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Appendix R
Report on
Geotechnical Investigation

Cockle Bay Park Redevelopment
241-249 Wheat Road, Sydney

Prepared for
DPT Operator Pty Ltd

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Report on Geotechnical Investigation
Cockle Bay Park Redevelopment
241-249 Wheat Road, Sydney

1. Introduction

This report presents the results of a geotechnical investigation undertaken for the proposed Cockle Bay Park Redevelopment at 241-249 Wheat Road, Sydney. The investigation was commissioned by DPT Operator Pty Ltd and DPPT Operator Pty Ltd, and was undertaken in accordance with Douglas Partners' (DP) proposal SYD200097.P.001.Rev1 dated 11 November 2020.

It is understood that the proposed development of the site includes demolition of the existing Cockle Bay Wharf and pedestrian bridge and construction of a new building. The building will contain new retail along Cockle Bay with a high-rise tower set away from the water's edge, adjacent to Wheat Road. A land-bridge will be constructed over Wheat Road, Harbour Street and the Western Distributor to connect the waterfront to the existing commercial towers of Darling Park.

The aim of the investigation was to assess the subsurface soil and groundwater conditions across the site in order to provide advice on excavation conditions, excavation support, foundation design and suitable construction methodologies, earthworks, groundwater, and any other geotechnical construction issues considered relevant to the proposed development.

The investigation included the drilling of 15 boreholes and laboratory testing of selected samples. The details of the field work are presented in this report, together with comments and recommendations on the aforementioned items.

It is noted that the investigation field work and laboratory testing is still underway, and this interim report has been prepared based upon the results obtained to date. This interim report will be revised following completion of the remaining field work, and the advice herein is subject to change.

This report has been prepared in response to the Secretary's Environmental Assessment Requirements (SEARS) dated 12 November 2020 for SSD-9978934. Specifically, this report has been prepared to respond to those SEARS summarised in Table 1.

Table 1: SEARS Requirements

Item	Description of Requirement	Section Reference
Condition 15	The EIS must demonstrate that the proposed development can be accommodated on the site, having regard to any geotechnical and acid sulphate soil impacts.	This report contains geotechnical information relevant to the development. Acid sulphate soil impacts are covered in DPs site contamination report (reference 202546.00.R.002)

This report has also been prepared in response to the following Stage 1 (SSD 7684) conditions of consent summarised in Table 2.

Table 2: Concept Approval for Conditions of Consent

Item	Description of Requirement	Section Reference
Condition C25	Future Development Application(s) shall include a Geotechnical and Structural Investigation Report considering design and construction methodology.	This report covers the Geotechnical component (only) of Condition C25

A preliminary contamination site investigation (PSI) with limited sampling has been undertaken in parallel with the geotechnical investigation works. The results of the PSI are reported separately (202546.00.R.002). This report should be read in conjunction with the PSI report.

2. Proposed Development

The proposed scope of works includes the demolition of the existing Cockle Bay Wharf building and pedestrian bridge for the progression of a new proposed development. The existing Cockle Bay Wharf deck structure along the Harbour foreshore will be retained and used as a platform for the construction of the proposed podium structure. The proposed development includes several major components with proposed foundations as summarised below:

- Podium structure on Cockle Bay Wharf:
  - Low rise retail podium structure on Cockle Bay Wharf;
  - Reinforced concrete columns with an estimated column working load of 5 MN;
  - Superstructure proposed to be transferred at ground level onto a regular pile foundation grid.
- Tower structure:
  - 43 storey high rise commercial office tower located on the east side of the podium;
  - Reinforced concrete columns with an estimated column working load of 130 MN;

  - Columns proposed to be founded on pile groups of large diameter socketed in high strength rock with tower core to be founded on a piled 1.5 m deep raft;
  - Raking piles proposed to be used to support lateral tower forces.
- Land bridge spanning across the existing Western Distributor:
  - Deck structure connecting the new podium structure on Cockle Bay Wharf with the existing Darling Park towers;
  - The deck structure will cover the area of Western Distributor between the new development and the Darling Park towers;
  - Reinforced concrete columns with an estimated column working load of 35 MN and ultimate horizontal impact load of 2.7 MN;
  - Proposed to be founded on pile or pad foundations.

Temporary excavations are required adjacent to existing Harbour Street for the construction of core rafts, lift pits, large ground floor set-downs and loading docks.

It is understood that a bulk excavation to approximately 6 m depth will also be required towards the southern end of the proposed development to accommodate a large in-ground fire water tank.

3. Site Description

Cockle Bay Park is located at 241-249 Wheat Road, Darling Harbour, currently occupied by the existing Cockle Bay Wharf precinct. The site comprises an irregular shaped area of about 21,000 m^2, the general layout of which is shown on Drawing 1 in Appendix B. The site is bound by Darling Harbour to the west, Pyrmont Bridge to the north and The Ribbon development to the south. The northern end of the site extends out to the east, across the Western Distributor, to the existing Darling Park Towers. The areas north, south, and west of the existing building are typically paved public walkways. Loading docks and back-of-house facilities are located on the eastern side of the building.

The existing Cockle Bay Wharf building is generally used for retail purposes. The existing developments surrounding the site are a combination of retail and commercial office spaces. The ground surface is relatively level to the east of the existing Cockle Bay Wharf precinct, with surface levels at or about Reduced Level (RL) 3 m relative to Australian Height Datum (AHD). The ground surface falls away into the harbour to the west of the existing precinct, with the bottom of the harbour at about RL -5 m AHD. The foreshore deck continues over the water to the west of the precinct, at about RL 2.2 m AHD.

An existing sheet pile sea wall is located beneath the site, running roughly north-south, with the western portion of the site supported on a suspended deck which extends out over Darling Harbour, the surface of which is at about RL 2.2 m AHD. The approximate location of the existing sheet pile wall is shown on Drawings 4, 5 and 6, in Appendix B.

4. Previous Investigations

4.1 Coffey Geotechnics Pty Ltd

A geotechnical desktop study report was prepared by Coffey Geotechnics Pty Ltd (Coffey) in 2017 for the proposed Cockle Bay Wharf development (reference: GEOTLCOV25496AB-AB Rev.2). A similar geotechnical desktop study was prepared by Coffey in 2015 for the Sydney Harbour Foreshore Authority (reference: GEOTLCOV25293AA-AD). Both desktop studies summarise several previous geotechnical investigations undertaken by Coffey in the vicinity of the proposed Cockle Bay Wharf development site. The past geotechnical investigations of note include:

- "North Western Expressway Project" conducted for Department of Main Roads, 1971. Borehole reference number R1;
- "Darling Harbour Development Maritime Structures Geotechnical Investigation Zones 1 to 6" conducted for Leighton Contractors Pty Ltd, 1985. Borehole reference number R2;

Information from several borehole locations provided in the desktop studies by Coffey has been used to supplement information obtained during the current geotechnical investigation by DP. Information was taken from Coffey boreholes R1-A328, R1-D28, R1-D40, R1-B59, R2-L1 and R2-L5, the locations of which are shown on Drawing 1 in Appendix B. The results of the current geotechnical investigation generally agree with the subsurface conditions described by Coffey. It is noted that the detailed boreholes logs for these Coffey bores have not been made available to DP, and the adaptation is based on the summary logs presented on cross-sections prepared by Coffey.

5. Published Data

5.1 Geology

The Sydney 1:100 000 Geological Series Sheet indicates the site spans across the boundary between Hawkesbury Sandstone (medium to coarse-grained sandstone with minor shale and laminate lenses) and Quaternary-aged alluvial and estuarine sediment (silty/peaty sand, silt, clay, common shell layers). The area south of Darling Harbour is mapped as having man-made fill placed over the Quaternary-aged sediments, resulting from historical land reclamation works. A review of mapping suggests that no geological structures such as major fault zones or dykes cross the site.

The results of the geotechnical investigation confirmed the presence of alluvial and estuarine sediments underlain by Hawkesbury Sandstone bedrock, which is generally consistent with the geological mapping.

5.2 Soil Landscape

The Sydney 1:100 000 Soils Landscape Sheet indicates the site spans across the boundary between 'Disturbed Terrain' and erosional sandy soils. 'Disturbed Terrain' is considered to have been extensively altered by anthropogenic influences, likely by placement of land fill material (soil, rock, building and waste materials). Fill has been placed to raise surface elevations allowing the expansion of the

foreshore as part of land reclamation works carried out mainly between the 1820s to 1890s, with minor infilling and straightening undertaken in the 1900s to 1910s.

5.3 Acid Sulphate Soils

Acid Sulphate Soils (ASS) Risk Mapping by the NSW Department of Planning Industry and Environment identify the site to span across the boundary between a 'High Probability of Occurrence' and Class 2 zone. There is a high probability of encountering potential or actual ASS if the Darling Harbour seabed is disturbed. An ASS assessment has been undertaken as part of the PSI. The results of the ASS assessment are currently pending and will be addressed in a separate DP site contamination report.

6. Field Work

6.1 Field Work Methods

The field work for the geotechnical investigation to date includes:

- Prior to drilling, on-site electronic scanning was completed to identify buried services during set-out of each proposed borehole location. For borehole locations situated on the existing suspended deck, the underside of the deck was inspected for structural components and under-slung utilities;
- Diatube coring methods were used to drill through the hardstand surface at each borehole location. The over-land holes were then advanced using non-destructive drilling techniques to check for the presence of underground utilities and services;
- Drilling of 15 boreholes (W1-W5, CW1-CW7, SS1-SS2, CP2) using a combination of track and bobcat mounted drilling rigs. The boreholes were drilled to, or close to, the top of rock using a combination of solid flight auger and rotary wash boring methods. Once weathered rock was encountered, the holes were advanced to depths of between 16.8 m and 45 m, using NMLC (52 mm diameter) diamond core drilling techniques to obtain continuous core samples of the rock;
- Six boreholes (CW2, CW3, CW5, CW6, CP2 and SS2) were converted into groundwater monitoring wells at the completion of drilling. This involved inserting Class 18 uPVC screen and casing to the required depth, backfilling the screened length with gravel, plugging the top of the gravel with bentonite pellets, and backfilling the remaining casing length with drilling spoil. A steel gatic cover was concreted flush with the ground surface at each location. The construction details of the groundwater monitoring wells are provided in Table 3.

Table 3: Construction Details of Groundwater Monitoring Wells

Well Location	RL Ground Surface	RL Top of Screen	RL Base of Screen
CP2	2.5	0	-16.1
CW2	2.9	0.3	-9.7
CW3	3.1	0.6	-11.9
CW5	2.8	1.8	-2.2
CW6	3.0	2.3	-4.0
SS2	3.5	0.2	-14.3

Note: All levels are in metres and relative to AHD

Boreholes located above the suspended deck collapsed upon withdrawal of casing. The suspended deck was reinstated at these locations with quick-set concrete and pavers. All other borehole locations which did not require the installation of groundwater monitoring wells were backfilled with drilling spoil at the completion of drilling and reinstated at the ground surface with quick-set concrete and/or cold-mix bitumen as appropriate to the surrounding surface.

The location coordinates and reduced levels of boreholes W1-W5 and CW1 were measured using a high precision differential GPS unit. Coordinates for the remaining boreholes were estimated using georeferenced satellite imagery and reduced levels were estimated from an available site survey report (reference Rygate Plan No. 77631_77101).

6.2 Field Work Results

The subsurface conditions encountered in the boreholes are presented in the boreholes logs in Appendix C, together with notes defining descriptive terms and abbreviations used in their preparation.

6.2.1 Subsurface Profile

The general sequence of subsurface conditions encountered can be summarised as follows:

FILL: Variably compacted road base, sands, gravelly sands, silty sands, clayey sands, sandy gravels, and sandy clay fill with building rubble (bricks, concrete fragments, timber, metal), sandstone gravel and cobbles.. In over-land borehole locations fill was typically encountered down to elevations between RL 1.3 m and RL -6.5 m AHD. In boreholes CW1 and W1, which were drilled through the suspended deck, fill was encountered from the 'seabed' to elevations of between RL -7 and RL -7.2 m AHD.

All locations had a hardstand at the surface, comprising pavers, asphalt or concrete. The suspended deck was typically 0.39 m thick.

ALLUVIAL / ESTUARINE SEDIMENTS: Generally comprising very soft to firm clays, silty clays and sandy clays interbedded with very loose to loose sands, silty sands and clayey sands, with some apparently discontinuous firm to stiff and medium dense to dense bands. Typically encountered down to elevations between RL -6.5 m and RL -18.2 m AHD. No natural soils were encountered in SS1 or SS2.

A thin layer of possible residual soil was encountered immediately above the sandstone bedrock in several locations, although the consistency of these soils was not dissimilar to the overlying sediments.

SANDSTONE BEDROCK: The top of sandstone bedrock was encountered between RL 1.3 m (near SS1 and SS2) and RL -18.2 m AHD (over the harbour). A relatively thin weathered profile, comprised of pale grey, brown and red-brown, very low to low strength and low to medium strength sandstone, up to a maximum thickness of about 4.8 m, was present at the top of the bedrock profile in boreholes W3, CW1, CW2, CW3, CW4 and CW5. Pale grey medium to high strength sandstone was encountered in all boreholes, at elevations ranging between RL 1.3 m and RL-20.9 m AHD.

In boreholes CW1 and CW2, a low to medium strength, predominantly siltstone band, about 0.6 m thick, was encountered at RL -27.6 m and RL -28.3 m respectively. In CW3, a similar low to medium and medium strength interbedded siltstone and sandstone band presented between about RL -25.9 m and RL -30 m, with another 0.2 m thick medium to high strength siltstone band at about RL -36.6 m.

6.2.2 Groundwater

Groundwater was encountered between RL 0.0 m and RL -0.1 m AHD during auger drilling of borehole CW4 and CW5. The use of water as a drilling fluid during rotary wash-boring and core drilling of the boreholes precluded any further groundwater observations during drilling. Water from the harbour was observed in all boreholes drilled through the suspended deck. Groundwater levels were manually measured in installed standpipe piezometers. A summary of the measured groundwater levels to date is provided in Table 4 below.

Table 4: Summary of Groundwater Measurements

Borehole Location	Water RL (m AHD)	Date Measured	Comments
W1	0.0	06/072021	Harbour water level
W2	0.1	06/07/2021	Harbour water level
W3	0.1	04/07/2021	Harbour water level
W4	0.1	01/07/2021	Harbour water level
W5	0.8	07/07/2021	Harbour water level
CW1	-0.1	12/07/2021	Harbour water level
CW4	-0.1	14/07/2021	Groundwater observed during auger drilling
CW5	0.0	07/07/2021	Groundwater observed during auger drilling
CP2	-1.7	26/08/2021	Measured in Standpipe
CW2	0.55	26/08/2021	Measured in Standpipe
CW3	0.7	26/08/2021	Measured in Standpipe
CW5	0.25	26/08/2021	Measured in Standpipe
CW6	0.5	26/08/2021	Measured in Standpipe

Borehole Location	Water RL (m AHD)	Date Measured	Comments
SS2	0	26/08/2021	Measured in Standpipe

It is noted that groundwater levels are transient and may fluctuate over time in response to climatic variations, tides, and anthropogenic influences. It is expected that the groundwater level at this site will be closely related to the tidal water level in Darling Harbour.

7. Laboratory Testing

Laboratory testing on selected samples is currently underway. The results of laboratory testing will be presented in the final revision of this report.

8. Comments

8.1 Geotechnical Model

The interpreted subsurface profile encountered at the borehole locations has been grouped into six geotechnical units. Five geotechnical cross sections (Section A-A', B-B', C-C', D-D' and E-E') showing the interpreted subsurface profile between the borehole locations are shown in Drawings 2 to 5 in Appendix B.

It should be noted that the subsurface profile will likely vary away from and in between the borehole locations due to the high variability observed. The interpreted boundaries are accurate only at the test locations and are indicative only.

UNIT 1: FILL Comprises apparently moderately compacted road base beneath road pavements at the surface, underlain by sands, gravelly sands, silty sands, clayey sands, sandy gravels, and sandy clay uncontrolled fill with building rubble (bricks, concrete fragments, timber, metal) and sandstone gravel and cobbles. The fill generally appeared to be in a loose condition most likely a result of 'end-tipped' placement.

UNIT 2: ESTUARINE / MARINE SEDIMENTS Typically comprised of clays, silty clays and sandy clays interbedded with sands, silty sands and clayey sands. The clayey material is generally very soft to firm, tending towards a firm to stiff consistency with increasing sand content. The sandy material appears generally very loose to loose, apparently becoming medium dense to dense with reduced fines content.

UNIT 3: VL-L SANDSTONE Generally very low and low strength, highly to moderately weathered medium to coarse grained sandstone.

UNIT 4: L-M SANDSTONE	Low and medium strength, slightly to highly weathered, slightly fractured to fractured medium to coarse grained sandstone, with occasional bands of highly weathered very low strength sandstone.
UNIT 5: M-H SANDSTONE	Medium and high strength, slightly weathered and fresh, slightly fractured and unbroken, medium to coarse grained sandstone.
UNIT 6: L-M SILTSTONE:	Dark grey, low to medium strength, slightly weathered to fresh siltstone band and interbedded siltstone and sandstone.

Uncontrolled fill material of varying thickness across the site is underlain by estuarine / marine sediment deposits. The thickness of the fill material retained by the existing sea wall appears to decrease towards the eastern end of the site. It is apparent that some fill material was tipped over the western side of the sea wall in some locations forming part of the Darling Harbour seabed. The thickness of the estuarine sediments appears to be greatest along the western edge of the site (beneath the foreshore deck), with thickness tapering away towards the eastern edge. Near SS1 and SS2, the site is underlain by probable ripped sandstone fill material underlain directly by sandstone bedrock.

The interpreted surface of the top of sandstone bedrock generally dips downwards towards the west towards Darling Harbour, with the shallowest depth to rock encountered along the eastern end of the site (SS1, RL 1.3 m) and the deepest depth to rock at the western edge of the site (W2, RL -18.2 m).

The depth to the top of rock also generally falls towards the centre of the site along a north-south alignment, from RL -6.5 m and RL -11.0 m AHD at the northern (CW4) and the southern (CW5) end of the site respectively, to RL -17.5 m in the centre (CW1).

It is noted that the changes in the rock head elevation are unlikely to be gradual, and sudden changes may occur over relatively short distances due to the presence of buried cliff lines. Further comment on this is provided in Section 8.5.

The main geotechnical issues considered to be relevant to the proposed development are:

- Design and construction of suitable foundations for the large proposed structural loads;
- Excavation support and dewatering for the proposed bulk excavation at the southern end of the site;
- Construction and maintenance of a suitable working platform for use during construction.

Comments on geotechnical design and construction issues are provided in the following sections.

8.2 Excavation Conditions

Bulk excavation will be required to about 6 m depth in the southern part of the site, for the proposed in-ground fire water tank. Excavations will also be required to allow for the construction of slabs on ground, lift pits, rafts, building cores, piles and pile caps. The removal or cutting down of below-ground obstructions such as piles, pile caps and beams from the existing and previous structures on the site may also require localised excavations.

All anticipated excavations will likely encounter filling, and in the case of the bulk excavation, most likely also estuarine / marine sediments near the bottom of the excavation. Excavation of these materials should be readily achievable with conventional hydraulic excavators. It is noted that the presence of large concrete rubble and other debris may slow productivity of excavation through the fill layer, and some allowance should be made for breaking up particularly large debris as necessary to aid excavation.

Groundwater will, most likely, be encountered where excavation extends below or near RL 0.8 m (certainly within the proposed bulk excavation).

8.3 Waste Disposal

All excavated materials will need to be disposed of in accordance with the provisions of the current legislation and guidelines including the Waste Classification Guidelines (DECC, April 2008; updated 2009). This includes filling and natural materials that may be removed from site. Reference should be made to DP's PSI report.

8.4 Excavation Support

Vertical excavations in fill and estuarine / marine soils will not be self-supporting. Temporary batters may be feasible where the groundwater table is not intersected, and should be cut no steeper than 1.5(H):1(V), up to a maximum excavation depth of 4 m. Permanent batters above the water table should be no steeper than 2.5(H):1(V), up to a maximum excavation of 4 m. Where surcharge loads are applied near the crest then flatter batters and geotechnical review will be required.

Shoring support will be required in areas where batters cannot be utilised and areas below the water table. Suitable shoring systems for the site could include trench boxes, sheet piling (depending on the extent and nature of obstructions) and pile walls. Permanent retention systems appropriate for the high water table and variable filling include secant piled walls or diaphragm walls, and are discussed further in Section 8.6. The selection of a suitable system should consider the likely obstructions in the filling, the soft/loose nature of the underlying sediments, and the need to reduce groundwater inflow/drawdown and impact to potential ASS.

Retaining wall/shoring design should include hydrostatic pressures, lateral earth pressures and any surcharge loads acting behind the walls that can result in additional lateral loading. Cantilevered retaining walls or retaining walls with a single row of props or anchors could be designed on the basis of a triangular earth pressure distribution using the parameters in Table 5. If a limit state approach is adopted for the design of the retaining walls, these values should be appropriately factored in accordance with AS4678-2002 "Earth Retaining Structures". The at-rest coefficient should be used if wall deflections are to be minimised.

Table 5: Material and Strength Parameters for Excavation Support Structures

Material	Bulk Density (kN/m^3)	Coefficient of Active Earth Pressure (K_a)	Coefficient of Earth Pressure at Rest (K_o)
Filling and Marine / Estuarine Sediments	20	0.4	0.6

The preliminary design for lateral earth pressures where multiple rows of anchors or propping are used (i.e. two or more rows) may be based on a trapezoidal earth pressure distribution using the parameters in Table 5. The maximum pressure generally acts over the central 60% of the wall height, reducing to zero at the top and base of the retained soil.

It should be noted that the earth pressure coefficients in Table 3 above are intended for 'effective stress' analysis method using 'drained' Mohr-Coulomb parameters only and are generally suitable for sandy soils or clayey soils with consistencies of firm or greater. Soft clayey soils, in short-term 'undrained' conditions, may exert greater lateral earth pressures upon the retaining walls compared to those assessed using 'effective stress' method. It is therefore recommended that both 'undrained' and 'drained' analyses be carried out to determine the worst case.

Lateral pressures due to surcharge loads from adjacent structures, roads, sloping ground surfaces and construction machinery should be considered. For 'drained' analysis below the water table, hydrostatic pressure acting on the shoring walls should also be included in the design, while at the same time, allowing for a reduction in unit weight due to buoyancy.

In order to adequately restrain the toe of any significant shoring or basement walls, the piles will need to be socketed below the bulk excavation level. Due to the relatively poor strength of the fill and estuarine soils there will be relatively limited passive support provided in these soils and it may be necessary to socket into the underlying rock for deeper excavations below the water table to provide adequate support and reduce inflows. Table 6 outlines the ultimate passive values that may be adopted for shoring design, from at least 1 m below the bulk excavation level.

Table 6: Ultimate Passive Pressures

Material		Ultimate Passive Pressures (kPa)
Fill		K_p = 2.5 (Passive Earth Pressure Coefficient)
Marine / Estuarine Sediments	vs-s clay	25
	f-st clay	100
	vl-l sand	K_p = 2.0
	md-d sand	K_p = 3.5
VL-L Sandstone		1,000
L-M Sandstone		3,000
M-H Sandstone		6,000

It may be necessary to incorporate support using temporary props or anchors until the permanent structure is erected. Further advice should be sought regarding ground anchors if they are proposed. Note, anchors in fill and soft of very loose soils should not be considered as a means of support.

If a more accurate assessment of predicted ground movements at nearby buildings / infrastructure as a result of the proposed excavation is required, then numerical modelling (using commercially available software such as Plaxis 2D) may be required.

