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Report on
Geotechnical Investigation

Proposed Industrial Development
42 Boorea Road, Lidcombe

Prepared for
Hale Property Services Pty Ltd

Project 210950.00
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The undersigned, on behalf of Douglas Partners Pty Ltd, confirm that this document and all attached drawings, logs and test results have been checked and reviewed for errors, omissions and inaccuracies.

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Table of Contents

Page

Report on Geotechnical Investigation
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1. Introduction

This report presents the results of a geotechnical investigation for a proposed industrial development at 42 Boorea Road, Lidcombe. The investigation was commissioned in an email dated by Mr Luka Krivacic of Tactical Group Pty Ltd and was undertaken in accordance with Douglas Partners Pty Ltd (DP) proposal SYD210950 dates 19 November 2021.

It is understood that the proposed development of the site includes the construction of a two-storey warehouse building with associated offices, hardstand areas, pavements and carparking areas. Geotechnical investigation was carried out to provide information on subsurface conditions for design purposes.

The investigation included the drilling of boreholes, cone penetration tests (CPTs) and laboratory testing of selected samples. The details of the field work and laboratory testing are presented in this report, together with comments and recommendations on design and construction.

2. Site Description

The site is a battle axe block comprising an irregular shaped area of approximately 4.1 hectares, with maximum north-south and east-west dimensions of approximately 390 m and 150 m, respectively.

At the time of the field work the site was occupied by a commercial warehouse building with associated heavy-duty pavements and landscaped areas. A driveway approximately 115 m long extends along the eastern boundary to connect the site to Boorea Street. An asphalt surfaced carpark with landscaped areas was located at the northern end of the site and numerous small to large sized trees, estimated to be up to 15 m high, were located along all boundaries and in the carpark area.

The site topography generally slopes down to the south-west at gradients estimated to be less than 2° with the maximum elevation at about RL 12 (m AHD) at the northern end of the site and the minimum elevation at about RL 6 (m AHD) on the western side of the site. Haslam's Creek, a tributary of the Parramatta River, is located adjacent to the western boundary of the site.

The site is bounded by commercial/industrial properties to the north, east and south. To the west is an open channel for Haslam's Creek, with commercial properties and a new development under construction further to the west.

A location plan showing the approximate site area is presented in Figure 1.

Figure 1: Site Location Plan (Source: Metro Map)

3. Published Data

3.1 Geology

Reference to the Sydney 1:100 000 Geological Series Sheet indicates that the site is predominantly underlain by Quaternary-aged sediments comprising silty to peaty quartz sand, silt and clay with ferruginous and humic cementation in places. These materials are expected to be underlain by Ashfield Shale which typically comprises dark grey to black shale, siltstone and laminite.

3.2 Hydrogeology

The closest surface water receptor to the site is Haslam's Creek located adjacent to the western boundary of the site.

Based on the local topography, groundwater is anticipated to flow to the north-west towards Haslam's Creek.

A search of the NSW Department of Primary Industries Water (DPI Water) online map of registered groundwater works was undertaken as part of the investigation. The search carried out on 15 March 2022 identified no registered groundwater boreholes within 500 m of the site that contained groundwater information.

3.3 Soil Landscape

Reference to the Sydney 1: 100 000 scale Soil Landscape Series Sheet indicates that the site is located near the boundary between the Blacktown and Birrong soil landscape groups. The Blacktown group typically consists of shallow to moderately deep red and brown podzolic soils on crests, upper slopes and well drained areas and is characterised by moderately reactive, highly plastic subsoil with poor drainage. The Birrong group typically consists of deep yellow podzolic soils and yellow sodic soils on older alluvial terraces with deep sodic soils and yellow solonetzic soils on floodplains. The Birrong groups is characterised by localised flooding, erosion hazard, saline subsoil, seasonal waterlogging and very low soil fertility.

3.4 Acid Sulfate Soils

Review of published mapping indicates that the site is in an area of 'no known occurrence of acid sulfate soils.' The NSW Acid Sulfate Soils Manual 1998 published by the Acid Sulfate Soils Management Advisory Committee (ASSMAC) indicates that ASS (and Potential Acid Sulfate Soils – PASS) normally occur in alluvial or estuarine soils below RL 5 m AHD although occasionally are encountered up to RL 12 m AHD. It is understood that the potential for ASS on-site has been considered by another consultant.

3.5 Salinity

The Department of Infrastructure, Planning and Natural Resources (DIPNR) "Map of Salinity Potential in Western Sydney 2002" suggests that the site is in an area of "moderate salinity potential" with a higher potential in the lower elevation areas further to the south east.

3.6 Historical Information

A review of historical plans of the Sydney Harbour and Surrounding Districts – Department of Lands (1919) indicates that the north-east and south-east corners of the site were either on, or near the old alignment of Haslam's creek, prior to the creek being diverted into the culvert on the western boundary of the site. The creek fed into a dam to the north-east of the site. The plan showing the old creek alignment is shown in Figure 2 below.

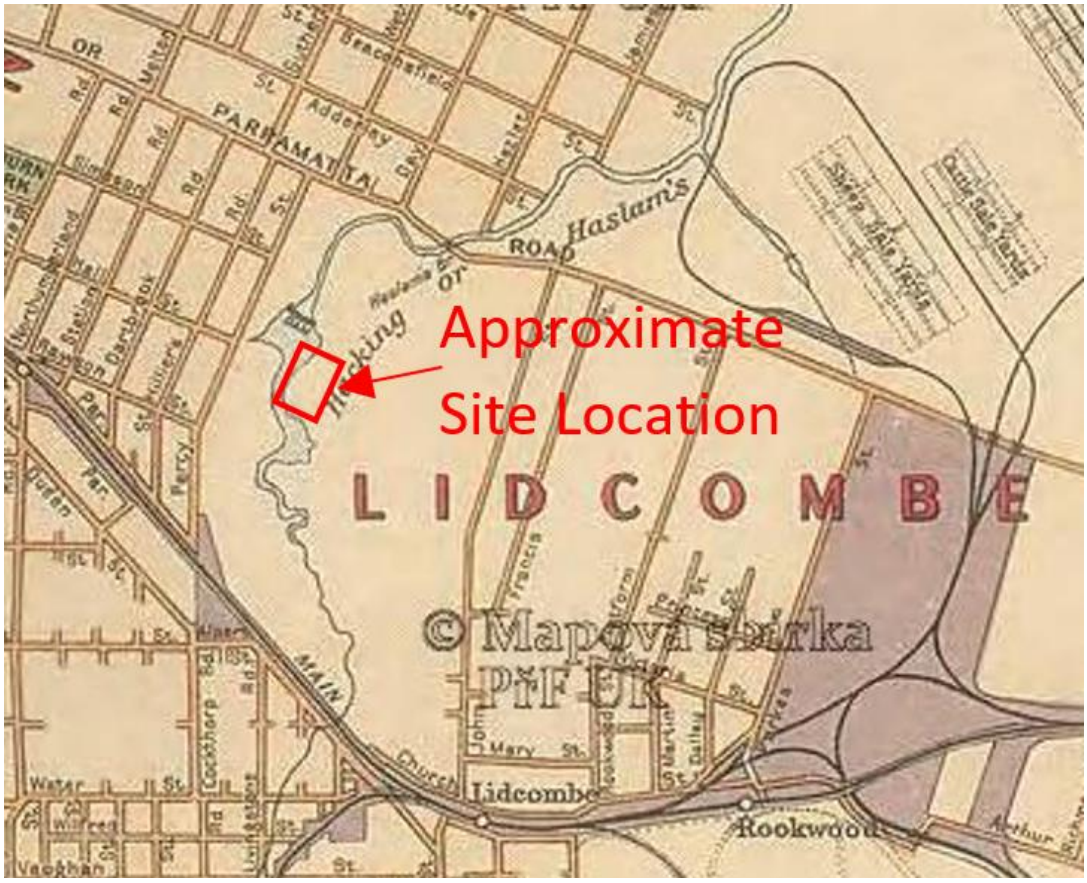

Figure 2. Excerpt of Plan titled "Sydney Harbour and Surrounding Districts – Department of Lands 1919" (Available at https://www.oldmapsonline.org/map/cuni/1182153)

A review of the 1943 Aerial Photograph indicates that the culvert was installed between 1919 and 1943. The alignment of the old watercourse is visible in the 1943 and is shown on Drawing 2 in Appendix B.

4. Field Work

4.1 Methods

The field work was undertaken between 1 February 2022 and 8 February 2022 and included the following:

- CPT testing at 10 locations (CPTs 1 to 10) using a ballasted truck-mounted test rig to push a 35 mm diameter cone tipped probe into the soil with a hydraulic ram system. Continuous measurements were made of the end-bearing pressure on the cone tip and the friction of the sleeve located directly behind the cone. The cone tip resistance and friction readings were displayed during the test and were stored on a computer for subsequent plotting of results and interpretation. The CPTs were undertaken to depths ranging between 1.7 m and 7.3 m where either practical refusal or excessive bending of the rods was encountered.
- Drilling of six boreholes (Bores 101 to 104, 111 and 112) using a truck-mounted drill rig with 110 mm diameter spiral flight augers and rotary drilling techniques. The boreholes were drilled to depths of between 2.6 m and 7.1 m. Standard penetration tests (SPTs) were completed at regular depths within the overburden.
- Extension of all boreholes into the underlying bedrock using NMLC coring techniques to obtain continuous 50 mm diameter core samples of the rock for identification and strength testing purposes. The boreholes were core drilled to depths of between 6.1 m and 10.5 m.
- The installation of groundwater monitoring wells in Bores 101, 102 and 103 at the completion of drilling. The wells involved inserting Class 18 uPVC screen and casing to the required depths, backfilling the screened length with clean gravel, plugging the top of the gravel with bentonite pellets and backfilling the casing with clean sand. The top of the well was finished with a gatic cover mounted flush with the surface.

Undisturbed and disturbed samples were collected from the boreholes to assist with logging and for laboratory testing. Bulk samples were taken in some of the boreholes to enable testing to be undertaken for compaction properties and California bearing ratio (CBR).

The ground surface levels (measured in ‘metres above Australian Height Datum AHD’) together with the Eastings and Northings (measure to GDA 2020) at the borehole and CPT locations were determined by using a high precision Differential GPS which is accurate to approximately 0.1 m. The locations of the boreholes and CPT tests are shown on Drawing 1 in Appendix B.

4.2 Results

The detailed borehole logs and interpreted CPT logs are provided in Appendix C. Notes defining classification methods and terms used to describe the soils and rocks along with notes on the methods used for interpretation of the CPT results are provided in Appendix A. The subsurface conditions encountered underlying the site can be summarised as follows:

- Pavement - asphalt concrete (50 mm to 80 mm thick) overlying roadbase gravels to depths ranging between 0.2 m and 0.25 m at the surface of Bores 101, 102 and 112. Asphaltic concrete overlying roadbase gravels was inferred at the surface of CPT 1 to CPT 6 to depths of between 0.2 m and 0.4 m. Concrete (140 mm to 200 mm thick) overlying roadbase gravels to depths ranging between 0.2 m and 0.4 m at the surface of Bores 103, 104 and 111 and CPT 7 to CPT 10;
- Fill - silty clay fill in all bores to depths ranging between 0.4 m and 2.2 m. Inclusions of gravel and sand were encountered within the fill. Fill was inferred to depths of between 1.0 m to 2.0 m in CPTs 1, 3, 5, 8 and 9;
- Natural Soil - Very soft to firm silty clays with some stiffer layers, gravel and sand layers were encountered to variable depths in Bores 103 and 104 and CPTs 8 and 10 as outlined below;
  - to depths of 6.8 m to 6.9 m in Bore 103 and CPT 8 respectively.
  - to depths of 2.3 m to 2.6 m in Bore 104 and CPT 10 respectively.
- Natural Soil (Stiff to Hard Clays) - typically stiff to hard silty and sandy clay to depths ranging between 2.0 m and 7.4 m in all bores except Bores 103 and 104 and CPTs 8 and 10. Stiff to hard silty or sandy clays were inferred in all CPTs to depths of between 1.7 m and 7.3 m.
- Very Low to Low Strength Rock - very low or very low to low strength, extremely to moderately weathered, siltstone in all bores except Bore 103 to depths ranging between 2.6 m and 7.1 m;
- Low and Medium Strength Rock - low strength, slightly to moderately weathered siltstone in Bore 101 below a depth of 5.8 m. Low to medium strength, fresh stained laminite at a depth of 6.6 m in Bore 112. Medium strength, slightly weathered to fresh stained siltstone or laminite at depths ranging between 2.6 m and 7.9 m in all bores except Bore 101;
- High Strength Rock - high strength, fresh stained siltstone or laminite at depths ranging between 3.2 m and 8.9 m in all bores except Bore 101 and Bore 112.

No free groundwater was observed during the drilling of the boreholes or on completion of the CPT tests. The use of water as a drilling fluid prevented groundwater observations during rotary drilling and coring.

The groundwater wells were measured for groundwater on 10 February 2022. The groundwater levels were measured at depths of 4.6 m, 1.5 m and 3.85 m in Bores 101, 102 and 103, respectively. It is noted, however, that groundwater levels are affected by preceding climatic conditions and soil/rock permeability and can therefore fluctuate with time.

5. Laboratory Testing

5.1 Mechanical Testing

Selected samples from the boreholes were tested in the laboratory for measurement of plasticity, dispersion potential, shrink-swell, moisture content, compaction properties and CBR. The detailed results are given in Appendix D and summarised in Tables 1 and 2.

Table 1A: Results of Laboratory Testing – Physical

Sample Location	Material	Depth (m)	FMC (%)	OMC (%)	MDD (t/m^3)	CBR (%)
TP1*	Silty Clay	0.2 – 0.3	10.2	13.5	1.87	12
Bore 102	Silty Clay	0.5 - 0.7	10.5	12.5	1.96	6
Bore 103	Silty Clay	2.0 – 2.27	-	-	-	-
Bore 111	Silty Clay Fill	0.4 – 0.5	-	-	-	-
Bore 111	Silty Clay	2.0 – 2.3	-	-	-	-
Bore 111	Silty Clay	0.5 – 0.7	21.1	16.0	1.72	1.5
Bore 112	Silty Clay Fill	0.5 – 0.6	-	-	-	-

Notes: FMC = Field Moisture Content OMC = Standard Optimum Moisture Content
MDD = Maximum Dry Density CBR = California bearing ratio
* adjacent to Bore 101

Table 2: Results of Laboratory Testing – Physical

Sample Location	Material	Depth (m)	W_L (%)	W_P (%)	PI (%)	I_{ss} (% Δpf)	ECN
TP1*	Silty Clay	0.2 – 0.3	-	-	-	-	-
Bore 102	Silty Clay	0.5 - 0.7	-	-	-	-	-
Bore 103	Silty Clay	2.0 – 2.27	-	-	-	2.0	-
Bore 111	Silty Clay Fill	0.4 – 0.5	38	16	22	-	2
Bore 111	Silty Clay	2.0 – 2.3	-	-	-	2.9	-
Bore 111	Silty Clay	0.5 – 0.7	-	-	-	-	-
Bore 112	Silty Clay Fill	0.5 – 0.6	47	17	30	-	6

Notes: W_L = Liquid Limit W_P = Plastic Limit
PI = Plasticity Index I_{SS} = Shrink Swell Index
ECN = Emerson Crumb number * adjacent to Bore 101

The results of the laboratory testing indicate the following:

- The Atterberg Limit results indicate that the silty clay samples were generally of medium plasticity.
- The shrink-swell results indicate the silty clays are typically moderately to highly reactive and therefore susceptible to shrink and swell movements due to changes in soil moisture content.
- The CBR values were of variable remoulded strength and ranged from 1.5 % to 12 % for the natural silty clay samples tested.
- The field moisture contents ranged from 10.2 % to 21.1% for the silty clay samples tested. The field moisture contents of the samples were between 3.2 % dry and 5.1 % wet of standard optimum moisture content.
- The Emerson Crumb Numbers were 2 and 6, indicating the clays have a moderate to high dispersion potential with a result of 2 being highly dispersive.

5.2 Chemical Testing

Selected samples collected from the boreholes were also tested in the laboratory for determination of aggressivity to concrete and steel, sodicity, textural classification and salinity.

A result summary table (Appendix D) presents the results of laboratory tests, assessments of aggressivity to concrete and steel, sodicity class, textural classification, calculated salinity electrical conductivity (ECe) and salinity class inferred from ECe values using the method of Richards (1954). The detailed laboratory test reports and chain of custody information are also provided in Appendix D.

The total test sample numbers and the range of test results obtained are summarised in Table 3.

Table 3: Results of Laboratory Testing - Chemical

Parameter		Units	Number of Tests	Range of Results
pH		pH units	28	4.5 – 9.1
Chlorides		(mg/kg)	3	<10 – 100
Sulphates		(mg/kg)	3	85 – 650
Aggressivity [AS 2159]	to Concrete	-	-	non-aggressive – moderately aggressive
	to Steel	-	-	non-aggressive to mildy aggressive
Exchangeable Sodium (Na)		(meq/100g)	2	0.3 – 06
CEC (cation exchange capacity)		(meq/100g)	2	2.3 – 18
Sodicity [Na/CEC]		(ESP%)	2	4 – 13

Parameter	Units	Number of Tests	Range of Results
Sodicity Class	[after DLWC]	2	Non-Sodic to Sodic
EC1:5 [Lab.]	(mS/cm)	28	150 – 980
ECe [M x EC1:5] [1]	(dS/m)	28	<2 – 6.8
Resistivity	(ohm.cm)		
Salinity Class [after Richards]	-	28	Non-Saline to Moderately Saline

Notes: 1 M is soil textural factor

5.2.1 Aggressivity

Test results showing the aggressivity assessed by pH, resistivity, sulphate concentrations and chloride concentration criteria (of AS 2159) at the borehole locations, together with the aggressivity class ranges indicated in Australian Standard AS 2159 are given in Appendix D. The absence of free groundwater in the boreholes and the inferred very low permeability of the sampled clay-rich soils indicate that soils at all boreholes are in Condition “B” as defined by AS 2159.

The results show that the samples tested indicate the ground conditions are non-aggressive to moderately aggressive to concrete and non-aggressive to mildly steel with reference to AS2159. The pH profiles with depth are shown in Figure 3.

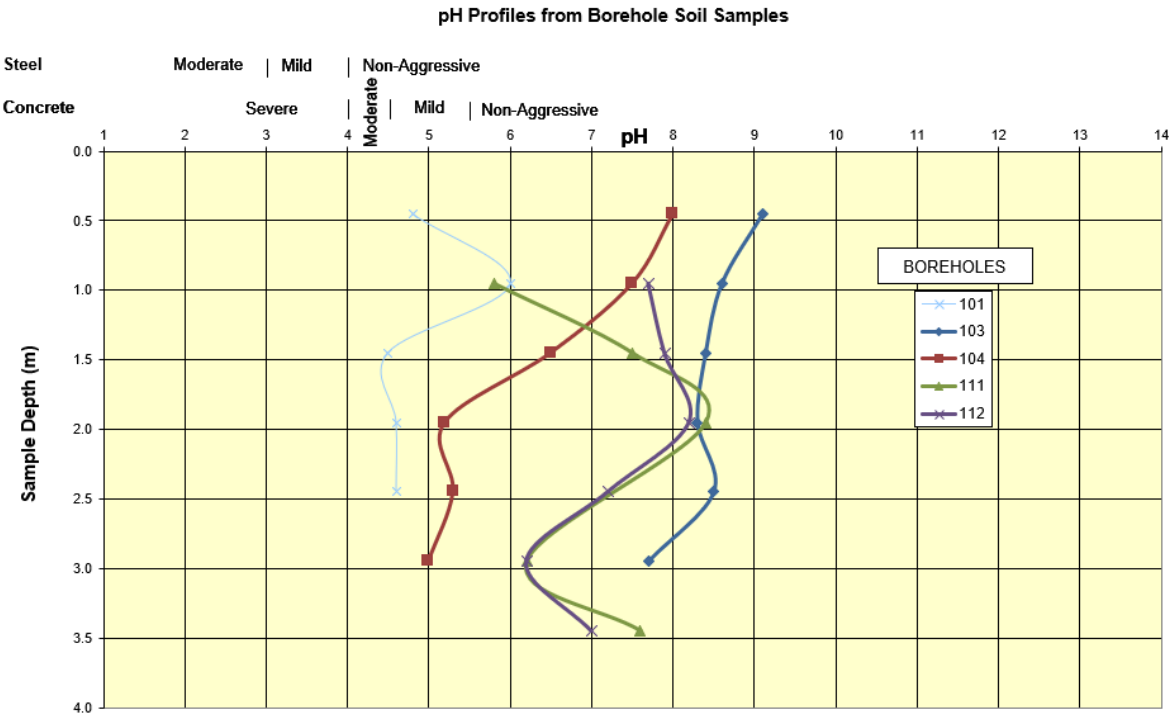

Figure 3. Vertical pH Profiles

5.2.2 Salinity

Figure 4 shows the salinity classifications based on the electrical conductivity (ECe) at borehole locations, together with the salinity classifications of Richards (1954). Test results are provided in Appendix D.

The results indicate that the samples tested were varied ranging from non-saline to moderately saline.

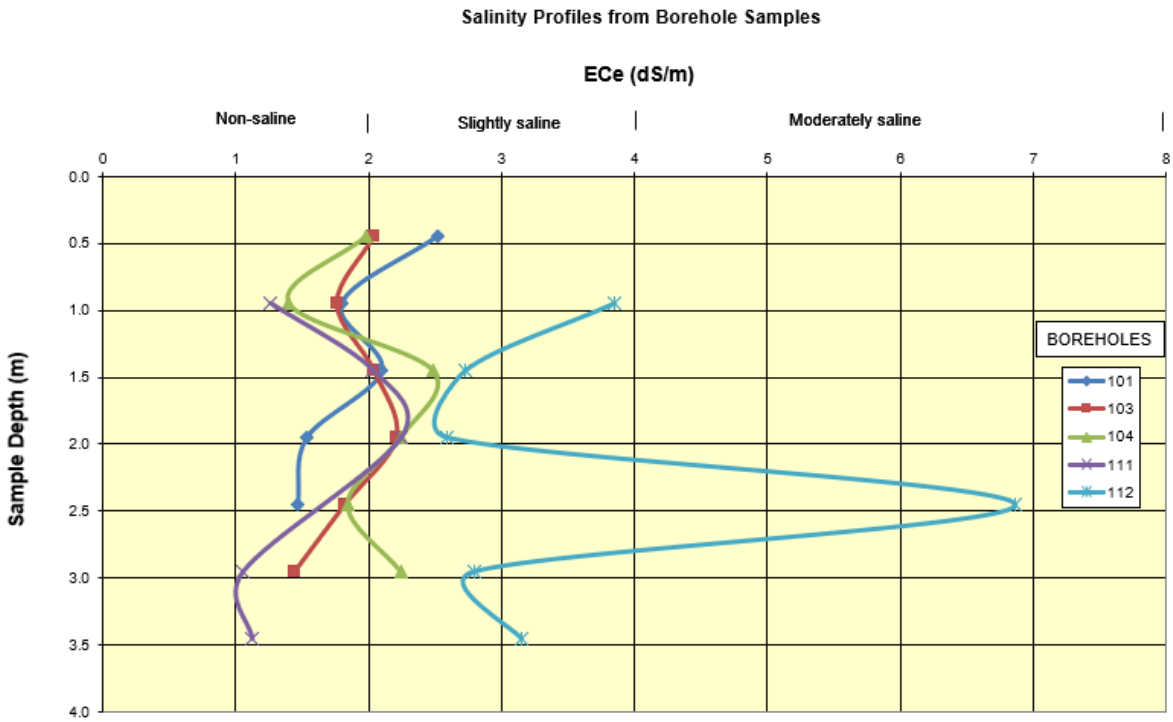

Figure 4. Vertical Salinity Profiles and Salinity Classes

5.2.3 Sodicity

The sodicity test results (refer Appendix D) indicates non-sodic to sodic soils, indicating a high potential for erosion of soils left exposed.

5.3 Point Load Testing

Point Load Strength Index (Is_{50}) testing was carried out on selected rock core specimens. The results of the tests are shown on the borehole logs at the appropriate depths. Figure 5 (following page) shows the range of Is_{50} results at the various depths (shown as Reduced Levels relative to AHD).

