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www.psm.com.au

Our Ref: PSM4029-105L (SEARs Cover Letter - PSM)

19 January 2022

520 Gardeners Rd, Alexandria
Project Strategy NSW Pty Ltd

landrew@projectstrategy.com.au

Attention: Lachlan Andrew

Dear Lachlan

RE: SEARS ITEMS RELATING TO 520 GARDENERS ROAD, ALEXANDRIA - RESULTS OF GEOTECHNICAL INVESTIGATION (PSM4029.103L)

1. Introduction

Pells Sullivan Meynink (PSM) was engaged by Project Strategy NSW Pty Ltd on behalf of Charter Hall (the client) to prepare this letter addressing parts of Planning Secretary's Environmental Assessment Requirements for Warehouse and distribution centres (SEARs document) for the proposed Ascent Logistics Centre located at 520 Gardeners Road, Alexandria, NSW. Specifically, this letter outlines where part Items 12 of the SEARs document are addressed, in PSM report "PSM4029-103L REV.01".

2. SEARs Items Addressed by PSM in its Report PSM4029-103L REV.01

The following report has been prepared for the site by PSM:

- PSM4029-103L REV.01: 520 Gardeners Road, Alexandria – Results of Geotechnical Investigation – dated 19 January 2022.

Table 1 summarises the SEARs document Item and specific requirement met by PSM.

Table 1 - Table A – SEARs Items Addressed by PSM Report

SEARs Item	SEARs Item Requirement and Documentation	PSM Report Addressing SEARs Item
1	Provide an assessment of the potential impacts on soil resources, including related infrastructure and riparian lands on and near the site.	This was addressed in section 7 of report "PSM4029-103L REV.01".

2	Provide an assessment of the potential impacts on surface and groundwater resources (quality and quantity), including related infrastructure, hydrology, aquatic and groundwater-dependent ecosystems, drainage lines, downstream assets, and watercourses.	The potential impacts on the quality and the quantity of the surface and groundwater resources were addressed in section 7 of report "PSM4029-103L REV.01". The other parts of this item were not addressed by PSM.
3	Identify predicted water discharge points to surface/groundwater and consider discharge quality against relevant water quality criteria.	This was not addressed by PSM.
4	Provide a detailed site water balance including identification of water requirements for the life of the development, and measures to ensure an adequate and secure water supply.	This was not addressed by PSM.
5	Provide an assessment of salinity and acid sulphate soil impacts.	This was not addressed by PSM.

Should there be any queries, do not hesitate to contact the undersigned.

For and on behalf of
PELLS SULLIVAN MEYNINK

JULIAN DAHER
SENIOR GEOTECHNICAL ENGINEER

DAVID PICCOLO
PRINCIPAL

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Our Ref: PSM4029-103L REV1

19 January 2022

520 Gardeners Rd, Alexandria
Charter Hall
Level 20,
No.1 Martin Place,
Sydney NSW 2000

theodore.berney@charterhall.com.au

Attention: Theodore Berney

Dear Theodore

RE: 520 GARDENERS ROAD, ALEXANDRIA - RESULTS OF GEOTECHNICAL INVESTIGATION

1. Introduction

This report presents the results of geotechnical investigation undertaken by PSM at 520 Gardeners Road, Alexandria. The work has been undertaken in accordance with PSM proposal (Ref: PSM4029-101L) dated 7 July 2021.

2. Background

To assist us in preparing this proposal we were supplied with the following documents:

- Option 3 – Ground Floor Plan (Plan number 11596_SK030)
- Option 3 – Level 1 Plan (Plan number 11596_SK031)
- Option 3 – Level 2 Plan (Plan number 11596_SK032)
- Option 3 – 3d and Section (Drawing number 11596_SK033)
- Option 3 – 3D Views (Drawing number 11596_SK034).

Figure 1 presents a locality plan of the site and approximate investigation locations.

The proposed development comprises two levels of warehouses.

With regards to the bulk earthworks, we understand that:

- Bulk earthworks on the site will be minor overall and limited to minor import to lift the new building to a level of RL 7.0m AHD. This requires raising the existing building by 0.4m. The increase in floor level is proposed to ensure the building is sited 0.5m above the level of Bourke Road (to ensure nuisance flooding from gutter flow is minimised)
- Final levels would be subject to a +/-0.5 m variance to allow for variations in allowances for geotechnical conditions, final building layout and allowable building height, and drainage considerations

- Soil Erosion and Sediment Control measures, including sedimentation basins are to be placed in accordance with the submitted drawings and the Soil and Water Management Plan
- All geotechnical testing and inspections performed during the filling operations will be undertaken to Level 1 geotechnical control, in accordance with the Bulk Earthworks Specification "PSM4029-104S" attached in Appendix F.

We have previously completed a due diligence study for the site in January 2020 (Ref. PSM4029-002L dated 31 January 2020). As part of the study, PSM also completed one borehole within the site. Figure 1 showed the location of the borehole. Appendix D presents the borehole log.

3. Geotechnical Investigation – 9-10 August 2021

3.1 Fieldwork

The fieldwork for the geotechnical investigation was undertaken on 9 and 10 August 2021.

1. Cone penetrometer tests (CPT).
2. Boreholes.

3.1.1 CPTs

A total of 3 CPTs (CPT01 to CPT03) were completed to refusal depths of between 24.2 m to 27.2 m. The CPTs were carried out using a 24-tonne truck mounted rig. At the completion of each test, the holes were backfilled with sand fill and cement.

The results of the CPTs including interpreted subsurface profiles are included in Appendix A.

3.1.2 Boreholes

Two (2) boreholes (BH A & BH B) were drilled to a depth of 31 m using a track mounted drill rig at the locations shown in figure 1. Augering was undertaken through the soil above the groundwater level and then continued with wash boring. NMLC triple tube coring was then used to recover bedrock.

Point load index tests were undertaken on the retrieved rock cores.

The borehole logs are presented in Appendix B.

One standpipe piezometer was also installed in BH A to monitor groundwater level. Details of the piezometer construction in presented in Appendix E.

3.1.3 General

All work was conducted under the full-time supervision of a PSM geotechnical engineer, who undertook the following tasks:

- Directing testing locations
- Preparing borehole logs of material encountered
- Collecting soil samples for geotechnical laboratory testing
- Undertaking Point Load Testing on the recovered core.

Prior to testing, on-site service location "scans" were undertaken by a licenced service locator in the presence of a PSM geotechnical engineer to assess if the test locations were free from buried utilities.

The investigation locations were recorded with a hand-held GPS unit with a horizontal accuracy of approximately +/- 5 m.

Figures 2 to 5 present selected photos of the fieldwork.

3.2 Laboratory Testing

A total of two samples were collected for CBR tests.

4. Site Conditions

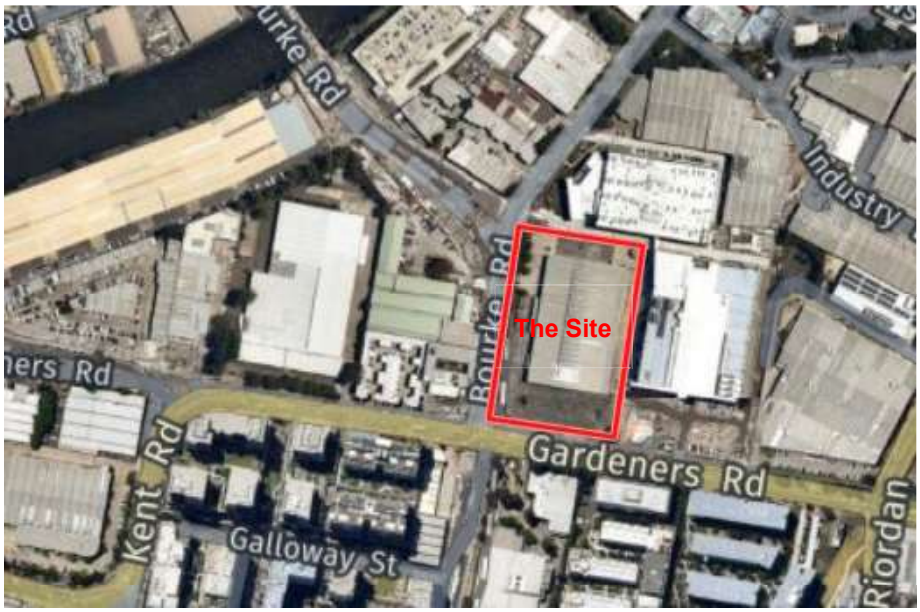
4.1 Geological Setting

The 1:100,000 Sydney Geological Map indicates that the site is underlain by medium to fine-grained 'marine' sand with podsols. This is presented in Inset 1.

Inset 1: Geological setting as shown on 1:100,000 Sydney Geological Map

4.2 Surface Conditions

The site is approximately 175 x 100 m metres in size. It bounded by Gardeners Road to the south, Bourke Road to the west and existing industrial developments to the north and east. The existing land use comprises light industrial development (warehouse) facility. Alexandra Canal meanders in a north-easterly direction approximately 300 m north-west of the site. The site location is presented in Inset 2.



Inset 2: The Site

4.3 Subsurface Conditions

The subsurface conditions inferred from the CPT results and the rock cores retrieved from the boreholes are summarised in Table 1 and Table 2.

With regards to Bedrock unit, we have inferred CPT refusal depths as the top of the unit.

Table 1 - Summary of Inferred Subsurface Conditions Encountered in the CPTs

Inferred Unit	Encountered Depth to Top of Inferred Unit (m)	Description
Pavement	0 0.13 to 0.18	Asphalt Concrete (underlying the asphalt pavement) – 70 mm thick
FILL [2]	0.25 to 0.32	Gravelly SAND, brown to grey, dry, poorly sorted subangular to subrounded fine to medium coarse grains, with inclusions of gravel up to 40mm, thickness ranging from approximately 1.7 m to 1.75 m.
SAND	2.0 to 2.35	Medium dense to dense silty sand to sand, thickness ranging from approximately 12.65 m to 13.3 m, interbedded with bands of clay and silty clay up to 500mm thick. A clay layer up to 0.75 m thick (between 2.6 m and 3.3 m) could be observed in this unit (in CPT03). The clay is assessed to be soft to firm consistency.
CLAY	15.0 to 15.3	Firm to very stiff clay to silty clay, orange grey to brown-grey thickness ranging from approximately 8.1 m to 11.33 m.
BEDROCK A	23.1 to 26.6	Shale; extremely too highly weathered, very low strength.
BEDROCK B	25.4 to 27.5	Shale; moderate grey to dark grey, low to medium strength.

Table 2 – The Depth to the Top of Inferred Geotechnical Units Encountered in the CPTs and BHs

TEST ID	Encountered Depth to Top of Inferred Unit (m)						END OF HOLE (m)
	PAVEMENT[1]	FILL	SAND	CLAY	BEDROCK A [3]	BEDROCK B	
CPT01	0	0.33	2.0	15.2	26.5	27.2	27.2
CPT02	0	0.18[2]	2.35	15.0	23.5	NE	24.2
CPT03	0	0.18	2.0	15.0	24.0	25.0	25.0
BH A	0	0.33	2.0	15.3	26.5	27.5	31.0
BH B	0	0.33	2.0	15.0	23.1	25.4	31.0

1 A concrete pavement was encountered beneath the asphalt in CPT01 location, which required the use of dia-tube coring.
A dummy cone was used to penetrate the asphaltic pavement and underlying fill in CPT01, CPT02 and CPT03 to depths of 0.6m, 1.41 m and 1.0 m respectively.

2 Very dense gravelly sand fill was encountered between 2.03 and 2.35 m in CPT02. A dummy cone was used to penetrate this layer.

3 These levels are inferred from BH rock cores visual inspection and from CPT resistance analysis.

4.4 Groundwater

Groundwater was detected in the standpipe installed in BH A at 2m below the surface and 2.5m below the surface in BH B during drilling. This is consistent with PSM previous local experience.

No long-term monitoring of the water table was undertaken. However, groundwater monitoring could be undertaken on the installed piezometer at BH A if required.

5. Laboratory Results

Table 3 present a summary of CBR test results. The laboratory test sheet is included in Appendix C.

Table 3 – Summary of CBR test results

Sample ID	Borehole ID (Depth)	Material Description	Soaked CBR (%)	Moisture Content (%)	OMC (%)	Standard Maximum Dry Density (t/m3)	Swell (%)
SA 1	BH A (0 m – 0.5 m)	Silty SAND with Gravel	18	17.9	11.9	1.90	0.0
SA 2	BH B (0 m – 0.5 m)	Silty SAND with Gravel	35	14.7	11.9	1.91	0.5

6. Discussion and Recommendations

6.1 General

The design advice in the following sections is provided on the basis that:

- The subsurface conditions are as those encountered in the geotechnical investigation reported in Section 4 of this letter
- Minor filling and subgrade preparation will be undertaken in accordance with the PSM bulk earthworks specification PSM4029-104S (Appendix F).

If any of those bases are not applicable, PSM should be requested to confirm that the design advice below is still applicable.

6.2 Site Classification

While the proposed development is out of scope of AS2870-2011 “Residential slabs and footings”, we assess that due to the presence of clay soil layers which are inferred to be soft to firm consistency (e.g., in CPT3), the site is classified as Class P.

6.3 Permanent and Temporary Batters

The batter slope angles shown in Table 4, are recommended for the design of batters up to a nominal 3 m height above groundwater table, subject to the following recommendations:

- All batters shall be protected from erosion
- Permanent batters shall be drained
- Temporary batters shall not be left unsupported for more than 2 months without further advice, and inspection by a geotechnical engineer should be undertaken following significant rain events
- No buildings, loads, or services should be located within 1 batter height of the crest.

If the conditions above cannot be met, further advice should be sought.

Table 4 - Batter slope angles

Unit name	Temporary	Permanent
FILL	2.0H:1V	2.5H:1V
SAND (above water table)	2.0H:1V	2.5H:1V

The batters should be inspected by an experienced geotechnical engineer or engineering geologist during excavation to confirm the batter advice provided (including existing fill) and assess the need for localised support.

Proper and suitable safe work method statements and OHS documents need to be developed for works to be undertaken in the vicinity of the crest and toe of batters.

Steeper batters may be possible subject to further advice, probably including inspection during construction and possible shotcreting, etc.

6.4 Excavation Support

Cuts in the soil steeper than the recommended permanent batter slopes in Table 4 will need to be supported by some form of retaining structure.

The design of these structures should be based on the following geotechnical properties:

- Effective soil strength parameters in Table 5
- Surcharge loads behind the retention
- Water pressure (depending on the type of structure).

Note that design of retention systems may be based on either K_a or K_o earth pressures. Design using active earth pressures (K_a) provides the minimum lateral earth pressure that must be supported to avoid failure and requires a wall that can rotate or translate to allow the pressures to reduce to these values (vertical and lateral movements up to 2% of height may occur, typical movements will be much less).

Where the design is based on K_o pressures, construction should be carefully controlled to avoid unwanted effects. It should be noted that designing for K_o pressures does not, of itself, ensure that movement does not occur. Movements are controlled by the construction method, especially sequence.

Both surface and sub-surface drainage needs to be designed and constructed properly to prevent pore water pressures from building up behind the retaining walls or appropriate water pressures must be included in the design.

Where excavations are proposed in the vicinity of existing structures designers shall consider the effects of the excavation including horizontal and vertical deflections on the neighbouring structures. Excavation near existing building should not undermine the existing footings and structures.

Table 5 - Engineering Parameters of Inferred Geotechnical Units for Excavation Support Design

Inferred Unit	Bulk Unit Weight (kN/m3)	Soil Effective Strength Parameters		Elastic Parameters	
		c' (kPa)	□' (deg)	Long Term Young Modulus (MPa)	Poisson's Ratio
FILL	18	0	30	10	0.3
SAND	18	0	30	15	0.3

6.5 Footings

6.5.1 Shallow footings

Pad footings can be founded on or within the FILL or SAND unit. They can be proportioned based on the allowable bearing pressure (ABP) for centric vertical loads of 100 kPa. These pads are to have a minimum horizontal dimension of 1 m and an embedment depth of at least 500 mm.

Please note that an allowable bearing pressure (ABP) is not a soil property. It depends on many factors such as the size of the footings, the embedment depth, the load direction and eccentricity, the stiffness of the footing, the adopted factor of safety (FOS), as well as the soil properties. As footings get bigger or deeper the capacity increases very quickly, as the load gets eccentric or inclined the capacity reduces very quickly.

Higher ABPs may be available but these depend on the size, depth, loads, etc. and would be subject to specific advice.

Settlement of footings should be assessed based on a foundation material with a long-term Young's modulus shown in Table 5; if pad footings are adopted then overall building settlement should also be considered.

