BURROWS INDUSTRIAL ESTATE 1-3 BURROWS ROAD, ALEXANDRIA

Geotechnical Report

PSM2808-005R REV4 16 December 2024

Goodman Property Services (Aust) Pty Ltd

Table of Contents

List of Tables

List of Figures

List of Appendices

1. Preamble

1.1 Amended Project Description

The project description is to be updated to reflect the following:

- Demolition of all existing structures and buildings on site
- Tree removal both on site and for a limited number of trees in the public domain and adjoining lot
- Site remediation, and establishment works, including minor excavation / bulk earthworks
- Design, construction and operation of a two-storey warehouse and distribution centre building with ancillary offices for each warehouse tenancy, including:
  - Approximately 34,051sqm of total GFA, comprising:
    - 30,389sqm of warehouse and distribution centre GFA.
    - 3,353sqm of GFA for ancillary office space; and
    - End of Trip Facilities on the ground floor of 309 sqm GFA.
  - Maximum building height of RL 29.70 (maximum 25m from existing ground level).
  - Operation 24 hours per day seven days a week.
- Provision of on grade car parking accessed off Burrows Road which provides 145 tenant and visitor car parking spaces (including 8 accessible bays), 14 motorcycle spaces, and bicycle parking and end-of-trip facilities (including 66 bicycle parking spaces, showers, lockers and change rooms for occupants).
- New crossings to Burrows Road for truck and car access
- Single fire and utilities services ingress crossing off Canal Road
- Site landscaping works totalling approximately 6,856sqm (or 19.8% of the site), including
  - Two x 6-metre landscaped setback areas to both the Burrows Road and Canal Road site frontages.
  - 3,829sqm or 11.0% deep soil landscaping.
  - 3,027sqm or 8.7% of permeable paving; and
  - 5,450sqm or 15.7% tree canopy coverage.
- Provision of building / business identification and wayfinding signage.

1.2 Change to the Proposal

The proposed design has been amended in response to issues relating to site contamination, potential flood impacts, assessment of the local logistics market and construction cost escalation. The intent of the proposal remains the same, however there have been changes to the physical layout/ built form of the warehouse and distribution facility as outlined below:

- Reduction of the proposed warehouse from 3 storeys (30.14m) to 2 storeys (25m). Despite the reduction of 1 storey, the building height has been reduced by approximately 5m. The remaining 2 storeys have increased in height to provide a more efficient warehouse facility.
- Re-orientation of the layout from an east-west central hardstand with smaller warehouse tenancies on the north and south, to a north-south central hardstand with larger/deeper warehouse tenancies on the east and west. This provides for more efficient warehouse layouts and truck access.
- Previously, truck access to the warehouse tenancies was facilitated via north and south spiral ramps from Burrows Road, connecting to a north-south hardstand on each level. Under the amended proposal, truck access will be provided directly to the ground level from Burrows Road, and upper level hardstand access will be provided via a northern ramp, also from Burrows Road.
- Previously, the offices associated with the warehouse tenancies were arranged over six levels in a separate block at the northern end of the site, featuring a shared rooftop garden terrace. The revised design situates the offices in a mezzanine layout within each warehouse tenancy, each having direct access to an elevated garden terrace along the building's east and west facade.
- Previously carparking was located in an under croft basement below the warehouse and accessed from Burrows Road. The amended design situates car parking at ground level, either externally to the building's footprint or within a ground-level under croft at the site's southern end.

- The facade has been redesigned to simplify the raked cladding panels, making them predominantly vertical while still maintaining a stepped appearance. The prominent corners of the development at the south-east and south-west extents of the building continue to feature expressive detailing.
- The proposal maintains a 6m landscaped setback to Burrows Road with a curved façade and a minimum 6m landscaped setback to Canal Road.
- The landscape design has been modified to reflect the revised site arrangement and orientation. However, the design concept retains the use of native and endemic species, as a key aspect of Connecting with Country.

The numerical changes to the proposal are detailed in Table 1 below.

Table 1 - Overview of Key Numeric Amendments

Element	Exhibited Proposal	Amended Proposal	Difference
Total Site Area	34,614sqm	34,614sqm	Nil
Total Warehouse Area	47,076sqm	30,389sqm	Decrease of 16,687 sqm
Total Office Area	5,014sqm	3,353sqm	Decrease of 1,661sqm
Total Café Area	60sqm	0sqm	Decrease of 60ssqm
Total GFA	52,150sqm	34,051sqm	Decrease of 18,099sqm
Carparking	241 car parking spaces (including 12 accessible bays)	145 car parking spaces (including 8 accessible bays)	Decrease of 96 car parking spaces
Maximum Building Height	30.14m	25m	Decrease of 5.14m
Landscaped Area	7,464 sqm (or 21.6% of the site)	6,856sqm (or 19.8% of the site)	Decrease of 608sqm

2. Introduction

This report presents the results of the geotechnical investigation undertaken by PSM in 2015 and 2019 for the proposed Burrows Industrial Estate Warehouse Development at 1 – 3 Burrows Road, Alexandria. The aim of the geotechnical investigation was to assess the subsurface conditions and to provide geotechnical design advice and recommendations for the proposed development.

The work has been undertaken in accordance with our proposals:

- PSM2808-001L dated 20 July 2015
- PSM2808-006L dated 18 March 2019.

This report was previously revised (ref. PSM2808-005R REV1 dated 13 May 2019) to include the results of the site investigation on the following dates:

1. 13 August 2015.
2. Between 23 April and 24 April 2019.

3. Reviewed Documents

The following documents have been provided to inform the geotechnical report:

- Architectural Drawings by SBA (ref. 24132 DA000 to DA710 dated 13 September 2024)
- Civil Drawings by Costin Roe Consulting (ref. CO11035.05-SSDA100 to SSDA551 dated 17 October 2024)
- Structural Drawings by Costin Roe Consulting (ref. CO11035.05 – S010 to S504 dated 30 July 2024)
- Email from Angus Harrold dated 14 May 2024.

Based on your email and drawings, we understand the following:

- The previous development, consisting of a three (3) storey commercial and industrial building with an external carpark has been revised to a two (2) storey scheme
- The current proposed redevelopment will comprise demolition of the existing buildings and pavements and construction of a double-storey warehouse
- The proposed floor level is at RL 4.4 m. No basement structure is proposed for the site.

4. Geotechnical Investigation

4.1 Fieldwork – 13 August 2015

Fieldwork was undertaken on 13 August 2015 and comprised:

- 6 x Cone Penetrometer Tests (CPT 1 to CPT 6)
- 3 x Bulk samples (CBR1 to CBR 3).

The CPTs were carried out using a 15.5 tonne truck mounted testing rig. The CPTs were undertaken to a refusal depth between 12 and 14 m. CPT results and interpreted profiles are presented in Appendix A.

Prior to testing, on-site service location "scans" were undertaken by a service locator in the presence of a PSM geotechnical engineer to ensure the test locations were free from buried utilities. Coring through pavement was undertaken to allow the CPT cone to test the underlying material and also to recover bulk samples for testing.

The testing and sampling locations are shown in Figure 1. Testing and sampling locations were located with a GPS with the accuracy of +5 m.

4.2 Geotechnical Laboratory Testing (August 2015)

Three (3) bulk samples (CBR 1, CBR 2 & CBR 3) recovered during the fieldwork using hand-auger were sent to a NATA registered geotechnical testing laboratory for California bearing ratio (CBR) testing. The test result sheets are attached in Appendix B and the results are tabulated in Table 2 below.

Table 2 – CBR Testing Results Summary

CBR SAMPLE ID	SAMPLE DEPTH (m)	MATERIAL DESCRIPTION	FIELD MOISTURE CONTENT (%)	STANDARD MAXIMUM DRY DENSITY (t/m^3)	OPTIMUM MOISTURE CONTENT (%)	4 DAY – SOAKED CBR (%)
CBR 1	0.2 – ~0.5	Clayey SAND	25.5	1.63	20.1	15
CBR 2	0.2 – ~0.5	Clayey SAND	30.8	1.26	31.0	10
CBR 3	0.2 – ~0.5	Clayey SAND	17.3	1.69	17.5	50

4.3 Fieldwork – 23 to 24 April 2019

Additional fieldwork was undertaken on 23 to 24 April 2019 and comprised:

- 3 x Cored boreholes (BH01 to BH03).

The boreholes were drilled using a track mounted rig. All boreholes employed rotary auger drilling in soil, with NMLC coring used to recover bedrock. The boreholes were drilled to a depth of 15 m and piezometer were installed in each of the boreholes following completion of drilling. Point load index testing has been undertaken on the recovered rock cores at approximately 1 m intervals. Boreholes logs are presented in Appendix C and point load index testing results are presented in Appendix D.

Testing and sampling locations are shown in Figure 1.

4.3.1 Standpipe Piezometers

Three standpipe piezometers were installed at the borehole locations. Appendix E presents the construction records of the piezometers. A water level logger was installed in each piezometer to record water level e.g. every hour (automatic data collection). This allows us to assess the effect of rainfall on the groundwater, etc.

5. Site Conditions

5.1 Geological Setting

The 1:100,000 Sydney Geological map indicates that the site is underlain by Quaternary alluvium being peat, sandy peat and mud.

5.2 Surface Conditions

The site is currently occupied by single storey warehouses and up to two storey offices. The north west of the site is paved with asphalt overlying a concrete slab and the north east of the site is covered with a concrete slab. The pavement is up to 300 mm thick.

5.3 Subsurface Conditions

The subsurface conditions encountered by the CPTs are summarised in Table 3 and Table 4.

Table 3 – Summary of Subsurface Units Encountered at CPT Locations

UNIT NAME	APPROXIMATE DEPTH TO THE TOP OF UNIT (m)	DESCRIPTION
PAVEMENT	0.0	Pavement comprises asphalt and concrete slab or concrete slab only.
FILL	0.2 to 0.3	Gravelly SAND to Clayey SAND. Density index ranges from medium dense to very dense.
UPPER SAND	1.0 to 3.0	Silty SAND. Density index ranges from loose to dense.
UPPER CLAY	2.8 to 5.2	CLAY to Silty CLAY. Soft to firm clay.
LOWER SAND	4.0 to 8.7	SAND to Silty Sand. Density index ranges from dense to very dense. Grey, fine to medium grained.
LOWER CLAY	7.9 to 10.7	CLAY to Silty Clay. Consistency stiff to very stiff. Pale grey mottled brown and red to mottled dark grey and brown. High Plasticity.
BEDROCK A	10.4 to 13.5	SHALE: Dark grey with some brown stains to black, inferred to be very low strength. Extremely weathered to moderately weathered. Inferred from CPT refusal.
BEDROCK B		SHALE: Dark grey to black, inferred to be low to medium strength. Slightly weathered to Fresh.

Table 4 – Assessed Levels of Geotechnical Unit at CPT and BH Locations

UNIT NAME	APPROXIMATE REDUCED LEVEL OF TOP OF UNIT (m AHD)								
	CPT1	CPT2	CPT3	CPT4	CPT5	CPT6	BH01	BH02	BH03
Concrete PAVEMENT (COLLAR RL)	2.8	2.3	3.75	2.9	3.5	3.45	2.05	2.3	3.5
FILL	2.6	2.1	3.55	2.7	3.2	3.25	1.75	2.1	3.25
UPPER SAND	1.2	1.3	2.25	-0.1	0.5	1.45	-2.35	-1.7	-1
UPPER CLAY	-0.2	-0.5	-0.25	-1.6	-1.2	-1.75	NE	NE	NE
LOWER SAND	-3	-3.9	-2.25	-4.7	-4	-5.25	NE	NE	NE
LOWER CLAY	-5.1	-8.4	-5.85	-6.1	-6.7	-5.95	-5.95	-6.5	-5.5
BEDROCK A	-9.2	-10.1	-9.05	-11	-9.8	-10.65	-8.35	-10.9	-8
BEDROCK B	NE	NE	NE	NE	NE	NE	-9.75	NE	-9.3
End of Hole	-9.2	-10.1	-9.05	-11	-9.8	-10.65	-12.97	-12.88	-11.5

[1] NE = Not Encountered

The collar levels were estimated from the survey plan provided to PSM.

5.4 Groundwater

Groundwater was encountered during drilling / augering between 0.6 and 1.8 m below the surface; (i.e. between RL 1.4 m and 1.7). We note that these levels were higher than those recorded in the water loggers below.

A PSM geotechnical engineer visited the site on 8 May 2019 to download the water level data from the loggers. The monitoring data from the piezometer is presented in Figure 4 to Figure 6. The data is consistent with dip measurement undertaken manually using a measuring tape.

PSM's groundwater assessment report is presented in PSM2808-019L REV3 dated 16 December 2024.

6. Assessment of SEARS – Geotechnical Items

6.1 Introduction

This section presents our response to some of Item 12 of the SEARs for warehouses and distribution centres from a geotechnical point of view. Table 5 reproduces Item 12 of the warehouse and distribution centre, Industry Specific Secretary's Environmental Assessment Requirements (SEARs). We have been provided with and used the following documents during our assessment:

- Architectural Drawings by SBA (ref. 24132 DA000 to DA710 dated 13 September 2024)
- Civil Drawings by Costin Roe Consulting (ref. CO11035.05-SSDA100 to SSDA551 dated 17 October 2024).