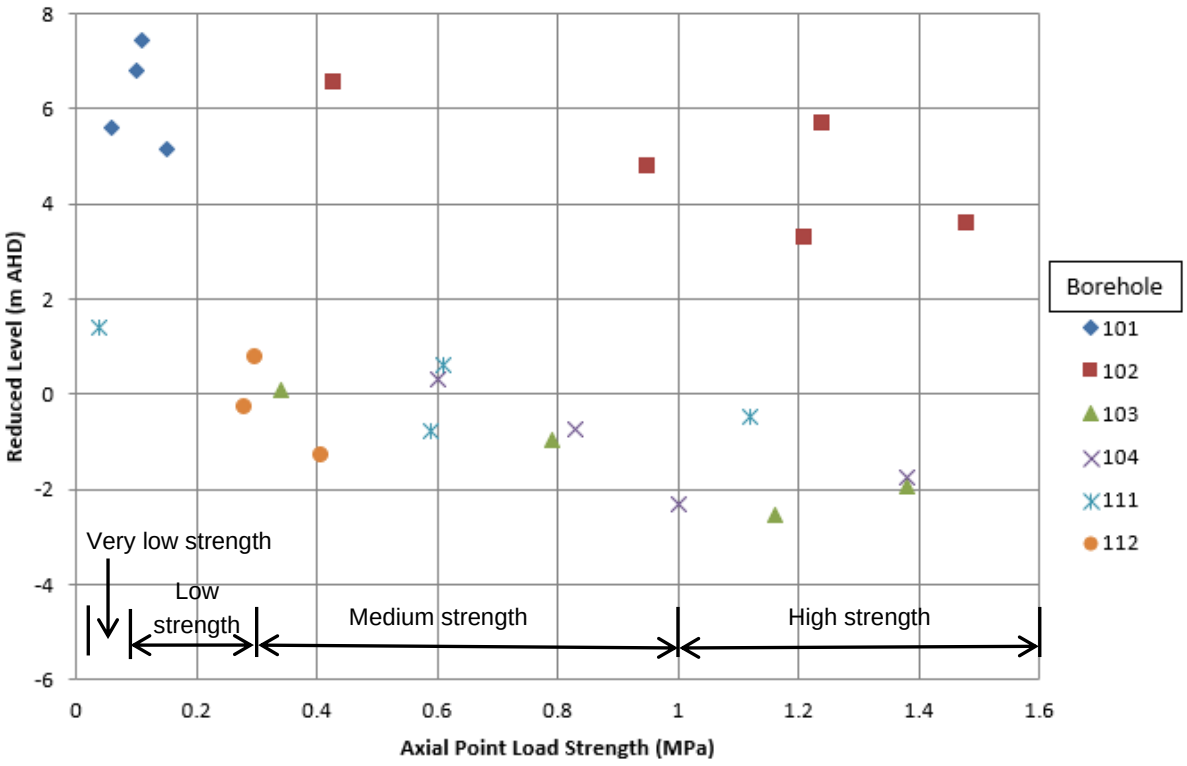

Figure 5. Results of Axial Point Load Tests

6. Proposed Development

It is understood that the proposed development will involve the construction of a two-storey warehouse building with associated offices, hardstand areas, pavements, landscaping and carparking areas. It is further understood that there will be four large warehouses on the ground floor and eight smaller warehouses on the upper level. No basement is proposed.

At the time of this report, the proposed levels for the new warehouse were not available. It is anticipated that a maximum of 0.5 m of cut, and fill will be required based on the existing site topography.

7. Geotechnical Model

The geotechnical model for the site can be considered to comprise several units as follows, in increasing depth order:

Fill (Unit 1)	-	Fill comprising the pavement profile and silty clay up to 2.2 m depth. Localised deeper zones of fill could be present on-site. The fill material on-site appears uncontrolled.

Natural Soils – soft to firm clays (Unit 2)	-	Very soft to firm silty clays with some stiffer layers, gravel and sand layers were encountered to depths of 6.8 m to 6.9 m in in Bores 103 and CPT 8 and 2.3 m to 2.6 m in Bore 104 and CPT 10. The approximate extent of these areas appears to correlate to the old alignment of the creek in the south-west corner, however, the presence of firm clay alluvial soils indicates other localised locations on the western boundary. The extent of these softer clay soils is expected to be variable along the western boundary. The adjacent areas do not appear to be affected by these softer soils, however, additional investigation is recommended to confirm the extent of softer clay soils on-site. The old creek alignment and the locations of the softer soils are shown in Figure 6.
Natural Soils (Unit 3)	-	Stiff to hard natural clay soils to depths of 1.7 m to 7.4 m. Given the alluvial deposition of the natural soils it is possible that the natural soils include sand lenses and possibly gravel. Along the western side of the site, closest to Haslam's Creek, weaker strength alluvial clays are present. The clays appear moderately to highly reactive.
Weathered Rock (Unit 4)	-	Very low and very low to low, extremely to moderately weathered, grey siltstone was encountered below depths of 2.0 m to 6.9 m. The depths to the top of the rock profile were generally shallower on the eastern side of the site (2.0 m to 3.2 m) and deeper on the western side of the site (6.1 m to 7.4 m).
Low and Medium Strength Rock (Unit 5)	-	Low strength, moderately to slightly weathered, dark grey siltstone below 5.8 m depth in Bore 101 and low to medium strength, fresh stained dark grey and black laminite in Bore 112 below 6.6 m depth.
Medium and High Strength Rock (Unit 6)	-	Medium and high strength, slightly weathered to fresh stained, dark grey siltstone or laminate below depths of 2.6 m to 7.9 m in all boreholes except Bore 101.

The groundwater level has been recorded by DP during this investigation at 1.5 m to 3.85 m depth. Notwithstanding this, water seepage is expected to flow over the soil/rock interface and along bedding planes and joints within the rock. Groundwater levels are expected to fluctuate with variations in climatic conditions.

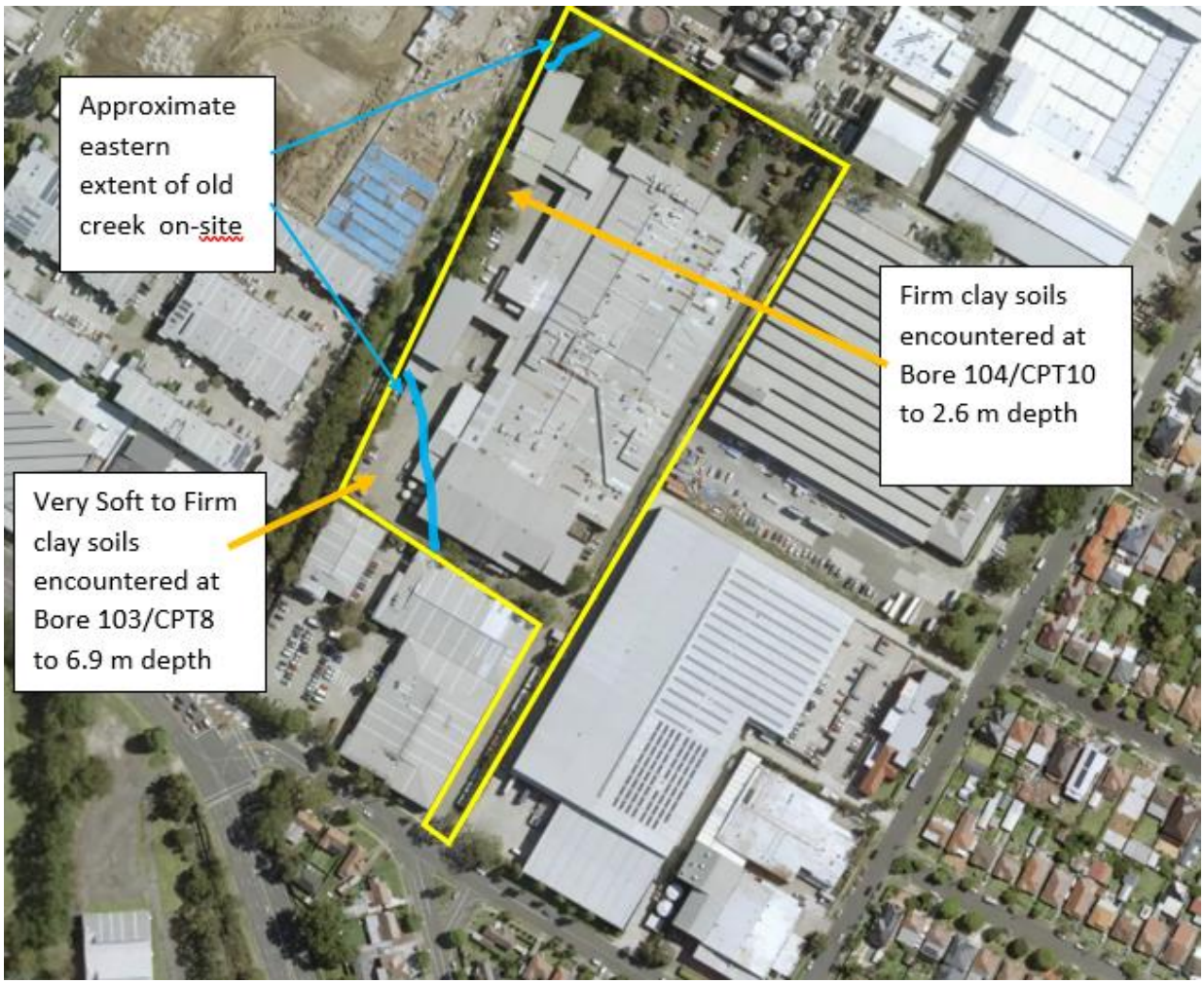

Figure 6. Approximate Extent of Old Creek Alignment on-site and Test Location where softer soils were encountered.

8. Comments

8.1 Geotechnical Risks

The results of the investigation and desktop review of available information indicates that the key geotechnical issues identified are:

- The potential for areas of significant thicknesses of fill of variable composition and compaction could affect the development of either site. The investigation indicates that deeper areas of fill are present over the old alignment of the creek and the western side of the site. It is likely that additional fill to form a bridging layer across the site was placed to create a level platform.

  Pavements and floor slabs constructed on uncontrolled fill of variable thickness are at risk of differential settlement. To reduce this risk it will be necessary to either design these structures to be supported on piles taken down to rock or remove and replace all the fill with engineered fill placed and compacted in a controlled manner.

- The softer clay soils (Unit 2) on the western side of the site are likely to experience ongoing settlements and consolidation. Furthermore, during construction these areas are more likely to form soft spots, particularly with frequent heavy traffic loads, with significant rectification works required. The lowest risk method for pavements over this area is to suspend the structure on piles. Consideration could be given to placing a bridging layer over this area, however, there is a risk of ongoing settlement which could result in cracking and failure of the pavement with this approach. Underground services within this area would also be subject to the same settlements and consolidation which could result in cracking and damage to the service.
- The natural clay soils below the surface fill are moderately to highly reactive and likely to be susceptible to shrink-swell movements with changing moisture contents. Floor slabs that are particularly susceptible to shrink-swell movements would generally need to be suspended and constructed with a void below the slab (i.e. cast on void-formers).
- Piled foundations, supported on bedrock, are likely to be required for the construction of the major structures.
- Saline soils and sodic soils are naturally occurring features of the local landscape and are not considered significant impediments for future development of the site, provided appropriate remediation or management techniques are employed. Structures in contact with soils of higher salinity levels and lower acidity (e.g. pH levels) will generally require concrete of higher strengths and greater cover thickness to steel reinforcement. Drainage to reduce the potential for concentrated flows of water and to limit the potential for water ponding for pavements and structures, as well as to limit the potential for scour and erosion of exposed areas, will be required.
- For pavement construction, it would be prudent to either lime stabilise the subgrade or provide a subgrade replacement layer (e.g. a 300 mm thick high-quality ripped sandstone) layer. These layers will limit the susceptibility of the pavement to shrink-swell movements and reduce flexible pavement thicknesses.
- Acid Sulfate Soils (ASS) or Potential Acid Sulfate Soils (PASS) are expected to be present within site soils. It is understood that the potential for ASS on-site has been separately addressed.
- The off-site disposal of any site soils from site will require a waste classification in accordance with current EPA policies. Fill materials are generally more expensive to dispose of off-site than natural soils and rock classified as Virgin Excavated Natural Materials (VENM). The presence of ASS may affect the waste classification of site soils.

Further geotechnical investigation will be required to confirm the risks outlined above.

8.2 Site Classification

The results of field work indicate that the site is underlain by fill (typically up to about 2.2 m depth) overlying alluvial and residual clay soils then weathered rock. Furthermore, the site is located in close proximity to trees predominantly on the northern and western boundaries. Where mature trees are located near the proposed building footprints, a “P” classification would therefore be assigned to the site in accordance with the abnormal moisture provisions and uncontrolled fill greater than 0.4 m thick as described in AS2870 – 2011 “Residential Slabs and Footings”. Class P sites require design based on engineering principles.

The laboratory testing indicates that the clays at the site are of medium plasticity and therefore likely to be susceptible to shrink-swell movements in response to seasonal variations in soil moisture content. Based on the soil depth, and the results of laboratory testing, it is considered that the natural soil profile would generally be consistent with a Class "H1" site as per AS 2870. AS2870 indicates that characteristic surface movements (y_s) of up 60 mm are expected for a Class "H1" site.

Considering the need for tree removal, additional ground movement due to swell of the clay soils could occur as the ground recovers to its equilibrium moisture content, particularly in the six months following removal of the trees.

8.3 Site Preparation and Earthworks

8.3.1 Excavation Conditions

It is expected that there will be some form of excavation works on site for the installation of services. Excavation to depths of up to say 0.5 m below current levels is generally expected to be within fill soils and natural clay soils which should be achievable using conventional earthmoving equipment.

Vibration generated during earthworks operations would generally be at a level that would not adversely affect the neighbouring structures.

The proposed excavations on site are expected to be shallow in which case the guidelines as given in SafeWork would be appropriate. If batters are required for shallow excavations, a batter of 1H:1V could be adopted for natural clay or clay filling.

All excavated materials disposed of off-site will need to be classified in accordance with the provisions of the current legislation and guidelines including the *Waste Classification Guidelines* (EPA, 2014). This includes topsoil, fill and natural materials that may be removed from the site. The presence of ASS may affect the waste classification of site soils.

8.3.2 Site Preparation

The extent of site preparation works will be dependent on the part of the site where pavements are to be constructed. Conventional site preparation methods can be used over most of the site except where the Unit 2 materials associated with the old creek-bed are present (refer Section 7).

For planning purposes, the following site preparation measures are recommended for subgrade preparation and any site platform fill placement for the development across the main part of the site (excluding the areas underlain by Unit 2 materials):

- remove any deleterious, soft, wet or highly compressible material or material rich in organics or root matter. Fill materials could potentially be reused on-site subject to geotechnical inspection and approval;
- roll the exposed surface with at least six passes of a minimum 12 tonne deadweight smooth drum roller, with a final test roll pass accompanied by careful visual inspection to ensure that any deleterious materials such as soft, wet or highly compressible soil and any organics are identified and removed;

- place approved fill, where required, in layers not exceeding 250 mm loose thickness, with each layer compacted to a minimum dry density ratio of 98% Standard and within 2% of optimum moisture content (OMC). Fill placed within 0.5 m of the subgrade level should be compacted to o a minimum dry density ratio of 100% and within 2% of optimum moisture content (OMC). New fill should be free of oversize particles (>75mm) and deleterious material;
- moisture conditioning of clay soils may be required if soils are saturated or dry. Moisture conditioning of saturated soils would involve drying in 'sunny and windy' weather, blending with other drier materials or lime stabilisation. Where the soil is dry, it is expected that this will involve either tyning or excavation with the addition of water to increase the moisture content;
- promptly cover any exposed clay at subgrade level with a minimum 150 mm of select granular fill (minimum CBR 15%) to reduce potential wetting and drying and trafficability problems; and
- new fill required to achieve design levels for support of any on-ground slabs and/or structural loads will need to be carried out under Level 1 testing conditions as defined in AS 3798–2007 "Guidelines on Earthworks for Commercial and Residential Developments". Level 2 testing is recommended for fill materials beneath pavements, recreational and landscaping areas.

The above procedures will require geotechnical inspection and testing services during construction.

In the areas underlain by Unit 2 materials the following site preparation methods could be adopted if a higher risk approach to the support the pavement is nominated by the client;

- Excavate to 1.5 m below the design subgrade level with inspection by a geotechnical engineer.
- Place a geotextile (e.g. Bidim A34) to provide separation between the bridging layer and the underlying soils.
- Pace a geogrid (e.g. Tensar SS30) on the stripped surface to provide some tensile strength to the base of the bridging layer and to reduce post construction differential settlements.
- Place a nominal 800 mm thick bridging layer of durable free draining well-graded angular fill such as ripped rock (igneous) or recycled concrete with a soaked CBR value of at least 20% and a particle size of 25 mm to 300 mm. It is recommended that the proposed bridging material be inspected and approved by a geotechnical engineer at least 3 weeks prior to the commencement of construction or delivery to site (whichever is earlier).
- Test roll the exposed surface with a minimum 12 tonne deadweight smooth drum roller to confirm the adequacy of the 800 mm nominated thickness, with additional bridging material to be placed in areas where deflections are observed.
- Place a top layer of geotextile to fully encapsulate the bridging layer.
- Place and compact pavement layers as indicated above for other sections of site.

8.4 Foundations

It is recommended that all structural loads be transferred to a uniform founding stratum to avoid potential excessive differential settlement across the building. The different foundation systems that could be considered are outline in Sections 8.4.1 to 8.4.2 below.

8.4.1 Shallow Foundations

Shallow footings (e.g. pad or strip footings) for stand-alone structures (e.g. light poles) founded on controlled fill or stiff natural clays prepared in accordance with Section 7.3.2 could be designed for an allowable bearing pressure of 150 kPa. The design of shallow footings should also take account of shrink-swell movements associated with the site classification outlined in Section 7.2.

The foundation parameters provided for shallow footings assume all footings are free of water and loose debris immediately prior to pouring concrete. All foundations should be constructed below the zone of influence of any existing of proposed service trenches. The zone of influence can be conservatively defined by a plane extending upwards at 45° from the base of the service trench.

8.4.2 Piled Foundation

The support of higher loads of the building and other structures will require to be supported on a deep-footing system, probably founding on weathered rock, would be required. Bored piles are considered a feasible pile type although temporary or permanent liners (i.e. casing) may be required to manage issues associated with possible water seepage. Alternatively, piles may be constructed using continuous flight auger (CFA) piles.

The design of piled footings, for axial compression loading may be based on the maximum Limit State Design or Working Stress parameters given in Table 4.

Table 4: Maximum Foundation Design Parameters

Unit	Working Stress Design Values		Limit State Design Values		Elastic Modulus (MPa)
	Allowable End Bearing Pressure (kPa)	Shaft Adhesion (kPa)	Ultimate End Bearing Pressure (kPa)	Shaft Adhesion (kPa)	
Very Low and Low strength siltstone (Unit 4)	1000	150	3,000	300	100
Low and Medium Strength Siltstone and Laminite (Unit 5)	2000	200	18,000	450	800
Medium and High Strength Siltstone and Laminite (Unit 6)	3500	350	30,000	600	1200

A geotechnical strength reduction factor (ϕ_g) should be applied to the ultimate values provided in Table 3 if the limit-state design process is undertaken to design the piles. Australian Standard AS 2159:2009 “Piling – Design and Installation” (2009) provides information on how to determine an appropriate value of ϕ_g which is based on a risk assessment. The serviceability assessment should be based on using geotechnical parameters that are appropriately selected and to which no reduction factor is applied.

The total (long-term) settlement of a piled footing designed using the allowable parameters provided in this report should be less than about 1% of the pile diameter upon application of the design dead load.

Serviceability analysis should be undertaken if the ultimate bearing pressures (incorporating a suitable reduction factor) are used to proportion the piles.

Over the designated 'socket length', the sidewalls of bored piles should be clean and free of clay 'smear'. Also, the sidewalls should meet the minimum roughness category of "R2" (defined as grooves of 1 to 4 mm depth and width greater than 2 mm, at a spacing of 50 mm to 200 mm) in Pells et.al (1998). A 'grooving' or 'roughening' tool may be required to achieve this criterion.

The foundation parameters provided in this report assume all footings are free of water and loose debris immediately prior to pouring concrete. All foundations should be constructed below the zone of influence of any existing or proposed service trenches. The zone of influence can be conservatively defined by a plane extending upwards at 45° from the base of the service trench.

All footings in one structure should be founded on the same strata to achieve uniform founding conditions and limit the potential for differential movement between different parts of the structure.

It is recommended that all footing excavations be inspected by an experienced geotechnical engineer or engineering geologist prior to the placement of concrete and steel to confirm the design bearing pressure.

8.5 Seismic Design

In accordance with Part 4 of the Structural design actions Standard, AS1170.4 – 2007, the site is assessed to have a Site Sub-Soil Class of "C_e". This is in accordance with the definitions presented in Section 4.2 – Class Definitions.

8.6 Floor Slabs

Where the warehouse buildings are to be designed with a suspended floor slab, site preparation measures will be minimal. If slabs are to be cast on ground (but designed as suspended slabs), then checks should be made to ensure that concrete is not poured onto softened or wet ground that could lead to deformation of the slab. Furthermore, in areas where clay is present, to reduce the potential for swelling of soils beneath the slab, the top 100 mm of the ground surface should be scarified and loosed prior to forming up for the slab. Alternatively, void formers could be used.

Where site preparation is undertaken in accordance with Section 8.3.2, on-grade slabs could be constructed in place of suspended slabs. Based on the results of the subsurface investigations, subgrade conditions are expected to be formed over natural clay or clay fill.

Floor slabs should be cast independently of pads or pile and beam footings and incorporate control joints to allow for differential movements. Edge protection, such as deepened stiffening edge beams in conjunction with surface paving should also be included to minimise the effects of reactivity movements due to the high/moderate reactivity of the site clays.

8.7 Pavements

Based on the highly reactive clays on-site, concrete pavements and ground slabs should be articulated to allow for differential movement together with a drainage system to limit the potential for shrink-swell movements that could potentially damage pavements.

Laboratory testing for CBR and compaction was carried out on representative samples recovered from the subgrade soils over the site. The CBR values obtained range from 1.5 % to 12% for the clay fill samples tested. Given experience in the area and allowing for variability of results, it is suggested that the design of pavements be based on a design CBR value for the subgrade of 1.5 %. Pavements should be placed on a subgrade prepared in accordance with the recommendations provided in Section 8.3.2.

Where a subgrade replacement option is adopted, it would need to be determine in accordance with the methods outlined in AUSTROADS "Guide to Pavement Technology – Part 2: Pavement Structural Design"- 2017 (AUSTROADS). Furthermore, the contractor will need to carry out CBR testing to confirm the proposed materials or subgrade are consistent with Council's design requirements. As a guide, using the methods of AUSTROADS, a 300 mm thick subgrade replacement layer comprising a high-quality ripped sandstone (CBR>20%) overlying the natural clays on-site with a CBR value of 1.5 % is considered to achieve an effective CBR value of 6 %.

The design CBR value given above depends on the provision of adequate surface and subsoil drainage to maintain the subgrade as close to OMC as possible. Subsoil drainage should be installed to not less than 500 mm depth below subgrade level adjacent to the pavement. Preparation of subgrade surfaces should be such that adequate cross-falls for the surface drainage purposes are achievable across the final pavement.

8.8 Site Maintenance and Drainage

Surface and subsurface drainage for the building should be incorporated into the design. Preparation of subgrade surfaces should be such that adequate cross-falls for the surface drainage purposes are achievable across the final pavement.

Care should be taken to avoid external influences on the soil moisture-regime to prevent erosion and softening of the exposed soils. Detailing of surface and subsurface drainage should be aimed at avoiding substantial wetting of the soils beneath building and pavement areas. Surface water should be directed away from building or hardstand areas and the upper section of services trenches should be backfilled with compacted clay soil to avoid the trench acting as an inlet drain.

Site trafficability during dry weather should pose no problems, however inclement weather may cause clayey soils to soften and become unsuitable for construction traffic until the site conditions dry. In areas where high levels of construction traffic are expected, a temporary hardstand comprising crushed rock could be constructed to aid in trafficability during wet weather.

8.9 Salinity

8.9.1 Impact of the Saline Soils on the Proposed Development

The moderate aggressivity to concrete, mild aggressivity to steel, the presence of slightly to moderately saline soils and sodic soils are naturally occurring features of the local landscape and are not considered significant impediments for future redeveloped of the Site, provided appropriate remediation or management techniques are employed.

Salinity and aggressivity affects the durability of concrete and steel by causing premature breakdown of concrete and corrosion of steel. This has impacts on the longevity of structures in contact with these materials. As a result management will be required.

