Douglas Partners
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Integrated Practical Solutions

Report on
Geotechnical Investigation

Proposed Mixed Used Development
9 Albert Street and 31 O'Connell Street, North Parramatta

Prepared for
Peterose Pty Ltd

Project 209535.00
February 2024

Douglas Partners
Geotechnics / Environment / Groundwater

Document History

Document details

Project No.	209535.00	Document No.	R.001.Rev2
Document title	Report on Geotechnical Investigation Proposed Mixed Used Development		
Site address	9 Albert Street and 31 O'Connell Street, North Parramatta		
Report prepared for	Peterose Pty Ltd		
File name	209535.00.R.001.Rev2		

Document status and review

Status	Prepared by	Reviewed by	Date issued
Revision 0	Pooncalalon Yoganathan	John Braybrooke	01 March 2022
Revision 1	Emily Benjamin	John Braybrooke	30 November 2022
Revision 2	Emily Benjamin	John Braybrooke Scott McFarlane (DEP 0000364)	21 February 2024
Revision 3	Emily Benjamin	John Braybrooke Scott McFarlane (DEP 0000364)	23 February 2024

Distribution of copies

Status	Electronic	Paper	Issued to
Revision 0	1	0	Mitchell Favaloro, Ceerose Pty Ltd on behalf of Peterose Pty Ltd
Revision 1	1	0	Mitchell Favaloro, Ceerose Pty Ltd on behalf of Peterose Pty Ltd
Revision 2	1	0	Mitchell Favaloro, Ceerose Pty Ltd on behalf of Peterose Pty Ltd

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

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Report on Geotechnical Investigation
Proposed Mixed Used Development
9 Albert Street and 31 O'Connell Street, North Parramatta

1. Introduction

This report presents the results of a geotechnical investigation undertaken for a proposed mixed used development at 9 Albert Street and 31 O'Connell Street, North Parramatta. The investigation was commissioned in an email dated 24 September 2021 by Mitchell Favaloro of Ceerose Pty Ltd on behalf of Peterose Pty Ltd and was undertaken in accordance with Douglas Partners Pty Ltd (DP) proposal P209535.00.P.001.Rev2 dated 8 November 2021.

It is understood that the proposed development will consist of demolition of the existing building and associated structures on the site and subsequent construction of a large residential complex comprising approximately 370 apartments and ground floor retail spaces with two-levels of basement car parking. The drawings, provided by Ceerose and prepared by DKO Architecture, show that the lowest finished floor level (FFL) is RL 13.6 AHD. DP assumes detailed excavation for lift cores and footings will be no deeper than approximately RL 9 m.

The aim of the investigation was to assess the subsurface conditions across the site to provide comment on the following:

- The indicative geological profile for the site, including anticipated subsurface conditions;
- Excavatability of materials and methods of excavation;
- Groundwater;
- Shoring/boundary support and design parameters and general advice on the likely impact of the excavation on adjacent structures and appropriate limits for ground movement and ground-borne vibration; and,
- Preliminary advice to assist in the design of the building foundations including allowable bearing capacity of likely founding materials encountered.

The site was previously investigated by SMEC Testing Services Pty Ltd in 2010 for Housing NSW. The investigation comprised six cored boreholes to 6 m depth. The current geotechnical investigation comprised a further four cored boreholes drilled to 12 m below existing ground level. The boreholes were logged by DP's engineering geologist and point load testing was carried out on selected rock samples. Details of the field work are presented in this report, together with relevant engineering comments relating to the proposed construction works.

This report has been updated to include drawings received in January and February 2024.

2. Previous Investigations

Douglas Partners has been provided with a previous Geotechnical Investigation report by SMEC Testing Services Pty Ltd (STS) dated February 2010 (Project No. 10530/2416, Report No. 10/2416). STS's investigation consisted of six boreholes, each to 6m depth, and the installation of two Standpipe Piezometers to monitor the groundwater level at the site.

DP has previously undertaken a number of investigations near the site. The information from the previous investigation by SMEC and DP's experience in the area has been used in conjunction with the boreholes drilled during the current investigation to develop the geotechnical model for the site.

3. Site Description

The site (Lot DP1143431 and DP 998240) is located on the corner of Albert Street and O'Connell Street, North Parramatta (refer to Figure 1). The site is trapezoidal in shape, approximately 8921 m^2 in area and is bounded by Albert Street to the north, O'Connell Street to the east, Southern Cross Care Marian Nursing Home and Hope Hostel to the west and Parramatta MH Community Centre to the south.

The surface level varies and slopes upward towards the northeast of the site. The survey drawing provided (Total Surveying Solutions Ref. 211685 dated 27 Sept 2021) indicates that the site has an overall difference in elevation of about 5 m from the north-eastern corner of the site on Albert Street (at about RL 23.06 AHD) to the southwest corner of the property (at about RL 17.75 AHD), giving an average gentle fall towards the southwest of about 6°.

Figure 1: Aerial Photograph of Site

4. Site Geology

Reference to the Sydney 1:100 000 Geological Series Sheet indicates that the site is underlain by rocks of the Triassic aged Hawkesbury Sandstone. This formation mostly comprises 1 – 3 m thick beds of medium to coarse grained quartz sandstone, with very minor shale and laminite interbeds. The geological mapping was confirmed by the rock cores obtained from the boreholes.

Structurally the sandstone has two main sets of steeply dipping joints, oriented NNE and ESE, generally spaced 1 to 10m with small swarms of more closely spaced joints. Low angle thrust faulting is also common in some areas, generally oriented E-W and dipping at 0 – 20 degrees north or south.

High horizontal stresses are present within the rock mass with a maximum horizontal stress usually oriented NNE with an average value of approximately 0.5MPa + 2.5 x 0.024MPa/m x depth.

The map of Salinity Potential in Western Sydney, 2002, produced by the NSW Department of Infrastructure, Planning and Natural Resources, indicates that the site is generally located in an area of moderate salinity potential.

According to 1:25 000 Acid Sulphate Soil Risk Mapping (1994-1998), there is no known occurrence of Acid Sulphate Soils (ASS) at the site.

5. Field Work

5.1 Field Work Methods

The field work included four boreholes (BH101 to BH104), drilled to depths of approximately 12 m. The boreholes were initially cored through the asphalt (apart from BH104 which was drilled initially through fill), followed by auger and rotary drilling within the soils and extremely weathered (EW) sandstone. A standard penetration test was carried out within the EW sandstone in each hole to determine its relative strength. On reaching the top of less weathered rock, diamond core drilling was carried out to obtain 50 mm diameter core samples for strata identification and strength testing

The core was returned to the DP office where it was reviewed, logged, photographed and point load tested for Strength Index (Is_{50}) values. Point loads were carried out on selected samples of the rock core at regular intervals (~1.0 m).

A standpipe piezometer was installed in BH102 to allow measurements of groundwater levels. Construction details of the standpipe piezometer and an initial water level reading are included in the attached borehole log in Appendix C.

The borehole locations are shown on Drawing 1 in Appendix B. Ground surface levels were determined from survey information and should be considered approximate.

5.2 Field Work Results

Details of the subsurface conditions encountered in each borehole are given in the logs in Appendix C, together with notes defining classification methods and descriptive terms. Colour photos of the rock core are also included. The general sequence of materials encountered at DP's borehole locations BH101 - BH104 and STS's boreholes BH 1- BH6 can be summarised as follows:

Asphalt:	Asphalt to 0.1 m (BH101) to 0.25 m (BH102) overlying;
Fill and Residual soil:	Generally, sandy clay or silty clay soil with sandstone and ironstone gravel to depths of 0.8 m to 1.7m, overlying;
Extremely Low Strength Sandstone	Extremely low strength (0.5 – 2MPa unconfined compressive strength based on the SPT results), extremely weathered Hawkesbury Sandstone to depths of 1.25 – 2.5m overlying
Medium to High Strength Sandstone:	Medium to high strength, moderately weathered to slightly weathered, slightly fractured to unbroken cross-bedded Hawkesbury Sandstone to depths of 2.3 – 3.8m, with very low strength bands; overlying
High Strength Sandstone:	Fresh, high strength, slightly fractured to unbroken Hawkesbury Sandstone to the depth of investigation.

Note: Extremely low strength is not a description used in the current Australian Standard for Geotechnical Site investigations (AS 1726:2017) but has been used in this report to describe an extremely weathered material with soil-like properties because the logs by STS predate the current version of AS1726.

Depths to the top of the strata are shown below in Table .

Table 1: Summary of Strata Levels at Each Borehole

Stratum	Top of Stratum Depth (m)									
	DP's Boreholes				SMEC's Boreholes					
	BH101	BH102	BH103	BH104	BH1	BH2	BH3	BH4	BH5	BH6
Asphalt	0.0 m	0.0 m	0.0 m	0.0 m	0.0 m	0.0 m	0.0 m	0.0 m	0.0 m	0.0 m
Fill & Residual Soil	0.1 m	0.2 m	0.25 m	0.6 m	0.0 m	0.0 m	0.0 m	0.0 m	0.0 m	0.0 m
Extremely Low Strength Sandstone	0.8 m	0.9 m	1.0 m	1.3 m	0.9 m	0.8 m	0.9 m	0.7 m	1.7 m	1.2 m
Medium to High Strength Sandstone	1.8 m	1.7 m	1.6 m	2.5 m	1.25 m	1.7 m	1.55 m	1.8 m	2.3 m	1.3 m
High Strength Sandstone	3.8 m	2.6 m	3.46 m	2.8 m	2.3 m	3.1 m	3.1 m	3.4 m	2.8 m	2.3 m
End of Borehole	**12.17 m**	**12.0 m**	**11.91 m**	**12.0 m**	**6.0 m**	**6.0 m**	**6.0 m**	**6.0 m**	**6.0 m**	**6.0 m**

A cross section summarising the subsurface conditions at the boreholes is presented in Drawing 2 in Appendix B.

5.3 Geological structures

The sandstone is horizontally bedded with clayey partings along some of the beds, particularly in the upper 4m of the profile. Cross bedding dips at 10 – 15 degrees with clayey veneers on some cross beds.

Few joints were intersected by the drilling, generally dipping at 70 – 90 degrees, with a few dipping at 35 – 45 degrees.

5.4 Groundwater

Groundwater was not observed during drilling in any of the boreholes. The use of water as a drilling fluid during NMLC coring precluded groundwater observations in the rock section. SMEC bailed the drilling water out of their boreholes and noted that the standing water level after 5 days was at a depth of 2.5m. They commented that this was possible seepage from the soil/rock interface.

On completion of drilling BH102, a temporary water monitoring well was installed with the slotted section sealed within the rock. The borehole was purged of drilling fluids prior to installation of the well. A summary of water level observations and measurements made to date are presented in Table 2 below. Note the measurement made on 15 February 2022 may have had surface water intrusion into the borehole. It should be noted that groundwater levels are affected by factors such as climatic conditions, soil / rock permeabilities and will therefore vary with time.

Table 2: Summary of Water Level Measurements

Location ID	Surface RL (AHD)	Water Level Depth (m)	Water Level RL (AHD)	Date Measured
BH102	21.7 m	1.0 m	21.0 m	15/02/22

6. Laboratory Testing

6.1 Point Load Tests

The results of axial (ie normal to the near horizontal bedding) Point Load Strength Index testing ($Is_{(50)}$), carried out on selected rock cores, are shown on the borehole logs as PL(A) at the respective depths (see Appendix C).

The results ranged from 0.4 MPa to 3.1 MPa, but generally 1.2 MPato 2.1 MPa in the sandstone, indicating that the rock tested ranged from very low strength to high strength rock. The $Is_{(50)}$ results suggest an unconfined compressive strength (UCS) range of between about 6 MPa and 50 MPa (based on $Is_{(50}$ x 16 = UCS), but generally 20 MPa to 35 MPa.

7. Geotechnical Model

Basically, the site comprises 1.25 m to 2.5 m of soil and extremely low strength sandstone overlying generally medium and then high strength sandstone to at least a depth of 12m.

Jointing and bedding is anticipated to be widely spaced below a depth of about 4 m to 5 m. High horizontal stress is anticipated, particularly in the stronger fresh sandstone.

8. Proposed Development

As per the architectural drawings provided (refer to Appendix E), it is understood that the proposed development will consist of demolition of the existing building and associated structures on the site and subsequent construction of a residential complex comprising approximately 370 apartments and ground floor retail spaces with two-levels of basement car parking. The drawings provided by Ceerose and prepared by DKO Architecture show the deepest finished floor level (FFL) is RL 13.6 AHD (see Figure 2 below). DP assumes that detailed excavation for lift cores and footings will be no deeper than approximately RL 9 AHD.

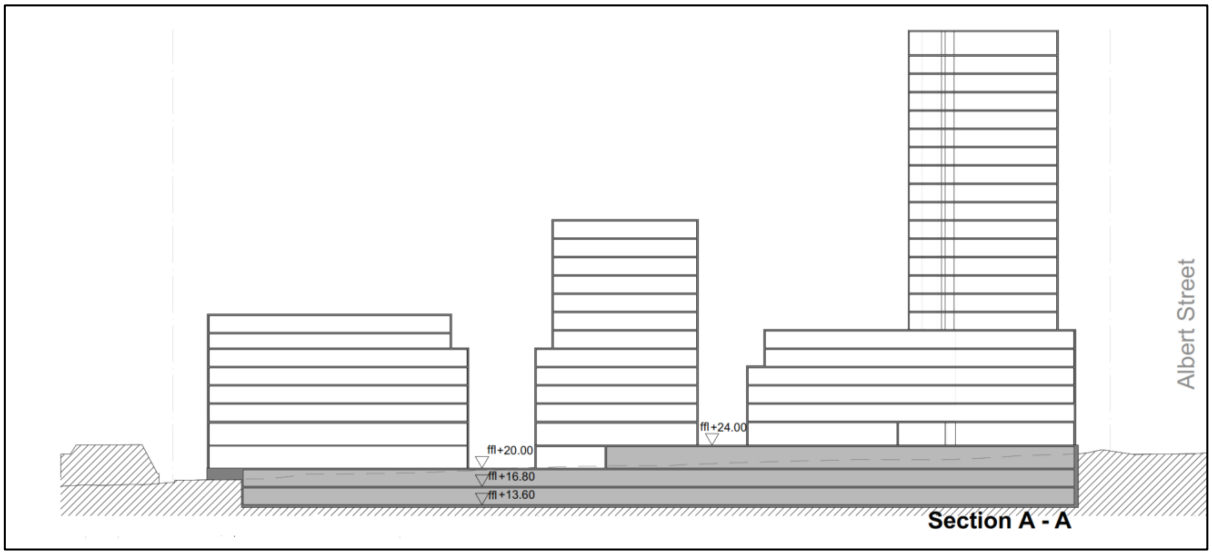


Figure 2: Cross-Section (top) of site from the DKO Architecture drawings.

Currently no information is available on adjacent building foundations and basement levels. These levels should be confirmed prior to proceeding with detailed design and basement excavation.

9. Comments

9.1 Excavations

9.1.1 Excavation Conditions

The proposed finished basement floor level is RL 13.6 AHD (for a 2-level basement) with detailed excavation assumed to be to ~RL 10.0 AHD for lift pits, requiring bulk excavation to about 10.0 AHD below the existing asphalt level at the northern end of the site and to about 7 m below the existing ground level at the south-western end. Based on the likely subsurface conditions, excavations to depths of up to 1.3 m to 2.5 m is likely to be in soil and extremely low strength sandstone. These materials should be readily excavated using conventional earthmoving equipment, such as excavators. Below this level, the type of excavation equipment will largely be dependent on the rock's strength and discontinuity spacing. Excavation of medium and high strength, fractured to slightly fractured sandstone, as encountered in the boreholes, can be achieved by heavy ripping with a large bulldozer and/or by use of excavator mounted hydraulic rock hammers. However, the combination of high strength and thickly bedded sandstone with few joints suggests ripping may be difficult, with low productivity, even when using large bulldozers and/or rock hammers.

The use of such equipment will generally cause dust, noise and vibration, the latter has the potential to affect adjacent below ground infrastructure and occupants of nearby buildings. Where rock hammers are required in the vicinity of adjacent structures (closer than 20 m) it would be prudent to monitor and limit vibrations on these structures, as further discussed in Section 9.2 together with undertaking dilapidation survey of adjacent buildings, services and structures.

Prior to commencing bulk excavation, it will be necessary to investigate / obtain accurate information on all adjacent foundations and founding conditions. It will also be necessary to determine the extent and depth of any adjacent basements.