8.5 Foundations

To support the large proposed structural loads and reduce the risk of differential settlements, the proposed structures will need to be uniformly supported on deep foundations (piles or barrettes) in good quality sandstone bedrock.

The possibility of foundations bearing on the edge of buried cliff-lines or near-vertical steps in the rock shelf, or 'overhangs' (i.e. caves) dictate that foundations supporting all but lightly loaded structures will likely need to be founded at least several metres into uniform medium to high strength sandstone (Unit 5), particularly where foundations are in proximity to interpreted changes in rock shelf elevation.

Consideration will need to be given to the presence of low to medium strength siltstone bands at depth in the medium to high strength sandstone, and the effect of negative skin friction or 'down-drag' on piles due to consolidation of the soft estuarine / marine sediments.

8.5.1 Foundation Options

Due to the potential for collapse of the filling and marine / estuarine soils below the high groundwater table, appropriate construction methods would include bored piling using casing and / or drilling mud, Continuous Flight Auger (CFA) piling, and slurry supported trench excavation to form diaphragm walls and/or barrettes. Note that, the method(s) chosen will need to be capable of dealing with obstructions in the filling (timber, large concrete rubble, etc.), potential buried boulders ('floaters') at the soil rock interface as well as penetrating into medium and high strength sandstone. It would be advisable to contact a number of specialist piling contractors to discuss the respective methods and combinations thereof.

Bored piling would be appropriate for large diameter piles. Large diameter casing will be required to prevent collapse of the open pile hole below the water table. Casing oscillators may be required to set casing depending on obstructions in the fill.

CFA piling may have the benefit of better production rates than bored piling where pile sizes allow (typically smaller diameter). Piling using CFA techniques should consider penetration into the medium or high strength sandstone, and close monitoring of flight pitch/rotation and speed/penetration rate will be required due to the potential for 'flighting' in the soils, especially when encountering obstructions or bedrock. 'Flighting', also referred to as 'decompression' or 'side-loading', involves the removal of significant amounts of soil overburden from around the augered hole, which can lead to the settlement of existing structures and the general loss of density and strength of the soil profile. This phenomenon typically occurs when the penetration rate of the advancing auger is substantially slowed during drilling of strong rock. Sand and other granular soils are 'drawn in' to the rotating auger and brought to the

surface on the flights of the auger, causing collapse of the soils around the auger/pile. In addition to flighting, concrete pump rates and pressure versus flight withdrawal rates will need to be closely monitored to prevent pile necking in the softer and low cohesion materials and to prevent potential wash-out in higher permeability layers.

Barrettes could replace the larger diameter piles and are well suited for carrying heavy loads especially when combined to form 'T' or 'H' shapes. Barrettes are rectangular piles of typically 2.4 m or 3.6 m length (depending on equipment size) formed in a slurry trench supported excavation up to 1500 mm in width. Barrettes, either rectangular or 'T'/'H' shaped, have several advantages over piles:

- resistance to horizontal stress and to bending moments are greater than for piles of the same cross-sectional area;
- better mobilisation of lateral friction in soil than a circular pile of the same cross-sectional area due to the larger perimeter; and
- due to the flexibility of the shape they have the ability to carry very large loads.

Barrettes are usually excavated in 'panels' which can be excavated up to 1500 mm in width using clam-shells or hydraulic grabs in soils and low strength rock layers, and by rock cutters in medium or better strength rock. Guide walls are required to maintain excavation verticality and stability at the top of the trench.

Barrette construction is slower than piling and requires a considerable amount of plant as the excavations are uncased. The temporary support of the soil in the excavated open trench is achieved using a bentonite slurry that requires silos for storing bentonite before and after mixing in a batching plant. The bentonite is circulated from the batching plant to the trench and back again using grout pumps and de-sanding units, required to clean the recycled bentonite. A number of service cranes are also required for lifting equipment and reinforcement cages and for inserting water stops between each wall panel. In addition, large volumes of high slump concrete are used to form the barrette.

With respect to foundation construction, the following points are noted:

- No major obstructions were found during the current drilling investigation, although building rubble (concrete) and traces of timber were observed, and hence large obstructions may be present across the site which could make excavation difficult in terms of penetrating these materials and maintaining the verticality or alignment of foundation elements. It may be possible to remove obstructions within the upper 4 – 5 m using a large hydraulic excavator or hydraulic grabs. Below this level, however, this approach may not be practical. Deeper obstructions may require the use of oscillators for bored techniques. Large steel sections remnant from the port, such as rail lines, wooden wharf structure or steel columns, would also present challenges during foundation excavation, if present. It may become necessary to incorporate some flexibility in the positioning of foundations, whereby column loads (or similar) can be supported by 'replacement' elements, with a pile cap bridging the obstruction.
- CFA piling is a "blind" piling technique in which cuttings are not progressively returned to the surface (for geotechnical inspection) during the drilling process. Operators usually rely on an increased coverage of subsurface investigations (i.e. bores or CPTs) to confirm founding levels, together with on-board digital monitoring of excavation installation parameters such as the torque and vertical force used during the drilling process. In recognition of this difficulty in performing geotechnical inspections, the 1978 Piling Code (now superseded) for example, advised one borehole to be drilled per ten piles. Although nowadays, digital monitoring of the pile installation process partly

overcomes the need for such comprehensive borehole coverage, the rationale is clear and still has some currency. It is therefore recommended that more conservative end bearing capacities be assumed at this stage with CFA piling techniques, rather than using the very high bearing capacities achievable through limit state design.

Only high-powered CFA piling rigs, with a torque capacity in excess of 20 tonne metres, should be considered for the construction of rock-socketed piles at this site. The piles would need to penetrate into the sandstone bedrock and drill through any high and possibly very high strength bands. Prospective foundation contractors should be invited to inspect the cores to make their own assessment of machine requirements. Also, only skilled foundation contractors with demonstrable experience of successful construction of the respective foundation technique(s) to depths of at least 25 m should be considered.

The use of CFA piling methods in an environment characterized by loose granular soils overlying generally strong rock will be associated with a significant risk of causing 'flighting'.

For Cockle Bay Wharf, the main concerns arising from 'flighting' relate to the risk of causing settlement to existing services and utilities, as well as the potential for reducing the strength and lateral support provided by the soil profile to existing structures. This could include existing culverts and other structures bearing on the soil overburden/filling. Where CFA piling will be undertaken close to existing structures or services/utilities, the advice of the piling contractor should be sought in relation to the risk of 'flighting'.

- The construction of large diameter, rock-socketed bored piles will generally require the use of steel casing down into weathered rock, in order to provide a seal against uncontrolled water/soil ingress. Also, bentonite or polymer mud will likely be required to further support the open pile holes. The base of the pile holes may require a cleaning bucket or even 'air-lifting' techniques to effectively remove debris from the bottom of the piles prior to concrete placement, which will necessarily involve proper tremie pouring techniques, as described in RMS B58/59.

  Screwing or driving steel casing is expected to be very difficult in areas where the existing filling includes boulders, rubble and other obstructions. The advice of the piling contractor should be sought in this regard. Where casing is to be screwed in, the leading edge should be equipped with a cutting shoe with tungsten carbide inserts, so as to aid the advancement of the casing.

- Foundation construction will produce significant amounts of spoil, much of which will be saturated below the groundwater table. This material is likely to negatively affect trafficability and access conditions if not handled and removed in a systematic and tidy manner. The likely presence of acid sulphate soils and deleterious materials within the filling will also have to be dealt with in the appropriate manner.

- Over the designated 'socket length', the sidewalls of excavated bores, diaphragm walls or barrette panels should be clean and free of clay 'smear' or bentonite cake. Also, the sidewalls should meet the minimum roughness category of "R2" (defined as grooves of 1 to 4 mm depth and width greater than 2 mm, at a spacing of 50 mm to 200 mm), or equivalent for diaphragm wall and barrette panels. A 'grooving' or 'roughening' tool may be required to achieve this criterion.

- Integrity testing should be carried out on between 15% and 25% of piles to assess the structural integrity of pile shafts. The results of integrity testing should be used as a 'screening' method to assess if further investigation or testing, such as load testing, is appropriate. It is noted that different length and socket details will require different methods of integrity testing. For example, the 'pulse echo' method of sonic integrity testing as defined in AS2159-2009 is likely to be suitable only for piles of less than about 12-15 m in length, with rock sockets of less than 2 – 3 m. Large diameter,

rock-socketed piles, however, are likely to require cross-hole sonic logging performed from reservation tubes incorporated into the reinforcement. This assessment can also be carried out in diaphragm wall and barrette panels, if required.

8.5.2 Axial Loading

Preliminary design of rock socketed piles, barrettes, or diaphragm walls for axial compression loading may be based on the working stress parameters in Table 7 or the Limit State parameters in Table 8.

Table 7: Working Stress Parameters for Axial Loading

Unit	Allowable End Bearing Pressure (kPa)	Allowable Shaft Adhesion (kPa)
Unit 3: VL-L Sandstone	1,000	75 (50)
Unit 4: L-M Sandstone	3,500	300 (200)
Unit 5: M-H Sandstone	8,000	800 (600)
Unit 6: L-M Siltstone	3,500	150

Notes:

- Allowable bearing pressures assume a minimum embedment of one pile diameter into the relevant bearing stratum
- All shaft adhesion parameters are based on adequately cleaned and roughened sockets of category “R2” or better.
- Bracketed shaft adhesion values represent maximum shaft adhesions values appropriate for CFA piling methods, where the shaft cannot be inspected

Table 8: Limit State Parameters for Axial Loading

Unit	Ultimate End Bearing Pressure (kPa)	Ultimate Shaft Adhesion (kPa)	Elastic Modulus, E_v (MPa)	Static Shear Modulus, G_v (MPa)
Unit 3: VL-L Sandstone	4,000	150 (100)	100 to 200	40 to 80
Unit 4: L-M Sandstone	15,000	800 (600)	700 to 900	250 to 350
Unit 5: M-H Sandstone	80,000	2000 (1500)	1,500 to 3,000	600 to 1,200
Unit 6: L-M Siltstone	15,000	500	400 to 600	150 to 250

Notes:

- Ultimate bearing pressures assume a minimum embedment of one pile diameter into the relevant bearing stratum
- All shaft adhesion parameters are based on adequately cleaned and roughened sockets of category “R2” or better.
- Bracketed shaft adhesion values represent maximum shaft adhesions values appropriate for CFA piling methods, where the shaft cannot be inspected
- Ultimate parameters mobilised at large settlements (>5% of pile diameter / foundation width)
- d = diameter

The shaft adhesion parameters provided in Table 7 and Table 8 may be adopted for axial compression loading. For uplift or tension loading, 70% of the above shaft adhesion parameters may be adopted for design of foundations or large anchors. In addition to traditional sidewall slip / ‘piston pull out’ failure mechanisms, the uplift capacity should be checked for ‘cone pull out’ failure modes. This should be

based on an assumed cone angle of 45° from the mid-height of the bond length considering the submerged / buoyant unit weight of the rock and resistance from the soil overburden above the rock and adopting a factor of safety of 1.1 against cone pull out. Uplift capacity for groups of pile / barrette foundations will need to consider interaction between individual foundations, which will generally lead to a lesser capacity than the sum of the capacity of individual foundations in the group.

The design of rock-socketed foundations is usually governed by settlement criteria and performance (Serviceability Limit State, SLS) rather than the ultimate bearing capacity or Ultimate Limit State, ULS condition. The SLS should be assessed for normal 'static' load cases, using the elastic modulus values given in Table 8. These modulus values are considered appropriate for the anticipated working stress values, or strain expected under serviceability loading. Non-linear effects should be considered depending on the working loads.

It should be noted that the allowable pressures for a working stress approach given in Table 7 are based on a limiting settlement of about 1% of the pile diameter or foundation width.

Where the ultimate bearing pressures are adopted for Limit State Design, a geotechnical strength reduction factor (ϕ_g) should be applied to the Ultimate geotechnical strength of the foundation ($R_{d,ug}$), in accordance with AS2159 – 2009 (Piling – Design and Installation). The ϕ_g value adopted is dependent on the level of confidence in the selected design parameters, design methods and construction/installation methods. The level of site investigation and pile load testing are key inputs in this respect. Given the relatively modest coverage of boreholes over the building footprint and the variability in rock depth, an Individual Risk Rating (IRR) of not less than 3.0 is considered appropriate. This risk rating should be combined with appropriate IRR's for the design and installation of the piles to yield an overall Average Risk Rating (ARR) and basic geotechnical strength reduction factor (ϕ_{gb}). This factor may be increased dependent on the amount of pile load testing employed, to give an ϕ_g value that is greater than ϕ_{gb}.

Pile/barrette load testing will generally be required to support the design and also to demonstrate that the method and standard of construction is suitable for the site conditions. It is expected that testing will primarily involve dynamic load testing (DLT), although static load testing or bi-directional load testing (eg. Osterberg Cell) may be appropriate, particularly where loads exceed that which can be practically undertaken using DLT methods.

The possibility of foundations being located on or near buried cliffs, steps, or overhangs in the rock shelf is such that a comprehensive programme of 'proof' coring will be required, which should be undertaken prior to commencing the excavation of foundations. Where an ultimate end bearing pressure of 30 MPa or greater is adopted, initial allowance should be made for coring all individual foundation or foundation group locations. This requirement may be able to be reduced once the results of initial 'proof' coring becomes available.

Excavation of all deep foundations should be witnessed by an experienced geotechnical professional and a high level of certification, in terms of base cleanliness and sidewall roughness/cleanliness from the contractor is, therefore, warranted for these foundation types. In the case of CFA piles however, geotechnical inspection of cuttings is generally not possible. For this reason, it is important that there is an increased coverage of boreholes (proof coring) with CFA piling.

8.5.3 Lateral Loading

The preliminary design of individual foundations and foundation groups for lateral or moment loadings may be based on elastic analysis methods using the parameters in Table 9.

Due to the potential for liquefaction within the fill and sandy marine soils below the water table, the calculation of lateral resistance due to the soils will have to be carefully considered. Where it is considered reasonable to allow for some contribution to deflection performance from the filling and overburden soils a cautious and conservative approach to the selection of soil modulus parameters for lateral foundation analysis is warranted.

Table 9: Static Serviceability Parameters for Lateral Loading

Unit		Unit Weight, (kN/m^3)	Range of Static Young's Modulus E_h (MPa)	Characteristic Static Young's Modulus, E_h (MPa)	Characteristic Static Shear Modulus, G_h (MPa)	Horizontal Modulus of Subgrade Reaction for pile diameter d, in mm, k_h (kPa/mm)	Lateral Limiting Pressure (kPa)
Unit 1: Variably compacted fill		17	2 to 20	6	2	(2,000 to 10,000) / d	3 x K_p K_p = 2.5
Unit 2: Estuarine / Marine Sediments	vs-s clay	15	1 to 5	2.5	1	(1,000 to 5,000) / d	100
	f-st clay	18	5 to 20	10	4	(5,000 to 20,000) / d	450
	vl-l sand	16	4 to 15	8	3	(4,000 to 15,000) / d	3 x K_p K_p = 2.0
	md-d sand	18	30 to 100	60	23	(30,000 to 100,000) / d	3 x K_p K_p = 3.5
Unit 3: VL-L Sandstone		22	50 to 300	150	55	(50,000 to 300,000) / d	1,000
Unit 4: L-M Sandstone		23	400 to 1500	800	320	(400,000 to 1,500,000) / d	4,000
Unit 5: M-H Sandstone		24	1000 to 3000	2000	830	(1,000,000 to 3,000,000) / d	20,000
Unit 6: L-M Siltstone		22	300 to 800	500	200	(300,000 to 800,000) / d	3,000

Notes:

- For soil, the modulus is valid for a typical foundation working strain (i.e., 1% to 5% strain) and within the elastic stress range; no effect of pile interaction is taken in to account and larger modulus values may be appropriate for small strain circumstances.

- For the rock, modulus values only applicable over linear elastic range with maximum strain of 1% and should only be used when there is no interaction between piles
- The modulus of subgrade reaction values shown in Table 7 are intended for single pile with no pile group effects, for which more sophisticated assessment will need to be carried out using pile group analysis methods.
- The lateral limiting pressures should always be used together with the elastic modulus of subgrade reaction. The limiting pressures define the failure points after which the reaction pressure is no longer increasing with lateral deflections.

The lateral resistance that can be expected from the rock in front of the deep foundations over the first metre should be ignored or significantly reduced, as it is likely to be affected by at least one horizontal bedding plane (i.e. 'release plane'). The weight of the rock is also reduced due to buoyancy, thus affecting the frictional resistance on any bedding planes. It is therefore likely that additional lateral support will be required to assist in resistance of lateral loads, especially in areas where the cliff line / step in the rock head is close to the foundation. A more accurate estimation of lateral capacity can be made following numerical modelling.

The lateral capacity of the rock mass itself can be approximated as a triangular mass of rock with the weight of the rock reduced to account for the buoyancy, and assuming sliding on a horizontal bedding plane with a friction angle of 25°. Each foundation should be assumed to engage a maximum of 3 pile diameters or 3 equivalent widths of rock (i.e. 6 m for a 2 m diameter pile), or less if in close proximity to other piles.

Additional lateral support can be provided by raked foundations, anchors, or a combination of the two. The use of tensioned anchors, however, will require careful consideration as they will introduce additional lateral load, and will increase the vertical loads, shear-forces, and moments in the deep foundations. These anchors, if viable, should be installed through the foundations or pile caps, as close to the rock level as possible.

8.5.4 Seismic Design

In accordance with the Earthquake Loading Standard, AS1170.4 – 2007, the site has been assessed as having a Site Sub-Soil Class of "D_e" (Deep or soft soil site).

Design should consider the risk of liquefaction of loose sandy soils below the water table under dynamic loading. This will be of particular importance if the contribution of these soils to the lateral capacity of foundations is to be relied upon.

8.6 Groundwater

The mean high water level for Sydney is approximately RL +0.5 m AHD. It can be expected that generally groundwater could fluctuate between approximately RL -0.8 and RL +0.8 m AHD during construction. However, the groundwater level could temporarily rise at leasyt 1 to 2 m higher during heavy rainfall events when coupled with a high tide. It would also be prudent to take into consideration future predicted rises in sea levels. Note, the *"Derivation of the NSW Government's sea level rise planning benchmarks – Technical Note"* from the Department of Climate Change and Water NSW suggests projected sea level rises of 40 cm by 2050 and 90 cm by 2100.

The presence of a high groundwater table will mean that the proposed fire water tank excavation may need to be tanked with watertight floors and walls to prevent the inflow of groundwater into the basement

excavations. The inflow into excavation that are not tanked is expected to be high due to the site's proximity to the harbour.

Tanking of the proposed excavation could be achieved with a secant pile or diaphragm cut-off wall to rock combined with a hydrostatic slab.

Secant piled walls are typically constructed using CFA methods, however, verticality can be an issue depending on pile length and obstructions in the filling and whether the auger kicks off-line when encountering floaters or a sloping rockhead that might be expected in cliff line areas. The secant overlap aims to ensure that piles are sealed. If the secant pile wall can be installed with only slight misalignment at the bottom of the wall, a secant pile wall can form a relatively water tight structure with only minor seepage. It may, however, still be necessary to undertake post-grouting (i.e. jet-grouting) or injection works if misalignment does occur because the high groundwater pressures near the base of the excavation will probably mean that it is not feasible to patch any minor gaps in the secant pile wall, should they occur. For this reason, it is essential to specify a construction verticality tolerance of 1 in 75 for CFA piles, as opposed to the 4% specified for CFA piles in AS2159. Even with specifying a 1 in 75 verticality, misalignment using CFA techniques can still occur, resulting in gaps in the wall. To minimise the risk of misalignment, an increased overlap may be possible but this will require an increased pile size or an increased number of piles, with a commensurate increase in cost. Alternatively, Cased Secant Piling (CSP) techniques can provide increased verticality control (1 in 100 to 1 in 150) and significantly reduce the risk of misalignment. The CSP technique uses a double rotary head system advancing the casing just ahead of the auger tip with increased verticality control being achieved by the straighter cutting of the casing.

Diaphragm walls are constructed in panels, typically the same way as barrettes, with similar equipment. Joints between panels are sealed with a waterstop so that a water-tight wall is usually achieved.

8.7 Site Preparation

The following general subgrade preparation measures are recommended for the construction of pavements, filled embankments and working platforms:

- Proof roll the exposed surface using a minimum 10 tonne smooth drum roller in non-vibration mode. The surface 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 heaving materials identified during proof rolling should be removed, or otherwise treated (e.g. with geosynthetics and/or 'ripped sandstone' bridging layers), as directed by the geotechnical engineer;
- Excavated filling on-site may be suitable for re-use as filling on site, from a geotechnical perspective, provided it does not contain peaty clays, excessively silty material, vegetation or deleterious materials (e.g. rubbish, bricks, concrete). Any oversized material (> 100 mm) will inhibit compaction and therefore should also be removed. Reference to the PSI report should be made and an environmental engineer should be consulted as to the waste classification of excavated materials on site and its appropriateness for re-use.
- Moisture conditioning of fill materials proposed for re-use may need to be carried out. If the material is excessively wet, moisture conditioning is likely to involve drying using one of the following methods:

- exposure to sunny and/or windy weather, or
- mixing with drier materials.

Drying methods that are dependent on exposure to the environment are obviously associated with a risk of being affected by wet weather.

Caution will be required when using compaction or other tracked plant around and over existing buried services or nearby structures. In particular, vibratory rollers should only be used after an assessment of the sensitivity of any existing services or structures.

8.7.1 Engineered Fill Construction

Any new filling should be placed in layers of 300 mm maximum loose thickness and compacted to a dry density ratio of between 98% and 102% Standard compaction and with moisture contents maintained within 2% of standard optimum moisture content.

Imported fill material should preferably be free of oversize particles (>100 mm), any deleterious material and be non-saline to slightly-saline, non-dispersive, have a plasticity index of <25% and a California bearing ratio (CBR) of greater than 5%.

Density testing of the filling should be carried out in accordance with AS3798 “Guidelines for Earthworks for Commercial and Residential Developments”.

Drainage measures should be incorporated for all earthworks operations carried out on site, with due regard given to the potential for the erosion of granular materials (e.g. sand and ripped sandstone) from concentrated water flows. Geofabrics should be incorporated in subsoil drainage works, where appropriate, to reduce the potential of water erosion/piping.

8.7.2 Working Platforms

Piling rigs and cranes will need a suitable working platform during construction to reduce the risk of bearing capacity failures or differential settlement, both of which could lead to overturning or toppling of such plant.

The design of piling platforms will be dependent on the maximum applied track pressures (and dimensions) of any piling rigs that will be used. It is expected that large plant will be required for construction of the foundation piles, and piling platforms up to at least 1.0 m thick may be required in areas with loose / soft subgrades, particularly following demolition / removal of hardstands.

Demolished concrete could be crushed down for the purpose of this working platform, but should be well graded with no particles larger than 70 mm. Alternatively, imported material could be used. The working platform should be placed in accordance with the previous advice provided for placement of engineered fill.

The proximity of the groundwater table to the working (platform) surface should be noted. Where the water table is within 2.0 m of the working surface, the bearing capacity of the material could be reduced. Water was typically encountered at or below RL 0.8 m but is likely to be subject to tidal influences. On this basis, provided that the working surface is above RL 2.8, groundwater should not have an effect on

the bearing capacity of the material. Conversely, where the water table is found to be within 2.0 m of the working platform (surface), further geotechnical advice should be sought.