Sodic soils have low permeability due to infilling of interstices with fine clay particles during the weathering process, restricting infiltration of surface water and potentially creating perched water tables, seepage in cut faces or ponding of water in flat open areas. In addition, sodic soils tend to erode when exposed. Management of sodic soils would therefore be required to prevent these adverse effects.

8.9.2 Salinity Management Plan

The current salinity investigation indicates that materials within the site range from non-saline to moderately saline. Testing of other parameters associated with salinity indicates that the materials are non – aggressive to moderately aggressive to concrete and mildly aggressive to steel. In addition, shallow soils were highly sodic.

The amount of information regarding the distribution of salinity across the site is limited. Therefore, the management strategies assume the most conservative approach of moderately soils being present across the site. Further investigation may be able to delineate areas of lower salinity, however, given the proximity to Haslam's Creek it is likely that moderately saline soils will probably be encountered elsewhere on-site.

The following management strategies are confined to the management of those factors with a potential to impact on the development:

A. Management should focus on capping of the upper surface of the sodic soils, both exposed by excavation and placed as filling, with a more permeable material to prevent ponding, to reduce capillary rise, to act as a drainage layer and to reduce the potential for erosion.

B. With respect to any required imported filling, which is expected to be only in small quantities, testing should be undertaken prior to importation, to determine the salinity characteristics of the material, which should be no greater than moderately aggressive to concrete, mildly-aggressive to steel and moderately saline in classification.

C. Sodic soils can also be managed by maintaining vegetation where possible and planting new salt tolerant species. The addition of organic matter, gypsum and lime can also be considered where appropriate. After gypsum addition, reduction of sodicity levels may require some time for sufficient infiltration and leaching of sodium into the subsoils, however capping of exposed sodic material should remain the primary management method. Topsoil added at the completion of construction is, in effect, also adding organic matter which may help infiltration and leaching of sodium.

D. Avoiding water collecting in low lying areas, in depressions, or behind fill. This can lead to water logging of the soils, evaporative concentration of salts, and eventual breakdown in soil structure resulting in accelerated erosion.

E. Any pavements should be designed to be well drained of surface water. There should not be excessive concentrations of runoff or ponding that would lead to waterlogging of the pavement or additional recharge to the groundwater through any more permeable zones in the underlying filling material.

F. Surface drains should generally be provided along the top of batter slopes to reduce the potential for concentrated flows of water down slopes possibly causing scour.

G. Salt tolerant grasses and trees should be considered for landscaping, to reduce soil erosion and to maintain the existing evapo – transpiration and groundwater levels. Reference should be made to an experienced landscape planner or agronomist.

The following additional strategies are recommended for completion of service installation and for building construction. These strategies should be complementary to standard good building practices recommended within the Building Code of Australia, including cover to reinforcement within concrete and correct installation of a brick damp course, so that it cannot be bridged to allow moisture to move into brick work and up the wall.

H. Soils within the site are classified as moderately aggressive to concrete. Concrete piles, cast-in place, exposed to moderately aggressive soils should have a minimum strength of 40 MPa and a minimum cover to reinforcement of 65 mm (as per AS2159) for a 50-year design life to limit the corrosive effects of the surrounding soils (in accordance with AS2159).

I. With regard to concrete structures, moderately saline and moderately aggressive, soils have been identified within the site and as such, slabs and foundations should have a minimum strength of 32 MPa, a minimum cover to reinforcement of 45 mm from unprotected ground and should be allowed to cure for a minimum of seven days (as per AS3600) to limit the corrosive effects of the surrounding soils.

J. Wet cast concrete pipes and currently manufactured spun concrete pipes are understood to have estimated compressive strengths of 50 MPa and 60 – 70 MPa, respectively, in excess of the requirements for mass concrete in H to J above. Reference to the maximum and minimum test results of Table 4 (Section 6.2 of this report) and to Tables E1 and 3.1 of AS 4058 – 2007 “Precast concrete pipes” indicates that the site falls within the AS 4058 Clay/Stagnant (low sulphate) soil type (chlorides <=20,000 ppm, pH>=4.5 and sulphates <=1,000 ppm) and (in the absence of tidal water flow) falls within the AS 4058 Normal durability environment. Under these conditions, AS 4058-compliant reinforced concrete pipes of general-purpose Portland cement, with a minimum cover to reinforcement of 10 mm, are expected to have a design life in excess of 100 years. Any concrete pipes installed within the site should employ AS 4058-compliant steel reinforced pipes of general-purpose Portland cement, with minimum cover to reinforcement of 10 mm, or should be fibre reinforced.

K. Resistivity results indicate soils within the site that are mildly aggressive to steel. The following corrosion allowances (as per AS 2159 – 2009) should be taken into account by the designer:

- Mild: uniform corrosion allowance 0.01 – 0.02 mm/year;

In instances where a coating is applied to the pile, if the design life of the pile is greater than the design life for the coating, consideration must be given to corrosion of the pile in accordance with the above list.

8.10 Additional Investigation

It is recommended that additional investigation be carried out to delineate the extend of the fill and softer clays associated with Unit 2 outlined in the investigation.

9. Limitations

Douglas Partners Pty Ltd (DP) has prepared this report for this project at 42 Boorea Road, Lidcombe in accordance with DP's proposal dated 19 November 2022 and acceptance received from Mr Luka Krivacic. The work was carried out under DP's Conditions of Engagement. This report is provided for the exclusive use of Tactical Group Pty Ltd for this project only and for the purposes as described in the report. It should not be used by or relied upon for other projects or purposes on the same or other site or by a third party. Any party so relying upon this report beyond its exclusive use and purpose as stated above, and without the express written consent of DP, does so entirely at its own risk and without recourse to DP for any loss or damage. In preparing this report DP has necessarily relied upon information provided by the client and/or their agents.

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

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

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

This report must be read in conjunction with all of the attached notes 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

August 2020

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.

continued next page

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.

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Introduction to Terminology, Symbols and Abbreviations

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

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

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

Abbreviation Codes

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

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

Data Integrity Codes

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

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

Graphic Symbols

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

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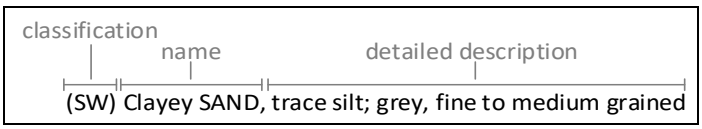
Introduction

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



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

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

Particle size designation and Behaviour Model

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

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

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

[1] – refer grain size subdivision descriptions below

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

Component proportions

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

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

[1] – As defined in AS1726-2017 6.1.4.4

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

Composite Materials

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

Classification

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

Soil Name

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

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

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

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

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

Identification of minor components

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

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

Soil Composition

Plasticity

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

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

Grain Size

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

Grading

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

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

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Soil Condition

Moisture

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

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

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

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

Consistency/Density/Compaction/Cementation/Extremely Weathered Rock

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

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

Quantitative engineering performance of these materials may be determined by laboratory testing, or estimated by correlated field tests (for example penetration or shear vane testing), or by tactile methods, as appropriate.

Consistency (fine grained soils)

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

Relative Density (coarse grained soils)

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

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

Compaction (anthropogenically modified soil)

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

Cementation (natural and anthropogenic)

Cementation Term	Abbreviation Code
Moderately cemented	MCE
Weakly cemented	WKCE
Cemented	CE
Strongly bound	SB
Weakly bound	WB
Unbound	UB

Extremely Weathered Rock

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

Soil Origin

Term	Description	Abbreviation Code
Residual	Derived from in-situ weathering of the underlying rock	RES
Extremely weathered material	Formed from in-situ weathering of geological formations. Has strength of less than 'very low' as per as1726 but retains the structure or fabric of the parent rock.	XWM
Alluvial	Deposited by streams and rivers	ALV
Estuarine	Deposited in coastal estuaries	EST
Marine	Deposited in a marine environment	MAR
Lacustrine	Deposited in freshwater lakes	LCS
Aeolian	Carried and deposited by wind	AEO
Colluvial	Soil and rock debris transported down slopes by gravity	COL
Topsoil	Mantle of surface soil, often with high levels of organic material	TOP
Fill	Any material which has been moved by man	FILL
Littoral	Deposited on the lake or sea shore	LIT
Unidentifiable	Not able to be identified	UID

Cobbles and Boulders

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

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

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Rock Strength

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

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

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

[1] Assumes a ratio of 20:1 for UCS to $I_{s(50)}$. It should be noted that the UCS to $I_{s(50)}$ ratio varies significantly for different rock types and specific ratios may be required for each site.

On investigation logs only, the following data contiguity codes may be in rock strength tables for layers or seams of material "within rock", but for which the equivalent UCS strength is less than 0.6 MPa.

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

Degree of Weathering

The degree of weathering of rock is classified as follows:

Weathering Term	Description	Abbreviation Code
Residual Soil[1,2]	Material is weathered to such an extent that it has soil properties. Mass structure and material texture and fabric of original rock are no longer visible, but the soil has not been significantly transported.	RS
Extremely weathered[1,2]	Material is weathered to such an extent that it has soil properties. Mass structure and material texture and fabric of original rock are still visible	XW
Highly weathered	The whole of the rock material is discoloured, usually by iron staining or bleaching to the extent that the colour of the original rock is not recognisable. Rock strength is significantly changed by weathering. Some primary minerals have weathered to clay minerals. Porosity may be increased by leaching, or may be decreased due to deposition of weathering products in pores.	HW
Moderately weathered	The whole of the rock material is discoloured, usually by iron staining or bleaching to the extent that the colour of the original rock is not recognisable, but shows little or no change of strength from fresh rock.	MW
Slightly weathered	Rock is partially discoloured with staining or bleaching along joints but shows little or no change of strength from fresh rock.	SW
Fresh	No signs of decomposition or staining.	FR
Note: If HW and MW cannot be differentiated use DW (see below)		
Distinctly weathered	Rock strength usually changed by weathering. The rock may be highly discoloured, usually by iron staining. Porosity may be increased by leaching or may be decreased due to deposition of weathered products in pores.	DW

[1] – AS1726-2017 6.1.9 provides similar definitions for "residual soil" and "extremely weathered material" as soil origins. Generally, the soil origin terms would be used above the depth at which very low strength or stronger rock material is first encountered, while both soil origin and weathering should may be stated for soil encountered below the first contact with rock material, where appropriate.

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

Degree of Alteration

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

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

Degree of Fracturing

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

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

Rock Quality Designation

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

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

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

Stratification Spacing

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

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

Defect Descriptions

Defect Type

Term	Abbreviation Code
Bedding plane	B
Clay seam	CS
Cleavage	CV
Crushed zone	CZ
Decomposed seam	DS
Fault	F
Joint	J
Lamination	LAM
Parting	PT
Sheared zone	SZ
Vein	VN
Drilling/handling break	DB , HB
Fracture	FCT

Rock Defect Orientation

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

Rock Defect Coating

Term	Abbreviation Code
Clean	CLN
Coating	CO
Healed	HE
Infilled	INF
Stained	STN
Tight	TI
Veneer	VEN

Rock Defect Infill

Term	Abbreviation Code
Calcite	CA
Carbonaceous	CBS
Clay	CLY
Iron oxide	FE
Manganese	MN
Silty	SLT

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Rock Defect Shape/Planarity

Term	Abbreviation Code
Curved	CU
Irregular	IR
Planar	PL
Stepped	ST
Undulating	UN

Rock Defect Roughness

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

Other Rock Defect Attributes

Term	Abbreviation Code
Fragmented	FG
Band	BND
Quartz	QTZ

Defect Orientation

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

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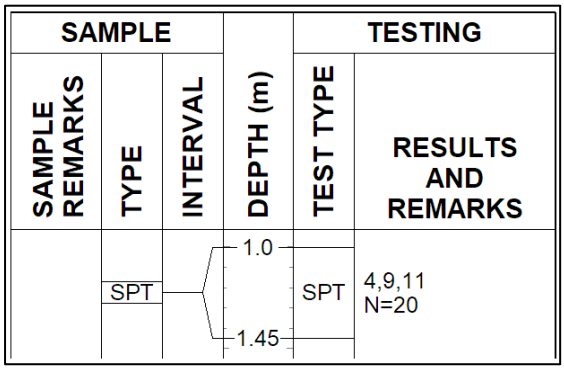
Sampling, Testing and Excavation Methodology

Terminology
Symbols
Abbreviations

August 2020

Sampling and Testing

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



Sampling

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

Sample Type	Code
Auger sample	A
Acid sulfate sample	ASS
Bulk sample	B
Core sample	C
Disturbed sample	D
Sample from SPT test	SPT
Environmental sample	E
Gas sample	G
Jar sample	J
Undisturbed tube sample	U[1]
Water sample	W
Piston sample	P
Core sample for unconfined compressive strength testing	UCS

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

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

Field and Laboratory Testing

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

Test Type	Code
Pocket penetrometer (kpa)	PP
Photo ionisation detector	PID
Standard Penetration Test	SPT
Shear vane (kpa)	V
Unconfined compressive strength, (MPa)	UCS
Point load test, axial (A), diametric (D), irregular (I)	PLT(_)

Field and laboratory testing (continued)

Test Type	Code
Dynamic cone penetrometer, followed by blow count penetration increment in mm (cone tip, generally in accordance with AS1289.6.3.2)	DCP/150
Perth sand penetrometer, followed by blow count penetration increment in mm (flat tip, generally in accordance with AS1289.6.3.3)	PSP/150

Groundwater Observations

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

Drilling or Excavation Methods/Tools

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

Method	Abbreviation Code
Excavator/backhoe bucket	B[1]
Toothed bucket	TB[1]
Mud/blade bucket	MB[1]
Ripping tyne/ripper	RT
Rock breaker/hydraulic hammer	RB
Hand auger	HA[1]
NMLC series coring	NMLC
HMLC series coring	HMLC
NQ coring	NQ
HQ coring	HQ
PQ coring	PQ
Push tube	PT [1]
Rock roller	RR[1]
Solid flight auger. Suffixes (TC) and (V) indicate tungsten carbide or v-shaped tip respectively	SFA[1]
Sonic drilling	SON[1]
Vibrocore	VC[1]
Wash bore (unspecified bit type)	WB[1]
Existing exposure	X
Hand tools (unspecified)	HT
Predrilled	PD
Specialised bit (refer report)	SPEC[1]
Diatube	DT[1]
Hollow flight auger	HFA[1]
Vacuum excavation	VE

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

Cone Penetration Testing

August 2020

Introduction

The Cone Penetration Test (CPT) is a sophisticated soil profiling test carried out in-situ. A special cone shaped probe is used which is connected to a digital data acquisition system. The cone and adjoining sleeve section contain a series of strain gauges and other transducers which continuously monitor and record various soil parameters as the cone penetrates the soils.

The soil parameters measured depend on the type of cone being used, however they always include the following basic measurements

- Cone tip resistance q_c
- Sleeve friction f_s
- Inclination (from vertical) i
- Depth below ground z

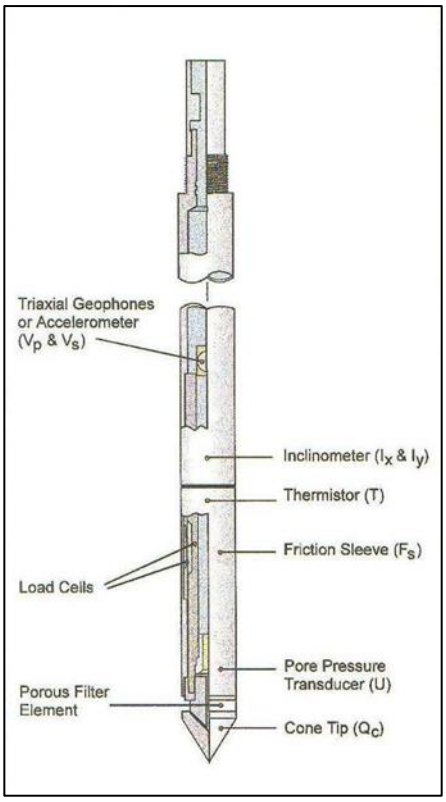


Figure 1: Cone Diagram

The inclinometer in the cone enables the verticality of the test to be confirmed and, if required, the vertical depth can be corrected.

The cone is thrust into the ground at a steady rate of about 20 mm/sec, usually using the hydraulic rams of a purpose built CPT rig, or a drilling rig. The testing is carried out in accordance with the Australian Standard AS1289 Test 6.5.1.

Figure 2: Purpose built CPT rig

The CPT can penetrate most soil types and is particularly suited to alluvial soils, being able to detect fine layering and strength variations. With sufficient thrust the cone can often penetrate a short distance into weathered rock. The cone will usually reach refusal in coarse filling, medium to coarse gravel and on very low strength or better rock. Tests have been successfully completed to more than 60 m.

Types of CPTs

Douglas Partners (and its subsidiary GroundTest) owns and operates the following types of CPT cones:

Type	Measures
Standard	Basic parameters (qc, fs, i & z)
Piezocone	Dynamic pore pressure (u) plus basic parameters. Dissipation tests estimate consolidation parameters
Conductivity	Bulk soil electrical conductivity (□) plus basic parameters
Seismic	Shear wave velocity (Vs), compression wave velocity (Vp), plus basic parameters

Strata Interpretation

The CPT parameters can be used to infer the Soil Behaviour Type (SBT), based on normalised values of cone resistance (Qt) and friction ratio (Fr). These are used in conjunction with soil classification charts, such as the one below (after Robertson 1990)

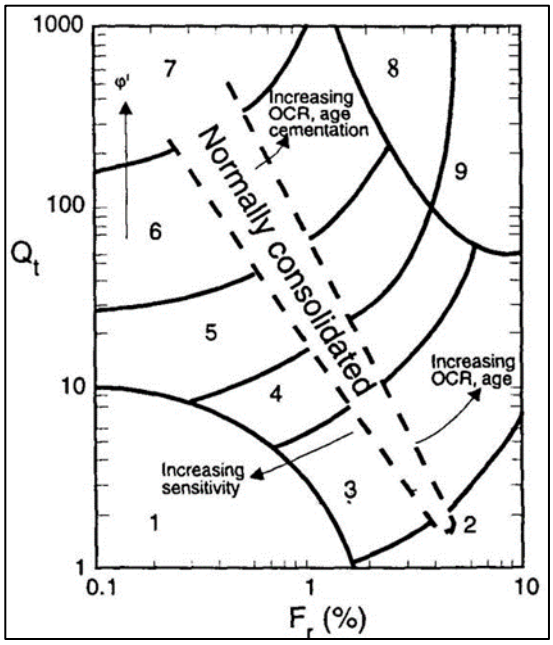


Figure 3: Soil Classification Chart

DP's in-house CPT software provides computer aided interpretation of soil strata, generating soil descriptions and strengths for each layer. The software can also produce plots of estimated soil parameters, including modulus, friction angle, relative density, shear strength and over consolidation ratio.

DP's CPT software helps our engineers quickly evaluate the critical soil layers and then focus on developing practical solutions for the client's project.

Engineering Applications

There are many uses for CPT data. The main applications are briefly introduced below:

Settlement

CPT provides a continuous profile of soil type and strength, providing an excellent basis for settlement analysis. Soil compressibility can be estimated from cone derived moduli, or known consolidation parameters for the critical layers (eg. from laboratory testing). Further, if pore pressure dissipation tests are undertaken using a piezocone, in-situ consolidation coefficients can be estimated to aid analysis.

Pile Capacity

The cone is, in effect, a small scale pile and, therefore, ideal for direct estimation of pile capacity. DP's in-house program ConePile can analyse most pile types and produces pile capacity versus depth plots. The analysis methods are based on proven static theory and empirical studies, taking account of scale effects, pile materials and method of installation. The results are expressed in limit state format, consistent with the Piling Code AS2159.

Dynamic or Earthquake Analysis

CPT and, in particular, Seismic CPT are suitable for dynamic foundation studies and earthquake response analyses, by profiling the low strain shear modulus G0. Techniques have also been developed relating CPT results to the risk of soil liquefaction.

Other Applications

Other applications of CPT include ground improvement monitoring (testing before and after works), salinity and contaminant plume mapping (conductivity cone), preloading studies and verification of strength gain.

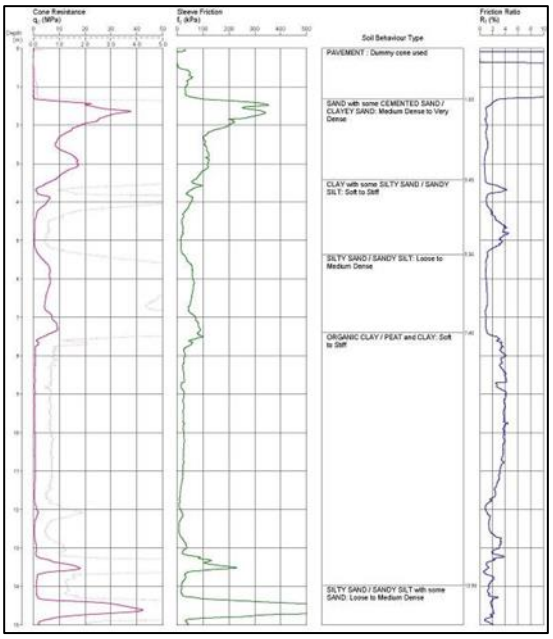


Figure 4: Sample Cone Plot

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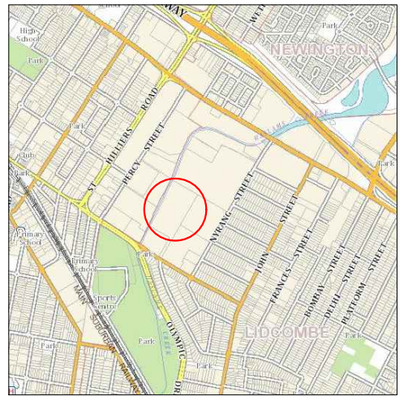
Appendix B

Drawings



SITE LOCALITY

NOTE:
1: Base image from MetroMap.com.au (Dated 09.02.2022)

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

LEGEND

- Test Bore Location
- Test Bore with Standpipe Location
- CPT Location and Number
- Site Boundary

Douglas Partners
Geotechnics / Environment / Groundwater

CLIENT: Tactical Group		TITLE: **Test Location Plan** **Proposed Industrial Development** **42 Boorea Street, Lidcombe**
OFFICE: Sydney	DRAWN BY: CJ	
SCALE: 1:1250 @ A3	DATE: 07.03.2022	

N

PROJECT No:	210950.00
DRAWING No:	1
REVISION:	0

Appendix C

Results of Field Work

BOREHOLE LOG

CLIENT: Tactical Group Pty Ltd
PROJECT: Proposed Industrial Development
LOCATION: 42 Boorea Street, Lidcombe

SURFACE LEVEL: 11.3
COORDINATE **E:**319001.5 **N:** 6252653.1
DATUM/GRID: GDA2020 Zone 56
DIP/AZIMUTH: 90°/---

LOCATION ID: 101
PROJECT No: 210950.00
DATE: 04/02/22
SHEET: 1 of 1

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	SOIL ORIGIN(#)	SOIL CONSIS.(*) DENSITY.(*)	SOIL MOISTURE	ROCK WEATH.	ROCK DEPTH (m)	ROCK STRENGTH	ROCK RECOVERY (%)	ROCK RQD	FRACTURE SPACING (m)	DEFECTS & REMARKS	SAMPLE REMARKS	SAMPLE TYPE	SAMPLE INTERVAL	DEPTH (m)	TESTING TEST TYPE	TESTING RESULTS AND REMARKS
No free groundwater observed	11.25	0.05	FILL/ ASPHALTIC CONCRETE;		FILL	NA WC	NA													
	11.1	0.2	FILL/ Sandy GRAVEL; brown, grey; (roadbase)																	
			FILL/ (CI) Silty CLAY; orange/red, pale grey; medium plasticity; trace gravel and sand		FILL	VC	<PL									A B A SPT A	0.4 0.5 0.7 0.9 1.0 1.4 1.45 1.5	SPT	SPT 9,8,12 N=20
	10	1.1	(CI-CH) Silty CLAY; pale orange, pale brown; medium to high plasticity; possible trace ironstone and gravel		ALV	VST	<PL													
	9	1.9	(CI-CH) Silty CLAY; pale grey; medium to high plasticity; (possibly extremely weathered siltstone)		RES	H	<PL									A A SPT	1.9 2.0 2.4 2.5 2.95	SPT	SPT 13,26,25/100
	8	3.2	SILTSTONE; pale grey; distinct and indistinct bedding 0-10°, very low to low strength, with clay seams, Ashfield Shale					HW	3.2	VL-L	98	69		Note: Unless otherwise stated all defects are bedding dipping at 0-10° 3.31-3.7m: B (x4) PL, SM, 120mm, CLY, VN				4	PLT 0.11	
	7	4												4.33m: J 30° PL, SM, STN, 5mm 4.02-4.74m: B (x9) SM, STN, CLY					PLT 0.10	
	6	5									90	76		4.94m: B PL, SM, 40mm, CLY, VN 5.07m: J 20° PL, SM, STN, 5mm 5.26m: J 70° PL, SM, 20mm 5.41m: B PL, SM, 20mm, CLY, VN						
	5.75	5.56							5.56	VL										
		5.75	SILTSTONE; dark grey; distinct and indistinct bedding 0-10°, low strength, Ashfield Shale					SW-MW	5.75	L	96	94		5.6-5.91m: J (x3) 45°-60° PL, SM, 10mm 5.95m: B PL, SM, 50mm, CLY, VN 6.07-6.1m: J (x2) 40°-50° PL, SM, 2mm				6	PLT 0.06 PLT 0.15	
	5	6.3	Borehole discontinued at 6.30m depth						6.3											