9.1.2 Disposal of Excavated Material

All surplus excavated materials will need to be disposed of in accordance with the Protection of the Environment Operations Act 1997 (POEO Act). All materials removed from the site are defined as waste under the POEO Act and must be disposed of in accordance with one of the following:

- Virgin Excavated Natural Materials (VENM) as defined under the POEO Act, permitting beneficial reuse; or,
- A waste category meeting the criteria set out in the NSW EPA Waste Classification Guidelines 2014, with the materials disposed to a landfill licenced to receive the waste under the assigned classification or taken to a recycling facility licenced to receive the waste; or
- Material complying with a Resource Recovery Order (RRO) as defined under the Protection of the Environment Operations (Waste) Regulation 2014, with complying materials able to be reused under certain conditions.

Accordingly, environmental testing will need to be carried out to determine the most appropriate off-site destination(s) for the surplus excavated material.

9.1.3 Excavation Support

To reduce the risks of causing instability and damage to adjacent structures and surrounding public footpaths/roads, careful consideration must be given to the planning and design of any excavation, including any underpinning and excavation retention required to shore the faces.

9.1.3.1 Batter Slopes

Excavated faces in the fill and soil cannot stand vertically unsupported. In areas where the excavation does not extend to the boundary there may be room to use battering within the soils.

Suggested temporary and permanent batter slopes for unsupported excavations up to a maximum height of 3 m are shown in Table 3. The use of higher batters, if required, will be subject to further geotechnical review and input. These batters are subject to assessment of jointing in the rock by a geotechnical engineer. If adverse jointing is present in the rock flatter batters or stabilisation may be required. Also, if surcharge loads are applied near the crest of the slope further geotechnical review and probably flatter batters or stabilisation using rock bolts or soil nails may be required.

Table 3: Maximum Safe Batter Slopes (for batters up to 3 m in height)

Material	Batter Slope (H:V)	
	Temporary	Long Term
Fill, Residual Soil and Extremely low strength sandstone	1.5:1	2:1(1)
Medium and High Strength Sandstone	Vertical*	Vertical*

*Providing no adversely oriented jointing is present

The extremely low strength sandstone is expected to deteriorate and be readily eroded if left exposed to the weather, therefore it should be treated as a soil.

9.1.3.2 Retaining/Shoring

If vertical excavation in the soil is required adjacent to the site boundaries or to structures, shoring will be needed to support it. Vertical excavated faces in medium strength or better sandstone are generally self-supporting, apart from where adversely oriented jointing is present.

Where space permits, shoring along the boundary could include soldier piles and infill shotcrete panels.

The design for the excavation support should take all surcharge loads into account, including the neighbouring building loads, traffic loads, construction surcharge loads, hydrostatic pressure, etc.

It is suggested that the design of cantilevered shoring systems (or shoring systems with one row of anchors) be based on a triangular earth pressure distribution using the earth pressure coefficients provided in Table 4.

Table 4: Recommended Design Parameters for Shoring Systems

Material	Unit Weight (kN/m^3)	Earth Pressure Coefficient	
		Active (K_a)	At Rest (K_o)
Fill, Clay and Sandy Clay	20	0.35	0.5
Extremely Low to Low Strength Sandstone	22	0.2	0.3
Medium Strength or stronger Sandstone	24	0*	0*

Notes: The values above assume a level surface behind the wall.
* It is assumed that the medium strength rock mass is free of adverse dipping joints and seams.
It should also be noted that the K_a and the K_o designs will not prevent stress relief movement.

The horizontal or lateral pressures acting on the wall can be calculated based on the following triangular earth pressure distribution:

$$H_z = K (\gamma z + p)$$

Where: H_z = horizontal pressure at depth z
γ = unit weight of soil or rock
K = earth pressure coefficient (see Table 4).
z = depth (m)
p = vertical surcharge pressure

'Active' earth pressure coefficient (K_a) values may be used where some wall movement is acceptable. 'At Rest' earth pressure coefficient (Ko) values should be used where the wall movement needs to be limited.

For braced walls or where two or more rows of anchors are used, the shoring can be designed using a rectangular or trapezoidal earth pressure distribution. Where there are no movement-sensitive structures an earth pressure distribution equal to 4H kPa (where H, in metres, equals the depth to the top of self-supporting medium strength or stronger rock) can be used. Where the wall movement is to be minimised (i.e. close to adjacent buildings or services) the lateral earth pressure can be calculated using 6H kPa. For movement-sensitive structures, where it is critical that deformation is controlled, it may be necessary to calculate the pressure using 8H kPa. These pressures can be applied as either rectangular or trapezoidal earth pressure distributions. Note these earth pressure distributions are "pressure envelopes", selected to ensure that no row of anchors is overloaded during the temporary support phase. The actual magnitude and distribution of lateral earth pressures for the building in its final (long term) condition may differ from the uniform distributions given above.

In all cases, additional surcharge loads such as new and existing footings, construction loads, etc., must be allowed for in the design, applied as a rectangular earth pressure distribution over the depth of influence. Hydrostatic pressure should also be assumed to act over the full height of the basement walls to account for increases in groundwater levels caused by significant rainfall events and flooding.

Passive resistance for piles founded below the base of the bulk excavation may be based on a working passive bearing pressure of at least 3500 kPa, provided that the rock comprises medium strength or

stronger sandstone, which is not adversely affected by defects. The first 0.5 m of rock socket below the bulk excavation level should not be taken into account for the purpose of passive restraint. The minimum socket depth should be equal to the greater of one pile diameter or 1.0 m below the lowest level of any nearby excavation (including any detailed excavations), but subject to analysis. This is also relevant where toe anchors are installed, just prior to fully exposing the toe of the pile.

Staged excavation and inspection by a suitably qualified geotechnical engineer will be required to confirm that the rock in front of the wall/pile is not adversely affected by defects, especially where passive resistance is relied upon.

9.1.3.3 Anchoring

Pre-stressed ground anchors, rockbolts and dowels (support elements) can be used to laterally support shoring, underpinning works or unstable rock masses (i.e. rock wedges). These support elements should be bonded in the stronger rock, inclined as required, but preferably not steeper than 30° below the horizontal. Table 5 provides allowable bond stresses for estimating purposes.

Table 5: Allowable Bond Stresses

Material	Allowable Bond Stress (kPa)
Medium Strength Sandstone	350
Medium to High Strength Sandstone or better	600

These values should be confirmed by pull-out tests prior to installation of support elements. Ultimately, it is the contractor's responsibility to ensure that the correct design values (specific to the support system and method of installation) are used and that the support element holes are carefully cleaned prior to grouting.

For the installation of pre-stressed ground anchors, it is recommended that they are tested to 125% of their nominal working load. Where stress relief or further unavoidable movement of the shoring is expected, it is recommended that the support elements are locked-off at between 60% and 80% of their working loads, as required, to accommodate the additional rock stress relief movement and subsequent increase in stress in the support elements. Checks should be carried out to confirm that the load in the support elements has been maintained and that losses from creep or other causes have not occurred.

Shorter support elements (rockbolts dowels and pins) may be required to support unstable rock wedges, slivers or blocks. Short dowels and pins may be required to support feather edges where sub-parallel joints intersect the face. Shotcrete or mesh may be required where beds/seams of extremely or very low strength rock are encountered within higher strength sandstone, secured with anchors, rockbolts, dowels and pins, as required.

Care should be exercised to ensure that anchors are installed progressively during excavation and stressed prior to excavation of the next drop to ensure that stability is maintained at all times.

Vertical hold-down anchors could also be considered to resist temporary or long-term uplift of the core and should be designed as per AS4678. The designer should check the cone pull-out failure mechanism by assuming a 90˚ cone in medium to high strength, slightly fractured sandstone (or better). Note that

the buoyant weight of the rock should be used below the water table. Vertical ground anchors may also be designed using the parameters provided in Table 5.

9.2 Vibration

During excavation, it will be necessary to use appropriate methods and equipment to keep ground vibration at adjacent buildings and structures within acceptable limits. The level of acceptable vibration is dependent on various factors including the type of structure (e.g. reinforced concrete, brick, etc.), its structural condition, founding conditions, the frequency range of vibrations produced by the construction equipment, the natural frequency of the building and the vibration transmitting medium.

It is noted, however, that ground vibration can be strongly perceptible to humans at levels above 2.5 mm/s peak particle velocity (PPV). This is generally much lower than the vibration levels required to cause structural damage to most buildings. The Standard AS/ISO 2631.2 – 2014 “Mechanical vibration and shock – Evaluation of human exposure to whole-body vibration – Vibration in buildings (1 Hz to 80 Hz)” suggests an acceptable daytime limit of 8 mm/s PPV for human comfort.

As the magnitude of vibration transmission is site specific, it is recommended that a vibration trial be carried out at the commencement of rock excavation. These trials may indicate that smaller or different types of excavation equipment are required to reduce vibration to acceptable levels. It may also be necessary to install vibration monitors to monitor the vibration during the works.

Although the threshold for damage to most buildings is much higher than the 8 mm/s PPV limit set for human comfort, it is suggested that a maximum PPV of 8 mm/s (measured at the first occupied level of existing buildings) be employed at this site for both structural / architectural and human comfort considerations.

It is recommended that building condition (dilapidation) surveys of adjacent buildings be undertaken prior to commencement of excavation and that their founding conditions be determined, to assess the maximum acceptable vibration level for prevention of damage and to provide evidence in the event of any damage claims.

9.3 Foundations

9.3.1 Pad or Strip Footings

The design of pad or strip foundations on low, medium strength or stronger sandstone may be carried out using the values given in Table 6.

Table 6: Design Parameters and Deformation Moduli for Foundation Design (after Pells et al[1])

Rock Strength	Ultimate End Bearing Pressure (MPa)	Allowable End Bearing Pressure (MPa)	Field Elastic Modulus* (MPa)	Testing Requirements
Low Strength Sandstone	4 – 15	1.0 – 3.5	100 – 700	Site inspections with at least 2 cored bores.
Medium strength or better	20 – 40	3.5 – 6	350 – 1200	Minimum 4 cored bores with spoon testing or cores in at least ⅓ of footings.

*Note that additional analysis will be required to calculate the modulus of subgrade reaction for individual footings.

- Bearing pressure values assume a minimum embedment of one footing width into the relevant bearing stratum.
- Ultimate parameters are mobilised at large settlements (i.e. >5% of minimum foundation width).
- Allowable end bearing pressures to cause settlement of less than 1% of minimum footing dimension.

The foundation design parameters given in Table 6 assume that the foundation excavations are clean and free of loose debris prior to concrete placement.

Prior to placing rebar or blinding, the base of all footings should be inspected by a geotechnical engineer and proof drilled, or spoon tested, as appropriate, to confirm that founding conditions are suitable for the design parameters. Spoon testing is required in accordance with the requirements in Table 6. Spoon testing should extend to below the footing base for a depth of at least 1.5 times the footing width or 2.5 m, whichever is shallower. Test holes for spoon testing should be at least 40 mm in diameter. If weak seams or defects are encountered, footings may need to be deepened until suitable foundation material is reached. A reduced bearing pressure of less than 3.5 MPa should be adopted if spoon testing is not carried out.

Foundations proportioned on the basis of the allowable bearing pressures in Table 6 are expected to experience total settlements of less than 1% of the foundation width under the applied working load, with differential settlements between adjacent foundations expected to be less than half of this value.

The allowable bearing pressure is generally reduced by at least one quarter for all high-level footings bearing on competent, self-supporting (i.e. not affected by defects) medium strength or stronger sandstone near the edge of a vertical excavation (to be assessed by a suitably experienced geotechnical engineer/engineering geologist).

9.4 Groundwater

Near surface groundwater levels have been measured in standpipes, fluctuating between 1 m to 3 m below surface level within the soil. It is anticipated that the permanent water table within rock will be below the surface level by at least 5 m. The proposed basement is likely to intersect this water table.

[1] Design Values for Foundations on Sandstone and Shale in the Sydney Region – Pells, Mostyn & Walker. AGS 1998

Based on the borehole logs, the rock mass permeability is anticipated to be low with inflow into the basement likely to be readily handled by a sump and pump out. Note iron precipitates should be anticipated within the groundwater.

According to the City of Parramatta's flood risk mapping, the site is on the edge of the low risk zone and hence flooding will need to be considered in the design.

9.5 Seismicity

A Hazard Factor (Z) of 0.08 would be appropriate for the development site in accordance with Australian Standard AS 1170.4 – 2007 Structural design actions – Part 4: Earthquake actions in Australia. The site sub-soil class is Class Be based on the geotechnical model for the site.

9.6 Geotechnical Inspection and Monitoring

It is suggested that the following be carried out either prior to or during the construction phase of the project, as appropriate.

9.6.1 Monitoring

It is recommended that survey points be installed on the top of the shoring to monitor wall deflection during the works. Monitoring targets should also be considered on adjacent buildings, particularly if heritage, and on any retained façade walls (Structural Engineer to advise). Readings relating to the geotechnical aspects of the work will generally need to be taken in advance of any demolition and excavation, at intervals during excavation works, and after completion of all excavation works and forwarded on to the geotechnical engineer for assessment.

9.6.2 Dilapidation Surveys (Buildings)

Prior to commencing with demolition or excavation work, dilapidation surveys should be carried out on adjacent buildings, pavements and infrastructure, to document any existing defects and ensure that claims for damage due to construction related activities can be accurately assessed.

9.6.3 Excavation Inspections

Inspections by a geotechnical engineer will be required during shoring works. Inspections of excavation faces will also be required during excavation in the rock to identify any adversely dipping joints or defects that could form wedges and determine if any additional support is required. In addition to the above it is also recommended that drilling, installation, grouting and stressing of rockbolts and anchors are witnessed by a geotechnical engineer.

The level and frequency of inspections can be outlined in an inspection and test plan once the design has been finalised if required.

10. References

Pells PGN, Mostyn G and Walker BF, 1998, Foundation on sandstone and shale in the Sydney region, Australian Geomechanics, December 1998, p 17-29.

11. Limitations

Douglas Partners (DP) has prepared this report for this project at 9 Albert Street and 31 O'Connell Street, North Parramatta in accordance with DP's proposal 209535.00.P.001.Rev2, dated 08/11/2021 and acceptance received from Mitchell Favaloro dated 24 September 2021. The work was carried out under DP's Conditions of Engagement. This report is provided for the exclusive use of Ceerose Pty Ltd for this project only and for the purposes as described in the report. It should not be used by or be relied upon for other projects or purposes on the same or another 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.