Irrespective of the position of the water table, all platforms will require detailed design. Specific assessment of the additional stresses caused by track loadings on existing culverts or other utilities should be undertaken in conjunction with the structural engineer. Methods of keeping the applied pressures to acceptable levels may include the placement of extra rock fill thicknesses to 'bridge over' the subject structures/services and/or the use of steel road plates to more evenly distribute the applied track pressure.

In areas where piling rigs will operate directly on existing ground slabs or pavements, there will always be a risk that subgrade conditions are different to those assumed for design. For example, if a weak or soft subgrade is present, rather than the 'ripped sandstone' or 'sandy gravel' layer, this could result in the sudden shear or 'punching' failure of the concrete slab, which may result in rig instability. Similar concerns would obviously prevail if there are voids beneath existing ground slabs. For this reason, it will be important that the geotechnical engineer witnesses the materials exposed at all slab/road penetrations carried out for piling, services location or other reasons. Some additional 'probing' may be required in other areas to confirm the subgrade conditions below existing slabs.

Most of the incidents relating to the stability of piling rigs (or cranes) occur due to localised problems and variability such as poorly compacted filling, soft/spongy spots or working too close to batter slopes or excavations. Accordingly, it will be important that the site controller and earthworks contractor are vigilant in inspecting and maintaining the integrity of the piling platform throughout the construction programme.

The suitability of the existing wharf structure for accommodating the piling loads is another consideration to take into account. The wharf will have to be assessed by a suitably qualified structural engineer to confirm that it can handle the high loading from the piling machines.

Finally, mobile crane outrigger pads should be assessed on a case-by-case basis with dynamic cone penetration (DCP) testing and 'proof' rolling carried out for each pad, as necessary.

8.8 Pavements

It is understood that pavements are proposed on the eastern side of the proposed development, along Wheat Road. If settlements cannot be tolerated then new pavements will need to be supported by suspended slabs supported on piles founded on bedrock. If some settlements are acceptable, Preliminary flexible pavement design could be based on a nominal California Bearing Ratio (CBR) of 3-5% for the existing fill.

This CBR value is based on the presumption that the defined layer will be at least 800 mm thick and is well-compacted throughout. Where weaker soils underlie the subgrade materials, a lower, 'composite' overall design CBR value may be appropriate. It would generally be necessary to carry out dynamic cone penetration (DCP) testing and proof rolling to confirm the adequacy of any existing filling to be used as a subgrade surface. Further, the subgrade surface should be compacted to a minimum dry density ratio of 98% Standard or 80% Density Index for clean sand material.

In the case of imported materials, the design CBR value will depend on the nature of the material and the thickness of layer.

As with all pavement areas, the importance of good surface and subsoil drainage (particularly for cohesive soils) cannot be overemphasized. Given the potential for long term settlement of pavements, due to consolidation of the underlying materials, it will be important to incorporate exaggerated cross falls and pipe grades with flexible connections and suitable construction joints. This measure should reduce the potential for future surface ponding of water or flow problems with water service pipelines.

A regular and long-term inspection and maintenance programme should be adopted by the operator of the pavement. The maintenance program should be primarily aimed at limiting the amount of moisture infiltrating to the subgrade (e.g. inspecting drainage lines and repairing as required, maintaining construction joints and sealing or repairing cracks as they develop).

9. Limitations

Douglas Partners (DP) has prepared this report for this project at 241-249 Wheat Road, Sydney in accordance with DP's proposal 200099.P.001.Rev1 dated 11 November 2020 and acceptance received from DPT Operator Pty Ltd and DPPT Operator Pty Ltd. The work was carried out under the CBP Professional Services Agreement (513963472.3). This report is provided for the exclusive use of DPT Operator Pty Ltd and DPPT Operator Pty Ltd for this project only and for the purposes as described in the report. It should not be used by or relied upon for other projects or purposes on the same or other site or by a third party. Any party so relying upon this report beyond its exclusive use and purpose as stated above, and without the express written consent of 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.

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

This report must be read in conjunction with all of the attached and should be kept in its entirety without separation of individual pages or sections. 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.

Douglas Partners Pty Ltd

Appendix A

About This Report

About this Report

Douglas Partners

Introduction

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

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

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

Borehole and Test Pit Logs

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

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

Groundwater

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

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

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

Reports

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

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

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

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

About this Report

Site Anomalies

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

Information for Contractual Purposes

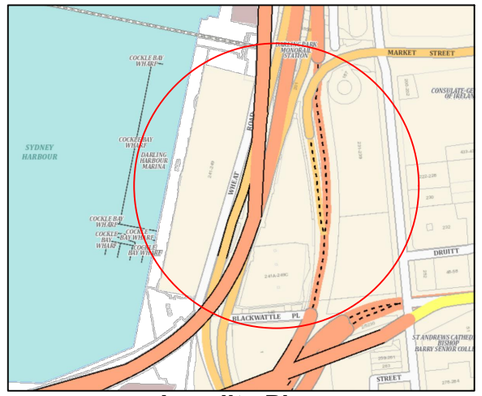
Where information obtained from this report is provided for tendering purposes, it is recommended that all information, including the written report and discussion, be made available. In circumstances where the discussion or comments section is not relevant to the contractual situation, it may be appropriate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

Site Inspection

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

Appendix B

Drawings



Locality Plan

LEGEND

- Approximate Proposed Development Outline
- Approximate Tower Outline
- Approximate Proposed Bulk Excavation Outline
- Borehole Location, Current Investigation
- Borehole Location, Coffey, 1971
- Borehole Location, Coffey, 1985
- P Standpipe Piezometer
- Geological Cross Section

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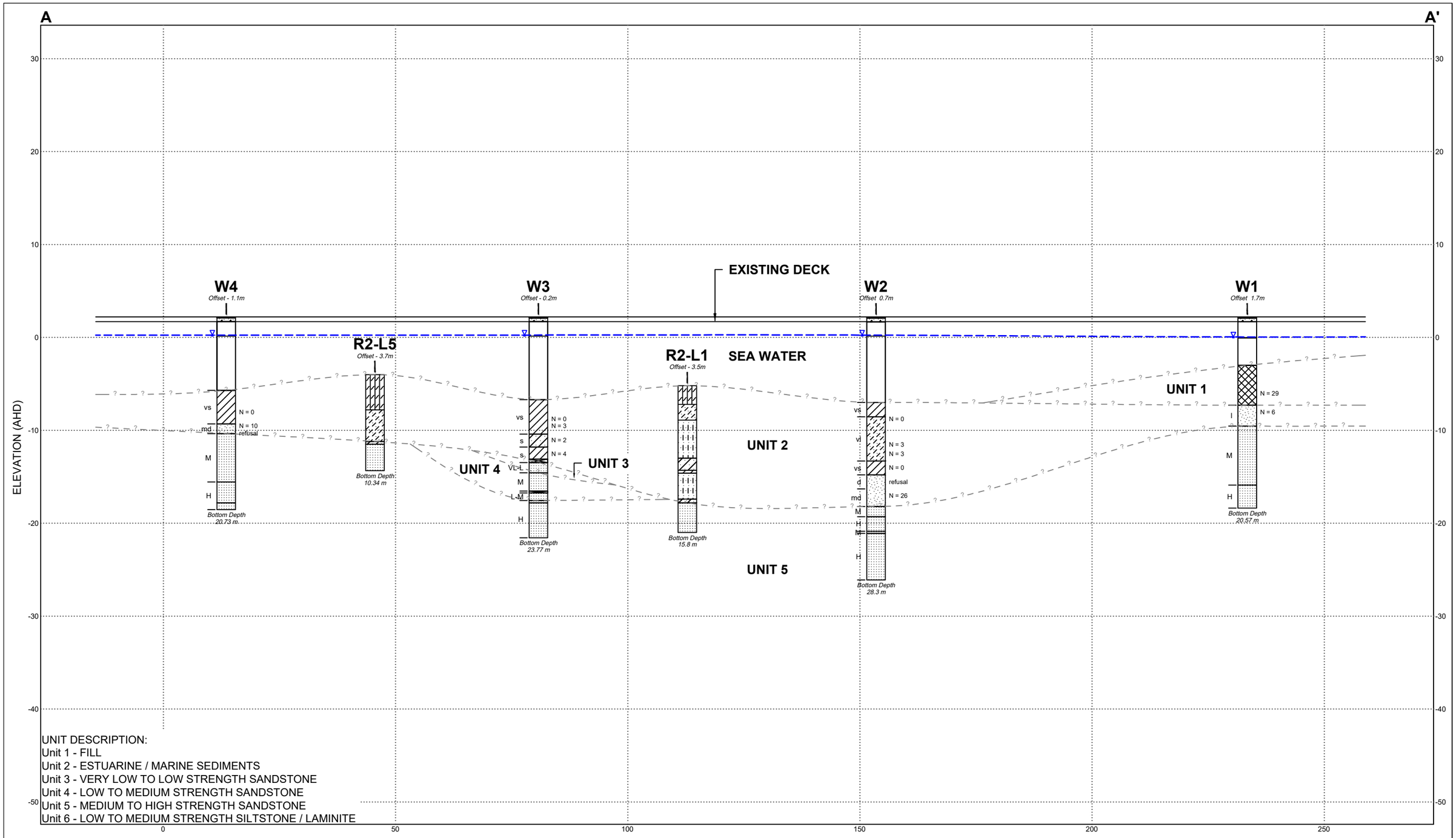
Geotechnics / Environment / Groundwater

CLIENT: DPT Operator Pty Ltd		TITLE: **Test Location Plan**	PROJECT No: 202546.00
OFFICE: Sydney	DRAWN BY: MG	**Cockle Bay Park Redevelopment**	DRAWING No: 1
SCALE: 1:1000 @ A3	DATE: 09.09.2021	**241-249 Wheat Road, Sydney**	REVISION: 1



UNIT DESCRIPTION:
Unit 1 - FILL
Unit 2 - ESTUARINE / MARINE SEDIMENTS
Unit 3 - VERY LOW TO LOW STRENGTH SANDSTONE
Unit 4 - LOW TO MEDIUM STRENGTH SANDSTONE
Unit 5 - MEDIUM TO HIGH STRENGTH SANDSTONE
Unit 6 - LOW TO MEDIUM STRENGTH SILTSTONE / LAMINITE

LEGEND

Core Loss	Concrete	Sand
Clay	Blank Lithology (with border)	Sandstone
Clayey Sand	Filling	Sandy Clay
Clayey Silt	Pavers	Silty Sand

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

ROCK STRENGTH	SOIL CONSISTENCY	SOIL DENSITY
EL - Extremely Low	vs - Very Soft	vl - Very Loose
VL - Very Low	s - Soft	l - Loose
L - Low	f - Firm	md - Medium Dense
M - Medium	st - Stiff	d - Dense
H - High	vst - Very Stiff	vd - Very Dense
VH - Very High	h - Hard	

TESTS / OTHER
N - Standard penetration test value
— ? — — - Interpreted geotechnical boundary
▽ - Water level

0 16
Horizontal Scale (metres)
Vertical Exaggeration = 2.0

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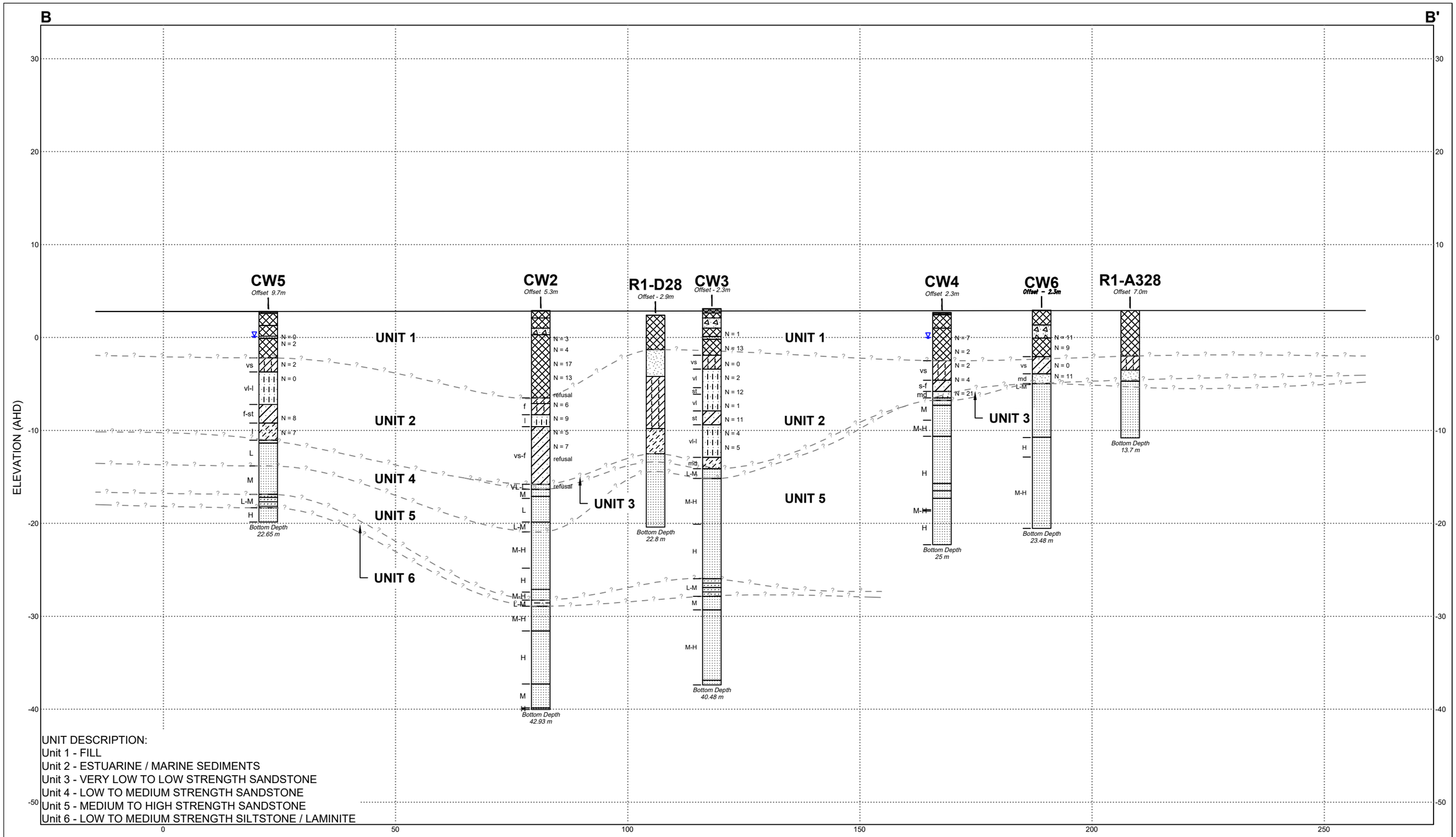
Geotechnics / Environment / Groundwater

CLIENT: DPT Operator Pty Ltd		TITLE: **Cross-Section A-A'**	PROJECT No: 202546.00
OFFICE: Sydney	DRAWN BY: MG	**Cockle Bay Park Redevelopment**	DRAWING No: 2
SCALE: 1:800 (H) 1:400 (V) @ A3	DATE: 03.08.2021	**241-249 Wheat Road, Sydney**	REVISION: 0



UNIT DESCRIPTION:
Unit 1 - FILL
Unit 2 - ESTUARINE / MARINE SEDIMENTS
Unit 3 - VERY LOW TO LOW STRENGTH SANDSTONE
Unit 4 - LOW TO MEDIUM STRENGTH SANDSTONE
Unit 5 - MEDIUM TO HIGH STRENGTH SANDSTONE
Unit 6 - LOW TO MEDIUM STRENGTH SILTSTONE / LAMINITE

LEGEND

- Asphaltic Concrete
- Filling
- Concrete
- Silty Clay
- Silty Sand
- Sandy Clay
- Sandstone
- Siltstone
- Blank Lithology (with border)
- Clayey Sand
- Laminite
- Sand

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

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EL -	Extremely Low	vs -	Very Soft	vl -	Very Loose
VL -	Very Low	s -	Soft	l -	Loose
L -	Low	f -	Firm	md -	Medium Dense
M -	Medium	st -	Stiff	d -	Dense
H -	High	vst -	Very Stiff	vd -	Very Dense
VH -	Very High	h -	Hard		

TESTS / OTHER
- N - Standard penetration test value
- Interpreted geotechnical boundary
- Water level

0 16
Horizontal Scale (metres)
Vertical Exaggeration = 2.0

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Geotechnics / Environment / Groundwater

CLIENT: DPT Operator Pty Ltd		PROJECT No: 202546.00
OFFICE: Sydney	DRAWN BY: MG	DRAWING No: 3
SCALE: 1:800 (H) 1:400 (V) @ A3	DATE: 09.09.2021	REVISION: 1

TITLE: **Cross-Section B-B'**
Cockle Bay Park Redevelopment
241-249 Wheat Road, Sydney

C

C'

EXISTING DECK

APPROXIMATE LOCATION OF EXISTING SHEET PILE WALL - TOE DEPTH UNKNOWN

SEA WATER

UNIT 1

UNIT 2

UNIT 3

UNIT 5

W1
Offset 4.3m
N = 29
N = 6
M
H
Bottom Depth 20.57 m

CW7
Offset 3.9m
N = 4
N = 4
N = 0
vs
L-M
M
M-H
Bottom Depth 16.79 m

R1-A328
Offset 3.9m
refusal
Bottom Depth 13.7 m

SS2
Offset 9.6m
M
VL
H
M-H
H
refusal
Bottom Depth 17.8 m

ELEVATION (AHD)

30 20 10 0 -10 -20 -30 -40 -50

-50 0 50 100 150 200

DISTANCE ALONG PROFILE (m)

UNIT DESCRIPTION:
Unit 1 - FILL
Unit 2 - ESTUARINE / MARINE SEDIMENTS
Unit 3 - VERY LOW TO LOW STRENGTH SANDSTONE
Unit 4 - LOW TO MEDIUM STRENGTH SANDSTONE
Unit 5 - MEDIUM TO HIGH STRENGTH SANDSTONE
Unit 6 - LOW TO MEDIUM STRENGTH SILTSTONE / LAMINITE

LEGEND

- Filling
- Silty Clay
- Sand
- Sandstone
- Pavers
- Concrete
- Blank Lithology (with border)

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

ROCK STRENGTH		SOIL CONSISTENCY		SOIL DENSITY	
EL	Extremely Low	vs	Very Soft	vl	Very Loose
VL	Very Low	s	Soft	l	Loose
L	Low	f	Firm	md	Medium Dense
M	Medium	st	Stiff	d	Dense
H	High	vst	Very Stiff	vd	Very Dense
VH	Very High	h	Hard		

TESTS / OTHER
- N - Standard penetration test value
- — ? — — - Interpreted geotechnical boundary
- ▽ - Water level

0 16
Horizontal Scale (metres)

Vertical Exaggeration = 2.0

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Geotechnics / Environment / Groundwater

CLIENT: DPT Operator Pty Ltd		TITLE: **Cross-Section C-C'**	PROJECT No: 202546.00
OFFICE: Sydney	DRAWN BY: MG	**Cockle Bay Park Redevelopment**	DRAWING No: 4
SCALE: 1:800 (H) 1:400 (V) @ A3	DATE: 09.09.2021	**241-249 Wheat Road, Sydney**	REVISION: 1

D

D'

ELEVATION (AHD)

EXISTING DECK

APPROXIMATE LOCATION OF EXISTING SHEET PILE WALL - TOE DEPTH UNKNOWN

SEA WATER

UNIT 1

UNIT 2

UNIT 3

UNIT 4

UNIT 5

UNIT 6

CW1 Offset 7.2m

CW2 Offset - 13.0m

R1-D28 Offset 11.2m

R1-D40 Offset 10.2m

CP2 Offset - 1.0m

R2-L1 Offset - 8.7m

Bottom Depth 15.8 m

Bottom Depth 22.8 m

Bottom Depth 20.7 m

Bottom Depth 18.55 m

Bottom Depth 42.93 m

Bottom Depth 45 m

DISTANCE ALONG PROFILE (m)

UNIT DESCRIPTION:
Unit 1 - FILL
Unit 2 - ESTUARINE / MARINE SEDIMENTS
Unit 3 - VERY LOW TO LOW STRENGTH SANDSTONE
Unit 4 - LOW TO MEDIUM STRENGTH SANDSTONE
Unit 5 - MEDIUM TO HIGH STRENGTH SANDSTONE
Unit 6 - LOW TO MEDIUM STRENGTH SILTSTONE / LAMINITE

LEGEND

Core Loss
Asphaltic Concrete
Clay
Clayey Sand
Clayey Silt
Concrete
Blank Lithology (with border)
Filling
Sand
Sandstone
Sandy Clay
Siltstone
Silty Clay
Silty Sand

NOTES:
1. Subsurface conditions are accurate at the borehole locations only. Variations in subsurface conditions may occur between borehole locations. Interpreted strata boundaries are approximate and should be used as a guide only.
2. Summary logs only and should be read in conjunction with detailed logs.
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ROCK STRENGTH
EL - Extremely Low
VL - Very Low
L - Low
M - Medium
H - High
VH - Very High

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

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

TESTS / OTHER
N - Standard penetration test value
- Interpreted geotechnical boundary
- Water level

Horizontal Scale (metres) 0 16

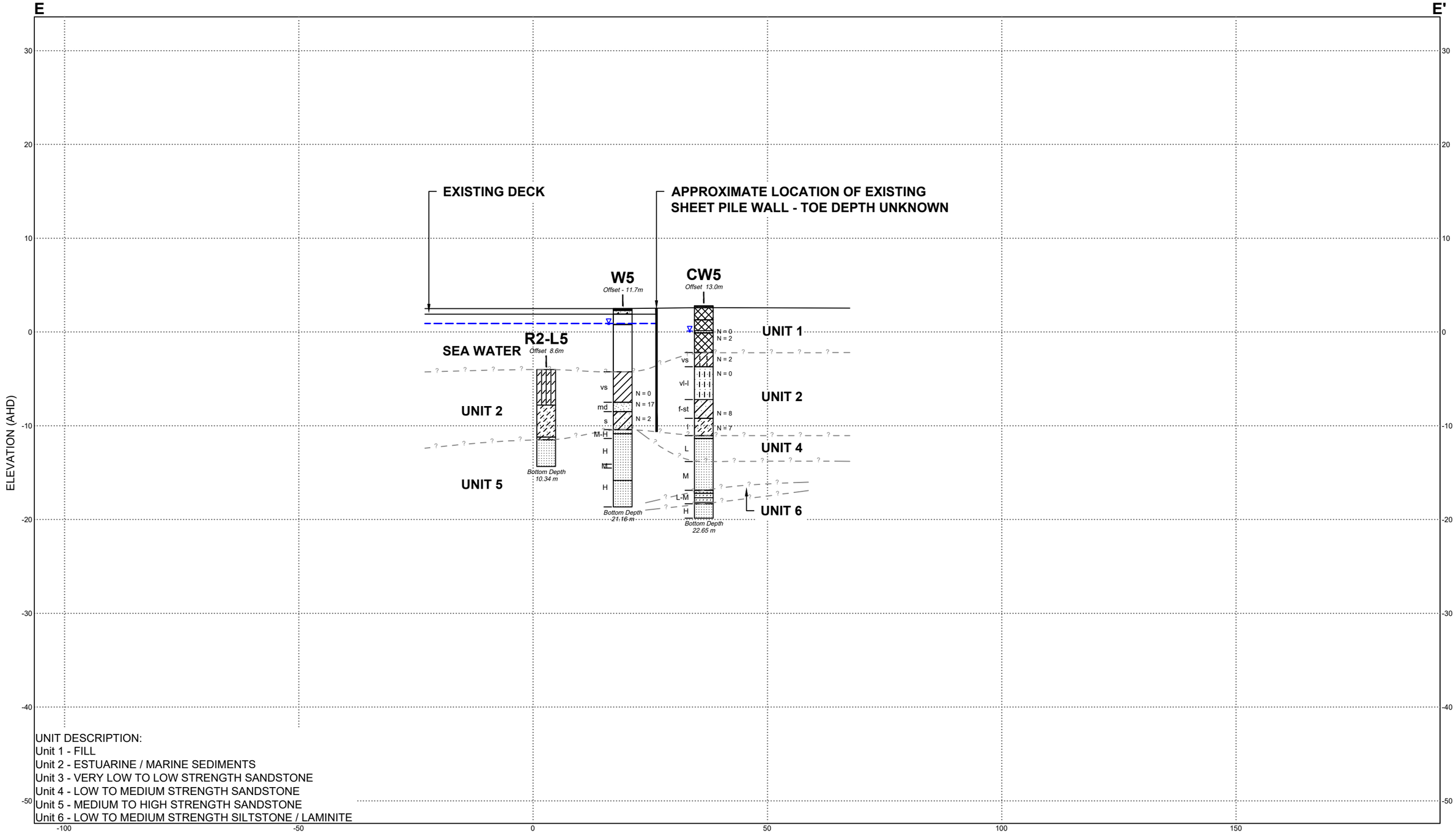
Vertical Exaggeration = 2.0

Douglas Partners
Geotechnics / Environment / Groundwater

CLIENT: DPT Operator Pty Ltd		TITLE: **Cross-Section D-D'**	PROJECT No: 202546.00
OFFICE: Sydney	DRAWN BY: MG	**Cockle Bay Park Redevelopment**	DRAWING No: 5
SCALE: 1:800 (H) 1:400 (V) @ A3	DATE: 09.09.2021	**241-249 Wheat Road, Sydney**	REVISION: 1