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

PLANT: Scout 4
OPERATOR: Ground Test
LOGGED: RD

METHOD: 110mm SFA to 3.2m, NMLC coring to 6.3m
CASING: HQ to 3.2m, HW to 6.3m

REMARKS: Well construction: Gatic cover, Blank 0 – 3.0m, Screen 3.0 – 6.0m. Backfill: Bentonite 0 – 1.8m, 2mm Gravel 1.8m-6.0m, Spoil 6.0-6.3m

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BORE: BH101 **PROJECT: 210950.00** **February 2022**

3.2m – 6.3m

BOREHOLE LOG

CLIENT: Tactical Group Pty Ltd
PROJECT: Proposed Industrial Development
LOCATION: 42 Boorea Street, Lidcombe

SURFACE LEVEL: 9.3
COORDINATE **E:**318940.6 **N:** 6252526.1
DATUM/GRID: GDA2020 Zone 56
DIP/AZIMUTH: 90°/---

LOCATION ID: 102
PROJECT No: 210950.00
DATE: 03/02/22
SHEET: 1 of 1

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	SOIL ORIGIN(#)	SOIL CONSIS.(*) DENSITY.(*)	SOIL MOISTURE	ROCK WEATH.	ROCK DEPTH (m)	ROCK STRENGTH	ROCK RECOVERY (%)	ROCK RQD	FRACTURE SPACING (m)	DEFECTS & REMARKS	SAMPLE SAMPLE REMARKS	SAMPLE TYPE	SAMPLE INTERVAL	DEPTH (m)	TESTING TEST TYPE	TESTING RESULTS AND REMARKS
No free groundwater observed	9	0.05	FILL/ ASPHALTIC CONCRETE;		FILL	WC	NA											0.5		
	9	0.25	FILL/ Sandy GRAVEL; grey, brown; (roadbase)																	
		0.7	FILL/ (Cl) Silty CLAY; pale orange, mottled grey; medium plasticity; trace asphalt		FILL	VC	<PL									B		0.7		
	8	1	(Cl) Silty CLAY; pale orange and grey; medium plasticity															1.0	SPT	9,23,25/80
			1.4m: possibly extremely weathered siltstone below		RES	H	<PL									SPT		1.38		
	7	2.0	SILTSTONE; grey; very low strength, Ashfield Shale		XWM	XWR	NA											2		
		2.6	LAMINITE; dark grey and black; medium strength, Ashfield Shale					SW	2.6	M				Note: Unless otherwise stated all defects are bedding dipping at 0-10°		SPT		2.5	SPT	15/20
	6	3.15	LAMINITE; dark and light grey; medium and high strength, Ashfield Shale						3.15	H	100	94		2.79-3.17m: B (x5) 5° PL, VN, CLY				2.52	PLT	0.43
																		3	PLT	1.2
								FS	4.42	M				4.26m: J 80° PL, RO, 50mm				4	PLT	0.95
	5								4.8	H	100	97		4.87-4.99m: J x6 20°-30° PL, RO				5		
														5.02-5.49m: B (x2) 10° PL, RO					PLT	1.5
	4	6.08	Borehole discontinued at 6.08m depth						6.08									6	PLT	1.2

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

PLANT: Explora
OPERATOR: Ground Test
LOGGED: RD

METHOD: 110mm SFA to 2.6m, NMLC coring to 6.08m
CASING: HQ to 2.6m, HW to 6.08m

REMARKS: Well construction: Gatic cover, Blank 0 – 3.0m, Screen 3.0 – 6.0m. Backfill: Bentonite 0 – 1.5m, 2mm Gravel 1.5-6m, Spoil 6.0-6.1m

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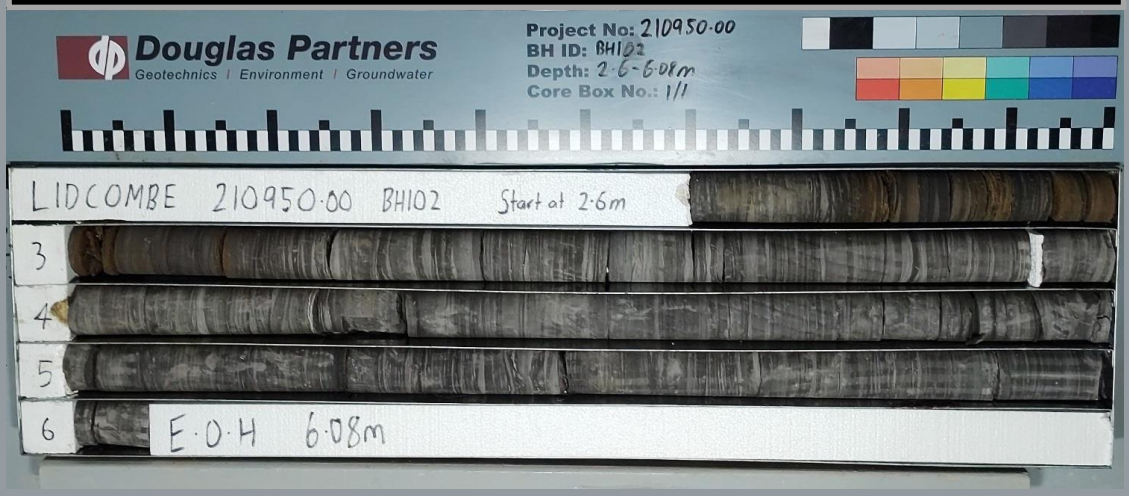
BORE: BH102 **PROJECT: 210950.00** **February 2022**



2.6m – 6.08m

BOREHOLE LOG

CLIENT: Tactical Group Pty Ltd
PROJECT: Proposed Industrial Development
LOCATION: 42 Boorea Street, Lidcombe

SURFACE LEVEL: 7.7
COORDINATE **E:**318797.6 **N:** 6252526.9
DATUM/GRID: GDA2020 Zone 56
DIP/AZIMUTH: 90°/---

LOCATION ID: 103
PROJECT No: 210950.00
DATE: 07/02/22
SHEET: 1 of 2

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	SOIL ORIGIN(#)	SOIL CONSIS.(*) DENSITY.(*)	SOIL MOISTURE	ROCK WEATH.	ROCK DEPTH (m)	ROCK STRENGTH	ROCK RECOVERY (%)	ROCK RQD	FRACTURE SPACING (m)	DEFECTS & REMARKS	SAMPLE REMARKS	SAMPLE TYPE	SAMPLE INTERVAL	DEPTH (m)	TESTING TEST TYPE	TESTING RESULTS AND REMARKS
No free groundwater observed	7	0.0	FILL/ CONCRETE;		FILL	NA	NA											0.4		
		0.18	FILL/ Sandy GRAVEL; grey, pale brown; (roadbase)		FILL	NA	NA									A		0.5		
		0.25	FILL/ (Cl) Silty CLAY; pale grey and orange; medium plasticity; trace gravel													B		0.7		
																A		0.9		
	1																	1.0		
					FILL	PC	<PL									SPT			SPT	1,2,3 N=5
																A		1.4		
																		1.45		
	6																	1.5		
	2															A		1.9		
																		2.0		
																U		2.27		
		2.2	(Cl) Silty CLAY; pale grey; medium plasticity; trace gravel and sand													A		2.4		
	5																	2.5		
																SPT			SPT	2,4,4 N=8
					ALV	F TO ST	<PL									A		2.9		
	3																	2.95		
																		3.0		
																A		3.4		
																		3.5		
		3.8	(Cl-CH) Silty CLAY; pale brown and black; medium to high plasticity; trace rootlets, trace sand															4.0		
	4															SPT			SPT	0,0,2 N=2
																		4.45		
	5																	5		
					ALV	VS TO S	>PL													
																		5.5		
	2															SPT			SPT	0,1,1 N=2
																		5.95		
	6																			
	1	6.9																7.0		
	7		(Cl) Silty CLAY; dark grey, black, mottled orange; medium plasticity; (possibly extremely weathered siltstone)		RES	H	>PL									SPT			SPT	13,23,5/20
		7.4							7.4						Note: Unless otherwise stated all defects are bedding dipping at 0-10°				7.32		
	0		SILTSTONE; dark grey and pale grey; distinct and indistinct bedding 0-10°, medium strength, Ashfield Shale					SW							7.6m: B SM, VN, CLY					PLT	0.34
									7.82											
	8							FS		M	100	84			7.4-8.65m: B x7 SM, STN, CLY				8		
															8.48-8.54m: J x2 70°-80° PL, RO, 40mm					PLT	0.79
	-1	8.9							8.9						8.89m: J 10° PL, RO, 10mm						
	9		SILTSTONE; dark grey; distinct and indistinct bedding 0-10°, high strength, Ashfield Shale					FS		H	100	91							9		
																				PLT 1.4
	-2																			

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

PLANT: Explora
OPERATOR: Ground Test
LOGGED: RD

METHOD: 110mm SFA to 7.4m, NMLC coring to 10.45m
CASING: HQ to 7.4m, HW to 10.45m

REMARKS: Well construction: Gatic cover, Blank 0 – 7m, Screen 7 – 10m. Backfill: Sand 0 - 4m, Bentonite 4-6.0m, 2mm Gravel 6m-10m, Spoil 10 -10.45m

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BOREHOLE LOG

CLIENT: Tactical Group Pty Ltd
PROJECT: Proposed Industrial Development
LOCATION: 42 Boorea Street, Lidcombe

SURFACE LEVEL: 7.7
COORDINATE **E:**318797.6 **N:** 6252526.9
DATUM/GRID: GDA2020 Zone 56
DIP/AZIMUTH: 90°/---

LOCATION ID: 103
PROJECT No: 210950.00
DATE: 07/02/22
SHEET: 2 of 2

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	SOIL: ORIGIN(#)	SOIL: CONSIS.(*) DENSITY.(*)	SOIL: MOISTURE	ROCK: WEATH.	ROCK: DEPTH (m)	ROCK: STRENGTH (VL L M H VH EH)	ROCK: RECOVERY (%)	ROCK: RQD	ROCK: FRACTURE SPACING (m) (0.01 0.05 0.10 0.50 1.00 5.00)	ROCK: DEFECTS & REMARKS	SAMPLE: SAMPLE REMARKS	SAMPLE: TYPE	SAMPLE: INTERVAL	DEPTH (m)	TESTING: TEST TYPE	TESTING: RESULTS AND REMARKS
No free groundwater observed			SILTSTONE; dark grey; distinct and indistinct bedding 0-10°, high strength, Ashfield Shale *(continued)*					FS			100	91							PLT	1.2
		10.45	Borehole discontinued at 10.45m depth						10.45											

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

PLANT: Explora
OPERATOR: Ground Test
LOGGED: RD

METHOD: 110mm SFA to 7.4m, NMLC coring to 10.45m
CASING: HQ to 7.4m, HW to 10.45m

REMARKS: Well construction: Gatic cover, Blank 0 – 7m, Screen 7 – 10m. Backfill: Sand 0 - 4m, Bentonite 4-6.0m, 2mm Gravel 6m-10m, Spoil 10 -10.45m

BORE: BH103 **PROJECT: 210950.00** **February 2022**

7.4m – 10.45m

BOREHOLE LOG

CLIENT: Tactical Group Pty Ltd
PROJECT: Proposed Industrial Development
LOCATION: 42 Boorea Street, Lidcombe

SURFACE LEVEL: 7.8
COORDINATE **E:**318870.3 **N:** 6252647.3
DATUM/GRID: GDA2020 Zone 56
DIP/AZIMUTH: 90°/---

LOCATION ID: 104
PROJECT No: 210950.00
DATE: 08/02/22
SHEET: 1 of 2

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	SOIL ORIGIN(#)	SOIL CONSIS.(*) DENSITY.(*)	SOIL MOISTURE	ROCK WEATH.	ROCK DEPTH (m)	ROCK STRENGTH	ROCK RECOVERY (%)	ROCK RQD	FRACTURE SPACING (m)	DEFECTS & REMARKS	SAMPLE REMARKS	SAMPLE TYPE	SAMPLE INTERVAL	DEPTH (m)	TESTING TEST TYPE	TESTING RESULTS AND REMARKS
No free groundwater observed	7.8	0.0	FILL/ CONCRETE;		FILL	NA	NA													
	7.65	0.15	FILL/ Sandy GRAVEL; brown grey; with timber fragments, (roadbase)		FILL	PC	<PL													
	7.6	0.2	FILL/ (SP) Sandy CLAY; brown; trace gravel																	
	7.4	0.4	(Cl) Silty CLAY; pale grey, brown; medium plasticity; with gravel		ALV	F	<PL									A		0.4		
																		0.5		
																A		0.9		
																		1.0		
																SPT			SPT	1,1,4 N=5
																A		1.4		
																		1.45		
																		1.5		
																A		1.9		
																		2.0		
																U50				
		2.3	(Cl) Silty CLAY; pale grey and red mottled orange; medium plasticity													A		2.4		
																		2.5		
																SPT			SPT	3,7,9 N=16
																A		2.9		
																		2.95		
																		3.0		
					ALV	ST TO VST	<PL									A		3.4		
																		3.5		
																		4.0		
																SPT			SPT	4,4,5 N=9
																		4.45		
		5.0	(Cl-CH) Silty CLAY; dark grey and pale grey; medium to high plasticity; (possibly extremely weathered siltstone)															5		
																		5.5		
					RES	VST	<PL									SPT			SPT	7,12,17 N=29
																		5.95		
		6.9																6		
		7.1	SILTSTONE; grey; distinct and indistinct bedding 0-10°, very low strength strength, Ashfield Shale		XWM	XWR	NA		7.1					Note: Unless otherwise stated all defects are bedding dipping at 0-10°		SPT		7.0	SPT	5/10
																		7.01		
			SILTSTONE; dark grey; distinct and indistinct bedding 0-10°, medium strength, Ashfield Shale							M	100	88		7.23-7.42m: B x8 SM, VN, CLY 7.5-7.59m: J x2 40° PL, RO, 10mm					PLT	0.60
								FS										8		
		8.7							8.7										PLT	0.83
			SILTSTONE; dark grey; distinct and indistinct bedding 0-10°, high strength, Ashfield Shale							H	100	83		8.18-9.24m: B x6 PL, SM, STN				9		
																			PLT	1.4

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

PLANT: Explora
OPERATOR: Ground Test
LOGGED: RD

METHOD: 110mm SFA to 5.5m, Rotary to 7.1m, NMLC coring to 10.2m
CASING: HQ to 7.1m, HW to 10.2m

REMARKS:

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BOREHOLE LOG

CLIENT: Tactical Group Pty Ltd
PROJECT: Proposed Industrial Development
LOCATION: 42 Boorea Street, Lidcombe

SURFACE LEVEL: 7.8
COORDINATE **E:**318870.3 **N:** 6252647.3
DATUM/GRID: GDA2020 Zone 56
DIP/AZIMUTH: 90°/---

LOCATION ID: 104
PROJECT No: 210950.00
DATE: 08/02/22
SHEET: 2 of 2

CONDITIONS ENCOUNTERED																		SAMPLE				TESTING	
				SOIL			ROCK																
GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(#)	CONSIS.(*) DENSITY.(*)	MOISTURE	WEATH.	DEPTH (m)	STRENGTH VL L M H VH EH	RECOVERY (%)	RQD	FRACTURE SPACING (m) 0.01 0.05 0.10 0.50 1.00 5.00	DEFECTS & REMARKS	SAMPLE REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
No free groundwater observed	10.2		Borehole discontinued at 10.20m depth					FS	10.2		100	83							PLT	1.0
	-3	11																11		
	-4	12																12		
	-5	13																13		
	-6	14																14		
	-7	15																15		
	-8	16																16		
	-9	17																17		
	-10	18																18		
	-11	19																19		
	-12																			

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

PLANT: Explora
OPERATOR: Ground Test
LOGGED: RD

METHOD: 110mm SFA to 5.5m, Rotary to 7.1m, NMLC coring to 10.2m
CASING: HQ to 7.1m, HW to 10.2m

REMARKS:

BORE: BH104 **PROJECT: 210950.00** **February 2022**

7.1m – 10.2m

BOREHOLE LOG

CLIENT: Tactical Group Pty Ltd
PROJECT: Proposed Industrial Development
LOCATION: 42 Boorea Street, Lidcombe

SURFACE LEVEL: 8.3
COORDINATE **E:**318838.5 **N:** 6252575.3
DATUM/GRID: GDA2020 Zone 56
DIP/AZIMUTH: 90°/---

LOCATION ID: 111
PROJECT No: 210950.00
DATE: 04/02/22
SHEET: 1 of 1

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	SOIL ORIGIN(#)	SOIL CONSIS.(*) DENSITY.(*)	SOIL MOISTURE	ROCK WEATH.	ROCK DEPTH (m)	ROCK STRENGTH	ROCK RECOVERY (%)	ROCK RQD	FRACTURE SPACING (m)	DEFECTS & REMARKS	SAMPLE REMARKS	SAMPLE TYPE	SAMPLE INTERVAL	DEPTH (m)	TESTING TEST TYPE	TESTING RESULTS AND REMARKS
No free groundwater observed	8	0.0	FILL/ CONCRETE;		FILL	NA	NA													
		0.15																		
		0.2	FILL/ Sandy GRAVEL; grey and brown; (roadbase)																	
			FILL/ (CI) Silty CLAY; dark brown, mottled orange; medium plasticity; trace gravel and sand		FILL	PC	>PL									A	0.4		
																B	0.5			
																	0.7			
	7	1														A	0.9			
																	1.0			
																SPT		SPT	2,5,7 N=12	
		1.3	(CH) Silty CLAY; pale brown, mottled red, motted black; high plasticity; trace gravel		ALV	ST	<PL									A	1.4			
																	1.45			
																	1.5			
	6	2														A	1.9			
																	2.0			
																U				
																	2.3			
		2.7	(CI-CH) Silty CLAY; pale grey, mottled orange; medium to high plasticity		ALV	ST	<PL										2.5			
																SPT		SPT	3,5,6 N=11	
		3														A	2.9			
	5																2.95			
																	3.0			
																A	3.4			
																	3.5			
		4	4.4m: becoming pale grey														4.0			
																SPT		SPT	2,5,8 N=13	
																	4.45			
		5.1	(CI-CH) Silty CLAY; pale to dark grey; medium to high plasticity; (possibly extremely weathered siltstone)		RES	VST	<PL											5		
	3																			
															Note: Unless otherwise stated all defects are bedding dipping at 0-10°		SPT	5.5	SPT	7,10,18 N=28
		6																5.95		
		6.1	SILTSTONE; pale grey, mottled orange; distinct and indistinct bedding 0-10°, very low strength, Ashfield Shale					MW	6.1	VL				6.26m: J 15° PL, SM, 50mm, VN, CLY						
	2													6.34m: B PL, SM, VN, CLY						
														6.55m: J 40° PL, SM, 20mm, VN, CLY						
											100	90		6.75m: J 30° PL, SM, STN, 30mm				7	PLT	0.04
		7.0	LAMINITE; dark grey; distinct and indistinct bedding 0-10°, medium and high strength, Ashfield Shale						7.0					7.14m: J 10° PL, SM, STN, 10mm						
										M				7.18m: J 40° PL, SM, 40mm						
	1																			
									7.75					7.86m: J 120° PL, SM, 25mm					PLT	0.61
								FS			100	92						8		
	0									H										
																			PLT	1.1
		9							9.0									9		
		9.13							9.13	M									PLT	0.59
	-1		Borehole discontinued at 9.13m depth																	

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

PLANT: Explora
METHOD: 110m SFA to 6.1, NMLC coring to 9.13m
REMARKS:

OPERATOR: Ground Test
CASING: HQ to 6.1m, HW to 9.13m

LOGGED: RD

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BORE: BH111 **PROJECT: 210950.00** **February 2022**

6.1m – 9.13m

BOREHOLE LOG

CLIENT: Tactical Group Pty Ltd
PROJECT: Proposed Industrial Development
LOCATION: 42 Boorea Street, Lidcombe

SURFACE LEVEL: 7.5
COORDINATE **E:**318900.5 **N:** 6252718.8
DATUM/GRID: GDA2020 Zone 56
DIP/AZIMUTH: 90°/---

LOCATION ID: 112
PROJECT No: 210950.00
DATE: 03/02/22
SHEET: 1 of 1

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	SOIL ORIGIN(#)	SOIL CONSIS.(*) DENSITY.(*)	SOIL MOISTURE	ROCK WEATH.	ROCK DEPTH (m)	ROCK STRENGTH	ROCK RECOVERY (%)	ROCK RQD	FRACTURE SPACING (m)	DEFECTS & REMARKS
No free groundwater observed	7.42	0.08	FILL/ ASPHALTIC CONCRETE;		FILL	NA	NA							
	7.25	0.25	FILL/ Sandy GRAVEL; brown, grey; (roadbase)		FILL	WC	NA							
			FILL/ (CI) Silty CLAY; pale brown, red pale orange, mottled grey; medium plasticity		FILL	PC	<PL							
	6	1.4	(CL-CI) Sandy CLAY; brown; low to medium plasticity; trace gravel		ALV	VST	<PL							
			2.7m: becoming dark red colour below											
	4	3.3	(CI-CH) Silty CLAY; dark red; medium to high plasticity; trace gravel		ALV	VST	<PL							
	2	5.3	(CI-CH) Silty CLAY; pale grey, mottled red; medium to high plasticity; trace gravel (possibly extremely weathered siltstone)		RES	H	<PL							
	1	6.1	SILTSTONE; grey; distinct and indistinct bedding 0-10°, very low and low strength, Ashfield Shale					HW	6.1	VL				Note: Unless otherwise stated all defects are bedding dipping at 0-10°
	0	6.6	LAMINITE; dark grey and black; distinct and indistinct bedding 0-10°, low and medium strength, Ashfield Shale						6.55					6.33m: B SM, VN, CLY
									6.75					6.38m: J 40° SM, 20mm, VN, CLY
														6.48m: B PL, SM, STN
														6.73m: B PL, SM, STN
										L-M	95	96		
	-1	8.9						FS	7.9					8.1m: J 80° PL, RO, 50mm
										M				8.15m: J 80° PL, RO, 60mm
	-2	8.9	Borehole discontinued at 8.90m depth						8.9					

SAMPLE TYPE	SAMPLE INTERVAL	DEPTH (m)	TESTING TEST TYPE	TESTING RESULTS AND REMARKS
A	0.5-0.7	0.5		
B		0.6		
		0.7		
A	0.9-1.0	0.9		
		1.0		
SPT			SPT	7,11,10 N=21
A	1.4-1.5	1.4		
		1.45		
		1.5		
A	1.9-2.0	1.9		
		2.0		
A	2.4-2.5	2.4		
		2.5		
SPT			SPT	7,7,12 N=19
A	2.9-3.0	2.9		
		2.95		
		3.0		
A	3.4-3.5	3.4		
		3.5		
SPT		4.0	SPT	5,7,12 N=19
		4.45		
SPT		5.5	SPT	9,22,25/120
		5.92		
			PLT	0.30
			PLT	0.28
			PLT	0.41

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

PLANT: Explora
METHOD: 110m SFA to 6.1, NMLC coring to 8.9m
REMARKS:

