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Report on
Geotechnical Investigation

Hospital Road North (Stage 2)
Hospital Road, Randwick

Prepared for
Lendlease Building Pty Ltd on behalf of Health Infrastructure

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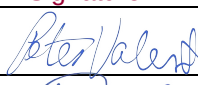
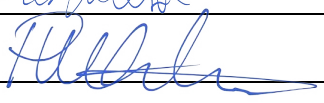
Author		19 February 2021
Reviewer		19 February 2021

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Douglas Partners Pty Ltd
ABN 75 053 980 117
www.douglaspartners.com.au
96 Hermitage Road
West Ryde NSW 2114
PO Box 472
West Ryde NSW 1685
Phone (02) 9809 0666

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Hospital Road North (Stage 2)
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1. Introduction

This report presents the results of a geotechnical investigation undertaken for the proposed Hospital Road North (Stage 2) at Hospital Road, Randwick. The investigation was commissioned by Lendlease Building Pty Ltd (LLB) on behalf of Health Infrastructure (HI). This report was undertaken in accordance with Douglas Partners' proposal SYD200742.P.002.Rev0 dated 23 November 2020.

The investigation was carried out in consultation with LLB, PricewaterhouseCoopers (PwC) the project managers for HI, the structural engineers Bonacci Group Pty Ltd (Bonacci) and the civil engineers Acor Consultants Pty Ltd (Acor).

It is understood that the proposed Hospital Road North (Stage 2) development includes services diversions, installation of shoring piles and lowering of Hospital Road by up to about 10 m at the northern (High Street) end, with the excavation depth reducing towards the south.

The works detailed above on Hospital Road are pivotal in allowing for the development of an interlinked campus and removing the interface between pedestrians and vehicles to provide for a safe and interconnected campus link.

The investigation included a desktop review of previous boreholes, in situ permeability tests and laboratory data in proximity to the site from investigations for the Randwick Campus Redevelopment (RCR) Acute Services Building (ASB) Stage 1, together with the drilling of eight boreholes on and near the site (where access was readily available to drilling rigs) to fill in data gaps, installation of four groundwater monitoring wells to monitor the groundwater levels, permeability tests in soil and rock, and laboratory tests for geotechnical purposes.

Details of the field work methods and results are provided in this report, together with comments on geotechnical issues for planning and design of the proposed Hospital Road North (Stage 2). It is understood that this report will be used to support the Review of Environmental Factors (REF) for the proposed Hospital Road REF works.

The geotechnical investigation was conducted in conjunction with a detailed site (contamination) investigation (DSI), the results for which are reported separately (refer to DP Report 72505.22.R.002). DP has also prepared a Remediation Action Plan (RAP) for this site (refer to report 72505.22.R.003).

2. Previous Investigations

DP previously carried out a number of geotechnical investigations within the Randwick Hospital Campus to the east of Hospital Road (Ref: DP Project 85461.00, dated 8 August 2016), the University of New

South Wales (UNSW) Kensington Campus to the west of Botany Street (Ref: DP Projects 71543.00, dated 19 March 2010 and 73492.00, dated 28 June 2013), and most recently within the RCR site as part of the ASB and HRL Stage 1 (Ref: DP Project 72505.11, dated 8 February 2018 and 72505.13, dated 2018 to 2019).

The approximate locations of the previous boreholes of relevance to the subject development are shown on Drawing 1 in Appendix B. The results of previous boreholes including photographs of rock core samples are provided in Appendix C, and are also included in interpreted geotechnical cross sections in Appendix B.

The subsurface conditions encountered in previous investigations can generally be summarised as sandy and ripped sandstone fill to depths of between 1 m and 3 m, underlain by loose and medium dense sand, then Hawkesbury Sandstone including about 1 – 2 m of variable strength/weathered rock underlain by more consistent medium strength sandstone with some high strength bands.

South of the subject site, low strength siltstone and laminite bands were encountered in boreholes BH2 and BH8 at about RL 40 m and RL 43 m.

At the Wallace Wurth Building within UNSW, approximately 90 m west of the subject site, an igneous dyke in BH2 and BH3 included highly variable strength material, ranging from clay-like and very low strength, extremely weathered rock to very high strength, fresh stained rock. The sandstone rock near the dyke was typically highly fractured and fractured. The dyke is expected to strike east – south-east, and may extend across Botany Street into the north-western corner of the RCR where the proposed HTH site is located. The inferred strike of the two dykes is shown on Drawing 1 in Appendix B. It is noted that this dyke has not been encountered in more recent boreholes located on the eastern side of Botany Street within the larger RCR site.

Groundwater was generally measured near the soil and rock interface and less than 1 m above the top of rock in some boreholes.

Plasticity tests on the fill indicate that it is of low plasticity, with test results on natural sand indicating it is non-plastic. Particle size distribution tests on sand indicate that it is mostly of fine to medium grain size with either 0%, with trace of (0 – 5%), or with some (5 – 12%) silt or clay content (i.e. fines <0.075 mm diameter).

For tests located upslope of the proposed Sydney Children's Hospital Stage 1 and Children's Comprehensive Cancer Centre (SCH 1 / CCCC) southern site boundary, permeability testing within sand gave a permeability ranging between 1.1 x 10^{-5} and 4.1 x 10^{-7} m/s (for tests in BH12, BH13 and BH16). Permeability testing within rock gave a permeability of 1.7 x 10^{-7} m/s in BH4 and 1.1 x 10^{-6} m/s in BH17.

3. Site Description

The proposed Hospital Road North (Stage 2) site is located approximately 6 km from the Sydney Central Business District (CBD), within the Randwick Local Government Area (LGA) and the Randwick Health and Education Precinct (RHEP). The RHEP includes the Randwick Hospital Campus (RHC), which is home to the SCH, Prince of Wales Hospital (POWH), the Royal Hospital for Women (RHW), the Prince

of Wales Private Hospital (POWPH), UNSW Kensington Campus and several other medical research institutes including the Children's Cancer Institute (CCI). The site includes a rectangular area within Hospital Road of approximately 8 m by 122 m, and the SCH 1 / CCCC northern shoring wall area that continues about 64 m further west along High Street. Both areas are located in the north-eastern corner of the larger RCR redevelopment site.

At the time of the investigation, Hospital Road was an asphaltic concrete pavement with some on-street car parking. Hospital Road provides access to Delivery Drive and is currently accessed by vehicles and pedestrians from Magill Street to the south and High Street to the north. The ground surface along Hospital Road undulates between about RL 55 m and RL 57 m relative to Australian Height Datum (AHD).

Drawing 1 in Appendix B includes an aerial photograph of the site and surrounding area, taken on 2 August 2020. The site location and the general site topography are shown in Figure 1 below.

The site is bordered by High Street with South East Light Rail infrastructure followed by residential properties to the north, the ASB Stage 1 site currently under construction to the south, the Hospital Precinct with multi-storey buildings to the east and the proposed SCH 1 / CCCC followed by the proposed UNSW Health Translation Hub (HTH) site and Botany Street to the west.

In terms of nearby basements, it is understood that the ASB basement Level -02 is at about RL 47.0 m and was constructed as a drained basement with an anchored contiguous pile shoring wall. The proposed SCH 1 / CCCC basement includes Level -02 at RL 46.8 m to RL 47.5 m and Loading Dock at the northern end at RL 45.8 m. The proposed HTH basement level that will be located west of the SCH 1 / CCCC will be about RL 50.2 m.

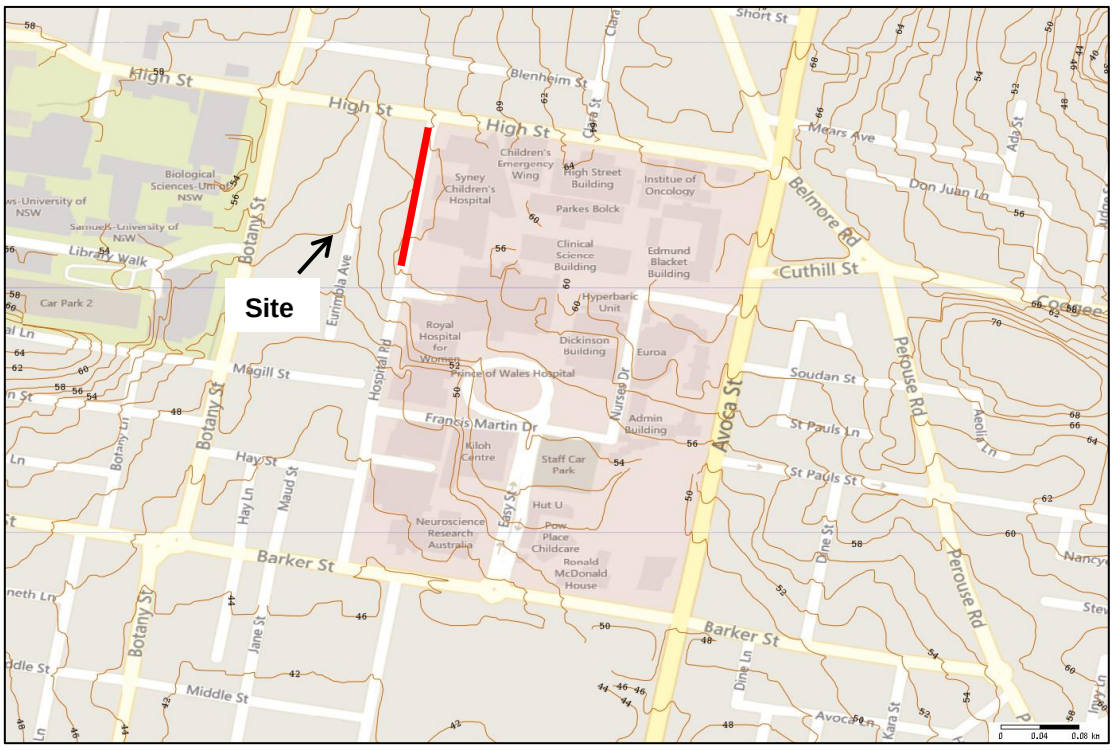

Figure 1: Site Location and Topography with 2 m Contours

4. Regional Geology

Reference to the Sydney 1:100 000 Series Geological Sheet indicates that the site is underlain by fine to medium grained sand (shown in yellow in Figure 2). Hawkesbury Sandstone comprising medium to coarse grained quartz sandstone with minor shale and laminite bands (shown in green in Figure 2) is present in areas to the north-east, south-east and south-west of the site. The current investigation confirmed the presence of sand and Hawkesbury Sandstone.

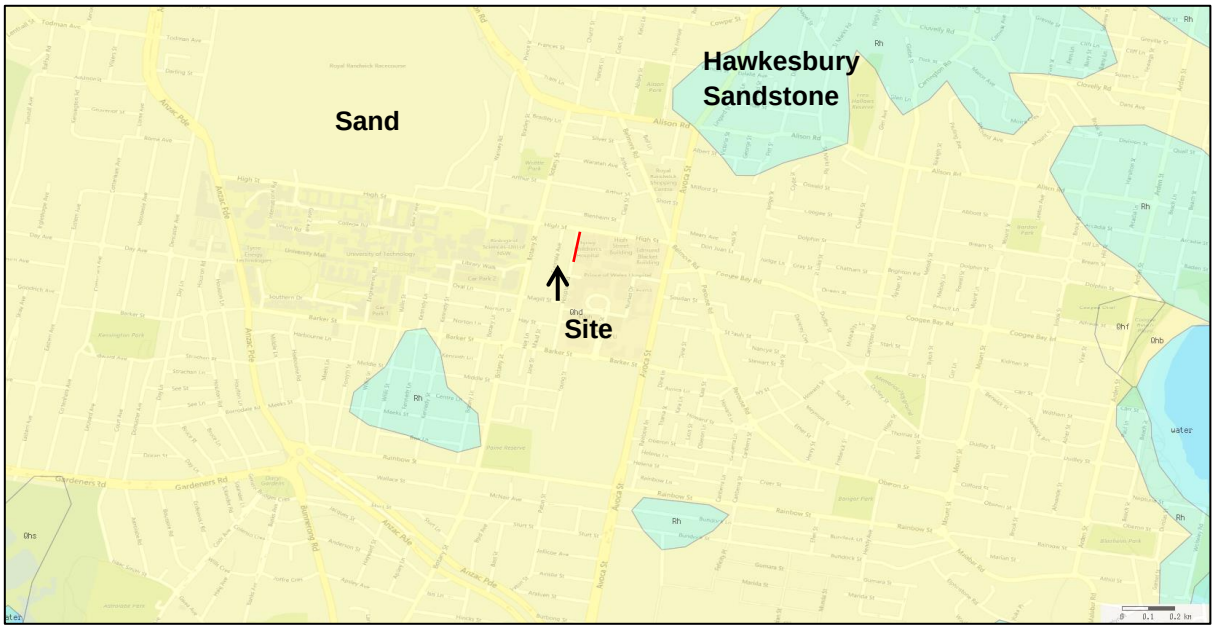

Figure 2: Regional Geology (Source: Sydney 1:100 000 Series Geological Sheet)

The site is located well beyond the mapped extent of potential saline soil areas shown in the NSW Salinity Potential Western Sydney map prepared by the former Department of Infrastructure Planning and Natural Resources (2002). Therefore, a soil salinity assessment and a soil salinity management plan are considered to be unnecessary for this development.

The Acid Sulfate Soils Map (Sheet ASS_007) sourced from the Randwick Local Environment Plan 2012 indicates that the site is located in an area which is not known to have acid sulfate soils. Therefore, an acid sulfate soils assessment and an acid sulfate soils management plan are considered to be unnecessary for this development.

5. Field Work Methods

The current investigation included:

- Scanning for Services:
  - Scanning for services using a ground penetrating radar and an electromagnetic scanner to set out all boreholes a safe distance away from underground services with the aid of Dial-Before-You-Dig (DBYD) service plans and a services plan provided by the client.

- Pot-Holing:
  - The five boreholes (BH601 to BH605) within Hospital Road were firstly cored through the pavement and then pot-holed using non-destructive drilling (NDD) methods (i.e. vacuum) and with a hand auger to confirm that the borehole locations were unaffected by buried services.
- Drilling of Boreholes:
  - Eight boreholes (BH601 to BH608) were drilled with a bobcat-mounted drilling rig near the locations nominated by the structural engineers (Bonacci), to fill in the data-gaps across the site. The borehole locations were positioned where accessible to the drill rig, to avoid underground services and to minimise disruption to site activities;
  - The boreholes were drilled through soil to the top of weathered rock using solid flight auger and rotary/washbore drilling (i.e. with circulating drilling fluid) techniques;
  - Standard penetration tests (SPTs) were undertaken below the depths of NDD or hand augering at approximate 1.5 m depth intervals to assess the strength of the soils/weathered rock and to collect samples for tactile assessment and laboratory testing;
  - Observation of any groundwater whilst augering the boreholes;
  - Six out of the eight boreholes were continued into the rock to depths of between 16.0 m and 17.6 m using diamond core drilling techniques to recover 50 mm diameter (NMLC-size) rock core samples for logging and strength testing;
  - Colour photographs were taken of the rock core samples, followed by point load (axial) strength tests at approximately 1 m depth intervals to assess the unconfined compressive strength (UCS) of the rock; and
  - Logging of the boreholes and co-ordination of the field work by a geotechnical engineer.
- Groundwater Monitoring Wells:
  - Two groundwater monitoring wells were installed (within BH602 and BH606) to allow groundwater monitoring and permeability testing within the sand profile.

    Two groundwater monitoring wells were installed (within BH605 and BH608) to allow groundwater monitoring and permeability testing within the rock profile.

    Wells included 50 mm diameter, machine-slotted polyvinyl chloride (PVC) pipes over the subsurface section of interest;
  - Data loggers were installed within the four new wells to measure the groundwater level throughout the investigation period and for on-going, longer term monitoring; and
  - The groundwater levels recorded by data loggers within previous wells at BH12 and BH13 were downloaded to supplement current groundwater data.
- Permeability Testing:
  - Falling-head or rising permeability tests were undertaken within the four new wells using water data-loggers. The permeability tests within BH602 and BH606 targeted the soil permeability and tests within BH605 and BH608 targeted the rock permeability.
- Surveying:
  - The ground surface levels at the borehole locations were measured using a high-precision global positioning system (GPS). Horizontal positions are relative to the Map Grid of Australia 1994 (MGA94), Zone 56 datum. Vertical positions are relative to AHD. The accuracy of the vertical and horizontal measurements is typically better than 0.1 m.

The locations of the boreholes are shown on Drawing 1 in Appendix B.

6. Field Work Results

6.1 Boreholes

Details of the subsurface conditions encountered in the current boreholes BH601 to BH608, together with photographs of the rock cores and notes defining classification methods and descriptive terms, are provided in Appendix D.

The subsurface profile encountered in boreholes BH601 to BH608 is summarised as follows:

- PAVEMENT: A 40 – 110 mm thick asphaltic concrete surfacing underlain by roadbase gravel to less than 0.5 m depth;
- FILL: Gravelly sand, silty sand, sand and gravel (crushed sandstone) fill to depths of between 0.6 m and 1.6 m;
- NATURAL SAND AND CLAY (AEOLIAN and RESIDUAL): Loose and medium dense sand and clayey sand to depths of between 1.6 m and 4.0 m. Sandy clay or extremely weathered sandstone was encountered in BH605 at a depth of 2.5 – 3.2 m. Apparently cemented, iron-indurated sand known locally as “coffee rock” was encountered in BH602 at 2.2 – 2.6 m; and
- HAWKESBURY SANDSTONE: The top of rock was encountered below levels of between RL 48.7 m and RL 52.5 m, about 1.7 m to 4 m below the ground surface. The upper rock profile included variably extremely low to medium strength sandstone. More consistent medium and high strength sandstone was encountered below levels ranging between RL 46.2 m and RL 50.7 m, except in BH602 and BH604, which were discontinued in weathered rock.

  The rock discontinuities are predominantly along bedding planes dipping between 0° and 20° below the horizontal or decomposed seams, with the occasional rock joint dipping between 30° and 60°.

  Some core loss occurred in the boreholes, possibly indicating decomposed seams or very low strength rock.

6.2 Groundwater

6.2.1 Groundwater Monitoring

Groundwater seepage was measured near the soil and rock interface in BH601, BH603 and BH605 at depths of 3.95 m, 1.8 m and 3.1 m, respectively. No groundwater was observed during auger drilling in the other five boreholes. The use of water for rotary/washbore drilling and rock coring purposes precluded any further observation of groundwater.

The results of the measured groundwater levels within boreholes drilled during the previous investigation period are provided in Table 1, with the top of rock depths/levels provided for comparison. In all previous boreholes, the groundwater levels were measured at or below the top or rock level.

Table 1: Summary of Tape-Measured Groundwater Levels and Rock Levels

Bore	Groundwater During Drilling	Groundwater in Well (Post-Purging of Residual Water from Drilling and Tests)				Approximate Depth (& RL) to Top of Rock (m (& m AHD))
	Approximate Depth (& RL) (m (& m AHD))	Date	Approximate Depth (& RL) (m (& m AHD))	Date	Approximate Depth (& RL) (m (& m AHD))	
BH4	Dry	10.5.18	3.6 (48.3)	17.5.18	3.7 (48.2)	3.5 (48.4)
BH7	Dry	13.10.17	5.1 (49.5)	17.5.18	Not Accessed	3.9 (50.7)
BH8	Dry	10.5.18	Dry	17.5.18	Not Accessed	2.6 (47.9)
BH12	Dry	10.5.18	6.3 (49.4)	17.5.18	6.1 (49.6)	6.1 (49.6)
BH13	Dry	10.5.18	Dry	17.5.18	3.5 (48.5)	3.2 (48.8)
BH16	Dry	10.5.18	4.2 (51.0)	17.5.18	4.1 (51.1)	4.1 (51.1)
BH17	Dry	10.5.18	5.1 (50.1)	17.5.18	5.0 (50.2)	4.4 (50.8)

The results of the groundwater levels measured by electronic data-loggers in current groundwater wells at BH602, BH605, BH606 and BH608, and in previously installed wells at BH12 and BH13 over a longer monitoring period are provided in Appendix H. The well construction details are provided in the respective well logs in Appendix G.

The results are plotted against rainfall data from a nearby weather station located at Randwick Street, Randwick (Station No. 66052, operated by the Bureau of Meteorology). Labels are shown at the respective time on the graphs where the data-loggers were manually handled for tests during the monitoring period (i.e. to identify false readings).

At BH12 and BH13, the groundwater levels measured between 1 December 2019 and 8 September 2020 rise following heavy rainfall events and slowly fall towards original levels within the rock and above the proposed Hospital Road Lowering Stage 2 and SCH 1 / CCCC basement level.

At BH602, BH605, BH606 and BH608, the groundwater levels measured between 29 August 2020 and 21 September 2020 were close to or below the top of rock, and above the proposed Hospital Road Lowering Stage 2 and the proposed SCH 1 / CCCC basement level.

6.2.2 Falling-Head Tests

The detailed results of the in situ falling or rising head tests within previous and current groundwater wells are provided in Appendix I and are summarised in Table 2.

Table 2: Results of Permeability Tests

Well Location	Hydraulic Conductivity (m/s)			
	Sand		Sandstone	
	Test 1	Test 2	Test 1	Test 2
BH602	4.7×10^{-5}	-	-	-
BH605	-	-	5.9×10^{-8}	-
BH606	3.8×10^{-5}	-	-	-
BH608	-	-	1.2×10^{-7}	-
BH4	-	-	1.7×10^{-7}	1.7×10^{-7}
BH8	8.9×10^{-7}	Inaccessible	-	-
BH12	3.0×10^{-7}	3.2×10^{-7}	-	-
BH13	8.7×10^{-6}	1.1×10^{-5}	-	-
BH16	2.1×10^{-7}	4.1×10^{-7}	-	-
BH17	-	-	1.1×10^{-6}	1.2×10^{-6}

7. Laboratory Testing

7.1 Physical Soil Properties

The detailed laboratory test results of the physical properties are included in Appendix E.

Selected soil samples were tested in DP's National Association of Testing Authorities (NATA) accredited laboratory to assess a range of physical properties including the field moisture content, soil plasticity, California bearing ratio (CBR), maximum dry density and optimum moisture content at Standard compaction. The laboratory test results for previous and current boreholes are summarised in Table 3.

Table 3: Laboratory Results of Physical Soil Properties

Borehole	Depth (m)	Material	W_F (%)	W_P (%)	W_L (%)	PI (%)	CBR (%)	MDD (t/m^3)	OMC (%)
BH601	2.0 - 3.8	Sand	6.5	-	-	-	15	1.67	12.0
BH605	0.4 – 1.0	Fill/Gravelly Sand, Sand	13.9	-	-	-	25	1.76	13.5
BH603	1.4 – 1.5	Clayey Sand	17.2	17	20	3	-	-	-
BH605	2.0 – 2.45	Clayey Sand	18.4	15	21	6	-	-	-
BH607	1.9 – 2.0	Clayey Sand	17.8	16	19	3	-	-	-
BH2	0.3 – 0.4	Sand Fill	7.3	NO	NO	NP	-	-	-

Borehole	Depth (m)	Material	W_F (%)	W_P (%)	W_L (%)	PI (%)	CBR (%)	MDD (t/m^3)	OMC (%)
BH3	0.4 – 0.5	Sand Fill	4.5	NO	NO	NP	-	-	-
BH4	2.5 – 2.95	Sand	4.9	NO	NO	NP	-	-	-
BH4	0.75 – 1.3	Sand Fill with some Sandstone Gravel	4.9	-	-	-	25	1.68	12.5

Notes: W_F = Field Moisture Content W_P = Plastic Limit W_L = Liquid Limit
PI = Plasticity Index CBR = California Bearing Ratio
MDD = Maximum Dry Density NO = Not Observed NP = Non-Plastic

Three particle size distribution (PSD) tests were also carried out in DP's laboratory on natural soil samples from BH606, BH607 and BH608 to assess the soil grading and to allow the estimation of the soil permeability using empirical methods. The results of the PSD tests indicate that the natural soil is fine to medium grained sand, with (5 – 12%) or a trace (0 – 5%) of silt or clay content. An estimate of the sand permeability using empirical methods is described in Section 9.2.1.1 of this report.

7.2 Chemical Soil Properties

Four soil samples from the current 600 series boreholes were tested at an external NATA-accredited laboratory to assess the soil aggressivity (pH, chloride, sulphate content and electrical conductivity) to buried concrete and steel elements. The detailed laboratory test results of chemical properties are included in Appendix F and are summarised in Table 4, together with the results of tests from previous boreholes nearby.

Table 4: Summary of Laboratory Chemical Soil Analysis

Borehole	Depth (m)	Material	pH	Chloride (mg/kg)	Sulphate (mg/kg)	Electrical Conductivity (µS/cm)
BH601	3.5 - 3.6	Sand	6.5	<10	20	31
BH605	2.5 - 2.6	Sandy Clay	5.1	<10	32	27
BH606	2.5 - 2.95	Sand	6.9	<10	29	27
BH607	2.5 - 2.95	Clayey Sand	6.1	<10	42	35
BH2	4.0 – 4.45	Sand	8.5	<10	10	20
BH3	1.3 – 1.4	Sand	8.0	<10	28	41
BH4	2.5 – 2.95	Sand	7.7	<10	22	20
BH8	2.5 – 2.66	Sand/Weathered Sandstone	11.6	<10	66	730
BH13	3.0 – 3.2	Sand	5.4	<10	<10	12

7.3 Rock Strength Testing

Selected samples of the rock core were tested to determine the Point Load Strength Index (Is_{50}) values for classification of the rock strength. The test results are shown on the borehole logs at the appropriate depths. The $Is_{(50)}$ values for the tested rock cores ranged from less than 0.1 MPa to 2.2 MPa, corresponding to a rock classification from very low to high strength. The unconfined compressive strength (UCS) of the rock is inferred to range between about 1 MPa and 40 MPa using a typical correlation ratio of 20:1 for UCS:$Is_{(50)}$ in Hawkesbury Sandstone.

8. Proposed Development

It is understood that the proposed Hospital Road North (Stage 2) development includes:

- Diversion of existing services;
- Piling for shoring walls north-south on Hospital Road and east-west along the High Street boundary;
- Excavation of Hospital Road North to depths up to about 10 m at the northern end and reducing in height towards the south. The lowered Hospital Road will slope from about RL 51.0 m at the southern end down to RL 45.8 m at the northern end.

Directly west of the proposed Hospital Road lowering, the SCH 1 / CCCC project is also proposed and this includes a multi-storey building with basement Level -02 at RL 46.8 m to RL 47.5 m and Loading Dock at the northern end at RL 45.8 m.

9. Comments

9.1 Geological Model

A summary of the subsurface conditions encountered across the site is shown in two geotechnical cross-sections A - A' and B - B' in Drawings 2 and 3 in Appendix B, with the proposed levels for Hospital Road lowering and proposed SCH 1 / CCCC basement Level -02 also shown indicatively.

Pavement materials are expected along Hospital Road and the former Eurimbla Avenue. In other areas of the site, the subsurface conditions are expected to include sandy and crushed sandstone fill to depths of between 1 m and 2 m, underlain by loose and medium dense sand and clayey sand, then Hawkesbury Sandstone including about 1 – 2 m of variable strength/weathered rock underlain by consistent medium strength sandstone with some high strength bands. The rock surface undulates across the site, although generally dips down towards the south and west in some areas.

The Hawkesbury Sandstone is generally cut by two main sets of steeply dipping joints trending north – north-east and east – south-east. These main sets of rock joints are likely to be near-parallel to excavation faces for the proposed basement and road excavations.

The igneous dykes encountered at the Wallace Wurth Building within UNSW, approximately 90 m west of the subject site, were not intersected in any of the current boreholes or in the previous boreholes located within the RCR site (i.e. east of Botany Street).

Based on the site topography, published mapping and subsurface conditions encountered to date, acid sulfate soils and saline soils are unlikely to be geotechnical issues at this site.

Based on measurements of groundwater within previous and current boreholes and monitoring wells, groundwater seepage is expected near the soil and rock interface and within rock along joints and extremely/highly weathered rock bands. The groundwater seepage levels are above the proposed Hospital Road level and basement Level -02. Beyond the Hospital Road North site, a water table is expected within the sand profile over rock at the southern, lower-lying end of the adjacent ASB site (i.e. near Magill Street).

The groundwater seepage levels should be expected to fluctuate with variations in climatic conditions. For design, based on groundwater monitoring data to date and DP's experience in the area, the groundwater seepage level may periodically rise by up to 1 m (and possibly more) over the rock surface, following extended periods of rainfall. Groundwater is expected to flow downslope over the rock surface, generally towards the south and west.

9.2 Excavation Conditions

The Hospital Road excavation is likely to intersect pavements, fill, natural sand and Hawkesbury Sandstone of variable strength. Excavation of soil and very low strength rock should be readily achieved using conventional earthmoving equipment, such as tracked excavators with bucket attachments. Removal of low strength and stronger rock will require relatively large excavators fitted with hydraulic rock hammers and/or rotary rock saws. Excavation of existing pavements is also likely to require similar plant and equipment. For productive excavation of low strength and stronger rock within large areas, ripping of rock with large dozers could be considered.

9.2.1 Groundwater and Dewatering

Based on the groundwater data available to date, groundwater seepage is expected near the soil and rock interface, and within rock along rock joints and extremely/highly weathered rock bands, all of which lie above the proposed Hospital Road levels and future basement levels.

A tanked basement comprising water-tight walls and floors would eliminate the requirement for permanent dewatering and approval from regulatory authorities for permanent dewatering and disposal of groundwater off-site. Alternatively, a drained basement is also considered to be suitable but would require approval from regulatory authorities.

For a drained basement, any immediate lowering of groundwater seepage levels through weep holes/spitter pipes within basement walls is expected to be within local historical fluctuations. The proposed development levels are also above the water table located further south of the site, and consequently, there is no requirement to lower the water table. Therefore, the effect of drawdown (i.e. additional soil stresses causing vertical settlement of the ground surface and nearby structures) is not expected to be an issue with dewatering for a drained basement.

Dewatering during excavation for the basement should be able to be managed through sump and pump techniques.

9.2.1.1 Groundwater Ingress

Based on the results of three particle size distribution tests on natural sand and using Hazen's equation to predict the soil permeability or hydraulic conductivity (k), the sand has an average 'k' value in the order of 2.3 x 10^{-4} m/s to 5.6 x 10^{-5} m/s.

Based on the results of the of nine falling-head tests in natural sand, the sand has a 'k' value in the order of 4.7 x 10^{-5} m/s to 2.1 x 10^{-7} m/s.

These 'k' values represent a soil of medium to high permeability, and within the typical range of permeability for fine to medium grained sand with varying inclusions of silt and clay. It is noted that the hydraulic conductivity of sandy soil is highly dependent upon the grain size, the soil density, the amount of silt and clay content (i.e. fine particles less than 0.075 mm diameter) and the degree of saturation over the full depth of the sand profile, and for these reasons will vary across the site.

The permeability of rock depends on the primary permeability of the rock, which considers the rock mass, and the secondary permeability of the rock, which is governed by the frequency and aperture (i.e. tightness, open or tight) of the rock joints and discontinuities. Based on the results of six in situ falling head tests within rock, the rock has a 'k' value in the order of 1.2 x 10^{-6} m/s to 5.9 x 10^{-8} m/s. If open rock joints are intersected then the secondary permeability of the rock would be expected to be greater than the estimate provided. The permeability of the rock can be more accurately measured during the excavation stage of construction.

Based on the current information on groundwater monitoring, rainfall data, rock contours, and permeability testing at this site, groundwater inflow to the Hospital Road excavation is estimated to be in the order of 9,000 – 10,000 L/day, or about 3.3 – 3.7 ML/year. This estimate of groundwater considers that the excavation for the proposed Hospital Road and the adjacent proposed SCH 1 / CCCC basement will occur at the same time. If the Hospital Road excavation occurs first and independently to the adjacent SCH 1 / CCCC basement excavation, with a shoring wall extending along the western side of Hospital Road, then the groundwater inflow to the Hospital Road excavation is estimated to be in the order of 18,000 L/day, or about 6.6 ML/year. Detailed modelling should be undertaken to refine this estimate, if required.

The volume of groundwater ingress will ultimately depend on the soil permeability, rock fracturing, the amount of ground surface infiltration compared to surface run-off, and prevailing weather conditions. Greater volumes of groundwater ingress to the basement may also be experienced if leaking stormwater systems are present in the surrounding sandy soils or heavy continuous rainfall is experienced. Consideration should be given to whether a dewatering licence from a regulatory authority is required for this site.

A drainage blanket including a free-draining, single-sized (typically 20 mm) durable crushed rock should be constructed below the Hospital Road pavement. The thickness of the drainage blanket (typically 100 – 150 mm thick) will ultimately depend on the granular material adopted, and should be designed by the civil or hydraulic engineers. By way of example, a 100 mm thick drainage blanket should be appropriate for the estimated rate of groundwater ingress to the basement. This assumes the use of a free-draining granular material with a permeability of 1 x 10^{-2} m/s.

9.2.1.2 Disposal of Groundwater

The potential to dewater and dispose groundwater off-site into Randwick City Council's (Council) stormwater system will depend on the contamination status of the groundwater and other groundwater properties.

In the absence of Council criteria for disposal of groundwater to the local stormwater system, DP proposes the following stormwater quality assessment criteria from Australian and New Zealand guidelines for fresh and marine water quality, Australian and New Zealand Conservation Council & Agriculture, and Resource Management Council of Australia and New Zealand (ANZECC/ARMCANZ (2000):

- Conductivity (µs/cm) 125-2200;
- pH 6.5-8.5;
- Dissolved Oxygen (% saturation) 85-110;
- Turbidity (NTU) <50; and
- Suspended solids (mg/L) <40.

Laboratory testing on groundwater for the purpose of disposal off-site was not part of the current scope, and this should be completed with further soil/groundwater contamination assessments and/or during construction directly from the holding tank or sump.

Reference should be made to the contamination assessment reports by DP for further advice and recommendations in relation to the contamination status of groundwater and any remedial works.

9.2.2 Disposal of Excavated Materials

All excavated materials will need to be disposed of in accordance with the provisions of the current legislation and guidelines including "Waste Classification Guidelines" – 2014, New South Wales Environment Protection Authority (NSW EPA). This includes fill and natural materials that may be removed from the site.

Reference should be made to DP's DSI Contamination Report (DP Project 72505.22.R.002) for guidance on the off-site disposal of excavated materials.

9.2.3 Ground Vibrations

Vibrations may be induced by a large number of site activities, including demolition of existing pavements or buried structures, excavation, driving sheet piles, piling and compaction works. Hence, particular care to avoid damaging adjacent buildings or structures will be required.

The level of acceptable vibration is site-specific and is dependent on various factors including the type of building structure (e.g. reinforced concrete, brick, etc.), its structural condition, the frequency range of vibrations produced by the construction equipment, the natural frequency of the building and the vibration transmitting medium.

The Australian Standard AS 2187.2 - 1993 “Explosives Code” recommends a maximum peak particle velocity (PPV) of 10 mm/s to avoid architectural damage to houses and low-rise residential or commercial buildings. Ground vibration arising from excavation plant is of a continuous nature, as opposed to transient nature such as with blasting events. More stringent vibration limits should generally apply for excavation plant than for blasting.

It is suggested that vector sum peak particle velocity (VSPPV) be initially limited to 8 mm/s at the foundation level of adjacent buildings for this site. The presence of medical equipment within existing facilities may warrant more stringent vibration limits for their operation. Utility and light rail owners or operators may also request a specific vibration limit to protect their asset.

It should also be noted that human perception of vibrations is much greater than that of buildings and consequently vibration levels considered insignificant for buildings may disturb humans.

Vibration trials should occur at the commencement of excavation in rock to determine minimum set-backs from existing buildings or sensitive areas for specific plant, whether the use of other plant or continuous vibration monitoring is required.

9.3 Excavation Support

9.3.1 Batter Slopes

Vertical excavations in fill and natural sand are not expected to be stable for any extended period of time. Therefore, both temporary and permanent shoring support will be required for proposed excavations.

Where there is sufficient space, maximum temporary and permanent batters of 1.5H:1V and 2H:1V, respectively, are suggested for cuts less than 3 m high in fill and natural sand above groundwater, and where not subjected to surcharge loads. If vegetation and maintenance of permanent batters is proposed, a flatter permanent batter of 3H:1V is suggested. Erosion control should also be provided for permanent batters and this may simply include a layer of geofabric covered by grass.

Excavations in consistent medium and high strength sandstone can be cut vertically and remain unsupported provided there are no adversely oriented joints, faults or other defects in the rock mass.

During construction of the and service trenches, any exposed excavation faces should be inspected at regular 1.5 m depth intervals by an experienced geotechnical engineer to assess whether there are any further stabilisation requirements, such as reducing the steepness of a batter, installation of ground anchors or shotcrete protection.

9.3.2 Retaining Wall Types

Due to the presence of sand, groundwater seepage near the soil and rock interface and possibly rising groundwater seepage levels above rock during extended wet periods, a secant pile shoring wall comprising interlocking Continuous Flight Auger (CFA) piles or CFA piles with jet grouted columns in between piles is recommended as this shoring system can generally provide an effective seal to minimise sand loss and water inflow from behind the wall, and if adequately supported, minimise lateral

deflections. A secant pile shoring wall can be designed as a tanked or drained basement and can be incorporated into the vertical load carrying footing system.

Alternatively, a contiguous pile wall, with the gaps between the piles plugged with dry-pack grout or reinforced shotcrete during excavation to retain soil, together with a drainage plenum around the site perimeter for collection and subsequent discharge of groundwater is also considered to be a feasible retaining system. It is recommended that weep holes/spitter pipes covered with a filter fabric on their back-end be installed at regular vertical and horizontal spacing through the plugged gaps in the contiguous pile wall to prevent the build-up of hydrostatic pressure behind the wall. A contiguous pile shoring wall can be designed as a drained basement and can be incorporated into the vertical load carrying footing system provided the pile toes extend below the excavation level.

It will be necessary to ensure that gaps between contiguous piles are generally limited to less than 50 mm to minimise the risk of sand loss from behind the wall. Some groundwater ingress between piles should also be expected during construction. Any gaps between the contiguous piles should be progressively plugged as the excavation proceeds (at every 1.5 m depth of excavation) to prevent such sand loss. The gaps in between the piles are typically filled with dry-packed grout, however, shotcrete or grout injection may be required to provide greater support.

The shoring piles can be terminated in consistent medium strength (or stronger) rock above the excavation level, and this would most likely require lateral restraint of the pile toe using steel beams and ground anchors. Mapping of the rock cutting below the shoring piles at 1.5 m deep drops in excavation is required to determine if any additional stabilisation is required.

Given the presence of sands over rock, together with the proximity of adjacent structures, light rail and utilities, particular care will be required by the piling contractor to avoid "decompression" of the upper sands. Decompression involves the drilling auger drawing in the surrounding soils, usually due to a sudden decrease in the rate of penetration relative to auger rotation. Decompression can lead to settlement of the ground surface and damage to existing structures founded within sand. For this and other reasons, only experienced piling contractors with suitable high-powered drilling rigs should be considered for this project.

For temporary support of localised excavations such as service trenches, sheet pile walls or steel trench boxes may be appropriate, provided no vibration or movement sensitive structures are located in close proximity to the excavation.

9.3.3 Retaining Wall Design

The recommended bulk density and earth pressure coefficients for the design of cantilevered walls or walls with one row of ground anchors are provided in Table 5. Active earth pressure coefficients (K_a) may be used where some wall movement is acceptable. “At rest” earth pressure coefficients (K_o) should be used where wall movement is to be minimised such as close to structures, or where the wall is propped or braced prior to excavation. A triangular lateral earth pressure distribution could be adopted for cantilevered walls or walls with one row of anchors.

Table 5: Earth Pressure Coefficients and Bulk Unit Weights

Material	Active Earth Pressure Coefficient (K_a)		At Rest Earth Pressure Coefficient (K_o)	Bulk Unit Weight γ (kN/m^3)
	Short Term / Temporary	Long Term / Permanent		
Fill / Sand	0.3	0.4	0.5	20
Variable Very Low to Low Strength Sandstone	0.1	0.15	0.2	22
Medium Strength (or stronger) Sandstone	0	0	0	24

The above earth pressure coefficients assume a level ground surface behind the top of the wall. Additional allowances should be made for the effects of building or structure surcharge loads on the wall, as well as any short-term surcharges such as construction plant or vehicles operating behind the top of the wall.