E

E'



UNIT DESCRIPTION:
Unit 1 - FILL
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Unit 3 - VERY LOW TO LOW STRENGTH SANDSTONE
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Unit 5 - MEDIUM TO HIGH STRENGTH SANDSTONE
Unit 6 - LOW TO MEDIUM STRENGTH SILTSTONE / LAMINITE

DISTANCE ALONG PROFILE (m)

LEGEND

- Asphaltic Concrete
- Concrete
- Filling
- Blank Lithology (with border)
- Silty Clay
- Silty Sand
- Sandy Clay
- Clayey Sand
- Sandstone
- Laminite
- Clayey Silt
- Pavers
- Clay
- Sand

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

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

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

TESTS / OTHER
N - Standard penetration test value
— ? — — - Interpreted geotechnical boundary
▽ - Water level

Horizontal Scale (metres) 0 16
Vertical Exaggeration = 2.0

Douglas Partners
Geotechnics / Environment / Groundwater

CLIENT: DPT Operator Pty Ltd		TITLE: **Cross-Section E-E'**	PROJECT No: 202546.00
OFFICE: Sydney	DRAWN BY: MG	**Cockle Bay Park Redevelopment**	DRAWING No: 6
SCALE: 1:800 (H) 1:400 (V) @ A3	DATE: 03.08.2021	**241-249 Wheat Road, Sydney**	REVISION: 0

Appendix C

Field Work Results

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

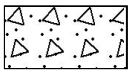
Symbols & Abbreviations

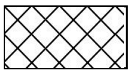
Graphic Symbols for Soil and Rock

General

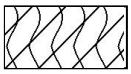

Asphalt

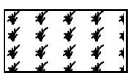

Road base

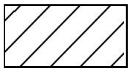

Concrete

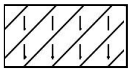

Filling

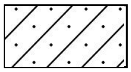
Soils


Topsoil

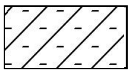

Peat

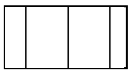

Clay

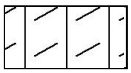

Silty clay

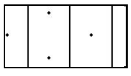

Sandy clay

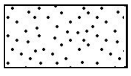

Gravelly clay

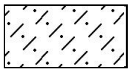

Shaly clay

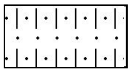

Silt


Clayey silt


Sandy silt

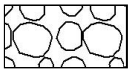

Sand

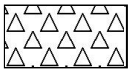

Clayey sand


Silty sand


Gravel

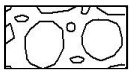

Sandy gravel


Cobbles, boulders

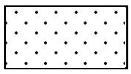

Talus

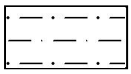
Sedimentary Rocks

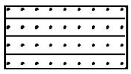

Boulder conglomerate

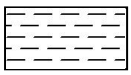

Conglomerate


Conglomeratic sandstone

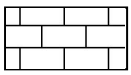

Sandstone


Siltstone

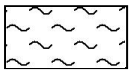

Laminite

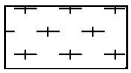

Mudstone, claystone, shale

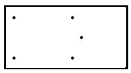

Coal


Limestone

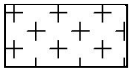
Metamorphic Rocks

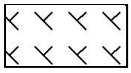

Slate, phyllite, schist

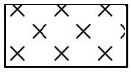

Gneiss

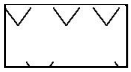

Quartzite

Igneous Rocks


Granite


Dolerite, basalt, andesite


Dacite, epidote


Tuff, breccia


Porphyry

BOREHOLE LOG

CLIENT: DPT Operator Pty Ltd
PROJECT: Cockle Bay Park Redevelopment
LOCATION: 241-249 Wheat Road, Sydney

SURFACE LEVEL: 2.5 AHD
EASTING: 333780
NORTHING: 6250566
DIP/AZIMUTH: 90°/--

BORE No: CP2
PROJECT No: 202546.00
DATE: 20 - 21/8/2021
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
2.5	0.26	CONCRETE: two row of reo (approximately 10mm diameter)										
2	0.5	FILL/Clayey GRAVEL: medium to coarse gravel, dark grey, low plasticity clay, moist							A/E			
1	1	FILL/Gravelly SAND: fine to medium sand, medium to coarse gravel, dark grey, moist							A/E			
1	1.5	FILL/Silty CLAY: medium plasticity, dark grey, with medium to coarse gravel, w~PL							A/E			
0	2.0	Silty CLAY: medium plasticity, pale brown, w>PL, possibly estuarine							A/E			
0	3								A/E			
-1	3.5	Sandy CLAY: low plasticity, dark grey, medium sand, with shell fragments, w>PL, possibly estuarine							A/E			
-1	4					20-08-21			A/E			
-2	4.5	Sandy CLAY: low to medium plasticity, pale brown mottled orange, medium sand, w~PL, possibly estuarine							A/E			
-3	5								A/E			
-4	6											
-5	7											
-6	8											
-7	9											

RIG: Underpinner **DRILLER:** Ground Test **LOGGED:** JY **CASING:** 90mm PVC to 6.0m

TYPE OF BORING: Diacore to 0.26m, hand auger to 0.50m, Spiral flight auger (TC Bit) to 5.0m, Rotary drilling to 14.0m, NMLC to 18.55m

WATER OBSERVATIONS: Free groundwater observed at 3.9m depth whilst augering

REMARKS: Location coordinates are in MGA94 Zone 56. Groundwater well constructed: blank PVC 0.0 to 3.0m, Slotted PVC pipe 3.0 to 18.55m, backfill 0.0 to 2m, bentonite 2 to 2.5m, gravel 2.5 to 18.55m, gatic at surface

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: DPT Operator Pty Ltd
PROJECT: Cockle Bay Park Redevelopment
LOCATION: 241-249 Wheat Road, Sydney

SURFACE LEVEL: 2.5 AHD
EASTING: 333780
NORTHING: 6250566
DIP/AZIMUTH: 90°/--

BORE No: CP2
PROJECT No: 202546.00
DATE: 20 - 21/8/2021
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
-8	11	Sandy CLAY: low to medium plasticity, pale brown mottled orange, medium sand, w~PL, possibly estuarine *(continued)*										
-9	12											
-10	13							Unless otherwise stated, rock is fractured along planar, rough and clean bedding plane defects dipping 0-10°				
-11	14											
	14.0	SANDSTONE: medium to coarse grained, red brown and pale brown, thinly bedded, medium to high strength, moderately weathered, slightly fractured, Hawkesbury Sandstone						14.22m: B 20°, pl, ro, cln 14.4m: B 20°, pl, ro, cly 10mm 14.59m: B 20°, pl, ro, cln 14.92m: B 20°, pl, ro, fe 15.05m, 15.06m: Bx2 0°, pl, ro, fe 15.14m: B 20°, pl, ro, cln 15.18m, 15.20m: Bx2 0°, pl, ro, fe 15.2m: B 0°, pl, ro, fe, cly 25mm 15.3m: Jx2 20°, cu, ro, fe 15.65m, 15.69m: B 0°, un, ro, cbs	C	100	87	PL(A) = 0.5 PL(A) = 1.2
-12	15											
-13	15.65	SANDSTONE: fine to medium grained, pale grey, thinly bedded, high strength, slightly weathered to fresh, unbroken, Hawkesbury Sandstone							C	100	100	PL(A) = 1.5
-14	16	Below 16.7m: with siltstone clasts										
-15	17								C	100	100	PL(A) = 1.7
-16	18	Below 18m: medium to coarse grained										PL(A) = 1.5
	18.55	Bore discontinued at 18.55m - Limit of investigation (equipment limitation)										
-17	19											

RIG: Underpinner **DRILLER:** Ground Test **LOGGED:** JY **CASING:** 90mm PVC to 6.0m

TYPE OF BORING: Diacore to 0.26m, hand auger to 0.50m, Spiral flight auger (TC Bit) to 5.0m, Rotary drilling to 14.0m, NMLC to 18.55m

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REMARKS: Location coordinates are in MGA94 Zone 56. Groundwater well constructed: blank PVC 0.0 to 3.0m, Slotted PVC pipe 3.0 to 18.55m, backfill 0.0 to 2m, bentonite 2 to 2.5m, gravel 2.5 to 18.55m, gatic at surface

SAMPLING & IN SITU TESTING LEGEND

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

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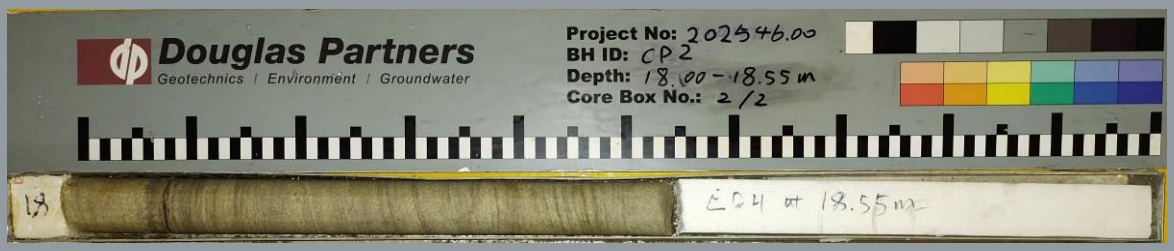
Geotechnics / Environment / Groundwater

BORE: CP2 PROJECT: Cockle Bay Wharf AUGUST 2021

14.00 – 18.00m

BORE: CP2 PROJECT: Cockle Bay Wharf AUGUST 2021



18.00 – 18.55m

BOREHOLE LOG

CLIENT: DPT Operator Pty Ltd
PROJECT: Cockle Bay Park Redevelopment
LOCATION: 241-249 Wheat Road, Sydney

SURFACE LEVEL: 3.3 AHD
EASTING: 333717
NORTHING: 6250585
DIP/AZIMUTH: 90°/--

BORE No: CW1
PROJECT No: 202546.00
DATE: 12 - 14/7/2021
SHEET 1 OF 5

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
3	0.2	CONCRETE: igneous gravel of 20mm nominal diameter										
		VOID										
2	0.93	CONCRETE: igneous gravel of 20mm nominal diameter										
1	1.31	VOID										
0	3.4	SEAWATER				12-07-21						
-1												
-2												
-3												
-4	6.8	FILL/SAND: fine to coarse, brown, with sandstone gravel, cobbles and brick fragments, wet, appears generally in a loose condition							S^			25/140 refusal
-5												
-6									S^			9,25/100 refusal

RIG: Comacchio 205 **DRILLER:** Ground Test **LOGGED:** LHS **CASING:** HW to 10.0m; HQ to 21.0m

TYPE OF BORING: Diacore to 0.2m, NDD to 0.93m, Diacore to 1.31m; Rotary wash bore 6.8m to 20.8m, NMLC Coring to 45.0m

WATER OBSERVATIONS: Water observed at 3.40m at 2:00pm on 12 July 2021

REMARKS: Location coordinates are in MGA94 Zone 56. ^SPT at 8.15m and 8.75m undertaken in HW casing; *Field replicate BD07/120721 taken at 12.0-12.45m depth and field replicate BD08/130721 taken at 20.5-20.95m depth

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: DPT Operator Pty Ltd
PROJECT: Cockle Bay Park Redevelopment
LOCATION: 241-249 Wheat Road, Sydney

SURFACE LEVEL: 3.3 AHD
EASTING: 333717
NORTHING: 6250585
DIP/AZIMUTH: 90°/--

BORE No: CW1
PROJECT No: 202546.00
DATE: 12 - 14/7/2021
SHEET 2 OF 5

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
-7									S			12,13,8 N = 21
	10.5	Sandy CLAY CL: low plasticity, grey, medium to coarse sand, w>PL, stiff, estuarine										
-8	11											
									U_{75}			pp = 190
-9	12								S/E*			4,8,8 N = 16
	12.7	CLAY CI: medium plasticity, grey, with medium to coarse sand, w>PL, firm, estuarine										
-10	13								S/E			1,2,4 N = 6
-11	14											
									S/E			13,11,6 N = 17
-12	15											
		Below 15.5m: grading to grey mottled orange-brown, trace medium to coarse sand, soft										
-13	16								S/E			0,0,3 N = 3
	17.0	SAND SP: medium to coarse, grey mottled orange-brown, trace clay, wet, dense, estuarine										
-14	17	Below 17.5m: grading to pale brown, without clay							S/E			25/140 refusal
-15	18											
	19	Below 19m: grading to medium dense							S/E			2,1,10 N = 11
-16												

RIG: Comacchio 205 **DRILLER:** Ground Test **LOGGED:** LHS **CASING:** HW to 10.0m; HQ to 21.0m

TYPE OF BORING: Diacore to 0.2m, NDD to 0.93m, Diacore to 1.31m; Rotary wash bore 6.8m to 20.8m, NMLC Coring to 45.0m

WATER OBSERVATIONS: Water observed at 3.40m at 2:00pm on 12 July 2021

REMARKS: Location coordinates are in MGA94 Zone 56. ^SPT at 8.15m and 8.75m undertaken in HW casing; *Field replicate BD07/120721 taken at 12.0-12.45m depth and field replicate BD08/130721 taken at 20.5-20.95m depth

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: DPT Operator Pty Ltd
PROJECT: Cockle Bay Park Redevelopment
LOCATION: 241-249 Wheat Road, Sydney

SURFACE LEVEL: 3.3 AHD
EASTING: 333717
NORTHING: 6250585
DIP/AZIMUTH: 90°/--

BORE No: CW1
PROJECT No: 202546.00
DATE: 12 - 14/7/2021
SHEET 3 OF 5

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
-17		SAND SP: medium to coarse, grey mottled orange-brown, trace clay, wet, dense, estuarine *(continued)*						Unless otherwise stated, rock is fractured along rough, planar bedding, dipping 0-10°				
		Below 20.4m: grading to pale brown mottled yellow-brown, possibly residual							S/E*			12,23,27 N = 50
	20.8											
-18	21	SANDSTONE: medium to coarse grained, red and orange-brown, very low to low strength, highly						21.15m: Ds, 60mm				PL(A) = 0.08 PL(A) = 0.2
	21.45	weathered to moderately weathered, slightly fractured, Hawkesbury Sandstone										PL(A) = 0.2 PL(A) = 0.5
-19	22	SANDSTONE: medium to coarse grained, pale grey and orange-brown, distinctly and indistinctly bedded at 5-10°, medium strength, slightly weathered, Hawkesbury Sandstone						21.79m: B10°, pl, cly 3mm 22.11-22.23m: J70°, pl, ro, fe stn 22.32m: B20°, un, ro, cln	C	100	89	PL(A) = 0.5
		Below 22.23m: becoming pale grey, fresh										
	23	Between 22.79-22.81m: carbonaceous laminations						22.79-22.95m: B20° (x2), pl, cly vn 23m: B0°, pl, cly 5mm				PL(A) = 0.4 PL(A) = 0.7
-20	23.3											PL(A) = 1.3
		SANDSTONE: medium to coarse grained, pale grey, distinctly and indistinctly bedded at 5-20°, high strength, fresh, slightly fractured, Hawkesbury Sandstone										PL(A) = 1.1
-21	24							23.9m: B10°, pl, cly vn				
								24.4-24.47m: B10° (x2), pl, cly vn				PL(A) = 1.4
-22	25								C	100	98	
								25.33m: B5°, pl, cly vn				PL(A) = 1.2
-23	26											
												PL(A) = 1.5
-24	27											
								27.63m: B10°, pl, cly vn				PL(A) = 1.5
	28							27.84m: B0°, pl, cly vn	C	100	98	
-25		Between 28.4-29.3m: with siltstone specks and clasts										PL(A) = 1.7
	29											
-26								29.12m: B5°, un, ro, cln 29.19m: B0°, pl, cly vn				PL(A) = 2.2
								29.75m: B10°, pl, cly	C	100	94	

RIG: Comacchio 205 **DRILLER:** Ground Test **LOGGED:** LHS **CASING:** HW to 10.0m; HQ to 21.0m

TYPE OF BORING: Diacore to 0.2m, NDD to 0.93m, Diacore to 1.31m; Rotary wash bore 6.8m to 20.8m, NMLC Coring to 45.0m

WATER OBSERVATIONS: Water observed at 3.40m at 2:00pm on 12 July 2021

REMARKS: Location coordinates are in MGA94 Zone 56. ^SPT at 8.15m and 8.75m undertaken in HW casing; *Field replicate BD07/120721 taken at 12.0-12.45m depth and field replicate BD08/130721 taken at 20.5-20.95m depth

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: DPT Operator Pty Ltd
PROJECT: Cockle Bay Park Redevelopment
LOCATION: 241-249 Wheat Road, Sydney

SURFACE LEVEL: 3.3 AHD
EASTING: 333717
NORTHING: 6250585
DIP/AZIMUTH: 90°/--

BORE No: CW1
PROJECT No: 202546.00
DATE: 12 - 14/7/2021
SHEET 4 OF 5

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
-27		SANDSTONE: medium to coarse grained, pale grey, distinctly and indistinctly bedded at 5-20°, high strength, fresh, slightly fractured, Hawkesbury Sandstone *(continued)*						2mm				
									C	100	94	PL(A) = 1.3
	30.92											PL(A) = 0.2
-28	31	SILTSTONE: dark grey, low strength with 40% clay bands, highly weathered, slightly fractured, Hawkesbury Sandstone						31.18m: Cs, 100mm				
	31.48	Between 31.28-31.36: medium grained sandstone bed						31.37m: Cs, 110mm				
												PL(A) = 1.2
	32	SANDSTONE: medium to coarse grained, pale grey, distinctly and indistinctly bedded 5-20°, high strength, fresh, unbroken, Hawkesbury Sandstone										
-29		Between 32.67-32.74m: with carbonaceous laminations, low strength							C	100	96	PL(A) = 1.4
	33	Between 32.99-34.44m: slightly fractured						32.99m: Cs, 15mm				
-30		Between 33.43-34.5m: with siltstone specks and clasts						33.37m: B5°, pl, cly 3mm				PL(A) = 2
								33.59m: B10°, un, ro, cln				
	34											
-31								34.44m: B0°, un, ro, cln				PL(A) = 1.4
		Between 34.79-34.81m: carbonaceous laminations										
	35	Between 34.85-36.4m: massive							C	100	100	PL(A) = 1.5
-32												
	36											PL(A) = 1.8
-33												
	37											
-34												PL(A) = 1.5
	38											
-35		Between 38.3-39.75m: massive							C	100	100	PL(A) = 1.4
	39							>>				
-36												PL(A) = 1.6

RIG: Comacchio 205 **DRILLER:** Ground Test **LOGGED:** LHS **CASING:** HW to 10.0m; HQ to 21.0m

TYPE OF BORING: Diacore to 0.2m, NDD to 0.93m, Diacore to 1.31m; Rotary wash bore 6.8m to 20.8m, NMLC Coring to 45.0m

WATER OBSERVATIONS: Water observed at 3.40m at 2:00pm on 12 July 2021

REMARKS: Location coordinates are in MGA94 Zone 56. ^SPT at 8.15m and 8.75m undertaken in HW casing; *Field replicate BD07/120721 taken at 12.0-12.45m depth and field replicate BD08/130721 taken at 20.5-20.95m depth

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: DPT Operator Pty Ltd
PROJECT: Cockle Bay Park Redevelopment
LOCATION: 241-249 Wheat Road, Sydney

SURFACE LEVEL: 3.3 AHD
EASTING: 333717
NORTHING: 6250585
DIP/AZIMUTH: 90°/--

BORE No: CW1
PROJECT No: 202546.00
DATE: 12 - 14/7/2021
SHEET 5 OF 5

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
-37		SANDSTONE: medium to coarse grained, pale grey, distinctly and indistinctly bedded 5-20°, high strength, fresh, unbroken, Hawkesbury Sandstone *(continued)*							C	100	100	PL(A) = 1.4
	41											
-38		Between 41.3-41.5m: siltstone breccia										
		Between 41.5-42.1m: with siltstone specks							C	100	100	PL(A) = 1.5
	42											
-39												PL(A) = 1.5
	43											
-40								43.3m: B10°, un, cly vn				PL(A) = 1.4
	44								C	100	100	
-41								44.16m: B10°, pl, cly vn				PL(A) = 1
	45 45.0	Bore discontinued at 45.0m - Limit of investigation										
-42												
	46											
-43												
	47											
-44												
	48											
-45												
	49											
-46												

RIG: Comacchio 205 **DRILLER:** Ground Test **LOGGED:** LHS **CASING:** HW to 10.0m; HQ to 21.0m

TYPE OF BORING: Diacore to 0.2m, NDD to 0.93m, Diacore to 1.31m; Rotary wash bore 6.8m to 20.8m, NMLC Coring to 45.0m

WATER OBSERVATIONS: Water observed at 3.40m at 2:00pm on 12 July 2021

REMARKS: Location coordinates are in MGA94 Zone 56. ^SPT at 8.15m and 8.75m undertaken in HW casing; *Field replicate BD07/120721 taken at 12.0-12.45m depth and field replicate BD08/130721 taken at 20.5-20.95m depth

SAMPLING & IN SITU TESTING LEGEND

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

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BORE: CW1 PROJECT: Cockle Bay Wharf JULY 2021

20.80 – 25.00m

BORE: CW1 PROJECT: Cockle Bay Wharf JULY 2021

25.00 – 30.00m

BORE: CW1 PROJECT: Cockle Bay Wharf JULY 2021

30.00 – 35.00m

BORE: CW1 PROJECT: Cockle Bay Wharf JULY 2021

35.00 – 40.00m

BORE: CW1 PROJECT: Cockle Bay Wharf JULY 2021

40.00 – 45.00m

BOREHOLE LOG

CLIENT: DPT Operator Pty Ltd
PROJECT: Cockle Bay Park Redevelopment
LOCATION: 241-249 Wheat Road, Sydney

