbroken, cross-bedding 5°-10°, Hawkesbury Sandstone	9.91m: B 2°, un, ro, clay 1mm	C	100	100	
9	11						PL(A) = 0.89
				C	100	100	
8	12						PL(A) = 1.6
		Between 12.4-12.49m: with thin black carbonaceous laminations	12.44m: B 0°, pl, sm, cbs 12.47m: B 1°, ro, pl				
7	13			C	100	100	PL(A) = 1.2
			13.16m: B 0°, pl, sm 13.27m: Ds 2mm				
6	14						PL(A) = 1.5
				C	100	100	
5	15						PL(A) = 1.2
4	16			C	100	100	PL(A) = 1.6
			>>				
3	17						PL(A) = 1.9
		Between 17.35-14.42m: with black carbonaceous laminations					
2	18			C	100	100	PL(A) = 1.9
1	19						PL(A) = 1.9
				C	100	100	
	20.0						PL(A) = 0.9

Bore discontinued at 20.0m

RIG: Proline **DRILLER:** Tightsite **LOGGED:** WFY/NB **CASING:** HW to 6.44m

TYPE OF BORING: Diacore 0-1.3m; Hand auger 1.3m-5.0m; NMLC coring 5.0-20.0m

WATER OBSERVATIONS: No groundwater observed during auger drilling

REMARKS: Groundwater well installed: 20-7.2m backfilled with sand, 7.2-6.3m bentonite, 6.3-4.3m screened PVC with sand backfill, 4.3-4.2m blank PVC with sand backfill, 4.2-0.2m blank PVC with bentonite backfill, 0.2-0m sand, gatic cover at surface

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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BORE: BH1 PROJECT: HAYMARKET AUGUST 2019

6 – 10m

BORE: BH1 PROJECT: HAYMARKET AUGUST 2019

10m – 15m

BORE: BH1 PROJECT: HAYMARKET AUGUST 2019

15m – 20m

BOREHOLE LOG

CLIENT: Atlassian Pty Ltd
PROJECT: Proposed Commercial Development
LOCATION: 8-10 Lee Street, Haymarket

SURFACE LEVEL: 20.1 AHD
EASTING: 333983.4
NORTHING: 6249262.5
DIP/AZIMUTH: 90°/--

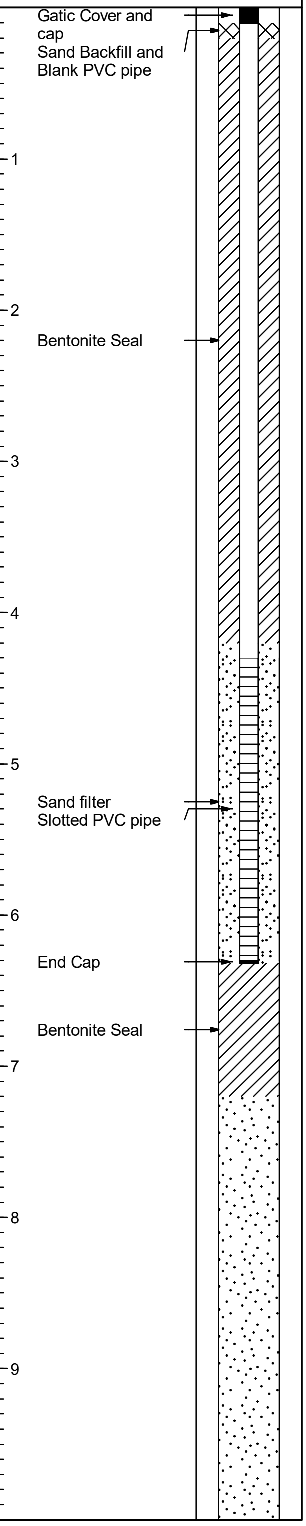
BORE No: BH1
PROJECT No: 86767.00
DATE: 10 - 12/7/2019
SHEET 1 OF 2

RL	Depth (m)	Description of Strata
20	0.03	BALLAST (BLUE METAL), PLASTIC
	0.075	CONCRETE
	0.38	BRICK PAVEMENT
		CONCRETE At 1.3m: interface with lower concrete slab
18	1.8	FILL/Sandy CLAY: low plasticity, grey mottled red-brown, fine grained sand, trace ironstone bands, slag and ash, w<PL, apparently in a very soft condition Below 3.0m: with ash and slag, trace glass, brick and ceramic tile fragments
17	3.2	FILL/SAND: fine to medium grained sand, dark brown to black, moist, apparently in a very loose condition
16	4.0	SAND SP: fine to medium grained sand, orange brown, moist, very loose, alluvial soil Below 4.3m: grading to pale yellow-grey
14	6.0	Silty CLAY CI-CH: medium to high plasticity, orange, red and pale grey, with fine to medium grained sand, with relict rock texture, w<PL, residual soil
	6.54	SANDSTONE: medium grained, orange-red, medium strength with very low strength bands, highly weathered, fractured, Mittagong Formation
	7.7	SANDSTONE: medium grained, brown and pale yellow, medium to high strength, moderately weathered, slightly fractured, Hawkesbury Sandstone
	8.23	SANDSTONE: medium grained, pale grey, high strength, fresh, slightly fractured, cross bedding 5°-10°, Hawkesbury Sandstone
	10.0	

Sampling & In Situ Testing

Type	Depth	Sample	Results & Comments
E	1.8 1.9		PID<1
E	2.2 2.4		PID<1
E	2.8 3.0		PID<1
E	3.3 3.5		PID<1
E	3.8 4.0		PID<1
E	4.3 4.5		PID<1
C	6.0 6.6 7.6		PL(A) = 0.97
C	7.74 8.4 9.2		PL(A) = 0.15 PL(A) = 0.52
C	9.95		PL(A) = 1.3

Well Construction Details



RIG: Proline **DRILLER:** Tightsite **LOGGED:** WFY/NB **CASING:** HW to 6.44m

TYPE OF BORING: Diacore 0-1.3m; Hand auger 1.3m-5.0m; NMLC coring 5.0-20.0m

WATER OBSERVATIONS: No groundwater observed during auger drilling

REMARKS: Groundwater well installed: 20-7.2m backfilled with sand, 7.2-6.3m bentonite, 6.3-4.3m screened PVC with sand backfill, 4.3-4.2m blank PVC with sand backfill, 4.2-0.2m blank PVC with bentonite backfill, 0.2-0m sand, gatic cover at surface

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Atlassian Pty Ltd
PROJECT: Proposed Commercial Development
LOCATION: 8-10 Lee Street, Haymarket

SURFACE LEVEL: 20.1 AHD
EASTING: 333983.4
NORTHING: 6249262.5
DIP/AZIMUTH: 90°/--

BORE No: BH1
PROJECT No: 86767.00
DATE: 10 - 12/7/2019
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
10		SANDSTONE: medium grained, pale grey, high strength, fresh, unbroken, cross-bedding 5°-10°, Hawkesbury Sandstone		C					
					10.72				
					10.95		PL(A) = 0.89		
9	11								11
				C					
					11.95		PL(A) = 1.6		
8	12								12
					12.33				
		Between 12.4-12.49m: with thin black carbonaceous laminations							
					12.95		PL(A) = 1.2		
7	13			C					13
									Sand backfill
					13.91 13.93		PL(A) = 1.5		
6	14								14
				C					
					14.95		PL(A) = 1.2		
5	15								15
					15.47				
					15.95		PL(A) = 1.6		
4	16								16
				C					
					16.95 17.09		PL(A) = 1.9		
3	17								17
		Between 17.35-14.42m: with black carbonaceous laminations							
				C	17.95		PL(A) = 1.9		
2	18								18
					18.71				
					18.95		PL(A) = 1.9		
1	19								19
				C					
	20.0	Bore discontinued at 20.0m			19.95		PL(A) = 0.9		

RIG: Proline **DRILLER:** Tightsite **LOGGED:** WFY/NB **CASING:** HW to 6.44m

TYPE OF BORING: Diacore 0-1.3m; Hand auger 1.3m-5.0m; NMLC coring 5.0-20.0m

WATER OBSERVATIONS: No groundwater observed during auger drilling

REMARKS: Groundwater well installed: 20-7.2m backfilled with sand, 7.2-6.3m bentonite, 6.3-4.3m screened PVC with sand backfill, 4.3-4.2m blank PVC with sand backfill, 4.2-0.2m blank PVC with bentonite backfill, 0.2-0m sand, gatic cover at surface

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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BOREHOLE LOG

CLIENT: Atlassian Pty Ltd
PROJECT: Proposed Commercial Development
LOCATION: 8-10 Lee Street, Haymarket

SURFACE LEVEL: 21.2 AHD
EASTING: 333968
NORTHING: 6249250
DIP/AZIMUTH: 90°/--

BORE No: BH2
PROJECT No: 86767.00
DATE: 10 - 11/7/2019
SHEET 1 OF 3

Depth (m)	Description of Strata	Water	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Type	Core Rec. %	RQD %	Test Results & Comments
0.28	CONCRETE SLAB 0.08m: interface with lower concrete slab						
2.5	FILL/SAND: fine to medium grained sand, brown, moist, apparently moderately compacted Below 1.5m: trace ash and slag Below 2.1m: with clay, trace shale gravel, moderately compacted			A/E* A/E A/E A/E S A/E			PID<1 PID<1 PID<1 PID<1 0,0,2 N = 2 PID<1
4.0	Fill/Clayey SAND: fine to coarse grained sand, brown, 15% plastic fines, trace gravel 2-5mm, moist, apparently moderately compacted			A/E A/E S			PID<1 PID<1 0,0,0 N = 0
5.2	Fill/Silty CLAY: medium plasticity, brown-grey, trace sand, w<PL Below 4.8m: with angular shale and ironstone gravel to 20mm			A/E S			PID<1 2,2,2 N = 4
6.2	Fill/Silty SAND: fine grained sand, grey and dark grey, trace gravel 2-5mm, moist, apparently variably compacted			A/E S			PID<1 1,1,1 N = 2
8.0	Fill/SAND: fine grained sand, grey, with silt, wet, apparently variably compacted	▼ 10-07-19		A/E S			PID<1 0,0,1 N = 1
9.0	Silty CLAY CI-CH: medium to high plasticity, orange brown, with fine to medium grained sand and ironstone gravel, w<PL, soft, residual soil						
9.47	Sandy CLAY CL: low plasticity, pale grey, fine to medium grained sand, w<PL, hard, residual soil			S			25/100 refusal
10.0	SANDSTONE: refer following page		9.74 to 9.80m: J 65°, st, ro	C	100	95	PL(A) = 1.4

RIG: XC **DRILLER:** Terratest **LOGGED:** NB **CASING:** HQ to 8.9m

TYPE OF BORING: Diacore 0-0.28m; solid flight auger (TC Bit) 0.28-7.5m; Wash bore 7.5-9.47m; NMLC coring 9.47-23.27m

WATER OBSERVATIONS: Saturated sand (fill) encountered at 6.2m

REMARKS: *BD1 at 0.28m

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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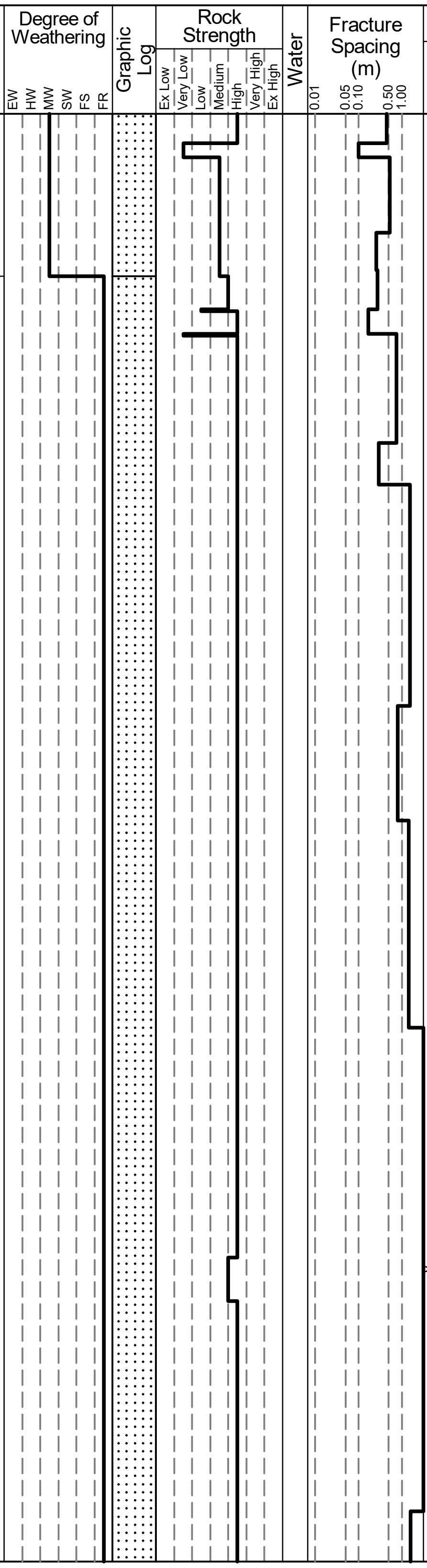
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Atlassian Pty Ltd
PROJECT: Proposed Commercial Development
LOCATION: 8-10 Lee Street, Haymarket

SURFACE LEVEL: 21.2 AHD
EASTING: 333968
NORTHING: 6249250
DIP/AZIMUTH: 90°/--

BORE No: BH2
PROJECT No: 86767.00
DATE: 10 - 11/7/2019
SHEET 2 OF 3



RL	Depth (m)	Description of Strata	Discontinuities (B - Bedding, J - Joint, S - Shear, F - Fault)	Type	Core Rec. %	RQD %	Test Results & Comments
11		SANDSTONE: medium grained, pale grey and brown, medium strength with some very low strength bands, moderately weathered, slightly fractured, Hawkesbury Sandstone	10.2 to 10.3m: Ds 100mm	C	100	95	
			10.82m: B 15°, pl, sm, fe				
	11		11.08m: Cs 10mm				PL(A) = 1.5
10	11.12	SANDSTONE: medium grained, pale grey, high strength, fresh, slightly fractured, cross bedding 5°-10°, Hawkesbury Sandstone	11.35m: B 5°, fe, pl, ro				
			11.52m: Ds 10mm				
	12	Below 12m: unbroken					PL(A) = 1.1
9			12.27m: B 5°, pl, ro				
			12.56m: B 5°, pl, sm	C	100	100	
	13						PL(A) = 1.3
8							
	14						PL(A) = 1.6
7			14.09m: B 2°, un, sm clay 2mm				
	15		14.88m: B 5°, st, sm cly 2mm				PL(A) = 1.4
6				C	100	100	
	16						PL(A) = 1.4
5			16.31m: B 20°, pl, sm				
	17						PL(A) = 1.3
4							
	18						PL(A) = 0.96
3				C	100	100	
	19						PL(A) = 1.3
2		At 19.52m: carbonaceous laminations, dipping 25°	19.75m: B 5°, un, ro, cly 1mm				PL(A) = 2.2

RIG: XC **DRILLER:** Terratest **LOGGED:** NB **CASING:** HQ to 8.9m

TYPE OF BORING: Diacore 0-0.28m; solid flight auger (TC Bit) 0.28-7.5m; Wash bore 7.5-9.47m; NMLC coring 9.47-23.27m

WATER OBSERVATIONS: Saturated sand (fill) encountered at 6.2m

REMARKS: *BD1 at 0.28m

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

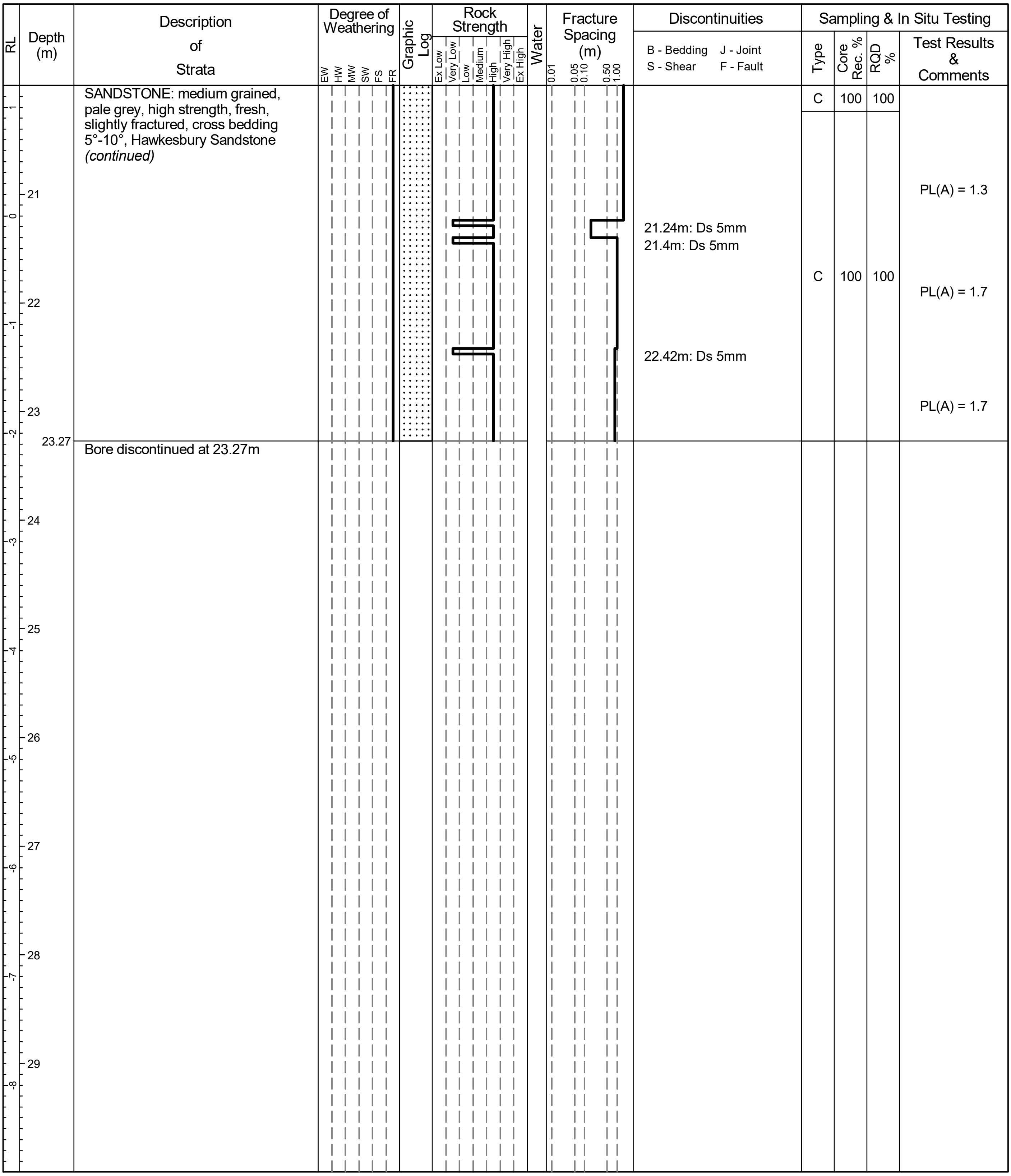
Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Atlassian Pty Ltd
PROJECT: Proposed Commercial Development
LOCATION: 8-10 Lee Street, Haymarket

SURFACE LEVEL: 21.2 AHD
EASTING: 333968
NORTHING: 6249250
DIP/AZIMUTH: 90°/--

BORE No: BH2
PROJECT No: 86767.00
DATE: 10 - 11/7/2019
SHEET 3 OF 3



Depth (m)	Description of Strata	Discontinuities	Type	Core Rec. %	RQD %	Test Results & Comments
	SANDSTONE: medium grained, pale grey, high strength, fresh, slightly fractured, cross bedding 5°-10°, Hawkesbury Sandstone *(continued)*		C	100	100	
21						PL(A) = 1.3
		21.24m: Ds 5mm 21.4m: Ds 5mm				
			C	100	100	
22						PL(A) = 1.7
		22.42m: Ds 5mm				
23						PL(A) = 1.7
23.27	Bore discontinued at 23.27m					

RIG: XC **DRILLER:** Terratest **LOGGED:** NB **CASING:** HQ to 8.9m

TYPE OF BORING: Diacore 0-0.28m; solid flight auger (TC Bit) 0.28-7.5m; Wash bore 7.5-9.47m; NMLC coring 9.47-23.27m

WATER OBSERVATIONS: Saturated sand (fill) encountered at 6.2m

REMARKS: *BD1 at 0.28m

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
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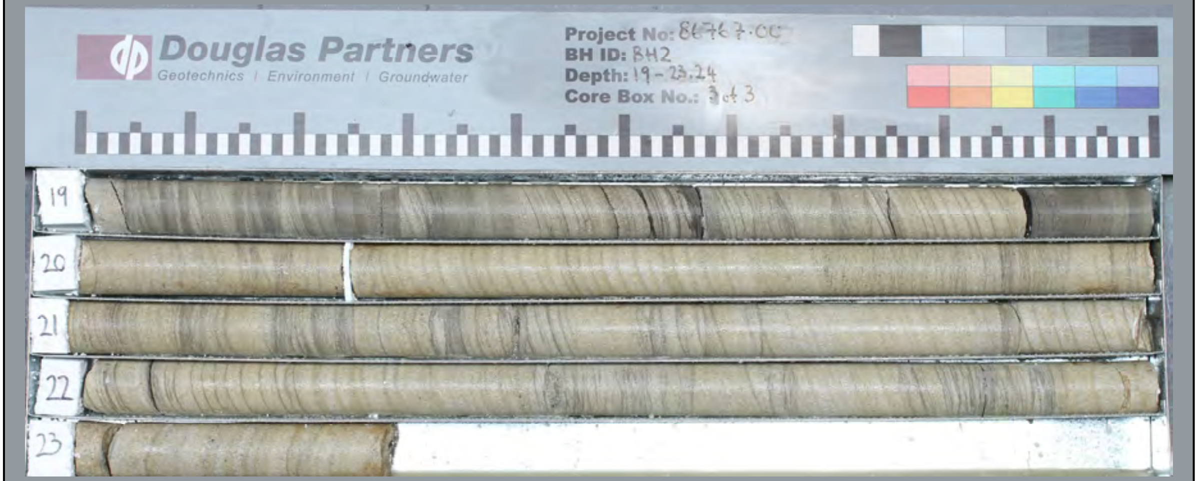
BORE: BH2 PROJECT: HAYMARKET AUGUST 2019

9.57 – 14m

BORE: BH2 PROJECT: HAYMARKET AUGUST 2019

14m – 19m

BORE: BH2 PROJECT: HAYMARKET AUGUST 2019



19m – 23.24m

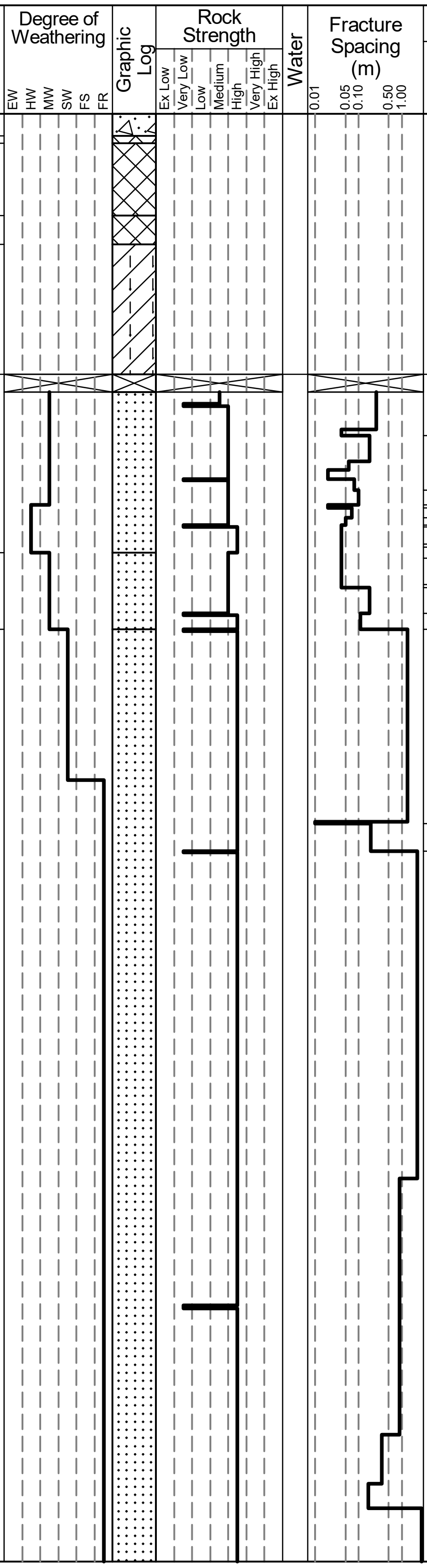
BOREHOLE LOG

CLIENT: Atlassian Pty Ltd
PROJECT: Proposed Commercial Development
LOCATION: 8-10 Lee Street, Haymarket

SURFACE LEVEL: 15.5 AHD
EASTING: 333982
NORTHING: 6249281
DIP/AZIMUTH: 90°/--

BORE No: BH3
PROJECT No: 86767.00
DATE: 12 - 13/7/2019
SHEET 1 OF 2

Depth (m)	Description of Strata
	CONCRETE SLAB
0.15 0.2	Fill/SAND: fine to medium grained sand, yellow-grey, moist, apparently poorly to moderately compacted
0.7 0.9	Fill/Silty CLAY: medium plasticity, grey and red-brown, with medium grained sand and angular basalt gravel to 70mm, w<PL
	Fill/SAND: fine to medium grained sand, yellow, moist, apparently moderately compacted
1.8 1.92	Silty CLAY CH: high plasticity, grey mottled red, trace ironstone gravel 2-3mm, w<PL, very stiff, residual soil
	SANDSTONE: medium grained, brown and grey, medium strength, highly and moderately weathered, fractured, Hawkesbury Sandstone
3.03	SANDSTONE: medium grained, yellow-grey, high strength, moderately weathered, slightly fractured, Hawkesbury Sandstone
3.56	SANDSTONE: medium grained, pale grey, high strength, slightly weathered then fresh, unbroken, Hawkesbury Sandstone
	Between 7.35 - 7.41m: carbonaceous laminations
	Between 9.96-10.12m: fine grained sandstone, dark grey



Discontinuities

B - Bedding J - Joint
S - Shear F - Fault

Unless otherwise specified, defects are B 0-5°, pl, sm
1.8m: CORE LOSS: 120mm
2.18m: B 2°, st, ro
2.22m: B 5°, un, ro
2.52m: Cs 0°, 5mm, white
2.6m: Cs, 2mm, grey
2.7m: B 2°, st, ro, fe
2.72m: B 0°, st, ro, fe
2.79m: B 0°, pl, ro, fe
2.84m: Cs 10mm
2.85 to 3.21m: B 0° (x10), pl, ro, fe
2.97m: B 2°, pl, ro, fe
2.99m: B 1°, pl, ro, fe
3.07m: J 20°, pl, ro
3.25m: B 2°, un, ro
3.27 to 3.61m: B 0° (x3), ro, pl, fe
3.45m: Cs, 2mm
3.56m: Cs, 4mm
4.89m: J 15°, pl, ro, open
4.9m: J 15°, pl, ro, open
5.09m: Ds 5mm
7.35m: B 5°, un, carbonaceous clay 15mm
8.23m: Ds, 20mm
9.63m: B 0°, pl, sm, carbonaceous clay 1mm

Sampling & In Situ Testing

Type	Core Rec. %	RQD %	Test Results & Comments
E			PID<1
E			PID<1
C	66	33	PL(A) = 1
C	100	95	PL(A) = 0.92
C	100	100	PL(A) = 1.6 PL(A) = 1.4 PL(A) = 1.3
C	100	100	PL(A) = 1.1 PL(A) = 1.7 PL(A) = 2

RIG: XC **DRILLER:** Terratest **LOGGED:** NB **CASING:** HWT to 2.0m
TYPE OF BORING: Diacore 0-0.15m; Hand auger 0.15-0.9m; Solid flight auger (TC Bit) 0.9-1.8m; NMLC coring 1.8-15.0m
WATER OBSERVATIONS: No groundwater observed during auger drilling
REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	₮	Water level	V	Shear vane (kPa)

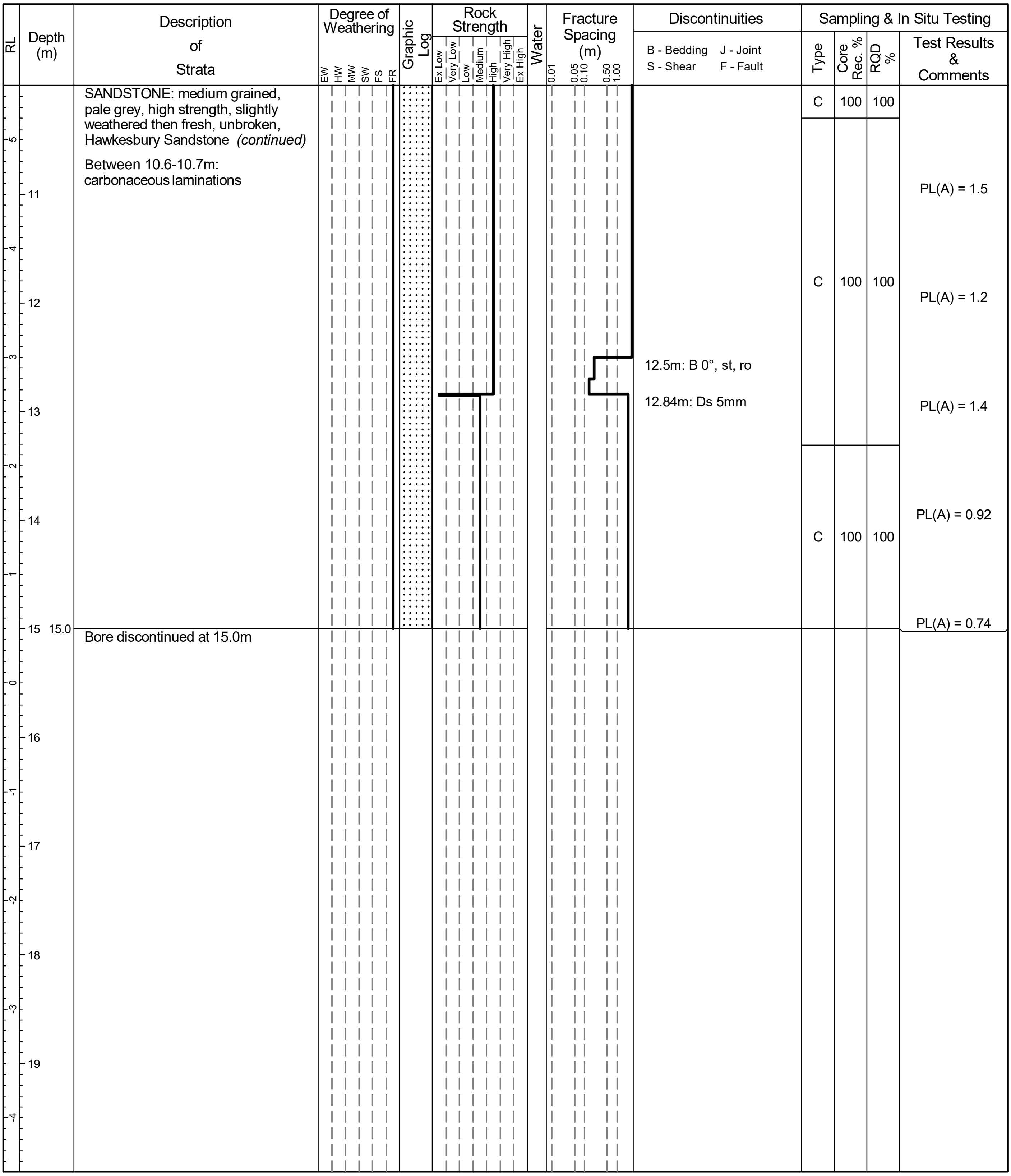
Douglas Partners
Geotechnics | Environment | Groundwater

BOREHOLE LOG

CLIENT: Atlassian Pty Ltd
PROJECT: Proposed Commercial Development
LOCATION: 8-10 Lee Street, Haymarket

SURFACE LEVEL: 15.5 AHD
EASTING: 333982
NORTHING: 6249281
DIP/AZIMUTH: 90°/--

BORE No: BH3
PROJECT No: 86767.00
DATE: 12 - 13/7/2019
SHEET 2 OF 2



Depth (m)	Description of Strata	Discontinuities	Type	Core Rec. %	RQD %	Test Results & Comments
	SANDSTONE: medium grained, pale grey, high strength, slightly weathered then fresh, unbroken, Hawkesbury Sandstone *(continued)*		C	100	100	
	Between 10.6-10.7m: carbonaceous laminations		C	100	100	PL(A) = 1.5
						PL(A) = 1.2
		12.5m: B 0°, st, ro				
		12.84m: Ds 5mm				PL(A) = 1.4
			C	100	100	PL(A) = 0.92
						PL(A) = 0.74
15.0	Bore discontinued at 15.0m					

RIG: XC **DRILLER:** Terratest **LOGGED:** NB **CASING:** HWT to 2.0m
TYPE OF BORING: Diacore 0-0.15m; Hand auger 0.15-0.9m; Solid flight auger (TC Bit) 0.9-1.8m; NMLC coring 1.8-15.0m
WATER OBSERVATIONS: No groundwater observed during auger drilling
REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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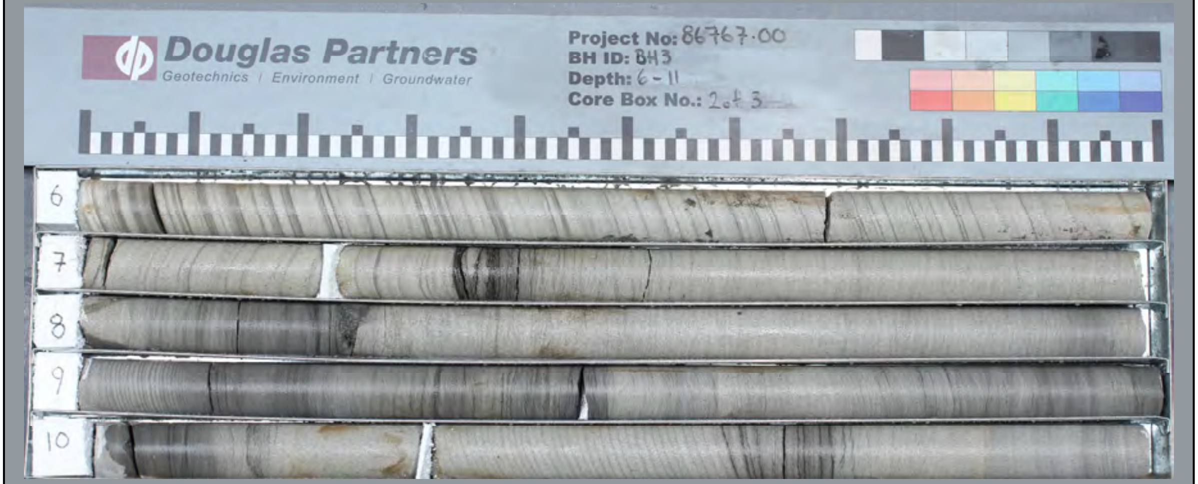
BORE: BH3 PROJECT: HAYMARKET AUGUST 2019

1.8 – 6m

BORE: BH3 PROJECT: HAYMARKET AUGUST 2019



6m – 11m

BORE: BH3 PROJECT: HAYMARKET AUGUST 2019

11m – 15m

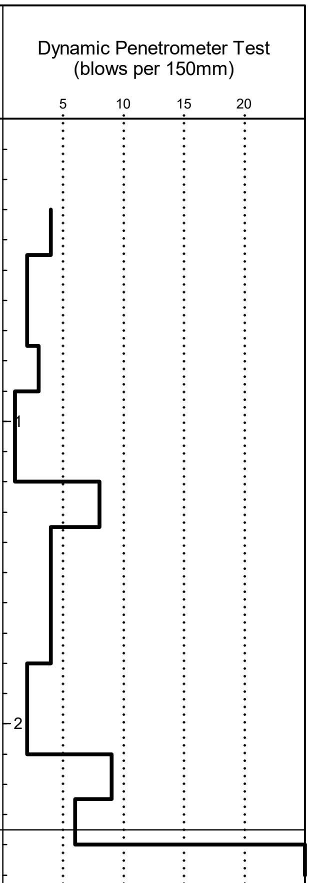
BOREHOLE LOG

CLIENT: Atlassian Pty Ltd
PROJECT: Proposed Commercial Development
LOCATION: 8-10 Lee Street, Haymarket

SURFACE LEVEL: 15.5 AHD
EASTING: 333994
NORTHING: 6249287
DIP/AZIMUTH: 90°/--

BORE No: BH4
PROJECT No: 86767.00
DATE: 12 - 13/7/2019
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Type	Depth	Sample	Results & Comments	Water
	0.15	CONCRETE SLAB					
	0.16	Fill/SAND: fine to medium grained sand, moist, apparently loose, moderately compacted					
	0.3	CONCRETE SLAB					
	0.4	Fill/Sandy CLAY: fine to medium grained sand, with approx. 15% black ash, w<PL, generally in a stiff condition					
15		Fill/Silty CLAY: medium plasticity, brown, pale grey and red, with fine to medium grained sand and angular ironstone gravel up to 5-10mm, w<PL, generally in a firm condition 0.8-0.9m: with angular to sub-rounded ironstone gravel, up to 50mm					
	1.0	FILL/Sandy CLAY: low to medium plasticity, fine to medium grained sand, brown, with 15-30mm angular to sub-angular ironstone gravel, w~PL, generally in a soft condition	E	1.4 1.5		PID<1	
14	1.7	Silty CLAY CH: high plasticity, grey mottled red and yellow, w~PL, firm to stiff, residual soil	E	2.0 2.1		PID<1	
	2.3 2.35	SANDSTONE: medium strength, grey, Hawkesbury Sandstone					
13		Bore discontinued at 2.35m Refusal on sandstone					



RIG: Miniprobe **DRILLER:** Terratest **LOGGED:** NB/AS **CASING:** NA
TYPE OF BORING: Diacore 0-0.16m; hand auger 0.16-1m; Pushtube and solid flight auger (TC Bit) 1.0-2.35m
WATER OBSERVATIONS: No groundwater observed during auger drilling
REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

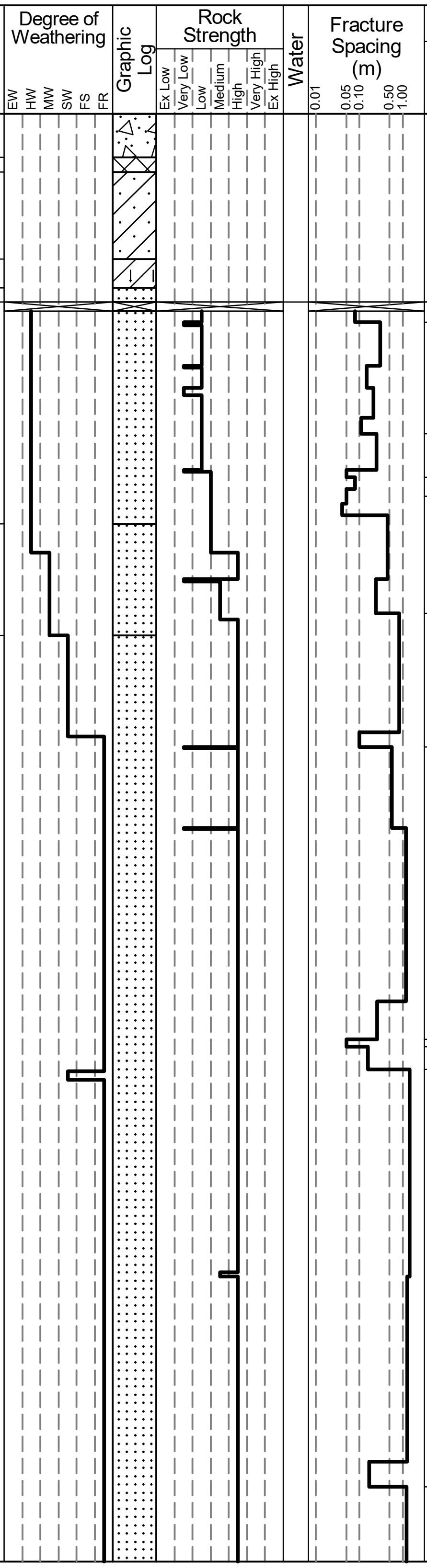
Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Atlassian Pty Ltd
PROJECT: Proposed Commercial Development
LOCATION: 8-10 Lee Street, Haymarket

SURFACE LEVEL: 15.5 AHD
EASTING: 333980
NORTHING: 6249298
DIP/AZIMUTH: 90°/--

BORE No: BH5
PROJECT No: 86767.00
DATE: 13/7/2019
SHEET 1 OF 2



RL	Depth (m)	Description of Strata	Discontinuities B - Bedding J - Joint S - Shear F - Fault	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
		CONCRETE SLAB					
15	0.3 0.4	FILL/Gravelly SAND: medium grained sand, grey, fine to medium 5-15mm sub-rounded to sub-angular gravel, dry		E E			PID<1 PID<1
	1 1.0	Sandy CLAY CI: medium plasticity, grey mottled red, fine to medium grained sand, with fine gravel, w~PL, residual soil	Unless otherwise specified, defects are B 0-5°, pl, ro, fe	E E			PID<1 PID<1
14	1.2 1.3 1.36	SILTY CLAY CI: medium plasticity, grey mottled red and yellow, trace fine sand, w~PL, residual soil	1.3m: CORE LOSS: 60mm 1.44m: Ds 20mm 1.74m: Ds 10mm 1.89m: Ds 50mm	C	95	60	
	2	SANDSTONE: highly weathered, ironstained, Hawkesbury Sandstone	2.1m: B 0°, st, ro 2.21m: B 0°, st, ro				PL(A) = 0.2
13	2.83	SANDSTONE: medium grained, pale grey and orange, medium strength with bands of very low strength, highly weathered, fractured, Hawkesbury Sandstone	2.46m: Ds 10mm 2.51m: B 0°, pl, ro 2.64m: B 10°, un, ro, fe				PL(A) = 0.16
12	3 3.6	SANDSTONE: medium grained, pale grey, medium and high strength, moderately weathered, slightly fractured, Hawkesbury Sandstone	3.21m: Cs, 20mm, dark grey 3.45m: J 25°, pl, ro, open	C	100	85	PL(A) = 0.72
11	4	SANDSTONE: medium grained, pale grey, high strength, slightly weathered then fresh, unbroken, Hawkesbury Sandstone	4.27m: B 0°, pl, ro, cly vn 4.37m: Cs 10mm				
	5		4.93m: Cs 10mm				PL(A) = 1.2
10				C	100	98	
9	6	Between 6.60-6.65m: carbonaceous laminations	6.13m: B 5°, pl, ro, clay co 1mm 6.39m: B 5°, ir, ro, cln 6.44m: B 0°, pl, ro, st 6.6m: B 2°, pl, cly co 1mm				PL(A) = 1 PL(A) = 1.2
8	7 8		8.03m: Cs 10mm				PL(A) = 2.1
7				C	100	100	
6	9		9.31m: B 0°, pl, sm, mica 9.48m: B 5°, pl, sm, cly vn				PL(A) = 1.8

RIG: Hand tools, Miniprobe and XC **DRILLER:** Terratest **LOGGED:** AS/NB/KR **CASING:** HW to 1.1m

TYPE OF BORING: Diacore 0-0.3m; Pushtube and solid flight auger (TC Bit) 0.3-1.3m; NMLC coring 1.3-15.27m

WATER OBSERVATIONS: No groundwater observed during auger drilling

REMARKS: Groundwater well installed: 15.17-2.2m screened PVC with sand backfill, 2.2-1.8m blank PVC with sand backfill, 2.2-0m blank PVC, 1.8-0.8m bentonite backfill, 0.8-0m backfilled, gatic cover at surface. Refusal to TC-bit auger at 1.2m

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Atlassian Pty Ltd
PROJECT: Proposed Commercial Development
LOCATION: 8-10 Lee Street, Haymarket

SURFACE LEVEL: 15.5 AHD
EASTING: 333980
NORTHING: 6249298
DIP/AZIMUTH: 90°/--

BORE No: BH5
PROJECT No: 86767.00
DATE: 13/7/2019
SHEET 2 OF 2

Depth (m)	Description of Strata	Discontinuities (B - Bedding, J - Joint, S - Shear, F - Fault)	Type	Core Rec. %	RQD %	Test Results & Comments
	SANDSTONE: medium grained, pale grey, high strength, slightly weathered then fresh, unbroken, Hawkesbury Sandstone *(continued)*		C	100	100	PL(A) = 1.2
		10.7m: B 10°, pl, sm, mica				
11						PL(A) = 1.9
		11.77m: B 20°, pl, sm, mica	C	100	100	
12						PL(A) = 1.2
	Between 12.3-12.57m: fine grained sandstone, cross-bedded at base					
13						PL(A) = 1.5
14			C	100	100	PL(A) = 1.1
		14.57m: B 5°, ir, sm, cly vn 14.75m: Cs 20mm				
15						PL(A) = 1.4
15.27	Bore discontinued at 15.27m					

Depth scale: 11, 12, 13, 14, 15, 16, 17, 18, 19
RL scale: 5, 4, 3, 2, 1, 0, -1, -2, -3, -4

RIG: Hand tools, Miniprobe and XC **DRILLER:** Terratest **LOGGED:** AS/NB/KR **CASING:** HW to 1.1m

TYPE OF BORING: Diacore 0-0.3m; Pushtube and solid flight auger (TC Bit) 0.3-1.3m; NMLC coring 1.3-15.27m

WATER OBSERVATIONS: No groundwater observed during auger drilling

REMARKS: Groundwater well installed: 15.17-2.2m screened PVC with sand backfill, 2.2-1.8m blank PVC with sand backfill, 2.2-0m blank PVC, 1.8-0.8m bentonite backfill, 0.8-0m backfilled, gatic cover at surface. Refusal to TC-bit auger at 1.2m

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BORE: BH5 PROJECT: HAYMARKET AUGUST 2019

1.3 – 6m

BORE: BH5 PROJECT: HAYMARKET AUGUST 2019

6m – 11m

BORE: BH5 PROJECT: HAYMARKET AUGUST 2019

11m – 15.27m

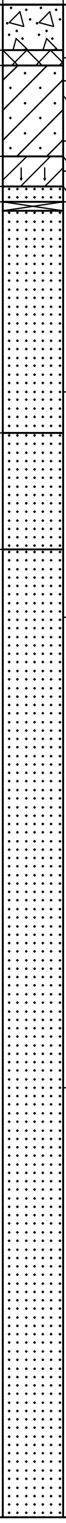
BOREHOLE LOG

CLIENT: Atlassian Pty Ltd
PROJECT: Proposed Commercial Development
LOCATION: 8-10 Lee Street, Haymarket

SURFACE LEVEL: 15.5 AHD
EASTING: 333980
NORTHING: 6249298
DIP/AZIMUTH: 90°/--

BORE No: BH5
PROJECT No: 86767.00
DATE: 13/7/2019
SHEET 1 OF 2

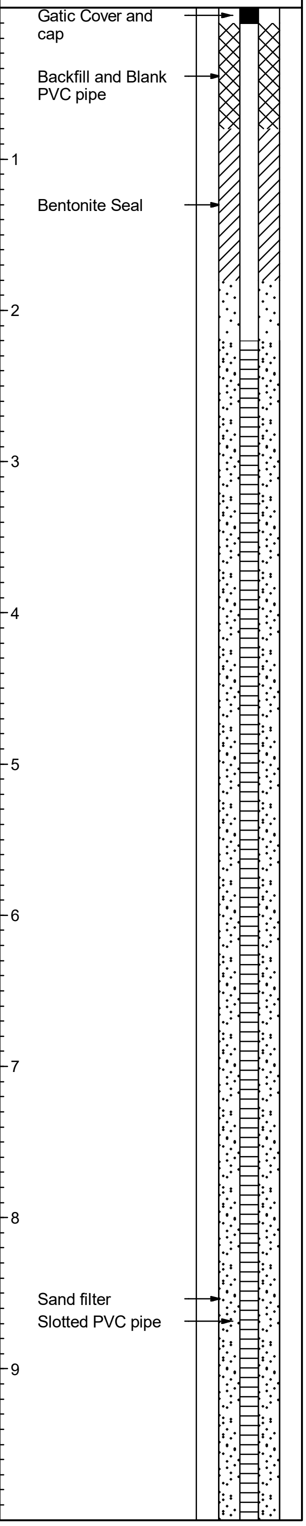
Depth (m)	Description of Strata
	CONCRETE SLAB
0.3	FILL/Gravelly SAND: medium grained sand, grey, fine to medium 5-15mm sub-rounded to sub-angular gravel, dry
0.4	Sandy CLAY CI: medium plasticity, grey mottled red, fine to medium grained sand, with fine gravel, w~PL, residual soil
1.0	SILTY CLAY CI: medium plasticity, grey mottled red and yellow, trace fine sand, w~PL, residual soil
1.2	
1.3	SANDSTONE: highly weathered, ironstained, Hawkesbury Sandstone
1.36	SANDSTONE: medium grained, pale grey and orange, medium strength with bands of very low strength, highly weathered, fractured, Hawkesbury Sandstone
2.83	SANDSTONE: medium grained, pale grey, medium and high strength, moderately weathered, slightly fractured, Hawkesbury Sandstone
3.6	SANDSTONE: medium grained, pale grey, high strength, slightly weathered then fresh, unbroken, Hawkesbury Sandstone
	Between 6.60-6.65m: carbonaceous laminations



Sampling & In Situ Testing

Type	Depth	Sample	Results & Comments	Water
E	0.35 0.5		PID<1	
E	0.5 0.6		PID<1	
E	0.9 1.0		PID<1	
E	1.1 1.2		PID<1	
	1.3			
C	2.1		PL(A) = 0.2	
	2.56			
	2.7		PL(A) = 0.16	
C	3.31		PL(A) = 0.72	
	4.05			
	4.95		PL(A) = 1.2	
C	5.95		PL(A) = 1	
	6.95		PL(A) = 1.2	
	7.16			
	7.95		PL(A) = 2.1	
C	9.0		PL(A) = 1.8	
	10.0		PL(A) = 1.2	

Well Construction Details



RIG: Hand tools, Miniprobe and XC **DRILLER:** Terratest **LOGGED:** AS/NB/KR **CASING:** HW to 1.1m

TYPE OF BORING: Diacore 0-0.3m; Pushtube and solid flight auger (TC Bit) 0.3-1.3m; NMLC coring 1.3-15.27m

WATER OBSERVATIONS: No groundwater observed during auger drilling

REMARKS: Groundwater well installed: 15.17-2.2m screened PVC with sand backfill, 2.2-1.8m blank PVC with sand backfill, 2.2-0m blank PVC, 1.8-0.8m bentonite backfill, 0.8-0m backfilled, gatic cover at surface. Refusal to TC-bit auger at 1.2m

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

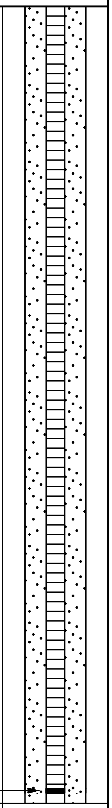
CLIENT: Atlassian Pty Ltd
PROJECT: Proposed Commercial Development
LOCATION: 8-10 Lee Street, Haymarket

SURFACE LEVEL: 15.5 AHD
EASTING: 333980
NORTHING: 6249298
DIP/AZIMUTH: 90°/--

BORE No: BH5
PROJECT No: 86767.00
DATE: 13/7/2019
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Type	Depth	Sample	Results & Comments	Water
		SANDSTONE: medium grained, pale grey, high strength, slightly weathered then fresh, unbroken, Hawkesbury Sandstone *(continued)*	C				
				10.2			
5							
	11			11.02		PL(A) = 1.9	
4							
			C				
	12			12.0		PL(A) = 1.2	
		Between 12.3-12.57m: fine grained sandstone, cross-bedded at base					
3							
	13			13.0		PL(A) = 1.5	
				13.24			
2							
	14			14.0		PL(A) = 1.1	
			C				
1							
	15			15.0		PL(A) = 1.4	
	15.27	Bore discontinued at 15.27m		15.27			
0							
	16						
-1							
	17						
-2							
	18						
-3							
	19						
-4							

Well Construction Details



RIG: Hand tools, Miniprobe and XC **DRILLER:** Terratest **LOGGED:** AS/NB/KR **CASING:** HW to 1.1m

TYPE OF BORING: Diacore 0-0.3m; Pushtube and solid flight auger (TC Bit) 0.3-1.3m; NMLC coring 1.3-15.27m

WATER OBSERVATIONS: No groundwater observed during auger drilling

REMARKS: Groundwater well installed: 15.17-2.2m screened PVC with sand backfill, 2.2-1.8m blank PVC with sand backfill, 2.2-0m blank PVC, 1.8-0.8m bentonite backfill, 0.8-0m backfilled, gatic cover at surface. Refusal to TC-bit auger at 1.2m

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

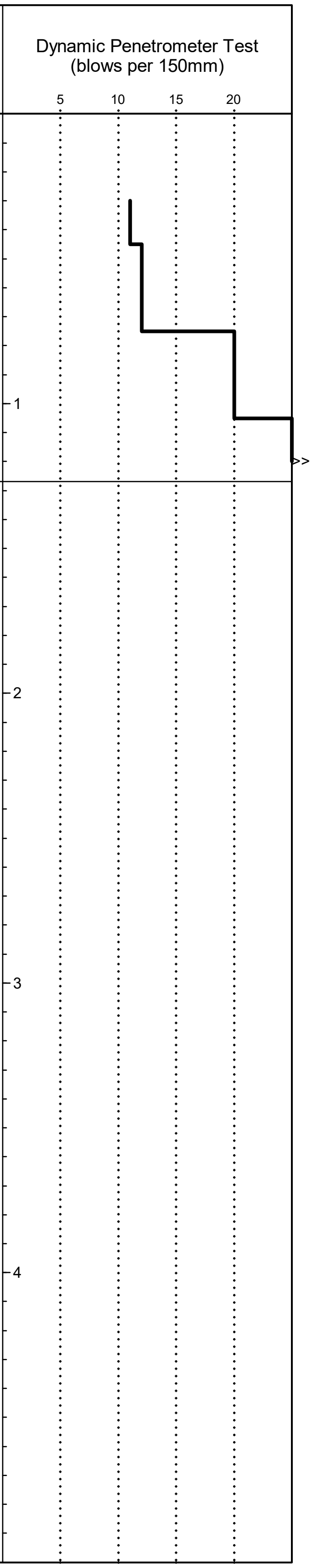
BOREHOLE LOG

CLIENT: Atlassian Pty Ltd
PROJECT: Proposed Commercial Development
LOCATION: 8-10 Lee Street, Haymarket

SURFACE LEVEL: 15.5 AHD
EASTING: 333967
NORTHING: 6249305
DIP/AZIMUTH: 90°/--

BORE No: BH6
PROJECT No: 86767.00
DATE: 14/7/2019
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Type	Depth	Sample	Results & Comments	Water
	0.06	CONCRETE SLAB: platy aggregate to 6mm, with voids					
	0.09	ASPHALT					
	0.23	CONCRETE SLAB: fine to medium igneous aggregate to 25mm, 8mm diameter steel reinforcement bar at 0.15m, voids below 0.21m	E	0.2 0.3		PID<1	
15		Silty CLAY CH: high plasticity, orange-grey, with fine ironstone gravel, w<PL, residual soil	A	0.5 0.6		PID<1	
	1.0	SANDSTONE: medium strength, grey, Hawkesbury Sandstone					
	1.27	Bore discontinued at 1.27m Refusal on sandstone					



RIG: Hand tools **DRILLER:** NB **LOGGED:** NB **CASING:** NA

TYPE OF BORING: Diacore 0-0.2m; hand auger 0.2-1.27m

WATER OBSERVATIONS: No groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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Photo D1 – View of concrete core from Borehole BH6, showing two separate concrete slabs separated by a 30 mm thick asphalt layer. Reinforcement steel (8 mm diameter) was encountered in the lower concrete slab.