Where more than one row of temporary anchors is used, it is recommended that the shoring design is based on a rectangular earth pressure distribution. Where there are no movement sensitive structures or services in close proximity to the excavation, the maximum pressure (kPa) could be calculated using 4H (where H equals the depth (m) to the excavation level or to the top of medium strength sandstone, whichever is shallower). Where the wall movement is to be minimised, the maximum pressure could be calculated using 6H.

Passive lateral resistance for piles embedded below the base of the excavation may be based on an ultimate passive lateral pressure provided in Table 6. A factor of safety of at least two must be applied to the ultimate values to limit wall movement that is required to mobilise the full passive resistance. Passive resistance should be assumed to start at least 0.5 m below excavation level due to disturbance and fracturing of the rock and toe drains.

Table 6: Ultimate Passive Lateral Coefficient/Pressures for Embedded Retaining Wall Piles

Material	Ultimate Passive Lateral Coefficient and Pressures
Sand	$K_p = 3$
Very Low Strength Sandstone	400 kPa
Low to Medium Strength (or Stronger) Sandstone	2000 kPa

If a water-tight retaining wall system is used to provide a tanked basement without drainage or relief measures, the retaining walls should be designed for full hydrostatic pressures.

Detailed design of shoring should preferably be carried out using WALLAP, FLAC or other computer analysis programs capable of modelling the proposed excavation and anchoring sequence and potential movements of the wall.

9.3.4 Ground Anchors

Temporary ground anchors may be required to restrict wall movements during the construction phase, with permanent support of retaining walls anticipated to be provided by the final structure.

Ground anchors are typically inclined at about 10° below the horizontal, have a free length equal to or greater than the height of the anchor above the base of the excavation and have a minimum free length of 3 m. A minimum bond length of 3 m should also be used.

For anchors in sands, the bond length design is dependent upon the overburden soil pressure, which depends upon the depth of the anchor below ground and the unit weight of the soil. The design of temporary ground anchors bonded into natural sand below at least 2 m depth may be carried out using an allowable bond stress of 25 kPa at the grout-sand interface. Secondary-grouted anchors could be used in the natural sand to increase the anchor capacity. This technique involves installing a conventionally-grouted anchor and then, once cured, injecting grout into the anchor at a higher pressure to crack the primary grout and densify the surrounding materials. This technique is specialised, and only experienced contractors should be engaged for the design and installation of secondary-grouted anchors.

For ground anchors within rock, the bond length can be designed on the basis of the maximum allowable bond stresses provided in Table 7.

Table 7: Maximum Allowable Bond Stresses for Ground Anchors

Material	Allowable Working Bond Stress
Very Low to Low Strength Sandstone	150 kPa
Medium Strength Sandstone	500 kPa
High Strength Sandstone	1000 kPa

After installation, anchors should be proof stressed to 125% of their nominal working load and locked-off no higher than 85% of the Working Load. Periodic checks should also be carried out throughout the construction phase to ensure that the lock-off load is maintained and not lost due to creep effects or other causes. Proof stressing should also be carried out at intervals after installation to ensure that the load is maintained in the anchors and not lost due to creep effects.

The parameters given above for ground anchors in sand and rock assume that anchor holes are clean, with grouting and other installation procedures carried out carefully and in accordance with normal ground anchoring practice.

Where vertical anchors are required, anchor design should also consider cone pull-out failure mechanism within the surrounding rock.

If ground anchors extend into adjacent properties then permission from the property owners for their installation will be required.

It is anticipated that the building will restrain the basement excavation over the long term and therefore ground anchors are expected to be temporary only. The use of permanent anchors, if required, would

generally need careful attention to corrosion protection. Further advice on design and specification should be sought if permanent anchors are to be employed at this site.

9.3.5 Excavation Induced Ground Movements (Stress Relief)

Locked in stresses are present in rock. During excavation, these stresses will be released, which will result in lateral movement, typically along existing sub-horizontal bedding planes. These lateral movements may cause cracking of adjacent buildings and services founding in rock and may also cause increases in the loads on any anchors used to provide lateral restraint to the shoring walls.

For excavations within medium strength (or stronger) rock, some stress relief movement of medium strength (or stronger) rock in exposed cut faces should be expected. This would occur in excavations where shoring piles are terminated above the excavation level and where deep service trenches extend below the excavation level and are adjacent to perimeter shoring piles. Any re-entrant corners within the perimeter of the excavation are likely to move more than the straight sides of the excavation. The top mid-section of each excavation face is likely to move inwards in the order of 0.5 mm to 1.0 mm per metre depth of excavation within medium strength (or stronger) rock. The amount of stress relief is also related to the length of the excavation. Most of the stress-relief movement is expected to be complete once the excavation level has been reached.

At the ground surface, this movement is expected to reduce away from the excavation at an initial rate of 0.5 mm/m to 1 mm/m, possibly giving rise to some differential strain and possible cracking of structures founded on rock in the near vicinity of the excavation.

9.4 Survey Monitoring During Excavation

The use of instrumentation to monitor existing adjacent roads/footpaths, buildings and structure movements will be important for this development as the existing structures are likely to be sensitive to differential foundation movement.

Precise survey points should be established on existing roads, buildings and structures adjacent to the proposed basement as well as along the shoring wall capping beam, prior to the commencement of any excavation works. Monitoring should be undertaken to an accuracy of at least ± 1 mm and should be continued throughout the construction phase until excavation faces are permanently supported by the new building structure.

Survey readings must be taken prior to commencement of any excavation works to provide baseline readings. The frequency of survey monitoring should be at every 1.5 m drop in excavation or at least weekly.

A “trigger” or alarm level appropriate for the shoring system and based on expected movement, should be adopted for survey monitoring of existing buildings and the proposed shoring wall. A monitoring plan should be developed that includes trigger levels, hold points and actions by responsible parties, at which time the builder would be obliged to seek further advice from structural and geotechnical engineers.

9.5 Foundations

9.5.1 Site Classification

Based on the depth of sandy fill within some of the boreholes, the site has a site classification of 'Class P' in accordance with AS 2870 - 2011 "Residential slabs and footings". Design of footings for Class P sites should be based on engineering principles. Provided all footings are designed to be founded beneath the fill on natural medium dense sand or rock, a 'Class A' site classification would be appropriate.

9.5.2 Footings

If the shoring wall piles are also used for building foundation piles, the design of pile footings socketed below the basement excavation level may be based on the design parameters provided in Table 8.

Table 8: Design Parameters for Footings

Material Description	Allowable Pressure (kPa)		Ultimate Pressure [3] (kPa)		Young's Modulus E (MPa)
	End Bearing	Shaft Adhesion[1,2]	End Bearing	Shaft Adhesion[1,2]	
Very Low to Low Strength Sandstone	-	100	-	250	-
Medium Strength (or stronger) Sandstone	3500	300	20,000	800	500

Notes:

1. Shaft adhesion applies only for the design of rock socketed piles of adequate sidewall roughness.
2. Where piles are also required to resist uplift, it is suggested that the shaft adhesion values be reduced by 50%.
3. Ultimate values occur at large settlements, typically >5% of the minimum footing dimension.

For the design of pile footings, an appropriate geotechnical strength reduction factor ($Ø_g$) should be selected using the procedure outlined in AS 2159 – 2009 "Piling design and installation" if using the limit-state design approach. The calculation of $Ø_g$ should be carried out by the pile designer given the variables for various design and testing procedures.

Footings founded at a high-level above a 45° zone of influence line extending up from the base of any adjacent excavation or retaining wall should be designed using a reduced allowable end bearing pressure of 1,000 kPa for consistent medium strength sandstone, with the adjacent excavation face inspected by a geotechnical engineer for any adverse rock joints that may require the footing to be founded at a deeper level or stabilisation of the rock face to be undertaken. Such a case may exist near the steps in the basement floor levels.

The settlement of footings is dependent upon the foundation conditions and applied loads and may be estimated using the elastic (Young's) modulus given in Table 8. For footings bearing in rock, the settlement of footings is expected to be about 1% of the minimum footing dimension when using allowable (working) pressures.

The foundation design parameters in Table 8 assume that the foundation excavations are clean and free of loose debris, with pile sockets (i.e. shafts) free of smear and adequately roughened prior to concrete placement.

Beyond the Hospital Road excavation and the future basement excavation, any lightly-loaded structures may be supported on shallow, pad or strip footings bearing on loose to medium dense sand. The design of shallow footings founded in sand is dependent upon the size of the footing, the depth of footing embedment, the friction angle of the founding material as well as the depth to the water table.

By way of example, a 0.5 m by 0.5 m pad footing or a 0.5 m wide strip footing, embedded 1 m deep, founded in loose to medium dense sand, with a water table at least twice the minimum footing width below the base of the footing, may be designed for a maximum allowable bearing pressure of 250 kPa. Reduced bearing pressures will apply in cases where footings are founded close to the water table. Therefore, targeted investigations of subsurface conditions are recommended where shallow footings in sand are proposed. The settlement of a footing bearing in sand is dependent upon several factors and should be confirmed to be within the tolerance of the structure.

All foundation excavations should be inspected by an experienced geotechnical professional prior to pouring of concrete to confirm that the material is suitable for the design parameters adopted. It is noted that CFA piles are a proprietary product that involves a 'blind' drilling technique and therefore the piling contractor should certify the installation of CFA piles.

9.6 Soil Aggressivity

Based on the results of the chemical analysis and with reference to Tables 6.4.2(C) and 6.5.2(C) of AS 2159 – 2009 "Piling design and installation", the samples tested from previous and current boreholes have a 'non-aggressive' exposure classification with respect to buried concrete, except the samples from BH605/2.5 – 2.6 m and BH13/3.0 – 3.2 m that have a 'mild' exposure classification due to their pH levels.

For buried steel elements, the samples tested have a 'non-aggressive' exposure classification, except one sample of weathered sandstone from BH8/2.5 – 2.66 m that has a 'mild' exposure classification based on its electrical conductivity. All classifications consider the presence of 'Soil Conditions B' (i.e. all soils above groundwater).

9.7 Seismic Design

In accordance with AS 1170 - 2007 "Structural Design Actions, Part 4: Earthquake Actions in Australia" a hazard factor (Z) of 0.08 and a site subsoil Class C_e (shallow soil site) is considered to be appropriate for the site.

If all of the building footings are socketed into the medium strength (or stronger) rock then it may be permissible to treat the site as a Class B_e (rock) site. However, the seismic impact of the soils above the rock on the retaining walls must be considered in this case. Pad footings must be embedded entirely within medium strength rock to provide lateral resistance to deformation under cyclic loading.

9.8 Subgrade Preparation

From a geotechnical perspective, the existing fill and natural sand are likely to be suitable for re-use as engineered fill on site provided oversize material (i.e. particles greater than 100 mm) and any deleterious material is removed. The suitability of re-using site-won fill and natural soil should also be considered from a contamination perspective (refer to DP's DSI contamination report).

Subgrade preparation measures for pavements or slabs on grade should include:

- Removal of any fill to a maximum depth of 0.6 m below design subgrade level or to the top of natural soil or rock, whichever is shallower;
- Proof roll the exposed surface using a minimum 12-tonne roller in non-vibration mode. The subgrade should be rolled a minimum of six times with the last two passes observed by an experienced geotechnical engineer to detect any soft spots. Any loose/soft areas identified during proof rolling should be removed as directed by the geotechnical engineer;
- Placement of engineered fill in loose layer thicknesses of 200 – 300 mm (dependent upon compaction equipment used) and compact to a minimum dry density ratio of 98% (for slabs on grade) and 100% for pavements relative to Standard compaction and with moisture contents maintained within 2% of Standard optimum moisture content. New fill should be free of oversize particles (>100 mm) and deleterious material. The use of a readily compacted material such as medium to high strength ripped sandstone or dense graded basecourse (DGB) material would generally be appropriate. Such materials are likely to have a CBR value greater than 8%; and
- Density testing in accordance with AS 3798 - 2007 "Guidelines for earthworks for commercial and residential developments" should be undertaken to verify the above compaction criteria is achieved.

For areas where rock is exposed beneath slabs and pavements, which is likely to be the case for most of Hospital Road, the loading dock and basement Level -02, the upper 0.3 m of rock should be ripped and re-compacted to a density ratio as outlined above or alternatively left in-situ with a drainage layer constructed between the rock and pavement materials. Any loose rock from the excavation process should be removed.

9.9 Pavements

9.9.1 General

It is understood that the proposed road lowering of Hospital Road North (Stage 2) will slope down from about RL 51.0 m at the southern end to RL 45.8 m (i.e. loading dock level) at the northern end. As per Hospital Road Stage 1, an asphaltic concrete (i.e. flexible) pavement may be adopted along the straight section and a concrete (rigid) pavement at entrances to the car park and loading dock, where the pavement is subjected to shearing forces from turning vehicles.

It is anticipated that the excavation levels for the pavement will expose sand (less than 1 m deep over rock) at the southern end, grading to weathered sandstone then medium and high strength sandstone towards to the north (refer to Drawing 2 in Appendix B).

The CBR tests indicated that the sand and sand fill with gravel had a CBR of 8% and 25%, respectively. The higher CBR for the sandy fill is most likely attributed to the gravel inclusions in the samples tested.

Subject to the subgrade preparation outlined in Section 9.8, the design of pavements on sandy subgrade or on re-worked rock may be based on a CBR value of 8%. If the pavement is constructed directly on medium strength rock with a drainage layer between the rock and pavement with a CBR equal to the rock, then a design CBR of 30% may be used. These CBR values assume all pavements are protected by adequate surface and subsoil drainage to minimise the risk of water infiltration and softening of pavement materials.

Control joints should be provided in rigid concrete slabs at the soil and rock interface to reduce the effects of differential movement and possible cracking of the slabs at these locations.

Based on a CBR value of 8% for sand and provided subgrade preparation is carried out in accordance with Section 9.8, a Young's elastic modulus of 30 MPa for short term loading and 25 MPa for long term loading is appropriate for pavement design in accordance with "Industrial Floors and Pavements" 1999.

9.9.2 Pavement Thickness

Preliminary pavement thickness design for three pavement options was undertaken using "Austroads" 2012 and 2017, an equivalent standard axle (ESA) traffic loading of 5 x 10^5 provided by Acor, and a 95% project reliability as used for Hospital Road lowering Stage 1.

Presumptive parameters that were adopted for the analysis are outlined in Table 9.

Table 9: Material Properties for Pavement Thickness

Layer	Material	Minimum Compaction
AC layer	E≥3000 MPa	Dependant on mix design
Base (Flexible Pavements)	DGB20, CBR ≥ 80%	Minimum dry density ratio of 98% (Modified) compaction
Sub-Base (Flexible Pavements)	DGB40, CBR ≥ 30%	Minimum dry density ratio of 95% (Modified) compaction
Subgrade	Sand, Soaked CBR≥ 8 %	Site preparation as per Section 9.8 of this report.
Subgrade replacement (if required)	Soaked CBR ≥ 8%; Granular	Minimum dry density ratio of 100% (Standard) compaction or 80% density index

The materials used for construction should meet the requirements in Table 9, or allowance made for further analysis based on the actual materials used. All granular pavement materials should meet the criteria outlined in the NSW Roads and Maritime Services (RMS) Specification 3051. All pavement materials and associated construction and drainage works should also meet the requirements of Austroads 2017.

It is noted that long term pavement performance is often dictated by construction stage works, and therefore, careful attention should be made to adopting appropriate construction processes, including quality controls, inspections and testing, to ensure that the subgrade is suitably prepared, and pavement is constructed in accordance with all requirements.

The analysis indicates the pavement design thicknesses given in Tables 10 to 12 are appropriate.

Table 10: Pavement Thickness (Option 1 – Unbound Pavement)

Material	Minimum Thickness (mm)
AC layer	40
Base, unbound granular	125
Sub-base	175
Total pavement thickness	340

Table 11: Pavement Thickness (Option 2 – Deep Lift Asphaltic Concrete Pavement)

Material	Minimum Thickness (mm)
AC layer	125
Base, unbound granular	200
Total pavement thickness	325

Table 12: Pavement Thickness (Option 3 – Rigid, Jointed Reinforced Concrete Pavement)

Material	Minimum Thickness (mm)
Base, concrete (f'_c = 32 MPa) with steel mesh reinforcement	180
Sub-base, cemented (≥ 5%) bound granular	150
Total pavement thickness	330

9.9.3 Drainage

Water within the pavement and upper subgrade materials will reduce pavement performance, and allowance must be made for appropriate surface and subsurface drainage to maintain and protect the pavement and subgrade, in order to achieve the pavement design life.

It is recommended that the subsurface drain should generally extend to at least 0.5 m below subgrade level on both sides of the road pavement. Such drainage could potentially be integrated with other drainage works, such as bedding for stormwater lines.

If a final AC layer is not placed immediately following pavement construction, it is suggested that diversion mounds and appropriate temporary drainage measures be provided to prevent excessive water flows running into the pavement (as may occur where the 'lip' of permanent kerbing and drainage measures acts as a dam to water movement). Such infiltration may result in premature pot-holing and pavement failure.

9.10 Stormwater Management Systems

Given that less than 1 m of sand over rock is expected at the southern end of the lowered Hospital Road and that the proposed SCH 1 / CCCC basement Level -02 will be cut into rock, an absorption system is considered to be inappropriate to manage stormwater at this site. Stormwater should be discharged off-site via stormwater services, subject to approval from regulatory authorities.

9.11 Working Platforms

Working platforms are likely to be required where heavy loads such as from large piling rigs or outrigger cranes are used during construction. Such platforms will require a site-specific geotechnical assessment for the proposed plant, and typically require the use of additional layers of durable, high strength crushed rock or similar.

9.12 Dilapidation Surveys

It is recommended that dilapidation (building condition) reports be prepared for adjacent structures and infrastructure located within about 15 m from the site boundaries, prior to commencing excavation work on the site. Dilapidation reports are undertaken to document any existing defects, so that any potential claims for damage from third parties can be accurately assessed.

10. References

1. Department of Mineral Resources, Geological Survey of New South Wales, “Geology of the Sydney 1:100,000 Sheet 9130”, 1983;
2. Randwick Local Environment Plan 2012, Acid Sulfate Soils Map (Sheet ASS_007);
3. NSW Environment Protection Authority, “Waste Classification Guidelines” 2014;
4. Standards Australia, AS 2187.2 - 1993 “Explosives – Storage, Transport and Use”;
5. Standards Australia, AS 2870 - 2011 “Residential Slabs and Footings”;
6. Standards Australia, AS 2159 – 2009 “Piling Design and Installation”;
7. Standards Australia, AS 1170 - 2007 “Structural Design Actions, Part 4: Earthquake Actions in Australia”;
8. Standards Australia, AS 3798 - 2007 “Guidelines on Earthworks for Commercial and Residential Developments”;
9. Cement and Concrete Association of Australia, “Industrial Floors and Pavements” Second Edition 1999;
10. Austroads Ltd, “Guide to Pavement Technology Part 2: Pavement Structural Design” 2012 and 2017;
11. ANZECC & ARMCANZ 2000, National water quality management strategy. Australian and New Zealand guidelines for fresh and marine water quality, Australian and New Zealand Conservation Council & Agriculture, and Resource Management Council of Australia and New Zealand (ANZECC 2000);

12. Pells, P.J., Mostyn, G. and Walker, B.F. "Foundations on Sandstone and Shale in the Sydney Region". Australian Geomechanics Journal, Vol. No. 33 Part 3, Dec. 1998;
13. Pells, P.J., Douglas, D.J., B., Thorne, C. and McMahon, B.K. "Design Loadings for Foundations on Shale and Sandstone in the Sydney Region". Australian Geomechanics Journal, Vol. 3, 1978; and
14. Walker, B.F. and Pells, P.J.N. "The Construction of Bored Piles Socketed into Shale and Sandstone". Australian Geomechanics Journal, Vol. No. 33 Part 3, Dec. 1998.

11. Limitations

Douglas Partners Pty Ltd (DP) has prepared this report for this project at the corner of Hospital Road and High Street, Randwick in accordance with DP's proposals (SYD200742. P.002.Rev0 dated 23 November 2020) and acceptance received from PricewaterhouseCoopers (Variation Notice, dated 1 December 2020) on behalf of Health Infrastructure and Lendlease Building Pty Ltd. The work was carried out as a variation under a professional services agreement with Health Infrastructure (Contract No. HI17299). This report is provided for the exclusive use of Health Infrastructure for this project only and for the purposes as described in the report. It should not be used for other projects 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 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 scope for work for this investigation/report did not include the assessment of surface or sub-surface materials or groundwater for contaminants, within or adjacent to the site. Should evidence of 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.

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.

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Appendix A

About This Report

About this Report

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Introduction

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

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

Copyright

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.

Sampling Methods

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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.

Description and Classification Methods

The methods of description and classification of soils and rocks used in this report are generally based on Australian Standard AS1726:2017, Geotechnical Site Investigations. 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	19 - 63
Medium gravel	6.7 - 19
Fine gravel	2.36 – 6.7
Coarse sand	0.6 - 2.36
Medium sand	0.21 - 0.6
Fine sand	0.075 - 0.21

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

The proportions of secondary constituents of soils are described as follows:

In fine grained soils (>35% fines)

Term	Proportion of sand or gravel	Example
And	Specify	Clay (60%) and Sand (40%)
Adjective	>30%	Sandy Clay
With	15 – 30%	Clay with sand
Trace	0 - 15%	Clay with trace sand

In coarse grained soils (>65% coarse)
- with clays or silts

Term	Proportion of fines	Example
And	Specify	Sand (70%) and Clay (30%)
Adjective	>12%	Clayey Sand
With	5 - 12%	Sand with clay
Trace	0 - 5%	Sand with trace clay

In coarse grained soils (>65% coarse)
- with coarser fraction

Term	Proportion of coarser fraction	Example
And	Specify	Sand (60%) and Gravel (40%)
Adjective	>30%	Gravelly Sand
With	15 - 30%	Sand with gravel
Trace	0 - 15%	Sand with trace gravel

The presence of cobbles and boulders shall be specifically noted by beginning the description with 'Mix of Soil and Cobbles/Boulders' with the word order indicating the dominant first and the proportion of cobbles and boulders described together.

Soil Descriptions

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
Friable	Fr	-

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	Density Index (%)
Very loose	VL	<15
Loose	L	15-35
Medium dense	MD	35-65
Dense	D	65-85
Very dense	VD	>85

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;
- Extremely weathered material – formed from in-situ weathering of geological formations. Has soil strength but retains the structure or fabric of the parent rock;
- Alluvial soil – deposited by streams and rivers;
- Estuarine soil – deposited in coastal estuaries;
- Marine soil – deposited in a marine environment;
- Lacustrine soil – deposited in freshwater lakes;
- Aeolian soil – carried and deposited by wind;
- Colluvial soil – soil and rock debris transported down slopes by gravity;
- Topsoil – mantle of surface soil, often with high levels of organic material.
- Fill – any material which has been moved by man.

Moisture Condition – Coarse Grained Soils

For coarse grained soils the moisture condition should be described by appearance and feel using the following terms:

- Dry (D) Non-cohesive and free-running.
- Moist (M) Soil feels cool, darkened in colour.
  Soil tends to stick together.
  Sand forms weak ball but breaks easily.
- Wet (W) Soil feels cool, darkened in colour.
  Soil tends to stick together, free water forms when handling.

Moisture Condition – Fine Grained Soils

For fine grained soils the assessment of moisture content is relative to their plastic limit or liquid limit, as follows:

- ‘Moist, dry of plastic limit’ or ‘w <PL’ (i.e. hard and friable or powdery).
- ‘Moist, near plastic limit’ or ‘w ≈ PL (i.e. soil can be moulded at moisture content approximately equal to the plastic limit).
- ‘Moist, wet of plastic limit’ or ‘w >PL’ (i.e. soils usually weakened and free water forms on the hands when handling).
- ‘Wet’ or ‘w ≈LL’ (i.e. near the liquid limit).
- ‘Wet’ or ‘w >LL’ (i.e. wet of the liquid limit).

Rock Strength

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

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

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

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

Rock Descriptions

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 occasional fragments
Fractured	Core lengths of 30-100 mm with occasional shorter and longer sections
Slightly Fractured	Core lengths of 300 mm or longer with occasional sections of 100-300 mm
Unbroken	Core contains very few fractures

Rock Quality Designation

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

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

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

Stratification Spacing

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

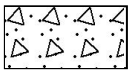
Symbols & Abbreviations

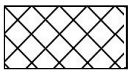
Graphic Symbols for Soil and Rock

General

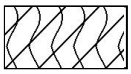

Asphalt

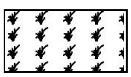

Road base

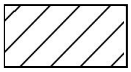

Concrete

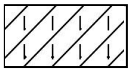

Filling

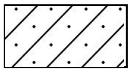
Soils


Topsoil

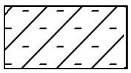

Peat

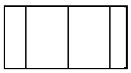

Clay

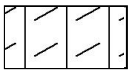

Silty clay

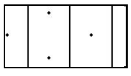

Sandy clay

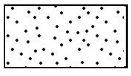

Gravelly clay

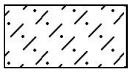

Shaly clay

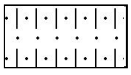

Silt


Clayey silt


Sandy silt

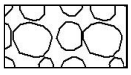

Sand

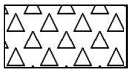

Clayey sand


Silty sand


Gravel

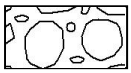

Sandy gravel


Cobbles, boulders

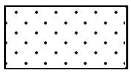

Talus

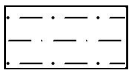
Sedimentary Rocks

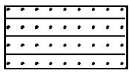

Boulder conglomerate

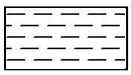

Conglomerate


Conglomeratic sandstone

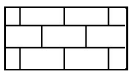

Sandstone


Siltstone

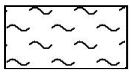

Laminite

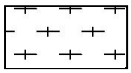

Mudstone, claystone, shale

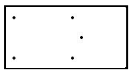

Coal


Limestone

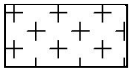
Metamorphic Rocks

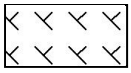

Slate, phyllite, schist

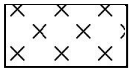

Gneiss

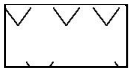

Quartzite

Igneous Rocks


Granite


Dolerite, basalt, andesite

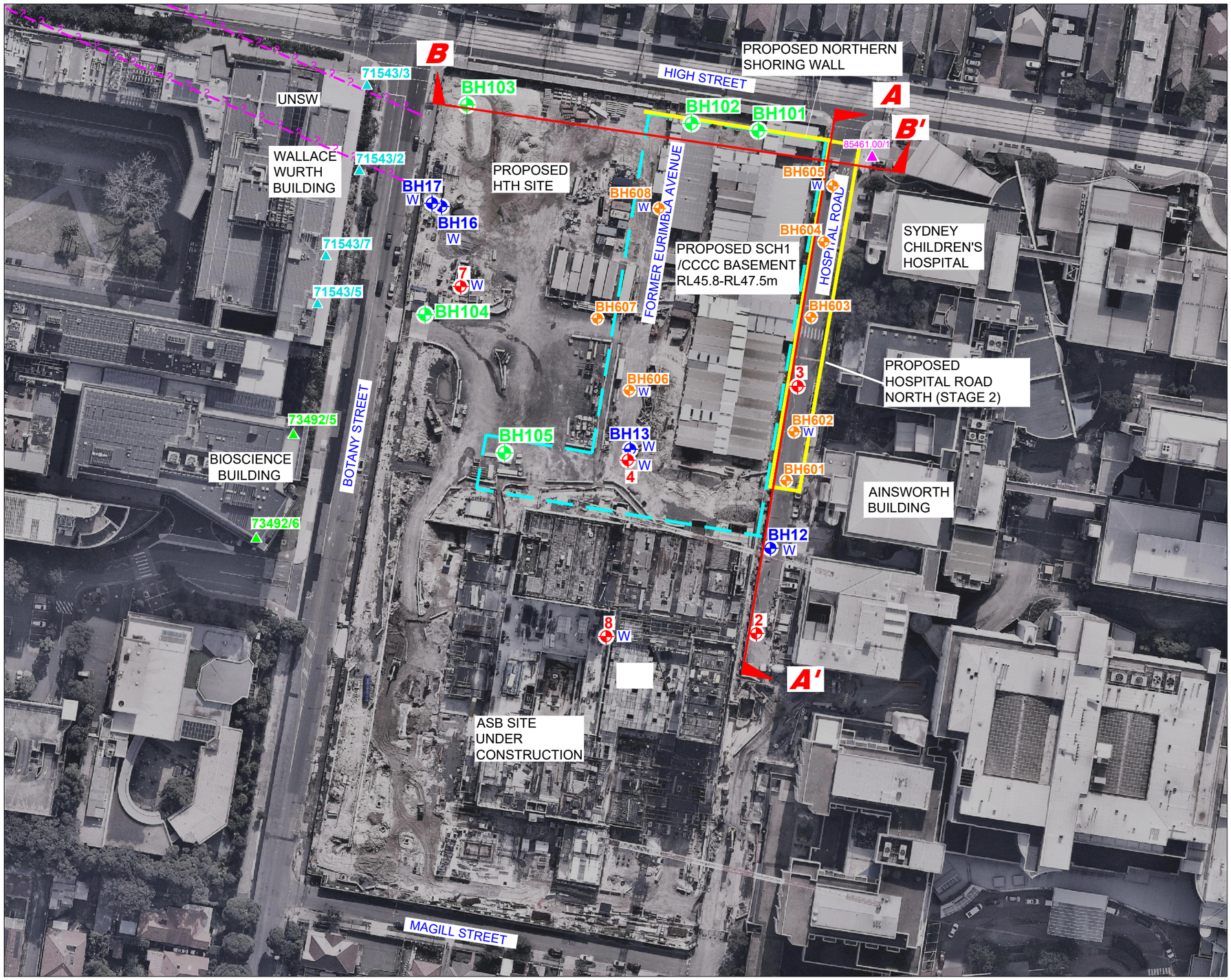

Dacite, epidote

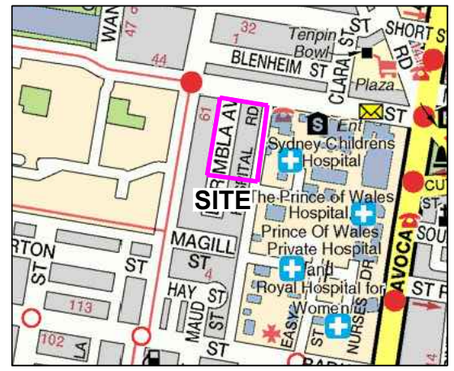

Tuff, breccia


Porphyry

Appendix B

Drawings 1 to 3





Locality Plan

NOTE:
1: Base image from Nearmap.com (Dated 2.8.2020)

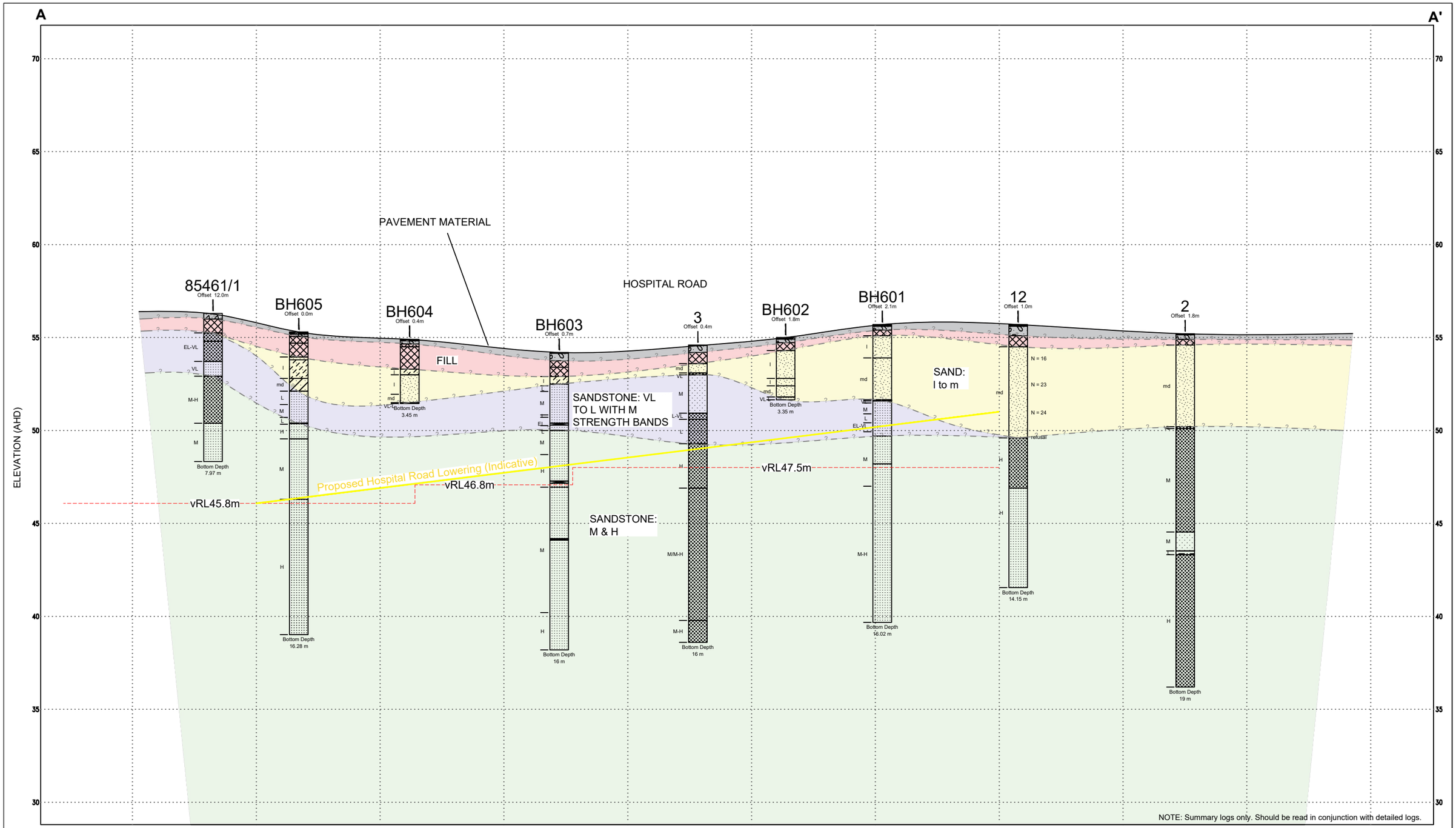
0 5 10 20 30 40 50 75 100 125m
1:1250 @ A3

LEGEND

- Previous borehole (UNSW Wallace Wurth Building, Proj. 71543, 2010)
- Previous borehole (UNSW Bioscience Building Proj. 73492, 2013)
- Previous borehole (Prince of Wales Hospital Proj. 85461.00, 2016)
- Previous borehole (Proj. 72505.11, Feb 2018)
- Previous borehole (Proj. 72505.13, May 2018)
- Previous borehole (Proj. 72505.13, March 2019)
- Borehole (Proj. 72505.18, Sept 2020)
- W Groundwater monitoring well
- Interpreted geotechnical boundary
- A — A' Interpreted geotechnical Cross Section

Douglas Partners
Geotechnics / Environment / Groundwater

CLIENT: Lendlease Building Pty Ltd c/o Health Infrastructure		TITLE: **Locations of Previous and Current Boreholes Hospital Road North (Stage 2) Hospital Road, Randwick**	PROJECT No: 72505.20
OFFICE: Sydney	DRAWN BY: CJ		DRAWING No: 1
SCALE: 1:1250 @ A3	DATE: 10.12.2020		REVISION: 1



DISTANCE ALONG PROFILE (m)

NOTES:
1. Subsurface conditions are accurate at the borehole locations only. Variations in subsurface conditions may occur between borehole locations. Interpreted strata boundaries are approximate and should be used as a guide only.
2. Summary logs included only and should be read in conjunction with detailed logs.

LEGEND

- Core Loss
- Asphaltic Concrete
- Clayey Sand
- Concrete
- Filling
- Roadbase
- Sand
- Sandstone
- Sandstone coarse grained
- Sandstone fine grained
- Sandy Clay
- Siltstone

ROCK STRENGTH

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

SOIL DENSITY

vl	- Very Loose
l	- Loose
md	- Medium Dense
d	- Dense
vd	- Very Dense

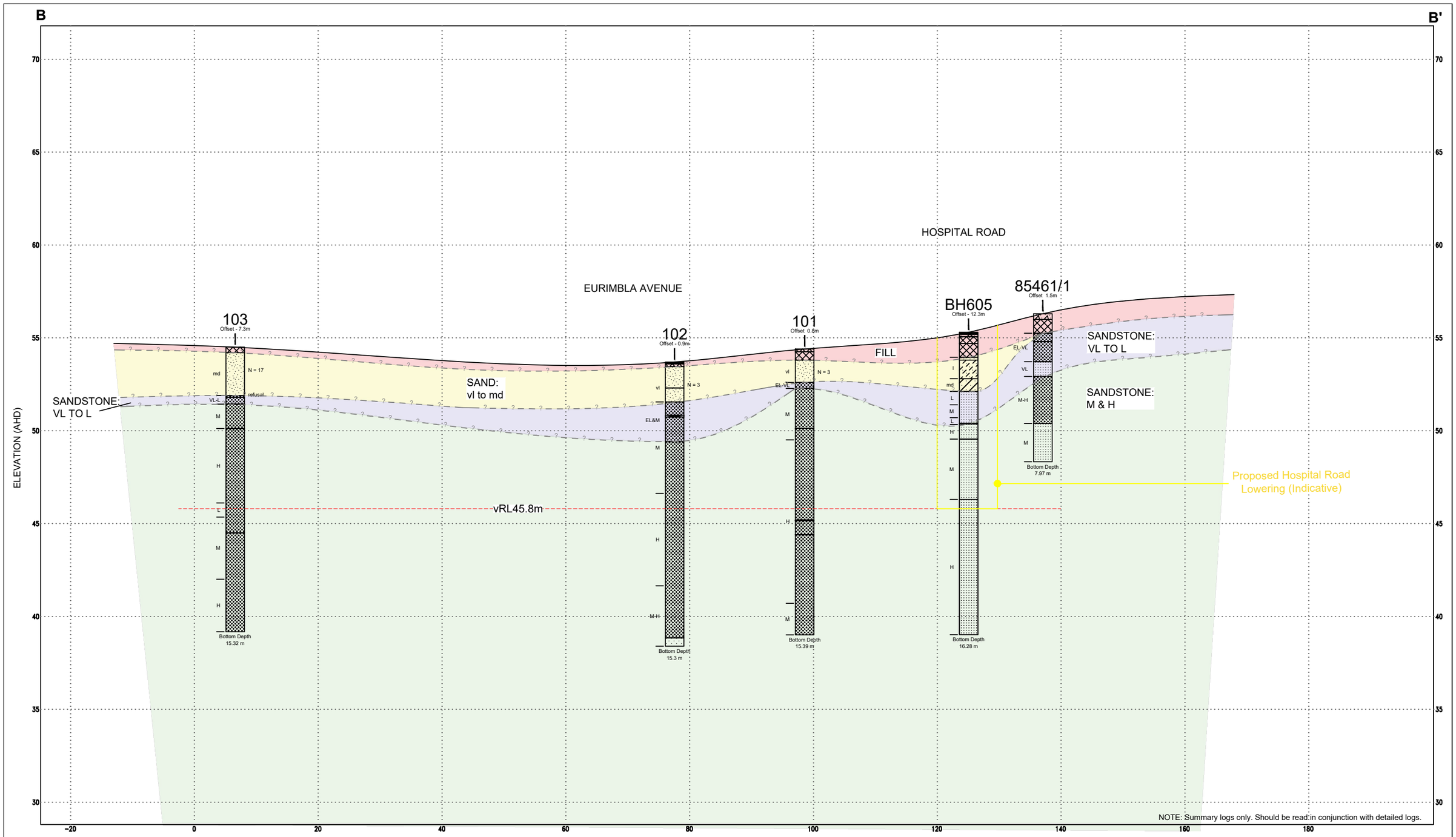
TESTS / OTHER

- ▽ - Water level
- — ? — — - Interpreted geotechnical boundary
- ------- - Proposed SCH/CCCC basement level (indicative)

0 12
Horizontal Scale (metres)
Vertical Exaggeration = 3.0

Douglas Partners
Geotechnics / Environment / Groundwater

CLIENT: Lendlease Building Pty Ltd c/o Health Infrastructure		TITLE: **Interpreted Geotechnical Cross Section A-A'**	PROJECT No: 72505.20
OFFICE: Sydney	DRAWN BY: LH/CJ	**Hospital Road North (Stage 2)**	DRAWING No: 2
SCALE: 1:600 (H) 1:200 (V) @ A3	DATE: 13.01.2021	**Hospital Road, Randwick**	REVISION: 1



NOTES:
1. Subsurface conditions are accurate at the borehole locations only.
   Variations in subsurface conditions may occur between borehole locations.
   Interpreted strata boundaries are approximate and should be used as a guide only.
2. Summary logs included only and should be read in conjunction with detailed logs.