SURFACE LEVEL: 2.9 AHD
EASTING: 333732
NORTHING: 6250562
DIP/AZIMUTH: 90°/--

BORE No: CW2
PROJECT No: 202546.00
DATE: 9 - 13/7/2021
SHEET 1 OF 5

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
	0.06	ASPHALTIC CONCRETE							E			
		FILL/Sandy GRAVEL: fine to coarse igneous gravel, grey, fine to coarse sand, moist, appears moderately compacted							E			
	0.8	Below 0.2m: grading to fine to coarse sandstone gravel, brown, with bricks, trace steel bars, concrete rubble, glass fragments and possible charcoal, appears generally in a loose condition							E*			
									E			
	1.9	FILL/Gravelly SAND: fine to coarse sand, brown, with fine to coarse sandstone gravel, trace sandstone cobbles, moist, appears generally in a loose condition										
	2.6	FILL/CONCRETE										
		FILL/Clayey SAND: medium to coarse, brown and pale grey, silty clay, sandstone gravel, cobbles, boulders and brick fragments, wet, appears generally in a very loose to loose condition							S/E			3,2,1 N = 3
									S/E			1,2,2 N = 4
		Below 5.5m: appears generally in a medium dense condition							S/E			9,9,8 N = 17
									S/E			5,6,7 N = 13
		Between 7.6-8.3m: likely concrete rubble										
									S			10 refusal bouncing, no sample recovered
		Between 9.15-9.4m: piece of timber (possible sleeper)										
	9.4	Silty CLAY CL-CI: (continued on next page)										
	10.0											

RIG: Bobcat **DRILLER:** Ground Test **LOGGED:** JS **CASING:** HW to 2.35m; HQ to 20.6m

TYPE OF BORING: Diacore to 0.06m, NDD to 1.9m, Solid flight auger (TC Bit) to 2.35m, Rotary wash boring to 19.24m, NMLC Coring to 42.93m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Location coordinates are in MGA94 Zone 56. *Field replicate BD02/20210630 taken at 0.9-1.0m; Groundwater well constructed: blank PVC 0.0 to 3.1m, Slotted PVC pipe 3.1 to 12.6m, backfill 0.0 to 0.6m, bentonite 0.6 to 2.6m, gravel 2.6 to 12.6m; gatic at surface

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: DPT Operator Pty Ltd
PROJECT: Cockle Bay Park Redevelopment
LOCATION: 241-249 Wheat Road, Sydney

SURFACE LEVEL: 2.9 AHD
EASTING: 333732
NORTHING: 6250562
DIP/AZIMUTH: 90°/--

BORE No: CW2
PROJECT No: 202546.00
DATE: 9 - 13/7/2021
SHEET 2 OF 5

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
-8	11	Silty CLAY CL-CI: low to medium plasticity, dark grey, with roots and rootlets, trace charcoal, w>PL, firm, estuarine							S/E S/E U_{50}			2,3,3 N = 6
-9	11.2 12	Silty SAND SM: medium to coarse, pale grey, with sandy clay beds, trace seashells, wet, loose, estuarine							S			3,4,5 N = 9
-10	12.5 13	Sandy CLAY CL-CI: low to medium plasticity, pale grey, brown and red-brown, with silt, clayey sand and silty clay beds, trace ironstone gravel, w>PL, firm with very soft to soft beds, estuarine							S			2,2,3 N = 5
-11	14											
-12	15								S			5,4,3 N = 7
-13	16								S			25/100 refusal bouncing, no sample recovered
-14	17											
-15	18							Unless otherwise stated, rock is fractured along rough, planar bedding dipping 0-10°, with ironstaining or clay coating				
-16	18.7 19	SANDSTONE: brown, pale grey and red-brown, apparently very low to low strength							S			10/50 refusal bouncing, no sample recovered
-17	19.24 20.0	SANDSTONE: (continued on next page)							C	100	97	PL(A) = 0.5

RIG: Bobcat **DRILLER:** Ground Test **LOGGED:** JS **CASING:** HW to 2.35m; HQ to 20.6m

TYPE OF BORING: Diacore to 0.06m, NDD to 1.9m, Solid flight auger (TC Bit) to 2.35m, Rotary wash boring to 19.24m, NMLC Coring to 42.93m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Location coordinates are in MGA94 Zone 56. *Field replicate BD02/20210630 taken at 0.9-1.0m; Groundwater well constructed: blank PVC 0.0 to 3.1m, Slotted PVC pipe 3.1 to 12.6m, backfill 0.0 to 0.6m, bentonite 0.6 to 2.6m, gravel 2.6 to 12.6m; gatic at surface

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: DPT Operator Pty Ltd
PROJECT: Cockle Bay Park Redevelopment
LOCATION: 241-249 Wheat Road, Sydney

SURFACE LEVEL: 2.9 AHD
EASTING: 333732
NORTHING: 6250562
DIP/AZIMUTH: 90°/--

BORE No: CW2
PROJECT No: 202546.00
DATE: 9 - 13/7/2021
SHEET 3 OF 5

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
-18	21	SANDSTONE: medium to coarse grained, brown, pale grey and red-brown, distinctly and indistinctly bedded at 0-10°, low to medium strength with very low strength bands, highly weathered to slightly weathered, fractured and slightly fractured, Hawkesbury Sandstone	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	20.54m: J60°, ir, ro, cln (healed) 20.57m: J40°, ir, ro, cly vn 20.64m: Ds, 30mm 21.05m: J50°, ir, ro, cly vn 21.15m: Ds, 10mm 21.32m: Ds, 10mm 21.44-21.46m: J50°(x2), pl, ro, cly co 21.52m: B0-10°, un, ro, cly co 5mm 21.62-21.76m: J70°, ir, ro, cly co 21.96-22.05m: J50°, pl, ro, cly vn 22.07-22.12m: J80°, ir, ro, cln 22.10-22.17m: J50°, pl, ro, cly vn 22.38m: J50°, pl, ro, cly vn 23.61m: Ds, 10mm 23.83m: J20°, pl ro, cly co 24.15m: J20°, pl, ro, cly vn 25.11m: B10°, pl, ro, cly co 5mm	C	100	97	PL(A) = 0.2
-19	22								C	100	25	PL(A) = 0.2
-20	22.75 23	SANDSTONE: medium to coarse grained, pale grey, distinctly and indistinctly bedded at 0-10°, 1-5% siltstone and carbonaceous laminations, low to medium strength, slightly weathered, slightly fractured, Hawkesbury Sandstone										PL(A) = 0.4
-21	24	Below 23.83m: medium to high strength, fresh										PL(A) = 0.6
-22	25								C	100	88	PL(A) = 1.1
-23	26											PL(A) = 0.9
-24	27											PL(A) = 1
-25	28								C	100	100	PL(A) = 1.3
-26	29											PL(A) = 1.2
-27	30.0	Between 29.45-29.51m: 25% siltstone clasts							C	100	98	PL(A) = 1.5

RIG: Bobcat **DRILLER:** Ground Test **LOGGED:** JS **CASING:** HW to 2.35m; HQ to 20.6m

TYPE OF BORING: Diacore to 0.06m, NDD to 1.9m, Solid flight auger (TC Bit) to 2.35m, Rotary wash boring to 19.24m, NMLC Coring to 42.93m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Location coordinates are in MGA94 Zone 56. *Field replicate BD02/20210630 taken at 0.9-1.0m; Groundwater well constructed: blank PVC 0.0 to 3.1m, Slotted PVC pipe 3.1 to 12.6m, backfill 0.0 to 0.6m, bentonite 0.6 to 2.6m, gravel 2.6 to 12.6m; gatic at surface

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: DPT Operator Pty Ltd
PROJECT: Cockle Bay Park Redevelopment
LOCATION: 241-249 Wheat Road, Sydney

SURFACE LEVEL: 2.9 AHD
EASTING: 333732
NORTHING: 6250562
DIP/AZIMUTH: 90°/--

BORE No: CW2
PROJECT No: 202546.00
DATE: 9 - 13/7/2021
SHEET 4 OF 5

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
-28	31	SANDSTONE: (continued)							C	100	98	PL(A) = 0.9
	31.15	SILTSTONE: dark grey, thinly laminated at 0-10°, low strength, fresh, slightly fractured, Hawkesbury Sandstone						31.45m: J40°, pl, ro, cly vn				PL(A) = 0.2 PL(A) = 0.6
-29	31.82	Between 31.59-31.69m: sandstone bed, pale grey, medium strength						31.81m: Ds, 10mm				
	32	SANDSTONE: medium to coarse grained, pale grey, distinctly and indistinctly bedded at 0-10°, 1-5% siltstone laminations and clasts, medium to high strength, fresh, slightly fractured, Hawkesbury Sandstone										PL(A) = 1
-30	33								C	100	99	
		Between 33.45-33.47m: siltstone clasts										
-31	34							33.99-34.06m: B0-5°(x5), pl, ro, cly co				PL(A) = 0.8
	34.47	Between 34.43-34.47m: siltstone clasts										
-32	35	SANDSTONE: medium to coarse grained, pale grey, indistinctly bedded, 5% siltstone flecks, high strength, fresh, unbroken, Hawkesbury Sandstone							C	100	97	PL(A) = 1.3 (UCS Sample 35.61-35.95m)
-33	36											PL(A) = 1.3
-34	37											PL(A) = 1.3
-35	38											PL(A) = 1.2
									C	100	100	
-36	39											PL(A) = 1.3
-37												

RIG: Bobcat **DRILLER:** Ground Test **LOGGED:** JS **CASING:** HW to 2.35m; HQ to 20.6m

TYPE OF BORING: Diacore to 0.06m, NDD to 1.9m, Solid flight auger (TC Bit) to 2.35m, Rotary wash boring to 19.24m, NMLC Coring to 42.93m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Location coordinates are in MGA94 Zone 56. *Field replicate BD02/20210630 taken at 0.9-1.0m; Groundwater well constructed: blank PVC 0.0 to 3.1m, Slotted PVC pipe 3.1 to 12.6m, backfill 0.0 to 0.6m, bentonite 0.6 to 2.6m, gravel 2.6 to 12.6m; gatic at surface

SAMPLING & IN SITU TESTING LEGEND

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

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BOREHOLE LOG

CLIENT: DPT Operator Pty Ltd
PROJECT: Cockle Bay Park Redevelopment
LOCATION: 241-249 Wheat Road, Sydney

SURFACE LEVEL: 2.9 AHD
EASTING: 333732
NORTHING: 6250562
DIP/AZIMUTH: 90°/--

BORE No: CW2
PROJECT No: 202546.00
DATE: 9 - 13/7/2021
SHEET 5 OF 5

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
-38	40.19	SANDSTONE: medium to coarse grained, pale grey, distinctly and indistinctly bedded at 0-10°, 5-10% dark grey siltstone laminations, medium strength, fresh, slightly fractured, Hawkesbury Sandstone						40.21m: Ds, 10mm	C	100	99	PL(A) = 1.4
	41	Between 40.99-41.33m: 20% siltstone clasts, up to 30mm										PL(A) = 0.7
-39	42	Between 42.33-42.38m: 10% siltstone clasts							C	100	99	PL(A) = 0.6
-40	42.76	SANDSTONE: fine to medium grained, grey, 10% dark grey siltstone laminations, high strength, fresh, slightly fractured, Hawkesbury Sandstone										PL(A) = 1.5
	42.93	Bore discontinued at 42.93m - Limit of investigation										
-41	43											
-42	44											
-43	45											
-44	46											
-45	47											
-46	48											
-47	49											

RIG: Bobcat **DRILLER:** Ground Test **LOGGED:** JS **CASING:** HW to 2.35m; HQ to 20.6m

TYPE OF BORING: Diacore to 0.06m, NDD to 1.9m, Solid flight auger (TC Bit) to 2.35m, Rotary wash boring to 19.24m, NMLC Coring to 42.93m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Location coordinates are in MGA94 Zone 56. *Field replicate BD02/20210630 taken at 0.9-1.0m; Groundwater well constructed: blank PVC 0.0 to 3.1m, Slotted PVC pipe 3.1 to 12.6m, backfill 0.0 to 0.6m, bentonite 0.6 to 2.6m, gravel 2.6 to 12.6m; gatic at surface

SAMPLING & IN SITU TESTING LEGEND

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

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BORE: CW2 PROJECT: Cockle Bay Wharf JULY 2021

19.24 – 24.00m

BORE: CW2 PROJECT: Cockle Bay Wharf JULY 2021

24.00 – 29.00m

BORE: CW2 PROJECT: Cockle Bay Wharf JULY 2021

29.00 – 34.00m

BORE: CW2 PROJECT: Cockle Bay Wharf JULY 2021

34.00 – 39.00m

BORE: CW2 PROJECT: Cockle Bay Wharf JULY 2021

39.00 – 42.93m

BOREHOLE LOG

CLIENT: DPT Operator Pty Ltd
PROJECT: Cockle Bay Park Redevelopment
LOCATION: 241-249 Wheat Road, Sydney

SURFACE LEVEL: 3.1 AHD
EASTING: 333747
NORTHING: 6250596
DIP/AZIMUTH: 90°/--

BORE No: CW3
PROJECT No: 202546.00
DATE: 8/7 - 11/8/2021
SHEET 1 OF 5

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
3	0.05	ASPHALTIC CONCRETE							E			
	0.45	FILL/Sandy GRAVEL: fine to coarse igneous gravel, dark grey, fine to coarse sand, possibly cement stablised, moist							E			
2	1.0	FILL/Silty Sandy GRAVEL: fine to coarse igneous and sandstone gravel, brown, fine to coarse sand, with sandstone cobbles, asphalt and concrete fragments, moist, appears loose							E			
		CONCRETE										
1	2.1	FILL/SAND: fine to medium, brown and pale grey, with fine gravel and shell fragments, generally very loose							S			1,0,1 N = 1 No sample recovered
0	3.0	CONCRETE										
	3.3	FILL/SAND: fine to coarse, brown and grey, with sandy clay, fine to medium gravel, concrete rubble, generally medium dense							S/E			6,5,8 N = 13
-1	5.0	Silty CLAY CL-CI: low to medium plasticity, grey, with fine sand, shell fragments, rootlets, w>PL, very soft, estuarine							S/E*			0,0,0 N = 0
-2	6.5	Silty SAND SW: fine to coarse, grey and brown, with pale grey sandy clay and shell fragments, wet, very loose, estuarine							U_{75}			No sample recovered
-3									S			2,2,0 N = 2
-4		Between 8.5-9.2m: sandy clay bed, pale grey, w>PL, stiff							S			3,6,6 N = 12
-5												
-6												

RIG: Bobcat **DRILLER:** Ground Test **LOGGED:** JS **CASING:** HW to 1.0m, HQ to 17.8m

TYPE OF BORING: NDD to 1.0m, Rotary wash boring to 17.22m, NMLC Coring to 40.48m

WATER OBSERVATIONS: No free ground water observed whilst augering

REMARKS: Location coordinates are in MGA94 Zone 56. *BD1/09.08.21 and PFAS taken at 5.7-6.15m depth
Standpipe installed to 15.0m, bentonite seal 0.5-2.5m, gravel pack 2.5-15.0m, screen length 3.0-15.0m

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: DPT Operator Pty Ltd
PROJECT: Cockle Bay Park Redevelopment
LOCATION: 241-249 Wheat Road, Sydney

SURFACE LEVEL: 3.1 AHD
EASTING: 333747
NORTHING: 6250596
DIP/AZIMUTH: 90°/--

BORE No: CW3
PROJECT No: 202546.00
DATE: 8/7 - 11/8/2021
SHEET 2 OF 5

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
-7		Silty SAND SW: fine to coarse, grey and brown, with pale grey sandy clay and shell fragments, wet, very loose, estuarine *(continued)*										
									S			3,1,0 N = 1 No sample recovered
-8	11 11.0	Sandy CLAY CL-CI: low to medium plasticity, pale grey, brown and red-brown, w>PL, stiff, estuarine										
-9	12								S			3,6,5 N = 11
	12.5	Silty SAND SW: fine to coarse, brown and pale grey, wet, very loose to loose, estuarine										
-10	13								S			4,2,2 N = 4
-11	14											
-12	15								S			7,4,1 N = 5
-13	16 16.0	Clayey SAND SW: medium to coarse, brown and red-brown, with very low strength sandstone bands, medium dense, residual						Unless otherwise stated, rock is fractured along rough planar bedding dipping at 0-10° with ironstaining or clay coating				
-14	17											
	17.22	SANDSTONE: medium to coarse grained, brown and red-brown, low then medium strength, moderately weathered, slightly fractured, Hawkesbury Sandstone						17.71m: Ds, 20mm	C	100	65	PL(A) = 0.1
-15	18											PL(A) = 0.6
	18.26	SANDSTONE: medium to coarse grained, pale grey, distinctly and indistinctly bedded at 0-10°, medium to high then high strength, fresh, slightly fractured, Hawkesbury Sandstone							C	100	99	PL(A) = 0.9
-16	19											PL(A) = 1

RIG: Bobcat **DRILLER:** Ground Test **LOGGED:** JS **CASING:** HW to 1.0m, HQ to 17.8m

TYPE OF BORING: NDD to 1.0m, Rotary wash boring to 17.22m, NMLC Coring to 40.48m

WATER OBSERVATIONS: No free ground water observed whilst augering

REMARKS: Location coordinates are in MGA94 Zone 56. *BD1/09.08.21 and PFAS taken at 5.7-6.15m depth
Standpipe installed to 15.0m, bentonite seal 0.5-2.5m, gravel pack 2.5-15.0m, screen length 3.0-15.0m

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: DPT Operator Pty Ltd
PROJECT: Cockle Bay Park Redevelopment
LOCATION: 241-249 Wheat Road, Sydney

SURFACE LEVEL: 3.1 AHD
EASTING: 333747
NORTHING: 6250596
DIP/AZIMUTH: 90°/--

BORE No: CW3
PROJECT No: 202546.00
DATE: 8/7 - 11/8/2021
SHEET 3 OF 5

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
-17		SANDSTONE: medium to coarse grained, pale grey, distinctly and indistinctly bedded at 0-10°, medium to high then high strength, fresh, slightly fractured, Hawkesbury Sandstone *(continued)*							C	100	99	
-18	21								C	100	100	PL(A) = 0.9
		Between 21.80-22.00m: fine to medium grained										PL(A) = 1.1
-19	22							22.12m: Ds, 5mm				
-20	23								C	100	99	PL(A) = 0.9
-21	24											PL(A) = 1.3
-22	25											PL(A) = 1.7
-23	26								C	100	100	PL(A) = 1.1
		Between 26.30-26.36m: 20% siltstone clasts, up to 15mm										PL(A) = 1.4
-24	27											
-25	28							27.87m: B15°, ir, ro, cly co				PL(A) = 1.8
-26	29								C	100	65	PL(A) = 1.3
	29.05	INTERBEDDED SANDSTONE AND SILTSTONE: *refer to following page*						29.31-29.41m: J30°-50°(x3), pl, ro, cly vn				PL(A) = 0.4
	30.0											

RIG: Bobcat **DRILLER:** Ground Test **LOGGED:** JS **CASING:** HW to 1.0m, HQ to 17.8m

TYPE OF BORING: NDD to 1.0m, Rotary wash boring to 17.22m, NMLC Coring to 40.48m

WATER OBSERVATIONS: No free ground water observed whilst augering

REMARKS: Location coordinates are in MGA94 Zone 56. *BD1/09.08.21 and PFAS taken at 5.7-6.15m depth
Standpipe installed to 15.0m, bentonite seal 0.5-2.5m, gravel pack 2.5-15.0m, screen length 3.0-15.0m

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: DPT Operator Pty Ltd
PROJECT: Cockle Bay Park Redevelopment
LOCATION: 241-249 Wheat Road, Sydney

SURFACE LEVEL: 3.1 AHD
EASTING: 333747
NORTHING: 6250596
DIP/AZIMUTH: 90°/--

BORE No: CW3
PROJECT No: 202546.00
DATE: 8/7 - 11/8/2021
SHEET 4 OF 5

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
-27		INTERBEDDED SANDSTONE AND SILTSTONE: medium to coarse grained, pale grey sandstone, interbedded with 30-40% dark grey siltstone beds up to 200mm thick, medium strength, fresh, fractured to slightly fractured, Hawkesbury Sandstone						29.95m: Ds, 10mm 30.01-30.30m: J70°-80°, pl, ro, cln 30.09m: Ds, 10mm 30.12m: J70°-80°(x2), ir, ro, cln 30.33m: Ds, 5mm 30.36m: Ds, 80mm	C	100	65	
-28	31 30.95											PL(A) = 0.7
		SANDSTONE: medium to coarse grained, pale grey, distinctly and indistinctly bedded at 0-10°, 10% fine grained beds up to 80mm thick, medium to high strength, fresh, slightly fractured, Hawkesbury Sandstone										
-29	32											PL(A) = 0.9
	32.4	SANDSTONE: medium to coarse grained, pale grey, distinctly and indistinctly bedded at 0-10°, medium to high and high strength, fresh, slightly fractured to unbroken, Hawkesbury Sandstone						32.03-32.08m: B5°-10°(x3), pl, ro, cly co	C	100	94	
-30	33											PL(A) = 1.3
												PL(A) = 1
-31	34	Between 33.79-34.80m: 20% siltstone clasts up to 20mm						33.83m: Ds, 5mm				
-32	35											PL(A) = 1.3
									C	100	100	
-33	36											PL(A) = 1.1
-34	37								C	100	100	PL(A) = 1.2
									C	100	100	
-35	38											PL(A) = 1.1
-36	39	Between 39.60-39.65m: 50% siltstone clasts							C	100	100	PL(A) = 0.9
	39.98	39.7-39.98m: interbedded siltstone and sandstone										PL(A) = 0.9

RIG: Bobcat **DRILLER:** Ground Test **LOGGED:** JS **CASING:** HW to 1.0m, HQ to 17.8m

TYPE OF BORING: NDD to 1.0m, Rotary wash boring to 17.22m, NMLC Coring to 40.48m

WATER OBSERVATIONS: No free ground water observed whilst augering

REMARKS: Location coordinates are in MGA94 Zone 56. *BD1/09.08.21 and PFAS taken at 5.7-6.15m depth
Standpipe installed to 15.0m, bentonite seal 0.5-2.5m, gravel pack 2.5-15.0m, screen length 3.0-15.0m

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: DPT Operator Pty Ltd
PROJECT: Cockle Bay Park Redevelopment
LOCATION: 241-249 Wheat Road, Sydney

SURFACE LEVEL: 3.1 AHD
EASTING: 333747
NORTHING: 6250596
DIP/AZIMUTH: 90°/--

BORE No: CW3
PROJECT No: 202546.00
DATE: 8/7 - 11/8/2021
SHEET 5 OF 5

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
-37		SANDSTONE: medium grained, pale grey, indistinctly bedded, 10% siltstone flecks, high strength, fresh, slightly fractred to unbroken, Hawkesbury Sandstone *(continued)*							C	100	100	PL(A) = 1.3
	40.48	Bore discontinued at 40.48m - Limit of investigation										
-38	41											
-39	42											
-40	43											
-41	44											
-42	45											
-43	46											
-44	47											
-45	48											
-46	49											

RIG: Bobcat **DRILLER:** Ground Test **LOGGED:** JS **CASING:** HW to 1.0m, HQ to 17.8m

TYPE OF BORING: NDD to 1.0m, Rotary wash boring to 17.22m, NMLC Coring to 40.48m

WATER OBSERVATIONS: No free ground water observed whilst augering

REMARKS: Location coordinates are in MGA94 Zone 56. *BD1/09.08.21 and PFAS taken at 5.7-6.15m depth
Standpipe installed to 15.0m, bentonite seal 0.5-2.5m, gravel pack 2.5-15.0m, screen length 3.0-15.0m