OPERATOR: Ground Test
CASING: HQ to 6.1m, HW to 8.9m

LOGGED: RD

EXPORTED 16/03/22 13:38. TEMPLATE ID: DP_103.02.00_COMBINED

BORE: BH112 PROJECT: 210950.00 February 2022

6.1m – 8.9m

CONE PENETRATION TEST

CLIENT: TACTICAL GROUP PTY LTD

PROJECT: PROPOSED INDUSTRIAL DEVELOPMENT

LOCATION: 42 BOOREA STREET, LIDCOMBE

REDUCED LEVEL: 7.6 m AHD

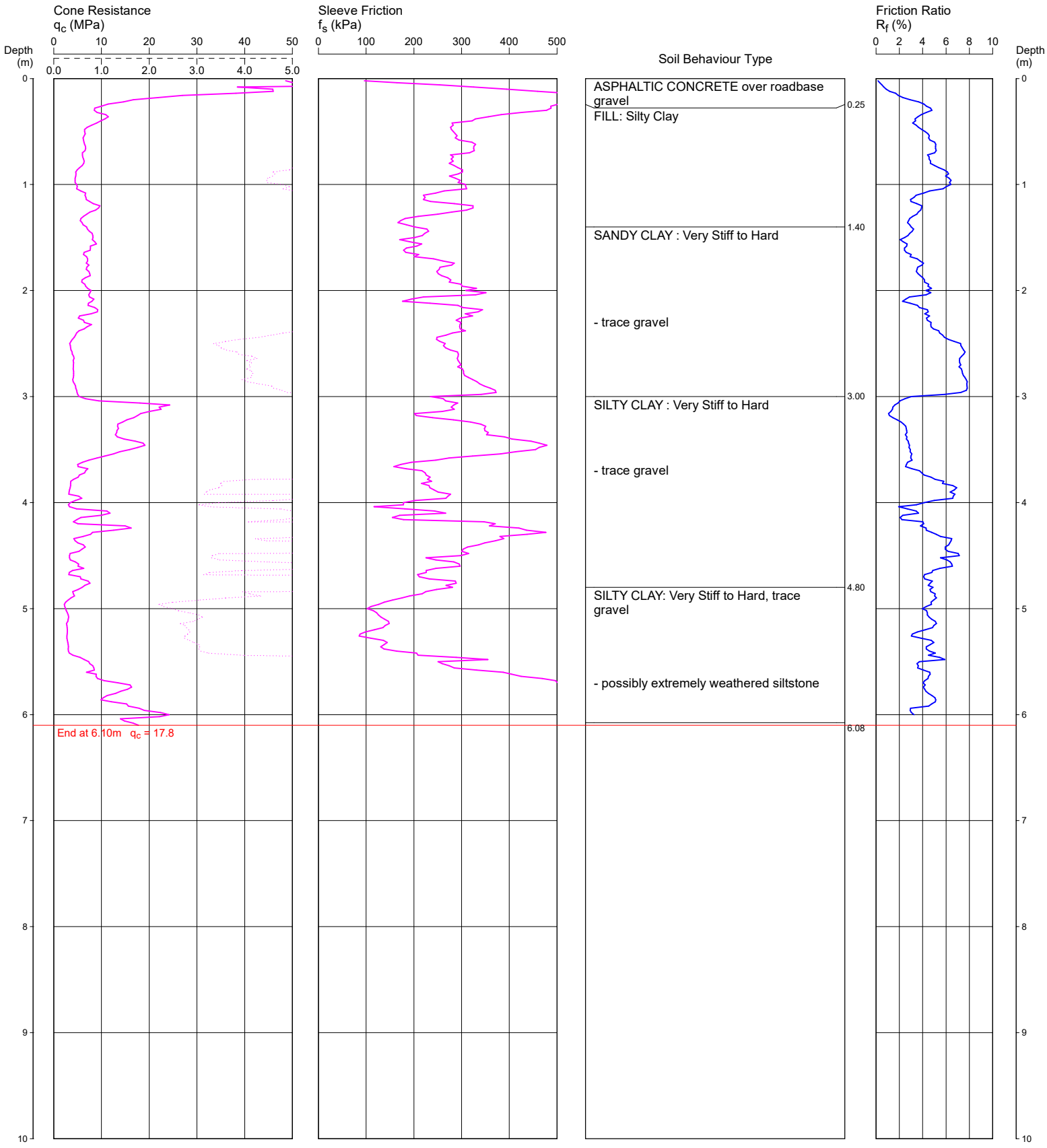
COORDINATES: 318899.8E 6252717.7N

CPT1

Page 1 of 1

DATE 01/02/2022

PROJECT No: 210950.00



REMARKS: TEST DISCONTINUED DUE TO REFUSAL ON WEATHERED ROCK
NO GROUNDWATER OBSERVED AFTER WITHDRAWAL OF RODS

File: Z:\210950.00 - Lidcombe, 42 Boorea Street Geo Env Inv\4.0 Field Work\4.2 Testing\210950.00 Lidcombe\CPT1.CP5
Cone ID: 200312 **Type:** I-CFXY-10

ConePlot Version 5.9.2

Douglas Partners
Geotechnics / Environment / Groundwater

CONE PENETRATION TEST

CLIENT: TACTICAL GROUP PTY LTD

PROJECT: PROPOSED INDUSTRIAL DEVELOPMENT

LOCATION: 42 BOOREA STREET, LIDCOMBE

REDUCED LEVEL: 10.7 m AHD

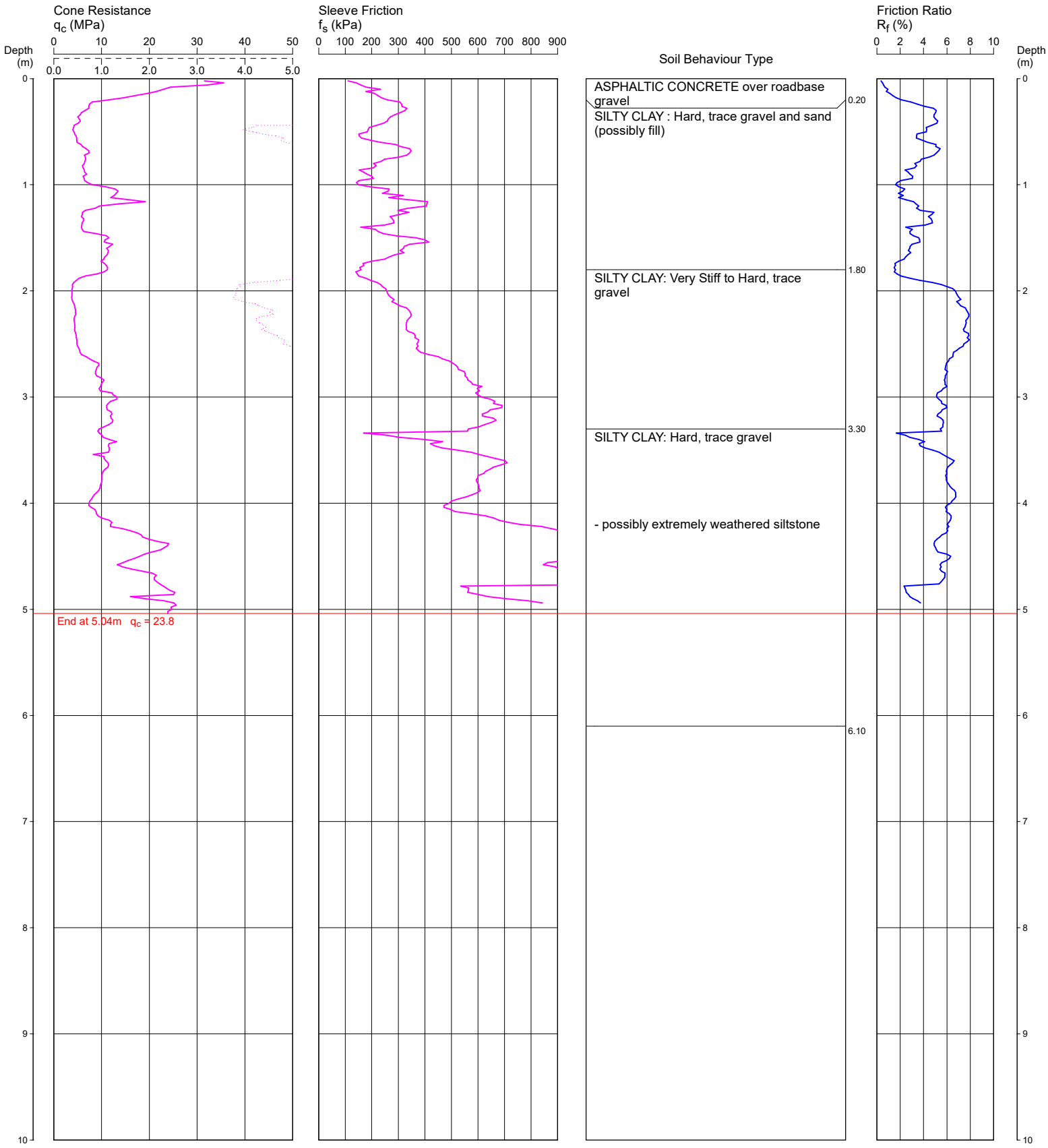
COORDINATES: 318951.3E 6252685.2N

CPT2

Page 1 of 1

DATE 01/02/2022

PROJECT No: 210950.00



REMARKS: TEST DISCONTINUED DUE TO REFUSAL ON WEATHERED ROCK
NO GROUNDWATER OBSERVED AFTER WITHDRAWAL OF RODS

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Cone ID: 200312 **Type:** I-CFXY-10

ConePlot Version 5.9.2

Douglas Partners
Geotechnics / Environment / Groundwater

CONE PENETRATION TEST

CLIENT: TACTICAL GROUP PTY LTD

PROJECT: PROPOSED INDUSTRIAL DEVELOPMENT

LOCATION: 42 BOOREA STREET, LIDCOMBE

REDUCED LEVEL: 11.3 m AHD

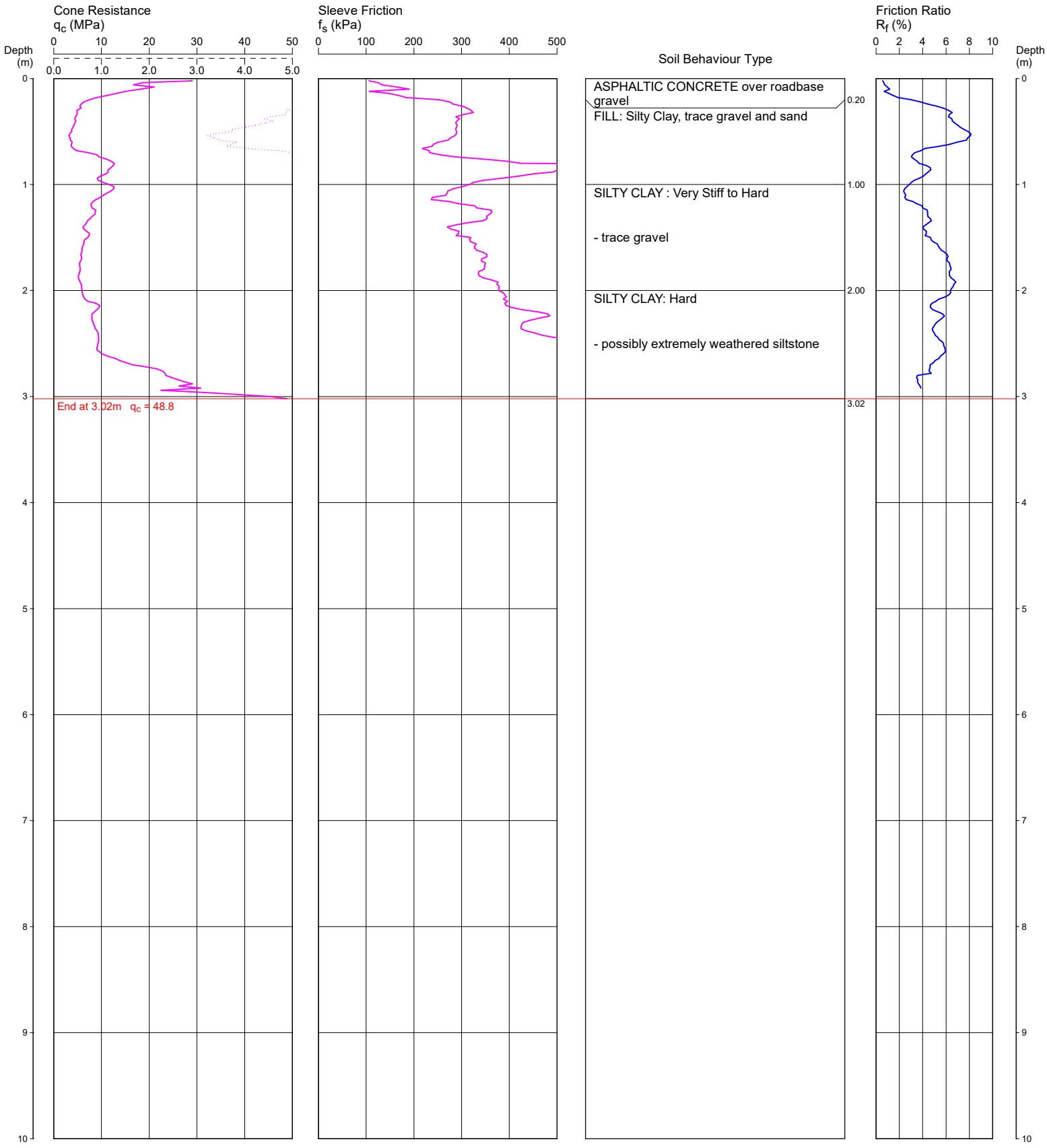
COORDINATES: 319000.9E 6252652.3N

CPT3

Page 1 of 1

DATE 01/02/2022

PROJECT No: 210950.00



REMARKS: TEST DISCONTINUED DUE TO REFUSAL ON WEATHERED ROCK
NO GROUNDWATER OBSERVED AFTER WITHDRAWAL OF RODS

File: Z:\210950.00 - Lidcombe, 42 Boorea Street Geo Env Inv\4.0 Field Work\4.2 Testing\210950.00 Lidcombe\CPT3.CP5
Cone ID: 200312 **Type:** I-CFXY-10

ConePlot Version 5.9.2

Douglas Partners
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CONE PENETRATION TEST

CLIENT: TACTICAL GROUP PTY LTD

PROJECT: PROPOSED INDUSTRIAL DEVELOPMENT

LOCATION: 42 BOOREA STREET, LIDCOMBE

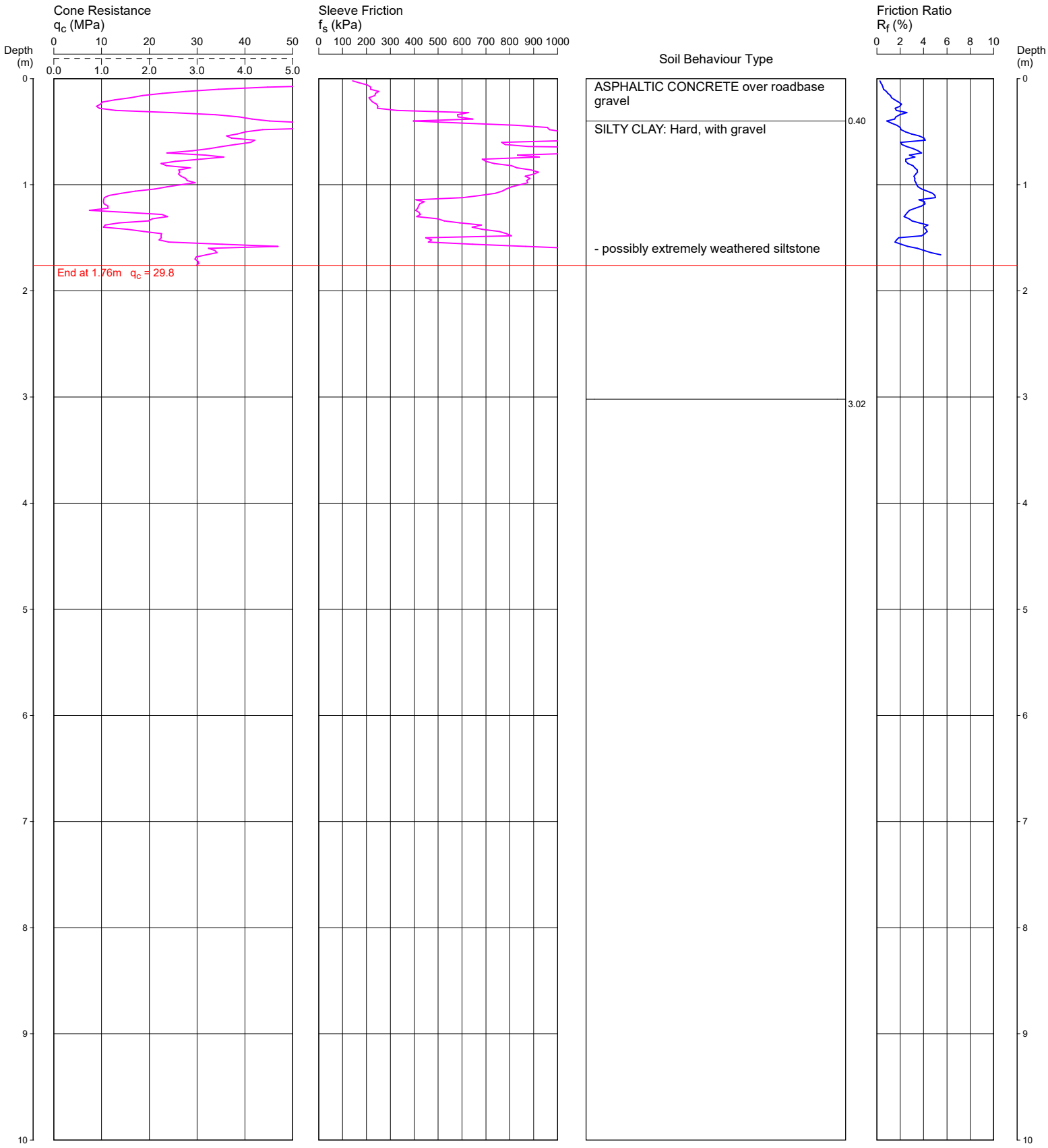
REDUCED LEVEL: 9.3 m AHD

COORDINATES: 318973.6E 6252586.3N

CPT4

DATE 01/02/2022

PROJECT No: 210950.00



REMARKS: TEST DISCONTINUED DUE TO REFUSAL ON WEATHERED ROCK
NO GROUNDWATER OBSERVED AFTER WITHDRAWAL OF RODS

File: Z:\210950.00 - Lidcombe, 42 Boorea Street Geo Env Inv\4.0 Field Work\4.2 Testing\210950.00 Lidcombe\CPT4.CP5
Cone ID: 200312 **Type:** I-CFXY-10

ConePlot Version 5.9.2

Douglas Partners
Geotechnics / Environment / Groundwater

CONE PENETRATION TEST

CLIENT: TACTICAL GROUP PTY LTD

PROJECT: PROPOSED INDUSTRIAL DEVELOPMENT

LOCATION: 42 BOOREA STREET, LIDCOMBE

REDUCED LEVEL: 9.3 m AHD

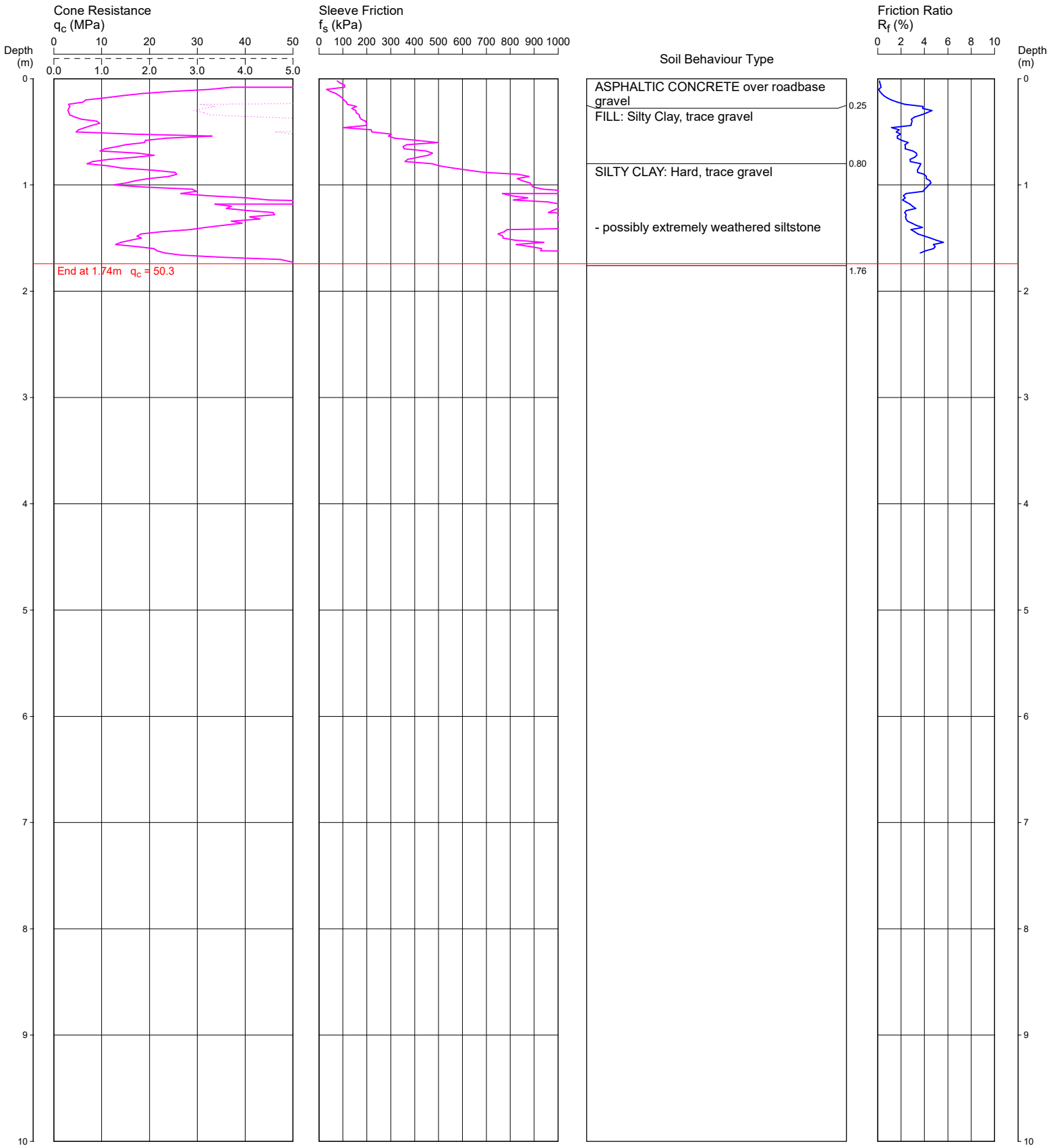
COORDINATES: 318940.4E 6252525.9N

CPT5

Page 1 of 1

DATE 01/02/2022

PROJECT No: 210950.00



REMARKS: TEST DISCONTINUED DUE TO REFUSAL ON WEATHERED ROCK
NO GROUNDWATER OBSERVED AFTER WITHDRAWAL OF RODS

File: Z:\210950.00 - Lidcombe, 42 Boorea Street Geo Env Inv\4.0 Field Work\4.2 Testing\210950.00 Lidcombe\CPT5.CP5
Cone ID: 200312 **Type:** I-CFXY-10