LEGEND

- Core Loss
- Asphaltic Concrete
- Clayey Sand
- Concrete
- Filling
- Roadbase
- Sand
- Sandstone
- Sandstone coarse grained
- Sandstone fine grained
- Sandy Clay
- Siltstone

ROCK STRENGTH
EL - Extremely Low
VL - Very Low
L - Low
M - Medium
H - High
VH - Very High

SOIL DENSITY
vl - Very Loose
l - Loose
md - Medium Dense
d - Dense
vd - Very Dense

TESTS / OTHER
- Water level
- Interpreted geotechnical boundary
- Proposed SCH/CCCC basement level (indicative)

0 12
Horizontal Scale (metres)
Vertical Exaggeration = 3.0

Douglas Partners
Geotechnics / Environment / Groundwater

CLIENT: Lendlease Building Pty Ltd c/o Health Infrastructure	TITLE: **Interpreted Geotechnical Cross Section B-B'**		PROJECT No: 72505.20
OFFICE: Sydney	DRAWN BY: LH/CJ	**Hospital Road North (Stage 2)**	DRAWING No: 3
SCALE: 1:600 (H) 1:200 (V) @ A3	DATE: 13.01.2021	**Hospital Road, Randwick**	REVISION: 1

Appendix C

Results of Previous Investigations

BOREHOLE LOG

CLIENT: LendLease Building Pty Ltd
PROJECT: Randwick Campus Redevelopment
LOCATION: Hospital Road and High, Magill and Botany Streets, Randwick

SURFACE LEVEL: 54.4 AHD
EASTING: 337086
NORTHING: 6245667
DIP/AZIMUTH: 90°/--

BORE No: 101
PROJECT No: 72505.13
DATE: 25/2/2019
SHEET 1 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
54	0.15	FILLING: grey, fine to medium sand and gravel filling, damp (roadbase)							A			
	0.6	FILLING: yellow-grey, fine to medium sand with sandstone cobbles and coarse sandstone gravel filing, moist							A			
53	1	SAND: loose, brown, fine to medium sand, moist							A S			2,2,1 N = 3
	1.8	SANDSTONE: extremely low to very low strength, extremely to highly weathered, red-brown, medium to coarse grained sandstone										
52	2.12	SANDSTONE: medium strength, moderately weathered, red-brown, medium to coarse grained sandstone with some very low strength bands						2.15&2.17m: B 0°-15°, cu, ro, cly vnr 2.35m: B 0°, pl, ro, cly 10mm 2.41m: B 10°, un, ro, cly co	C	100	82	PL(A) = 0.6
51	3							3.25m: B 0°, pl, ro, fg 10mm				PL(A) = 0.7
50	4											
	4.27	SANDSTONE: medium and high strength, fresh, fractured and slightly fractured, pale grey, medium to coarse grained sandstone with some extremely low strength clay bands						4.26m: B 0°, pl, ro, cly vn 4.87-4.89m: Cs 5.10-5.11m: Cs 5.36m: B 0°, pl, ro, cln	C	100	99	PL(A) = 0.4 PL(A) = 0.8
49	5											
48	6							5.93-5.96m: Cs	C	100	96	PL(A) = 1.1 PL(A) = 1
47	7							7.57m: B 5°, pl, ro, cln 7.76m: B 10°, pl, ro, cln 7.84m: J 30°, pl, ro, cly 7.86-7.89m: Cs				PL(A) = 0.7
46	8											
45	9							9.14-9.16m: J 30°, pl, ro, cbs co 9.16-9.21m: fg 9.21m: CORE LOSS: 30mm	C	99	96	PL(A) = 1.4
	9.24											
	10.0											

RIG: Hanjin D8 **DRILLER:** BG Drilling **LOGGED:** SLB **CASING:** HW to 2.05m

TYPE OF BORING: Solid flight auger to 2.05m, NMLC-coring to 15.39m

WATER OBSERVATIONS: No free groundwater observed whilst augering

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: LendLease Building Pty Ltd
PROJECT: Randwick Campus Redevelopment
LOCATION: Hospital Road and High, Magill and Botany Streets, Randwick

SURFACE LEVEL: 54.4 AHD
EASTING: 337086
NORTHING: 6245667
DIP/AZIMUTH: 90°/--

BORE No: 101
PROJECT No: 72505.13
DATE: 25/2/2019
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)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
44	11	SANDSTONE: medium and high strength, fresh, fractured and slightly fractured, pale grey, medium to coarse grained sandstone with some extremely low strength clay bands *(continued)*							C	99	96	PL(A) = 0.8
43								11.32-11.37m: J 60°, pl, ro, fg				
	12											PL(A) = 1.4
42												PL(A) = 1.2
	13								C	100	96	
41												PL(A) = 0.4
	14											PL(A) = 0.9
40												
	15							14.82m: B 0°, pl, ro, cly 10mm	C	100	100	PL(A) = 0.7
39	15.39	Bore discontinued at 15.39m Target depth reached										
	16											
38												
	17											
37												
	18											
36												
	19											
35												

RIG: Hanjin D8 **DRILLER:** BG Drilling **LOGGED:** SLB **CASING:** HW to 2.05m
TYPE OF BORING: Solid flight auger to 2.05m, NMLC-coring to 15.39m
WATER OBSERVATIONS: No free groundwater observed whilst augering
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
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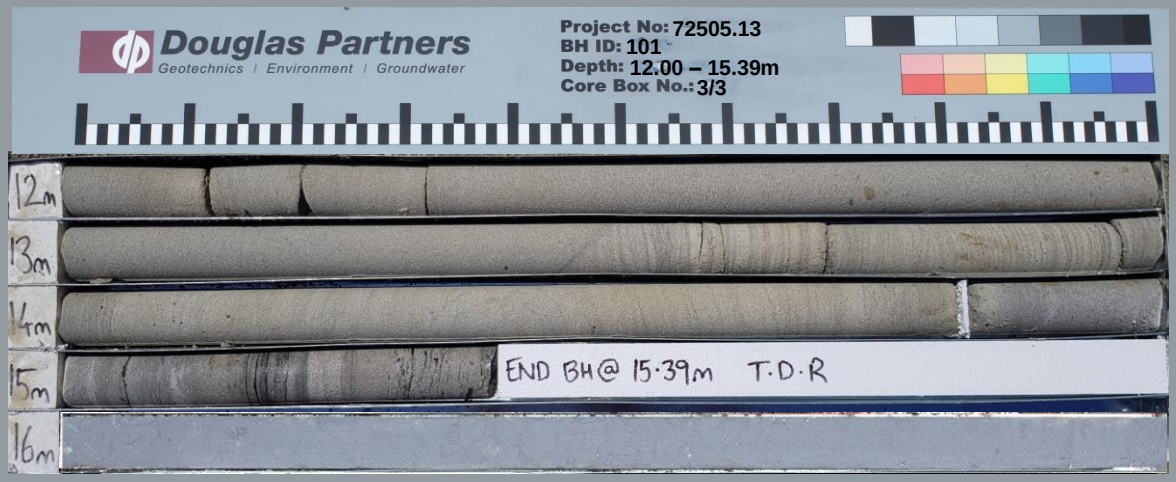
BORE: 101 PROJECT: Randwick February 2019

2.05 – 7.00 m

BORE: 101 PROJECT: Randwick February 2019

7.00 – 12.00 m

BORE: 101 PROJECT: Randwick February 2019



12.00 – 15.39 m

BOREHOLE LOG

CLIENT: LendLease Building Pty Ltd
PROJECT: Randwick Campus Redevelopment
LOCATION: Hospital Road and High, Magill and Botany Streets, Randwick

SURFACE LEVEL: 53.7 AHD
EASTING: 337065
NORTHING: 6245669
DIP/AZIMUTH: 90°/--

BORE No: 102
PROJECT No: 72505.13
DATE: 26/2/2019
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering	Graphic Log	Rock Strength	Water	Fracture Spacing (m)	Discontinuities	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
			EW HW MW SW FS FR		Ex Low Very Low Low Medium High Very High Ex High		0.01 0.05 0.10 0.50 1.00	B - Bedding J - Joint S - Shear F - Fault				
53	0.1	ASPHALTIC CONCRETE							A			
	0.25	FILLING: grey, fine to medium sand and gravel filling, damp (roadbase)							A			
1		SAND: loose, grey-brown, fine to medium sand with trace of fine sandstone gravel, damp (possibly filling)							A			
	1.4								S			1,1,2 N = 3
52		SAND: medium dense, yellow-brown, medium to coarse sand with trace clay, moist										
2	2.15	SANDSTONE: medium strength, extremely then moderately weathered, fragmented and fractured, red-brown and yellow-brown medium to coarse grained sandstone with some extremely low strength clay bands							C	100	92	PL(A) = 0.4
51								2.82-2.86m: Cs				
3	2.96							2.86m: CORE LOSS: 100mm				
								3.1m: B 0°, pl, ro, fe				PL(A) = 0.4
								3.20-3.28m: Cs				
50								3.44-3.61m: Cs				
4								3.88-3.92m: Cs				
								4.14-4.18m: Cs				
	4.29	SANDSTONE: medium and high strength, fresh, slightly fractured, pale grey, medium to coarse grained sandstone							C	97	84	PL(A) = 0.5
49		5.00-8.20m: some low and extremely low strength bands										
5								4.98-5.03m: Cs				
								5.38-5.41m: Cs				PL(A) = 0.8
48												PL(A) = 0.8
6												
47								7.07m: B 0°, pl, ro, fg 10mm	C	100	100	PL(A) = 1.1
7												
46								8.18m: B 0°, pl, ro, fg 10mm				PL(A) = 1.1
8												
45												
9									C	100	100	
44								9.61m: B 0°, pl, ro, cly co				PL(A) = 1.2

RIG: Hanjin D8 **DRILLER:** BG Drilling **LOGGED:** SLB **CASING:** HW to 2.15m
TYPE OF BORING: Solid flight auger to 2.15m, NMLC-coring to 15.30m
WATER OBSERVATIONS: No free groundwater observed whilst augering
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: LendLease Building Pty Ltd
PROJECT: Randwick Campus Redevelopment
LOCATION: Hospital Road and High, Magill and Botany Streets, Randwick

SURFACE LEVEL: 53.7 AHD
EASTING: 337065
NORTHING: 6245669
DIP/AZIMUTH: 90°/--

BORE No: 102
PROJECT No: 72505.13
DATE: 26/2/2019
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
43	11	SANDSTONE: medium and high strength, fresh, slightly fractured, pale grey, medium to coarse grained sandstone *(continued)*						10.89m: B 5°, pl, ro, cly co	C	100	100	PL(A) = 1.1 PL(A) = 1.3
42	12							12.63m: B 0°, pl, ro, cln				PL(A) = 0.7
41	13							13.16m: B 0°, pl, ro, fg	C	100	100	PL(A) = 1.1
40	14	13.90-14.10m: indistinct siltstone laminations						13.81m: J 30°, pl, ro, cln 13.92m: B 0°, pl, ro, cbs				
39	14.85							14.49m: B 5°, pl, ro, cly 5mm				PL(A) = 0.9
	15	14.85-15.30m: fine to medium grained sandstone with approximately 5% carbonaceous laminations						14.79m: B 0°, pl, ro, cly 5mm 14.84m: B 0°, pl, ro, cly 8mm	C	100	63	
	15.3	Bore discontinued at 15.3m Target depth reached										
38	16											
37	17											
36	18											
35	19											
34												

RIG: Hanjin D8 **DRILLER:** BG Drilling **LOGGED:** SLB **CASING:** HW to 2.15m
TYPE OF BORING: Solid flight auger to 2.15m, NMLC-coring to 15.30m
WATER OBSERVATIONS: No free groundwater observed whilst augering
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

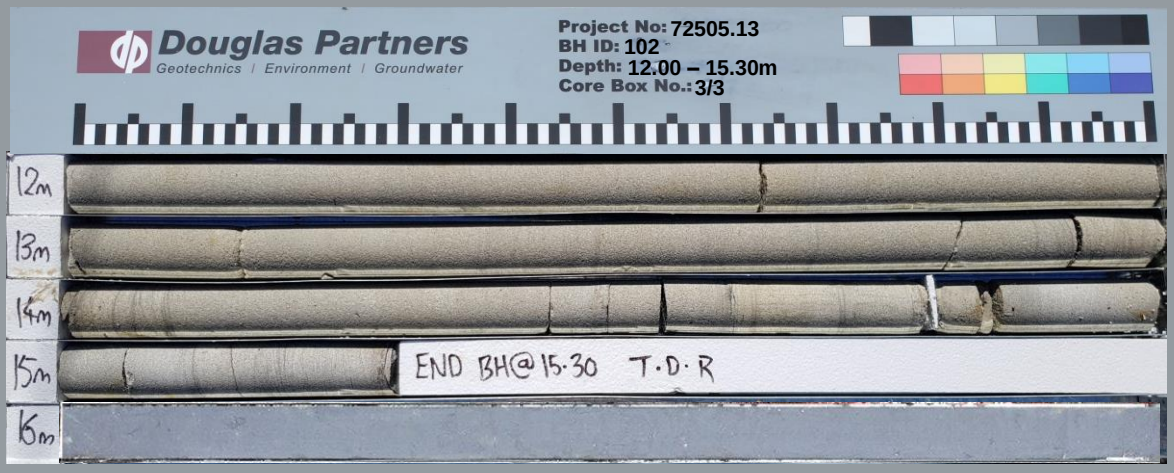
BORE: 102 PROJECT: Randwick February 2019

2.15 – 7.00 m

BORE: 102 PROJECT: Randwick February 2019

7.00 – 12.00 m

BORE: 102 **PROJECT: Randwick** **February 2019**



12.00 – 15.30 m

BOREHOLE LOG

CLIENT: LendLease Building Pty Ltd
PROJECT: Randwick Campus Redevelopment
LOCATION: Hospital Road and High, Magill and Botany Streets, Randwick

SURFACE LEVEL: 54.5 AHD
EASTING: 336994
NORTHING: 6245675
DIP/AZIMUTH: 90°/--

BORE No: 103
PROJECT No: 72505.13
DATE: 26/2/2019
SHEET 1 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)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
54	0.3	FILLING: pale grey, fine to medium sand filling with trace sandstone gravel and building rubble (terracotta, concrete, glass), humid							A			
		SAND: medium dense, red-brown mottled dark grey, medium to coarse sand, moist							A			
53	1								A			
									S			3,8,9 N = 17
	2	2.30m: orange-brown										
52	2.6								S			25/100 refusal
	2.7	SANDSTONE: extremely low strength, extremely weathered, yellow-brown, medium to coarse grained sandstone										
	3	3.07 SANDSTONE: low strength, extremely to highly weathered, medium to coarse grained sandstone with extremely low and very low strength bands										PL(A) = 0.3
51	4								C	100	93	
		4.38 SANDSTONE: medium strength, moderately weathered, fractured and slightly fractured, red-brown, medium to coarse grained sandstone										PL(A) = 0.5
50		SANDSTONE: medium and high strength, fresh, fractured and slightly fractured, pale grey, medium to coarse grained sandstone with some extremely and very low strength bands						4.79m: B 0°, pl, ro, cly vn				
	5							5.32-5.41m: J 70°, pl, ro, cln				PL(A) = 1.3
49												
	6							6.17-6.24m: Cs				
								6.37-6.49m: J 70°, pl, ro, cln				PL(A) = 1.1
48	7							6.96m: J 50°, pl, ro, fg	C	100	93	
								7.26-7.36m: J 45°-90°, cu, ro, cln				PL(A) = 2.3
47								7.52-7.72m: B(x4) 5°-15°, pl, ro, fe				
	8											
		8.39-9.10m: low strength										PL(A) = 0.2
46	9											
								9.15m: B 0°, pl, ro, cln	C	100	99	
45								9.47-9.50m: Cs				PL(A) = 0.8
	10.0											

RIG: Hanjin D8 **DRILLER:** BG Drilling **LOGGED:** SLB **CASING:** HW to 2.6

TYPE OF BORING: Solid flight auger to 2.6m, NMLC-coring to 15.32m

WATER OBSERVATIONS: No free groundwater observed whilst augering

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: LendLease Building Pty Ltd
PROJECT: Randwick Campus Redevelopment
LOCATION: Hospital Road and High, Magill and Botany Streets, Randwick

SURFACE LEVEL: 54.5 AHD
EASTING: 336994
NORTHING: 6245675
DIP/AZIMUTH: 90°/--

BORE No: 103
PROJECT No: 72505.13
DATE: 26/2/2019
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)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
44		SANDSTONE: medium and high strength, fresh, slightly fractured, pale grey, medium to coarse grained sandstone with some extremely and very low strength bands							C	100	99	PL(A) = 0.8
43	11							>>				PL(A) = 0.7
42	12											PL(A) = 1.2
41	13								C	100	99	
40	14							13.75m: B 0°, pl, ro, cly vn				PL(A) = 1
	15								C	100	100	PL(A) = 1.2
39	15.32	Bore discontinued at 15.32m Target depth reached										
38	16											
37	17											
36	18											
35	19											

RIG: Hanjin D8 **DRILLER:** BG Drilling **LOGGED:** SLB **CASING:** HW to 2.6
TYPE OF BORING: Solid flight auger to 2.6m, NMLC-coring to 15.32m
WATER OBSERVATIONS: No free groundwater observed whilst augering
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: 103 PROJECT: Randwick February 2019

2.60 – 7.00 m

BORE: 103 PROJECT: Randwick February 2019

7.00 – 12.00 m

BORE: 103 PROJECT: Randwick February 2019

12.00 – 15.32 m

BOREHOLE LOG

CLIENT: LendLease Building Pty Ltd
PROJECT: Randwick Campus Redevelopment
LOCATION: Hospital Road and High, Magill and Botany Streets, Randwick

SURFACE LEVEL: 54.4 AHD
EASTING: 336981
NORTHING: 6245609
DIP/AZIMUTH: 90°/--

BORE No: 104
PROJECT No: 72505.13
DATE: 27/2/2019
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering	Graphic Log	Rock Strength	Water	Fracture Spacing (m)	Discontinuities	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
			EW HW MW SW FS FR		Ex Low Very Low Low Medium High Very High Ex High		0.01 0.05 0.10 0.50 1.00	B - Bedding J - Joint S - Shear F - Fault				
54	0.2	FILLING: pale grey, fine to medium sand filling with building rubble (terracotta pipe, glass), damp							A			
	0.5	SAND: brown, fine to medium sand, damp (possibly filling)							A			
53	1	SAND: medium dense, yellow-brown mottled white, medium to coarse sand, moist							A			
									S			2,5,7 N = 12
52	2											
									S			5,8,9 N = 17
51	3	3.40m: becoming yellow							A			
	4								S			10/120 refusal Hammer bouncing
50	4.12	SANDSTONE: low to medium strength, highly, moderately and slightly weathered, fractured and slightly fractured, red-brown and pale grey, medium to coarse grained sandstone with some extremely to very low strength bands						4.88m: B 0°, pl, ro, cly 5.10-5.15m: B(x3) 0°, pl, ro, cly	C	100	91	PL(A) = 0.3 PL(A) = 0.6
49	5											
48	6								C	100	100	PL(A) = 0.7
47	7											PL(A) = 0.8
46	8											
	8.12	8.12-9.10m: fine to medium grained 8.43-9.10m: high strength						8.12m: B 10°, pl, ro, cly 5mm 8.42m: B 5°, pl, ro, cly co				PL(A) = 0.3
45	9								C	100	98	
	9.1	SANDSTONE: medium and high strength, fresh, fractured and slightly fractured, pale grey, medium to coarse grained sandstone						9.1m: B 0°, pl, ro, fg 5mm 9.44m: B 5°-10°, st, ro, cly 8mm				PL(A) = 1.2

RIG: Hanjin D8 **DRILLER:** BG Drilling **LOGGED:** SLB **CASING:** HW to 4.12m

TYPE OF BORING: Solid flight auger to 4.12m, NMLC-coring to 15.81m

WATER OBSERVATIONS: No free groundwater observed whilst augering

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: LendLease Building Pty Ltd
PROJECT: Randwick Campus Redevelopment
LOCATION: Hospital Road and High, Magill and Botany Streets, Randwick

SURFACE LEVEL: 54.4 AHD
EASTING: 336981
NORTHING: 6245609
DIP/AZIMUTH: 90°/--

BORE No: 104
PROJECT No: 72505.13
DATE: 27/2/2019
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
44		SANDSTONE: medium and high strength, fresh, fractured and slightly fractured, pale grey, medium to coarse grained sandstone *(continued)*										PL(A) = 1.2
43	11	10.92m: siltstone laminations and clasts						10.93-10.96m: B(x2) 0°-20°, cu, ro, cbs 11.02m: J 90°, pl, ro, cly	C	100	98	PL(A) = 0.8
42	12	12.00-12.35m: indistinct siltstone laminations						12.2m: B 5°, pl, ro, cly 5mm 12.34m: B 10°, pl, ro, fg 12.71-12.74m: Cs				PL(A) = 1.1
41	13							13.24-13.30m: J 70°, pl, ro, cln	C	100	99	PL(A) = 0.9
40	14	13.81-15.81m: indistinct siltstone laminations						13.81-13.85m: J 45°, pl, ro, cly 3mm 13.85m: B 5°, pl, ro, cly vn				PL(A) = 1.3
39	15								C	100	100	PL(A) = 0.9
	15.81	Bore discontinued at 15.81m Target depth reached										
38	16											
37	17											
36	18											
35	19											

RIG: Hanjin D8 **DRILLER:** BG Drilling **LOGGED:** SLB **CASING:** HW to 4.12m

TYPE OF BORING: Solid flight auger to 4.12m, NMLC-coring to 15.81m

WATER OBSERVATIONS: No free groundwater observed whilst augering

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: 104 PROJECT: Randwick February 2019

4.12 – 9.00 m

BORE: 104 PROJECT: Randwick February 2019

9.00 – 14.00 m

BORE: 104 PROJECT: Randwick February 2019

14.00 – 15.81 m

BOREHOLE LOG

CLIENT: LendLease Building Pty Ltd
PROJECT: Randwick Campus Redevelopment
LOCATION: Hospital Road and High, Magill and Botany Streets, Randwick

SURFACE LEVEL: 51.6 AHD
EASTING: 337006
NORTHING: 6245565
DIP/AZIMUTH: 90°/--

BORE No: 105
PROJECT No: 72505.13
DATE: 27 - 28/2/2019
SHEET 1 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)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
51	0.3	FILLING: grey-brown, fine to medium sand filling with some building rubble (concrete, terracotta fragments), humid							A			
		SAND: medium dense, yellow-brown, fine to medium sand, damp							A			
50	1								A			
									S			3,5,6 N = 11
	2											
	2.0	SAND: loose, yellow-brown mottled brown, medium to coarse sand with some clay, trace of decomposed wood and ironstone gravel, moist							A			
49									S			2,2,2 N = 4
	3											
	3.5	SAND: loose, dark brown, fine to medium sand with some silt, wet										
48		3.9m: becoming saturated				27-02-19						
	4								S			15/100 refusal Hammer bouncing
	4.1	SANDSTONE: low to medium strength, slightly weathered and fresh, fractured and slightly fractured, medium to coarse grained, red-brown and pale grey sandstone with some extremely low strength bands						4.19-4.51m: B(x4) 5°-10°, pl, ro, cly, fe				PL(A) = 0.2
47									C	100	74	
	5							4.93m: J 30°, pl, ro, cly				PL(A) = 0.7
								5.52-5.56m: Cs				
46	6							5.76m: B 0°, pl, ro, cly vn				PL(A) = 0.4
45	7							6.82m: B 0°-5°, un, ro, fe	C	100	97	
	7.23	SANDSTONE: medium and high strength, fresh, slightly fractured, pale grey, medium to coarse grained sandstone with some very low strength bands						6.88m: B 0°-10°, st, ro, cly 5mm				PL(A) = 0.7
44								7.35m: B 0°, pl, ro, cly vn				
	8											PL(A) = 0.9
43												
	9								C	100	93	
42												PL(A) = 1.2

RIG: Hanjin D8 **DRILLER:** BG Drilling **LOGGED:** SLB **CASING:** HW to 4.1m

TYPE OF BORING: Solid flight auger to 4.1m, NMLC-coring to 15.50m

WATER OBSERVATIONS: Free groundwater observed at 3.9m whilst augering

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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BOREHOLE LOG

CLIENT: LendLease Building Pty Ltd
PROJECT: Randwick Campus Redevelopment
LOCATION: Hospital Road and High, Magill and Botany Streets, Randwick

SURFACE LEVEL: 51.6 AHD
EASTING: 337006
NORTHING: 6245565
DIP/AZIMUTH: 90°/--

BORE No: 105
PROJECT No: 72505.13
DATE: 27 - 28/2/2019
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
41	10	SANDSTONE: medium and high strength, fresh, slightly fractured, pale grey, medium to coarse grained sandstone with some very low strength bands *(continued)*						10.02m: J 30°-40°, cu, ro, cln	C	100	93	PL(A) = 1
40	11							11.11-11.12m: B 0°, pl, ro, fg				PL(A) = 0.8
39	12								C	100	99	PL(A) = 1
38	13	13.32-14.68m: indistinct and distinct carbonaceous laminations						13.66-13.68m: Cs				PL(A) = 0.6
37	14								C	100	95	PL(A) = 0.8
36	15											
	15.5	15.40-15.50m: carbonaceous flecks Bore discontinued at 15.5m Target depth reached										PL(A) = 0.8
35	16											
34	17											
33	18											
32	19											

RIG: Hanjin D8 **DRILLER:** BG Drilling **LOGGED:** SLB **CASING:** HW to 4.1m

TYPE OF BORING: Solid flight auger to 4.1m, NMLC-coring to 15.50m

WATER OBSERVATIONS: Free groundwater observed at 3.9m whilst augering

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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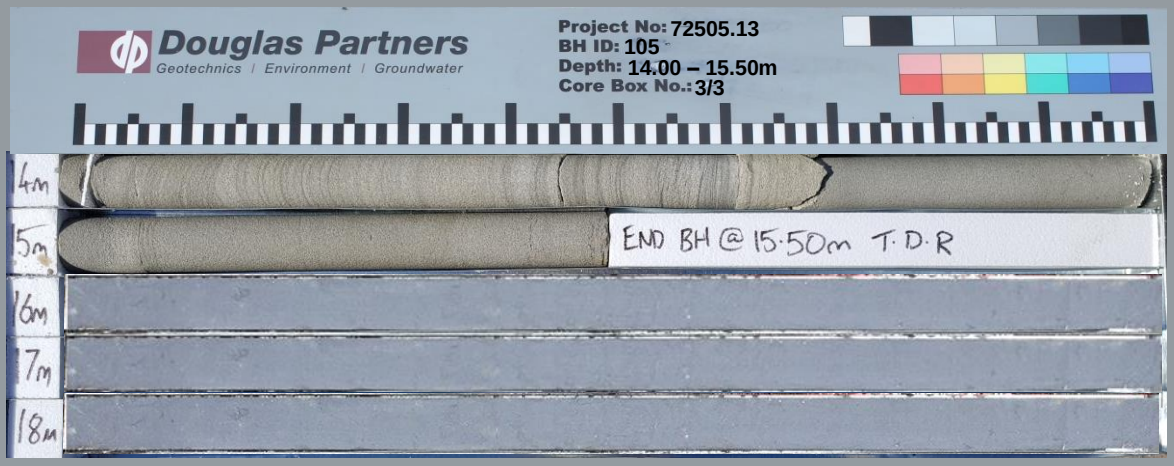
BORE: 105 PROJECT: Randwick February 2019

4.10 – 9.00 m

BORE: 105 PROJECT: Randwick February 2019

9.00 – 14.00 m

BORE: 105 PROJECT: Randwick February 2019



14.00 – 15.50 m

BOREHOLE LOG

CLIENT: Health Infrastructure
PROJECT: Site Infrastructure Investigation
LOCATION: Prince of Wales Hospital, Randwick

SURFACE LEVEL: 56.3 AHD^
EASTING: 337123.2
NORTHING: 6245657.1
DIP/AZIMUTH: 90°/--

BORE No: 1
PROJECT No: 85461.00
DATE: 26/5/2016
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Degree of Weathering	Graphic Log	Rock Strength	Water	Fracture Spacing (m)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Type	Core Rec. %	RQD %	Test Results & Comments
56	0.31	CONCRETE SLAB										
		FILLING - apparently moderately compacted, orange-brown and grey, gravelly clayey sand filling with a trace of sandstone cobbles, damp						Note: Unless otherwise stated, rock is fractured along rough planar bedding dipping 0°- 10°	E			
55	1.05	SANDSTONE - extremely low and very low strength, orange-brown and purple, medium to coarse grained sandstone with some iron-cemented bands							E			
	1.5	SANDSTONE - extremely low and very low strength, extremely then highly weathered, slightly fractured, red-brown, orange-brown and grey medium to coarse grained sandstone with some iron-cemented bands - very fine grained sandstone/siltstone below 2.3m						2.06m: B0°, cly, 10mm 2.12m: B0°, cly, 30mm 2.26m: B0°, cly, 30mm	C	100	76	PL(A) = 0.04
54	2.58							2.67 & 2.78m: B0°, cly vn, fe stn				PL(A) = 0.08 PL(A) = 0.09
53	3.38	SANDSTONE - very low strength, moderately weathered, slightly fractured, pink-grey and pale grey fine to medium grained sandstone with up to 15% siltstone laminations						3.28m: B0°, cly, 20mm 3.3-3.36m: J90°, pl, ro, cly vn 3.37m: B0°, cly, 20mm 3.7m: B5°, cly vn	C	100	96	PL(A) = 0.08 PL(A) = 0.6
52		SANDSTONE - medium and high strength, slightly then moderately weathered, slightly fractured, pale grey, grey and purple-brown, medium to coarse grained sandstone with some extremely low strength, extremely weathered bands and some iron-cemented bands						4.31m: Ds, 150mm 4.57 & 4.74m: B5°, cly vn				PL(A) = 1.2
51								5.11 & 5.37m: B5°, cly vn 5.14 & 5.44m: B0°, cly, 10mm 5.45-5.52m: J45°, ir, ro 5.68m: B5°, cln				PL(A) = 0.4
50	5.91	SANDSTONE - medium strength, fresh, slightly fractured, pale grey, medium to coarse grained sandstone with some extremely low strength bands						6.11m: B0°, cly, 15mm 6.26m: B0°, cly vn	C	100	89	PL(A) = 0.6
49								7.18m: B0°, cly vn				PL(A) = 0.7
								7.89 & 7.91m: B5°, cly vn				
48	7.97	Bore discontinued at 7.97m - target depth reached										
47												

RIG: Bobcat **DRILLER:** GM **LOGGED:** MP **CASING:** HW to 1.5m

TYPE OF BORING: Diacore to 0.31m; NDD to 1.05m; Solid flight auger to 1.55m; NMLC-Coring to 7.97m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: NDD = Non destructive suction drilling. ^Surface level provided by LTS Lockley Pty Ltd

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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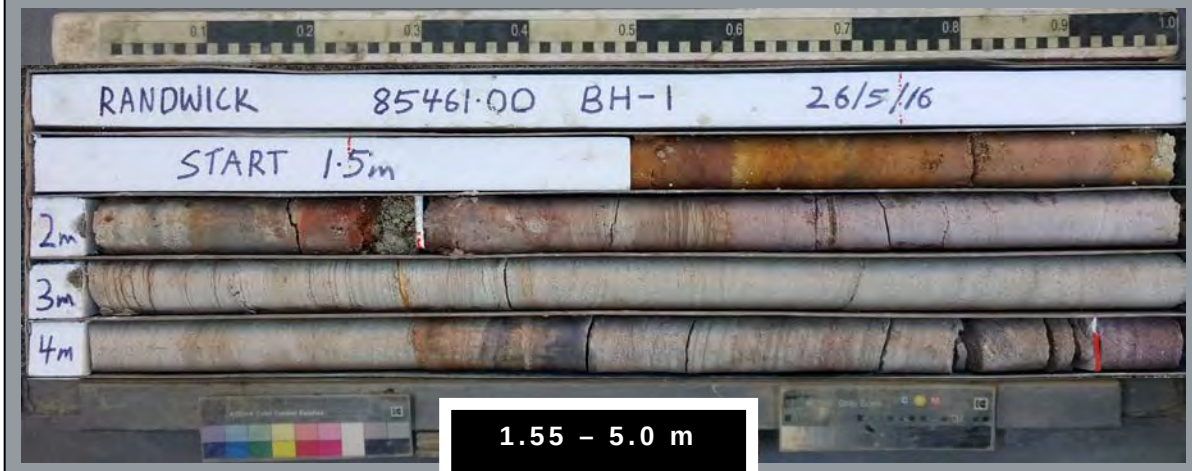
DOUGLAS PARTNERS PTY LTD

SITE INFRASTRUCTURE INVESTIGATION - RANDWICK

BORE 1 PROJECT 85461.00 MAY 2016

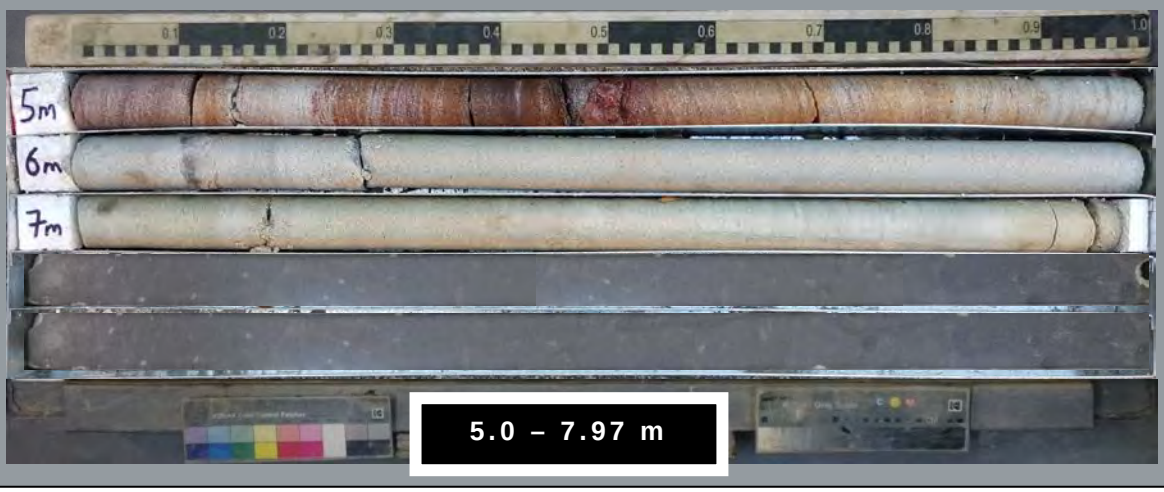


1.55 – 5.0 m

DOUGLAS PARTNERS PTY LTD

SITE INFRASTRUCTURE INVESTIGATION - RANDWICK

BORE 1 PROJECT 85461.00 MAY 2016



5.0 – 7.97 m

BOREHOLE LOG

CLIENT: Bovis Lend Lease
PROJECT: Wallace Wurth Redevelopment
LOCATION: Cnr High & Botany St, UNSW, Kensington

SURFACE LEVEL: 55.8 AHD
EASTING:
NORTHING:
DIP/AZIMUTH: 60°/0

BORE No: 2
PROJECT No: 71543
DATE: 01 Feb 10
SHEET 1 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 D - Drill Break)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
56	0.1	FILLING - dark grey, fine grained, silty sand filling with some rootlets (topsoil)							A			
		FILLING - dark grey brown, fine to medium grained, sand filling with a trace of gravel, humid							A			
									A			
									A/E			
57	1 1.0	FILLING - light grey, fine to medium grained, sand filling with a trace of concrete fragments							A			
									A/E			
	1.8	SAND - orange and light grey, fine to medium grained sand, moist										
58	2											
									A/E			
	3											
	3.5	SAND - orange brown, medium grained sand, moist							A			
59	4							Note: Unless otherwise stated, rock is fractured along rough planar bedding dipping 0°- 10° or joints				
	4.3	SANDSTONE - extremely low and very low strength, extremely to highly weathered, light grey then light grey brown, medium to coarse grained sandstone with extremely low strength, igneous rock inclusions										
	4.65							4.65m: CORE LOSS: 100mm				
60	5							4.75-4.85m: dyke	C	92	0	PL(A) = 0.7MPa
61	6							6.33-7.25m: dyke				
	6.52	SANDSTONE - medium then high to very high strength, highly and slightly weathered, highly fractured to fractured, grey and brown, medium to coarse grained sandstone with extremely low strength, igneous rock inclusions (cooked sandstone)						6.53-7.25m: highly fractured to fractured sandstone (dyke) in subvertical joints	C	100	0	
62	7							7.2m: CORE LOSS: 480mm				
	7.2							7.68-7.78m: fragmented in 0.02m intervals	C	62	0	PL(A) = 1.9MPa
	8							7.88-8.13m: J, subvertical, rough 8.05-8.08m: clay band				PL(A) = 4.9MPa
63	8.4	IGNEOUS ROCK & SANDSTONE extremely low and very low strength, extremely and highly weathered, grey and orange brown, medium to coarse grained sandstone with frequent igneous rock intrusions. Some high strength fractured bands						8.13m: J75°, rough 8.28-8.31m: clay band 8.31m: J, subvertical, ironstained 8.4m: CORE LOSS: 1050mm	C	34	0	
	9							9.45-9.65m: fragmented to 0.02m intervals				PL(A) = 1.3MPa

RIG: Bobcat **DRILLER:** Steve S **LOGGED:** SI **CASING:** HW to 2.6m

TYPE OF BORING: Solid flight auger to 2.5m; Rotary to 4.65m; NMLC-Coring to 14.4m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Standpipe installed to 14.4m

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U$_x$	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ▼ Water level

CHECKED
Initials: STE
Date: 17/3/10

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BOREHOLE LOG

CLIENT: Bovis Lend Lease
PROJECT: Wallace Wurth Redevelopment
LOCATION: Cnr High & Botany St, UNSW, Kensington

SURFACE LEVEL: 55.8 AHD
EASTING:
NORTHING:
DIP/AZIMUTH: 60°/0

BORE No: 2
PROJECT No: 71543
DATE: 01 Feb 10
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 D - Drill Break)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
65	10.0	IGNEOUS ROCK & SANDSTONE - extremely low and very low strength, extremely and highly weathered, grey and orange brown, medium to coarse grained sandstone with frequent igneous rock intrusions. Some high strength fractured bands *(continued)*						10m: CORE LOSS: 450mm 10.45-10.6m: fragmented to 0.01m intervals	C	50	0	
66	10.9							10.9m: CORE LOSS: 1100mm	C	19	0	
67	12.0	SANDSTONE - alternate bands of very low and medium to high strength, highly and moderately to slightly weathered, fragmented to slightly fractured, light grey and brown, coarse grained sandstone with bands of igneous rock intrusions						12.0-12.25m: fragmented 12.3m: J80°, healed 12.37m: J20°, ironstained 12.43m: J15°, ironstained 12.47-12.6m: very low strength band 12.64m: J70°, healed 12.8m: J65°, ironstained 12.92m: B0°, very low strength band 13.13m: J80°, healed 13.29m: J65°, ironstained very low strength band	C	88	0	PL(A) = 1.7MPa
68	13.56											
	14.35											
69	14.4	Bore discontinued at 14.4m						13.4m: J30°, ironstained very low strength band 13.48-13.56m: fragmented in 0.02mm intervals 13.56m: CORE LOSS: 200mm 13.76m: J60°, ironstained 13.76-13.92m: fragmented 14m: J85° 14.15m: J70°, ironstained, clay band 14.25m: J50°, ironstained 14.3-14.4m: fragmented 14.35m: CORE LOSS: 50mm				
70	15											
71	16											
72	17											
	18											
	19											