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: CW3 PROJECT: Cockle Bay Wharf AUGUST 2021

17.22 – 21.00m

BORE: CW3 PROJECT: Cockle Bay Wharf AUGUST 2021

21.00 – 26.00m

BORE: CW3 PROJECT: Cockle Bay Wharf AUGUST 2021

26.00 – 31.00m

BORE: CW3 PROJECT: Cockle Bay Wharf AUGUST 2021

31.00 – 36.00m

BORE: CW3 PROJECT: Cockle Bay Wharf AUGUST 2021

36.00 – 40.48m

BOREHOLE LOG

CLIENT: DPT Operator Pty Ltd
PROJECT: Cockle Bay Park Redevelopment
LOCATION: 241-249 Wheat Road, Sydney

SURFACE LEVEL: 2.7 AHD
EASTING: 333753
NORTHING: 6250645
DIP/AZIMUTH: 90°/--

BORE No: CW4
PROJECT No: 202546.00
DATE: 14 - 15/7/2021
SHEET 1 OF 3

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
	0.06	ASPHALTIC CONCRETE							E			
	0.2	FILL/Sandy GRAVEL: fine to coarse igneous gravel, grey, fine to coarse sand, dry, appears moderately compacted							E			
	0.25	CONCRETE										
	1	FILL/Gravelly SAND: fine to coarse sand, brown, fine to coarse igneous and sandstone gravel, cobbles and brick fragments, moist, appears generally in a loose condition							E			
	1.7	Below 1.0m: with ceramic fragments, trace ash and charcoal							E			
	2	FILL/Clayey SAND: medium to coarse, grey and brown, with sandstone and igneous gravel and cobbles, building rubble (concrete and brick), moist, appears generally in a loose condition							A/E*			
						14-07-21			S/E			3,4,3 N = 7
	4	Between 4.4-5.8m: likely concrete rubble							S/E			0,1,1 N = 2 no sample recovered
	5	Between 5.0-5.2m: piece of timber (possible sleeper)										
	5.2	Silty CLAY CL-CI: low to medium plasticity, grey, with fine to medium sand, fine seashells, w>PL, very soft, estuarine							S/E			0,1,1 N = 2
	6								U_{75}			no sample recovered
	7								S			2,2,2 N = 4
	7.3	Sandy CLAY CL-CI: low to medium plasticity, brown, pale grey and red-brown, w>PL, soft to firm, estuarine										
	8											
	8.5	Silty SAND SM: medium to coarse, pale grey and brown, with clayey sand, wet, medium dense, alluvial						Unless otherwise stated, rock is fractured along rough, planar bedding dipping 0-10°, with ironstaining or clay coating	S			4,9,12 N = 21
	9											
	9.2	SANDSTONE: brown, apparently low to medium strength										
	9.46	SANDSTONE: (continued on next page)							C	100	96	PL(A) = 0.7
	10.0											

RIG: Bobcat **DRILLER:** Ground Test **LOGGED:** JS **CASING:** HW to 4.5m; HQ to 9.46m

TYPE OF BORING: Diacore to 0.06m, NDD to 1.5m, Solid flight auger (TC Bit) to 4.5m, Rotary wash boring to 9.46m, NMLC Coring to 25.0m

WATER OBSERVATIONS: Free groundwater observed at 2.8m depth whilst augering

REMARKS: Location coordinates are in MGA94 Zone 56. *Field replicate BD1/14.07.21 taken at 1.9-2.0m depth

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: DPT Operator Pty Ltd
PROJECT: Cockle Bay Park Redevelopment
LOCATION: 241-249 Wheat Road, Sydney

SURFACE LEVEL: 2.7 AHD
EASTING: 333753
NORTHING: 6250645
DIP/AZIMUTH: 90°/--

BORE No: CW4
PROJECT No: 202546.00
DATE: 14 - 15/7/2021
SHEET 2 OF 3

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
-8	11	SANDSTONE: medium to coarse grained, brown, pale grey and red-brown, distinctly and indistinctly bedded at 0-10°, medium then medium to high strength, moderately weathered, slightly fractured, Hawkesbury Sandstone							C	100	96	PL(A) = 0.8
-9	12											PL(A) = 1
-10	13								C	100	100	PL(A) = 1.1
-11	13.33	SANDSTONE: medium to coarse grained, pale grey, distinctly and indistinctly bedded at 0-10°, 1-5% carbonaceous laminations up to 3mm thick, high strength, fresh, slightly fractured then unbroken, Hawkesbury Sandstone										PL(A) = 1.7
-12	14											
-13	15											PL(A) = 1.2
-14	16								C	100	99	PL(A) = 1.2
-15	17											PL(A) = 1.1
-16	18											PL(A) = 1.4
-17	18.41	SANDSTONE: fine to medium grained, pale grey, distinctly bedded at 0-5°, high strength, fresh, slightly fractured, Hawkesbury Sandstone							C	100	97	
	19											PL(A) = 1.5
	19.19	Below 19.08m: 30-40% siltstone clasts and beds, up to 30mm thick						19.16m: Ds, 30mm				
		SANDSTONE: (continued next page)										
	20.0											PL(A) = 1.1

RIG: Bobcat **DRILLER:** Ground Test **LOGGED:** JS **CASING:** HW to 4.5m; HQ to 9.46m

TYPE OF BORING: Diacore to 0.06m, NDD to 1.5m, Solid flight auger (TC Bit) to 4.5m, Rotary wash boring to 9.46m, NMLC Coring to 25.0m

WATER OBSERVATIONS: Free groundwater observed at 2.8m depth whilst augering

REMARKS: Location coordinates are in MGA94 Zone 56. *Field replicate BD1/14.07.21 taken at 1.9-2.0m depth

SAMPLING & IN SITU TESTING LEGEND

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

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Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: DPT Operator Pty Ltd
PROJECT: Cockle Bay Park Redevelopment
LOCATION: 241-249 Wheat Road, Sydney

SURFACE LEVEL: 2.7 AHD
EASTING: 333753
NORTHING: 6250645
DIP/AZIMUTH: 90°/--

BORE No: CW4
PROJECT No: 202546.00
DATE: 14 - 15/7/2021
SHEET 3 OF 3

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
-18	21	SANDSTONE: medium to coarse grained, distinctly and indistinctly bedded at 0-10°, high strength, fresh, slightly fractured to unbroken, Hawkesbury Sandstone							C	100	97	
												PL(A) = 1.2
-19		Between 21.24-21.37m: fine to medium grained bed, medium to high strength						21.37m: Ds, 5mm				PL(A) = 0.9
	22								C	100	100	
-20		Between 22.62-24.16m: slightly weathered										
	23											PL(A) = 1.7
-21												
	24								C	100	100	PL(A) = 2.3 (UCS Sample 23.48-23.79m) PL(A) = 1.5
-22	25 25.0	Bore discontinued at 25.0m - Limit of investigation										
-23												
	26											
-24												
	27											
-25												
	28											
-26												
	29											
-27												

RIG: Bobcat **DRILLER:** Ground Test **LOGGED:** JS **CASING:** HW to 4.5m; HQ to 9.46m

TYPE OF BORING: Diacore to 0.06m, NDD to 1.5m, Solid flight auger (TC Bit) to 4.5m, Rotary wash boring to 9.46m, NMLC Coring to 25.0m

WATER OBSERVATIONS: Free groundwater observed at 2.8m depth whilst augering

REMARKS: Location coordinates are in MGA94 Zone 56. *Field replicate BD1/14.07.21 taken at 1.9-2.0m depth

SAMPLING & IN SITU TESTING LEGEND

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

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BORE: CW4 PROJECT: Cockle Bay Wharf JULY 2021

9.46 – 14.00m

BORE: CW4 PROJECT: Cockle Bay Wharf JULY 2021

14.00 – 19.00m

BORE: CW4 PROJECT: Cockle Bay Wharf JULY 2021

19.00 – 24.00m

BORE: CW4 PROJECT: Cockle Bay Wharf JULY 2021

24.00 – 25.00m

BOREHOLE LOG

CLIENT: DPT Operator Pty Ltd
PROJECT: Cockle Bay Park Redevelopment
LOCATION: 241-249 Wheat Road, Sydney

SURFACE LEVEL: 2.8 AHD
EASTING: 333715
NORTHING: 6250505
DIP/AZIMUTH: 90°/--

BORE No: CW5
PROJECT No: 202546.00
DATE: 7 - 8/7/2021
SHEET 1 OF 3

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
	0.06	ASPHALTIC CONCRETE										
	0.21	CONCRETE										
		FILL/Sandy GRAVEL: fine to coarse igneous gravel, grey, fine to coarse sand, with concrete rubble, dry, appears moderately compacted							E			
		Below 0.4m: grading to fine to coarse igneous and sandstone gravel, brown, with bricks and clay, trace siltstone, moist, appears generally in a loose condition							E			
	1.5	Below 1.1m: grading to sandstone cobbles							E			
		FILL/Sandy CLAY: low to medium plasticity, grey, with building rubble (concrete and brick), sandstone and igneous gravel and cobbles, w>PL,							A/E			
	2.65	appears generally in a soft condition							S			5,0,0 N = 0 no sample recovered
	2.9	VOID				07-07-21						
		FILL/Silty SAND: fine to medium, dark grey, with clay and fine to medium gravel, with seashells, wet, appears generally in a very loose condition							S			1,1,1 N = 2 no sample recovered
	5.0	Silty CLAY CL-CI: low to medium plasticity, dark grey, with rootlets, trace shells, w>PL, very soft, estuarine							A			
									S/E			0,1,1 N = 2
	6.5	Silty SAND SM: fine to medium, grey, with shells, wet, very loose, estuarine										
									S			1,0,0 N = 0
		Between 8.7m and 9.2m: apparently loose										
									U_{75}			no sample recovered
	10.0											

RIG: Bobcat **DRILLER:** Ground Test **LOGGED:** JS **CASING:** HW to 2.2m; HQ to 11.25m

TYPE OF BORING: Diacore to 0.06m, NDD to 1.5m, Solid flight auger (TC Bit) to 7.0m, Rotary wash boring to 14.15m, NMLC Coring to 22.65m

WATER OBSERVATIONS: Free groundwater observed at 2.8m depth whilst augering

REMARKS: Location coordinates are in MGA94 Zone 56. Groundwater well constructed: blank PVC 0.0 to 1.0m, Slotted PVC pipe 1.0 to 5.0m, backfill 0.0 to 0.3m, bentonite 0.3 to 1.0m, gravel 1.0 to 5.0m, bentonite 5.0 to 22.65m, gatic at surface

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: DPT Operator Pty Ltd
PROJECT: Cockle Bay Park Redevelopment
LOCATION: 241-249 Wheat Road, Sydney

SURFACE LEVEL: 2.8 AHD
EASTING: 333715
NORTHING: 6250505
DIP/AZIMUTH: 90°/--

BORE No: CW5
PROJECT No: 202546.00
DATE: 7 - 8/7/2021
SHEET 2 OF 3

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
-8	11	Sandy CLAY CL-CI: low to medium plasticity, pale grey mottled brown and red-brown, w~PL, firm to stiff, estuarine							S			3,4,4 N = 8
-9	12 12.0	Clayey SAND SC: medium to coarse, pale grey, brown and red-brown, wet, loose, residual										
-10	13							Unless otherwise stated, rock is fractured along rough, planar bedding dipping 0-10°, with ironstaining or clay coating	S			4,2,5 N = 7
-11	13.85											
	14	SANDSTONE: brown, pale grey and red-brown, apparently low strength										
	14.15	SANDSTONE: medium to coarse grained, brown, pale grey and red-brown, distinctly and indistinctly bedded at 0-10°, low then medium strength, moderately weathered, slightly fractured, Hawkesbury Sandstone										
-12	15								C	100	88	PL(A) = 0.2
-13	16							15.84m: Ds, 70mm 16.30m: Ds, 120mm 16.50m: Ds, 120mm				PL(A) = 0.2
-14	17											PL(A) = 0.7
-15		Between 17.6-18.4m: slightly weathered										
	18								C	100	98	PL(A) = 0.6
-16	19											PL(A) = 0.8
		Below 19.08m: 5% carbonaceous laminations						19.08m: B10-50°, ir, ro, cbs co 19.47m: B10-30°, ir, ro, cbs vn				
-17	19.68							19.68m: Ds, 220mm				
	20.0	INTERBEDDED SILTSTONE AND SANDSTONE: (continued page 3)							C	100	86	PL(A) = 0.2

RIG: Bobcat **DRILLER:** Ground Test **LOGGED:** JS **CASING:** HW to 2.2m; HQ to 11.25m

TYPE OF BORING: Diacore to 0.06m, NDD to 1.5m, Solid flight auger (TC Bit) to 7.0m, Rotary wash boring to 14.15m, NMLC Coring to 22.65m

WATER OBSERVATIONS: Free groundwater observed at 2.8m depth whilst augering

REMARKS: Location coordinates are in MGA94 Zone 56. Groundwater well constructed: blank PVC 0.0 to 1.0m, Slotted PVC pipe 1.0 to 5.0m, backfill 0.0 to 0.3m, bentonite 0.3 to 1.0m, gravel 1.0 to 5.0m, bentonite 5.0 to 22.65m, gatic at surface

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: DPT Operator Pty Ltd
PROJECT: Cockle Bay Park Redevelopment
LOCATION: 241-249 Wheat Road, Sydney

SURFACE LEVEL: 2.8 AHD
EASTING: 333715
NORTHING: 6250505
DIP/AZIMUTH: 90°/--

BORE No: CW5
PROJECT No: 202546.00
DATE: 7 - 8/7/2021
SHEET 3 OF 3

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
-18	21	INTERBEDDED SILTSTONE AND SANDSTONE: dark grey, interbedded with 20-30% medium to coarse grained, pale grey sandstone with siltstone clasts up to 50mm, distinctly bedded at 0-20°, low then medium strength, fresh, slightly fractured, Hawkesbury Sandstone										PL(A) = 0.6
	21.12	SANDSTONE: medium to coarse grained, pale grey, distinctly and indistinctly bedded at 0-10°, 1-5% siltstone clasts and flecks, high strength, fresh, slightly fractured, Hawkesbury Sandstone						21.05m: Ds, 70mm	C	100	86	
-19	22	Between 21.90 and 22.05m: fine to medium grained bed						21.49m: J20°, pl, ro, cly vn				PL(A) = 1.7
	22.65	Bore discontinued at 22.65m - Limit of investigation										PL(A) = 1.5
-20	23											
-21	24											
-22	25											
-23	26											
-24	27											
-25	28											
-26	29											
-27												

RIG: Bobcat **DRILLER:** Ground Test **LOGGED:** JS **CASING:** HW to 2.2m; HQ to 11.25m

TYPE OF BORING: Diacore to 0.06m, NDD to 1.5m, Solid flight auger (TC Bit) to 7.0m, Rotary wash boring to 14.15m, NMLC Coring to 22.65m

WATER OBSERVATIONS: Free groundwater observed at 2.8m depth whilst augering

REMARKS: Location coordinates are in MGA94 Zone 56. Groundwater well constructed: blank PVC 0.0 to 1.0m, Slotted PVC pipe 1.0 to 5.0m, backfill 0.0 to 0.3m, bentonite 0.3 to 1.0m, gravel 1.0 to 5.0m, bentonite 5.0 to 22.65m, gatic at surface

SAMPLING & IN SITU TESTING LEGEND

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

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BORE: CW5 PROJECT: Cockle Bay Wharf JULY 2021

14.15 – 19.00m

BORE: CW5 PROJECT: Cockle Bay Wharf JULY 2021

19.00 – 22.65m

BOREHOLE LOG

CLIENT: DPT Operator Pty Ltd
PROJECT: Cockle Bay Park Redevelopment
LOCATION: 241-249 Wheat Road, Sydney

SURFACE LEVEL: 3.0 AHD
EASTING: 333762
NORTHING: 6250665
DIP/AZIMUTH: 90°/--

BORE No: CW6
PROJECT No: 202546.00
DATE: 16/7 - 3/8/2021
SHEET 1 OF 3

RL	Depth (m)	Description of Strata	Graphic Log	Type	Core Rec. %	RQD %	Test Results & Comments
	0.06	ASPHALTIC CONCRETE		E			
		FILL/Sandy GRAVEL: fine to coarse igneous gravel, grey, fine to coarse sand, moist, appears moderately compacted		E*			
	1	Below 0.3m: grading to fine to coarse sandstone gravel, brown, with bricks, with clay, trace siltstone, moist, appears loose		E			
		Below 1.0m: trace igneous gravel, trace glass					
	1.6	1.3m to 1.9m: with sandstone cobbles					
	2	CONCRETE					
	3.0	FILL/Clayey SAND: medium to coarse, brown, wet, generally in a loose condition		S/E			4,4,7 N = 11
	4			S/E			2,2,7 N = 9
	5.0	Sandy CLAY CL-CI: low to medium plasticity, dark grey, fine to medium sand, trace shell fragments, w>PL, very soft, estuarine		U_{75}			no recovery
	6			S/E			0,0,0 N = 0
	6.85	SAND SW: fine to medium, grey and brown, trace silty clay, trace shell fragments, medium dense, estuarine		S			2,5,6 N = 11
	7.9	SANDSTONE: medium to coarse grained, yellow-brown and pale pink-grey, distinctly and indistinctly bedded at 0-10°, medium strength, moderately and slightly weathered, slightly fractured, Hawkesbury Sandstone		C	100	100	PL(A) = 0.3
	8			C	100	100	
	9			C	100	100	PL(A) = 0.8
				C	100	100	
		Between 9.65-10.70m: becoming purple-brown, high strength		C	100	96	
				C	100	100	PL(A) = 1

Discontinuities: B - Bedding, J - Joint, S - Shear, F - Fault

Unless otherwise stated, rock is fractured along rough planar bedding dipping at 0-10° with ironstaining or clay veneer

9.71-9.73m: J20°(x2), pl, ro, cly vn

RIG: Bobcat **DRILLER:** Ground Test **LOGGED:** TM **CASING:** HW to 2.7m; HQ to 7.9m

TYPE OF BORING: NDD to 1.6m, Solid flight auger (TC Bit) to 1.7m, Rotary wash boring to 7.9m, NMLC Coring to 23.48m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Location coordinates are in MGA94 Zone 56. *Blind duplicate BD01/20210630 taken at 0.5-0.6m depth; Groundwater well constructed: blank PVC 0.0 to 1.2m, Slotted PVC pipe 1.2 to 7.0m, backfill 0.0 to 0.2m, bentonite 0.2 to 0.7m, gravel 0.7 to 7.0m, bentonite 7.0 to 23.48m, gatic at surface

SAMPLING & IN SITU TESTING LEGEND

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

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Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: DPT Operator Pty Ltd
PROJECT: Cockle Bay Park Redevelopment
LOCATION: 241-249 Wheat Road, Sydney

SURFACE LEVEL: 3.0 AHD
EASTING: 333762
NORTHING: 6250665
DIP/AZIMUTH: 90°/--

BORE No: CW6
PROJECT No: 202546.00
DATE: 16/7 - 3/8/2021
SHEET 2 OF 3

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
-7		SANDSTONE: medium to coarse grained, yellow-brown and pale pink-grey, distinctly and indistinctly bedded at 0-10°, medium strength, moderately and slightly weathered, slightly fractured, Hawkesbury Sandstone *(continued)*						9.92m: B0-5°, pl, ro, cly inf 5mm				
-8	11											PL(A) = 0.9
								11.12m: B0-5°, pl, he, cly inf 5mm	C	100	100	
-9	12											PL(A) = 0.8
								12.13m: B0-5°, pl, ro, fe stn, cly inf 5mm				
-10	13											PL(A) = 0.9
	13.67	SANDSTONE: medium to coarse grained, pale grey, distinctly and indistinctly bedded at 0-10°, medium to high strength, fresh, slightly fractured and unbroken, Hawkesbury Sandstone						13.68m: B0°, pl, ro, cbs stn				PL(A) = 1.6
-11	14								C	100	99	
-12	15											PL(A) = 1.6
								15.57m: B0°, pl, ro, cbs vn				
-13	16							15.85m: B0°, pl, ro, cbs/cly vn				PL(A) = 0.9
												PL(A) = 0.9
-14	17	Between 16.88-16.93m: siltstone clast						16.83m: B0-5°, pl, ro, cbs vn				PL(A) = 1
-15	18											PL(A) = 0.9
								18.13m: B5-10°, pl, ro, cbs vn				
-16	19								C	100	100	PL(A) = 0.8
									C	100	100	

RIG: Bobcat **DRILLER:** Ground Test **LOGGED:** TM **CASING:** HW to 2.7m; HQ to 7.9m

TYPE OF BORING: NDD to 1.6m, Solid flight auger (TC Bit) to 1.7m, Rotary wash boring to 7.9m, NMLC Coring to 23.48m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Location coordinates are in MGA94 Zone 56. *Blind duplicate BD01/20210630 taken at 0.5-0.6m depth; Groundwater well constructed: blank PVC 0.0 to 1.2m, Slotted PVC pipe 1.2 to 7.0m, backfill 0.0 to 0.2m, bentonite 0.2 to 0.7m, gravel 0.7 to 7.0m, bentonite 7.0 to 23.48m, gatic at surface

SAMPLING & IN SITU TESTING LEGEND

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

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BOREHOLE LOG

CLIENT: DPT Operator Pty Ltd
PROJECT: Cockle Bay Park Redevelopment
LOCATION: 241-249 Wheat Road, Sydney

SURFACE LEVEL: 3.0 AHD
EASTING: 333762
NORTHING: 6250665
DIP/AZIMUTH: 90°/--

BORE No: CW6
PROJECT No: 202546.00
DATE: 16/7 - 3/8/2021
SHEET 3 OF 3

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
-17		SANDSTONE: medium to coarse grained, pale grey, distinctly and indistinctly bedded at 0-10°, medium to high strength, fresh, slightly fractured and unbroken, Hawkesbury Sandstone *(continued)*										PL(A) = 0.8
-18	21								C	100	100	PL(A) = 1
-19	22											PL(A) = 1.1
									C	100	100	
-20	23											PL(A) = 1.1
	23.48	Bore discontinued at 23.48m - Limit of investigation										PL(A) = 1.1
-21	24											
-22	25											
-23	26											
-24	27											
-25	28											
-26	29											

RIG: Bobcat **DRILLER:** Ground Test **LOGGED:** TM **CASING:** HW to 2.7m; HQ to 7.9m

TYPE OF BORING: NDD to 1.6m, Solid flight auger (TC Bit) to 1.7m, Rotary wash boring to 7.9m, NMLC Coring to 23.48m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Location coordinates are in MGA94 Zone 56. *Blind duplicate BD01/20210630 taken at 0.5-0.6m depth; Groundwater well constructed: blank PVC 0.0 to 1.2m, Slotted PVC pipe 1.2 to 7.0m, backfill 0.0 to 0.2m, bentonite 0.2 to 0.7m, gravel 0.7 to 7.0m, bentonite 7.0 to 23.48m, gatic at surface.