6.5.2 Piles

Piles should be designed in accordance with the requirements in AS 2159 (2009), Piling – Design and Installation. Selection of the pile system depends on many considerations and should be undertaken by the designer in conjunction with the principal and contractor / builder. The effects of piling works (e.g., CFA piles or bored piles installation) on adjacent ground and structures should be considered in any design.

Design parameters and load factors will vary based on numerous factors such as the type of piling method selected, the founding soil, the level of construction control and performance monitoring implemented. It is recommended that a piling contractor be engaged to design the piles based on the results of the CPTs and the advice provided in this report.

6.5.2.1 Piles on BEDROCK unit

The parameters provided in Table 6 may be adopted in the design of piles founded in the BEDROCK unit.

The foundation designer should note the following with regards to the pile design:

- The ABP needs to be confirmed by a geotechnical engineer during a pile inspection
- Under permanent load, the contribution of side adhesion for soils including soil units should be ignored
- Higher ABP in BEDROCK unit can be adopted if the pile and structure can tolerate more settlement. The pile settlement can be estimated using Young's Modulus presented in Table 6**.**

Pile settlement needs to be checked using the recommended elastic parameters in Table 6.

The bearing capacities provided are contingent on piles or footings being vertically and centrally loaded. Further advice should be sought if the footings are not vertically centrically loaded.

With regards to the pile design, we recommend that:

- A geotechnical strength reduction factor, Φ_g = 0.56 (AS2159 CL. 4.3.2) be adopted for a high redundancy system for an assessed average risk rating (ARR) between 2.5 and 3.0. This should be reviewed to suit the specific design and appropriate pile testing proposed by the structural designers in accord with the requirements of AS2159
- It may be possible to increase the pile reduction factors, if the details of the proposed pile installation procedures indicate a high level of quality control with regards to concrete placement, base cleanliness, etc.
- If a geotechnical strength reduction factor, Φ_g = 0.40 is adopted then no pile testing will be required (AS2159 Clause 8.2.4 (b)).

Table 6 - Engineering Parameters of Inferred Geotechnical Units for Pile Foundation Design on BEDROCK UNITS

Inferred Unit	Bulk Unit Weight (kN/m^3)	Ultimate Bearing Pressure under Vertical Centric Loading (kPa)	Allowable Bearing Pressure (ABP) under Vertical Centric Loading (kPa)	Ultimate Shaft Adhesion (kPa)	Elastic Parameters	
					Long Term Young Modulus (MPa)	Poisson's Ratio
BEDROCK A	22	3,000	1,000	150	100	0.25
BEDROCK B	24	6,000	2,000	350	500	0.25

Note: 1. Ultimate values occur at large settlement (>5% of minimum footing dimensions).
2. End bearing pressure to cause settlement of <1% of minimum footing dimensions.

6.5.2.2 Piles on SAND

If piles need to be founded in SAND unit, we advise they are founded within SAND unit with a density index of least medium dense. The piling designer / contractor shall review the CPT data when designing the piles in SAND unit.

For design purposes, piles in the SAND, we recommend that:

- A geotechnical strength reduction factor, Φ_{gb} = 0.56 (AS2159 CL. 4.3.2)
- Factor for bored concrete and grout piles, a concrete placement factor, k = 0.75 (AS 2159 CL 5.3.2) be adopted.

Table 7 – Recommended Design Parameters for CFA Piles in SAND unit

Inferred Unit	Bulk Unit Weight (kN/m^3)	Ultimate Bearing Pressure under Vertical Centric Loading (kPa)	Ultimate Shaft Adhesion (kPa)	Elastic Parameters	
				Long Term Young Modulus (MPa)	Poisson's Ratio
SAND*	18	2,000	20	15	0.3

We note that the top of the CLAY unit is at approximately 15 m below the existing surface. The base of piles would have to be kept at least 6 diameters (or more for groups of piles) above the clay to limit the effect of the clay on base capacity.

The effects of pile installation (CFA) on adjacent ground and structures should be considered in any design.

6.5.3 Grade slab

The design of slab founded on sand can be based on a subgrade with Young's modulus (E) shown in Table 5.

6.5.4 Pavements

Two (2) soaked CBR tests were undertaken on samples of the existing fill which include the existing pavement formation. The results were between 18% and 35%.

A CBR of 10% can be adopted for design of pavements on the existing fill.

We recommend that specific CBR testing be undertaken at subgrade level when pavement layouts are finalised. CBR testing shall be undertaken for any new imported material within the pavement subgrade (e.g., within 1 m below pavement).

7. Response to SEARS requirements

7.1 General

In this section we provide specific responses to Items 12 Dot 1 and 12 Dot 2 of the SEARS (SSD-32489140 dated 30th November 2021). These are reproduced below:

- *"Provide an assessment of the potential impacts on soil resources, including related infrastructure and riparian lands on and near the site.*
- *Provide an assessment of the potential impacts on surface and groundwater resources (quality and quantity), including related infrastructure, hydrology, aquatic and groundwater dependent ecosystems, drainage lines, downstream assets, and watercourses."*

7.2 Cl. 12 Dot 1 "Soil Resources"

With regards to this clause and the potential impacts of the proposed developments on soil resources, we assess that the proposed development has close to no impact on the soil resource at the site.

This assessment is based on the following considerations:

- The site has been industrial development for many decades.
- The proposed development:
  - Does not change the site use.
  - Does not disturb the existing ground. Earthworks essentially comprise minor filling across the site.
  - Includes importation of VENM fill to change design levels.
- We understand that the civil designer has designed or will design the stormwater system, surface gradients and landscaping requirements to control surface flows and minimise soil erosion and the effects of soil erosion on adjacent waterways. We note that the vast majority of the site will be sealed by the proposed development and appropriate surface runoff collection and disposal systems have been included in the design. We understand that appropriate erosion control will also be included during construction.

7.3 Cl. 12 Dot 2 "Groundwater resources"

With regards to this clause and the potential impacts of the proposed developments on groundwater resource, we assess that the proposed development has close to no impact on the groundwater resource at the site.

This assessment is based on the following considerations:

- The groundwater table at the site is located more than 2.0 m below the surface
- The proposed development does not include basements or bulk excavations
- Minor detailed excavations for footings or services will be mostly above the water table and be temporary in nature.

Should there be any queries, do not hesitate to contact the undersigned.

For and on behalf of
PELLS SULLIVAN MEYNINK

JULIAN DAHER
SENIOR GEOTECHNICAL ENGINEER

DAVID PICCOLO
PRINCIPAL

Encl.

Figure 1 Location Plan

Figure 2 Selected Site Photos (1 of 3)

Figure 3 Selected Site Photos (2 of 3)

Figure 4 Selected Site Photos (3 of 3)

Appendix A CPT Results

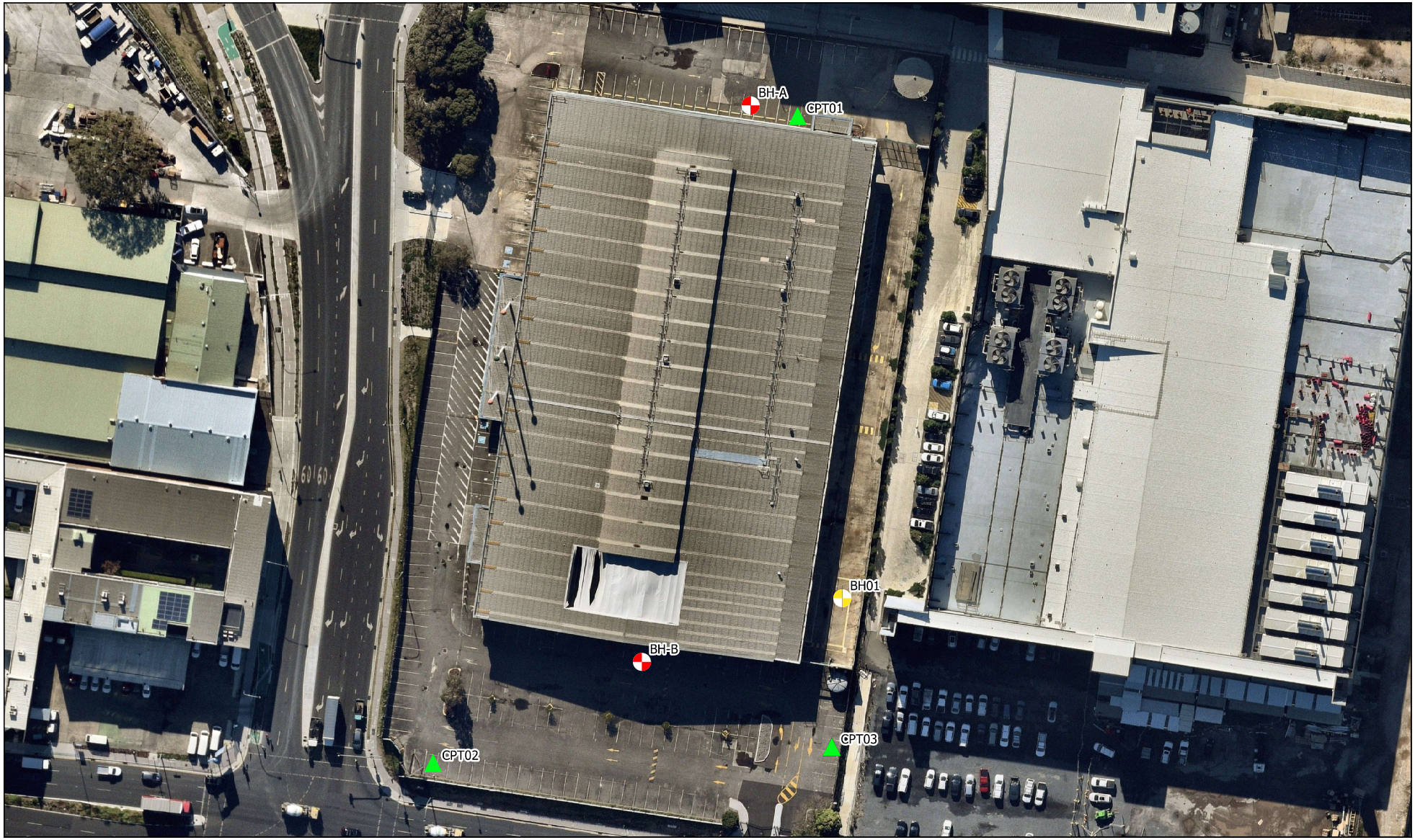
Appendix B Borehole Logs

Appendix C CBR Results

Appendix D Previous PSM borehole

Appendix E Piezometer Construction

Appendix F PSM4029-104S – Earthworks Specification



Legend

- PSM Boreholes 2020
- PSM CPT - 09.08.2021
- PSM Boreholes - 09.08.2021

Scale 1:800

N

0 10 20 30 m

Map Projection:
Horizontal Datum:
Grid: EPSG:7856

P S M	Created By: PSM	Revision: A	
	Date: 27 Aug 2021	Paper Size: A3	

Charter Hall
520 Gardeners Road
Alexandria 2015

Locality Plan

PSM4029.10 | Figure 1

C:\Users\JulianJaher\Pells Sullivan Meyrink\GIS - ArcGIS\PSM4029.10\02 Workspace\PSM4029.10 - Locality Plan.qgz Layout: A3_LandscapeTemplate_V1_QGIS

Photo 1 - Site general conditions facing west showing CPT01 & BH01 locations

Photo 2 - Diatube coring in the location of CPT01

Charter Hall	
520 Gardeners Road	
520 Gardeners Road, Alexandria	
SITE INVESTIGATION (09/08/2021 & 10/08/2021)	
SELECTED SITE PHOTOS [1 OF 3]	
PSM4029-003L	FIGURE 2

Photo 3 - BH01 location with the CPT truck in the background at CPT01 location

Photo 4 - Washout material colour at 5m (on the left - SAND) and 16m (on the right - CLAY) at BH01

Charter Hall	
520 Gardeners Road	
520 Gardeners Road, Alexandria	
SITE INVESTIGATION (09/08/2021 & 10/08/2021)	
SELECTED SITE PHOTOS [2 OF 3]	
PSM4029-003L	**FIGURE 3**

Photo 5 - General site conditions facing north on the eastern end showing CPT03 location

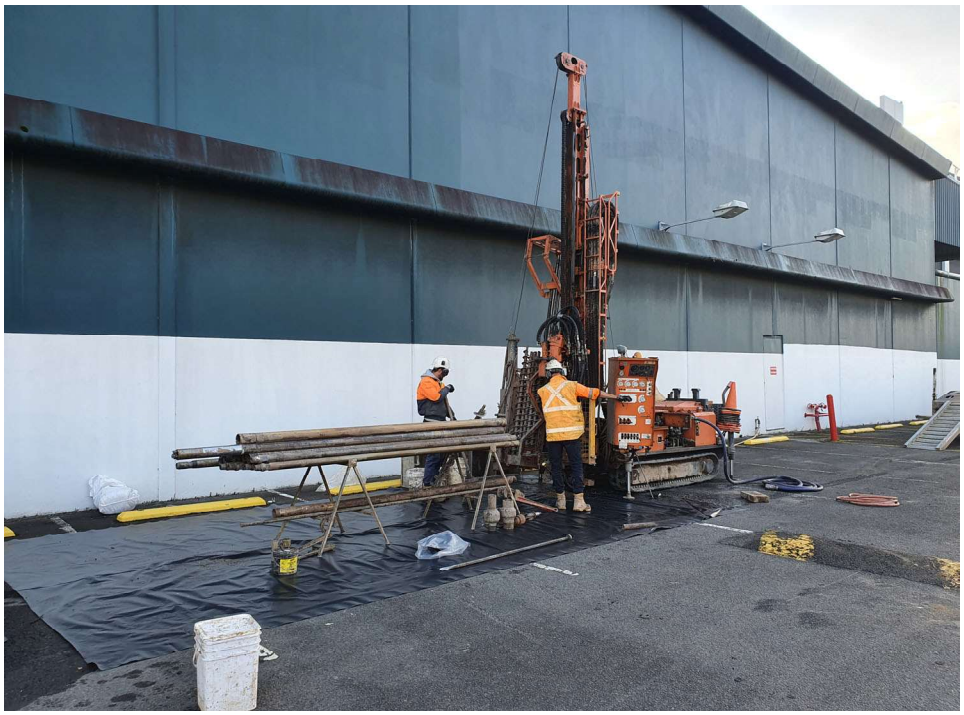


Photo 6 - BH02 location

Charter Hall	
520 Gardeners Road	
520 Gardeners Road, Alexandria	
SITE INVESTIGATION (09/08/2021 & 10/08/2021)	
SELECTED SITE PHOTOS [3 OF 3]	
PSM4029-003L	FIGURE 4