Douglas Partners Geotechnics / Environment / Groundwater	**Borehole Photographs**	PROJECT: 86867.00
	Proposed Commercial Development	PLATE No: D1
	8-10 Lee Street, Haymarket	REV: 0
	CLIENT: Atlassian Pty Ltd	DATE: 15/08/2019

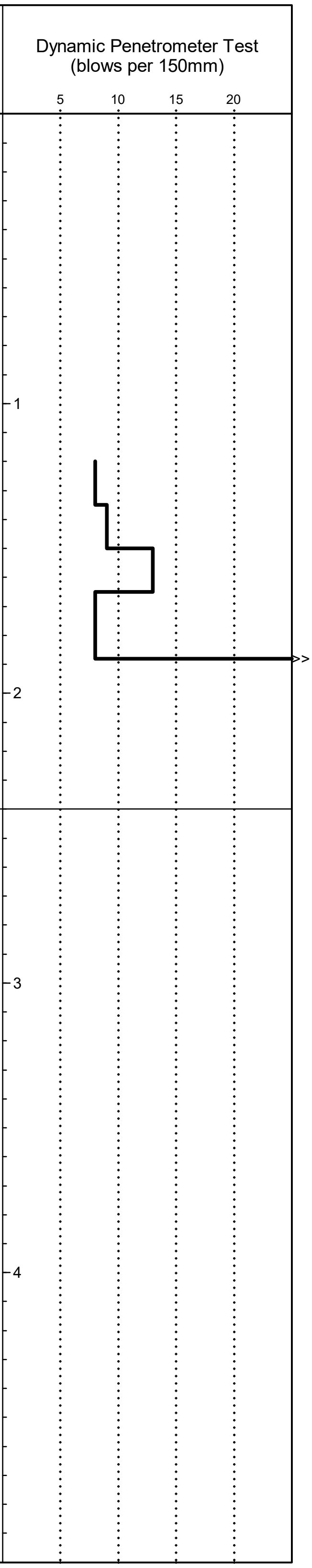
BOREHOLE LOG

CLIENT: Atlassian Pty Ltd
PROJECT: Proposed Commercial Development
LOCATION: 8-10 Lee Street, Haymarket

SURFACE LEVEL: 15.5 AHD
EASTING: 333965
NORTHING: 6249265
DIP/AZIMUTH: 90°/--

BORE No: BH7
PROJECT No: 86767.00
DATE: 12 - 13/7/2019
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water
		CONCRETE SLAB, 8mm diameter reinforcement steel						
	0.2	CONCRETE SLAB, angular igneous aggregate		E	0.2 0.3		PID<1	
15	0.38	Fill/Silty SAND: fine to medium grained sand, brown, 15% non plastic fines, moist, trace of crushed brick above 0.5m						
14	0.6	Fill/SAND: fine to medium grained sand, pale grey, trace silt, moist, generally in a dense condition		E E*	1.0 1.1 1.4 1.5		PID<1 PID<1	
	1.6	Silty CLAY CH: high plasticity, grey, mottled red and yellow, trace fine to medium sandstone gravel, w~PL, very stiff, residual soil 1.80-1.85m: crushed ironstone gravel		E	1.6 1.7		PID<1	
	1.85	Silty CLAY CI: medium plasticity, red mottled grey, with sand and fine to medium sandstone and ironstone gravel, w~PL, hard, residual soil		E	2.0 2.1		PID<1	
	2.2	SANDSTONE: medium strength, grey, Mittagong Formation						
13 12 11	2.4	Bore discontinued at 2.4m Refusal on sandstone						



RIG: Hand tools and Miniprobe **DRILLER:** NB/Terratest **LOGGED:** NB/AS **CASING:** NA
TYPE OF BORING: Hand auger 0.2-1.0m; Pushtube and solid flight auger (TC Bit) 1.0-2.4m
WATER OBSERVATIONS: No groundwater observed
REMARKS: *BD1 and BT120190713

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

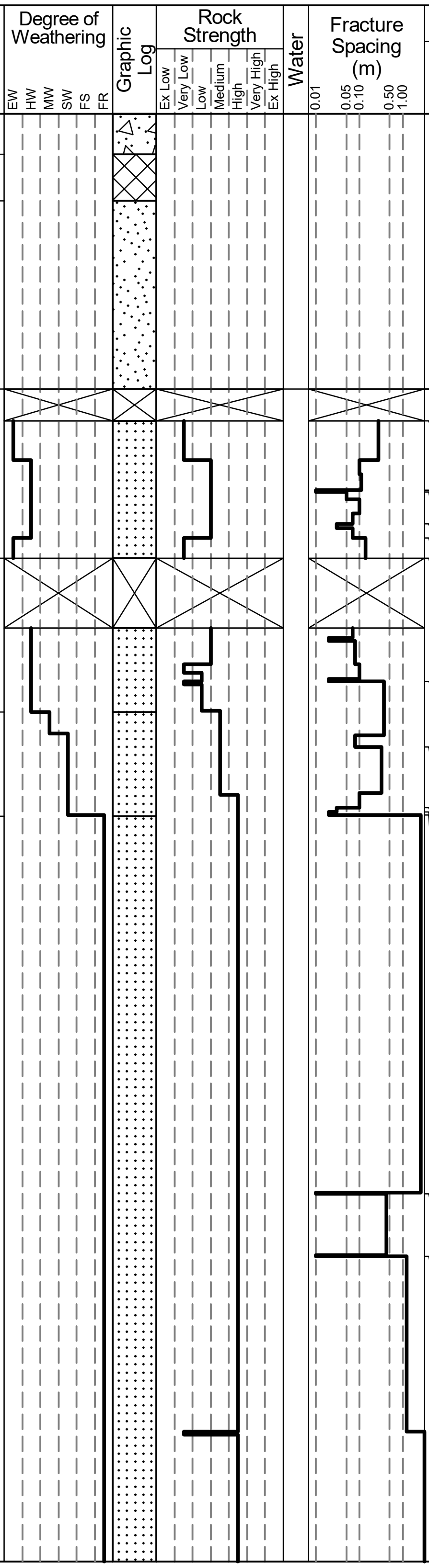
BOREHOLE LOG

CLIENT: Atlassian Pty Ltd
PROJECT: Proposed Commercial Development
LOCATION: 8-10 Lee Street, Haymarket

SURFACE LEVEL: 15.5 AHD
EASTING: 333954
NORTHING: 6249289
DIP/AZIMUTH: 90°/--

BORE No: BH8
PROJECT No: 86767.00
DATE: 14/7/2019
SHEET 1 OF 2

Depth (m)	Description of Strata
0.28	CONCRETE SLAB: angular to subangular aggregate to 15mm, negligible voids, 10mm diameter steel reinforcement at 0.09m and 0.10m, plastic at lower interface
0.6	Fill/Clayey SAND: fine to coarse grained sand, brown and yellow, 15% plastic fines, with fine gravel, apparently moderately compacted, moist
1.9	SAND SW: fine to medium grained sand, yellow, with clay, trace gravel, moist, alluvial soil
2.12	SANDSTONE: medium grained, orange-red and grey, low to medium strength, with some very low strength bands, highly weathered, fractured, Mittagong Formation
3.07	SANDSTONE: medium grained, orange and red, medium strength with some very low strength bands, highly weathered, fractured, Mittagong Formation
3.55	
4.13	SANDSTONE: medium grained, yellow-grey, medium then high strength, moderately weathered, slightly fractured, Hawkesbury Sandstone
4.85	SANDSTONE: medium grained, grey, high strength, fresh, unbroken, Hawkesbury Sandstone



Discontinuities (B - Bedding, J - Joint, S - Shear, F - Fault)

Unless otherwise specified, defects are B 0°, pl, ro
1.9m: CORE LOSS: 220mm
2.12m: Ds 270mm
2.49m: B 4°, st, ro
2.6m: B 0°, st, ro
2.61m: B 0°, st, sm
2.83m: B 0°, st, ro
2.93m: Ds 140mm
3.07m: CORE LOSS: 480mm
3.8m: Ds 60mm
3.92m: Cs 20mm
4.29m: J 30°, pl, ro, open
4.37m: J 30°, pl, ro, open
4.79m: J 15°, pl, ro, clay 1mm
4.82m: B 10°, pl, ro, fe stn
4.84m: B 5°, un, ro
7.45m: B 0°, pl, sm
7.46m: B 0°, pl, sm
7.88m: B 0°, pl, sm
7.89m: B 0°, pl, sm
9.1m: Ds 20mm

Sampling & In Situ Testing

Type	Core Rec. %	RQD %	Test Results & Comments
A/E			PID<1
C	82	20	PL(A) = 1.5
C	66	33	PL(A) = 0.15
			PL(A) = 0.66
C	100	100	PL(A) = 1.2 PL(A) = 1.3
C	100	100	PL(A) = 1.9 PL(A) = 1.2 PL(A) = 1.4

RIG: XC **DRILLER:** Terratest **LOGGED:** NB **CASING:** HQ to 1.9m

TYPE OF BORING: Diacore 0-0.28m; Hand auger 0.28-1.0m; solid flight auger (TC Bit) 1.0-1.9m; NMLC coring 1.9-15.0m

WATER OBSERVATIONS: No groundwater observed during auger drilling

REMARKS: Groundwater well installed: 15.0-2.9m screened PVC with sand backfill, 2.9-2.4m blank PVC with sand backfill, 2.4-0m blank PVC, 2.4-0m bentonite backfill, gatic cover at surface.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

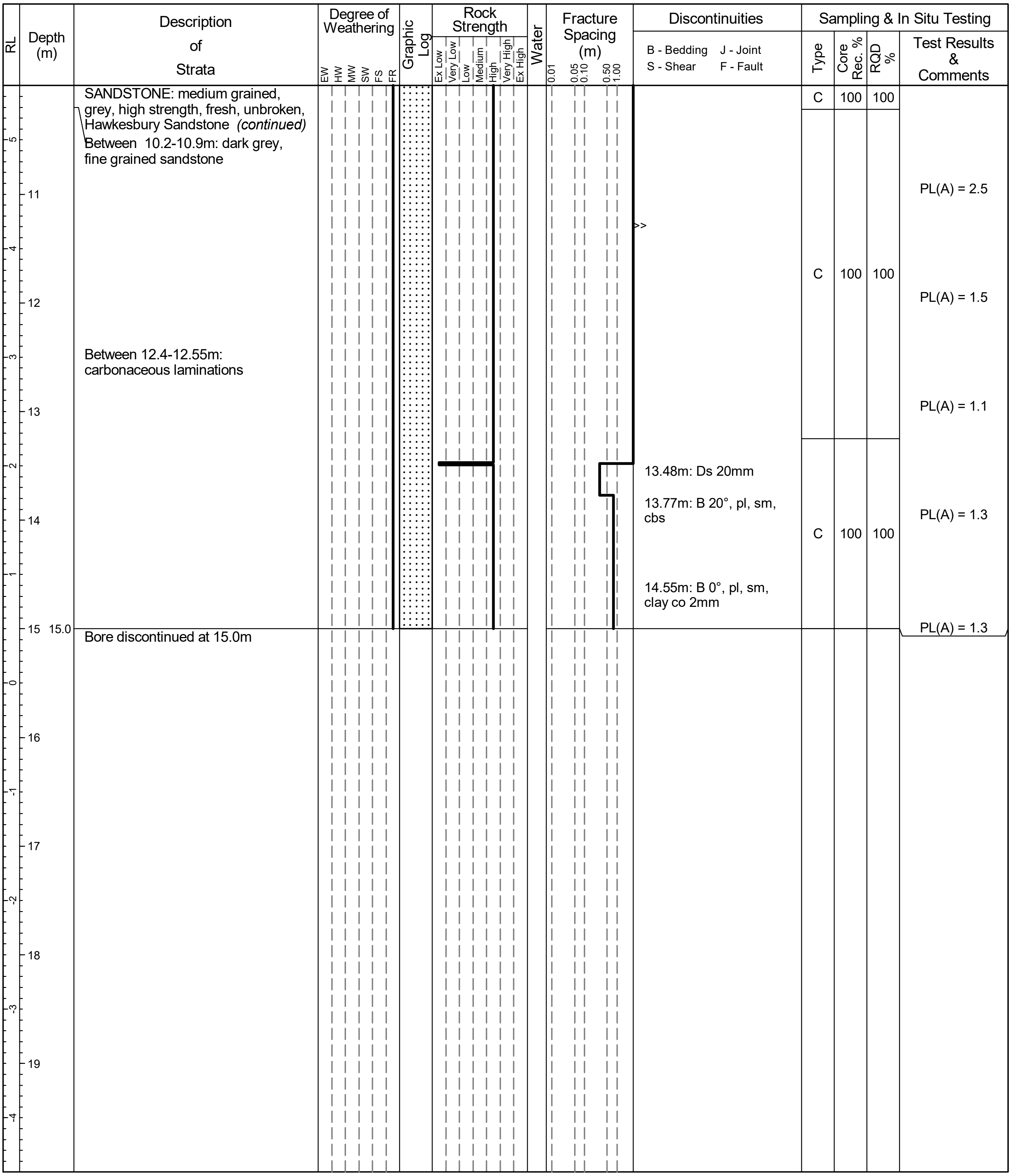
Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Atlassian Pty Ltd
PROJECT: Proposed Commercial Development
LOCATION: 8-10 Lee Street, Haymarket

SURFACE LEVEL: 15.5 AHD
EASTING: 333954
NORTHING: 6249289
DIP/AZIMUTH: 90°/--

BORE No: BH8
PROJECT No: 86767.00
DATE: 14/7/2019
SHEET 2 OF 2



Depth (m)	Description of Strata	Discontinuities	Type	Core Rec. %	RQD %	Test Results & Comments
	SANDSTONE: medium grained, grey, high strength, fresh, unbroken, Hawkesbury Sandstone *(continued)*		C	100	100	
	Between 10.2-10.9m: dark grey, fine grained sandstone					
11						PL(A) = 2.5
			C	100	100	
12						PL(A) = 1.5
	Between 12.4-12.55m: carbonaceous laminations					
13						PL(A) = 1.1
		13.48m: Ds 20mm				
		13.77m: B 20°, pl, sm, cbs				
14			C	100	100	PL(A) = 1.3
		14.55m: B 0°, pl, sm, clay co 2mm				
15.0	Bore discontinued at 15.0m					PL(A) = 1.3

RIG: XC **DRILLER:** Terratest **LOGGED:** NB **CASING:** HQ to 1.9m

TYPE OF BORING: Diacore 0-0.28m; Hand auger 0.28-1.0m; solid flight auger (TC Bit) 1.0-1.9m; NMLC coring 1.9-15.0m

WATER OBSERVATIONS: No groundwater observed during auger drilling

REMARKS: Groundwater well installed: 15.0-2.9m screened PVC with sand backfill, 2.9-2.4m blank PVC with sand backfill, 2.4-0m blank PVC, 2.4-0m bentonite backfill, gatic cover at surface.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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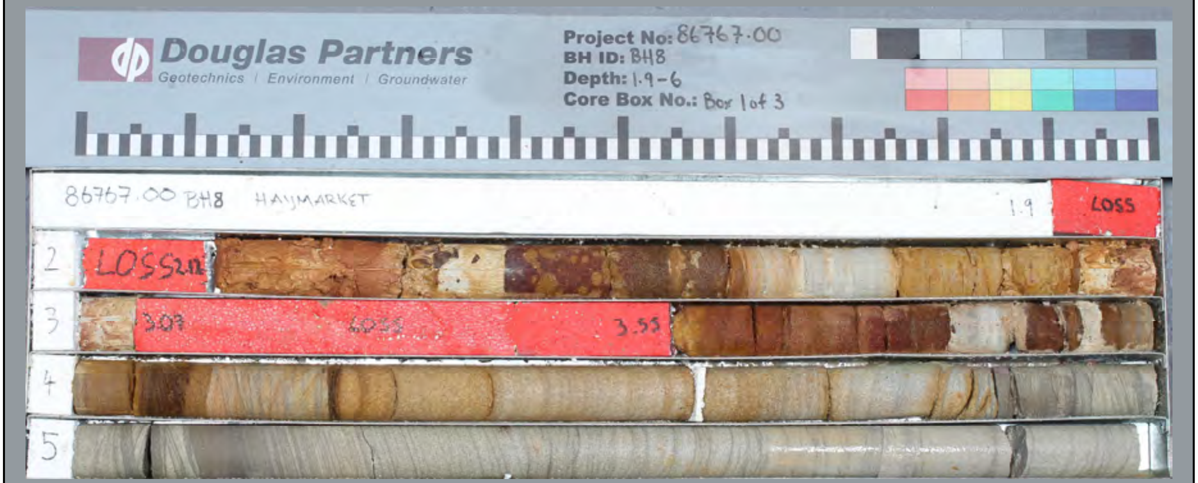
BORE: BH8 PROJECT: HAYMARKET AUGUST 2019



1.9 – 6m

BORE: BH8 PROJECT: HAYMARKET AUGUST 2019

6m – 11m

BORE: BH8 PROJECT: HAYMARKET AUGUST 2019

11m – 15.19m

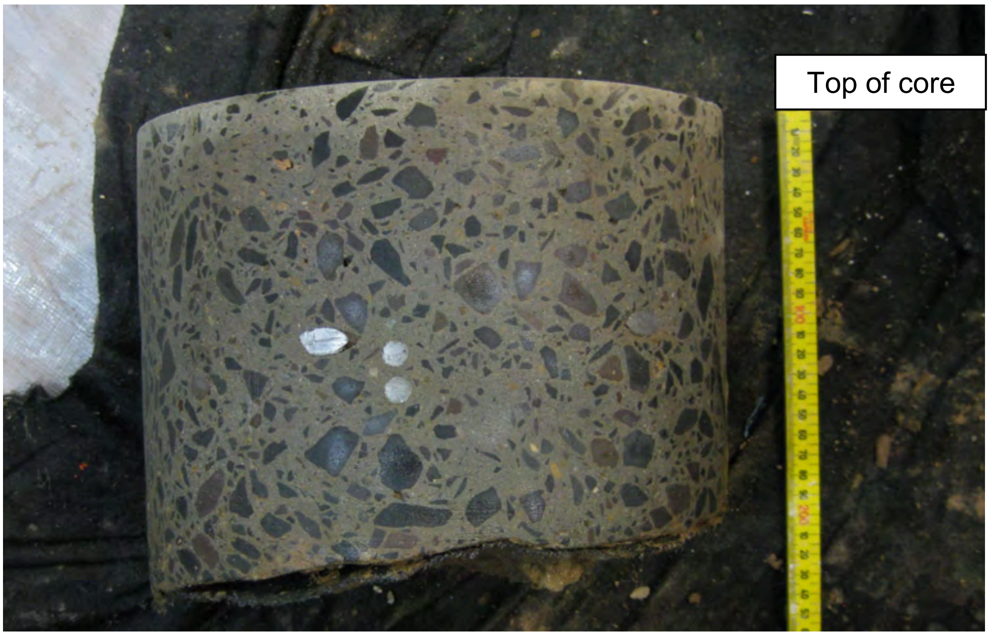


Photo D2 – View of concrete core from Borehole BH8. Two layers of reinforcement steel (10 mm diameter) were encountered at 0.09 m and 0.10 m depth, with a layer of plastic at the underside of the slab.

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Borehole Photographs

Proposed Commercial Development

8-10 Lee Street, Haymarket

CLIENT: Atlassian Pty Ltd

PROJECT: 86867.00

PLATE No: D2

REV: 0

DATE: 15/08/2019

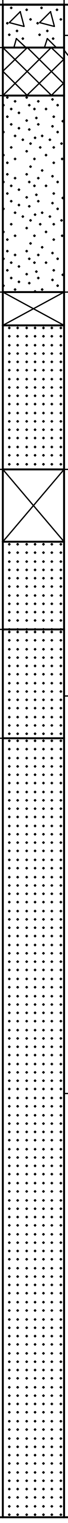
BOREHOLE LOG

CLIENT: Atlassian Pty Ltd
PROJECT: Proposed Commercial Development
LOCATION: 8-10 Lee Street, Haymarket

SURFACE LEVEL: 15.5 AHD
EASTING: 333954
NORTHING: 6249289
DIP/AZIMUTH: 90°/--

BORE No: BH8
PROJECT No: 86767.00
DATE: 14/7/2019
SHEET 1 OF 2

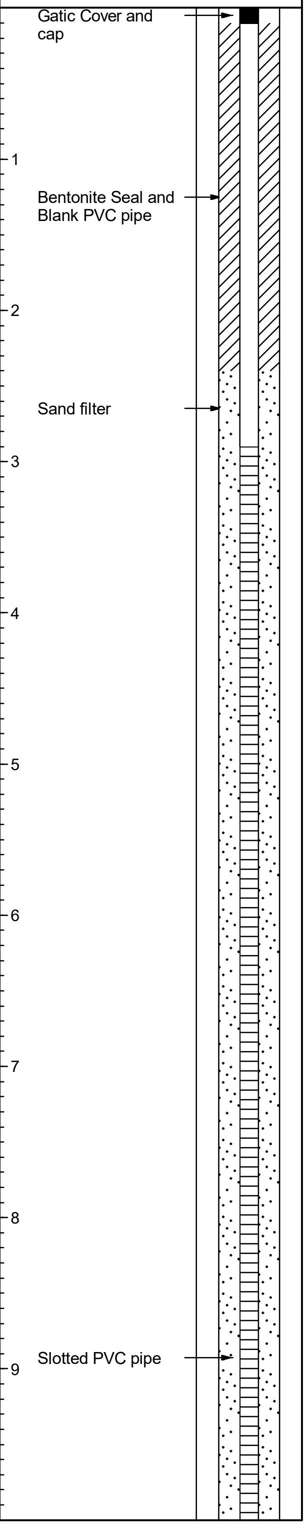
Depth (m)	Description of Strata
0.28	CONCRETE SLAB: angular to subangular aggregate to 15mm, negligible voids, 10mm diameter steel reinforcement at 0.09m and 0.10m, plastic at lower interface
0.6	Fill/Clayey SAND: fine to coarse grained sand, brown and yellow, 15% plastic fines, with fine gravel, apparently moderately compacted, moist
1.9	SAND SW: fine to medium grained sand, yellow, with clay, trace gravel, moist, alluvial soil
2.12	
3.07	SANDSTONE: medium grained, orange-red and grey, low to medium strength, with some very low strength bands, highly weathered, fractured, Mittagong Formation
3.55	SANDSTONE: medium grained, orange and red, medium strength with some very low strength bands, highly weathered, fractured, Mittagong Formation
4.13	
4.85	SANDSTONE: medium grained, yellow-grey, medium then high strength, moderately weathered, slightly fractured, Hawkesbury Sandstone
	SANDSTONE: medium grained, grey, high strength, fresh, unbroken, Hawkesbury Sandstone



Sampling & In Situ Testing

Type	Depth	Sample	Results & Comments
A/E	0.2 0.3		PID<1
	1.9		
C	2.47		PL(A) = 1.5
	3.07		
C	3.66		PL(A) = 0.15
	4.57		
	4.66		PL(A) = 0.66
C	5.95		PL(A) = 1.2
	6.95		PL(A) = 1.3
	7.2		
	7.89		PL(A) = 1.9
C	8.95		PL(A) = 1.2
	9.95		PL(A) = 1.4

Well Construction Details



RIG: XC **DRILLER:** Terratest **LOGGED:** NB **CASING:** HQ to 1.9m

TYPE OF BORING: Diacore 0-0.28m; Hand auger 0.28-1.0m; solid flight auger (TC Bit) 1.0-1.9m; NMLC coring 1.9-15.0m

WATER OBSERVATIONS: No groundwater observed during auger drilling

REMARKS: Groundwater well installed: 15.0-2.9m screened PVC with sand backfill, 2.9-2.4m blank PVC with sand backfill, 2.4-0m blank PVC, 2.4-0m bentonite backfill, gatic cover at surface.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics | Environment | Groundwater

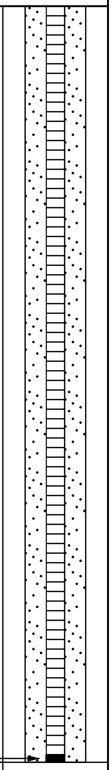
BOREHOLE LOG

CLIENT: Atlassian Pty Ltd
PROJECT: Proposed Commercial Development
LOCATION: 8-10 Lee Street, Haymarket

SURFACE LEVEL: 15.5 AHD
EASTING: 333954
NORTHING: 6249289
DIP/AZIMUTH: 90°/--

BORE No: BH8
PROJECT No: 86767.00
DATE: 14/7/2019
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
		SANDSTONE: medium grained, grey, high strength, fresh, unbroken, Hawkesbury Sandstone *(continued)* Between 10.2-10.9m: dark grey, fine grained sandstone		C	10.22				
5									
	11				10.95		PL(A) = 2.5		11
4				C					
	12				11.95		PL(A) = 1.5		12
3		Between 12.4-12.55m: carbonaceous laminations							
	13				12.95		PL(A) = 1.1		13
					13.25				
2									
	14			C	13.95		PL(A) = 1.3		14
1									
	15 15.0	Bore discontinued at 15.0m			14.99 15.0		PL(A) = 1.3		15 End Cap
0									
	16								16
-1									
	17								17
-2									
	18								18
-3									
	19								19
-4									



RIG: XC **DRILLER:** Terratest **LOGGED:** NB **CASING:** HQ to 1.9m

TYPE OF BORING: Diacore 0-0.28m; Hand auger 0.28-1.0m; solid flight auger (TC Bit) 1.0-1.9m; NMLC coring 1.9-15.0m

WATER OBSERVATIONS: No groundwater observed during auger drilling

REMARKS: Groundwater well installed: 15.0-2.9m screened PVC with sand backfill, 2.9-2.4m blank PVC with sand backfill, 2.4-0m blank PVC, 2.4-0m bentonite backfill, gatic cover at surface.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

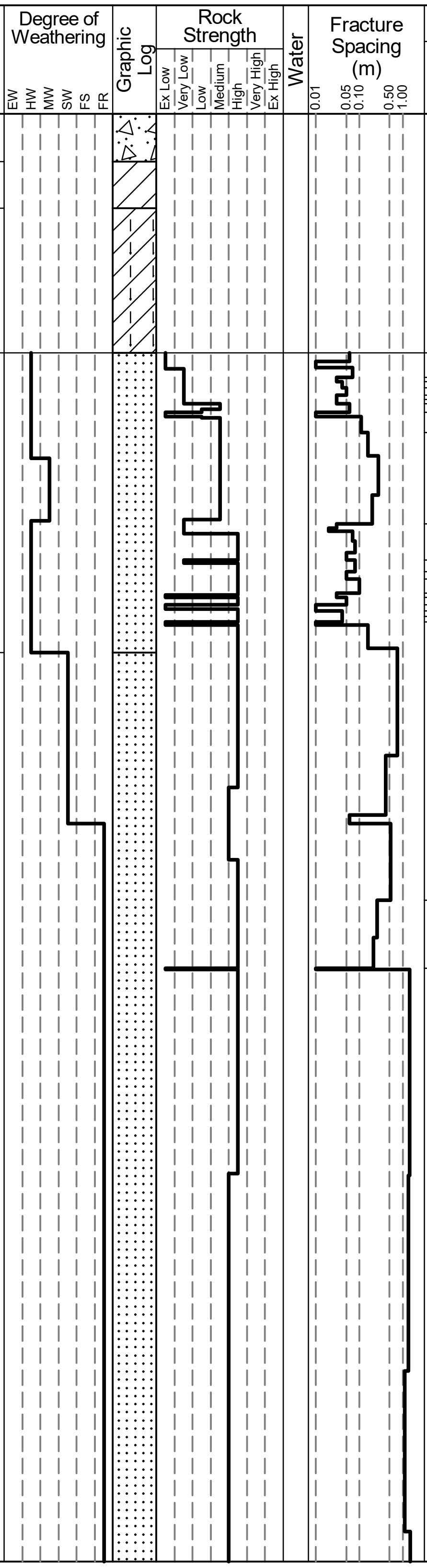
Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Atlassian Pty Ltd
PROJECT: Proposed Commercial Development
LOCATION: 8-10 Lee Street, Haymarket

SURFACE LEVEL: 15.5 AHD
EASTING: 333966
NORTHING: 6249295
DIP/AZIMUTH: 90°/--

BORE No: BH9
PROJECT No: 86767.00
DATE: 11 - 12/7/2019
SHEET 1 OF 2



Depth (m)	Description of Strata	Discontinuities B - Bedding J - Joint S - Shear F - Fault	Type	Core Rec. %	RQD %	Test Results & Comments
	CONCRETE SLAB					
0.33	CLAY CL: low to medium plasticity, pale grey and yellow, with fine to medium grained sand, trace fine ironstone gravel, w>PL, residual soil		E/A			PID<1
0.65	Silty CLAY CL-CI: low to medium plasticity, pale grey and red, with fine grained sand, trace fine ironstone gravel, w<PL, residual soil		E/A			PID<1
			E/A			PID<1
	0.85-1.4m: w~PL 1.4m: fine ironstone gravel, w<PL	Unless otherwise specified, defects are B 0-5°, pl, ro, cly vn	E/A			PID<1
1.65	SANDSTONE: fine grained, orange-grey, very low to medium strength with extremely low strength bands, highly to moderately weathered, fractured, Mittagong Formation	1.71m: Cs 40mm 1.82m: B 0°, pl, ro, cly co 1mm 1.82-1.85m: J 80°, pl, ro, cly co 1mm 1.85m: B 0°, pl, ro, cly co 1mm	C	100	44	
		1.85-1.89m: J 80°, pl, ro, cly co 1mm 1.89m: B 0°, pl, ro, cly co 1mm 1.89-1.94m: J 80°, pl, ro, cly co 1mm	C	100	53	PL(A) = 0.88
3.72	SANDSTONE: medium grained, grey, medium to high strength, slightly weathered then fresh, slightly fractured, Hawkesbury Sandstone	1.94m: B 5°, pl, ro, cbs 1.94-1.97m: J 80°, pl, ro, cbs B 10°, pl, ro, cbs 1.9-2.0m: J 80°, pl, ro, cbs 2m: B 0°, pl, ro, cbs 2.06m: Cs 30mm 2.2m: B 0°, ir, ro, cly vn 2.83-3.03m: B0-2° (x5), pl, ro, cbs 3.08m: B 0°, pl, ro, clay co 1mm	C	100	87	PL(A) = 0.28
	Below 5.91m: unbroken	3.16m: B 10°, pl, ro, cbs 3.21m: B 0°, ir, ro, cbs 3.31m: B 0°, pl, ro, cly co 2mm 3.34m: B 0°, pl, ro, cly co 1mm 3.39m: Ds 30mm 3.43m: B 0°, pl, ro, cbs 3.47m: B 5°, pl, ro, cly co 1mm		100	100	PL(A) = 0.94 PL(A) = 1.6
		3.51-3.53m: Fg 5.43m: B 10°, pl, ro, cly vn 5.9m: Cs 10mm 7.33m: B 0°, pl, ro, cly co 1mm	C	100	100	PL(A) = 1.3 PL(A) = 0.76
		8.68m: B 0°, pl, ro, cly co 1mm	C	100	100	PL(A) = 1.9
	Between 9.50-9.56m: with carbonaceous laminations	9.79m: B 0°, pl, ro, cbs	C	100	100	PL(A) = 0.97

RIG: XC **DRILLER:** Terratest **LOGGED:** KR **CASING:** HW to 2.5m

TYPE OF BORING: Diacore to 0.32m; hand auger 0.32-1.0m; Solid flight auger (TC Bit) 1.0-1.6m; NMLC coring 1.6-14.6m

WATER OBSERVATIONS: No groundwater observed during auger drilling

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

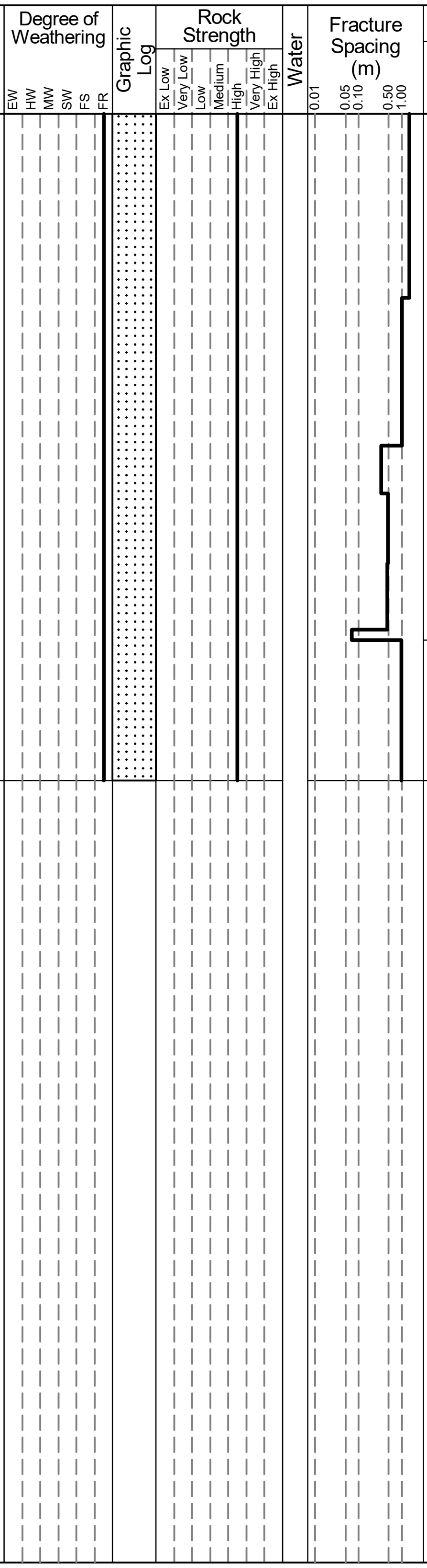
Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Atlassian Pty Ltd
PROJECT: Proposed Commercial Development
LOCATION: 8-10 Lee Street, Haymarket

SURFACE LEVEL: 15.5 AHD
EASTING: 333966
NORTHING: 6249295
DIP/AZIMUTH: 90°/--

BORE No: BH9
PROJECT No: 86767.00
DATE: 11 - 12/7/2019
SHEET 2 OF 2



RL	Depth (m)	Description of Strata	Discontinuities B - Bedding J - Joint S - Shear F - Fault	Type	Core Rec. %	RQD %	Test Results & Comments
		SANDSTONE: medium grained, grey, medium to high strength, slightly weathered then fresh, slightly fractured, Hawkesbury Sandstone *(continued)*		C	100	100	
5	11			C	100	100	PL(A) = 1.3
		Between 11.17-11.30m: with carbonaceous laminations	11.27m: B 0°, pl, ro, cbs				
4	12			C	100	100	PL(A) = 1.5
3			12.29m: B 0°, pl, sm, cbs 12.62m: B 0°, pl, sm, cbs				
	13		13.1m: B 0°, pl, sm, cbs				PL(A) = 3.1
2	14		13.56m: B 0°, pl, sm, cbs 13.63m: B 0°, pl, sm, clay vn	C	100	100	PL(A) = 1.3
1	14.6	Bore discontinued at 14.6m					PL(A) = 1
	15						
0	16						
-1	17						
-2	18						
-3	19						
-4							

RIG: XC **DRILLER:** Terratest **LOGGED:** KR **CASING:** HW to 2.5m
TYPE OF BORING: Diacore to 0.32m; hand auger 0.32-1.0m; Solid flight auger (TC Bit) 1.0-1.6m; NMLC coring 1.6-14.6m
WATER OBSERVATIONS: No groundwater observed during auger drilling
REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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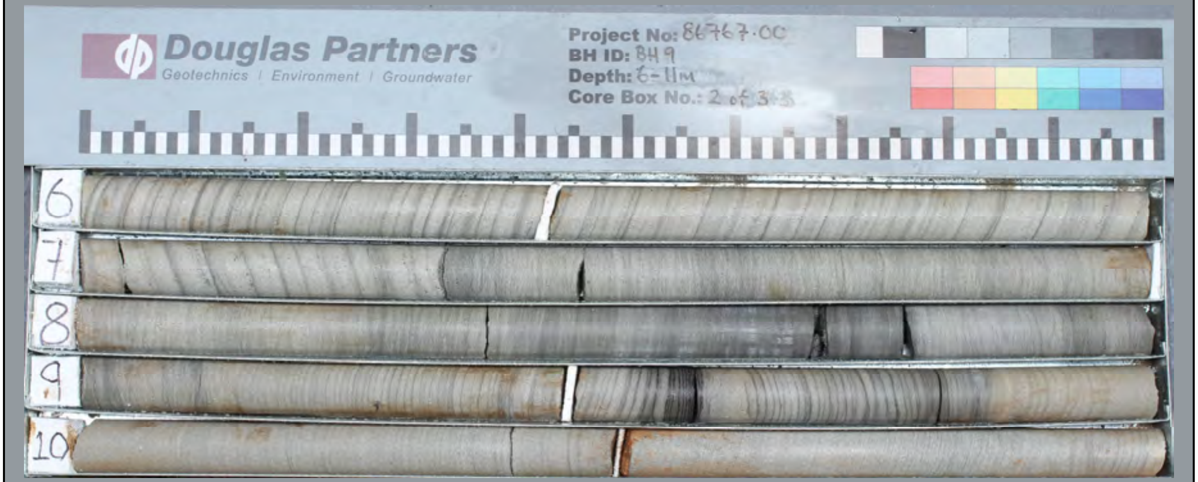
BORE: BH9 PROJECT: HAYMARKET AUGUST 2019

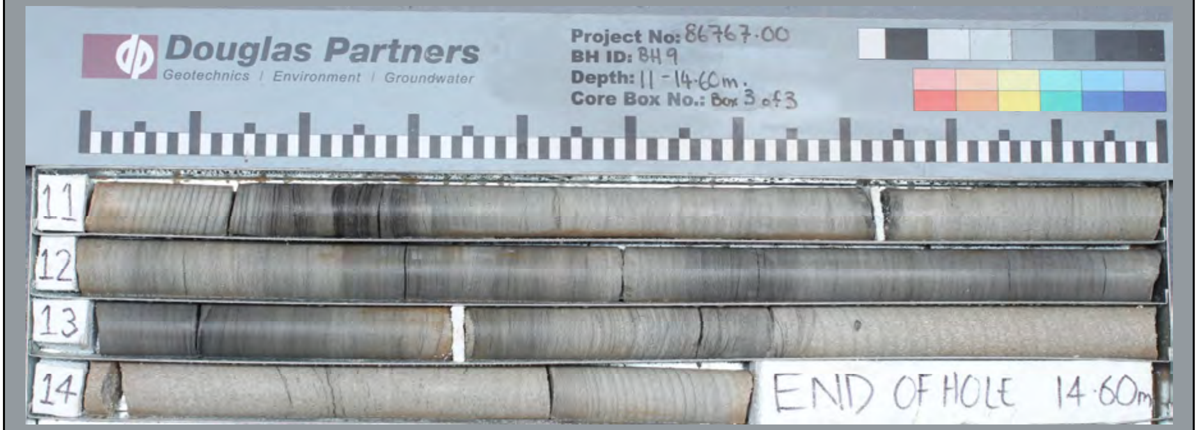
1.65 – 6m

BORE: BH9 PROJECT: HAYMARKET AUGUST 2019



6m – 11m

BORE: BH9 PROJECT: HAYMARKET AUGUST 2019



11m – 14.60m

Appendix F

Groundwater Data

YHA well

water level: 5.95m

well depth: 6.3m

23/07/19

14:30

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BH 3

Groundwater Field Sheet

Bore Volume = casing volume + filter pack volume
$= \pi h_1 d_1^2/4 + n(\pi h_2 d_2^2/4 - \pi h_2 d_1^2/4)$

Where: $\pi = 3.14$
n = porosity (0.3 for most filter pack material)
h_1 = height of water column
d_2 = diameter of annulus
h_2 = length of filter pack
d_1 = diameter of casing

Bore Vol Normally: 7.2*h

Project and Bore Installation Details

Bore / Standpipe ID:	BH3 (GG)
Project Name:	HAYMARKET DSI
Project Number:	86767.01
Site Location:	
Bore GPS Co-ord:	
Installation Date:	
GW Level (during drilling):	- m bgl
Well Depth:	m bgl
Screened Interval:	m bgl
Contaminants/Comments:	-

Bore Development Details

Date/Time:	23/07/19 12:00
Purged By:	AS
GW Level (pre-purge):	2.6 m bgl
GW Level (post-purge):	14.4 m bgl
PSH observed:	Yes / [✓ No] (interface / visual). Thickness if observed:
Observed Well Depth:	15.2 m bgl
Estimated Bore Volume:	90 L *Actual bore volume: ~40 L (dry)
Total Volume Purged:	(target: no drill mud, min 3 well vol. or [✓ dry]) 40
Equipment:	pump, battery, interface metre, bailer/line, water cubes

Micropurge and Sampling Details

Date/Time:	
Sampled By:	
Weather Conditions:	
GW Level (pre-purge):	m bgl
GW Level (post sample):	m bgl
PSH observed:	Yes / No (interface / visual). Thickness if observed:
Observed Well Depth:	m bgl
Estimated Bore Volume:	L
Total Volume Purged:	L
Equipment:	

Water Quality Parameters

Time / Volume	Temp (°C)	DO (mg/L)	EC (µS or mS/cm)	pH	Turbidity	Redox (mV)
Stabilisation Criteria (3 readings)	**0.1° C**	**+/- 0.3 mg/L**	**+/- 3%**	**+/- 0.1**	**+/- 10%**	**+/- 10 mV**
Additional Readings Following stabilisation:	DO % Sat	SPC	TDS			

Sample Details

Sampling Depth (rationale):	m bgl,
Sample Appearance (e.g. colour, siltiness, odour):	clear - brown, silt, odourless
Sample ID:	
QA/QC Samples:	
Sampling Containers and filtration:	
Comments / Observations:	

BH8

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Groundwater Field Sheet

Bore Volume = casing volume + filter pack volume
$= \pi h_1 d_2^2/4 + n(\pi h_2 d_1^2/4 - \pi h_2 d_2^2/4)$
Where: $\pi = 3.14$
n = porosity (0.3 for most filter pack material)
h_1 = height of water column
d_1 = diameter of annulus
h_2 = length of filter pack
d_2 = diameter of casing

Bore Vol Normally: 7.2*h

Project and Bore Installation Details

Bore / Standpipe ID:	BH8 (TOGA)
Project Name:	HAYMARKET DSI
Project Number:	86767.01
Site Location:	
Bore GPS Co-ord:	
Installation Date:	
GW Level (during drilling):	- m bgl
Well Depth:	m bgl
Screened Interval:	m bgl
Contaminants/Comments:	-

Bore Development Details

Date/Time:	23/07/19 15:00
Purged By:	AS
GW Level (pre-purge):	2.3 m bgl
GW Level (post-purge):	8.9 m bgl
PSH observed:	Yes / [✓ No] (interface / visual). Thickness if observed:
Observed Well Depth:	15.2 m bgl
Estimated Bore Volume:	93 L *actual bore volume ~40L (dry/slow rechar
Total Volume Purged:	(target: no drill mud, min 3 well vol. or [✓ dry]) 100L
Equipment:	pump, battery, interface metre, bailer/line, water cubes

Micropurge and Sampling Details

Date/Time:	
Sampled By:	
Weather Conditions:	
GW Level (pre-purge):	m bgl
GW Level (post sample):	m bgl
PSH observed:	Yes / No (interface / visual). Thickness if observed:
Observed Well Depth:	m bgl
Estimated Bore Volume:	L
Total Volume Purged:	L
Equipment:	

Water Quality Parameters

Time / Volume	Temp (°C)	DO (mg/L)	EC (µS or mS/cm)	pH	Turbidity	Redox (mV)
Stabilisation Criteria (3 readings)	**0.1° C**	**+/- 0.3 mg/L**	**+/- 3%**	**+/- 0.1**	**+/- 10%**	**+/- 10 mV**
Additional Readings Following stabilisation:	DO % Sat	SPC	TDS			

Sample Details

Sampling Depth (rationale):	m bgl,
Sample Appearance (e.g. colour, siltiness, odour):	yellow-brown, still, odourless
Sample ID:	
QA/QC Samples:	
Sampling Containers and filtration:	
Comments / Observations:	actual well V ≈ 40 (?) L - slow pumping, water coming out on/off

Groundwater Field Sheet

Bore Volume = casing volume + filter pack volume
$= \pi h_1 d_2^2/4 + n(\pi h_1 d_1^2/4 - \pi h_2 d_2^2/4)$
Where: $\pi = 3.14$
n = porosity (0.3 for most filter pack material)
h_1 = height of water column
d_1 = diameter of annulus
h_2 = length of filter pack
d_2 = diameter of casing
Bore Vol Normally: 7.2*h

Project and Bore Installation Details	
Bore / Standpipe ID:	BH 1
Project Name:	Haymarket DSI
Project Number:	86767.00
Site Location:	
Bore GPS Co-ord:	
Installation Date:	
GW Level (during drilling):	- m bgl
Well Depth:	m bgl
Screened Interval:	m bgl
Contaminants/Comments:	-
Bore Development Details	
Date/Time:	1400 30.7.19
Purged By:	TSH
GW Level (pre-purge):	6.07 m bgl
GW Level (post-purge):	6.30 m bgl (NB: ~15 L of demin water added)
PSH observed:	Yes / [✓ No] (interface / visual). Thickness if observed: little sediment remaining.
Observed Well Depth:	6.22 m bgl
Estimated Bore Volume:	L
Total Volume Purged:	(target: no drill mud, min 3 well vol. or dry) ~20 L, dry
Equipment:	Twister pump, interface meter
Micropurge and Sampling Details	
Date/Time:	
Sampled By:	
Weather Conditions:	
GW Level (pre-purge):	m bgl
GW Level (post sample):	m bgl
PSH observed:	Yes / No (interface / visual). Thickness if observed:
Observed Well Depth:	m bgl
Estimated Bore Volume:	L
Total Volume Purged:	L
Equipment:	

Water Quality Parameters

Time / Volume	Temp (°C)	DO (mg/L)	EC (µS or mS/cm)	pH	Turbidity	Redox (mV)
Stabilisation Criteria (3 readings)	***0.1°C***	**+/- 0.3 mg/L**	**+/- 3%**	**+/- 0.1**	**+/- 10%**	**+/- 10 mV**
Additional Readings Following stabilisation:	DO % Sat	SPC	TDS			

Sample Details

Sampling Depth (rationale):	m bgl,
Sample Appearance (e.g. colour, siltiness, odour):	
Sample ID:	
QA/QC Samples:	
Sampling Containers and filtration:	
Comments / Observations:	Level logger (SN) installed at

6.1m, approx at 1445

31.7.19 - Falling head test; GW level 5.95 prior to filling.
1327, GW filled to GL
NB: water fell to [illegible] within <5 mins

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Groundwater Field Sheet

Bore Volume = casing volume + filter pack volume
$= \pi h_1 d_1^2/4 + n(\pi h_2 d_2^2/4 - \pi h_2 d_1^2/4)$

Where: $\pi = 3.14$
n = porosity (0.3 for most filter pack material)
h_1 = height of water column
d_2 = diameter of annulus
h_2 = length of filter pack
d_1 = diameter of casing

Bore Vol Normally: 7.2*h

Project and Bore Installation Details

Bore / Standpipe ID:	BH5 (GG)
Project Name:	HAYMARKET DSI
Project Number:	86767.01
Site Location:	
Bore GPS Co-ord:	
Installation Date:	
GW Level (during drilling):	- m bgl
Well Depth:	m bgl
Screened Interval:	m bgl
Contaminants/Comments:	-

Bore Development Details

Date/Time:	23/07/19 12:00
Purged By:	AS
GW Level (pre-purge):	2.6 m bgl
GW Level (post-purge):	14.4 m bgl
PSH observed:	Yes / [✓ No] (interface / visual). Thickness if observed:
Observed Well Depth:	15.2 m bgl
Estimated Bore Volume:	90 L *Actual bore volume: ~40L (dry)
Total Volume Purged:	(target: no drill mud, min 3 well vol. or [✓ dry]) 40
Equipment:	pump, battery, interface metre, bailer/line, water cubes

Micropurge and Sampling Details

Date/Time:	
Sampled By:	
Weather Conditions:	
GW Level (pre-purge):	m bgl
GW Level (post sample):	m bgl
PSH observed:	Yes / No (interface / visual). Thickness if observed:
Observed Well Depth:	m bgl
Estimated Bore Volume:	L
Total Volume Purged:	L
Equipment:	

Water Quality Parameters

Time / Volume	Temp (°C)	DO (mg/L)	EC (µS or mS/cm)	pH	Turbidity	Redox (mV)
Stabilisation Criteria (3 readings)	***0.1°C***	**+/- 0.3 mg/L**	**+/- 3%**	**+/- 0.1**	**+/- 10%**	**+/- 10 mV**
Additional Readings Following stabilisation:	DO % Sat	SPC	TDS			

Sample Details

Sampling Depth (rationale):	m bgl,
Sample Appearance (e.g. colour, siltiness, odour):	clear-brown, still, odourless
Sample ID:	
QA/QC Samples:	
Sampling Containers and filtration:	
Comments / Observations:	

Rev March 2012

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Groundwater Field Sheet

Bore Volume = casing volume + filter pack volume
$= \pi h_1 d_2^2/4 + n(\pi h_1 d_1^2/4 - \pi h_2 d_2^2/4)$
Where: $\pi = 3.14$
n = porosity (0.3 for most filter pack material)
h_1 = height of water column
d_1 = diameter of annulus
h_2 = length of filter pack
d_2 = diameter of casing
Bore Vol Normally: 7.2*h

Project and Bore Installation Details	
Bore / Standpipe ID:	BH5 (GG)
Project Name:	Haymarket DSI
Project Number:	86761.01
Site Location:	
Bore GPS Co-ord:	
Installation Date:	
GW Level (during drilling):	- m bgl
Well Depth:	m bgl
Screened Interval:	m bgl
Contaminants/Comments:	-
Bore Development Details	
Date/Time:	
Purged By:	
GW Level (pre-purge):	m bgl
GW Level (post-purge):	m bgl
PSH observed:	Yes / No (interface / visual). Thickness if observed:
Observed Well Depth:	m bgl
Estimated Bore Volume:	L
Total Volume Purged:	(target: no drill mud, min 3 well vol. or dry)
Equipment:	
Micropurge and Sampling Details	
Date/Time:	30.7.19
Sampled By:	JJN
Weather Conditions:	(overcast) indoors
GW Level (pre-purge):	2.44 m bgl
GW Level (post sample):	4.2 m bgl
PSH observed:	Yes / [✓ No] (interface / [✓ visual]). Thickness if observed:
Observed Well Depth:	15.1 m bgl
Estimated Bore Volume:	L
Total Volume Purged:	~3 L (micropurge)
Equipment:	Peripump, WQM, Bailer, Interface meter

Water Quality Parameters

Time / Volume	Temp (°C)	DO (mg/L)	EC (µS or mS/cm)	pH	Turbidity	Redox (mV)
Stabilisation Criteria (3 readings)	**0.1° C**	**+/- 0.3 mg/L**	**+/- 3%**	**+/- 0.1**	**+/- 10%**	**+/- 10 mV**
1319	17.4	3.33	460	5.44	36	187
1320	18.9	1.94	431	5.43	21.1	182
1321	19.1	1.24	420	5.43	25.1	182
1322	19.2	0.89	428	5.49	22.3	176
1323	19.2	0.87	428	5.49	19.7	174
6						
7						
Additional Readings Following stabilisation:	DO % Sat	SPC	TDS			

9L

Sample Details

Sampling Depth (rationale):	~8 m bgl, middle of water column
Sample Appearance (e.g. colour, siltiness, odour):	clear to pale grey
Sample ID:	BH5
QA/QC Samples:	BD1/20190730
Sampling Containers and filtration:	1x Amber, 1x 500mL G, 1x Purple, 1x red (filtered) 3x Vials
Comments / Observations:	Level logger (SN 4205 7242) installed

OC at ~ 14.5m; at 1350

31.7.19
RH test; pre-purge (2.44m), purge finish 1300
approx (50L to dry)

Rev March 2012

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BH8

Groundwater Field Sheet

Bore Volume = casing volume + filter pack volume
$= \pi h_1 d_2^2/4 + n(\pi h_2 d_1^2/4 - \pi h_2 d_2^2/4)$
Where: $\pi = 3.14$
n = porosity (0.3 for most filter pack material)
h_1 = height of water column
d_1 = diameter of annulus
h_2 = length of filter pack
d_2 = diameter of casing
Bore Vol Normally: 7.2*h

Project and Bore Installation Details	
Bore / Standpipe ID:	BH8 (JOGA)
Project Name:	HAYMARKET DSI
Project Number:	86767.01
Site Location:	
Bore GPS Co-ord:	
Installation Date:	
GW Level (during drilling):	- m bgl
Well Depth:	m bgl
Screened Interval:	m bgl
Contaminants/Comments:	-
Bore Development Details	
Date/Time:	23/07/19 15:00
Purged By:	AS
GW Level (pre-purge):	2.3 m bgl
GW Level (post-purge):	8.9 m bgl
PSH observed:	Yes / [✓ No] (interface / visual). Thickness if observed:
Observed Well Depth:	15.2 m bgl
Estimated Bore Volume:	93 L *actual bore volume ~40L (dry/slow recharge
Total Volume Purged:	(target: no drill mud, min 3 well vol. or [✓ dry]) 100L
Equipment:	pump, battery, interface metre, bailer/line, water cubes
Micropurge and Sampling Details	
Date/Time:	1500 30.7.19
Sampled By:	JSH
Weather Conditions:	overcast (indoors)
GW Level (pre-purge):	2.3 m bgl
GW Level (post sample):	2.7 m bgl
PSH observed:	Yes / [✓ No] (interface / [✓ visual]). Thickness if observed:
Observed Well Depth:	15.2 m bgl
Estimated Bore Volume:	93 L
Total Volume Purged:	3 L
Equipment:	Peripump, WQM, Interface meter, Bailer

Water Quality Parameters

Time / Volume	Temp (°C)	DO (mg/L)	EC (µS or mS/cm)	pH	Turbidity	Redox (mV)
Stabilisation Criteria (3 readings)	**0.1° C**	**+/- 0.3 mg/L**	**+/- 3%**	**+/- 0.1**	**+/- 10%**	**+/- 10 mV**
1515	18.0	3.51	329	5.4	41	189
1516	18.8	2.97	327	5.4	28	184
1517	19.1	2.53	315	5.4	28	160
1518	19.2	2.28	313	5.4	28	157
1519	19.2	1.94	311	5.4	29	154
1520	19.3	1.62	312	5.4	24	151
1521	19.3	1.43	312	5.4	26	150
1522	19.3	1.36	310	5.4	20	148
Additional Readings Following stabilisation:	DO % Sat	SPC	TDS			

Sample Details

Sampling Depth (rationale):	m bgl,
Sample Appearance (e.g. colour, siltiness, odour):	yellow-brown, still, odourless
Sample ID:	
QA/QC Samples:	
Sampling Containers and filtration:	
Comments / Observations:	actual well V ≈ 40 (?) L - slow pumping, water coming out on/off

Post sample purge ~ 100 L ; depth 11.9m to water (dipped)
Installed level logger at ~14.8m (SN)
at approx 1420

Rev March 2012

TPS FLT90 CALIBRATION RECORD

Serial Number: 428561

DP Identification No. DP595

WQM 2

Project: Haymarket.

Project Number: 86767.01

PARAMETER	STANDARD	PRE CALIBRATION READING		POST CALIBRATION READING	
Temperature	* ~~23.0~~ 20.0	20.6	degrees C	20.6	degrees C
pH	10	9.70	pH units	10.0	pH units
	7	6.89	pH units	7.0	pH units
	4	4.65	pH units	4.0	pH units
Conductivity	0.0** uS/cm		µS/cm		µS/cm
	2.76 mS/cm	2475	~~m~~µS/cm	2711	~~m~~µS/cm
TDS	0.0** ppm		ppm		ppm
	36.0 ppk		ppk		ppk
Dissolved Oxygen	0.0% sat		ppm		
			%		%
	100.0**% sat	7	ppm	3	
			%		%
Turbidity	0*** NTU		NTU		NTU
	90 NTU	87	NTU	90.1	NTU
ORP #	240 mV	253	mV	-	mV

Calibrated by: JJM

Date: 29.7.19

* use NATA certified reference thermometer from soils clean lab
** air
*** distilled water
\# factory calibrated – do a bump test

NOTES:

Form Updated
21Mar2011

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Groundwater Field Sheet

Bore Volume = casing volume + filter pack volume
$= \pi h_1 d_2^2/4 + n(\pi h_1 d_1^2/4 - \pi h_2 d_2^2/4)$
Where: $\pi = 3.14$
n = porosity (0.3 for most filter pack material)
h_1 = height of water column
d_1 = diameter of annulus
h_2 = length of filter pack
d_2 = diameter of casing
Bore Vol Normally: 7.2*h

Project and Bore Installation Details	
Bore / Standpipe ID:	BH 1
Project Name:	Haymarket DSI
Project Number:	86767.00
Site Location:	
Bore GPS Co-ord:	
Installation Date:	
GW Level (during drilling):	- m bgl
Well Depth:	m bgl
Screened Interval:	m bgl
Contaminants/Comments:	-
Bore Development Details	
Date/Time:	1400 30.7.19
Purged By:	JSM
GW Level (pre-purge):	6.07 m bgl
GW Level (post-purge):	6.30 m bgl (NB: ~15 L of demin water added)
PSH observed:	Yes / [✓ No] (interface / visual). Thickness if observed: little sediment remaining.
Observed Well Depth:	6.22 m bgl
Estimated Bore Volume:	L
Total Volume Purged:	(target: no drill mud, min 3 well vol. or dry) ~20 L, dry
Equipment:	Twister pump, interface meter
Micropurge and Sampling Details	
Date/Time:	
Sampled By:	
Weather Conditions:	
GW Level (pre-purge):	m bgl
GW Level (post sample):	m bgl
PSH observed:	Yes / No (interface / visual). Thickness if observed:
Observed Well Depth:	m bgl
Estimated Bore Volume:	L
Total Volume Purged:	L
Equipment:	

Water Quality Parameters

Time / Volume	Temp (°C)	DO (mg/L)	EC (µS or mS/cm)	pH	Turbidity	Redox (mV)
Stabilisation Criteria (3 readings)	***0.1° C***	**+/- 0.3 mg/L**	**+/- 3%**	**+/- 0.1**	**+/- 10%**	**+/- 10 mV**
Additional Readings Following stabilisation:	DO % Sat	SPC	TDS			

Sample Details

Sampling Depth (rationale):	m bgl,
Sample Appearance (e.g. colour, siltiness, odour):	
Sample ID:	
QA/QC Samples:	
Sampling Containers and filtration:	
Comments / Observations:	Level logger (SN) installed at

6.1m, approx at 1445

31.7.19 - Falling head test; GW level 5.95 prior to filling
1327, GW filled to GL
NB: water fell to [illegible] within <5 mins

Groundwater Field Sheet

Bore Volume = casing volume + filter pack volume
$= \pi h_1 d_2^2/4 + n(\pi h_2 d_1^2/4 - \pi h_2 d_2^2/4)$
Where: $\pi = 3.14$
n = porosity (0.3 for most filter pack material)
h_1 = height of water column
d_1 = diameter of annulus
h_2 = length of filter pack
d_2 = diameter of casing
Bore Vol Normally: 7.2*h

Project and Bore Installation Details	
Bore / Standpipe ID:	BH5 (GG)
Project Name:	HAYMARKET DSI
Project Number:	86767.01
Site Location:	
Bore GPS Co-ord:	
Installation Date:	
GW Level (during drilling):	- m bgl
Well Depth:	m bgl
Screened Interval:	m bgl
Contaminants/Comments:	-
Bore Development Details	
Date/Time:	23/07/19 12:00
Purged By:	AS
GW Level (pre-purge):	2.6 m bgl
GW Level (post-purge):	14.4 m bgl
PSH observed:	Yes / [✓ No] (interface / visual). Thickness if observed:
Observed Well Depth:	15.2 m bgl
Estimated Bore Volume:	90 L *Actual bore volume: ~40 L (dry)
Total Volume Purged:	(target: no drill mud, min 3 well vol. or [✓ dry]) 40
Equipment:	pump, battery, interface metre, bailer/line, water cubes
Micropurge and Sampling Details	
Date/Time:	
Sampled By:	
Weather Conditions:	
GW Level (pre-purge):	m bgl
GW Level (post sample):	m bgl
PSH observed:	Yes / No (interface / visual). Thickness if observed:
Observed Well Depth:	m bgl
Estimated Bore Volume:	L
Total Volume Purged:	L
Equipment:	

Water Quality Parameters

Time / Volume	Temp (°C)	DO (mg/L)	EC (µS or mS/cm)	pH	Turbidity	Redox (mV)
Stabilisation Criteria (3 readings)	***0.1° C***	**+/- 0.3 mg/L**	**+/- 3%**	**+/- 0.1**	**+/- 10%**	**+/- 10 mV**
Additional Readings Following stabilisation:	DO % Sat	SPC	TDS			

Sample Details

Sampling Depth (rationale):	m bgl,
Sample Appearance (e.g. colour, siltiness, odour):	clear-brown, still, odourless
Sample ID:	
QA/QC Samples:	
Sampling Containers and filtration:	
Comments / Observations:	

Groundwater Field Sheet

Bore Volume = casing volume + filter pack volume
= $\pi h_1 d_2^2/4 + n(\pi h_1 d_1^2/4 - \pi h_2 d_2^2/4)$

Where: $\pi = 3.14$
n = porosity (0.3 for most filter pack material)
h_1 = height of water column
d_1 = diameter of annulus
h_2 = length of filter pack
d_2 = diameter of casing

Bore Vol Normally: 7.2*h

Project and Bore Installation Details	
Bore / Standpipe ID:	BH5 (GG)
Project Name:	Haymarket DSI
Project Number:	86761.01
Site Location:	
Bore GPS Co-ord:	
Installation Date:	
GW Level (during drilling):	- m bgl
Well Depth:	m bgl
Screened Interval:	m bgl
Contaminants/Comments:	-
Bore Development Details	
Date/Time:	
Purged By:	
GW Level (pre-purge):	m bgl
GW Level (post-purge):	m bgl
PSH observed:	Yes / No (interface / visual). Thickness if observed:
Observed Well Depth:	m bgl
Estimated Bore Volume:	L
Total Volume Purged:	(target: no drill mud, min 3 well vol. or dry)
Equipment:	
Micropurge and Sampling Details	
Date/Time:	30.7.19
Sampled By:	JJN
Weather Conditions:	(overcast) indoors
GW Level (pre-purge):	2.44 m bgl
GW Level (post sample):	4.2 m bgl
PSH observed:	Yes / [✓ No] (interface / [✓ visual]). Thickness if observed:
Observed Well Depth:	15.1 m bgl
Estimated Bore Volume:	L
Total Volume Purged:	~3 L (micropurge)
Equipment:	Peripump, WQM, Bailer, Interface meter

Water Quality Parameters

Time / Volume	Temp (°C)	DO (mg/L)	EC (µS or mS/cm)	pH	Turbidity	Redox (mV)
Stabilisation Criteria (3 readings)	***0.1° C***	**+/- 0.3 mg/L**	**+/- 3%**	**+/- 0.1**	**+/- 10%**	**+/- 10 mV**
1319	17.4	3.33	460	5.44	36	187
1320	18.9	1.94	431	5.43	21.1	182
1321	19.1	1.24	420	5.43	25.1	182
1322	19.2	0.89	428	5.49	22.3	176
1323	19.2	0.87	428	5.49	19.7	174
0						
7						
Additional Readings Following stabilisation:	DO % Sat	SPC	TDS			

[illegible]

9L

Sample Details

Sampling Depth (rationale):	~8 m bgl, middle of water column
Sample Appearance (e.g. colour, siltiness, odour):	clear to pale grey
Sample ID:	BH5
QA/QC Samples:	BD1/20190730
Sampling Containers and filtration:	1x Amber, 1x 500mL G, 1x Purple, 1x red (filtered) 3x Vials
Comments / Observations:	Level logger (SN 4205 7242) installed

at 2 14.5m; at 1350

31.7.19
RH test; pre-purge (2.44m), purge finish 1300
approx (50L to dry)

Rev March 2012

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BH8

Groundwater Field Sheet

Bore Volume = casing volume + filter pack volume
= πh.d₂ /4 + n(πh.d /4-πh.d 4)
Where: π = 3.14
n = porosity (0.3 for most filter pack material)
h₁ = height of water column
d₁ = diameter of annulus
h₂ = length of filter pack
d₂ = diameter of casing
Bore Vol Normally: 7.2*h

Project and Bore Installation Details

Bore / Standpipe ID:	BH8 (JOGA)
Project Name:	HAYMARKET DSI
Project Number:	86767.01
Site Location:	
Bore GPS Co-ord:	
Installation Date:	
GW Level (during drilling):	- m bgl
Well Depth:	m bgl
Screened Interval:	m bgl
Contaminants/Comments:	-

Bore Development Details

Date/Time:	23/07/19 15:00
Purged By:	AS
GW Level (pre-purge):	2.3 m bgl
GW Level (post-purge):	8.9 m bgl
PSH observed:	Yes / [✓ No] (interface / visual). Thickness if observed:
Observed Well Depth:	15.2 m bgl
Estimated Bore Volume:	93 L *actual bore volume ~40L (dry/slow recharge
Total Volume Purged:	(target: no drill mud, min 3 well vol. or [✓ dry]) 100L
Equipment:	pump, battery, interface metre, bailer/line, water cubes

Micropurge and Sampling Details

Date/Time:	1500 30.7.19
Sampled By:	JSH
Weather Conditions:	overcast (indoors)
GW Level (pre-purge):	2.3 m bgl
GW Level (post sample):	2.3 m bgl
PSH observed:	Yes / [✓ No] (interface / [✓ visual]). Thickness if observed:
Observed Well Depth:	15.2 m bgl
Estimated Bore Volume:	93 L
Total Volume Purged:	3 L
Equipment:	Peripump, WQM, Interface meter, Bailer

Water Quality Parameters

Time / Volume	Temp (°C)	DO (mg/L)	EC (µS or mS/cm)	pH	Turbidity	Redox (mV)
Stabilisation Criteria (3 readings)	***0.1° C***	**+/- 0.3 mg/L**	**+/- 3%**	**+/- 0.1**	**+/- 10%**	**+/- 10 mV**
1515	18.0	3.51	329	5.4	47	189
1516	18.8	2.97	327	5.4	28	184
1517	19.1	2.53	315	5.4	28	160
1518	19.2	2.28	313	5.4	29	157
1519	19.2	1.94	311	5.4	29	154
1520	19.3	1.62	312	5.4	24	151
1521	19.3	1.43	312	5.4	26	150
1522	19.3	1.36	310	5.4	20	148
Additional Readings Following stabilisation:	DO % Sat	SPC	TDS			

Sample Details

Sampling Depth (rationale):	m bgl,
Sample Appearance (e.g. colour, siltiness, odour):	yellow-brown, still, odourless
Sample ID:	
QA/QC Samples:	
Sampling Containers and filtration:	
Comments / Observations:	actual well V ≈ 40 (?) L - slow pumping, water coming out on/off

Post sample purge ~ 100L ; depth 11.9m to water (dipped)
Installed level logger at ~14.8m (SN)
at approx 1420

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TPS FLT90 CALIBRATION RECORD

Serial Number: 428561

DP Identification No. DP595

WQm 2

Project: Haymarket.