SAMPLING & IN SITU TESTING LEGEND

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

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BORE: CW6 PROJECT: Cockle Bay Wharf AUGUST 2021

7.90 – 12.00m

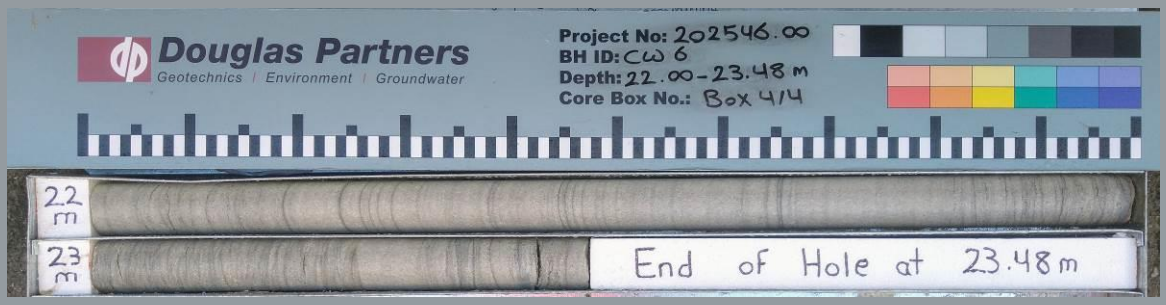
BORE: CW6 PROJECT: Cockle Bay Wharf AUGUST 2021

12.00 – 17.00m

BORE: CW6 PROJECT: Cockle Bay Wharf AUGUST 2021

17.00 – 22.00m

BORE: CW6 PROJECT: Cockle Bay Wharf AUGUST 2021



22.00 – 23.48m

BOREHOLE LOG

CLIENT: DPT Operator Pty Ltd
PROJECT: Cockle Bay Park Redevelopment
LOCATION: 241-249 Wheat Road, Sydney

SURFACE LEVEL: 2.8 AHD
EASTING: 333748
NORTHING: 6250687
DIP/AZIMUTH: 90°/--

BORE No: CW7
PROJECT No: 202546.00
DATE: 6/7 - 5/8/2021
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				
	0.07	PAVER										
	0.1	FILL/SAND: medium to coarse, brown, moist							E*			
		FILL/Sandy GRAVEL: medium to coarse igneous gravel, brown, fine to coarse sand, trace silt, moist, appears moderately compacted							B			
	0.8	Below 0.4m: appears poorly compacted							E			
		FILL/SAND: fine to coarse, brown, trace coarse sandstone gravel, moist, appears poorly compacted							B			
	2.0	1.3-2.0m: with brick and ceramic fragments							A			
		FILL/SAND: fine to coarse, dark brown and brown, trace clay, fine to coarse sandstone gravel, moist, very loose							S			0,2,2 N = 4
		3.5m: becoming dark grey and grey							S			1,2,2 N = 4
		4.8-4.9m: possible concrete rubble										
	5.3	Sandy CLAY CL-CI: low to medium plasticity, dark grey, medium to coarse, with silt, trace rootlets and shell fragments, w>PL, very soft, estuarine						Unless otherwise stated, rock is fractured along rough, planar bedding dipping at 0-10° with clay veneer	S			0,0,0 N = 0
									U			
	7.3								S			0,0,25/100 refusal
	7.5	SANDSTONE: brown, apparently low to medium strength										
		SANDSTONE: medium to coarse grained, red-brown and pale brown, cross bedded at 0-10°, medium strength, moderately weathered, slightly fractured, Hawkesbury Sandstone						8.35m: B0-10°, un, he, fe stn 8.45m: B0-10°, un, he, fe stn 8.55m: B0-5°, pl, he, fe stn 8.61m: B0-5°, pl, he, fe stn	C	100	97	PL(A) = 0.7 PL(A) = 0.9
									C	100	100	PL(A) = 0.7

RIG: Bobcat **DRILLER:** Ground Test **LOGGED:** LHS/YB **CASING:** HW to 7.5m; HQ to 8.0m

TYPE OF BORING: NDD to 2.0m,Solid flight auger (TC bit) to 4.0m, Rotary wash boring to 7.5m, NMLC Coring to 16.79m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Location coordinates are in MGA94 Zone 56. *Blind duplicate BD03/060721 taken at 0.4-0.5m depth

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: DPT Operator Pty Ltd
PROJECT: Cockle Bay Park Redevelopment
LOCATION: 241-249 Wheat Road, Sydney

SURFACE LEVEL: 2.8 AHD
EASTING: 333748
NORTHING: 6250687
DIP/AZIMUTH: 90°/--

BORE No: CW7
PROJECT No: 202546.00
DATE: 6/7 - 5/8/2021
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
-8	11	SANDSTONE: medium to coarse grained, red-brown and pale brown, cross bedded at 0-10°, medium strength, moderately weathered, slightly fractured, Hawkesbury Sandstone *(continued)*						10.57m: B0°, pl, ro, fe stn, cly vn	C	100	100	PL(A) = 0.8
-9	12							11.89m: B0-5°, pl, ro, fe stn, cly vn	C	100	100	PL(A) = 0.8 PL(A) = 0.8
-10	13							13.03m: B0°, pl, ro, cbs/cly vn				PL(A) = 1.3
-11	13.42	SANDSTONE: medium to coarse grained, pale grey, distinctly and indistinctly bedded at 0-10°, medium to high strength, fresh, slightly fractured, Hawkesbury Sandstone										
-12	14							14.18m: B0°, pl, ro, cbs vn 14.5m: B0°, pl, ro, cbs stn				PL(A) = 0.7
-13	15								C	100	100	PL(A) = 1.1
-14	16							15.76m: B0°, pl, ro, cly inf 5mm 15.87m: Cs 20mm				PL(A) = 0.8
	16.79	Bore discontinued at 16.79m - Limit of investigation										PL(A) = 0.7
-15	17											
-16	18											
-17	19											

RIG: Bobcat **DRILLER:** Ground Test **LOGGED:** LHS/YB **CASING:** HW to 7.5m; HQ to 8.0m

TYPE OF BORING: NDD to 2.0m,Solid flight auger (TC bit) to 4.0m, Rotary wash boring to 7.5m, NMLC Coring to 16.79m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Location coordinates are in MGA94 Zone 56. *Blind duplicate BD03/060721 taken at 0.4-0.5m depth

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

BORE: CW7 PROJECT: Cockle Bay Wharf AUGUST 2021

7.50 – 12.00m

BORE: CW7 PROJECT: Cockle Bay Wharf AUGUST 2021

12.00 – 16.79m

BOREHOLE LOG

CLIENT: DPT Operator Pty Ltd
PROJECT: Cockle Bay Park Redevelopment
LOCATION: 241-249 Wheat Road, Sydney

SURFACE LEVEL: 3.5 AHD
EASTING: 333822
NORTHING: 6250707
DIP/AZIMUTH: 90°/--

BORE No: SS1
PROJECT No: 202546.00
DATE: 15 - 16/7/2021
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
		CONCRETE: igneous gravel of 20mm nominal diameter						Unless otherwise stated, rock is fractured along rough, planar bedding, dipping 0-10°				
	0.35	FILL/Sandy GRAVEL: fine to coarse igneous gravel, dark grey, fine to coarse sand, trace silt, moist, appears generally in a medium dense to dense condition							E			
	0.6	below 0.4m: grading to fine to coarse sandstone and igneous gravel, brown							E			
	1.67	CONCRETE: sandstone and igneous gravel of up to 40mm diameter						1.67m: CORE LOSS: 490mm	C	75	70	
	2.16	CORE LOSS										
		SANDSTONE: medium to coarse grained, pale grey and yellow-brown, distinctly and indistinctly bedded at 0-20°, medium strength, slightly weathered, fractured to slightly fractured, Hawkesbury Sandstone						2.67-2.78m: B10°(x4), un, ti				PL(A) = 0.9
								3.39m: B20°, pl, cly vn 3.44m: B0°, pl, cly vn	C	100	95	PL(A) = 0.5 PL(A) = 1.3
	3.7	SANDSTONE: medium to coarse grained, orange-brown, high strength, moderately weathered, slightly fractured, Hawkesbury Sandstone										PL(A) = 1.2
		Below 4.21m: becoming red-brown, high strength with very high strength bands, highly weathered						4.21m: B0°, un, ro, cln				PL(A) = 1.4
									C	100	100	PL(A) = 3.3
	5.53	SANDSTONE: medium to coarse grained, orange-brown, medium strength, moderately weathered, unbroken, Hawkesbury Sandstone										PL(A) = 0.8
								6.45m: B10°, pl, cly vn				PL(A) = 0.9
	7.05	Below 6.98m: becoming pale grey, low strength, highly weathered										PL(A) = 0.2 PL(A) = 1.2
		SANDSTONE: fine to medium grained, pale grey, with siltstone laminations, distinctly and indistinctly bedded at 5-10°, high strength, fresh, unbroken, Hawkesbury Sandstone							C	100	100	PL(A) = 1.1
		Below 7.8m: grading to medium to coarse grained										
		Between 8.3-9.8m: with siltstone specks, clasts and beds										PL(A) = 1.3
									C	100	97	
		Below 9.8m: medium bedded, with										PL(A) = 1.1

RIG: Comacchio 205 **DRILLER:** Ground Test **LOGGED:** LHS **CASING:** HQ to 1.0m

TYPE OF BORING: Diacore to 0.35m, NDD to 0.6m, Auger to 1.0m, NMLC Coring to 17.72m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Location coordinates are in MGA94 Zone 56.

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: DPT Operator Pty Ltd
PROJECT: Cockle Bay Park Redevelopment
LOCATION: 241-249 Wheat Road, Sydney

SURFACE LEVEL: 3.5 AHD
EASTING: 333822
NORTHING: 6250707
DIP/AZIMUTH: 90°/--

BORE No: SS1
PROJECT No: 202546.00
DATE: 15 - 16/7/2021
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
-7		occasional cross-beds										
		SANDSTONE: fine to medium grained, pale grey, with siltstone laminations, distinctly and indistinctly bedded at 5-10°, high strength, fresh, unbroken, Hawkesbury Sandstone *(continued)*						10.23-10.42m: J sv, pl, ro, cln 10.29m: B0°, pl, cly vn 10.33m: B20°, un, cly vn	C	100	97	PL(A) = 1.3
-8	11	Between 10.29-10.34m: siltstone bed										PL(A) = 1.4
-9	12							12.55m: B0°, pl, cly vn				PL(A) = 1.3
-10	13								C	100	100	
								13.53m: B10°, pl, cly vn				PL(A) = 1.6
-11	14											
								14.56m: B0°, pl, cly vn				PL(A) = 1.1
-12	15							15.21m: B0°, un, cly 1mm				PL(A) = 1.4
-13	16	Below 16.18m: distinctly and indistinctly bedded at 20°							C	100	100	PL(A) = 1.4
-14	17							16.9m: B10°, pl, cly 3mm				
	17.72	Bore discontinued at 17.72m - Limit of investigation										PL(A) = 1.8
-15	18											
-16	19											

RIG: Comacchio 205 **DRILLER:** Ground Test **LOGGED:** LHS **CASING:** HQ to 1.0m

TYPE OF BORING: Diacore to 0.35m, NDD to 0.6m, Auger to 1.0m, NMLC Coring to 17.72m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Location coordinates are in MGA94 Zone 56.

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: SS1 PROJECT: Cockle Bay Wharf JULY 2021

1.00 – 5.00m

BORE: SS1 PROJECT: Cockle Bay Wharf JULY 2021

5.00 – 10.00m

BORE: SS1 PROJECT: Cockle Bay Wharf JULY 2021

10.00 – 15.00m

BORE: SS1 PROJECT: Cockle Bay Wharf JULY 2021

15.00 – 17.72m

BOREHOLE LOG

CLIENT: DPT Operator Pty Ltd
PROJECT: Cockle Bay Park Redevelopment
LOCATION: 241-249 Wheat Road, Sydney

SURFACE LEVEL: 3.5 AHD
EASTING: 333825
NORTHING: 6250684
DIP/AZIMUTH: 90°/--

BORE No: SS2
PROJECT No: 202546.00
DATE: 14 - 15/7/2021
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)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
	0.05	PAVER										
	0.25	FILL/Gravelly SAND: fine to coarse, brown, fine to medium igneous gravel, moist, appears generally in a medium dense condition							E			
		FILL/Sandy GRAVEL: fine to coarse igneous and sandstone gravel, grey, fine to coarse sand, with sandstone cobbles and boulders, moist, appears generally in a medium dense to dense condition						Unless otherwise stated, rock is fractured along rough, planar bedding, dipping 0-10°	E			
	2.79								S/E			19,10/90 refusal
		SANDSTONE: medium to coarse grained, pale grey and orange-brown, medium and high strength, highly weathered, slightly fractured, Hawkesbury Sandstone										PL(A) = 1.5
												PL(A) = 0.6
		Between 3.51-3.64m: fine grained with carbonaceous laminations, very low strength						3.52m: B0°, pl, cly vn 3.64m: B0°, pl, cly 5mm				PL(A) = 0.07
								3.66-3.69m: B0°(x3), pl, ro, fe stn				PL(A) = 1.7
		Below 4.05m: grading to pale grey and orange-brown, moderately weathered						3.91m: B0°, pl, ro, fe stn 4.39-4.49m: B0°(x2), un, ti	C	100	89	
								4.75-5.26m: B10°(x5), un, ti				PL(A) = 1.2
		Below 5.5m: grading to orange and red-brown						5.65m: B0°, pl, cly vn				PL(A) = 1
		Below 6.52m: grading to pale grey and orange-brown, distinctly and indistinctly bedded at 0-20°, slightly weathered										PL(A) = 1.3
								7.04m: Cs, 80mm	C	100	97	
								7.22m: B0°, un, ro, cln 7.31m: B5°, pl, cly vn				PL(A) = 0.5
												PL(A) = 1.5
		Below 8.2m: grading to fresh						8.24m: B10°, pl, cly 1mm				PL(A) = 0.5
		Between 8.5-8.72m: with siltstone specks and clasts						8.64m: B10°, cu, ro, cln				PL(A) = 0.8
	8.8	SANDSTONE: medium to coarse grained, pale grey, distinctly and indistinctly bedded at 0-20°, high strength, fresh, unbroken, Hawkesbury Sandstone										PL(A) = 1.2
									C	100	97	
		Between 9.65-10.32m: grading to fine to medium grained						9.65m: B0°, pl, cly vn				PL(A) = 1.3

RIG: Comacchio 205 **DRILLER:** Ground Test **LOGGED:** LHS **CASING:** HQ to 1.1m

TYPE OF BORING: NDD 0.05m to 1.1m, Rotary wash bore to 2.79m, NMLC Coring to 17.81m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Location coordinates are in MGA94 Zone 56. Groundwater well constructed: blank PVC 0.0 to 3.8m; Slotted PVC 3.8 to 17.81m; bentonite 0.0 to 3.3m; gravel 3.3 to 17.81m, gatic at surface

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: DPT Operator Pty Ltd
PROJECT: Cockle Bay Park Redevelopment
LOCATION: 241-249 Wheat Road, Sydney

SURFACE LEVEL: 3.5 AHD
EASTING: 333825
NORTHING: 6250684
DIP/AZIMUTH: 90°/--

BORE No: SS2
PROJECT No: 202546.00
DATE: 14 - 15/7/2021
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
-7	11	SANDSTONE: medium to coarse grained, pale grey, distinctly and indistinctly bedded at 0-20°, high strength, fresh, unbroken, Hawkesbury Sandstone *(continued)*						10.24m: B5°, pl, cly vn 10.31m: Cs, 15mm	C	100	97	PL(A) = 1.4
-8	12	Between 11.85-16.65m: with siltstone specks and clasts						12.08-12.56m: J 80°, un, ro , cln	C	100	100	PL(A) = 1.6 PL(A) = 1.1
-9	13							12.94-13.34m: J 80°, un, ro, cln				
-10	14								C	100	100	PL(A) = 1.6 PL(A) = 1.8
-11	15											
-12	16								C	100	100	PL(A) = 1.5 PL(A) = 1.3
-13	17											
-14	17.81	Between 17.45-17.5m: carbonaceous laminations										PL(A) = 1.4
-15	18	Bore discontinued at 17.81m - Limit of investigation										
-16	19											

RIG: Comacchio 205 **DRILLER:** Ground Test **LOGGED:** LHS **CASING:** HQ to 1.1m

TYPE OF BORING: NDD 0.05m to 1.1m, Rotary wash bore to 2.79m, NMLC Coring to 17.81m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Location coordinates are in MGA94 Zone 56. Groundwater well constructed: blank PVC 0.0 to 3.8m; Slotted PVC 3.8 to 17.81m; bentonite 0.0 to 3.3m; gravel 3.3 to 17.81m, gatic at surface

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

BORE: SS2 PROJECT: Cockle Bay Wharf JULY 2021

2.79 – 7.00m

BORE: SS2 PROJECT: Cockle Bay Wharf JULY 2021

7.00 – 12.00m

BORE: SS2 PROJECT: Cockle Bay Wharf JULY 2021

12.00 – 17.00m

BORE: SS2 PROJECT: Cockle Bay Wharf JULY 2021

17.00 – 17.81m

BOREHOLE LOG

CLIENT: DPT Operator Pty Ltd
PROJECT: Cockle Bay Park Redevelopment
LOCATION: 241-249 Wheat Road, Sydney

SURFACE LEVEL: 2.2 AHD
EASTING: 333712
NORTHING: 6250691
DIP/AZIMUTH: 90°/--

BORE No: W1
PROJECT No: 202546.00
DATE: 6 - 11/7/2021
SHEET 1 OF 3

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
2	0.07	PAVER										
1.9	0.12	FILL/SAND: medium to coarse, brown, moist, appears poorly compacted										
1.7	0.51	CONCRETE: igneous gravel of 20mm nominal diameter										
1		VOID										
0	2.25	WATER				06-07-21						
-3	5.2	FILL/SAND: medium to coarse, dark grey, with clay, sandstone cobbles, timber and possible brick fragments, wet, appears generally in a loose condition							S/E			7,12,17 N = 29
-7	9.5	SAND SP: medium to coarse, grey, wet, loose, estuarine										

RIG: Comacchio 205 **DRILLER:** Ground Test **LOGGED:** LHS **CASING:** HW to 11.5m; HQ to 13.0m

TYPE OF BORING: Diacore 0.07m to 0.51m, Rotary wash bore 5.2m to 11.75m, NMLC Coring to 20.57m

WATER OBSERVATIONS: Water observed at 2.25m at 10:36pm on 6 July 2021

REMARKS: Location coordinates are in MGA94 Zone 56.

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: DPT Operator Pty Ltd
PROJECT: Cockle Bay Park Redevelopment
LOCATION: 241-249 Wheat Road, Sydney

SURFACE LEVEL: 2.2 AHD
EASTING: 333712
NORTHING: 6250691
DIP/AZIMUTH: 90°/--

BORE No: W1
PROJECT No: 202546.00
DATE: 6 - 11/7/2021
SHEET 2 OF 3

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
-8		SAND SP: medium to coarse, grey, wet, loose, estuarine *(continued)*							S/E			2,4,2 N = 6
-9	11							Unless otherwise stated, rock is fractured along rough, planar bedding, dipping 0-10°				
-10	11.75 12	SANDSTONE: medium to coarse grained, red and yellow-brown, medium strength, highly to moderately weathered, slightly fractured, Hawkesbury Sandstone						12.08m: B20°, pl, ro, cln	C	100	100	PL(A) = 0.3
-11	13	Between 13.08-15.23m: unbroken						12.32-12.47m: J80°, pl, ro, cln 12.47m: B0°, un, ti 13.02m: Ds, 60mm	C	100	92	PL(A) = 0.5
-12	14	Below 14.15m: grading to slightly weathered, distinctly and indistinctly bedded at 20° Between 14.55-14.95m: distinctly and indistinctly bedded at 0-10°							C	100	100	PL(A) = 0.4
-13	15	Below 15.55m: distinctly and indistinctly bedded at 0-10°						15.23m: J40°, pl, ro, cln 15.6m: B20°, pl, ro, cln 15.8m: B0°, un, ro, cbs vn	C	100	100	PL(A) = 0.9 PL(A) = 0.7
-14	16							16.44m: B5°, pl, cly vn 16.57m: Ds, 10mm	C	100	99	PL(A) = 0.9
-15	17	Between 17.30-17.85m: massive Below 17.32m: fresh						17.11-17.32m: J80°, un, ro, fe stn				PL(A) = 0.6
-16	18 18.1	SANDSTONE: medium to coarse grained, pale grey, distinctly and indistinctly bedded at 0-10°, high strength, fresh, unbroken, Hawkesbury Sandstone						17.9m: B10°, pl, cly 3mm 17.92m: B0°, pl, cly 1mm				PL(A) = 0.5 PL(A) = 1.4 PL(A) = 1.2
-17	19	Between 18.9-19.05m: siltstone clasts and bits						18.92m: B0°, un, ro, cln	C	100	100	PL(A) = 1
	20.0											

RIG: Comacchio 205 **DRILLER:** Ground Test **LOGGED:** LHS **CASING:** HW to 11.5m; HQ to 13.0m

TYPE OF BORING: Diacore 0.07m to 0.51m, Rotary wash bore 5.2m to 11.75m, NMLC Coring to 20.57m

WATER OBSERVATIONS: Water observed at 2.25m at 10:36pm on 6 July 2021

REMARKS: Location coordinates are in MGA94 Zone 56.

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: DPT Operator Pty Ltd
PROJECT: Cockle Bay Park Redevelopment
LOCATION: 241-249 Wheat Road, Sydney

SURFACE LEVEL: 2.2 AHD
EASTING: 333712
NORTHING: 6250691
DIP/AZIMUTH: 90°/--

BORE No: W1
PROJECT No: 202546.00
DATE: 6 - 11/7/2021
SHEET 3 OF 3

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
-18		SANDSTONE: (continued)										
		Below 20.25m: distinctly and indistinctly crossbedded at 20° with siltstone specks							C	100	100	PL(A) = 1.1
	20.57	Bore discontinued at 20.57m - Limit of investigation										
-19	21											
-20	22											
-21	23											
-22	24											
-23	25											
-24	26											
-25	27											
-26	28											
-27	29											

RIG: Comacchio 205 **DRILLER:** Ground Test **LOGGED:** LHS **CASING:** HW to 11.5m; HQ to 13.0m

TYPE OF BORING: Diacore 0.07m to 0.51m, Rotary wash bore 5.2m to 11.75m, NMLC Coring to 20.57m

WATER OBSERVATIONS: Water observed at 2.25m at 10:36pm on 6 July 2021

REMARKS: Location coordinates are in MGA94 Zone 56.