RIG: Bobcat **DRILLER:** Steve S **LOGGED:** SI **CASING:** HW to 2.6m

TYPE OF BORING: Solid flight auger to 2.5m; Rotary to 4.65m; NMLC-Coring to 14.4m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Standpipe installed to 14.4m

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep
		▽	Water level

CHECKED
Initials: STE
Date: 17/3/10

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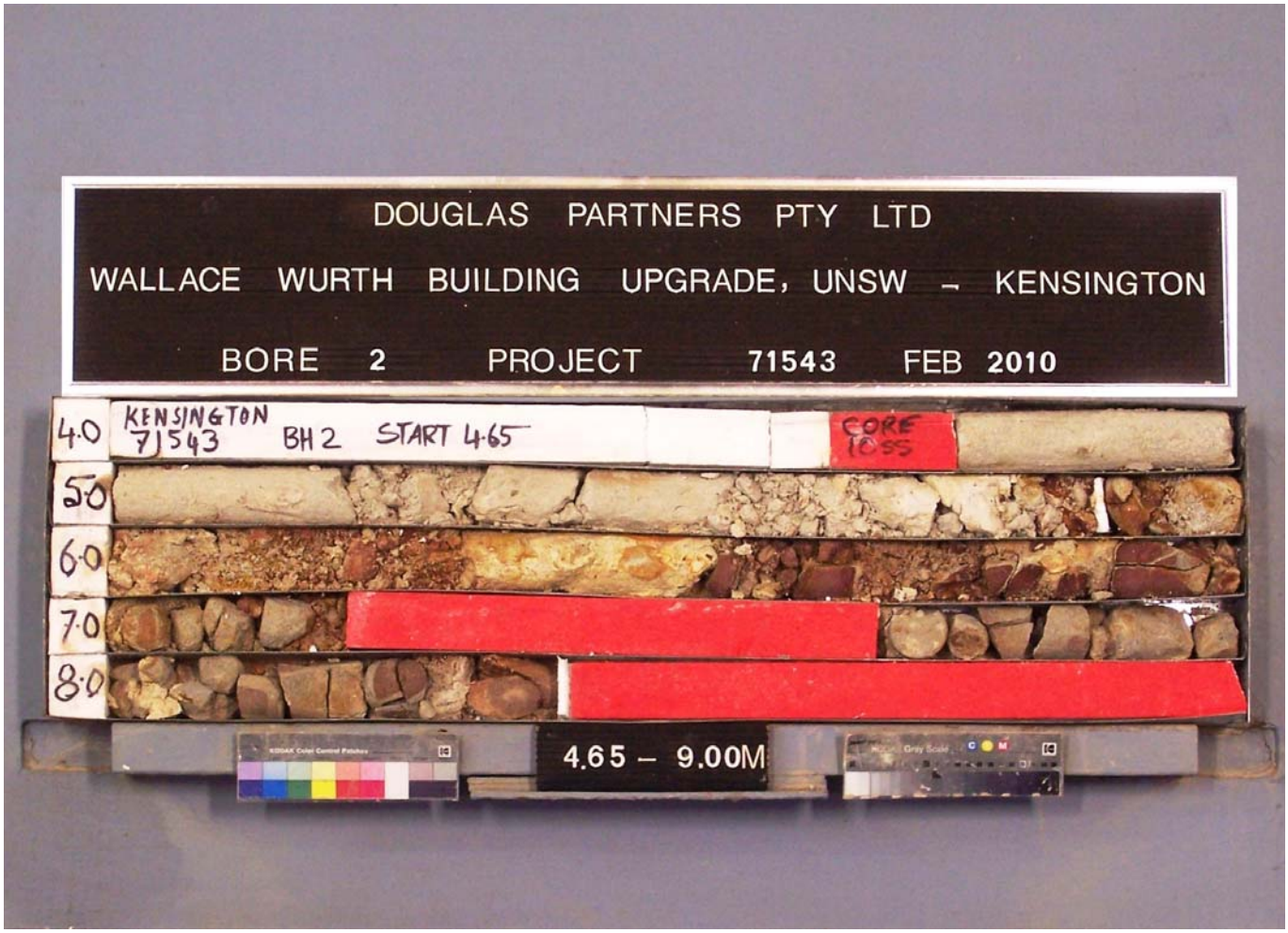
DOUGLAS PARTNERS PTY LTD
WALLACE WURTH BUILDING UPGRADE, UNSW – KENSINGTON
BORE 2 PROJECT 71543 FEB 2010
4.0
KENSINGTON 71543 BH2 START 4.65
CORE LOSS
5.0
6.0
7.0
8.0
4.65 – 9.00M


DOUGLAS PARTNERS PTY LTD
WALLACE WURTH BUILDING UPGRADE, UNSW – KENSINGTON
BORE 2 PROJECT 71543 FEB 2010
9.0
10.0
12
13.
9.00 – 14.00M


DOUGLAS PARTNERS PTY LTD
WALLACE WURTH BUILDING UPGRADE, UNSW - KENSINGTON
BORE 2 PROJECT 71543 FEB 2010
U.N.S.W. KENSINGTON - 71543 B/H. 2. @ 60° START 12.25m.
14
END OF HOLE 14.4m
14.00 - 14.40M

BOREHOLE LOG

CLIENT: Bovis Lend Lease
PROJECT: Wallace Wurth Redevelopment
LOCATION: Cnr High & Botany St, UNSW, Kensington

SURFACE LEVEL: 56.2 AHD
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 3
PROJECT No: 71543
DATE: 3-8 Feb 2010
SHEET 1 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 D - Drill Break)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
56	0	FILLING - dark brown, sand filling							A			
									A			
	0.7	SAND - medium dense, light brown, fine to medium grained sand										
55	1								S			4,6,9 N = 15
54	2	- yellow below 2.2m							S			3,6,11 N = 17
									A			
53	3							Note: Unless otherwise stated, rock is fractured along rough planar bedding dipping at 0°-10° or joints				
	3.2	IGNEOUS ROCK (DYKE) - extremely low to very low strength, extremely to highly weathered, light grey to red brown, igneous rock (dyke)										
52	4								C	90	0	
	4.86					05-03-10		4.86m: CORE LOSS: 140mm				
51	5											
	5.8							5.8m: CORE LOSS: 1200mm	C	40	0	
50	6											
	7.0	ROTARY DRILLING						7.0-9.5m: rotary drilling in extremely weathered dyke				
49	7											
48	8								R			
47	9											
	9.5	IGNEOUS ROCK - description next page						9.7-9.95m: fragmented into 0.05mm intervals	C	83	0	PL(A) = 0.8MPa

RIG: Bobcat **DRILLER:** Steve S **LOGGED:** SI **CASING:** HW to 3.6m

TYPE OF BORING: Solid flight auger to 3.6m; NMLC-Coring to 7.0m; Rotary to 9.5m; NMLC-Coring to 13.0m; Rotary to 14.5m; NMLC-Coring to 15.15m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Groundwater well installed to 18.0m. Water measured in well at 4.9m on 5/3/10

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U,	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep
		▼	Water level

CHECKED
Initials: STE
Date: 17/3/10

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BOREHOLE LOG

CLIENT: Bovis Lend Lease
PROJECT: Wallace Wurth Redevelopment
LOCATION: Cnr High & Botany St, UNSW, Kensington

SURFACE LEVEL: 56.2 AHD
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 3
PROJECT No: 71543
DATE: 3-8 Feb 2010
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 D - Drill Break)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
46	10.0	IGNEOUS ROCK (DYKE) - extremely low to very low and medium strength, extremely to highly weathered, fractured, light grey brown to red brown, igneous rock with medium strength sandstone bands						10m: CORE LOSS: 100mm 10.6m: J70°, clay band 11.2-11.6m: fragmented in 0.02mm intervals	C	69	0	PL(A) = 0.6MPa
45	11											
	11.77							11.77m: CORE LOSS: 830mm				
44	12											PL(A) = 0.5MPa
	12.95							12.6-12.8m: fragmented in 0.02 to 0.05mm intervals 12.8-12.95m: clay band 12.95m: CORE LOSS: 50mm				
43	13.0	ROTARY DRILLING						13.0-14.15m: rotary drilling to weathered rock	R			
	14											
42	14.15	SANDSTONE - high then medium strength, highly to moderately weathered, fractured, red brown, coarse grained sandstone (cooked sandstone)						14.23m: J10°, 30mm clay 14.23-14.43m: (x4) B0°-5°, ironstained				PL(A) = 2.1MPa
	14.73							14.59m: B0°, 20mm clay 14.74-14.8m: extremely low strength dyke	C	100	0	
	15											
41	15.15	IGNEOUS ROCK (DYKE) - extremely low to very low strength, extremely weathered, light grey brown, igneous rock (dyke)						14.78-15.15m: extremely low strength dyke				
		ROTARY DRILLING							R			
	16											
40												
	17											
39	17.2	IGNEOUS ROCK (DYKE) - high to very high strength, fresh stained, fractured to slightly fractured, light greenish grey and brown, igneous rock (dyke). Some medium strength bands						17.2m: J, subvertical, healed, ironstained 17.3m: J70°, healed, ironstained 17.4-17.6m: J, subvertical, partially healed, fragmented into 0.05mm intervals	C	100	63	PL(A) = 9.2MPa PL(A) = 3MPa
	18											PL(A) = 0.7MPa
38	18.3	Bore discontinued at 18.3m						17.74m: J85°, partially healed 17.85m: J70° 18.07m: J65°, rough 18.21-18.3m: J75°, clay smear & fragmented into 0.03mm intervals				
	19											
37												

RIG: Bobcat **DRILLER:** Steve S **LOGGED:** SI **CASING:** HW to 3.6m

TYPE OF BORING: Solid flight auger to 3.6m; NMLC-Coring to 7.0m; Rotary to 9.5m; NMLC-Coring to 13.0m; Rotary to 14.5m; NMLC-Coring to 15.15m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Groundwater well installed to 18.0m. Water measured in well at 4.9m on 5/3/10

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ▼ Water level

CHECKED
Initials: STE
Date: 17/3/10

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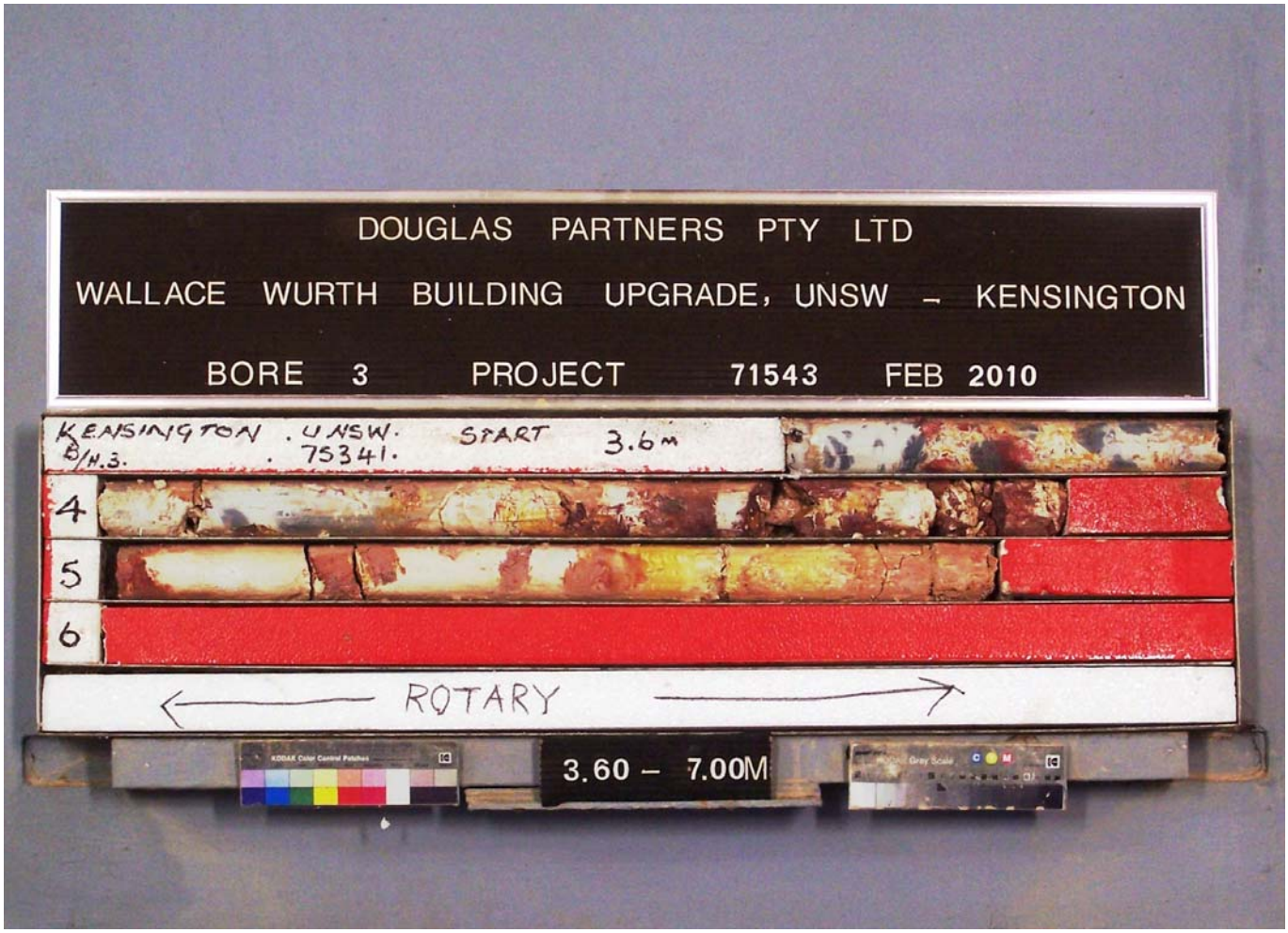
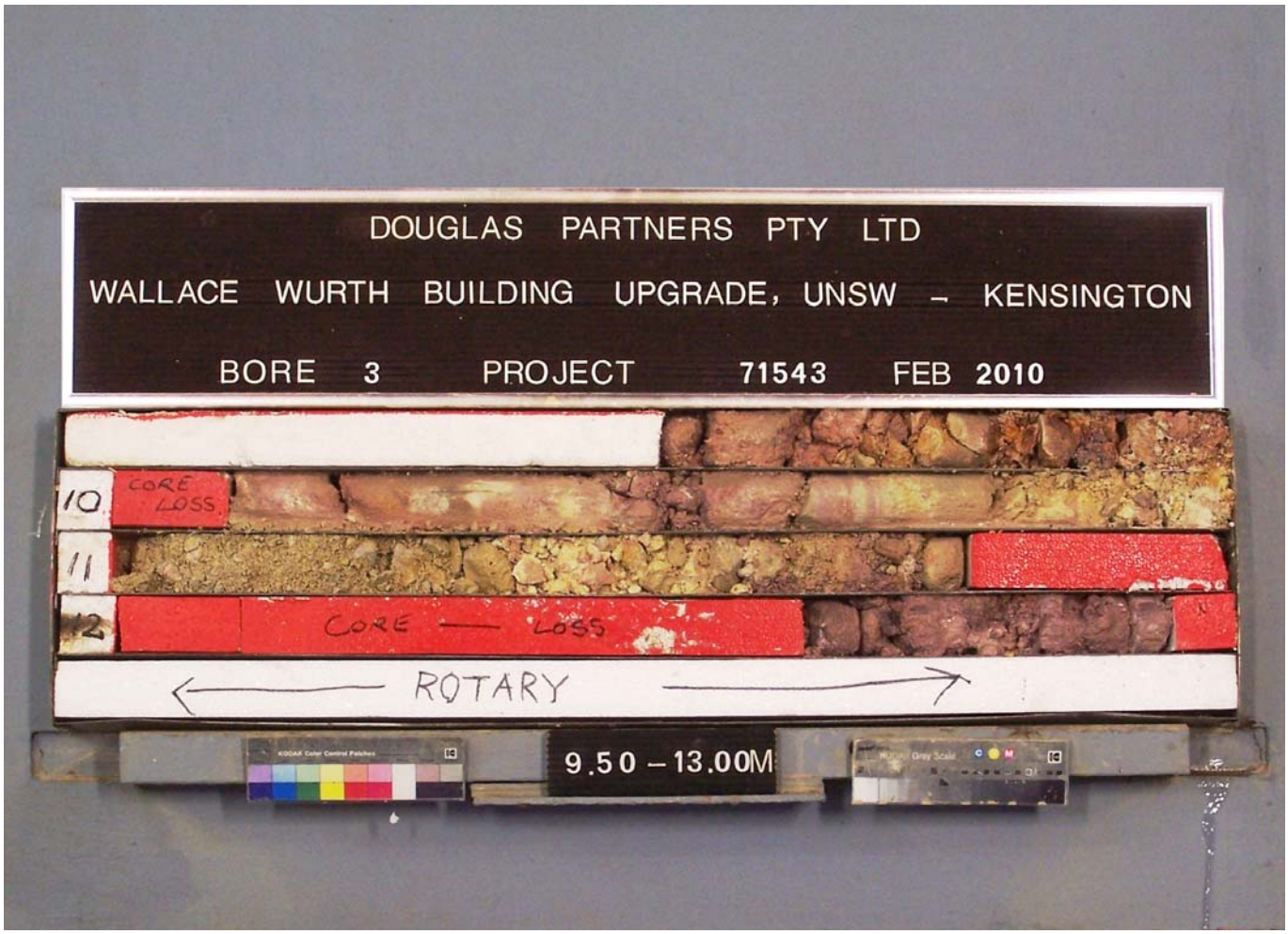

DOUGLAS PARTNERS PTY LTD
WALLACE WURTH BUILDING UPGRADE, UNSW – KENSINGTON
BORE 3 PROJECT 71543 FEB 2010
KENSINGTON . UNSW. START 3.6m
B/H.3. . 75341.
4
5
6
ROTARY
3.60 – 7.00M


DOUGLAS PARTNERS PTY LTD
WALLACE WURTH BUILDING UPGRADE, UNSW – KENSINGTON
BORE 3 PROJECT 71543 FEB 2010
10 CORE LOSS
11
12 CORE — LOSS
ROTARY
9.50 – 13.00M


DOUGLAS PARTNERS PTY LTD
WALLACE WURTH BUILDING UPGRADE, UNSW - KENSINGTON
BORE 3 PROJECT 71543 FEB 2010
14
15
ROTARY DRILLING
16
17
18
BH END @ 18.3 M
14.15 – 18.30M

BOREHOLE LOG

CLIENT: Bovis Lend Lease
PROJECT: Wallace Wurth Redevelopment
LOCATION: Cnr High & Botany St, UNSW, Kensington

SURFACE LEVEL: 55.9 AHD
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 5
PROJECT No: 71543
DATE: 01 Feb 10
SHEET 1 OF 1

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 D - Drill Break)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
55	0.2	FILLING - dark grey brown, fine grained, silty sand filling (topsoil) with some organic matter and a trace of concrete cobble and crushed sandstone fragments							A			
55	0.9	FILLING - brown, fine to medium grained, sand filling with some silt and gravel and a trace of slag and ceramic tile fragments, humid							A			
54	2.0	FILLING - light brown, medium grained, sand filling with some crushed sandstone							A			
54									A			
54									A			
54									A/E			
54									A/E			
54									S			3,8,8 N = 16
54		SAND - medium dense, orange and light grey, fine to medium grained sand, moist							A			
53									A/E A			
53									A S			6,10,12 N = 22
52												
51									S			9,10,13 N = 23
51								Note: Unless otherwise stated, rock is fractured along rough planar bedding dipping at 0°-10°				
51	5.3	SANDSTONE - very low strength, orange brown, medium grained sandstone							S			20,20/25mm refusal
50	5.8	SANDSTONE - medium then high strength, slightly then moderately weathered, slightly fractured, light grey brown then red brown, medium to coarse grained sandstone						6.1m: B0°, ironstained	C	100	99	PL(A) = 0.5MPa
49								6.62m: B0°, 5mm sandy clay				PL(A) = 0.4MPa
49								6.65m: B0°, 10mm sandy clay				
48								7.44 & 8.28m: (x2) B0°-5°, clay veneer				PL(A) = 1.1MPa
47	8.8	Bore discontinued at 8.8m										PL(A) = 1.1MPa

RIG: Bobcat **DRILLER:** Steve S **LOGGED:** SI **CASING:** HW to 5.8m

TYPE OF BORING: Solid flight auger to 5.5m; Rotary to 8.8m; NMLC-Coring to 8.8m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ▼ Water level

CHECKED
Initials: STE
Date: 17/3/10

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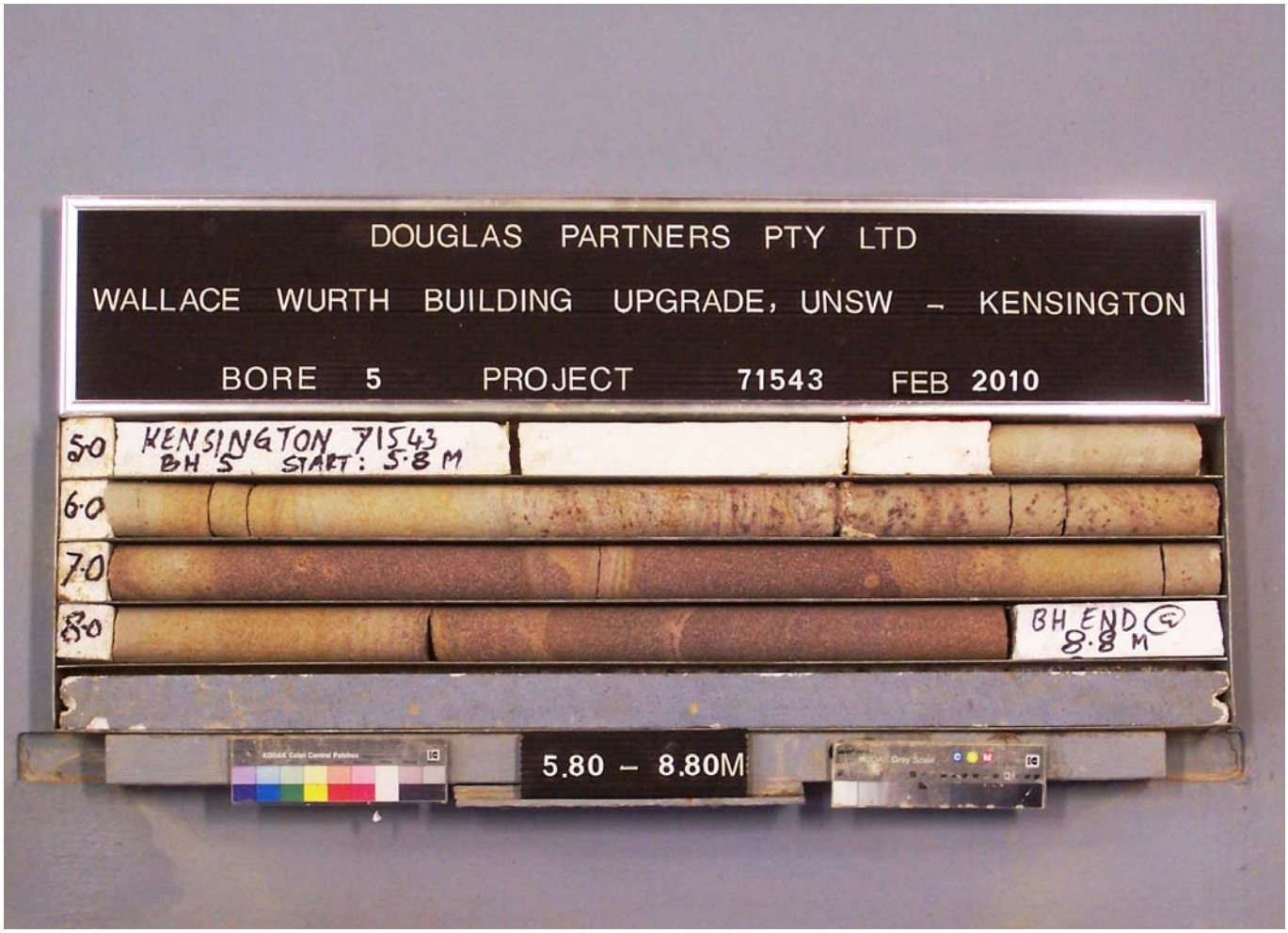
DOUGLAS PARTNERS PTY LTD
WALLACE WURTH BUILDING UPGRADE, UNSW - KENSINGTON
BORE 5 PROJECT 71543 FEB 2010
5.0
KENSINGTON 71543
BH 5 START: 5.8 M
6.0
7.0
8.0
BH END @ 8.8 M
5.80 - 8.80M

BOREHOLE LOG

CLIENT: Bovis Lend Lease
PROJECT: Wallace Wurth Redevelopment
LOCATION: Cnr High & Botany St, UNSW, Kensington

SURFACE LEVEL: 55.8 AHD
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 7
PROJECT No: 71543
DATE: 29 Jan 10
SHEET 1 OF 1

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 D - Drill Break)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
55	0.1	FILLING - brown, fine grained, silty sand filling (topsoil) with some gravel and rootlets							A			
	0.4	FILLING - brown sand and crushed sandstone filling, humid							A			
1		FILLING - light to dark brown, fine to medium grained sand filling, with a trace of gravel, humid to moist							A/E			
		1.3-1.45m: concrete fragments							A/E			
	1.5	FILLING - light brown, fine to medium grained sand with some sandstone gravel (possible natural)							A			
54									A			
2									A			
									S			4,5,5 N = 10
53	3.0	SAND - medium dense, orange brown, medium grained sand, moist							A			
									A			
52									A			
4									S			11,15,20/10mm refusal
	4.9	SANDSTONE - very low strength, light grey brown, medium grained sandstone						Note: Unless otherwise stated, rock is fractured along rough planar bedding dipping at 0°-10° or joints				
51	5.2	SANDSTONE - medium strength, moderately weathered, fractured to slightly fractured, red brown, medium grained sandstone						5.42m: B5°, clay veneer 5.58m: B10°, 10mm sandy clay 5.63m: B5°, 50mm clay 5.68-8.35m: massive sandstone				PL(A) = 0.6MPa
5	5.68	SANDSTONE - medium then high strength, slightly weathered and fresh, unbroken, light grey and red brown, medium to coarse grained, massive sandstone										PL(A) = 0.8MPa
50									C	100	97	
6												PL(A) = 0.9MPa
49												
7												PL(A) = 1.4MPa
48												
8	8.35	Bore discontinued at 8.35m										
47												
9												
46												

RIG: Bobcat **DRILLER:** Steve S **LOGGED:** SI **CASING:** HW to 5.0m

TYPE OF BORING: Solid flight auger to 5.2m; NMLC-Coring to 8.35m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U$_x$	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ▼ Water level

CHECKED
Initials: STE
Date: 17/3/10

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DOUGLAS PARTNERS PTY LTD
WALLACE WURTH BUILDING UPGRADE, UNSW - KENSINGTON
BORE 7 PROJECT 71543 FEB 2010
NSW KENSINGTON
71543. B/H-7. START. 5.2
START
6
7
8
FIN 8.3 m.
5.20 - 8.30M

BOREHOLE LOG

CLIENT: The University of New South Wales
PROJECT: Proposed Building Upgrade
LOCATION: UNSW, Botany Road, Kensington

SURFACE LEVEL: 55.1 AHD^
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 5
PROJECT No: 73492
DATE: 7/6/2013
SHEET 1 OF 1

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)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
55	0.1	CONCRETE							A/E			
	0.4	FILLING - yellow brown, sand and crushed sandstone filling, humid							E			
54	1	FILLING - poorly compacted, brown, fine to medium grained sand filling with some sandstone gravel and a trace of organic matter, humid							E			
		- with some brick fragments at 1.5m							E S			5,3,2 N = 5
53	2								E			
									E			
52	3								E S			2,2,4 N = 6
	3.4	SAND - loose becoming medium dense, yellow brown, fine to medium grained sand, humid										
51	4								E			
									S			5,10,15 N = 25
50	5											
49	6							Unless otherwise stated rock is fractured along rough planar bedding dipping at 0°-10°				
	6.2	SANDSTONE - extremely low then very low strength, light grey, fine to medium grained sandstone							S			10,35/150mm refusal
	6.47	SANDSTONE - high strength, slightly then moderately weathered, slightly fractured and unbroken, light grey and light purple brown, medium to coarse grained sandstone										PL(A) = 1.1
48	7							7.11m: B0, fe, cly co 1mm				PL(A) = 1.3
47	8								C	100	100	
								8.35m: B20, cly vn				PL(A) = 1.7
46	9	9.05m to 9.58m: fresh										PL(A) = 1.8
	9.58	Bore discontinued at 9.58m										

RIG: Terrier **DRILLER:** Tightsite **LOGGED:** SI/AG **CASING:** HQ to 6.3m

TYPE OF BORING: Diatube to 0.1m, hand auger to 1.5m, solid flight auger to 6.47m, NMLC-Coring to 9.58m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: ^Surface level interpolated from Dwg No K-FME-2013.0002, Rev A, 31.5.13.

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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PROPOSED BUILDING UPGRADE, UNSW - KENSINGTON

BORE 5 PROJECT 73492 JUNE 2013

6.47 – 9.58m

BOREHOLE LOG

CLIENT: The University of New South Wales
PROJECT: Proposed Building Upgrade
LOCATION: UNSW, Botany Road, Kensington

SURFACE LEVEL: 52.8 AHD^
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 6
PROJECT No: 73492
DATE: 6/6/2013
SHEET 1 OF 1

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)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
52	0.08	BRICK PAVING										
		FILLING - brown and yellow brown, fine to medium grained sand filling with a trace of gravel and rootlets, humid							D/E*			
	0.5								B			
		SAND - apparently loose, yellow brown, fine to medium grained sand, humid							D/E			
51	1.0											
		SAND - loose to medium dense becoming medium dense, yellow brown, fine to medium grained sand, humid							D/E			
									E			
									S			3,3,7 N = 10
50	2								A			
	3								S			4,8,14 N = 22
49												
	4	- wet below 4.0m				06-06-13						
48	4.8								S			4,6,20 N = 26
	4.9	SANDSTONE - extremely low strength, light grey and orange brown, fine to medium grained sandstone										PL(A) = 1.1
	5											
47		SANDSTONE - high strength, moderately then slightly weathered, slightly fractured and unbroken, light purple yellow brown and light grey, medium to coarse grained sandstone										PL(A) = 1.6
	6								C	100	100	PL(A) = 1.4
46												
	7											PL(A) = 1.4
45								7.68m: B10, cly vn				
	8	8.0 Bore discontinued at 8.0m										
44	9											
43												

RIG: Terrier **DRILLER:** Tightsite **LOGGED:** SI/AG **CASING:** HQ to 4.9m

TYPE OF BORING: Vacuum excavation to 1.4m, solid flight auger to 4.9m, NMLC-Coring to 8.0m

WATER OBSERVATIONS: Free groundwater observed at 4.0m whilst augering

REMARKS: *Environmental sample duplicate BD2/050613, ^surface level interpolated from Dwg No K-FME-2013.0002, Rev A, 31.5.13.

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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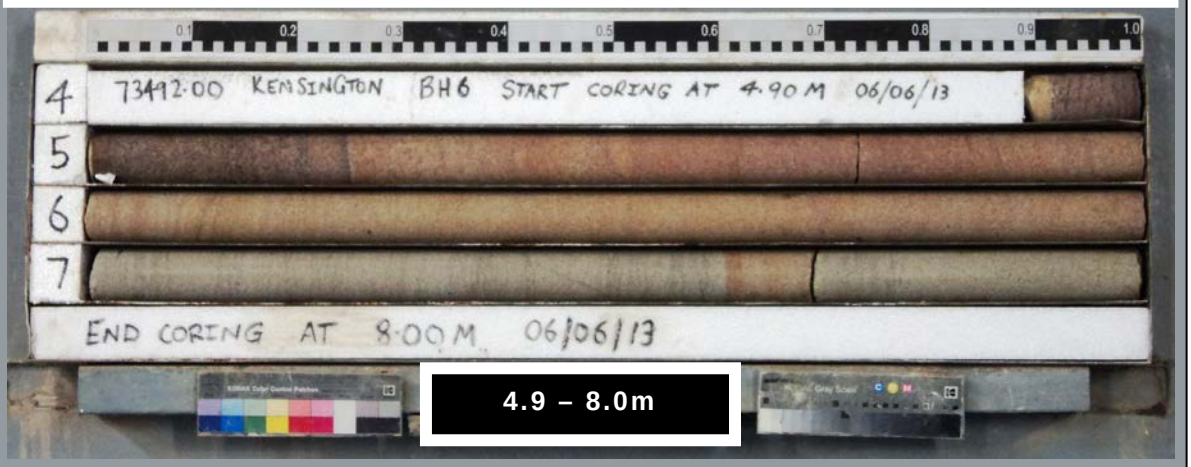
DOUGLAS PARTNERS PTY LTD

PROPOSED BUILDING UPGRADE, UNSW - KENSINGTON

BORE 6 PROJECT 73492 JUNE 2013



4.9 – 8.0m

BOREHOLE LOG

CLIENT: LendLease Building Pty Ltd
PROJECT: Randwick Campus Redevelopment
LOCATION: Hospital Road and High, Magill and Botany Streets, Randwick

SURFACE LEVEL: 55.2 AHD
EASTING: 337086
NORTHING: 6245508.3
DIP/AZIMUTH: 90°/--

BORE No: 2
PROJECT No: 72505.11
DATE: 18 - 20/9/2017
SHEET 1 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)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
55	0.05	ASPHALTIC CONCRETE							A			
	0.3	ROADBASE - dark grey, sandy fine to medium grained igneous gravel roadbase (possibly recycled road surface)							A*			
	0.6	FILLING - grey-brown, fine to medium sand filling with trace fine gravel and glass fragments, damp							A			
54	1	SAND - medium dense, yellow-brown, medium grained sand, damp							A			
53	2	- with some dark brown silty sand bands to 2.0m							S			4,7,7 N = 14
52	3											
51	4							Note: Unless otherwise stated, rock is fractured along rough planar bedding dipping 0°- 20°	S			6,11,13 N = 24
50	5	5.0 5.1 SANDSTONE - very low strength, light yellow-brown, medium grained sandstone						5.18m: B0°- 5°, ro, un, fe stn 5.27m: B5°, ro, pl, cln				PL(A) = 0.43
		SANDSTONE - medium strength, slightly weathered, slightly fractured then unbroken, light yellow-brown medium grained sandstone. Typically indistinctly bedded with some distinct ironstained beds										PL(A) = 0.62
49	6								C	100	92	
												PL(A) = 0.71
48	7							>>				PL(A) = 0.67
47	8								C	100	100	PL(A) = 0.94
46	9	9.47-9.7m: ironstained cross bedding at 70°- 45°						9.47m: B5°, he, fe stn				PL(A) = 0.91

RIG: DT100 **DRILLER:** SS **LOGGED:** ARM/RMM **CASING:** HW to 2.5

TYPE OF BORING: Diatube to 0.05m; Non-destructive drilling to 1.9m; Solid flight auger (TC-bit) to 2.0m; Rotary to 5.1m; NMLC-Coring to 19.0m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: *BD1/20170918 taken at 0.3m to 0.4m

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: LendLease Building Pty Ltd
PROJECT: Randwick Campus Redevelopment
LOCATION: Hospital Road and High, Magill and Botany Streets, Randwick

SURFACE LEVEL: 55.2 AHD
EASTING: 337086
NORTHING: 6245508.3
DIP/AZIMUTH: 90°/--

BORE No: 2
PROJECT No: 72505.11
DATE: 18 - 20/9/2017
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering	Graphic Log	Rock Strength	Water	Fracture Spacing (m)	Discontinuities (B - Bedding, J - Joint, S - Shear, F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
		SANDSTONE *(continued)*										
45	10.66	SANDSTONE - medium strength, fresh, slightly fractured, light grey medium and fine grained sandstone. Typically indistinctly bedded						10.63m: Ds, 30mm				PL(A) = 0.71
44	11							11.46m: B5°, ro, pl, cly vn	C	100	97	
	11.68	SILTSTONE - low strength, slightly weathered, dark grey siltstone with approximately 30% sandstone beds						11.69m: Ds, 10mm				PL(A) = 0.17
	11.88	SANDSTONE - high strength, fresh, unbroken, light grey to grey, medium and coarse grained sandstone. Typically indistinctly bedded and massive						11.87m: Ds, 10mm				PL(A) = 1.24
43	12											
42	13							13.48m: Ds, 30mm				PL(A) = 0.9
								13.68m: Ds, 20mm				
41	14											PL(A) = 1.22
									C	100	94	
40	15	15.34-15.8m: some distinct siltstone beds						15.09-15.28m: B (x4) 10°, pl, cly, 5mm				PL(A) = 1.29
								15.72m: B10°, pl, he				
39	16							15.76m: Ds, 20mm				PL(A) = 1.31
38	17											PL(A) = 1.52
								17.63m: Ds, 10mm	C	100	99	
37	18											PL(A) = 1.25
36	19 19.0	Bore discontinued at 19.0m - target depth reached										

RIG: DT100 **DRILLER:** SS **LOGGED:** ARM/RMM **CASING:** HW to 2.5

TYPE OF BORING: Diatube to 0.05m; Non-destructive drilling to 1.9m; Solid flight auger (TC-bit) to 2.0m; Rotary to 5.1m; NMLC-Coring to 19.0m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: *BD1/20170918 taken at 0.3m to 0.4m

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: 2 PROJECT: RANDWICK SEPTEMBER 2017

5.1m – 9.0m

BORE: 2 PROJECT: RANDWICK SEPTEMBER 2017

9.0m – 14.0m

BORE: 2 PROJECT: RANDWICK SEPTEMBER 2017

14.0m – 19.0m

BOREHOLE LOG

CLIENT: LendLease Building Pty Ltd
PROJECT: Randwick Campus Redevelopment
LOCATION: Hospital Road and High, Magill and Botany Streets, Randwick

SURFACE LEVEL: 54.6 AHD
EASTING: 337098.7
NORTHING: 6245586
DIP/AZIMUTH: 90°/--

BORE No: 3
PROJECT No: 72505.11
DATE: 21-9-2017
SHEET 1 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
54	0.03	ASPHALTIC CONCRETE - typically <10mm diameter							A/E			
	0.4	ROADBASE - dark grey, sandy gravel, igneous, angular, up to 30mm diameter, damp							A/E			
1	1.0	FILLING - light brown to brown, fine to medium grained sand filling with traces of fine gravel, damp - grey-brown with trace of earthenware fragments from 0.7m						Note: Unless otherwise stated, rock is fractured along rough planar bedding dipping 0°- 20°	A/E			
53	1.5 1.6	SAND - apparently medium dense, yellow-brown medium grained sand, damp						1.87m: B0°, ro, un, fe stn 2.06-2.09m: B10°, ro, un, cly, 5mm 2.14m: B5°, ro, un, cly & organic material, 5mm 2.22m: Ds, 10mm 2.56-2.58m: B (x2) 5°, ro, un, fe stn 2.68m: B5°, ro, un, cly, 5mm 3.16m: B5°, pl, partially he, fe stn 3.52m: J30°, un, ti 3.68m: B5°, ro, un, fe stn 13.68m: Ds, 30mm 3.72m: J60°- 70°, ro, un, cln 3.85m: Ds, 10mm 3.9m: J60°- 70°, ro, un, cln 3.93m: Ds, 70mm 4.1m: Ds, 10mm 4.22-4.5m: B (x6) un, ti, fe stn, cly, 5-10mm 5.09m: Ds, 10mm 5.3m: Cs, 10mm 5.71m: B10°, ro, pl, fe stn	C	100	81	PL(A) = 0.32 PL(A) = 0.48 PL(A) = 0.12 PL(A) = 0.14 PL(A) = 0.26 PL(A) = 1.42
52	2	SANDSTONE - very low strength, light yellow-brown, medium grained sandstone										
		SANDSTONE - medium strength, slightly weathered, slightly fractured, light grey, medium grained sandstone with some ironstaining. Typically indistinctly bedded										
51	3 3.67											
	4 4.0	SANDSTONE - low and very low strength, moderately then slightly weathered, light grey and grey, fine and medium grained sandstone										
50		SANDSTONE - low strength, slightly weathered, slightly fractured, light grey, medium grained sandstone. Typically indistinctly bedded										
	5											
49	5.31	SANDSTONE - high strength, slightly weathered then fresh, slightly fractured, light grey medium and coarse grained sandstone. Typically indistinctly bedded										
	6											
48		6.42m:-6.52m: very low strength band - distinctly bedded from 6.54m						6.41m: Cs, 10mm 6.52m: Cs, 20mm				PL(A) = 0.08 PL(A) = 1.85
	7							7.14-7.53m: B (x9) 10°, ro, pl, cln or cbs stn	C	100	24	PL(A) = 1.33
47		- medium strength from 7.5m										
	7.7	SANDSTONE - medium then medium to high strength, fresh, slightly fractured to unbroken, light grey to grey, medium grained sandstone with some carbonaceous flecks. Typically massive						7.78m: B5°, ro, un, cln 7.93m: Ds, 20mm				PL(A) = 0.62 PL(A) = 0.52
46	8							8.55m: B0°, ro, un, cly, 5mm	C	100	99	
	9							9.32m: B0°, ro, un, cly, 5mm				PL(A) = 1.16
45												