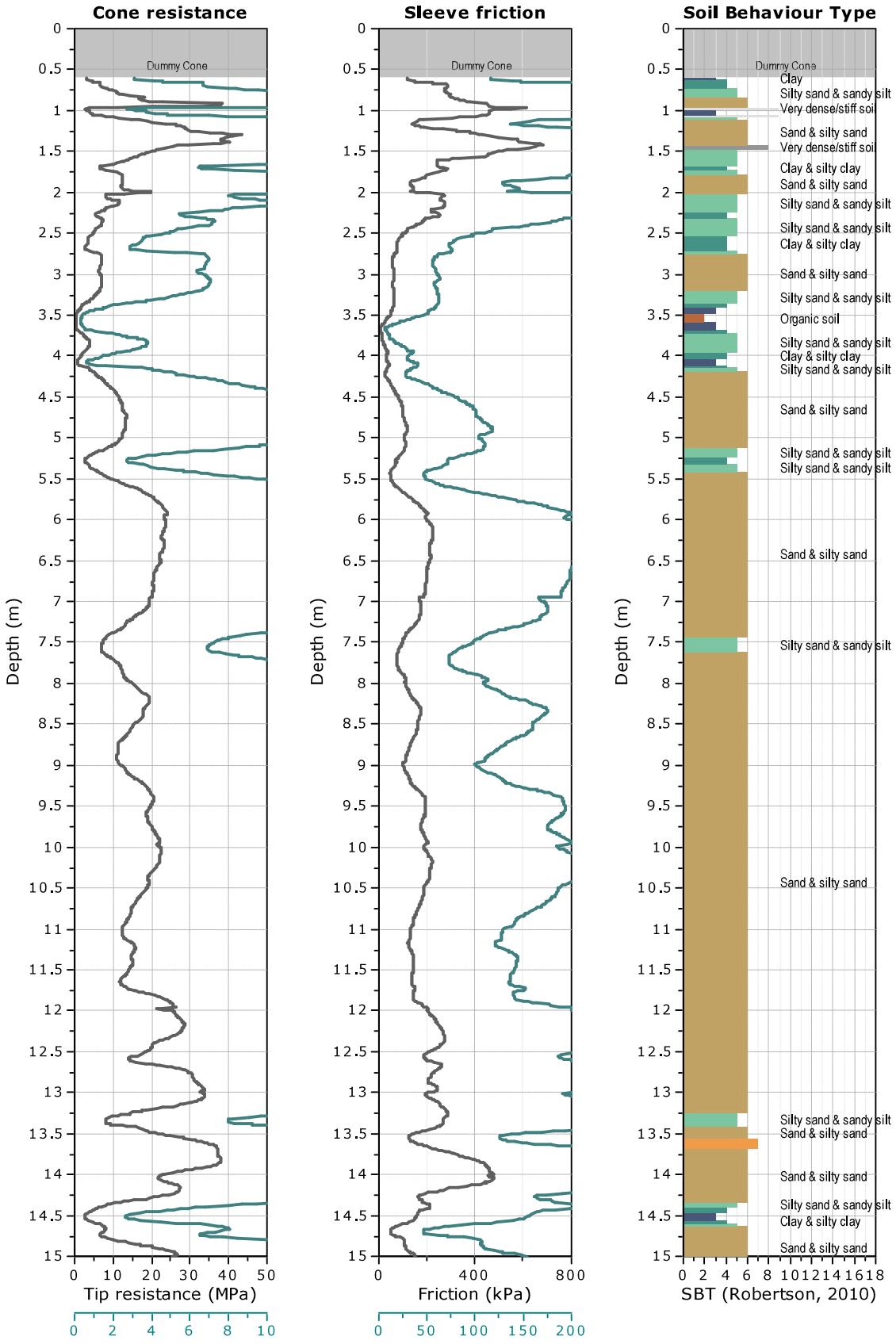
Appendix A
CPT Results

PSM
Engineering Consultants | Rock Soil Water
G3 56 Delhi Road, North Ryde NSW 2133 Australia
www.psm.com.au

CPT: CPT01

Project: 520 Gardeners Road, Alexandria
Total depth: 27.17 m, Date: 9/08/2021

Location: 520 Gardeners Road, Alexandria
Coords: N 6245380, E 332586

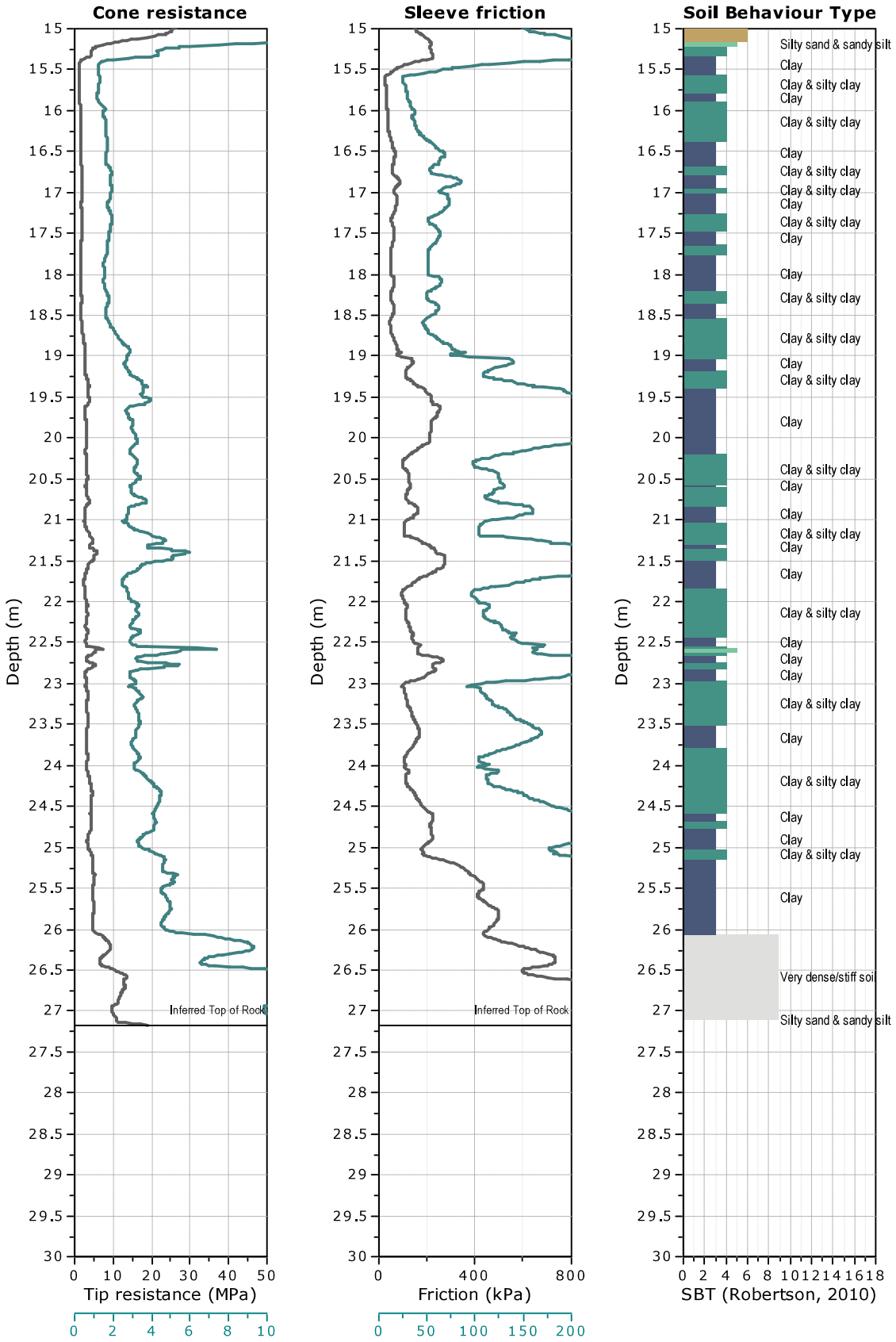


PSM
Engineering Consultants | Rock Soil Water
G3 56 Delhi Road, North Ryde NSW 2133 Australia
www.psm.com.au

CPT: CPT01

Project: 520 Gardeners Road, Alexandria
Total depth: 27.17 m, Date: 9/08/2021

Location: 520 Gardeners Road, Alexandria
Coords: N 6245380, E 332586

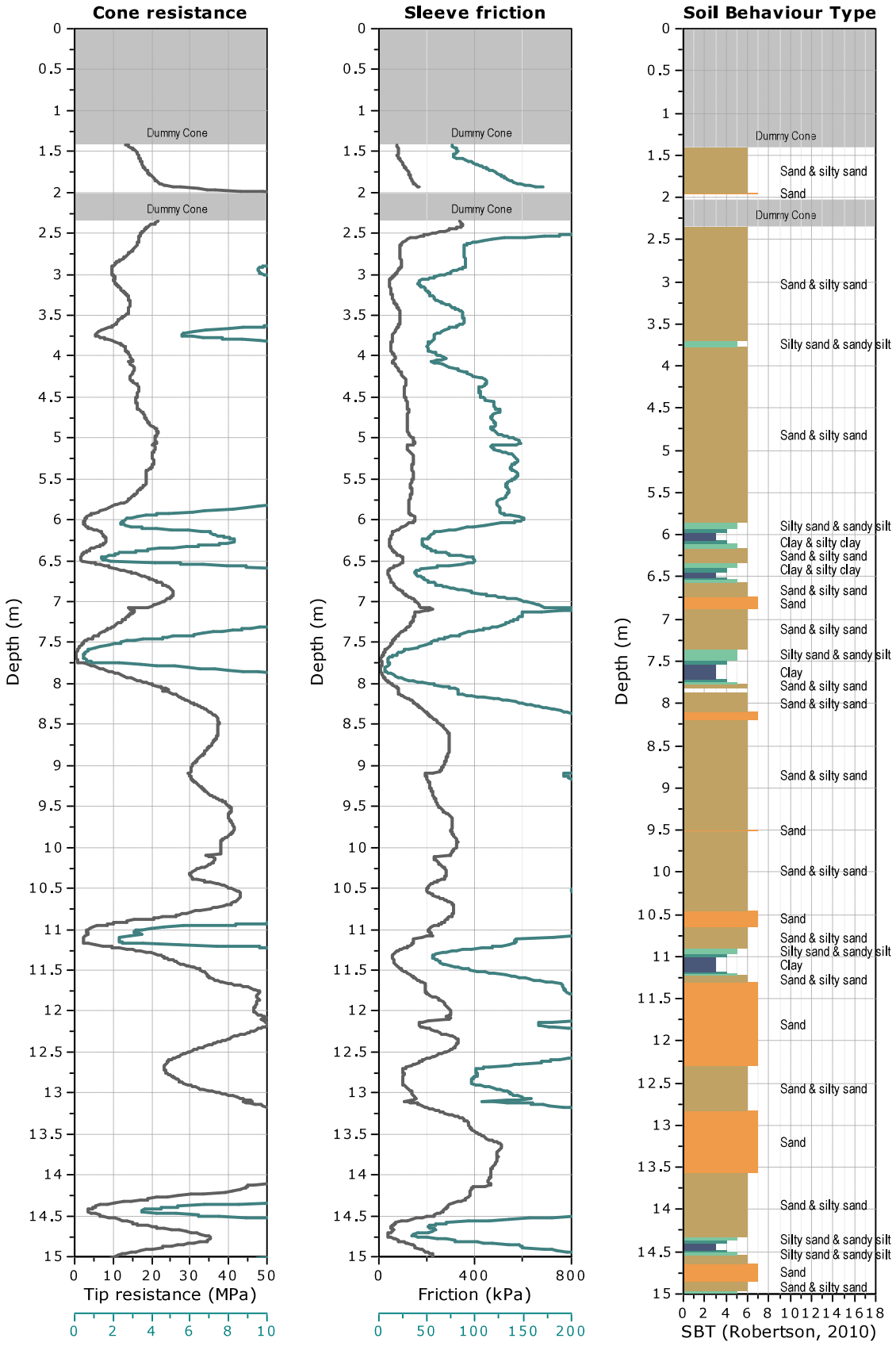


PSM
Engineering Consultants | Rock Soil Water
G3 56 Delhi Road, North Ryde NSW 2133 Australia
www.psm.com.au

CPT: CPT02

Project: 520 Gardeners Road, Alexandria
Total depth: 24.17 m, Date: 9/08/2021

Location: 520 Gardeners Road, Alexandria
Coords: N 6245236, E 332517

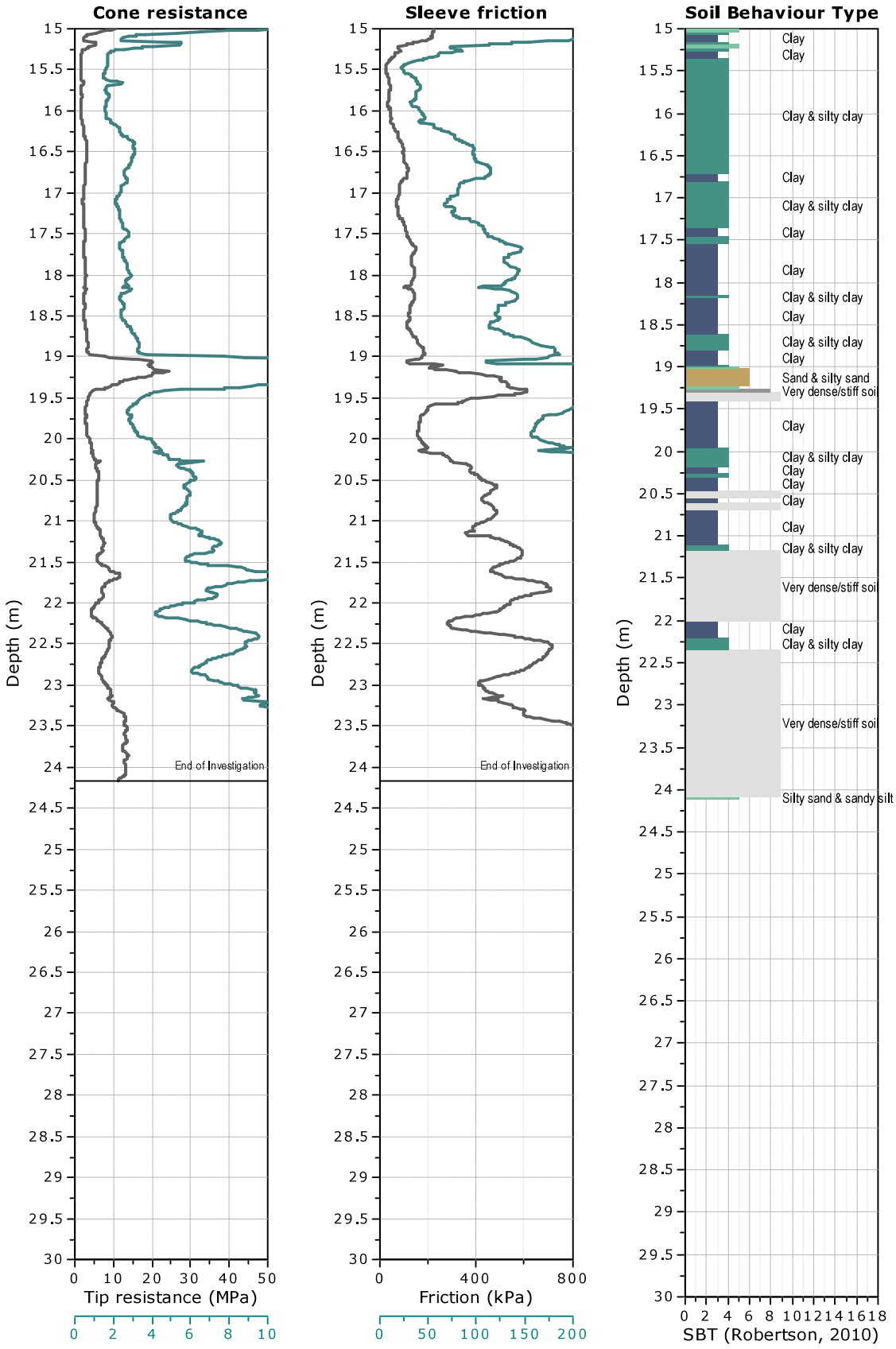


PSM
Engineering Consultants | Rock Soil Water
G3 56 Delhi Road, North Ryde NSW 2133 Australia
www.psm.com.au

CPT: CPT02

Project: 520 Gardeners Road, Alexandria
Total depth: 24.17 m, Date: 9/08/2021

Location: 520 Gardeners Road, Alexandria
Coords: N 6245236, E 332517

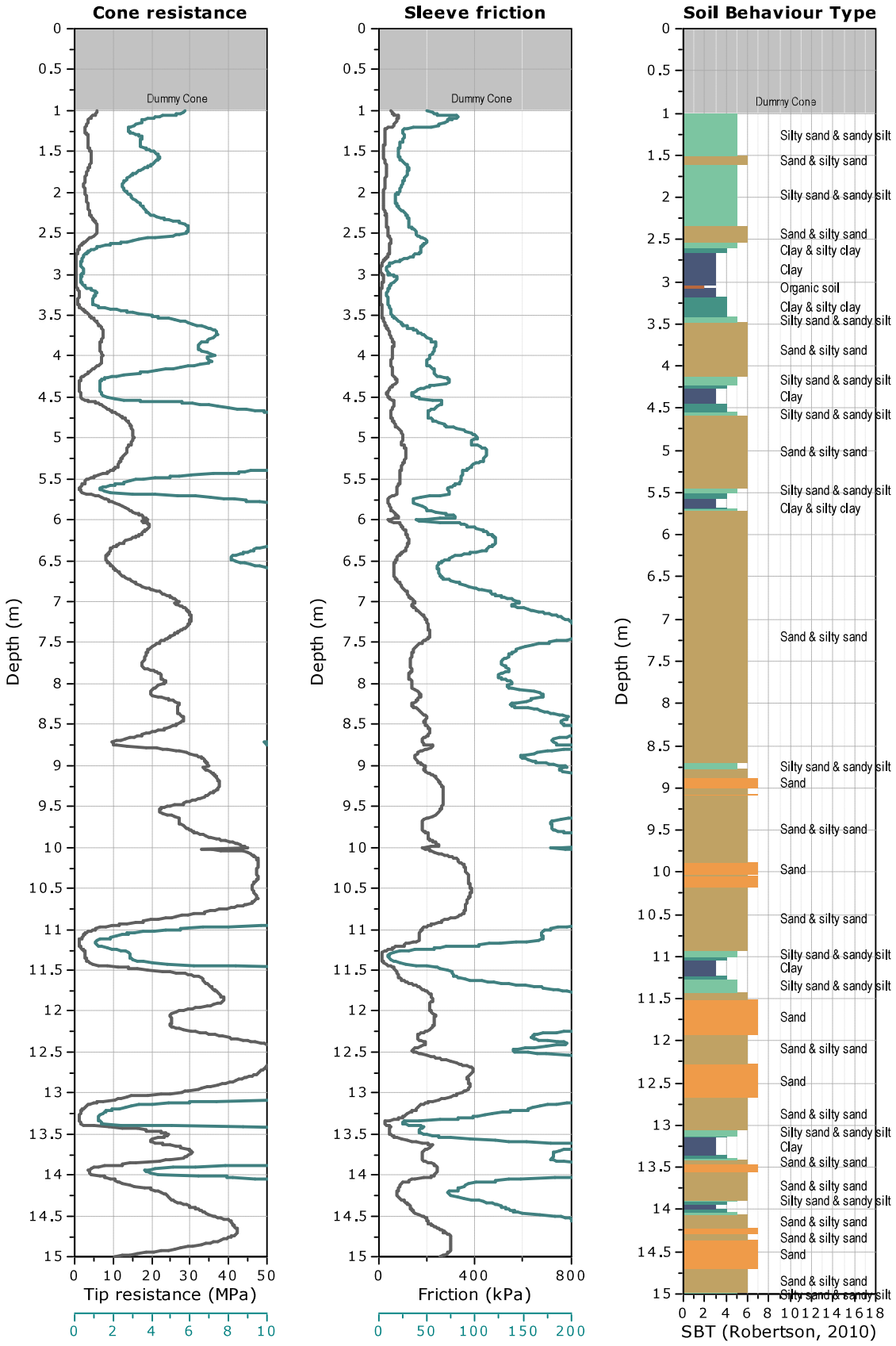


PSM
Engineering Consultants | Rock Soil Water
G3 56 Delhi Road, North Ryde NSW 2133 Australia
www.psm.com.au