Copyright

Borehole and Test Pit Logs

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

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

Groundwater

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

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

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

Reports

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

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

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

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

About this Report

Site Anomalies

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

Information for Contractual Purposes

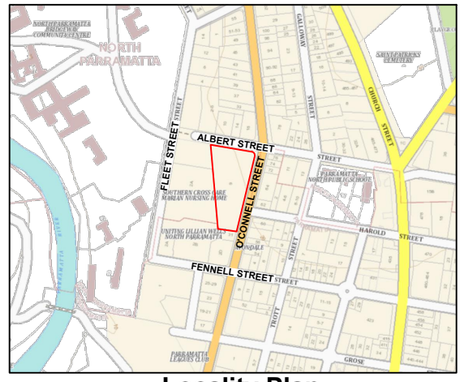
Where information obtained from this report is provided for tendering purposes, it is recommended that all information, including the written report and discussion, be made available. In circumstances where the discussion or comments section is not relevant to the contractual situation, it may be appropriate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

Site Inspection

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

Appendix B

DP Drawings



Locality Plan

NOTES:
1: Base image from MetroMap (Dated 30.07.2021)
2: Base Survey Plan from Total Surveying Solutions, Job No. 211685 (Dated 27.09.2021)
3: Previous borehole locations are approximate and estimated from Drawing No. 10/2416, Project No. 10530/2416, Report No. 10/2416, by SMEC Testing Services Pty Ltd (Dated February 2010)
4: Basement footprint from DKO Architecture, Project No.13387(Dated 06.02.2024)

0 5 10 15 20 30 40 50 75m
1:750 @ A3

LEGEND

- Approximate Site Boundary
- Borehole Location (DP - 2021)
- Approximate Previous Borehole Location (SMEC Testing Services - 2010)
- Geological Cross Section

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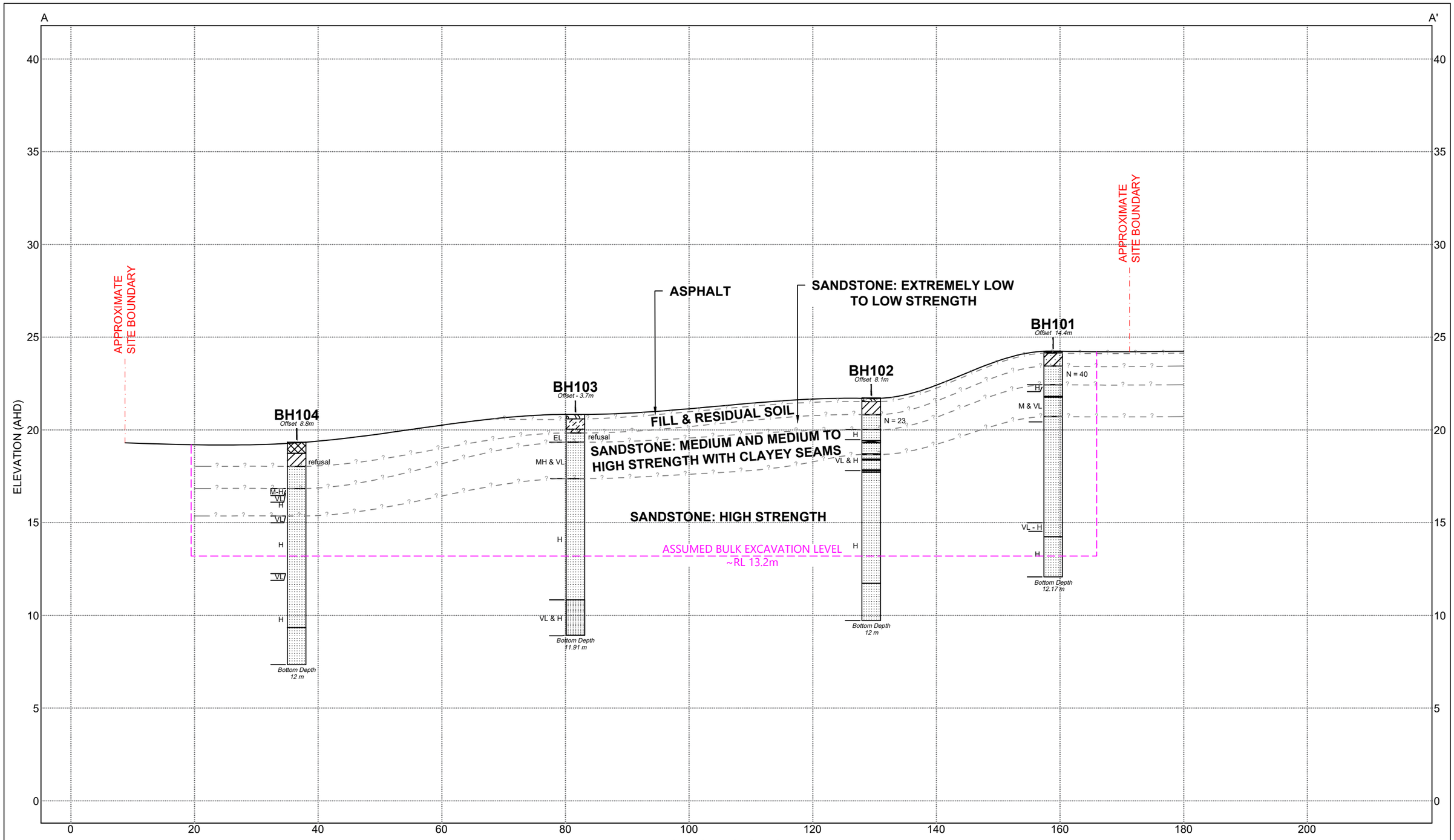
CLIENT: Peterose Pty Ltd		TITLE: **Test Location Plan** **Proposed Residential Development** **9 Albert Street and 31 O'Connell Street, North Parramatta**
OFFICE: Sydney	DRAWN BY: MG/MN	
SCALE: 1:750 @ A3	DATE: 14.02.2024	

PROJECT No: 209535.00
DRAWING No: 1
REVISION: 2



LEGEND

- Core Loss
- Asphaltic Concrete
- Clay
- Clayey Sand
- Filling
- Roadbase
- Sandstone
- Sandy Clay

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.

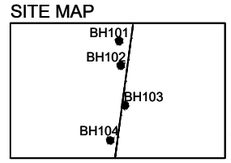
ROCK STRENGTH

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

TESTS / OTHER

- N - Standard penetration test value
- — ? — — - Interpreted geotechnical boundary

SITE MAP



0 12

Horizontal Scale (metres)

Vertical Exaggeration = 3.0

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Geotechnics / Environment / Groundwater

CLIENT: Peterose Pty Ltd		TITLE: **Cross-Section A-A'**	PROJECT No: 209535.00
OFFICE: Sydney	DRAWN BY: CJ/MN	**Proposed Residential Development**	DRAWING No: 2
SCALE: 1:600 (H) 1:200 (V) @ A3	DATE: 14.02.2024	**9 Albert Street and 31 O'Connell Street, North Parramatta**	REVISION: 2

Appendix C

Field Work Results

BOREHOLE LOG

CLIENT: Ceerose Pty Ltd
PROJECT: Proposed Residential Development
LOCATION: 9 Albert Street and 31 O'Connell Street, North Parramatta

SURFACE LEVEL: 24.2414 AHD
EASTING: 315103.8
NORTHING: 6257857
DIP/AZIMUTH: 90°/--

BORE No: BH101
PROJECT No: 209535.00
DATE: 29/11/2021
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)	Type	Core Rec. %	RQD %	Test Results & Comments
24	0.1	ASPHALTIC CONCRETE										
		Sandy CLAY: red brown, with ironstone gravel, residual										
	0.8	SANDSTONE: grey, weathered							S			10,15,25 N = 40
23	1											
	1.8	SANDSTONE: medium to coarse grained, pale grey and brown, medium and high strength, slightly and highly to moderately weathered, slightly fractured, Hawkesbury Sandstone						1.94m: B0°, cly 3mm 2.25m: J30°, un, ro, cln				PL(A) = 1.8
22	2											
	2.48							2.44m: CORE LOSS: 40mm 2.48m: J60°, pl, ro, cly co 5-10mm 2.76m: B10°, cly 5mm 3.1m: B0°, cly co and J50°, pl, ro, cln 3.3m: J45°, pl, ro, cly co 5mm 3.4m: B0°, cly 10mm 3.5m: B°, fe, cly 10mm 3.70-3.72m: Ds 3.8m: B0°, cly 10mm	C	98	90	PL(A) = 0.4
21	3											PL(A) = 0.4
	3.52	SANDSTONE: medium to coarse grained, pale grey and brown, bedded and cross-bedded at 10°-15°, high strength, moderately weathered then fresh, slightly fractured and unbroken, Hawkesbury Sandstone										PL(A) = 1.5
20	4							4.32m: B0°, cly co 2mm	C	100	98	PL(A) = 1
19	5											
								5.65m: B0°, cly co 5mm				PL(A) = 2.3
18	6								C	100	100	PL(A) = 2.2
17	7							6.92m: B0°, fe				PL(A) = 1.9
16	8											PL(A) = 1.8
								8.75m: J35°, pl, ro cln 8.88m: B5°, cly co 5mm	C	100	99	
15	9							9.25m: B0°, cly 10mm				PL(A) = 1.6
	10.0							9.7m: B0°, cly 10mm				

RIG: Scout 1 **DRILLER:** JD **LOGGED:** SI **CASING:** HW to 1.5m, HQ to 1.8m

TYPE OF BORING: Solid Flight Auger to 1.5m, Rotary (Water) to 1.8m, NMLC Coring to 12.17m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Ceerose Pty Ltd
PROJECT: Proposed Residential Development
LOCATION: 9 Albert Street and 31 O'Connell Street, North Parramatta

SURFACE LEVEL: 24.2414 AHD
EASTING: 315103.8
NORTHING: 6257857
DIP/AZIMUTH: 90°/--

BORE No: BH101
PROJECT No: 209535.00
DATE: 29/11/2021
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
14	11	SANDSTONE: medium to coarse grained, pale grey and brown, bedded and cross-bedded at 10°-15°, high strength, fresh, unbroken, Hawkesbury Sandstone Below 10.75m: grading to fine to medium grained							C	100	99	PL(A) = 2
13	12								C	100	100	PL(A) = 1.4
12	12.17	Bore discontinued at 12.17m										
11	13											
10	14											
9	15											
8	16											
7	17											
6	18											
5	19											

RIG: Scout 1 **DRILLER:** JD **LOGGED:** SI **CASING:** HW to 1.5m, HQ to 1.8m

TYPE OF BORING: Solid Flight Auger to 1.5m, Rotary (Water) to 1.8m, NMLC Coring to 12.17m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

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

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BORE: BH101 PROJECT: 209535.00 DECEMBER 2021

1.80 – 6.00m

BORE: BH101 PROJECT: 209535.00 DECEMBER 2021

6.00 – 11.00m

BORE: BH101 PROJECT: 209535.00 DECEMBER 2021

11.00 – 12.17m

BOREHOLE LOG

CLIENT: Ceerose Pty Ltd
PROJECT: Proposed Residential Development
LOCATION: 9 Albert Street and 31 O'Connell Street, North Parramatta

SURFACE LEVEL: 21.724 AHD
EASTING: 315106.1
NORTHING: 6257827
DIP/AZIMUTH: 90°/--

BORE No: BH102
PROJECT No: 209535.00
DATE: 30/11/2021
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Type	Core Rec. %	RQD %	Test Results & Comments
21	0.02	ASPHALTIC CONCRETE										
	0.2	ROADBASE GRAVEL										
		CLAY/Sandy CLAY: orange-brown and red-brown with fine ironstone and sandstone gravel, residual										
1	0.9	SANDSTONE: white and red, highly weathered							S			5,12,11 N = 23
20	1.7	SANDSTONE: medium to coarse grained, pale grey and brown, high strength with very low strength bands, moderately then slightly weathered, slightly fractured, Hawkesbury Sandstone										PL(A) = 1.8
2								2.25m: B5°, cly 10mm				
	2.42							2.3m: CORE LOSS: 120mm				PL(A) = 1.1
19								2.42-2.60m: Ds				
								2.8m: B0°, fe	C	88	80	
3	3.05							3m: CORE LOSS: 50mm				
	3.35							3.3m: CORE LOSS: 50mm				
18								3.55m: B0°-5°, fe, fg 10mm				PL(A) = 1.5
	3.92							3.88m: CORE LOSS: 40mm				
4	4.0	SANDSTONE: medium to coarse grained, pale grey and brown, high strength, slightly weathered then fresh, slightly fractured and unbroken, Hawkesbury Sandstone										PL(A) = 1.4
17												
5												
								5.52m: B0°, cly 5mm	C	100	100	
16												PL(A) = 1.9
6												
												PL(A) = 1.9
15												
7												
												PL(A) = 1.9
14								7.75m: B20°, cly vn				
8												
									C	100	100	
13												PL(A) = 1.4
9												
								9.25m: B10°, cly vn				
12												PL(A) = 1.8
	10.0											

RIG: Scout **DRILLER:** JJ **LOGGED:** SI **CASING:** HW to 1.7m

TYPE OF BORING: Solid Flight Auger to 1.5m, Rotary (Water) to 1.7m, NMLC Coring to 12.00m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Standpipe installed to 12.0m (Screen 1.5-12.0m, Gravel 1.0-12.0m, Bentonite to 0.1m, 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: Ceerose Pty Ltd
PROJECT: Proposed Residential Development
LOCATION: 9 Albert Street and 31 O'Connell Street, North Parramatta

SURFACE LEVEL: 21.724 AHD
EASTING: 315106.1
NORTHING: 6257827
DIP/AZIMUTH: 90°/--

BORE No: BH102
PROJECT No: 209535.00
DATE: 30/11/2021
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (EW, HW, MW, SW, FS, FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding, J - Joint, S - Shear, F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
11	11	SANDSTONE: medium to coarse grained, pale grey and brown, high strength, slightly weathered then fresh, unbroken, Hawkesbury Sandstone							C	100	100	PL(A) = 2
10	12 12.0	Bore discontinued at 12.0m										PL(A) = 1.7
9	13											
8	14											
7	15											
6	16											
5	17											
4	18											
3	19											
2												

RIG: Scout **DRILLER:** JJ **LOGGED:** SI **CASING:** HW to 1.7m

TYPE OF BORING: Solid Flight Auger to 1.5m, Rotary (Water) to 1.7m, NMLC Coring to 12.00m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Standpipe installed to 12.0m (Screen 1.5-12.0m, Gravel 1.0-12.0m, Bentonite to 0.1m, 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: BH102 PROJECT: 209535.00 DECEMBER 2021

1.70 – 6.00m

BORE: BH102 PROJECT: 209535.00 DECEMBER 2021

6.00 – 11.00m

BORE: BH102 PROJECT: 209535.00 DECEMBER 2021

11.00 – 12.00m

BOREHOLE LOG

CLIENT: Ceerose Pty Ltd
PROJECT: Proposed Residential Development
LOCATION: 9 Albert Street and 31 O'Connell Street, North Parramatta

SURFACE LEVEL: 20.8377 AHD
EASTING: 315111.4
NORTHING: 6257778
DIP/AZIMUTH: 90°/--

BORE No: BH103
PROJECT No: 209535.00
DATE: 1/12/2021
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)	Type	Core Rec. %	RQD %	Test Results & Comments
20	0.25	ROADBASE GRAVEL										
		Clayey SAND: red, with ironstone gravel										
	0.8	CLAY: red, with sandstone and ironstone gravel, residual										
1	1.0	SANDSTONE: red and white, weathered, with ironstone bands							S			3,22,25/125 refusal
	1.5	SANDSTONE: medium grained, pale grey brown and red brown, medium to high strength with very low strength bands, highly and slightly weathered, slightly fractured, Hawkesbury Sandstone						1.6m: B0°, cly co 2.12m: B10°, cly 10mm 2.3m: J30°, pl, ro, cly co	C	100	85	PL(A) = 1 PL(A) = 0.4
19								2.68-2.76m: Cs 2.7m: B0°, cly 5mm 2.8m: B10°, cly 5mm				
2												
18												
3												
	3.46	SANDSTONE: medium to coarse grained, pale grey brown, high strength, slightly to moderately weathered then fresh, slightly fractured and unbroken, Hawkesbury Sandstone						3.32m: B5°, cly vn 3.45m: B5°, fe, cly 10mm				PL(A) = 1.4
17									C	100	97	PL(A) = 1.7
4												
16												
5								5.2m: B20°, cly 5mm				PL(A) = 1.8
15												
6												PL(A) = 3.1
14												
7								7.25m: J25°, ti 7.62m: F20°, ti	C	100	100	PL(A) = 1.9
13												
8												PL(A) = 1.4
12												
9									C	100	100	PL(A) = 2.4
11												

RIG: Bobcat **DRILLER:** JJ **LOGGED:** SI **CASING:** HW to 1.5m

TYPE OF BORING: Solid Flight Auger to 1.5m, NMLC Coring to 11.91m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Ceerose Pty Ltd
PROJECT: Proposed Residential Development
LOCATION: 9 Albert Street and 31 O'Connell Street, North Parramatta

SURFACE LEVEL: 20.8377 AHD
EASTING: 315111.4
NORTHING: 6257778
DIP/AZIMUTH: 90°/--

BORE No: BH103
PROJECT No: 209535.00
DATE: 1/12/2021
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
10	11	SANDSTONE: medium to coarse grained, pale grey brown, high strength, slightly to moderately weathered then fresh, slightly fractured and unbroken, Hawkesbury Sandstone *(continued)* SANDSTONE: medium to coarse grained, pale grey brown, high strength, fresh, slightly fractured and unbroken, Hawkesbury Sandstone						10.45m: B0°, cly 5mm 10.5m: B0°, cly 5mm 11.04m: J80°, pl, ro, fg, cly, Sz 50mm	C	100	100	PL(A) = 1.5 PL(A) = 1.6
9	11.91 12	Bore discontinued at 11.91m										
8	13											
7	14											
6	15											
5	16											
4	17											
3	18											
2	19											
1												

RIG: Bobcat **DRILLER:** JJ **LOGGED:** SI **CASING:** HW to 1.5m

TYPE OF BORING: Solid Flight Auger to 1.5m, NMLC Coring to 11.91m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

BORE: BH103 PROJECT: 209535.00 DECEMBER 2021

1.50 – 6.00m

BORE: BH103 PROJECT: 209535.00 DECEMBER 2021

6.00 – 11.00m

BORE: BH103 PROJECT: 209535.00 DECEMBER 2021

11.00 – 11.91m

BOREHOLE LOG

CLIENT: Ceerose Pty Ltd
PROJECT: Proposed Residential Development
LOCATION: 9 Albert Street and 31 O'Connell Street, North Parramatta