RIG: DT100 **DRILLER:** SS **LOGGED:** RMM **CASING:** HW to 1.6m

TYPE OF BORING: Solid flight auger (TC-bit) to 0.03m; Non-destructive drilling to 1.5m; Solid flight auger (TC-bit) to 1.6m; NMLC-Coring to 16.0m

WATER OBSERVATIONS: No free groundwater observed whilst augering

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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BOREHOLE LOG

CLIENT: LendLease Building Pty Ltd
PROJECT: Randwick Campus Redevelopment
LOCATION: Hospital Road and High, Magill and Botany Streets, Randwick

SURFACE LEVEL: 54.6 AHD
EASTING: 337098.7
NORTHING: 6245586
DIP/AZIMUTH: 90°/--

BORE No: 3
PROJECT No: 72505.11
DATE: 21-9-2017
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
44	11	SANDSTONE - medium then medium to high strength, fresh, slightly fractured to unbroken, light grey to grey, medium grained sandstone with some carbonaceous flecks. Typically massive *(continued)* 10.36-10.5m: low strength band						10.45m: B0°, ro, un, cln				PL(A) = 0.17
												PL(A) = 0.82
												PL(A) = 0.89
43									C	100	99	
	12							12.18-12.2m: B (x2) 0°-10°, pl, ro, cln				PL(A) = 1.16
42												
	13											PL(A) = 1.2
41												
	14											
40	14.82								C	100	96	PL(A) = 1.09
	15	SANDSTONE - medium to high strength, fresh, slightly fractured, light grey medium grained sandstone with some medium strength bands. Typically distinctly bedded						14.78m: Ds, 40mm				
												PL(A) = 1.21
39								15.67m: J30°- 40°, ro, un, cln				
	16	16.0 Bore discontinued at 16.0m - target depth reached						15.75-15.9m: B (x2) 10°, ro, pl, cln				PL(A) = 0.76
38												
	17											
37												
	18											
36												
	19											
35												

RIG: DT100 **DRILLER:** SS **LOGGED:** RMM **CASING:** HW to 1.6m

TYPE OF BORING: Solid flight auger (TC-bit) to 0.03m; Non-destructive drilling to 1.5m; Solid flight auger (TC-bit) to 1.6m; NMLC-Coring to 16.0m

WATER OBSERVATIONS: No free groundwater observed whilst augering

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: 3 PROJECT: RANDWICK SEPTEMBER 2017

1.6m – 6.0m

BORE: 3 PROJECT: RANDWICK SEPTEMBER 2017

6.0m – 11.0m

BORE: 3 PROJECT: RANDWICK SEPTEMBER 2017

11.0m – 16.0m

BOREHOLE LOG

CLIENT: LendLease Building Pty Ltd
PROJECT: Randwick Campus Redevelopment
LOCATION: Hospital Road and High, Magill and Botany Streets, Randwick

SURFACE LEVEL: 51.9 AHD
EASTING: 337044.9
NORTHING: 6245563
DIP/AZIMUTH: 90°/--

BORE No: 4
PROJECT No: 72505.11
DATE: 19 - 21/9/2017
SHEET 1 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
	0.04	ASPHALTIC CONCRETE (typically <10mm diameter)							A			
	0.07											
	0.2	ASPHALTIC CONCRETE (typically <20mm diameter)							A			
51	0.8	ROADBASE - dark grey, angular, igneous gravel typically 40-80mm diameter, slight hydrocarbon odour							A			
	1	FILLING - orange-brown, medium grained sand filling with some sandstone gravel and a trace of clay (ripped sandstone)							A			
50	2	SAND - pale yellow-brown, fine to medium grained sand, damp 2.2m: brown							A			
	2.6	SAND - medium dense to dense, orange, fine to medium sand with some clay, damp						Note: Unless otherwise stated, rock is fractured along rough planar bedding dipping 0°- 20°	S			8,14,17 N = 31
49	3											
	3.5	SANDSTONE - extremely low to very low strength sandstone										
	3.65	SANDSTONE - low strength, slightly weathered, fractured to slightly fractured, pale brown, medium to coarse grained sandstone						3.75m: B0°, pl, ro, cln 4.12-4.14m: Ds, 20mm, cly	C	100	98	PL(A) = 0.22
48	4											
	4.15	SANDSTONE - medium strength, slightly weathered then fresh, slightly fractured and fractured, medium to coarse grained sandstone - limonite staining to 4.40m 5.5m: distinct irregular bedding dipping 15°- 20°										PL(A) = 0.76
47	5											
								5.21m: B0°, pl, ro, co, sandy clay, 5mm 5.23m: Ds, 15mm, cly 5.71m: B20°, pl, vn, co, 5mm sandy cly 5.92m: B20°, pl, ro, stn, cly 5.96m: B20°, pl, ro, vn, cly 6.14m: B20°, pl, ro, vn, cly	C	100	99	PL(A) = 0.71
46	6	6.4m: indistinct irregular bedding dipping 0°- 20°										PL(A) = 0.71
45	6.91	SANDSTONE - medium strength, fresh, slightly fractured and unbroken, pale grey, medium to coarse grained sandstone, massive, trace carbonaceous flecks										
	7							7.63m: Ds, 15mm sandy clay				PL(A) = 0.66
44	8											
43	9							>>	C	100	95	PL(A) = 0.95
42												PL(A) = 0.73

RIG: Bobcat **DRILLER:** GM **LOGGED:** ARM **CASING:** HW to 3.65m

TYPE OF BORING: Diatube to 0.08m; NDD to 1.7m; Solid flight auger (TC-bit) to 3.65m; NMLC-Coring to 17.31m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Well installed, blank to 4.0 m, screen to 7.0 m, gatic cover at surface, asphalt to 0.2 m, sand & cement to 3.0 m, bentonite to 3.8 m, sand to 7.0 m, bentonite to 8.0 m, NDD = Non-destructive drilling

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: LendLease Building Pty Ltd
PROJECT: Randwick Campus Redevelopment
LOCATION: Hospital Road and High, Magill and Botany Streets, Randwick

SURFACE LEVEL: 51.9 AHD
EASTING: 337044.9
NORTHING: 6245563
DIP/AZIMUTH: 90°/--

BORE No: 4
PROJECT No: 72505.11
DATE: 19 - 21/9/2017
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)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
41	11	SANDSTONE - medium strength, fresh, slightly fractured and unbroken, pale grey, medium to coarse grained sandstone, massive, trace carbonaceous flecks *(continued)*						10.91-10.94m: Ds, 30mm, cly 11.03-11.06m: Ds, 30mm cly	C	100	95	PL(A) = 0.61
40	12	12.0 SANDSTONE - medium to high strength, fresh, slightly fractured to unbroken, pale grey, medium to coarse grained sandstone, indistinct bedding typically dipping 10°- 20°						12.42m: Ds, 10mm, sandy cly				PL(A) = 0.69
39	13								C	100	98	PL(A) = 1.1
38	14							13.29-13.31m: 20mm sandy cly 13.51-13.54m: Ds, 30mm, sandy cly				PL(A) = 0.91
37	15	14.6 SANDSTONE - high then medium strength, fresh, unbroken, pale grey, fine to medium grained sandstone, occasional carbonaceous laminations and flecks						14.59-14.64m: Ds, 50mm, sandy cly 14.83m: B0°- 5°, un, sm, vn, cbs				PL(A) = 1.33
36	16								C	100	94	PL(A) = 0.59
35	17	16.78-16.97m: siltstone clasts and laminations, slightly fractured						16.85m: B10°, un, sm, co, cly, 5-10mm 16.94-16.97m: Ds, 30mm, sandy cly				PL(A) = 0.76
34	18	17.31 Bore discontinued at 17.31m - target depth reached										
33	19											
32												

RIG: Bobcat **DRILLER:** GM **LOGGED:** ARM **CASING:** HW to 3.65m

TYPE OF BORING: Diatube to 0.08m; NDD to 1.7m; Solid flight auger (TC-bit) to 3.65m; NMLC-Coring to 17.31m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Well installed, blank to 4.0 m, screen to 7.0 m, gatic cover at surface, asphalt to 0.2 m, sand & cement to 3.0 m, bentonite to 3.8 m, sand to 7.0 m, bentonite to 8.0 m, NDD = Non-destructive drilling

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: 4 PROJECT: RANDWICK SEPTEMBER 2017

3.65m – 8.0m

BORE: 4 PROJECT: RANDWICK SEPTEMBER 2017

8.0m – 13.0m

BORE: 4 **PROJECT: RANDWICK** **SEPTEMBER 2017**

13.0m – 17.31m

BOREHOLE LOG

CLIENT: LendLease Building Pty Ltd
PROJECT: Randwick Campus Redevelopment
LOCATION: Hospital Road and High, Magill and Botany Streets, Randwick

SURFACE LEVEL: 54.6 AHD
EASTING: 336990.5
NORTHING: 6245617.7
DIP/AZIMUTH: 90°/--

BORE No: 7
PROJECT No: 72505.11
DATE: 6-10-2017
SHEET 1 OF 3

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)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
54	0.2	FILLING - brown, fine to medium grained sand filling with traces of rootlets, humid							A/E			
		SAND - loose to medium dense becoming medium dense, yellow-brown mottled orange-brown fine to medium grained sand, damp							A/E			
53	1								A/E			
									S			4,5,5 N = 10
52	2											
									S			7,10,10 N = 20
51	3	3.5m: becoming orange-brown with traces of clay						Note: Unless otherwise stated, rock is fractured along rough planar bedding dipping 0°- 20°				
	3.9	SANDSTONE - low to medium strength, orange-brown and grey medium to coarse grained sandstone							S			10/50mm refusal bouncing
50	4.1	SANDSTONE - low to medium strength, slightly weathered, slightly fractured, orange-brown and light grey, medium to coarse grained sandstone. Bedding typically indistinct and ironstained						4.32m: Cs, 10mm 4.77m: Cs, 5mm 4.91m: Cs, 20mm 4.95m: Cs, 15mm 5.09m: CORE LOSS: 50mm				PL(A) = 0.31 PL(A) = 0.35 PL(A) = 0.19
49	5.09 5.14	SANDSTONE - medium strength, slightly weathered, slightly fractured to unbroken, orange-brown and light grey, medium to coarse grained sandstone 5.14-5.7m: cross bedding at approximately 40°, bedding typically indistinct							C	98	97	PL(A) = 0.72 PL(A) = 0.75 PL(A) = 0.81
48	6											
47	7	7.77-7.94m: extremely low to very low strength ironstained seam						7.77m: Ds, 170mm				PL(A) = 0.25
46	7.94 8	SANDSTONE - low to medium strength, slightly weathered, slightly fractured, light grey, medium grained sandstone. Bedding typically indistinct						8.26m: B0°- 10°, un, cly, 5mm 8.62m: B0°- 10°, ro, un, cly vn	C	100	92	PL(A) = 0.26
	9											PL(A) = 0.17
45	9.48	SANDSTONE - see next page						9.42m: Cs, 60mm				PL(A) = 0.48

RIG: DT100 **DRILLER:** RKE **LOGGED:** RMM **CASING:** HW to 4.0m; HQ to 4.1m

TYPE OF BORING: Solid flight auger (TC-bit) to 4.0m; Rotary to 4.1m; NMLC-Coring to 20.47m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Groundwater monitoring well installed (screen 4.0-20.47m; gravel 5.0-20.47m; bentonite 3.5-5.0m; backfill surface to 3.5m with concrete set gatic cover). Groundwater well purged >3 well volumes following installation

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: LendLease Building Pty Ltd
PROJECT: Randwick Campus Redevelopment
LOCATION: Hospital Road and High, Magill and Botany Streets, Randwick

SURFACE LEVEL: 54.6 AHD
EASTING: 336990.5
NORTHING: 6245617.7
DIP/AZIMUTH: 90°/--

BORE No: 7
PROJECT No: 72505.11
DATE: 6-10-2017
SHEET 2 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering	Graphic Log	Rock Strength	Water	Fracture Spacing (m)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
44	11	SANDSTONE - medium strength, slightly weathered to fresh, slightly fractured to unbroken, light grey medium to coarse grained sandstone. Massive with some siltstone flecking to indistinctly bedded with approximately 5% siltstone bands *(continued)*							C	100	99	PL(A) = 0.84
								10.46m: J15°- 20°, ro, un, cln				PL(A) = 0.62
	11.12							11.11m: Ds, 10mm				PL(A) = 3.2
43		SANDSTONE - high strength slightly weathered to fresh, slightly fractured to unbroken, light grey medium to coarse grained sandstone with some low and very high strength bands. Massive with some siltstone flecking, to indistinctly bedded with approximately 10% siltstone bands							C	100	99	PL(A) = 1.37
	12											
42								12.44m: Ds, 20mm				PL(A) = 3.56
	13											
		13.33-13.6m: fine grained band						13.3-13.31m: B (x2) 0°, ro, un, cbs vn				PL(A) = 1.9
41								13.61m: Ds, 30mm				PL(A) = 0.12
	14											PL(A) = 1.86
40								14.58m: B20°, pl, he	C	100	98	
	15											PL(A) = 1.13
39												
	16											PL(A) = 0.74
								16.32m: J45°, ro, un, cln				
38								16.32-16.34m: B (x2) 5°-10°, ro, un, cbs vn				PL(A) = 1.26
	17	16.95-18.05m: fine grained band with some carbonaceous laminations						17m: Ds, 10mm				PL(A) = 0.16
37								17.39m: B0°- 5°, ro, un, cbs vn	C	100	97	
								17.59m: B0°- 5°, ro, pl, cbs vn				PL(A) = 1.22
	18							17.9m: B0°- 5°, ro, pl, cbs vn				
								18.05m: Ds, 20mm				PL(A) = 1.46
36								18.39-18.45m: J30°-60°,un, he, cbs, 1mm				
								18.77m: Ds, 20mm				
	19											PL(A) = 1.39
								19.19m: B5°, ro, pl, cln	C	100	100	
35								19.77m: B0°- 5°, ro, un, cbs vn				

RIG: DT100 **DRILLER:** RKE **LOGGED:** RMM **CASING:** HW to 4.0m; HQ to 4.1m

TYPE OF BORING: Solid flight auger (TC-bit) to 4.0m; Rotary to 4.1m; NMLC-Coring to 20.47m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Groundwater monitoring well installed (screen 4.0-20.47m; gravel 5.0-20.47m; bentonite 3.5-5.0m; backfill surface to 3.5m with concrete set gatic cover). Groundwater well purged >3 well volumes following installation

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: 7 PROJECT: RANDWICK OCTOBER 2017

4.1m – 8.0m

BORE: 7 PROJECT: RANDWICK OCTOBER 2017

8.0m – 13.0m

BORE: 7 PROJECT: RANDWICK OCTOBER 2017

13.0m – 18.0m

BORE: 7 PROJECT: RANDWICK OCTOBER 2017

18.0m – 20.47m

BOREHOLE LOG

CLIENT: LendLease Building Pty Ltd
PROJECT: Randwick Campus Redevelopment
LOCATION: Hospital Road and High, Magill and Botany Streets, Randwick

SURFACE LEVEL: 54.6 AHD
EASTING: 336990.5
NORTHING: 6245617.7
DIP/AZIMUTH: 90°/--

BORE No: 7
PROJECT No: 72505.11
DATE: 6-10-2017
SHEET 3 OF 3

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
34		SANDSTONE *(continued)*							C	100	100	
								20.24m: B5°, ro, pl, cln				PL(A) = 0.88
	20.47							20.42m: J20°, ro, un, cln				
		Bore discontinued at 20.47m - target depth reached										
33	21											
	22											
32	23											
31	24											
30	25											
29	26											
28	27											
27	28											
26	29											
25												

RIG: DT100 **DRILLER:** RKE **LOGGED:** RMM **CASING:** HW to 4.0m; HQ to 4.1m

TYPE OF BORING: Solid flight auger (TC-bit) to 4.0m; Rotary to 4.1m; NMLC-Coring to 20.47m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Groundwater monitoring well installed (screen 4.0-20.47m; gravel 5.0-20.47m; bentonite 3.5-5.0m; backfill surface to 3.5m with concrete set gatic cover). Groundwater well purged >3 well volumes following installation

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: LendLease Building Pty Ltd
PROJECT: Randwick Campus Redevelopment
LOCATION: Hospital Road and High, Magill and Botany Streets, Randwick

SURFACE LEVEL: 50.5 AHD
EASTING: 337038.1
NORTHING: 6245507
DIP/AZIMUTH: 90°/--

BORE No: 8
PROJECT No: 72505.11
DATE: 23 - 24/1/2018
SHEET 1 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)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
50	0.1	ASPHALTIC CONCRETE (typically <10mm diameter)										
	0.25	ROADBASE - dark grey, angular, igneous gravel typically 40-80mm diameter							A			
	0.6	FILLING - pale grey and brown sandstone gravel and cobbles up to 100mm diameter (ripped sandstone)							A*			
49	1	SAND - pale brown, medium grained sand with a trace of fine gravel, damp										
									A			
48	2							Note: Unless otherwise stated, rock is fractured along rough planar bedding dipping 0°- 20°				
	2.6	SANDSTONE - extremely low strength, orange-brown sandstone							S			7,10/10mm refusal
	2.77	SANDSTONE - low to medium strength, slightly weathered, fractured to slightly fractured, orange and grey, medium to coarse grained sandstone										PL(A) = 0.26
47	3								C	100	100	
								3.71m: B15°, vn, cly				PL(A) = 0.43
	4							4.15m: B10°, vn, cly				
46								4.38m: B20°, co, cly, 2mm				
								4.61m: B20°, co, sandy cly, 1mm				
	5							4.64m: B15°, co, cly, 2mm				PL(A) = 0.6
45	5.45	SANDSTONE - high then medium strength, fresh, slightly fractured to unbroken, pale grey, medium to coarse grained sandstone with a trace of carbonaceous flecks						4.72m: B0°, sm, co, cly, 3mm	C	100	95	
	6											PL(A) = 1.12
44		6.4-6.9m: red-brown iron staining										
								6.49m: B0-5°, cu, co, cly, 10mm				
	7							6.69-6.76m: J50°, un, ro, vn, fe				PL(A) = 0.69
43												
	8											PL(A) = 0.63
		8.1-8.55m: low strength band										
42								>>	C	100	100	PL(A) = 0.22
	9											PL(A) = 0.63
41												
												PL(A) = 1.03

RIG: Bobcat **DRILLER:** GM **LOGGED:** ARM **CASING:** HW to 2.5m; HQ to 2.7m

TYPE OF BORING: Diatube to 0.10m; Non-destructive drilling to 1.7m; Solid flight auger (TC-bit) to 2.77m; NMLC-Coring to 17.39m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Well installed, blank to 2.0 m, screen to 3.0 m, gatic cover at surface, asphalt to 0.2 m, sand & cement to 0.8 m, bentonite to 1.5 m, sand to 3.0 m, bentonite to 3.5 m, *BD1/20180123 replicate taken at 0.4m to 0.5m

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)

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BORE: 8 PROJECT: RANDWICK JANUARY 2018

2.77m – 7.0m

BORE: 8 PROJECT: RANDWICK JANUARY 2018

7.0m – 12.0m

BORE: 8 PROJECT: RANDWICK JANUARY 2018

12.0m – 17.0m

BORE: 8 PROJECT: RANDWICK JANUARY 2018

17.0m – 17.39m

BOREHOLE LOG

CLIENT: LendLease Building Pty Ltd
PROJECT: Randwick Campus Redevelopment
LOCATION: Hospital Road and High, Magill and Botany Streets, Randwick

SURFACE LEVEL: 50.5 AHD
EASTING: 337038.1
NORTHING: 6245507
DIP/AZIMUTH: 90°/--

BORE No: 8
PROJECT No: 72505.11
DATE: 23 - 24/1/2018
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)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
40	10.41	10.2-10.41m: with 25% siltstone clasts up to 20mm diameter, fragmented (possibly drilling induced)						10.14-10.41m: fg, 270mm 10.41m: B0°, sm, co, cly, 5mm	C	100	88	
		LAMINITE - low strength, fresh, slightly fractured, dark grey siltstone interlaminated and interbedded with 40% pale grey, fine grained sandstone						10.73m: J35°, sm, co, cly, 1mm 11.04m: J30°x2, sm, vn, cly				PL(A) = 0.18
39	11.45	SANDSTONE - high strength, fresh, slightly fractured to unbroken, pale grey, medium to coarse grained sandstone, massive						11.38-11.45m: J30-45°x3, sm, vn, cly 11.57m: B0°, vn, cly 11.78m: B0°, vn, cly	C	100	88	PL(A) = 2.23
38												PL(A) = 1.54
37		12.84-13.03m: with 50% carbonaceous laminations 13.03-13.21: fine to medium grained 13.21m: medium to coarse grained, irregular bedding dipping 10-20°						12.79m: Ds, 20mm, sandy cly 12.96m: Ds, 20mm, sandy cly 13.21m: B10°, vn, cly				PL(A) = 1.19
36								13.97m: Ds, 15mm, cly 14.38m: B20°, vn, cly	C	100	99	
35		14.8m: massive										PL(A) = 1.27
34		16.44m: irregular bedding dipping 10-20°						16.44m: B0-10°, cu, co, sandy cly, 10mm	C	100	99	PL(A) = 1.36
33	17.39	Bore discontinued at 17.39m - target depth reached						17.29m: B20°, vn, cly				PL(A) = 1.57
32												
31												

RIG: Bobcat **DRILLER:** GM **LOGGED:** ARM **CASING:** HW to 2.5m; HQ to 2.7m

TYPE OF BORING: Diatube to 0.10m; Non-destructive drilling to 1.7m; Solid flight auger (TC-bit) to 2.77m; NMLC-Coring to 17.39m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Well installed, blank to 2.0 m, screen to 3.0 m, gatic cover at surface, asphalt to 0.2 m, sand & cement to 0.8 m, bentonite to 1.5 m, sand to 3.0 m, bentonite to 3.5 m, *BD1/20180123 replicate taken at 0.4m to 0.5m

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: LendLease Building Pty Ltd
PROJECT: Randwick Campus Redevelopment
LOCATION: Hospital Road and High, Magill and Botany Streets, Randwick

SURFACE LEVEL: 55.7 AHD
EASTING: 337090
NORTHING: 6245535
DIP/AZIMUTH: 90°/--

BORE No: 12
PROJECT No: 72505.13
DATE: 30-4-2018
SHEET 1 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)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
	0.09	ASPHALTIC CONCRETE							D			
	0.6	ROADBASE: dark grey, sandy fine to coarse grain igneous gravel, damp										
	1	FILLING: brown, medium to coarse sand filling, with some silt, damp 0.8-1.2m: with some roots.							D			
	1.2	SAND: medium dense, yellow brown, medium sand with trace of silt, damp							S			2,7,9 N = 16
	3								S			5,10,13 N = 23
	5								S			6,11,13 N = 24
	6								S			11/110 refusal
	6.1	SANDSTONE: high strength, slightly weathered becoming fresh, slightly fractured to unbroken, pale grey, medium to coarse grained sandstone, some iron staining						7.44m: B5°, pl, ro, cly 5mm 7.6m: Ds, 50mm	C	100	100	PL(A) = 2.42 PL(A) = 2.29
	8.8	SANDSTONE: high strength, fresh, unbroken, pale grey, medium grained sandstone							C	100	100	PL(A) = 1.24 PL(A) = 1.9

RIG: Han Jin 8D **DRILLER:** BG Drilling **LOGGED:** JAP **CASING:** HW to 5.5 m

TYPE OF BORING: Diatube to 0.09 m, NDD to 1.5 m, Solid flight auger (TC-bit) to 4.0 m, Rotary to 6.1 m, HQ-Coring to 14.15 m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Well installed, blank to 3.8 m, screen to 6.8 m, gatic cover at surface, concrete to 0.2 m, sand & cement to 2.0 m, bentonite to 3.0 m, sand to 6.8 m, bentonite to 7.8 m, sand to 14.15 m

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: LendLease Building Pty Ltd
PROJECT: Randwick Campus Redevelopment
LOCATION: Hospital Road and High, Magill and Botany Streets, Randwick

SURFACE LEVEL: 55.7 AHD
EASTING: 337090
NORTHING: 6245535
DIP/AZIMUTH: 90°/--

BORE No: 12
PROJECT No: 72505.13
DATE: 30-4-2018
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)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
45	11	SANDSTONE: high strength, fresh, unbroken, pale grey, medium grained sandstone *(continued)*							C	100	100	PL(A) = 2.54
												PL(A) = 0.93
44	12								C	100	100	PL(A) = 1.33
									C	100	100	
43	13								C	100	100	
42	14	13.57m: becoming slightly fractured						13.57m: B5° pl, ro, cly vn				PL(A) = 1.2
												PL(A) = 1.04
	14.15	Bore discontinued at 14.15m Target depth reached										
41	15											
40	16											
39	17											
38	18											
37	19											
36												

RIG: Han Jin 8D **DRILLER:** BG Drilling **LOGGED:** JAP **CASING:** HW to 5.5 m

TYPE OF BORING: Diatube to 0.09 m, NDD to 1.5 m, Solid flight auger (TC-bit) to 4.0 m, Rotary to 6.1 m, HQ-Coring to 14.15 m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Well installed, blank to 3.8 m, screen to 6.8 m, gatic cover at surface, concrete to 0.2 m, sand & cement to 2.0 m, bentonite to 3.0 m, sand to 6.8 m, bentonite to 7.8 m, sand to 14.15 m

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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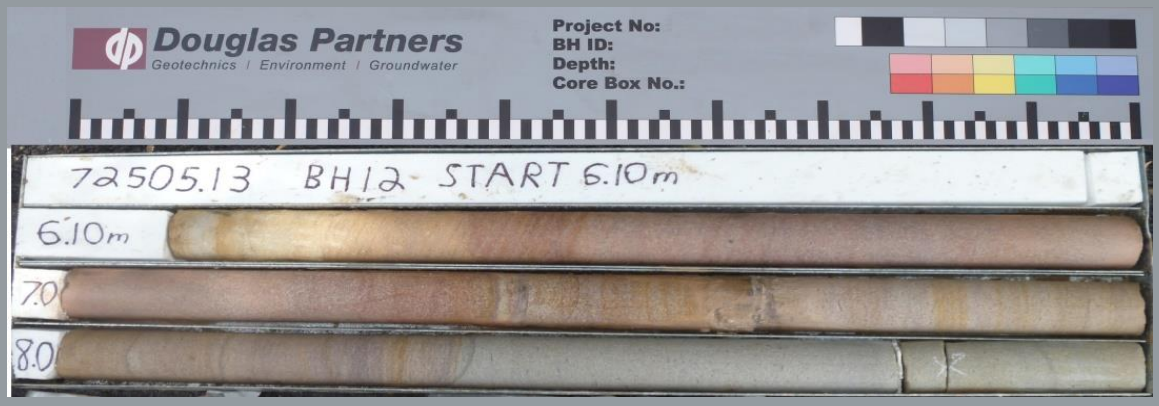
BORE: 12 PROJECT: RANDWICK APRIL 2018



6.10 – 9.00 m

BORE: 12 PROJECT: RANDWICK APRIL 2018

9.00– 13.00 m

BORE: 12 PROJECT: RANDWICK APRIL 2018

13.00 – 14.15 m

BOREHOLE LOG

CLIENT: LendLease Building Pty Ltd
PROJECT: Randwick Campus Redevelopment
LOCATION: Hospital Road and High, Magill and Botany Streets, Randwick

SURFACE LEVEL: 52.0 AHD
EASTING: 337045
NORTHING: 6245565
DIP/AZIMUTH: 90°/--

BORE No: 13
PROJECT No: 72505.13
DATE: 3-5-2018
SHEET 1 OF 1

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)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
52	0.05	ASPHALT: (typically <10 mm diameter)										
	0.11	ASPHALT: (typically <20 mm diameter)										
	0.4	ROADBASE: dark grey, angular igneous gravels (30-80 mm)										
	0.6	FILLING: grey-brown, ripped sandstone filling, (40-80mm)										
51	0.9	FILLING: orange brown, medium sandy gravel filling with some coarse sandstone gravel, damp										
	1	SAND: medium dense, pale yellow, medium sand, damp							S			2,6,9 N = 15
50	2											
	2.5	SAND: medium dense to dense, brown orange, fine to medium sand with some silt, damp							D			
49	3								S			14,8/80 refusal
	3.2	SANDSTONE: extremely low to very low strength, orange brown sandstone										
	3.8	Bore discontinued at 3.8m Limit of investigation										
48	4											
47	5											
46	6											
45	7											
44	8											
43	9											

RIG: Han Jin 8D **DRILLER:** BG Drilling **LOGGED:** JAP **CASING:** Uncased

TYPE OF BORING: Diatube to 0.15 m, Non-destructive drilling to 1.6 m, solid flight auge (TC-bit) to 3.8 m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Well installed, blank to 1.3 m, screen to 3.8 m, gatic cover at surface, asphalt to 0.2 m, sand & cement to 0.4 m, bentonite to 1.0 m, sand to 3.8 m

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: LendLease Building Pty Ltd
PROJECT: Randwick Campus Redevelopment
LOCATION: Hospital Road and High, Magill and Botany Streets, Randwick

SURFACE LEVEL: 55.2 AHD
EASTING: 336986
NORTHING: 6245643
DIP/AZIMUTH: 90°/--

BORE No: 16
PROJECT No: 72505.13
DATE: 8-5-2018
SHEET 1 OF 1

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)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
55	0.12	CONCRETE SLAB										
		FILLING: brown, fine to medium sand filling with some silt and trace of igneous gravel, humid										
	0.55	SAND: yellow, fine to medium sand, damp										
54	1											
53	2								S			4,9,11 N = 20
	2.0	SAND: medium dense, yellow, fine to medium sand, damp										
52	3											
	3.2	SAND: medium dense, brown, fine to medium sand with trace of clay, damp							S			7,9,20 N = 29
51	4											
	4.1	SANDSTONE: very low strength, orange-brown and light grey, medium to coarse grained sandstone							S			6/30, Bouncing
	4.7	Bore discontinued at 4.7m Limit of investigation										
50	5											
49	6											
48	7											
47	8											
46	9											

RIG: Han Jin 8D **DRILLER:** BG Drilling **LOGGED:** JAP **CASING:** HW to 4.0 m

TYPE OF BORING: Diatube to 0.12 m, Non-destructive drilling to 1.8 m, solid flight auger (TC-bit) to 2.0 m, Rotary to 4.7 m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Well installed, blank to 2.1 m, screen to 4.7 m, gatic cover at surface, concrete to 0.2 m, sand & cement to 1.2 m, bentonite to 2.0 m, sand to 4.7 m

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: LendLease Building Pty Ltd
PROJECT: Randwick Campus Redevelopment
LOCATION: Hospital Road and High, Magill and Botany Streets, Randwick

SURFACE LEVEL: 55.2 AHD
EASTING: 336983
NORTHING: 6245644
DIP/AZIMUTH: 90°/--

BORE No: 17
PROJECT No: 72505.13
DATE: 8-5-2018
SHEET 1 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)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
55	0.11	CONCRETE SLAB										
	0.6	FILLING: brown, fine to medium sand filling with some silt and trace of igneous and sandstone gravel, humid										
54	1	SAND: yellow-brown, fine to medium sand, damp										
53	2.0	SAND: medium dense yellow-brown fine to medium sand, damp							S			4,6,9 N = 15
52	3											
	3.3	SAND: medium dense, brown, fine to medium sand with trace of clay, damp							S			9,10,14 N = 24
51	4											
	4.4	SANDSTONE: very low to low strength, orange-brown and light grey, medium to coarse grained sandstone										
50	5											
	5.08	SANDSTONE: medium strength, slightly weathered, slightly fractured, light grey and red-brown, medium to coarse grained sandstone						5m: CORE LOSS: 80mm 5.13m: J25° pl, ro, cln	C	90	83	PL(A) = 0.6
49	6							6.05m: J20° pl, ro, fe, stn				PL(A) = 0.8
48	7								C	100	100	
47	8							7.54-7.57m: B5-10°, he, cu, ro, fe, stn x2 7.92-8.05m: B0-10°, pl, ro, fe, stn x3 8m: J30°, pl, ro 8.31m: Ds, 110mm				PL(A) = 1.1
46	9											PL(A) = 0.5
	9.5	SANDSTONE (see over page)						9.32-9.50 m: B0-10°, un, ro fe, stn x5 9.36m: Cs, 20mm	C	100	90	PL(A) = 0.5

RIG: Han Jin 8D **DRILLER:** BG Drilling **LOGGED:** JAP **CASING:** HW to 4.5 m

TYPE OF BORING: Diatube to 0.11 m, Non-destructive drilling to 1.8 m, Auger to 2.0 m, Rotary to 5.0 m, NMLC Coring to 14.80 m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Well installed, blank to 5.1 m, screen to 9.6 m, gatic cover at surface, concrete to 0.2 m, sand & cement to 1.5 m, sand to 4.0 m, bentonite to 5.0 m, sand to 10.0 m, bentonite to 11.0 m, sand to 15.0 m

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: LendLease Building Pty Ltd
PROJECT: Randwick Campus Redevelopment
LOCATION: Hospital Road and High, Magill and Botany Streets, Randwick

SURFACE LEVEL: 55.2 AHD
EASTING: 336983
NORTHING: 6245644
DIP/AZIMUTH: 90°/--

BORE No: 17
PROJECT No: 72505.13
DATE: 8-5-2018
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)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
45		SANDSTONE: medium strength, fresh, slightly fractured to unbroken, light grey, fine to medium grained sandstone with some low strength bands, cross bedding at 10-15° *(continued)*										PL(A) = 0.8
44	11							10.69m: Ds, 10mm	C	100	90	PL(A) = 0.12
43	12							11.99-12.09m: J60°, pl, ro, cln				PL(A) = 0.39
	12.24	SANDSTONE: medium and high strength, fresh, unbroken, light grey, medium grained sandstone						12.41m: J20°, pl, ro, cln				PL(A) = 1.38
42	13								C	100	100	PL(A) = 0.69
41	14											
	14.8	Bore discontinued at 14.8m Target depth reached										PL(A) = 1.16
40	15											
39	16											
38	17											
37	18											
36	19											

RIG: Han Jin 8D **DRILLER:** BG Drilling **LOGGED:** JAP **CASING:** HW to 4.5 m

TYPE OF BORING: Diatube to 0.11 m, Non-destructive drilling to 1.8 m, Auger to 2.0 m, Rotary to 5.0 m, NMLC Coring to 14.80 m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Well installed, blank to 5.1 m, screen to 9.6 m, gatic cover at surface, concrete to 0.2 m, sand & cement to 1.5 m, sand to 4.0 m, bentonite to 5.0 m, sand to 10.0 m, bentonite to 11.0 m, sand to 15.0 m

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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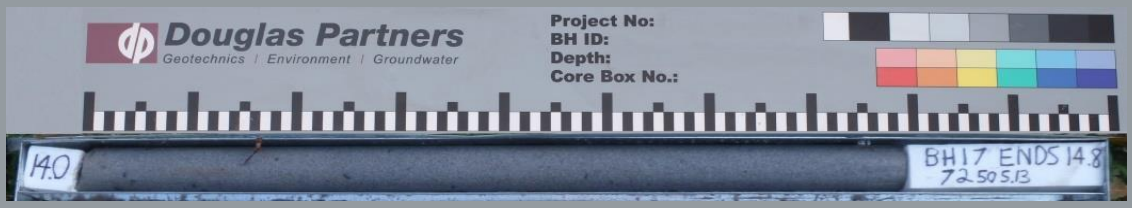
BORE: 17 PROJECT: RANDWICK MAY 2018

5.00 – 9.00 m

BORE: 17 PROJECT: RANDWICK MAY 2018

9.00 – 14.00 m

BORE: 17 PROJECT: RANDWICK MAY 2018



14.00 – 14.80 m

WELL LOG

CLIENT: LendLease Building Pty Ltd
PROJECT: Randwick Campus Redevelopment
LOCATION: Hospital Road and High, Magill and Botany Streets, Randwick

SURFACE LEVEL: 51.9 AHD
EASTING: 337044.9
NORTHING: 6245563
DIP/AZIMUTH: 90°/--

BORE No: 4 (72505.11)
PROJECT No: 72505.13
DATE: 19 - 21/9/2017
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
51	0.04	ASPHALTIC CONCRETE (typically <10mm diameter)		A	0.07				Gatic Cover
	0.07	ASPHALTIC CONCRETE (typically <20mm diameter)		A	0.15				
	0.2	ROADBASE - dark grey, angular, igneous gravel typically 40-80mm diameter, slight hydrocarbon odour		A	0.5				
	0.8	FILLING - orange-brown, medium grained sand filling with some sandstone gravel and a trace of clay (ripped sandstone)		A	0.6				
50	1			A	0.9				Backfill
				A	1.0				
				A	1.4				
	2			A	1.6				
				A	1.9				
					2.0				
	2.6	SAND - pale yellow-brown, fine to medium grained sand, damp		S	2.5		8,14,17 N = 31		
49	3	2.2m: brown			2.95				
	3.5								Bentonite
	3.65	SAND - medium dense to dense, orange, fine to medium sand with some clay, damp			3.65				
48	4				3.9		PL(A) = 0.22		
	4.15	SANDSTONE - extremely low to very low strength sandstone		C					
47	5	SANDSTONE - low strength, slightly weathered, fractured to slightly fractured, pale brown, medium to coarse grained sandstone			4.95		PL(A) = 0.76		
					5.29				Gravel Screen 4-7m
46	6	SANDSTONE - medium strength, slightly weathered then fresh, slightly fractured and fractured, medium to coarse grained sandstone			5.93		PL(A) = 0.71		
45	6.91	- limonite staining to 4.40m		C					
	7	5.5m: distinct irregular bedding dipping 15°- 20°			6.95		PL(A) = 0.71		
		6.4m: indistinct irregular bedding dipping 0°- 20°							Bentonite
44	8	SANDSTONE - medium strength, fresh, slightly fractured and unbroken, pale grey, medium to coarse grained sandstone, massive, trace carbonaceous flecks			7.95		PL(A) = 0.66		
					8.38				
43	9				8.95		PL(A) = 0.95		
42	10			C	9.95		PL(A) = 0.73		
41	11				10.88		PL(A) = 0.61		
					11.39				
40	12				11.95		PL(A) = 0.69		
	12.0	SANDSTONE - medium to high strength, fresh, slightly fractured to unbroken, pale grey, medium to coarse grained sandstone, indistinct bedding typically dipping 10°- 20°							Backfill
39	13			C	12.95		PL(A) = 1.1		
38	14				13.95		PL(A) = 0.91		
					14.37				
	14.6	SANDSTONE - high then medium strength, fresh, unbroken, pale grey, fine to medium grained sandstone, occasional carbonaceous laminations and flecks			14.95		PL(A) = 1.33		
37	15								
36	16			C	15.93		PL(A) = 0.59		
35	17	16.78-16.97m: siltstone clasts and laminations, slightly fractured			17.04		PL(A) = 0.76		
	17.31	Bore discontinued at 17.31m			17.31				
34	18	- target depth reached							