Table 5 – SEARs Requirements

Item	Description of Requirement
12. Ground and Water Conditions	• Assess potential impacts on soil resources and related infrastructure and riparian lands on and near the site, including soil erosion, salinity and acid sulfate soils. • Provide a surface and groundwater impact assessment that assess potential impacts on: – Surface water resources (quality and quantity) including related infrastructure, hydrology, dependent ecosystems, drainage lines, downstream assets and watercourses – Groundwater resources in accordance with the Groundwater Guidelines

6.2 ITEM 1 – Assess potential impacts on soil resources and related infrastructure and riparian lands on and near the site, including soil erosion, salinity and acid sulfate soils

PSM Response:

PSM understands that the Site will either be in a net import or export balance depending on whether a piling platform is opted for across the site. From the cut fill plan, cut depths up to 1.25 m and fill depths up to 3.25 m are proposed with a final bulk earthworks level of RL 4.4 m AHD ± 1000 mm. The range in bulk earthworks level means that the site and design can be amended to achieve cut fill balance across the site.

We assess that from a geotechnical point of view, the proposed development will likely have close to no impact on the soil resource at the site as existing cut material from the site proposed to be reused. Imported fill is understood to be clean material which will have minimal impacts on the existing soil resource.

With regards to riparian lands, we understand that no riparian lands are present within the site boundary. It is expected that appropriate erosion control will be included during construction and the civil engineer will design the stormwater system, surface gradients and landscaping requirements to control surface flows and minimise soil erosion and the effects of soil erosion. We note that the vast majority of the site will be sealed by the proposed development and the appropriate surface runoff collection and disposal systems have been included in the design.

6.3 ITEM 2a – Provide a surface and groundwater impact assessment that assess potential impacts on: *Surface water resources (quality and quantity) including related infrastructure, hydrology, dependent ecosystems, drainage lines, downstream assets and watercourses.*

PSM Response:

We note that impacts on surface water resource (quality and quantity), impacts on dependent ecosystems, drainage lines, downstream assets and watercourses are not a geotechnical item. These items can be addressed by a suitably qualified person(s), (e.g., ecologist, drainage/civil designer and environmental consultant or other suitably qualified persons). These items are not considered by PSM.

6.4 ITEM 2b – Provide a surface and groundwater impact assessment that assess potential impacts on: *Groundwater resources in accordance with the Groundwater Guidelines.*

Based on our geotechnical investigation and previous groundwater monitoring, we understand that groundwater levels vary between RL 0.5 m AHD and RL 0.7 m AHD. No significant excavation works or basements are proposed for the development with the site having a maximum cut depth of 1.25 m to a bulk earthwork level of RL 4.4 m AHD. As such we deem that impacts on the groundwater resource at the Site is negligible and will not be impacted by the proposed development.

7. Discussion and Recommendations

7.1 General

The design advice provided in the following sections has been prepared on the following basis:

- Earthworks will be undertaken on the site with the following depths:
  - Maximum cut depth: -1.25 m
  - Maximum Fill depth: 3.25 m
- Any proposed earthworks are to be completed in accordance with the Bulk Earthworks Specification (ref. PSM2808-023S dated 25 September 2024 in Appendix F)
- Further testing including plate load testing and additional CBR testing will be undertaken following demolition to confirm the advice provided in the following Sections.

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

7.2 Site Classification

While the proposed development is out of scope of AS2870 (2011) *Residential slabs and footings*, we assess that, for the subgrade, the characteristic surface movement, y_s, would be less than 20 mm and thus would classify the site as Class S.

7.3 Permanent and Temporary Batters

The batter slope angles shown in Table 6 are recommended for the design of batters up to 3 m height and above the groundwater table; subject to the following recommendations:

1. The batters shall be protected from erosion.
2. Permanent batters shall be drained.
3. Temporary batters shall not be left unsupported for more than 1 month without further advice, and inspection by a geotechnical engineer should be undertaken following significant rain events.

Where loads are imposed or structures/services are located within one batter height of the crest of the batter, further advice should be sought.

Table 6 – Batter Slope Angles

UNIT	TEMPORARY	PERMANENT
SOIL UNITS, eg. ENGINEERED FILL, NATURAL SOIL	2.0 H : 1V	2.5 H : 1V

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

7.4 Excavation Support

Permanent cuts in the ENGINEERED FILL, NATURAL SOIL and BEDROCK units steeper than the recommended permanent batter slopes in Table 6 will need to be supported by some form of retaining structure.

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

- Effective soil strength parameters in Table 7 when assessing the earth pressure on retaining structures
- Water pressure (depending on the type of structure). Both water pressure acting directly on the structure, and the effect of water pressure on effective stresses within the retained ground
- Surcharge loads.

Note that design of retention systems may be based on either K_a or K_o earth pressures. Design using active earth pressures 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.

7.5 Slab on Ground

The design of slabs can be based on a subgrade with a Young's modulus *(E)* shown in Table 7 and subsurface profile discussed in Section 5.3. A short-term Young's modulus of 15 MPa can be adopted for slab founded on FILL or UPPER SAND unit.

We note that slabs will be affected by settlement of the deeper soil layers.

The structural designer or builder may wish to employ a surface layer of road base / crushed sandstone / concrete for trafficability or structural purposes. This is not required to achieve the properties provided in this design advice.

7.6 Footings

7.6.1 Shallow Footings

Pad footings can be founded on or within the FILL or UPPER SAND unit. They can be proportioned on the basis of an allowable bearing pressure (ABP) presented in Table 7. These pads are to have a minimum horizontal dimension of 1 m and an embedment depth of at least 0.5 m. Shallow footings should not be founded closer than their minimum plan dimension to the UPPER CLAY unit.

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 7.

7.6.2 Pile Footings

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.

We envisage that piles to be founded within the BEDROCK unit. If piles need to be founded within SAND units, further advice should be sought, but we do not expect this to be practical.

With regards to the pile design we recommend that:

- A geotechnical strength reduction factor, Φg = 0.60 (AS2159 CL. 4.3.2) be adopted for a high redundancy system for an assessed average risk rating (ARR) of 3.0. This should be reviewed to suit the specific design and construction methods proposed by the structural designers.
- 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.

Where the pile is sized using the allowable bearing capacity in Table 7 (i.e. assuming all the serviceability load is carried by the base), the settlement would be expected to be less than 1% of the pile diameter.

Any structural settlement due to shortening (or extension) of the footing element itself should be considered.

Where the founding or loading conditions between footings vary consideration should be given to the effects of differential settlements.

7.6.3 Differential Settlements

Where adjacent foundation and slab details differ (e.g. between the remaining existing structure and new extension), differential settlement will need to be assessed.

7.7 Groundwater

Assessment regarding groundwater is presented in our groundwater assessment letter (ref. PSM2808-019L REV3 dated 16 December 2024.

Table 7 – Engineering Parameters of Inferred Geotechnical Units

INFERRED UNIT	BULK UNIT WEIGHT (kN/m³)	SOIL EFFECTIVE STRENGTH PARAMETERS		ULTIMATE BEARING PRESSURE UNDER CENTRIC VERTICAL LOADING (kPa)	ALLOWABLE BEARING PRESSURE UNDER CENTRIC VERTICAL LOADING (kPa)	ULTIMATE SHAFT ADHESION (kPa)	ELASTIC PARAMETERS	
		c' (kPa)	*ϕ'* (deg)				Young Modulus (MPa)	POISSON'S RATIO
Fill	18	0	25	250*	100*	N/A	10	0.3
UPPER SAND	18	0	25	250*	100*	N/A	10	0.3
Upper clay	18	0	20	No footings anticipated in this unit		N/A	4	0.3
lower sand	18	0	35	No footings anticipated in this unit		N/A	30	0.3
LOWER CLAY	18	0	32	No footings anticipated in this unit		N/A	20	0.3
bedrock A	22	N/A	N/A	3000	1000**	100	100	0.3
bedrock B	22	N/A	N/A	6000	2500**	350	500	0.25

[2] Note: * Minimum footing dimensions: 1 m x 1 m in plan with an embedment depth at least = 0.5 m.

[3] ** ABP in BEDROCK to cause settlement of <1% of minimum footing dimension.

7.8 Pavements

Due to limited access to the subgrade underlying the concrete pavement, only three (3) CBR tests were undertaken. The CBR test results show a wide range of values.

For the purposes of preliminary structural pavement thickness design, a design CBR of 10% can be adopted for existing subgrade. Higher CBR values might be possible if testing is undertaken at specific areas. We recommend that specific CBR testing be undertaken at subgrade level when pavement layouts are finalised and after the demolition work is completed.

7.9 Earthquake Classification

Given that the sub-surface conditions comprise material with an assessed consistency of soft, e.g. UPPER CLAY unit and that it is less than 20 m thick, we have classified the site sub-soil to be Class Ce in accordance with AS 1170.4-2007 Section 4.2.

7.10 Site Suitability for Development

Based on the results of our geotechnical investigation and reviewed documents, PSM confirms that the site is geotechnically suitable for the development provided:

- The design of the development is undertaken in accordance with PSM advice provided in this report
- Any earthworks are undertaken in accordance with PSM bulk earthworks specification (ref. PSM2808-023S in Appendix F.

Should you have any queries, please do not hesitate to contact the undersigned.

Yours Sincerely

KEN TONG LEE
GEOTECHNICAL ENGINEER

HARLEY ZHENG
GEOTECHNICAL ENGINEER

AGUSTRIA SALIM
PRINCIPAL

Brisbane

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

Sydney

G3-56 Delhi Road
North Ryde NSW 2113
+61 2 9812 5000

Melbourne

Office 16
Level 4, 60 Moorabool Street
Geelong VIC 3220
+61 3 7068 5699

Perth

Level 3 22 Delhi Street
West Perth WA 6005
+61 8 9462 8400

Notes:

1. Plan obtained from Google Earth.

Previous site investigation on 13 August 2015 (Approx. only)

Cored Boreholes locations on 23 and 24 April 2019 (Approx. only)

Pells Sullivan Meynink

Goodman Limited

1 - 3 Burrows Road, St Peters

Geotechnical Investigation

LOCALITY PLAN

PSM2808-005R	Figure 1

Photo 1 - General Site Conditions - Site Entrance

Photo 2 - General Site Conditions - View to the South from entrance

Photo 3 - General Site Conditions - North part of the site looking South

Goodman Limited

1 - 3 Burrows Road, St Peters

Geotechnical Investigation

SITE INVESTIGATION 23 and 24 April 2019

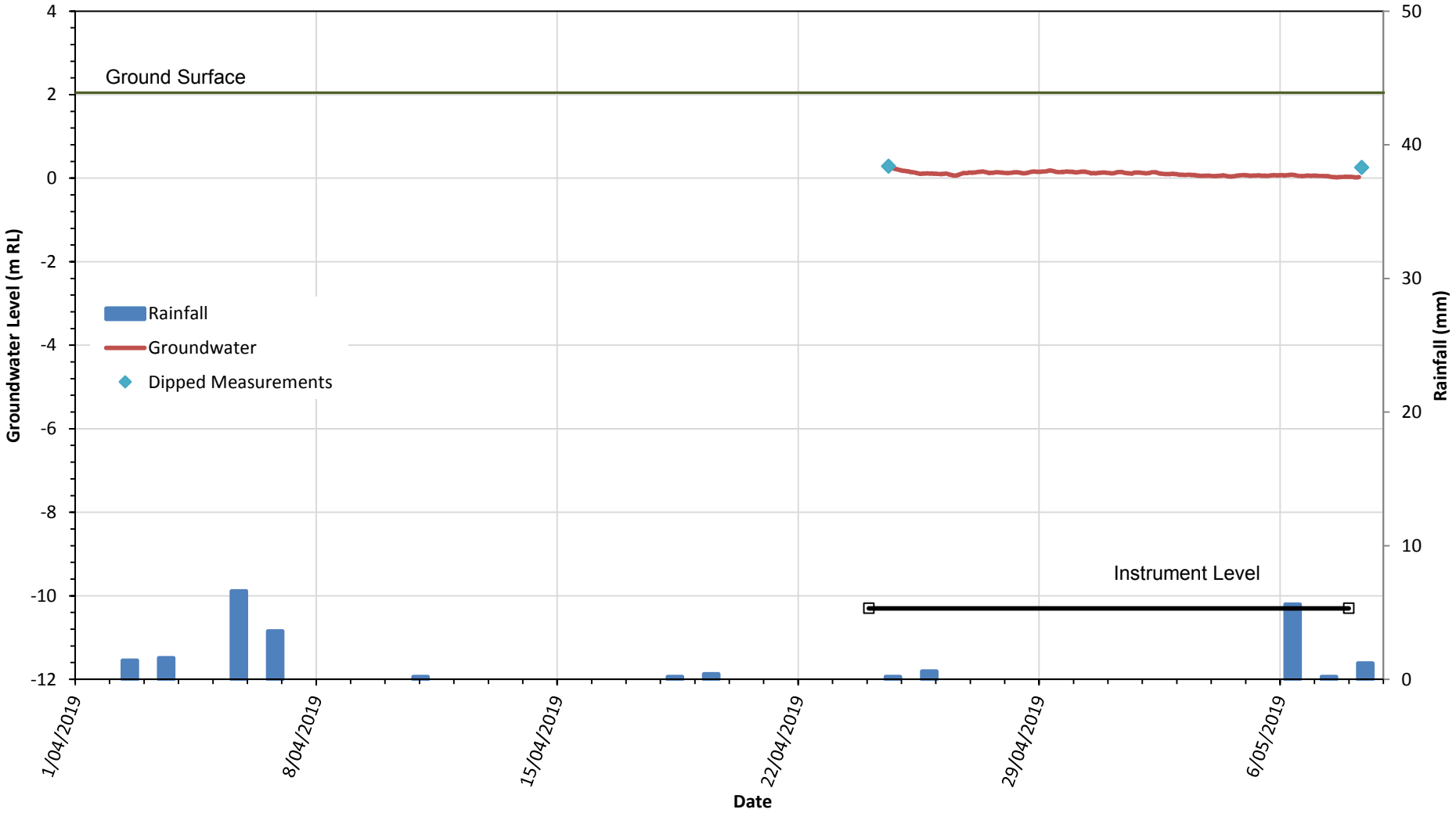
SELECTED SITE PHOTOS [1 OF 2]