ConePlot Version 5.9.2

Douglas Partners
Geotechnics / Environment / Groundwater

CONE PENETRATION TEST

CLIENT: TACTICAL GROUP PTY LTD

PROJECT: PROPOSED INDUSTRIAL DEVELOPMENT

LOCATION: 42 BOOREA STREET, LIDCOMBE

REDUCED LEVEL: 9.6 m AHD

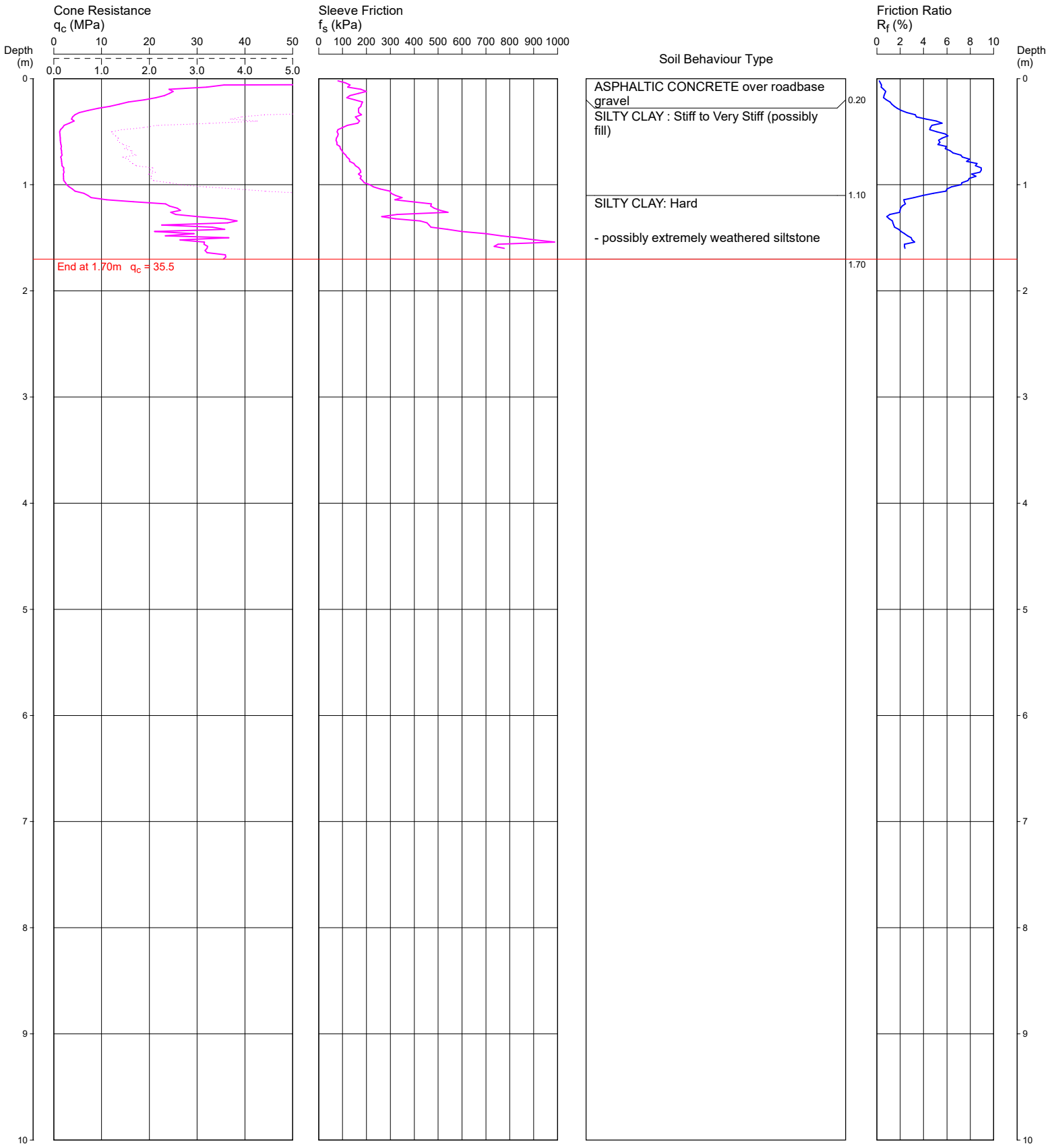
COORDINATES: 318907.7E 6252467.0N

CPT6

Page 1 of 1

DATE 01/02/2022

PROJECT No: 210950.00



REMARKS: TEST DISCONTINUED DUE TO REFUSAL ON WEATHERED ROCK
NO GROUNDWATER OBSERVED AFTER WITHDRAWAL OF RODS

File: Z:\210950.00 - Lidcombe, 42 Boorea Street Geo Env Inv\4.0 Field Work\4.2 Testing\210950.00 Lidcombe\CPT6.CP5
Cone ID: 200312 **Type:** I-CFXY-10

ConePlot Version 5.9.2

Douglas Partners
Geotechnics / Environment / Groundwater

CONE PENETRATION TEST

CLIENT: TACTICAL GROUP PTY LTD

PROJECT: PROPOSED INDUSTRIAL DEVELOPMENT

LOCATION: 42 BOOREA STREET, LIDCOMBE

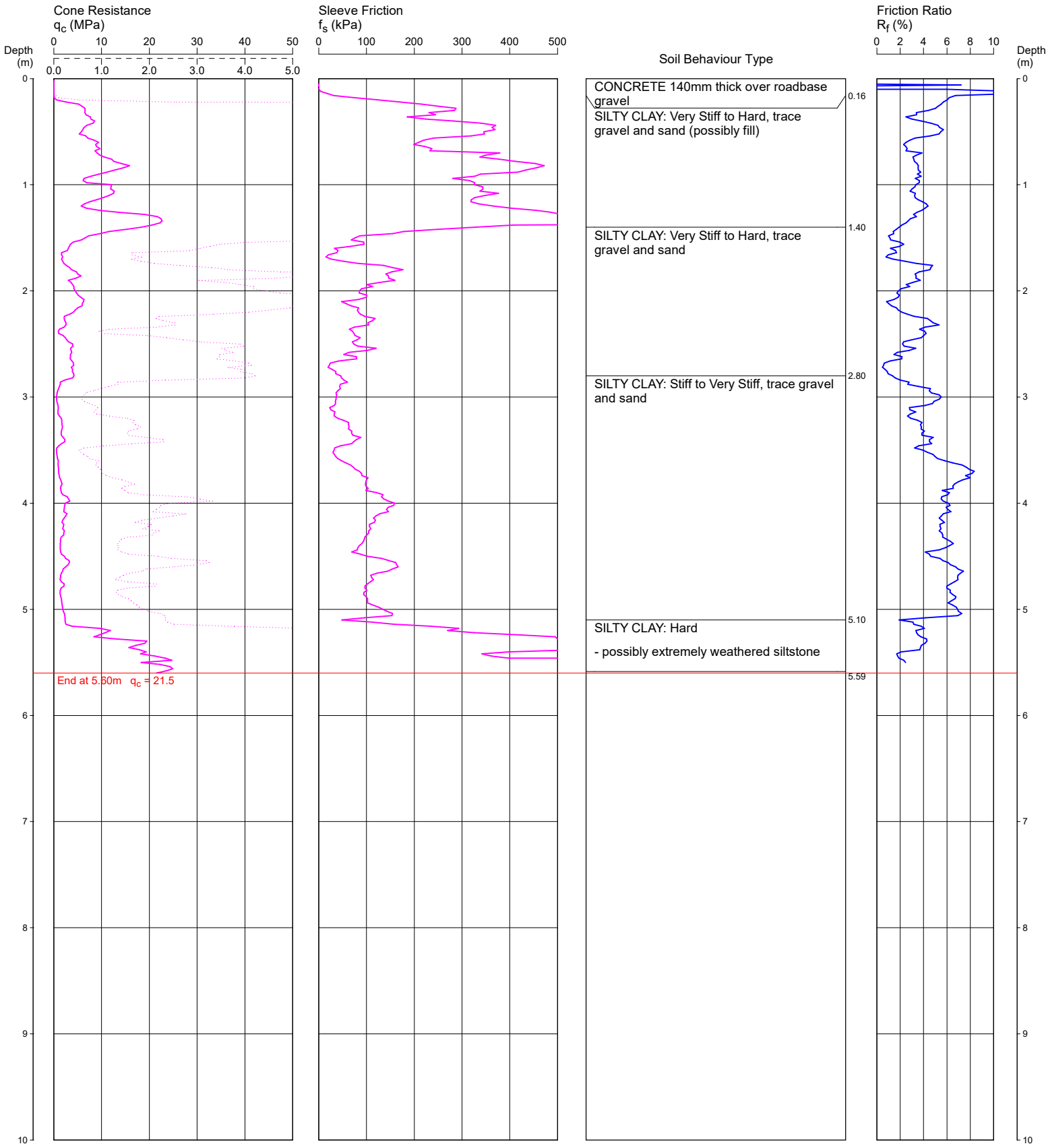
REDUCED LEVEL: 8.9 m AHD

COORDINATES: 318827.0E 6252474.3N

CPT7

DATE 01/02/2022

PROJECT No: 210950.00



REMARKS: TEST DISCONTINUED DUE TO REFUSAL ON WEATHERED ROCK
NO GROUNDWATER OBSERVED AFTER WITHDRAWAL OF RODS

File: Z:\210950.00 - Lidcombe, 42 Boorea Street Geo Env Inv\4.0 Field Work\4.2 Testing\210950.00 Lidcombe\CPT7.CP5
Cone ID: 200312 **Type:** I-CFXY-10

ConePlot Version 5.9.2

Douglas Partners
Geotechnics / Environment / Groundwater

CONE PENETRATION TEST

CLIENT: TACTICAL GROUP PTY LTD

PROJECT: PROPOSED INDUSTRIAL DEVELOPMENT

LOCATION: 42 BOOREA STREET, LIDCOMBE

REDUCED LEVEL: 7.6 m AHD

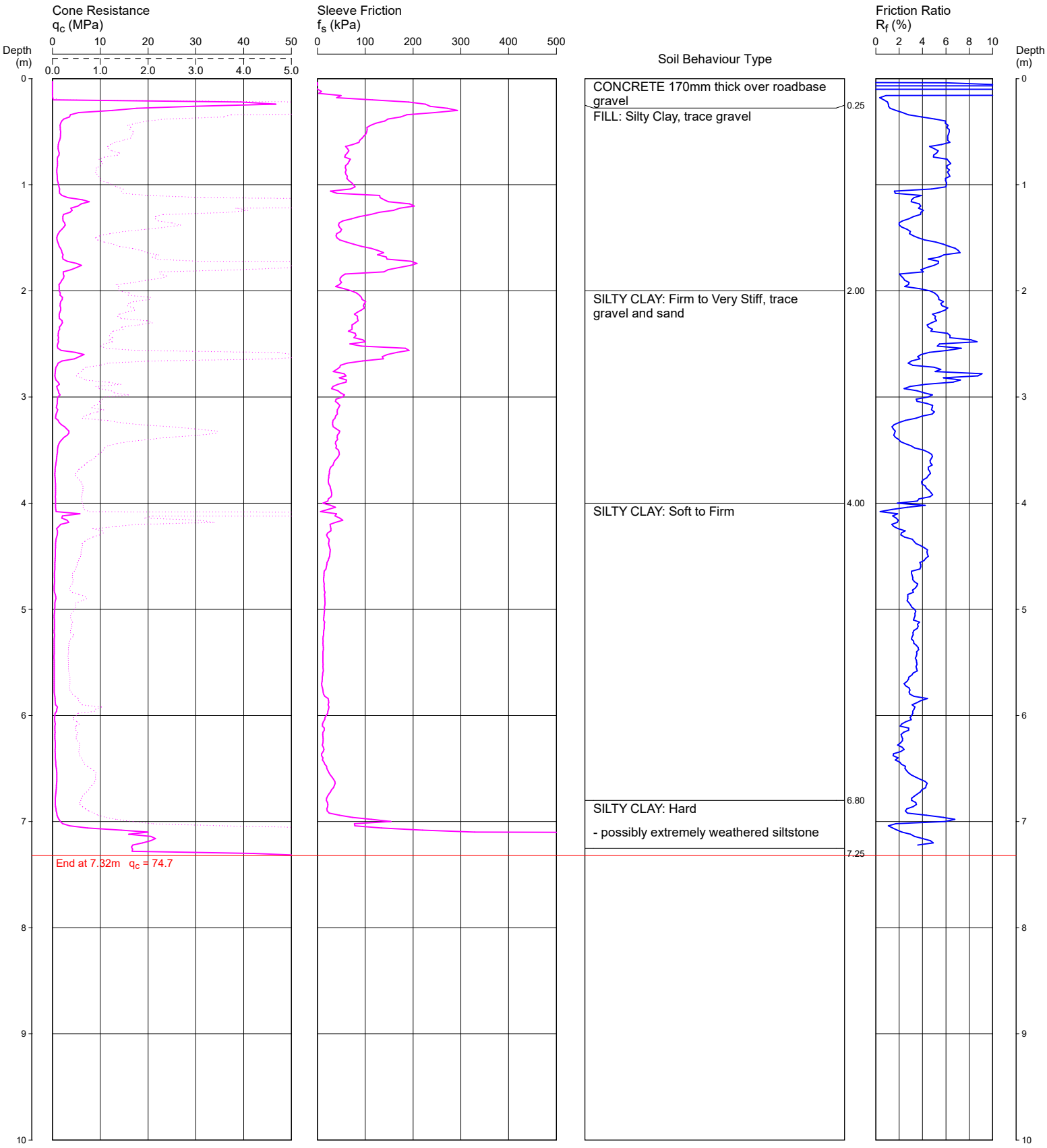
COORDINATES: 318797.7E 6252525.2N

CPT8

Page 1 of 1

DATE 01/02/2022

PROJECT No: 210950.00



REMARKS: TEST DISCONTINUED DUE TO REFUSAL ON WEATHERED ROCK
NO GROUNDWATER OBSERVED AFTER WITHDRAWAL OF RODS

File: Z:\210950.00 - Lidcombe, 42 Boorea Street Geo Env Inv\4.0 Field Work\4.2 Testing\210950.00 Lidcombe\CPT8.CP5
Cone ID: 200312 **Type:** I-CFXY-10

ConePlot Version 5.9.2

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Geotechnics / Environment / Groundwater

CONE PENETRATION TEST

CLIENT: TACTICAL GROUP PTY LTD

PROJECT: PROPOSED INDUSTRIAL DEVELOPMENT

LOCATION: 42 BOOREA STREET, LIDCOMBE

REDUCED LEVEL: 8.3 m AHD

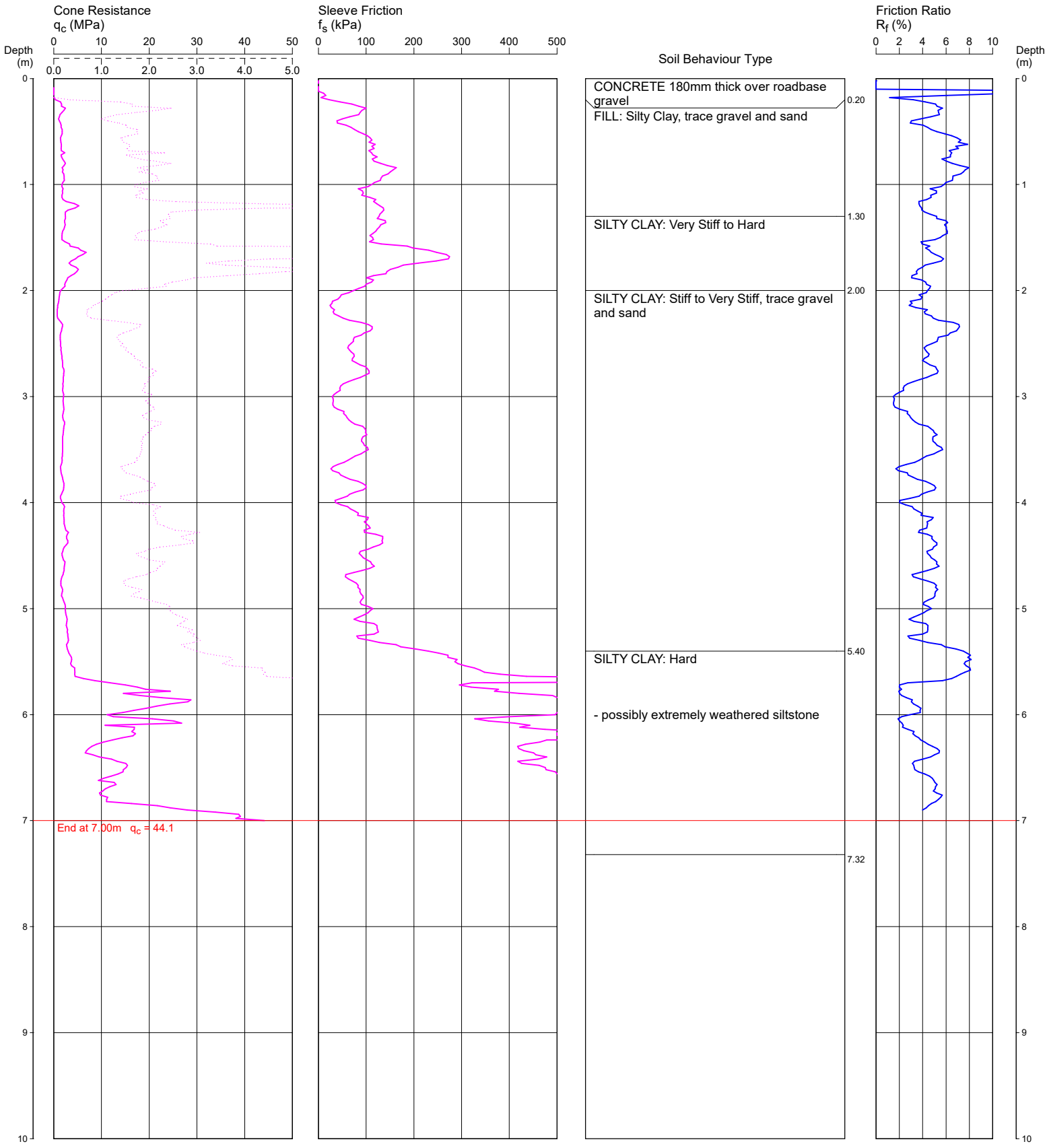
COORDINATES: 318838.9E 6252575.9N

CPT9

Page 1 of 1

DATE 01/02/2022

PROJECT No: 210950.00



REMARKS: TEST DISCONTINUED DUE TO REFUSAL ON WEATHERED ROCK
NO GROUNDWATER OBSERVED AFTER WITHDRAWAL OF RODS
HOLE COLLAPSED at 4.5 m DEPTH AFTER WITHDRAWAL OF RODS

File: Z:\210950.00 - Lidcombe, 42 Boorea Street Geo Env Inv\4.0 Field Work\4.2 Testing\210950.00 Lidcombe\CPT9.CP5
Cone ID: 200312 **Type:** I-CFXY-10

ConePlot Version 5.9.2

Douglas Partners
Geotechnics / Environment / Groundwater

CONE PENETRATION TEST

CLIENT: TACTICAL GROUP PTY LTD

PROJECT: PROPOSED INDUSTRIAL DEVELOPMENT

LOCATION: 42 BOOREA STREET, LIDCOMBE

REDUCED LEVEL: 7.7 m AHD

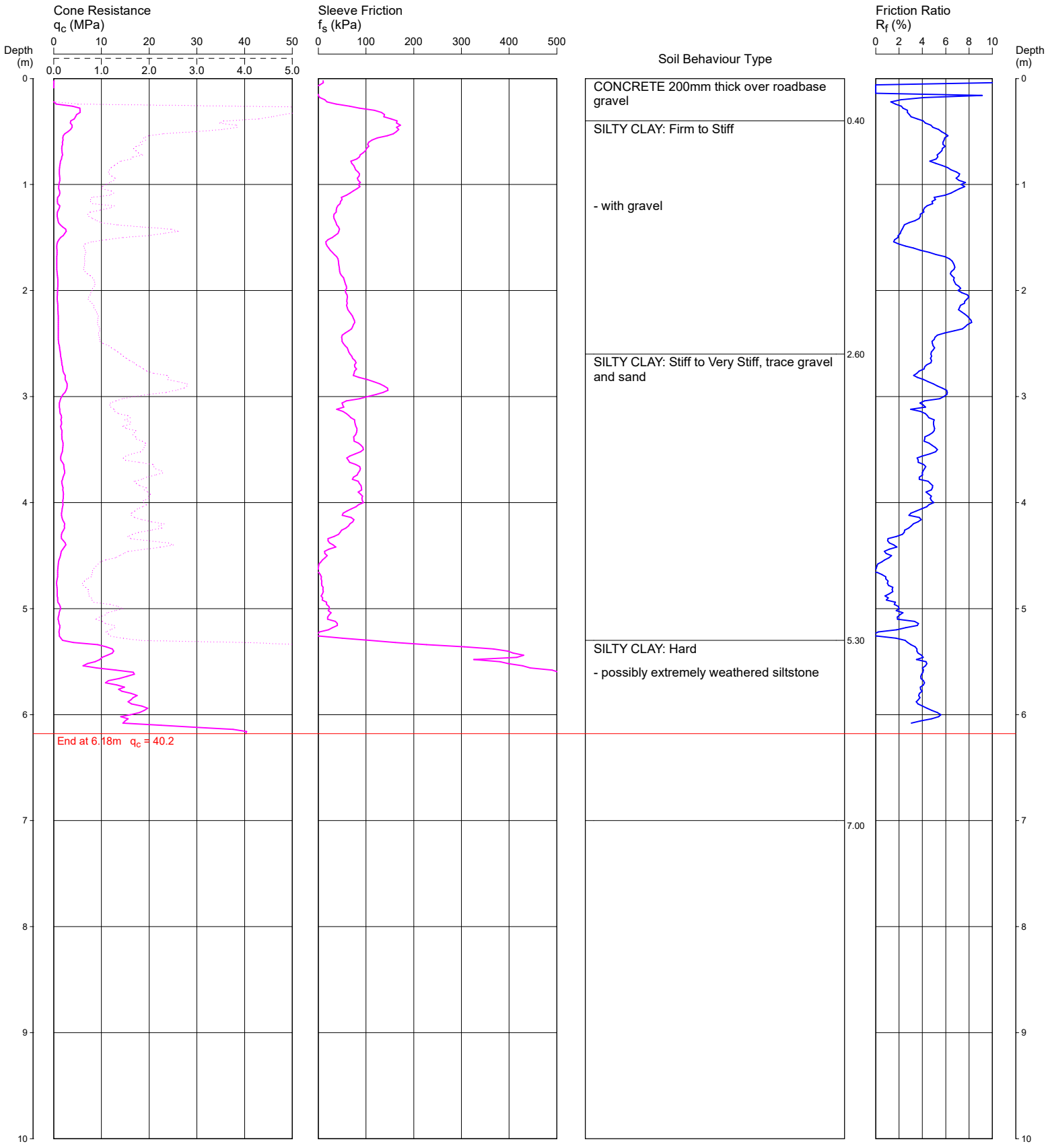
COORDINATES: 318870.9E 6252648.3N

CPT10

Page 1 of 1

DATE 01/02/2022

PROJECT No: 210950.00



REMARKS: TEST DISCONTINUED DUE TO REFUSAL ON WEATHERED ROCK.
NO GROUNDWATER OBSERVED AFTER WITHDRAWAL OF RODS

File: Z:\210950.00 - Lidcombe, 42 Boorea Street Geo Env Inv\4.0 Field Work\4.2 Testing\210950.00 Lidcombe\CPT10.CP5
Cone ID: 200312 **Type:** I-CFXY-10

ConePlot Version 5.9.2

Douglas Partners
Geotechnics / Environment / Groundwater

Appendix D

Laboratory Test Results

Material Test Report

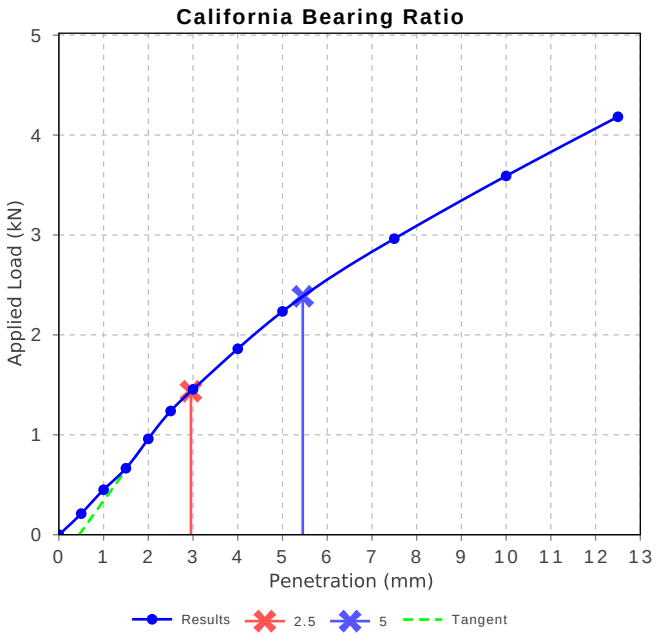
Douglas Partners
Geotechnics / Environment / Groundwater
Douglas Partners Pty Ltd
Sydney Laboratory
96 Hermitage Road West Ryde NSW 2114
Phone: (02) 9809 0666
Email: andrew.hutchings@douglaspartners.com.au

Accredited for compliance with ISO/IEC 17025 - Testing

Approved Signatory: Andrew Hutchings
Laboratory Manager
Laboratory Accreditation Number: 828