SURFACE LEVEL: 19.3389 AHD
EASTING: 315093
NORTHING: 6257735
DIP/AZIMUTH: 90°/--

BORE No: BH104
PROJECT No: 209535.00
DATE: 29 - 30/11/2021
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
19	0.0	FILL										
	0.6	CLAY/Sandy CLAY: dark brown and red-brown, with fine ironstone gravel, residual										
18	1.3	SANDSTONE: yellow, red and white, highly weathered with clayey layers							S			1,2,10/50 refusal
17	2.5	SANDSTONE: medium to coarse grained, medium to high strength, moderately to slightly weathered then fresh, slightly fractured and unbroken, Hawkesbury Sandstone						2.61m: B10°, cly co, Ds 150mm				PL(A) = 1
16	3.0											PL(A) = 1.6
15	4.0							3.98m: B0°, cly 10mm 4.12m: J30°, pl, ro, cln	C	100	95	
14	5.0											PL(A) = 2.5
13	6.0											PL(A) = 2.1
12	7.0							7.06m: B5°, cly vn 7.09m: B0°, cly 5mm 7.42m: J20°, un, ro, cln	C	100	97	PL(A) = 2
11	8.0											PL(A) = 2.1
10	9.0							8.65m: B0°(x2), cly co 1-2mm 8.71m: B0°(x2), cly co 1-2mm 9.15m: B5°, cly vn	C	100	98	PL(A) = 1.6
	10.0											PL(A) = 1.9

RIG: Bobcat **DRILLER:** JJ **LOGGED:** SI **CASING:** HW to 2.5m

TYPE OF BORING: Solid Flight Auger to 1.5m, Rotary (Water) to 2.5m, NMLC Coring to 12.00m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Ceerose Pty Ltd
PROJECT: Proposed Residential Development
LOCATION: 9 Albert Street and 31 O'Connell Street, North Parramatta

SURFACE LEVEL: 19.3389 AHD
EASTING: 315093
NORTHING: 6257735
DIP/AZIMUTH: 90°/--

BORE No: BH104
PROJECT No: 209535.00
DATE: 29 - 30/11/2021
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (EW, HW, MW, SW, FS, FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding, J - Joint, S - Shear, F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
		SANDSTONE: medium to coarse grained, high strength, fresh, unbroken, Hawkesbury Sandstone						10.45m: B5°, cly 5mm	C	100	98	PL(A) = 1.3
	11								C	100	100	PL(A) = 1.2
	12 12.0	Bore discontinued at 12.0m										
	13											
	14											
	15											
	16											
	17											
	18											
	19											

RIG: Bobcat **DRILLER:** JJ **LOGGED:** SI **CASING:** HW to 2.5m

TYPE OF BORING: Solid Flight Auger to 1.5m, Rotary (Water) to 2.5m, NMLC Coring to 12.00m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

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

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BORE: BH104 PROJECT: 209535.00 DECEMBER 2021

2.50 – 7.00m

BORE: BH104 PROJECT: 209535.00 DECEMBER 2021

7.00 – 12.00m

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

Introduction

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

Drilling or Excavation Methods

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

Water

▷	Water seep
▽	Water level

Sampling and Testing

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

Description of Defects in Rock

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

Defect Type

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

Orientation

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

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

Coating or Infilling Term

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

Coating Descriptor

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

Shape

cu	curved
ir	irregular
pl	planar
st	stepped
un	undulating

Roughness

po	polished
ro	rough
sl	slickensided
sm	smooth
vr	very rough

Other

fg	fragmented
bnd	band
qtz	quartz

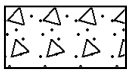
Symbols & Abbreviations

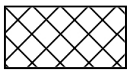
Graphic Symbols for Soil and Rock

General

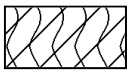

Asphalt

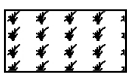

Road base

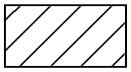

Concrete

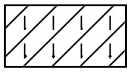

Filling

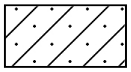
Soils


Topsoil

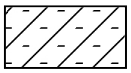

Peat

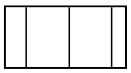

Clay

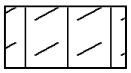

Silty clay

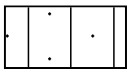

Sandy clay

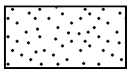

Gravelly clay

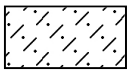

Shaly clay

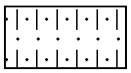

Silt


Clayey silt


Sandy silt

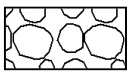

Sand

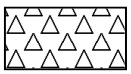

Clayey sand


Silty sand


Gravel

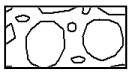

Sandy gravel


Cobbles, boulders

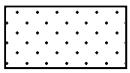

Talus

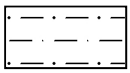
Sedimentary Rocks

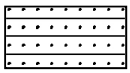

Boulder conglomerate

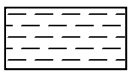

Conglomerate


Conglomeratic sandstone

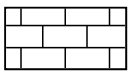

Sandstone


Siltstone

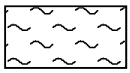

Laminite

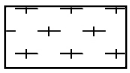

Mudstone, claystone, shale

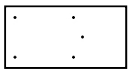

Coal


Limestone

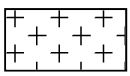
Metamorphic Rocks

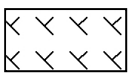

Slate, phyllite, schist

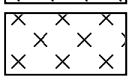

Gneiss

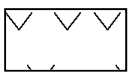

Quartzite

Igneous Rocks


Granite


Dolerite, basalt, andesite

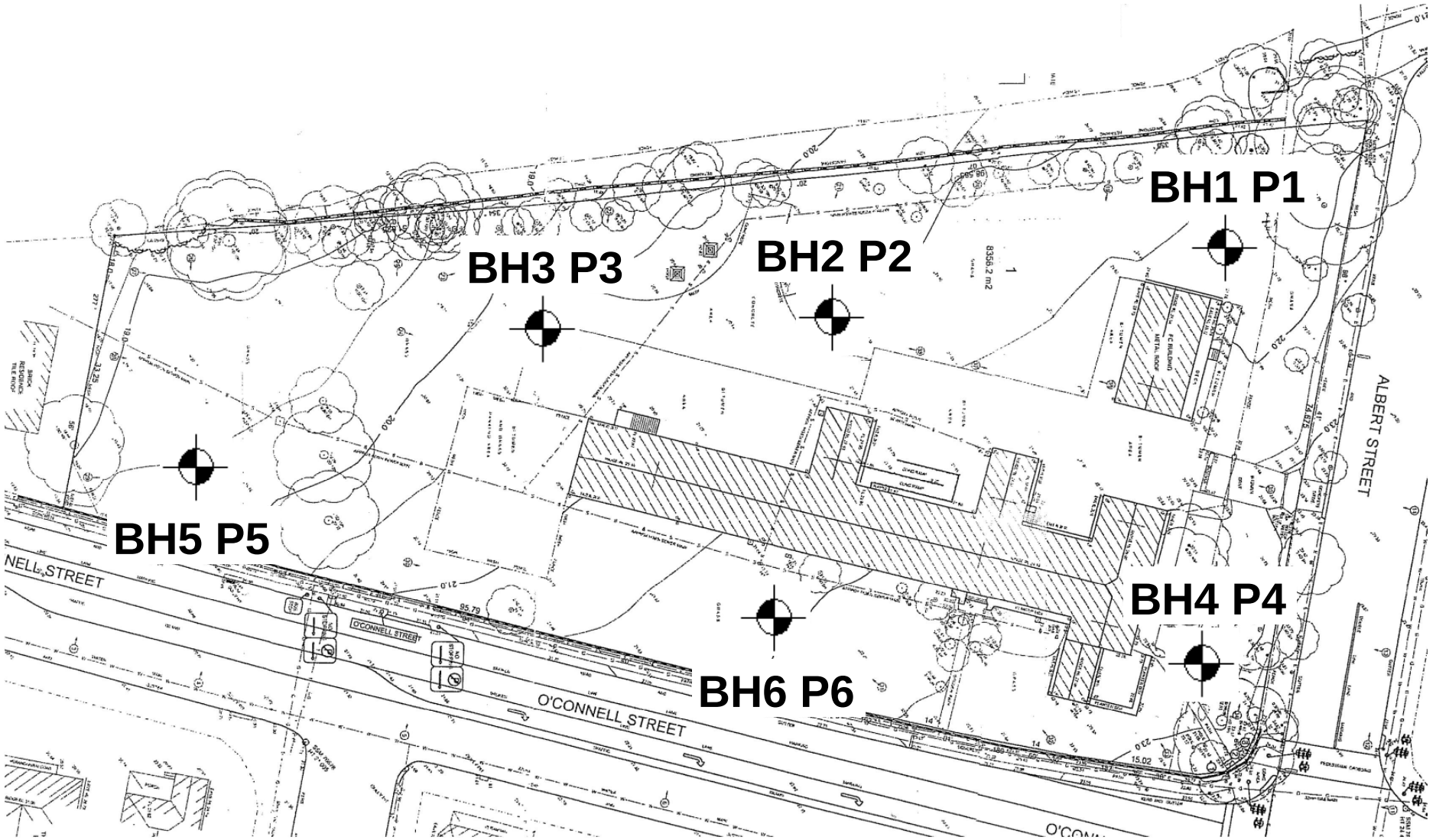

Dacite, epidote


Tuff, breccia


Porphyry

Appendix D

SMEC Testing Services Pty Ltd Geotechnical Investigation Report Data



SMEC TESTING SERVICES Pty. Ltd.	Scale: Unknown	Date: Feb 2010
Client: HOUSING NSW SURVEY AND TITLING INFRASTRUCTURE		
SITE INVESTIGATION **9 ALBERT STREET, PARRAMATTA** **BOREHOLE AND PENETROMETER LOCATIONS**		Project No. 10530/2416 Drawing No: 10/2416

APPENDIX A

BOREHOLE LOGS AND EXPLANATION SHEETS

SMEC Testing Services Pty Ltd

GEOTECHNICAL LOG - NON CORE BOREHOLE

Client: Housing NSW Survey and Titling Infrastructure
Project: 9 Albert Street, Parramatta
Location: Refer to Drawing No. 10/2416

Project No.: 10530/2416
Date : February 9, 2010
Logged: JK

BOREHOLE NO.: BH 1

Sheet 1 of 2

WATER TABLE	SAMPLES	DEPTH (m)	DESCRIPTION OF DRILLED PRODUCT (Soil type, colour, grain size, plasticity, minor components, observations)	SYMBOL	CONSISTENCY (cohesive soils) or RELATIVE DENSITY (sands and gravels)	MOISTURE
			SILTY CLAY: dark brown, low plasticity, trace of fine grained sand, occasional gravel TOPSOIL	CL		M
			SILTY CLAY: orange brown with occasional red brown and light grey, low plasticity, trace of fine grained sand	CL		M
			SANDY CLAY: red brown with light grey, fine grained sand, low plasticity, (CW Sandstone)	CL		M-D
		1.0	SANDSTONE: red brown with light grey, fine to medium grained sand, clay seams		EXTREMELY LOW STRENGTH	D
			AUGERING DISCONTINUED AT 1.25 M ON WEATHERED SANDSTONE For core details, refer to core log sheets			
		2.0				
		3.0				
		4.0				
		5.0				

NOTES: D - disturbed sample U - undisturbed tube sample B - bulk sample
WT - level of water table or free water N - Standard Penetration Test (SPT)

See explanation sheets for meaning of all descriptive terms and symbols

Contractor: Terratest
Equipment: Hydropower
Hole Diameter (mm): 100
Angle from Vertical (°) 0

SMEC Testing Services Pty Ltd — **GEOTECHNICAL LOG - CORED BOREHOLE**

Client: Housing NSW Survey & Titling Infrastructure
Project: 9 Albert Street, Parramatta
Location: Refer to Drawing No. 10/2416
Project / STS No.: 10530/2416
Date : February 9, 2010
Logged: JK
Checked By: JH

BOREHOLE NO.: BH 1
Sheet 2 of 2

DRILLING				MATERIAL STRENGTH										DISCONTINUITIES							
						Estimated Rock Strength							Joint Spacing (mm)								
Method	Water	Recovery	Depth (m)	Rock Type (Colour, Grain Size, Structure & Minor Components)	Weathering	Extremely Low	Very Low	Low	Medium	High	Very High	Extremely High	20	40	100	300	1000	Visual	Additional Data (Joints, partings, seams, zones etc. Description, orientation, infilling, or coating, shape, roughness, thickness, other)
				For non core details, refer to non core log sheets															
			1.0	START CORING AT 1.25 M															
N M L C C O R I N G				SANDSTONE: red brown with orange brown and light grey, fine to medium grained sand	MW														1.33m, Jt, 0 deg. Pl, Ro 1.74m, Jt, 0 deg. Pl, Ro 1.78-1.83m, Cy, Sm 1.94m, Jt, Und, Ro 2.0-2.3m, Cy, Sm 2.36m, Jt, 0 deg. Pl, Cy, infill 2.5-2.53m, Cy, Sm
			2.0																
			3.0	SANDSTONE: orange brown with light grey and occasional red brown, fine to medium grained sand	HW/ SW														3.0-3.15m, Jt, 90 deg. Ir, Ro 3.62m, Jt, 3 deg. Pl, Ro
			4.0																
			5.0																4.24m, Pt, 30 deg. Pl, Ro 4.38m, Jt, 20 deg. Pl, Sm, Cy infill 4.5m, Jt, 20 deg. Pl, Sm 4.76m, Jt, 0 deg. Pl, Sm, Cy infill 4.86m, Pt, 0 deg. Pl, Ro 4.92m, Pt, 3 deg. Pl, Ro 5.05m, Jt, 20 deg. Pl, Sm 5.37m, Pt, 3 deg. Pl, Ro 5.51m, Pt, 0 deg. Pl, Ro
			6.0	BOREHOLE DISCONTINUED AT 6.0 M															5.87m, Pt, 5 deg. Pl, Ro

Notes:

Contractor: Terratest
Equipment: Hydropower
Hole Diameter (mm):
Angle from Vertical (°):

See explanation sheets for meaning of all descriptive terms and symbols

Project: 9 Albert Street,
Parramatta
Project No: 10530 / 2416
Client: Resitech Australia
Date Cored: 09/02/2010
Borehole No: 1
Depth (m): Start 1.25 - 6.00 End
Box 1 of 1

SMEC Testing Services

BH. 10530 Start 1.25
9 Albert St. Parra.

2

3

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SMEC Testing Services Pty Ltd

GEOTECHNICAL LOG - NON CORE BOREHOLE

Client: Housing NSW Survey and Titling Infrastructure	Project No.: 10530/2416	**BOREHOLE NO.: BH 2**
Project: 9 Albert Street, Parramatta	Date : February 9, 2010	Sheet 1 of 2
Location: Refer to Drawing No. 10/2416	Logged: JK	

WATER TABLE	SAMPLES	DEPTH (m)	DESCRIPTION OF DRILLED PRODUCT (Soil type, colour, grain size, plasticity, minor components, observations)	SYMBOL	CONSISTENCY (cohesive soils) or RELATIVE DENSITY (sands and gravels)	MOISTURE
			SILTY CLAY: dark brown, low plasticity, trace of fine grained sand TOPSOIL	CL		VM
			SILTY SANDY CLAY: orange brown with red brown, fine grained sand, low plasticity	CL		M
		1.0	SANDSTONE: red brown with orange brown, fine to medium grained sand, occasional clay seams, iron staining		EXTREMELY LOW STRENGTH	D
			AUGERING DISCONTINUED AT 1.2 M For core details, refer to core log sheets			
		2.0				
		3.0				
		4.0				
		5.0				

NOTES: D - disturbed sample U - undisturbed tube sample B - bulk sample
WT - level of water table or free water N - Standard Penetration Test (SPT)

See explanation sheets for meaning of all descriptive terms and symbols

Contractor: Terratest
Equipment: Hydropower
Hole Diameter (mm): 100
Angle from Vertical (°) 0

SMEC Testing Services Pty Ltd — **GEOTECHNICAL LOG - CORED BOREHOLE**

Client: Housing NSW Survey & Titling Infrastructure
Project: 9 Albert Street, Parramatta
Location: Refer to Drawing No. 10/2416
Project / STS No.: 10530/2416
Date : February 9, 2010
Logged: JK
Checked By: JH