CPT: CPT03

Project: 520 Gardeners Road, Alexandria
Total depth: 25.04 m, Date: 9/08/2021

Location: 520 Gardeners Road, Alexandria
Coords: N 6245232, E 332601

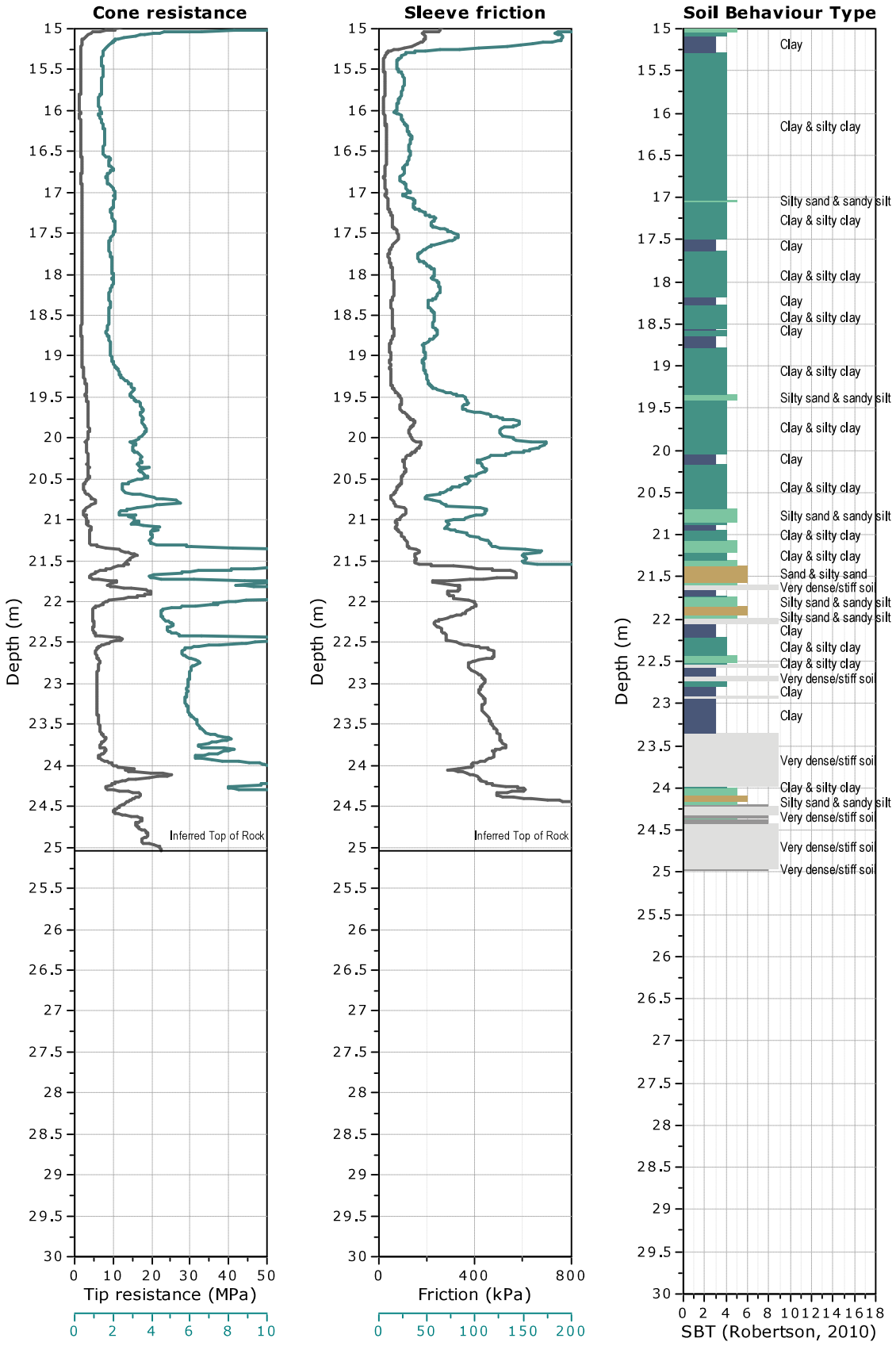


PSM
Engineering Consultants | Rock Soil Water
G3 56 Delhi Road, North Ryde NSW 2133 Australia
www.psm.com.au

CPT: CPT03

Project: 520 Gardeners Road, Alexandria
Total depth: 25.04 m, Date: 9/08/2021

Location: 520 Gardeners Road, Alexandria
Coords: N 6245232, E 332601



Appendix B
Borehole Logs

Borehole ID

BH A

Engineering Log - Non Cored Borehole

Project No.: PSM4029

Client:	Charter Hall	Commenced:	09/08/2021
Project Name:	520 Gardeners Road Alexandria	Completed:	09/08/2021
Hole Location:		Logged By:	BT
Hole Position:	332588.0 m E 6245377.0 m N MGA2020 Zone 56	Checked By:	AS

Drill Model and Mounting:	Hanjin DB8	Inclination:	-90°	RL Surface:	No survey
Hole Diameter:		Bearing:		Datum:	AHD

Operator: JK Drilling

Drilling Information								*Soil Description*					*Observations*
Method	Penetration	Support	Water	Samples Tests Remarks	Recovery	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description SOIL NAME: Plasticity, behaviour or particle characteristics of primary component, colour, secondary components, additional observations	Moisture Condition	Consistency / Relative Density	Hand Penetrometer UCS (kPa) 100 200 300 400 500	Structure, Zoning, Origin, Additional Observations
										ASPHALT - 130 mm.	D	D		
										CONCRETE - 200 mm.	D	D		
AD/T		N					1		SP	Gravelly Silty SAND: brown-grey, medium to coarse grained, sub-rounded to sub-angular, gravel up to 40 mm.	M	D to VD		
			▽				2		SM	Silty SAND: grey, medium to coarse grained, sub-rounded to sub-angular.	M	D		
									Cl	Sandy CLAY; dark grey, medium plasticity, dark grey; medium grained, sub-rounded sand.	W	F		
WB		C					3		SM	Silty SAND: grey, medium to coarse grained, sub-rounded to sub-angular.	W			
							4		SM	Silty SAND: dark grey, coarse grained, sub-angular.	W			

Method
AD/T - Auger drilling TC bit
AD/V - Auger drilling V bit
WB - Washbore
SPT - Standard penetration test
PT - Push tube
AS - Auger screwing
CT - Continuous push tube 1.5m long 76mm diameter

Penetration
No resistance
Refusal

Water
▽ Inflow
◁ Partial Loss
◀ Complete Loss

Samples and Tests
U - Undisturbed Sample
D - Disturbed Sample
SPT - Standard Penetration Test
ES - Environmental Sample
TW - Thin Walled
LB - Large Disturbed Sample

Moisture Condition
D - Dry
M - Moist
W - Wet

Consistency/Relative Density
VS - Very soft
S - Soft
F - Firm
St - Stiff
VSt - Very stiff
H - Hard
VL - Very loose
L - Loose
MD - Medium dense
D - Dense
VD - Very dense
Ce - Cemented
C - Compact

Logged in accordance with AS 1726:2017 Geotechnical site investigations

Engineering Log - Non Cored Borehole

Project No.: PSM4029

Client:	Charter Hall	Commenced:	09/08/2021
Project Name:	520 Gardeners Road Alexandria	Completed:	09/08/2021
Hole Location:		Logged By:	BT
Hole Position:	332588.0 m E 6245377.0 m N MGA2020 Zone 56	Checked By:	AS

Drill Model and Mounting:	Hanjin DB8	Inclination:	-90°	RL Surface:	No survey
Hole Diameter:		Bearing:		Datum:	AHD

Operator: JK Drilling

Drilling Information								Soil Description						Observations
Method	Penetration	Support	Water	Samples Tests Remarks	Recovery	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description SOIL NAME: Plasticity, behaviour or particle characteristics of primary component, colour, secondary components, additional observations	Moisture Condition	Consistency / Relative Density	Hand Penetrometer UCS (kPa) 100 200 300 400 500	Structure, Zoning, Origin, Additional Observations
WB		C					6		SM	Silty SAND: dark grey, coarse grained, sub-angular. *(continued)*	W			
							7							
							8							
							9							

Method
AD/T - Auger drilling TC bit
AD/V - Auger drilling V bit
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CT - Continuous push tube 1.5m long 76mm diameter

Penetration
No resistance
Refusal

Water
Inflow
Partial Loss
Complete Loss

Samples and Tests
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Logged in accordance with AS 1726:2017 Geotechnical site investigations

Engineering Log - Non Cored Borehole

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Client:	Charter Hall	Commenced:	09/08/2021
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Hole Location:		Logged By:	BT
Hole Position:	332588.0 m E 6245377.0 m N MGA2020 Zone 56	Checked By:	AS

Drill Model and Mounting:	Hanjin DB8	Inclination:	-90°	RL Surface:	No survey
Hole Diameter:		Bearing:		Datum:	AHD Operator: JK Drilling

Drilling Information								*Soil Description*					*Observations*
Method	Penetration	Support	Water	Samples Tests Remarks	Recovery	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description SOIL NAME: Plasticity, behaviour or particle characteristics of primary component, colour, secondary components, additional observations	Moisture Condition	Consistency / Relative Density	Hand Penetrometer UCS (kPa) 100 200 300 400 500	Structure, Zoning, Origin, Additional Observations
WB		C					11			CLAY band: dark grey.	W			
							12			CLAY band: dark grey.				
							13			CLAY band: dark grey.				
							14			CLAY band: dark grey.				

Method
AD/T - Auger drilling TC bit
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No resistance
Refusal

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Partial Loss
Complete Loss

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Logged in accordance with AS 1726:2017 Geotechnical site investigations

Engineering Log - Non Cored Borehole

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Hole Position:	332588.0 m E 6245377.0 m N MGA2020 Zone 56	Checked By:	AS

Drill Model and Mounting:	Hanjin DB8	Inclination:	-90°	RL Surface:	No survey
Hole Diameter:		Bearing:		Datum:	AHD

Operator: JK Drilling

Drilling Information								*Soil Description*					*Observations*
Method	Penetration	Support	Water	Samples Tests Remarks	Recovery	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description SOIL NAME: Plasticity, behaviour or particle characteristics of primary component, colour, secondary components, additional observations	Moisture Condition	Consistency / Relative Density	Hand Penetrometer UCS (kPa) 100 200 300 400 500	Structure, Zoning, Origin, Additional Observations
WB		C					16			CLAY band: dark grey.				
									CH	CLAY: grey, high plasticity.				
							17			Becomes orange-grey.	W			
							18							
							19							

Method
AD/T - Auger drilling TC bit
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Engineering Log - Non Cored Borehole

Project No.: PSM4029

Client:	Charter Hall	Commenced:	09/08/2021
Project Name:	520 Gardeners Road Alexandria	Completed:	09/08/2021
Hole Location:		Logged By:	BT
Hole Position:	332588.0 m E 6245377.0 m N MGA2020 Zone 56	Checked By:	AS

Drill Model and Mounting:	Hanjin DB8	Inclination:	-90°	RL Surface:	No survey
Hole Diameter:		Bearing:		Datum:	AHD

Operator: JK Drilling

Drilling Information								Soil Description						Observations
Method	Penetration	Support	Water	Samples Tests Remarks	Recovery	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description SOIL NAME: Plasticity, behaviour or particle characteristics of primary component, colour, secondary components, additional observations	Moisture Condition	Consistency / Relative Density	Hand Penetrometer UCS (kPa) 100 200 300 400 500	Structure, Zoning, Origin, Additional Observations
WB		C					21			Becomes orange-grey. *(continued)* Becomes reddish grey.	W			
							22							
							23							
							24			Continued from non-cored borehole sheet				

Method
AD/T - Auger drilling TC bit
AD/V - Auger drilling V bit
WB - Washbore
SPT - Standard penetration test
PT - Push tube
AS - Auger screwing
CT - Continuous push tube 1.5m long 76mm diameter

Penetration
No resistance
Refusal

Water
Inflow
Partial Loss
Complete Loss

Samples and Tests
U - Undisturbed Sample
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Moisture Condition
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VL - Very loose
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MD - Medium dense
D - Dense
VD - Very dense
Ce - Cemented
C - Compact

Logged in accordance with AS 1726:2017 Geotechnical site investigations

Engineering Log - Cored Borehole

Project No.: PSM4029

Client:	Charter Hall	Commenced:	09/08/2021
Project Name:	520 Gardeners Road Alexandria	Completed:	09/08/2021
Hole Location:		Logged By:	BT
Hole Position:	332588.0 m E 6245377.0 m N MGA2020 Zone 56	Checked By:	AS

Drill Model and Mounting:	Hanjin DB8	Inclination:	-90°	RL Surface:	No survey		
Barrel Type and Length:	NLMC 3 m	Bearing:		Datum:	AHD	Operator:	JK Drilling

Drilling Information | **Rock Substance** | **Rock Mass Defects**

Method	Water	RQD (%)	Samples and Field Tests	WPT (Lugeons)	RL (m)	Depth (m)	Graphic Log	Material Description: ROCK NAME: particle/grain characteristics, colour, fabric/texture, inclusions or minor components, moisture, mineral composition, alteration	Weathering (XW HW MW SW FR)	Strength Is(50) ● - Axial ○ - Diametral (VL L M H VH EH; 0.1 0.3 1 3 10)	Defect Spacing (mm) (<20 60 200 600 1000)	Defect Descriptions / Comments: Description, alpha/beta, infilling or coating, shape, roughness, thickness, other
NMLC		85	Is(50) a=0.01 MPa			26		Continued from non-cored borehole sheet CLAY: red - grey and brown, high plasticity, hard.				25.00: PP: 360 kPa. 25.20: PP: 370 kPa.
								Becomes grey.				25.40: PP: 410 kPa. 25.60: PP: 510 kPa. 25.80: PP: 500 kPa. 26.00: PP: 480 kPa. 26.20: PP: 480 kPa. 26.40: PP: 450 kPa.
			Is(50) a=0.07 MPa			27		SHALE: dark grey.				FZ 26.60: PP: 280 kPa. FZ 26.80: PP: 270 kPa. FZ 27.00: PP: 160 kPa. BP, 10°, CL, 10 mm 27.20: PP: >600 kPa. FZ, 20 mm BP, 0°, CL, 15 mm BP, 0°, CN, CU, S BP, 0°, CN, CU, S BP, 0°, CL, S BP, 0°, CN, PR, S BP, 0°, SN, PR, S BP, 0°, CN, PR, S
			Is(50) a=0.25 MPa									
			Is(50) a=0.23 MPa			28						
		68	Is(50) a=0.28 MPa			29						BP, 0°, CN, PR, S BP, 5°, CN, PR, S FZ, CN, PR, S, 10 mm BP, 5°, CN, CU, S BP, 5°, CN, PR, S BP, 5°, CN, PR, S BP, 5°, CN, S BP, 5°, CN, S FZ, 250 mm
			Is(50) a=0.28 MPa									
			Is(50) a=0.47 MPa									
			Is(50) a=0.34 MPa									