Pells Sullivan Meynink	**PSM2808-005R** / **FIGURE 2**

Photo 4 - General Site Conditions - View to the North from the South

Photo 5 - Drilling rig and exclusion zone

Goodman Limited **1 - 3 Burrows Road, St Peters** **Geotechnical Investigation** **SITE INVESTIGATION 23 and 24 April 2019** **SELECTED SITE PHOTOS [2 OF 2]**	
Pells Sullivan Meynink	**PSM2808-005R** / **FIGURE 3**



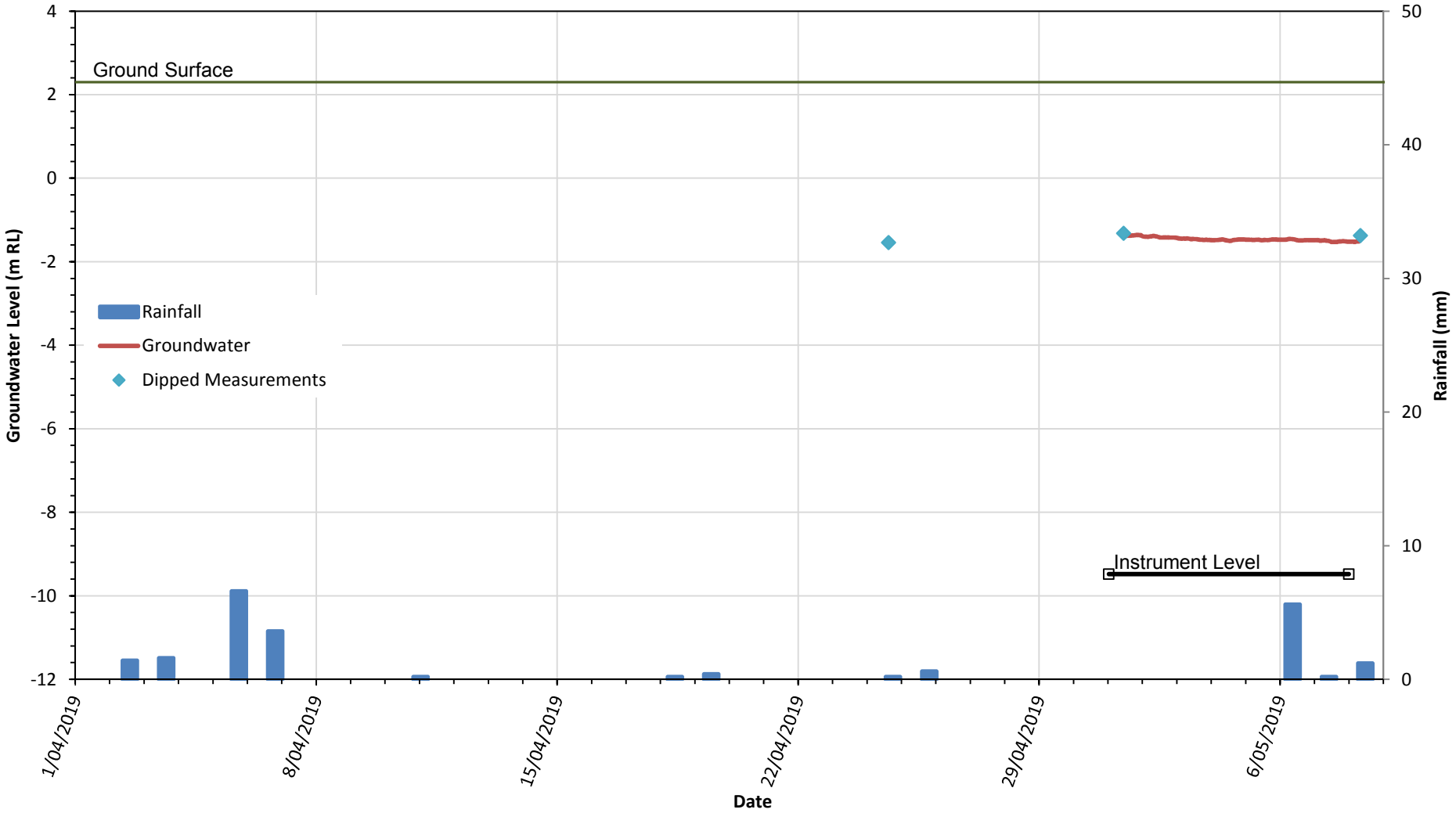
Notes:

1. Instrument depth (m RL): -10.3
2. Rainfall data source: BoM Sydney Aeroport (station number: 66037)
3. Measured water level on 24/04/2019 at -1.76 (m BGL)
4. Data logger installed on 24/04/2019 ☐

Pells Sullivan Meynink

Goodman Limited
Burrows Road Estate
St Peters, NSW
GROUNDWATER MONITORING
BH01

PSM2808	Figure 4



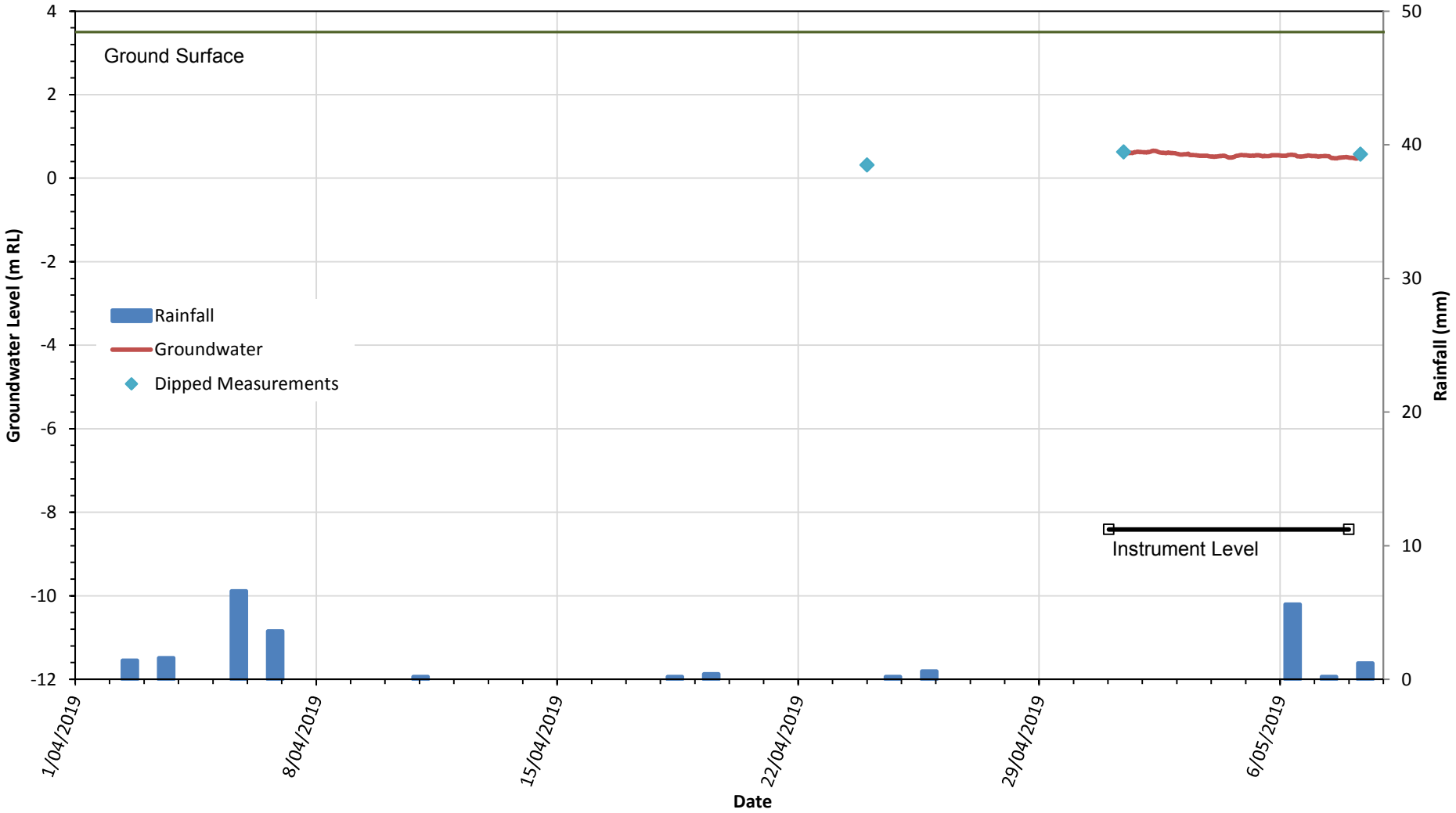
Notes:

1. Instrument depth (m BGL): -9.48
2. Rainfall data source: BoM Sydney Aeroport (station number: 66037)
3. Measured water level on 24/04/2019 at -3.84 (m BGL)
4. Data logger installed on 1/05/2019

Pells Sullivan Meynink

Goodman Limited
Burrows Road Estate
St Peters, NSW
GROUNDWATER MONITORING
BH02

PSM2808	Figure 5



Notes:

1. Instrument depth (m BGL): -8.41
2. Rainfall data source: BoM Sydney Aeroport (station number: 66037)
3. Measured water level on 24/04/2019 at -3.18 (m BGL)
4. Data logger installed on 1/05/2019