BOREHOLE NO.: BH 2
Sheet 2 of 2

DRILLING				MATERIAL STRENGTH										DISCONTINUITIES							
						Estimated Rock Strength							Joint Spacing (mm)								
Method	Water	Recovery	Depth (m)	Rock Type (Colour, Grain Size, Structure & Minor Components)	Weathering	Extremely Low	Very Low	Low	Medium	High	Very High	Extremely High	20	40	100	300	1000	Visual	Additional Data (Joints, partings, seams, zones etc. Description, orientation, infilling, or coating, shape, roughness, thickness, other)
				For non core details, refer to non core log sheets															
			1.0	START CORING AT 1.2 M															
				NO CORE - 1.20 TO 1.70 M															
N M L C C O R I N G				SANDSTONE: red brown with light grey, fine to medium grained sand	MW														1.75-1.93m, Cy, Sm 2.08m, Jt, 0 deg. Pl, Ro 2.44m, Jt, 30 deg. Ir, Ro 2.5m, Jt, 0 deg. Pl, Ro 2.51-2.52m, Cy, Sm 2.58-2.64m, Cy, Sm
			2.0																
			3.0																2.93m, Jt, 0 deg. Pl, Ro, Cy, veneer 3.03m, Jt, 3 deg. Pl, Ro 3.12m, Pt, 3 deg. Pl, Ro 3.21m, Jt, 10 deg. Pl, Sm, Cy infill
				SANDSTONE: orange brown with light grey and occasional red brown, fine to mediu grained sand	MW/ SW														3.64m, Jt, 0 deg. Pl, Ro 3.8m, Pt, 5 deg. Pl, Sm
			4.0																3.9m, Pt, 5 deg. Pl, Sm 4.03m, Pt, 10 deg. Pl, Ro 4.27m, Pt, 0 deg. Pl, Ro
			5.0																4.82m, Jt, 10 deg. Pl, Sm, Cy veneer 4.87m, Jt, 15 deg. Pl, Sm 4.91m, Jt, 15 deg. Pl, Sm 5.14m, Pt, 5 deg. Pl, Sm 5.5m, Pt, 0 deg. Pl, Ro
			6.0	BOREHOLE DISCONTINUED AT 6.0 M															

Notes:

Contractor: Terratest
Equipment: Hydropower
Hole Diameter (mm):
Angle from Vertical (°):

See explanation sheets for meaning of all descriptive terms and symbols

Project: 9 Albert Street,
Parramatta
Project No: 10530 / 2416
Client: Resitech Australia
Date Cored: 09/02/2010
Borehole No: 2
Depth (m): Start 1.20 - 6.00 End
Box 1 of 1

SMEC Testing Services

SMEC Testing Services Pty Ltd

GEOTECHNICAL LOG - NON CORE BOREHOLE

Client: Housing NSW Survey and Titling Infrastructure	Project No.: 10530/2416	**BOREHOLE NO.: BH 3**
Project: 9 Albert Street, Parramatta	Date : February 9, 2010	Sheet 1 of 2
Location: Refer to Drawing No. 10/2416	Logged: JK	

WATER TABLE	SAMPLES	DEPTH (m)	DESCRIPTION OF DRILLED PRODUCT (Soil type, colour, grain size, plasticity, minor components, observations)	SYMBOL	CONSISTENCY (cohesive soils) or RELATIVE DENSITY (sands and gravels)	MOISTURE
			SILTY CLAY: dark brown, low plasticity, trace of fine grained sand TOPSOIL	CL		M
			SANDY CLAY: orange brown/red brown, fine grained sand, medium plasticity, occasional ironstone gravel	CL		M
		1.0	SANDSTONE: orange brown/red brown, fine grained sand		EXTREMELY LOW STRENGTH	D
			AUGERING DISCONTINUED AT 1.3 M For core details, refer to core log sheets			
		2.0				
		3.0				
		4.0				
		5.0				

NOTES: D - disturbed sample U - undisturbed tube sample B - bulk sample
WT - level of water table or free water N - Standard Penetration Test (SPT)

See explanation sheets for meaning of all descriptive terms and symbols

Contractor: Terratest
Equipment: Hydropower
Hole Diameter (mm): 100
Angle from Vertical (°) 0

SMEC Testing Services Pty Ltd — **GEOTECHNICAL LOG - CORED BOREHOLE**

Client: Housing NSW Survey & Titling Infrastructure
Project: 9 Albert Street, Parramatta
Location: Refer to Drawing No. 10/2416
Project / STS No.: 10530/2416
Date : February 9, 2010
Logged: JK
Checked By: JH

BOREHOLE NO.: BH 3
Sheet 2 of 2

DRILLING				MATERIAL STRENGTH										DISCONTINUITIES							
						Estimated Rock Strength							Joint Spacing (mm)								
Method	Water	Recovery	Depth (m)	Rock Type (Colour, Grain Size, Structure & Minor Components)	Weathering	Extremely Low	Very Low	Low	Medium	High	Very High	Extremely High	20	40	100	300	1000	Visual	Additional Data (Joints, partings, seams, zones etc. Description, orientation, infilling, or coating, shape, roughness, thickness, other)
				For non core details, refer to non core log sheets															
			1.0	START CORING AT 1.3 M															
				NO CORE - 1.30 TO 1.58 M															
N				SANDSTONE: red brown with light grey, fine to medium grained sand, iron staining	MW														1.68m, Jt, 10 deg. Pl, Ro
M			2.0																1.84m, Jt, 0 deg. Pl, Sm
L																			2.04m, Jt, 40 deg. Pl, Sm
C																			2.16m, Jt, 0 deg. Pl, Sm, Cy veneer
																			2.24m, Jt, 0 deg. Pl, Sm
C																			
O																			
R																			Ro
I																			2.65m, Jt, 0 deg. Pl,
N																			
G																			2.92-2.94m, Jt/Sm, Cy
			3.0																3.05m, Jt, 3 deg. Pl, Sm
																			3.08m, Jt, 0 deg. Pl, Sm, Cy veneer
				SANDSTONE: orange brown with light grey and occasional red brown, fine to medium grained sand	MW/SW														3.13m, Jt, 10 deg. Pl, Ro
																			3.72m, Jt, 20 deg. Pl, Sm
																			3.8m, Pt, 0 deg. Pl, Ro
			4.0																
																			4.51m, Jt, 10 deg. Pl, Ro
																			4.68m, Jt, 10 deg. Pl, Ro
																			4.76m, Jt, 5 deg. Pl, Ro, tight
			5.0																5.15m, Jt, 20 deg. Pl, Sm
			6.0	BOREHOLE DISCONTINUED AT 6.0 M															

Notes:

Contractor: Terratest
Equipment: Hydropower
Hole Diameter (mm):
Angle from Vertical (°):

See explanation sheets for meaning of all descriptive terms and symbols

Project: 9 Albert Street,
Parramatta
Project No: 10530 / 2416
Client: Resitech Australia
Date Cored: 09/02/2010
Borehole No: 3
Depth (m): Start 1.30 - 6.00 End
Box 1 of 1

SMEC Testing Services

BH3 9 Albert St Parramatta Start 1.30m No Core

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SMEC Testing Services Pty Ltd

GEOTECHNICAL LOG - NON CORE BOREHOLE

Client: Housing NSW Survey and Titling Infrastructure	Project No.: 10530/2416	**BOREHOLE NO.: BH 4**
Project: 9 Albert Street, Parramatta	Date : February 9, 2010	Sheet 1 of 2
Location: Refer to Drawing No. 10/2416	Logged: JK	

WATER TABLE	SAMPLES	DEPTH (m)	DESCRIPTION OF DRILLED PRODUCT (Soil type, colour, grain size, plasticity, minor components, observations)	SYMBOL	CONSISTENCY (cohesive soils) or RELATIVE DENSITY (sands and gravels)	MOISTURE
			SILTY CLAY: dark brown, low plasticity, trace of fine grained sand TOPSOIL	CL		M
			SILTY CLAY: red brown/orange brown with occasional light grey, medium plasticity, trace of ironstone gravel	CL		M-D
		1.0	SANDSTONE: red brown, fine grained sand, clay seams		EXTREMELY LOW STRENGTH	D
			AUGERING DISCONTINUED AT 1.12 M ON WEATHERED SANDSTONE For core details, refer to core log sheets PVC Sandpipe piezometre installed			
		2.0				
		3.0				
		4.0				
		5.0				

NOTES: D - disturbed sample U - undisturbed tube sample B - bulk sample
WT - level of water table or free water N - Standard Penetration Test (SPT)

See explanation sheets for meaning of all descriptive terms and symbols

Contractor: Terratest
Equipment: Hydropower
Hole Diameter (mm): 100
Angle from Vertical (°) 0

SMEC Testing Services Pty Ltd — **GEOTECHNICAL LOG - CORED BOREHOLE**

Client: Housing NSW Survey & Titling Infrastructure
Project: 9 Albert Street, Parramatta
Location: Refer to Drawing No. 10/2416
Project / STS No.: 10530/2416
Date : February 9, 2010
Logged: JK
Checked By: JH

BOREHOLE NO.: BH 4
Sheet 2 of 2

DRILLING				MATERIAL STRENGTH										DISCONTINUITIES								
						Estimated Rock Strength							Joint Spacing (mm)									
													20	40	100	300	1000					
Method	Water	Recovery	Depth (m)	Rock Type (Colour, Grain Size, Structure & Minor Components)	Weathering	Extremely Low	Very Low	Low	Medium	High	Very High	Extremely High							Visual	Additional Data (Joints, partings, seams, zones etc. Description, orientation, infilling, or coating, shape, roughness, thickness, other)		
				For non core details, refer to non core log sheets																		
			1.0	START CORING AT 1.12 M																		
				SANDSTONE: light grey with red brown, fine grained sa	CW																1.47-1.56m, Cy, Sm		
																					1.58-1.71m, Cy, Sm	
N				SANDSTONE: light grey with red brown, fine to	MW																1.8m, Jt, 0 deg. Pl, Ro, Cy	
M			2.0	medium grained sand																	1.85m, Jt, 2 deg. Pl, Ro, Cy	
L																					1.92m, Jt, 5 deg. Pl, Ro	
C																					2.07m, Pt. 0 deg. Pl, Ro	
																					2.28m, Jt, 10 deg. Pl, Ro, Cy veneer	
C																						
O																						
R																					2.54m, Sm, Cy	
I																					2.62m, Jt, 0 deg. Pl, Sm	
N																					2.72-2.77m, Jt, 90 deg. Cy, Sm	
G																						
			3.0																		2.95m, Jt, 3 deg. Pl, Ro, Cy infill	
																					3.3-3.33m, Cy, Sm	
				SANDSTONE: orange brown with light grey, fine	SW																3.36m, Jt, 0 deg. PL, Ro, Cy infill	
				to medium grained sand																		
																					3.58m, Jt, 10 deg. Pl, Ro	
																					3.64m, Jt, 0 deg. Pl, Sm	
			4.0																		3.89m, Pt, 0 deg. Pl, Ro	
																					4.02m, Sm, Cy	
																					4.06m, Jt, 0 deg. Pl, Ro	
																					4.5m, Pt, 0 deg. PL, Ro	
																					4.85m, Pt, 0 deg. Ro, Cy infill	
																					4.95m, Pt, 0 deg. Pl, Ro	
			5.0																		5.11m, Pt, 0 deg. Pl, Ro	
				SANDSTONE: red brown with orange brown and	SW/																5.2m, Pt, 0 deg. Pl, Ro	
				occasional light grey, fine to medium	MW																5.36m, Jt, 15 deg. Pl, Ro	
				grained sand																		
																					5.83m, Jt, 0 deg Pl, Ro	
																					5.92m, Pt, 10 deg. Pl, Ro	
			6.0	BOREHOLE DISCONTINUED AT 6.0 M																		

Notes:

STANDPIPE PIEZOMETER INSTALLED

Contractor: Terratest
Equipment: Hydropower
Hole Diameter (mm):
Angle from Vertical (°):

See explanation sheets for meaning of all descriptive terms and symbols

Project: 9 Albert Street,
Parramatta
Project No: 10530 / 2416
Client: Resitech Australia
Date Cored: 09/02/2010
Borehole No: 4
Depth (m): Start 1.12 - 6.00 End
Box 1 of 1

SMEC Testing Services

SMEC Testing Services Pty Ltd

GEOTECHNICAL LOG - NON CORE BOREHOLE

Client: Housing NSW Survey and Titling Infrastructure	Project No.: 10530/2416	**BOREHOLE NO.: BH 5**
Project: 9 Albert Street, Parramatta	Date : February 9, 2010	Sheet 1 of 2
Location: Refer to Drawing No. 10/2416	Logged: JK	

WATER TABLE	SAMPLES	DEPTH (m)	DESCRIPTION OF DRILLED PRODUCT (Soil type, colour, grain size, plasticity, minor components, observations)	SYMBOL	CONSISTENCY (cohesive soils) or RELATIVE DENSITY (sands and gravels)	MOISTURE
			SILTY SANDY CLAY: dark brown, fine grained sand, low plasticity, trace of gravel	CL		M
		1.0	FILL			
			SANDY CLAY: light grey with orange brown, fine to medium grained sand, low plasticity	CL		M
			SANDSTONE: red brown, fine to medium grained sand		EXTREMELY LOW STRENGTH	D
		2.0	V-BIT REFUSAL AT 1.8 M ON WEATHERED SANDSTONE			
			For core details, refer to core log sheets			
			PVC Standpipe piezometre installed			
		3.0				
		4.0				
		5.0				

NOTES: D - disturbed sample U - undisturbed tube sample B - bulk sample
WT - level of water table or free water N - Standard Penetration Test (SPT)

See explanation sheets for meaning of all descriptive terms and symbols

Contractor: Terratest
Equipment: Hydropower
Hole Diameter (mm): 100
Angle from Vertical (°) 0

SMEC Testing Services Pty Ltd — **GEOTECHNICAL LOG - CORED BOREHOLE**

Client: Housing NSW Survey & Titling Infrastructure
Project: 9 Albert Street, Parramatta
Location: Refer to Drawing No. 10/2416
Project / STS No.: 10530/2416
Date : February 9, 2010
Logged: JK
Checked By: JH

BOREHOLE NO.: BH 5
Sheet 2 of 2

DRILLING				MATERIAL STRENGTH		DISCONTINUITIES													
						Estimated Rock Strength							Joint Spacing (mm)						
Method	Water	Recovery	Depth (m)	Rock Type (Colour, Grain Size, Structure & Minor Components)	Weathering	Extremely Low	Very Low	Low	Medium	High	Very High	Extremely High	20	40	100	300	1000	Visual	Additional Data (Joints, partings, seams, zones etc. Description, orientation, infilling, or coating, shape, roughness, thickness, other)
			1.0	For non core details, refer to non core log sheets															
				START CORING AT 1.8 M															
N				NO CORE - 1.80 TO 1.90 M															
M			2.0	SANDSTONE: light grey with occasional red brown, fine to medium grained sand, iron staining	SW														1.9-2.3m, numerous Jt, Ir, Ro, minor Cy
L																			
C																			
C																			2.32-2.37m, Jt, 45 deg. Pl, Ro
O																			2.42-2.5m, Jt, 90 deg. Ir, Ro, occasional Cy
R																			
I																			2.61-2.64m, Sm, Cy
N																			2.69m, Jt, 0 deg. Pl, Ro, Cy infill
G					MW														2.84-2.86m, Jt, Pl, Ro, Cy infill
			3.0																
				SANDSTONE: orange brown with light grey, fine to medium grained sand	SW/ MW														3.12m, Pt, 0 deg. Pl, Ro
																			3.21m, Pt, 10 deg. Pl, Ro
																			3.29m, Pt, 0 deg. Pl, Ro
																			3.57m, Pt, 0 deg. Pl, Ro
																			3.79m, Pt, 0 deg. Pl, Ro
			4.0																
																			4.27m, Pt, 0 deg. Pl, Ro
				SANDSTONE: orange brown with red brown and occasional light grey, fine to medium grained sand	MW														4.35m, Jt, 0 deg. Pl, Ro open-tight
																			4.7-4.74m, Pt, 30 deg. Pl, Sm
			5.0																
																			5.14m, Jt, 5 deg. Pl, Sm
																			5.41-5.51m, numerous Jt, 0 deg. Tight-open minor Cy
																			5.75m, Pt, 0 Def. Ro
			6.0	BOREHOLE DISCONTINUED AT 6.0 M															5.85m, Pt, 0 deg. Pl, Ro

Notes:

STANDPIPE PIEZOMETER INSTALLED

Contractor: Terratest
Equipment: Hydropower
Hole Diameter (mm):
Angle from Vertical (°):

See explanation sheets for meaning of all descriptive terms and symbols

Project: 9 Albert Street,
Parramatta
Project No: 10530 / 2416
Client: Resitech Australia
Date Cored: 09/02/2010
Borehole No: 5
Depth (m): Start 1.80 - 6.00 End
Box 1 of 1

SMEC Testing Services

BH5
10530
9 Albert St Parramatta.
Start 1.80 m
No Core
2
3
4
5

SMEC Testing Services Pty Ltd

GEOTECHNICAL LOG - NON CORE BOREHOLE

Client: Housing NSW Survey and Titling Infrastructure	Project No.: 10530/2416	**BOREHOLE NO.: BH 6**
Project: 9 Albert Street, Parramatta	Date : February 9, 2010	
Location: Refer to Drawing No. 10/2416	Logged: JK	Sheet 1 of 2