Method
AD/T - Auger drilling TC bit
AD/V - Auger drilling V bit
WB - Washbore
HQ3- Wireline core (63.5 mm)
PQ3- Wireline core (85.0 mm)
SPT - Standard penetration test
PT - Push tube
WPT - Water pressure test

Water
Inflow
Partial Loss
Complete Loss

Graphic Log/Core Loss
Core recovered (hatching indicates material)
No core recovery

Weathering
XW - Extremely Weathered
HW - Highly Weathered
MW - Moderately Weathered
SW - Slightly Weathered
FR - Fresh

Strength
VL - Very Low
L - Low
M - Medium
H - High
VH - Very High
EH - Extremely High

Defect Type
FT - Fault
SS - Shear Surface
SZ - Shear Zone
BP - Bedding parting
SM - Seam
IS - Infilled Seam
JT - Joint
CO - Contact
CZ - Crushed Zone
VN - Vein
FZ - Fracture Zone
BSH - Bedding Shear
DB - Drilling Break

Infilling/Coating
CN - Clean
SN - Stain
VN - Veneer
CO - Coating
RF - Rock fragments
G - Gravel
S - Sand
Z - Silt
CA - Calcite
CL - Clay
FE - Iron
QZ - Quartz
X - Carbonaceous

Roughness
SL - Slickensided
POL - Polished
S - Smooth
RF - Rough
VR - Very Rough

Shape
PR - Planar
CU - Curved
UN - Undulating
ST - Stepped
IR - Irregular

Logged in accordance with AS 1726:2017 Geotechnical site investigations

Engineering Log - Cored Borehole

Project No.: PSM4029

Client:	Charter Hall	Commenced:	09/08/2021
Project Name:	520 Gardeners Road Alexandria	Completed:	09/08/2021
Hole Location:		Logged By:	BT
Hole Position:	332588.0 m E 6245377.0 m N MGA2020 Zone 56	Checked By:	AS

Drill Model and Mounting:	Hanjin DB8	Inclination:	-90°	RL Surface:	No survey		
Barrel Type and Length:	NLMC 3 m	Bearing:		Datum:	AHD	Operator:	JK Drilling

Drilling Information | **Rock Substance** | **Rock Mass Defects**

Method	Water	RQD (%)	Samples and Field Tests	WPT (Lugeons)	RL (m)	Depth (m)	Graphic Log	Material Description (ROCK NAME: particle/grain characteristics, colour, fabric/texture, inclusions or minor components, moisture, mineral composition, alteration)	Weathering (XW HW MW SW FR)	Strength Is(50) (● - Axial, O - Diametral) (VL 0.1 L 0.3 M 1 H 3 VH 10 EH)	Defect Spacing (mm) (<20 60 200 600 1000)	Defect Descriptions / Comments (Description, alpha/beta, infilling or coating, shape, roughness, thickness, other)
NMLC		68	Is(50) d=1 MPa; Is(50) d=0.4 MPa					SHALE: dark grey.*(continued)*	SW	M–H		BP, 10°, CN, PR, S BP, 10°, CN, PR, S FZ JT, 20°, CN, ST, S JT, 20°, CN, ST, S SM, CL FZ JT, 0°, CN, PR, S JT, 0°, CN, PR, S JT, 90°, CN, PR, S JT, 0°, CN, PR, S JT, 0°, CN, PR, S JT, 0°, CN, PR, S JT, 0°, CN, PR, S
						31		Hole Terminated at 31.00 m Target depth				
						32						
						33						
						34						

Method
AD/T - Auger drilling TC bit
AD/V - Auger drilling V bit
WB - Washbore
HQ3- Wireline core (63.5 mm)
PQ3- Wireline core (85.0 mm)
SPT - Standard penetration test
PT - Push tube
WPT - Water pressure test

Water
Inflow
Partial Loss
Complete Loss

Graphic Log/Core Loss
Core recovered (hatching indicates material)
No core recovery

Weathering
XW - Extremely Weathered
HW - Highly Weathered
MW - Moderately Weathered
SW - Slightly Weathered
FR - Fresh

Strength
VL - Very Low
L - Low
M - Medium
H - High
VH - Very High
EH - Extremely High

Defect Type
FT - Fault
SS - Shear Surface
SZ - Shear Zone
BP - Bedding parting
SM - Seam
IS - Infilled Seam
JT - Joint
CO - Contact
CZ - Crushed Zone
VN - Vein
FZ - Fracture Zone
BSH - Bedding Shear
DB - Drilling Break

Infilling/Coating
CN - Clean
SN - Stain
VN - Veneer
CO - Coating
RF - Rock fragments
G - Gravel
S - Sand
Z - Silt
CA - Calcite
CL - Clay
FE - Iron
QZ - Quartz
X - Carbonaceous

Roughness
SL - Slickensided
POL - Polished
S - Smooth
RF - Rough
VR - Very Rough

Shape
PR - Planar
CU - Curved
UN - Undulating
ST - Stepped
IR - Irregular

Logged in accordance with AS 1726:2017 Geotechnical site investigations


PSM
JOB No.: PSM4029.10
PROJECT: Gardeners Rd
LOCATION:
BH ID: BH01
FROM: 25.0m
TO: 31.0m
DATE: 9/08/2021
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1m
25
26
27
28
29
30

Borehole ID

BH B

Engineering Log - Non Cored Borehole

Project No.: PSM4029

Client:	Charter Hall	Commenced:	10/08/2021
Project Name:	520 Gardeners Road Alexandria	Completed:	10/08/2021
Hole Location:		Logged By:	JD
Hole Position:	332601.0 m E 6245232.0 m N MGA2020 Zone 56	Checked By:	AS

Drill Model and Mounting:	Hanjin DB8	Inclination:	-90°	RL Surface:	No survey
Hole Diameter:	125 mm	Bearing:		Datum:	AHD

Operator: JK Drilling

Drilling Information								Soil Description						Observations
Method	Penetration	Support	Water	Samples Tests Remarks	Recovery	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description SOIL NAME: Plasticity, behaviour or particle characteristics of primary component, colour, secondary components, additional observations	Moisture Condition	Consistency / Relative Density	Hand Penetrometer UCS (kPa) 100 200 300 400 500	Structure, Zoning, Origin, Additional Observations
										ASPHALT - 120 mm.	D	D		
										CONCRETE - 200 mm.	D	D		
AD/T		N					1		SP	Gravelly SAND with Silt: brown, sub-rounded, gravels up to 40 mm.	M	D L		
							2		SM	Silty SAND: grey, medium to coarse grained, sub-rounded to sub-angular.	W W	L L		2.00: Encontered interbedded clay bands up to 500mm thick.
WB		C					3							
							4			CLAY band: dark grey.	W			

Method
AD/T - Auger drilling TC bit
AD/V - Auger drilling V bit
WB - Washbore
SPT - Standard penetration test
PT - Push tube
AS - Auger screwing
CT - Continuous push tube 1.5m long 76mm diameter

Penetration
No resistance
Refusal

Water
Inflow
Partial Loss
Complete Loss

Samples and Tests
U - Undisturbed Sample
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ES - Environmental Sample
TW - Thin Walled
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Engineering Log - Non Cored Borehole

Project No.: PSM4029

Client:	Charter Hall	Commenced:	10/08/2021
Project Name:	520 Gardeners Road Alexandria	Completed:	10/08/2021
Hole Location:		Logged By:	JD
Hole Position:	332601.0 m E 6245232.0 m N MGA2020 Zone 56	Checked By:	AS

Drill Model and Mounting:	Hanjin DB8	Inclination:	-90°	RL Surface:	No survey
Hole Diameter:	125 mm	Bearing:		Datum:	AHD

Operator: JK Drilling

Drilling Information								*Soil Description*						*Observations*
Method	Penetration	Support	Water	Samples Tests Remarks	Recovery	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description SOIL NAME: Plasticity, behaviour or particle characteristics of primary component, colour, secondary components, additional observations	Moisture Condition	Consistency / Relative Density	Hand Penetrometer UCS (kPa) 100 200 300 400 500	Structure, Zoning, Origin, Additional Observations
WB		C					6 7 8 9		SM	Silty SAND: grey, medium to coarse grained, sub-rounded to sub-angular. *(continued)*	W			

Method
AD/T - Auger drilling TC bit
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Hole Position:	332601.0 m E 6245232.0 m N MGA2020 Zone 56	Checked By:	AS

Drill Model and Mounting:	Hanjin DB8	Inclination:	-90°	RL Surface:	No survey
Hole Diameter:	125 mm	Bearing:		Datum:	AHD

Operator: JK Drilling

Drilling Information								*Soil Description*					*Observations*
Method	Penetration	Support	Water	Samples Tests Remarks	Recovery	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description SOIL NAME: Plasticity, behaviour or particle characteristics of primary component, colour, secondary components, additional observations	Moisture Condition	Consistency / Relative Density	Hand Penetrometer UCS (kPa) 100 200 300 400 500	Structure, Zoning, Origin, Additional Observations
WB		C					11		SM	Silty SAND: grey, medium to coarse grained, sub-rounded to sub-angular. *(continued)*	W			
									CH	CLAY band: dark grey.	W			
									SM	Silty SAND: grey, medium to coarse grained, sub-rounded to sub-angular.				
							12							
							13				W			
							14							

Method
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Logged in accordance with AS 1726:2017 Geotechnical site investigations

Engineering Log - Non Cored Borehole

Project No.: PSM4029

Client:	Charter Hall	Commenced:	10/08/2021
Project Name:	520 Gardeners Road Alexandria	Completed:	10/08/2021
Hole Location:		Logged By:	JD
Hole Position:	332601.0 m E 6245232.0 m N MGA2020 Zone 56	Checked By:	AS

Drill Model and Mounting:	Hanjin DB8	Inclination:	-90°	RL Surface:	No survey
Hole Diameter:	125 mm	Bearing:		Datum:	AHD

Operator: JK Drilling

Drilling Information								Soil Description						Observations
Method	Penetration	Support	Water	Samples Tests Remarks	Recovery	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description SOIL NAME: Plasticity, behaviour or particle characteristics of primary component, colour, secondary components, additional observations	Moisture Condition	Consistency / Relative Density	Hand Penetrometer UCS (kPa) 100 200 300 400 500	Structure, Zoning, Origin, Additional Observations
WB		C					16 17 18 19		CH	CLAY: orange-grey to brown-grey, high plasticity.	W			15.00: Inferred NATURAL.

Method
AD/T - Auger drilling TC bit
AD/V - Auger drilling V bit
WB - Washbore
SPT - Standard penetration test
PT - Push tube
AS - Auger screwing
CT - Continuous push tube 1.5m long 76mm diameter

Penetration
No resistance
Refusal

Water
Inflow
Partial Loss
Complete Loss

Samples and Tests
U - Undisturbed Sample
D - Disturbed Sample
SPT - Standard Penetration Test
ES - Environmental Sample
TW - Thin Walled
LB - Large Disturbed Sample

Moisture Condition
D - Dry
M - Moist
W - Wet

Consistency/Relative Density
VS - Very soft
S - Soft
F - Firm
St - Stiff
VSt - Very stiff
H - Hard
VL - Very loose
L - Loose
MD - Medium dense
D - Dense
VD - Very dense
Ce - Cemented
C - Compact

Logged in accordance with AS 1726:2017 Geotechnical site investigations

Engineering Log - Non Cored Borehole

Project No.: PSM4029

Client:	Charter Hall	Commenced:	10/08/2021
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Hole Location:		Logged By:	JD
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Drill Model and Mounting:	Hanjin DB8	Inclination:	-90°	RL Surface:	No survey
Hole Diameter:	125 mm	Bearing:		Datum:	AHD

Operator: JK Drilling

Drilling Information								*Soil Description*					*Observations*
Method	Penetration	Support	Water	Samples Tests Remarks	Recovery	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description SOIL NAME: Plasticity, behaviour or particle characteristics of primary component, colour, secondary components, additional observations	Moisture Condition	Consistency / Relative Density	Hand Penetrometer UCS (kPa) 100 200 300 400 500		Structure, Zoning, Origin, Additional Observations
WB		C					21		CH	CLAY: orange-grey to brown-grey, high plasticity. *(continued)*	W				
							22			Continued on cored borehole sheet					
							23								
							24								

Method
AD/T - Auger drilling TC bit
AD/V - Auger drilling V bit
WB - Washbore
SPT - Standard penetration test
PT - Push tube
AS - Auger screwing
CT - Continuous push tube 1.5m long 76mm diameter

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Engineering Log - Cored Borehole

Project No.: PSM4029

Client:	Charter Hall	Commenced:	10/08/2021
Project Name:	520 Gardeners Road Alexandria	Completed:	10/08/2021
Hole Location:		Logged By:	JD
Hole Position:	332601.0 m E 6245232.0 m N MGA2020 Zone 56	Checked By:	AS

Drill Model and Mounting:	Hanjin DB8	Inclination:	-90°	RL Surface:	No survey	
Barrel Type and Length:	NLMC 3 m	Bearing:		Datum:	AHD	Operator: JK Drilling

Drilling Information							*Rock Substance*						*Rock Mass Defects*	
Method	Water	RQD (%)	Samples and Field Tests	WPT (Lugeons)	RL (m)	Depth (m)	Graphic Log	Material Description ROCK NAME: particle/grain characteristics, colour, fabric/texture, inclusions or minor components, moisture, mineral composition, alteration	Weathering XW HW MW SW FR	Strength Is(50) ● - Axial ○ - Diametral VL L M H VH EH 0.1 0.3 1 3 10	Defect Spacing (mm) <20 60 200 600 1000	Defect Descriptions / Comments Description, alpha/beta, infilling or coating, shape, roughness, thickness, other
						21						
						22		Continued from non-cored borehole sheet				
NMLC		33	Is(50) a=0.05 MPa Is(50) a=0.06 MPa Is(50) a=0.03 MPa Is(50) a=0.01 MPa			22 23 24		CLAY: orange-grey to brown-grey, high plasticity.*(continued)* SHALE: dark grey.				22.50: PP: 190 kPa. 22.60: PP: 350 kPa. 22.75: PP: 310 kPa. 22.85: PP: 480 kPa. 23.00: PP: 550 kPa. SM, 0°, CL, 200 mm 23.25: PP: >600 kPa. 23.35: PP: >600 kPa. 23.50: PP: 420 kPa. SM, 0°, CL, PR, 20 mm 23.60: PP: >600 kPa. BP, 0°, CL, PR, RF 23.75: PP: >600 kPa. 23.80: PP: 520 kPa. 23.90: PP: >600 kPa. BP, 0°, FE, PR, RF 24.00: PP: >600 kPa. BP, 0°, FE-SN, PR, RF FZ, 10°, RF, 100 mm JT, 30°, FE-SN, PR, RF BP, 15°, FE-SN, PR, VR 24.35: PP: >600 kPa. BP, 5°, FE-SN, PR, RF 24.45: PP: >600 kPa. BP, 5°, FE-SN, PR, RF 24.60: PP: 490 kPa. BP, 5°, FE-SN, PR, RF

Method
AD/T - Auger drilling TC bit
AD/V - Auger drilling V bit
WB - Washbore
HQ3- Wireline core (63.5 mm)
PQ3- Wireline core (85.0 mm)
SPT- Standard penetration test
PT - Push tube
WPT - Water pressure test

Water
Inflow
Partial Loss
Complete Loss

Graphic Log/Core Loss
Core recovered (hatching indicates material)
No core recovery

Weathering
XW - Extremely Weathered
HW - Highly Weathered
MW - Moderately Weathered
SW - Slightly Weathered
FR - Fresh

Strength
VL - Very Low
L - Low
M - Medium
H - High
VH - Very High
EH - Extremely High

Defect Type
FT - Fault
SS - Shear Surface
SZ - Shear Zone
BP - Bedding parting
SM - Seam
IS - Infilled Seam
JT - Joint
CO - Contact
CZ - Crushed Zone
VN - Vein
FZ - Fracture Zone
BSH - Bedding Shear
DB - Drilling Break

Infilling/Coating
CN - Clean
SN - Stain
VN - Veneer
CO - Coating
RF - Rock fragments
G - Gravel
S - Sand
Z - Silt
CA - Calcite
CL - Clay
FE - Iron
QZ - Quartz
X - Carbonaceous