Pells Sullivan Meynink

Goodman Limited
Burrows Road Estate
St Peters, NSW
GROUNDWATER MONITORING
BH03

PSM2808	Figure 6

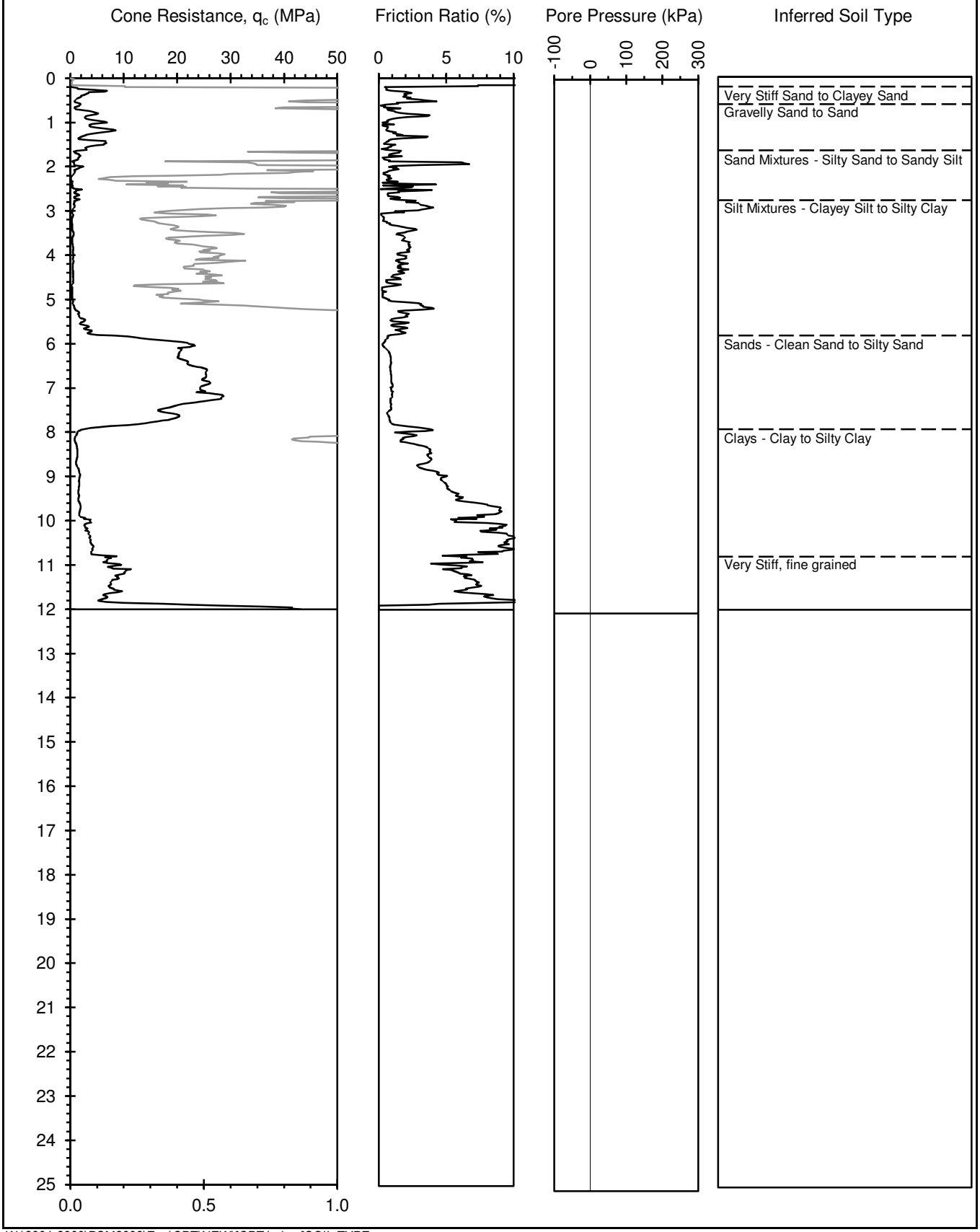
Appendix A
CPT Results

Pells Sullivan Meynink

CONE PENETRATION TEST - INFERRED SOIL TYPE

Job No.	***PSM2808***	**Test No.**	***CPT1***
Project	***1-3 Burrows Avenue, Alexandria***	**Page**	***1 of 1***

Pushing rig	*Ground Test 15.5T CPT Rig*	Test date	*13/08/2015*
Location	*331594 m E, 6245451 m N*	Cone I.D.	*120631*
Surface R.L.	*#N/A*	Field work	*HP*

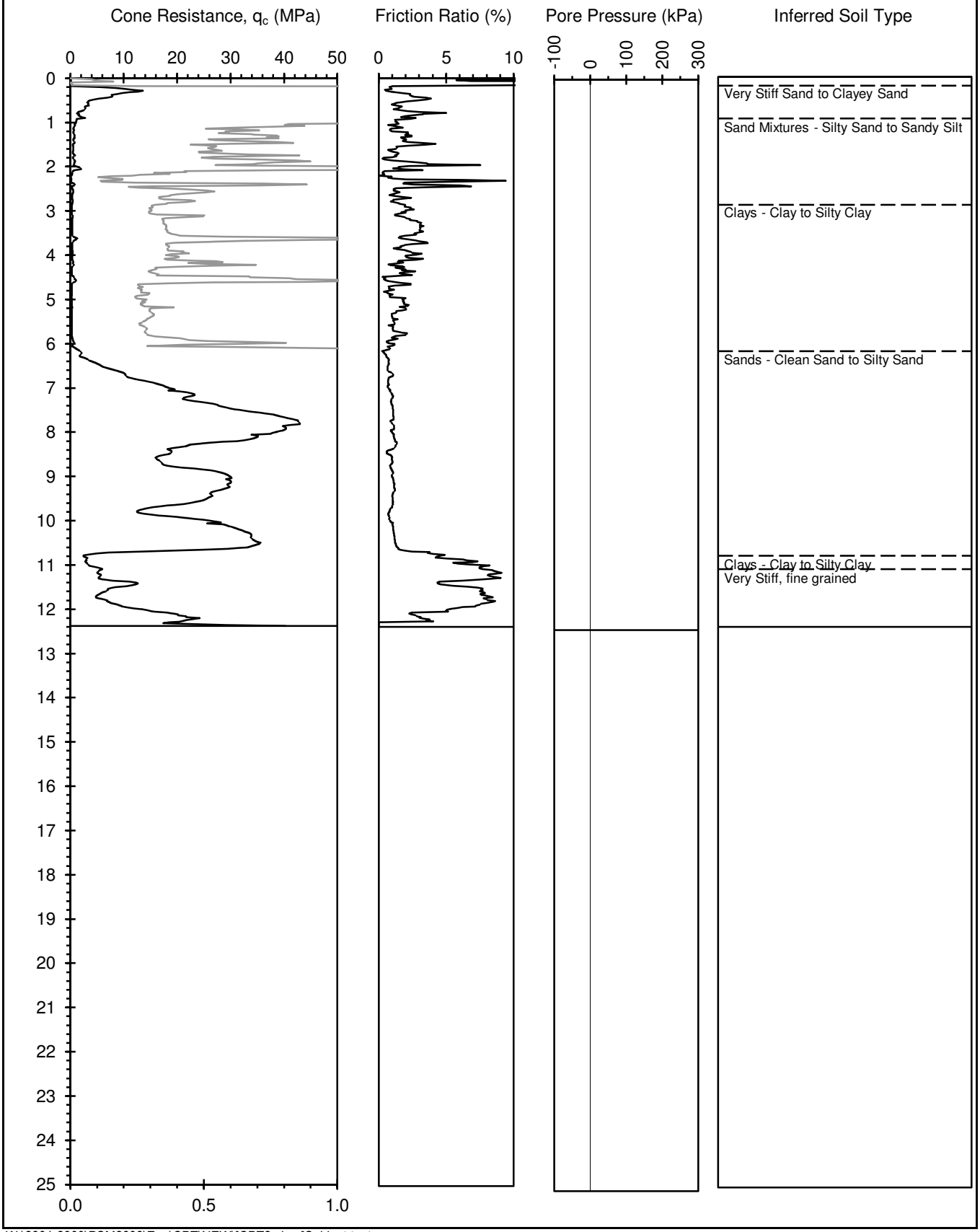


Pells Sullivan Meynink

CONE PENETRATION TEST - INFERRED SOIL TYPE

Job No.	***PSM2808***	**Test No.**	***CPT2***
Project	***1-3 Burrows Avenue, Alexandria***	**Page**	***1 of 1***

Pushing rig	*Ground Test 15.5T CPT Rig*	Test date	*13/08/2015*
Location	*331599 m E, 6245403 m N*	Cone I.D.	*120631*
Surface R.L.	*#N/A*	Field work	*HP*

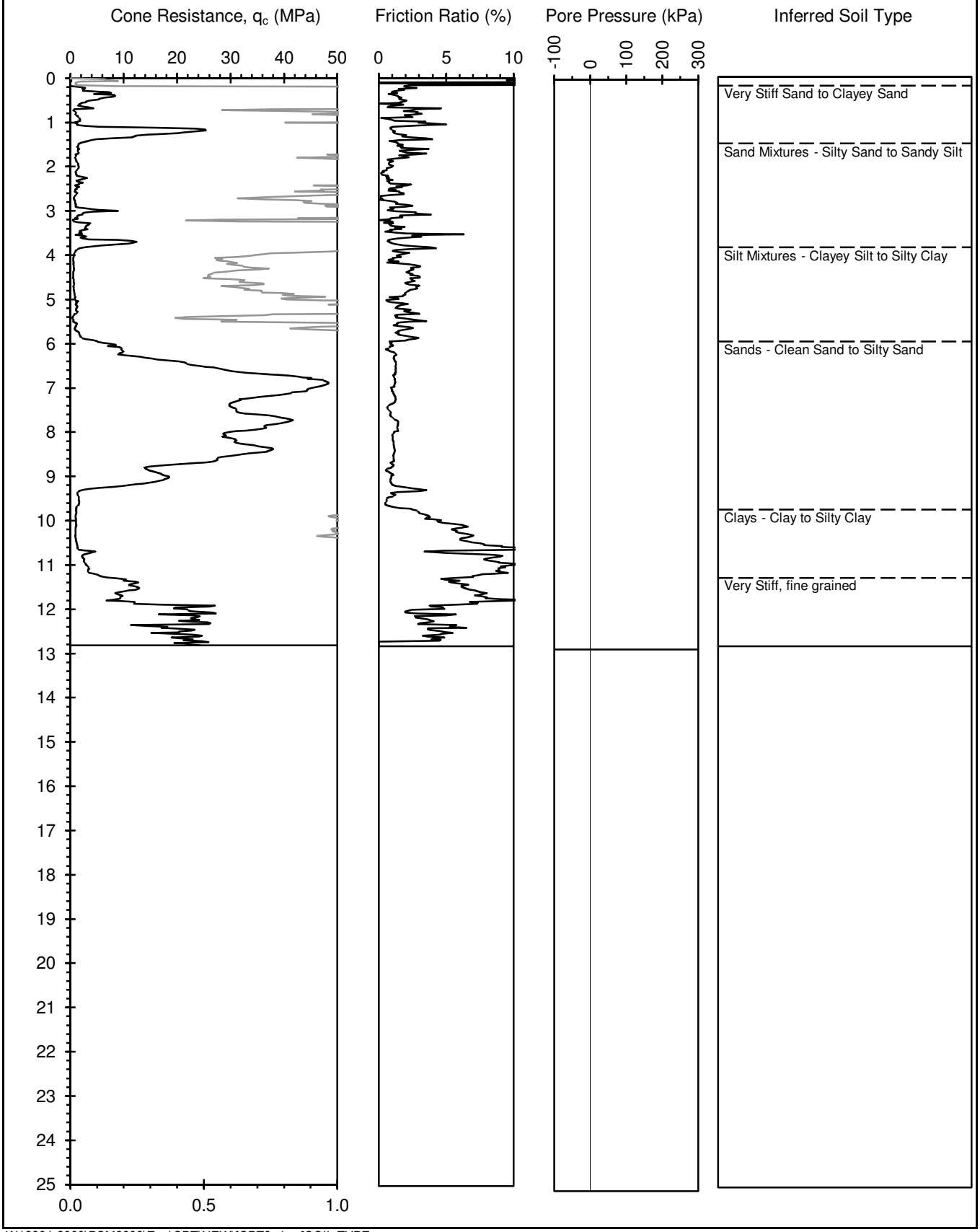


Pells Sullivan Meynink

CONE PENETRATION TEST - INFERRED SOIL TYPE

Job No.	***PSM2808***	**Test No.**	***CPT3***
Project	***1-3 Burrows Avenue, Alexandria***	**Page**	***1 of 1***

Pushing rig	*Ground Test 15.5T CPT Rig*	Test date	*13/08/2015*
Location	*331640 m E, 6245486 m N*	Cone I.D.	*120631*
Surface R.L.	*#N/A*	Field work	*HP*

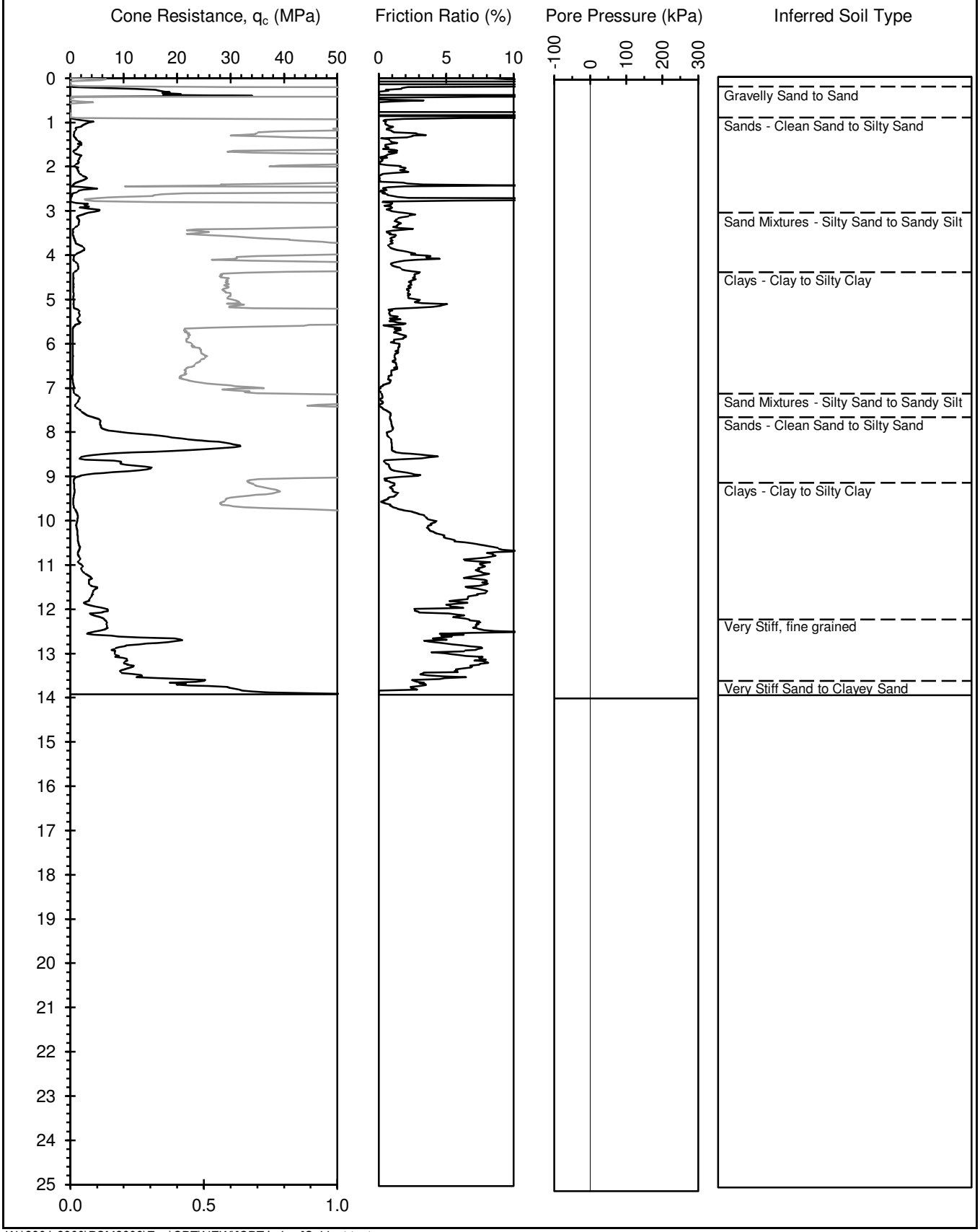


Pells Sullivan Meynink

CONE PENETRATION TEST - INFERRED SOIL TYPE

Job No.	***PSM2808***	**Test No.**	***CPT4***
Project	***1-3 Burrows Avenue, Alexandria***	**Page**	***1 of 1***