Report Number: **210950.00-1**
Issue Number: 1
Date Issued: 08/03/2022
Client: Tactical Group Pty Ltd
Level 15/124 Walker Street, North Sydney NSW 2060
Contact: Luka Krivacic
Project Number: 210950.00
Project Name: Lidcombe, 42 Boorea Street
Project Location: 42 Boorea Road, Lidcombe NSW
Work Request: 8846
Sample Number: SY-8846A
Date Sampled: 02/02/2022
Dates Tested: 15/02/2022 - 25/02/2022
Sampling Method: Sampled by Engineering Department
The results apply to the sample as received
Sample Location: **TP1 (0.2-0.3m)**
Material: Silty CLAY: orange/red, pale grey

California Bearing Ratio (AS 1289 6.1.1 & 2.1.1)		Min	Max
CBR taken at	5 mm		
CBR %	**12**		
Method of Compactive Effort	Standard		
Method used to Determine MDD	AS 1289 5.1.1 & 2.1.1		
Method used to Determine Plasticity	Visual Assessment		
Maximum Dry Density (t/m^3)	1.87		
Optimum Moisture Content (%)	13.5		
Laboratory Density Ratio (%)	100.0		
Laboratory Moisture Ratio (%)	97.5		
Dry Density after Soaking (t/m^3)	1.87		
Field Moisture Content (%)	10.2		
Moisture Content at Placement (%)	13.1		
Moisture Content Top 30mm (%)	16.2		
Moisture Content Rest of Sample (%)	15.1		
Mass Surcharge (kg)	4.5		
Soaking Period (days)	4		
Curing Hours	76.3		
Swell (%)	0.5		
Oversize Material (mm)	19		
Oversize Material Included	Excluded		
Oversize Material (%)	6.4		



Material Test Report

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

Accredited for compliance with ISO/IEC 17025 - Testing

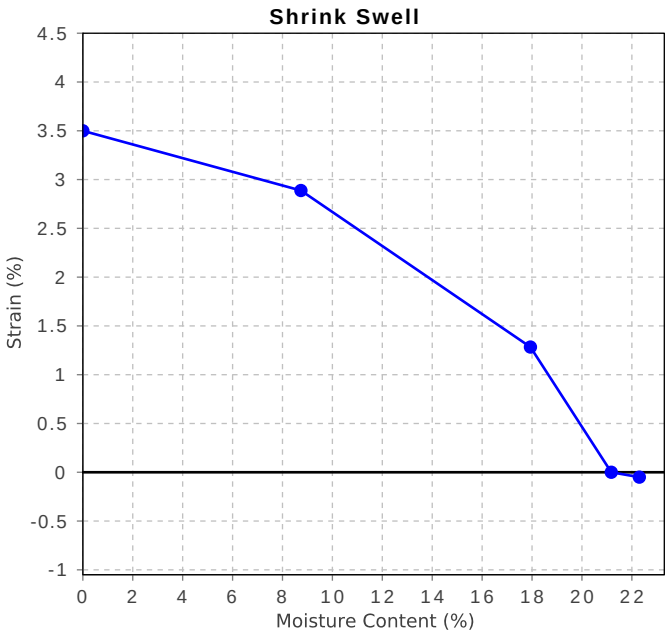
Approved Signatory: Andrew Hutchings
Laboratory Manager
Laboratory Accreditation Number: 828

Report Number:	**210950.00-1**
Issue Number:	1
Date Issued:	08/03/2022
Client:	Tactical Group Pty Ltd
	Level 15/124 Walker Street, North Sydney NSW 2060
Contact:	Luka Krivacic
Project Number:	210950.00
Project Name:	Lidcombe, 42 Boorea Street
Project Location:	42 Boorea Road, Lidcombe NSW
Work Request:	8846
Sample Number:	SY-8846B
Date Sampled:	02/02/2022
Dates Tested:	15/02/2022 - 07/03/2022
Sampling Method:	Sampled by Engineering Department
	The results apply to the sample as received
Sample Location:	**BH103 (2.0-2.27m)**
Material:	Silty CLAY: pale grey and orange

Shrink Swell Index (AS 1289 7.1.1 & 2.1.1)	
Iss (%)	**2.0**
Visual Description	Silty CLAY
* Shrink Swell Index (Iss) reported as the percentage vertical strain per pF change in suction.	

Core Shrinkage Test	
Shrinkage Strain - Oven Dried (%)	**3.5**
Estimated % by volume of significant inert inclusions	10
Cracking	Moderately Cracked
Crumbling	No
Moisture Content (%)	21.2

Swell Test	
Initial Pocket Penetrometer (kPa)	300
Final Pocket Penetrometer (kPa)	140
Initial Moisture Content (%)	19.2
Final Moisture Content (%)	22.3
Swell (%)	**0.0**
* NATA Accreditation does not cover the performance of pocket penetrometer readings.	



Material Test Report

Douglas Partners
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Sydney Laboratory
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Accredited for compliance with ISO/IEC 17025 - Testing

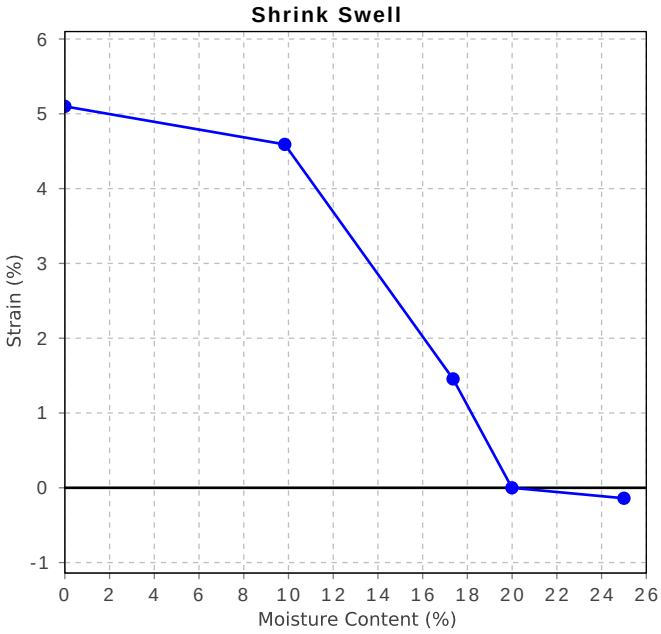
Approved Signatory: Andrew Hutchings
Laboratory Manager
Laboratory Accreditation Number: 828

Report Number:	**210950.00-1**
Issue Number:	1
Date Issued:	08/03/2022
Client:	Tactical Group Pty Ltd
	Level 15/124 Walker Street, North Sydney NSW 2060
Contact:	Luka Krivacic
Project Number:	210950.00
Project Name:	Lidcombe, 42 Boorea Street
Project Location:	42 Boorea Road, Lidcombe NSW
Work Request:	8846
Sample Number:	SY-8846C
Date Sampled:	02/02/2022
Dates Tested:	15/02/2022 - 03/03/2022
Sampling Method:	Sampled by Engineering Department
	The results apply to the sample as received
Sample Location:	**BH111 (2.0-2.3m)**
Material:	Silty CLAY: pale brown, mottled red, mottled black, trace gravel

Shrink Swell Index (AS 1289 7.1.1 & 2.1.1)	
Iss (%)	**2.9**
Visual Description	Silty CLAY
* Shrink Swell Index (Iss) reported as the percentage vertical strain per pF change in suction.	

Core Shrinkage Test	
Shrinkage Strain - Oven Dried (%)	**5.1**
Estimated % by volume of significant inert inclusions	25
Cracking	Highly Cracked
Crumbling	No
Moisture Content (%)	20.0

Swell Test	
Initial Pocket Penetrometer (kPa)	230
Final Pocket Penetrometer (kPa)	90
Initial Moisture Content (%)	21.2
Final Moisture Content (%)	25.0
Swell (%)	**0.1**
* NATA Accreditation does not cover the performance of pocket penetrometer readings.	



Material Test Report

Douglas Partners
Geotechnics / Environment / Groundwater
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96 Hermitage Road West Ryde NSW 2114
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Email: andrew.hutchings@douglaspartners.com.au

Accredited for compliance with ISO/IEC 17025 - Testing

Approved Signatory: Andrew Hutchings
Laboratory Manager
Laboratory Accreditation Number: 828

Report Number: **210950.00-1**
Issue Number: 1
Date Issued: 08/03/2022
Client: Tactical Group Pty Ltd
Level 15/124 Walker Street, North Sydney NSW 2060
Contact: Luka Krivacic
Project Number: 210950.00
Project Name: Lidcombe, 42 Boorea Street
Project Location: 42 Boorea Road, Lidcombe NSW
Work Request: 8846
Sample Number: SY-8846D
Date Sampled: 02/02/2022
Dates Tested: 15/02/2022 - 02/03/2022
Sampling Method: Sampled by Engineering Department
The results apply to the sample as received
Sample Location: **BH111 (0.4-0.5m)**
Material: Silty CLAY: dark brown, mottled orange, medium plasticity, trace gravel and sand

Atterberg Limit (AS1289 3.1.2 & 3.2.1 & 3.3.1)		Min	Max
Sample History	Oven Dried		
Preparation Method	Dry Sieve		
Liquid Limit (%)	38		
Plastic Limit (%)	16		
Plasticity Index (%)	**22**		

Emerson Class Number of a Soil (AS 1289 3.8.1)		Min	Max
Emerson Class	**2**		
Soil Description	Silty CLAY		
Nature of Water	Distilled		
Temperature of Water (^{o}C)	23		

Material Test Report

Douglas Partners
Geotechnics / Environment / Groundwater
Douglas Partners Pty Ltd
Sydney Laboratory
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Email: andrew.hutchings@douglaspartners.com.au

Accredited for compliance with ISO/IEC 17025 - Testing

Approved Signatory: Andrew Hutchings
Laboratory Manager
Laboratory Accreditation Number: 828

Report Number: **210950.00-1**
Issue Number: 1
Date Issued: 08/03/2022
Client: Tactical Group Pty Ltd
Level 15/124 Walker Street, North Sydney NSW 2060
Contact: Luka Krivacic
Project Number: 210950.00
Project Name: Lidcombe, 42 Boorea Street
Project Location: 42 Boorea Road, Lidcombe NSW
Work Request: 8846
Sample Number: SY-8846E
Date Sampled: 02/02/2022
Dates Tested: 15/02/2022 - 02/03/2022
Sampling Method: Sampled by Engineering Department
The results apply to the sample as received
Sample Location: **BH112 (0.5-0.6m)**
Material: FILL/ Silty CLAY: pale brown, red pale orange, mottled grey

Atterberg Limit (AS1289 3.1.2 & 3.2.1 & 3.3.1)		Min	Max
Sample History	Oven Dried		
Preparation Method	Dry Sieve		
Liquid Limit (%)	47		
Plastic Limit (%)	17		
Plasticity Index (%)	**30**		

Emerson Class Number of a Soil (AS 1289 3.8.1)		Min	Max
Emerson Class	**6**		
Soil Description	Silty CLAY		
Nature of Water	Distilled		
Temperature of Water (^{o}C)	23		

Material Test Report

Douglas Partners
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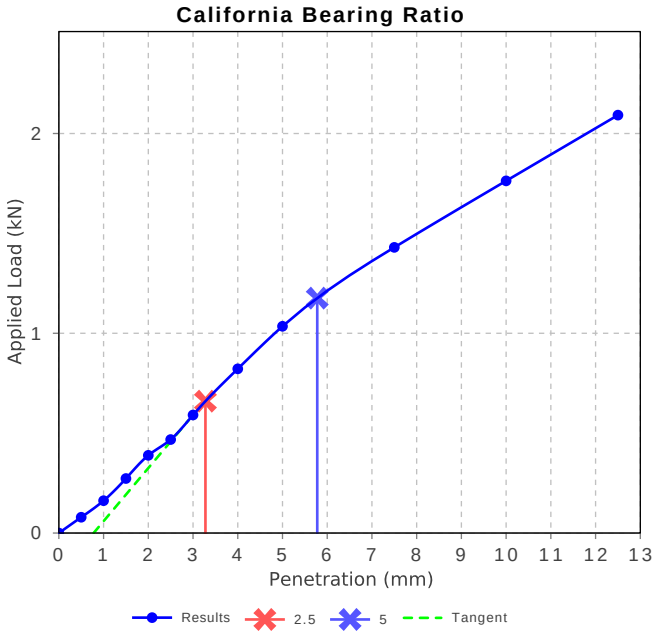
Approved Signatory: Andrew Hutchings
Laboratory Manager
Laboratory Accreditation Number: 828

Report Number: **210950.00-1**
Issue Number: 1
Date Issued: 08/03/2022
Client: Tactical Group Pty Ltd
Level 15/124 Walker Street, North Sydney NSW 2060
Contact: Luka Krivacic
Project Number: 210950.00
Project Name: Lidcombe, 42 Boorea Street
Project Location: 42 Boorea Road, Lidcombe NSW
Work Request: 8846
Sample Number: SY-8846F
Date Sampled: 02/02/2022
Dates Tested: 15/02/2022 - 25/02/2022
Sampling Method: Sampled by Engineering Department
The results apply to the sample as received
Sample Location: **BH102 (0.5-0.7m)**
Material: Silty CLAY: pale orange, mottled grey, trace black asphalt gravel

California Bearing Ratio (AS 1289 6.1.1 & 2.1.1)		Min	Max
CBR taken at	5 mm		
CBR %	**6**		
Method of Compactive Effort	Standard		
Method used to Determine MDD	AS 1289 5.1.1 & 2.1.1		
Method used to Determine Plasticity	Visual Assessment		
Maximum Dry Density (t/m^3)	1.96		
Optimum Moisture Content (%)	12.5		
Laboratory Density Ratio (%)	100.5		
Laboratory Moisture Ratio (%)	98.0		
Dry Density after Soaking (t/m^3)	1.94		
Field Moisture Content (%)	10.5		
Moisture Content at Placement (%)	12.1		
Moisture Content Top 30mm (%)	14.5		
Moisture Content Rest of Sample (%)	13.4		
Mass Surcharge (kg)	4.5		
Soaking Period (days)	4		
Curing Hours	77.0		
Swell (%)	1.0		
Oversize Material (mm)	19		
Oversize Material Included	Excluded		
Oversize Material (%)	3.1		



Material Test Report

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Sydney Laboratory
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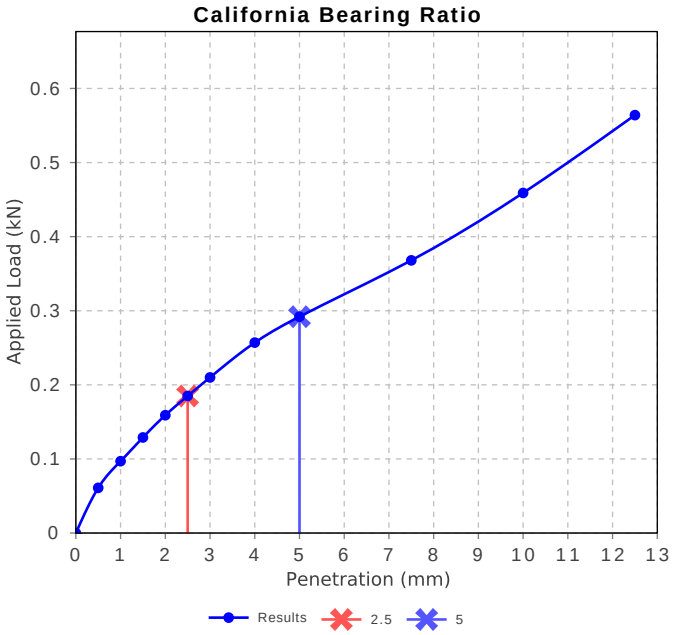
Approved Signatory: Andrew Hutchings
Laboratory Manager
Laboratory Accreditation Number: 828

Report Number: **210950.00-1**
Issue Number: 1
Date Issued: 08/03/2022
Client: Tactical Group Pty Ltd
Level 15/124 Walker Street, North Sydney NSW 2060
Contact: Luka Krivacic
Project Number: 210950.00
Project Name: Lidcombe, 42 Boorea Street
Project Location: 42 Boorea Road, Lidcombe NSW
Work Request: 8846
Sample Number: SY-8846G
Date Sampled: 02/02/2022
Dates Tested: 15/02/2022 - 25/02/2022
Sampling Method: Sampled by Engineering Department
The results apply to the sample as received
Sample Location: **BH111 (0.5-0.7m)**
Material: Silty CLAY: dark brown, mottled orange, trace gravel and sand

California Bearing Ratio (AS 1289 6.1.1 & 2.1.1)		Min	Max
CBR taken at	5 mm		
CBR %	**1.5**		
Method of Compactive Effort	Standard		
Method used to Determine MDD	AS 1289 5.1.1 & 2.1.1		
Method used to Determine Plasticity	Visual Assessment		
Maximum Dry Density (t/m^3)	1.72		
Optimum Moisture Content (%)	16.0		
Laboratory Density Ratio (%)	100.5		
Laboratory Moisture Ratio (%)	98.5		
Dry Density after Soaking (t/m^3)	1.68		
Field Moisture Content (%)	21.1		
Moisture Content at Placement (%)	16.0		
Moisture Content Top 30mm (%)	23.9		
Moisture Content Rest of Sample (%)	19.5		
Mass Surcharge (kg)	4.5		
Soaking Period (days)	4		
Curing Hours	144.2		
Swell (%)	3.0		
Oversize Material (mm)	19		
Oversize Material Included	Excluded		
Oversize Material (%)	0.0		



Envirolab Services Pty Ltd
ABN 37 112 535 645
12 Ashley St Chatswood NSW 2067
ph 02 9910 6200 fax 02 9910 6201
customerservice@envirolab.com.au
www.envirolab.com.au

CERTIFICATE OF ANALYSIS 288981

Client Details

Client	Douglas Partners Pty Ltd
Attention	Gavin Boyd
Address	96 Hermitage Rd, West Ryde, NSW, 2114

Sample Details

Your Reference	**210950.00, Lidcombe**
Number of Samples	28 Soil
Date samples received	16/02/2022
Date completed instructions received	16/02/2022

Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.

Samples were analysed as received from the client. Results relate specifically to the samples as received.

Results are reported on a dry weight basis for solids and on an as received basis for other matrices.

Please refer to the last page of this report for any comments relating to the results.

Report Details

Date results requested by	23/02/2022
Date of Issue	23/02/2022

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Results Approved By
Diego Bigolin, Inorganics Supervisor
Hannah Nguyen, Metals Supervisor
Priya Samarawickrama, Senior Chemist

Authorised By

Nancy Zhang, Laboratory Manager

Misc Inorg - Soil						
Our Reference		288981-1	288981-2	288981-3	288981-4	288981-5
Your Reference	UNITS	BH103	BH103	BH103	BH103	BH103
Depth		0.4-0.5	0.9-1	1.4-1.5	1.9-2	2.4-2.5
Date Sampled		7/02/2022	7/02/2022	7/02/2022	7/02/2022	7/02/2022
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	21/02/2022	21/02/2022	21/02/2022	21/02/2022	21/02/2022
Date analysed	-	21/02/2022	21/02/2022	21/02/2022	21/02/2022	21/02/2022
pH 1:5 soil:water	pH Units	9.1	8.6	8.4	8.3	8.5
Chloride, Cl 1:5 soil:water	mg/kg	<10	[NA]	[NA]	[NA]	[NA]
Sulphate, SO4 1:5 soil:water	mg/kg	230	[NA]	[NA]	[NA]	[NA]

Misc Inorg - Soil						
Our Reference		288981-6	288981-7	288981-8	288981-9	288981-10
Your Reference	UNITS	BH103	BH111	BH111	BH111	BH111
Depth		2.9-3	0.9-1	1.4-1.5	1.9-2	2.9-3
Date Sampled		7/02/2022	4/02/2022	4/02/2022	4/02/2022	4/02/2022
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	21/02/2022	21/02/2022	21/02/2022	21/02/2022	21/02/2022
Date analysed	-	21/02/2022	21/02/2022	21/02/2022	21/02/2022	21/02/2022
pH 1:5 soil:water	pH Units	7.7	5.8	7.5	8.4	6.2

Misc Inorg - Soil						
Our Reference		288981-11	288981-12	288981-13	288981-14	288981-15
Your Reference	UNITS	BH111	BH112	BH112	BH112	BH112
Depth		3.4-3.5	0.9-1	1.4-1.5	1.9-2	2.4-2.5
Date Sampled		4/02/2022	3/02/2022	3/02/2022	3/02/2022	3/02/2022
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	21/02/2022	21/02/2022	21/02/2022	21/02/2022	21/02/2022
Date analysed	-	21/02/2022	21/02/2022	21/02/2022	21/02/2022	21/02/2022
pH 1:5 soil:water	pH Units	7.6	7.7	7.9	8.2	7.2
Chloride, Cl 1:5 soil:water	mg/kg	[NA]	75	[NA]	[NA]	[NA]
Sulphate, SO4 1:5 soil:water	mg/kg	[NA]	650	[NA]	[NA]	[NA]

Misc Inorg - Soil						
Our Reference		288981-16	288981-17	288981-18	288981-19	288981-20
Your Reference	UNITS	BH112	BH112	BH101	BH101	BH101
Depth		3	3.4-3.5	0.4-0.5	0.9-1	1.4-1.5
Date Sampled		3/02/2022	3/02/2022	4/02/2022	4/02/2022	4/02/2022
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	21/02/2022	21/02/2022	21/02/2022	21/02/2022	21/02/2022
Date analysed	-	21/02/2022	21/02/2022	21/02/2022	21/02/2022	21/02/2022
pH 1:5 soil:water	pH Units	6.2	7.0	4.8	6.0	4.5
Chloride, Cl 1:5 soil:water	mg/kg	[NA]	[NA]	[NA]	100	[NA]
Sulphate, SO4 1:5 soil:water	mg/kg	[NA]	[NA]	[NA]	85	[NA]

Misc Inorg - Soil						
Our Reference		288981-21	288981-22	288981-23	288981-24	288981-25
Your Reference	UNITS	BH101	BH101	BH104	BH104	BH104
Depth		1.9-2	2.42.5	0.4-0.5	0.9-1	1.4-1.5
Date Sampled		4/02/2022	4/02/2022	8/02/2022	8/02/2022	8/02/2022
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	21/02/2022	21/02/2022	21/02/2022	21/02/2022	21/02/2022
Date analysed	-	21/02/2022	21/02/2022	21/02/2022	21/02/2022	21/02/2022
pH 1:5 soil:water	pH Units	4.6	4.6	8.0	7.5	6.5

Misc Inorg - Soil				
Our Reference		288981-26	288981-27	288981-28
Your Reference	UNITS	BH104	BH104	BH104
Depth		1.9-2	2.4-2.5	2.9-3
Date Sampled		8/02/2022	8/02/2022	8/02/2022
Type of sample		Soil	Soil	Soil
Date prepared	-	21/02/2022	21/02/2022	21/02/2022
Date analysed	-	21/02/2022	21/02/2022	21/02/2022
pH 1:5 soil:water	pH Units	5.2	5.3	5.0

ESP/CEC			
Our Reference		288981-8	288981-20
Your Reference	UNITS	BH111	BH101
Depth		1.4-1.5	1.4-1.5
Date Sampled		4/02/2022	4/02/2022
Type of sample		Soil	Soil
Date prepared	-	22/02/2022	22/02/2022
Date analysed	-	22/02/2022	22/02/2022
Exchangeable Ca	meq/100g	14	0.4
Exchangeable K	meq/100g	0.3	<0.1
Exchangeable Mg	meq/100g	2.6	1.5
Exchangeable Na	meq/100g	0.6	0.3
Cation Exchange Capacity	meq/100g	18	2.3
ESP	%	4	13

Texture and Salinity*						
Our Reference		288981-1	288981-2	288981-3	288981-4	288981-5
Your Reference	UNITS	BH103	BH103	BH103	BH103	BH103
Depth		0.4-0.5	0.9-1	1.4-1.5	1.9-2	2.4-2.5
Date Sampled		7/02/2022	7/02/2022	7/02/2022	7/02/2022	7/02/2022
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	21/02/2022	21/02/2022	21/02/2022	21/02/2022	21/02/2022
Date analysed	-	21/02/2022	21/02/2022	21/02/2022	21/02/2022	21/02/2022
Electrical Conductivity 1:5 soil:water	µS/cm	240	220	240	260	260
Texture Value	-	8.5	8.0	8.5	8.5	7.0
Texture	-	LIGHT CLAY	LIGHT MEDIUM CLAY	LIGHT CLAY	LIGHT CLAY	MEDIUM CLAY
ECe	dS/m	2.0	<2	2.1	2.2	<2
Class	-	SLIGHTLY SALINE	NON SALINE	SLIGHTLY SALINE	SLIGHTLY SALINE	NON SALINE