Roughness
SL - Slickensided
POL - Polished
S - Smooth
RF - Rough
VR - Very Rough

Shape
PR - Planar
CU - Curved
UN - Undulating
ST - Stepped
IR - Irregular

Logged in accordance with AS 1726:2017 Geotechnical site investigations

Engineering Log - Cored Borehole

Project No.: PSM4029

Client:	Charter Hall	Commenced:	10/08/2021
Project Name:	520 Gardeners Road Alexandria	Completed:	10/08/2021
Hole Location:		Logged By:	JD
Hole Position:	332601.0 m E 6245232.0 m N MGA2020 Zone 56	Checked By:	AS

Drill Model and Mounting:	Hanjin DB8	Inclination:	-90°	RL Surface:	No survey	
Barrel Type and Length:	NLMC 3 m	Bearing:		Datum:	AHD	Operator: JK Drilling

Drilling Information							Rock Substance					Rock Mass Defects	
Method	Water	RQD (%)	Samples and Field Tests	WPT (Lugeons)	RL (m)	Depth (m)	Graphic Log	Material Description ROCK NAME: particle/grain characteristics, colour, fabric/texture, inclusions or minor components, moisture, mineral composition, alteration	Weathering XW HW MW SW FR	Strength Is(50) ● - Axial ○ - Diametral VL L M H VH EH 0.1 0.3 1 3 10	Defect Spacing (mm) <20 60 200 600 1000	Defect Descriptions / Comments Description, alpha/beta, infilling or coating, shape, roughness, thickness, other
NMLC		68	Is(50) a=0.13 MPa			26		SHALE: grey to dark grey.				BP, 5°, CL, PR, 5 mm 24.85: PP: 380 kPa. FZ, 0°, RF, 250 mm BP, 5°, CL, PR, 20 mm FZ, 0°, RF, 170 mm BP, 0°, CN, PR, S BP, 0°, FE-SN, PR, S BP, 0°, CN, PR, RF
			Is(50) a=0.24 MPa									BP, 0°, CN, PR, RF BP, 0°, CN, PR, RF BP, 0°, CN, PR, RF BP, 0°, CN, PR, RF BP, 0°, CN, PR, RF BP, 0°, CN, PR, RF BP, 0°, CN, PR, RF BP, 0°, CN, PR, RF
			Is(50) a=0.18 MPa									
			Is(50) a=0.08 MPa			27						BP, 0°, CN, PR, RF BP, 0°, CN, PR, RF BP, 0°, CN, PR, RF BP, 0°, CN, PR, RF BP, 0°, CN, PR, RF BP, 0°, CN, PR, RF BP, 0°, CN, PR, RF BP, 0°, CN, PR, RF BP, 0°, CN, PR, RF BP, 0°, CN, PR, RF BP, 0°, CN, PR, RF BP, 0°, CL, PR, 120 mm BP, 5°, CN, PR, RF
			Is(50) a=0.16 MPa									
		67	Is(50) a=0.32 MPa			28						BP, 0°, FE-SN, PR, RF BP, 0°, FE-SN, PR, RF FZ, 0°, RF, 20 mm BP, CL, PR, 5 mm BP, CL, PR, 5 mm BP, 5°, FE-SN, ST, RF
			Is(50) a=0.24 MPa									BP, 5°, FE-SN, PR, RF FZ, 0°, RF, 100 mm BP, 5°, FE-SN, PR, S
			Is(50) a=0.32 MPa			29						BP, 0°, FE-SN, PR, RF
			Is(50) a=0.24 MPa									BP, 0°, FE-SN, PR, RF

Method
AD/T - Auger drilling TC bit
AD/V - Auger drilling V bit
WB - Washbore
HQ3- Wireline core (63.5 mm)
PQ3- Wireline core (85.0 mm)
SPT- Standard penetration test
PT - Push tube
WPT - Water pressure test

Water
Inflow
Partial Loss
Complete Loss

Graphic Log/Core Loss
Core recovered (hatching indicates material)
No core recovery

Weathering
XW - Extremely Weathered
HW - Highly Weathered
MW - Moderately Weathered
SW - Slightly Weathered
FR - Fresh

Strength
VL - Very Low
L - Low
M - Medium
H - High
VH - Very High
EH - Extremely High

Defect Type
FT - Fault
SS - Shear Surface
SZ - Shear Zone
BP - Bedding parting
SM - Seam
IS - Infilled Seam
JT - Joint
CO - Contact
CZ - Crushed Zone
VN - Vein
FZ - Fracture Zone
BSH - Bedding Shear
DB - Drilling Break

Infilling/Coating
CN - Clean
SN - Stain
VN - Veneer
CO - Coating
RF - Rock fragments
G - Gravel
S - Sand
Z - Silt
CA - Calcite
CL - Clay
FE - Iron
QZ - Quartz
X - Carbonaceous

Roughness
SL - Slickensided
POL - Polished
S - Smooth
RF - Rough
VR - Very Rough

Shape
PR - Planar
CU - Curved
UN - Undulating
ST - Stepped
IR - Irregular

Logged in accordance with AS 1726:2017 Geotechnical site investigations

Engineering Log - Cored Borehole

Project No.: PSM4029

Client:	Charter Hall	Commenced:	10/08/2021
Project Name:	520 Gardeners Road Alexandria	Completed:	10/08/2021
Hole Location:		Logged By:	JD
Hole Position:	332601.0 m E 6245232.0 m N MGA2020 Zone 56	Checked By:	AS

Drill Model and Mounting:	Hanjin DB8	Inclination:	-90°	RL Surface:	No survey	
Barrel Type and Length:	NLMC 3 m	Bearing:		Datum:	AHD	Operator: JK Drilling

Drilling Information							Rock Substance								Rock Mass Defects	
Method	Water	RQD (%)	Samples and Field Tests	WPT (Lugeons)	RL (m)	Depth (m)	Graphic Log	Material Description ROCK NAME: particle/grain characteristics, colour, fabric/texture, inclusions or minor components, moisture, mineral composition, alteration	Weathering XW HW MW SW FR	Strength Is(50) ● - Axial ○ - Diametral VL L M H VH EH 0.1 0.3 1 3 10	Defect Spacing (mm) <20 60 200 600 1000	Defect Descriptions / Comments Description, alpha/beta, infilling or coating, shape, roughness, thickness, other
NMLC		67	Is(50) a=0,24 MPa					SHALE: grey to dark grey.*(continued)*				BP, 0°, CN, PR, RF SM, 0°, CL, PR, 20 mm BP, 15°, FE-SN, ST, RF FZ, 0°, RF, 100 mm
			Is(50) a=0,68 MPa			31		Hole Terminated at 31.00 m Target depth				
						32						
						33						
						34						

Method
AD/T - Auger drilling TC bit
AD/V - Auger drilling V bit
WB - Washbore
HQ3- Wireline core (63.5 mm)
PQ3- Wireline core (85.0 mm)
SPT- Standard penetration test
PT - Push tube
WPT - Water pressure test

Water
Inflow
Partial Loss
Complete Loss

Graphic Log/Core Loss
Core recovered (hatching indicates material)
No core recovery

Weathering
XW - Extremely Weathered
HW - Highly Weathered
MW - Moderately Weathered
SW - Slightly Weathered
FR - Fresh

Strength
VL - Very Low
L - Low
M - Medium
H - High
VH - Very High
EH - Extremely High

Defect Type
FT - Fault
SS - Shear Surface
SZ - Shear Zone
BP - Bedding parting
SM - Seam
IS - Infilled Seam
JT - Joint
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CZ - Crushed Zone
VN - Vein
FZ - Fracture Zone
BSH - Bedding Shear
DB - Drilling Break

Infilling/Coating
CN - Clean
SN - Stain
VN - Veneer
CO - Coating
RF - Rock fragments
G - Gravel
S - Sand
Z - Silt
CA - Calcite
CL - Clay
FE - Iron
QZ - Quartz
X - Carbonaceous

Roughness
SL - Slickensided
POL - Polished
S - Smooth
RF - Rough
VR - Very Rough

Shape
PR - Planar
CU - Curved
UN - Undulating
ST - Stepped
IR - Irregular

Logged in accordance with AS 1726:2017 Geotechnical site investigations


PSM
JOB No.: PSM4029.1G
PROJECT: Gardeners Rd
LOCATION:
BH ID: BH02
FROM: 22.20m
TO: 31.0m
DATE: 10/08/2021
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1m
22
22.2m
CORE LOSS 300mm
23
24
25
26
27
28
29
30

Appendix C
CBR Results

115 Wicks Road
Macquarie Park, NSW 2113
PO Box 976
North Ryde, Bc 1670
Telephone: 02 9888 5000
Facsimile: 02 9888 5001

SOIL TEST SERVICES

ABN 43 002 145 173

FOUR DAY SOAKED CALIFORNIA BEARING RATIO TEST REPORT

Client: Pells Sullivan Meynink
PSM Job No.: PSM4029.10

Ref No: L4658E
Report: 1
Report Date: 18/08/2021
Page 1 of 1

SAMPLE NUMBER	SA 1	SA 2
Surcharge (kg)	4.5	4.5
Maximum Dry Density (t/m^3)	1.90 STD	1.91 STD
Optimum Moisture Content (%)	11.9	11.9
Moulded Dry Density (t/m^3)	1.91	1.93
Sample Density Ratio (%)	101	101
Sample Moisture Ratio (%)	89	82
Moisture Contents		
Insitu (%)	17.9	14.7
Moulded (%)	10.6	9.8
After soaking and		
After Test, Top 30mm(%)	14.3	12.8
Remaining Depth (%)	12.6	12.2
Material Retained on 19mm Sieve (%)	0	0
Swell (%)	0.0	0.5
C.B.R. value:		
@5.0mm penetration	18	35

NOTES: Sampled and supplied by client. Samples tested as received.

- Refer to appropriate notes for soil descriptions
- Test Methods : AS 1289 6.1.1, 5.1.1 & 2.1.1.
- Date of receipt of sample: 11/08/2021.

NATA

NATA Accredited Laboratory Number:1327

18/08/2021
Authorised Signature / Date
(D. Treweek)

Appendix D
Previous PSM borehole

Borehole ID

BH-01

Engineering Log - Non Cored Borehole

Project No.: PSM4029.10

Client:		Commenced:	24/01/2020
Project Name:	520 Gardeners Road Alexandria Alexandria	Completed:	29/01/2020
Hole Location:	NSW	Logged By:	OS
Hole Position:	332608.0 m E 6245265.0 m N MGA94 Zone 56	Checked By:	AS
Drill Model and Mounting:	Hanjin DB8	Inclination: -90°	RL Surface: No survey
Hole Diameter:	HQ 3m	Bearing:	Datum: Operator: Terratest

Drilling Information								Soil Description						Observations
Method	Penetration	Support	Water	Samples Tests Remarks	Recovery	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description SOIL NAME: Plasticity, behaviour or particle characteristics of primary component, colour, secondary components, additional observations	Moisture Condition	Consistency / Relative Density	Hand Penetrometer UCS (kPa) 100 200 300 400 500	Structure, Zoning, Origin, Additional Observations
		N								CONCRETE.	D	Ce		0.00: PAVEMENT.
AD/T		N							SP	SAND: medium grained, brown; trace clay; observed occasional bands of clay, brown with organics.				
WB		C					5							
											W			
							10							
WB		N								Clay bands increasing in frequency from 14m.				
							15		CH	CLAY: high plasticity, pale grey red and orange.				
											W			
							20							
										Continued on cored borehole sheet				
							25							

Method
AD/T - Auger drilling TC bit
AD/V - Auger drilling V bit
WB - Washbore
SPT - Standard penetration test
PT - Push tube
AS - Auger Screwing

Penetration
No resistance
Refusal

Water
Inflow
Partial Loss
Complete Loss

Samples and Tests
U - Undisturbed Sample
D - Disturbed Sample
SPT - Standard Penetration Test
ES - Environmental Sample
TW - Thin Walled
LB - Large Disturbed Sample

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L - Loose
MD - Medium dense
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VD - Very dense
Ce - Cemented
C - Compact

Logged in accordance with AS 1726:2017 Geotechnical site investigations

Engineering Log - Cored Borehole

Project No.: PSM4029.10

Client:		Commenced:	24/01/2020
Project Name:	520 Gardeners Road Alexandria Alexandria	Completed:	29/01/2020
Hole Location:	NSW	Logged By:	OS
Hole Position:	332608.0 m E 6245265.0 m N MGA94 Zone 56	Checked By:	AS

Drill Model and Mounting:	Hanjin DB8	Inclination:	-90°	RL Surface:	No survey
Barrel Type and Length:	NMLC	Bearing:		Datum:	Operator: Terratest

Drilling Information							***Rock Substance***			***Rock Mass Defects***	
Method	Water	RQD (%)	Samples and Field Tests	WPT (Lugeons)	RL (m)	Depth (m)	Graphic Log	Material Description ROCK NAME: particle/grain characteristics, colour, fabric/texture, inclusions or minor components, moisture, mineral composition, alteration	Weathering XW HW MW SW FR Strength Is(50) ● - Axial ○ - Diametral VL L M H VH EH 0.1 0.3 1 3 10	Defect Spacing (mm) <20 60 200 600 1000	Defect Descriptions / Comments Description, alpha/beta, infilling or coating, shape, roughness, thickness, other
						21					
						22					
						23		Continued from non-cored borehole sheet			
NMLC		0				24		CLAY: high plasticity, pale grey and red brown, very stiff to hard, moist.			- 23.60: PP: 320kPa. - 23.80: PP: 400kPa. - 23.90: PP: 350kPa. - 24.10: PP: 220kPa. - 24.20: PP: 400kPa.
		82						NO CORE for 140mm.			
								SHALE: grey brown & orange, iron-stained.			FZ, 10°, RF, 100 mm SM, 0°, CL, PR, SM, 20 mm BP, 5°, FE SN, PR, RF BP, 5°, FE SN, PR, RF

Method
AD/T - Auger drilling TC bit
AD/V - Auger drilling V bit
WB - Washbore
HQ3- Wireline core (63.5 mm)
PQ3- Wireline core (85.0 mm)
SPT- Standard penetration test
PT - Push tube
WPT - Water pressure test

Water
Inflow
Partial Loss
Complete Loss

Graphic Log/Core Loss
Core recovered (hatching indicates material)
No core recovery

Weathering
XW - Extremely Weathered
HW - Highly Weathered
MW - Moderately Weathered
SW - Slightly Weathered
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Strength
VL - Very Low
L - Low
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Defect Type
FT - Fault
SS - Shear Surface
SZ - Shear Zone
BP - Bedding parting
SM - Seam
IS - Infilled Seam
JT - Joint
CO - Contact
CZ - Crushed Zone
VN - Vein
FZ - Fracture Zone
BSH - Bedding Shear
DB - Drilling Break

Infilling/Coating
CN - Clean
SN - Stain
VN - Veneer
CO - Coating
RF - Rock fragments
G - Gravel
S - Sand
Z - Silt
CA - Calcite
CL - Clay
FE - Iron
QZ - Quartz
X - Carbonaceous

Roughness
SL - Slickensided
POL - Polished
S - Smooth
RF - Rough
VR - Very Rough

Shape
PR - Planar
CU - Curved
UN - Undulating
ST - Stepped
IR - Irregular

Logged in accordance with AS 1726:2017 Geotechnical site investigations

Engineering Log - Cored Borehole

Project No.: PSM4029

Client:	JBS&G	Commenced:	24/01/2020
Project Name:	520-530 Gardeners Road Alexandria	Completed:	29/01/2020
Hole Location:	Alexandria NSW	Logged By:	OS
Hole Position:	332608.0 m E 6245265.0 m N MGA94 Zone 56	Checked By:	AS

Drill Model and Mounting:	Hanjin DB8	Inclination:	-90°	RL Surface:	No survey
Barrel Type and Length:	NMLC	Bearing:		Datum:	Operator: Terratest

Drilling Information							***Rock Substance***			***Rock Mass Defects***	
Method	Water	RQD (%)	Samples and Field Tests	WPT (Lugeons)	RL (m)	Depth (m)	Graphic Log	Material Description ROCK NAME: particle/grain characteristics, colour, fabric/texture, inclusions or minor components, moisture, mineral composition, alteration	Weathering (XW HW MW SW FR) / Strength Is(50) ● Axial ○ Diametral (VL L M H VH EH; 0.1 0.3 1 3 10)	Defect Spacing (mm) (<20 60 200 600 1000)	Defect Descriptions / Comments Description, alpha/beta, infilling or coating, shape, roughness, thickness, other
NMLC		82	Is(50) a=0.06 d=0 MPa			26		SHALE: grey brown & orange, iron-stained.*(continued)* Becomes grey, rock substance no longer ironstained.			BP, 5°, FE SN, PR, RF BP, 5°, FE/CL CO, PR, SM
								Iron staining no longer observed.			SM, 0°, CL, PR, SM, 10 mm, x2
			Is(50) a=0.09 MPa								JT, 80°, CN, PR, SM
			Is(50) a=0.02 MPa			27		Hole Terminated at 26.96 m Target depth			
						28					
						29					