Pushing rig	*Ground Test 15.5T CPT Rig*	Test date	*13/08/2015*
Location	*331657 m E, 6245405 m N*	Cone I.D.	*120631*
Surface R.L.	*#N/A*	Field work	*HP*

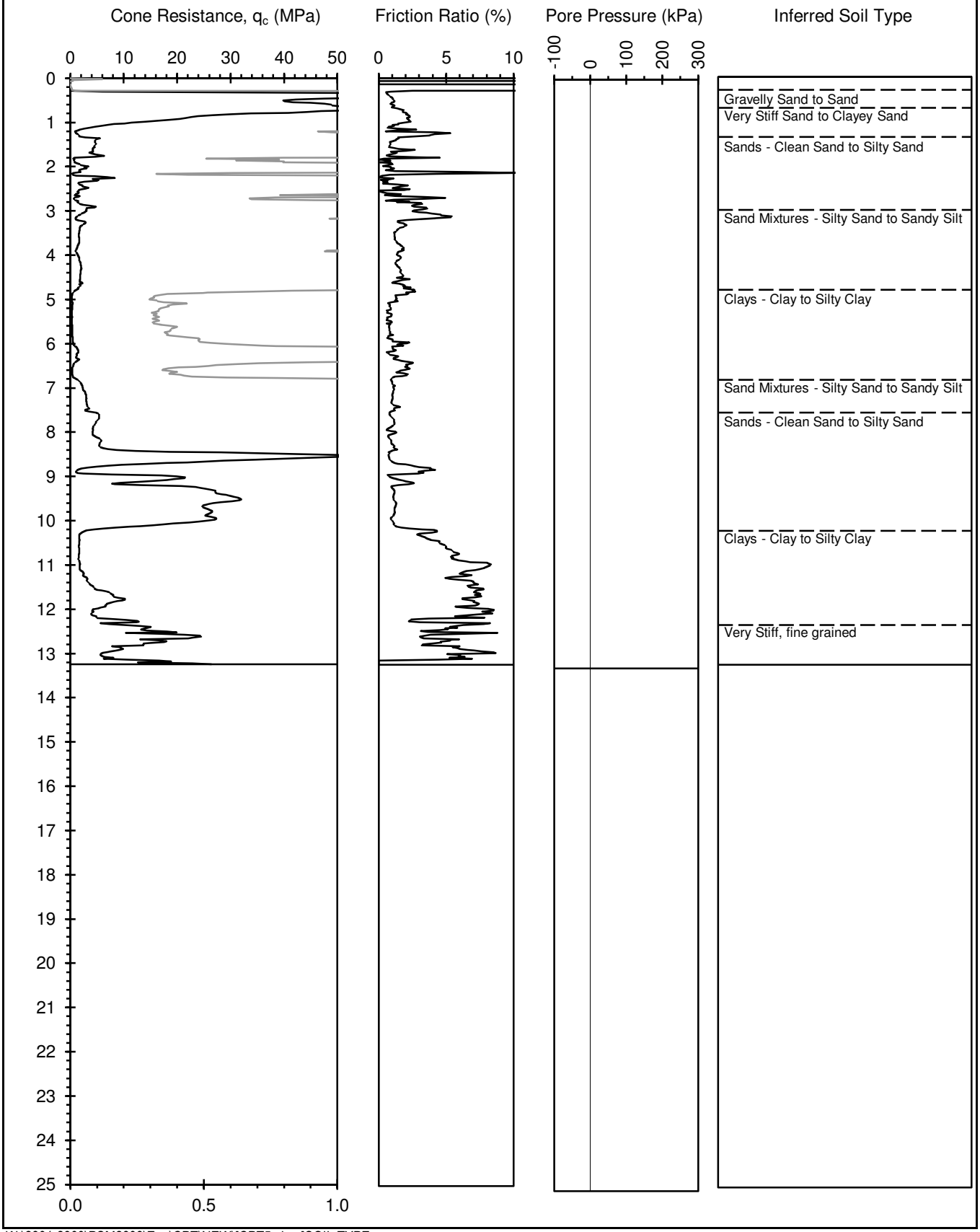


Pells Sullivan Meynink

CONE PENETRATION TEST - INFERRED SOIL TYPE

Job No.	***PSM2808***	**Test No.**	***CPT5***
Project	***1-3 Burrows Avenue, Alexandria***	**Page**	***1 of 1***

Pushing rig	*Ground Test 15.5T CPT Rig*	Test date	*13/08/2015*
Location	*331754 m E, 6245523 m N*	Cone I.D.	*120631*
Surface R.L.	*#N/A*	Field work	*HP*

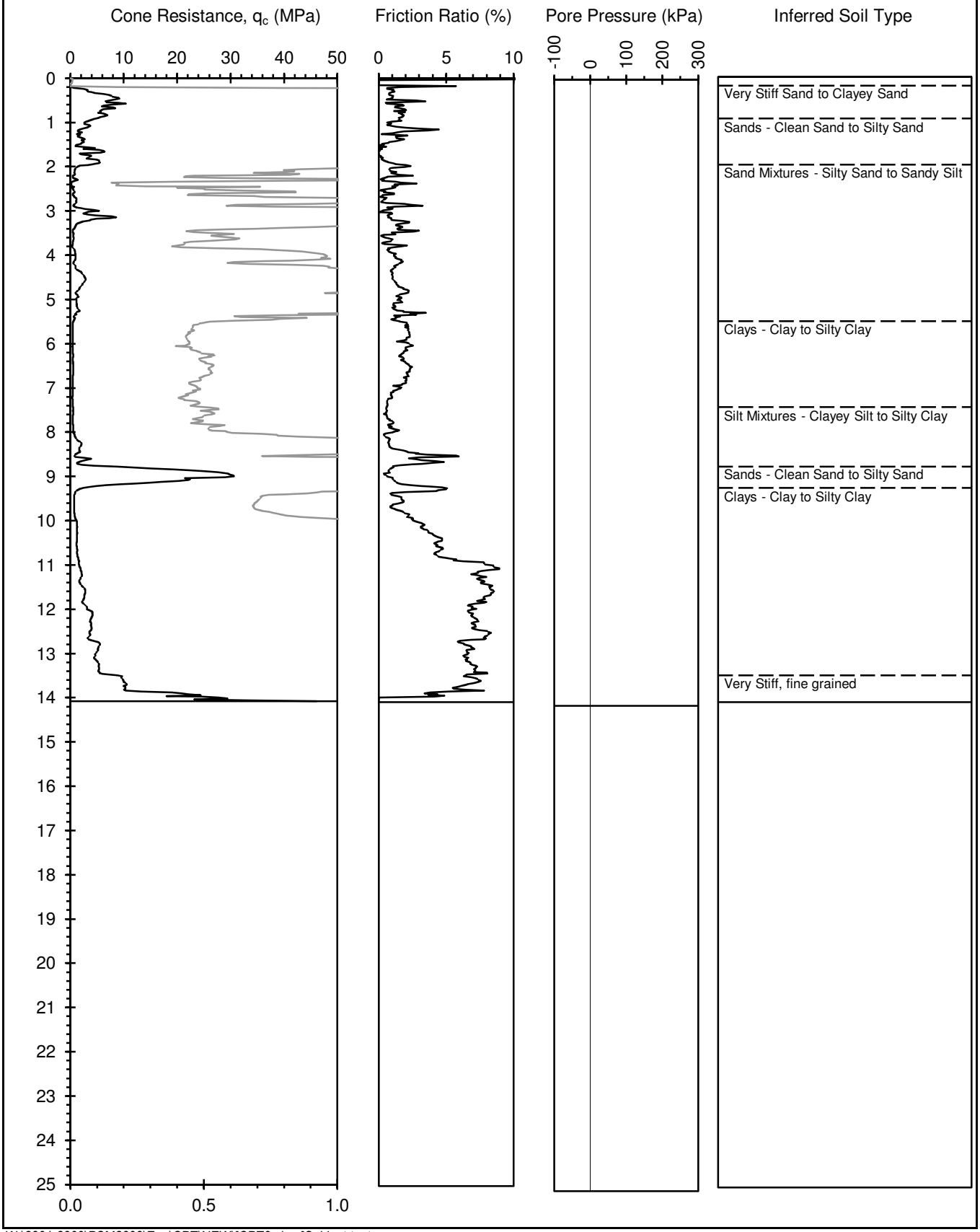


Pells Sullivan Meynink

CONE PENETRATION TEST - INFERRED SOIL TYPE

Job No.	***PSM2808***	**Test No.**	***CPT6***
Project	***1-3 Burrows Avenue, Alexandria***	**Page**	***1 of 1***

Pushing rig	*Ground Test 15.5T CPT Rig*	Test date	*13/08/2015*
Location	*331738 m E, 6245487 m N*	Cone I.D.	*120631*
Surface R.L.	*#N/A*	Field work	*HP*



Appendix B
CBR Test 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 Pty Ltd
PSM Project No.: PSM2808-004L

Ref No: L3788E
Report: 1
Report Date: 25/08/2015
Page 1 of 1

SAMPLE NUMBER	1	2	3
Surcharge (kg)	4.5	4.5	4.5
Maximum Dry Density (t/m^3)	1.63 STD	1.26 STD	1.69 STD
Optimum Moisture Content (%)	20.1	31.0	17.5
Moulded Dry Density (t/m^3)	1.55	1.28	1.68
Sample Density Ratio (%)	95	101	99
Sample Moisture Ratio (%)	118	95	91
Moisture Contents			
Insitu (%)	25.5	30.8	17.3
Moulded (%)	23.7	29.4	16.0
After soaking and			
After Test, Top 30mm(%)	24.1	29.9	18.6
Remaining Depth (%)	22.9	33.5	18.6
Material Retained on 19mm Sieve (%)	5*	7*	15*
Swell (%)	0.0	0.0	0.0
C.B.R. value:			
@5.0mm penetration	15	10	50

NOTES:

- Refer to appropriate notes for soil descriptions
- Test Methods : AS1289 6.1.1, 5.1.1 & 2.1.1.
- Date of receipt of sample: 14/08/2015.
- * Denotes not used in test sample.

NATA
NATA Accredited Laboratory Number:1327

Accredited for compliance with ISO/IEC 17025.
This document shall not be reproduced except in full.

Authorised Signature / Date
(D. Treweek)
25/8/15

All services provided by STS are subject to our standard terms and conditions. A copy is available on request.