WATER TABLE	SAMPLES	DEPTH (m)	DESCRIPTION OF DRILLED PRODUCT (Soil type, colour, grain size, plasticity, minor components, observations)	SYMBOL	CONSISTENCY (cohesive soils) or RELATIVE DENSITY (sands and gravels)	MOISTURE
			SILTY CLAY: dark brown, low plasticity, trace of fine sand	CL		M
			SILTY CLAY: red brown, low plasticity, trace of fine sand, occasional gravel and ironstone	CL		M
		1.0	SANDY CLAY: light grey with red brown, fine to medium grained sand, (completely weathered sandstone)	CL		M
			SANDSTONE: red brown with light grey, fine to medium grained		EXTREMELY LOW STRENGTH	D
			BOREHOLE DISCONTINUED AT 1.3 M			
		2.0	(For non core details refer to core log sheet)			
		3.0				
		4.0				
		5.0				

NOTES: D - disturbed sample U - undisturbed tube sample B - bulk sample
WT - level of water table or free water N - Standard Penetration Test (SPT)

See explanation sheets for meaning of all descriptive terms and symbols

Contractor: Terratest
Equipment: Hydropower
Hole Diameter (mm): 100
Angle from Vertical (°) 0

SMEC Testing Services Pty Ltd — **GEOTECHNICAL LOG - CORED BOREHOLE**

Client: Housing NSW Survey & Titling Infrastructure
Project: 9 Albert Street, Parramatta
Location: Refer to Drawing No. 10/2416
Project / STS No.: 10530/2416
Date : February 9, 2010
Logged: JK
Checked By: JH

BOREHOLE NO.: BH 6
Sheet 2 of 2

DRILLING				MATERIAL STRENGTH														DISCONTINUITIES	
						Estimated Rock Strength							Joint Spacing (mm)						
Method	Water	Recovery	Depth (m)	Rock Type (Colour, Grain Size, Structure & Minor Components)	Weathering	Extremely Low	Very Low	Low	Medium	High	Very High	Extremely High	20	40	100	300	1000	Visual	Additional Data (Joints, partings, seams, zones etc. Description, orientation, infilling, or coating, shape, roughness, thickness, other)
			1.0	For non core details, refer to non core log sheets															
				START CORING AT 1.8 M															
N				SANDSTONE: red brown with orange brown and light gre fine to medium grained	MW														1.31 m,Jt 0 Deg. Pl, Ir, Ro 1.34-1.36m, Jt, 0 Deg. Pl, Ir, Ro, Cy infill 1.72m, Jt, 0 Deg. Pl, Ro 1.79m, Jt, 0 Deg. Pl, Ro, Cy infill 1.82-1.89m, Cy sn
M			2.0																2.01-2.30m, Jt, 90 deg. Pl, Ir, Ro, Minor cy
L																			
C																			2.35-2.38m, Sm, Cy
C																			2.46m Jt, 0 Deg. Pl, Ro, Fe staining
O																			
R																			
I				SANDSTONE: orange brown with light grey and occasion red brown, fine to medium grained	SW														
N																			2.88m, Jt, 3 Deg. Pl, Ro
G			3.0																3.0-3.02m, Jt, Ir, Ro 3.11m, Pt, 0 Deg. Pl, Sm 3.25m, Pt, 0 Deg. Pl, Sm
																			3.43m, Jt, 0 Deg. Pl, Ro 3.50m, Jt, 0 Deg. Pl, Ro 3.66m, Jt, 0 Deg. Pl, Ro 3.72-3.75m, Jt, Ir, Ro, Cy infill 3.82m, Jt, 0 Deg. Pl, Ro
			4.0																4.11m, Pt, 0 Deg. Pl, Ro
																			4.89m, Jt, 0 Deg. Pl, Ro, Cy infill
			5.0																5.08m, Pt, 0 Deg. Pl, Sm 5.20m, Pt, 5 Deg. Pl, Sm
																			5.40m, Pt, 0 Deg. Pl, Ro
																			5.75m, Pt, 0 Deg. Pl, Ro
																			5.91m, Jt, 3 Deg. Pl, Ro
			6.0	BOREHOLE DISCONTINUED AT 6.0 M															

Notes:

Contractor: Terratest
Equipment: Hydropower
Hole Diameter (mm):
Angle from Vertical (°):

See explanation sheets for meaning of all descriptive terms and symbols

Project: 9 Albert Street,
Parramatta
Project No: 10530 / 2416
Client: Resitech Australia
Date Cored: 09/02/2010
Borehole No: 6
Depth (m): Start 1.30 - 6.00 End
Box 1 of 1

SMEC Testing Services

E1. CLASSIFICATION OF SOILS

E1.1 Soil Classification and the Unified System

An assessment of the site conditions usually includes an appraisal of the data available by combining values of engineering properties obtained by the site investigation with descriptions, from visual observation of the materials present on site.

The system used by SMEC in the identification of soil is the Unified Soil Classification system (USC) which was developed by the US Army Corps of Engineers during World War II and has since gained international acceptance and has been adopted in its metricated form by the Standards Association of Australia.

The Australian Site Investigation Code (AS1726-1981, Appendix D) recommends that the description of a soil includes the USC group symbols which are an integral component of the system.

The soil description should contain the following information in order:

Soil composition

- SOIL NAME and USC classification symbol (IN BLOCK LETTERS)
- plasticity or particle characteristics
- colour
- secondary and minor constituents (name estimated proportion, plasticity or particle characteristics, colour

Soil condition

- moisture condition
- consistency or density index

Soil structure

- structure (zoning, defects, cementing)

Soil origin

interpretation based on observation eg FILL, TOPSOIL, RESIDUAL, ALLUVIUM.

E1.2 Soil Composition

(a) Soil Name and Classification Symbol

The USC system is summarized in Figure E1.2.1. The primary division separates soil types on the basis of particle size into:

- Coarse grained soils - more than 50% of the material less than 60 mm is larger than 0.06 mm (60 µm).

- Fine grained soils - more than 50% of the material less than 60 mm is smaller than 0.06 mm (60 µm).

Initial classification is by particle size as shown in Table E1.2.1. Further classification of fine grained soils is based on plasticity.

TABLE E1.2.1 - CLASSIFICATION BY PARTICLE SIZE

NAME	SUB-DIVISION	SIZE
Clay (1)		< 2 µm
Silt (2)		2 µm to 60 µm
Sand	Fine Medium Coarse	60 µm to 200 µm 200 µm to 600 µm 600 µm to 2 mm
Gravel (3)	Fine Medium Coarse	2 mm to 6 mm 6 mm to 20 mm 20 mm to 60 mm
Cobbles (3)		60 mm to 200 mm
Boulders (3)		> 200 mm

Where a soil contains an appropriate amount of secondary material, the name includes each of the secondary components (greater than 12%) in increasing order of significance, eg sandy silty clay.

Minor components of a soil are included in the description by means of the terms “some” and “trace” as defined in Table E1.2.2.

TABLE E1.2.2 - MINOR SOIL COMPONENTS

TERM	DESCRIPTION	APPROXIMATE PROPORTION (%)
Trace	presence just detectable, little or no influence on soil properties	0-5
Some	presence easily detectable, little influence on soil properties	5-12

The USC group symbols should be included with each soil description as shown in Table E1.2.3

TABLE E1.2.3 - SOIL GROUP SYMBOLS

SOIL TYPE	PREFIX
Gravel	G
Sand	S
Silt	M
Clay	C
Organic	O
Peat	Pt

The group symbols are combined with qualifiers which indicate grading, plasticity or secondary components as shown on Table E1.2.4

TABLE E1.2.4 - SOIL GROUP QUALIFIERS

SUBGROUP	SUFFIX
Well graded	W
Poorly Graded	P
Silty	M
Clayey	C
Liquid Limit <50% - low to medium plasticity	L
Liquid Limit >50% - low to medium plasticity	H

(b) Grading

"Well graded" Good representation of all particle sizes from the largest to the smallest.

"Poorly graded" One or more intermediate sizes poorly represented

"Gap graded" One or more intermediate sizes absent

"Uniformly graded" Essentially single size material.

(c) Particle shape and texture

The shape and surface texture of the coarse grained particles should be described.

Angularity may be expressed as "rounded", "sub-rounded", "sub-angular" or "angular".

Particle **form** can be "equidimensional", "flat" or elongate".

Surface texture can be "glassy", "smooth", "rough", pitted" or striated".

(d) Colour

The colour of the soil should be described in the moist condition using simple terms such as:

Black White Grey Red
Brown Orange Yellow Green
Blue

These may be modified as necessary by "light" or "dark". Borderline colours may be described as a combination of two colours, eg. red-brown.

For soils that contain more than one colour terms such as:

- Speckled Very small (<10 mm dia) patches
- Mottled Irregular
- Blotched Large irregular (>75 mm dia)
- Streaked Randomly oriented streaks

(e) Minor Components

Secondary and minor components should be individually described in a similar manner to the dominant component.

E1.3 ***S****oil Condition*

(a) Moisture

Soil moisture condition is described as "dry", "moist" or "wet".

The moisture categories are defined as:
Dry (D) - Little or no moisture evident. Soils are running.
Moist (M) - Darkened in colour with cool feel. Granular soil particles tend to adhere. No free water evident upon remoulding of cohesive soils.

In addition the moisture content of cohesive soils can be estimated in relation to their liquid or plastic limit.

(b) Consistency

Estimates of the consistency of a clay or silt soil may be made from manual examination, hand penetrometer test, SPT results or from laboratory tests to determine undrained shear or unconfined compressive strengths. The classification of consistency is defined in Table E1.3.1.

TABLE E1.3.1 - CONSISTENCY OF FINE-GRAINED SOILS

TERM	UNCONFINED STRENGTH (kPa)	FIELD IDENTIFICATION
Very Soft	<25	Easily penetrated by fist. Sample exudes between fingers when squeezed in the fist.
Soft	25 – 50	Easily moulded in fingers. Easily penetrated 50 mm by thumb.
Firm	50 – 100	Can be moulded by strong pressure in the fingers. Penetrated only with great effort.
Stiff	100 – 200	Cannot be moulded in fingers. Indented by thumb but penetrated only with great effort.
Very Stiff	200 – 400	Very tough. Difficult to cut with knife. Readily indented with thumb nail.
Hard	>400	Brittle, can just be scratched with thumb nail. Tends to break into fragments.

Unconfined compressive strength as derived by a hand penetrometer can be taken as approximately double the undrained shear strength ($q_u = 2\ c_u$).

(c) Density Index

The insitu density index of granular soils can be assessed from the results of SPT or cone penetrometer tests. Density index should not be estimated visually.

TABLE E1.3.2 - DENSITY OF GRANULAR SOILS

TERM	SPT N VALUE	STATIC CONE VALUE q_c (MPa)	DENSITY INDEX (%)
Very Loose	0 – 3	0 - 2	0 - 15
Loose	3 – 8	2 - 5	15 - 35
Medium Dense	8 – 25	5 - 15	35 - 65
Dense	25 – 42	15 - 20	65 - 85
Very Dense	>42	>20	>85

E1.4 Soil Structure

(a) Zoning

A sample may consist of several zones differing in colour, grain size or other properties. Terms to classify these zones are:

Layer - continuous across exposure or sample
Lens - discontinuous with lenticular shape
Pocket - irregular inclusion
Each zone should be described, their distinguishing features, and the nature of the interzone boundaries.

(b) Defects

Defects which are present in the sample can include:

- fissures
- roots (containing organic matter)
- tubes (hollow)
- casts (infilled)

Defects should be described giving details of dimensions and frequency. Fissure orientation, planarity, surface condition and infilling should be noted. If there is a tendency to break into blocks, block dimensions should be recorded

E1.5 Soil Origin

Information which may be interpretative but which may contribute to the usefulness of the material description should be included. The most common interpreted feature is the origin of the soil. The assessment of the probable origin is based on the soil material description, soil structure and its relationship to other soil and rock materials.

Common terms used are:

“Residual Soil” - Material which appears to have been derived by weathering from the underlying rock. There is no evidence of transport.

“Colluvium” - Material which appears to have been transported from its original location. The method of movement is usually the combination of gravity and erosion.

“Landslide Debris” - An extreme form of colluvium where the soil has been transported by mass movement. The material is obviously distributed and contains distinct defects related to the slope failure.

“Alluvium” - Material which has been transported essentially by water. Usually associated with former stream activity.

“Fill” - Material which has been transported and placed by man. This can range from natural soils which have been placed in a controlled manner in engineering construction to dumped waste material. A description of the constituents should include an assessment of the method of placement.

E1.6 Fine Grained Soils

The physical properties of fine grained soils are dominated by silts and clays.

The definition of clay and silt soils is governed by their Atterberg Limits. Clay soils are characterised by the properties of cohesion and plasticity with cohesion defines as the ability to deform without rupture. Silts exhibit cohesion but have low plasticity or are non-plastic.

The field characteristics of clay soils include:

- dry lumps have appreciable dry strength and cannot be powdered
- volume changes occur with moisture content variation
- feels smooth when moist with a greasy appearance when cut.

The field characteristics of silt soils include:

- dry lumps have negligible dry strength and can be powdered easily
- dilatancy - an increase in volume due to shearing - is indicted by the presence of a shiny film of water after a hand sample is shaken. The water disappears upon remoulding. Very fine grained sands may also exhibit dilatancy.
- low plasticity index
- feels gritty to the teeth

E1.7 Organic Soils

Organic soils are distinguished from other soils by their appreciable content of vegetable matter, usually derived from plant remains.

The soil usually has a distinctive smell and low bulk density.

The USC system uses the symbol Pt for partly decomposed organic material. The O symbol is combined with suffixes “O” or “H” depending on plasticity.

Where roots or root fibres are present their frequency and the depth to which they are encountered should be recorded. The presence of roots or root fibres does not necessarily mean the material is an “organic material” by classification.

Coal and lignite should be described as such and not simply as organic matter.

E2 CLASSIFICATION OF ROCKS

E2.1 Uniform Rock Description

The aim of a rock description for engineering purposes is to give an indication of the expected engineering properties of the material.

In a similar manner to soil materials, the assessment of site conditions where rock is encountered has to be based on the use of a descriptive method which is uniform and repeatable. Description has to:

- provide a clear identification of the rock substance and its engineering properties, and
- include details of the features which affect the engineering properties of the rock mass.

There is no internationally accepted system for rock description but SMEC Testing Services Pty Ltd has adopted a method which incorporates terminology defined by common usage in the engineering geological profession. Most feature definitions are as recommended by the International Society of Rock Mechanics and by the Standards Association of Australia.

For uniform presentation the different features are described in order:

Rock Substance

- NAME (in block letters)
- Mineralogy
- Grain Size
- Colour
- Fabric
- Strength
- Weathering/Alteration

Rock Mass

- Defect type
- Defect orientation
- Defect features
- Defect spacing

E2.2 Rock Substance

(a) Rock name

Each rock type has a specific name which is based on:

- mineralogy
- grain size
- fabric
- origin

The only method of determining the precise rock name is by thin section petrography.

Field identification of rocks for engineering purposes should be based on the use of common, easily understood, simple, geological names. In many cases knowledge of the precise name is of little consequence in the assessment of site conditions. If required the “field name” can be qualified by reference to a petrographic report. Reference to local geological reports often provides information on the rock types which may be expected.

(b) Mineralogy

The rock description should include the identification of the prominent minerals. This identification is usually restricted to the more common minerals in medium and coarse grained rocks.

(c) Grain Size

Rock material descriptions should include general grouping of the size of the predominant mineral grains as defined in Table E2.2.1. The maximum size, or size range, of the larger mineral grains or rock fragments should be recorded.

TABLE E2.2.1. - GRAIN SIZE GROUPS

TERM	GRAIN SIZE (mm)
Very Coarse	>60
Coarse	2 - 60
Medium	0.06 - 2
Fine	0.002 - 0.06
Very Fine	<0.002
Glassy	

(d) Colour

The colour of the rock should be described in the moist condition using simple terms such as:

Black White Grey Red
Brown Orange Yellow Green
Blue

These may be modified as necessary by “light” or “dark”. Borderline colours may be described by a combination of two colours, eg: grey-blue.

(e) Fabric

The fabric of a rock includes all the features of texture and structure, though the term refers specifically to the arrangement of the constituent grains or crystals in a rock. The fabric can provide an indication of the mode of formation of the rock:

- in sedimentary rocks bedding indicates depositional conditions,
- in igneous rocks the texture indicates the rate of cooling, and
- in metamorphic rocks the foliation indicates the stress conditions

Descriptions of fabric should include structure orientation, either with reference to North and horizontal, or to a plane normal to the core axis.

Tables E2.2.2, E2.2.3 and E2.2.4 list common textural features of sedimentary, igneous and metamorphic rocks with the subdivision of stratification spacing in Table E2.2.5.