Project Number: 8~~6~~767.01

PARAMETER	STANDARD	PRE CALIBRATION READING		POST CALIBRATION READING	
Temperature	* ~~23.0~~ 20.0	20.6	degrees C	20.6	degrees C
pH	10	9.70	pH units	10.0	pH units
	7	6.89	pH units	7.0	pH units
	4	4.65	pH units	4.0	pH units
Conductivity	0.0** uS/cm		µS/cm		µS/cm
	2.76 mS/cm	2475	~~m~~µS/cm	2711	~~m~~µS/cm
TDS	0.0** ppm		ppm		ppm
	36.0 ppk		ppk		ppk
Dissolved Oxygen	0.0% sat		ppm		
			%		%
	100.0**% sat	7	ppm	3	
			%		%
Turbidity	0*** NTU		NTU		NTU
	90 NTU	87	NTU	90.1	NTU
ORP #	240 mV	253	mV	-	mV

Calibrated by: JJN

Date: 29.7.19

* use NATA certified reference thermometer from soils clean lab
** air
*** distilled water
\# factory calibrated – do a bump test

NOTES:

Form Updated 21Mar2011

Douglas Partners
Geotechnics / Environment / Groundwater

Groundwater Field Sheet

Bore Volume = casing volume + filter pack volume
$= \pi h_1 d_1^2/4 + n(\pi h_2 d_2^2/4 - \pi h_2 d_1^2/4)$

Where: $\pi = 3.14$
n = porosity (0.3 for most filter pack material)
h_1 = height of water column
d_2 = diameter of annulus
h_2 = length of filter pack
d_1 = diameter of casing

Bore Vol Normally: 7.2*h

Project and Bore Installation Details

Bore / Standpipe ID:	BH1
Project Name:	Haymarket DSI
Project Number:	86767.00
Site Location:	
Bore GPS Co-ord:	
Installation Date:	
GW Level (during drilling):	- m bgl
Well Depth:	m bgl
Screened Interval:	m bgl
Contaminants/Comments:	-

Bore Development Details

Date/Time:	07/08/2019 1430
Purged By:	AS
GW Level (pre-purge):	6.15 m bgl
GW Level (post-purge):	6.35 m bgl
PSH observed:	Yes / [✓ No] (interface / visual). Thickness if observed:
Observed Well Depth:	6.35 m bgl
Estimated Bore Volume:	144 ~~1.08~~ L
Total Volume Purged:	(target: no drill mud, min 3 well vol. or dry) ~1.5L (dry, no recharge)
Equipment:	interface metre

Micropurge and Sampling Details

Date/Time:	
Sampled By:	
Weather Conditions:	
GW Level (pre-purge):	m bgl
GW Level (post sample):	m bgl
PSH observed:	Yes / No (interface / visual). Thickness if observed:
Observed Well Depth:	m bgl
Estimated Bore Volume:	L
Total Volume Purged:	L
Equipment:	

Water Quality Parameters

Time / Volume	Temp (°C)	DO (mg/L)	EC (µS or mS/cm)	pH	Turbidity	Redox (mV)
Stabilisation Criteria (3 readings)	***0.1° C***	**+/- 0.3 mg/L**	**+/- 3%**	**+/- 0.1**	**+/- 10%**	**+/- 10 mV**
Additional Readings Following stabilisation:	DO % Sat	SPC	TDS			

Sample Details

Sampling Depth (rationale):	6.3 m bgl, very little water in well (~1L)
Sample Appearance (e.g. colour, siltiness, odour):	brown, lots of sediment, still, odourless
Sample ID:	
QA/QC Samples:	
Sampling Containers and filtration:	
Comments / Observations:	

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Groundwater Field Sheet

Bore Volume = casing volume + filter pack volume
$= \pi h_1 d_2^2/4 + n(\pi h_1 d_1^2/4 - \pi h_2 d_2^2/4)$

Where: $\pi = 3.14$
n = porosity (0.3 for most filter pack material)
h_1 = height of water column
d_1 = diameter of annulus
h_2 = length of filter pack
d_2 = diameter of casing

Bore Vol Normally: 7.2*h

Project and Bore Installation Details	
Bore / Standpipe ID:	BH103
Project Name:	
Project Number:	86767.03
Site Location:	Haymarket
Bore GPS Co-ord:	
Installation Date:	
GW Level (during drilling):	- m bgl
Well Depth:	m bgl
Screened Interval:	m bgl
Contaminants/Comments:	-
Bore Development Details	(for data logger purposes)
Date/Time:	24/04/20
Purged By:	AS
GW Level (pre-purge):	7.5 m bgl
GW Level (post-purge):	8.98 m bgl
PSH observed:	Yes / No (interface / visual). Thickness if observed:
Observed Well Depth:	9.4 m bgl
Estimated Bore Volume:	13.68 L
Total Volume Purged:	(target: no drill mud, min 3 well vol. or dry) ~10L, dry
Equipment:	twister pump, int meter, bailer
Micropurge and Sampling Details	
Date/Time:	24/04/20
Sampled By:	AS
Weather Conditions:	clear, warm
GW Level (pre-purge):	7.5 m bgl
GW Level (post sample):	8.7 m bgl
PSH observed:	Yes / [✓ No] ([✓ interface] / visual). Thickness if observed:
Observed Well Depth:	9.4 m bgl
Estimated Bore Volume:	13.68 L
Total Volume Purged:	~15 L
Equipment:	WQM, peripump, int meter

Water Quality Parameters

Time / Volume	Temp (°C)	DO (mg/L)	EC (µS or mS/cm)	pH	Turbidity	Redox (mV)
Stabilisation Criteria (3 readings)	**0.1° C**	**+/- 0.3 mg/L**	**+/- 3%**	**+/- 0.1**	**+/- 10%**	**+/- 10 mV**
15:43	22.3	5.14	172.9	6.05	334	119
15:44	21.7	1.77	450	5.99	239	116
15:45	21.4	2.64	444	5.99	181	114
15:46	21.3	0.78	439	5.99	123.3	113
15:47	21.3	0.73	439	5.99	100.5	112
15:48	21.3	0.79	435	5.98	84.7	111
15:49	21.3	0.78	434	5.99	64.9	110
					↓	
Additional Readings Following stabilisation:	DO % Sat	SPC	TDS		39.5	

Sample Details

Sampling Depth (rationale):	9.0 m bgl, midpoint
Sample Appearance (e.g. colour, siltiness, odour):	Clear-brown, odourless, slightly silty
Sample ID:	BH103
QA/QC Samples:	BD1/20200424
Sampling Containers and filtration:	see green sheet
Comments / Observations:	—

GW level sampling
* 7.5m bgl at 11:40 24/04/20 (pre-~~purge~~)
8.98m bgl at 16:10 (post - purge)

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Groundwater Field Sheet

Bore Volume = casing volume + filter pack volume
$= \pi h_1 d_2^2/4 + n(\pi h_1 d_1^2/4 - \pi h_2 d_2^2/4)$

Where: $\pi = 3.14$
n = porosity (0.3 for most filter pack material)
h_1 = height of water column
d_1 = diameter of annulus
h_2 = length of filter pack
d_2 = diameter of casing

Bore Vol Normally: 7.2*h

Project and Bore Installation Details	
Bore / Standpipe ID:	BH104
Project Name:	
Project Number:	86767.03
Site Location:	Haymarket
Bore GPS Co-ord:	
Installation Date:	
GW Level (during drilling):	- m bgl
Well Depth:	m bgl
Screened Interval:	m bgl
Contaminants/Comments:	-
Bore Development Details	(for data logger purposes)
Date/Time:	24/04/20
Purged By:	AS
GW Level (pre-purge):	7.75 m bgl
GW Level (post-purge):	11.15 m bgl
PSH observed:	Yes / [✓ No] ([✓ interface] / visual). Thickness if observed:
Observed Well Depth:	20.35 m bgl
Estimated Bore Volume:	91 L
Total Volume Purged:	(target: no drill mud, min 3 well vol. or dry) ~40L
Equipment:	twister pump, int. meter
Micropurge and Sampling Details	
Date/Time:	24/04/20
Sampled By:	AS
Weather Conditions:	warm, clear
GW Level (pre-purge):	7.6 m bgl
GW Level (post sample):	7.75 m bgl
PSH observed:	Yes / [✓ No] ([✓ interface] / visual). Thickness if observed:
Observed Well Depth:	20.35 m bgl
Estimated Bore Volume:	92 L
Total Volume Purged:	~15 L
Equipment:	WQM, peripump, int. meter

Water Quality Parameters

Time / Volume	Temp (°C)	DO (mg/L)	EC (µS or mS/cm)	pH	Turbidity	Redox (mV)
Stabilisation Criteria (3 readings)	***0.1° C***	**+/- 0.3 mg/L**	**+/- 3%**	**+/- 0.1**	**+/- 10%**	**+/- 10 mV**
14:57	24.8	6.74	541	5.20	10.3	167
14:58	23.6	1.29	525	5.25	9.6	161
14:59	21.6	1.16	481	5.25	13.2	153
15:00	21.1	0.98	457	5.25	28.5	149
15:01	20.9	0.79	445	5.24	23.6	142
15:02	20.9	0.74	439	5.23	24.9	140
15.03	20.8	0.71	438	5.22	23.5	138
Additional Readings Following stabilisation:	DO % Sat	SPC	TDS			

Sample Details

Sampling Depth (rationale):	15 m bgl, ~midpoint
Sample Appearance (e.g. colour, siltiness, odour):	clear, odourless
Sample ID:	BH104
QA/QC Samples:	—
Sampling Containers and filtration:	see green sheet
Comments / Observations:	—

GW
* 7.6m bgl at 11:37 24/04/20 Sampling (pre-~~purge~~)
7.75mbgl at 15:13 (post-sampling)
11.15mbgl at 15:37 (post-purge)

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Groundwater Field Sheet

Bore Volume = casing volume + filter pack volume
$= \pi h_1 d_2^2/4 + n(\pi h_1 d_1^2/4 - \pi h_2 d_2^2/4)$

Where: $\pi = 3.14$
n = porosity (0.3 for most filter pack material)
h_1 = height of water column
d_1 = diameter of annulus
h_2 = length of filter pack
d_2 = diameter of casing

Bore Vol Normally: 7.2*h

Project and Bore Installation Details

Bore / Standpipe ID:	BH1
Project Name:	
Project Number:	86767.03
Site Location:	Haymarket
Bore GPS Co-ord:	
Installation Date:	
GW Level (during drilling):	- m bgl
Well Depth:	m bgl
Screened Interval:	m bgl
Contaminants/Comments:	-

Bore Development Details

Date/Time:	
Purged By:	
GW Level (pre-purge):	m bgl
GW Level (post-purge):	m bgl
PSH observed:	Yes / No (interface / visual). Thickness if observed:
Observed Well Depth:	m bgl
Estimated Bore Volume:	L
Total Volume Purged:	(target: no drill mud, min 3 well vol. or dry)
Equipment:	

Micropurge and Sampling Details

Date/Time:	
Sampled By:	
Weather Conditions:	
GW Level (pre-purge):	m bgl
GW Level (post sample):	m bgl
PSH observed:	Yes / No (interface / visual). Thickness if observed:
Observed Well Depth:	m bgl
Estimated Bore Volume:	L
Total Volume Purged:	L
Equipment:	

Water Quality Parameters

Time / Volume	Temp (°C)	DO (mg/L)	EC (µS or mS/cm)	pH	Turbidity	Redox (mV)
Stabilisation Criteria (3 readings)	***0.1°C***	**+/- 0.3 mg/L**	**+/- 3%**	**+/- 0.1**	**+/- 10%**	**+/- 10 mV**
~~14:57~~	~~24[illegible]~~	~~6.74~~	~~541~~	~~5.20~~	~~10.3~~	~~167~~
~~14:58~~	~~23.6~~	~~1.29~~	~~525~~	~~5.28~~	~~9.6~~	~~161~~
~~14:59~~	~~21.6~~	~~1.16~~	~~491~~	~~5.26~~	~~12.2~~	~~153~~
~~15:00~~						
~~15:01~~						
~~15:02~~						
15:03						
Additional Readings Following stabilisation:	DO % Sat	SPC	TDS			

Sample Details

Sampling Depth (rationale):	m bgl,
Sample Appearance (e.g. colour, siltiness, odour):	
Sample ID:	
QA/QC Samples:	
Sampling Containers and filtration:	
Comments / Observations:	

GW level
* 6.4m bgl (no GW - well depth) 1145 24/04/20
*

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PROJECT Haymarket SSI | Job No 86767.03 | Page 1 of 1

BH107b 17/05/20

depth: 11m AS

WL: pre purge 1.85m (volume = 9.15 × 7.2 = 65.8L)
~131L or dry

WL: post purge 10.6m

data logger installed to 10.5m post purge at 10:51am

v purged: ~30L → well dry

equipment: twister pump

BH107a

depth: 4m

WL prepurge 3.2m (volume = 5.76L)
~15L or dry

WL post purge 4m (dry)

data logger installed to 3.5m post purge (11:30am)

v purged: ~3L

equipment: bailer

Comps By / /

Checked By / /

Approved By / /

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Groundwater Field Sheet

Bore Volume = casing volume + filter pack volume
$= \pi h_w d_c^2/4 + n(\pi h_f d_a^2/4 - \pi h_f d_c^2/4)$
Where: $\pi = 3.14$
n = porosity (0.3 for most filter pack material)
h_w = height of water column
d_a = diameter of annulus
h_f = length of filter pack
d_c = diameter of casing

Bore Vol Normally: 7.2*h

Project and Bore Installation Details

Bore / Standpipe ID:	BH109B.
Project Name:	
Project Number:	
Site Location:	
Bore GPS Co-ord:	
Installation Date:	
GW Level (during drilling):	NA . . m bgl
Well Depth:	m bgl
Screened Interval:	m bgl
Contaminants/Comments:	-

Bore Development Details

Date/Time:	21.05.2020 80 Litres emptied.
Purged By:	Slow Recharge.
GW Level (pre-purge):	7.78 m bgl
GW Level (post-purge):	11.4m. m bgl
PSH observed:	Yes / No (interface / visual). Thickness if observed:
Observed Well Depth:	m bgl
Estimated Bore Volume:	L Data logger set @
Total Volume Purged:	(target: no drill mud, min 3 well vol. or dry)
Equipment:	11m.

Micropurge and Sampling Details

Date/Time:	
Sampled By:	
Weather Conditions:	
GW Level (pre-purge):	m bgl
GW Level (post sample):	m bgl
PSH observed:	Yes / No (interface / visual). Thickness if observed:
Observed Well Depth:	m bgl
Estimated Bore Volume:	L
Total Volume Purged:	L
Equipment:	

Water Quality Parameters

Time / Volume	Temp (°C)	DO (mg/L)	EC (µS or mS/cm)	pH	Turbidity	Redox (mV)
Stabilisation Criteria (3 readings)	***0.1 °C***	**+/- 0.3 mg/L**	**+/- 3%**	**+/- 0.1**	**+/- 10%**	**+/- 10 mV**
Additional Readings Following stabilisation:	DO % Sat	SPC	TDS			

Sample Details

Sampling Depth (rationale):	m bgl,
Sample Appearance (e.g. colour, siltiness, odour):	
Sample ID:	
QA/QC Samples:	
Sampling Containers and filtration:	
Comments / Observations:	

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Groundwater Field Sheet

Bore Volume = casing volume + filter pack volume
$= \pi h_w d_c^2/4 + n(\pi h_f d_a^2/4 - \pi h_f d_c^2/4)$

Where: $\pi = 3.14$
n = porosity (0.3 for most filter pack material)
h_w = height of water column
d_a = diameter of annulus
h_f = length of filter pack
d_c = diameter of casing

Bore Vol Normally: 7.2*h

Project and Bore Installation Details	
Bore / Standpipe ID:	BH112A.
Project Name:	
Project Number:	
Site Location:	
Bore GPS Co-ord:	
Installation Date:	
GW Level (during drilling):	NA. - m bgl
Well Depth:	m bgl
Screened Interval:	m bgl
Contaminants/Comments:	-
Bore Development Details	
Date/Time:	21.5.20
Purged By:	NB 30 litres
GW Level (pre-purge):	3.45 m bgl Very slow Recharge.
GW Level (post-purge):	4.4 m bgl
PSH observed:	Yes / No (interface / visual). Thickness if observed: BH was augered
Observed Well Depth:	m bgl No drilling water
Estimated Bore Volume:	L introduced.
Total Volume Purged:	(target: no drill mud, min 3 well vol. or dry)
Equipment:	Data logger set @ 4m.
Micropurge and Sampling Details	
Date/Time:	
Sampled By:	
Weather Conditions:	
GW Level (pre-purge):	m bgl
GW Level (post sample):	m bgl
PSH observed:	Yes / No (interface / visual). Thickness if observed:
Observed Well Depth:	m bgl
Estimated Bore Volume:	L
Total Volume Purged:	L
Equipment:	

Water Quality Parameters

Time / Volume	Temp (°C)	DO (mg/L)	EC (µS or mS/cm)	pH	Turbidity	Redox (mV)
Stabilisation Criteria (3 readings)	**0.1° C**	**+/- 0.3 mg/L**	**+/- 3%**	**+/- 0.1**	**+/- 10%**	**+/- 10 mV**
Additional Readings Following stabilisation:	DO % Sat	SPC	TDS			

Sample Details

Sampling Depth (rationale):	m bgl,
Sample Appearance (e.g. colour, siltiness, odour):	
Sample ID:	
QA/QC Samples:	
Sampling Containers and filtration:	
Comments / Observations:	

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Groundwater Field Sheet

Bore Volume = casing volume + filter pack volume
$= \pi h_2 d_2^2/4 + n(\pi h_1 d_1^2/4 - \pi h_1 d_2^2/4)$

Where: $\pi = 3.14$
n = porosity (0.3 for most filter pack material)
h_2 = height of water column
d_1 = diameter of annulus
h_1 = length of filter pack
d_2 = diameter of casing

Bore Vol Normally: 7.2*h

Project and Bore Installation Details

Bore / Standpipe ID:	BH112B
Project Name:	
Project Number:	
Site Location:	
Bore GPS Co-ord:	
Installation Date:	
GW Level (during drilling):	5.05 - m bgl
Well Depth:	11.4m m bgl
Screened Interval:	11.4 – 5.5m m bgl
Contaminants/Comments:	-

Bore Development Details

Date/Time:	21.5.20.
Purged By:	NB. Removed 150 Litres
GW Level (pre-purge):	5.05 m bgl still Running Dirty.
GW Level (post-purge):	8.1 m bgl
PSH observed:	Yes / No (interface / visual). Thickness if observed: Fast Recharge.
Observed Well Depth:	m bgl
Estimated Bore Volume:	L Data logger set @
Total Volume Purged:	(target: no drill mud, min 3 well vol. or dry) 11m Below ground level.
Equipment:	

Micropurge and Sampling Details

Date/Time:	
Sampled By:	
Weather Conditions:	
GW Level (pre-purge):	m bgl
GW Level (post sample):	m bgl
PSH observed:	Yes / No (interface / visual). Thickness if observed:
Observed Well Depth:	m bgl
Estimated Bore Volume:	L
Total Volume Purged:	L
Equipment:	

Water Quality Parameters

Time / Volume	Temp (°C)	DO (mg/L)	EC (μS or mS/cm)	pH	Turbidity	Redox (mV)
Stabilisation Criteria (3 readings)	*0.1° C*	**+/- 0.3 mg/L**	**+/- 3%**	**+/- 0.1**	**+/- 10%**	**+/- 10 mV**
Additional Readings Following stabilisation:	DO % Sat	SPC	TDS			

Sample Details

Sampling Depth (rationale):	m bgl,
Sample Appearance (e.g. colour, siltiness, odour):	
Sample ID:	
QA/QC Samples:	
Sampling Containers and filtration:	
Comments / Observations:	

Groundwater Field Sheet

Bore Volume = casing volume
volume
$= \pi h_1 d_2^2/4 + r$
Where: $\pi = 3.14$
n = porosity (0.? material)
h_1 = height of wa.
d_2 = diameter of annulus
h_2 = length of filter pack
d_2 = diameter of casing
Bore Vol Normally: 7.2*h

Project and Bore Installation Details

Bore / Standpipe ID:	BH107a
Project Name:	Haymarket SSI
Project Number:	86767.03
Site Location:	
Bore GPS Co-ord:	
Installation Date:	
GW Level (during drilling):	- m bgl
Well Depth:	m bgl
Screened Interval:	m bgl
Contaminants/Comments:	-

Bore Development Details

Date/Time:	
Purged By:	
GW Level (pre-purge):	m bgl
GW Level (post-purge):	m bgl
PSH observed:	Yes / No (interface / visual). Thickness if observed:
Observed Well Depth:	m bgl
Estimated Bore Volume:	L
Total Volume Purged:	(target: no drill mud, min 3 well vol. or dry)
Equipment:	

Micropurge and Sampling Details

Date/Time:	26/05/20
Sampled By:	AS
Weather Conditions:	rainy
GW Level (pre-purge):	2.1 m bgl data logger retrieved 10:30am
GW Level (post sample):	3.85 m bgl data logger put in 11:01am
PSH observed:	Yes / [✓ No] (interface / visual). Thickness if observed:
Observed Well Depth:	3.85 m bgl
Estimated Bore Volume:	12.6 L
Total Volume Purged:	~5 L
Equipment:	geopump, WQM, int meter

Water Quality Parameters

Time / Volume	Temp (°C)	DO (mg/L)	EC (µS or mS/cm)	pH	Turbidity	Redox (mV)
Stabilisation Criteria (3 readings)	***0.1° C***	**+/- 0.3 mg/L**	**+/- 3%**	**+/- 0.1**	**+/- 10%**	**+/- 10 mV**
13:07	18.8	3.23	494	7.16	137.3	74
13:08	21.3	2.06	462	6.84	127.1	72
13:09	22.1	1.68	125	6.78	—	67
Additional Readings Following stabilisation:	DO % Sat	SPC	TDS			

Sample Details

Sampling Depth (rationale):	3.2 m bgl,
Sample Appearance (e.g. colour, siltiness, odour):	grey, odourless
Sample ID:	BH107A
QA/QC Samples:	—
Sampling Containers and filtration:	see COC
Comments / Observations:	note - samples taken prior to WQM readings due to low vol, slow recharge

well dry after 3 readings

Groundwater Field Sheet

Bore Volume = casing volume + filter pack volume

$= \pi h_1 d_2^2/4 + n(\pi h_2 d_1^2/4 - \pi h_2 d_2^2/4)$

Where: $\pi = 3.14$

n = porosity (0.3 for most filter pack material)

h_1 = height of water column

d_1 = diameter of annulus

h_2 = length of filter pack

d_2 = diameter of casing

Bore Vol Normally: 7.2*h

Project and Bore Installation Details

Bore / Standpipe ID:	BH107B
Project Name:	Haymarket SSI
Project Number:	86767.03
Site Location:	
Bore GPS Co-ord:	
Installation Date:	
GW Level (during drilling):	- m bgl
Well Depth:	m bgl
Screened Interval:	m bgl
Contaminants/Comments:	-

Bore Development Details

Date/Time:	
Purged By:	
GW Level (pre-purge):	m bgl
GW Level (post-purge):	m bgl
PSH observed:	Yes / No (interface / visual). Thickness if observed:
Observed Well Depth:	m bgl
Estimated Bore Volume:	L
Total Volume Purged:	(target: no drill mud, min 3 well vol. or dry)
Equipment:	

Micropurge and Sampling Details

Date/Time:	26/05/20
Sampled By:	AS
Weather Conditions:	rainy
GW Level (pre-purge):	2.6 m bgl data logger retrieved 11:11
GW Level (post sample):	5.3 m bgl data logger put in, 30s int, 11:28
PSH observed:	Yes / [✓ No] (interface / visual). Thickness if observed:
Observed Well Depth:	11.15 m bgl
Estimated Bore Volume:	61 L
Total Volume Purged:	~15 L
Equipment:	geopump, WQM, int. meter

Water Quality Parameters

Time / Volume	Temp (°C)	DO (mg/L)	EC (µS or mS/cm)	pH	Turbidity	Redox (mV)
Stabilisation Criteria (3 readings)	***0.1° C***	**+/- 0.3 mg/L**	**+/- 3%**	**+/- 0.1**	**+/- 10%**	**+/- 10 mV**
13:27	19.3	3.47	501	7.04	–	12
13:28	21.3	1.09	499	7.22	–	-28
13:29	22.1	0.62	494	7.19	82.2	-56
13:30	22.3	0.33	492	7.18	35.5	-68
13:31	22.4	0.24	474	7.23	24.0	-75
13:32	22.5	0.18	474	7.27	18.6	-77
13:33	22.5	0.14	472	7.24	16.8	-76
Additional Readings Following stabilisation:	DO % Sat	SPC	TDS			

Sample Details

Sampling Depth (rationale):	8.0 m bgl,
Sample Appearance (e.g. colour, siltiness, odour):	clear-grey, odourless
Sample ID:	BH107B
QA/QC Samples:	–
Sampling Containers and filtration:	see COC
Comments / Observations:	–

Groundwater Field Sheet

Bore Volume = casing volume + filter pack volume
$= \pi h_1 d_2^2/4 + n(\pi h_2 d_1^2/4 - \pi h_2 d_2^2/4)$
Where: $\pi = 3.14$
n = porosity (0.3 for most filter pack material)
h_1 = height of water column
d_1 = diameter of annulus
h_2 = length of filter pack
d_2 = diameter of casing
Bore Vol Normally: 7.2*h

Project and Bore Installation Details	
Bore / Standpipe ID:	BH109B
Project Name:	Haymarket SSI
Project Number:	86767.03
Site Location:	
Bore GPS Co-ord:	
Installation Date:	
GW Level (during drilling):	- m bgl
Well Depth:	m bgl
Screened Interval:	m bgl
Contaminants/Comments:	-
Bore Development Details	
Date/Time:	
Purged By:	
GW Level (pre-purge):	m bgl
GW Level (post-purge):	m bgl
PSH observed:	Yes / No (interface / visual). Thickness if observed:
Observed Well Depth:	m bgl
Estimated Bore Volume:	L
Total Volume Purged:	(target: no drill mud, min 3 well vol. or dry)
Equipment:	
Micropurge and Sampling Details	
Date/Time:	26/05/20
Sampled By:	AS
Weather Conditions:	cloudy
GW Level (pre-purge):	8.2 m bgl data logger retrieved, 12:17pm
GW Level (post sample):	10.9 m bgl data logger put in (30s), 12:59pm
PSH observed:	Yes / [✓ No] (interface / visual). Thickness if observed:
Observed Well Depth:	12.0 m bgl
Estimated Bore Volume:	27 L
Total Volume Purged:	~15 L
Equipment:	geopump, int meter, WQM, bailer

Water Quality Parameters

Time / Volume	Temp (°C)	DO (mg/L)	EC (µS or mS/cm)	pH	Turbidity	Redox (mV)
Stabilisation Criteria (3 readings)	***0.1° C***	**+/- 0.3 mg/L**	**+/- 3%**	**+/- 0.1**	**+/- 10%**	**+/- 10 mV**
14:39	19.9	3.16	760	7.42	—	-1
14:40	20.9	2.10	764	7.38	—	-10
14:41	22.2	1.25	735	7.39	3.2	-24
14:41	22.8	0.71	719	7.36	99.2	-33
14:42	23.0	0.53	711	7.42	110.5	-36
14:43	23.1	0.60	735	7.31	114.1	-41
14.44	23.1	0.55	731	7.31	91.0	-42
Additional Readings Following stabilisation:	DO % Sat	SPC	TDS			

Sample Details

Sampling Depth (rationale):	10.5 m bgl,
Sample Appearance (e.g. colour, siltiness, odour):	brown-grey, slightly silty, odourless
Sample ID:	BH109B
QA/QC Samples:	—
Sampling Containers and filtration:	see COC
Comments / Observations:	—

Geotechnics / Environment / Groundwater

Groundwater Field Sheet

Bore Volume = casing volume + filter pack volume
$= \pi h_1 d_2^2/4 + n(\pi h_2 d_1^2/4 - \pi h_2 d_2^2/4)$

Where: $\pi = 3.14$
n = porosity (0.3 for most filter pack material)
h_1 = height of water column
d_1 = diameter of annulus
h_2 = length of filter pack
d_2 = diameter of casing

Bore Vol Normally: 7.2*h

Project and Bore Installation Details

Bore / Standpipe ID:	BH112A
Project Name:	Haymarket SSI
Project Number:	86767.03
Site Location:	
Bore GPS Co-ord:	
Installation Date:	
GW Level (during drilling):	- m bgl
Well Depth:	m bgl
Screened Interval:	m bgl
Contaminants/Comments:	-

Bore Development Details

Date/Time:	
Purged By:	
GW Level (pre-purge):	m bgl
GW Level (post-purge):	m bgl
PSH observed:	Yes / No (interface / visual). Thickness if observed:
Observed Well Depth:	m bgl
Estimated Bore Volume:	L
Total Volume Purged:	(target: no drill mud, min 3 well vol. or dry)
Equipment:	

Micropurge and Sampling Details

Date/Time:	26/05/20
Sampled By:	AS
Weather Conditions:	rainy
GW Level (pre-purge):	3.10 m bgl (9:08, data logger retrieved)
GW Level (post sample):	4.3 m bgl (10:15, data logger put in) (30s int)
PSH observed:	Yes / [✓ No] (interface / visual). Thickness if observed:
Observed Well Depth:	4.3 m bgl
Estimated Bore Volume:	8.6 L
Total Volume Purged:	~10 L
Equipment:	pump, WQM, int meter

Water Quality Parameters

Time / Volume	Temp (°C)	DO (mg/L)	EC (µS or mS/cm)	pH	Turbidity	Redox (mV)
Stabilisation Criteria (3 readings)	***0.1° C***	**+/- 0.3 mg/L**	**+/- 3%**	**+/- 0.1**	**+/- 10%**	**+/- 10 mV**
11:28	19.2	3.89	374	8.21	-0.5	91
11:29	22.3	3.05	361	8.34	4.1	90
11:30	23.9	2.83	354	8.40	5.2	87
11:31	24.4	3.37	358	8.32	5.2	79
11:32						
(well dry						
Additional Readings Following stabilisation:	DO % Sat	SPC	TDS			

Sample Details

Sampling Depth (rationale):	4.0 m bgl,
Sample Appearance (e.g. colour, siltiness, odour):	clear, odourless
Sample ID:	BH112A
QA/QC Samples:	—
Sampling Containers and filtration:	see COC
Comments / Observations:	well dry after 3 readings -

let recharge for 1 min, put tubing deeper then sampled.

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Geotechnics / Environment / Groundwater

Groundwater Field Sheet

Bore Volume = casing volume
volume
$= \pi h_2 d_2^2/4 + n$
Where: $\pi = 3.14$
n = porosity (0.3
material)
h_1 = height of
d_1 = diameter of annu
h_2 = length of filter pack
d_2 = diameter of casing
Bore Vol Normally: 7.2*h

Project and Bore Installation Details

Bore / Standpipe ID:	BH112B
Project Name:	Haymarket SSI
Project Number:	86767.03
Site Location:	
Bore GPS Co-ord:	
Installation Date:	
GW Level (during drilling):	- m bgl
Well Depth:	m bgl
Screened Interval:	m bgl
Contaminants/Comments:	-

Bore Development Details

Date/Time:	
Purged By:	
GW Level (pre-purge):	m bgl
GW Level (post-purge):	m bgl
PSH observed:	Yes / No (interface / visual). Thickness if observed:
Observed Well Depth:	m bgl
Estimated Bore Volume:	L
Total Volume Purged:	(target: no drill mud, min 3 well vol. or dry)
Equipment:	

Micropurge and Sampling Details

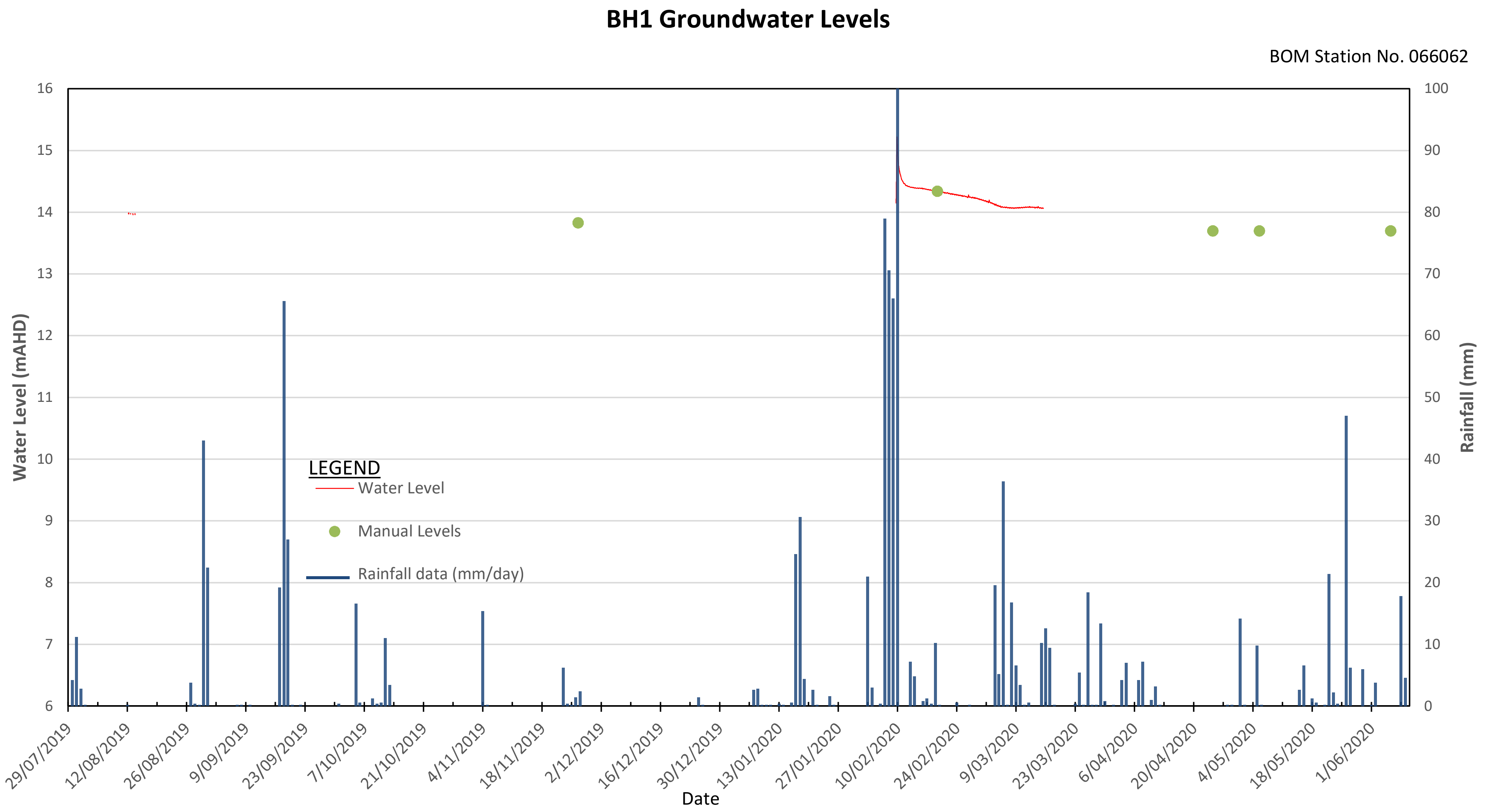
Date/Time:	26/05/20
Sampled By:	AS
Weather Conditions:	rainy
GW Level (pre-purge):	5.2 m bgl (8:24) datalogger retrieved
GW Level (post sample):	5.85 m bgl (9:00) datalogger put in (30s int
PSH observed:	Yes [✓ No] (interface / visual). Thickness if observed:
Observed Well Depth:	10.85 m bgl
Estimated Bore Volume:	40 L
Total Volume Purged:	~15 L
Equipment:	pump, WQM, int meter

Water Quality Parameters

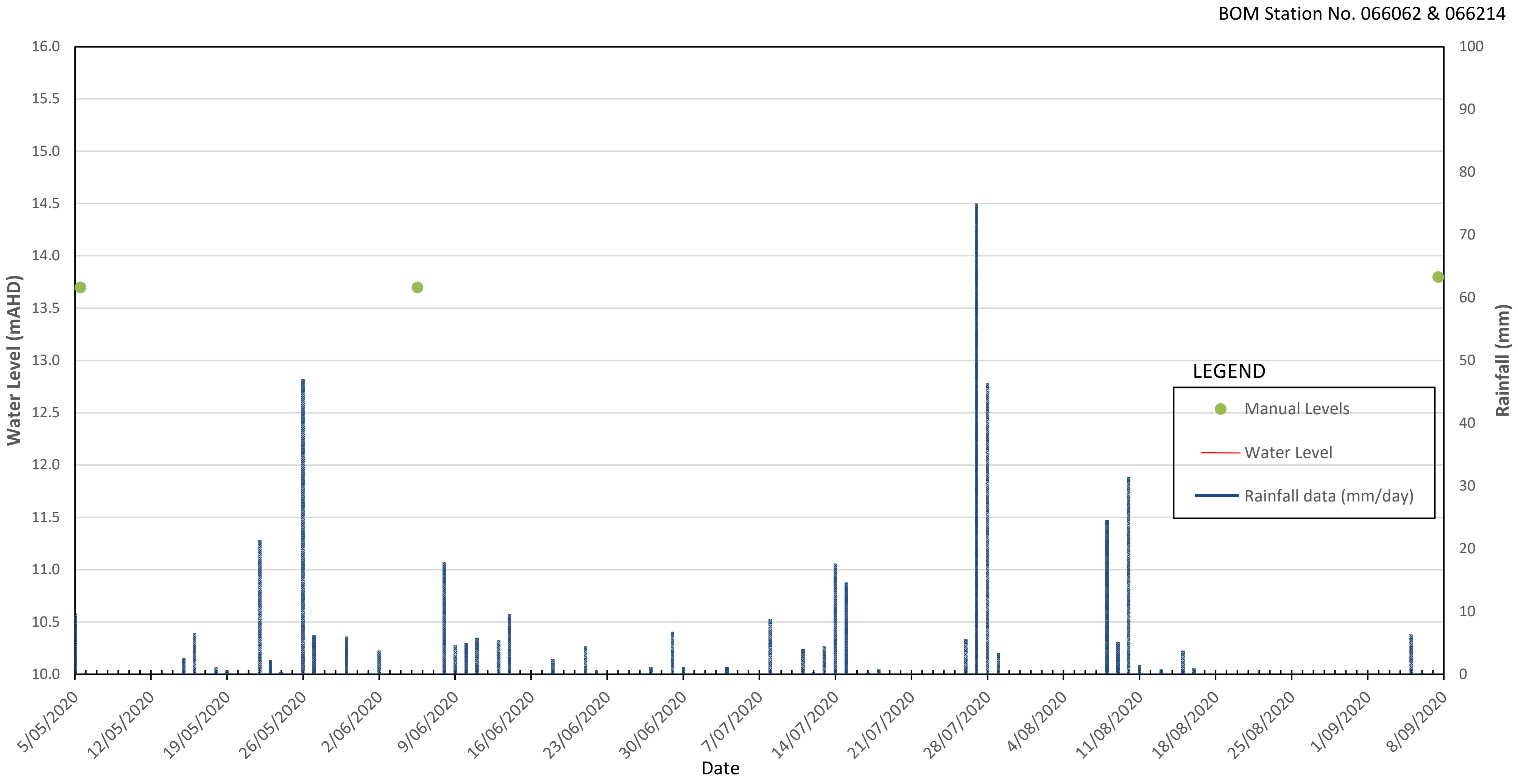
Time / Volume	Temp (°C)	DO (mg/L)	EC (µS or mS/cm)	pH	Turbidity	Redox (mV)
Stabilisation Criteria (3 readings)	***0.1°C***	**+/- 0.3 mg/L**	**+/- 3%**	**+/- 0.1**	**+/- 10%**	**+/- 10 mV**
10:51	17.2	2.51	377	4.94	114	159
10:52	21.8	1.77	311	5.08	1089	145
10:53	23.8	1.52	285	5.32	966	134
10:54	24.1	1.20	282	5.46	933	130
10:55	24.3	1.14	278	5.54	796	126
10:56	24.5	1.07	279	5.62	680	121
10:57	24.5	1.10	279	5.65	626	120
Additional Readings Following stabilisation:	DO % Sat	SPC	TDS			

Sample Details

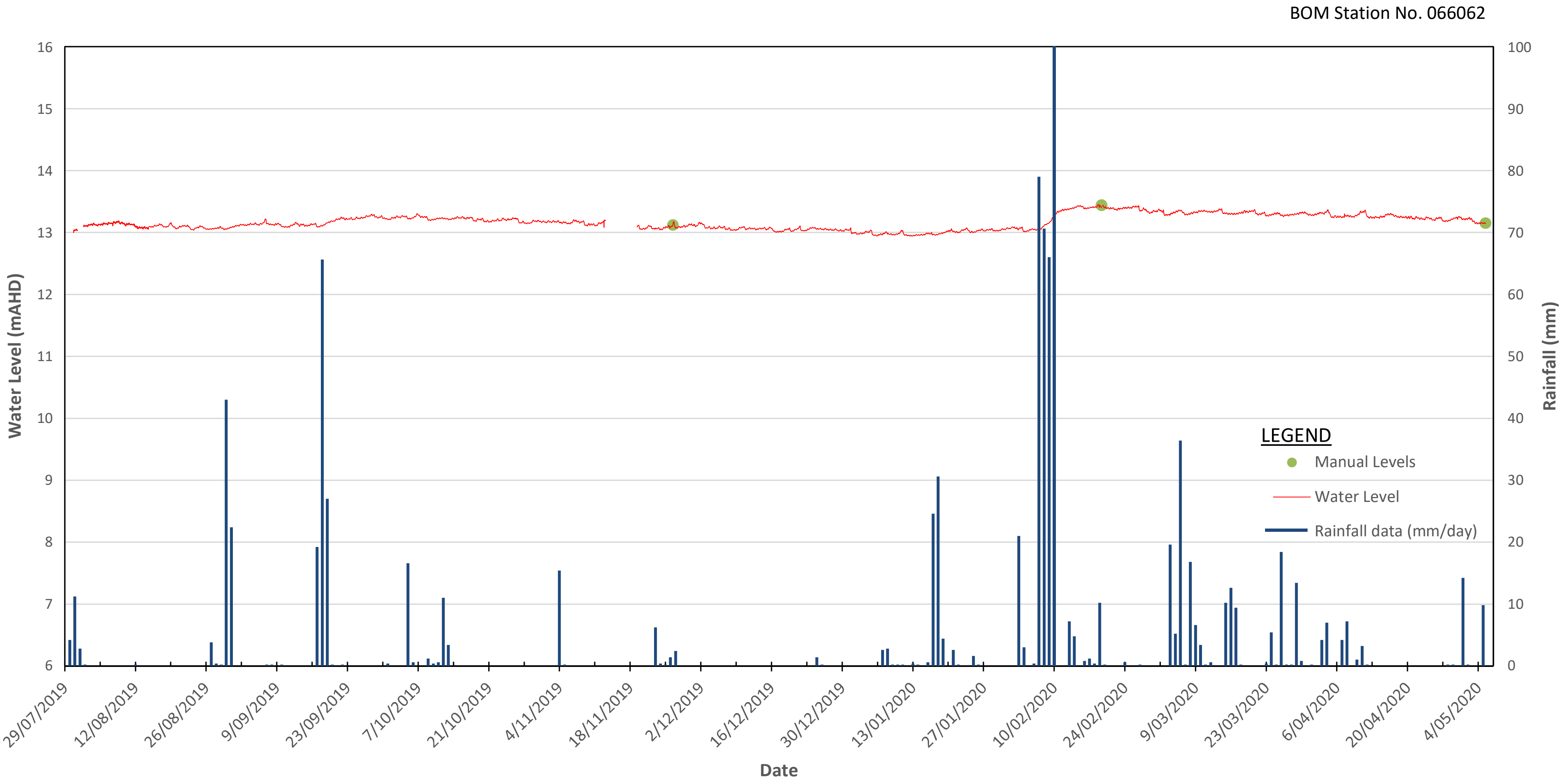
Sampling Depth (rationale):	8.0 m bgl,
Sample Appearance (e.g. colour, siltiness, odour):	brown, silty
Sample ID:	BH112B
QA/QC Samples:	BD1/20200526
Sampling Containers and filtration:	see CoC
Comments / Observations:	—

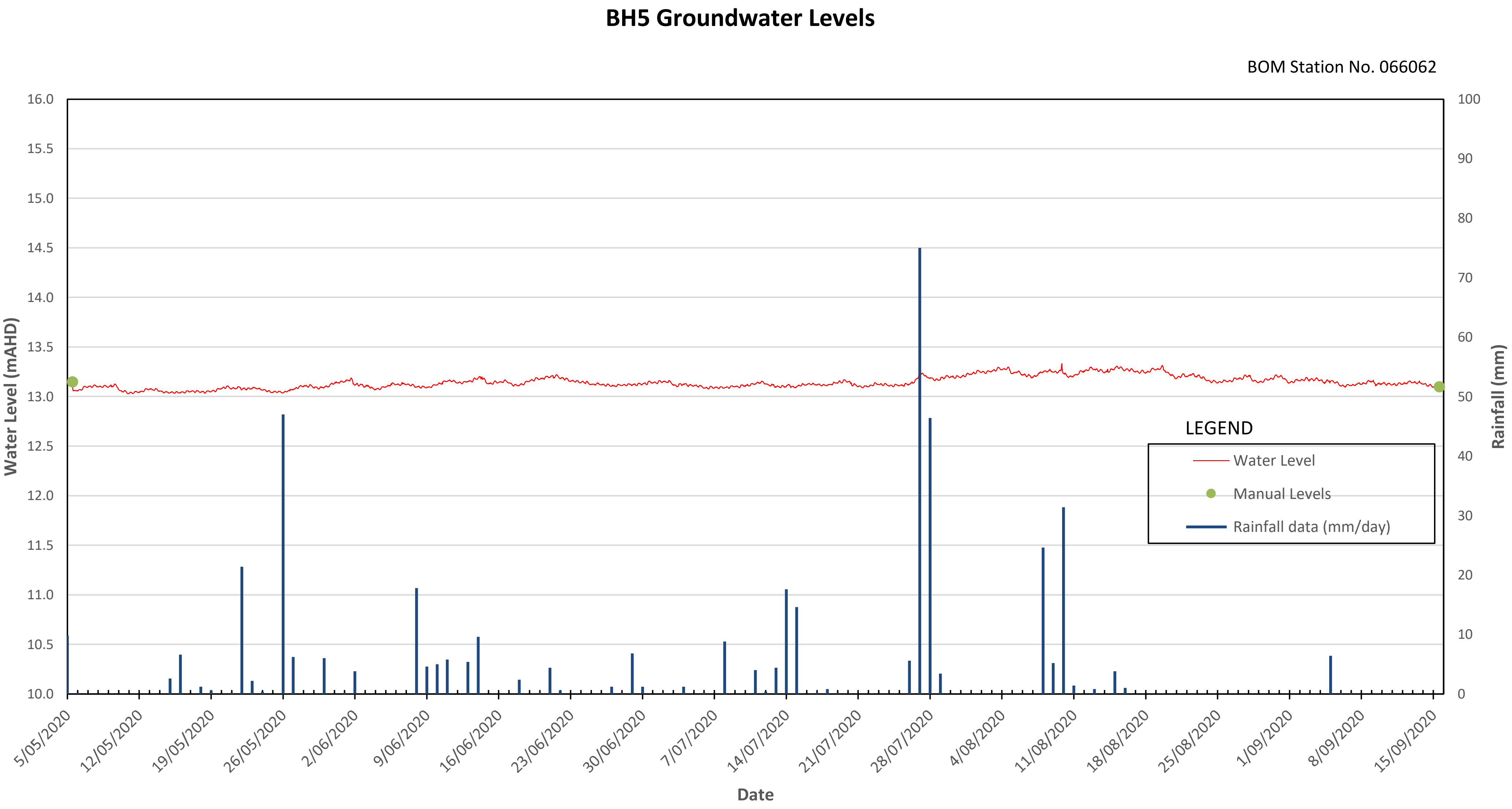

BH1 Groundwater Levels
BOM Station No. 066062
Water Level (mAHD)
Rainfall (mm)
16
15
14
13
12
11
10
9
8
7
6
100
90
80
70
60
50
40
30
20
10
0
LEGEND
Water Level
Manual Levels
Rainfall data (mm/day)
29/07/2019
12/08/2019
26/08/2019
9/09/2019
23/09/2019
7/10/2019
21/10/2019
4/11/2019
18/11/2019
2/12/2019
16/12/2019
30/12/2019
13/01/2020
27/01/2020
10/02/2020
24/02/2020
9/03/2020
23/03/2020
6/04/2020
20/04/2020
4/05/2020
18/05/2020
1/06/2020
Date

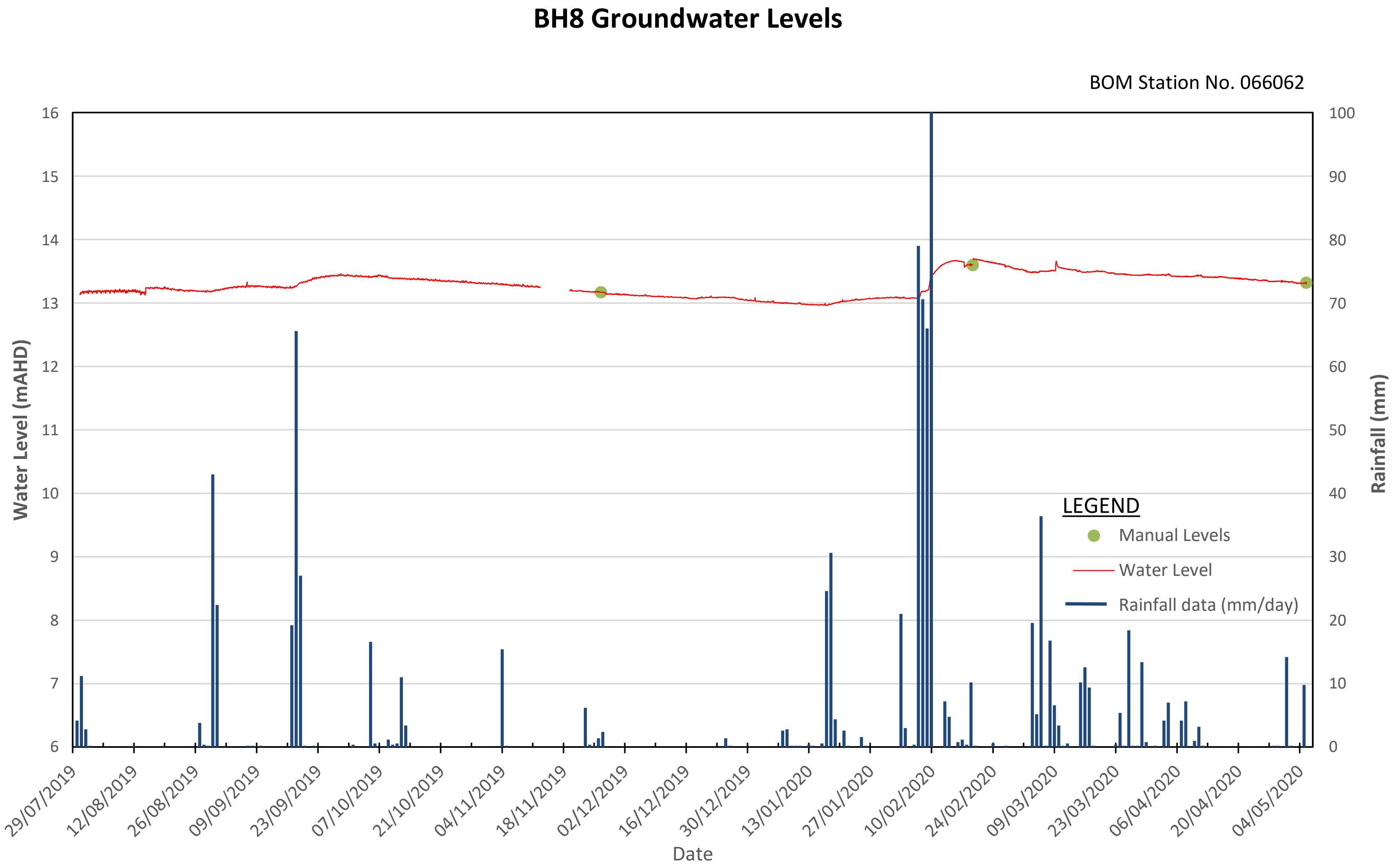
BH1 Groundwater Levels



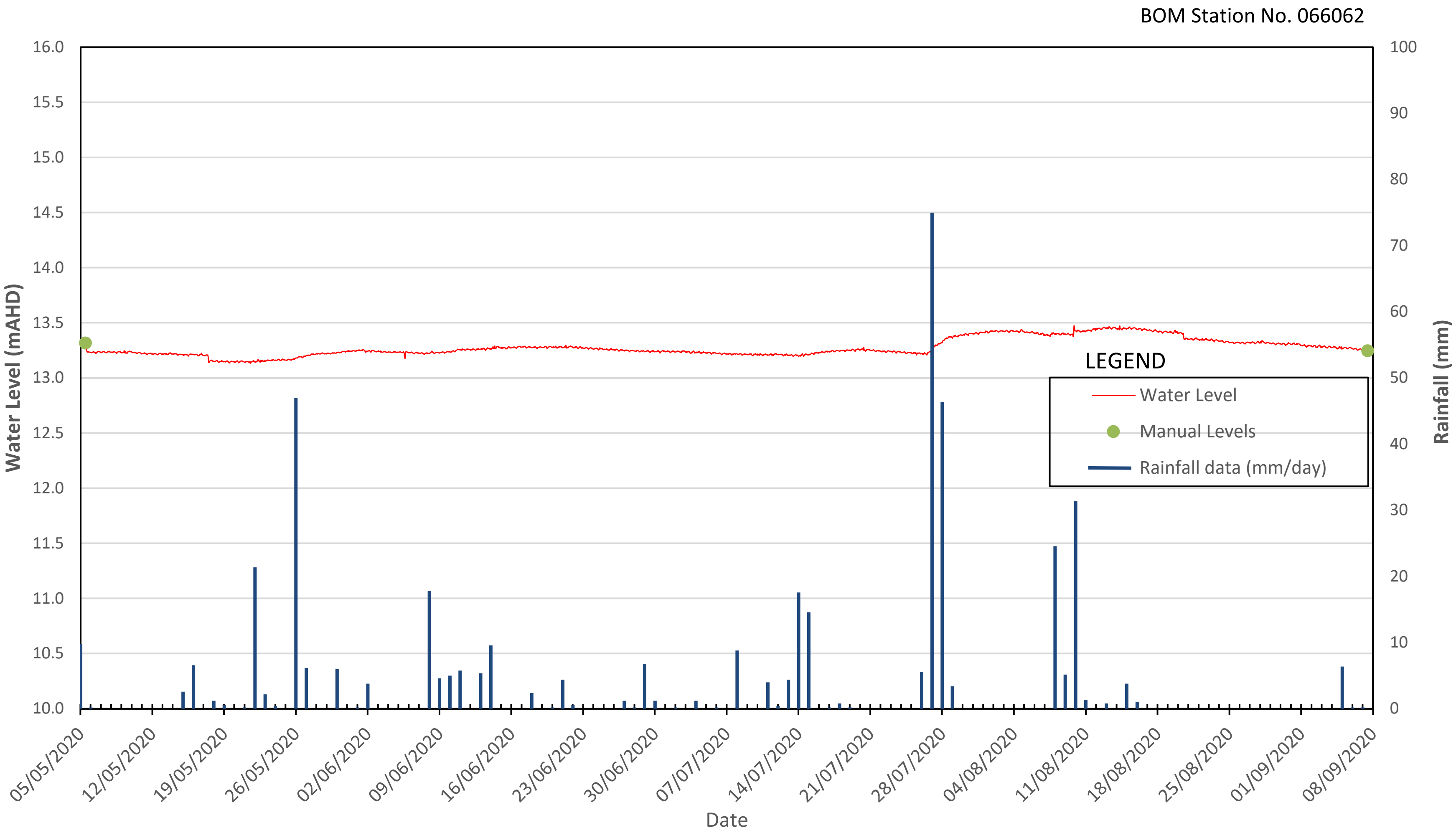
BH5 Groundwater Levels



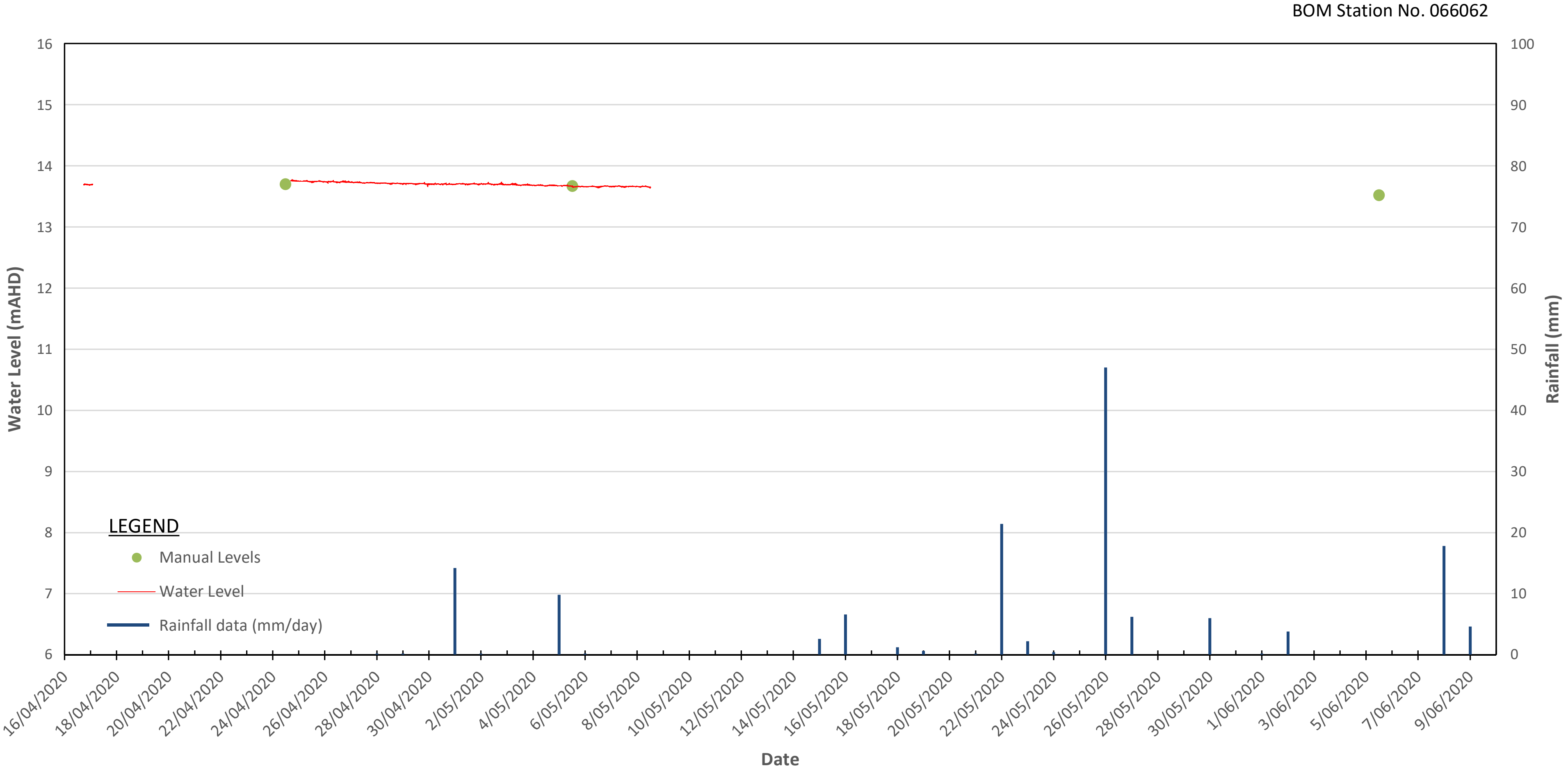

BH5 Groundwater Levels
BOM Station No. 066062
Water Level (mAHD)
16.0
15.5
15.0
14.5
14.0
13.5
13.0
12.5
12.0
11.5
11.0
10.5
10.0
Rainfall (mm)
100
90
80
70
60
50
40
30
20
10
0
5/05/2020
12/05/2020
19/05/2020
26/05/2020
2/06/2020
9/06/2020
16/06/2020
23/06/2020
30/06/2020
7/07/2020
14/07/2020
21/07/2020
28/07/2020
4/08/2020
11/08/2020
18/08/2020
25/08/2020
1/09/2020
8/09/2020
15/09/2020
Date
LEGEND
Water Level
Manual Levels
Rainfall data (mm/day)

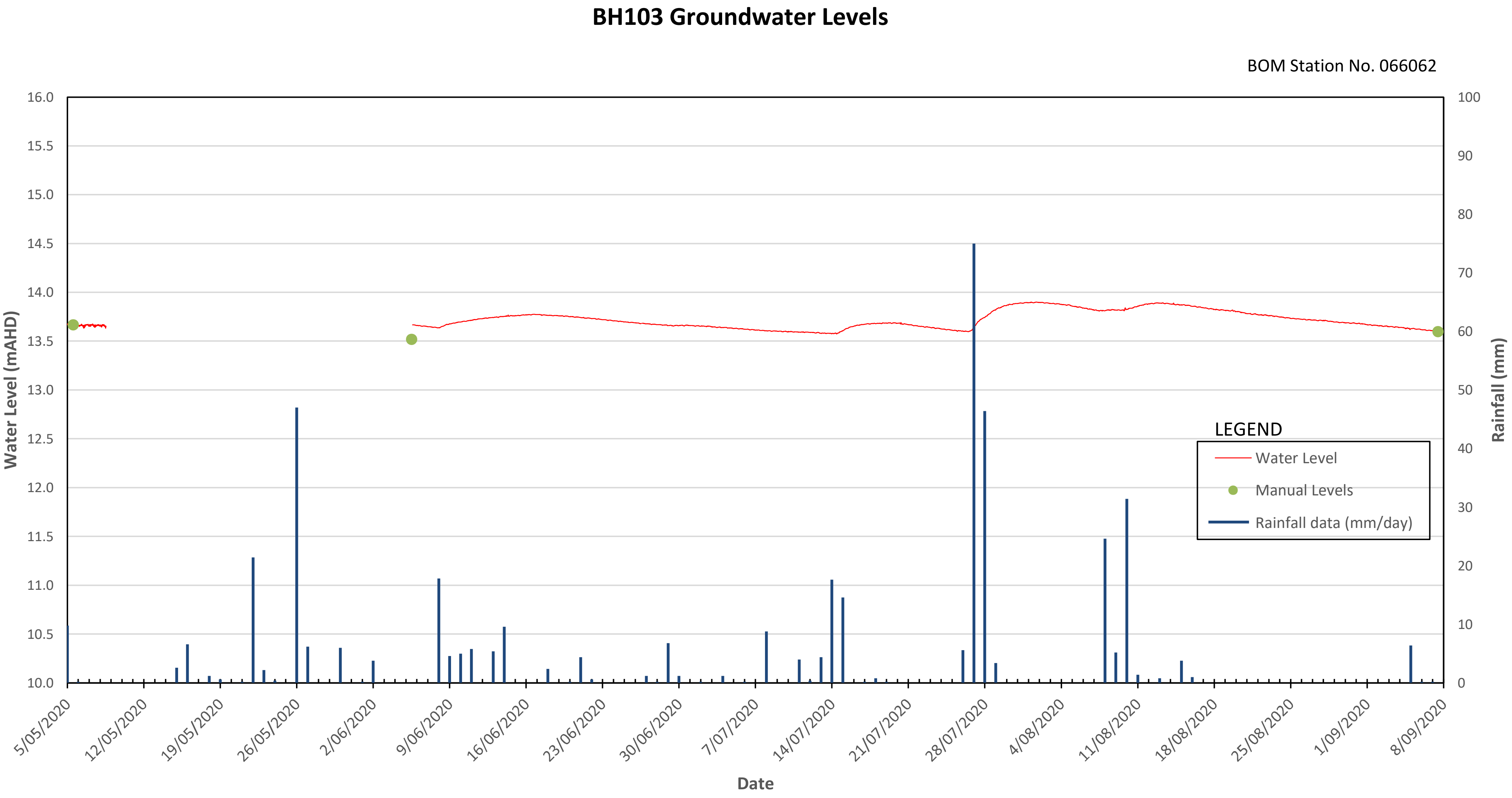

BH8 Groundwater Levels
BOM Station No. 066062
Water Level (mAHD)
16
15
14
13
12
11
10
9
8
7
6
Rainfall (mm)
100
90
80
70
60
50
40
30
20
10
0
LEGEND
Manual Levels
Water Level
Rainfall data (mm/day)
29/07/2019
12/08/2019
26/08/2019
09/09/2019
23/09/2019
07/10/2019
21/10/2019
04/11/2019
18/11/2019
02/12/2019
16/12/2019
30/12/2019
13/01/2020
27/01/2020
10/02/2020
24/02/2020
09/03/2020
23/03/2020
06/04/2020
20/04/2020
04/05/2020
Date