RIG: Bobcat **DRILLER:** GM **LOGGED:** ARM **CASING:** HW to 3.65m

TYPE OF BORING: Diatube to 0.08m; NDD to 1.7m; Solid flight auger (TC-bit) to 3.65m; NMLC-Coring to 17.31m

WATER OBSERVATIONS: No free groundwater observed whilst augering

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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WELL LOG

CLIENT: LendLease Building Pty Ltd
PROJECT: Randwick Campus Redevelopment
LOCATION: Hospital Road and High, Magill and Botany Streets, Randwick

SURFACE LEVEL: 50.5 AHD
EASTING: 337038.1
NORTHING: 6245507
DIP/AZIMUTH: 90°/--

BORE No: 8 (72505.11)
PROJECT No: 72505.13
DATE: 23 - 24/1/2018
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
50.4	0.1	ASPHALTIC CONCRETE (typically <10mm diameter)							Gatic Cover
50.25	0.25			A	0.4				Backfill
50	0.6	ROADBASE - dark grey, angular, igneous gravel typically 40-80mm diameter		A*	0.5				
					0.6				
49	1	FILLING - pale grey and brown sandstone gravel and cobbles up to 100mm diameter (ripped sandstone)			0.7				Bentonite
				A	1.6				
48	2	SAND - pale brown, medium grained sand with a trace of fine gravel, damp			1.7				Gravel Screen 2-3m
47.9	2.6			S	2.5		7,10/10mm refusal		
47.73	2.77	SANDSTONE - extremely low strength, orange-brown sandstone			2.66		PL(A) = 0.26		
47	3	SANDSTONE - low to medium strength, slightly weathered, fractured to slightly fractured, orange and grey, medium to coarse grained sandstone		C	2.77				Bentonite
					2.95				
46	4				3.88		PL(A) = 0.43		
					3.91				
45	5				4.95		PL(A) = 0.6		
44.55	5.45	SANDSTONE - high then medium strength, fresh, slightly fractured to unbroken, pale grey, medium to coarse grained sandstone with a trace of carbonaceous flecks		C					
44	6	6.4-6.9m: red-brown iron staining			5.95		PL(A) = 1.12		
					6.89		PL(A) = 0.69		
43	7				6.95				
					7.95		PL(A) = 0.63		
42	8	8.1-8.55m: low strength band		C	8.41		PL(A) = 0.22		
41	9				8.95		PL(A) = 0.63		
					9.93		PL(A) = 1.03		
40	10	10.2-10.41m: with 25% siltstone clasts up to 20mm diameter, fragmented (possibly drilling induced)			9.95				Backfill
39.55	10.41	LAMINITE - low strength, fresh, slightly fractured, dark grey siltstone interlaminated and interbedded with 40% pale grey, fine grained sandstone							
	11				10.95		PL(A) = 0.18		
39	11.45	SANDSTONE - high strength, fresh, slightly fractured to unbroken, pale grey, medium to coarse grained sandstone, massive		C					
38	12				11.95		PL(A) = 2.23		
					12.75		PL(A) = 1.54		
37	13	12.84-13.03m: with 50% carbonaceous laminations 13.03-13.21: fine to medium grained 13.21m: medium to coarse grained, irregular bedding dipping 10-20°			12.92				
	14				13.85		PL(A) = 1.19		
36	15	14.8m: massive		C	14.95		PL(A) = 1.27		
35	16				15.89		PL(A) = 1.36		
					15.95				
34	17	16.44m: irregular bedding dipping 10-20°		C	16.95		PL(A) = 1.57		
33.11	17.39	Bore discontinued at 17.39m - target depth reached			17.39				
32	18								

RIG: Bobcat **DRILLER:** GM **LOGGED:** ARM **CASING:** HW to 2.5m; HQ to 2.7m

TYPE OF BORING: Diatube to 0.10m; Non-destructive drilling to 1.7m; Solid flight auger (TC-bit) to 2.77m; NMLC-Coring to 17.39m

WATER OBSERVATIONS: No free groundwater observed whilst augering

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

WELL LOG

CLIENT: LendLease Building Pty Ltd
PROJECT: Randwick Campus Redevelopment
LOCATION: Hospital Road and High, Magill and Botany Streets, Randwick

SURFACE LEVEL: 55.7 AHD
EASTING: 337090
NORTHING: 6245535
DIP/AZIMUTH: 90°/--

BORE No: 12
PROJECT No: 72505.13
DATE: 30-4-2018
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
55	0.09	ASPHALTIC CONCRETE		D	0.1				Gatic Cover
					0.2				
	0.6	ROADBASE: dark grey, sandy fine to coarse grain igneous gravel, damp		D	0.8				
54	1	FILLING: brown, medium to coarse sand filling, with some silt, damp			0.9				Backfill
	1.2	0.8-1.2 m: with some roots.							
		SAND: medium dense, yellow brown, medium sand, damp			1.6				
53	2			S			2,7,9 N = 16		
					2.05				
52	3				3.0				Bentonite
				S			5,10,13 N = 23		
					3.45				
51	4								
					4.5				
	5			S			6,11,13 N = 24		Gravel
					4.95				Screen 3.8-6.8m
50	6			S	6.0		11/110 refusal		
	6.1	SANDSTONE: high strength, slightly weathered becoming fresh, slightly fractured, pale grey, medium to coarse grained sandstone, some iron stained bedding			6.1				
					6.11				
49	7				7.0		PL(A) = 2.42		
				C			PL(A) = 2.29		Bentonite
48	8								
47	8.8				8.79		PL(A) = 1.24		
	9	SANDSTONE: high strength, fresh, unbroken, pale grey, medium grained sandstone			8.8				
		9.40-9.45 m: bedding typically 10-20°			9.81		PL(A) = 1.9		
46	10			C					
					10.72		PL(A) = 2.54		
45	11								Backfill
					11.48		PL(A) = 0.93		
44					11.81				
	12			C	12.06		PL(A) = 1.33		
				C	12.27				
43					12.55				
	13			C					
		13.57-14.15 m: becoming slightly fractured			13.71		PL(A) = 1.2		
42	14	13.66-13.76 m: bedding typically 5 - 10°			14.0		PL(A) = 1.04		
	14.15	Bore discontinued at 14.15m			14.15				
		Target depth reached							
41									

RIG: Han Jin 8D **DRILLER:** BG Drilling **LOGGED:** JAP **CASING:** HW to 5.5 m

TYPE OF BORING: Diatube to 0.09 m, NDD to 1.5 m, Solid flight auger (TC-bit) to 4.0 m, Rotary to 6.1 m, HQ Coring to 14.15 m

WATER OBSERVATIONS: No free groundwater observed whilst augering

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

WELL LOG

CLIENT: LendLease Building Pty Ltd
PROJECT: Randwick Campus Redevelopment
LOCATION: Hospital Road and High, Magill and Botany Streets, Randwick

SURFACE LEVEL: 52.0 AHD
EASTING: 337045
NORTHING: 6245565
DIP/AZIMUTH: 90°/--

BORE No: 13
PROJECT No: 72505.13
DATE: 3-5-2018
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
52	0.05	ASPHALTIC CONCRETE: (typically <10 mm diameter)							Gatic Cover
	0.11	ASPHALTIC CONCRETE: (typically <20 mm diameter)							
		ROADBASE: dark grey, angular igneous gravels, (typically 30-80 mm diameter)							Backfill
	0.4								
	0.6	FILLING: grey-brown, ripped sandstone filling, (typically 40-80mm diameter)							Bentonite
	0.9	FILLING: orange brown, medium sandy gravel filling with some coarse sandstone gravel, damp							
51	1	SAND: medium dense, pale yellow, medium sand, damp							1
					1.8				
50	2			S			2,6,9 N = 15		2
					2.25				Gravel
	2.5	SAND: medium dense to dense, brown orange, fine to medium sand with some silt, damp							Screen 1.3-3.8m
					2.8				
49	3			D					3
					3.0				
				S			14,8/80 refusal		
	3.2	SANDSTONE: extremely low to very low strength, orange brown sandstone			3.2				
	3.8	Bore discontinued at 3.8m Limit of investigation							
48	4								4
47	5								5

RIG: Han Jin 8D **DRILLER:** BG Drilling **LOGGED:** JAP **CASING:** Uncased

TYPE OF BORING: Diatube to 0.15 m, Non-destructive drilling to 1.6 m, solid flight auge (TC-bit) to 3.8 m

WATER OBSERVATIONS: No free groundwater observed whilst augering

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

WELL LOG

CLIENT: LendLease Building Pty Ltd
PROJECT: Randwick Campus Redevelopment
LOCATION: Hospital Road and High, Magill and Botany Streets, Randwick

SURFACE LEVEL: 55.2 AHD
EASTING: 336986
NORTHING: 6245643
DIP/AZIMUTH: 90°/--

BORE No: 16
PROJECT No: 72505.13
DATE: 8-5-2018
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
55	0.12	CONCRETE SLAB							Gatic Cover
		FILLING: brown, fine to medium sand filling with some silt and trace of igneous gravel, humid							
	0.55	SAND: yellow, fine to medium sand, damp							Backfill
54	1								1
									Bentonite
	2.0	SAND: medium dense, yellow, fine to medium sand, damp		S	2.0 2.45		4,9,11 N = 20		2
53	3								3
52	3.2	SAND: medium dense, brown, fine to medium sand with trace of clay, damp		S	3.5 3.95		7,9,20 N = 29		Gravel Screen 2.1-4.7m
	4								4
51	4.1	SANDSTONE: very low strength, orange-brown and light grey, medium to coarse grained sandstone		S	4.1 4.15		6/30, Bouncing		
	4.7	Bore discontinued at 4.7m Limit of investigation							
50	5								5

RIG: Han Jin 8D **DRILLER:** BG Drilling **LOGGED:** JAP **CASING:** HW to 4.0 m

TYPE OF BORING: Diatube to 0.12 m, Non-destructive drilling to 1.8 m, solid flight auger (TC-bit) to 2.0 m, Rotary to 4.7 m

WATER OBSERVATIONS: No free groundwater observed whilst augering

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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WELL LOG

CLIENT: LendLease Building Pty Ltd
PROJECT: Randwick Campus Redevelopment
LOCATION: Hospital Road and High, Magill and Botany Streets, Randwick

SURFACE LEVEL: 55.2 AHD
EASTING: 336983
NORTHING: 6245644
DIP/AZIMUTH: 90°/--

BORE No: 17
PROJECT No: 72505.13
DATE: 8-5-2018
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
55	0.11	CONCRETE SLAB							Gatic Cover
	0.6	FILLING: brown, fine to medium sand filling with some silt and trave of igneous and sandstone gravel, humid							
54	1	SAND: yellow-brown, fine to medium sand, damp							
53	2.0	SAND: medium dense yellow-brown fine to medium sand, damp		S	2.0 2.45		4,6,9 N = 15		Backfill
52	3.3	SAND: medium dense, brown, fine to medium sand with trace of clay, damp		S	3.5 3.95		9,10,14 N = 24		
51	4.4	SANDSTONE: very low to low strength, orange-brown and light grey, medium to coarse grained sandstone							Bentonite
50	5.08	SANDSTONE: medium strength, slightly weathered, slightly fractured, light grey and red-brown, medium to coarse grained sandstone, bedding typically 0-10°		C	5.0 5.79 5.8 6.71 7.86 8.8 8.88 9.34		PL(A) = 0.6 PL(A) = 0.8 PL(A) = 1.1 PL(A) = 0.5 PL(A) = 0.5		Gravel Screen 5.1-9.6m
49	9.5	SANDSTONE: medium strength, fresh, slightly fractured to unbroken, light grey sandstone with some low strength bands, bedding typically 10-15° with some cross bedding		C	10.0 11.0 11.85 11.95		PL(A) = 0.8 PL(A) = 0.12 PL(A) = 0.39		Bentonite
43	12.24	SANDSTONE (see over page) SANDSTONE: medium and high strength, fresh, unbroken, light grey and grey sandstone		C	12.37 13.44		PL(A) = 1.38 PL(A) = 0.69		Backfill
		13.4-13.8: Bedding typically 5-10°							
40	14.8	Bore discontinued at 14.8m Target depth reached			14.76 14.8		PL(A) = 1.16		

RIG: Han Jin 8D **DRILLER:** BG Drilling **LOGGED:** JAP **CASING:** HW to 4.5 m

TYPE OF BORING: Diatube to 0.11 m, Non-destructive drilling to 1.8 m, Auger to 2.0 m, Rotary to 5.0 m, NMLC Coring to 14.80 m

WATER OBSERVATIONS: No free groundwater observed whilst augering

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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Appendix D

Results of Current Investigation

BOREHOLE LOG

CLIENT: Lendlease Building Pty Ltd
PROJECT: SCH Stage 1 / CCCC Project
LOCATION: High Street and Hospital Road, Randwick

SURFACE LEVEL: 55.7 AHD
EASTING: 337095
NORTHING: 6245556.4
DIP/AZIMUTH: 90°/--

BORE No: BH601
PROJECT No: 72505.18
DATE: 19 & 27/08/2020
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (XW 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)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
55	0.09	ASPHALTIC CONCRETE										
	0.3	FILL/ROADBASE: Sandy GRAVEL, sub-angular, fine igneous gravel, grey, medium sand, moist							E			
	0.6	FILL/Gravelly SAND: medium, brown, fine igneous subangular and subrounded, fine sandstone gravel, moist							E			
1									E/D			
		SAND SP: fine to medium, pale grey, moist, loose, aeolian										
54	1.8	SAND SP: fine to medium, yellow-brown, trace silt, moist, medium dense, aeolian							S			4,5,6 N = 11
2												
53												
3		Below 3.0m: dark red-brown, apparently dense						Unless noted otherwise, rock is fractured along rough, planar bedding planes dipping at 0-20°	D			
52		Below 4.0m: wet				▽						
4	4.05								S			18/50 refusal
	4.11	SANDSTONE: medium to coarse grained, pale grey and yellow brown, with 10% decomposed seams, very low then low and medium strength, highly and slightly weathered, slightly fractured, Hawkesbury Sandstone						4.05m: CORE LOSS: 60mm				PL(A) = 0.04
51												PL(A) = 0.4
5												PL(A) = 0.28
								5.29m: Ds 140mm				
								5.5m: Ds 10mm	C	98	77	
50								5.68m: Ds 90mm				
6	6.0	SANDSTONE: medium to coarse grained, pale grey, cross bedded at 10-20°, medium strength, slightly weathered then fresh, slightly fractured, Hawkesbury Sandstone										PL(A) = 0.85
49								6.65m: Ds 10mm, fe, st				
7												PL(A) = 0.72
	7.5	SANDSTONE: medium grained, pale grey, medium to high strength, fresh, unbroken, Hawkesbury Sandstone						7.59m: B10°, pl, ro, cly 1mm				
48												
8												PL(A) = 0.88
									C	100	99	
47								8.6m: Ds 20mm				
9												PL(A) = 1.2
46												

RIG: Vac Truck, Hand Tools & Bobcat **DRILLER:** VAC Group **LOGGED:** KR/JJH/TM **CASING:** HW to 4.0m, HQ to 4.0m

TYPE OF BORING: Diatube to 0.1m, Non-Destructive-Drilling (NDD) and Hand-Auger to 1.5m, Solid flight auger to 4.0m, NMLC Coring to 16.02m

WATER OBSERVATIONS: Water seepage at 3.95m, 20% water loss below 8.0m

REMARKS: Bulk samples taken 0.5-1.5m, 1.5-2.0m & 2.0-3.8m

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: Lendlease Building Pty Ltd
PROJECT: SCH Stage 1 / CCCC Project
LOCATION: High Street and Hospital Road, Randwick

SURFACE LEVEL: 55.7 AHD
EASTING: 337095
NORTHING: 6245556.4
DIP/AZIMUTH: 90°/--

BORE No: BH601
PROJECT No: 72505.18
DATE: 19 & 27/08/2020
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (XW 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)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
		SANDSTONE: medium grained, pale grey, medium to high strength, fresh, unbroken, Hawkesbury Sandstone *(continued)*										PL(A) = 1.3
45	11							10.68m: B0°, pl, ro, cly vn & J80-90°, un, ro, cln 10.76m: B0°, pl, ro, cly co				
44	12								C	100	98	PL(A) = 0.96 PL(A) = 1.3
43	13							>>				PL(A) = 0.97
42	14	Between 14.2-15.85m: cross bedded at 5-15°						14.35m: B5°, pl, ro, cly vn	C	100	97	PL(A) = 1
41	15							15.17m: B (x2) 5°, pl, ro, cly vn				PL(A) = 0.98
40	16 16.02	Bore discontinued at 16.02m Target depth reached										PL(A) = 0.68
39	17											
38	18											
37	19											
36												

RIG: Vac Truck, Hand Tools & Bobcat **DRILLER:** VAC Group **LOGGED:** KR/JJH/TM **CASING:** HW to 4.0m, HQ to 4.0m

TYPE OF BORING: Diatube to 0.1m, Non-Destructive-Drilling (NDD) and Hand-Auger to 1.5m, Solid flight auger to 4.0m, NMLC Coring to 16.02m

WATER OBSERVATIONS: Water seepage at 3.95m, 20% water loss below 8.0m

REMARKS: Bulk samples taken 0.5-1.5m, 1.5-2.0m & 2.0-3.8m

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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BORE: 601 PROJECT: RANDWICK AUGUST 2020

4.05-8.00m

BORE: 601 PROJECT: RANDWICK AUGUST 2020

8.00-13.00m

BORE: 601 PROJECT: RANDWICK AUGUST 2020

13.00-16.02m

BOREHOLE LOG

CLIENT: Lendlease Building Pty Ltd
PROJECT: SCH Stage 1 / CCCC Project
LOCATION: High Street and Hospital Road, Randwick

SURFACE LEVEL: 55 AHD
EASTING: 337097.5
NORTHING: 6245571.8
DIP/AZIMUTH: 90°/--

BORE No: BH602
PROJECT No: 72505.18
DATE: 19 & 24/08/2020
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Degree of Weathering (XW 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)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
55	0.09	ASPHALTIC CONCRETE										
	0.28	FILL/ROADBASE: Sandy GRAVEL, sub-angular, fine igneous gravel, grey, medium, moist							E			
	0.7	FILL/SAND: fine to medium, dark brown, with silt, moist							E/D			
54	1	SAND SP: fine to medium, pale grey, moist, aeolian							E/D			
53	2											
	2.2	SAND SP: fine to medium, orange-brown, apparently cemented, iron indurated, ("coffee rock"), aeolian							S			4,3,5 N = 8
	2.6								D			
52	3	SAND SP: fine to medium, yellow-brown, moist, aeolian							D			
	3.2	Below 3.1m: becoming wet							S			5,25/125 refusal
	3.35	SANDSTONE: medium grained, pale yellow-brown, apparently very low to low strength, Hawkesbury Sandstone										
51	4	Bore discontinued at 3.35m Target depth reached										
50	5											
49	6											
48	7											
47	8											
46	9											

RIG: Vac Truck, Hand Tools & Bobcat **DRILLER:** VAC Group **LOGGED:** KR/JJH **CASING:** None

TYPE OF BORING: Diatube to 0.1m, Non-Destructive-Drilling (NDD) and Hand-Auger to 1.5m, Solid flight auger to 3.35m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Bulk sample taken at 0.7-1.5m, Groundwater well installed, refer to Well Log for construction details, Data logger 2121809 installed in well

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: Lendlease Building Pty Ltd
PROJECT: SCH Stage 1 / CCCC Project
LOCATION: High Street and Hospital Road, Randwick

SURFACE LEVEL: 54.2 AHD
EASTING: 337102.9
NORTHING: 6245608
DIP/AZIMUTH: 90°/--

BORE No: BH603
PROJECT No: 72505.18
DATE: 19 & 26/08/2020
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering	Graphic Log	Rock Strength	Water	Fracture Spacing (m)	Discontinuities (B - Bedding, J - Joint, S - Shear, F - Fault)	Type	Core Rec. %	RQD %	Test Results & Comments
54	0.04	ASPHALTIC CONCRETE										
	0.45	FILL/ROADBASE: Sandy GRAVEL, sub-angular, fine igneous gravel, grey, medium, moist							E			
	0.8	FILL/Gravelly SAND: medium, brown, subangular, fine igneous and subrounded, fine sandstone gravel, moist							E/D			
53	1								E/D			
	1.3	FILL/Silty SAND: fine to medium, dark brown, non-plastic fines, with subangular, fine sandstone gravel, moist						Unless noted otherwise, rock is fractured along rough, planar bedding planes dipping at 0-20°	E/D			
	1.7	Clayey SAND SC: fine to medium, orange-brown, low plasticity, moist, residual							D			PL(A) = 0.28
52	2	below 1.5m: pale orange-brown										PL(A) = 0.62
		SANDSTONE: medium to coarse grained, orange-brown and pale grey, low and medium strength with extremely low strength bands, highly weathered, slightly fractured, Hawkesbury Sandstone						2.56m: B0°, pl, ro, cly vn 2.73m: Ds 10mm	C	96	76	
51	3							3.3m: Cs 60mm				PL(A) = 0.33
	3.91							3.8m: CORE LOSS: 110mm				
50	4							3.94m: B0°, pl, sm, cly 1mm				PL(A) = 0.26
	4.2	SANDSTONE: medium to coarse grained, pale grey with some yellow-brown, cross bedded at 20°, medium then high strength, slightly weathered,						4.61m: B0°, pl, sm, cly 1mm				
49	5											PL(A) = 0.55
								5.28m: B (x3) 10°, pl, ro, cly vn	C	100	88	
48	6											PL(A) = 1.8
								6.31m: Ds 50mm 6.56m: J40°, pl, ro, cln 6.64m: Ds 10mm				
	7							6.92m: CORE LOSS: 120mm				PL(A) = 1
47	7.04											
	7.25	SANDSTONE: medium grained, pale grey, medium then high strength, fresh, slightly fractured to unbroken, Hawkesbury Sandstone						7.75m: Ds 10mm				
	8											PL(A) = 0.92
46								8.46m: B0°, un, cly co	C	97	97	
	9											PL(A) = 0.46
45												

RIG: Vac Truck, Hand Tools & Bobcat **DRILLER:** VAC Group **LOGGED:** KR/JJH/TM **CASING:** HW to 1.8m, HQ to 1.8m

TYPE OF BORING: Diatube to 0.1m, Non-Destructive-Drilling (NDD) and Hand-Auger to 1.7m, Solid flight auger to 1.8m, NMLC Coring to 16.00m

WATER OBSERVATIONS: Water seepage at 1.8m

REMARKS: Bulk sample taken 0.45-0.8m

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: Lendlease Building Pty Ltd
PROJECT: SCH Stage 1 / CCCC Project
LOCATION: High Street and Hospital Road, Randwick

SURFACE LEVEL: 54.2 AHD
EASTING: 337102.9
NORTHING: 6245608
DIP/AZIMUTH: 90°/--

BORE No: BH603
PROJECT No: 72505.18
DATE: 19 & 26/08/2020
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (XW 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)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
44	10.09	SANDSTONE: medium grained, pale grey, medium then high strength, fresh, slightly fractured to unbroken, Hawkesbury Sandstone *(continued)*						10.02m: CORE LOSS: 70mm				PL(A) = 0.92
43	11								C	98	98	PL(A) = 0.84
42	12											PL(A) = 0.48
41	13											PL(A) = 0.81
40	14							13.55m: J30°, pl, ro, cln 14.2m: B0°, pl, ro, cly vn	C	100	99	PL(A) = 1.2
39	15							14.65m: J30°, pl, ro, cly vn 14.68m: B0°, pl, ro, cly vn				PL(A) = 1.1
	16	16.0										PL(A) = 1.1
38		Bore discontinued at 16.0m Target depth reached										
37	17											
36	18											
35	19											

RIG: Vac Truck, Hand Tools & Bobcat **DRILLER:** VAC Group **LOGGED:** KR/JJH/TM **CASING:** HW to 1.8m, HQ to 1.8m

TYPE OF BORING: Diatube to 0.1m, Non-Destructive-Drilling (NDD) and Hand-Auger to 1.7m, Solid flight auger to 1.8m, NMLC Coring to 16.00m

WATER OBSERVATIONS: Water seepage at 1.8m

REMARKS: Bulk sample taken 0.45-0.8m

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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BORE: 603 PROJECT: RANDWICK AUGUST 2020

1.80-6.00m

BORE: 603 PROJECT: RANDWICK AUGUST 2020

6.00-11.00m

BORE: 603 PROJECT: RANDWICK AUGUST 2020

11.00-16.00m

BOREHOLE LOG

CLIENT: Lendlease Building Pty Ltd
PROJECT: SCH Stage 1 / CCCC Project
LOCATION: High Street and Hospital Road, Randwick

SURFACE LEVEL: 54.9 AHD
EASTING: 337107
NORTHING: 6245631.8
DIP/AZIMUTH: 90°/--

BORE No: BH604
PROJECT No: 72505.18
DATE: 19 & 24/08/2020
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Degree of Weathering (XW 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)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
	0.075	ASPHALTIC CONCRETE										
	0.24	FILL/ROADBASE: Sandy GRAVEL, sub-angular, fine igneous gravel, grey, medium, moist							E			
	0.4	FILL/Gravelly SAND: medium, brown, subangular, fine igneous gravel, moist							E			
54	1											
		FILL/SAND: fine to medium, brown, trace subrounded, fine to coarse sandstone gravel, moist							E			
	1.6	Between 1.0-1.2m: large brick fragment, dark brown silty sand, with charcoal							E/D			
53	1.9								D			
	2	Clayey SAND SC: fine to medium, orange-brown, low plasticity, moist, residual							S			3,2,3 N = 5
		SAND: fine to medium, orange-brown, with clay, moist, loose, residual										
52	3	Below 2.7m: wet							D			
		Below 2.95m: with pale grey sand, medium dense							S			10,11,17 N = 28
	3.4											
	3.45	SANDSTONE: medium grained, pale grey, very low to low strength, Hawkesbury Sandstone										
51	4	Bore discontinued at 3.45m Target depth reached										
50	5											
49	6											
48	7											
47	8											
46	9											
45												

RIG: Vac Truck, Hand Tools & Bobcat **DRILLER:** VAC Group **LOGGED:** KR/JJH **CASING:** None

TYPE OF BORING: Diatube to 0.1m, Non-Destructive-Drilling (NDD) and Hand-Auger to 1.9m, Solid flight auger to 3.45m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Bulk samples taken 0.4-1.6m & 1.7-1.9m

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: Lendlease Building Pty Ltd
PROJECT: SCH Stage 1 / CCCC Project
LOCATION: High Street and Hospital Road, Randwick

SURFACE LEVEL: 55.3 AHD
EASTING: 337109.8
NORTHING: 6245649.5
DIP/AZIMUTH: 90°/--

BORE No: BH605
PROJECT No: 72505.18
DATE: 19 & 25/08/2020
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering	Graphic Log	Rock Strength	Water	Fracture Spacing (m)	Discontinuities	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
			XW HW MW SW FS FR		Ex Low Very Low Low Medium High Very High Ex High		0.01 0.05 0.10 0.50 1.00	B - Bedding J - Joint S - Shear F - Fault				
55	0.11	ASPHALTIC CONCRETE							E/D			
	0.24	FILL/ROADBASE: Sandy GRAVEL, sub-angular, fine igneous gravel, grey, medium, moist							E*/D			
	0.6	FILL/Gravelly SAND: medium, brown, subangular, fine igneous gravel, moist										
54	1	Between 0.4-0.55m: large brick fragment							E/D			
	1.35											
	1.5	FILL/SAND: fine to medium, brown, trace subrounded, fine to coarse sandstone gravel, silt, and glass fragment, moist							E			
									D			
53	2	SAND SP: fine to medium, pale grey, moist, aeolian							S			1,3,2 N = 5
	2.5	Clayey SAND SC: fine to medium, orange-brown, low plasticity, moist, loose, residual										
	3	Below 2.2m: with ironstone bands				▷		Unless noted otherwise, rock is fractured along rough, planar bedding planes dipping at 0-20°	D			
	3.18	Sandy CLAY CI: low to medium plasticity, pale grey, w~PL, residual (Extremely weathered sandstone)							S			7,25/30 refusal
52		SANDSTONE: medium to coarse grained, pale grey and red-brown, low to high strength, moderately and highly weathered, slightly fractured to unbroken, Hawkesbury Sandstone										PL(A) = 0.23
	4							3.7m: Cs 50mm				
								4m: J60°, pl, ro, fe st				PL(A) = 0.94
51									C	98	96	
	4.94							4.9m: CORE LOSS: 40mm				PL(A) = 1.3
	5											
50	5.75	SANDSTONE: medium grained, pale grey, medium strength, fresh, slightly fractured to unbroken, Hawkesbury Sandstone						5.66m: Ds 30mm				PL(A) = 0.76
	6											
49								6.48m: Ds 60mm				PL(A) = 0.84
	7								C	100	98	
48								7.57m: B0°, pl, ro, cly vn				PL(A) = 0.84
	8											
47												
	9											
	9.0	SANDSTONE: medium grained, pale grey, high strength, fresh, slightly fractured to unbroken, Hawkesbury Sandstone										PL(A) = 1.3
46								>>	C	100	100	

RIG: Vac Truck, Hand Tools & Bobcat **DRILLER:** VAC Group **LOGGED:** KR/JJH/TM **CASING:** HQ to 3.1m

TYPE OF BORING: Diatube to 0.1m, Non-Destructive-Drilling (NDD) and Hand-Auger to 1.8m, Solid flight auger to 3.18m, NMLC Coring to 16.28m

WATER OBSERVATIONS: Water seepage at 3.1m

REMARKS: *Field replicate sampleBD1/20200819, Bulk samples taken 0.4-1.0m & 1.5-1.8m, Groundwater well installed, refer to Well Log for construction details, Data logger 2119606 installed in well

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: Lendlease Building Pty Ltd
PROJECT: SCH Stage 1 / CCCC Project
LOCATION: High Street and Hospital Road, Randwick

SURFACE LEVEL: 55.3 AHD
EASTING: 337109.8
NORTHING: 6245649.5
DIP/AZIMUTH: 90°/--

BORE No: BH605
PROJECT No: 72505.18
DATE: 19 & 25/08/2020
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (XW 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)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
45	11	SANDSTONE: medium grained, pale grey, high strength, fresh, slightly fractured to unbroken, Hawkesbury Sandstone *(continued)* Between 10.7-12.17: cross bedded at 0-10°							C	100	100	PL(A) = 1.3 PL(A) = 1.6
44	12							12.15m: B0°, pl, ro, cln				PL(A) = 2
43	13								C	100	97	PL(A) = 1.4
42	14	Between 13.9-15.4m: cross bedded at 0-10°						13.97m: B5°, pl, cly 1mm 14.25m: B10°, pl, cly vn 14.33m: B10°, pl, cly vn				PL(A) = 1.4
41	15							15.38m: Ds 10mm	C	100	99	PL(A) = 2
40	16							16.11m: Ds 10mm				PL(A) = 2.2
39	16.28	Bore discontinued at 16.28m Target depth reached										
38	17											
37	18											
36	19											

RIG: Vac Truck, Hand Tools & Bobcat **DRILLER:** VAC Group **LOGGED:** KR/JJH/TM **CASING:** HQ to 3.1m

TYPE OF BORING: Diatube to 0.1m, Non-Destructive-Drilling (NDD) and Hand-Auger to 1.8m, Solid flight auger to 3.18m, NMLC Coring to 16.28m

WATER OBSERVATIONS: Water seepage at 3.1m

REMARKS: *Field replicate sampleBD1/20200819, Bulk samples taken 0.4-1.0m & 1.5-1.8m, Groundwater well installed, refer to Well Log for construction details, Data logger 2119606 installed in well

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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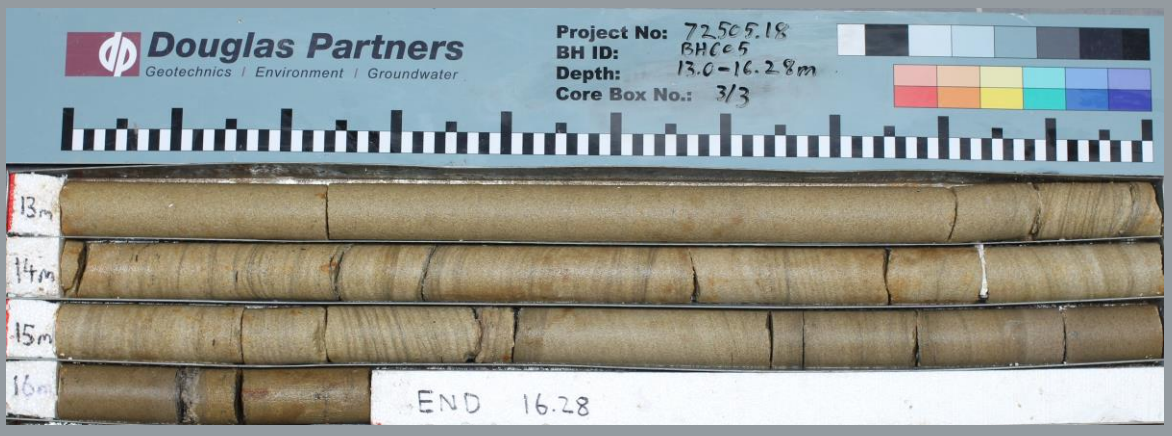
BORE: 605 PROJECT: RANDWICK AUGUST 2020

3.18-8.00m

BORE: 605 PROJECT: RANDWICK AUGUST 2020

8.00-13.00m

BORE: 605 PROJECT: RANDWICK AUGUST 2020



13.00-16.28m

BOREHOLE LOG

CLIENT: Lendlease Building Pty Ltd
PROJECT: SCH Stage 1 / CCCC Project
LOCATION: High Street and Hospital Road, Randwick

SURFACE LEVEL: 52.1 AHD
EASTING: 337045.4
NORTHING: 6245584.9
DIP/AZIMUTH: 90°/--

BORE No: BH606
PROJECT No: 72505.18
DATE: 28 - 31/8/2020
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (XW 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)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
52	0.06	ASPHALTIC CONCRETE							D			
	0.2	FILL/ROADBASE: GRAVEL, coarse, dark grey, igneous, subangular-subrounded, dry, roadbase							E/D*			
	0.6	FILL/ GRAVEL: medium, yellow-brown, sandstone, with clay, sand, crushed sandstone, dry							E/D			
51	1								S			3,4,4 N = 8
	1.4	FILL/ SAND: fine to medium, pale grey, dry										
		SAND SP: fine to medium, brown, dry, loose, aeolian										
50	2	Below 1.8m: moist							E/D			
		Below 2.5m: medium dense							S			5,7,9 N = 16
49	3							Unless noted otherwise, rock is fractured along rough, planar bedding planes dipping at 0-20°				
	3.1	SANDSTONE: medium to coarse grained, yellow-brown, very low to low strength, Hawkesbury Sandstone										
	3.6	SANDSTONE: medium to coarse grained, pale grey with some pale orange staining, low then medium strength, slightly weathered, slightly fractured, Hawkesbury Sandstone										~~PL(A) = 0.14~~
48	4											PL(A) = 0.23
									C	100	99	
47	5							5.24m: Ds 10mm				PL(A) = 0.61
												PL(A) = 0.68
46	6											
	6.25	SANDSTONE: medium grained, pale grey, medium strength, fresh, slightly fractured to unbroken, Hawkesbury Sandstone										
45	7							7.37m: Ds 20mm	C	100	98	PL(A) = 0.46
												PL(A) = 0.76
44	8											
								8.68m: Ds 40mm				
43	9							8.91m: Ds 20mm				PL(A) = 0.68
									C	100	96	

RIG: Bobcat **DRILLER:** JE **LOGGED:** TM **CASING:** HW to 3.2m, HQ to 3.6m

TYPE OF BORING: Diacore to 0.06m, Solid flight auger to 3.2m, Rotary to 3.6m, NMLC Coring to 16.19m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: *Field replicate sampleBD03/20200828, Bulk samples taken 0.6-1.0m & 1.5-3.0m, Groundwater well installed, refer to Well Log for construction details, Data logger 2121808 installed in well

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: Lendlease Building Pty Ltd
PROJECT: SCH Stage 1 / CCCC Project
LOCATION: High Street and Hospital Road, Randwick

SURFACE LEVEL: 52.1 AHD
EASTING: 337045.4
NORTHING: 6245584.9
DIP/AZIMUTH: 90°/--

BORE No: BH606
PROJECT No: 72505.18
DATE: 28 - 31/8/2020
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (XW 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)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
42		SANDSTONE: medium grained, pale grey, medium strength, fresh, slightly fractured to unbroken, Hawkesbury Sandstone *(continued)*										PL(A) = 0.52
41	11							11.09m: Ds 110mm 11.43m: Ds 60mm	C	100	96	PL(A) = 0.45
40	12											PL(A) = 0.88
39	13								C	100	98	PL(A) = 1
38	14							14.35m: B0°, pl, ro, cly vn 14.53m: Ds 40mm				PL(A) = 0.72
37	15								C	100	98	PL(A) = 0.64
36	16							15.95m: Ds 50mm				PL(A) = 0.08
	16.19	Bore discontinued at 16.19m Target depth reached						16.17m: Ds 20mm				
35	17											
34	18											
33	19											

RIG: Bobcat **DRILLER:** JE **LOGGED:** TM **CASING:** HW to 3.2m, HQ to 3.6m

TYPE OF BORING: Diacore to 0.06m, Solid flight auger to 3.2m, Rotary to 3.6m, NMLC Coring to 16.19m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: *Field replicate sampleBD03/20200828, Bulk samples taken 0.6-1.0m & 1.5-3.0m, Groundwater well installed, refer to Well Log for construction details, Data logger 2121808 installed in well

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: 606 PROJECT: RANDWICK AUGUST 2020

3.60-8.00m

BORE: 606 PROJECT: RANDWICK AUGUST 2020

8.00-13.00m

BORE: 606 PROJECT: RANDWICK AUGUST 2020

13.00-16.19m

BOREHOLE LOG

CLIENT: Lendlease Building Pty Ltd
PROJECT: SCH Stage 1 / CCCC Project
LOCATION: High Street and Hospital Road, Randwick

SURFACE LEVEL: 52.6 AHD
EASTING: 337035.3
NORTHING: 6245607.6
DIP/AZIMUTH: 90°/--

BORE No: BH607
PROJECT No: 72505.18
DATE: 31/8/2020
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (XW 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)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
52	0.06	ASPHALTIC CONCRETE							E/D			
	0.25	FILL/ROADBASE: GRAVEL, coarse, dark grey, igneous, subangular-subrounded, dry, roadbase							E/D			
	0.55	FILL/SAND: fine to medium, pale grey, trace brick and tile fragments, dry, loose							E/D			
51	1.4	SAND SP: fine to medium, yellow-brown, moist, loose, aeolian							S			7,8,6 N = 14
		SAND SC: fine to medium, dark brown, with clay, loose, moist, aeolian							E/D*			
50									S			1,3,3 N = 6
49								Unless noted otherwise, rock is fractured along rough, planar bedding planes dipping at 0-20°				
48	3.89 / 3.92	SANDSTONE: medium to coarse grained, pale grey and pale orange, low strength, slightly weathered, slightly fractured, Hawkesbury Sandstone						3.89m: CORE LOSS: 30mm 4.21m: B5°, pl, ro, cln 4.58m: B0°, pl, ro, cly vn	C	98	98	PL(A) = 0.14
47	4.9	SANDSTONE: medium grained, pale grey, low strength, fresh, unbroken, Hawkesbury Sandstone										PL(A) = 0.29
46	6.35	SANDSTONE: medium grained, pale grey, medium strength with high strength bands, fresh, unbroken, Hawkesbury Sandstone						6.27m: CORE LOSS: 80mm 7.41m: Ds 10mm	C	98	98	PL(A) = 0.22 PL(A) = 0.66 PL(A) = 0.84
45												
44									C	100	98	PL(A) = 0.76
43												