Texture and Salinity*						
Our Reference		288981-6	288981-7	288981-8	288981-9	288981-10
Your Reference	UNITS	BH103	BH111	BH111	BH111	BH111
Depth		2.9-3	0.9-1	1.4-1.5	1.9-2	2.9-3
Date Sampled		7/02/2022	4/02/2022	4/02/2022	4/02/2022	4/02/2022
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	21/02/2022	21/02/2022	21/02/2022	21/02/2022	21/02/2022
Date analysed	-	21/02/2022	21/02/2022	21/02/2022	21/02/2022	21/02/2022
Electrical Conductivity 1:5 soil:water	µS/cm	180	180	290	280	150
Texture Value	-	8.0	7.0	7.0	8.0	7.0
Texture	-	LIGHT MEDIUM CLAY	MEDIUM CLAY	MEDIUM CLAY	LIGHT MEDIUM CLAY	MEDIUM CLAY
ECe	dS/m	<2	<2	2.0	2.3	<2
Class	-	NON SALINE	NON SALINE	SLIGHTLY SALINE	SLIGHTLY SALINE	NON SALINE

Texture and Salinity*						
Our Reference		288981-11	288981-12	288981-13	288981-14	288981-15
Your Reference	UNITS	BH111	BH112	BH112	BH112	BH112
Depth		3.4-3.5	0.9-1	1.4-1.5	1.9-2	2.4-2.5
Date Sampled		4/02/2022	3/02/2022	3/02/2022	3/02/2022	3/02/2022
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	21/02/2022	21/02/2022	21/02/2022	21/02/2022	21/02/2022
Date analysed	-	21/02/2022	21/02/2022	21/02/2022	21/02/2022	21/02/2022
Electrical Conductivity 1:5 soil:water	µS/cm	160	550	390	370	980
Texture Value	-	7.0	7.0	7.0	7.0	7.0
Texture	-	MEDIUM CLAY	MEDIUM CLAY	MEDIUM CLAY	MEDIUM CLAY	MEDIUM CLAY
ECe	dS/m	<2	3.9	2.7	2.6	6.8
Class	-	NON SALINE	SLIGHTLY SALINE	SLIGHTLY SALINE	SLIGHTLY SALINE	MODERATELY SALINE

Texture and Salinity*						
Our Reference		288981-16	288981-17	288981-18	288981-19	288981-20
Your Reference	UNITS	BH112	BH112	BH101	BH101	BH101
Depth		3	3.4-3.5	0.4-0.5	0.9-1	1.4-1.5
Date Sampled		3/02/2022	3/02/2022	4/02/2022	4/02/2022	4/02/2022
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	21/02/2022	21/02/2022	21/02/2022	21/02/2022	21/02/2022
Date analysed	-	21/02/2022	21/02/2022	21/02/2022	21/02/2022	21/02/2022
Electrical Conductivity 1:5 soil:water	µS/cm	310	450	360	200	300
Texture Value	-	9.0	7.0	7.0	9.0	7.0
Texture	-	CLAY LOAM	MEDIUM CLAY	MEDIUM CLAY	CLAY LOAM	MEDIUM CLAY
ECe	dS/m	2.8	3.2	2.5	<2	2.1
Class	-	SLIGHTLY SALINE	SLIGHTLY SALINE	SLIGHTLY SALINE	NON SALINE	SLIGHTLY SALINE

Texture and Salinity*						
Our Reference		288981-21	288981-22	288981-23	288981-24	288981-25
Your Reference	UNITS	BH101	BH101	BH104	BH104	BH104
Depth		1.9-2	2.42.5	0.4-0.5	0.9-1	1.4-1.5
Date Sampled		4/02/2022	4/02/2022	8/02/2022	8/02/2022	8/02/2022
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	21/02/2022	21/02/2022	21/02/2022	21/02/2022	21/02/2022
Date analysed	-	21/02/2022	21/02/2022	21/02/2022	21/02/2022	21/02/2022
Electrical Conductivity 1:5 soil:water	µS/cm	220	210	220	200	310
Texture Value	-	7.0	7.0	9.0	7.0	8.0
Texture	-	MEDIUM CLAY	MEDIUM CLAY	CLAY LOAM	MEDIUM CLAY	LIGHT MEDIUM CLAY
ECe	dS/m	<2	<2	<2	<2	2.5
Class	-	NON SALINE	NON SALINE	NON SALINE	NON SALINE	SLIGHTLY SALINE

Texture and Salinity*				
Our Reference		288981-26	288981-27	288981-28
Your Reference	UNITS	BH104	BH104	BH104
Depth		1.9-2	2.4-2.5	2.9-3
Date Sampled		8/02/2022	8/02/2022	8/02/2022
Type of sample		Soil	Soil	Soil
Date prepared	-	21/02/2022	21/02/2022	21/02/2022
Date analysed	-	21/02/2022	21/02/2022	21/02/2022
Electrical Conductivity 1:5 soil:water	µS/cm	280	230	280
Texture Value	-	8.0	8.0	8.0
Texture	-	LIGHT MEDIUM CLAY	LIGHT MEDIUM CLAY	LIGHT MEDIUM CLAY
ECe	dS/m	2.2	<2	2.2
Class	-	SLIGHTLY SALINE	NON SALINE	SLIGHTLY SALINE

Method ID	Methodology Summary
Inorg-001	pH - Measured using pH meter and electrode in accordance with APHA latest edition, 4500-H+. Please note that the results for water analyses are indicative only, as analysis outside of the APHA storage times.
Inorg-002	Conductivity and Salinity - measured using a conductivity cell at 25°C in accordance with APHA latest edition 2510 and Rayment & Lyons.
Inorg-081	Anions - a range of Anions are determined by Ion Chromatography, in accordance with APHA latest edition, 4110-B. Waters samples are filtered on receipt prior to analysis. Alternatively determined by colourimetry/turbidity using Discrete Analyser.
INORG-123	Determined using a "Texture by Feel" method.
Metals-020	Determination of exchangeable cations and cation exchange capacity in soils using 1M Ammonium Chloride exchange and ICP-OES analytical finish.

QUALITY CONTROL: Misc Inorg - Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Date prepared	-			21/02/2022	1	21/02/2022	21/02/2022		21/02/2022	[NT]
Date analysed	-			21/02/2022	1	21/02/2022	21/02/2022		21/02/2022	[NT]
pH 1:5 soil:water	pH Units		Inorg-001	[NT]	1	9.1	9.1	0	100	[NT]
Chloride, Cl 1:5 soil:water	mg/kg	10	Inorg-081	<10	1	<10	[NT]		99	[NT]
Sulphate, SO4 1:5 soil:water	mg/kg	10	Inorg-081	<10	1	230	[NT]		88	[NT]

QUALITY CONTROL: Misc Inorg - Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-2	[NT]
Date prepared	-			[NT]	11	21/02/2022	21/02/2022		21/02/2022	[NT]
Date analysed	-			[NT]	11	21/02/2022	21/02/2022		21/02/2022	[NT]
pH 1:5 soil:water	pH Units		Inorg-001	[NT]	11	7.6	7.5	1	101	[NT]

QUALITY CONTROL: Misc Inorg - Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-			[NT]	21	21/02/2022	21/02/2022		[NT]	[NT]
Date analysed	-			[NT]	21	21/02/2022	21/02/2022		[NT]	[NT]
pH 1:5 soil:water	pH Units		Inorg-001	[NT]	21	4.6	4.6	0	[NT]	[NT]

QUALITY CONTROL: ESP/CEC						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	288981-20
Date prepared	-			22/02/2022	8	22/02/2022	22/02/2022		22/02/2022	22/02/2022
Date analysed	-			22/02/2022	8	22/02/2022	22/02/2022		22/02/2022	22/02/2022
Exchangeable Ca	meq/100g	0.1	Metals-020	<0.1	8	14	13	7	100	105
Exchangeable K	meq/100g	0.1	Metals-020	<0.1	8	0.3	0.3	0	105	102
Exchangeable Mg	meq/100g	0.1	Metals-020	<0.1	8	2.6	2.5	4	104	112
Exchangeable Na	meq/100g	0.1	Metals-020	<0.1	8	0.6	0.6	0	113	116
ESP	%	1	Metals-020	[NT]	8	4	4	0	[NT]	[NT]

QUALITY CONTROL: Texture and Salinity*						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Date prepared	-			21/02/2022	1	21/02/2022	21/02/2022		21/02/2022	[NT]
Date analysed	-			21/02/2022	1	21/02/2022	21/02/2022		21/02/2022	[NT]
Electrical Conductivity 1:5 soil:water	µS/cm	1	Inorg-002	<1	1	240	230	4	100	[NT]
Texture Value	-		INORG-123	[NT]	1	8.5	8.5	0	[NT]	[NT]

QUALITY CONTROL: Texture and Salinity*						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-2	[NT]
Date prepared	-			[NT]	11	21/02/2022	21/02/2022		21/02/2022	[NT]
Date analysed	-			[NT]	11	21/02/2022	21/02/2022		21/02/2022	[NT]
Electrical Conductivity 1:5 soil:water	µS/cm	1	Inorg-002	[NT]	11	160	190	17	101	[NT]
Texture Value	-		INORG-123	[NT]	11	7.0	7.0	0	[NT]	[NT]

QUALITY CONTROL: Texture and Salinity*						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-			[NT]	21	21/02/2022	21/02/2022		[NT]	[NT]
Date analysed	-			[NT]	21	21/02/2022	21/02/2022		[NT]	[NT]
Electrical Conductivity 1:5 soil:water	µS/cm	1	Inorg-002	[NT]	21	220	230	4	[NT]	[NT]
Texture Value	-		INORG-123	[NT]	21	7.0	7.0	0	[NT]	[NT]

Result Definitions

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

Quality Control Definitions

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

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

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

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

Laboratory Acceptance Criteria

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

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

Spikes for Physical and Aggregate Tests are not applicable.

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

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

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

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

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

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

Measurement Uncertainty estimates are available for most tests upon request.

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

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

Report Comments

pH/EC
Samples were out of the recommended holding time for this analysis.

Douglas Partners
Geotechnics / Environment / Groundwater

CHAIN OF CUSTODY DESPATCH SHEET

Project No:	210950.00	**Suburb:**	Lidcombe	**To:**	Envirolab Services
Project Manager:	G Boyd	**Order Number:**		**Sampler:**	R De Silva
Email:	gavin.boyd@douglaspartners.com.au, ravin.desilva@dougaspartners.com.au, kristine.nicodemus@douglaspart			**Attn:**	Aileen Hie
Turnaround time:	☑ Standard ☐ 72 hour ☐ 48 hour ☐ 24 hour ☐ Same day			**Contact:**	02 9910 6200 Ahie@envirolab.com.au
Prior Storage:	☑ Fridge ☐ Freezer ☐ Shelf	**Do samples contain 'potential' HBM?**	☑ No ☐ Yes (If YES, then handle, transport and store in accordance with FPM HAZID)		

Lab ID	Sample ID: Location / Other ID	Depth From	Depth To	Date Sampled	Sample Type: S - soil W - water	Container Type: G - glass P - plastic	Analytes: pH, ECE, Textural	Chlorides	Sulfates	Sodicity	Phenols	Moisture Content	Atterberg Limit				Notes/ Preservation/ Additional Requirements
1	BH103	0.4	0.5	7/02/22	S	P	•	•	•								
2	BH103	0.9	1	7/02/22	S	P	•										
3	BH103	1.4	1.5	7/02/22	S	P	•										
4	BH103	1.9	2	7/02/22	S	P	•										
5	BH103	2.4	2.5	7/02/22	S	P	•										
6	BH103	2.9	3	7/02/22	S	P	•										
7	BH111	0.9	1	4/02/22	S	P	•										
8	BH111	1.4	1.5	4/02/22	S	P	•			•							
9	BH111	1.9	2	4/02/22	S	P	•										
10	BH111	2.9	3	4/02/22	S	P	•										
11	BH111	3.4	3.5	4/02/22	S	P	•										
12	BH112	0.9	1	3/02/22	S	P	•	•	•								
13	BH112	1.4	1.5	3/02/22	S	P	•										
14	BH112	1.9	2	3/02/22	S	P	•										

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

Job No: 288981
Date Received: 16/02/22
Time Received: 1715
Received by: CR
Temp: Cool/Ambient
Cooling: Ice/Icepack
Security: Intact/Broken 25°C

Metals to analyse:			
Number of samples in container:		**Transported to laboratory by:**	Hunter Express
Send results to:	Douglas Partners Pty Ltd		
Address:	96 Hermitage Rd, West Ryde, 2114	**Phone:**	02 9809 0666
Relinquished by:	Ravin De Silva	**Date:**	15/02/2022 **Signed:**

LAB RECEIPT
Lab Ref. No: 288981
Received by: CR
Date & Time: 16/02/22 1715
Signed:

Douglas Partners
Geotechnics I Environment I Groundwater

CHAIN OF CUSTODY DESPATCH SHEET

Project No:	210950.00	**Suburb:**	Lidcombe	**To:**	Envirolab Services
Project Manager:		**Order Number:**		**Dispatch date:**	15/02/2022
					12 Ashley Street, Chatswood, NSW 2067

Lab ID	Sample ID			Date Sampled	Sample Type	Container Type	Analytes											Notes/ Preservation/ Additional Requirements
	Location / Other ID	Depth From	Depth To		S - soil W - water	G - glass P - plastic	pH, ECE, Textural	Chlorides	Sulfates	Sodicity	Phenols	Moisture Content	Atterberg Limit					
15	BH112	2.4	2.5	3/02/2022	S	P	•											
16	BH112	3	3	3/02/2022	S	P	•											
17	BH112	3.4	3.5	3/02/2022	S	P	•											
18	BH101	0.4	0.5	4/02/2022	S	P	•											
19	BH101	0.9	1	4/02/2022	S	P	•	•	•									
20	BH101	1.4	1.5	4/02/2022	S	P	•			•								
21	BH101	1.9	2	4/02/2022	S	P	•											
22	BH101	2.4	2.5	4/02/2022	S	P	•											
23	BH104	0.4	0.5	8/02/2022	S	P	•											
24	BH104	0.9	1	8/02/2022	S	P	•											
25	BH104	1.4	1.5	8/02/2022	S	P	•											
26	BH104	1.9	2	8/02/2022	S	P	•											
27	BH104	2.4	2.5	8/02/2022	S	P	•											
28	BH104	2.9	3	8/02/2022	S	P	•											

#288981

Douglas Partners
Geotechnics I Environment I Groundwater

CHAIN OF CUSTODY DESPATCH SHEET

Project No:	210950.00	**Suburb:**	Lidcombe	**To:**	Envirolab Services
Project Manager:	96 Hermitage Rd, West Ryde, 2114			**Dispatch date:**	

#288981

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12 Ashley St Chatswood NSW 2067
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www.envirolab.com.au

SAMPLE RECEIPT ADVICE

Client Details

Client	Douglas Partners Pty Ltd
Attention	Gavin Boyd

Sample Login Details

Your reference	210950.00, Lidcombe
Envirolab Reference	288981
Date Sample Received	16/02/2022
Date Instructions Received	16/02/2022
Date Results Expected to be Reported	23/02/2022

Sample Condition

Samples received in appropriate condition for analysis	Yes
No. of Samples Provided	28 Soil
Turnaround Time Requested	Standard
Temperature on Receipt (°C)	25
Cooling Method	None
Sampling Date Provided	YES

Comments

Nil

Please direct any queries to:

Aileen Hie	Jacinta Hurst
Phone: 02 9910 6200	**Phone: 02 9910 6200**
Fax: 02 9910 6201	**Fax: 02 9910 6201**
Email: ahie@envirolab.com.au	**Email: jhurst@envirolab.com.au**

Analysis Underway, details on the following page:

Envirolab Services Pty Ltd
ABN 37 112 535 645
12 Ashley St Chatswood NSW 2067
ph 02 9910 6200 fax 02 9910 6201
customerservice@envirolab.com.au
www.envirolab.com.au

Sample ID	Misc Inorg - Soil	ESP/CEC	Texture and Salinity*
BH103-0.4-0.5	✓		✓
BH103-0.9-1	✓		✓
BH103-1.4-1.5	✓		✓
BH103-1.9-2	✓		✓
BH103-2.4-2.5	✓		✓
BH103-2.9-3	✓		✓
BH111-0.9-1	✓		✓
BH111-1.4-1.5	✓	✓	✓
BH111-1.9-2	✓		✓
BH111-2.9-3	✓		✓
BH111-3.4-3.5	✓		✓
BH112-0.9-1	✓		✓
BH112-1.4-1.5	✓		✓
BH112-1.9-2	✓		✓
BH112-2.4-2.5	✓		✓
BH112-3	✓		✓
BH112-3.4-3.5	✓		✓
BH101-0.4-0.5	✓		✓
BH101-0.9-1	✓		✓
BH101-1.4-1.5	✓	✓	✓
BH101-1.9-2	✓		✓
BH101-2.42.5	✓		✓
BH104-0.4-0.5	✓		✓
BH104-0.9-1	✓		✓
BH104-1.4-1.5	✓		✓
BH104-1.9-2	✓		✓
BH104-2.4-2.5	✓		✓
BH104-2.9-3	✓		✓

The '✓' indicates the testing you have requested. **THIS IS NOT A REPORT OF THE RESULTS.**

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Additional Info

Sample storage - Waters are routinely disposed of approximately 1 month and soils approximately 2 months from receipt.
Requests for longer term sample storage must be received in writing.
Please contact the laboratory immediately if observed settled sediment present in water samples is to be included in the extraction and/or analysis (exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, Total Recoverable metals and PFAS analysis where solids are included by default.
TAT for Micro is dependent on incubation. This varies from 3 to 6 days.

Douglas Partners
Geotechnics · Environment · Groundwater

Table D1: Summary of Borehole Data, Laboratory Tests and Assessments

Borehole	Top of	Base of	Sample	pH	Chlorides	Sulphates	Resistivity	Aggressivity				Exchangeable	CEC	Sodicity	Sodicity Class	Soil Texture Group	Textural	$EC_{1:5}$	EC_e	Salinity Class
	soil unit	soil unit	Depth				By inversion of EC1.5	Soil Condition "B" used for natural soils and engineered fill from Sample pH		Soil Condition "B" used for natural soils and engineered fill from Sample Chloride and Sulfate Concrentration	Soil Condition "B" used for natural soils and engineered fill from Resistivity	Sodium (Na)	Cation exchange capacity	[Na/CEC]	5-15 Sodic >15 Highly Sodic		Factor [M]	[Lab.]	[M x $EC_{1:5}$]	
	(m)	(m)	(m)		(mg/kg)	(mg/kg)	Ω.cm	To Concrete [AS2159 pH criteria]	To Steel [AS2159 pH criteria]	To Concrete [AS2159, Chloride and Sulphate Criteria]	To Steel [AS2159, Resistivity Criteria]	(meq/100g)	(meq/100g)	(%)	[after DLWC]	[after DLWC]	[after DLWC]	(µS/cm)	(dS/m)	[Richards 1954]
101	0.40	0.50	0.45	4.8			2778	Mild	Non-Aggressive		Non-Aggressive					Medium clay	7	360	2.5	Slightly Saline
101	0.90	1.00	0.95	6.0	100	85	5000	Non-Aggressive	Non-Aggressive	Non-Aggressive	Non-Aggressive					Clay loam	9	200	1.8	Non Saline
101	1.40	1.50	1.45	4.5			3333	Moderate	Non-Aggressive		Non-Aggressive	0.3	2	13	Sodic	Medium clay	7	300	2.1	Slightly Saline
101	1.90	2.00	1.95	4.6			4545	Mild	Non-Aggressive		Non-Aggressive					Medium clay	7	220	1.5	Non Saline
101	2.40	2.50	2.45	4.6			4762	Mild	Non-Aggressive		Non-Aggressive					Medium clay	7	210	1.5	Non Saline
103	0.40	0.50	0.45	9.1	<10	230	4167	Non-Aggressive	Non-Aggressive	Non-Aggressive	Non-Aggressive					Light clay	8.5	240	2.0	Slightly Saline
103	0.90	1.00	0.95	8.6			4545	Non-Aggressive	Non-Aggressive		Non-Aggressive					Light medium clay	8	220	1.8	Non Saline
103	1.40	1.50	1.45	8.4			4167	Non-Aggressive	Non-Aggressive		Non-Aggressive					Light clay	8.5	240	2.0	Slightly Saline
103	1.90	2.00	1.95	8.3			3846	Non-Aggressive	Non-Aggressive		Non-Aggressive					Light clay	8.5	260	2.2	Slightly Saline
103	2.40	2.50	2.45	8.5			3846	Non-Aggressive	Non-Aggressive		Non-Aggressive					Medium clay	7	260	1.8	Non Saline
103	2.90	3.00	2.95	7.7			5556	Non-Aggressive	Non-Aggressive		Non-Aggressive					Light medium clay	8	180	1.4	Non Saline
104	0.40	0.50	0.45	8.0			4545	Non-Aggressive	Non-Aggressive		Non-Aggressive					Clay loam	9	220	2.0	Non Saline
104	0.90	1.00	0.95	7.5			5000	Non-Aggressive	Non-Aggressive		Non-Aggressive					Medium clay	7	200	1.4	Non Saline
104	1.40	1.50	1.45	6.5			3226	Non-Aggressive	Non-Aggressive		Non-Aggressive					Light medium clay	8	310	2.5	Slightly Saline
104	1.90	2.00	1.95	5.2			3571	Mild	Non-Aggressive		Non-Aggressive					Light medium clay	8	280	2.2	Slightly Saline
104	2.40	2.50	2.45	5.3			4348	Mild	Non-Aggressive		Non-Aggressive					Light medium clay	8	230	1.8	Non Saline
104	2.90	3.00	2.95	5.0			3571	Mild	Non-Aggressive		Non-Aggressive					Light medium clay	8	280	2.2	Slightly Saline
111	0.90	1.00	0.95	5.8			5556	Non-Aggressive	Non-Aggressive		Non-Aggressive					Medium clay	7	180	1.3	Non Saline
111	1.40	1.50	1.45	7.5			3448	Non-Aggressive	Non-Aggressive		Non-Aggressive	0.6	18	4	Non-Sodic	Medium clay	7	290	2.0	Slightly Saline
111	1.90	2.00	1.95	8.4			3571	Non-Aggressive	Non-Aggressive		Non-Aggressive					Light medium clay	8	280	2.2	Slightly Saline
111	2.90	3.00	2.95	6.2			6667	Non-Aggressive	Non-Aggressive		Non-Aggressive					Medium clay	7	150	1.1	Non Saline
111	3.40	3.50	3.45	7.6			6250	Non-Aggressive	Non-Aggressive		Non-Aggressive					Medium clay	7	160	1.1	Non Saline
112	0.90	1.00	0.95	7.7	75	650	1818	Non-Aggressive	Non-Aggressive	Non-Aggressive	Mildly Aggressive					Medium clay	7	550	3.9	Slightly Saline
112	1.40	1.50	1.45	7.9			2564	Non-Aggressive	Non-Aggressive		Non-Aggressive					Medium clay	7	390	2.7	Slightly Saline
112	1.90	2.00	1.95	8.2			2703	Non-Aggressive	Non-Aggressive		Non-Aggressive					Medium clay	7	370	2.6	Slightly Saline
112	2.40	2.50	2.45	7.2			1020	Non-Aggressive	Non-Aggressive		Mildly Aggressive					Medium clay	7	980	6.9	Moderately Saline
112	2.90	3.00	2.95	6.2			3226	Non-Aggressive	Non-Aggressive		Non-Aggressive					Clay loam	9	310	2.8	Slightly Saline
112	3.40	3.50	3.45	7.0			2222	Non-Aggressive	Non-Aggressive		Non-Aggressive					Medium clay	7	450	3.2	Slightly Saline

Notes: ESP = Exchangeable Sodium Percentage (sodicity)
$EC_{1.5}$ Electrical Conductivity (1:5 Soil/Water suspension)
M = Multiplier factor based on soil texture
EC_e Electrical Conductivity = $EC_{1.5}$ * M

Appendix E

Historical Aerial Photographs

Legend

- Approximate extent of Former Watercourse
- Pond
- Approximate Site Boundary

70 0 70 140 210 280 m

Drawing adapted from Metromap Image, dated January 1943

Douglas Partners
Geotechnics / Environment / Groundwater

CLIENT: Tactical Group		TITLE: **Historical Aerial Photo - Year 1943**	PROJECT No:210950.00
OFFICE: NW Sydney	DRAWN BY: KN	**Proposed Industrial Development**	DRAWING No: 1
SCALE: 1:2500 @ A3	DATE: 22.03.2022	**42 Boorea Street, Lidcombe**	REVISION: 0