BH8 Groundwater Levels

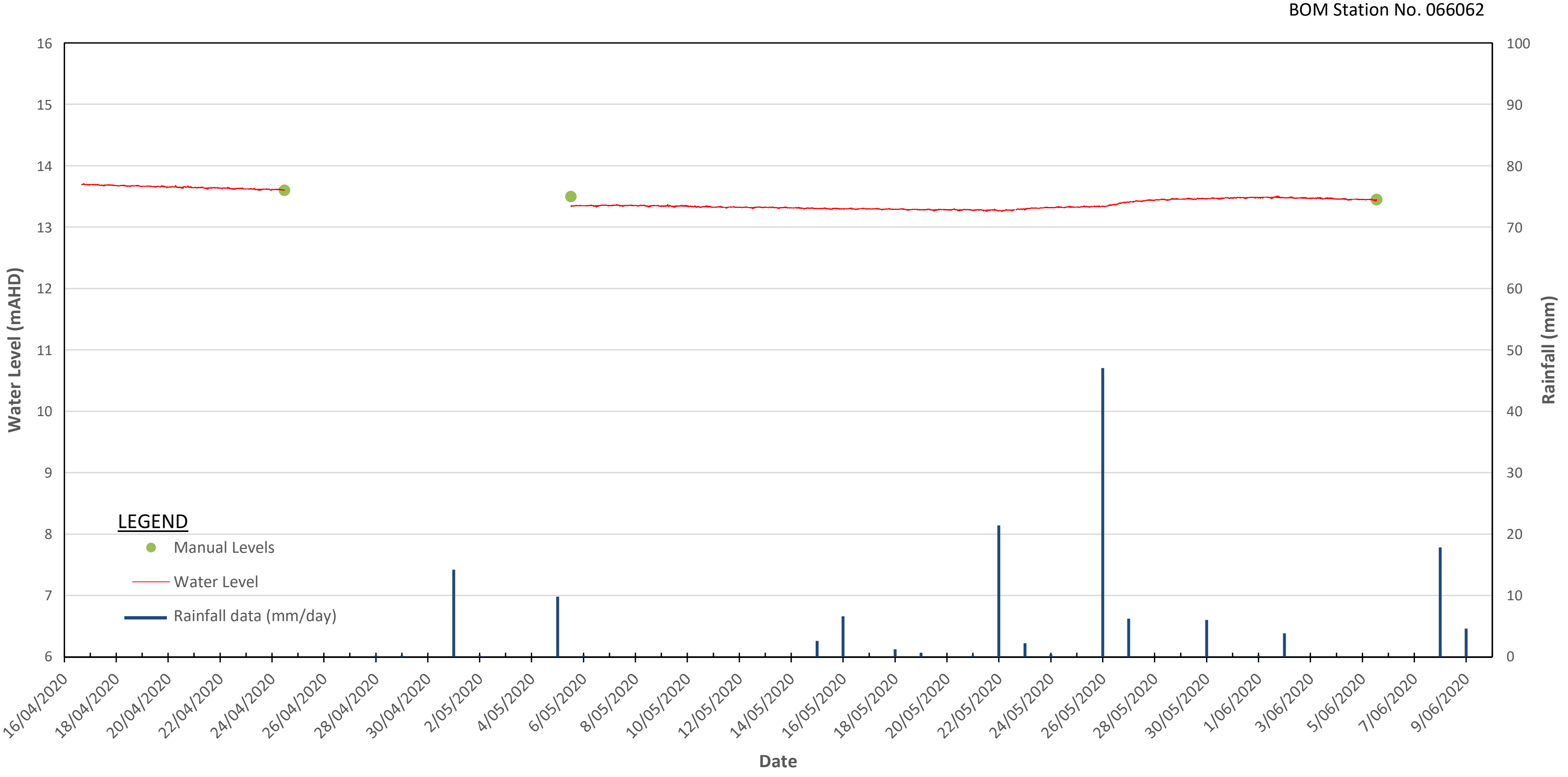


BH103 Groundwater Levels

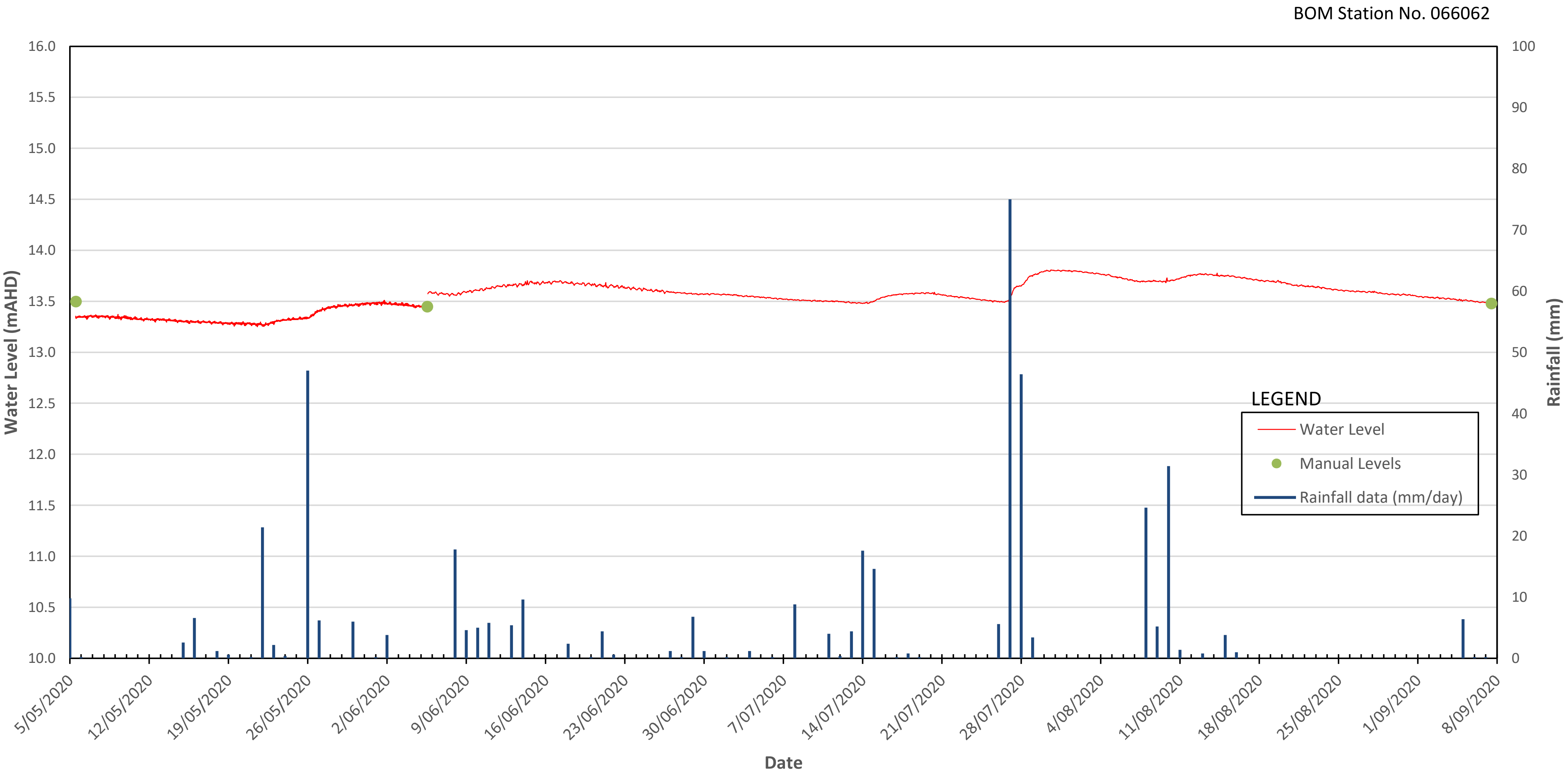



BH103 Groundwater Levels
BOM Station No. 066062
Water Level (mAHD)
16.0
15.5
15.0
14.5
14.0
13.5
13.0
12.5
12.0
11.5
11.0
10.5
10.0
Rainfall (mm)
100
90
80
70
60
50
40
30
20
10
0
5/05/2020
12/05/2020
19/05/2020
26/05/2020
2/06/2020
9/06/2020
16/06/2020
23/06/2020
30/06/2020
7/07/2020
14/07/2020
21/07/2020
28/07/2020
4/08/2020
11/08/2020
18/08/2020
25/08/2020
1/09/2020
8/09/2020
Date
LEGEND
Water Level
Manual Levels
Rainfall data (mm/day)

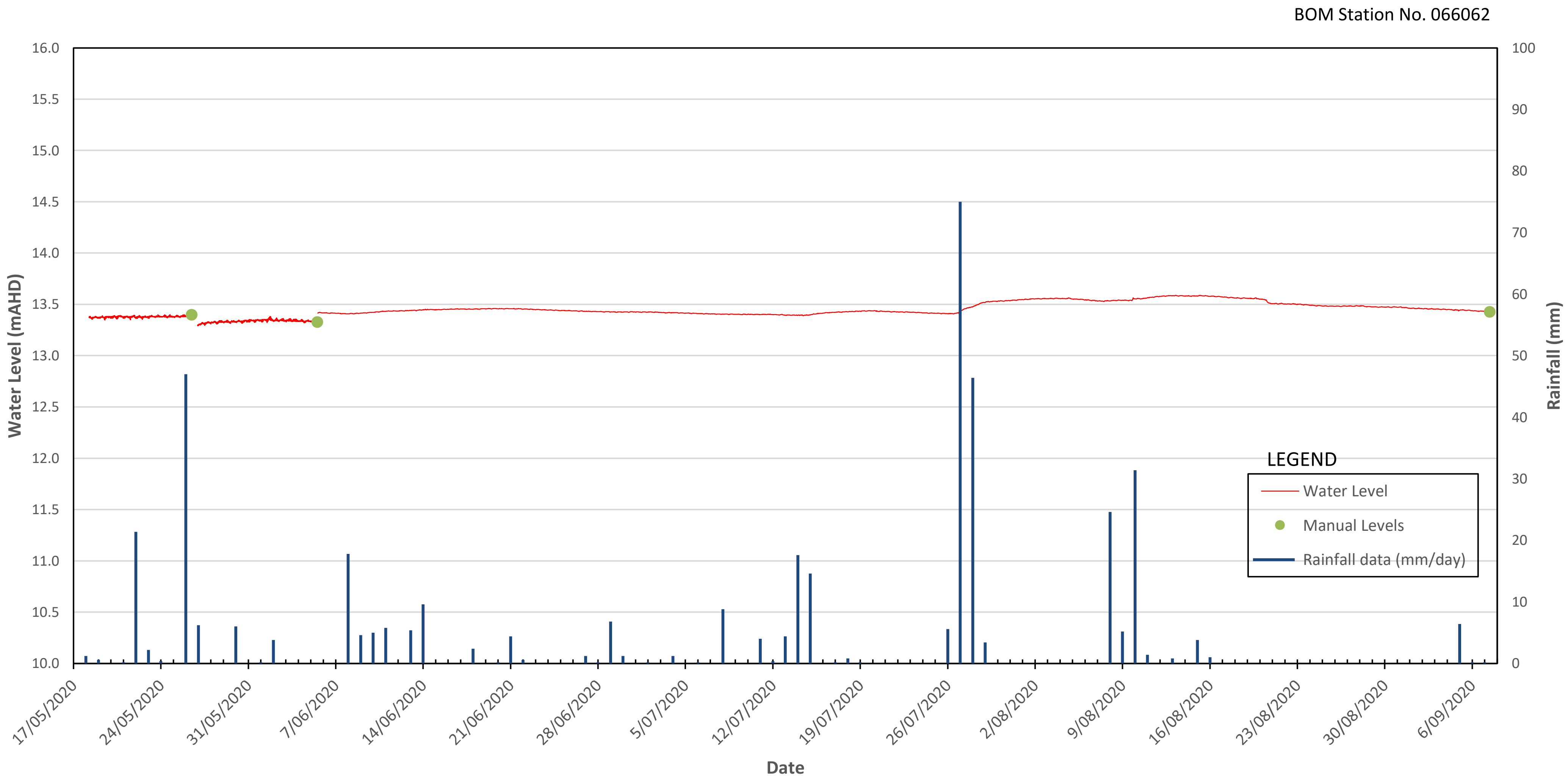
BH104 Groundwater Levels



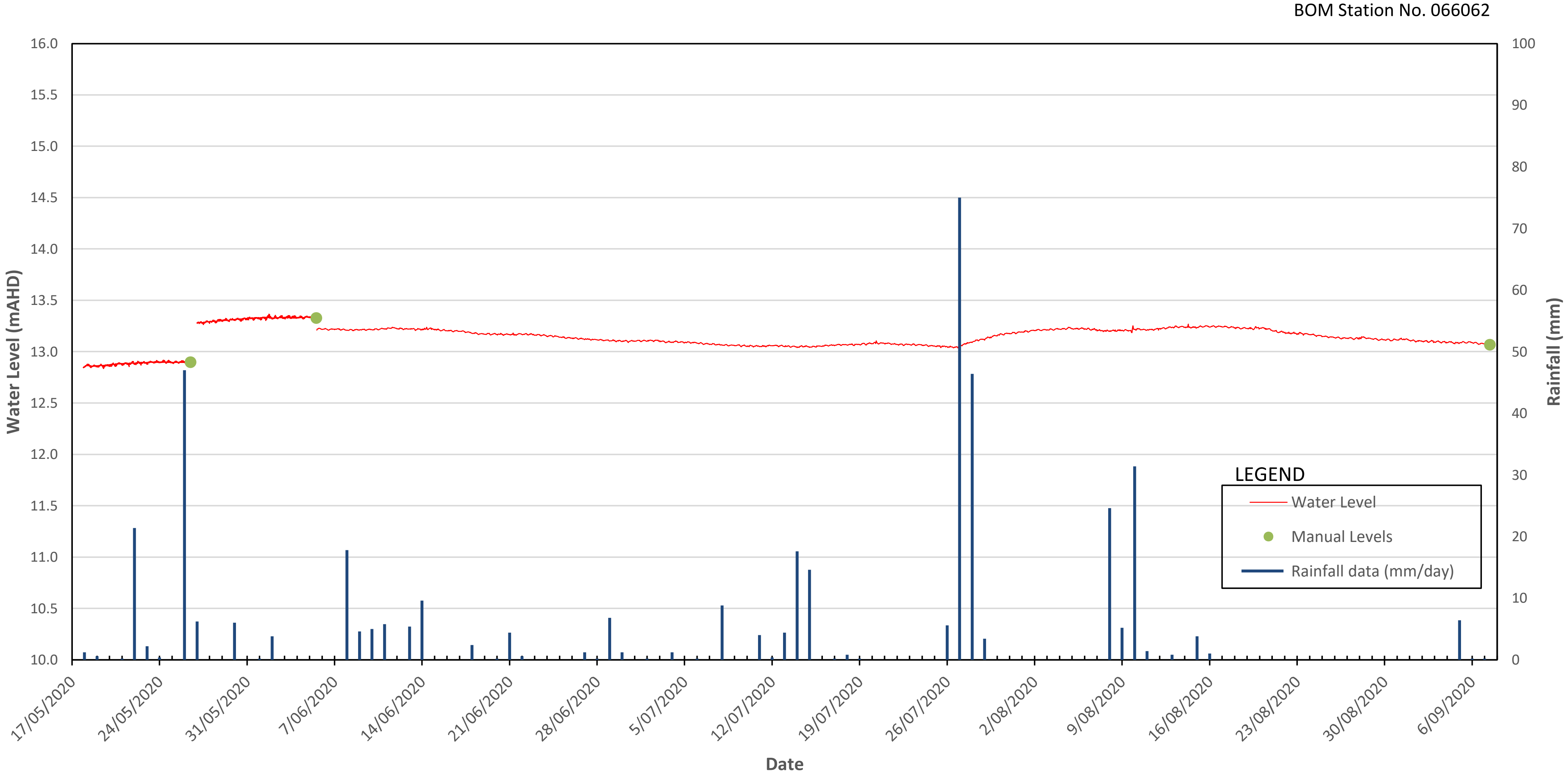
BH104 Groundwater Levels



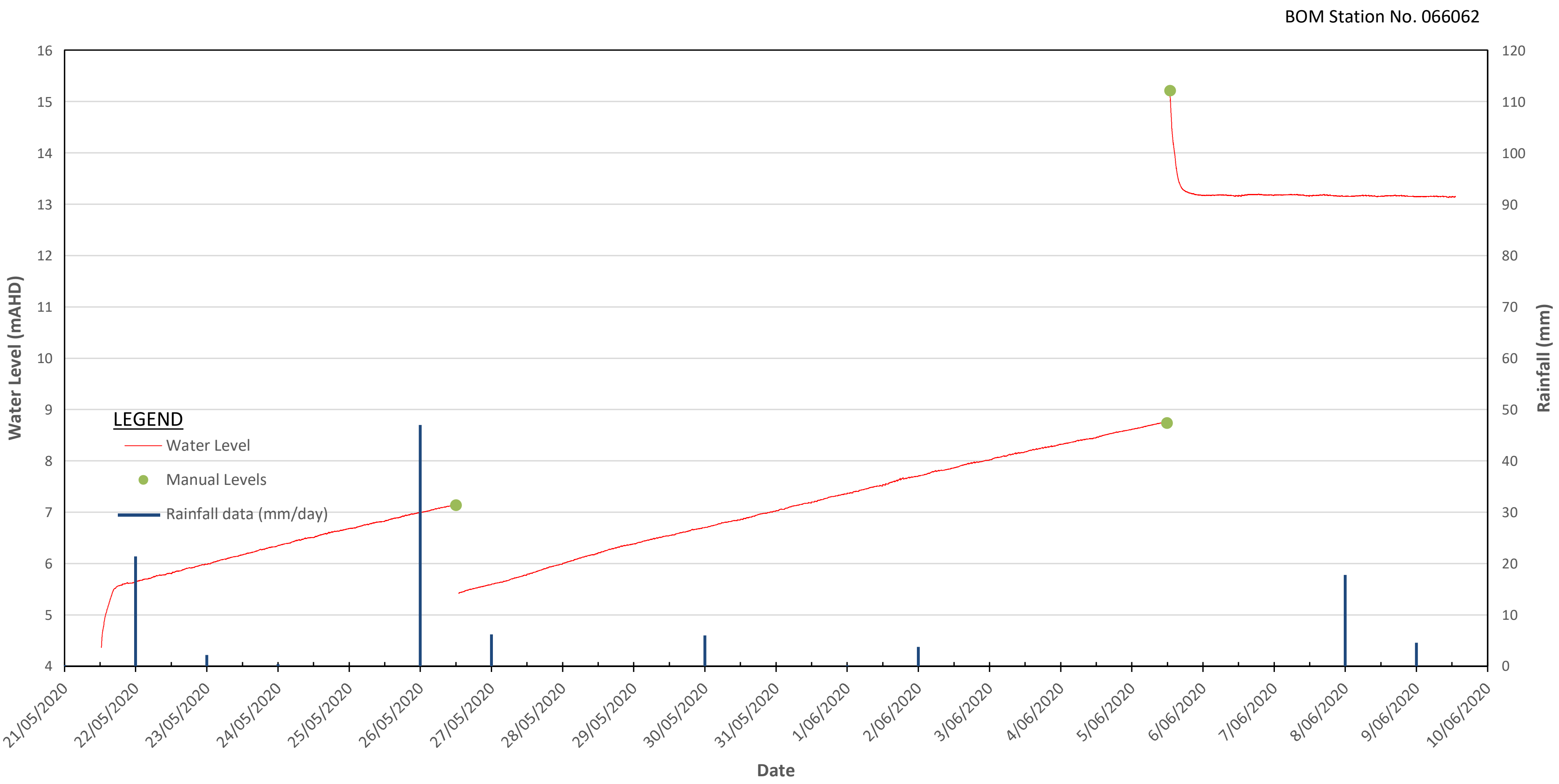
BH107A Groundwater Levels



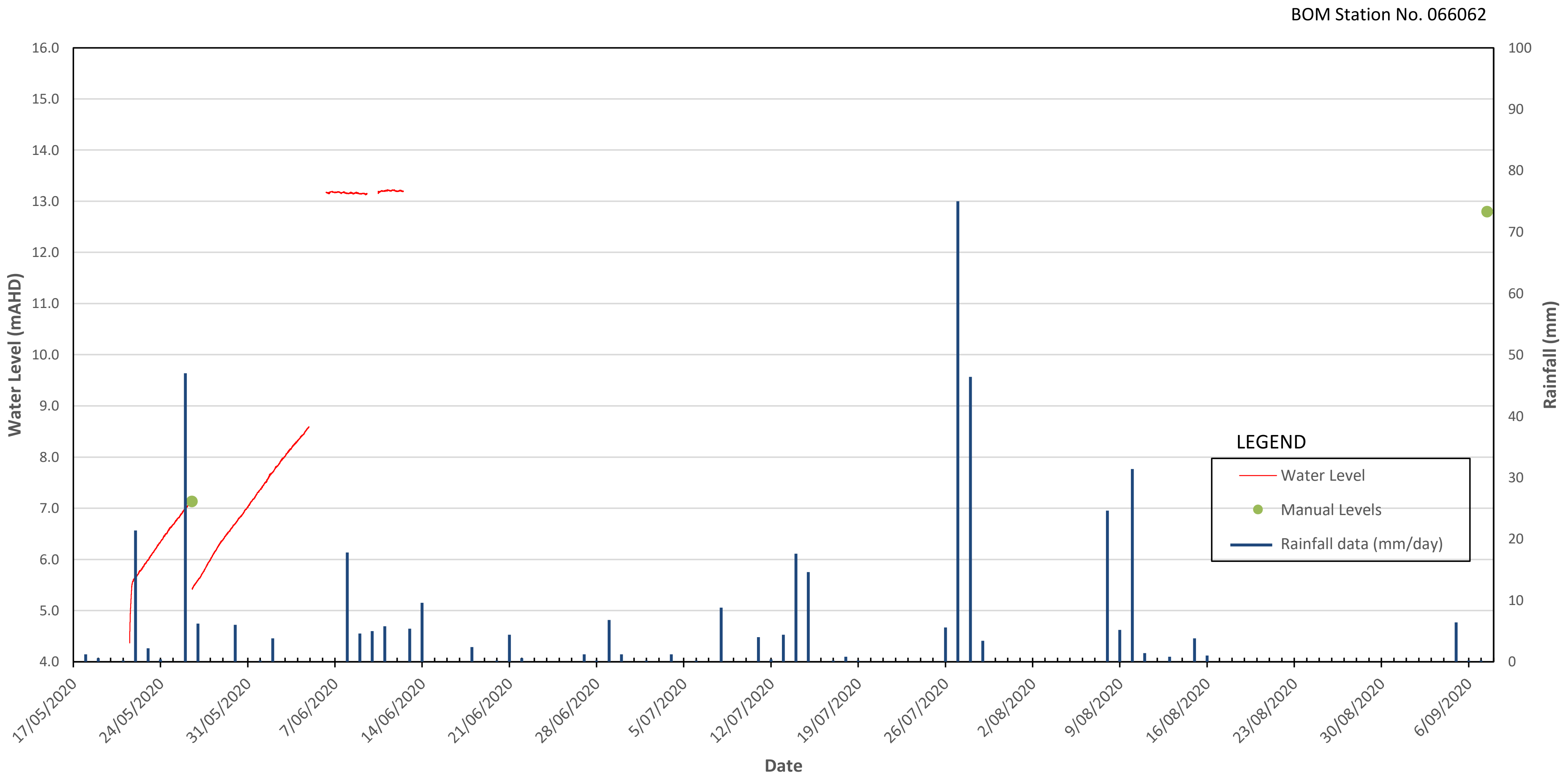
BH107B Groundwater Levels



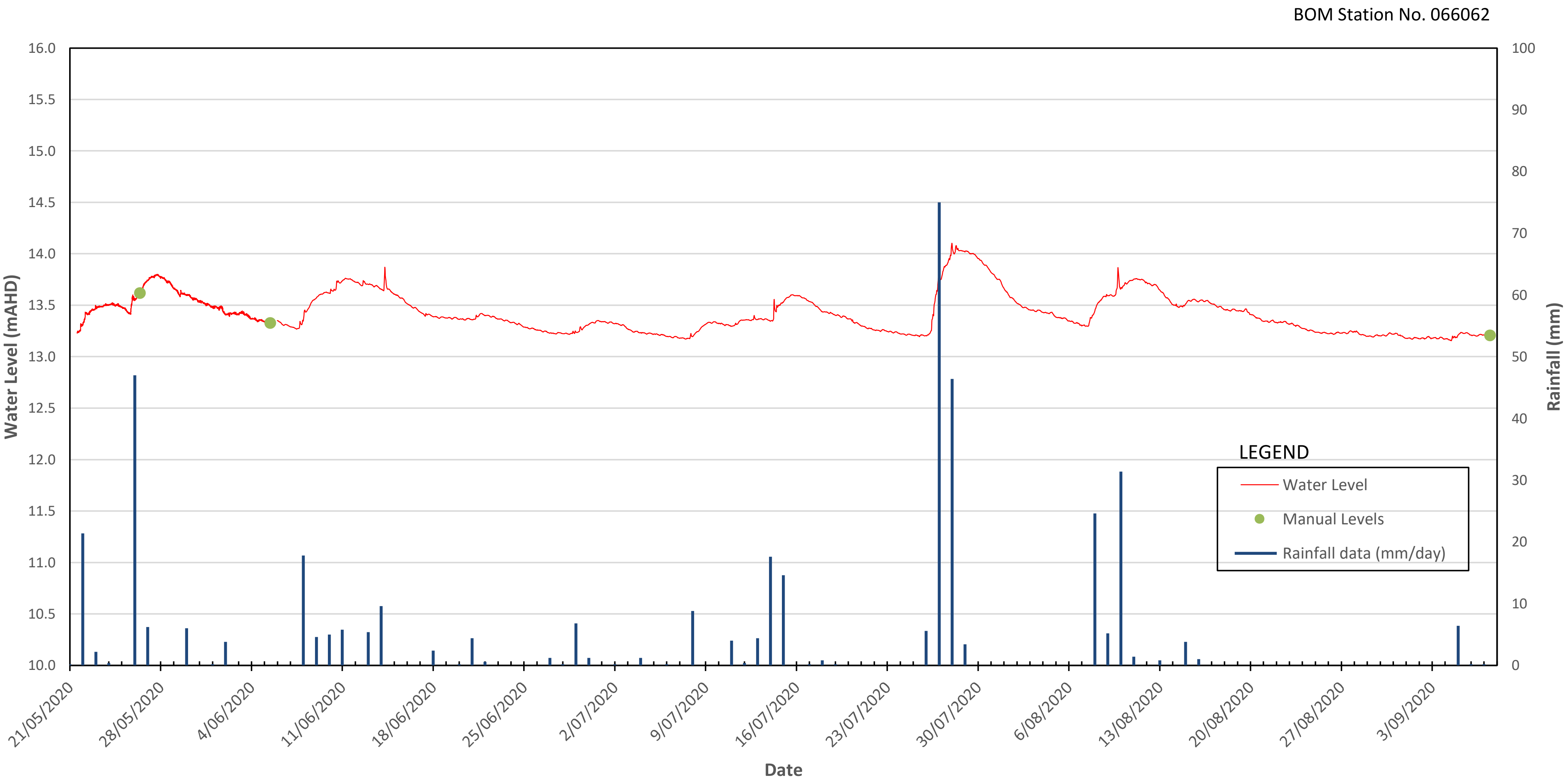
BH109B Groundwater Levels



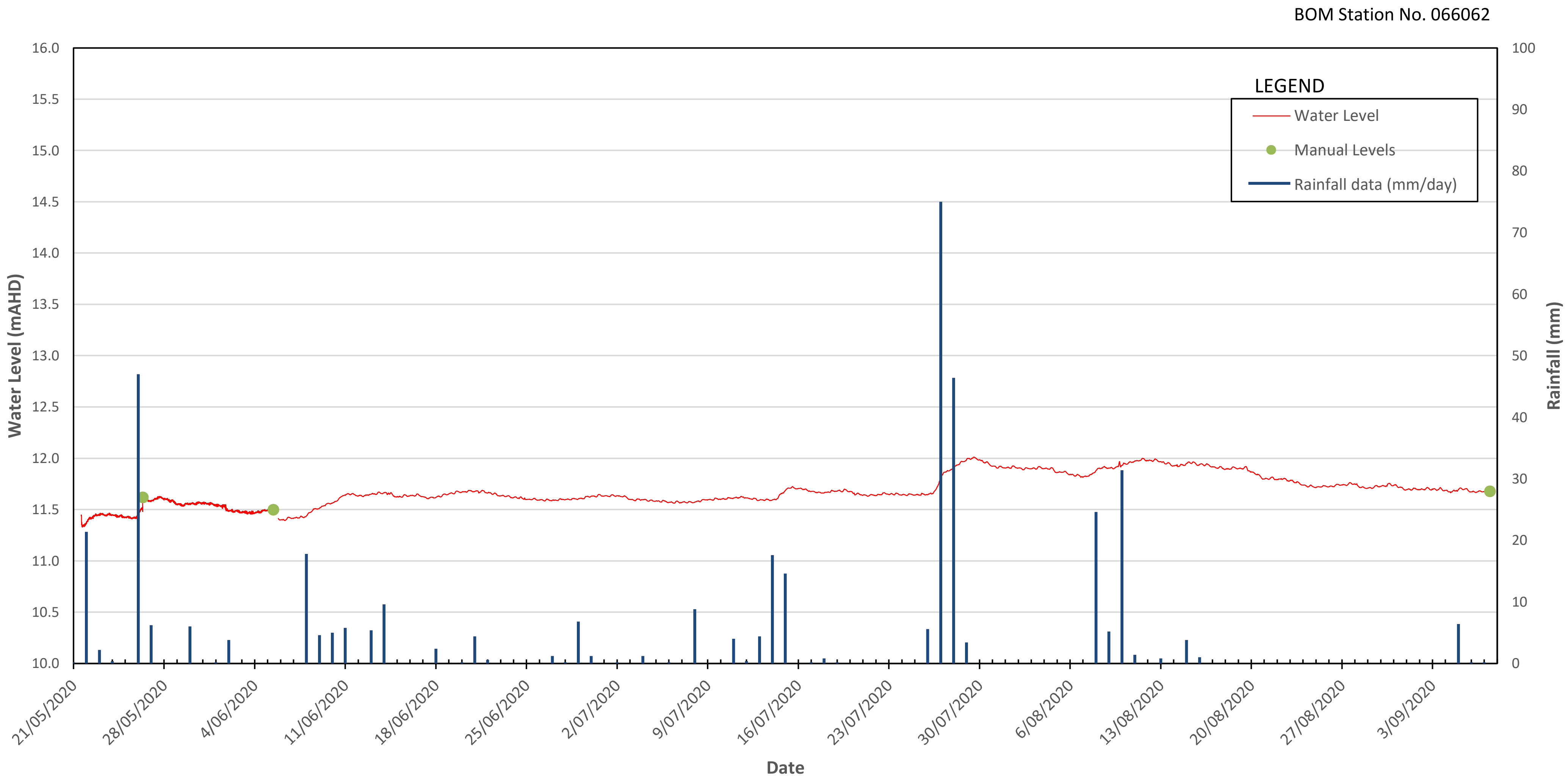
BH109B Groundwater Levels



BH112A Groundwater Levels



BH112B Groundwater Levels



Appendix G

Groundwater Permeability Test Results

Permeability Testing - Falling Head Test Report

Client:	Atlassian Pty Ltd	Project No:	86767.00
Project:	Proposed Commerical Development	Test date:	31-Jul-19
Location:	8-10 Lee Street, Haymarket	Tested by:	JJH

Test Location		**Test No.**	BH1	
Description:	Standpipe in borehole	Easting:	333983.4	m
Material type:	FILL/sandy CLAY, then SAND	Northing	6249262.5	m
		Surface Level:	20.1	m AHD

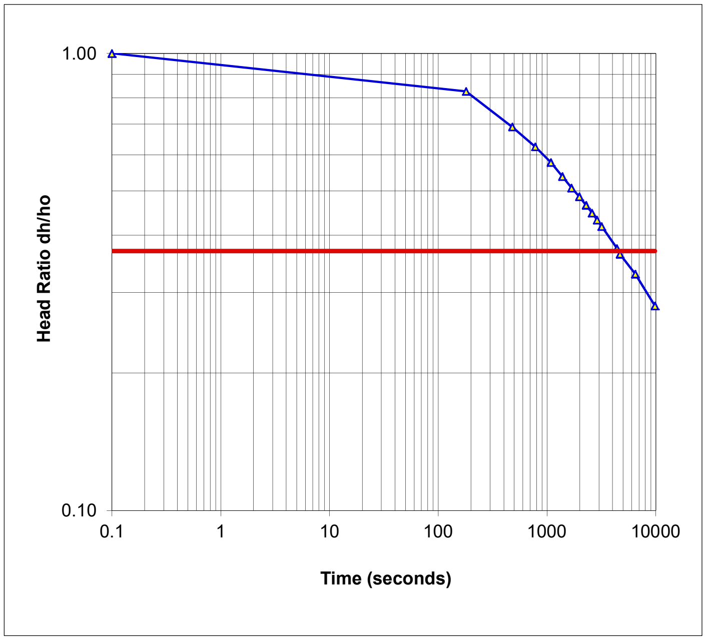
Details of Well Installation

Well casing diameter (2r)	114.3	mm	Depth to water before test	5.95	m
Well screen diameter (2R)	114.3	mm	Depth to water at start of test	0.00	m
Length of well screen (Le)	2	m			

PVC screen 6.3m-4.3m, sand 6.3-4.2m; blank from 4.3m onwards, bentonite from 4.2m onwards

Test Results

Time (sec)	Depth (m)	Change in Head: δH (m)	δH/Ho
0.1	0	5.95	1.000
180.0	1.03	4.92	0.827
480.0	1.84	4.11	0.691
780.0	2.23	3.72	0.625
1080.0	2.51	3.44	0.578
1380.0	2.74	3.21	0.539
1680.0	2.93	3.02	0.508
1980.0	3.05	2.90	0.487
2280.0	3.18	2.77	0.466
2580.0	3.28	2.67	0.448
2880.0	3.38	2.57	0.432
3180.0	3.46	2.49	0.418
4380.0	3.72	2.23	0.374
4680.0	3.78	2.17	0.364
6480.0	3.99	1.96	0.329
9780.0	4.28	1.67	0.281



To = 4500 seconds

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 =**	**6.5E-07**	m/sec
	=	**0.232**	cm/hour

Permeability Testing - Falling Head Test Report

Client: Atlassian Pty Ltd
Project: Proposed Commerical Development
Location: 8-10 Lee Street, Haymarket
Project No: 86767.00
Test date: 14-Aug-19
Tested by: KR

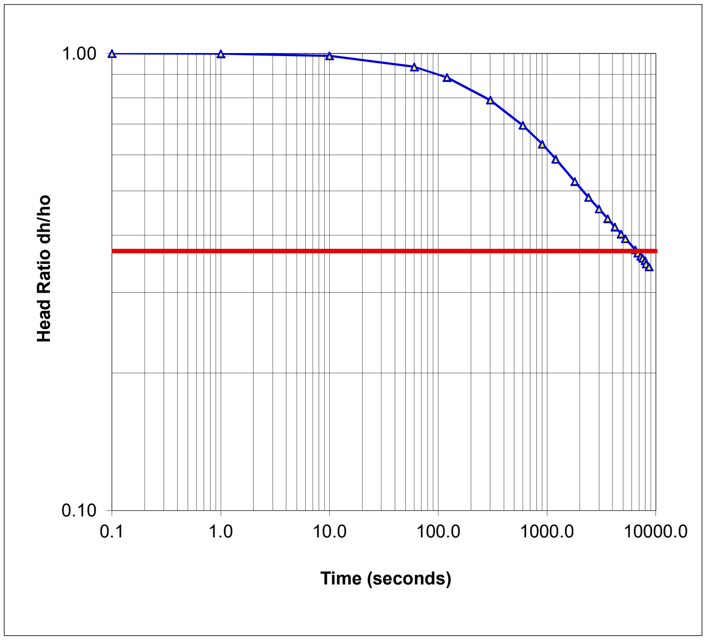
Test Location
Description: Standpipe in borehole
Material type: FILL/sandy CLAY, then SAND

Test No. BH1
Easting: 333983.4 m
Northing 6249262.5 m
Surface Level: 20.1 m AHD

Details of Well Installation
Well casing diameter (2r) 114.3 mm
Well screen diameter (2R) 114.3 mm
Length of well screen (Le) 2 m
Depth to water before test 6.27 m
Depth to water at start of test 0.36 m
PVC screen 6.3m-4.3m, sand 6.3-4.2m; blank from 4.3m onwards, bentonite from 4.2m onwards

Test Results

Time (sec)	Depth (m)	Change in Head: δH (m)	δH/Ho
0.1	0.36	5.91	1.000
1.0	0.36	5.91	0.999
10.0	0.43	5.84	0.988
60.0	0.74	5.53	0.935
120.0	1.03	5.24	0.886
300.0	1.59	4.68	0.791
600.0	2.15	4.12	0.697
900.0	2.52	3.75	0.633
1200.0	2.80	3.47	0.587
1800.0	3.17	3.10	0.525
2400.0	3.41	2.86	0.484
3000.0	3.57	2.70	0.457
3600.0	3.70	2.57	0.435
4200.0	3.80	2.47	0.417
4793.0	3.89	2.38	0.403
5250.0	3.94	2.33	0.394
6450.0	4.07	2.20	0.372
6810.0	4.11	2.17	0.366
7230.0	4.14	2.13	0.360
7530.0	4.16	2.11	0.357
7950.0	4.19	2.09	0.353
8130.0	4.22	2.05	0.347
8670.0	4.25	2.02	0.342



To = 6500 seconds

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 = **4.5E-07** m/sec
= **0.161** cm/hour

Permeability Testing - Rising or Falling Head Test Report

Client:	Atlassian Pty Ltd	Project No:	86767.00
Project:	Proposed Commercial Development	Test date:	31-Jul-19
Location:	8-10 Lee Street, Haymarket	Tested by:	JJH

Test Location

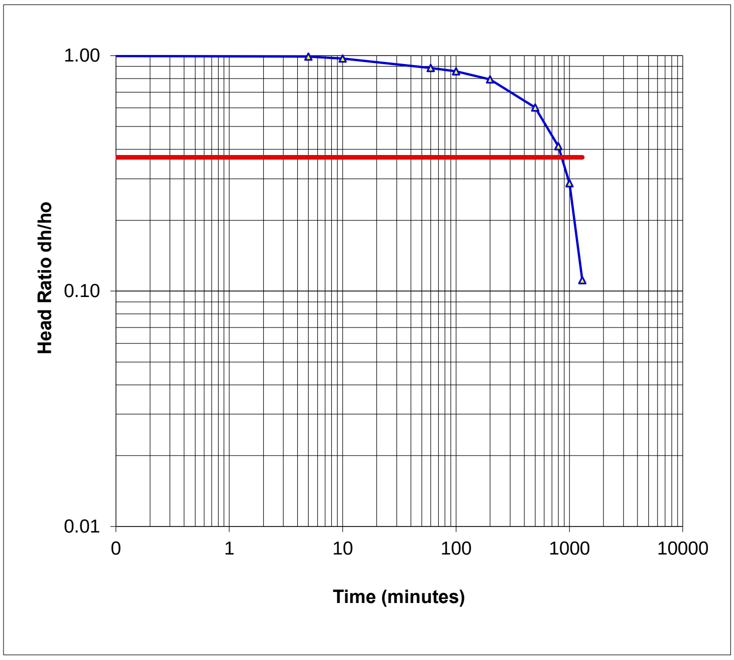
Description:	Standpipe in borehole	**Test No.**	BH5	
Material type:	Sandstone	Easting:	333980	m
		Northing	6249298	m
		Surface Level:	15.5	m AHD

Details of Well Installation

Well casing diameter (2r)	76	mm	Depth to water before test	2.44	m
Well screen diameter (2R)	76	mm	Depth to water at start of test	14.48	m
Length of well screen (Le)	12.97	m			

Test Results

Time (min)	Depth (m)	Change in Head: dH (m)	dH/Ho
0	14.48	12.04	1.000
5	14.36	11.92	0.990
10	14.14	11.70	0.972
60	13.12	10.68	0.887
100	12.77	10.33	0.858
200	11.99	9.55	0.793
500	9.69	7.25	0.602
800	7.41	4.97	0.413
1000	5.9	3.46	0.287
1300	3.78	1.34	0.111



To = 868 mins
52080 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 = 6.2E-09** m/sec
= 0.002 cm/hour

Permeability Testing - Rising Head Test Report

Client:	Atlassian Pty Ltd	Project No:	86767.00
Project:	Proposed Commercial Development	Test date:	30-Jul-19
Location:	8-10 Lee Street, Haymarket	Tested by:	JJH

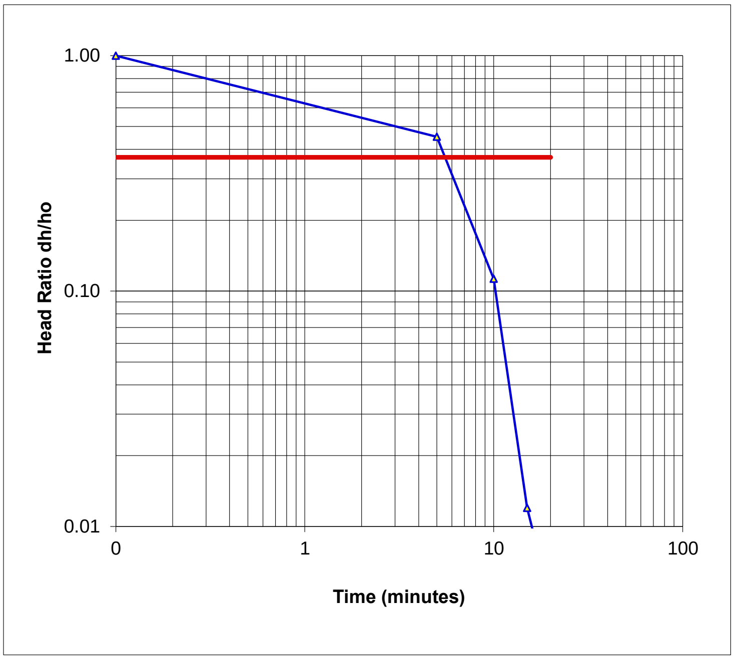
Test Location		**Test No.**	BH8	
Description:	Standpipe in borehole	Easting:	333954	m
Material type:	Sandstone	Northing	6249289	m
		Surface Level:	15.5	m AHD

Details of Well Installation

Well casing diameter (2r)	76	mm	Depth to water before test	2.3	m
Well screen diameter (2R)	76	mm	Depth to water at start of test	14.8	m
Length of well screen (Le)	12.1	m			

Test Results

Time (min)	Depth (m)	Change in Head: dH (m)	dH/Ho
0	14.80	12.50	1.000
5	7.95	5.65	0.452
10	3.71	1.41	0.113
15	2.45	0.15	0.012
20	2.36	0.06	0.005



To = 5.5 mins
330 secs

Theory: Falling Head Permeability calculated using equation by Hvorslev

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

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

Hydraulic Conductivity	**k =**	**1.0E-06**	m/sec
	=	**0.375**	cm/hour

Permeability Testing - Rising or Falling Head Test Report

Client:	Atlassian Pty Ltd	Project No:	86767.00
Project:	Proposed Commercial Development	Test date:	16-Apr-20
Location:	8-10 Lee Street, Haymarket	Tested by:	NB

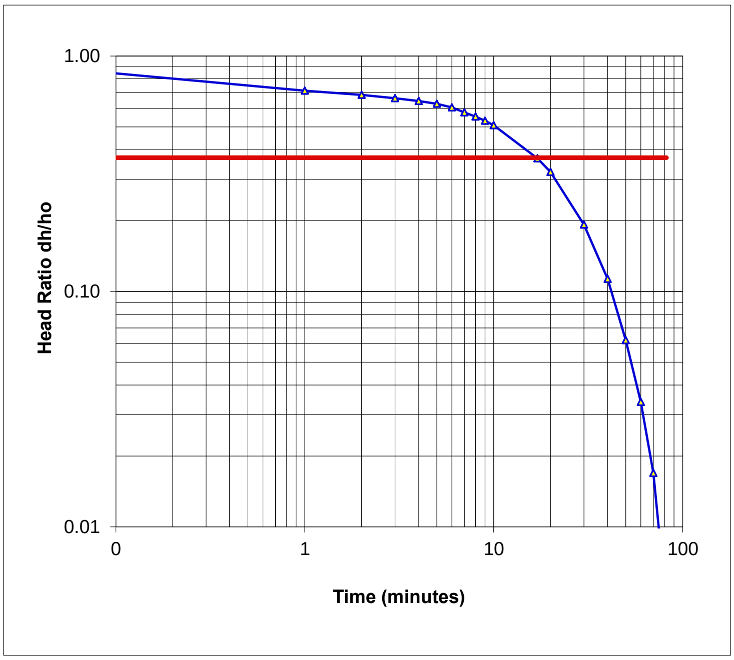
Test Location		**Test No.**	BH103	
Description:	Standpipe in borehole	Easting:	333978	m
Material type:	Sandstone	Northing	6249263	m
		Surface Level:	21.2	m AHD

Details of Well Installation

Well casing diameter (2r)	70	mm	Depth to water before test	7.5	m
Well screen diameter (2R)	76	mm	Depth to water at start of test	9.27	m
Length of well screen (Le)	0.8	m			

Test Results

Time (min)	Depth (m)	Change in Head: dH (m)	dH/Ho
0	9.27	1.77	1.000
1	8.76	1.26	0.712
2	8.71	1.21	0.684
3	8.67	1.17	0.661
4	8.64	1.14	0.644
5	8.61	1.11	0.627
6	8.57	1.07	0.605
7	8.52	1.02	0.576
8	8.48	0.98	0.554
9	8.44	0.94	0.531
10	8.4	0.90	0.508
17	8.15	0.65	0.367
20	8.07	0.57	0.322
30	7.84	0.34	0.192
40	7.7	0.2	0.113
50	7.61	0.11	0.062
60	7.56	0.06	0.034
70	7.53	0.03	0.017
80	7.51	0.01	0.006
82	7.5	0	0.000



To = 17 mins
1020 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-06**	m/sec
	=	**0.823**	cm/hour

Permeability Testing - Rising or Falling Head Test Report

Client:	Vertical First Pty Ltd	Project No:	86767.00
Project:	Proposed Commercial Development	Test date:	24-Apr-20
Location:	8-10 Lee Street, Haymarket	Tested by:	AS

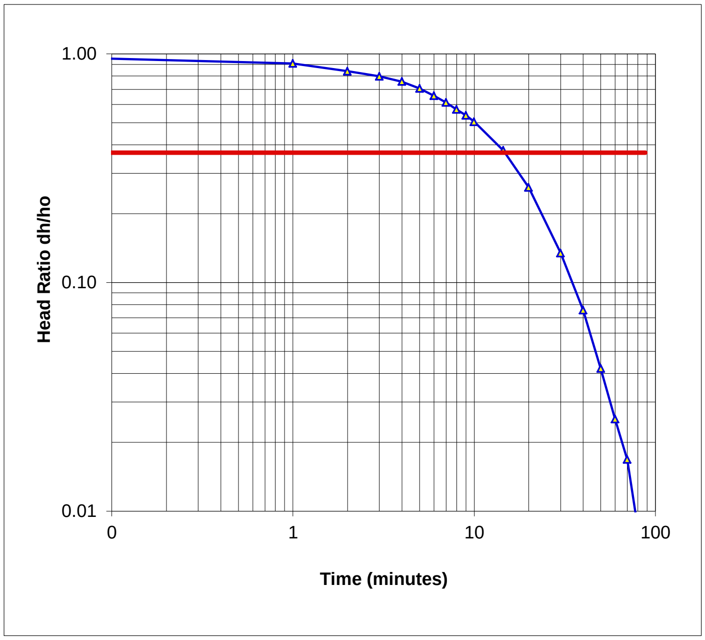
Test Location		**Test No.**	BH103	
Description:	Standpipe in borehole	Easting:	333978	m
Material type:	Sandstone	Northing	6249263	m
		Surface Level:	21.2	m AHD

Details of Well Installation

Well casing diameter (2r)	50	mm	Depth to water before test	7.44	m
Well screen diameter (2R)	76	mm	Depth to water at start of test	8.63	m
Length of well screen (Le)	0.8	m			

Test Results

Time (min)	Depth (m)	Change in Head: dH (m)	dH/Ho
0	8.63	1.19	1.000
1	8.52	1.08	0.908
2	8.44	1.00	0.840
3	8.39	0.95	0.798
4	8.34	0.90	0.756
5	8.28	0.84	0.706
6	8.22	0.78	0.655
7	8.17	0.73	0.613
8	8.12	0.68	0.571
9	8.08	0.64	0.538
10	8.04	0.60	0.504
14.5	7.89	0.45	0.378
20	7.75	0.31	0.261
30	7.6	0.16	0.134
40	7.53	0.09	0.076
50	7.49	0.05	0.042
60	7.47	0.03	0.025
70	7.46	0.02	0.017
80	7.45	0.01	0.008
88	7.44	0	0.000



To = 14.5 mins
870 secs

Theory: Falling Head Permeability calculated using equation by Hvorslev

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

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

Hydraulic Conductivity	k =	**1.4E-06**	m/sec
	=	**0.493**	cm/hour

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Permeability Testing - Rising or Falling Head Test Report

Client:	Atlassian Pty Ltd	Project No:	86767.00
Project:	Proposed Commercial Development	Test date:	16-Apr-20
Location:	8-10 Lee Street, Haymarket	Tested by:	NB

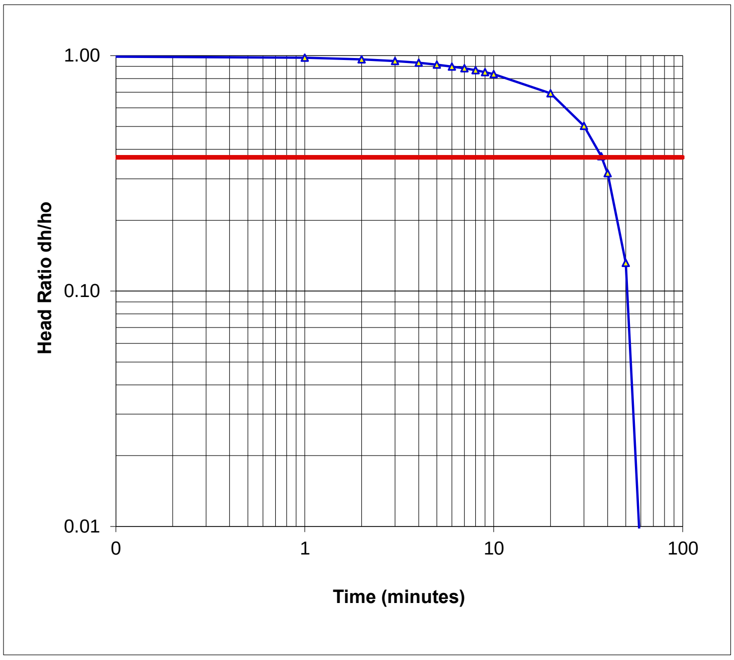
Test Location		**Test No.**	BH104	
Description:	Standpipe in borehole	Easting:	333983	m
Material type:	Sandstone	Northing	6249272	m
		Surface Level:	21.2	m AHD

Details of Well Installation

Well casing diameter (2r)	70	mm	Depth to water before test	7.5	m
Well screen diameter (2R)	76	mm	Depth to water at start of test	18.8	m
Length of well screen (Le)	6	m			

Test Results

Time (min)	Depth (m)	Change in Head: dH (m)	dH/Ho
0	18.80	11.30	1.000
1	18.57	11.07	0.980
2	18.39	10.89	0.964
3	18.21	10.71	0.948
4	18.04	10.54	0.933
5	17.84	10.34	0.915
6	17.66	10.16	0.899
7	17.48	9.98	0.883
8	17.3	9.80	0.867
9	17.11	9.61	0.850
10	16.93	9.43	0.835
20	15.31	7.81	0.691
30	13.19	5.69	0.504
37	11.72	4.22	0.373
40	11.08	3.58	0.317
50	8.99	1.49	0.132
60	7.58	0.08	0.007
70	7.52	0.02	0.002
80	7.52	0.02	0.002
90	7.51	0.01	0.001
100	7.51	0.01	0.001



To = 37 mins
2220 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
	=	**0.084**	cm/hour

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Permeability Testing - Rising Head Test Report

Client:	Vertical First Pty Ltd	Project No:	86767.00
Project:	Proposed Commercial Development	Test date:	22-May-20
Location:	8-10 Lee Street, Haymarket	Tested by:	NB

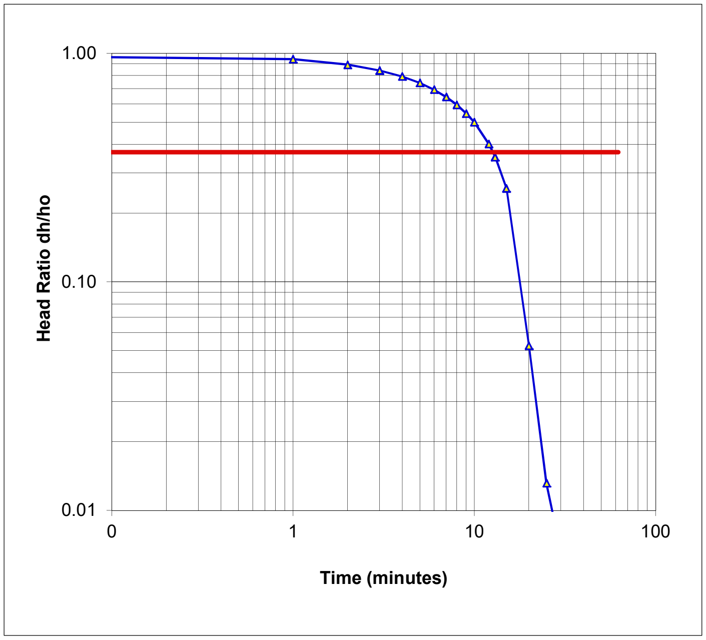
Test Location		**Test No.**	BH104	
Description:	Standpipe in borehole	Easting:	333983	m
Material type:	Sandstone	Northing	6249272	m
		Surface Level:	21.2	m AHD

Details of Well Installation

Well casing diameter (2r)	50	mm	Depth to water before test	7.91	m
Well screen diameter (2R)	76	mm	Depth to water at start of test	10.95	m
Length of well screen (Le)	6	m			

Test Results

Time (min)	Depth (m)	Change in Head: δH (m)	δH/Ho
0	10.95	3.04	1.000
1	10.78	2.87	0.944
2	10.62	2.71	0.891
3	10.47	2.56	0.842
4	10.32	2.41	0.793
5	10.17	2.26	0.743
6	10.02	2.11	0.694
7	9.87	1.96	0.645
8	9.72	1.81	0.595
9	9.57	1.66	0.546
10	9.43	1.52	0.500
12	9.13	1.22	0.401
13	8.98	1.07	0.352
15	8.69	0.78	0.257
20	8.07	0.16	0.053
25	7.95	0.04	0.013
30	7.93	0.02	0.007
35	7.92	0.01	0.003
62	7.91	0	0.000



To = 12.5 mins
750 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 =	**3.5E-07**	m/sec
	=	**0.127**	cm/hour

Permeability Testing - Rising or Falling Head Test Report

Client:	Vertical First Pty Ltd	Project No:	86767.00
Project:	Proposed Commercial Development	Test date:	17-May-20
Location:	8-10 Lee Street, Haymarket	Tested by:	NB

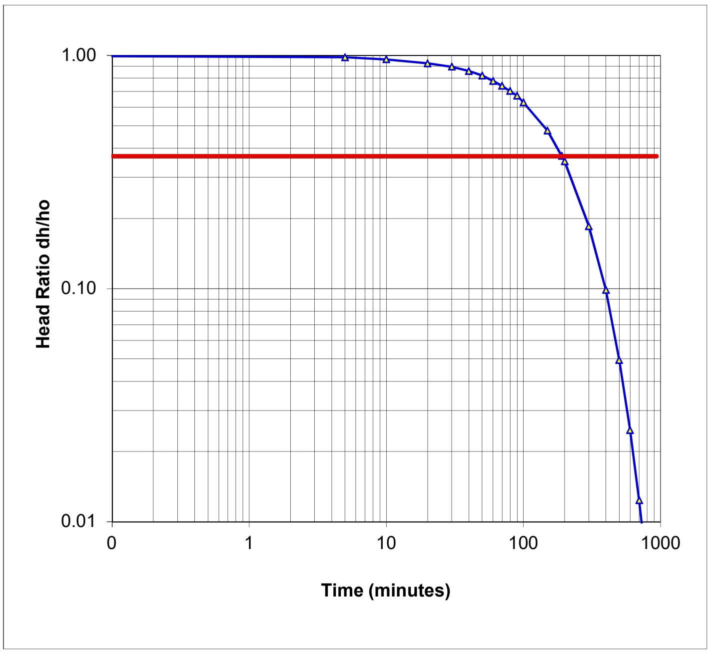
Test Location		**Test No.**	BH107A	
Description:	Standpipe in borehole	Easting:	333945	m
Material type:	Sandstone	Northing	6249270	m
		Surface Level:	15.5	m AHD

Details of Well Installation

Well casing diameter (2r)	50	mm	Depth to water before test	2.13	m
Well screen diameter (2R)	76	mm	Depth to water at start of test	3.75	m
Length of well screen (Le)	0.5	m			

Test Results

Time (min)	Depth (m)	Change in Head: δH (m)	δH/Ho
0	3.75	1.62	1.000
5	3.72	1.59	0.981
10	3.69	1.56	0.963
20	3.63	1.50	0.926
30	3.58	1.45	0.895
40	3.52	1.39	0.858
50	3.46	1.33	0.821
60	3.39	1.26	0.778
70	3.33	1.20	0.741
80	3.27	1.14	0.704
90	3.22	1.09	0.673
100	3.15	1.02	0.630
150	2.9	0.77	0.475
190.5	2.73	0.6	0.370
200	2.7	0.57	0.352
300	2.43	0.3	0.185
400	2.29	0.16	0.099
500	2.21	0.08	0.049
600	2.17	0.04	0.025
700	2.15	0.02	0.012
800	2.14	0.01	0.006
936	2.13	0	0.000



To = 190.5 mins
11430 secs

Theory: Falling Head Permeability calculated using equation by Hvorslev

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

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

Hydraulic Conductivity	**k =**	**1.4E-07**	m/sec
	=	**0.051**	cm/hour

Permeability Testing - Rising Head Test Report

Client: Vertical First Pty Ltd
Project: Proposed Commercial Development
Location: 8-10 Lee Street, Haymarket

Project No: 86767.00
Test date: 26-May-20
Tested by: AS

Test Location
Description: Standpipe in borehole
Material type: Sandstone

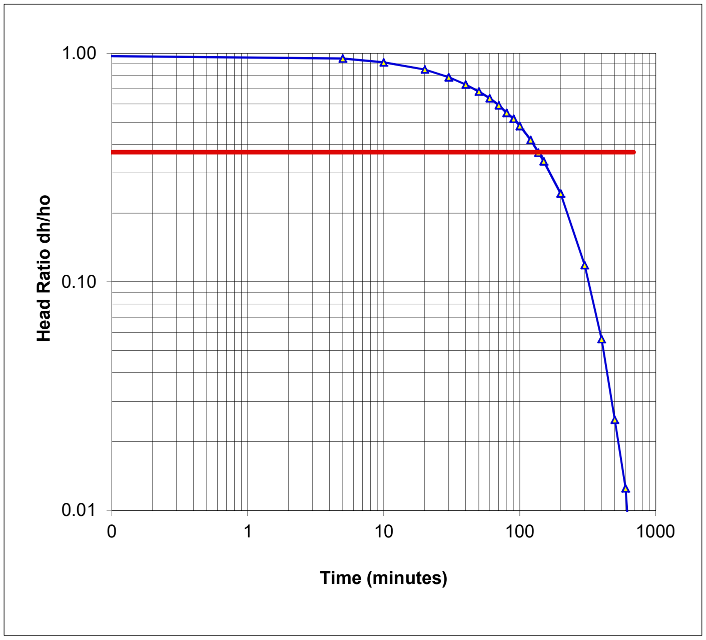
Test No. BH107A
Easting: 333945 m
Northing 6249270 m
Surface Level: 15.5 m AHD

Details of Well Installation
Well casing diameter (2r) 50 mm
Well screen diameter (2R) 76 mm
Length of well screen (Le) 0.5 m