Appendix C
Borehole logs

EXPLANATION SHEET
BOREHOLE LOG

GENERAL

Method

Non-Cored Borehole
Auger
Hand Auger
Diamond Rotary
Percussion
Other

Coring Size

Cored Borehole	Nominal Core Diameter (mm)
NMLC	51.9
BQ	36.5
BQ3	33.5
NQ	47.6
NQ3	45.1
HQ	63.5
HQ3	61.1
PQ	85
PQ3	83.1
Diatube	Variable
Other	-

Testing

Symbol	Description
UCS	Uniaxial Compressive Strength
TXL	Triaxial Test
BT	Brazilian Test
DT	Direct Tensile
SD	Slake Durability
Packer	Rock Mass Permeability

Samples

Symbol	Description
U50	50 mm undisturbed tube sample
D	Disturbed sample
Bs	Bulk sample

Water

Symbol	Description
	Water level
	Water inflow
	Complete water loss
	Partial water loss

SOIL DESCRIPTIONS

Unified Soil Classification System (USCS)

Major Divisions			Symbol	Typical Names
Coarse-Grained Soils More than 50% coarser than 0.075mm	Gravels (more than 50% coarser than 2mm)	Clean Gravels	GW	Well-graded gravels and gravel-sand mixtures, little or no fines.
			GP	Poorly graded gravels and gravel-sand mixtures, little or no fines.
		Gravels With Fines	GM	Silty gravels, gravel-sand-silt mixtures.
			GC	Clayey gravels. gravel-sand-clay mixtures.
	Sands (more than 50% of coarse fraction finer than 2mm)	Clean Sands	SW	Well-graded sands and gravelly sands, little or no fines.
			SP	Poorly graded sands and gravelly sands, little or no fines.
		Sand With Fines	SM	Silty sands, sand-silt mixture.
			SC	Clayey sands, sand-clay mixtures.
Fine-Grained Soils 50% or more finer than 0.075mm	Silts and Clays Liquid limit 50% or less		ML	Inorganic silts, very fine sands, rock flour silty or clayey fine sands.
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.
			OL	Organic silts and silty clays of low plasticity.
	Silts and Clays Liquid limit greater than 50%		MH	Inorganic silts, micaceous or diatomaceous fine sands or silts, elastic silts.
			CH	Inorganic clays of high plasticity, fat clays.
			OH	Organic clays of medium to high plasticity.
Highly Organic Soils			PT	Peat etc.

Moisture Condition

Term	Symbol
Dry	D
Moist	M
Wet	W
Wet at Plastic Limit	WP
Wet at Liquid Limit	WL

Strength

COHESIVE SOILS are described in terms of undrained shear strength, colour and structure with comments on minor constituents or apparent special features. Undrained shear strength is measured by hand penetrometer or determined by laboratory testing or estimated from experience. Classification in terms of undrained shear strength is as follows:

Term	Symbol	Description for Field Estimation	Shear Strength (kPa)	UCS (kPa)
Very Soft	VS	Easily penetrated several centimetres by fist.	<12	<25
Soft	S	Easily penetrated several centimetres by thumb. Can be moulded by light finger pressure.	12-25	25-50
Firm	F	Can be penetrated by thumb with moderate effort. Can be moulded by strong finger pressure.	25-50	50-100
Stiff	ST	Readily indented by thumb.	50-100	100-200
Very Stiff	VST	Readily indented by thumbnail.	100-200	200-400
Hard	H	Indented with difficulty by thumbnail	>200	>400

NON-COHESIVE SOILS are described in terms of density, colour, with comments on minor constituents or special features. Density (density index) is generally based on standard penetration testing (AS1289 Method 6.3.1), or other forms of penetration testing. Terms used in describing density are set out below:

Term	Symbol	Density Index	SPT N Values
Very Loose	VL	<15%	<5
Loose	L	15-35 %	5-10
Medium Dense	MD	35-65 %	10-30
Dense	D	65-85 %	30-50
Very Dense	VD	>85 %	>50

ROCK DESCRIPTIONS

Weathering

Term	Symbol	Description
Fresh	FR	Rock substance unaffected by weathering.
Slightly Weathered	SW	Rock substance affected by weathering to the extent that partial staining or partial discolouration of the rock substance usually by limonite has taken place. The colour and texture of the fresh rock is recognisable; strength properties are essentially those of the fresh rock substance.
Moderately Weathered	MW	Rock substance affected by weathering to the extent staining extends throughout whole of the rock substance and the original colour of the fresh rock is no longer recognisable.
Highly Weathered	HW	Rock substance affected by weathering to the extent that limonite staining or bleaching affects the whole of the rock substance and signs of chemical or physical decomposition of individual minerals are usually evident. Porosity and strength may be increased or decreased when compared to the fresh rock substance, usually as a result of the leaching or deposition of iron. The colour and strength of the original fresh rock substance is no longer recognisable.
Extremely Weathered	EW	Rock substance affected by weathering to the extent that the rock exhibits soil properties, i.e. it can be remoulded and can be classified according to the Unified Soil Classification System, but the texture of the original rock is still evident.

Strength

Term	Symbol	Description for Field Estimation	Point Load Index I_s50 (MPa)
Very Low	VL	Material crumbles under firm blows with sharp end of pick; can be peeled with a knife; pieces up to 30 mm thick can be broken by finger pressure.	<0.1
Low	L	Easily scored with a knife; indentations 1 mm to 3 mm show with firm blows of a pick point; has a dull sound under hammer. Pieces of core 150 mm long by 50 mm diameter may be broken by hand. Sharp edges of core may be friable and break during handling.	0.1 to 0.3
Medium	M	Readily scored with a knife; a piece of core 150 mm long by 50 mm diameter can be broken by hand with difficulty.	0.3 to 1.0
High	H	A piece of core 150mm long by 50mm cannot be broken by hand but can be broken by a pick with a single firm blow; rock rings under hammer.	1 to 3
Very High	VH	Hand specimen breaks after more than one blow of a pick; rock rings under hammer.	3 to 10
Extremely High	EH	Specimen requires many blows with geological pick to break; rock rings under hammer.	>10

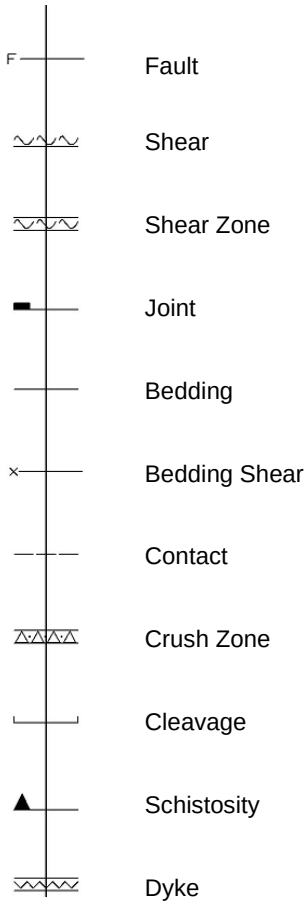
Defect Description

Order of description: type, inclination, shape, roughness, infill type, infill thickness, number

Defect Type

Symbol	Description
CL	Clay Seam
FL	Fault - fracture along which displacement is recognisable.
SR	Shear - a fracture along which movement has taken place but no displacement is recognisable. Evidence for movement may be slickensides, polishing and/or clay gouge.
SH	Sheared Zone - zone of multiple closely spaced fracture planes with roughly parallel planar boundaries usually forming blocks of lenticular or wedge shaped intact material. Fractures are typically smooth, polished or slickensided; and curved.
BG	Bedding parting - arrangement in layers of mineral grains or crystals parallel to surface of deposition along which a continuous observable parting occurs.
BSH	Bedding plane shear - a shear formed along a bedding plane
JN	Joint - a single fracture across which rock has little or no tensile strength and is not obviously related to rock fabric.
CN	Contact - surface between two lithologies.
SC	Schistosity - plane formed by the preferred orientation of the constituent minerals in a parallel arrangement in a coarse grained rock which has undergone regional metamorphism (schist).
CV	Cleavage - plane of mechanical fracture in a rock normally sufficiently closely spaced to form parallel-sided slices.
FO	Foliation
CZ	Crushed Zone - zone with roughly parallel, planar boundaries (commonly slickensided) containing disoriented usually angular rock fragments of variable size often in a soil matrix.
VN	Vein - fracture in which a tabular or sheet-like body of minerals have been intruded.
DK	Dyke - Igneous intrusion - often weathered and altered to a clay like substance.
DZ	Decomposed Zone - zone of any shape but commonly with parallel planar boundaries containing moderately to gradational boundaries into fresher rock.
FZ	Fractured Zone - a zone of closely spaced defects (mainly joints, bedding, cleavage and/or schistosity) comprised of core lengths in the order of 50 mm or less.

Standard Defect Symbols



Roughness Colour Code (for summary log)

Ro1
Ro2
Ro3
Ro4
Ro4

Shape

Term	Symbol	Description
Planar	PL	Forms a continuous plane without variation in orientation.
Curved	CU	Has a gradual change in orientation.
Undulating	UN	Has a wavy surface shape.
Stepped	ST	Has one or more well defined steps
Irregular	IR	Many changes of orientation.

Roughness

Term	Symbol	Description
Slickensided or polished	Ro1	Very smooth, reflects light.
Smooth	Ro2	Roughness not detected with finger.
Defined ridges	Ro3	Sandpaper feel (fine to medium sandpaper).
Small steps	Ro4	Sandpaper feel (medium to coarse sandpaper).
Very rough	Ro5	Very well defined ridges and/or steps.

Infill Type

Symbol	Description
KL	Clean
CA	Calcite
CB	Carbonaceous
CHL	Chlorite
FE	Iron oxide
QZ	Quartz
MG	Manganese
SU	Sulphides
SE	Sericite
RF	Rock fragments
G	Gravel
S	Sand
Z	Silt
CL	Clay

Infill Thickness

Where infilling is present, the thickness of infill is recorded using the following convention:

ST Iron oxide staining of less than 1 mm
VN Veneer coating of less than 1 mm

If the infilling is greater than 1 mm, the actual thickness of infill is recorded in millimeters.

If infill is not present, a dash (-) is recorded

Number

Number of defects with similar characteristics.

Borehole ID

BH01

Engineering Log - Non Cored Borehole

Project No.: PSM2808

Client:	Goodman Group	Commenced:	23/04/2019
Project Name:	Burrows Road	Completed:	23/04/2019
Hole Location:	1-3 Burrows Rd St Peters	Logged By:	JsR
Hole Position:	331557.0 m E 6245383.0 m N	Checked By:	AS

Drill Model and Mounting:	Track Mounted	Inclination:	-90°	RL Surface:	2.05 m		
Hole Diameter:	100 mm	Bearing:		Datum:	AHD	Operator:	Rockwell

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: Colour, structure, plasticity, additional	Moisture Condition	Consistency / Relative Density / Hand Penetrometer UCS (kPa) 100 200 300 400 500	Structure, Zoning, Origin, Additional Observations
DT		N								Asphalt: 50 mm thick.			
										Concrete: 250 mm thick.			
AD/V		N	Observed at 1.76 m in standpipe			1.1	1			Sandy Clayey GRAVEL: to 20 mm, sub-rounded to sub-angular, dark grey to black; clay non-plastic; sand fine to medium grained.	W	L to F	0.30: Inferred FILL.
						0.1	2			Silty CLAY: medium plasticity, black; some shale fragments, metal, rubber and plastic observed.			
						-1.0	3						
						-2.0	4		SW-SM	Silty SAND with clay: fine to medium grained, grey; clay low plasticity.		D to VD	4.40: Inferred alluvial soil.

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 through to 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

See Explanatory Notes for details of abbreviations and basis of descriptions.

Soil and rock descriptions in accordance with AS 1726:2017

PSM 3.02.1 LIB.GLB Log PSM AU NONCORE BH NZ AU PSM2808.GPJ <<DrawingFile>> 10/05/2019 16:52 10.0.000 Datgel Fence and Map Tool | Lib: PSM 3.02.1 2019-03-06 Prj: PSM 3.02.1 2019-03-06

Engineering Log - Non Cored Borehole

Project No.: PSM2808

Client:	Goodman Group	Commenced:	23/04/2019
Project Name:	Burrows Road	Completed:	23/04/2019
Hole Location:	1-3 Burrows Rd St Peters	Logged By:	JsR
Hole Position:	331557.0 m E 6245383.0 m N	Checked By:	AS

Drill Model and Mounting:	Track Mounted	Inclination:	-90°	RL Surface:	2.05 m		
Hole Diameter:	100 mm	Bearing:		Datum:	AHD	Operator:	Rockwell

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: Colour, structure, plasticity, additional	Moisture Condition	Consistency / Relative Density	Hand Penetrometer UCS (kPa) 100 200 300 400 500	Structure, Zoning, Origin, Additional Observations
AD/V		N	Observed at 1.76 m in standpipe			-4.0	6		SW-SM	Silty SAND with clay: fine to medium grained, grey; clay low plasticity. *(continued)*	W	D to VD		
						-5.0	7							
						-6.0	8		CH	CLAY: high plasticity, grey.		VSt		
						-7.0	9		CH	CLAY: high plasticity, pale grey-brown and red. Structure becomes visisble at 9.8m	M	H		

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 through to 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

See Explanatory Notes for details of abbreviations and basis of descriptions.