TABLE E2.2.2 - COMMON STRUCTURES IN IGNEOUS ROCKS

STRATIFICATION (Planar)	STRATIFICATION (Irregular)
Bedding	Washout
Cross Bedding	Slump Structure
Graded Bedding	Shale Breccia
Lamination	
Cross Lamination	

TABLE E2.2.3 - COMMON STRUCTURES IN IGNEOUS ROCKS

	FINE GRAINED ROCKS	COARSE GRAINED ROCKS
Uniform Grain Size	Massive	Massive
	Flow Banded	Granitic
	Vesicular	Pegmatitic
Different Grain Size	Porphyritic	Porphyritic

TABLE E.2.2.4 - COMMON STRUCTURES IN METAMORPHIC ROCKS

FINE GRAINED ROCKS	COARSE GRAINED ROCKS
Slatey Cleavage	Granoblastic
Spotted	Porphyroblastic
Hornsfelsic	Lincated
Foliated	Gneissic
Mylonitic	Mylonitic

TABLE E2.2.5 - STRATIFICATION SPACING

TERM	SEPARATION (mm)
Very Thickly Bedded	>2000
Thickly Bedded	600 - 2000
Medium Bedded	200 - 600
Thinly Bedded	60 - 200
Very Thinly Bedded	20 - 60
Laminated	6 - 20
Thinly Laminated	<6

(f) Strength

Substance strength is one of the most important engineering features of a rock and every description should include at least an estimate of the rock strength class of the material. This estimate can be calibrated by test results, either by Point Loan Strength Index or by Unconfined Compressive Strength.

The rock strength class in As 1726-1981 is defined by Point Loan Strength Index I_s,(50). The relationship between Point Loan and Unconfined Strength is commonly assumed to be about 20, but can range from 4 (in some carbonate rocks) to 40 (in some igneous rocks). It is necessary to confirm the relationship for each rock type and project. classification should be based on material at field moisture content, as some rocks give a significantly higher strength when tested dry.

Table E2.2.6 defines the rock strength classes, with indicative field tests listed in Table E2.2.7 which assist in classification when testing equipment is not available.

TABLE E2.2.6 - CLASSIFICATION OF ROCK STRENGTH

SYMBOL	TERM	POINT LOAD STRENGTH (MPa)	APPROX Qu (MPa)
EL	extremely low	<0.03	<1
VL	very low	0.03 - 0.1	1 - 3
L	low	0.1 - 0.3	3 - 10
M	medium	0.3 - 1	10 - 30
H	high	1 - 3	30 - 70
VH	very high	3 - 10	70 - 200
EH	extremely high	>10	>200

TABLE E2.2.7 - FIELD TESTS FOR ROCK STRENGTH CLASSIFICATION

STRENGTH CLASS	FIELD TEST
Extremely Low	Indented by thumb nail with difficulty
Very Low	Scratched by thumb nail
Low	Easily broken by hand or pared with a knife
Medium	Broken by hand or scraped with a knife
High	Broken in hand by firm hammer blows
Very High	Broken against solid object with several hammer blow
Extremely High	Difficult to break against solid object with several hammer blows

(g) Weathering/Alteration

In addition to the description of rock substance as examined, an assessment is required of the extent to which the original rock material has been affected by subsequent events. The usual processes are:

- Weathering - Decomposition due to the effect of surface or near surface activities
- Alteration - Chemical modification by the action of materials originating from within the mantle below.

The classification of weathering/alteration presented in Table E2.2.8 is based on the extent/degree to which the original rock substance has been affected. This classification has little engineering significance, as the properties of the rock as examined may bear no relationship to the properties of the fresh rock.

TABLE E2.2.8 - CLASSIFICATION OR ROCK WEATHERING/ALTERATION

TERMS	DEFINITION
Fresh (Fr)	Rock substance unaffected.
Fresh Stained (FR St)	Rock substance unaffected. Staining of defect surfaces.
Slightly (SW)	Partial staining or discolouration of rock substance.
Moderately (MW)	Staining or discolouration extends throughout the whole rock substance.
Highly (HW)	Rock substance partly decomposed.
Completely (CW)	Rock substance entirely decomposed.

E2.3 Rock Mass

The engineering properties of rock mass reflect the effect which the presence of defects has on the properties of the rock substance. Description of the rock mass properties consists of supplementing the description covered by Section E2.2 with data on the defects which are present.

(a) Defect type

The different defect types are described in Table E2.3.1.

(b) Defect orientation

Descriptions of defects should include orientation, either of individual fractures or of groups of fractures. Orientation should be with reference to North and horizontal, or to a plane normal to the core axis.

TABLE E2.3.1 - ROCK DEFECT TYPES

TYPE	SYMBOL	DESCRIPTION
Parting	Pt	A defect parallel or subparallel to a layered arrangement of mineral grains or micro-fractures which has caused planar anistrophy in the rock substance.
Joint	Jt	A defect across which the rock substance has little tensile strength and is not related to textural or structural features with the rock substance.
Sheared Zone	SZ	A zone with roughly parallel planar boundaries or rock substance containing closely spaced, often slickensided, joints.
Crushed Zone	CZ	A zone with roughly parallel planar boundaries of rock substance composed of disoriented, usually angular, fragments of rock.
Seam	Sm	A zone with roughly parallel boundaries infilled by soil or decomposed rock.

(c) Defect features

The character of a defect is described by its continuity, planarity, surface roughness, width, and infilling.

Continuity In outcrop the extent of a joint, bedding plane or similar defect both along and across the strike can be measured. In core, continuity measurement is restricted to defects nearly parallel to the core axis.

Planarity Described as “Planar”, “Irregular”, “Curved” or “Undulose”.

Roughness Described as “Rough”, “Smooth”, “Polished” or “Slickensided”.

Width Measured in millimetres normal to the plane of nthe defect

Infilling Described as “Clean”, “Stained”, “Veneer” (<1 mm) or “Infill” (>1 mm). The coating or infilling material should be identified.

(d) Defect spacing

The spacing of defects, particularly where they occur in parallel groups or sets, provides an indication of the rock block sizes which:

- have to be supported in the face or roof of an excavation
- will be produced by the excavation operation.

It is preferable to provide measured data but discontinuity spacing is grouped as shown in Table E2.3.2.

TABLE E2.3.2 - DISCONTINUITY SPACING

DESCRIPTION	SPACING (mm)
Extremely Widely Spaced	>6000
Very Widely Spaced	2000 - 6000
Widely Spaced	600 - 2000
Medium Spaced	200 - 600
Closely Spaced	60 - 200
Very Closely Spaced	20 - 60
Extremely Closely Spaced	<20

APPENDIX B

POINT LOAD TEST RESULTS

SMEC Testing Services Pty Ltd
14/1 Cowpasture Place, Wetherill Park NSW 2164
Phone: (02)9756 2166 Fax: (02)9756 1137 Email: smectesting@pacific.net.au

Point Load Strength Index Report

Project: 9 Albert Street, Parramatta
Client: Housing NSW Survey and Titling Infrastructure
Address: Locked Bag 4001, Ashfield
Test Method: AS 4133.4.1

Project No.: 10530/2416
Report No.: 10/0153
Report Date: 16/02/2010

Sampling Proceedure: Geotechnical Investigation (Not covered under NATA Terms of Registration)

Date Samples Drilled / Taken: 9/2/10

Borehole No. 1

Depth	Test Type	Is(50) (Mpa)	Rock Type	Rock Structure	Moisture
1.37	A	0.3	SS	BE	M/D
1.37	D	0.6	SS	BE	M/D
3.22	A	0.8	SS	BE	M/D
3.22	D	1.3	SS	BE	M/D
3.4	A	1.4	SS	BE	M/D
3.4	D	1.7	SS	BE	M/D
5.45	A	1.7	SS	BE	M/D
5.45	D	1.7	SS	BE	M/D

Sampling Proceedure: Geotechnical Investigation (Not covered under NATA Terms of Registration)

Date Samples Drilled / Taken: 9/2/10

Borehole No. 2

Depth	Test Type	Is(50) (Mpa)	Rock Type	Rock Structure	Moisture
2.72	D	0.2	SS	BE	M/D
2.72	A	0.3	SS	BE	M/D
3.85	D	1.3	SS	BE	M/D
3.85	A	1.3	SS	BE	M/D

STRUCTURE	TEST TYPE	MOISTURE CONDITION	ROCK TYPE
MA= MASSIVE	A= AXIAL	W= WET	SS= SANDSTONE
BE= BEDDED	D= DIMETRAL	M= MOIST	ST= SILTSTONE
LA= LAMINATED	I= IRREGULAR	D= DRY	SH= SHALE
CR= CRYSTALLINE	C= CUBE		YS= CLAYSTONE
			IG= IGNEOUS

Remarks:

Approved Signatory: .....

Technician:

Laurie Ihnativ - Manager

SMEC Testing Services Pty Ltd
14/1 Cowpasture Place, Wetherill Park NSW 2164
Phone: (02)9756 2166 Fax: (02)9756 1137 Email: smectesting@pacific.net.au

Point Load Strength Index Report

Project: 9 Albert Street, Parramatta
Client: Housing NSW Survey and Titling Infrastructure
Address: Locked Bag 4001, Ashfield
Test Method: AS 4133.4.1

Project No.: 10530/2416
Report No.: 10/0153
Report Date: 16/02/2010

Sampling Proceedure: Geotechnical Investigation (Not covered under NATA Terms of Registration)
Date Samples Drilled / Taken: 9/2/10
Borehole No. 3

Depth	Test Type	Is(50) (Mpa)	Rock Type	Rock Structure	Moisture
1.89	D	0.5	SS	BE	M/D
1.89	A	0.9	SS	BE	M/D
3.26	D	1.6	SS	BE	M/D
3.26	A	1.6	SS	BE	M/D
4.92	D	1.9	SS	BE	M/D
4.92	A	1.7	SS	BE	M/D

Sampling Proceedure: Geotechnical Investigation (Not covered under NATA Terms of Registration)
Date Samples Drilled / Taken: 9/2/10
Borehole No. 4

Depth	Test Type	Is(50) (Mpa)	Rock Type	Rock Structure	Moisture
2.04	D	0.5	SS	BE	M/D
2.04	A	0.7	SS	BE	M/D
2.82	D	0.5	SS	BE	M/D
2.82	A	0.4	SS	BE	M/D
4.46	D	1.6	SS	BE	M/D
4.46	A	1.5	SS	BE	M/D

STRUCTURE	TEST TYPE	MOISTURE CONDITION	ROCK TYPE
MA= MASSIVE	A= AXIAL	W= WET	SS= SANDSTONE
BE= BEDDED	D= DIMETRAL	M= MOIST	ST= SILTSTONE
LA= LAMINATED	I= IRREGULAR	D= DRY	SH= SHALE
CR= CRYSTALLINE	C= CUBE		YS= CLAYSTONE
			IG= IGNEOUS

Remarks:

Approved Signatory.....

Technician: Laurie Ihnativ - Manager

SMEC Testing Services Pty Ltd
14/1 Cowpasture Place, Wetherill Park NSW 2164
Phone: (02)9756 2166 Fax: (02)9756 1137 Email: smectesting@pacific.net.au

Point Load Strength Index Report

Project: 9 Albert Street, Parramatta
Client: Housing NSW Survey and Titling Infrastructure
Address: Locked Bag 4001, Ashfield
Test Method: AS 4133.4.1

Project No.: 10530/2416
Report No.: 10/0153
Report Date: 16/02/2010

Sampling Proceedure: Geotechnical Investigation (Not covered under NATA Terms of Registration)

Date Samples Drilled / Taken: 9/2/10

Borehole No. 5

Depth	Test Type	Is(50) (Mpa)	Rock Type	Rock Structure	Moisture
2.74	D	0.7	SS	BE	M/D
2.74	A	0.7	SS	BE	M/D
3.35	D	0.8	SS	BE	M/D
3.35	A	1.8	SS	BE	M/D
5.1	D	2.1	SS	BE	M/D
5.1	A	1.7	SS	BE	M/D

Sampling Proceedure: Geotechnical Investigation (Not covered under NATA Terms of Registration)

Date Samples Drilled / Taken: 9/2/10

Borehole No. 6

Depth	Test Type	Is(50) (Mpa)	Rock Type	Rock Structure	Moisture
1.4	D	0.8	SS	BE	M/D
1.4	A	1.8	SS	BE	M/D
2.51	D	0.5	SS	BE	M/D
2.51	A	1	SS	BE	M/D
4.06	D	1.3	SS	BE	M/D
4.06	A	1.6	SS	BE	M/D

STRUCTURE	TEST TYPE	MOISTURE CONDITION	ROCK TYPE
MA= MASSIVE	A= AXIAL	W= WET	SS= SANDSTONE
BE= BEDDED	D= DIMETRAL	M= MOIST	ST= SILTSTONE
LA= LAMINATED	I= IRREGULAR	D= DRY	SH= SHALE
CR= CRYSTALLINE	C= CUBE		YS= CLAYSTONE
			IG= IGNEOUS

Remarks:

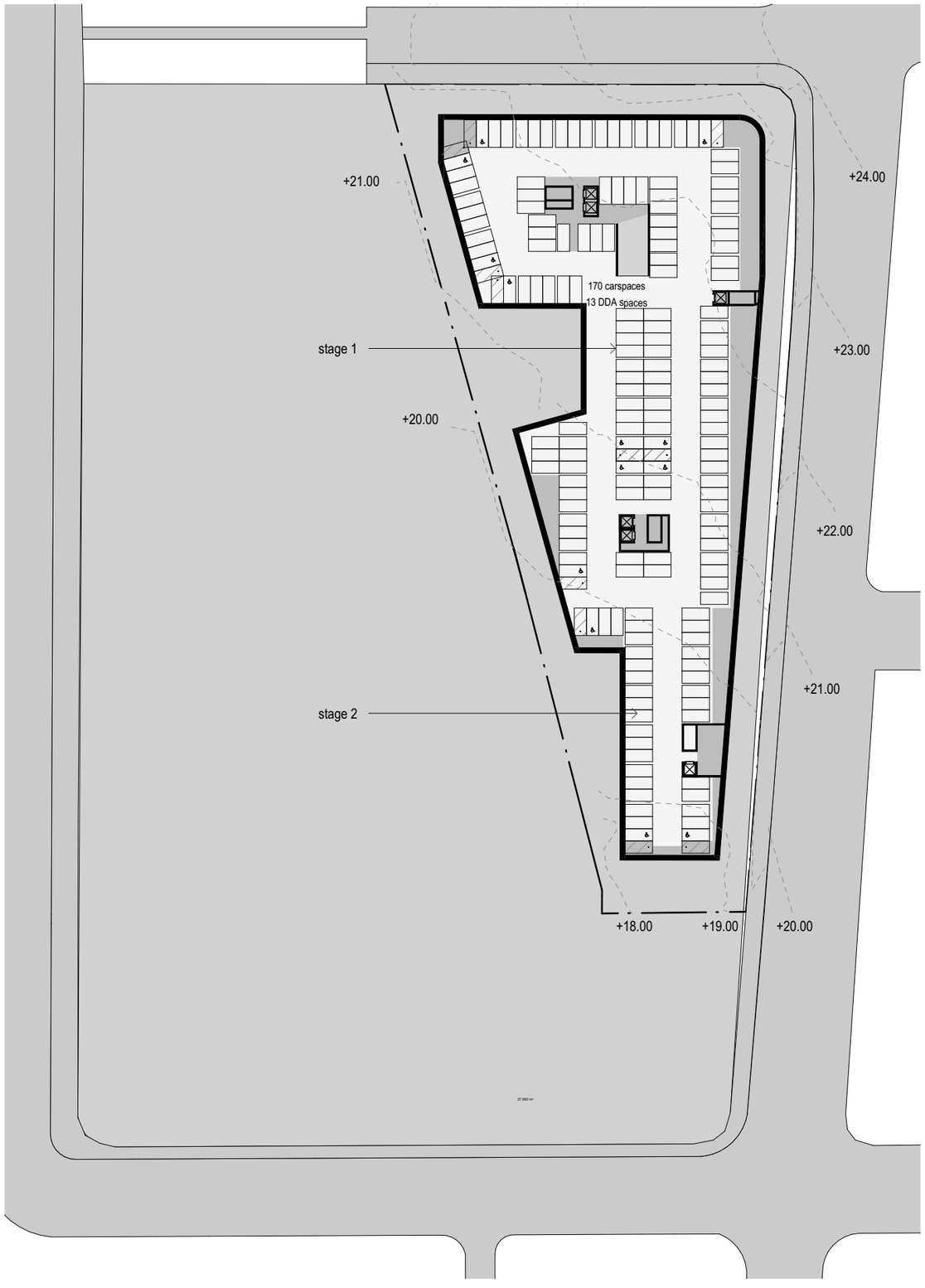
Approved Signatory: .....