Depth to water before test 2.2 m
Depth to water at start of test 3.8 m

Test Results

Time (min)	Depth (m)	Change in Head: δH (m)	δH/Ho
0	3.8	1.60	1.000
5	3.72	1.52	0.950
10	3.66	1.46	0.913
20	3.56	1.36	0.850
30	3.46	1.26	0.788
40	3.37	1.17	0.731
50	3.29	1.09	0.681
60	3.22	1.02	0.638
70	3.15	0.95	0.594
80	3.08	0.88	0.550
90	3.03	0.83	0.519
100	2.97	0.77	0.481
120	2.87	0.67	0.419
137	2.79	0.59	0.369
150	2.74	0.54	0.338
200	2.59	0.39	0.244
300	2.39	0.19	0.119
400	2.29	0.09	0.056
500	2.24	0.04	0.025
600	2.22	0.02	0.013
650	2.21	0.01	0.006
687	2.2	0	0.000



To = 137 mins
8220 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 = 2.0E-07** m/sec
= 0.071 cm/hour

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Permeability Testing - Rising or Falling Head Test Report

Client:	Vertical First Pty Ltd	Project No:	86767.00
Project:	Proposed Commercial Development	Test date:	17-May-20
Location:	8-10 Lee Street, Haymarket	Tested by:	NB

Test Location

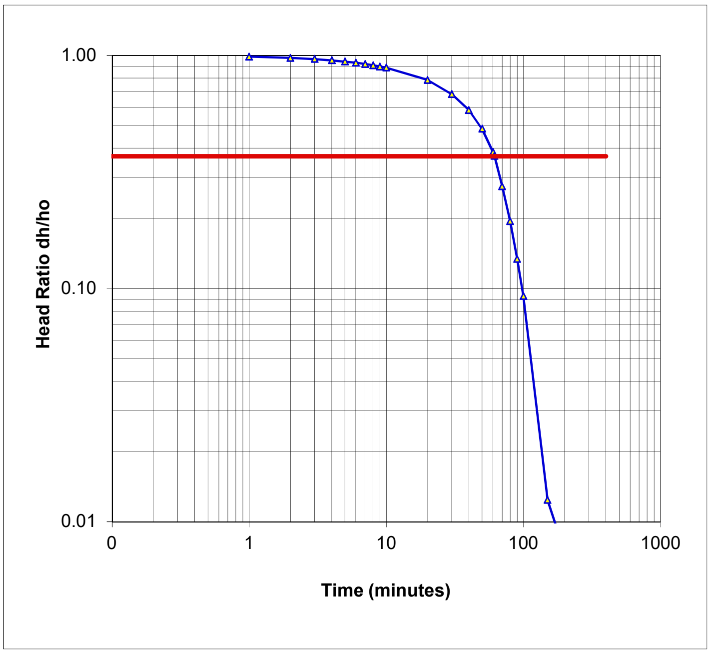
		Test No.	BH107B	
Description:	Standpipe in borehole	Easting:	333945	m
Material type:	Sandstone	Northing	6249272	m
		Surface Level:	15.5	m AHD

Details of Well Installation

Well casing diameter (2r)	50	mm	Depth to water before test	2.65	m
Well screen diameter (2R)	76	mm	Depth to water at start of test	10.72	m
Length of well screen (Le)	5.5	m			

Test Results

Time (min)	Depth (m)	Change in Head: δH (m)	δH/Ho
0	10.72	8.07	1.000
1	10.63	7.98	0.989
2	10.53	7.88	0.976
3	10.44	7.79	0.965
4	10.34	7.69	0.953
5	10.25	7.60	0.942
6	10.16	7.51	0.931
7	10.07	7.42	0.919
8	9.98	7.33	0.908
9	9.89	7.24	0.897
10	9.8	7.15	0.886
20	8.98	6.33	0.784
30	8.16	5.51	0.683
40	7.36	4.71	0.584
50	6.56	3.91	0.485
60	5.76	3.11	0.385
61.5	5.64	2.99	0.371
70	4.87	2.22	0.275
80	4.22	1.57	0.195
90	3.73	1.08	0.134
100	3.4	0.75	0.093
150	2.75	0.1	0.012
200	2.71	0.06	0.007
300	2.69	0.04	0.005
400	2.68	0.03	0.004
500	2.66	0.01	0.001
636	2.65	0	0.000



To = 61.5 mins
3690 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 =**	**7.7E-08**	m/sec
	=	**0.028**	cm/hour

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Permeability Testing - Rising Head Test Report

Client:	Vertical First Pty Ltd	Project No:	86767.00
Project:	Proposed Commercial Development	Test date:	26-May-20
Location:	8-10 Lee Street, Haymarket	Tested by:	AS

Test Location

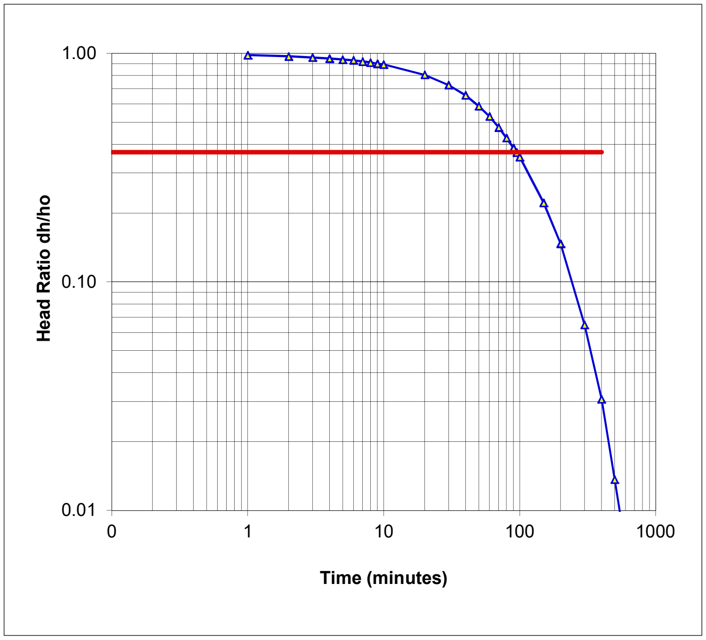
Description:	Standpipe in borehole	**Test No.**	BH107B	
Material type:	Sandstone	Easting:	333945	m
		Northing	6249272	m
		Surface Level:	15.5	m AHD

Details of Well Installation

Well casing diameter (2r)	50	mm	Depth to water before test	2.22	m
Well screen diameter (2R)	76	mm	Depth to water at start of test	5.15	m
Length of well screen (Le)	5.5	m			

Test Results

Time (min)	Depth (m)	Change in Head: δH (m)	δH/Ho
0	5.15	2.93	1.000
1	5.10	2.88	0.983
2	5.06	2.84	0.969
3	5.03	2.81	0.959
4	5.00	2.78	0.949
5	4.97	2.75	0.939
6	4.95	2.73	0.932
7	4.92	2.70	0.922
8	4.89	2.67	0.911
9	4.86	2.64	0.901
10	4.84	2.62	0.894
20	4.58	2.36	0.805
30	4.35	2.13	0.727
40	4.14	1.92	0.655
50	3.94	1.72	0.587
60	3.77	1.55	0.529
70	3.61	1.39	0.474
80	3.47	1.25	0.427
90	3.35	1.13	0.386
95	3.30	1.08	0.369
100	3.25	1.03	0.352
150	2.87	0.65	0.222
200	2.65	0.43	0.147
300	2.41	0.19	0.065
400	2.31	0.09	0.031
500	2.26	0.04	0.014
600	2.24	0.02	0.007



To = 95 mins
5700 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 =**	**5.0E-08**	m/sec
	=	**0.018**	cm/hour

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Permeability Testing - Falling Head Test Report

Client: Vertical First Pty Ltd
Project: Proposed Commercial Development
Location: 8-10 Lee Street, Haymarket
Project No: 86767.00
Test date: 5-Jun-20
Tested by: NB

Test Location
Description: Standpipe in borehole
Material type: Sandstone

Test No. BH109B
Easting: 333970 m
Northing 6249311 m
Surface Level: 15.3 m AHD

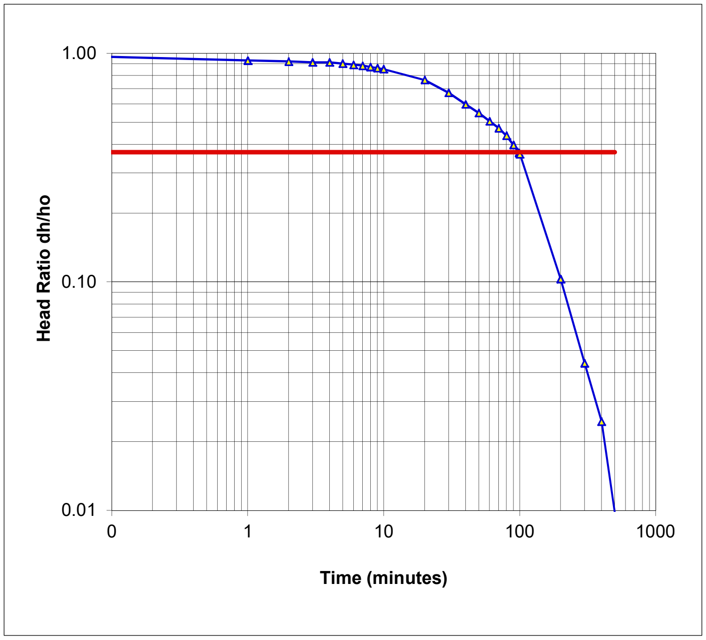
Details of Well Installation

Well casing diameter (2r) 50 mm
Well screen diameter (2R) 76 mm
Length of well screen (Le) 5.6 m

Depth to water at end of test 2.17 m
Depth to water at start of test 0.13 m

Test Results

Time (min)	Depth (m)	Change in Head: δH (m)	δH/Ho
0	0.13	2.04	1.000
1	0.27	1.90	0.931
2	0.29	1.88	0.922
3	0.31	1.86	0.912
4	0.31	1.86	0.912
5	0.33	1.84	0.902
6	0.35	1.82	0.892
7	0.37	1.80	0.882
8	0.39	1.78	0.873
9	0.41	1.76	0.863
10	0.43	1.74	0.853
20	0.61	1.56	0.765
30	0.8	1.37	0.672
40	0.95	1.22	0.598
50	1.05	1.12	0.549
60	1.14	1.03	0.505
70	1.21	0.96	0.471
80	1.28	0.89	0.436
90	1.36	0.81	0.397
98.5	1.42	0.75	0.368
100	1.43	0.74	0.363
200	1.96	0.21	0.103
300	2.08	0.09	0.044
400	2.12	0.05	0.025
500	2.15	0.02	0.010
600	2.17	0	0.000



To = 98.5 mins
5910 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 = **4.7E-08** m/sec
= **0.017** cm/hour

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Permeability Testing - Falling Head Test Report

Client: Vertical First Pty Ltd
Project: Proposed Commercial Development
Location: 8-10 Lee Street, Haymarket

Project No: 86767.00
Test date: 5-Jun-20
Tested by: NB

Test Location

Description: Standpipe in borehole
Material type: Sandstone

Test No. BH112A
Easting: 333926 m
Northing 6249325 m
Surface Level: 16.7 m AHD

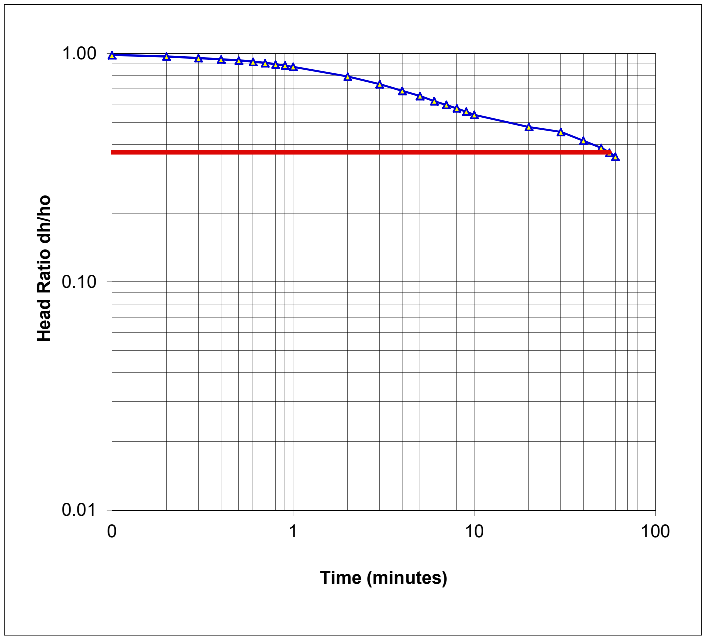
Details of Well Installation

Well casing diameter (2r) 50 mm
Well screen diameter (2R) 76 mm
Length of well screen (Le) 0.5 m

Depth to water before test 3.39 m
Depth to water at start of test 0.00 m

Test Results

Time (min)	Depth (m)	Change in Head: δH (m)	δH/Ho
0	0.00	3.39	1.000
0.10	0.05	3.34	0.985
0.20	0.1	3.29	0.971
0.30	0.15	3.24	0.956
0.40	0.19	3.20	0.944
0.50	0.23	3.16	0.932
0.60	0.27	3.12	0.920
0.70	0.31	3.08	0.909
0.80	0.35	3.04	0.897
0.90	0.38	3.01	0.888
1.00	0.42	2.97	0.876
2	0.7	2.69	0.794
3	0.9	2.49	0.735
4	1.06	2.33	0.687
5	1.18	2.21	0.652
6	1.29	2.1	0.619
7	1.37	2.02	0.596
8	1.44	1.95	0.575
9	1.5	1.89	0.558
10	1.56	1.83	0.540
20	1.77	1.62	0.478
30	1.85	1.54	0.454
40	1.98	1.41	0.416
50	2.08	1.31	0.386
55.6	2.14	1.25	0.369
60	2.19	1.2	0.354



To = 55.6 mins
3336 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 = **4.8E-07** m/sec
= **0.174** cm/hour

Permeability Testing - Rising or Falling Head Test Report

Client: Vertical First Pty Ltd
Project: Proposed Commercial Development
Location: 8-10 Lee Street, Haymarket

Project No: 86767.00
Test date: 21-May-20
Tested by: NB

Test Location
Description: Standpipe in borehole
Material type: Sandstone

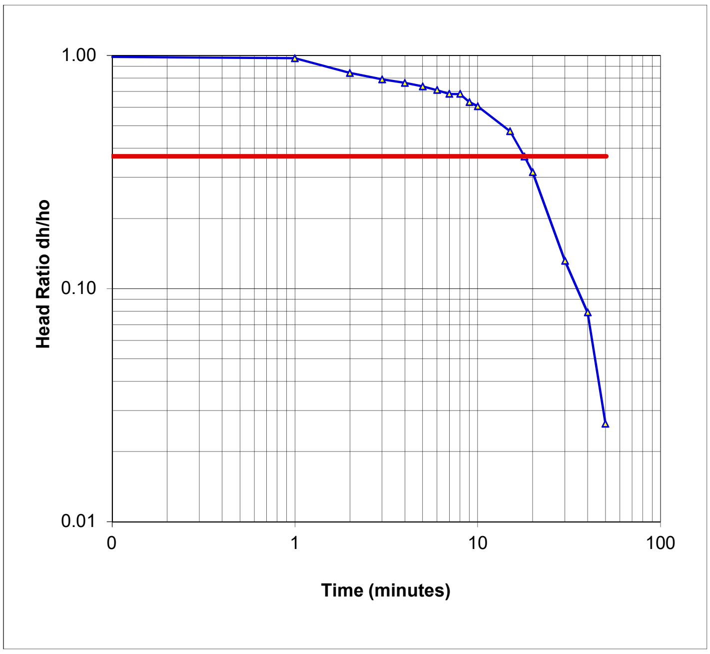
Test No. BH112B
Easting: 333928 m
Northing 6249324 m
Surface Level: 16.8 m AHD

Details of Well Installation
Well casing diameter (2r) 50 mm
Well screen diameter (2R) 76 mm
Length of well screen (Le) 6 m

Depth to water before test 5.37 m
Depth to water at start of test 5.75 m

Test Results

Time (min)	Depth (m)	Change in Head: δH (m)	δH/Ho
0	5.75	0.38	1.000
1	5.74	0.37	0.974
2	5.69	0.32	0.842
3	5.67	0.30	0.789
4	5.66	0.29	0.763
5	5.65	0.28	0.737
6	5.64	0.27	0.711
7	5.63	0.26	0.684
8	5.63	0.26	0.684
9	5.61	0.24	0.632
10	5.6	0.23	0.605
15	5.55	0.18	0.474
18	5.51	0.14	0.368
20	5.49	0.12	0.316
30	5.42	0.05	0.132
40	5.4	0.03	0.079
50	5.38	0.01	0.026
50.5	5.37	0	0.000



To = 18 mins
1080 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 = **2.4E-07** m/sec
= **0.088** cm/hour

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Permeability Testing - Falling Head Test Report

Client:	Vertical First Pty Ltd	Project No:	86767.00
Project:	Proposed Commercial Development	Test date:	5-Jun-20
Location:	8-10 Lee Street, Haymarket	Tested by:	NB

Test Location

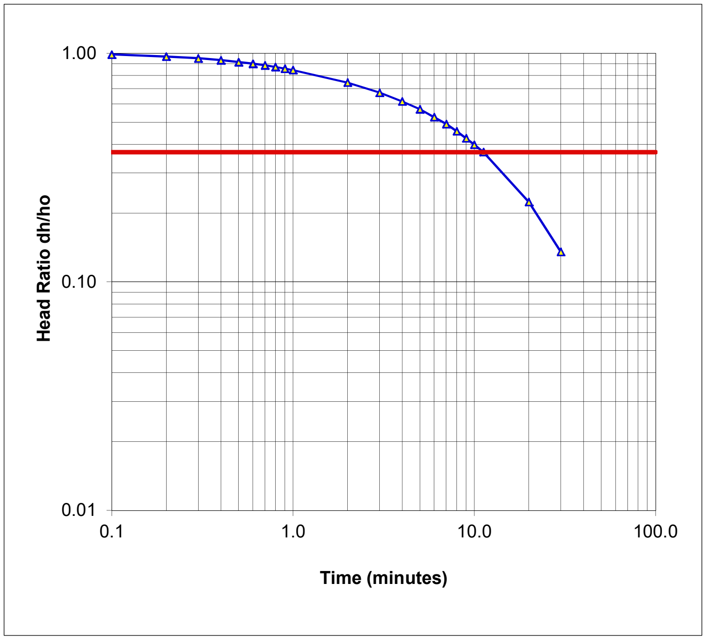
Description:	Standpipe in borehole	**Test No.**	BH112B	
Material type:	Sandstone	Easting:	333928	m
		Northing	6249324	m
		Surface Level:	16.8	m AHD

Details of Well Installation

Well casing diameter (2r)	50	mm	Depth to water before test	5.32	m
Well screen diameter (2R)	76	mm	Depth to water at start of test	0.00	m
Length of well screen (Le)	6	m			

Test Results

Time (min)	Depth (m)	Change in Head: δH (m)	δH/Ho
0.0	0.00	5.32	1.000
0.1	0.06	5.26	0.989
0.2	0.17	5.15	0.968
0.3	0.26	5.06	0.951
0.4	0.36	4.96	0.932
0.5	0.45	4.87	0.915
0.6	0.53	4.79	0.900
0.7	0.61	4.71	0.885
0.8	0.68	4.64	0.872
0.9	0.76	4.56	0.857
1	0.82	4.50	0.846
2	1.36	3.96	0.744
3	1.74	3.58	0.673
4	2.04	3.28	0.617
5	2.29	3.03	0.570
6	2.52	2.8	0.526
7	2.71	2.61	0.491
8	2.89	2.43	0.457
9	3.06	2.26	0.425
10	3.20	2.12	0.398
11.2	3.35	1.97	0.370
20	4.13	1.19	0.224
30	4.6	0.72	0.135



To = 11.2 mins
672 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 =**	**3.9E-07**	m/sec
	=	**0.141**	cm/hour

Appendix H

Laboratory Test Reports

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

CERTIFICATE OF ANALYSIS 221523-A

Client Details

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

Sample Details

Your Reference	**86767.01, DSI**
Number of Samples	19 Soil
Date samples received	12/07/2019
Date completed instructions received	23/07/2019

Analysis Details

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

Samples were analysed as received from the client. Results relate specifically to the samples as received.

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

Report Details

Date results requested by	30/07/2019
Date of Issue	15/08/2019
Reissue Details	This report replaces R00 created on 30/07/2019 due to: revised report with additional pH results.

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

Results Approved By
Nick Sarlamis, Inorganics Supervisor

Authorised By

Nancy Zhang, Laboratory Manager

Misc Inorg - Soil		
Our Reference		221523-A-3
Your Reference	UNITS	BH1/4.3-4.5
Date Sampled		10/07/2019
Type of sample		Soil
Date prepared	-	26/07/2019
Date analysed	-	26/07/2019
Electrical Conductivity 1:5 soil:water	µS/cm	20
Sulphate, SO4 1:5 soil:water	mg/kg	10
pH 1:5 soil:water	pH Units	6.0
Chloride, Cl 1:5 soil:water	mg/kg	<10

Method ID	Methodology Summary
Inorg-001	pH - Measured using pH meter and electrode in accordance with APHA latest edition, 4500-H+. Please note that the results for water analyses are indicative only, as analysis outside of the APHA storage times.
Inorg-002	Conductivity and Salinity - measured using a conductivity cell at 25°C in accordance with APHA latest edition 2510 and Rayment & Lyons.
Inorg-081	Anions - a range of Anions are determined by Ion Chromatography, in accordance with APHA latest edition, 4110-B. Waters samples are filtered on receipt prior to analysis. Alternatively determined by colourimetry/turbidity using Discrete Analyser.

Client Reference: 86767.01, DSI

QUALITY CONTROL: Misc Inorg - Soil					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Date prepared	-			26/07/2019	3	26/07/2019	26/07/2019		26/07/2019	[NT]
Date analysed	-			26/07/2019	3	26/07/2019	26/07/2019		26/07/2019	[NT]
Electrical Conductivity 1:5 soil:water	µS/cm	1	Inorg-002	<1	3	20	[NT]		106	[NT]
Sulphate, SO4 1:5 soil:water	mg/kg	10	Inorg-081	<10	3	10	[NT]		101	[NT]
pH 1:5 soil:water	pH Units		Inorg-001	[NT]	3	6.0	5.9	2	102	[NT]
Chloride, Cl 1:5 soil:water	mg/kg	10	Inorg-081	<10	3	<10	[NT]		97	[NT]

Result Definitions

NT	Not tested
NA	Test not required
INS	Insufficient sample for this test
PQL	Practical Quantitation Limit
<	Less than
>	Greater than
RPD	Relative Percent Difference
LCS	Laboratory Control Sample
NS	Not specified
NEPM	National Environmental Protection Measure
NR	Not Reported

Quality Control Definitions

Blank	This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.
Duplicate	This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.
Matrix Spike	A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.
LCS (Laboratory Control Sample)	This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.
Surrogate Spike	Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.
Australian Drinking Water Guidelines recommend that Thermotolerant Coliform, Faecal Enterococci, & E.Coli levels are less than 1cfu/100mL. The recommended maximums are taken from "Australian Drinking Water Guidelines", published by NHMRC & ARMC 2011.	

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.

Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.

Spikes for Physical and Aggregate Tests are not applicable.

For VOCs in water samples, three vials are required for duplicate or spike analysis.

Duplicates: >10xPQL - RPD acceptance criteria will vary depending on the analytes and the analytical techniques but is typically in the range 20%-50% – see ELN-P05 QA/QC tables for details; <10xPQL - RPD are higher as the results approach PQL and the estimated measurement uncertainty will statistically increase.

Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals; 60-140% for organics (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

In circumstances where no duplicate and/or sample spike has been reported at 1 in 10 and/or 1 in 20 samples respectively, the sample volume submitted was insufficient in order to satisfy laboratory QA/QC protocols.

When samples are received where certain analytes are outside of recommended technical holding times (THTs), the analysis has proceeded. Where analytes are on the verge of breaching THTs, every effort will be made to analyse within the THT or as soon as practicable.

Where sampling dates are not provided, Envirolab are not in a position to comment on the validity of the analysis where recommended technical holding times may have been breached.

Measurement Uncertainty estimates are available for most tests upon request.

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Douglas Partners
Geotechnics / Environment / Groundwater

CHAIN OF CUSTODY DESPATCH SHEET

Project No:	86767.00	**Suburb:**	Haymarket	**To:**	Envirolab Services
Project Name:	Haymarket, 8-10 Lee Street, Geo	**Order Number**			
Project Manager:	Huw Smith	**Sampler:**	NB/AS	**Attn:**	Simon Song
Emails:	huw.smith@douglaspartners.com.au			**Phone:**	
Date Required:	Same day ☐ 24 hours ☐ 48 hours ☐ 72 hours ☐ Standard x			**Email:**	

Prior Storage: ☐ Esky x Fridge x Shelved Do samples contain 'potential' HBM? Yes ☐ No x (If YES, then handle, transport and store in accordance with FPM HAZID)

3 –

Sample ID	Lab ID	Date Sampled	Sample Type S - soil W - water	Container Type G - glass P - plastic	Analytes Aggressivity (pH, EC, SO4, Cl)	Notes/preservation
BH1, 4.3-4.5m	@	10/07/19	S	P	X	@Already at laboratory, previous
BH4, 0.3-0.4m	@	13/07/19	S	P	X	Job No. 86767.01. Previous
BH5, 1.1-1.2m	1	13/07/19	S	G	X	testing completed for separate
BH6, 0.5-0.6m	2	14/07/19	S	P	X	DP job(enviro)
BH7, 0.4-0.5m	3	13/07/19	S	P	X	

ENVIROLAB
Envirolab Services
12 Ashley St
Chatswood NSW 2067
Ph: (02) 9910 6200
Job No: 222146
Date Received: 23/07/2019
Time Received: 9:40
Received by: TD
Temp: Cool/[✓ Ambient] 19°C
Cooling: Ice/Icepack
Security: [✓ Intact]/Broken/None

Ref: 221523-A
TAT: Std,
Due: 30/7/19

PQL (S) mg/kg

ANZECC PQLs req'd for all water analytes ☐

PQL = practical quantitation limit. If none given, default to Laboratory Method Detection Limit

Lab Report/Reference No:

Metals to Analyse: ~~8HM unless specified here:~~

Total number of samples in container: 3
Relinquished by: Huw Smith
Transported to laboratory by: COURIER

Send Results to: Douglas Partners Pty Ltd
Address: 96 Hermitage Road, West Ryde
Phone:
Fax:

~~**Signed:**~~ 22/7/19 4pm.
~~**Received by:**~~
~~**Date & Time:**~~ 23/07/2019

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

CERTIFICATE OF ANALYSIS 221667-A

Client Details

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

Sample Details

Your Reference	**86767.01, DSI, Haymarket**
Number of Samples	18 Soil, 1 Water
Date samples received	17/07/2019
Date completed instructions received	23/07/2019

Analysis Details

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

Samples were analysed as received from the client. Results relate specifically to the samples as received.

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

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

Report Details

Date results requested by	30/07/2019
Date of Issue	29/07/2019

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

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

Results Approved By
Nancy Zhang, Laboratory Manager, Sydney

Authorised By

Nancy

Nancy Zhang, Laboratory Manager

Misc Inorg - Soil		
Our Reference		221667-A-3
Your Reference	UNITS	BH4/0.3-0.4
Date Sampled		12/07/2019
Type of sample		Soil
Date prepared	-	26/07/2019
Date analysed	-	26/07/2019
pH 1:5 soil:water	pH Units	8.9
Electrical Conductivity 1:5 soil:water	µS/cm	170
Sulphate, SO4 1:5 soil:water	mg/kg	61
Chloride, Cl 1:5 soil:water	mg/kg	25

Method ID	Methodology Summary
Inorg-001	pH - Measured using pH meter and electrode in accordance with APHA latest edition, 4500-H+. Please note that the results for water analyses are indicative only, as analysis outside of the APHA storage times.
Inorg-002	Conductivity and Salinity - measured using a conductivity cell at 25°C in accordance with APHA latest edition 2510 and Rayment & Lyons.
Inorg-081	Anions - a range of Anions are determined by Ion Chromatography, in accordance with APHA latest edition, 4110-B. Waters samples are filtered on receipt prior to analysis. Alternatively determined by colourimetry/turbidity using Discrete Analyser.

QUALITY CONTROL: Misc Inorg - Soil					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Date prepared	-			26/07/2019	[NT]	[NT]	[NT]	[NT]	26/07/2019	[NT]
Date analysed	-			26/07/2019	[NT]	[NT]	[NT]	[NT]	26/07/2019	[NT]
pH 1:5 soil:water	pH Units		Inorg-001	[NT]	[NT]	[NT]	[NT]	[NT]	102	[NT]
Electrical Conductivity 1:5 soil:water	µS/cm	1	Inorg-002	<1	[NT]	[NT]	[NT]	[NT]	106	[NT]
Sulphate, SO4 1:5 soil:water	mg/kg	10	Inorg-081	<10	[NT]	[NT]	[NT]	[NT]	104	[NT]
Chloride, Cl 1:5 soil:water	mg/kg	10	Inorg-081	<10	[NT]	[NT]	[NT]	[NT]	98	[NT]

Result Definitions

NT	Not tested
NA	Test not required
INS	Insufficient sample for this test
PQL	Practical Quantitation Limit
<	Less than
>	Greater than
RPD	Relative Percent Difference
LCS	Laboratory Control Sample
NS	Not specified
NEPM	National Environmental Protection Measure
NR	Not Reported

Quality Control Definitions

Blank	This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.
Duplicate	This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.
Matrix Spike	A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.
LCS (Laboratory Control Sample)	This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.
Surrogate Spike	Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.
Australian Drinking Water Guidelines recommend that Thermotolerant Coliform, Faecal Enterococci, & E.Coli levels are less than 1cfu/100mL. The recommended maximums are taken from "Australian Drinking Water Guidelines", published by NHMRC & ARMC 2011.	

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.

Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.

Spikes for Physical and Aggregate Tests are not applicable.

For VOCs in water samples, three vials are required for duplicate or spike analysis.

Duplicates: >10xPQL - RPD acceptance criteria will vary depending on the analytes and the analytical techniques but is typically in the range 20%-50% – see ELN-P05 QA/QC tables for details; <10xPQL - RPD are higher as the results approach PQL and the estimated measurement uncertainty will statistically increase.

Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals; 60-140% for organics (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

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Report Comments

pH - out of recommended holding time

Douglas Partners
Geotechnics / Environment / Groundwater

CHAIN OF CUSTODY DESPATCH SHEET

Project No:	86767.00	**Suburb:**	Haymarket	**To:**	Envirolab Services
Project Name:	Haymarket, 8-10 Lee Street, Geo	**Order Number**			
Project Manager:	Huw Smith	**Sampler:**	NB/AS	**Attn:**	Simon Song
Emails:	huw.smith@douglaspartners.com.au			**Phone:**	
Date Required:	Same day ☐ 24 hours ☐ 48 hours ☐ 72 hours ☐ Standard x			**Email:**	

Prior Storage: ☐ Esky x Fridge x Shelved   Do samples contain 'potential' HBM? Yes ☐ No x (If YES, then handle, transport and store in accordance with FPM HAZID)

Sample ID	Lab ID	Date Sampled	Sample Type S - soil W - water	Container Type G - glass P - plastic	Analytes Aggressivity (pH, EC, SO4, Cl)								Notes/preservation
BH1, 4.3-4.5m	@	10/07/19	S	P	X								@Already at laboratory, previous
3 - BH4, 0.3-0.4m	@	13/07/19	S	P	X								Job No. 86767.01. Previous
BH5, 1.1-1.2m	1	13/07/19	S	G	X								testing completed for separate
BH6, 0.5-0.6m	2	14/07/19	S	P	X								DP job(enviro)
BH7, 0.4-0.5m	3	13/07/19	S	P	X								
PQL (S) mg/kg													ANZECC PQLs req'd for all water analytes ☐

ENVIROLAB
Envirolab Services
12 Ashley St
Chatswood NSW 2067
Ph (02) 9910 6200
Job No: 222176
Date Received: 23/07/2019
Time Received: 9:40
Received by: TD
Temp: Cool/[✓ Ambient] 19°C
Cooling: Ice/Icepack
Security: [✓ Intact]/Broken/None

Ref: 221667-A
TAT: std
Due: 30/7/19

PQL = practical quantitation limit. If none given, default to Laboratory Method Detection Limit

Lab Report/Reference No:

Metals to Analyse: ~~8HM unless specified here:~~

Total number of samples in container: 3   **Relinquished by:** Huw Smith   **Transported to laboratory by:** COURIER

Send Results to: Douglas Partners Pty Ltd   **Address:** 96 Hermitage Road, West Ryde   **Phone:**   **Fax:**

~~**Signed:**~~ Huw Smith 22/7/19 4pm.   ~~**Received by:**~~ Tony Doherty   ~~**Date & Time:**~~ 23/07/2019

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

CERTIFICATE OF ANALYSIS 222176

Client Details

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

Sample Details

Your Reference	**86768.00, Haymarket**
Number of Samples	3 SOIL
Date samples received	23/07/2019
Date completed instructions received	23/07/2019

Analysis Details

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

Samples were analysed as received from the client. Results relate specifically to the samples as received.

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

Report Details

Date results requested by	30/07/2019
Date of Issue	26/07/2019

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

Results Approved By
Nick Sarlamis, Inorganics Supervisor

Authorised By
Nancy Zhang, Laboratory Manager

Soil Aggressivity				
Our Reference		222176-1	222176-2	222176-3
Your Reference	UNITS	BH5	BH6	BH7
Depth		1.1-1.2	0.5-0.6	0.4-0.5
Date Sampled		13/07/2019	14/07/2019	13/07/2019
Type of sample		SOIL	SOIL	SOIL
pH 1:5 soil:water	pH Units	4.9	5.1	8.3
Electrical Conductivity 1:5 soil:water	µS/cm	92	89	120
Chloride, Cl 1:5 soil:water	mg/kg	29	10	20
Sulphate, SO4 1:5 soil:water	mg/kg	42	72	42

Method ID	Methodology Summary
Inorg-001	pH - Measured using pH meter and electrode in accordance with APHA latest edition, 4500-H+. Please note that the results for water analyses are indicative only, as analysis outside of the APHA storage times.
Inorg-002	Conductivity and Salinity - measured using a conductivity cell at 25°C in accordance with APHA latest edition 2510 and Rayment & Lyons.
Inorg-081	Anions - a range of Anions are determined by Ion Chromatography, in accordance with APHA latest edition, 4110-B. Waters samples are filtered on receipt prior to analysis. Alternatively determined by colourimetry/turbidity using Discrete Analyser.

Client Reference: 86768.00, Haymarket

QUALITY CONTROL: Soil Aggressivity					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
pH 1:5 soil:water	pH Units		Inorg-001	[NT]	[NT]	[NT]	[NT]	[NT]	102	[NT]
Electrical Conductivity 1:5 soil:water	µS/cm	1	Inorg-002	<1	[NT]	[NT]	[NT]	[NT]	101	[NT]
Chloride, Cl 1:5 soil:water	mg/kg	10	Inorg-081	<10	[NT]	[NT]	[NT]	[NT]	83	[NT]
Sulphate, SO4 1:5 soil:water	mg/kg	10	Inorg-081	<10	[NT]	[NT]	[NT]	[NT]	84	[NT]

Result Definitions

NT	Not tested
NA	Test not required
INS	Insufficient sample for this test
PQL	Practical Quantitation Limit
<	Less than
>	Greater than
RPD	Relative Percent Difference
LCS	Laboratory Control Sample
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Douglas Partners
Geotechnics / Environment / Groundwater

CHAIN OF CUSTODY DESPATCH SHEET

Project No: 86767.00
Suburb: Haymarket
To: Envirolab Services
Project Name: Haymarket, 8-10 Lee Street, Geo
Order Number
Project Manager: Huw Smith
Sampler: NB/AS
Attn: Simon Song
Emails: huw.smith@douglaspartners.com.au
Phone:
Date Required: Same day ☐ 24 hours ☐ 48 hours ☐ 72 hours ☐ Standard x
Email:
Prior Storage: ☐ Esky x Fridge x Shelved
Do samples contain 'potential' HBM? Yes ☐ No x (If YES, then handle, transport and store in accordance with FPM HAZID)

Sample ID	Lab ID	Date Sampled	Sample Type S - soil W - water	Container Type G - glass P - plastic	Analytes Aggressivity (pH, EC, SO4, Cl)								Notes/preservation
BH1, 4.3-4.5m	⊛	10/07/19	S	P	X								⊛Already at laboratory, previous
BH4, 0.3-0.4m	⊛	13/07/19	S	P	X								Job No. 86767.01. Previous
BH5, 1.1-1.2m	1	13/07/19	S	G	X								testing completed for separate
BH6, 0.5-0.6m	2	14/07/19	S	P	X								DP job (enviro)
BH7, 0.4-0.5m	3	13/07/19	S	P	X								
PQL (S) mg/kg													ANZECC PQLs req'd for all water analytes ☐

ENVIROLAB
Envirolab Services
12 Ashley St
Chatswood NSW 2067
Ph: (02) 9910 6200
Job No. 222176
Date Received: 23/07/2019
Time Received: 9:40
Received by: JD
Temp: Cool/[✓ Ambient] 19°C
Cooling: Ice/Icepack
Security: [✓ Intact]/Broken/None

PQL = practical quantitation limit. If none given, default to Laboratory Method Detection Limit
Lab Report/Reference No:
Metals to Analyse: ~~8HM unless specified here:~~
Total number of samples in container: 3
Relinquished by: Huw Smith
Transported to laboratory by: COURIER
Send Results to: Douglas Partners Pty Ltd
Address: 96 Hermitage Road, West Ryde
Phone:
Fax:
Signed: Huw Smith 22/7/19 4pm.
Received by: Tony Doherty
Date & Time: 23/07/2019

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

CERTIFICATE OF ANALYSIS 241152

Client Details

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

Sample Details

Your Reference	**86767.00, Haymarket, 8-10 Lee Street, Geo**
Number of Samples	4 Soil
Date samples received	20/04/2020
Date completed instructions received	20/04/2020

Analysis Details

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

Samples were analysed as received from the client. Results relate specifically to the samples as received.

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

Report Details

Date results requested by	27/04/2020
Date of Issue	27/04/2020

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Results Approved By
Priya Samarawickrama, Senior Chemist

Authorised By

Nancy Zhang, Laboratory Manager

Soil Aggressivity					
Our Reference	UNITS	241152-1	241152-2	241152-3	241152-4
Your Reference		BH103	BH103	BH104	BH104
Depth		2.9-3	5-5.1	2.8-2.9	6.3-6.45
Date Sampled		16/04/2020	16/04/2020	16/04/2020	16/04/2020
Type of sample		Soil	Soil	Soil	Soil
pH 1:5 soil:water	pH Units	4.8	6.3	4.7	6.4
Electrical Conductivity 1:5 soil:water	µS/cm	42	19	68	11
Chloride, Cl 1:5 soil:water	mg/kg	<10	<10	20	<10
Sulphate, SO4 1:5 soil:water	mg/kg	51	20	52	10

Method ID	Methodology Summary
Inorg-001	pH - Measured using pH meter and electrode in accordance with APHA latest edition, 4500-H+. Please note that the results for water analyses are indicative only, as analysis outside of the APHA storage times.
Inorg-002	Conductivity and Salinity - measured using a conductivity cell at 25°C in accordance with APHA latest edition 2510 and Rayment & Lyons.
Inorg-081	Anions - a range of Anions are determined by Ion Chromatography, in accordance with APHA latest edition, 4110-B. Waters samples are filtered on receipt prior to analysis. Alternatively determined by colourimetry/turbidity using Discrete Analyser.

QUALITY CONTROL: Soil Aggressivity					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
pH 1:5 soil:water	pH Units		Inorg-001	[NT]	2	6.3	6.3	0	101	[NT]
Electrical Conductivity 1:5 soil:water	µS/cm	1	Inorg-002	<1	2	19	20	5	99	[NT]
Chloride, Cl 1:5 soil:water	mg/kg	10	Inorg-081	<10	2	<10	<10	0	91	[NT]
Sulphate, SO4 1:5 soil:water	mg/kg	10	Inorg-081	<10	2	20	20	0	95	[NT]

Result Definitions

NT	Not tested
NA	Test not required
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RPD	Relative Percent Difference
LCS	Laboratory Control Sample
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LCS (Laboratory Control Sample)	This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.
Surrogate Spike	Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

Australian Drinking Water Guidelines recommend that Thermotolerant Coliform, Faecal Enterococci, & E.Coli levels are less than 1cfu/100mL. The recommended maximums are taken from "Australian Drinking Water Guidelines", published by NHMRC & ARMC 2011.

The recommended maximums for analytes in urine are taken from “2018 TLVs and BEIs”, as published by ACGIH (where available). Limit provided for Nickel is a precautionary guideline as per Position Paper prepared by AIOH Exposure Standards Committee, 2016.

Guideline limits for Rinse Water Quality reported as per analytical requirements and specifications of AS 4187, Amdt 2 2019, Table 7.2

Laboratory Acceptance Criteria

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Where sampling dates are not provided, Envirolab are not in a position to comment on the validity of the analysis where recommended technical holding times may have been breached.

Measurement Uncertainty estimates are available for most tests upon request.

Analysis of aqueous samples typically involves the extraction/digestion and/or analysis of the liquid phase only (i.e. NOT any settled sediment phase but inclusive of suspended particles if present), unless stipulated on the Envirolab COC and/or by correspondence. Notable exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, total recoverable metals and PFAS where solids are included by default.

Samples for Microbiological analysis (not Amoeba forms) received outside of the 2-8°C temperature range do not meet the ideal cooling conditions as stated in AS2031-2012.

Douglas Partners
Geotechnics / Environment / Groundwater

CHAIN OF CUSTODY DESPATCH SHEET

Project No: 86767.00
Suburb: Haymarket
To: Envirolab Services
Project Name: Haymarket, 8-10 Lee Street, Geo
Order Number
Project Manager: Huw Smith
Sampler: NB
Attn: Simon Song
Emails: huw.smith@douglaspartners.com.au
Phone:
Date Required: Same day ☐ 24 hours ☐ 48 hours ☐ 72 hours ☐ Standard x
Email:
Prior Storage: ☐ Esky x Fridge x Shelved Do samples contain 'potential' HBM? Yes ☐ No x (If YES, then handle, transport and store in accordance with FPM HAZID)

Sample ID	Lab ID	Date Sampled	Sample Type	Container Type	Analytes								Notes/preservation
			S - soil	P - plastic	Aggressivity (pH, EC, SO4, Cl)								
1 BH103 2.9-3		16.4	✓		✓								
2 5-5.1		"	✓		✓								
3 BH104 2.8-2.9		"	✓		✓								
4 6.3-6.45		"	✓		✓								
PQL (S) mg/kg													

Envirolab Services
12 Ashley St
Chatswood NSW 2067
Ph: (02) 9910 6200
Job No: 241152
Date Received: 20-4-20
Time Received: 11:00
Received by: Helen
Temp: Cool/[✓ Ambient]
Cooling: Ice/Icepack
Security: Intact/Broken/[✓ None]

ANZECC PQLs req'd for all water analytes ☐

PQL = practical quantitation limit. If none given, default to Laboratory Method Detection Limit

Lab Report/Reference No:

Total number of samples in container:
Relinquished by:
Transported to laboratory by:
Send Results to: Douglas Partners Pty Ltd
Address:
Phone:
Fax:
Signed:
Received by: Helen
Date & Time: 20-4-20 11:00

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

CERTIFICATE OF ANALYSIS 243755

Client Details

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

Sample Details

Your Reference	**86767.00, Haymarket**
Number of Samples	5 SOIL
Date samples received	28/05/2020
Date completed instructions received	28/05/2020

Analysis Details

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

Samples were analysed as received from the client. Results relate specifically to the samples as received.

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

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

Report Details

Date results requested by	04/06/2020
Date of Issue	01/06/2020

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

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

Results Approved By
Priya Samarawickrama, Senior Chemist

Authorised By

Nancy Zhang, Laboratory Manager

Soil Aggressivity						
Our Reference		243755-1	243755-2	243755-3	243755-4	243755-5
Your Reference	UNITS	BH108	BH107	BH112B	BH112B	BH112B
Depth		1.05-1.2	2.4-2.5	2-2.24	3-3.2	3.2-3.44
Date Sampled		18/05/2020	18/05/2020	18/05/2020	18/05/2020	18/05/2020
Type of sample		SOIL	SOIL	SOIL	SOIL	SOIL
pH 1:5 soil:water	pH Units	5.3	5.9	5.2	4.8	5.1
Electrical Conductivity 1:5 soil:water	µS/cm	22	24	40	30	29
Chloride, Cl 1:5 soil:water	mg/kg	<10	<10	<10	<10	<10
Sulphate, SO4 1:5 soil:water	mg/kg	10	20	36	25	25

Method ID	Methodology Summary
Inorg-001	pH - Measured using pH meter and electrode in accordance with APHA latest edition, 4500-H+. Please note that the results for water analyses are indicative only, as analysis outside of the APHA storage times.
Inorg-002	Conductivity and Salinity - measured using a conductivity cell at 25°C in accordance with APHA latest edition 2510 and Rayment & Lyons.
Inorg-081	Anions - a range of Anions are determined by Ion Chromatography, in accordance with APHA latest edition, 4110-B. Waters samples are filtered on receipt prior to analysis. Alternatively determined by colourimetry/turbidity using Discrete Analyser.

QUALITY CONTROL: Soil Aggressivity					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	243755-3
pH 1:5 soil:water	pH Units		Inorg-001	[NT]	2	5.9	5.9	0	101	[NT]
Electrical Conductivity 1:5 soil:water	µS/cm	1	Inorg-002	<1	2	24	24	0	97	[NT]
Chloride, Cl 1:5 soil:water	mg/kg	10	Inorg-081	<10	2	<10	<10	0	91	79
Sulphate, SO4 1:5 soil:water	mg/kg	10	Inorg-081	<10	2	20	20	0	102	94

Result Definitions

NT	Not tested
NA	Test not required
INS	Insufficient sample for this test
PQL	Practical Quantitation Limit
<	Less than
>	Greater than
RPD	Relative Percent Difference
LCS	Laboratory Control Sample
NS	Not specified
NEPM	National Environmental Protection Measure
NR	Not Reported

Quality Control Definitions

Blank	This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.
Duplicate	This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.
Matrix Spike	A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.
LCS (Laboratory Control Sample)	This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.
Surrogate Spike	Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

Australian Drinking Water Guidelines recommend that Thermotolerant Coliform, Faecal Enterococci, & E.Coli levels are less than 1cfu/100mL. The recommended maximums are taken from "Australian Drinking Water Guidelines", published by NHMRC & ARMC 2011.

The recommended maximums for analytes in urine are taken from “2018 TLVs and BEIs”, as published by ACGIH (where available). Limit provided for Nickel is a precautionary guideline as per Position Paper prepared by AIOH Exposure Standards Committee, 2016.

Guideline limits for Rinse Water Quality reported as per analytical requirements and specifications of AS 4187, Amdt 2 2019, Table 7.2

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.

Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.

Spikes for Physical and Aggregate Tests are not applicable.

For VOCs in water samples, three vials are required for duplicate or spike analysis.

Duplicates: >10xPQL - RPD acceptance criteria will vary depending on the analytes and the analytical techniques but is typically in the range 20%-50% – see ELN-P05 QA/QC tables for details; <10xPQL - RPD are higher as the results approach PQL and the estimated measurement uncertainty will statistically increase.

Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals (not SPOCAS); 60-140% for organics/SPOCAS (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

In circumstances where no duplicate and/or sample spike has been reported at 1 in 10 and/or 1 in 20 samples respectively, the sample volume submitted was insufficient in order to satisfy laboratory QA/QC protocols.

When samples are received where certain analytes are outside of recommended technical holding times (THTs), the analysis has proceeded. Where analytes are on the verge of breaching THTs, every effort will be made to analyse within the THT or as soon as practicable.

Where sampling dates are not provided, Envirolab are not in a position to comment on the validity of the analysis where recommended technical holding times may have been breached.

Measurement Uncertainty estimates are available for most tests upon request.

Analysis of aqueous samples typically involves the extraction/digestion and/or analysis of the liquid phase only (i.e. NOT any settled sediment phase but inclusive of suspended particles if present), unless stipulated on the Envirolab COC and/or by correspondence. Notable exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, total recoverable metals and PFAS where solids are included by default.

Samples for Microbiological analysis (not Amoeba forms) received outside of the 2-8°C temperature range do not meet the ideal cooling conditions as stated in AS2031-2012.

Report Comments

pH/EC: Samples were out of the recommended holding time for this analysis.

Douglas Partners
Geotechnics / Environment / Groundwater

F.14 - CHAIN OF CUSTODY DESPATCH SHEET

Project No:	86767.00	**Suburb:**	Haymarket	**To:**	Envirolab
Project Name:	Haymarket	**Order Number**			12 Ashbery Str, Chatswood
Project Manager:	Huw Smith	**Sampler:**	NB	**Attn:**	Aileen Hie
Emails:	Huw.Smith@douglaspartners.com.a			**Phone:**	
Date Required:	Same day ☐ 24 hours ☐ 48 hours ☐ 72 hours ☐ Standard ☒			**Email:**	

Prior Storage: ☐ Esky ☐ Fridge ☐ Shelved Do samples contain 'potential' HBM? Yes ☐ No ☐ (If YES, then handle, transport and store in accordance with FPM HAZ

Sample ID	Depth Range	Lab ID	Date Sampled	Sample Type S - soil W - water	Container G - glass P - plastic	Analytes Agressivity	Ph,EC,SO4,CL							Notes/preservation
BH108	1.05-1.2m	1	18.05.20	S	P	✓								ALL: 1.5 Soil to water ratio
BH107	2.4-2.5m	2	18.05.20	S	P	✓								
BH112B	2-2.24m	3	18.05.20	S	P	✓								
BH112B	3-3.2m	4	18.05.20	S	P	✓								
BH112B	3.2.-3.44m	5	18.05.20	S	P	✓								
PQL (S) mg/														ANZECC PQLs req'd for all water analy

Envirolab Services
12 Ashley St
Chatswood NSW 2067
Ph: (02) 9910 6200
Job No: 243755
Date Received: 29/5/20
~~Time Received:~~ 1150
Received by: JM
Temp: Cool/[✓ Ambient]
Cooling: Ice/Icepack
Security: [✓ Intact]/Broken/None

PQL = practical quantitation limit. If none given, default to Laboratory Method Detection Limit

Lab Report/Reference 243755

Metals to Analyse: 8HM unless specified here:

Total number of samples in container: **Relinquished by:** LT **Transported to laboratory by:**

Send Results to: Douglas Partners Pty Ltd **Address** **Phone** **Fax:**

Douglas Partners
Geotechnics / Environment / Groundwater

F.14 - CHAIN OF CUSTODY DESPATCH SHEET

Project No:	86767.00	**Suburb:**	Haymarket	**To:**	Envirolab
Project Name:	Haymarket	**Order Number**			12 Ashbery Str, Chatswood
Project Manager:	Huw Smith	**Sampler:**	NB	**Attn:**	Aileen Hie
Emails:	Huw.Smith@douglaspartners.com.au			**Phone:**	
Date Required:	Same day ☐ 24 hours ☐ 48 hours ☐ 72 hours ☐ Standard ☐X			**Email:**	

Prior Storage: ☐ Esky ☐ Fridge ☐ Shelved Do samples contain 'potential' HBM? Yes ☐ No ☐ (If YES, then handle, transport and store in accordance with FPM HAZ

Signed: **Received by:** Jason Day ELS SYD **Date & Time:** 28/5/20 1150

243755

Appendix I

Groundwater Modelling Report

Douglas Partners
Geotechnics | Environment | Groundwater

Integrated Practical Solutions

Report on
Groundwater Modelling

Proposed Commercial Development
8-10 Lee Street, Haymarket

Prepared for
Vertical First Pty Ltd

Project 86767.04
October 2020

Douglas Partners
Geotechnics | Environment | Groundwater

Document History

Document details

Project No.	86767.04	Document No.	R.003.Rev1
Document title	Report on Groundwater Modelling Proposed Commercial Development		
Site address	8-10 Lee Street, Haymarket		
Report prepared for	Vertical First Pty Ltd		
File name	86767.04.R.003.Rev1		

Document status and review

Status	Prepared by	Reviewed by	Date issued
Revision 0	Joel Huang	Fiona MacGregor	6 October 2020
Revision 1	Joel Huang	Fiona MacGregor	30 October 2020

Distribution of copies

Status	Electronic	Paper	Issued to
Revision 1	1		Josh Finnegan, Avenor Pty Ltd

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		30 October 2020
Reviewer	pp. Fiona MacGregor	30 October 2020

ISO 9001 Quality Management
FS 604853

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Table of Contents

Report on Groundwater Modelling
Proposed Commercial Development
8-10 Lee Street, Haymarket

1. Introduction

This report presents the results of groundwater modelling undertaken for a proposed commercial development at 8-10 Lee Street, Haymarket. The assessment was commissioned in an email by Avenor Pty Ltd (Avenor) on behalf of Vertical First Pty Ltd (Vertical), and was undertaken in accordance with a consultancy agreement and our proposal dated 8 May 2020.

This groundwater modelling follows on from a previous preliminary groundwater assessment undertaken by DP (Ref: 86767.04.R.002.Rev0, dated 28 July 2020), which used a simple analytical method and was based on a simplified hydrogeological environment. This groundwater modelling supersedes the previous preliminary assessment and used more sophisticated 3-dimensional (3D) Finite Difference Modelling (FDM) techniques to provide more accurate estimates of groundwater inflow and the extent of groundwater table drawdown due to the proposed basement excavation. The development of the groundwater model also considers the most recent groundwater monitoring results from the period between 5 May 2020 and 15 September 2020.

It is understood that the proposed development at the site is to be divided into a ‘Developer Works zone’ and a ‘State Works – Link zone’. The Developer Works are to include excavation for a two-level basement on the western side of Central Station (i.e. to an elevation of RL 5.0 m) followed by construction of a multi-storey commercial tower, whereas the State Works to the west of the tower include a two-level basement to a similar elevation, with a north-south connection to proposed future, adjoining basements.

The basement excavation within the Developer Works zone is expected to intersect the natural groundwater table. It is understood that the basement is currently designed as a ‘drained’ basement in both the construction phase and the full operational phase of the building (i.e. for the long-term), to eliminate the need for the provision of water-proof basement walls and a hydrostatic slab.

Under the NSW Aquifer Interference Policy, the project has been deemed to be an aquifer interference activity requiring an authorisation from an approval body (for State Significant Developments) under water management legislation. This groundwater assessment has been prepared to evaluate the feasibility of adopting a ‘drained’ basement for this project and includes:

- A summary of the geotechnical and hydrogeological investigations undertaken on site;
- Development of a conceptual hydrogeological model;
- Development of a 3D numerical groundwater model and calibrations to match the groundwater monitoring data;
- Estimation of transient groundwater inflow into a drained basement during and after the construction;
- Estimation of drawdown of the groundwater table caused by the drained basement.
- Estimation of settlements at adjacent key structures due to the drained basement.

- Considerations of the NSW Aquifer Interference Policy; and
- Comments on groundwater contaminants for disposal options.

2. Previous Work

Two rounds of combined geotechnical, environmental and hydrogeological investigations have been completed by Douglas Partners Pty Ltd (DP). The information obtained from the site investigations was presented in the following four reports:

- DP Report 86767.00.R.001.Rev0, dated August 2019 (Geotechnical Investigation);
- DP Report 86767.00.R.006.Rev3, dated September 2020 (Supplementary Geotechnical Investigation);
- DP Report 86767.01.R.001.DftB, dated 29 August 2019 (Preliminary Contamination Site Investigation); and
- DP Report 86767.03.R.001.DftA, dated 18 June 2020 (Supplementary Contamination Site Investigation).

2.1 Boreholes

The boreholes drilled on the site included:

- On eastern side of YHA: six cored boreholes below the lowest basement floor level (i.e. Boreholes BH1, BH2, BH3, BH5, BH8 and BH9), five cored boreholes at upper ground floor level (i.e. Boreholes BH101 to BH105, including two cored boreholes drilled from the concrete platform); and three boreholes drilled within the soil to depths of 1.3 m - 2.4 m below the existing lower ground floor level (i.e. Boreholes BH4, BH6 and BH7);
- Within the Gate Gourmet catering facility at Lower Ground Floor level: four boreholes (Boreholes BH106, BH113, BH114 and BH115: all for environmental testing purposes);
- Within the access corridor and storage areas, west of the Gate Gourmet facility and at Lower Ground Floor level: seven boreholes (BH107A, BH107B, BH108, BH109A, BH109B, BH116, BH117: including three cored boreholes);
- Within the Adina Hotel basement access driveway at Lower Ground Floor level: one borehole (Borehole BH110: for environmental testing purposes);
- Upper Carriage Lane / open-air access ramp: three boreholes (Boreholes BH111, BH112A and BH112B: including two cored boreholes);
- Ambulance Avenue footpath: two vertical boreholes drilled through the retaining wall footing (Boreholes W1 and W2); and
- Within the Adina Hotel basement: two inclined boreholes drilled below an existing concrete underpin (Boreholes W3 and W4).

A previous geotechnical investigation carried out by DP for a neighbouring site to the south (i.e. ‘Henry Deane Plaza’: DP Report 27282B, dated 1999) included the drilling of a borehole near to the southern site boundary.

2.2 Standpipes and Permeability Testing

Standpipe piezometers were installed into ten of the boreholes at the site (i.e. BH1, BH5, BH8, BH103, BH104, BH107A, BH107B, BH109B, BH112A, and BH112B) to measure groundwater levels. The standpipes comprised screened PVC pipe with gravel backfill, a bentonite pellet seal and a 'gatic' cover at ground level. The installed pipes are screened within either alluvial sand (i.e. BH1) or within the underlying very low to high strength rock. The suffix in the numbering of some boreholes indicates the alternatives for the position of the well screen as:

- Option A: within very low or low strength, fine to medium grained sandstone (interpreted to be Mittagong Formation): Boreholes BH103, BH107A, and BH112A; and
- Option B: within the underlying medium to high strength, medium grained sandstone (interpreted to be Hawkesbury Sandstone): Boreholes BH104, BH107B, BH109B and BH112B.

Groundwater permeability testing and long-term monitoring of groundwater levels in standpipes has been carried out at the site since July 2019, with the results presented in the following monitoring reports:

- DP Report 86767.00.R.002.Rev0 (dated 4 September 2019): Monitoring period July to August 2019;
- DP Report 86767.00.R.003.Rev0 (dated 10 December 2019): Monitoring to 26 November 2019;
- DP Report 86767.00.R.004.Rev0 (dated 2 March 2020): Monitoring to 19 February 2020;
- DP Report 86767.00.R.005.Rev0 (dated 26 May 2020): Monitoring to 5 May 2020; and
- DP Report 86767.00.R.008.Rev0 (dated 22 September 2020): Monitoring to 15 September 2020.

Either rising head or falling head permeability tests were completed within the installed standpipes.

3. Field Work Results

3.1 Boreholes

The locations of the boreholes and groundwater monitoring wells are shown on Drawing 1 (extract from Ref: 86767.00.R.006.Rev3) in Appendix B.

Six geotechnical cross-sections (Sections A-A to F-F) showing the interpreted subsurface profile are presented as Drawings 2 to 7 (extract from Ref: 86767.00.R.006.Rev3) in Appendix B. The sections show interpreted geotechnical divisions of underlying soil and rock together with the proposed basement floor level.

The subsurface conditions encountered on the site can be summarised as:

CONCRETE:	Single or multiple concrete slabs, with or without a brick pavement, asphalt layer, or surface ballast layer over
FILL	Gravel, sand or clay fill to depths ranging between 4.7 m and 6.3 m on the eastern side of the YHA, or 0.0-2.2 m depth within the access corridor and Gate Gourmet (i.e. the Lower Ground Floor level).
ALLUVIAL SAND:	Loose to medium dense, alluvial sand, 0.4-1.2 m thick; over
RESIDUAL SILTY CLAY:	Soft to hard, residual silty clay, with some ironstone gravel (0.75-2.2 m thick); over
RESIDUAL SANDY CLAY:	Very stiff to hard, residual sandy clay (0.2-0.6 m thick); over
SANDSTONE (FINE to MEDIUM):	Very low to low strength, fine to medium grained sandstone with some medium or high strength, iron-cemented bands (0.65-1.8 m thick). Numerous clay seams were encountered; over
SANDSTONE (MEDIUM):	Medium or high strength, medium grained sandstone

The upper fine to medium grained sandstone is interpreted to be part of the Mittagong Formation, and the underlying medium grained sandstone is interpreted to be Hawkesbury Sandstone.

3.2 Groundwater Levels

Groundwater level observations are summarised in Tables 1 and 2, and graphs of the groundwater levels for each data logger (corrected for barometric pressure effects) are included in Appendix C. The graphs include rainfall record data obtained from Observatory Hill, Sydney (Bureau of Meteorology Station 066062, http://www.bom.gov.au).

With the exception of Borehole BH109B, water level data affected by disturbance (such as due to rising or falling head testing) has been removed for clarity of presentation. Data is missing from short time periods from Boreholes BH103 and BH104 due to errors in placement of the logger within the borehole, or due to a very short recording interval being selected leading to the filling of the datalogger memory ahead of schedule.

The water level within the alluvial sand, as measured in Borehole BH1, rose by approximately 1.4 m following four consecutive days of heavy rain (i.e. 392 mm of rainfall between 7 February and 10 February 2020: to an elevation of RL15.2 m). In contrast, water levels for piezometers screened within the underlying very low to low strength sandstone (interpreted to be Mittagong Formation) were measured to rise by less than about 0.4 m in the same period. Water levels in piezometers screened within the underlying medium to high strength sandstone (interpreted to be Hawkesbury Sandstone) varied less than this over the same time period (e.g. refer graphs for BH112A and BH112B in Appendix C).

With the exception of Borehole BH109B (which had a very slow rate of recharge), the manual water level measurements presented in Tables 1 and 2 are similar to the long-term measurements obtained from data loggers. The typical standing water levels within the sandstone on the eastern and central parts of the site range between RL13.1 m and RL13.6 m, whereas standing water levels within the sandstone on the western part of the site range between RL11.5 m and RL13.3 m. It is noted that the measured water levels are generally similar to the elevation of the adjacent Adina Hotel basement floor slab (i.e. RL13.4 m).

Table 1: Groundwater Observations (Boreholes BH1, BH5, BH8, BH103 and BH104).