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: W1 PROJECT: Cockle Bay Wharf JULY 2021

11.75 – 16.00m

BORE: W1 PROJECT: Cockle Bay Wharf JULY 2021

16.00 – 20.57m

BOREHOLE LOG

CLIENT: DPT Operator Pty Ltd
PROJECT: Cockle Bay Park Redevelopment
LOCATION: 241-249 Wheat Road, Sydney

SURFACE LEVEL: 2.2 AHD
EASTING: 333698
NORTHING: 6250613
DIP/AZIMUTH: 90°/--

BORE No: W2
PROJECT No: 202546.00
DATE: 5 - 6/7/2021
SHEET 1 OF 3

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
2	0.07	PAVER										
1.87	0.13	FILL/SAND: medium to coarse, brown, moist, appears poorly compacted										
1.67	0.53	CONCRETE: igneous gravel of 20mm nominal diameter										
1		VOID										
0	2.05	WATER				06-07-21						
-7	9.2	CLAY CI: medium plasticity, grey, w>PL, very soft, estuarine										

RIG: Comacchio 205 **DRILLER:** Ground Test **LOGGED:** LHS **CASING:** HW to 13.5m; HQ to 20.4m

TYPE OF BORING: Diacore 0.13m to 0.53m, Rotary wash bore 9.2m to 20.4m, NMLC Coring to 28.3m

WATER OBSERVATIONS: Water observed at 2.05m at 10:06pm on 6 July 2021

REMARKS: Location coordinates are in MGA94 Zone 56. ^SPT at 10.75m undertaken within HW casing

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: DPT Operator Pty Ltd
PROJECT: Cockle Bay Park Redevelopment
LOCATION: 241-249 Wheat Road, Sydney

SURFACE LEVEL: 2.2 AHD
EASTING: 333698
NORTHING: 6250613
DIP/AZIMUTH: 90°/--

BORE No: W2
PROJECT No: 202546.00
DATE: 5 - 6/7/2021
SHEET 2 OF 3

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
-8		CLAY CI: medium plasticity, grey, w>PL, very soft, estuarine *(continued)*										
	10.75											
-9	11	Clayey SAND SC: fine to coarse, pale brown, wet, very loose, estuarine							S^			1,0,0 N = 0
									U_{75}			pp = 0
-10	12											
-11	13								U_{75}			pp = 50
									S			3,2,1 N = 3
-12	14											
									S			1,0,3 N = 3
-13	15											
	15.5	CLAY CI: medium plasticity, grey, trace fine to medium sand, w>PL, very soft, estuarine										
-14	16								S			1,0,0 N = 0
-15	17	17.0 SAND SP: medium to coarse, grey, with clay, wet, dense, estuarine							S			12,21,25/130 refusal
-16	18											
		Below 18.5m: grading to grey mottled orange-brown, trace clay, medium dense										
-17	19							Unless otherwise stated, rock is fractured along rough, planar bedding, dipping 0-10°	S			8,14,12 N = 26

RIG: Comacchio 205 **DRILLER:** Ground Test **LOGGED:** LHS **CASING:** HW to 13.5m; HQ to 20.4m

TYPE OF BORING: Diacore 0.13m to 0.53m, Rotary wash bore 9.2m to 20.4m, NMLC Coring to 28.3m

WATER OBSERVATIONS: Water observed at 2.05m at 10:06pm on 6 July 2021

REMARKS: Location coordinates are in MGA94 Zone 56. ^SPT at 10.75m undertaken within HW casing

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: DPT Operator Pty Ltd
PROJECT: Cockle Bay Park Redevelopment
LOCATION: 241-249 Wheat Road, Sydney

SURFACE LEVEL: 2.2 AHD
EASTING: 333698
NORTHING: 6250613
DIP/AZIMUTH: 90°/--

BORE No: W2
PROJECT No: 202546.00
DATE: 5 - 6/7/2021
SHEET 3 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
-18		SAND SP: medium to coarse, grey, with clay, wet, dense, estuarine *(continued)*										
-19	20.4	SANDSTONE: medium to coarse grained, brown, medium strength, moderately weathered, slightly fractured, Hawkesbury Sandstone Below 21.15m: grading to slightly weathered to fresh						20.95m: B0°, pl, ro, fe stn 21.1m: Ds, 50mm 21.24m: B0°, pl, cly 3mm	C	100	97	PL(A) = 0.3 PL(A) = 0.4 PL(A) = 0.9
-20	21.5	SANDSTONE: medium to coarse grained, pale grey, distinctly and indistinctly bedded at 10-20°, high strength, fresh, slightly fractured, Hawkesbury Sandstone						22.19m: B5°, un, ro, cln				PL(A) = 1 PL(A) = 1.4 PL(A) = 1.2 PL(A) = 1.3
-21	23.05	SANDSTONE: fine grained, grey, with siltstone laminations, medium strength, fresh, slightly fractured, Hawkesbury Sandstone						23.04m: B0°, pl, cly vn 23.29m: B0°, pl, cly vn				PL(A) = 0.3
-22	23.3	SANDSTONE: medium to coarse grained, pale grey, distinctly and indistinctly crossbedded at 20°, high strength, fresh, unbroken, Hawkesbury Sandstone Below 24.7m: distinctly and indistinctly bedded at 5-20° with siltstone laminations and specks						24.94m: B5°, pl, cly 10mm	C	100	100	PL(A) = 1.1 PL(A) = 1.9 PL(A) = 1.7
-23												
-24		Below 26.24m: slightly fractured						26.24m: B10°, pl, cly vn 26.28m: B10°, pl, cly 3mm 26.37m: B10°, pl, cly 1mm	C	100	100	PL(A) = 1.3
-25		Between 27.36-27.37m: carbonaceous lamination Below 27.45m: distinctly and indistinctly bedded at 0-5°						27.34m: B0°, un, cly 5mm				PL(A) = 1.1
-26	28	Below 27.91m: grading to massive						27.91m: B0°, pl, cly 5mm				
-27	28.3	Bore discontinued at 28.3m - Limit of investigation										PL(A) = 1.6
	29											

RIG: Comacchio 205 **DRILLER:** Ground Test **LOGGED:** LHS **CASING:** HW to 13.5m; HQ to 20.4m

TYPE OF BORING: Diacore 0.13m to 0.53m, Rotary wash bore 9.2m to 20.4m, NMLC Coring to 28.3m

WATER OBSERVATIONS: Water observed at 2.05m at 10:06pm on 6 July 2021

REMARKS: Location coordinates are in MGA94 Zone 56. ^SPT at 10.75m undertaken within HW casing

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: W2 PROJECT: Cockle Bay Wharf JULY 2021

20.40 – 24.00m

BORE: W2 PROJECT: Cockle Bay Wharf JULY 2021

24.00 – 28.30m

BOREHOLE LOG

CLIENT: DPT Operator Pty Ltd
PROJECT: Cockle Bay Park Redevelopment
LOCATION: 241-249 Wheat Road, Sydney

SURFACE LEVEL: 2.2 AHD
EASTING: 333685
NORTHING: 6250541
DIP/AZIMUTH: 90°/--

BORE No: W3
PROJECT No: 202546.00
DATE: 3 - 5/7/2021
SHEET 1 OF 3

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
2	0.07	PAVER										
1.87	0.13	FILL/SAND: medium to coarse, brown, moist, appears poorly compacted										
1.7	0.5	CONCRETE: igneous gravel of 20mm nominal diameter										
1		VOID										
0	2.05	WATER				04-07-21						
-1												
-2												
-3												
-4												
-5												
-6												
-7	8.9	CLAY CL: low plasticity, dark grey, trace medium sand and charcoal, sulphurous odour, w~PL, very soft, estuarine										

RIG: Comacchio 205 **DRILLER:** Ground Test **LOGGED:** LHS **CASING:** HW to 12.6m; HQ to 15.3m

TYPE OF BORING: Diacore 0.13m to 0.5m, Rotary wash bore 8.9m to 15.3m, NMLC Coring to 23.77m

WATER OBSERVATIONS: Water observed at 2.05m at 7:33pm on 4 July 2021

REMARKS: Location coordinates are in MGA94 Zone 56. ^SPT at 10.75m and 11.5m undertaken within HW casing; *Field replicate BD01/040721 taken at 13.0-13.45m depth

SAMPLING & IN SITU TESTING LEGEND

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

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BOREHOLE LOG

CLIENT: DPT Operator Pty Ltd
PROJECT: Cockle Bay Park Redevelopment
LOCATION: 241-249 Wheat Road, Sydney

SURFACE LEVEL: 2.2 AHD
EASTING: 333685
NORTHING: 6250541
DIP/AZIMUTH: 90°/--

BORE No: W3
PROJECT No: 202546.00
DATE: 3 - 5/7/2021
SHEET 2 OF 3

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
-8		CLAY CL: low plasticity, dark grey, trace medium sand and charcoal, sulphurous odour, w~PL, very soft, estuarine *(continued)*										
-9	11								S^/E			0,0,0 N = 0
									S^/E			0,1,2 N = 3
-10	12											
	12.6	Sandy CLAY CL: low plasticity, red-brown mottled pale grey, fine to medium sand, w>PL, soft, estuarine										
-11	13								S/E			2,1,1 N = 2
-12	14 14.0	CLAY CI: medium plasticity, grey, w>PL, soft, estuarine						Unless otherwise stated, rock is fractured along rough, planar bedding, dipping 0-10°				
									S/E			0,1,3 N = 4
-13	15											
								15.3m: CORE LOSS: 370mm				
	15.67	SANDSTONE: medium to coarse grained, red and yellow-brown, low to medium strength with very low strength bands, extremely weathered then highly weathered, slightly fractured, Hawkesbury Sandstone										PL(A) = 0.1
-14	16											PL(A) = 0.1
									C	84	74	
												PL(A) = 0.3
-15	17											PL(A) = 0.3
								17.51m: B20°, pl, cly vn				
												PL(A) = 0.4
-16	18							18m: B10°, pl, ro, fe stn				
												PL(A) = 0.4
								18.74m: CORE LOSS: 200mm	C	93	88	
-17	19 18.94	Between 18.94-19.44m: with 15% clay bands, fractured to slightly fractured						18.94m: Ds, 20mm 19.18m: Cs, 60mm				PL(A) = 0.3
		Below 19.43m: grading to pale grey, fresh						19.34m: B5°, pl, cly 8mm 19.37m: B0°, pl, cly 10mm				PL(A) = 0.4 PL(A) = 0.8
	19.75	SANDSTONE:(continue next page)						19.38m: B5°, pl, ro, fe				PL(A) = 1.4
	20.0											

RIG: Comacchio 205 **DRILLER:** Ground Test **LOGGED:** LHS **CASING:** HW to 12.6m; HQ to 15.3m

TYPE OF BORING: Diacore 0.13m to 0.5m, Rotary wash bore 8.9m to 15.3m, NMLC Coring to 23.77m

WATER OBSERVATIONS: Water observed at 2.05m at 7:33pm on 4 July 2021

REMARKS: Location coordinates are in MGA94 Zone 56. ^SPT at 10.75m and 11.5m undertaken within HW casing; *Field replicate BD01/040721 taken at 13.0-13.45m depth

SAMPLING & IN SITU TESTING LEGEND

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

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BOREHOLE LOG

CLIENT: DPT Operator Pty Ltd
PROJECT: Cockle Bay Park Redevelopment
LOCATION: 241-249 Wheat Road, Sydney

SURFACE LEVEL: 2.2 AHD
EASTING: 333685
NORTHING: 6250541
DIP/AZIMUTH: 90°/--

BORE No: W3
PROJECT No: 202546.00
DATE: 3 - 5/7/2021
SHEET 3 OF 3

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
-18		SANDSTONE: medium grained, grey, massive, high strength, fresh, unbroken, Hawkesbury Sandstone						stn 19.43m: B0°, pl, cly 3mm 19.95m: B20°, pl, ro, fe stn	C	93	88	PL(A) = 1.2 PL(A) = 1.9
-19	21	Below 20.75m: grading to medium to coarse grained, pale grey, distinctly and indistinctly bedded at 0-20°						>>				PL(A) = 1.2
-20	22								C	100	100	
-21	23											PL(A) = 1 PL(A) = 1.4
	23.77	Bore discontinued at 23.77m - Limit of investigation										
-22	24											
-23	25											
-24	26											
-25	27											
-26	28											
-27	29											

RIG: Comacchio 205 **DRILLER:** Ground Test **LOGGED:** LHS **CASING:** HW to 12.6m; HQ to 15.3m

TYPE OF BORING: Diacore 0.13m to 0.5m, Rotary wash bore 8.9m to 15.3m, NMLC Coring to 23.77m

WATER OBSERVATIONS: Water observed at 2.05m at 7:33pm on 4 July 2021

REMARKS: Location coordinates are in MGA94 Zone 56. ^SPT at 10.75m and 11.5m undertaken within HW casing; *Field replicate BD01/040721 taken at 13.0-13.45m depth

SAMPLING & IN SITU TESTING LEGEND

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

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BORE: W3 PROJECT: Cockle Bay Wharf JULY 2021

15.30 – 19.00m

BORE: W3 PROJECT: Cockle Bay Wharf JULY 2021

19.00 – 23.77m

BOREHOLE LOG

CLIENT: DPT Operator Pty Ltd
PROJECT: Cockle Bay Park Redevelopment
LOCATION: 241-249 Wheat Road, Sydney

SURFACE LEVEL: 2.2 AHD
EASTING: 333672
NORTHING: 6250475
DIP/AZIMUTH: 90°/--

BORE No: W4
PROJECT No: 202546.00
DATE: 1 - 2/7/2021
SHEET 1 OF 3

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
2	0.07	PAVER										
1.9	0.11	FILL/SAND: medium to coarse, brown, moist, appears poorly compacted										
1.7	0.5	CONCRETE: igneous gravel of 20mm nominal diameter										
1		VOID										
0	2.05	WATER				01-07-21						
-6	7.9	CLAY CL: low plasticity, dark grey, trace sand, sulphurous odour, w~PL, very soft, estuarine										

RIG: Comacchio 205 **DRILLER:** Ground Test **LOGGED:** LHS **CASING:** HW to 11.5m; HQ to 12.55m

TYPE OF BORING: Diacore 0.11m to 0.5m, Rotary wash bore 7.9m to 12.55m, NMLC Coring to 20.72m

WATER OBSERVATIONS: Water observed at 2.05m at 11:16pm on 1 July 2021

REMARKS: Location coordinates are in MGA94 Zone 56. ^SPT at 10.0m and 11.5m undertaken within HW casing

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: DPT Operator Pty Ltd
PROJECT: Cockle Bay Park Redevelopment
LOCATION: 241-249 Wheat Road, Sydney

SURFACE LEVEL: 2.2 AHD
EASTING: 333672
NORTHING: 6250475
DIP/AZIMUTH: 90°/--

BORE No: W4
PROJECT No: 202546.00
DATE: 1 - 2/7/2021
SHEET 2 OF 3

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
-8		CLAY CL: low plasticity, dark grey, trace sand, sulphurous odour, w~PL, very soft, estuarine *(continued)*							S^/E			1,0,0 N = 0
-9	11											
	11.5	SAND SP: medium to coarse, brown, with clay, wet, medium dense, estuarine						Unless otherwise stated, rock is fractured along rough, planar bedding, dipping 0-10°	S^/E			0,3,7 N = 10
-10	12											
	12.55	SANDSTONE: medium to coarse grained, orange and red-brown, medium strength, highly to moderately weathered, slightly fractured, Hawkesbury Sandstone							S/E			6/100 refusal PL(A) = 0.8
-11	13	Below 13.38-15.45m: unbroken						13.38m: B10°, pl, ro, fe stn	C	100	100	PL(A) = 0.9
-12	14	Below 14.27m: grading to pale grey, distinctly and indistinctly bedded at 5-20°, slightly weathered then fresh with occasional slightly weathered bands										PL(A) = 0.7
-13	15							>>				
	16								C	100	100	PL(A) = 0.8
-14												PL(A) = 0.9
-15	17							17.37m: J10°, pl, ro, cln				PL(A) = 0.9
	17.75	SANDSTONE: medium to coarse grained, pale grey, distinctly and indistinctly bedded at 5-20°, high strength, fresh, unbroken, Hawkesbury Sandstone										PL(A) = 1.2
-16	18											PL(A) = 1.2
								18.62m: B0°, pl, cly vn				PL(A) = 1.7
-17	19								C	100	100	
								19.32m: B0°, pl, cly 1mm				PL(A) = 1.5
	20.0											

RIG: Comacchio 205 **DRILLER:** Ground Test **LOGGED:** LHS **CASING:** HW to 11.5m; HQ to 12.55m

TYPE OF BORING: Diacore 0.11m to 0.5m, Rotary wash bore 7.9m to 12.55m, NMLC Coring to 20.72m

WATER OBSERVATIONS: Water observed at 2.05m at 11:16pm on 1 July 2021

REMARKS: Location coordinates are in MGA94 Zone 56. ^SPT at 10.0m and 11.5m undertaken within HW casing

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: DPT Operator Pty Ltd
PROJECT: Cockle Bay Park Redevelopment
LOCATION: 241-249 Wheat Road, Sydney

SURFACE LEVEL: 2.2 AHD
EASTING: 333672
NORTHING: 6250475
DIP/AZIMUTH: 90°/--

BORE No: W4
PROJECT No: 202546.00
DATE: 1 - 2/7/2021
SHEET 3 OF 3

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
-18		SANDSTONE: (continued)							C	100	100	PL(A) = 1.7
	20.73	Bore discontinued at 20.73m - Limit of investigation						20.62m: B40°, cu, cly 1mm				
-19	21											
-20	22											
-21	23											
-22	24											
-23	25											
-24	26											
-25	27											
-26	28											
-27	29											

RIG: Comacchio 205 **DRILLER:** Ground Test **LOGGED:** LHS **CASING:** HW to 11.5m; HQ to 12.55m

TYPE OF BORING: Diacore 0.11m to 0.5m, Rotary wash bore 7.9m to 12.55m, NMLC Coring to 20.72m

WATER OBSERVATIONS: Water observed at 2.05m at 11:16pm on 1 July 2021

REMARKS: Location coordinates are in MGA94 Zone 56. ^SPT at 10.0m and 11.5m undertaken within HW casing

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: W4 PROJECT: Cockle Bay Wharf JULY 2021

12.55 – 17.00m

BORE: W4 PROJECT: Cockle Bay Wharf JULY 2021

17.00 – 20.73m

BOREHOLE LOG

CLIENT: DPT Operator Pty Ltd
PROJECT: Cockle Bay Park Redevelopment
LOCATION: 241-249 Wheat Road, Sydney

SURFACE LEVEL: 2.5 AHD
EASTING: 333694
NORTHING: 6250483
DIP/AZIMUTH: 90°/--

BORE No: W5
PROJECT No: 202546.00
DATE: 7 - 8/7/2021
SHEET 1 OF 3

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
2.5	0.07	PAVER										
2.4	0.14											
2.3	0.2	FILL/SAND: medium to coarse, brown, moist, appears poorly compacted										
1.9	0.59	FILL/Sandy GRAVEL: fine to coarse igneous gravel, dark grey, fine to coarse sand, trace silt, moist, appears moderately compacted										
		CONCRETE: igneous gravel of 20mm nominal diameter										
0.8	1.7	VOID										
		WATER				07-07-21						
-4.25	6.75	CLAY CL: low plasticity, dark grey, trace fine to medium sand, sulphurous odour, w~PL, very soft, estuarine							S^/E			1,0,0 N = 0
									U_{75}			pp = 120
-7.5	10.0											

RIG: Comacchio 205 **DRILLER:** Ground Test **LOGGED:** LHS **CASING:** HW to 10.0m; HQ to 12.9m

TYPE OF BORING: Diacore 0.07m to 0.14m, Rotary wash bore 6.75m to 12.9m, NMLC Coring to 21.16m

WATER OBSERVATIONS: Water observed at 1.70m at 7:10pm on 7 July 2021

REMARKS: Location coordinates are in MGA94 Zone 56. ^SPT at 8.8m undertaken within HW casing; *Field replicate BD05/070721 taken at 11.5-11.95m depth

SAMPLING & IN SITU TESTING LEGEND

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

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BOREHOLE LOG

CLIENT: DPT Operator Pty Ltd
PROJECT: Cockle Bay Park Redevelopment
LOCATION: 241-249 Wheat Road, Sydney

SURFACE LEVEL: 2.5 AHD
EASTING: 333694
NORTHING: 6250483
DIP/AZIMUTH: 90°/--

BORE No: W5
PROJECT No: 202546.00
DATE: 7 - 8/7/2021
SHEET 2 OF 3

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
-8		SAND SP: medium to coarse, grey, trace clay, wet, medium dense, estuarine							S/E			3,7,10 N = 17
-9	11 11.0	Sandy CLAY CL: low plasticity, brown, medium to coarse sand, w<PL, soft, estuarine							S/E*			2,1,1 N = 2
-10	12							Unless otherwise stated, rock is fractured along rough, planar bedding, dipping 0-10°	U_{75}			No Recovery
-11	13 12.9	SANDSTONE: medium to coarse, red and yellow-brown, medium strength, highly weathered, slightly fractured, Hawkesbury Sandstone						13.03m: B20°, pl, ro, cln 13.19m: Ds, 30mm				PL(A) = 0.4 PL(A) = 0.4
	13.35	SANDSTONE: medium to coarse grained, red and yellow-brown, high strength with medium strength bands, highly weathered, unbroken, Hawkesbury Sandstone										PL(A) = 1.3 PL(A) = 0.6 PL(A) = 1.2 PL(A) = 1.4
-12	14								C	100	99	PL(A) = 1.4
	15	Below 14.8m: grading to moderately weathered Below 15.19m: with occasional cross-beds, slightly fractured						15.19m: B20°, pl, cly vn 15.43m: B0°, un, ro, cln				PL(A) = 1.2 PL(A) = 1.2
-13	16											PL(A) = 1.7
-14		Below 16.05m: grading to pale grey and brown, distinctly and indistinctly bedded at 5-20°, slightly weathered						16.05m: B0°, un, ro, cln 16.35m: B10°, pl, cly vn				PL(A) = 1.1 PL(A) = 0.7
	17							16.9m: B10°, pl, cly 3mm 16.93m: B0°, un, cly 4mm 17.5m: B5°, un, ro, cln	C	100	98	PL(A) = 1
-15	18											
-16	18.33	SANDSTONE: medium to coarse grained, pale grey, distinctly and indistinctly bedded at 5-20°, high strength, fresh, unbroken, Hawkesbury Sandstone						18.29m: B20°, pl, cly vn 18.33m: B10°, pl, cly 1mm				PL(A) = 1.3
	19											
-17								19.76m: B0°, pl, cly vn	C	100	100	PL(A) = 1.7

RIG: Comacchio 205 **DRILLER:** Ground Test **LOGGED:** LHS **CASING:** HW to 10.0m; HQ to 12.9m

TYPE OF BORING: Diacore 0.07m to 0.14m, Rotary wash bore 6.75m to 12.9m, NMLC Coring to 21.16m

WATER OBSERVATIONS: Water observed at 1.70m at 7:10pm on 7 July 2021

REMARKS: Location coordinates are in MGA94 Zone 56. ^SPT at 8.8m undertaken within HW casing; *Field replicate BD05/070721 taken at 11.5-11.95m depth

SAMPLING & IN SITU TESTING LEGEND

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

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Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: DPT Operator Pty Ltd
PROJECT: Cockle Bay Park Redevelopment
LOCATION: 241-249 Wheat Road, Sydney

SURFACE LEVEL: 2.5 AHD
EASTING: 333694
NORTHING: 6250483
DIP/AZIMUTH: 90°/--

BORE No: W5
PROJECT No: 202546.00
DATE: 7 - 8/7/2021
SHEET 3 OF 3

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
-18	21	SANDSTONE: medium to coarse grained, pale grey, distinctly and indistinctly bedded at 5-20°, high strength, fresh, unbroken, Hawkesbury Sandstone *(continued)*							C	100	100	PL(A) = 2
-19	21.16	Bore discontinued at 21.16m - Limit of investigation										
-20	22											
-21	23											
-22	24											
-23	25											
-24	26											
-25	27											
-26	28											
-27	29											

RIG: Comacchio 205 **DRILLER:** Ground Test **LOGGED:** LHS **CASING:** HW to 10.0m; HQ to 12.9m

TYPE OF BORING: Diacore 0.07m to 0.14m, Rotary wash bore 6.75m to 12.9m, NMLC Coring to 21.16m

WATER OBSERVATIONS: Water observed at 1.70m at 7:10pm on 7 July 2021

REMARKS: Location coordinates are in MGA94 Zone 56. ^SPT at 8.8m undertaken within HW casing; *Field replicate BD05/070721 taken at 11.5-11.95m depth

SAMPLING & IN SITU TESTING LEGEND

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

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BORE: W5 PROJECT: Cockle Bay Wharf JULY 2021

12.90 – 17.00m

BORE: W5 PROJECT: Cockle Bay Wharf JULY 2021

17.00 – 21.16m