Technician:

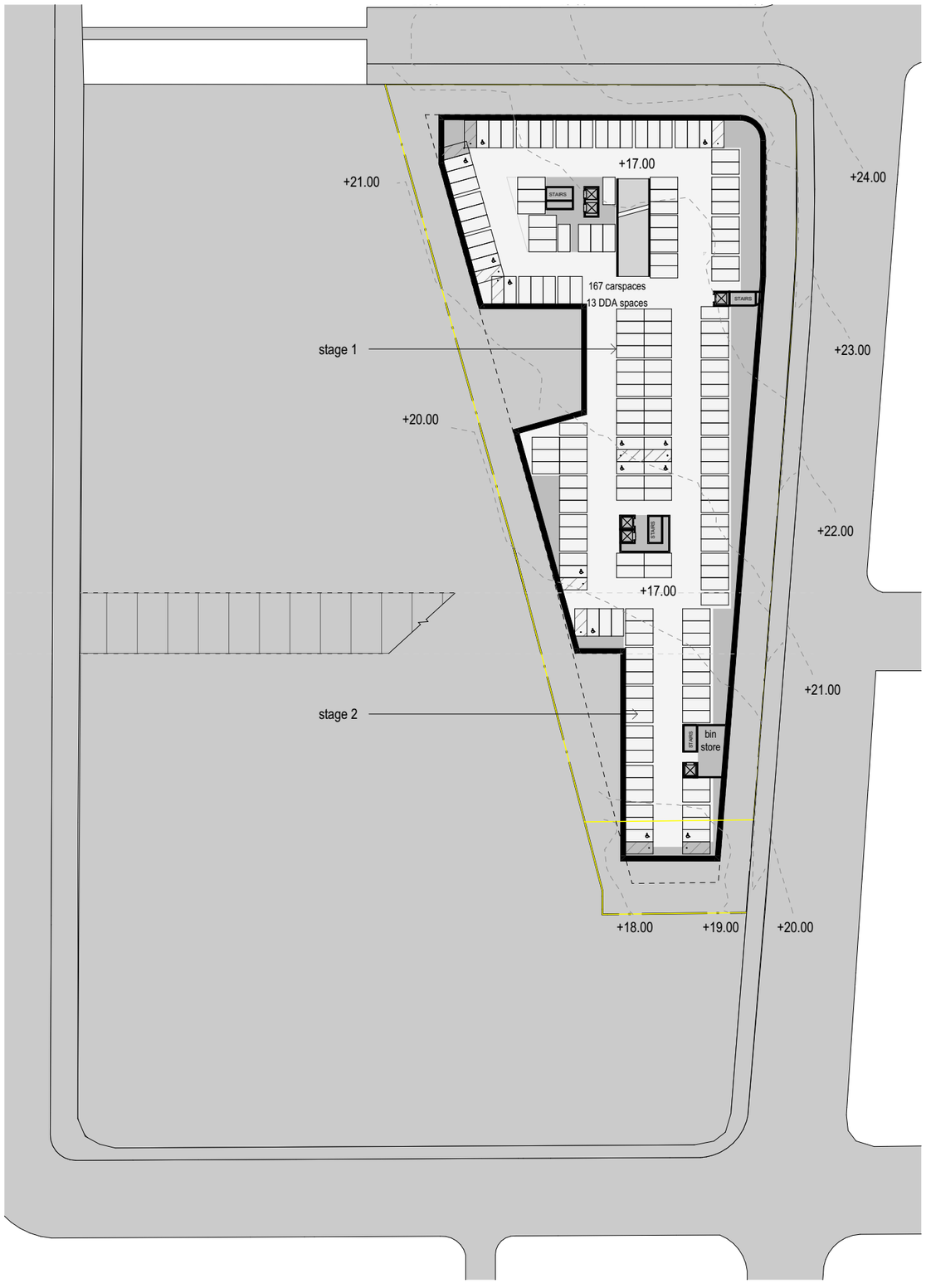
Laurie Ihnativ - Manager

Appendix E

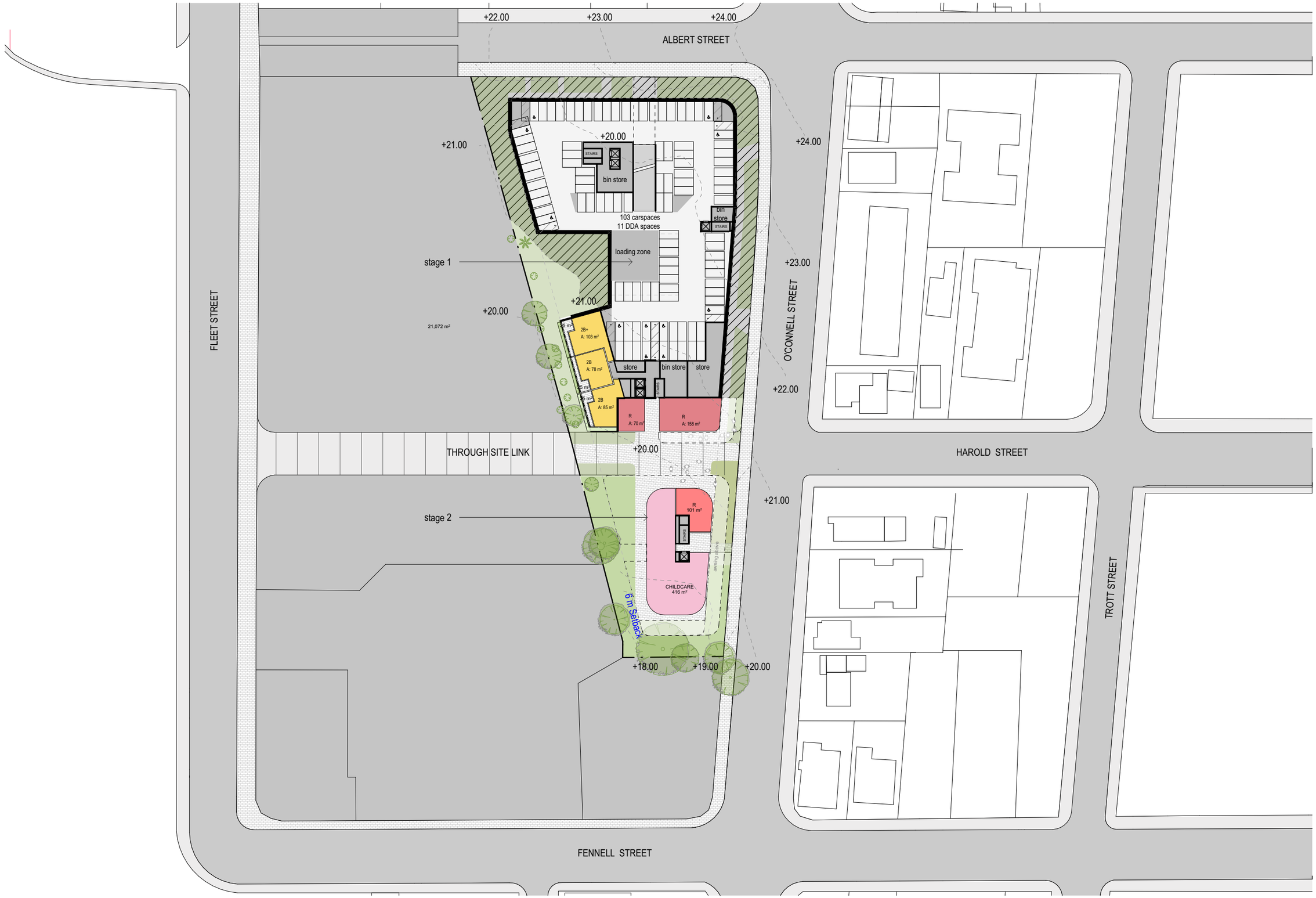
Architectural Drawings



BASEMENT 02



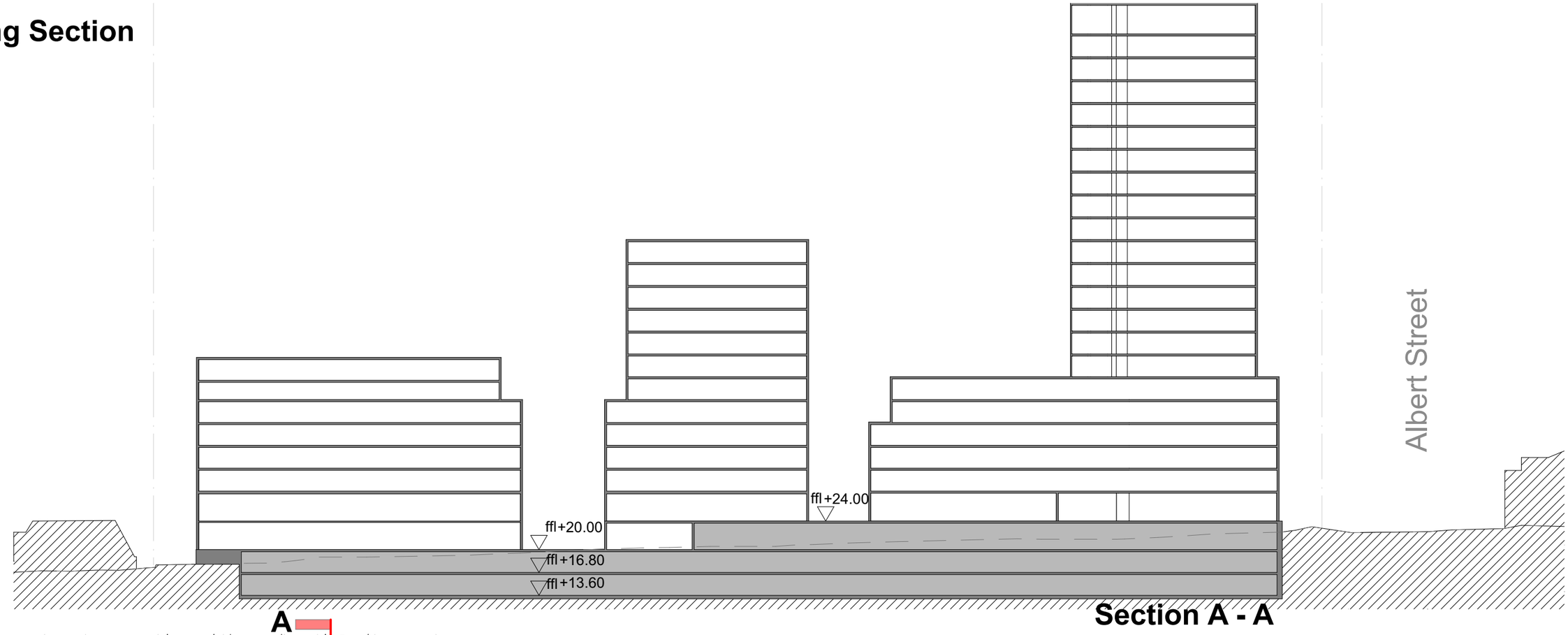
BASEMENT 01



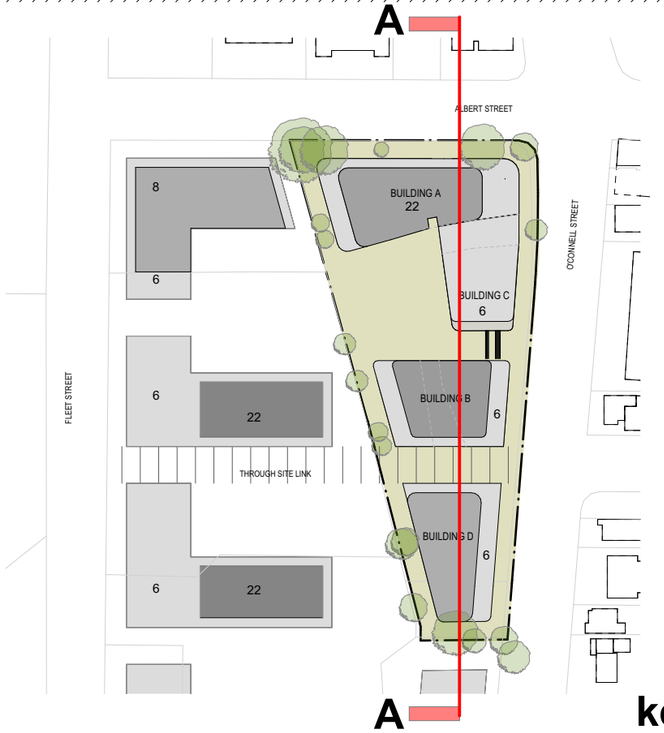
LOWER GROUND FLOOR


ALBERT STREET
FLEET STREET
O'CONNELL STREET
HAROLD STREET
FENNELL STREET
Site Boundary
6 m Setback
THROUGH SITE LINK BELOW
32,975 m²
+22.00
+23.00
+24.00
+21.00
+20.00
+22.50
+18.00
+19.00
awning above
awning below
Lobby
STAIRS
2B+ A: 88 m²
2B+ A: 83 m²
2B+ A: 104 m²
2B+ A: 93 m²
4B A: 143 m²
2B+ A: 88 m²
R A: 74 m²
R A: 140 m²
2B A: 87 m²
R A: 76 m²
2B+ A: 93 m²
3B+ A: 121 m²
R A: 136 m²
1B A: 50 m²
1B+ A: 59 m²
1B+ A: 59 m²
1B A: 52 m²
2B A: 83 m²
2B A: 82 m²
1B+ A: 74 m²
1B+ A: 79 m²
2B+ A: 98 m²
2B+ A: 97 m²
3B+ A: 100 m²
2B A: 78 m²
2B+ A: 85 m²
2B+ A: 90 m²
2B+ A: 85 m²
2B A: 73 m²
2B A: 75 m²
2B+ A: 90 m²

Massing Section

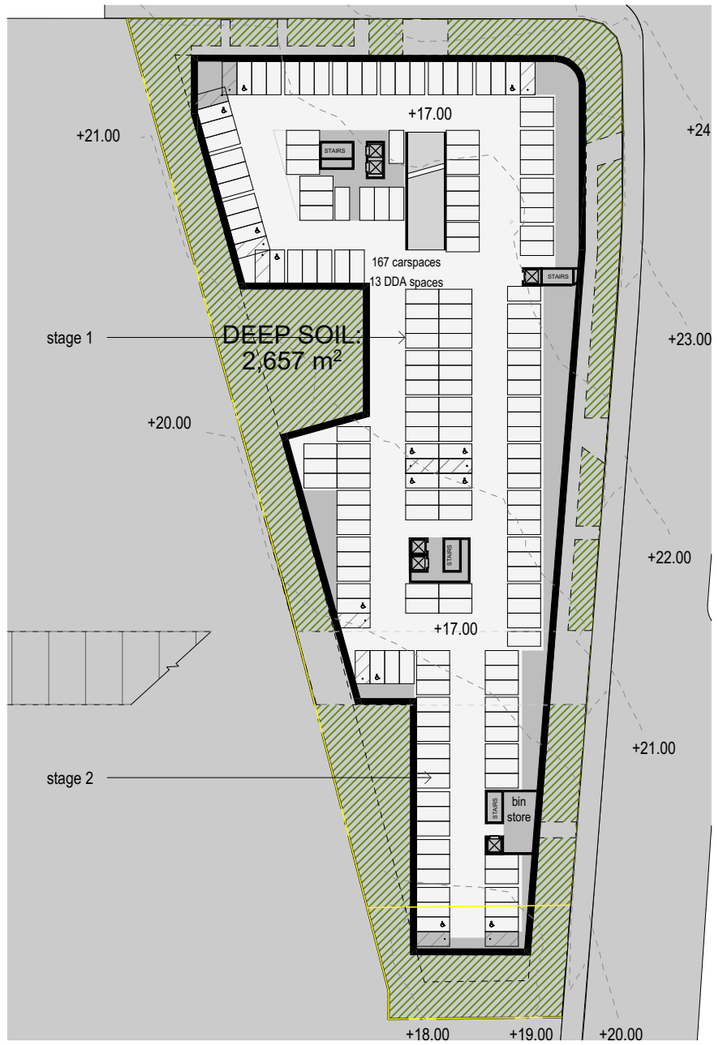


Section A - A



key plan

DEEP SOIL DIAGRAMS



LEGENDS

DEEP SOIL AREA:2,657 m² =30% OF THE SITE AREA

ADG:MIN.DEEP SOIL AREA >7% OF THE SITE AREA

PDCP:MIN.DEEP SOIL AREA >30% OF THE SITE AREA

LOWER GROUND

UPPER GROUND

0 10 20 30 40 50m