Measurement Date	Standing Water Level Measurements in Boreholes									
	BH1		BH5		BH8		BH103		BH104	
	Depth (m)	RL²	Depth (m)	RL²	Depth (m)	RL²	Depth (m)	RL²	Depth (m)	RL²
23/07/2019	5.95	14.2	2.6	12.9	2.3	13.2	-	-	-	-
30/07/2019	6.1	14.0	2.4	13.1	2.3	13.2	-	-	-	-
31/07/2019	6.0	14.2	2.4	13.1	-	-	-	-	-	-
7/08/2019	6.2	14.0	-	-	-	-	-	-	-	-
14/08/2019	6.3 (dry)	<13.8 (dry)	2.4	13.1	2.3	13.2	-	-	-	-
2/09/2019	6.3 (dry)	<13.8 (dry)	-	-	-	-	-	-	-	-
26/11/2019	6.3 (dry)	<13.8 (dry)	2.4	13.1	2.3	13.2	-	-	-	-
19/02/2020	5.8	14.3	2.1	13.4	1.9	13.6	-	-	-	-
24/04/2020	6.3 (dry)	<13.8 (dry)	-	-	-	-	7.5	13.7	7.6	13.6
5/05/2020	6.3 (dry)	<13.8 (dry)	2.4	13.2	2.2	13.3	7.5	13.7	7.7	13.5
5/06/2020	6.3 (dry)	<13.8 (dry)	-	-	-	-	7.7	13.5	7.8	13.4
7/09/2020	6.3 (dry)	<13.8 (dry)	-	-	2.3	13.2	7.6	13.6	7.7	13.5
15/09/2020	-	-	2.4	13.2	-	-	-	-	-	-

Notes: (1) "-" indicates Not Measured.
(2) Elevation (RL) in metres AHD.

Table 2: Groundwater Observations (Boreholes BH107A, BH107B, BH109B, BH112A and BH112B).

Measurement Date	Standing Water Level Measurements in Boreholes									
	BH107A		BH107B		BH109B		BH112A		BH112B	
	Depth (m)	RL[2]	Depth (m)	RL[2]	Depth (m)	RL[2]	Depth (m)	RL[2]	Depth (m)	RL[2]
17/05/2020	3.2	12.3	1.8	13.7	-	-	-	-	-	-
21/05/2020	-	-	-	-	7.8[3]	7.5[3]	3.5	13.2	5.1	11.7
26/05/2020	2.1	13.4	2.6	12.9	8.2[3]	7.1[3]	3.1	13.6	5.2	11.6
5/06/2020	2.0	13.5	2.2	13.3	6.6[3]	8.7[3]	3.4	13.3	5.3	11.5
7/09/2020	2.1	13.4	2.4	13.1	2.5	12.8	3.5	13.2	5.1	11.7
15/09/2020	-	-	-	-	-	-	-	-	-	-

Notes: (1) "-" indicates Not Measured.
(2) Elevation (RL) in metres AHD.
(3) Transient water level due to slow recharge rate – refer graphs attached

3.3 Results of Permeability Testing

Permeability testing was completed within each standpipe, with a total of 16 tests completed between 30 July 2019 and 5 June 2020. Rising head tests were carried out in each standpipe (with the exception of BH112A), with falling head tests completed in three standpipes (i.e. BH109B, BH112A and BH112B). The permeability of the screened interval was calculated using the Hvorslev analytical method. The results of the permeability testing are presented in Appendix D.

A summary of the calculated permeability results is presented in Table 3.

Table 3: Calculated Permeability Results

Borehole ID	Material Types within Screened Interval	Calculated Permeability (m/sec)
BH1 [1]	Sand	4.5×10^{-7} to 6.5×10^{-7}
BH5	Sandstone: fine and medium grained with clay seams in upper metre of screened interval	6.2×10^{-9}
BH8 [2]		1.0×10^{-6}
BH103 [1]	Sandstone: fine grained with extremely weathered bands, fractured	1.4×10^{-6} to 2.3×10^{-6}
BH104 [1]	Sandstone: fine to medium grained, slightly fractured then unbroken	2.3×10^{-7} to 3.5×10^{-7}
BH107A [1]	Sandstone: fine to medium grained, high strength with very low strength bands, fractured	1.4×10^{-7} to 2.0×10^{-7}
BH107B [1]	Sandstone: fine to medium grained, slightly fractured then unbroken	5.0×10^{-8} to 7.7×10^{-8}

Borehole ID	Material Types within Screened Interval	Calculated Permeability (m/sec)
BH109B	Sandstone: fine to medium grained, slightly fractured then unbroken	4.7 x 10^{-8}
BH112A [2]	Sandstone: fine grained with very low strength bands (core loss)	4.8 x 10^{-7}
BH112B [1]	Sandstone: medium grained, slightly fractured then unbroken	2.4 x 10^{-7} to 3.9 x 10^{-7}

Note: (1) Two tests carried out.
(2) Well screen includes an interval of core loss and clay seams, below the top of rock.

Typical permeability values for sand, both from our previous experience in the area and from published values, are usually in the range 1 x 10^{-4} m/sec to 1 x 10^{-5} m/sec. The calculated permeability values for the sand encountered in Borehole BH1 are not consistent with these values and are considered to be not representative of the permeability of the sand. Borehole BH1 was positioned near to basement walls for the YHA building, as well as adjacent to deep concrete footings founded on rock. It is considered that these factors have influenced the permeability test results for the sand layer in Borehole BH1.

A slow rate of groundwater recharge was observed for standpipes screened within high strength rock with few defects (i.e. BH109B), with water levels appearing to be similar for standpipes near to each other screened within different materials (e.g. BH107A and BH107B: screened within either the fine to medium grained sandstone or the underlying medium grained Hawkesbury Sandstone). The rapid increase in water level within the standpipe screened within the alluvial sand, and the observation of groundwater near the soil-rock interface in some boreholes (e.g. BH107A) indicates that a perched water table is probably present within the soils above rock level.

4. Proposed Development

It is understood that the proposed development will include the dismantling of the former 'Inward Parcels Shed' building (i.e. the YHA: to be re-built following construction of the Level 01 mega-floor/transfer deck), retention of the existing goods lift to Station platform level, removal of the carriage dormitories and rails, and excavation below the Lower Ground Floor level of the existing building for a two-level basement (to RL5.0 m), followed by construction of a multi-storey commercial tower.

Based on the preliminary drawings provided, it is understood that the proposed 2-level basement will extend close to the property boundaries to the north, east and west, and to the Devonshire Street Pedestrian Tunnel to the south. For extension of the proposed basement along the eastern boundary of the site, the existing setback of the lower ground floor of the YHA building on this side is to be removed. The drawings indicate that a basement entry ramp is to be constructed along the northern side from Lee Street, and a connection is proposed from the second basement level to potential future basements to the south of the site (i.e. beneath the pedestrian tunnel).

This will require excavation depths of about 17 m on the eastern boundary and about 11.5 m along the other boundaries to below the proposed two-level basement (FFL at RL5.0 m).

It is understood that the detailed design of the shoring system for the ‘drained’ basement is yet to be decided, however, it is anticipated that a relatively water-tight perimeter ‘cut-off’ wall socketed a minimum of 2 m into competent, slightly fractured to unbroken sandstone, will be required to prevent any direct inflow from high permeability fill, alluvial soils and upper fractured rock.

5. Geotechnical and Hydrogeological Model

The field work results are summarised on six geotechnical cross-sections (in Appendix B), which show the interpreted layers of fill, alluvial and residual soil and sandstone units between selected test locations. The interpreted boundaries shown on the sections are accurate only at the test locations and layers shown diagrammatically on the drawings are inferred only. Bands of lower or higher strength rock may be present within the generalised sandstone layers. Single or multiple concrete slabs were present at the surface over most of the site, with rail ballast encountered over concrete and bricks within the rail carriage dormitory area.

The interpreted geotechnical model for the site is:

- soft to stiff or very loose to dense fill materials (clay or sand: up to 8 m thick, below the current ground surface), over
- a discontinuous lens of very loose to medium dense sand alluvium (up to 2.0 m thick), over
- soft to hard silty clay or sandy clay residual soil (up to about 2.5 m thick), overlying
- fine to medium grained sandstone, very low strength with high strength iron-cemented bands (0.5- 2 m thick), and then overlying
- medium to high strength, medium grained sandstone;

Groundwater measurements from standpipe piezometers on site indicate that there is a relative consistent permanent (perennial) groundwater table within the residual soils and upper, fine grained, fractured sandstone (Mittagong Formation) that flows in the north westerly direction towards Lee Street, with an average level of around RL13.7 m in the centre of the site. The measured groundwater levels in piezometers screened in the lower, medium grained, less fractured sandstone (Hawkesbury Sandstone) were generally lower, by approximately 0.3 m in the centre of the site, increasing to 2 m towards Lee Street. The interpreted groundwater contours and flow directions are illustrated in Drawings 3 and 4 in Appendix C.

An intermittent perched groundwater table is also indicated to be present, near the soil-rock interface and also within the alluvial sand. The upper perched groundwater table is likely to be recharged by surface infiltration into sandy layers following periods of heavy rainfall. The groundwater tables in alluvium and in sandstone appeared to be relatively independent, separated by low permeable residual clay, as there was minimal variability in groundwater levels observed in the sandstone even after some heavy rainfall periods between July 2019 and June 2020.

The seepage within the sandstone bedrock is likely to be controlled by discontinuities in the rock such as the spacing, continuity and aperture of the bedding planes, faults and joints. The seams and other fractures in the weathered rock may also be acting as temporary water storage. Therefore, groundwater inflow is not expected to be uniform around the site and is probably concentrated around localised fracture zones. The regional groundwater flow is also expected to be affected by the nearby basements, pedestrian tunnels and new Sydney Metro underground station.

6. Groundwater Modelling

6.1 Methodology

Groundwater modelling was undertaken to assess the potential inflow rates into the proposed basements and the long term drawdown, or cone of depression, which could be induced by the construction of the basement.

Groundwater model simulations were conducted using MODFLOW (McDonald & Harbaugh, 1988) developed by the United States Geological Survey. Modflow is a three-dimensional groundwater head and flow model, which is widely used and accepted as an industry standard. The model was based on site-specific data where possible, as well as estimates of unknown parameters based on experience in similar environments. The model was developed using the pre-processor or graphical interface program Visual MODFLOW Flex V4.1 by Schlumberger Water Services.

6.2 Numerical Model Geometry

The aquifer surrounding the proposed development was simulated as a multi-layered numerical model to represent the subsurface conditions surrounding the site and to allow the vertical flow components to be simulated more accurately.

The aquifer boundaries of the model were extended approximately 200 m from the site boundaries in all directions to simulate the estimated groundwater catchment domain.

For the numerical model the geological units were subdivided into four layers corresponding to the main soil and rock units. The top of the model, i.e. top of Layer 1, was set to approximate the average ground surface across the site at RL 20.0 m. For simplicity, the conceptual model did not incorporate topography or variations in layer thickness. All layers were assigned as MODFLOW (Type 3) layers (confined / unconfined). Details of the model layers, together with the assigned hydraulic parameters for each layer are provided in Table 4.

6.3 Boundary Conditions and Aquifer Parameters

The northern and southern boundaries of the model were set as no-flow boundaries. Constant head conditions were applied to the eastern and western model boundaries.

The constant head 'far-end' boundary conditions were calibrated to generate a hydraulic gradient in the north westerly direction, while matching the measured groundwater levels at various monitoring points on site. For simplicity, the groundwater model was calibrated against the groundwater table of the upper fractured sandstone layer (Mittagong), as it gives higher results for predictions of groundwater inflow and drawdown, compared to the results if the lower groundwater table in Hawkesbury Sandstone is adopted.

Aquifer parameters required for the model included horizontal (K_h) and vertical (K_v) hydraulic conductivity or permeability, as well as specific yield or storage coefficient. Natural variations in the permeability of the sediments around the site are likely to occur due to the variations in the silt or clay content, and grain size of the sand.

Typical permeability values for sand, both from our previous experience in the area and from published values, are usually in the range 1 x 10^{-4} m/sec to 1 x 10^{-5} m/sec. The calculated values from the in-situ permeability testing for the sand encountered in Borehole BH1 are not consistent with these values and are considered to be not representative of the permeability of the sandy soils. Therefore, a typical permeability value of 5 x 10^{-5} m/sec was adopted for Layer 1 (fill and alluvium) in the model. In order to ensure that the modelling is not too optimistic, the vertical conductivity was set as equal to the horizontal hydraulic conductivity for this layer.

The hydraulic conductivity of the residual clay (Layer 2) was assumed to be 5 x 10^{-8} m/sec, with an assumed horizontal to vertical hydraulic conductivity ratio of 3.

The permeability or hydraulic conductivity of the rock units (Layers 3 & 4) will vary according to changes in the secondary structural features, such as joints and fractures, along which groundwater will flow. Whether the fractures have been filled by clay, as well as the orientation and interconnection of fractures will also cause changes in the rock mass permeability.

The modelling was carried out adopting mean (geometric) values of all the in-situ permeability test results in the fine grained, fractured sandstone (Mittagong Formation) and in the medium grained, slightly fractured to unbroken sandstone (Hawkesbury Sandstone). A horizontal to vertical hydraulic conductivity ratio of 3 has been assumed for each of these layers.

The adopted hydraulic conductivity or permeability values for all four layers are summarised in Table 4.

Table 4: Model Layer Summary

Model Layer	Top of Layer (RL m AHD	Layer Represents	Horizontal Hydraulic Conductivity (m/sec)	Vertical Hydraulic Conductivity (m/sec)
1	20.0	Fill and Alluvium	5 x 10^{-5}	5 x 10^{-5}
2	13.4	Residual Clay	5 x 10^{-8}	1.7 x 10^{-8}
3	11.9	Fractured Sandstone (Mittagong)	5.3 x 10^{-7}	1.8 x 10^{-7}
4	10.6	Slightly Fractured to Unbroken Sandstone (Hawkesbury)	1.3 x 10^{-7}	4.3 x 10^{-8}

The initial model, including the existing basement drainage in the adjacent Adina Hotel basement, was calibrated to match the existing water levels on the site with the groundwater level (or potentiometric head) ranging from about RL 13.8 m to RL 13.3 m. This calibration confirmed that the bedrock parameters chosen for the model appeared to be realistic. The calibrated initial (existing) groundwater levels are illustrated in Drawing M1 in Appendix D.

6.4 Basement Dewatering – Drain Cells

The MODFLOW drain package can be used to simulate water loss from the groundwater system which occurs due to dewatering operations. Drain cells set with a high conductance of 2,000 m/day simulated the dewatering during and post construction of the basements. The drain cells represent the sub-floor drainage and sumps/pumps located within the basement to dewater the site during construction and then to provide permanent drainage in the long term.

To simulate basement drainage in both the existing drained basement of Adina Hotel immediately adjacent to the site to the west and the proposed new basement, drain cells were set at the existing basement level of Adina Hotel and at the proposed new basement bulk excavation levels.

- Proposed New Basement Drain Cells @ RL 4.7 m AHD;
- Existing Basement of Adina Hotel Drain Cells @ RL 13.3 m AHD;

The predicted inflows into the drain cells, representing the basement dewatering system, were monitored throughout the model simulation using the zone budget module of MODFLOW.

6.5 Cut-off Walls

To reduce direct inflow through the sides of the excavation from the high permeability fill, alluvial soils and upper fractured rock, it is understood that relatively impermeable walls are to be installed around the basement excavation, except for the western boundary where the thickness of highly permeable soils is minimal.

Design of the cut-off walls is yet to be finalised, but they are envisaged to comprise contiguous piles with the gaps between piles sealed during construction by water-proof linings. The proposed cut-off walls were included in the numerical model by applying a horizontal flow barrier (HFB) to the cells at the excavation faces, which was assigned a nominal 0.5 m thickness with a hydraulic conductivity of 1×10^{-8} m. The wall was simulated to extend down to RL 8.6 m (i.e. at least 2 m cut-off into the slightly fractured and unbroken sandstone layer).

6.6 Groundwater Modelling Simulations

The model was initially run under a steady state flow condition with the Adina Hotel basement drain cell activated. Following calibration of the boundary conditions to match the existing groundwater measurement data, the cut-off walls and the drain cells for the proposed new basement were then activated and the model was run under transient flow conditions for a period of 5 years and then switched to long-term steady state flow conditions to assess the groundwater inflow rates into the basement during construction and then in the long-term.

7. Groundwater Modelling Results

7.1 Groundwater Inflow

Groundwater inflow into the drain cells representing the excavation dewatering system was monitored throughout the model simulations using the 'zone budget' module of MODFLOW. The inflow rates represent the estimated total rate of groundwater flowing into the excavation and the volume (per unit time) requiring extraction via the dewatering system (sump-and-pump) in order to dewater the basement excavation during construction and for the long-term case.

Simulated results are summarised in Table 5. During the early stages of construction, inflow rates will be higher and will then gradually decrease as the groundwater storage in the aquifer around the excavation decreases and the cone of depression in the potentiometric surface expands out from the basement.

The cumulative inflows during the first year of basement construction are predicted to be about 5.2 ML. In the long-term, inflows are predicted to be less than 2.1 ML per year.

Table 5: Predictive Model Simulated Inflow Results (i.e. Dewatering pumping rates)

Elapsed Time	Dewatering Inflow Rate		
	m^3 / day	L / min	ML / year
1 Day	22.5	15.6	5.2 (Cumulative during 1st Year)
5 Days	21.8	15.1	
14 Days	20.4	14.2	
30 Days	18.7	13.0	
90 Days	15.6	10.8	
180 Days	13.7	9.5	
300 Days	11.7	8.1	
1 Year	11.2	7.8	
2 Years	9.9	6.9	3.6
3 Years	9.3	6.5	3.4
5 Years	8.6	6.0	3.1
Long-term	5.7	4.0	2.1

It should be noted that these volumes are best estimates of the average inflows. It is entirely possible that there could be local zones of higher permeability which could increase the inflows significantly. Accordingly, it is recommended that a 'factor of safety' of at least 2 be applied to these numbers for design purposes and that these flow rates be monitored during excavation and construction.

It should be noted that the simulated dewatering rates and drawdown are dependent on the dewatering scheme adopted for the site as included in the numerical models. If the depth of the basement drainage and sumps or cut-off walls change then the currently predicted dewatering rates may change and further modelling will be required.

7.2 Predicted Groundwater Drawdown

Drawing M2 in Appendix D shows the predicted long-term groundwater table following the completion of the proposed 'drained' basement. The long-term drawdown contours were produced by subtracting the predicted water levels from the initial groundwater levels and are illustrated on Drawing M3 in Appendix D.

The model results indicate that the potential drawdown or impact on the water table may extend up to 50 m from the site boundaries on the upstream side and 110 m on the downstream side, as shown by the 0.5 m drawdown contour in Drawing M3.

The predicted drawdowns below key structures around the site are:

• Central Station - Regional Line Tracks and Platforms	Drawdown 0.5-2.5 m
• Adina Hotel	Drawdown 1.5-2.5 m
• Existing Devonshire Street Tunnel	Drawdown 0.5-2.5 m
• Office Complex at 8A, 12-30 Lee Street	Drawdown 0.5-2.5 m
• Railway Square	Drawdown 0.5-1.0 m

7.3 Drawdown Induced Settlement

The upper perched water table within the fill and alluvial soils is expected to be governed by rainfall infiltration. Assuming that perimeter cut-off walls are constructed down into the sandstone, this perched water table is expected to continue fluctuating above and below the soil-rock interface, even after the construction of the 'drained' basement. The neighbouring structures and pavement founded on fill or alluvial soils are therefore not expected to experience noticeable dewatering induced settlement.

The lower groundwater table in the sandstone, following the construction of the 'drained' basement, is expected to be close to the bulk excavation level immediately behind the excavation faces of the basement, corresponding a maximum drawdown of approximately 9 m, gradually reducing to less than 0.5 m drawdown at distances of about 50 m – 110 m away from the basement boundaries.

The maximum drawdowns below the adjacent key structures are predicted to be up to 2.5 m. Despite these relatively high levels of local drawdown, the drawdown is expected to occur mostly within sandstone. There should be minimal impact of this drawdown on adjacent structures founded on sandstone (i.e. total additional settlements or differential settlements < 5 mm), due to the high deformation modulus of the sandstone bedrock.

8. Potential Impact on Neighbouring Properties

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

Table 6: Assessment of Potential Effects of Dewatering.

Item	Comment
Proximity of Groundwater Dependent Ecosystems (GDEs)	No known groundwater dependent ecosystems within 1-kilometre radius of the site(1).
Water supply losses by neighbouring groundwater users	A review of registered bores within a 500 m radius to the surrounding site was undertaken. The search (2) identified no extraction bores within the search area. 43 monitoring bores were identified, with the nearest one located approximately 260 m from the site. All of the groundwater bores are located beyond the assessed zone-of-influence from the anticipated drawdown.
Potential subsidence of neighbouring structures	It is considered that the local lowering of the water levels within the sandstone will have no significant impact on the surrounding properties or structures.
Mounding of water upgradient of structure	Significant mounding of groundwater is not expected. A drained basement would eliminate potential mounding.

Note: (1) Based on the search results undertaken in Groundwater Dependent Ecosystem (GDE) Altas on the Bureau of Meteorology's (BoM) website

(2) Based on the search results undertaken in Australian Groundwater Explorer on the BoM's website.

9. Aquifer Interference Policy Considerations

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 basement dewatering on site is expected to occur in the sandstone profile of relatively low permeability with low yield, and is considered to be a "less productive groundwater source" as outlined in the AIP.

It is expected that the measured water levels within the rock on the site are probably associated with seepage flowing through bedding planes, fractures and joints in the rock. Once the groundwater level stabilises following initial excavation, these seepage flows are likely to be relatively minor during periods of dry weather and may increase slightly following periods of wet weather.

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 groundwater sources;

- less than or equal to 10% cumulative variation in water table 40 m from any high priority groundwater dependant ecosystem, high priority culturally significant site, 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;
- any change in groundwater quality should not lower the beneficial use category of the groundwater source beyond 40 m from the activity.

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

- the water take for the basement does not involve pumping or extraction of large volumes of groundwater. Water seepage through the rock is to be collected in subfloor drainage and directed to the stormwater or sewer system (subject to approval by Council or by Sydney Water);
- there are no registered groundwater users within 500 m of the site;
- DP is not aware of any groundwater dependant ecosystems within one-kilometre radius of the site;
- DP is not aware of any water sharing agreements in the area; and
- the water take can be easily measured during the construction period and in the long term, if required.

10. Disposal of Groundwater Contaminants

Selected groundwater samples were tested for common contaminants during the contamination site investigations in order to assess potential disposal options. The results are presented in the following DP Reports and summarised below:

- Report on Detailed Site (Contamination) Investigation, ref: 86767.01.R.001, dated August 2019 (DP 2019); and
- Report on Supplementary Site (Contamination) Investigation, ref: 86767.03.R.001, dated June 2020 (DP 2020).

DP has installed a total of five groundwater wells screened in Hawkesbury Sandstone include:

- an upgradient groundwater well (BH104);
- a downgradient groundwater well (BH112B) and
- three groundwater wells within the northern central (BH5), south-western portion (BH107B) and close to the northern boundary (BH112B) of the site.

DP has installed a total of three groundwater wells screened in Mittagong Formation include:

- an upgradient groundwater well (BH103);
- a downgradient groundwater well (BH112A) and
- a groundwater well in the south-western portion of the site (BH107A).

The location of the above groundwater wells is depicted on Drawings of DP (2020) report. The nested wells including BH107A / BH107B and BH112A / BH112B were installed to target different rock strata. The sampling design of the well locations/rock stratum was reviewed and approved by an NSW EPA accredited Auditor, Rod Harwood of Harwood Environmental Consultant on 3 September 2020. In addition, an upgradient well was installed in the sand profile (denoted as BH1) during the DP(2019) investigation located near the south-eastern boundary of the site.

No obvious signs of environmental concern (i.e. light nonaqueous phase liquids (LNAPLs) or odour) were noticed during field investigation. There were, however, detectable concentrations of total recoverable hydrocarbon (TRH) in groundwater wells: BH107A and BH107B and BH112A which may exhibit minor hydrocarbon odour.

In summary, laboratory test results confirmed the presence of some contaminants of potential concern (COPC) in the groundwater. Copper and zinc were detected at concentrations above the groundwater site assessment criteria (SAC), while polycyclic aromatic hydrocarbons (PAH), total recoverable hydrocarbons (TRH) and other metals were detected at levels below the SAC. PAH was only detected in the two down-gradient wells (BH112A and BH112B), indicating that the source of the PAH could be from the fill on site. However, soil leachability (TCLP) testing results do not indicate that PAH is likely to leach from the fill into the groundwater.

The elevated levels of copper and zinc in groundwater are common in heavily urbanised areas. Elevated levels of copper and zinc were identified in both the up-gradient and down-gradient groundwater wells. The source of the copper and zinc is uncertain but could be linked to the copper and zinc concentrations in the fill layer on site, or to the services network at or in proximity to the site. However, considering that elevated levels of copper and zinc were not evident in the fill, the copper and zinc levels identified in the groundwater wells at the site are likely to represent regional background levels rather than site-specific levels.

DP has carried out extensive groundwater contamination assessments across the site including two upgradient groundwater wells to determine the quality of groundwater flowing into the site. Given that bulk of the fill material will be removed as part of the basement excavation, any on-site source (e.g. primarily from historical fill material) of existing groundwater contamination would be removed. The overall risk of encountering (existing) groundwater contamination (if any) from on-site and off-site sources based on the recent groundwater investigations (DP 2019 and DP2020) appears to be low. There is, however, a risk of encountering groundwater contamination via the rock joints from future off-site sources or plumes (e.g. accidental chemical spill near the site) which occur within approximately a 110 m radius from the site, based on the drawdown modelling.

Further sampling and testing of the groundwater are likely to be required by the City of Sydney Council to assess the quality and suitability of the groundwater prior to discharge to the stormwater system. Alternatively, groundwater could be discharged into sewers, subject to approval from Sydney Water, or to a licensed liquid waste facility. No disposal of groundwater to stormwater or sewer can be carried out until a permit is issued by Council (for stormwater disposal) or Sydney Water (sewer disposal). It is likely that a groundwater management plan will be required as part of the application for a dewatering license.

On the basis of the current information, any water collected on site should be stored in a holding tank for further assessment of contaminants (including iron), pH, oil and grease, suspended solids, volatile organic compounds (VOC) and hardness prior to disposal. It is anticipated that the groundwater will be suitable for disposal following appropriate treatment (subject to monitoring results).

If treatment of contaminants is required by Council (stormwater discharge) or Sydney Water (sewer discharge), a remediation contractor can be engaged to devise a concept and/or detailed design of the treatment system. This would generally involve the following (or similar):

- Settlement tanks, to remove suspended solids from the dewatered excavation;
- Oil-water separator vessels, to recover floating product and separate sinking product (if any);
- Sand filtration, to remove fine sediment from the water stream,
- Aeration, to remove BOD; and
- Granular activated carbon (GAC) filtration and resultant filtration to adsorb contaminants.

11. Conclusions

The site investigations have identified fill and alluvial soils over residual clay and weak sandstone rock grading medium to high strength sandstone. A perennial groundwater level has been measured at about RL 13.7 m in standpipes on the site within the medium to high strength rock. A perched, intermittent groundwater table is present within the near surface fill and alluvial soils, but is not expected to be impacted by the proposed excavation provided that perimeter water-tight cut-off walls are constructed and extended 2 m into the slightly fractured or unbroken sandstone.

The proposed excavation is expected to extend to approximately 9 m below the measured groundwater level in medium to high strength sandstone.

An estimate of groundwater inflow into the new basement has been undertaken using 3D Finite Difference modelling techniques. The annual inflow rates have been estimated to be in the order of 5.2 ML for the first year of basement construction, gradually decreasing to 2.1 ML per year for the long term. However, based on our experience in other deep excavations into sandstone bedrock in the area, DP expects that the actual seepage into the excavation will be much lower than these predicted values due to the low volumes of water contained within the joints and defects in the rock.

If the predicted annual inflow is more than 3 ML/year, the proposed basement, if constructed as a ‘drained’ basement, will generally require a Water Access License and a Water Supply Approval for construction and long-term dewatering from the relevant approval bodies such as NRAR (DPIE) or Water NSW. On-going groundwater contamination testing and long-term on-site treatment may be required prior to discharge.

Due to the high deformation modulus (compressibility) of the sandstone, any long-term drawdown of the groundwater level is not expected to cause any significant settlement of the neighbouring structures.

In conclusion, it is considered, from a hydrogeological point of view, that a ‘drained’ basement is feasible without any significant impact to surrounding groundwater systems or property. This will be subject to review and approval from Council and relevant authorities

12. Limitations

Douglas Partners (DP) has prepared this report for this project at 8-10 Lee Street, Haymarket, in accordance with DP's proposal SYD190190.P.003.Rev5, and acceptance received from Avenor Pty Ltd on behalf of Vertical First Pty Ltd on 7 May 2020. The work was carried out under a consultancy agreement. This report is provided for the exclusive use of Vertical First Pty Ltd or their agents, for this project only and for the purposes as described in the report. It should not be used by or be relied upon for other projects or purposes on the same or other site or by a third party. Any party so relying upon this report beyond its exclusive use and purpose as stated above, and without the express written consent of DP, does so entirely at its own risk and without recourse to DP for any loss or damage. In preparing this report DP has necessarily relied upon information provided by the client and/or their agents.

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

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

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

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

The contents of this report do not constitute formal design components such as are required, by the Health and Safety Legislation and Regulations, to be included in a Safety Report specifying the hazards likely to be encountered during construction and the controls required to mitigate risk. This design process requires risk assessment to be undertaken, with such assessment being dependent upon factors relating to likelihood of occurrence and consequences of damage to property and to life. This, in turn, requires project data and analysis presently beyond the knowledge and project role respectively of DP. DP may be able, however, to assist the client in carrying out a risk assessment of potential hazards contained in the Comments section of this report, as an extension to the current scope of works, if so requested, and provided that suitable additional information is made available to DP. Any such risk assessment would, however, be necessarily restricted to the groundwater components set out in this report and to their application by the project designers to project design, construction, maintenance and demolition.

Douglas Partners Pty Ltd

Appendix A

About This Report

About this Report

Introduction

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

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

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Borehole and Test Pit Logs

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

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

Groundwater

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

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

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

Reports

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

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

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

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

About this Report

Site Anomalies

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

Information for Contractual Purposes

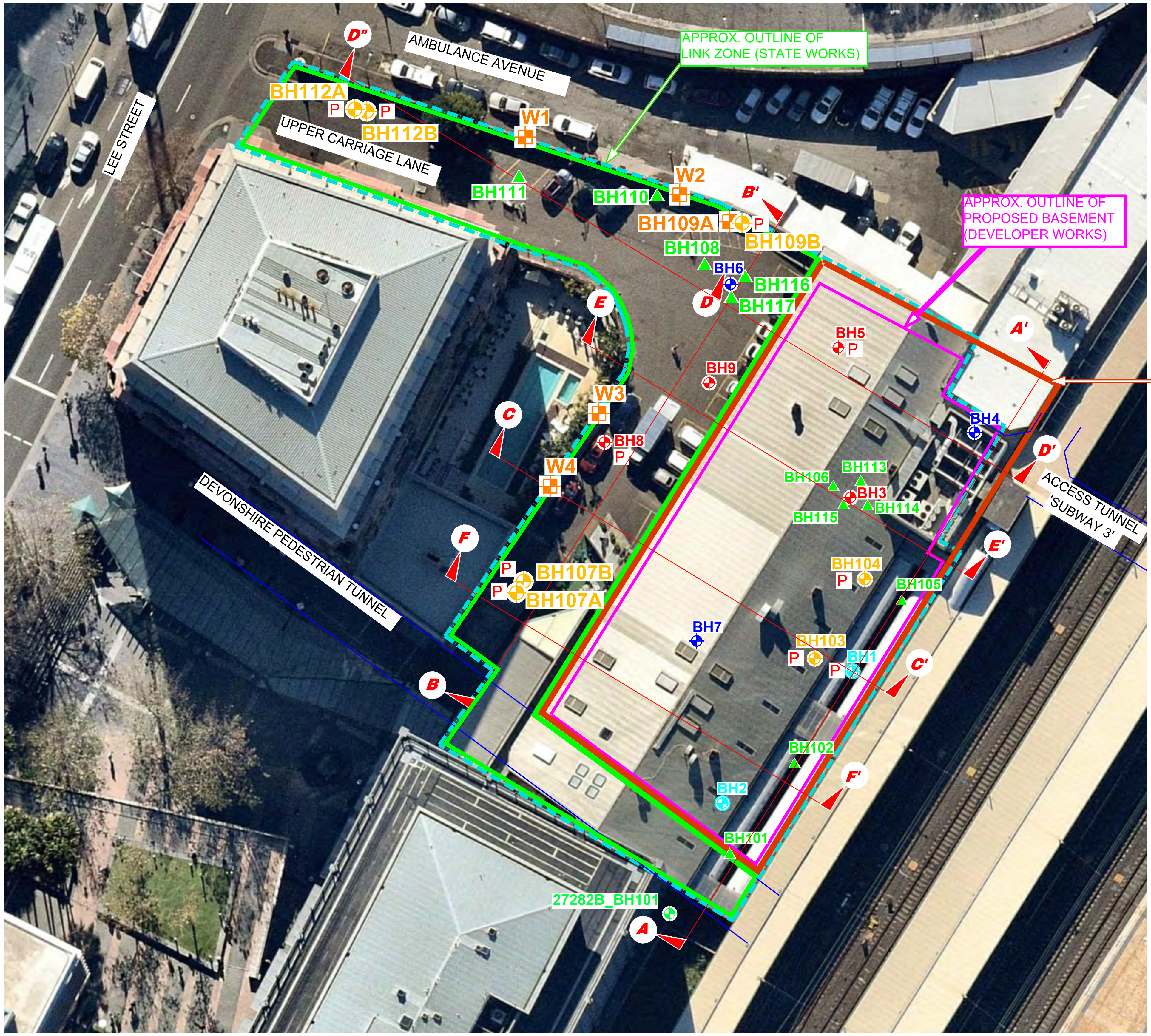
Where information obtained from this report is provided for tendering purposes, it is recommended that all information, including the written report and discussion, be made available. In circumstances where the discussion or comments section is not relevant to the contractual situation, it may be appropriate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

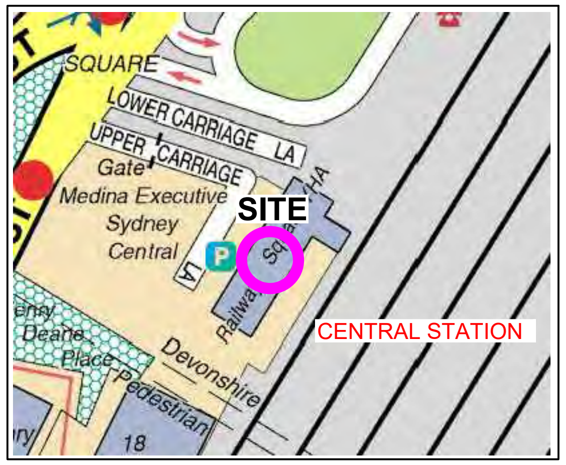
Site Inspection

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

Appendix B

Drawings





Locality Plan

LEGEND

- ⊕ Previous geotechnical borehole (DP Project 27282B, dated 1999)
- ⊕ Environmental borehole - Lower Ground Floor (DP Report 86767.01.R.001.DftB, dated 29 August 2019)
- ⊕ Geotechnical & environmental borehole - Lower Ground Floor (DP Report 86767.00.R.001.Rev0, dated 26 August 2019)
- ⊕ Geotechnical & environmental borehole - Upper Ground Floor (DP Report 86767.00.R.001.Rev0, dated 26 August 2019)
- ▲ Environmental borehole
- ⊕ Geotechnical & environmental borehole
- ⊞ Geotechnical borehole
- P Standpipe piezometer
- A A' Geotechnical Cross Section A-A'
- — · — Approximate site boundary

NOTE:

1: Base image from Nearmap.com (Dated 1 July 2019)

2: Test locations are approximate only and are shown with reference to existing features.

3. Approximate Development Outlines are as provided by Avenor Pty Ltd on 12 August 2019.

0 5 10 15 20 30 40 50m

1:500 @ A3

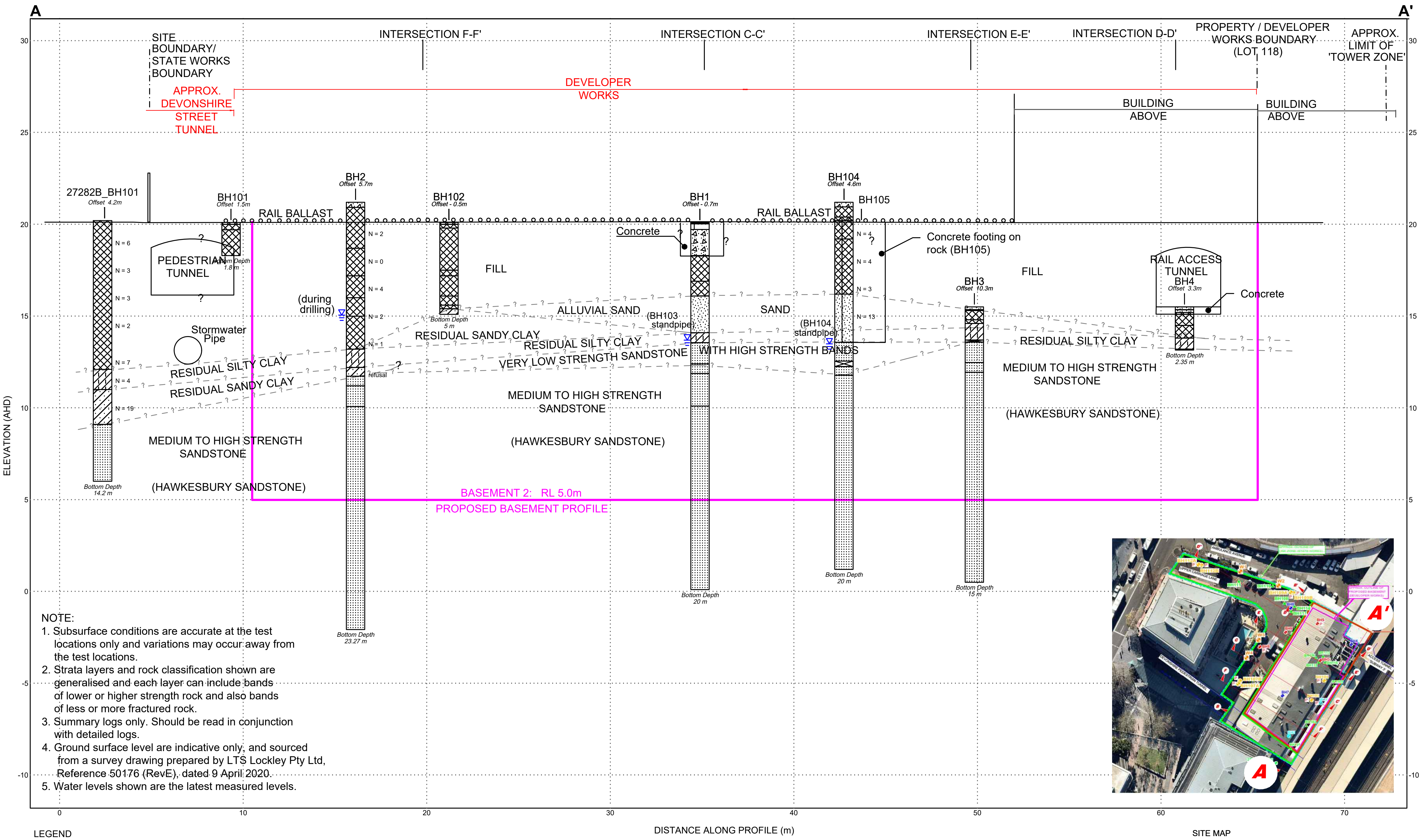
Douglas Partners
Geotechnics | Environment | Groundwater

CLIENT: Atlassian Pty Ltd
OFFICE: Sydney
DRAWN BY: HDS
SCALE: 1:500 @ A3
DATE: 16.06.2020

TITLE: **Test Location Plan**
Proposed Commercial Development
8-10 Lee Street, HAYMARKET

N

PROJECT No: 86767.00
DRAWING No: 1
REVISION: 8



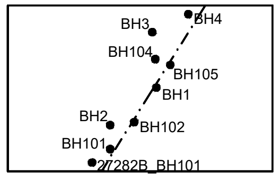
NOTE:
1. Subsurface conditions are accurate at the test locations only and variations may occur away from the test locations.
2. Strata layers and rock classification shown are generalised and each layer can include bands of lower or higher strength rock and also bands of less or more fractured rock.
3. Summary logs only. Should be read in conjunction with detailed logs.
4. Ground surface level are indicative only, and sourced from a survey drawing prepared by LTS Lockley Pty Ltd, Reference 50176 (RevE), dated 9 April 2020.
5. Water levels shown are the latest measured levels.

LEGEND

▨ Concrete	▨ Sand
▨ Bricks	▨ Silty Clay
▨ Fill	▨ Sandstone
▨ Sandy Clay	☒ Core Loss

TESTS / OTHER
N - Standard penetration test value
▽ - Water level

SITE MAP



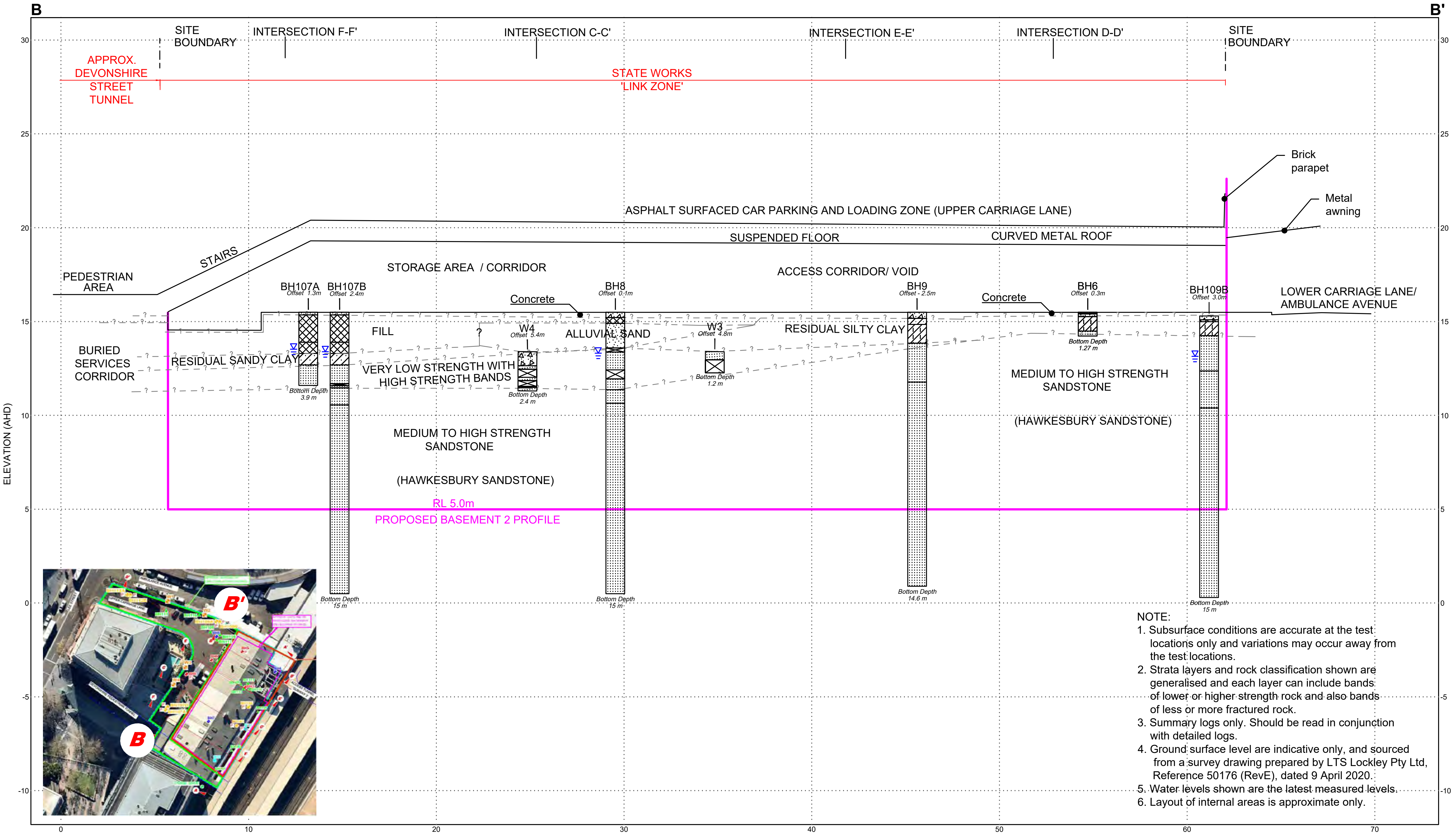
0 4
Horizontal Scale (metres)
Natural Scale

Douglas Partners
Geotechnics / Environment / Groundwater

CLIENT: Vertical First Pty Ltd
OFFICE: Sydney
DRAWN BY: HDS
SCALE: 1:200 (H) 1:200 (V) @ A3
DATE: 16.06.2020

TITLE: **Interpreted Geotechnical Cross-Section A-A'**
Proposed Commercial Development
8-10 Lee Street, HAYMARKET

PROJECT No: 86767.00
DRAWING No: 2
REVISION: 3



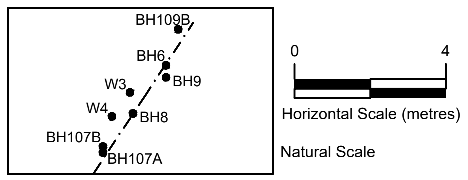
NOTE:
1. Subsurface conditions are accurate at the test locations only and variations may occur away from the test locations.
2. Strata layers and rock classification shown are generalised and each layer can include bands of lower or higher strength rock and also bands of less or more fractured rock.
3. Summary logs only. Should be read in conjunction with detailed logs.
4. Ground surface level are indicative only, and sourced from a survey drawing prepared by LTS Lockley Pty Ltd, Reference 50176 (RevE), dated 9 April 2020.
5. Water levels shown are the latest measured levels.
6. Layout of internal areas is approximate only.

LEGEND

☒ Core Loss	▩ Filling	▨ Silty Clay
■ Asphaltic Concrete	⛆ Sand	
▨ Clay	▦ Sandstone	
⛆ Concrete	▨ Silty Clay	

TESTS / OTHER
N - Standard penetration test value
▽ - Water level

SITE MAP

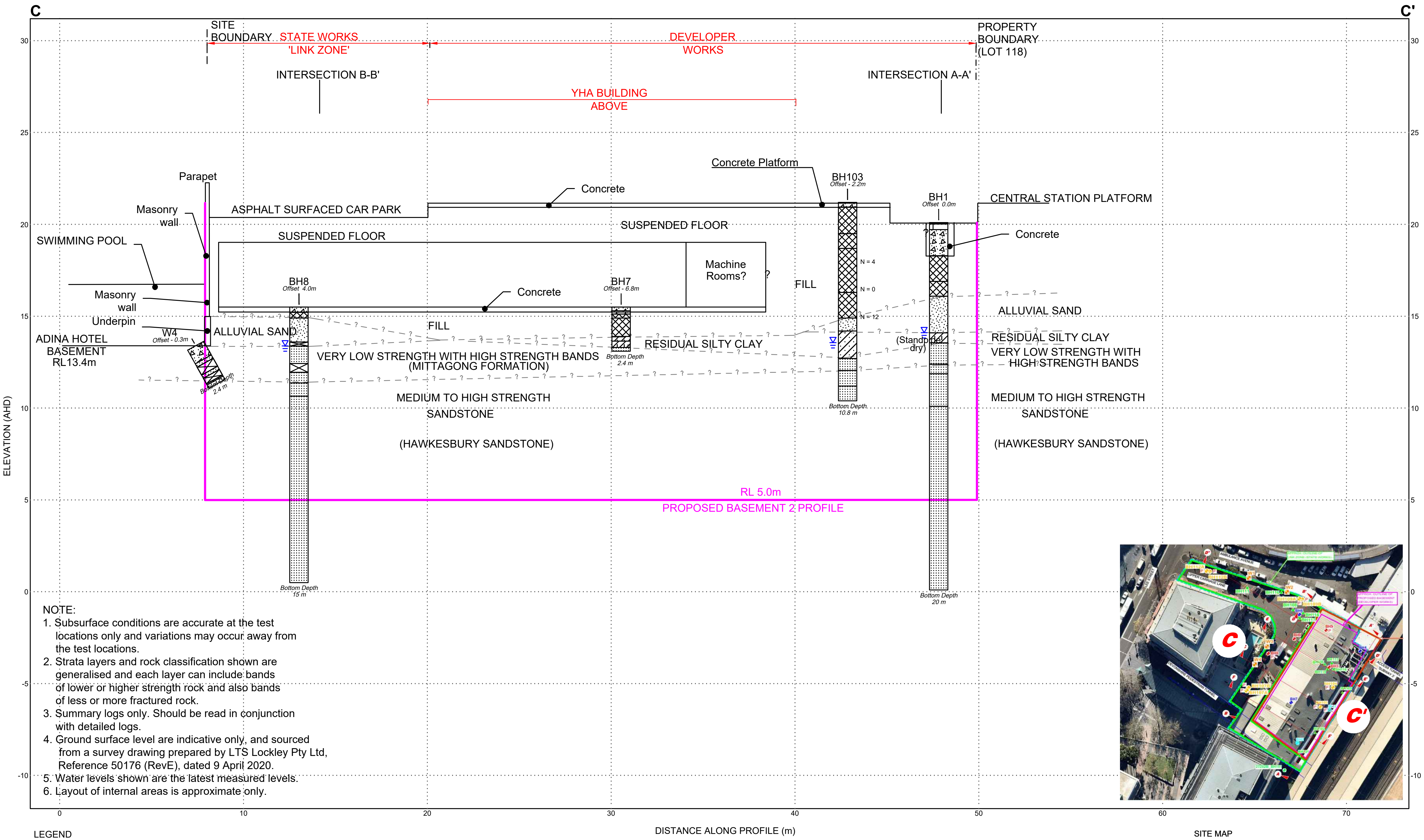


Douglas Partners
Geotechnics | Environment | Groundwater

CLIENT: Vertical First Pty Ltd
OFFICE: Sydney
DRAWN BY: HDS
SCALE: 1:200 (H) 1:200 (V) @ A3
DATE: 16.06.2020

TITLE: **Interpreted Geotechnical Cross-Section B-B'**
Proposed Commercial Development
8-10 Lee Street, HAYMARKET

PROJECT No: 86767.00
DRAWING No: 3
REVISION: 3



NOTE:

1. Subsurface conditions are accurate at the test locations only and variations may occur away from the test locations.
2. Strata layers and rock classification shown are generalised and each layer can include bands of lower or higher strength rock and also bands of less or more fractured rock.
3. Summary logs only. Should be read in conjunction with detailed logs.
4. Ground surface level are indicative only, and sourced from a survey drawing prepared by LTS Lockley Pty Ltd, Reference 50176 (RevE), dated 9 April 2020.
5. Water levels shown are the latest measured levels.
6. Layout of internal areas is approximate only.

LEGEND

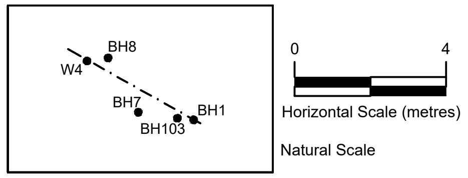
☒ Core Loss	▨ Sand
▤ Bricks	▦ Sandstone
▨ Concrete	▨ Silty Clay
▩ Filling	▨ Sandy Clay

TESTS / OTHER

N - Standard penetration test value

≚ - Water level

SITE MAP



Douglas Partners
Geotechnics | Environment | Groundwater

CLIENT: Vertical First Pty Ltd

OFFICE: Sydney

DRAWN BY: HDS

SCALE: 1:200 (H) 1:200 (V) @ A3

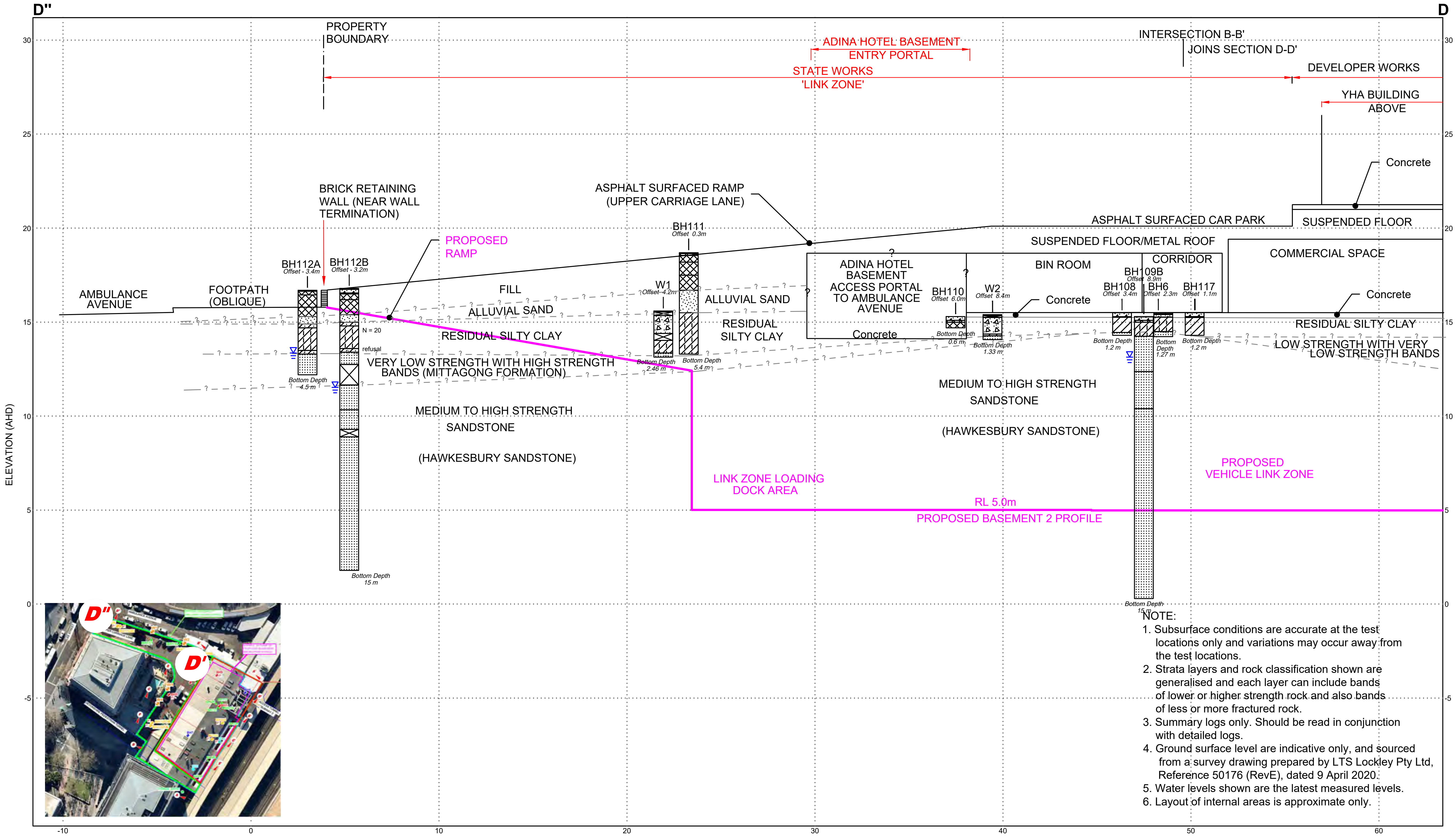
DATE: 16.06.2020

TITLE: **Interpreted Geotechnical Cross-Section C-C'**
Proposed Commercial Development
8-10 Lee Street, HAYMARKET

PROJECT No: 86767.00

DRAWING No: 4

REVISION: 3

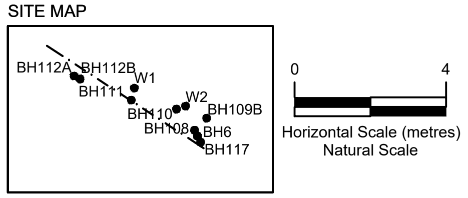


NOTE:
1. Subsurface conditions are accurate at the test locations only and variations may occur away from the test locations.
2. Strata layers and rock classification shown are generalised and each layer can include bands of lower or higher strength rock and also bands of less or more fractured rock.
3. Summary logs only. Should be read in conjunction with detailed logs.
4. Ground surface level are indicative only, and sourced from a survey drawing prepared by LTS Lockley Pty Ltd, Reference 50176 (RevE), dated 9 April 2020.
5. Water levels shown are the latest measured levels.
6. Layout of internal areas is approximate only.

LEGEND

- ☒ Core Loss
- ■ Asphaltic Concrete
- ▨ Clay
- △ Concrete
- ▩ Fill
- ░ Sand
- ▒ Sandstone
- ▨ Sandy Clay
- ▨ Silty Clay

SITE MAP

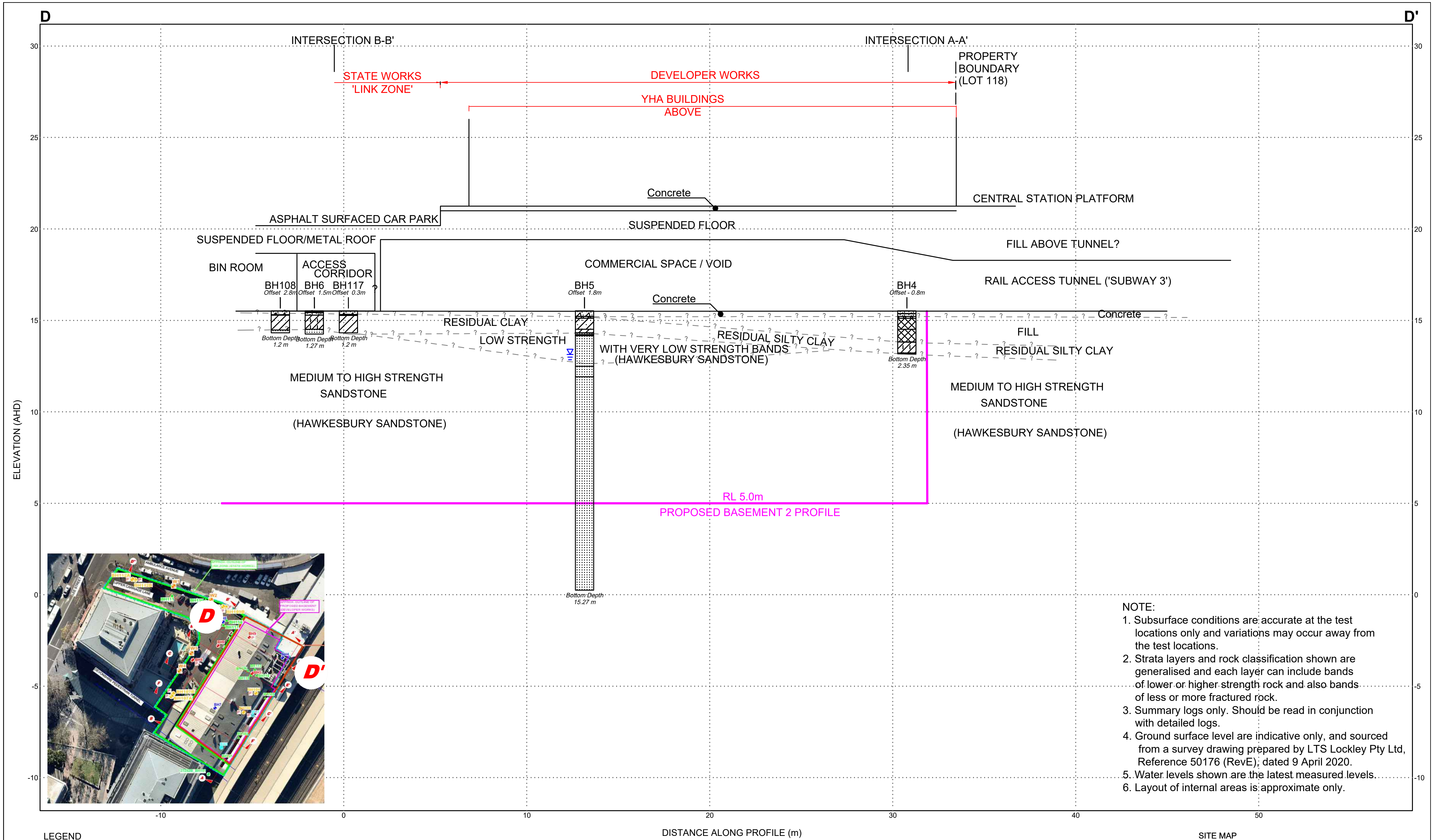


Douglas Partners
Geotechnics | Environment | Groundwater

CLIENT: Vertical First Pty Ltd
OFFICE: Sydney
DRAWN BY: HDS/ PSCH
SCALE: 1:200 (H) 1:200 (V) @ A3
DATE: 16.06.2020

TITLE: **Interpreted Geotechnical Cross-Section D"-D (extended)**
Proposed Commercial Development
8-10 Lee Street, HAYMARKET

PROJECT No: 86767.00
DRAWING No: 5
REVISION: 2

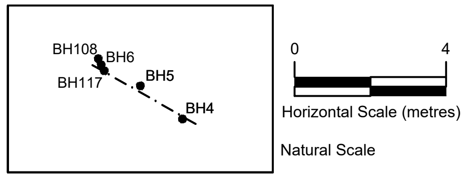


NOTE:
1. Subsurface conditions are accurate at the test locations only and variations may occur away from the test locations.
2. Strata layers and rock classification shown are generalised and each layer can include bands of lower or higher strength rock and also bands of less or more fractured rock.
3. Summary logs only. Should be read in conjunction with detailed logs.
4. Ground surface level are indicative only, and sourced from a survey drawing prepared by LTS Lockley Pty Ltd, Reference 50176 (RevE), dated 9 April 2020.
5. Water levels shown are the latest measured levels.
6. Layout of internal areas is approximate only.