Method
AD/T - Auger drilling TC bit
AD/V - Auger drilling V bit
WB - Washbore
HQ3- Wireline core (63.5 mm)
PQ3- Wireline core (85.0 mm)
SPT- Standard penetration test
PT - Push tube
WPT - Water pressure test

Water
Inflow
Partial Loss
Complete Loss

Graphic Log/Core Loss
Core recovered (hatching indicates material)
No core recovery

Weathering
XW - Extremely Weathered
HW - Highly Weathered
MW - Moderately Weathered
SW - Slightly Weathered
FR - Fresh

Strength
VL - Very Low
L - Low
M - Medium
H - High
VH - Very High
EH - Extremely High

Defect Type
FT - Fault
SS - Shear Surface
SZ - Shear Zone
BP - Bedding parting
SM - Seam
IS - Infilled Seam
JT - Joint
CO - Contact
CZ - Crushed Zone
VN - Vein
FZ - Fracture Zone
BSH - Bedding Shear
DB - Drilling Break

Infilling/Coating
CN - Clean
SN - Stain
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RF - Rock fragments
G - Gravel
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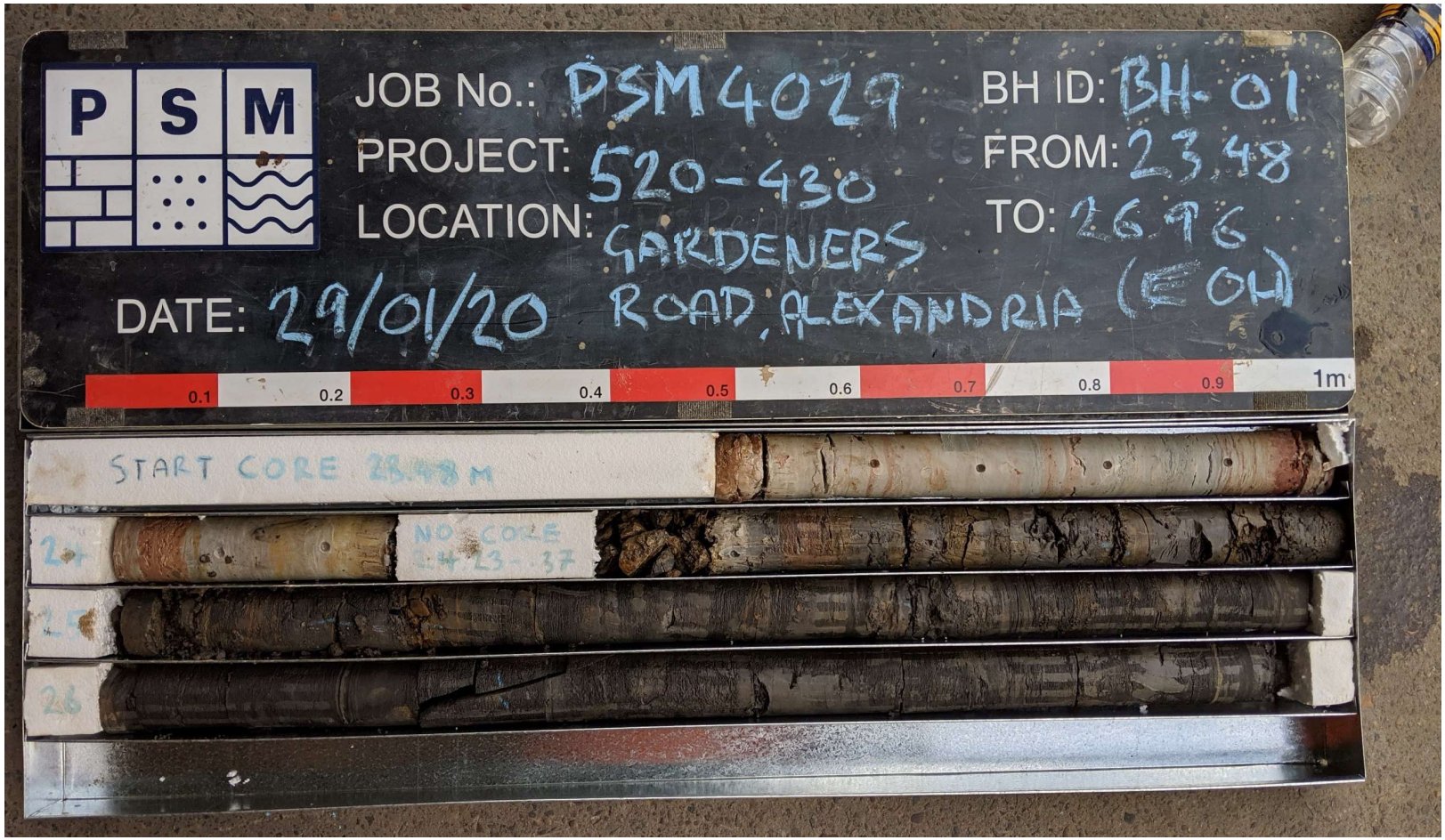
CA - Calcite
CL - Clay
FE - Iron
QZ - Quartz
X - Carbonaceous

Roughness
SL - Slickensided
POL - Polished
S - Smooth
RF - Rough
VR - Very Rough

Shape
PR - Planar
CU - Curved
UN - Undulating
ST - Stepped
IR - Irregular

Logged in accordance with AS 1726:2017 Geotechnical site investigations



Charter Hall
520 Gardeners Rd Alexandria
Alexandria NSW
BH-01
CORE PHOTO

PSM4029-103L	APPENDIX D

Appendix E
Piezometer Construction

Pells Sullivan Meynink
Engineering Consultants
Rock - Soil - Water

JOB no.: PSM4029.10

PROJECT: **520 Gardeners Rd, Alexandria**

PIEZOMETER CONSTRUCTION RECORD

HOLE NUMBER:	BH-A	DRILLING CONTRACTOR:	JKdrilling
PIEZOMETER:		DRILLING RIG:	
COLLAR EASTING:	332588.0	DEPTH OF HOLE (m):	8 m
COLLAR NORTHING:	6245377.0	BOREHOLE INCLINATION:	Vertical
COLLAR RL(m):		PIEZO INSTALLATION DATE:	09/08/2021
DATUM:	MGA 56	SUPERVISED BY:	JD

Tick boxes

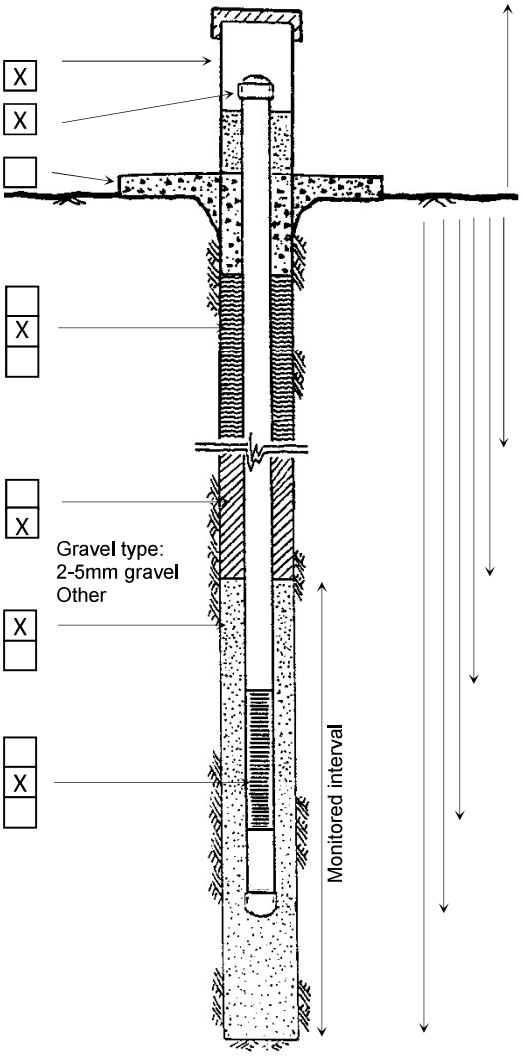
Steel protective well cover [X]
PVC cap [X]
Concrete Colar [ ]

Back Fill type
Cement bentonite [ ]
Soil [X]
None [ ]

Seal
Bentonite Pellets [ ]
Other [X]

Gravel type:
2-5 mm gravel [X]
Other [ ]

Perforation type:
Drill holes [ ]
Hack saw cuts [X]
40um machine slots [ ]



Complete dimensions if appropriate

Height of stickup (m)	
Diameter of PVC (mm)	50
Depth to top of seal	0.3 m
Depth to top of gravel pack	1.5 m
Depth to top of screen	2 m
Depth to base of screen	7 m
Depth to base of piezo	8 m
Depth to base of gravel	8 m

COMMENTS: Gatic cover were used for the protection

Appendix F
PSM4029-104S – Earthworks Specification

520 GARDENERS ROAD,

ALEXANDRIA, NSW

BULK EARTHWORKS SPECIFICATION

PSM4029-104S 27 August 2021

CHARTER HALL GROUP

PSM Consult Pty Limited ABN 47 134 739 496

www.psm.com.au

Table of Contents

List of Appendices

1 Scope

This specification details the requirements for the bulk earthworks to be undertaken at the proposed development at 520 Gardeners Road, Alexandria, NSW. The site area where this specification is applicable is shown in Appendix A

Fill placed in accordance with this specification is denoted as Engineered Fill.

This specification does not address any environmental, contamination or erosion issues with respect to the fill material.

2 Filling Works

2.1 Subgrade Preparation

The condition of the subgrade should be assessed immediately prior to filling commencing.

All Engineered Fill is to be placed on one of the following four (4) materials:

1. Bedrock.
2. Natural insitu material of at least stiff consistency.
3. Engineered compacted fill placed in accordance with this or other approved specifications for which the Geotechnical Inspection and Testing Authority (GITA) has a Level 1 certificate certifying compliance with that approved specification.
4. Other materials as approved by PSM.

Proof rolling shall only be undertaken under the direction of PSM. PSM may also direct a bridging layer of Engineered Fill be placed and compacted to a Dry or Hilf Density Ratio (Standard Compaction) of between 95% and 102%. Any such layer shall be a Lot under Clause 5.3.

The GITA should satisfy itself that the subgrade has not been desiccated, affected by rain or disturbed. If the GITA cannot so satisfy itself, then the subgrade should be moisture conditioned and compacted to be in accordance with Clauses 2.5 and 2.6 of this specification.

Engineered Fill shall be placed only on subgrade approved by the GITA as being in accordance with this specification.

2.2 Base Geometry

The slope of any buried batter shall be less than 1H:1V unless otherwise directed by PSM.

The contractor shall remove or flatten any geometrical obstructions (e.g., protrusions or holes) such that subsequent Engineered Fill can be placed to achieve the requirements of this specification.

Engineered Fill shall be placed only on areas where the base geometry has been approved by the GITA.

2.3 Material

2.3.1 Site won material

Site won material can be used as Engineered Fill as long as it meets the requirements in Clause 2.3.3.

2.3.2 Imported Fill

Imported Engineered Fill is to conform to one of the following definitions:

1. "Virgin excavated natural material" (**VENM**) as defined by the Protection of the Environment Operations Act 1997 No 156, Schedule 1, on Page 209:

   "Virgin excavated natural material (e.g., clay, gravel, sand, soil and rock) that is not mixed with any other waste and that:

a) has been excavated from areas that are not contaminated, as a result of industrial, commercial, mining or agricultural activities, with manufactured chemicals and that does not contain sulphide ores or soils, or

b) consists of excavated natural materials that meet such criteria as may be approved by the EPA".

2. "Excavated natural material" (**ENM**) as defined by the Protection of the Environment Operations (Waste) Regulation 2005 – General Exemption Under Part 6, Clause 51 and 51A, being the excavated natural material exemption 2012.

   "Excavated natural material is naturally occurring rock and soil (including but not limited to materials such as sandstone, shale, clay and soil) that has:

   a) been excavated from the ground, and.

   b) contains at least 98% (by weight) natural material, and.

   c) does not meet the definition of Virgin Excavated Natural Material in the Act.

   d) Excavated Natural Material does not include material that has been located in a hotspot; that has been processed; or that contains asbestos, Acid Sulphate Soils (ASS), Potential Acid Sulphate soils (PASS) or sulfidic ores."

   and which meets the requirements of this exemption.

2.3.3 All Fill

Engineered Fill shall be approved by the GITA as suitable for use in accordance with the requirements in this Specification.

Engineered Fill shall not comprise unsuitable material as defined by Clause 4.2 of AS3798-2007 "Guidelines on earthworks for commercial and residential developments" as:

a) "organic soils, such as many topsoils, severely root-affected subsoils and peat.

b) materials contaminated through past site usage which may contain toxic substances or soluble compounds harmful to water supply or agriculture.

c) materials containing substances which can be dissolved or leached out in the presence of moisture (e.g.: gypsum), or which undergo volume change or loss of strength when disturbed and exposed to moisture (e.g.: some shales and sandstones), unless these matters are specifically addressed in the design.

d) silts, or materials that have the deleterious engineering properties of silt.

e) other materials with properties that are unsuitable for the forming of structural fill; and

f) fill that contains wood, metal, plastic, boulders or other deleterious material, in sufficient proportions to affect the required performance of the fill."

The GITA shall assess that the proportion of deleterious material in each Lot is not greater than 0.25% by weight. Deleterious material is defined by Table 3015.3 of the RTA QA Specification 3051 (Edition 5 June 1998) as:

"Type III: Rubber, Plastic, Bitumen, Paper, Cloth, Paint, Wood and Other Vegetable Matter".

If the GITA is not able to visually assess the above criterion, the GITA shall arrange appropriate testing.

All Engineered Fill particles shall be able to be incorporated within a single layer. Further, less than 30% of particles shall be retained on the 37.5 mm sieve.

Engineered Fill shall be able to be tested in accordance with the Standard Compaction method (AS1289.5.4.1) or Hilf test method (AS1289.5.7.1). These methods require less than 20% retained on the 37.5 mm sieve. Where between 20% and 30% of particles are retained on the 37.5 mm sieve the above test methods shall still be adopted and test reports annotated appropriately.

These requirements should be met by the material after placement and compaction.

Only material approved by the GITA shall be placed as Engineered Fill.

2.4 Fill Zonation and Placement

Engineered Fill shall be placed in accordance with the following requirements:

1. In near horizontal, laterally extensive layers of uniform material and thickness, deposited systematically across the work area as determined by the GITA.
2. The compacted thickness of each layer shall be equal to or less than 300 mm.

Engineered Fill shall only be placed on subgrade in accordance with this specification and approved by the GITA.

2.5 Compaction

Engineered Fill shall be placed and compacted to a Dry or Hilf Density Ratio (Standard Compaction) of between 98% and 102%.

The in-situ density shall be measured over the full depth of each layer placed.

2.6 Moisture Control

The placement moisture variation or Hilf moisture variation shall be controlled to be between 2% dry of optimum and 2% wet of optimum.

Placement moisture content of the Engineered Fill shall be measured.

3 Cutting

3.1 Subgrade Condition

The subgrade is to comprise one of the following materials:

1. Bedrock.
2. Natural in-situ material of at least stiff consistency.
3. Other materials as approved by PSM.

Proof rolling shall only be undertaken under the direction of PSM.

The GITA should satisfy itself that the subgrade has not been desiccated, affected by rain or disturbed. If the GITA cannot so satisfy itself, then the subgrade should be excavated and filled to the BEL in accordance with this specification.

4 Survey

4.1 Filling areas

The survey requirements are as follows:

1. Any approved subgrade shall be surveyed prior to first filling such that subgrade levels are established to within ± 0.1 m.
2. The Lot boundaries shall be surveyed and shown on a plan drawing to an accuracy of at least +/- 1 m in plan and +/- 0.1 m in elevation.
3. The location of the field density tests shall be surveyed and shown on the Lot boundary plan drawing to an accuracy of at least +/-1 m in plan.
4. The elevation of the field density tests shall be surveyed to an accuracy of +/-0.05 m.

The plan drawing shall show at the boundaries of the site and other identifiable site features, so as to allow the location of the lots and the test to be recoverable.