Soil and rock descriptions in accordance with AS 1726:2017

PSM 3.02.1 LIB.GLB Log PSM AU NONCORE BH NZ AU PSM2808.GPJ <<DrawingFile>> 10/05/2019 16:52 10.0.000 Datgel Fence and Map Tool | Lib: PSM 3.02.1 2019-03-06 Prj: PSM 3.02.1 2019-03-06

Engineering Log - Non Cored Borehole

Project No.: PSM2808

Client:	Goodman Group	Commenced:	23/04/2019
Project Name:	Burrows Road	Completed:	23/04/2019
Hole Location:	1-3 Burrows Rd St Peters	Logged By:	JsR
Hole Position:	331557.0 m E 6245383.0 m N	Checked By:	AS

Drill Model and Mounting:	Track Mounted	Inclination:	-90°	RL Surface:	2.05 m		
Hole Diameter:	100 mm	Bearing:		Datum:	AHD	Operator:	Rockwell

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: Colour, structure, plasticity, additional	Moisture Condition	Consistency / Relative Density	Hand Penetrometer UCS (kPa) 100 200 300 400 500	Structure, Zoning, Origin, Additional Observations
AD/V		N	Observed at 1.76 m in standpipe			-9.0	11		CH	CLAY: high plasticity, pale grey-brown and red. *(continued)*	M	H		
										SHALE: grey-brown, extremely weathered, very low to low strength..				11.05: V-bit refusal.
										Continued on cored borehole sheet				
						-10.0	12							
						-11.0	13							
						-12.0	14							

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 through to 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

See Explanatory Notes for details of abbreviations and basis of descriptions.

Soil and rock descriptions in accordance with AS 1726:2017

PSM 3.02.1 LIB.GLB Log PSM AU NONCORE BH NZ AU PSM2808.GPJ <<DrawingFile>> 10/05/2019 16:52 10.0.000 Datgel Fence and Map Tool | Lib: PSM 3.02.1 2019-03-06 Prj: PSM 3.02.1 2019-03-06

Engineering Log - Cored Borehole

Project No.: PSM2808

Client:	Goodman Group	Commenced:	23/04/2019
Project Name:	Burrows Road	Completed:	23/04/2019
Hole Location:	1-3 Burrows Rd St Peters	Logged By:	JsR
Hole Position:	331557.0 m E 6245383.0 m N	Checked By:	AS

Drill Model and Mounting: Track Mounted | Inclination: -90° | RL Surface: 2.05 m
Barrel Type and Length: NMLC 3 m | Bearing: | Datum: AHD | Operator: Rockwell

Drilling Information							Rock Substance					Rock Mass Defects	
Method	Water	RQD (%)	SAMPLES & FIELD TESTS	WPT (Lugeons)	RL (m)	Depth (m)	Graphic Log	Material Description ROCK TYPE: Colour, grain size, structure (texture, fabric, mineral composition, hardness, alteration, cementation, etc as applicable), inclusions and minor components	Weathering XW HW MW SW FR	Strength Is(50) ● - Axial ○ - 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
					-9.0	11		Continued from non-cored borehole sheet				
NMLC	Observed at 1.76 m in standpipe	98	11.15m 1 Is(50) d=0.01 a=0.01 MPa		-10.0	12		SHALE: dark grey and brown, developed bedding. SHALE: dark grey, thinly laminated, well developed bedding.				IS, 0°, CL, PR, S, 10 mm IS, 0°, CL, PR, S, 25 mm IS, 0°, CL, PR, S, 5 mm IS, 0°, CL, PR, S, 10 mm JT, 20°, FE SN, PR, RF IS, 0°, CL, PR, S, 15 mm
			11.95m 2 Is(50) d=0.01 a=0.3 MPa									
			13.05m 3 Is(50) d=0.2 a=0.3 MPa		-11.0	13						
			13.95m 4 Is(50) d=0.1 a=0.4 MPa		-12.0	14						JT, 45°, KL, PR, RF JT, 30°, KL, PR, RF
		99	14.80m 6 Is(50) a=0.4 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

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

See Explanatory Notes for details of abbreviations and basis of descriptions.

PSM 3.02.1 LIB.GLB Log PSM AU CORE BH PSM2808.GPJ <<DrawingFile>> 10/05/2019 16:51 10.0.000 Datgel Fence and Map Tool | Lib: PSM 3.02.1 2019-03-06 Prj: PSM 3.02.1 2019-03-06

Engineering Log - Cored Borehole

Project No.: PSM2808

Client:	Goodman Group	Commenced:	23/04/2019
Project Name:	Burrows Road	Completed:	23/04/2019
Hole Location:	1-3 Burrows Rd St Peters	Logged By:	JsR
Hole Position:	331557.0 m E 6245383.0 m N	Checked By:	AS

Drill Model and Mounting:	Track Mounted	Inclination:	-90°	RL Surface:	2.05 m		
Barrel Type and Length:	NMLC 3 m	Bearing:		Datum:	AHD	Operator:	Rockwell

Drilling Information							***Rock Substance***								***Rock Mass Defects***	
Method	Water	RQD (%)	SAMPLES & FIELD TESTS	WPT (Lugeons)	RL (m)	Depth (m)	Graphic Log	Material Description ROCK TYPE: Colour, grain size, structure (texture, fabric, mineral composition, hardness, alteration, cementation, etc as applicable), inclusions and minor components	Weathering XW HW MW SW FR	Strength Is(50) ● - Axial ○ - 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
					-14.0	16		Hole Terminated at 15.02 m Target depth. Standpipe installed				
					-15.0	17						
					-16.0	18						
					-17.0	19						

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

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

See Explanatory Notes for details of abbreviations and basis of descriptions.

PSM 3.02.1 LIB.GLB Log PSM AU CORE BH PSM2808.GPJ <<DrawingFile>> 10/05/2019 16:51 10.0.000 Datgel Fence and Map Tool | Lib: PSM 3.02.1 2019-03-06 Prj: PSM 3.02.1 2019-03-06

Goodman Limited

1 - 3 Burrows Road, St Peters

Geotechnical Investigation

BOREHOLES CORE PHOTO

BH01 From 11.1 m to 15.02 m

PSM2808-005R	**Appendix C**

Pells Sullivan Meynink

Borehole ID

BH02

Engineering Log - Non Cored Borehole

Project No.: PSM2808

Client:	Goodman Group	Commenced:	23/04/2019
Project Name:	Burrows Road	Completed:	23/04/2019
Hole Location:	1-3 Burrows Rd St Peters	Logged By:	JsR
Hole Position:	331729.0 m E 6245470.0 m N	Checked By:	AS

Drill Model and Mounting:	Track Mounted	Inclination:	-90°	RL Surface:	2.30 m		
Hole Diameter:	100 mm	Bearing:		Datum:	AHD	Operator:	Rockwell

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: Colour, structure, plasticity, additional	Moisture Condition	Consistency / Relative Density	Hand Penetrometer UCS (kPa) 100 200 300 400 500	Structure, Zoning, Origin, Additional Observations
DT		N								Concrete: 200 mm thick.				
						1.3	1			Sandy GRAVEL: to 30 mm, sub-angular, dark grey to black; sand coarse grained; some metal, rubber, ceramics, copper and plastic observed.				0.20: Inferred FILL.
														1.00: Numerous bricks observed
AD/V		N	Observed at 3.84 m in standpipe			0.3	2				W	L to F		
						-0.7	3							
						-1.7	4		SW-SM	Silty SAND with clay: fine to medium grained, grey; clay low plasticity.	W	D to VD		4.00: Inferred alluvial soil.
														4.20: Some shells observed

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 through to 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

See Explanatory Notes for details of abbreviations and basis of descriptions.

Soil and rock descriptions in accordance with AS 1726:2017

PSM 3.02.1 LIB.GLB Log PSM AU NONCORE BH NZ AU PSM2808.GPJ <<DrawingFile>> 10/05/2019 16:52 10.0.000 Datgel Fence and Map Tool | Lib: PSM 3.02.1 2019-03-06 Prj: PSM 3.02.1 2019-03-06

Engineering Log - Non Cored Borehole

Project No.: PSM2808

Client:	Goodman Group	Commenced:	23/04/2019
Project Name:	Burrows Road	Completed:	23/04/2019
Hole Location:	1-3 Burrows Rd St Peters	Logged By:	JsR
Hole Position:	331729.0 m E 6245470.0 m N	Checked By:	AS

Drill Model and Mounting:	Track Mounted	Inclination:	-90°	RL Surface:	2.30 m		
Hole Diameter:	100 mm	Bearing:		Datum:	AHD	Operator:	Rockwell

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: Colour, structure, plasticity, additional	Moisture Condition	Consistency / Relative Density	Hand Penetrometer UCS (kPa) 100 200 300 400 500	Structure, Zoning, Origin, Additional Observations
AD/V		N	Observed at 3.84 m in standpipe			-3.7	6		SW-SM	Silty SAND with clay: fine to medium grained, grey; clay low plasticity. *(continued)*				
						-4.7	7				W	D to VD		
						-5.7	8							
						-6.7	9		CH	CLAY: high plasticity, pale grey-brown.	M	St to VSt		

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 through to 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

See Explanatory Notes for details of abbreviations and basis of descriptions.

Soil and rock descriptions in accordance with AS 1726:2017

PSM 3.02.1 LIB.GLB Log PSM AU NONCORE BH NZ AU PSM2808.GPJ <<DrawingFile>> 10/05/2019 16:52 10.0.000 Datgel Fence and Map Tool | Lib: PSM 3.02.1 2019-03-06 Prj: PSM 3.02.1 2019-03-06

Engineering Log - Non Cored Borehole

Project No.: PSM2808

Client:	Goodman Group	Commenced:	23/04/2019
Project Name:	Burrows Road	Completed:	23/04/2019
Hole Location:	1-3 Burrows Rd St Peters	Logged By:	JsR
Hole Position:	331729.0 m E 6245470.0 m N	Checked By:	AS

Drill Model and Mounting:	Track Mounted	Inclination:	-90°	RL Surface:	2.30 m		
Hole Diameter:	100 mm	Bearing:		Datum:	AHD	Operator:	Rockwell

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: Colour, structure, plasticity, additional	Moisture Condition	Consistency / Relative Density	Hand Penetrometer UCS (kPa) 100 200 300 400 500	Structure, Zoning, Origin, Additional Observations
AD/V		N	Observed at 3.84 m in standpipe			-8.7	11		CH	CLAY: high plasticity, pale grey-brown. *(continued)*	M	St to VSt		
						-9.7	12			Becomes dark grey				12.20: Becomes harder to drill
						-10.7	13							
										Continued on cored borehole sheet				
						-11.7	14							

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 through to 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

See Explanatory Notes for details of abbreviations and basis of descriptions.

Soil and rock descriptions in accordance with AS 1726:2017

PSM 3.02.1 LIB.GLB Log PSM AU NONCORE BH NZ AU PSM2808.GPJ <<DrawingFile>> 10/05/2019 16:52 10.0.000 Datgel Fence and Map Tool | Lib: PSM 3.02.1 2019-03-06 Prj: PSM 3.02.1 2019-03-06

Borehole ID
BH02

Engineering Log - Cored Borehole

Project No.: PSM2808

Client:	Goodman Group	Commenced:	23/04/2019
Project Name:	Burrows Road	Completed:	23/04/2019
Hole Location:	1-3 Burrows Rd St Peters	Logged By:	JsR/NTH
Hole Position:	331729.0 m E 6245470.0 m N	Checked By:	AS

Drill Model and Mounting: Track Mounted — Inclination: -90° — RL Surface: 2.30 m
Barrel Type and Length: NMLC 3m — Bearing: — Datum: AHD — Operator: Rockwell

Method	Water	RQD (%)	Samples & Field Tests	WPT (Lugeons)	RL (m)	Depth (m)	Graphic Log	Material Description	Weathering	Strength Is(50)	Defect Spacing (mm)	Defect Descriptions / Comments
					-8.7	11						
					-9.7	12						
					-10.7	13		Continued from non-cored borehole sheet				13.20: V-bit refusal.
NMLC	Observed at 3.84 m in standpipe	100			-11.7	14		SHALE: dark grey and brown, extremely weathered, very low to low strength.	XW	VL–L		
			14.35m 1 Is(50) d=0 a=0 MPa					SHALE: dark grey, thinly laminated, well developed bedding.	HW	VL–L		

Column headings: Drilling Information (Method, Water, RQD (%), Samples & Field Tests, WPT (Lugeons), RL (m), Depth (m)); Rock Substance (Graphic Log; Material Description — ROCK TYPE: Colour, grain size, structure (texture, fabric, mineral composition, hardness, alteration, cementation, etc as applicable), inclusions and minor components; Weathering XW HW MW SW FR; Strength Is(50) ● - Axial ○ - Diametral VL 0.1 L 0.3 M 1 H 3 VH 10 EH); Rock Mass Defects (Defect Spacing (mm) <20 60 200 600 1000; Defect Descriptions / Comments — Description, alpha/beta, infilling or coating, shape, roughness, thickness, other).

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

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

See Explanatory Notes for details of abbreviations and basis of descriptions.