LEGEND
- ☒ Core Loss
- ■ Asphaltic Concrete
- ▨ Concrete
- ▦ Fill
- ▒ Sandstone
- ▨ Sandy Clay
- ▥ Silty Clay
- ▨ Clay

TESTS / OTHER
N - Standard penetration test value
▽ - Water level

SITE MAP

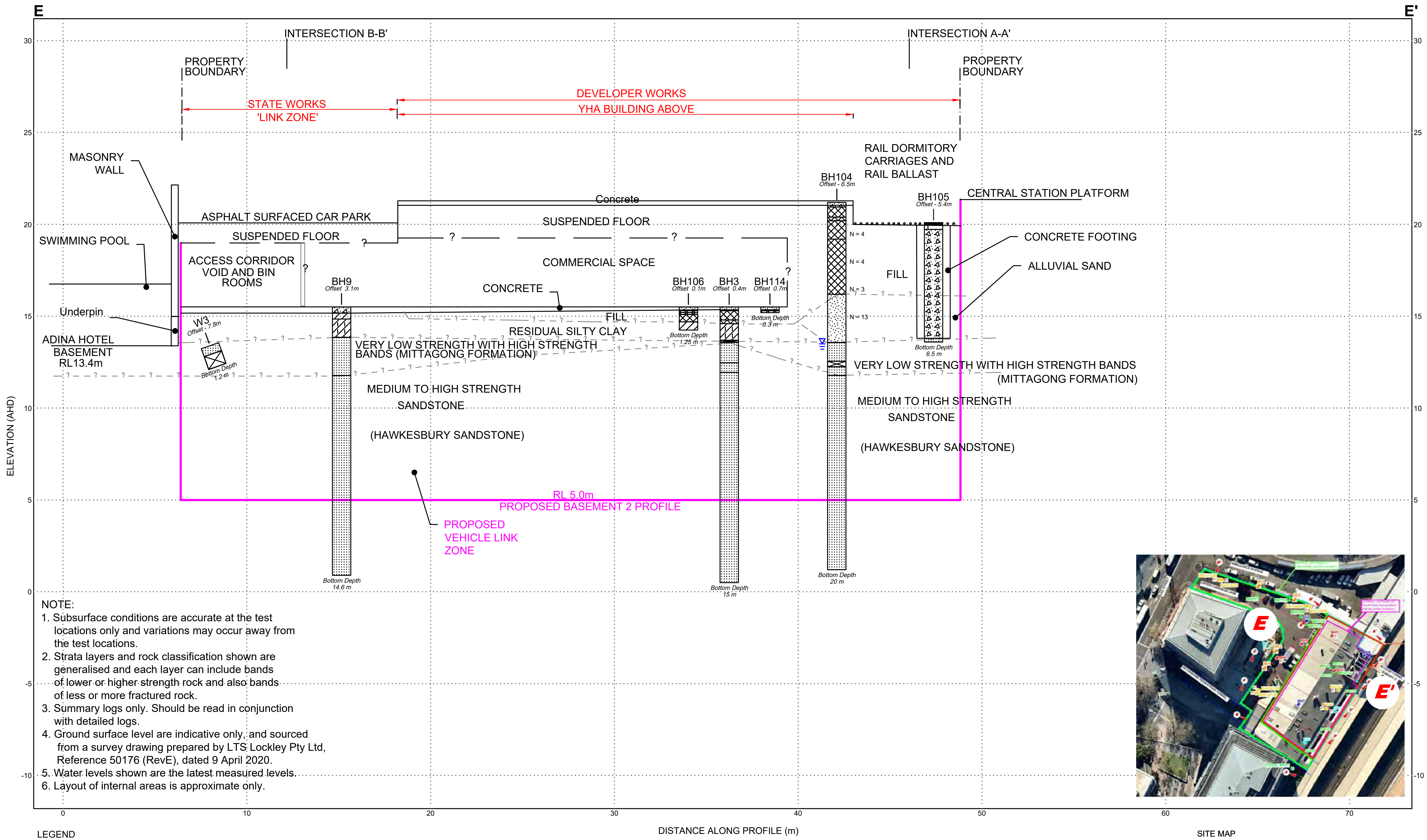


Douglas Partners
Geotechnics | Environment | Groundwater

CLIENT: Vertical First Pty Ltd
OFFICE: Sydney
DRAWN BY: HDS
SCALE: 1:200 (H) 1:200 (V) @ A3
DATE: 16.06.2020

TITLE: **Interpreted Geotechnical Cross-Section D-D'**
Proposed Commercial Development
8-10 Lee Street, HAYMARKET

PROJECT No: 86767.00
DRAWING No: 5A
REVISION: 3



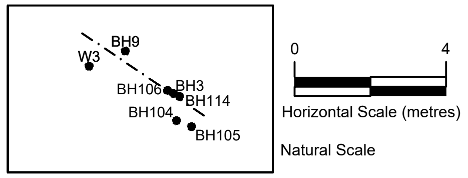
NOTE:
1. Subsurface conditions are accurate at the test locations only and variations may occur away from the test locations.
2. Strata layers and rock classification shown are generalised and each layer can include bands of lower or higher strength rock and also bands of less or more fractured rock.
3. Summary logs only. Should be read in conjunction with detailed logs.
4. Ground surface level are indicative only, and sourced from a survey drawing prepared by LTS Lockley Pty Ltd, Reference 50176 (RevE), dated 9 April 2020.
5. Water levels shown are the latest measured levels.
6. Layout of internal areas is approximate only.

LEGEND

☒ Core Loss	▦ Fill
▤ Bricks	░ Sand
▨ Clay	░ Sandstone
▩ Concrete	▨ Silty Clay

TESTS / OTHER
N - Standard penetration test value
▽ - Water level

SITE MAP

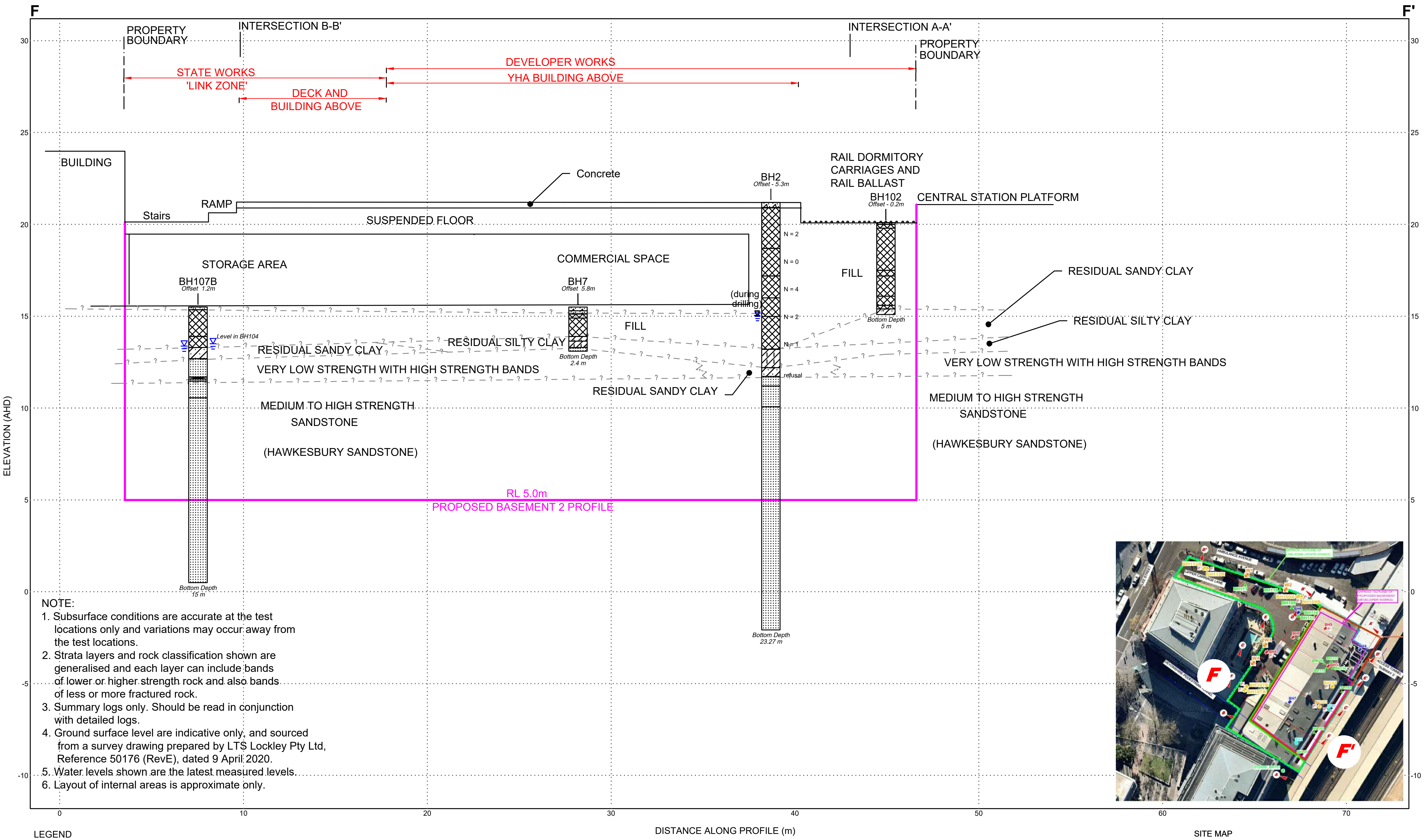


Douglas Partners
Geotechnics | Environment | Groundwater

CLIENT: Vertical First Pty Ltd
OFFICE: Sydney
DRAWN BY: HDS/ PSCH
SCALE: 1:200 (H) 1:200 (V) @ A3
DATE: 16.06.2020

TITLE: **Interpreted Geotechnical Cross-Section E-E'**
Proposed Commercial Development
8-10 Lee Street, HAYMARKET

PROJECT No: 86767.00
DRAWING No: 6
REVISION: 2



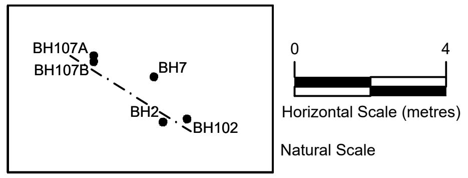
NOTE:
1. Subsurface conditions are accurate at the test locations only and variations may occur away from the test locations.
2. Strata layers and rock classification shown are generalised and each layer can include bands of lower or higher strength rock and also bands of less or more fractured rock.
3. Summary logs only. Should be read in conjunction with detailed logs.
4. Ground surface level are indicative only, and sourced from a survey drawing prepared by LTS Lockley Pty Ltd, Reference 50176 (RevE), dated 9 April 2020.
5. Water levels shown are the latest measured levels.
6. Layout of internal areas is approximate only.

LEGEND

☒	Core Loss
▨	Concrete
▩	Filling
░	Sandstone
▨	Sandy Clay
▨	Silty Clay

TESTS / OTHER
N - Standard penetration test value
▽ - Water level

SITE MAP



Douglas Partners
Geotechnics | Environment | Groundwater

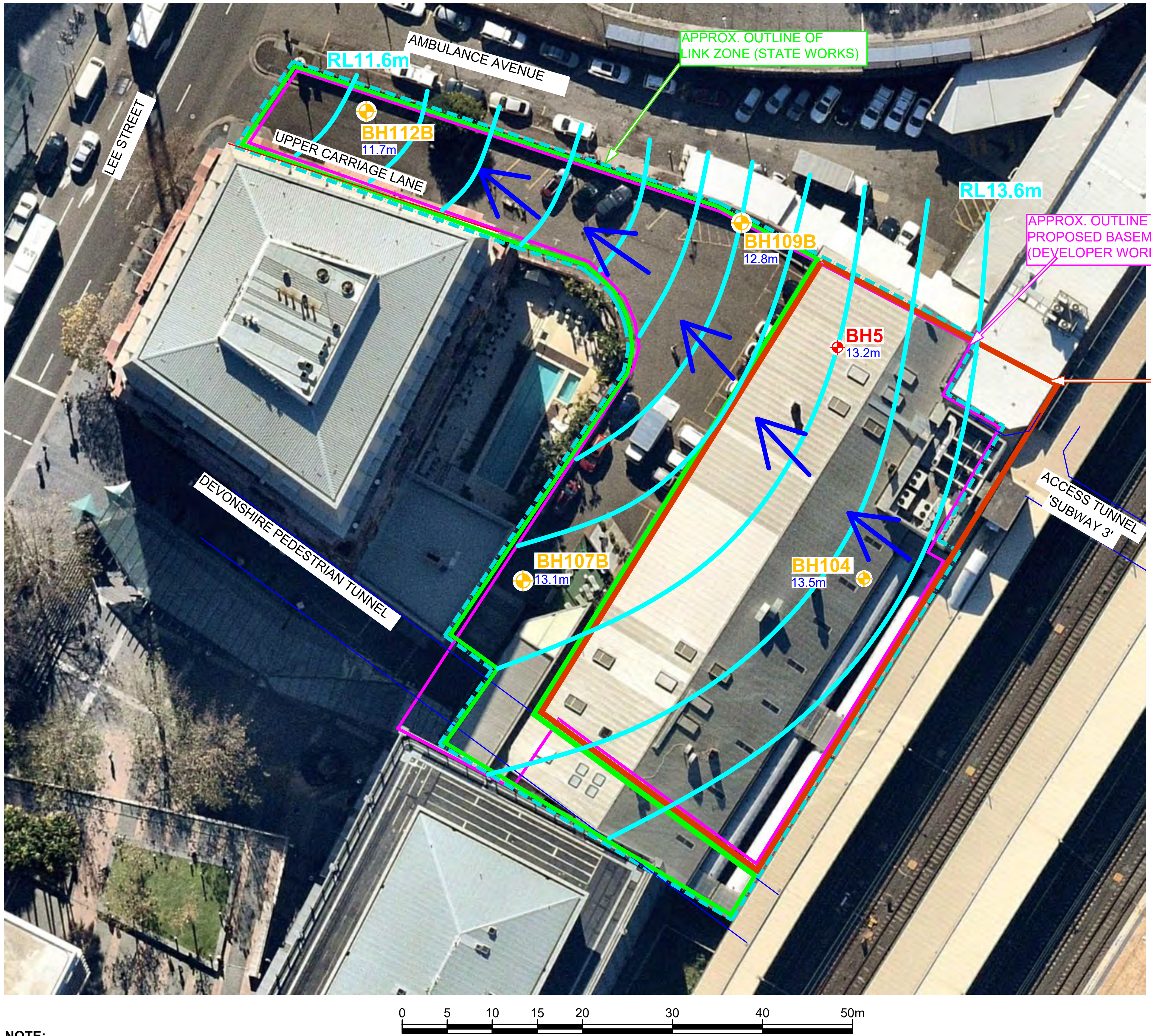
CLIENT: Vertical First Pty Ltd
OFFICE: Sydney
DRAWN BY: HDS
SCALE: 1:200 (H) 1:200 (V) @ A3
DATE: 16.06.2020

TITLE: **Interpreted Geotechnical Cross-Section F-F'**
Proposed Commercial Development
8-10 Lee Street, HAYMARKET

PROJECT No: 86767.00
DRAWING No: 7
REVISION: 2

Appendix C

Results of Groundwater Level Monitoring



Locality Plan

LEGEND

⊕	Geotechnical & environmental borehole - Lower Ground Floor (DP Report 86767.00.R.001.Rev0, dated 26 August 2019)
⊕	Geotechnical & environmental borehole (DP Report 86767.00.R001.Rev0, dated 26 August 2019)
━━━	Inferred groundwater contour (RL(m))
➔➔➔	Direction of flow
13.2m	Water elevation
RL13.6m	Contour elevation
— · — ·	Approximate site boundary

NOTE:

1. Base image from Nearmap.com (Dated 1 July 2019)
2. Test locations are approximate only and are shown with reference to existing features.
3. Approximate Development Outlines are as provided by Avenor Pty Ltd on 12 August 2019.
4. Groundwater level measurements taken on 05.05.2020 (BH5 and BH104) and 07.09.2020 (BH109B, 107B and 112B)
5. Bores not relevant to this drawing have been removed; refer to Drawing 1 or Report for location of all boreholes.
6. Groundwater contours shown for the site extents only.

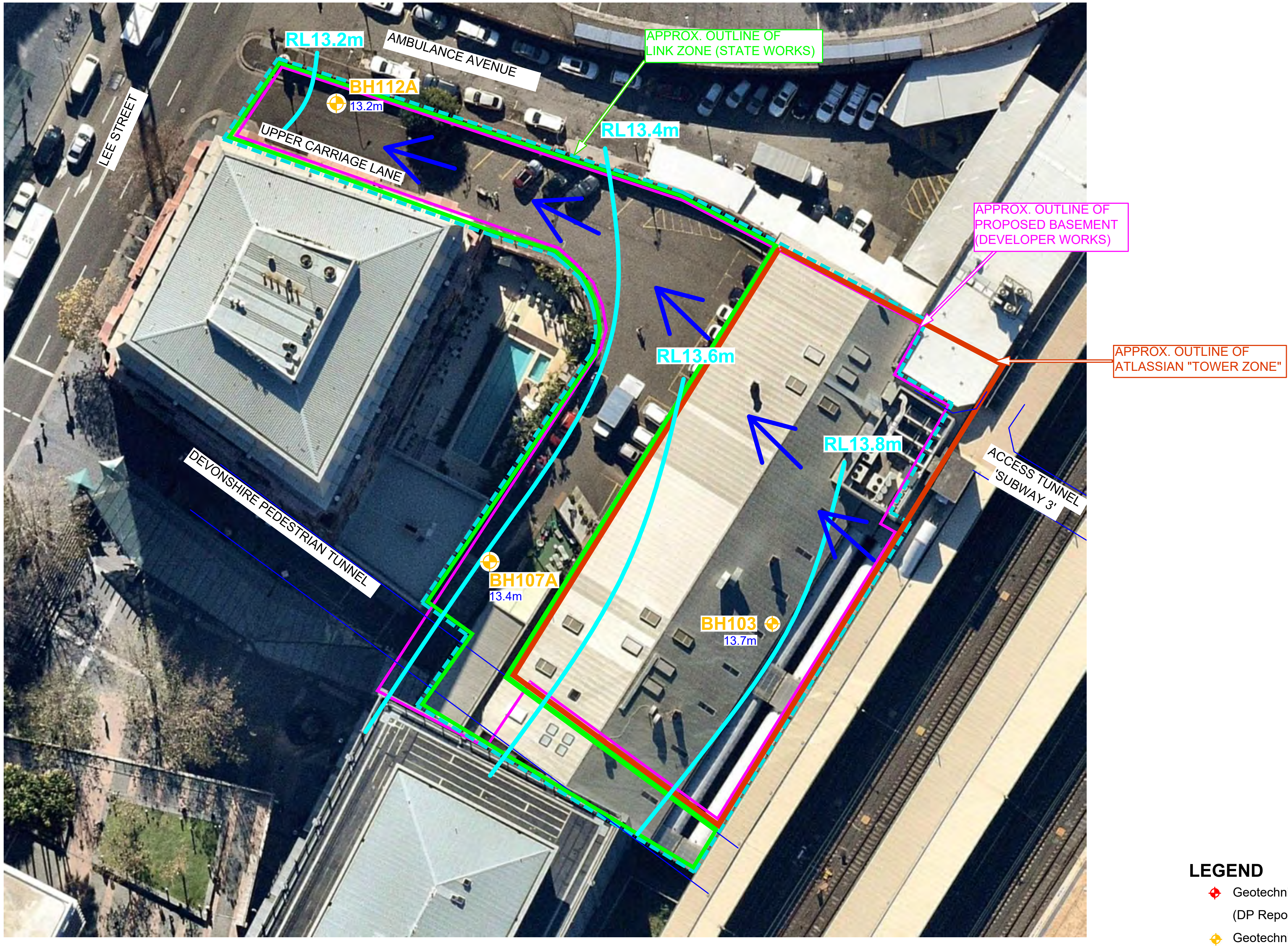
Douglas Partners
Geotechnics | Environment | Groundwater

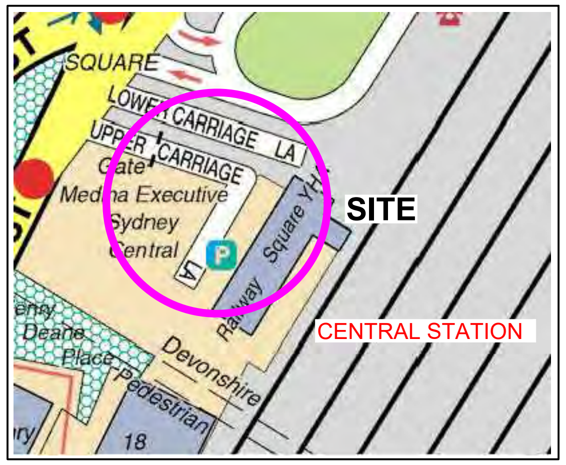
CLIENT: Vertical First Pty Ltd
OFFICE: Sydney
DRAWN BY: BZ
SCALE: 1:500 @ A3
DATE: 21.09.2020

TITLE: **Groundwater Levels and Flow Direction from Piezometers Screened in Hawkesbury Sandstone**
Proposed Commercial Development, 8-10 Lee Street, HAYMARKET

N

PROJECT No: 86767.06
DRAWING No: 3
REVISION: 0





Locality Plan

0 5 10 15 20 30 40 50m

1:500 @ A3

NOTE:

1. Base image from Nearmap.com (Dated 1 July 2019)
2. Test locations are approximate only and are shown with reference to existing features.
3. Approximate Development Outlines are as provided by Avenor Pty Ltd on 12 August 2019.
4. Groundwater level measurements taken on 05.05.2020 (BH5 and BH104) and 07.09.2020 (BH109B, 107B and 112B)
5. Bores not relevant to this drawing have been removed; refer to Drawing 1 or Report for location of all boreholes.
6. Groundwater contours shown for the site extents only.

LEGEND

⊕ Geotechnical & environmental borehole - Lower Ground Floor (DP Report 86767.00.R.001.Rev0, dated 26 August 2019)

⊕ Geotechnical & environmental borehole (DP Report 86767.00.R001.Rev0, dated 26 August 2019)

— Inferred groundwater contour (RL(m))

→→→ Direction of flow

13.2m Water elevation

RL13.6m Contour elevation

– – – Approximate site boundary

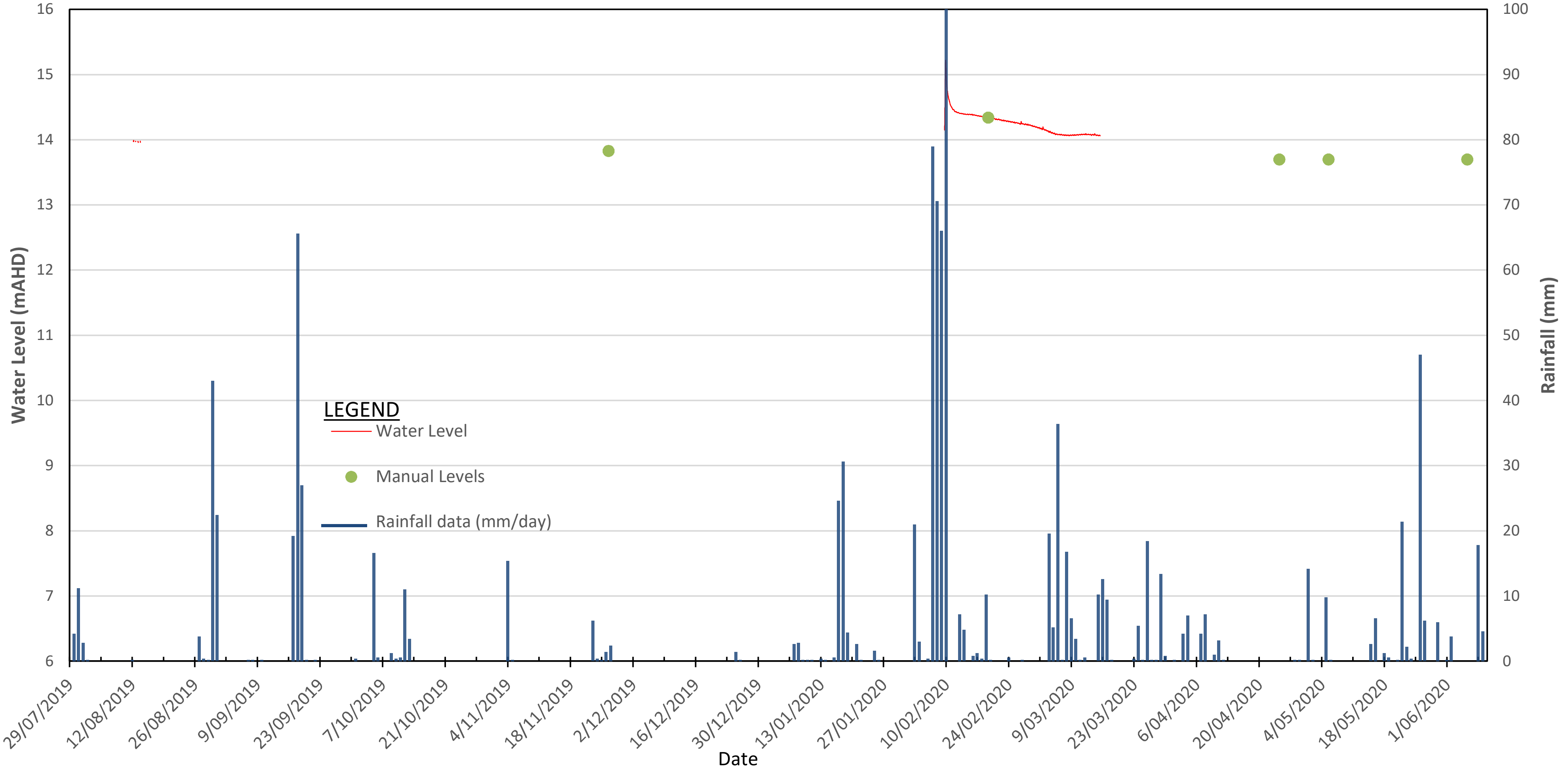
Douglas Partners
Geotechnics | Environment | Groundwater

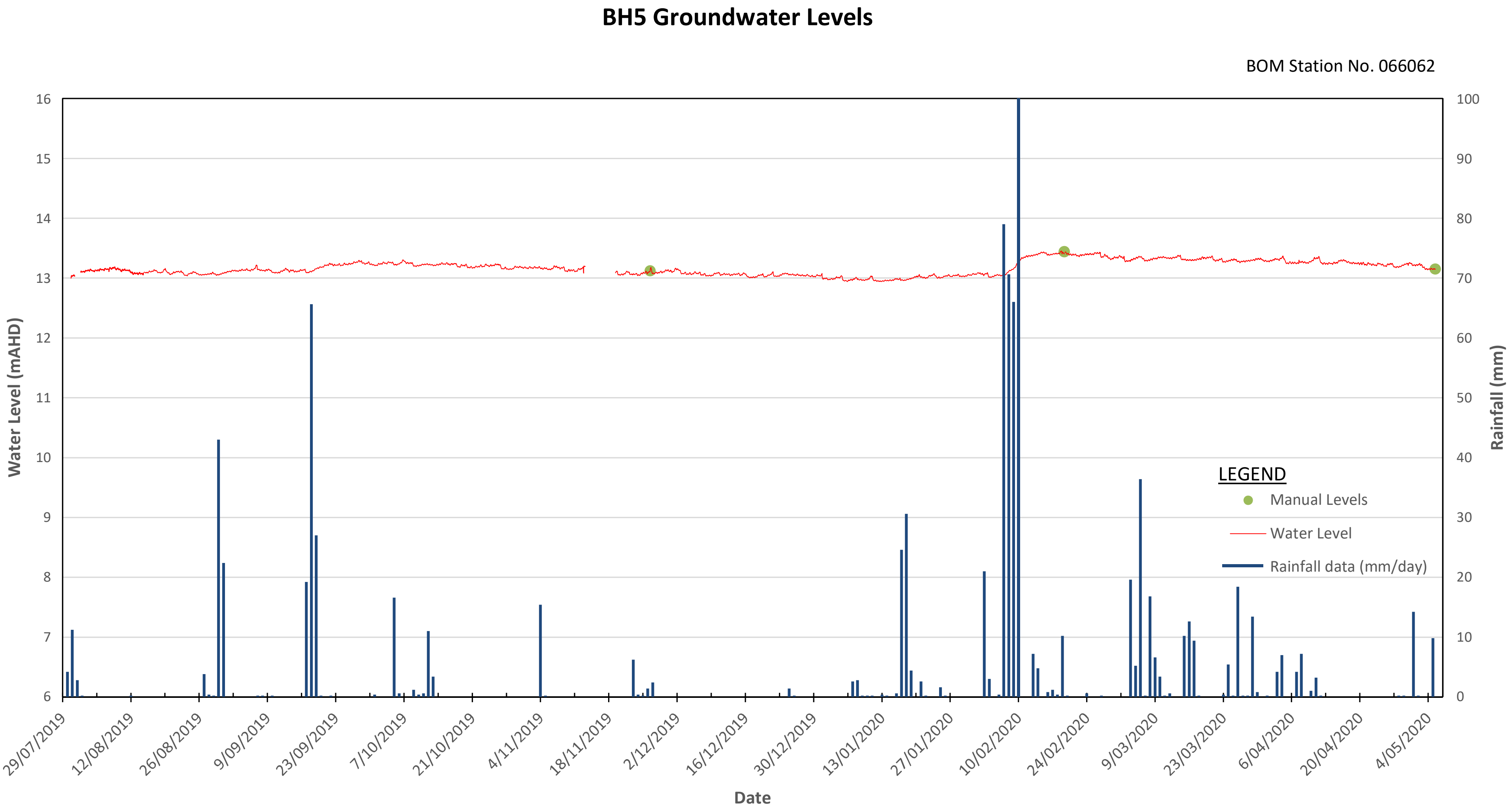
CLIENT: Vertical First Pty Ltd		TITLE: **Groundwater Levels and Flow Direction from Piezometers Screened in Mittagong Formation** **Proposed Commercial Development, 8-10 Lee Street, HAYMARKET**	PROJECT No: 86767.06
OFFICE: Sydney	DRAWN BY: BZ		DRAWING No: 4
SCALE: 1:500 @ A3	DATE: 21.09.2020		REVISION: 0

N

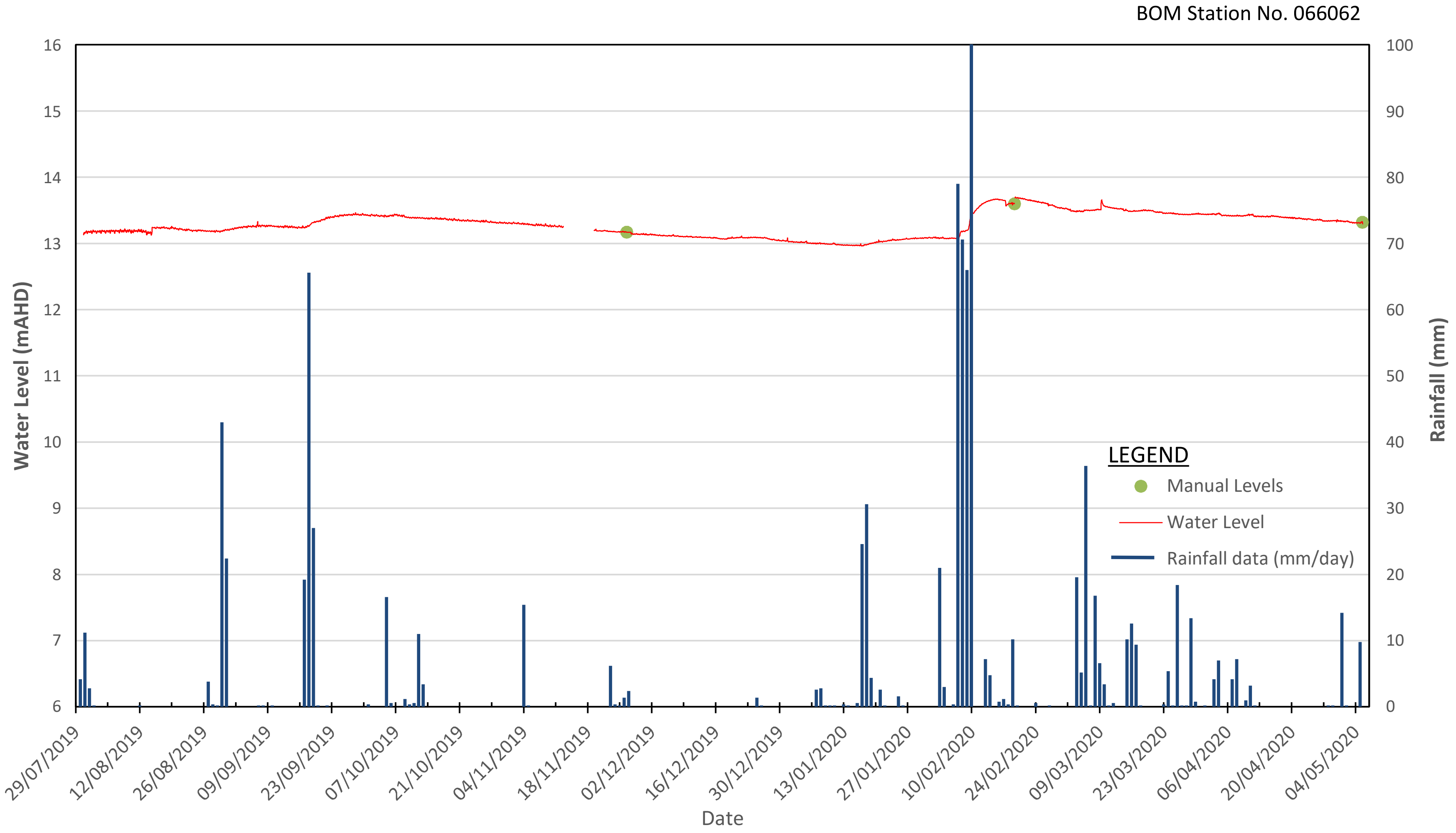
BH1 Groundwater Levels

BOM Station No. 066062

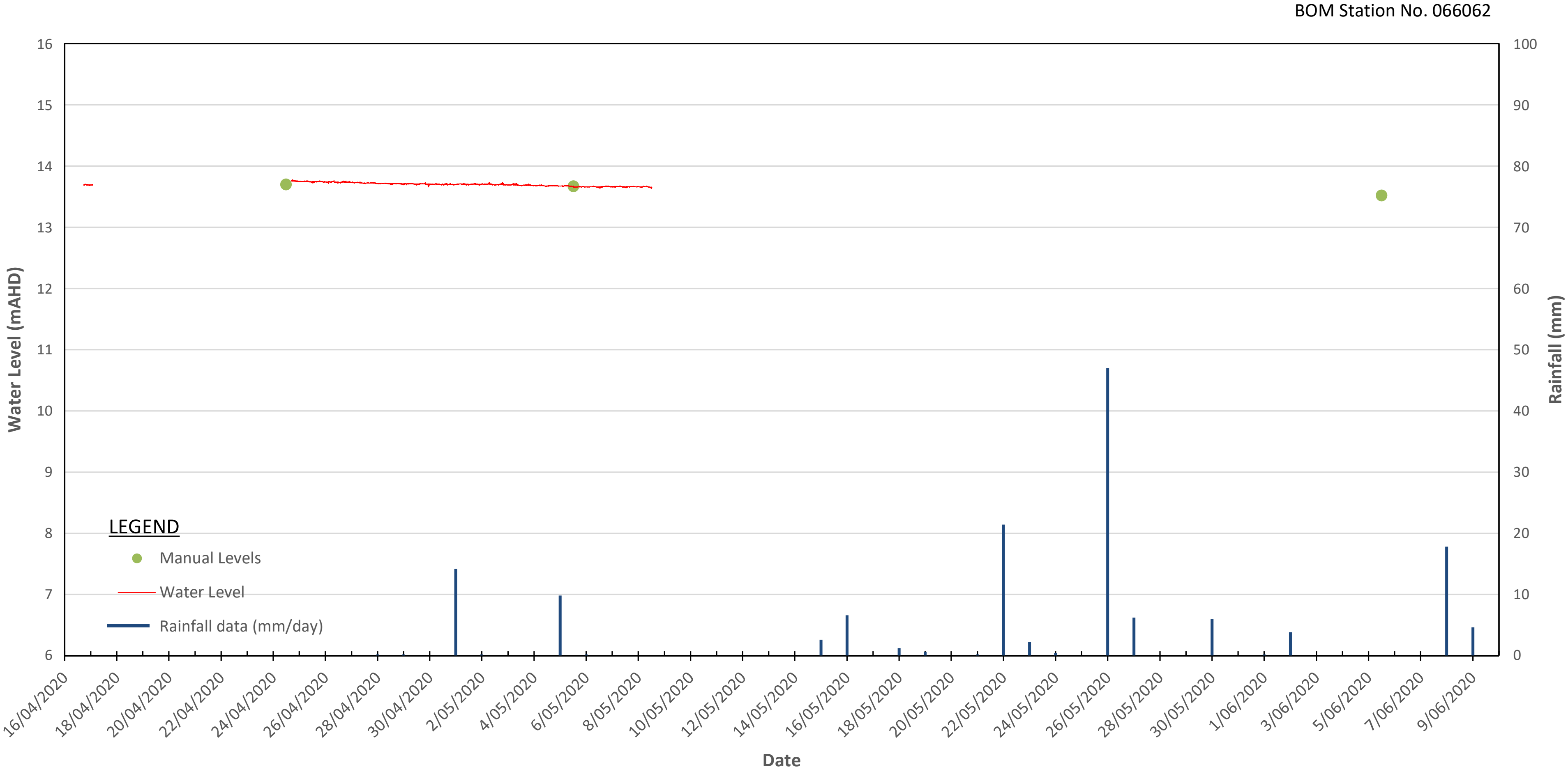


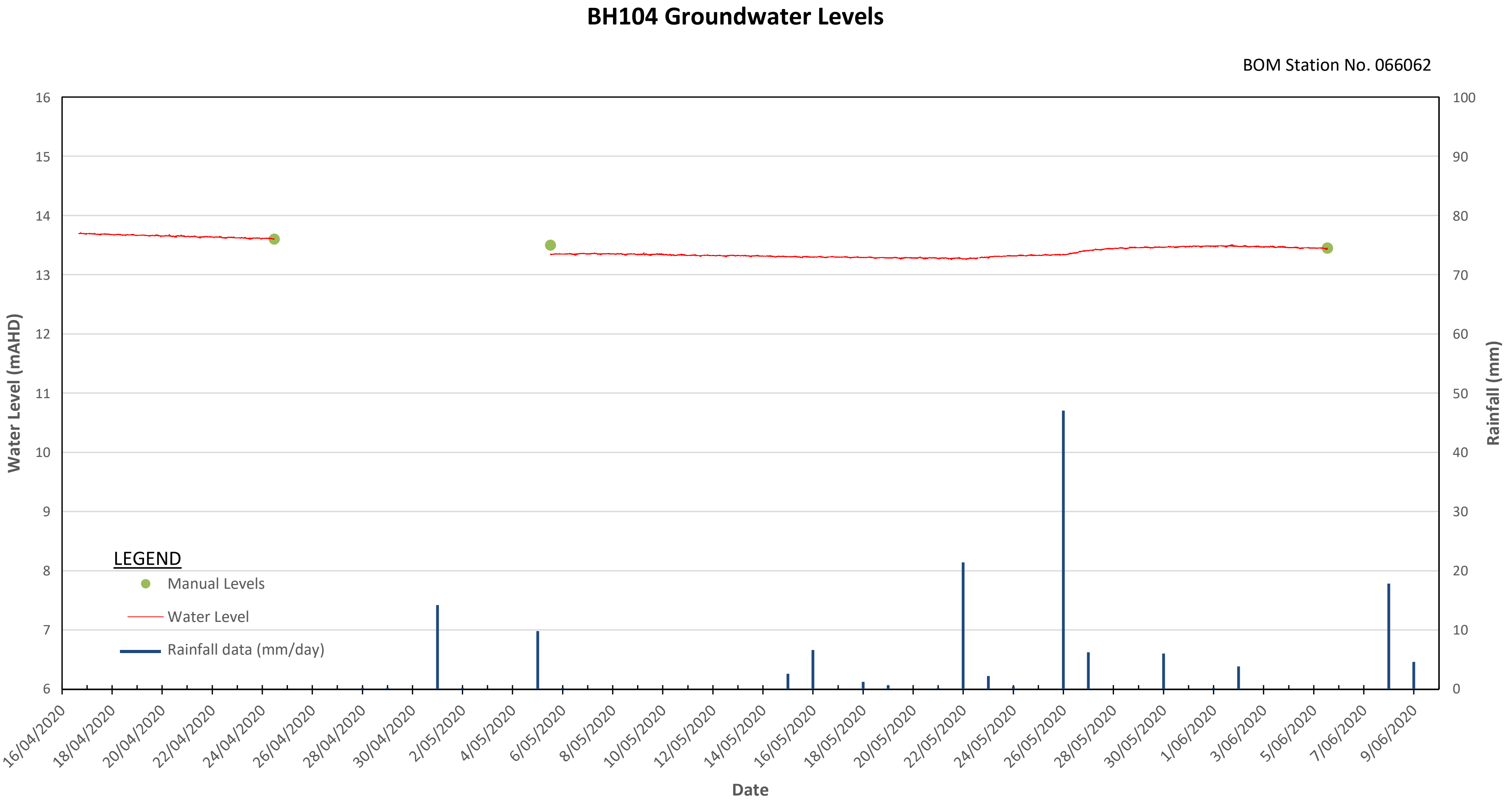

BH5 Groundwater Levels
BOM Station No. 066062
Water Level (mAHD)
Rainfall (mm)
16
15
14
13
12
11
10
9
8
7
6
100
90
80
70
60
50
40
30
20
10
0
29/07/2019
12/08/2019
26/08/2019
9/09/2019
23/09/2019
7/10/2019
21/10/2019
4/11/2019
18/11/2019
2/12/2019
16/12/2019
30/12/2019
13/01/2020
27/01/2020
10/02/2020
24/02/2020
9/03/2020
23/03/2020
6/04/2020
20/04/2020
4/05/2020
Date
LEGEND
Manual Levels
Water Level
Rainfall data (mm/day)

BH8 Groundwater Levels

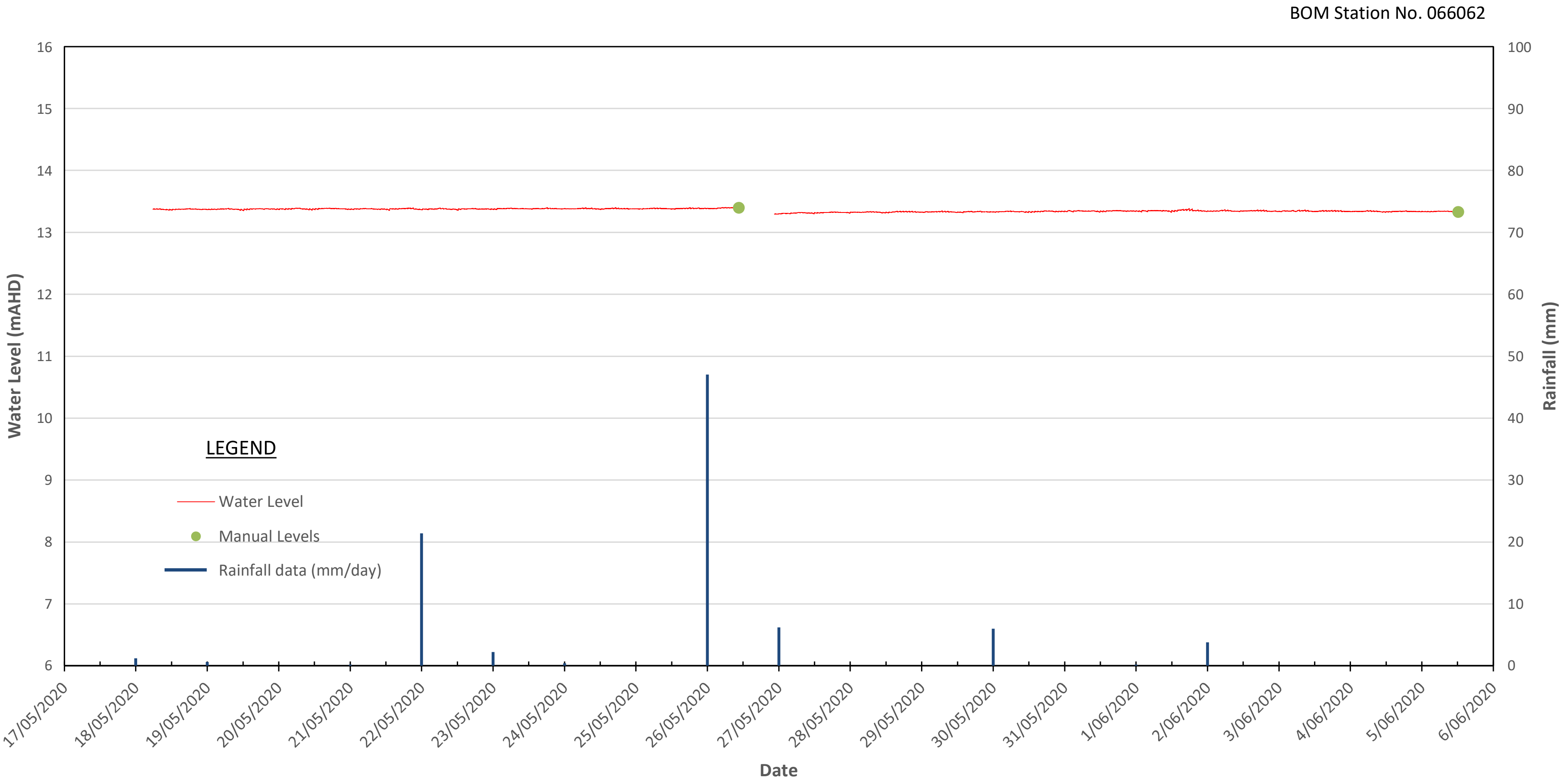


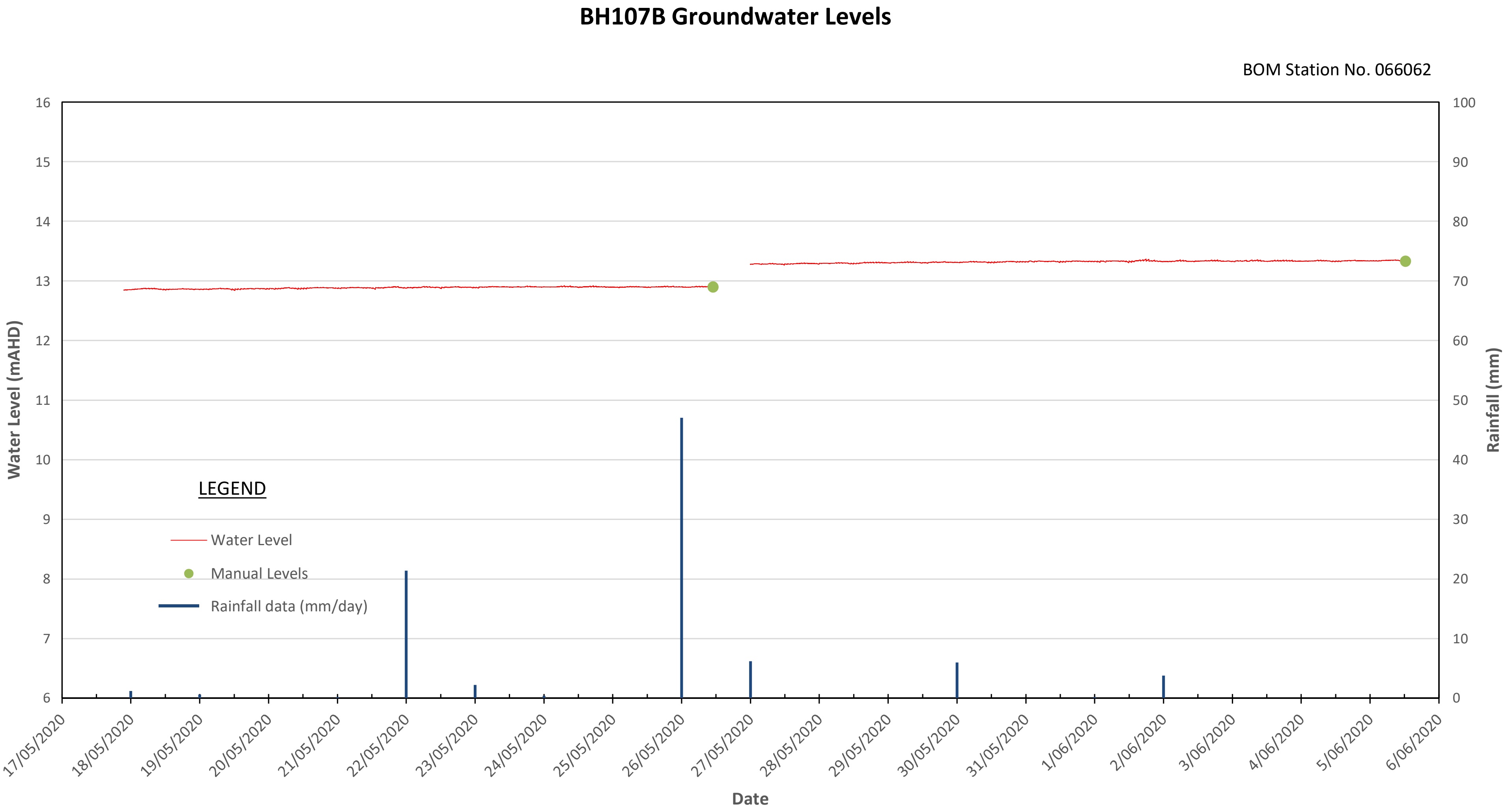
BH103 Groundwater Levels



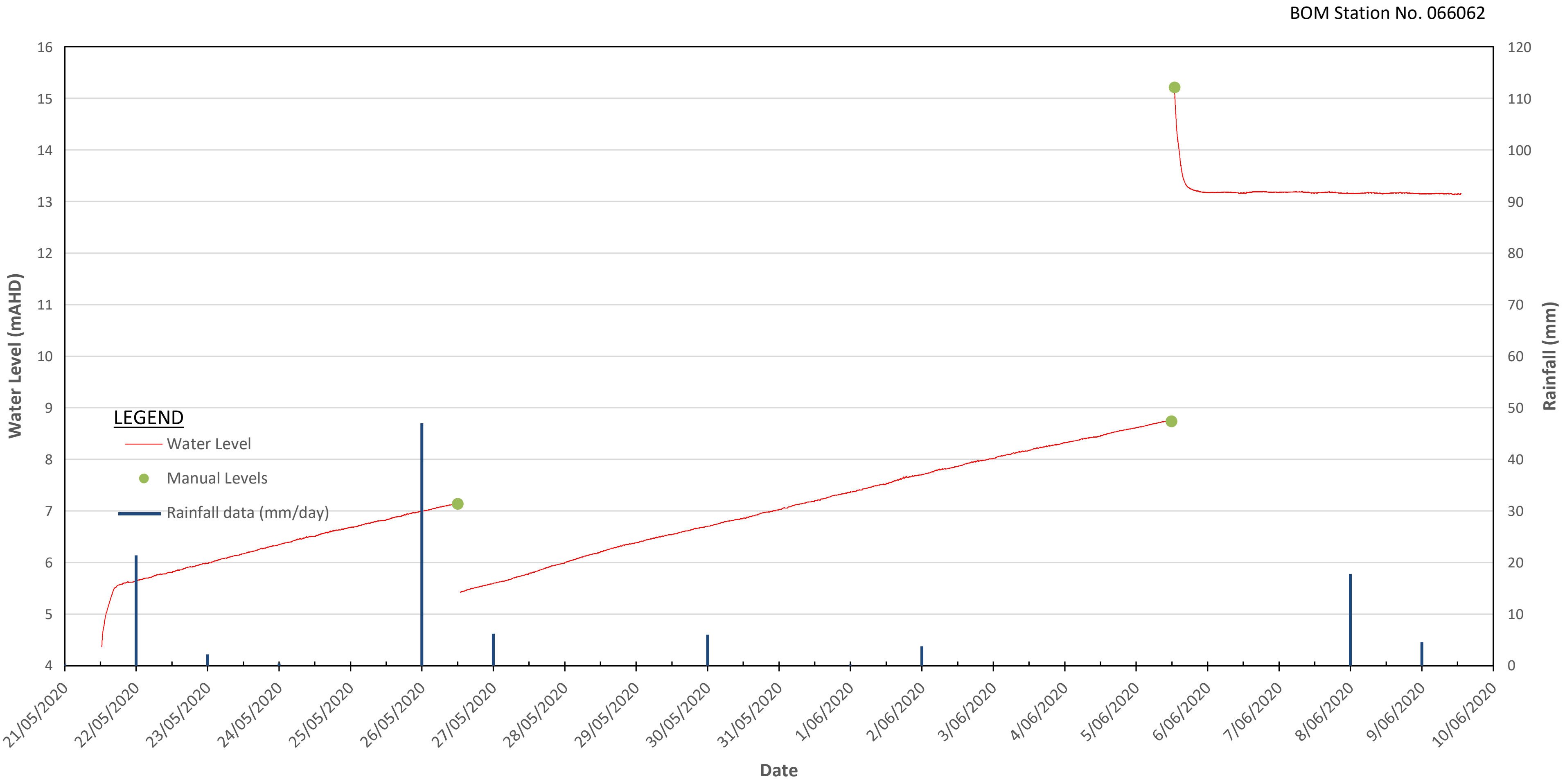

BH104 Groundwater Levels
BOM Station No. 066062
Water Level (mAHD)
Rainfall (mm)
Date
16
15
14
13
12
11
10
9
8
7
6
100
90
80
70
60
50
40
30
20
10
0
16/04/2020
18/04/2020
20/04/2020
22/04/2020
24/04/2020
26/04/2020
28/04/2020
30/04/2020
2/05/2020
4/05/2020
6/05/2020
8/05/2020
10/05/2020
12/05/2020
14/05/2020
16/05/2020
18/05/2020
20/05/2020
22/05/2020
24/05/2020
26/05/2020
28/05/2020
30/05/2020
1/06/2020
3/06/2020
5/06/2020
7/06/2020
9/06/2020
LEGEND
Manual Levels
Water Level
Rainfall data (mm/day)

BH107A Groundwater Levels

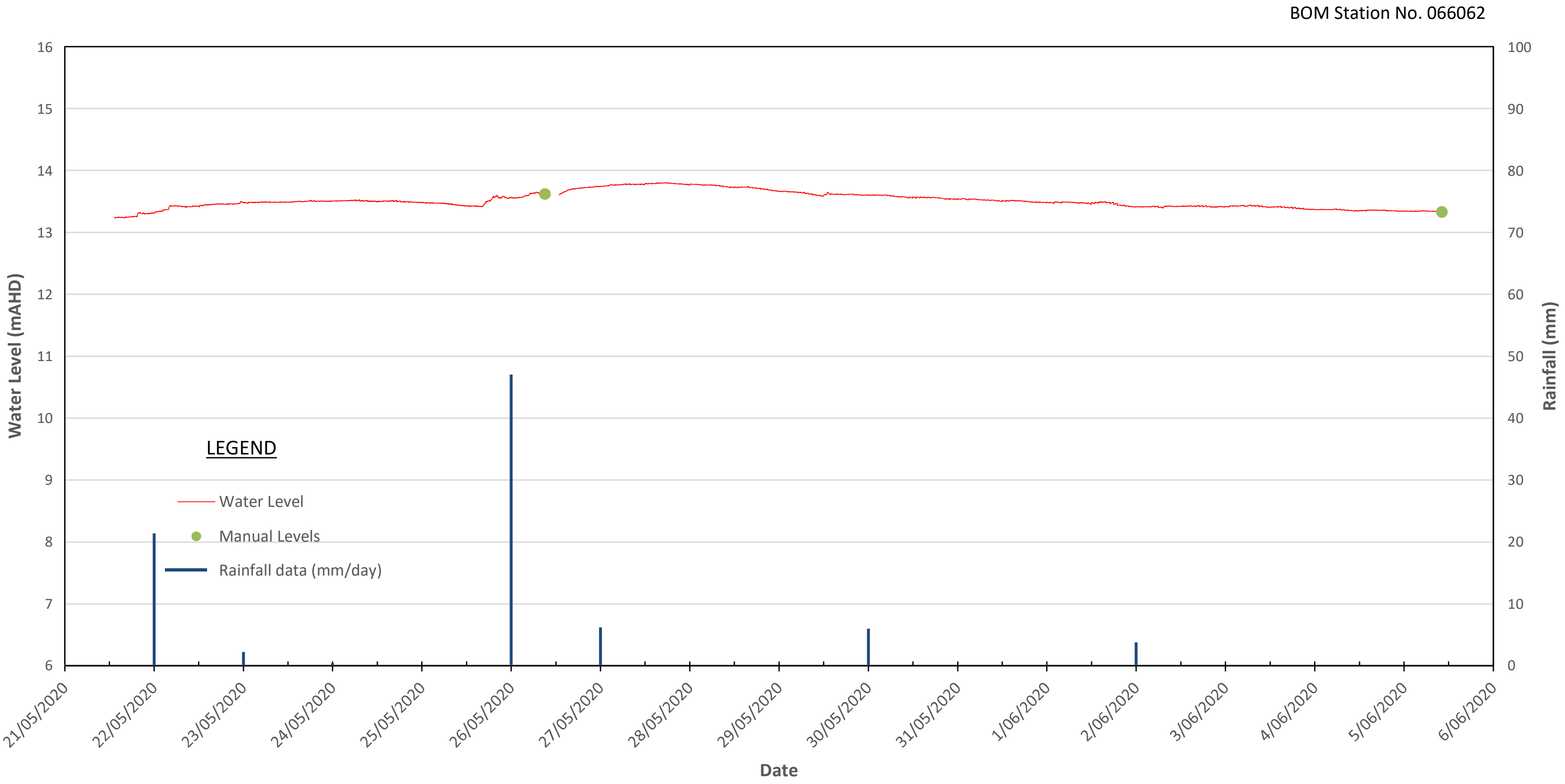


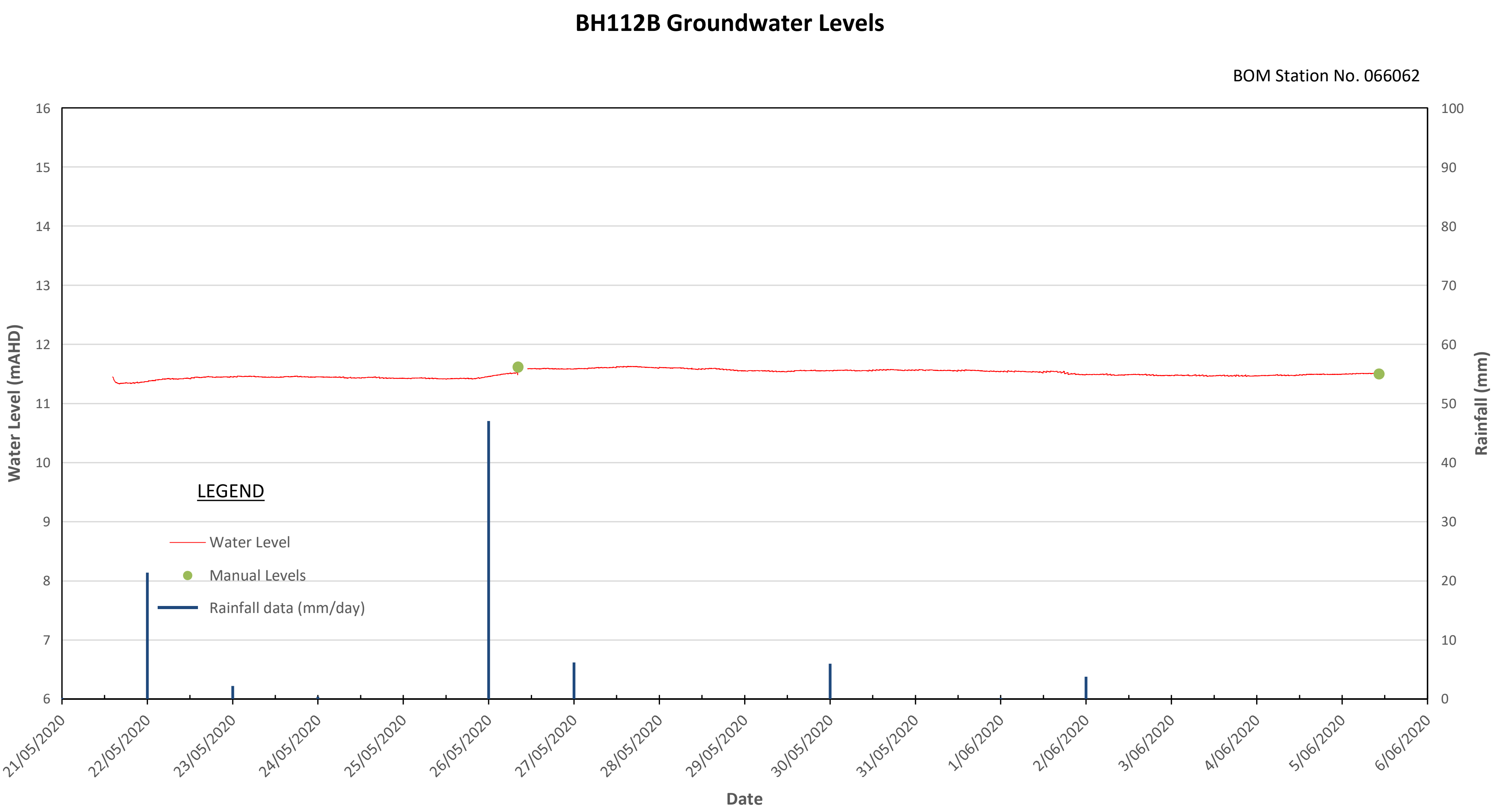
BH107B Groundwater Levels
BOM Station No. 066062
Water Level (mAHD)
16
15
14
13
12
11
10
9
8
7
6
Rainfall (mm)
100
90
80
70
60
50
40
30
20
10
0
LEGEND
Water Level
Manual Levels
Rainfall data (mm/day)
17/05/2020
18/05/2020
19/05/2020
20/05/2020
21/05/2020
22/05/2020
23/05/2020
24/05/2020
25/05/2020
26/05/2020
27/05/2020
28/05/2020
29/05/2020
30/05/2020
31/05/2020
1/06/2020
2/06/2020
3/06/2020
4/06/2020
5/06/2020
6/06/2020
Date