4.2 Cutting areas

Any approved subgrade for cut areas shall be surveyed such that subgrade levels are established to within ± 0.1 m.

5 Inspection and Testing

5.1 Role of the GITA

The Geotechnical Inspection and Testing Authority (GITA) shall be contracted to document and certify that the works undertaken by the contractor has been completed in accordance with the relevant design and specifications.

5.2 Level 1 Control

The GITA shall adopt Level 1 responsibility as described in Section 8.2 of AS 3798-2007 "Guidelines on earthworks for commercial and residential developments":

> "*The primary objective of Level 1 Inspection and Testing is for the geotechnical inspection and testing authority (GITA) to be able to express an opinion on the compliance of the work. The GITA is responsible for ensuring that the inspection and testing are sufficient for this purpose.*
>
> *The geotechnical inspection and testing authority needs to have competent personnel on site at all times while earthwork operations are undertaken. Such operations include:*
>
> - Completion of removal of topsoil
> - Placing of imported or cut material
> - Compaction and adding/removal of moisture
> - Trenching and backfilling
> - Test rolling
> - Testing.
>
> *The superintendent should agree a suitable inspection and testing plan prior to commencement of the works.*
>
> *On completion of the earthworks, the GITA will usually be required to provide a report setting out the inspections, sampling and testing it has carried out, and the locations and results thereof. Unless very unusual conditions apply, the GITA should also be able to express an opinion that the works (as far as it has been able to determine) comply with the requirements of the specification and drawings*."

For this particular contract, Level 1 responsibility includes:

1. Lot testing as per Clause 5.3 of this specification.
2. A frequency of compaction testing not less than that specified in Clause 5.4 of this specification.
3. The GITA documenting and reporting its activity in the terms required by Clause 6 of this specification.
4. The GITA undertaking adequate inspections and testing to comply with the above requirements and to be able to certify the fill in the terms required by Clause 6 of this specification.

5.3 Lot Testing

This specification requires lot testing to be undertaken.

A Lot is defined as a single layer of Engineered Fill consisting of uniform material which has undergone similar treatment.

Lot testing comprises the following:

1. A Lot shall be identified by the Contractor or the GITA with a Lot Number and presented for testing.
2. A Lot shall be deemed to be in accordance with the specification if all the tests undertaken within the Lot are in accordance with the specification, i.e., "a none to fail basis".
3. If any one test undertaken within a Lot fails, the whole of the Lot shall be reworked and retested.

Any portion of the placed Engineered Fill must be part of a single lot and all Lots will require approval by the GITA.

5.4 Testing Frequency (Compaction Testing)

The frequency of compaction testing for each lot shall be the greater of:

- 1 test per 500 m^3 of material placed
- 3 tests per lot.

A laboratory moisture content test shall be undertaken for each field density test.

5.5 Proof rolling and plate load testing

Proof rolling, together with minor boxing out and refilling, of the upper surface of the bulk earthworks will be undertaken as directed by PSM. The plant to be adopted depends upon the design loads adopted by the structural engineers for each section of the site.

Plate load testing shall be undertaken at final bulk earthworks level (BEL). Expected test frequency is up to two days of testing for the entire site. The contractor is to make a suitable reaction (e.g., 20 tonne excavator) available for the tests.

5.6 Inspection, Testing and Survey

The GITA shall at least undertake the following tasks:

1. Identify the subgrade as one of the three (3) subgrade types listed in Clause 3.1 of this specification and assess that the subgrade condition of cut areas is in accordance with the subgrade condition requirements of Clause 3.1 of this specification.
2. Should Engineered Fill be required to fill overcut areas, assess that filling has been placed in accordance with this specification.
3. Identify the subgrade as one of the four (4) subgrade types listed in Clause 2.1 of this specification and assess that the subgrade condition of any area prior to placement of fill material is in accordance with the subgrade preparation requirements of Clause 2.1 of this specification.
4. Assess that the base geometry of any area prior to placement of fill material is in accordance with the base geometry requirements of Clause 2.2 of this specification.
5. For each Lot, identify the material as defined in Clause 2.3.1, Clause 2.3.2 or Clause 2.3.3 of this specification and assess that the material placed is in accordance with the fill material requirements of Clause 2.3 of this specification.
6. Assess the proportion of deleterious material for each Lot is in accordance with Clause 2.3.3 of this specification.
7. Assess that the Engineered Fill has been placed in accordance with the requirements for fill zonation and placement of Clause 2.4 of this specification.
8. Assess that each Lot as presented for approval by the contractor is in accordance with the requirements for Lot definition of Clause 5.3 of this specification.
9. Ensure that the survey requirements in Clause 3 of this specification have been completed.
10. Estimate the approximate volume of Engineered Fill placed in each Lot presented for approval.
11. Conduct Lot testing in accordance with the construction control testing requirements of Clauses 5.3 and 5.4 of this specification.
12. Assess that the compaction of each Lot is in accordance with the requirements of Clause 2.5 of this specification. The GITA shall select a depth of in situ density testing that allows the density of the full layer to be assessed.
13. Assess that the moisture variation of each Lot is in accordance with the requirements for moisture control in Clause 2.6 of this specification.
14. Conduct material property testing in accordance with the material testing requirements in this specification (e.g., Deleterious material testing if required).

6 Reporting and Certification

6.1 Reporting

The GITA shall produce at least the following reports:

1. *Subgrade Approval Reports* (a sample is attached). Such a report shall:
   - Document assessments undertaken for tasks 1 and 3 of Clause 5.6 including reporting the subgrade type
   - Document the subgrade survey that has been undertaken
   - Approve or reject the subgrade condition for cut areas based on task 1 of Clause 5.6
   - Approve or reject the subgrade condition and base geometry for filling, based on tasks 3 and 4 of Clause 5.6.
2. *Lot Approval Reports* (a sample is attached). Such a report shall:
   - Document assessments, testing and survey undertaken for tasks 5 to 14 of Clause 5.6
   - Report material identification undertaken for task 5 of Clause 5.6
   - Report proportion of deleterious material for task 6 of Clause 5.6
   - Report the results of testing undertaken for task 11 of Clause 5.6
   - Approve or reject lots based on tasks 12 and 13 of Clause 5.6.
3. *Material Testing Reports.* Such a report shall:
   - Report the results of material property testing undertaken for task 14 of Clause 5.6.
4. *Daily Reports* (a sample is attached). Such a report shall be completed daily and shall:
   - Document time spent on site by the GITA personnel
   - List subgrade assessments and approvals undertaken each day with reference to relevant Subgrade Approval Report(s)
   - List Lots presented, accepted and approved or rejected each day, with reference to relevant Lot Approval Report(s)
   - List survey undertaken each day as for task 9 of Clause 5.6 and not already documented in the Subgrade or Lot Approval Reports
   - Document other relevant activities undertaken on site that day (site instructions, breakdowns, compaction equipment used, etc.).

6.2 Certification

6.2.1 Weekly Certificates

The GITA shall produce a Weekly Certificate for any week in which earthworks are undertaken in accordance with this specification. The Weekly Certificate will cover all works from the previous Weekly Certificate until the end of work on a Saturday.

The Weekly Certificate shall transmit the following:

- Copy or reference to the complete specification document(s)
- Subgrade Approval Reports
- Lot Approval Reports
- Material Testing Reports
- Daily Reports
- Survey of subgrade geometry prior to filling or in cut areas
- Plan survey drawing showing lot boundaries and location of density tests
- Survey documenting filling undertaken to date and showing location of testing.

And certify that:

> *"All the earthworks undertaken and the subgrade condition in the cut areas [in the stated period] are documented in the above reports and have been undertaken in accordance with the Specification (Ref. PSM4029_104S dated 27 August 2021)."*

6.2.2 Interim or Final Filling Certificate

At the completion of the bulk earthworks, or as requested by the Client, the GITA shall provide an Interim or Final Filling Certificate which shall:

1. Transmit a reference list of the Weekly Certificates.
2. Provide an Excel spreadsheet presenting the results of all the acceptance testing completed by the GITA.
3. Certify that *"All the earthworks undertaken and the subgrade condition in the cut areas [in the stated period] are documented in the above reports and have been undertaken in accordance with the Specification (Ref. PSM4029_104S dated 27 August 2021)."*

Brisbane

Level 6, 500 Queen St
Brisbane QLD 4000
+61 7 3220 8300

Sydney

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North Ryde NSW 2113
+61 2 9812 5000

Perth

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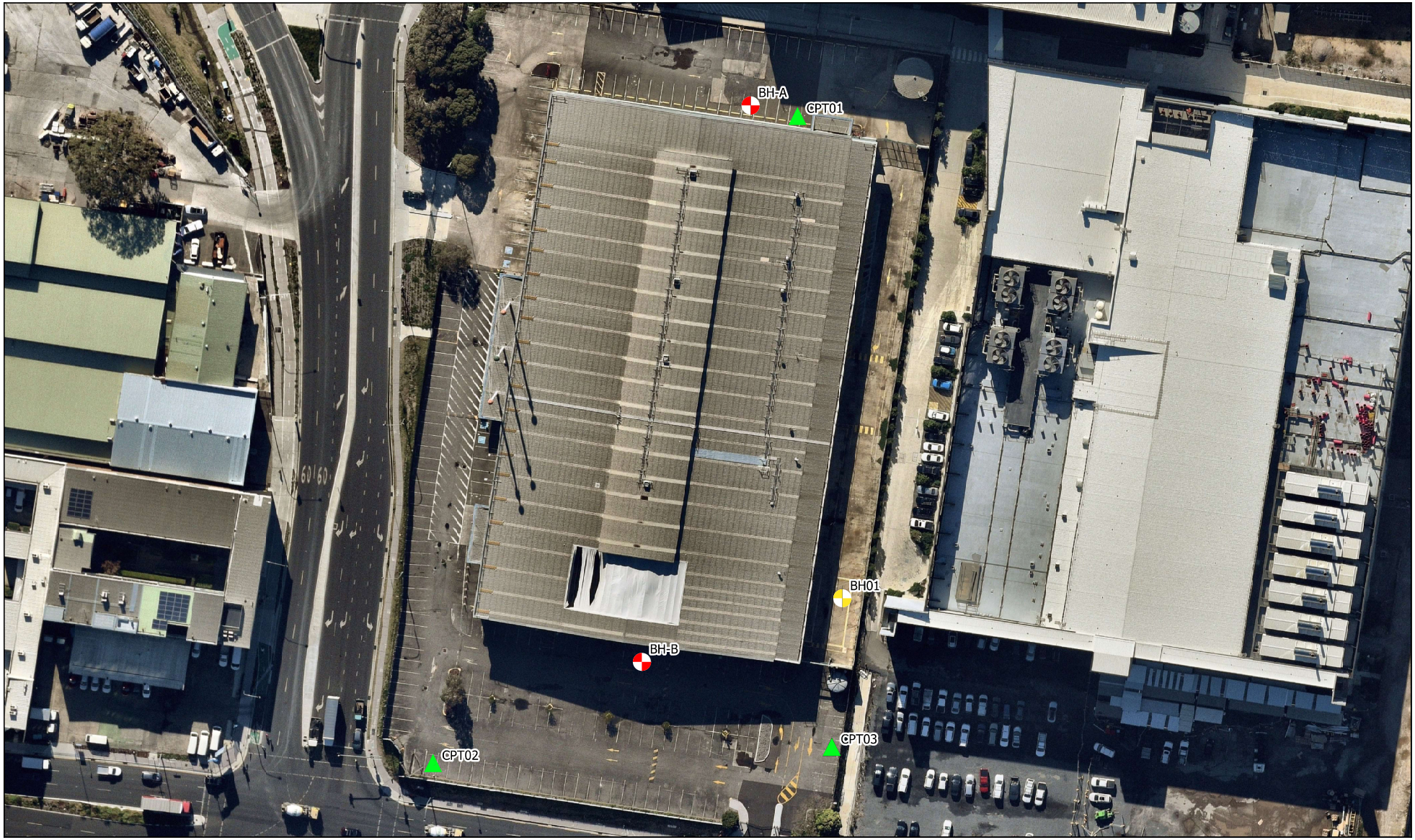
West Perth WA 6005
+61 8 9462 8400

Appendix A
Site Plan



Legend

- PSM Boreholes 2020
- PSM CPT - 09.08.2021
- PSM Boreholes - 09.08.2021

Scale 1:800

N

0 10 20 30 m

Map Projection:
Horizontal Datum:
Grid: EPSG:7856

P S M	Created By: PSM	Revision: A	
	Date: 27 Aug 2021	Paper Size: A3	

Charter Hall
520 Gardeners Road
Alexandria 2015

Locality Plan

PSM4029.10 | Figure 1

C:\Users\JulianJaher\Pells Sullivan Meyrink\GIS - ArcGIS\PSM4029.10\02 Workspace\PSM4029.10 - Locality Plan.qgz Layout: A3_LandscapeTemplate_V1_QGIS

Appendix B
Subgrade Approval Report (Sample Only)

GEOTECHNICAL INSPECTION AND TESTING AUTHORITY

NATA accreditation number

SUBGRADE APPROVAL REPORT

Client:	Contractor:
Job number:	Report number:
Project:	Technician:

Subgrade areas assessed:

Area ID	Date	Approximate extent	Subgrade description	Geometry summary	Specification reference	Compliance (Pass/Fail)	Survey reference	Approved (Yes/No)

COMMENTS:

Signed: Date:

Appendix C
Lot Approval Report (Sample Only)

GEOTECHNICAL INSPECTION AND TESTING AUTHORITY

NATA accreditation number

LOT APPROVAL REPORT

Client:	Report number:
Job number:	Report date:
Project:	Technician:
Contractor:	Test methods:

LOT ID:		**Sheet**	**of**
Retest (Yes/No)		Original test report number:	
Specification reference			
Location:			
Lot boundary survey reference/location:			
Materials description:	*(MATERIAL TYPE, colour, minor components, maximum particle size)*		
Material identification:	*(Identify the material as defined in Clause 2.3.1, Clause 2.3.2 or Clause 2.3.3 of the Specification)*		
Deleterious material assessment:	*(Report proportion of deleterious material)*		
Layer thickness:			
Accepted as Lot: (Yes/No)		Date:	
Approximate volume (m3)		Number of tests required:	

Test ID No.				
Test soil description				
Date tested:				
Grid reference				
Surveyed test locations (RL,E,N)				
Test depth (mm)				
Max size (mm)				
% Oversize material (wet)				
Field wet density (t/m^3)				
Field moisture content (%)				
PWCD (t/m^3)				
Compactive effort				
Moisture variation (%)				
HILF density ratio (%)				
TEST (Pass/Fail)				

LOT APPROVAL	(Pass/Fail)	Signed:	Date:

Appendix D
Daily Report (Sample Only)

GEOTECHNICAL INSPECTION AND TESTING AUTHORITY

NATA accreditation number

DAILY REPORT

Client:	Report number:
Job number:	Report date:
Project:	
Location:	Level of testing: Level 1
Contractor	Technician:
Time on site:	
Time off site:	

1. Subgrade Approval

Areas ID	Subgrade Approval Report No:	Comments

2. Lot Approval

Lot ID	Lot Approval Report No:	Comments

3. Survey

Type of survey	Survey undertaken by:	Reference

4. Instructions received on site

5. Instructions given on site

COMMENTS:

Signed:	Date:

Appendix E
Certification Letter (Sample Only)

Our Ref:

Date:

Addressed to: Earthwork Contractor

Attention: Earthwork Contractor Representative

Dear

RE: SAMPLE INTERIM (OR FINAL) FILLING CERTIFICATE
INDUSTRIAL DEVELOPMENT, BULK EARTHWORKS
CERTIFICATION OF EARTHWORKS
BETWEEN [DATE OF COMMENCEMENT] AND [DATE OF COMPLETION]

In the period between [date start] and [date finish] the contractor has undertaken earthworks in areas XXX and XXX.

During the above period:

- The GITA has prepared the following Subgrade Approval Reports:

1. Subgrade Approval Report No 1
2. ……

- The GITA has prepared the following Lot Approval Reports:

1. Lot Approval Report No 1
2. ……

- The GITA has prepared the following Daily Reports:

1. Daily Report No 1……
2. ……

- The following subgrade survey was undertaken:

1. Subgrade Survey reference……
2. ……

- The following weekly survey was undertaken:

1. Weekly survey of week ending ……reference……..
2. ……

Copies of all the above documents are attached.

The GITA certifies that all the earthworks undertaken in the above stated period are documented in the above reports and have been undertaken in accordance with the Specifications (ref. PSM1541-00xS, dated XXX) a copy of which is attached, with the exception of:

1. List outstanding issues (not approved subgrade, lots, unsuitable material, failed tests etc.)
2. ……..

Signed

GITA