RIG: Bobcat **DRILLER:** JE **LOGGED:** TM **CASING:** HQ to 3.89m

TYPE OF BORING: Solid flight auger to 3.8m, Rotary to 3.89m, NMLC Coring to 17.59m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: *Field replicate sampleBD04/20200831, Bulk samples taken 0.6-1.4m, 1.5-3.8m

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: Lendlease Building Pty Ltd
PROJECT: SCH Stage 1 / CCCC Project
LOCATION: High Street and Hospital Road, Randwick

SURFACE LEVEL: 52.6 AHD
EASTING: 337035.3
NORTHING: 6245607.6
DIP/AZIMUTH: 90°/--

BORE No: BH607
PROJECT No: 72505.18
DATE: 31/8/2020
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (XW 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)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
42		SANDSTONE: medium grained, pale grey, medium strength with high strength bands, fresh, unbroken, Hawkesbury Sandstone *(continued)*						10.3m: B5°, pl, ro, cln 10.49m: Ds 40 mm				PL(A) = 0.81
	11								C	100	98	PL(A) = 0.87
41	11.64							11.15m: B0°, pl, ro, cly, vn 11.58m: CORE LOSS: 60mm				
	12											PL(A) = 1.3
40												
	13								C	98	95	PL(A) = 0.5
39												
	14							13.9m: Ds 110mm				PL(A) = 1.7
38								14.46m: Ds 50mm				
	15											PL(A) = 0.3
37												
	16								C	100	100	PL(A) = 0.94
36								16.33m: Ds 10mm				
	17	Between 16.85-17.57: with siltstone clasts										PL(A) = 1.1
35	17.59	Bore discontinued at 17.59m Target depth reached						17.5m: B0°, pl, ro, cly vn				
	18											
34												
	19											
33												

RIG: Bobcat **DRILLER:** JE **LOGGED:** TM **CASING:** HQ to 3.89m

TYPE OF BORING: Solid flight auger to 3.8m, Rotary to 3.89m, NMLC Coring to 17.59m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: *Field replicate sampleBD04/20200831, Bulk samples taken 0.6-1.4m, 1.5-3.8m

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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BORE: 607 PROJECT: RANDWICK AUGUST 2020

3.89-8.00m

BORE: 607 PROJECT: RANDWICK AUGUST 2020

8.00-13.00m

BORE: 607 PROJECT: RANDWICK AUGUST 2020

13.00-17.57m

BOREHOLE LOG

CLIENT: Lendlease Building Pty Ltd
PROJECT: SCH Stage 1 / CCCC Project
LOCATION: High Street and Hospital Road, Randwick

SURFACE LEVEL: 52.9 AHD
EASTING: 337054.9
NORTHING: 6245642.4
DIP/AZIMUTH: 90°/--

BORE No: BH608
PROJECT No: 72505.18
DATE: 27 - 28/8/2020
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (XW 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
52	0.05	ASPHALTIC CONCRETE							E/D			
	0.2	FILL/ROADBASE: GRAVEL, coarse, dark grey, igneous, subangular-subrounded, dry							E/D			
	0.5	FILL/ GRAVEL: medium, yellow-brown, sandstone, with clay, sand, crushed sandstone, dry							E/D*			
51	1	FILL/SAND: fine to medium, brown, trace silt, and fine subangular igneous gravel, dry							S			1,1,1 N = 2
	1.5	SAND SP: fine to medium, yellow-brown, with clay, moist, loose, aeolian						Unless noted otherwise, rock is fractured along rough, planar bedding planes dipping at 0-20°	E/D			
50	2											
	2.5	SANDSTONE: medium to coarse grained, pale yellow and red, very low then low strength, highly weathered, slightly fractured, Hawkesbury Sandstone							S			25/90 refusal
49	3							2.92m: B5°, un, ro 3.06m: J10-90°, st, ro, cln 3.23m: Ds 5mm 3.26m: Ds 40mm 3.68m: Ds 80mm				PL(A) = 0.07
48	4							4.12m: B5°, pl, ro, st	C	97	72	PL(A) = 0.08
	4.83							4.72m: CORE LOSS: 110mm 4.83m: Ds 20mm				
	5											PL(A) = 0.19
	5.02	SANDSTONE: medium grained, pale grey, low then medium to high strength, fresh, slightly fractured to unbroken, Hawkesbury Sandstone										
47	6											PL(A) = 0.91
46	7							6.63m: Ds 60mm				PL(A) = 1
								7.31m: CORE LOSS: 20mm 7.33m: Ds 10mm	C	99	99	
45	8											PL(A) = 0.81
44	9							8.85m: CORE LOSS: 30mm				PL(A) = 0.97
43									C	99	99	

RIG: Bobcat **DRILLER:** JE **LOGGED:** TM **CASING:** HW to 2.6m, HQ to 2.75m

TYPE OF BORING: Diacore to 0.05m, Solid flight auger to 2.5m, Rotary to 2.75m, NMLC Coring to 16.0m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: *Field replicate sample BD02/20200827, Bulk samples taken 0.5-1.5m & 1.5-2.5m, Groundwater well installed, refer to Well Log for construction details, Data logger 2119607 installed in well

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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BOREHOLE LOG

CLIENT: Lendlease Building Pty Ltd
PROJECT: SCH Stage 1 / CCCC Project
LOCATION: High Street and Hospital Road, Randwick

SURFACE LEVEL: 52.9 AHD
EASTING: 337054.9
NORTHING: 6245642.4
DIP/AZIMUTH: 90°/--

BORE No: BH608
PROJECT No: 72505.18
DATE: 27 - 28/8/2020
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (XW 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
42	11	SANDSTONE: medium grained, pale grey, low then medium to high strength, fresh, slightly fractured to unbroken, Hawkesbury Sandstone *(continued)*										PL(A) = 1
								11.12m: B0°, pl, ro, cln	C	99	99	PL(A) = 1.1
41	11.89							11.83m: CORE LOSS: 60mm				PL(A) = 1.2
	12							12.14m: B0°, pl, ro, cln				
40	13							12.89m: B0°, pl, ro, cly vn	C	98	98	PL(A) = 0.83
								13.48m: B0°, pl, ro, cly vn				
39	14											PL(A) = 0.75
38	15											PL(A) = 1.1
								15.13m: Ds 30mm				PL(A) = 0.15
								15.45m: Ds 10mm	C	100	98	
37	16							15.98m: B0-10°, un, sm				PL(A) = 1.2
	16.33	Bore discontinued at 16.33m Target depth reached										
36	17											
35	18											
34	19											
33												

RIG: Bobcat **DRILLER:** JE **LOGGED:** TM **CASING:** HW to 2.6m, HQ to 2.75m

TYPE OF BORING: Diacore to 0.05m, Solid flight auger to 2.5m, Rotary to 2.75m, NMLC Coring to 16.0m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: *Field replicate sample BD02/20200827, Bulk samples taken 0.5-1.5m & 1.5-2.5m, Groundwater well installed, refer to Well Log for construction details, Data logger 2119607 installed in well

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

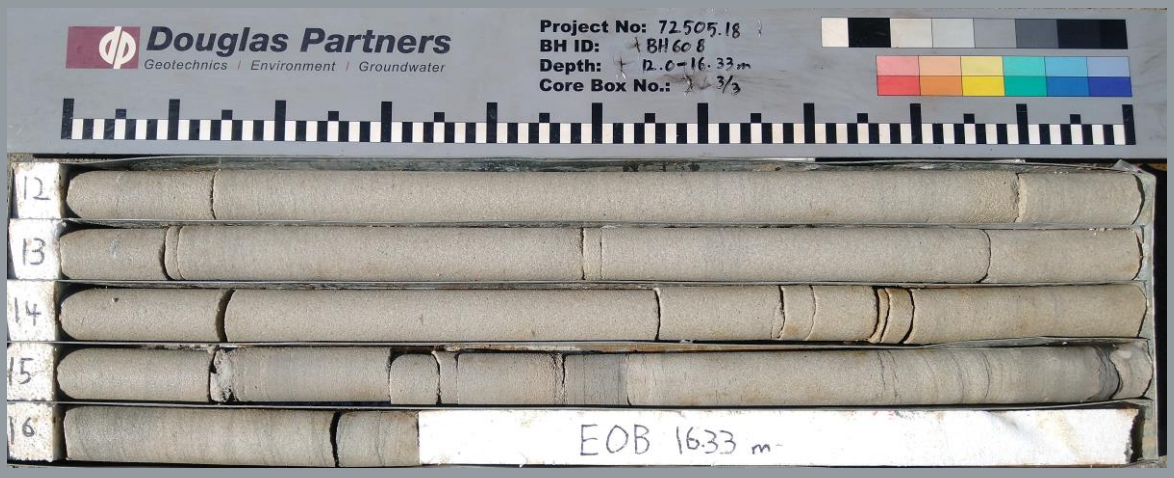
BORE: 608 PROJECT: RANDWICK AUGUST 2020

2.75-7.00m

BORE: 608 PROJECT: RANDWICK AUGUST 2020

7.00-12.00m

BORE: 608 PROJECT: RANDWICK AUGUST 2020



12.00-16.33m

Appendix E

Results of Laboratory Testing – Physical Properties

Material Test Report

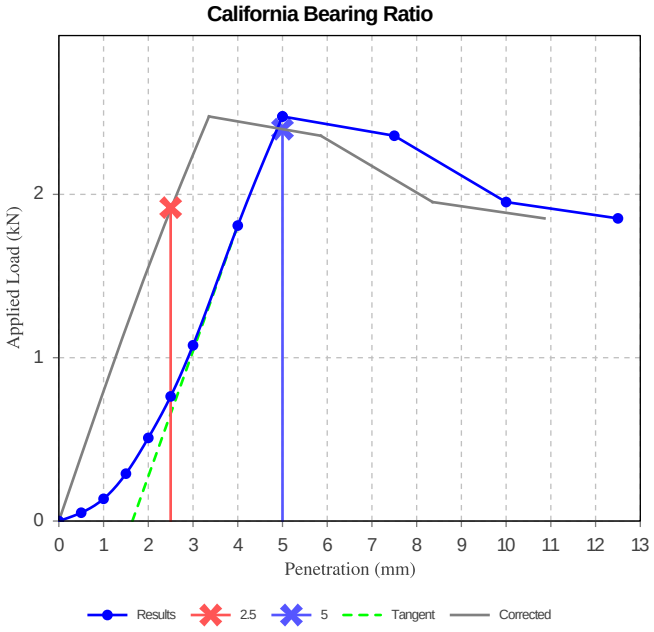
Douglas Partners
Geotechnics / Environment / Groundwater
Douglas Partners Pty Ltd
Sydney Laboratory
96 Hermitage Road West Ryde NSW 2114
Phone: (02) 9809 0666
Fax: (02) 9809 0666
Email: andrew.hutchings@douglaspartners.com.au

Accredited for compliance with ISO/IEC 17025 - Testing

Approved Signatory: Andrew Hutchings
Laboratory Manager
NATA Accredited Laboratory Number: 828

Report Number: **72505.18-1**
Issue Number: 1
Date Issued: 23/09/2020
Client: LendLease Building Pty Limited
Level 14, Tower Three, International Towers Sydney, BARANGAROO NSW 2000
Contact: Mark Elliott
Project Number: 72505.18
Project Name: SCH Stage 1 / CCCC Project
Project Location: High Street and Hospital Road, Randwick
Work Request: 6648
Sample Number: SY-6648A
Date Sampled: 02/09/2020
Dates Tested: 02/09/2020 - 18/09/2020
Sampling Method: Sampled by Engineering Department
The results apply to the sample as received
Sample Location: **BH601 (2-3.8m)**
Material: SAND: fine to medium, yellow-brown, trace silt

California Bearing Ratio (AS 1289 6.1.1 & 2.1.1)		Min	Max
CBR taken at	2.5 mm		
CBR %	**15**		
Method of Compactive Effort	Standard		
Method used to Determine MDD	AS 1289 5.1.1 & 2.1.1		
Method used to Determine Plasticity	Visual Assessment		
Maximum Dry Density (t/m^3)	1.67		
Optimum Moisture Content (%)	12.0		
Laboratory Density Ratio (%)	100.0		
Laboratory Moisture Ratio (%)	95.0		
Dry Density after Soaking (t/m^3)	1.68		
Field Moisture Content (%)	6.5		
Moisture Content at Placement (%)	11.5		
Moisture Content Top 30mm (%)	17.1		
Moisture Content Rest of Sample (%)	17.0		
Mass Surcharge (kg)	4.5		
Soaking Period (days)	4		
Curing Hours	72.1		
Swell (%)	0.0		
Oversize Material (mm)	19		
Oversize Material Included	Excluded		
Oversize Material (%)	0		



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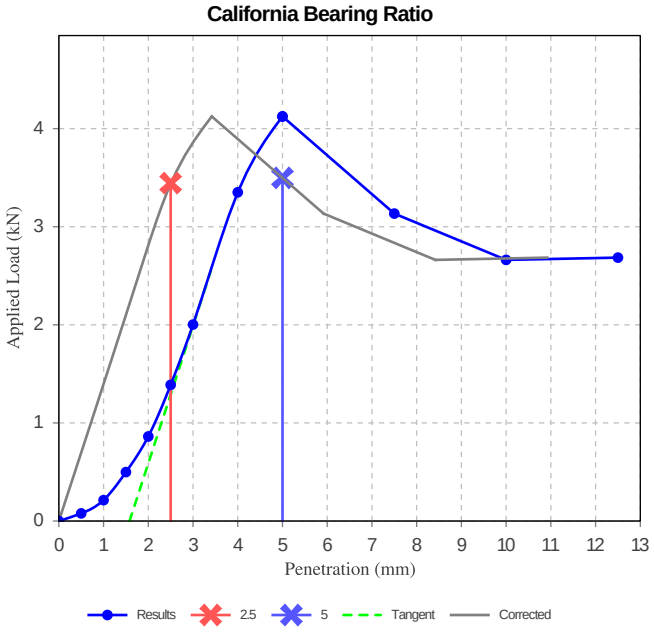
Report Number: **72505.18-1**
Issue Number: 1
Date Issued: 23/09/2020
Client: LendLease Building Pty Limited
Level 14, Tower Three, International Towers Sydney, BARANGAROO NSW 2000
Contact: Mark Elliott
Project Number: 72505.18
Project Name: SCH Stage 1 / CCCC Project
Project Location: High Street and Hospital Road, Randwick
Work Request: 6648
Sample Number: SY-6648B
Date Sampled: 02/09/2020
Dates Tested: 02/09/2020 - 18/09/2020
Sampling Method: Sampled by Engineering Department
The results apply to the sample as received
Sample Location: **BH605 (0.4-1.0m)**
Material: FILL/Gravelly SAND and SAND

California Bearing Ratio (AS 1289 6.1.1 & 2.1.1)		Min	Max
CBR taken at	2.5 mm		
CBR %	**25**		
Method of Compactive Effort	Standard		
Method used to Determine MDD	AS 1289 5.1.1 & 2.1.1		
Method used to Determine Plasticity	Visual Assessment		
Maximum Dry Density (t/m^3)	1.76		
Optimum Moisture Content (%)	13.5		
Laboratory Density Ratio (%)	100.5		
Laboratory Moisture Ratio (%)	95.0		
Dry Density after Soaking (t/m^3)	1.77		
Field Moisture Content (%)	13.9		
Moisture Content at Placement (%)	12.8		
Moisture Content Top 30mm (%)	15.2		
Moisture Content Rest of Sample (%)	14.4		
Mass Surcharge (kg)	4.5		
Soaking Period (days)	4		
Curing Hours	72		
Swell (%)	-0.5		
Oversize Material (mm)	19		
Oversize Material Included	Excluded		
Oversize Material (%)	1.8		



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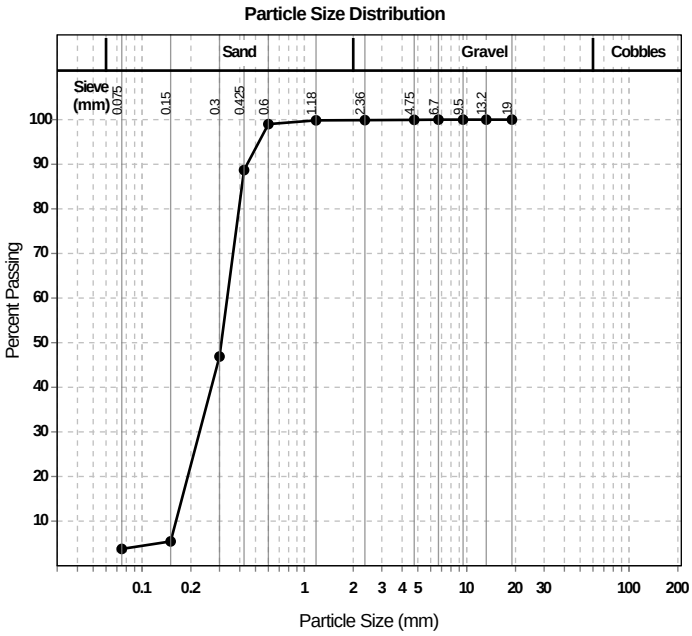
Issue Number: 1
Date Issued: 23/09/2020
Client: LendLease Building Pty Limited
Level 14, Tower Three, International Towers Sydney, BARANGAROO NSW 2000
Contact: Mark Elliott
Project Number: 72505.18
Project Name: SCH Stage 1 / CCCC Project
Project Location: High Street and Hospital Road, Randwick
Work Request: 6648
Sample Number: SY-6648C
Date Sampled: 02/09/2020
Dates Tested: 02/09/2020 - 17/09/2020
Sampling Method: Sampled by Engineering Department
The results apply to the sample as received
Sample Location: **BH606 (1.5-3m)**
Material: SAND: fine to medium, brown, trace clay

Particle Size Distribution (AS1289 3.6.1)			
Sieve	Passed %	Passing Limits	
19 mm	**100**		
13.2 mm	**100**		
9.5 mm	**100**		
6.7 mm	**100**		
4.75 mm	**100**		
2.36 mm	**100**		
1.18 mm	**100**		
0.6 mm	**99**		
0.425 mm	**89**		
0.3 mm	**47**		
0.15 mm	**5**		
0.075 mm	**4**		



Material Test Report

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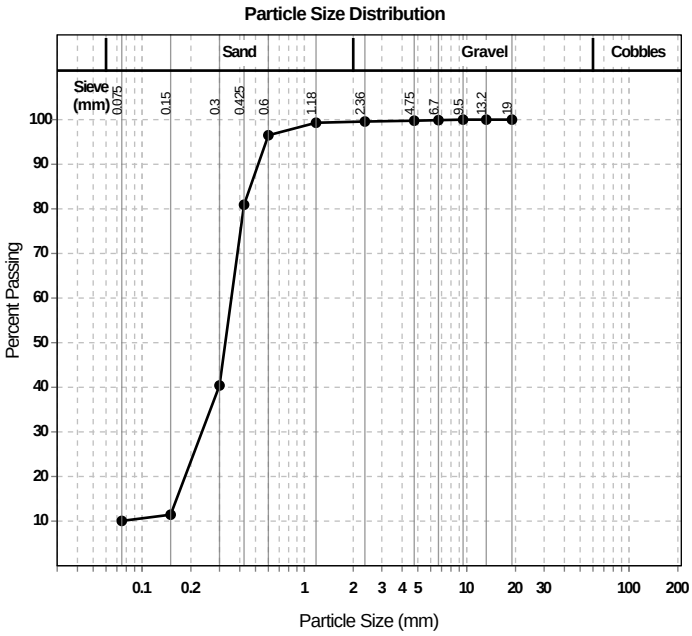
Report Number: **72505.18-1**
Issue Number: 1
Date Issued: 23/09/2020
Client: LendLease Building Pty Limited
Level 14, Tower Three, International Towers Sydney, BARANGAROO NSW 2000
Contact: Mark Elliott
Project Number: 72505.18
Project Name: SCH Stage 1 / CCCC Project
Project Location: High Street and Hospital Road, Randwick
Work Request: 6648
Sample Number: SY-6648D
Date Sampled: 02/09/2020
Dates Tested: 02/09/2020 - 17/09/2020
Sampling Method: Sampled by Engineering Department
The results apply to the sample as received
Sample Location: **BH607 (1.5-3.8m)**
Material: SAND: fine to medium, dark brown, with clay

Particle Size Distribution (AS1289 3.6.1)			
Sieve	Passed %	Passing Limits	
19 mm	**100**		
13.2 mm	**100**		
9.5 mm	**100**		
6.7 mm	**100**		
4.75 mm	**100**		
2.36 mm	**100**		
1.18 mm	**99**		
0.6 mm	**96**		
0.425 mm	**81**		
0.3 mm	**40**		
0.15 mm	**11**		
0.075 mm	**10**		



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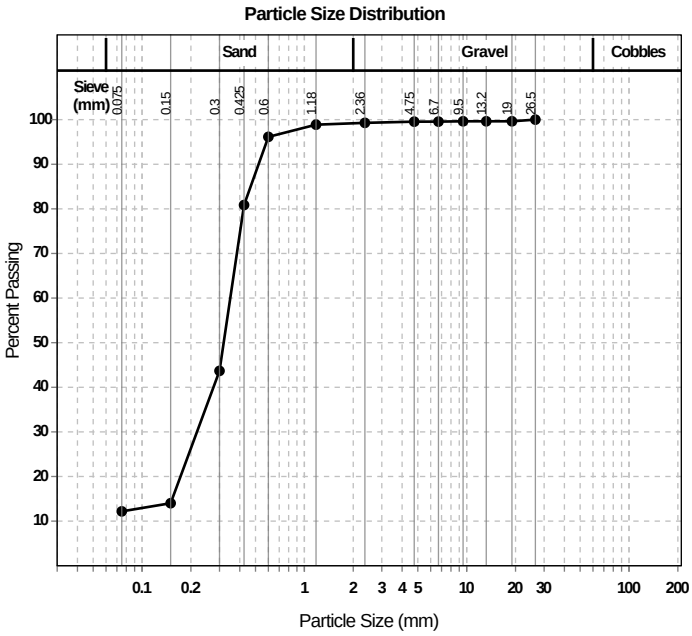
Report Number: **72505.18-1**
Issue Number: 1
Date Issued: 23/09/2020
Client: LendLease Building Pty Limited
Level 14, Tower Three, International Towers Sydney, BARANGAROO NSW 2000
Contact: Mark Elliott
Project Number: 72505.18
Project Name: SCH Stage 1 / CCCC Project
Project Location: High Street and Hospital Road, Randwick
Work Request: 6648
Sample Number: SY-6648E
Date Sampled: 02/09/2020
Dates Tested: 02/09/2020 - 17/09/2020
Sampling Method: Sampled by Engineering Department
The results apply to the sample as received
Sample Location: **BH608 (1.5-2.5m)**
Material: SAND: fine to medium, yellow-brown, with clay

Particle Size Distribution (AS1289 3.6.1)			
Sieve	Passed %	Passing Limits	
26.5 mm	**100**		
19 mm	**100**		
13.2 mm	**100**		
9.5 mm	**100**		
6.7 mm	**100**		
4.75 mm	**100**		
2.36 mm	**99**		
1.18 mm	**99**		
0.6 mm	**96**		
0.425 mm	**81**		
0.3 mm	**44**		
0.15 mm	**14**		
0.075 mm	**12**		



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Issue Number: 1
Date Issued: 23/09/2020
Client: LendLease Building Pty Limited
Level 14, Tower Three, International Towers Sydney, BARANGAROO NSW 2000
Contact: Mark Elliott
Project Number: 72505.18
Project Name: SCH Stage 1 / CCCC Project
Project Location: High Street and Hospital Road, Randwick
Work Request: 6648
Sample Number: SY-6648F
Date Sampled: 02/09/2020
Dates Tested: 02/09/2020 - 16/09/2020
Sampling Method: Sampled by Engineering Department
The results apply to the sample as received
Sample Location: **BH603 (1.4-1.5m)**
Material: Clayey SAND: fine to medium, orange-brown

Atterberg Limit (AS1289 3.1.2 & 3.2.1 & 3.3.1)		Min	Max
Sample History	Oven Dried		
Preparation Method	Dry Sieve		
Liquid Limit (%)	20		
Plastic Limit (%)	17		
Plasticity Index (%)	**3**		

Moisture Content (AS 1289 2.1.1)	
Moisture Content (%)	17.2

Material Test Report

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Report Number: **72505.18-1**
Issue Number: 1
Date Issued: 23/09/2020
Client: LendLease Building Pty Limited
Level 14, Tower Three, International Towers Sydney, BARANGAROO NSW 2000
Contact: Mark Elliott
Project Number: 72505.18
Project Name: SCH Stage 1 / CCCC Project
Project Location: High Street and Hospital Road, Randwick
Work Request: 6648
Sample Number: SY-6648G
Date Sampled: 02/09/2020
Dates Tested: 02/09/2020 - 17/09/2020
Sampling Method: Sampled by Engineering Department
The results apply to the sample as received
Sample Location: **BH605 (2.0-2.45m)**
Material: Clayey SAND: fine to medium, orange-brown

Atterberg Limit (AS1289 3.1.2 & 3.2.1 & 3.3.1)		Min	Max
Sample History	Oven Dried		
Preparation Method	Dry Sieve		
Liquid Limit (%)	21		
Plastic Limit (%)	15		
Plasticity Index (%)	**6**		

Moisture Content (AS 1289 2.1.1)	
Moisture Content (%)	18.4

Material Test Report

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Report Number: **72505.18-1**
Issue Number: 1
Date Issued: 23/09/2020
Client: LendLease Building Pty Limited
Level 14, Tower Three, International Towers Sydney, BARANGAROO NSW 2000
Contact: Mark Elliott
Project Number: 72505.18
Project Name: SCH Stage 1 / CCCC Project
Project Location: High Street and Hospital Road, Randwick
Work Request: 6648
Sample Number: SY-6648H
Date Sampled: 02/09/2020
Dates Tested: 02/09/2020 - 16/09/2020
Sampling Method: Sampled by Engineering Department
The results apply to the sample as received
Sample Location: **BH607 (1.9-2.0m)**
Material: SAND: fine to medium, dark brown, with clay

Atterberg Limit (AS1289 3.1.2 & 3.2.1 & 3.3.1)		Min	Max
Sample History	Oven Dried		
Preparation Method	Dry Sieve		
Liquid Limit (%)	19		
Plastic Limit (%)	16		
Plasticity Index (%)	**3**		

Moisture Content (AS 1289 2.1.1)	
Moisture Content (%)	17.8

Appendix F

Results of Laboratory Testing – Chemical Properties

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 250249

Client Details

Client	Douglas Partners Pty Ltd
Attention	Peter Valenti
Address	96 Hermitage Rd, West Ryde, NSW, 2114

Sample Details

Your Reference	**72505.18, SCH Stage 1 / CCC Precinct**
Number of Samples	4 SOIL
Date samples received	02/09/2020
Date completed instructions received	02/09/2020

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	09/09/2020
Date of Issue	08/09/2020

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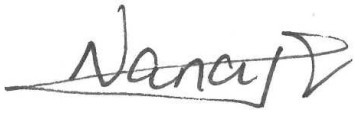
Accredited for compliance with ISO/IEC 17025 - Testing. **Tests not covered by NATA are denoted with ***

Results Approved By
Priya Samarawickrama, Senior Chemist

Authorised By



Nancy Zhang, Laboratory Manager

Soil Aggressivity					
Our Reference		250249-1	250249-2	250249-3	250249-4
Your Reference	UNITS	BH601	BH605	BH606	BH607
Depth		3.5-3.6	2.5-2.6	2.5-2.95	2.5-2.95
Date Sampled		27/08/2020	25/08/2020	28/08/2020	31/08/2020
Type of sample		SOIL	SOIL	SOIL	SOIL
pH 1:5 soil:water	pH Units	6.5	5.1	6.9	6.1
Electrical Conductivity 1:5 soil:water	µS/cm	31	27	27	35
Chloride, Cl 1:5 soil:water	mg/kg	<10	<10	<10	<10
Sulphate, SO4 1:5 soil:water	mg/kg	20	32	29	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.

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]	100	[NT]
Electrical Conductivity 1:5 soil:water	µS/cm	1	Inorg-002	<1	[NT]	[NT]	[NT]	[NT]	106	[NT]
Chloride, Cl 1:5 soil:water	mg/kg	10	Inorg-081	<10	[NT]	[NT]	[NT]	[NT]	84	[NT]
Sulphate, SO4 1:5 soil:water	mg/kg	10	Inorg-081	<10	[NT]	[NT]	[NT]	[NT]	113	[NT]

Result Definitions

NT	Not tested
NA	Test not required
INS	Insufficient sample for this test
PQL	Practical Quantitation Limit
<	Less than
>	Greater than
RPD	Relative Percent Difference
LCS	Laboratory Control Sample
NS	Not specified
NEPM	National Environmental Protection Measure
NR	Not Reported

Quality Control Definitions

Blank	This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.
Duplicate	This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.
Matrix Spike	A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.
LCS (Laboratory Control Sample)	This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.
Surrogate Spike	Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

Australian Drinking Water Guidelines recommend that Thermotolerant Coliform, Faecal Enterococci, & E.Coli levels are less than 1cfu/100mL. The recommended maximums are taken from "Australian Drinking Water Guidelines", published by NHMRC & ARMC 2011.

The recommended maximums for analytes in urine are taken from “2018 TLVs and BEIs”, as published by ACGIH (where available). Limit provided for Nickel is a precautionary guideline as per Position Paper prepared by AIOH Exposure Standards Committee, 2016.

Guideline limits for Rinse Water Quality reported as per analytical requirements and specifications of AS 4187, Amdt 2 2019, Table 7.2

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.

Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.

Spikes for Physical and Aggregate Tests are not applicable.

For VOCs in water samples, three vials are required for duplicate or spike analysis.

Duplicates: >10xPQL - RPD acceptance criteria will vary depending on the analytes and the analytical techniques but is typically in the range 20%-50% – see ELN-P05 QA/QC tables for details; <10xPQL - RPD are higher as the results approach PQL and the estimated measurement uncertainty will statistically increase.

Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals (not SPOCAS); 60-140% for organics/SPOCAS (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

In circumstances where no duplicate and/or sample spike has been reported at 1 in 10 and/or 1 in 20 samples respectively, the sample volume submitted was insufficient in order to satisfy laboratory QA/QC protocols.

When samples are received where certain analytes are outside of recommended technical holding times (THTs), the analysis has proceeded. Where analytes are on the verge of breaching THTs, every effort will be made to analyse within the THT or as soon as practicable.

Where sampling dates are not provided, Envirolab are not in a position to comment on the validity of the analysis where recommended technical holding times may have been breached.

Measurement Uncertainty estimates are available for most tests upon request.

Analysis of aqueous samples typically involves the extraction/digestion and/or analysis of the liquid phase only (i.e. NOT any settled sediment phase but inclusive of suspended particles if present), unless stipulated on the Envirolab COC and/or by correspondence. Notable exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, total recoverable metals and PFAS where solids are included by default.

Samples for Microbiological analysis (not Amoeba forms) received outside of the 2-8°C temperature range do not meet the ideal cooling conditions as stated in AS2031-2012.

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F.14 - CHAIN OF CUSTODY DESPATCH SHEET

Project No:	72505.18	**Suburb:**	Randwick	**To:**	Envirolab Services Pty Ltd
Project Name:	SCH Stage 1/CCCC Project	**Order Number**			12 Ashley Street, Chatswood, NSW 2067
Project Manager:	Peter Valenti	**Sampler:**	Tim McGrath	**Attn:**	Aileen Hie
Emails:	peter.valenti@douglaspartners.com.au			**Phone:**	
Date Required:	Standard TAT ☐			**Email:**	Ahie@envirolab.com.au

Prior Storage: Fridge/freezer Do samples contain 'potential' HBM? No ☐ (If YES, then handle, transport and store in accordance with FPM HAZID)

Sample ID	Depth Range	Lab ID	Date Sampled	Sample Type: S - soil, W - water	Container Type: G - glass, P - plastic	Analytes: Aggressivity (SO4, CL-, pH, EC)									Notes/preservation
BH601	3.5-3.6	1	27.8.20	S	P	x									
BH605	2.5-2.6	2	25.8.20	S	P	x									
BH606	2.5-2.95	3	28.8.20	S	P	x									
BH607	2.5-2.95	4	31.8.20	S	P	x									
PQL (S) mg/kg															ANZECC PQLs req'd for all water analytes ☐

ENVIROLAB GROUP
Envirolab Services
12 Ashley St
Chatswood NSW 2067
Ph: (02) 9910 6200

Job No: 250249
Date Received: 2/9/20
Time Received: 8:29
Received By: CM
Temp: Cool/Ambient
Cooling: Ice/Icepack
Security: Intact/Broken/None

PQL = practical quantitation limit. If none given, default to Laboratory Method Detection Limit

Metals to Analyse: 8HM unless specified here:

Lab Report/Reference No:

Total number of samples in container: **Relinquished by:** Tim Mc **Transported to laboratory by:**

Send Results to: Douglas Partners Pty Ltd **Address** **Phone:** **Fax:**

Signed: **Received by:** ELS Syd C.Mathews **Date & Time:** 2/9/20 8:29.

Appendix G

Groundwater Well Logs

BOREHOLE LOG

CLIENT: Lendlease Building Pty Ltd
PROJECT: SCH Stage 1 / CCCC Project
LOCATION: High Street and Hospital Road, Randwick

SURFACE LEVEL: 55 AHD
EASTING: 337097.5
NORTHING: 6245571.8
DIP/AZIMUTH: 90°/--

BORE No: BH602
PROJECT No: 72505.18
DATE: 19 & 24/08/2020
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
55	0.09	ASPHALTIC CONCRETE		E	0.1				Gatic cover
	0.28	FILL/ROADBASE: Sandy GRAVEL, sub-angular, fine igneous gravel, grey, medium, moist			0.3				
				E/D	0.4				Grout 0.0-1.0m
	0.7	FILL/SAND: fine to medium, dark brown, with silt, moist			0.6				
54	1	SAND SP: fine to medium, pale grey, moist, aeolian			0.8				
				E/D	1.0				Bentonite 1.0-1.5m
									Blank pipe 0.1-3.8m
53	2				2.0				
	2.2	SAND SP: fine to medium, orange-brown, apparently cemented, iron indurated, ("coffee rock"), aeolian		S			4,3,5 N = 8		
					2.45				Slotted PVC screen 1.5-3.34m
	2.6	SAND SP: fine to medium, yellow-brown, moist, aeolian		D	2.5				Gravel 1.5-3.35m
					2.6				
				D	2.8				
52	3				3.0				
	3.2	Below 3.1m: becoming wet		S			5,25/125 refusal		
	3.35	SANDSTONE: medium grained, pale yellow-brown, apparently very low to low strength, Hawkesbury Sandstone			3.27				End cap
		Bore discontinued at 3.35m Target depth reached							
51	4								
50	5								
49	6								
48	7								
47	8								
46	9								

RIG: Vac Truck, Hand Tools & Bobcat **DRILLER:** VAC Group **LOGGED:** KR/JJH **CASING:** None

TYPE OF BORING: Diatube to 0.1m, Non-Destructive-Drilling (NDD) and Hand-Auger to 1.5m, Solid flight auger to 3.35m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Bulk sample taken at 0.7-1.5m, Groundwater well installed, refer to Well Log for construction details, Data logger 2121809 installed in well

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: Lendlease Building Pty Ltd
PROJECT: SCH Stage 1 / CCCC Project
LOCATION: High Street and Hospital Road, Randwick

SURFACE LEVEL: 55.3 AHD
EASTING: 337109.8
NORTHING: 6245649.5
DIP/AZIMUTH: 90°/--

BORE No: BH605
PROJECT No: 72505.18
DATE: 19 & 25/08/2020
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
55	0.11	ASPHALTIC CONCRETE		E/D	0.1				Gatic cover
	0.24	FILL/ROADBASE: Sandy GRAVEL, sub-angular, fine igneous gravel, grey, medium, moist			0.3				
				E*/D	0.4				
	0.6	FILL/Gravelly SAND: medium, brown, subangular, fine igneous gravel, moist			0.5				
		Between 0.4-0.55m: large brick fragment			0.9				
1				E/D	1.1				
54		FILL/SAND: fine to medium, brown, trace subrounded, fine to coarse sandstone gravel, silt, and glass fragment, moist			1.4				Backfill 0.0-2.3m
	1.35			E	1.5				
	1.5	SAND SP: fine to medium, pale grey, moist, aeolian		D	1.6				
		Clayey SAND SC: fine to medium, orange-brown, low plasticity, moist, loose, residual			2.0				
2				S			1,3,2 N = 5		
53		Below 2.2m: with ironstone bands			2.45				
	2.5	Sandy CLAY CI: low to medium plasticity, pale grey, w~PL, residual (Extremely weathered sandstone)		D	2.5				
					2.6				
3					3.0				Bentonite 2.3-3.3m
				S			7,25/30 refusal		
	3.18	SANDSTONE: medium to coarse grained, pale grey and red-brown, low to high strength, moderately and highly weathered, slightly fractured to unbroken, Hawkesbury Sandstone			3.18		PL(A) = 0.23		
52					3.3				
4					4.2		PL(A) = 0.94		Blank pipe 0.1-3.8m
51				C					
	4.94				5.0		PL(A) = 1.3		
5									
50	5.75	SANDSTONE: medium grained, pale grey, medium strength, fresh, slightly fractured to unbroken, Hawkesbury Sandstone			5.84				
					6.0		PL(A) = 0.76		
6									
49					7.0		PL(A) = 0.84		
7				C					
48					8.0		PL(A) = 0.84		
8									
47					8.85				
					9.0		PL(A) = 1.3		
9				C					
46					10.0		PL(A) = 1.3		Gravel 3.3-3.8m

RIG: Vac Truck, Hand Tools & Bobcat **DRILLER:** VAC Group **LOGGED:** KR/JJH/TM **CASING:** HQ to 3.1m

TYPE OF BORING: Diatube to 0.1m, Non-Destructive-Drilling (NDD) and Hand-Auger to 1.8m, Solid flight auger to 3.18m, NMLC Coring to 16.28m

WATER OBSERVATIONS: Water seepage at 3.1m

REMARKS: *Field replicate sampleBD1/20200819, Bulk samples taken 0.4-1.0m & 1.5-1.8m, Groundwater well installed, refer to Well Log for construction details, Data logger 2119606 installed in well

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: Lendlease Building Pty Ltd
PROJECT: SCH Stage 1 / CCCC Project
LOCATION: High Street and Hospital Road, Randwick

SURFACE LEVEL: 55.3 AHD
EASTING: 337109.8
NORTHING: 6245649.5
DIP/AZIMUTH: 90°/--

BORE No: BH605
PROJECT No: 72505.18
DATE: 19 & 25/08/2020
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
45		SANDSTONE: medium grained, pale grey, medium strength, fresh, slightly fractured to unbroken, Hawkesbury Sandstone *(continued)*							Slotted PVC screen 3.8-16.27m
		SANDSTONE: medium grained, pale grey, high strength, fresh, slightly fractured to unbroken, Hawkesbury Sandstone							
44	11	SANDSTONE: medium grained, pale grey, high strength, fresh, slightly fractured to unbroken, Hawkesbury Sandstone *(continued)*		C	11.0		PL(A) = 1.6		11
		Between 10.7-12.17: cross bedded at 0-10°			11.81				
43	12				12.0		PL(A) = 2		12
	13			C	13.0		PL(A) = 1.4		13
42	14	Between 13.9-15.4m: cross bedded at 0-10°			14.0		PL(A) = 1.4		14
41					14.83				
	15			C	15.0		PL(A) = 2		15
40	16				16.0		PL(A) = 2.2		16
39	16.28	Bore discontinued at 16.28m Target depth reached			16.28				End cap
38	17								17
37	18								18
36	19								19

RIG: Vac Truck, Hand Tools & Bobcat **DRILLER:** VAC Group **LOGGED:** KR/JJH/TM **CASING:** HQ to 3.1m

TYPE OF BORING: Diatube to 0.1m, Non-Destructive-Drilling (NDD) and Hand-Auger to 1.8m, Solid flight auger to 3.18m, NMLC Coring to 16.28m