BH109B Groundwater Levels



BH112A Groundwater Levels




BH112B Groundwater Levels
BOM Station No. 066062
Water Level (mAHD)
Rainfall (mm)
16
15
14
13
12
11
10
9
8
7
6
100
90
80
70
60
50
40
30
20
10
0
LEGEND
Water Level
Manual Levels
Rainfall data (mm/day)
21/05/2020
22/05/2020
23/05/2020
24/05/2020
25/05/2020
26/05/2020
27/05/2020
28/05/2020
29/05/2020
30/05/2020
31/05/2020
1/06/2020
2/06/2020
3/06/2020
4/06/2020
5/06/2020
6/06/2020
Date

Appendix D

Results of In-situ Permeability Testing

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Permeability Testing - Falling Head Test Report

Client: Atlassian Pty Ltd
Project: Proposed Commerical Development
Location: 8-10 Lee Street, Haymarket

Project No: 86767.00
Test date: 31-Jul-19
Tested by: JJH

Test Location
Description: Standpipe in borehole
Material type: FILL/sandy CLAY, then SAND

Test No. BH1
Easting: 333983.4 m
Northing 6249262.5 m
Surface Level: 20.1 m AHD

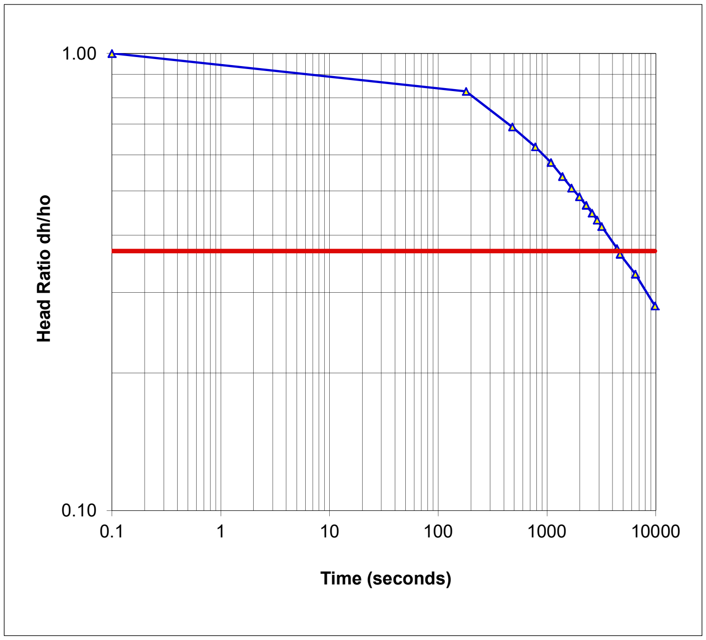
Details of Well Installation

Well casing diameter (2r)	114.3	mm	Depth to water before test	5.95	m
Well screen diameter (2R)	114.3	mm	Depth to water at start of test	0.00	m
Length of well screen (Le)	2	m			

PVC screen 6.3m-4.3m, sand 6.3-4.2m; blank from 4.3m onwards, bentonite from 4.2m onwards

Test Results

Time (sec)	Depth (m)	Change in Head: δH (m)	δH/Ho
0.1	0	5.95	1.000
180.0	1.03	4.92	0.827
480.0	1.84	4.11	0.691
780.0	2.23	3.72	0.625
1080.0	2.51	3.44	0.578
1380.0	2.74	3.21	0.539
1680.0	2.93	3.02	0.508
1980.0	3.05	2.90	0.487
2280.0	3.18	2.77	0.466
2580.0	3.28	2.67	0.448
2880.0	3.38	2.57	0.432
3180.0	3.46	2.49	0.418
4380.0	3.72	2.23	0.374
4680.0	3.78	2.17	0.364
6480.0	3.99	1.96	0.329
9780.0	4.28	1.67	0.281



To = 4500 seconds

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 = 6.5E-07** m/sec
= 0.232 cm/hour

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Permeability Testing - Falling Head Test Report

Client: Atlassian Pty Ltd
Project: Proposed Commerical Development
Location: 8-10 Lee Street, Haymarket

Project No: 86767.00
Test date: 14-Aug-19
Tested by: KR

Test Location
Description: Standpipe in borehole
Material type: FILL/sandy CLAY, then SAND

Test No. BH1
Easting: 333983.4 m
Northing 6249262.5 m
Surface Level: 20.1 m AHD

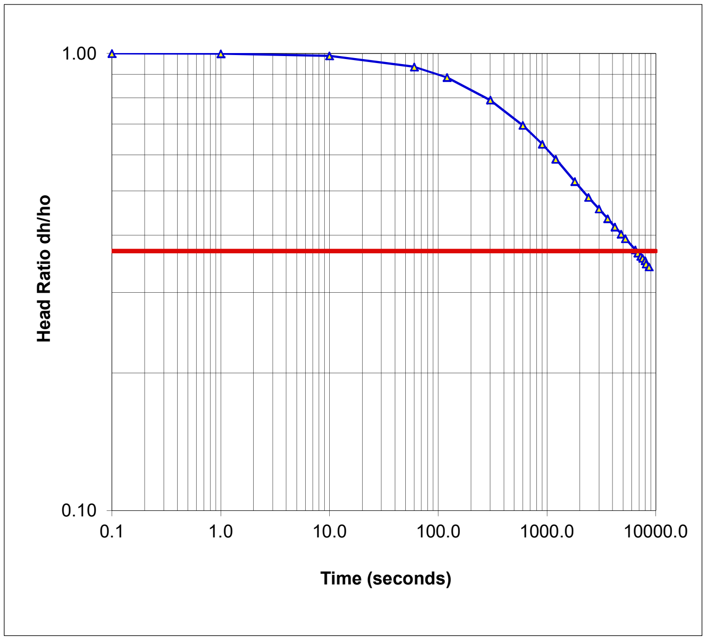
Details of Well Installation

Well casing diameter (2r)	114.3	mm
Well screen diameter (2R)	114.3	mm
Length of well screen (Le)	2	m
Depth to water before test	6.27	m
Depth to water at start of test	0.36	m

PVC screen 6.3m-4.3m, sand 6.3-4.2m; blank from 4.3m onwards, bentonite from 4.2m onwards

Test Results

Time (sec)	Depth (m)	Change in Head: δH (m)	δH/Ho
0.1	0.36	5.91	1.000
1.0	0.36	5.91	0.999
10.0	0.43	5.84	0.988
60.0	0.74	5.53	0.935
120.0	1.03	5.24	0.886
300.0	1.59	4.68	0.791
600.0	2.15	4.12	0.697
900.0	2.52	3.75	0.633
1200.0	2.80	3.47	0.587
1800.0	3.17	3.10	0.525
2400.0	3.41	2.86	0.484
3000.0	3.57	2.70	0.457
3600.0	3.70	2.57	0.435
4200.0	3.80	2.47	0.417
4793.0	3.89	2.38	0.403
5250.0	3.94	2.33	0.394
6450.0	4.07	2.20	0.372
6810.0	4.11	2.17	0.366
7230.0	4.14	2.13	0.360
7530.0	4.16	2.11	0.357
7950.0	4.19	2.09	0.353
8130.0	4.22	2.05	0.347
8670.0	4.25	2.02	0.342



To = 6500 seconds

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 = **4.5E-07** m/sec
= **0.161** cm/hour

Permeability Testing - Rising or Falling Head Test Report

Client:	Atlassian Pty Ltd	Project No:	86767.00
Project:	Proposed Commercial Development	Test date:	31-Jul-19
Location:	8-10 Lee Street, Haymarket	Tested by:	JJH

Test Location

Description: Standpipe in borehole
Material type: Sandstone

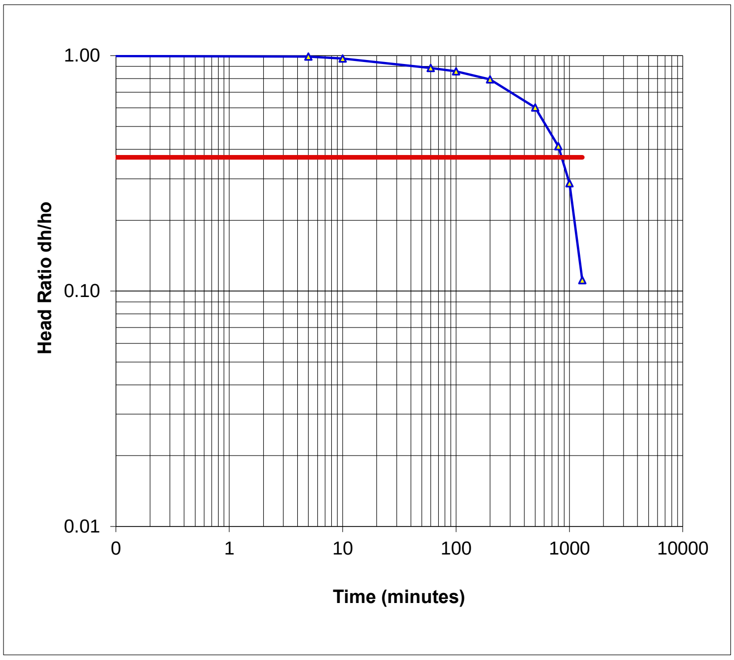
Test No. BH5
Easting: 333980 m
Northing 6249298 m
Surface Level: 15.5 m AHD

Details of Well Installation

Well casing diameter (2r)	76	mm	Depth to water before test	2.44	m
Well screen diameter (2R)	76	mm	Depth to water at start of test	14.48	m
Length of well screen (Le)	12.97	m			

Test Results

Time (min)	Depth (m)	Change in Head: dH (m)	dH/Ho
0	14.48	12.04	1.000
5	14.36	11.92	0.990
10	14.14	11.70	0.972
60	13.12	10.68	0.887
100	12.77	10.33	0.858
200	11.99	9.55	0.793
500	9.69	7.25	0.602
800	7.41	4.97	0.413
1000	5.9	3.46	0.287
1300	3.78	1.34	0.111



To = 868 mins
52080 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 = **6.2E-09** m/sec
= **0.002** cm/hour

Permeability Testing - Rising Head Test Report

Client: Atlassian Pty Ltd
Project: Proposed Commercial Development
Location: 8-10 Lee Street, Haymarket

Project No: 86767.00
Test date: 30-Jul-19
Tested by: JJH

Test Location
Description: Standpipe in borehole
Material type: Sandstone

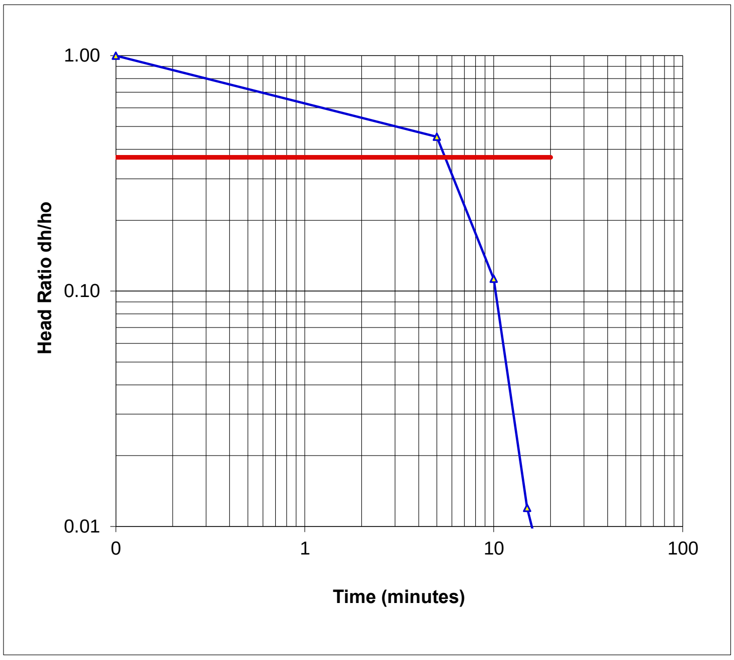
Test No. BH8
Easting: 333954 m
Northing 6249289 m
Surface Level: 15.5 m AHD

Details of Well Installation
Well casing diameter (2r) 76 mm
Well screen diameter (2R) 76 mm
Length of well screen (Le) 12.1 m

Depth to water before test 2.3 m
Depth to water at start of test 14.8 m

Test Results

Time (min)	Depth (m)	Change in Head: dH (m)	dH/Ho
0	14.80	12.50	1.000
5	7.95	5.65	0.452
10	3.71	1.41	0.113
15	2.45	0.15	0.012
20	2.36	0.06	0.005



To = 5.5 mins
330 secs

Theory: Falling Head Permeability calculated using equation by Hvorslev

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

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

Hydraulic Conductivity k = **1.0E-06** m/sec
= **0.375** cm/hour

Permeability Testing - Rising or Falling Head Test Report

Client: Atlassian Pty Ltd
Project: Proposed Commercial Development
Location: 8-10 Lee Street, Haymarket

Project No: 86767.00
Test date: 16-Apr-20
Tested by: NB

Test Location
Description: Standpipe in borehole
Material type: Sandstone

Test No. BH103
Easting: 333978 m
Northing 6249263 m
Surface Level: 21.2 m AHD

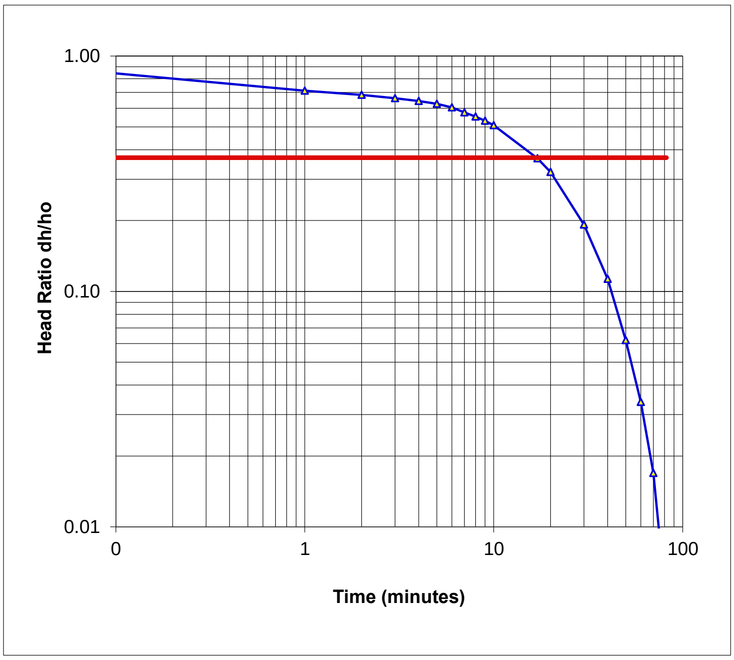
Details of Well Installation

Well casing diameter (2r)	70	mm
Well screen diameter (2R)	76	mm
Length of well screen (Le)	0.8	m

Depth to water before test	7.5	m
Depth to water at start of test	9.27	m

Test Results

Time (min)	Depth (m)	Change in Head: dH (m)	dH/Ho
0	9.27	1.77	1.000
1	8.76	1.26	0.712
2	8.71	1.21	0.684
3	8.67	1.17	0.661
4	8.64	1.14	0.644
5	8.61	1.11	0.627
6	8.57	1.07	0.605
7	8.52	1.02	0.576
8	8.48	0.98	0.554
9	8.44	0.94	0.531
10	8.4	0.90	0.508
17	8.15	0.65	0.367
20	8.07	0.57	0.322
30	7.84	0.34	0.192
40	7.7	0.2	0.113
50	7.61	0.11	0.062
60	7.56	0.06	0.034
70	7.53	0.03	0.017
80	7.51	0.01	0.006
82	7.5	0	0.000



To = 17 mins
1020 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-06** m/sec
= 0.823 cm/hour

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Permeability Testing - Rising or Falling Head Test Report

Client: Vertical First Pty Ltd
Project: Proposed Commercial Development
Location: 8-10 Lee Street, Haymarket
Project No: 86767.00
Test date: 24-Apr-20
Tested by: AS

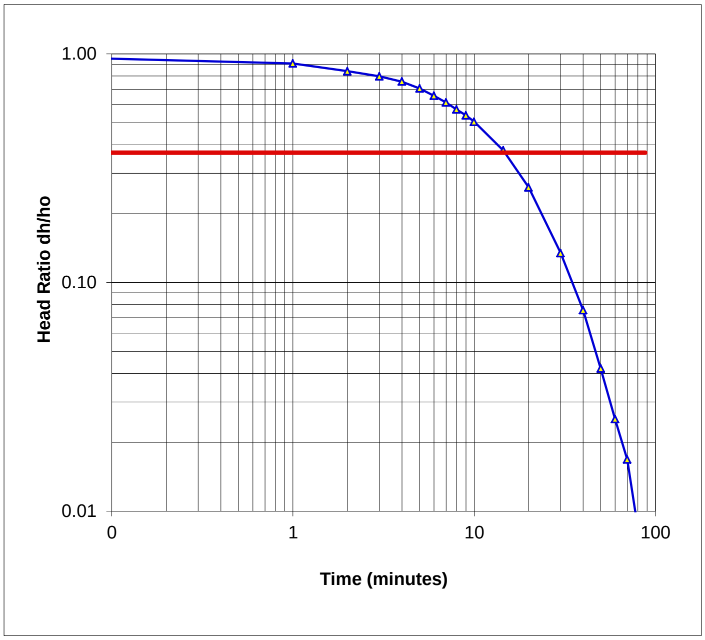
Test Location
Description: Standpipe in borehole
Material type: Sandstone

Test No. BH103
Easting: 333978 m
Northing 6249263 m
Surface Level: 21.2 m AHD

Details of Well Installation
Well casing diameter (2r) 50 mm
Well screen diameter (2R) 76 mm
Length of well screen (Le) 0.8 m
Depth to water before test 7.44 m
Depth to water at start of test 8.63 m

Test Results

Time (min)	Depth (m)	Change in Head: dH (m)	dH/Ho
0	8.63	1.19	1.000
1	8.52	1.08	0.908
2	8.44	1.00	0.840
3	8.39	0.95	0.798
4	8.34	0.90	0.756
5	8.28	0.84	0.706
6	8.22	0.78	0.655
7	8.17	0.73	0.613
8	8.12	0.68	0.571
9	8.08	0.64	0.538
10	8.04	0.60	0.504
14.5	7.89	0.45	0.378
20	7.75	0.31	0.261
30	7.6	0.16	0.134
40	7.53	0.09	0.076
50	7.49	0.05	0.042
60	7.47	0.03	0.025
70	7.46	0.02	0.017
80	7.45	0.01	0.008
88	7.44	0	0.000



To = 14.5 mins
870 secs

Theory: Falling Head Permeability calculated using equation by Hvorslev

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

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

Hydraulic Conductivity k = **1.4E-06** m/sec
= **0.493** cm/hour

Permeability Testing - Rising or Falling Head Test Report

Client: Atlassian Pty Ltd
Project: Proposed Commercial Development
Location: 8-10 Lee Street, Haymarket

Project No: 86767.00
Test date: 16-Apr-20
Tested by: NB

Test Location
Description: Standpipe in borehole
Material type: Sandstone

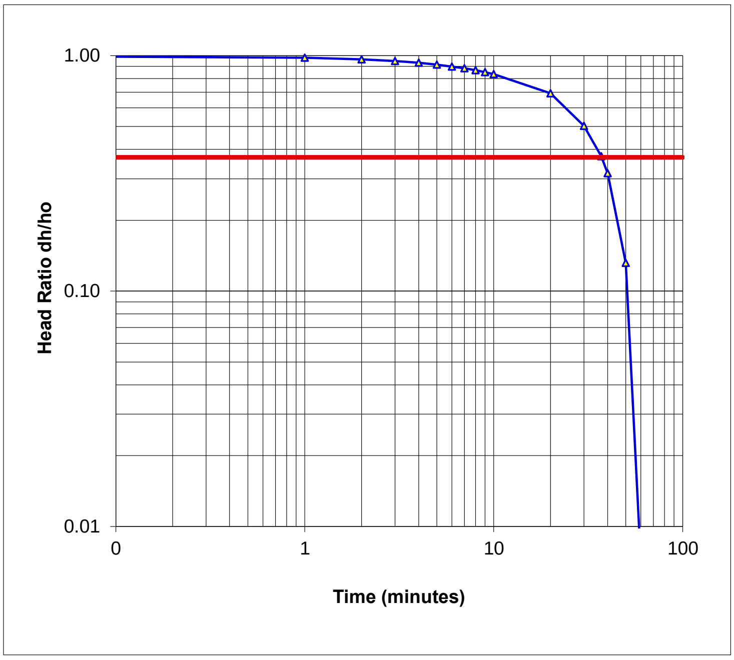
Test No. BH104
Easting: 333983 m
Northing 6249272 m
Surface Level: 21.2 m AHD

Details of Well Installation
Well casing diameter (2r) 70 mm
Well screen diameter (2R) 76 mm
Length of well screen (Le) 6 m

Depth to water before test 7.5 m
Depth to water at start of test 18.8 m

Test Results

Time (min)	Depth (m)	Change in Head: dH (m)	dH/Ho
0	18.80	11.30	1.000
1	18.57	11.07	0.980
2	18.39	10.89	0.964
3	18.21	10.71	0.948
4	18.04	10.54	0.933
5	17.84	10.34	0.915
6	17.66	10.16	0.899
7	17.48	9.98	0.883
8	17.3	9.80	0.867
9	17.11	9.61	0.850
10	16.93	9.43	0.835
20	15.31	7.81	0.691
30	13.19	5.69	0.504
37	11.72	4.22	0.373
40	11.08	3.58	0.317
50	8.99	1.49	0.132
60	7.58	0.08	0.007
70	7.52	0.02	0.002
80	7.52	0.02	0.002
90	7.51	0.01	0.001
100	7.51	0.01	0.001



To = 37 mins
2220 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
= 0.084 cm/hour

Permeability Testing - Rising Head Test Report

Client:	Vertical First Pty Ltd	Project No:	86767.00
Project:	Proposed Commercial Development	Test date:	22-May-20
Location:	8-10 Lee Street, Haymarket	Tested by:	NB

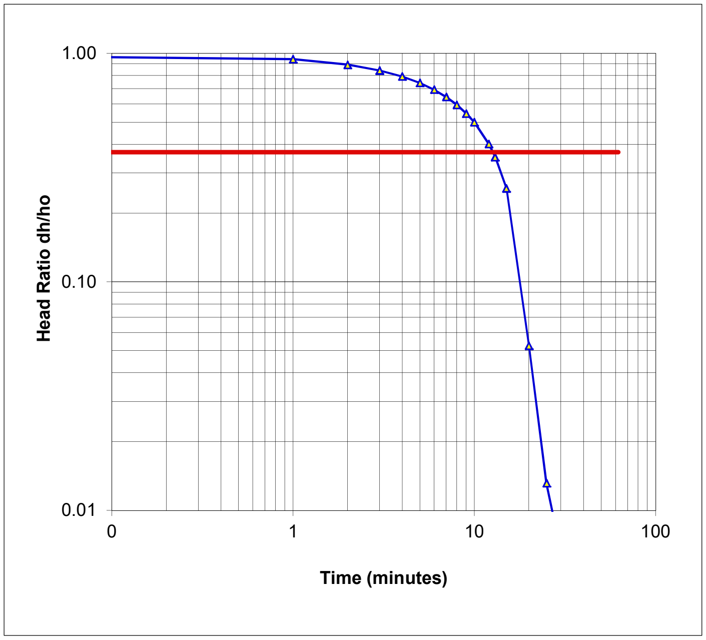
Test Location		**Test No.**	BH104	
Description:	Standpipe in borehole	Easting:	333983	m
Material type:	Sandstone	Northing	6249272	m
		Surface Level:	21.2	m AHD

Details of Well Installation

Well casing diameter (2r)	50	mm	Depth to water before test	7.91	m
Well screen diameter (2R)	76	mm	Depth to water at start of test	10.95	m
Length of well screen (Le)	6	m			

Test Results

Time (min)	Depth (m)	Change in Head: δH (m)	δH/Ho
0	10.95	3.04	1.000
1	10.78	2.87	0.944
2	10.62	2.71	0.891
3	10.47	2.56	0.842
4	10.32	2.41	0.793
5	10.17	2.26	0.743
6	10.02	2.11	0.694
7	9.87	1.96	0.645
8	9.72	1.81	0.595
9	9.57	1.66	0.546
10	9.43	1.52	0.500
12	9.13	1.22	0.401
13	8.98	1.07	0.352
15	8.69	0.78	0.257
20	8.07	0.16	0.053
25	7.95	0.04	0.013
30	7.93	0.02	0.007
35	7.92	0.01	0.003
62	7.91	0	0.000



To = 12.5 mins
750 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 =**	**3.5E-07**	m/sec
	=	**0.127**	cm/hour

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Permeability Testing - Rising or Falling Head Test Report

Client:	Vertical First Pty Ltd	Project No:	86767.00
Project:	Proposed Commercial Development	Test date:	17-May-20
Location:	8-10 Lee Street, Haymarket	Tested by:	NB

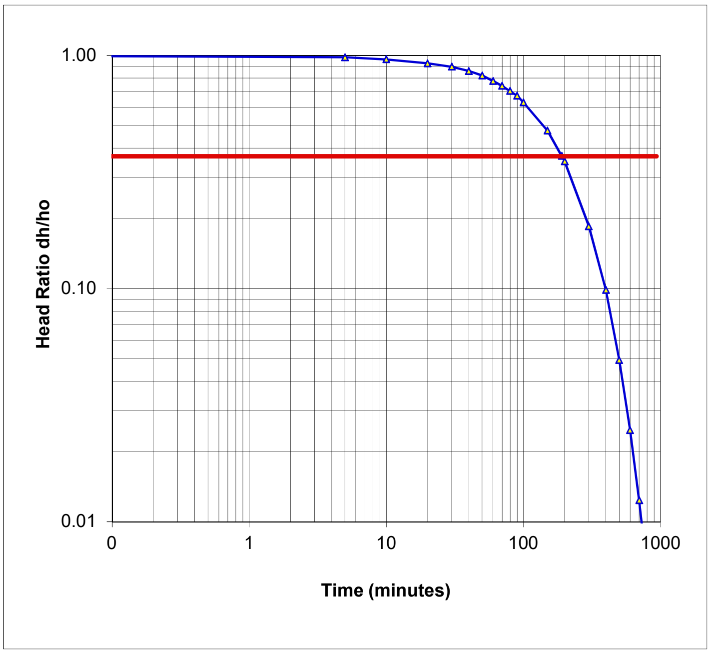
Test Location		**Test No.**	BH107A	
Description:	Standpipe in borehole	Easting:	333945	m
Material type:	Sandstone	Northing	6249270	m
		Surface Level:	15.5	m AHD

Details of Well Installation

Well casing diameter (2r)	50	mm	Depth to water before test	2.13	m
Well screen diameter (2R)	76	mm	Depth to water at start of test	3.75	m
Length of well screen (Le)	0.5	m			

Test Results

Time (min)	Depth (m)	Change in Head: δH (m)	δH/Ho
0	3.75	1.62	1.000
5	3.72	1.59	0.981
10	3.69	1.56	0.963
20	3.63	1.50	0.926
30	3.58	1.45	0.895
40	3.52	1.39	0.858
50	3.46	1.33	0.821
60	3.39	1.26	0.778
70	3.33	1.20	0.741
80	3.27	1.14	0.704
90	3.22	1.09	0.673
100	3.15	1.02	0.630
150	2.9	0.77	0.475
190.5	2.73	0.6	0.370
200	2.7	0.57	0.352
300	2.43	0.3	0.185
400	2.29	0.16	0.099
500	2.21	0.08	0.049
600	2.17	0.04	0.025
700	2.15	0.02	0.012
800	2.14	0.01	0.006
936	2.13	0	0.000



To = 190.5 mins
11430 secs

Theory: Falling Head Permeability calculated using equation by Hvorslev

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

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

Hydraulic Conductivity	**k =**	**1.4E-07**	m/sec
	=	**0.051**	cm/hour

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Permeability Testing - Rising Head Test Report

Client: Vertical First Pty Ltd
Project: Proposed Commercial Development
Location: 8-10 Lee Street, Haymarket

Project No: 86767.00
Test date: 26-May-20
Tested by: AS

Test Location
Description: Standpipe in borehole
Material type: Sandstone

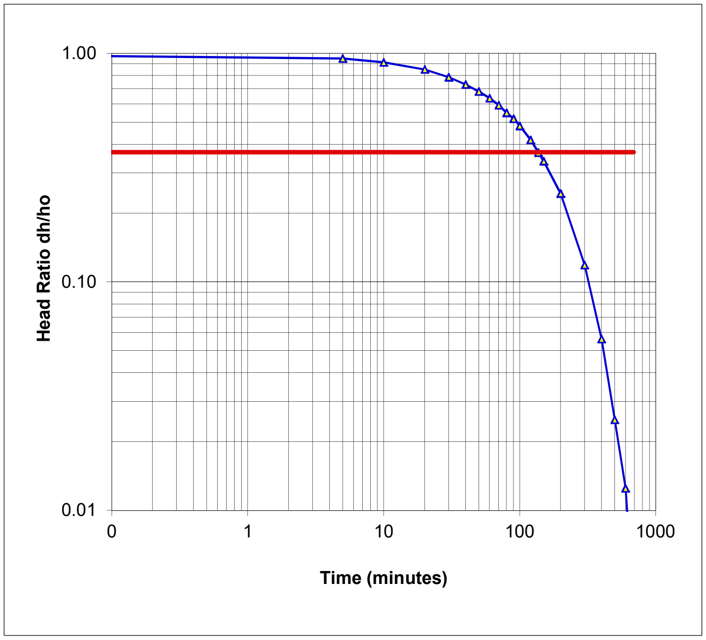
Test No. BH107A
Easting: 333945 m
Northing 6249270 m
Surface Level: 15.5 m AHD

Details of Well Installation
Well casing diameter (2r) 50 mm
Well screen diameter (2R) 76 mm
Length of well screen (Le) 0.5 m

Depth to water before test 2.2 m
Depth to water at start of test 3.8 m

Test Results

Time (min)	Depth (m)	Change in Head: δH (m)	δH/Ho
0	3.8	1.60	1.000
5	3.72	1.52	0.950
10	3.66	1.46	0.913
20	3.56	1.36	0.850
30	3.46	1.26	0.788
40	3.37	1.17	0.731
50	3.29	1.09	0.681
60	3.22	1.02	0.638
70	3.15	0.95	0.594
80	3.08	0.88	0.550
90	3.03	0.83	0.519
100	2.97	0.77	0.481
120	2.87	0.67	0.419
137	2.79	0.59	0.369
150	2.74	0.54	0.338
200	2.59	0.39	0.244
300	2.39	0.19	0.119
400	2.29	0.09	0.056
500	2.24	0.04	0.025
600	2.22	0.02	0.013
650	2.21	0.01	0.006
687	2.2	0	0.000



To = 137 mins
8220 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 = **2.0E-07** m/sec
= **0.071** cm/hour

Douglas Partners
Geotechnics / Environment / Groundwater

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

Permeability Testing - Rising or Falling Head Test Report

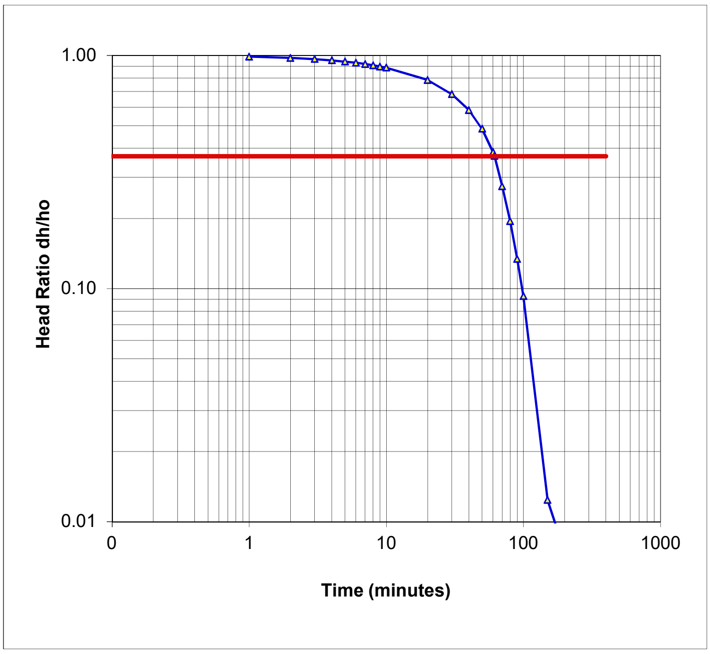
Client: Vertical First Pty Ltd
Project: Proposed Commercial Development
Location: 8-10 Lee Street, Haymarket
Project No: 86767.00
Test date: 17-May-20
Tested by: NB

Test Location
Description: Standpipe in borehole
Material type: Sandstone
Test No. BH107B
Easting: 333945 m
Northing 6249272 m
Surface Level: 15.5 m AHD

Details of Well Installation
Well casing diameter (2r) 50 mm
Well screen diameter (2R) 76 mm
Length of well screen (Le) 5.5 m
Depth to water before test 2.65 m
Depth to water at start of test 10.72 m

Test Results

Time (min)	Depth (m)	Change in Head: δH (m)	δH/Ho
0	10.72	8.07	1.000
1	10.63	7.98	0.989
2	10.53	7.88	0.976
3	10.44	7.79	0.965
4	10.34	7.69	0.953
5	10.25	7.60	0.942
6	10.16	7.51	0.931
7	10.07	7.42	0.919
8	9.98	7.33	0.908
9	9.89	7.24	0.897
10	9.8	7.15	0.886
20	8.98	6.33	0.784
30	8.16	5.51	0.683
40	7.36	4.71	0.584
50	6.56	3.91	0.485
60	5.76	3.11	0.385
61.5	5.64	2.99	0.371
70	4.87	2.22	0.275
80	4.22	1.57	0.195
90	3.73	1.08	0.134
100	3.4	0.75	0.093
150	2.75	0.1	0.012
200	2.71	0.06	0.007
300	2.69	0.04	0.005
400	2.68	0.03	0.004
500	2.66	0.01	0.001
636	2.65	0	0.000



To = 61.5 mins
3690 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 = 7.7E-08** m/sec
= 0.028 cm/hour

Douglas Partners
Geotechnics / Environment / Groundwater

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Permeability Testing - Rising Head Test Report

Client:	Vertical First Pty Ltd	Project No:	86767.00
Project:	Proposed Commercial Development	Test date:	26-May-20
Location:	8-10 Lee Street, Haymarket	Tested by:	AS

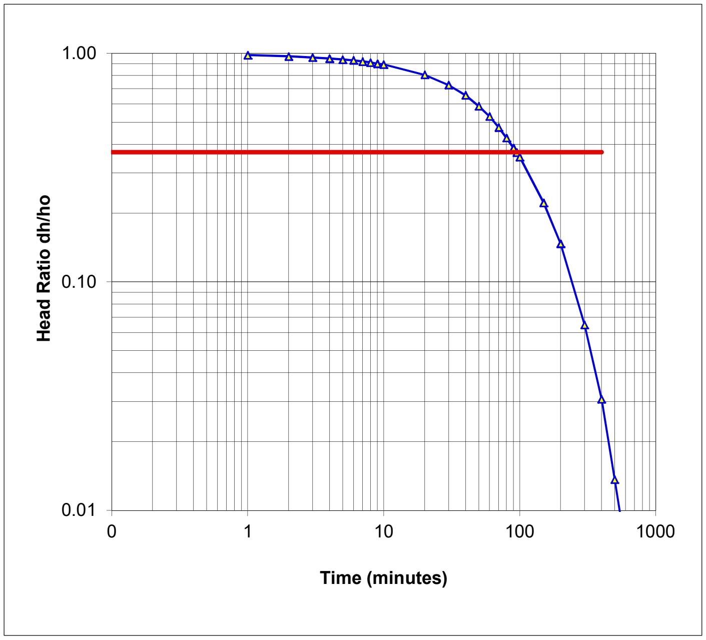
Test Location		**Test No.**	BH107B	
Description:	Standpipe in borehole	Easting:	333945	m
Material type:	Sandstone	Northing	6249272	m
		Surface Level:	15.5	m AHD

Details of Well Installation

Well casing diameter (2r)	50	mm	Depth to water before test	2.22	m
Well screen diameter (2R)	76	mm	Depth to water at start of test	5.15	m
Length of well screen (Le)	5.5	m			

Test Results

Time (min)	Depth (m)	Change in Head: δH (m)	δH/Ho
0	5.15	2.93	1.000
1	5.10	2.88	0.983
2	5.06	2.84	0.969
3	5.03	2.81	0.959
4	5.00	2.78	0.949
5	4.97	2.75	0.939
6	4.95	2.73	0.932
7	4.92	2.70	0.922
8	4.89	2.67	0.911
9	4.86	2.64	0.901
10	4.84	2.62	0.894
20	4.58	2.36	0.805
30	4.35	2.13	0.727
40	4.14	1.92	0.655
50	3.94	1.72	0.587
60	3.77	1.55	0.529
70	3.61	1.39	0.474
80	3.47	1.25	0.427
90	3.35	1.13	0.386
95	3.30	1.08	0.369
100	3.25	1.03	0.352
150	2.87	0.65	0.222
200	2.65	0.43	0.147
300	2.41	0.19	0.065
400	2.31	0.09	0.031
500	2.26	0.04	0.014
600	2.24	0.02	0.007



To = 95 mins
5700 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 =**	**5.0E-08**	m/sec
	=	**0.018**	cm/hour

Douglas Partners
Geotechnics / Environment / Groundwater

Douglas Partners Pty Ltd
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Permeability Testing - Falling Head Test Report

Client: Vertical First Pty Ltd
Project: Proposed Commercial Development
Location: 8-10 Lee Street, Haymarket

Project No: 86767.00
Test date: 5-Jun-20
Tested by: NB

Test Location
Description: Standpipe in borehole
Material type: Sandstone

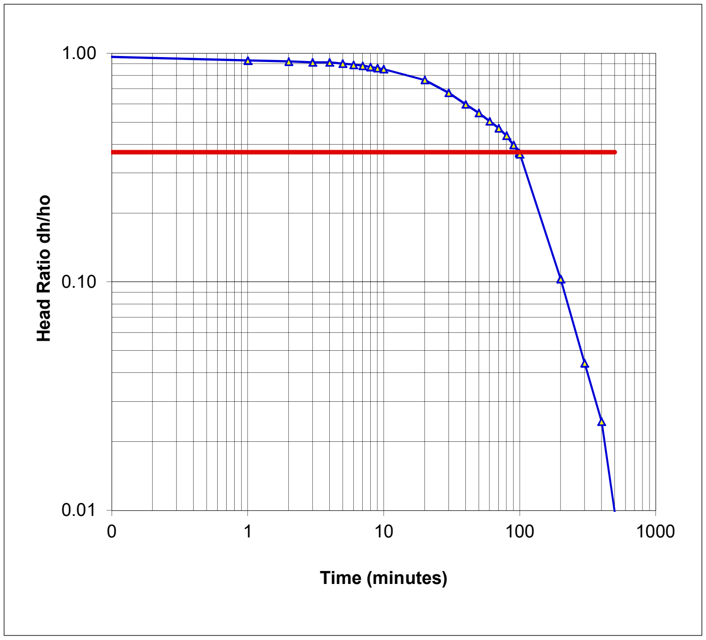
Test No. BH109B
Easting: 333970 m
Northing 6249311 m
Surface Level: 15.3 m AHD

Details of Well Installation
Well casing diameter (2r) 50 mm
Well screen diameter (2R) 76 mm
Length of well screen (Le) 5.6 m

Depth to water at end of test 2.17 m
Depth to water at start of test 0.13 m

Test Results

Time (min)	Depth (m)	Change in Head: δH (m)	δH/Ho
0	0.13	2.04	1.000
1	0.27	1.90	0.931
2	0.29	1.88	0.922
3	0.31	1.86	0.912
4	0.31	1.86	0.912
5	0.33	1.84	0.902
6	0.35	1.82	0.892
7	0.37	1.80	0.882
8	0.39	1.78	0.873
9	0.41	1.76	0.863
10	0.43	1.74	0.853
20	0.61	1.56	0.765
30	0.8	1.37	0.672
40	0.95	1.22	0.598
50	1.05	1.12	0.549
60	1.14	1.03	0.505
70	1.21	0.96	0.471
80	1.28	0.89	0.436
90	1.36	0.81	0.397
98.5	1.42	0.75	0.368
100	1.43	0.74	0.363
200	1.96	0.21	0.103
300	2.08	0.09	0.044
400	2.12	0.05	0.025
500	2.15	0.02	0.010
600	2.17	0	0.000



To = 98.5 mins
5910 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 = 4.7E-08** m/sec
= 0.017 cm/hour

Permeability Testing - Falling Head Test Report

Client: Vertical First Pty Ltd
Project: Proposed Commercial Development
Location: 8-10 Lee Street, Haymarket

Project No: 86767.00
Test date: 5-Jun-20
Tested by: NB

Test Location

Description: Standpipe in borehole
Material type: Sandstone

Test No. BH112A
Easting: 333926 m
Northing 6249325 m
Surface Level: 16.7 m AHD

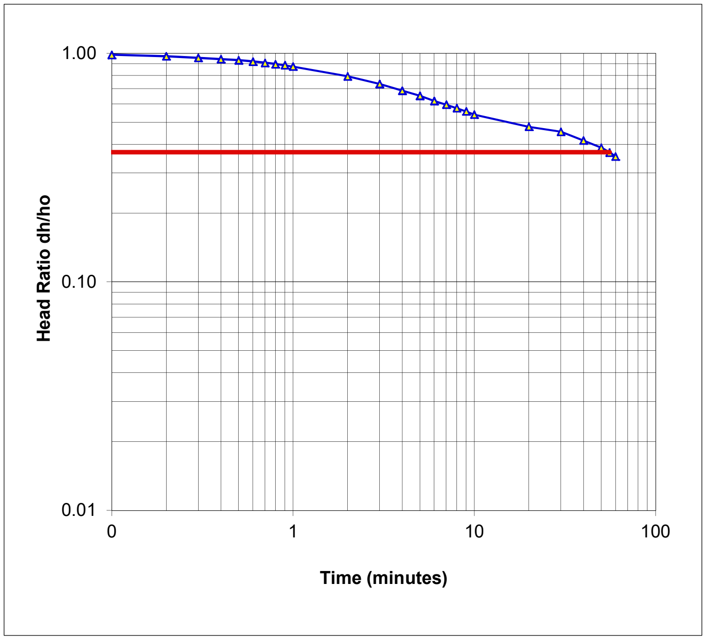
Details of Well Installation

Well casing diameter (2r) 50 mm
Well screen diameter (2R) 76 mm
Length of well screen (Le) 0.5 m

Depth to water before test 3.39 m
Depth to water at start of test 0.00 m

Test Results

Time (min)	Depth (m)	Change in Head: δH (m)	δH/Ho
0	0.00	3.39	1.000
0.10	0.05	3.34	0.985
0.20	0.1	3.29	0.971
0.30	0.15	3.24	0.956
0.40	0.19	3.20	0.944
0.50	0.23	3.16	0.932
0.60	0.27	3.12	0.920
0.70	0.31	3.08	0.909
0.80	0.35	3.04	0.897
0.90	0.38	3.01	0.888
1.00	0.42	2.97	0.876
2	0.7	2.69	0.794
3	0.9	2.49	0.735
4	1.06	2.33	0.687
5	1.18	2.21	0.652
6	1.29	2.1	0.619
7	1.37	2.02	0.596
8	1.44	1.95	0.575
9	1.5	1.89	0.558
10	1.56	1.83	0.540
20	1.77	1.62	0.478
30	1.85	1.54	0.454
40	1.98	1.41	0.416
50	2.08	1.31	0.386
55.6	2.14	1.25	0.369
60	2.19	1.2	0.354



To = 55.6 mins
3336 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 = **4.8E-07** m/sec
= **0.174** cm/hour

Permeability Testing - Rising or Falling Head Test Report

Client:	Vertical First Pty Ltd	Project No:	86767.00
Project:	Proposed Commercial Development	Test date:	21-May-20
Location:	8-10 Lee Street, Haymarket	Tested by:	NB

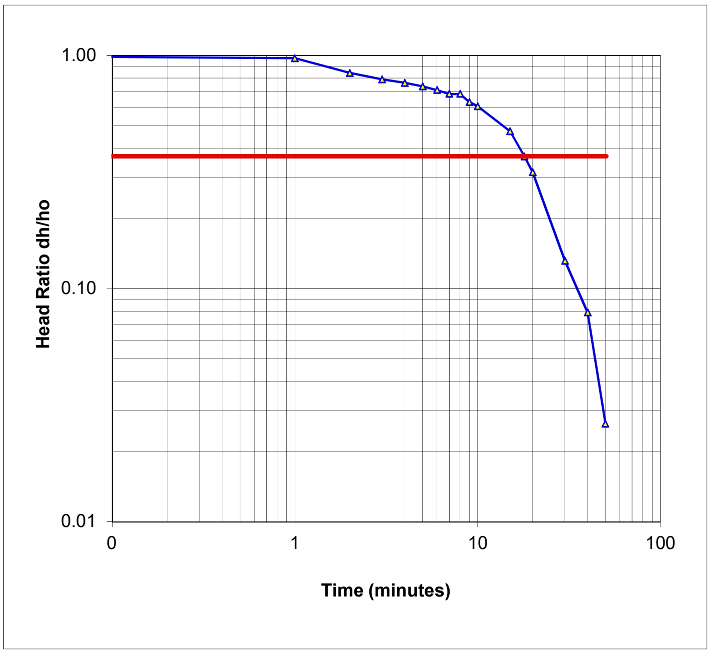
Test Location		**Test No.**	BH112B	
Description:	Standpipe in borehole	Easting:	333928	m
Material type:	Sandstone	Northing	6249324	m
		Surface Level:	16.8	m AHD

Details of Well Installation

Well casing diameter (2r)	50	mm	Depth to water before test	5.37	m
Well screen diameter (2R)	76	mm	Depth to water at start of test	5.75	m
Length of well screen (Le)	6	m			

Test Results

Time (min)	Depth (m)	Change in Head: δH (m)	δH/Ho
0	5.75	0.38	1.000
1	5.74	0.37	0.974
2	5.69	0.32	0.842
3	5.67	0.30	0.789
4	5.66	0.29	0.763
5	5.65	0.28	0.737
6	5.64	0.27	0.711
7	5.63	0.26	0.684
8	5.63	0.26	0.684
9	5.61	0.24	0.632
10	5.6	0.23	0.605
15	5.55	0.18	0.474
18	5.51	0.14	0.368
20	5.49	0.12	0.316
30	5.42	0.05	0.132
40	5.4	0.03	0.079
50	5.38	0.01	0.026
50.5	5.37	0	0.000



To = 18 mins
1080 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 =**	**2.4E-07**	m/sec
	=	**0.088**	cm/hour

Permeability Testing - Falling Head Test Report

Client: Vertical First Pty Ltd
Project: Proposed Commercial Development
Location: 8-10 Lee Street, Haymarket

Project No: 86767.00
Test date: 5-Jun-20
Tested by: NB

Test Location
Description: Standpipe in borehole
Material type: Sandstone

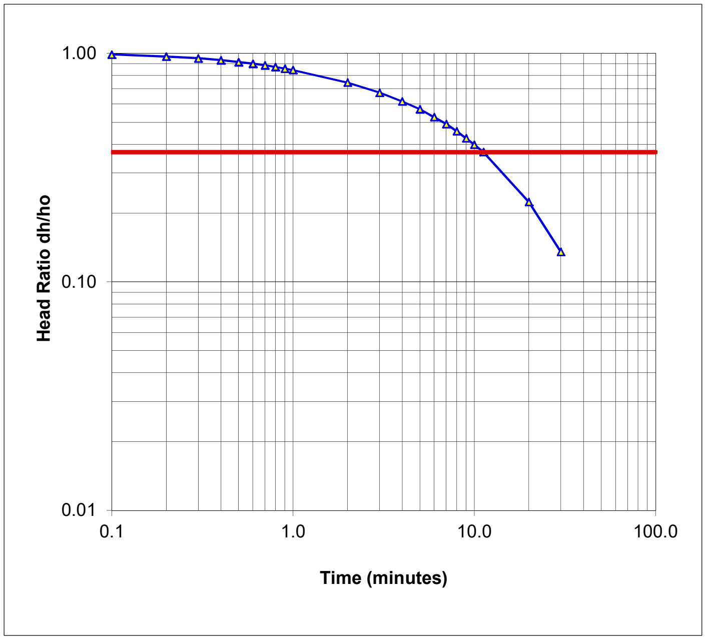
Test No. BH112B
Easting: 333928 m
Northing 6249324 m
Surface Level: 16.8 m AHD

Details of Well Installation
Well casing diameter (2r) 50 mm
Well screen diameter (2R) 76 mm
Length of well screen (Le) 6 m

Depth to water before test 5.32 m
Depth to water at start of test 0.00 m

Test Results

Time (min)	Depth (m)	Change in Head: δH (m)	δH/Ho
0.0	0.00	5.32	1.000
0.1	0.06	5.26	0.989
0.2	0.17	5.15	0.968
0.3	0.26	5.06	0.951
0.4	0.36	4.96	0.932
0.5	0.45	4.87	0.915
0.6	0.53	4.79	0.900
0.7	0.61	4.71	0.885
0.8	0.68	4.64	0.872
0.9	0.76	4.56	0.857
1	0.82	4.50	0.846
2	1.36	3.96	0.744
3	1.74	3.58	0.673
4	2.04	3.28	0.617
5	2.29	3.03	0.570
6	2.52	2.8	0.526
7	2.71	2.61	0.491
8	2.89	2.43	0.457
9	3.06	2.26	0.425
10	3.20	2.12	0.398
11.2	3.35	1.97	0.370
20	4.13	1.19	0.224
30	4.6	0.72	0.135



To = 11.2 mins
672 secs

Theory: Falling Head Permeability calculated using equation by Hvorslev

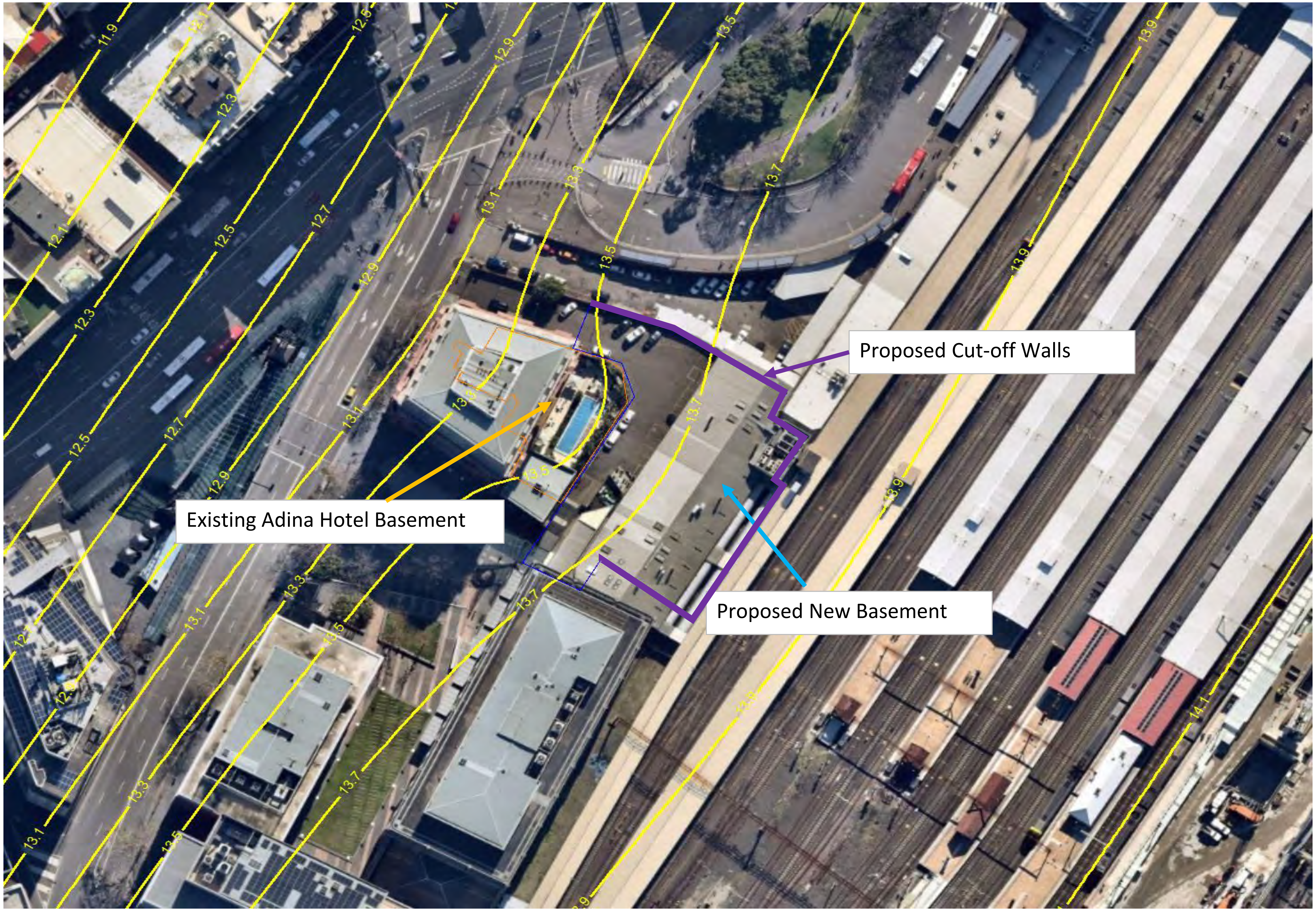
$k = [r^2 \ln(Le/R)]/2Le\ To$

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 = 3.9E-07** m/sec
= 0.141 cm/hour

Appendix E

Modelling Results
Estimated Groundwater Table and Drawdown Contours

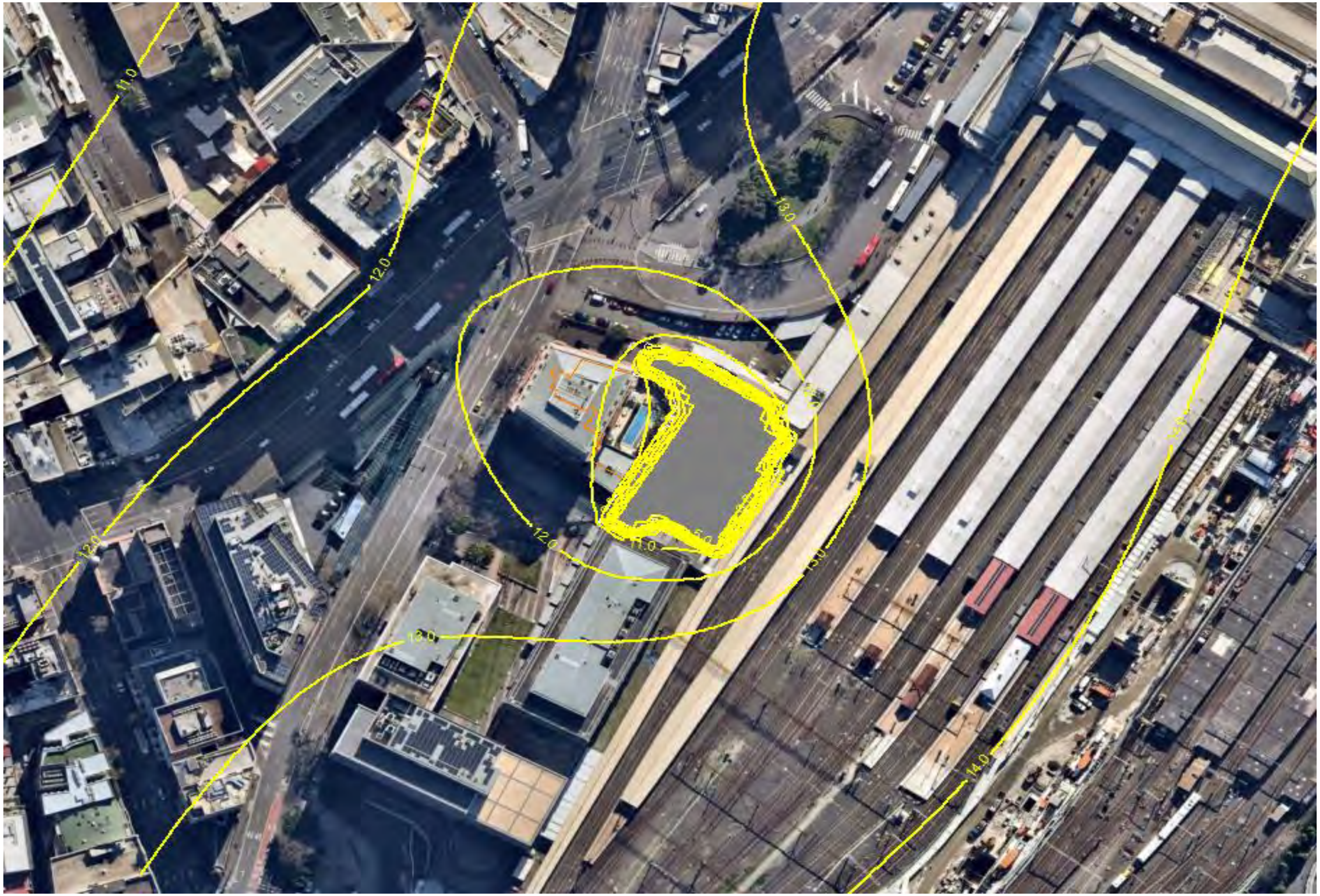


Douglas Partners
Geotechnics / Environment / Groundwater

CLIENT: Vertical First Pty Ltd
OFFICE: Sydney
DRAWN BY: JH
SCALE: NTS
DATE: 2.9.2020

TITLE: **Existing Groundwater Table**
Proposed Commerical Development
8-10 Lee Street, Haymarket

PROJECT No: 86767.04
DRAWING No: M1
REVISION: A

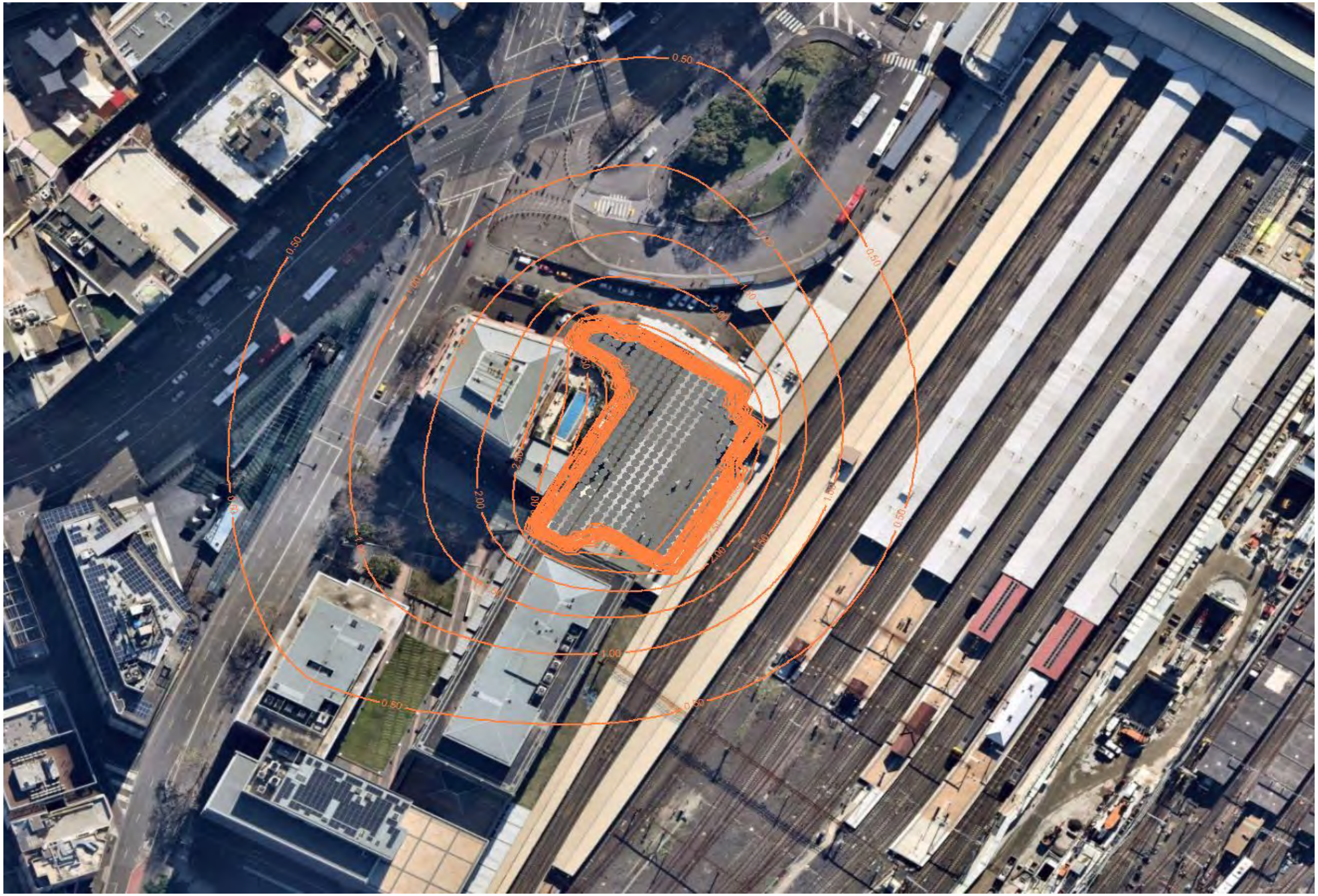


Douglas Partners
Geotechnics / Environment / Groundwater

CLIENT:	Vertical First Pty Ltd		
OFFICE:	Sydney	DRAWN BY:	JH
SCALE:	NTS	DATE:	2.9.2020

TITLE:
Long Term Groundwater Table After Dewatering
Proposed Commerical Development
8-10 Lee Street, Haymarket

PROJECT No:	86767.04
DRAWING No:	M2
REVISION:	A



Douglas Partners
Geotechnics / Environment / Groundwater

CLIENT: Vertical First Pty Ltd
OFFICE: Sydney
DRAWN BY: JH
SCALE: NTS
DATE: 2.9.2020

TITLE: **Long Term Drawdown Contour**
Proposed Commerical Development
8-10 Lee Street, Haymarket

PROJECT No: 86767.04
DRAWING No: M3
REVISION: A