WATER OBSERVATIONS: Water seepage at 3.1m

REMARKS: *Field replicate sampleBD1/20200819, Bulk samples taken 0.4-1.0m & 1.5-1.8m, Groundwater well installed, refer to Well Log for construction details, Data logger 2119606 installed in well

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: Lendlease Building Pty Ltd
PROJECT: SCH Stage 1 / CCCC Project
LOCATION: High Street and Hospital Road, Randwick

SURFACE LEVEL: 52.1 AHD
EASTING: 337045.4
NORTHING: 6245584.9
DIP/AZIMUTH: 90°/--

BORE No: BH606
PROJECT No: 72505.18
DATE: 28 - 31/8/2020
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
52	0.06	ASPHALTIC CONCRETE		D	0.1				Gatic cover
	0.2	FILL/ROADBASE: GRAVEL, coarse, dark grey, igneous, subangular-subrounded, dry, roadbase			0.2				Grout 0.0-1.0m
				E/D*	0.4				Bentonite 0.15-0.35m
	0.6	FILL/ GRAVEL: medium, yellow-brown, sandstone, with clay, sand, crushed sandstone, dry			0.5				Blank pipe 0.15-0.5m
				E/D	0.8				
51	1	FILL/ SAND: fine to medium, pale grey, dry			1.0				1
				S			3,4,4 N = 8		
	1.4	SAND SP: fine to medium, brown, dry, loose, aeolian			1.45				
50	2	Below 1.8m: moist		E/D	1.9 2.0				Slotted PVC screen 0.5-3.0m; 2 Gravel 0.5-3.0m
		Below 2.5m: medium dense		S	2.5		5,7,9 N = 16		
49	3				2.95				3 End cap
	3.1	SANDSTONE: medium to coarse grained, yellow-brown, very low to low strength, Hawkesbury Sandstone							Bentonite 3.0-4.0m
	3.6	SANDSTONE: medium to coarse grained, pale grey with some pale orange staining, low then medium strength, slightly weathered, slightly fractured, Hawkesbury Sandstone			3.6		PL(A) = 0.14		
48	4				4.0		PL(A) = 0.23		4
				C					
47	5				5.1		PL(A) = 0.61		5
					5.8				
46	6				6.0		PL(A) = 0.68		6
	6.25	SANDSTONE: medium grained, pale grey, medium strength, fresh, slightly fractured to unbroken, Hawkesbury Sandstone							
45	7				7.0		PL(A) = 0.46		7
				C					
44	8				8.0		PL(A) = 0.76		8
					8.8				
43	9				9.0		PL(A) = 0.68		9
				C					
					10.0		PL(A) = 0.52		

RIG: Bobcat **DRILLER:** JE **LOGGED:** TM **CASING:** HW to 3.2m, HQ to 3.6m

TYPE OF BORING: Diacore to 0.06m, Solid flight auger to 3.2m, Rotary to 3.6m, NMLC Coring to 16.19m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: *Field replicate sampleBD03/20200828, Bulk samples taken 0.6-1.0m & 1.5-3.0m, Groundwater well installed, refer to Well Log for construction details, Data logger 2121808 installed in well

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: Lendlease Building Pty Ltd
PROJECT: SCH Stage 1 / CCCC Project
LOCATION: High Street and Hospital Road, Randwick

SURFACE LEVEL: 52.1 AHD
EASTING: 337045.4
NORTHING: 6245584.9
DIP/AZIMUTH: 90°/--

BORE No: BH606
PROJECT No: 72505.18
DATE: 28 - 31/8/2020
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
42		SANDSTONE: medium grained, pale grey, medium strength, fresh, slightly fractured to unbroken, Hawkesbury Sandstone *(continued)*							Backfill 4.0-16.19m
41	11			C	11.0		PL(A) = 0.45		
					11.8				
40	12				12.0		PL(A) = 0.88		
39	13			C	13.0		PL(A) = 1		
38	14				14.0		PL(A) = 0.72		
					14.8				
37	15			C	15.0		PL(A) = 0.64		
36	16				16.05		PL(A) = 0.08		
	16.19	Bore discontinued at 16.19m Target depth reached			16.19				
35	17								
34	18								
33	19								

RIG: Bobcat **DRILLER:** JE **LOGGED:** TM **CASING:** HW to 3.2m, HQ to 3.6m

TYPE OF BORING: Diacore to 0.06m, Solid flight auger to 3.2m, Rotary to 3.6m, NMLC Coring to 16.19m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: *Field replicate sampleBD03/20200828, Bulk samples taken 0.6-1.0m & 1.5-3.0m, Groundwater well installed, refer to Well Log for construction details, Data logger 2121808 installed in well

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: Lendlease Building Pty Ltd
PROJECT: SCH Stage 1 / CCCC Project
LOCATION: High Street and Hospital Road, Randwick

SURFACE LEVEL: 52.9 AHD
EASTING: 337054.9
NORTHING: 6245642.4
DIP/AZIMUTH: 90°/--

BORE No: BH608
PROJECT No: 72505.18
DATE: 27 - 28/8/2020
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
52.9	0.05	ASPHALTIC CONCRETE		E/D	0.1				Gatic cover Grout 0.0-1.0m
52.7	0.2	FILL/ROADBASE: GRAVEL, coarse, dark grey, igneous, subangular-subrounded, dry		E/D	0.2 0.4				
52.4	0.5	FILL/ GRAVEL: medium, yellow-brown, sandstone, with clay, sand, crushed sandstone, dry		E/D*	0.5 0.8				
51.9	1	FILL/SAND: fine to medium, brown, trace silt, and fine subangular igneous gravel, dry		S	1.0		1,1,1 N = 2		Backfill 0.1-1.75m
51.4	1.5	SAND SP: fine to medium, yellow-brown, with clay, moist, loose, aeolian			1.45				
				E/D	1.8 2.0				Bentonite 0.15-0.35m
50.9	2.5	SANDSTONE: medium to coarse grained, pale yellow and red, very low then low strength, highly weathered, slightly fractured, Hawkesbury Sandstone		S	2.5 2.59		25/90 refusal		
					2.75 2.8		PL(A) = 0.07		Blank pipe 0.1-2.75m
				C	4.0		PL(A) = 0.08		
48.07	4.83								
47.88	5.02	SANDSTONE: medium grained, pale grey, low then medium to high strength, fresh, slightly fractured to unbroken, Hawkesbury Sandstone			5.3		PL(A) = 0.19		
					5.76				
					6.0		PL(A) = 0.91		
				C	7.0		PL(A) = 1		
					8.0		PL(A) = 0.81		
					8.85				
					9.0		PL(A) = 0.97		
				C					Gravel 0.5-3.0m Slotted PVC screen 0.5-3.0m
42.9	10.0				10.0		PL(A) = 1		

RIG: Bobcat **DRILLER:** JE **LOGGED:** TM **CASING:** HW to 2.6m, HQ to 2.75m

TYPE OF BORING: Diacore to 0.05m, Solid flight auger to 2.5m, Rotary to 2.75m, NMLC Coring to 16.0m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: *Field replicate sample BD02/20200827, Bulk samples taken 0.5-1.5m & 1.5-2.5m, Groundwater well installed, refer to Well Log for construction details, Data logger 2119607 installed in well

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: Lendlease Building Pty Ltd
PROJECT: SCH Stage 1 / CCCC Project
LOCATION: High Street and Hospital Road, Randwick

SURFACE LEVEL: 52.9 AHD
EASTING: 337054.9
NORTHING: 6245642.4
DIP/AZIMUTH: 90°/--

BORE No: BH608
PROJECT No: 72505.18
DATE: 27 - 28/8/2020
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
42	11	SANDSTONE: medium grained, pale grey, low then medium to high strength, fresh, slightly fractured to unbroken, Hawkesbury Sandstone *(continued)*		C	11.1		PL(A) = 1.1		11
41	11.89				11.83				
	12				12.0		PL(A) = 1.2		12
40	13			C	13.0		PL(A) = 0.83		13
39	14				14.0		PL(A) = 0.75		14
					14.65				
38	15				15.0		PL(A) = 1.1		15
				C	15.2		PL(A) = 0.15		
37	16				16.0		PL(A) = 1.2		16
	16.33	Bore discontinued at 16.33m Target depth reached			16.33				End cap
36	17								17
35	18								18
34	19								19
33									

RIG: Bobcat **DRILLER:** JE **LOGGED:** TM **CASING:** HW to 2.6m, HQ to 2.75m

TYPE OF BORING: Diacore to 0.05m, Solid flight auger to 2.5m, Rotary to 2.75m, NMLC Coring to 16.0m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: *Field replicate sample BD02/20200827, Bulk samples taken 0.5-1.5m & 1.5-2.5m, Groundwater well installed, refer to Well Log for construction details, Data logger 2119607 installed in well

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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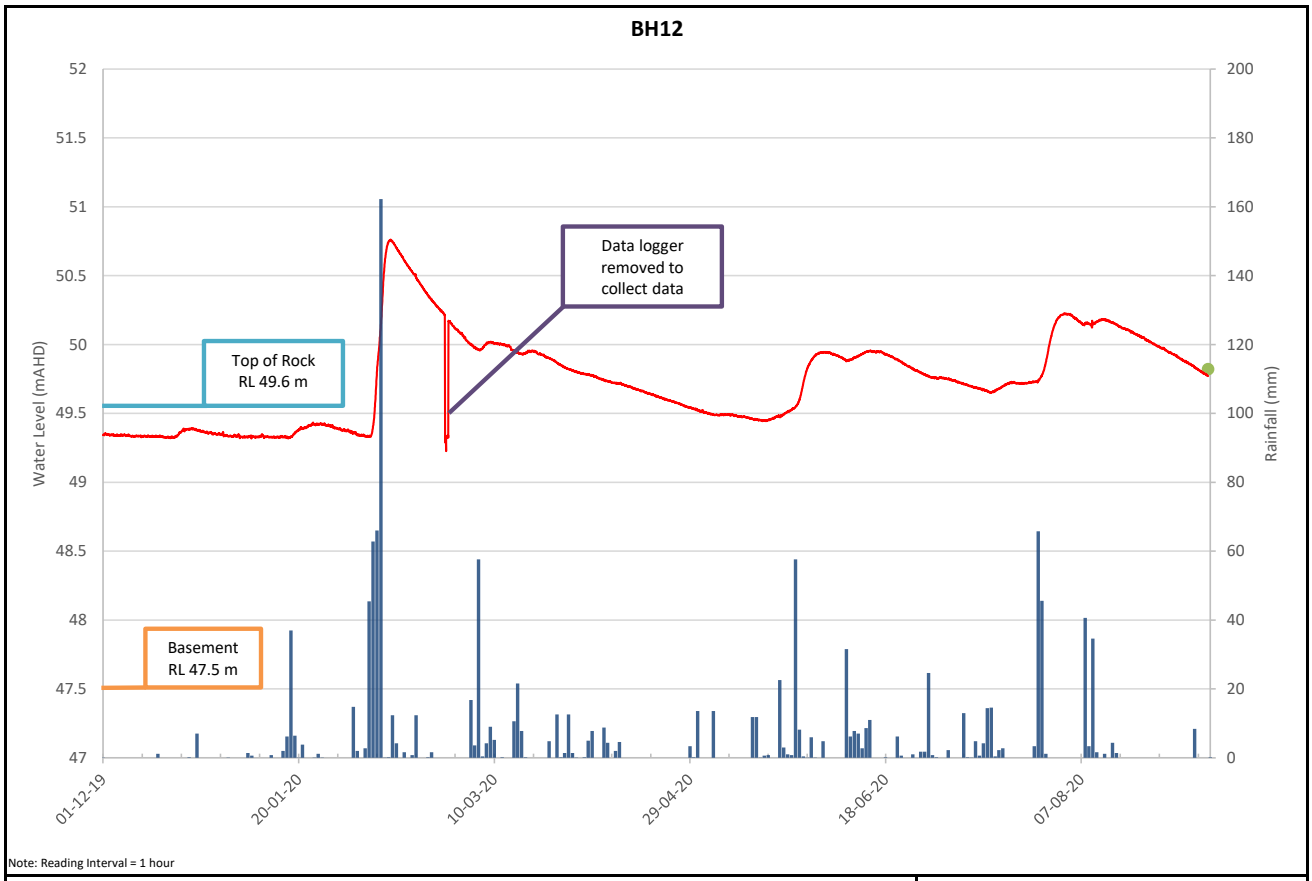
Appendix H

Results of Groundwater Monitoring



Note: Reading Interval = 1 hour

Douglas Partners
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Water Level
Manual Levels
Rainfall data

Date:	From:	Drawn:
21/09/2020	1/12/2019	TM
Project:	**To:**	**Checked:**
72505.18	8/09/2020	PAV

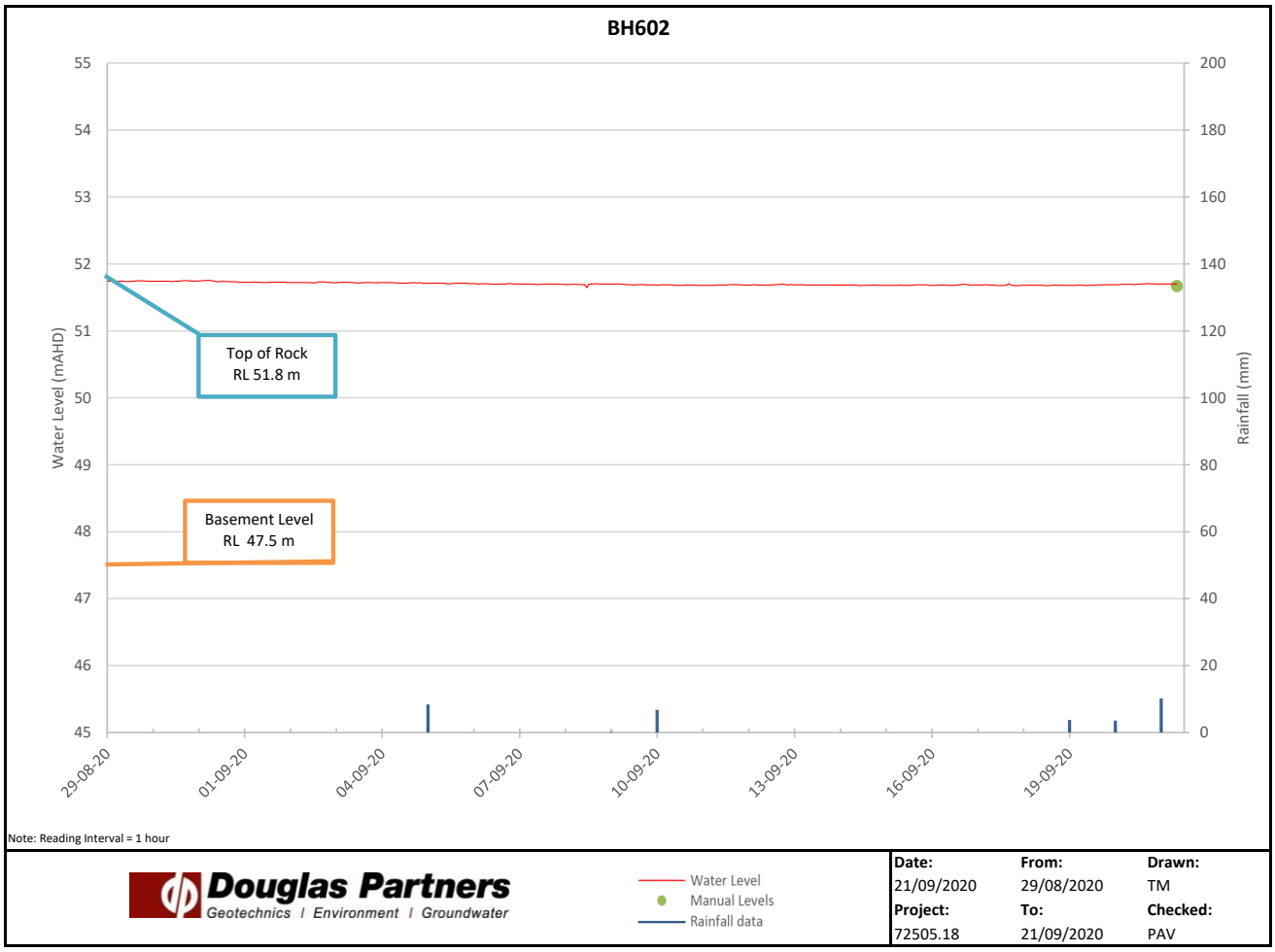
BH13

Note: Reading Interval = 1 hour

Douglas Partners
Geotechnics / Environment / Groundwater

Water Level
Manual Levels
Rainfall data

Date:	From:	Drawn:
23-09-20	01-12-19	TM
Project:	**To:**	**Checked:**
72505.18	08-09-20	PAV

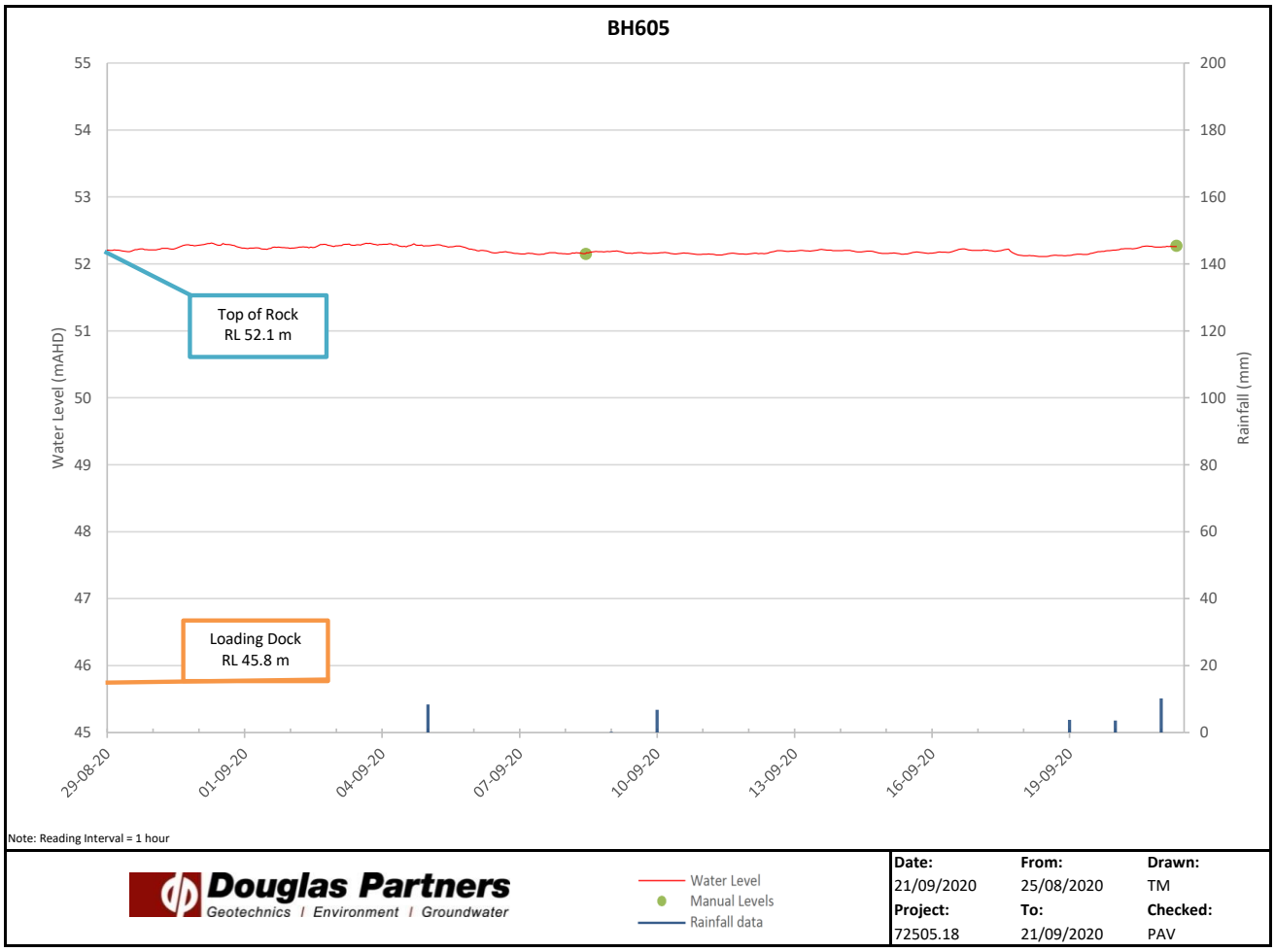


Note: Reading Interval = 1 hour

Douglas Partners
Geotechnics / Environment / Groundwater

Water Level
Manual Levels
Rainfall data

Date:	From:	Drawn:
21/09/2020	29/08/2020	TM
Project:	**To:**	**Checked:**
72505.18	21/09/2020	PAV

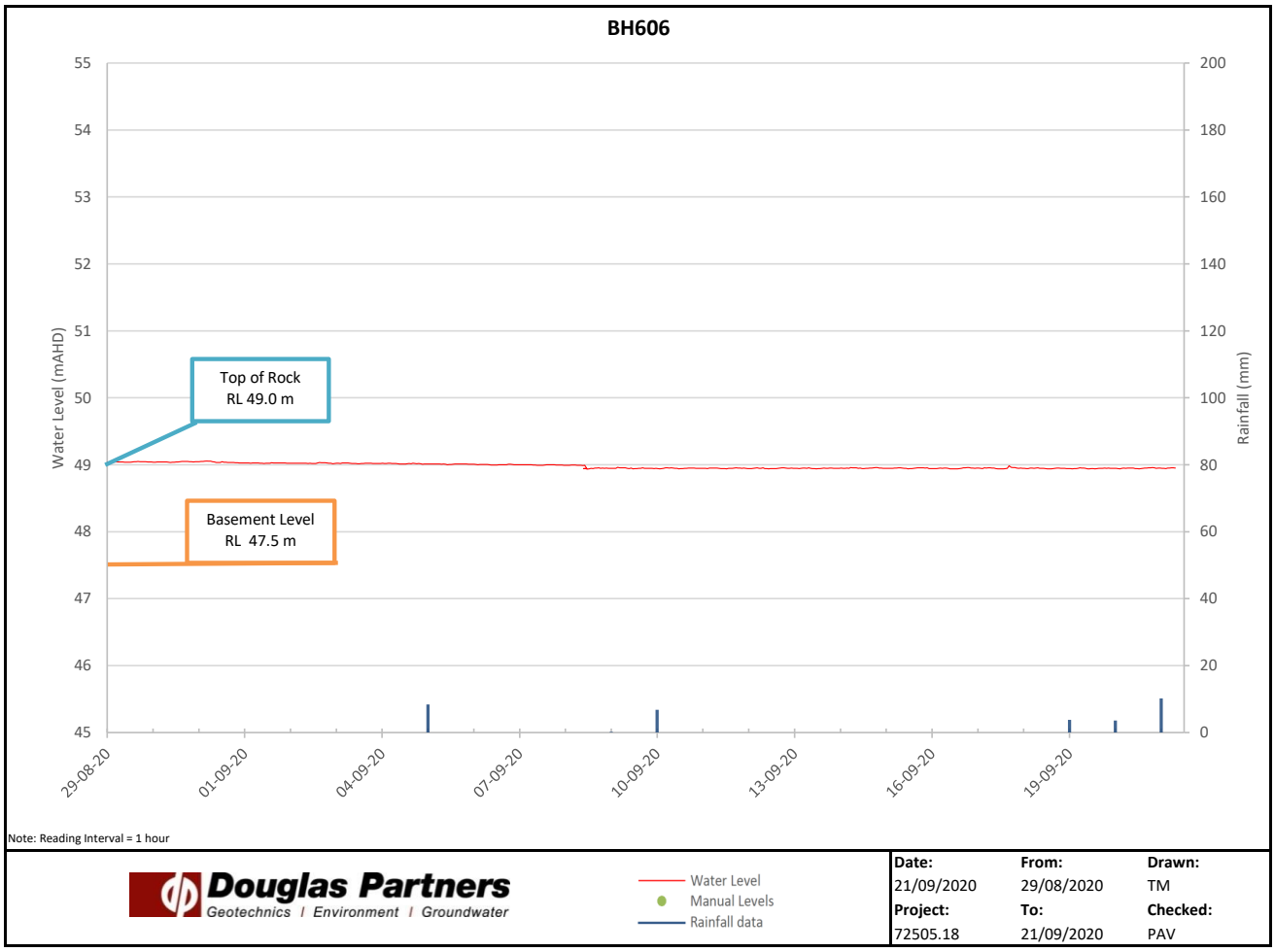


Note: Reading Interval = 1 hour

Douglas Partners
Geotechnics / Environment / Groundwater

Water Level
Manual Levels
Rainfall data

Date:	From:	Drawn:
21/09/2020	25/08/2020	TM
Project:	**To:**	**Checked:**
72505.18	21/09/2020	PAV



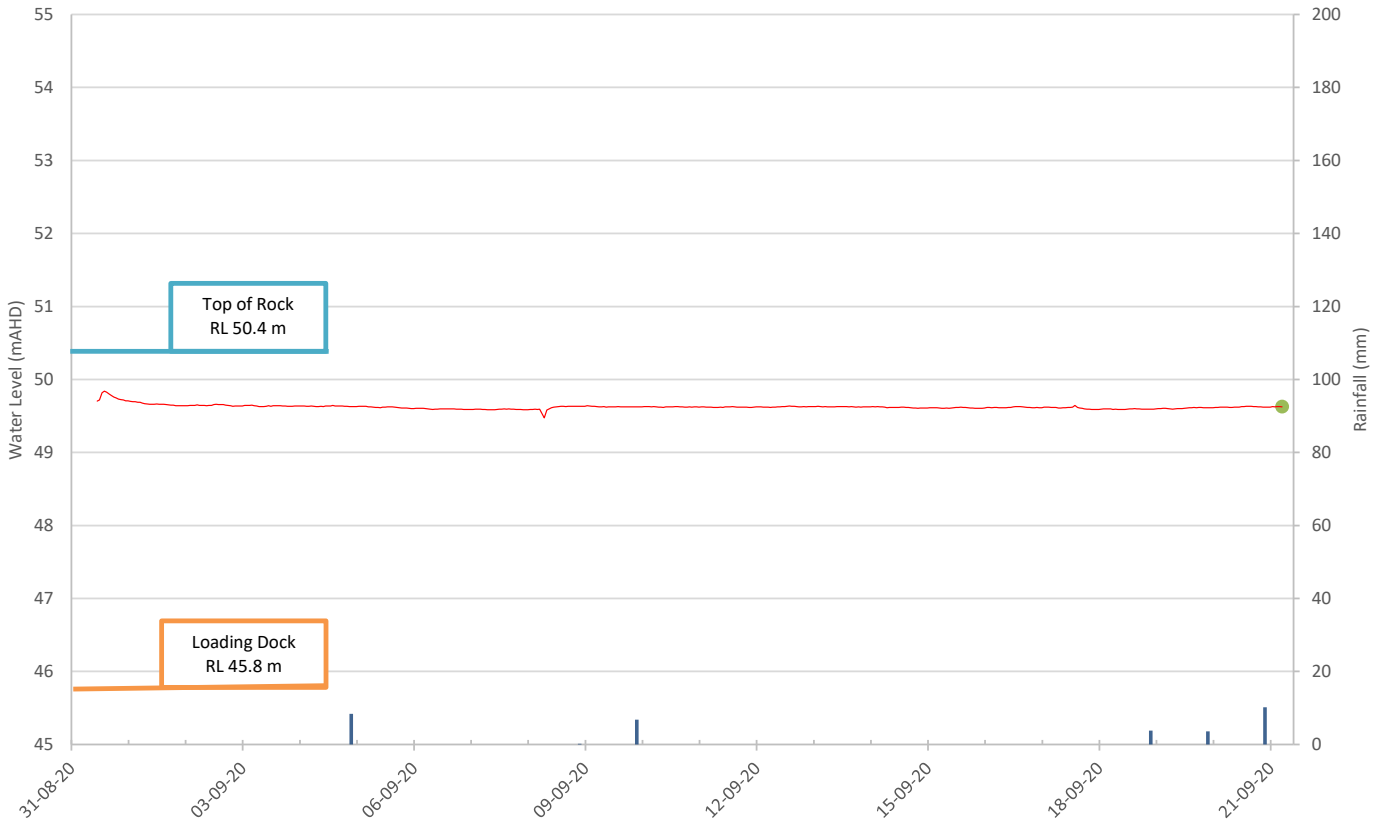
Note: Reading Interval = 1 hour

Douglas Partners
Geotechnics / Environment / Groundwater

Water Level
Manual Levels
Rainfall data

Date:	From:	Drawn:
21/09/2020	29/08/2020	TM
Project:	**To:**	**Checked:**
72505.18	21/09/2020	PAV

BH608



Note: Reading Interval = 1 hour

Douglas Partners
Geotechnics / Environment / Groundwater

Water Level
Manual Levels
Rainfall data

Date:	From:	Drawn:
23-09-20	31-08-20	TM
Project:	**To:**	**Checked:**
72505.18	21-09-20	PAV

Appendix I

Results of Permeability Tests

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

Permeability Testing - Falling Head Test Report

Client:	Lendlease Building Pty Ltd	Project No:	72505.18
Project:	SCH Stage 1 / CCCC Project	Test date:	31-Aug-20
Location:	High Street and Hospital Road, Randwick	Tested by:	TM

Test Location

Description:	Standpipe in borehole	**Test No.**	BH602	
Material type:	Sand	Easting:	337097.5	m
		Northing	6245571.8	m
		Surface Level:	55	m AHD

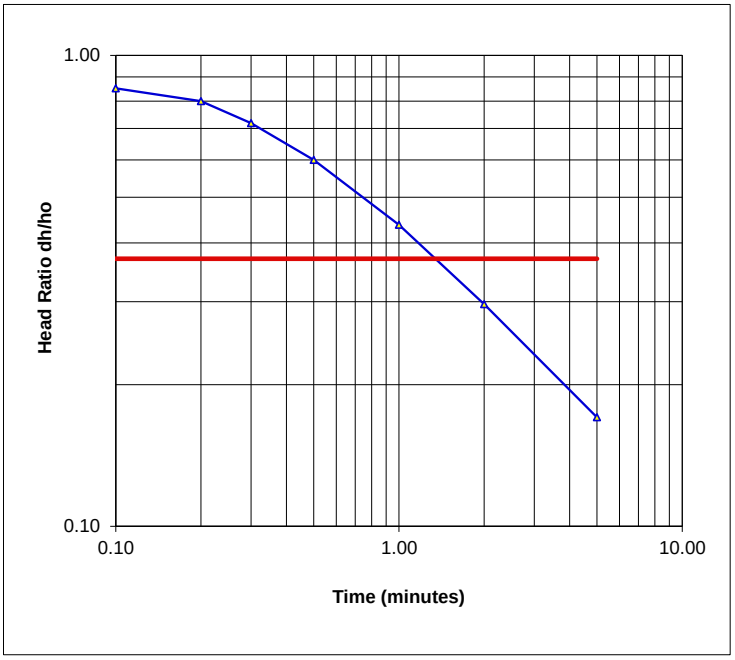
Details of Well Installation

Well casing diameter (2r)	110	mm	Depth to water before test	3.3	m
Well screen diameter (2R)	110	mm	Depth to water at start of test	1.95	m
Length of well screen (Le)	1.84	m			

Comments: Effective screen length reduced due to standing water level

Test Results

Time (min)	Depth (m)	Change in Head dH (m)	dH/Ho
0	1.95	-1.35	1.000
0.10	2.15	-1.15	0.852
0.20	2.22	-1.08	0.800
0.30	2.33	-0.97	0.719
0.50	2.49	-0.81	0.600
1.00	2.71	-0.59	0.437
2.00	2.9	-0.40	0.296
5.00	3.07	-0.23	0.170



To = 1.02 mins
61.2 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-05**	m/sec
	=	**16.973**	cm/hour

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

Permeability Testing - Rising Head Test Report

Client:	Lendlease Building Pty Ltd	Project No:	72505.18
Project:	SCH Stage 1 / CCCC Project	Test date:	25-Aug-20
Location:	High Street and Hospital Road, Randwick	Tested by:	JJH

Test Location

Description:	Standpipe in borehole	**Test No.**	BH605	
Material type:	Sandstone	Easting:	337109.8	m
		Northing	6245649.5	m
		Surface Level:	55.3	m AHD

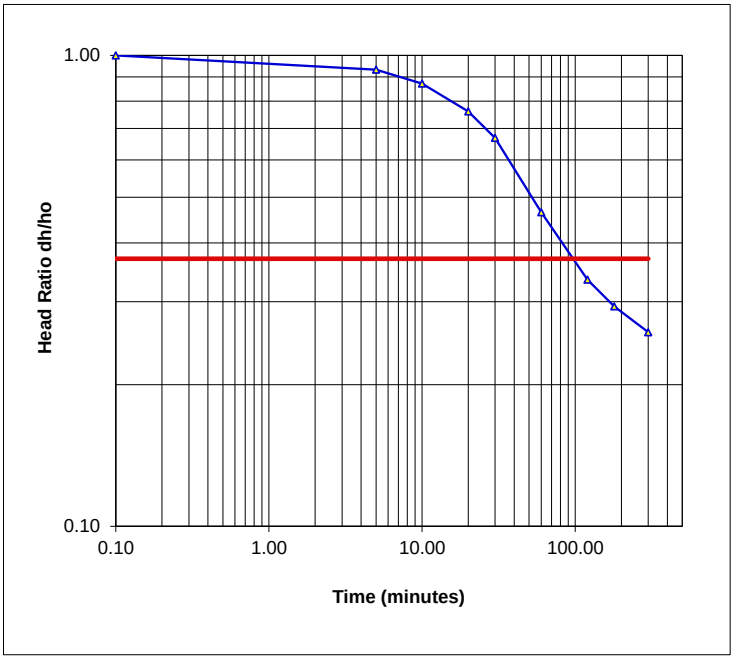
Details of Well Installation

Well casing diameter (2r)	76	mm	Depth to water before test		m
Well screen diameter (2R)	76	mm	Depth to water at start of test	14.4	m
Length of well screen (Le)	12.5	m			

Comments: Effective screen length reduced due to standing water level

Test Results

Time (min)	Depth (m)	Change in Head dH (m)	dH/Ho
0	14.4	14.40	1.000
5.0	13.43	13.43	0.933
10	12.54	12.54	0.871
20	10.95	10.95	0.760
30.0	9.62	9.62	0.668
60	6.69	6.69	0.465
120	4.81	4.81	0.334
180.0	4.22	4.22	0.293
300	3.72	3.72	0.258



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 =**	**5.9E-08**	m/sec
	=	**0.021**	cm/hour

Douglas Partners Pty Ltd
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Permeability Testing - Falling Head Test Report

Client:	Lendlease Building Pty Ltd	Project No:	72505.18
Project:	SCH Stage 1 / CCCC Project	Test date:	31-Aug-20
Location:	High Street and Hospital Road, Randwick	Tested by:	TM

Test Location

Description:	Standpipe in borehole	**Test No.**	BH606	
Material type:	Sand	Easting:	337045.4	m
		Northing	6245584.9	m
		Surface Level:	52.1	m AHD

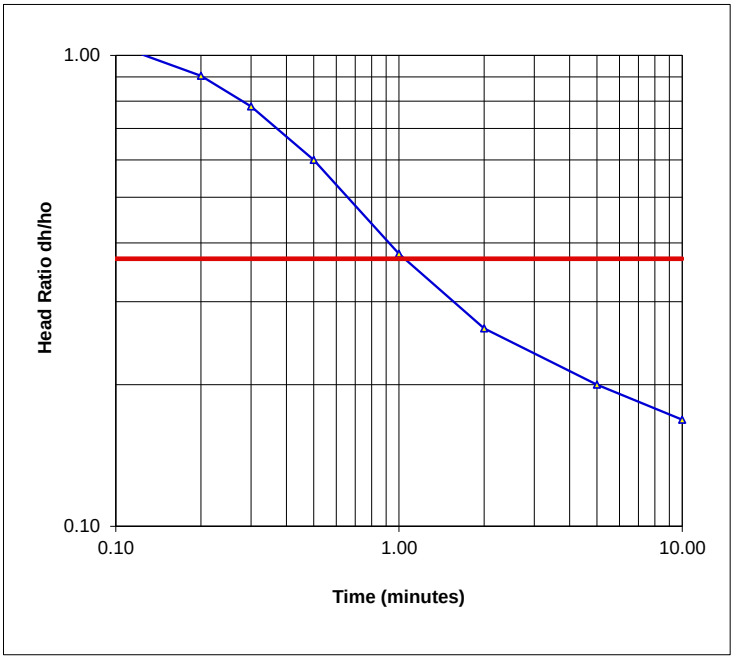
Details of Well Installation

Well casing diameter (2r)	110	mm	Depth to water before test	2.9	m
Well screen diameter (2R)	110	mm	Depth to water at start of test	1.95	m
Length of well screen (Le)	2.5	m			

Comments: Effective screen length reduced due to standing water level

Test Results

Time (min)	Depth (m)	Change in Head dH (m)	dH/Ho
0	1.7	-1.20	1.263
0.10	1.9	-1.00	1.053
0.20	2.04	-0.86	0.905
0.30	2.16	-0.74	0.779
0.50	2.33	-0.57	0.600
1.00	2.54	-0.36	0.379
2.00	2.65	-0.25	0.263
5.00	2.71	-0.19	0.200
10	2.74	-0.16	0.168



To = 1.01 mins
60.6 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 =**	**3.8E-05**	m/sec
	=	**13.717**	cm/hour

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

Permeability Testing - Rising Head Test Report

Client:	Lendlease Building Pty Ltd	Project No:	72505.18
Project:	SCH Stage 1 / CCCC Project	Test date:	31-Aug-20
Location:	High Street and Hospital Road, Randwick	Tested by:	TM

Test Location

Description:	Standpipe in borehole	**Test No.**	BH608	
Material type:	Sandstone	Easting:	337052.7	m
		Northing	6245601.5	m
		Surface Level:	52.4	m AHD

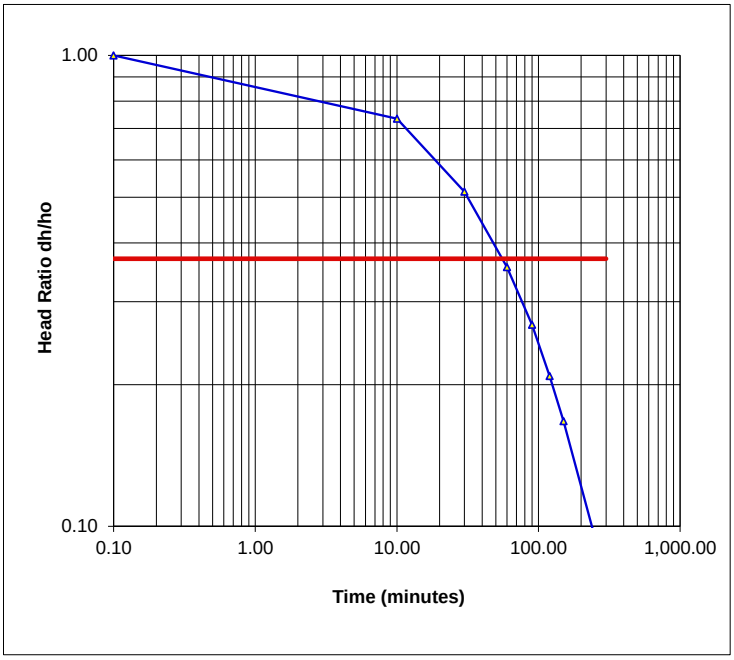
Details of Well Installation

Well casing diameter (2r)	76	mm	Depth to water before test	3.15	m
Well screen diameter (2R)	76	mm	Depth to water at start of test	10.39	m
Length of well screen (Le)	13.33	m			

Comments: Effective screen length reduced due to standing water level

Test Results

Time (min)	Depth (m)	Change in Head dH (m)	dH/Ho
0	10.39	7.24	1.000
10.0	8.46	5.31	0.733
30	6.87	3.72	0.514
60	5.72	2.57	0.355
90.0	5.09	1.94	0.268
120	4.66	1.51	0.209
150	4.36	1.21	0.167
300.0	3.71	0.56	0.077



To = 45 mins
2700 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 =**	**1.2E-07**	m/sec
	=	**0.042**	cm/hour