Engineering Log - Cored Borehole

Project No.: PSM2808

Client:	Goodman Group	Commenced:	23/04/2019
Project Name:	Burrows Road	Completed:	23/04/2019
Hole Location:	1-3 Burrows Rd St Peters	Logged By:	JsR
Hole Position:	331729.0 m E 6245470.0 m N	Checked By:	AS

Drill Model and Mounting:	Track Mounted	Inclination:	-90°	RL Surface:	2.30 m		
Barrel Type and Length:	NMLC 3 m	Bearing:		Datum:	AHD	Operator:	Rockwell

Drilling Information							***Rock Substance***										***Rock Mass Defects***	
Method	Water	RQD (%)	SAMPLES & FIELD TESTS	WPT (Lugeons)	RL (m)	Depth (m)	Graphic Log	Material Description ROCK TYPE: Colour, grain size, structure (texture, fabric, mineral composition, hardness, alteration, cementation, etc as applicable), inclusions and minor components	Weathering XW HW MW SW FR	Strength Is(50) ● - Axial ○ - 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
		100	15.05m 2 Is(50) d=0.1 a=0.1 MPa									
					-13.7	16		Hole Terminated at 15.18 m Target depth. Standpipe installed				
					-14.7	17						
					-15.7	18						
					-16.7	19						

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

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

See Explanatory Notes for details of abbreviations and basis of descriptions.

PSM 3.02.1 LIB.GLB Log PSM AU CORE BH PSM2808.GPJ <<DrawingFile>> 10/05/2019 16:51 10.0.000 Datgel Fence and Map Tool | Lib: PSM 3.02.1 2019-03-06 Prj: PSM 3.02.1 2019-03-06

Pells Sullivan Meynink

Goodman Limited

1 - 3 Burrows Road, St Peters

Geotechnical Investigation

BOREHOLES CORE PHOTO

BH02 From 13.2 m to 15.18 m

PSM2808-005R	**Appendix C**

Borehole ID

BH03

Engineering Log - Non Cored Borehole

Project No.: PSM2808

Client:	Goodman Group	Commenced:	24/04/2019
Project Name:	Burrows Road	Completed:	24/04/2019
Hole Location:	1-3 Burrows Rd St Peters	Logged By:	JsR
Hole Position:	331679.9 m E 6245385.0 m N	Checked By:	AS

Drill Model and Mounting:	Track Mounted	Inclination:	-90°	RL Surface:	3.50 m		
Hole Diameter:	100 mm	Bearing:		Datum:	AHD	Operator:	Rockwell

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: Colour, structure, plasticity, additional	Moisture Condition	Consistency / Relative Density	Hand Penetrometer UCS (kPa) 100 200 300 400 500	Structure, Zoning, Origin, Additional Observations
DT		N								Concrete: 250 mm thick.				
AD/V		N	Observed at 2.87 m in standpipe			2.5	1			Sandy GRAVEL: to 30 mm, sub-angular, black; sand fine to medium grained; some metal, ceramics observed.	M	L to F		0.25: Inferred FILL.
						1.5	2			Silty SAND: fine to medium grained, grey.				
						0.5	3			Some clay with medium plasticity at 3.0m	W	L to F		
						-0.5	4		SW-SM	Silty SAND with clay: fine to medium grained, grey; clay low plasticity.	W	D to VD		4.40: Inferred alluvial soil.

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 through to 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

See Explanatory Notes for details of abbreviations and basis of descriptions.

Soil and rock descriptions in accordance with AS 1726:2017

PSM 3.02.1 LIB.GLB Log PSM AU NONCORE BH NZ AU PSM2808.GPJ <<DrawingFile>> 10/05/2019 16:52 10.0.000 Datgel Fence and Map Tool | Lib: PSM 3.02.1 2019-03-06 Prj: PSM 3.02.1 2019-03-06

Engineering Log - Non Cored Borehole

Project No.: PSM2808

Client:	Goodman Group	Commenced:	24/04/2019
Project Name:	Burrows Road	Completed:	24/04/2019
Hole Location:	1-3 Burrows Rd St Peters	Logged By:	JsR
Hole Position:	331679.9 m E 6245385.0 m N	Checked By:	AS

Drill Model and Mounting:	Track Mounted	Inclination:	-90°	RL Surface:	3.50 m		
Hole Diameter:	100 mm	Bearing:		Datum:	AHD	Operator:	Rockwell

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: Colour, structure, plasticity, additional	Moisture Condition	Consistency / Relative Density	Hand Penetrometer UCS (kPa) 100 200 300 400 500	Structure, Zoning, Origin, Additional Observations
AD/V		N	Observed at 2.87 m in standpipe			-2.5	6		SW-SM	Silty SAND with clay: fine to medium grained, grey; clay low plasticity. *(continued)*	W	D to VD		
						-3.5	7		CH	CLAY: high plasticity, pale grey-brown.	M	St		
						-4.5	8		SM-SC	Silty SAND: fine to medium grained, grey.	W	D to VD		
						-5.5	9		CH	CLAY: high plasticity, pale grey-brown.	M	VSt to H		

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 through to 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

See Explanatory Notes for details of abbreviations and basis of descriptions.

Soil and rock descriptions in accordance with AS 1726:2017

PSM 3.02.1 LIB.GLB Log PSM AU NONCORE BH NZ AU PSM2808.GPJ <<DrawingFile>> 10/05/2019 16:52 10.0.000 Datgel Fence and Map Tool | Lib: PSM 3.02.1 2019-03-06 Prj: PSM 3.02.1 2019-03-06

Engineering Log - Non Cored Borehole

Project No.: PSM2808

Client:	Goodman Group	Commenced:	24/04/2019
Project Name:	Burrows Road	Completed:	24/04/2019
Hole Location:	1-3 Burrows Rd St Peters	Logged By:	JsR
Hole Position:	331679.9 m E 6245385.0 m N	Checked By:	AS

Drill Model and Mounting:	Track Mounted	Inclination:	-90°	RL Surface:	3.50 m		
Hole Diameter:	100 mm	Bearing:		Datum:	AHD	Operator:	Rockwell

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: Colour, structure, plasticity, additional	Moisture Condition	Consistency / Relative Density	Hand Penetrometer UCS (kPa) 100 200 300 400 500	Structure, Zoning, Origin, Additional Observations
AD/V		N	Observed at 2.87 m in standpipe			-7.5	11		CH	CLAY: high plasticity, pale grey-brown. *(continued)* Becomes pale grey-brown and red	M	VSt to H		11.50: V-bit refusal. 11.90: Cleaning by washing borehole
						-8.5	12			Continued on cored borehole sheet				
						-9.5	13							
						-10.5	14							

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 through to 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

See Explanatory Notes for details of abbreviations and basis of descriptions.

Soil and rock descriptions in accordance with AS 1726:2017

PSM 3.02.1 LIB.GLB Log PSM AU NONCORE BH NZ AU PSM2808.GPJ <<DrawingFile>> 10/05/2019 16:52 10.0.000 Datgel Fence and Map Tool | Lib: PSM 3.02.1 2019-03-06 Prj: PSM 3.02.1 2019-03-06

Engineering Log - Cored Borehole

Project No.: PSM2808

Client:	Goodman Group	Commenced:	24/04/2019
Project Name:	Burrows Road	Completed:	24/04/2019
Hole Location:	1-3 Burrows Rd St Peters	Logged By:	JsR
Hole Position:	331679.9 m E 6245385.0 m N	Checked By:	AS

Drill Model and Mounting: Track Mounted | Inclination: -90° | RL Surface: 3.50 m
Barrel Type and Length: NMLC 3 m | Bearing: | Datum: AHD | Operator: Rockwell

Drilling Information							Rock Substance				Rock Mass Defects	
Method	Water	RQD (%)	SAMPLES & FIELD TESTS	WPT (Lugeons)	RL (m)	Depth (m)	Graphic Log	Material Description ROCK TYPE: Colour, grain size, structure (texture, fabric, mineral composition, hardness, alteration, cementation, etc as applicable), inclusions and minor components	Weathering XW HW MW SW FR	Strength Is(50) ●- Axial ○- 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
					-7.5	11						
					-8.5	12		Continued from non-cored borehole sheet				
NMLC	Observed at 2.87 m in standpipe	97	12.95m 1 Is(50) d=0.1 a=0.1 MPa		-9.5	13		SHALE: dark grey, thinly laminated, well developed bedding.				IS, 0°, CL, PR, RF, 80 mm IS, 0°, CL, PR, RF, 10 mm BP, 0°, CN, PR, RF IS, 0°, CL, PR, RF, 50 mm BP, 0°, CN, PR, RF BP, 0°, FE SN, PR, RF CZ, RF, PR, RF, 60 mm JT, 60°, RF, PR, RF
			13.96m 2 Is(50) d=0.3 a=0.3 MPa		-10.5	14						
			14.94m 3 Is(50) d=0.1 a=0.2 MPa					Hole Terminated at 15.00 m. Target depth. Standpipe installed				JT, 60°, RF, 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

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

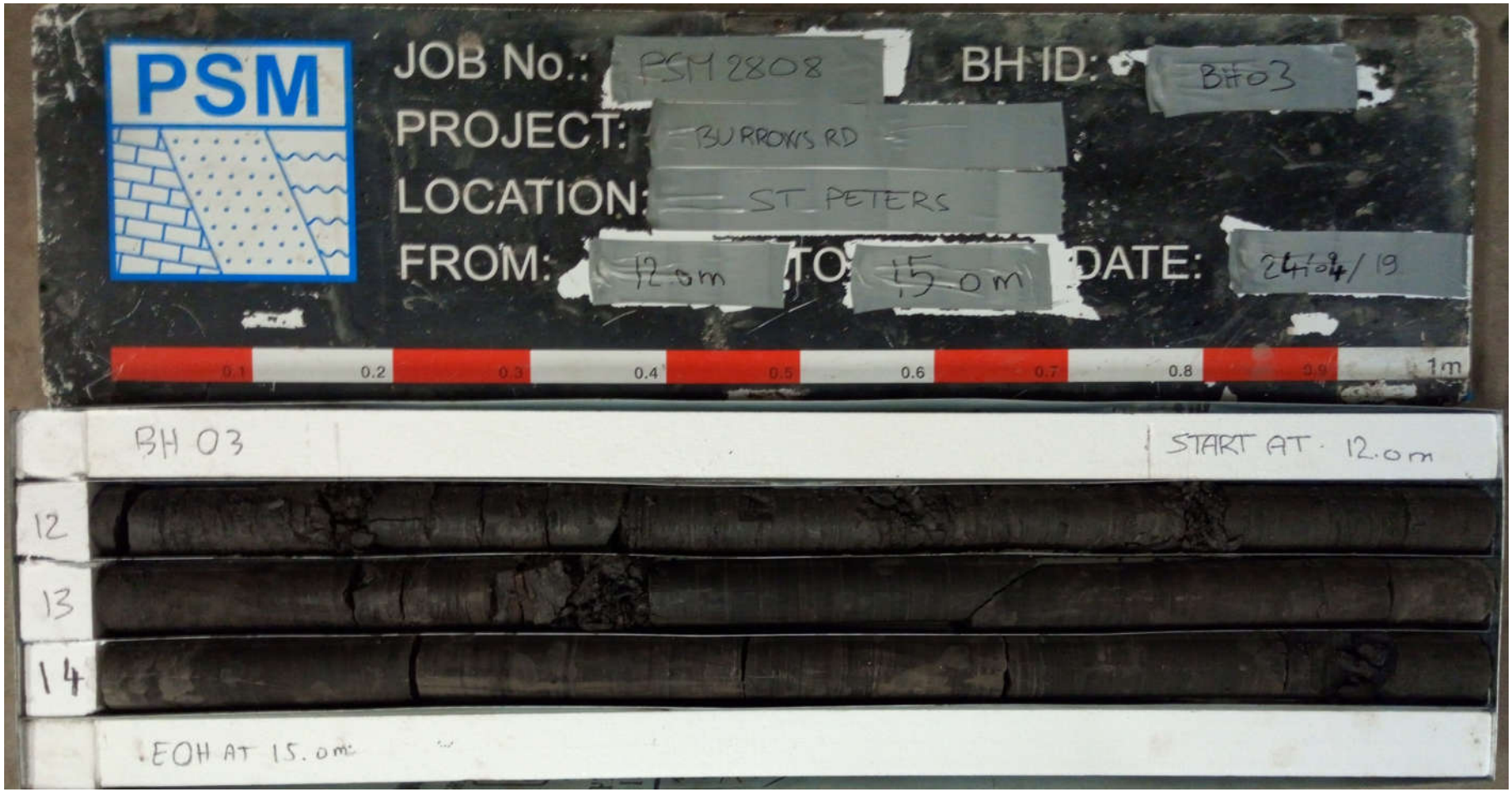
Infilling/Coating
CN - Clean
SN - Stain
VN - Veneer
CO - Coating
RF - Rock fragments
G - Gravel
S - Sand
Z - Silt
CA - Calcite
CL - Clay
FE - Iron
QZ - Quartz
X - Carbonaceous

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

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

See Explanatory Notes for details of abbreviations and basis of descriptions.

PSM 3.02.1 LIB.GLB Log PSM AU CORE BH PSM2808.GPJ <<DrawingFile>> 10/05/2019 16:51 10.0.000 Datgel Fence and Map Tool | Lib: PSM 3.02.1 2019-03-06 Prj: PSM 3.02.1 2019-03-06



Goodman Limited

1 - 3 Burrows Road, St Peters

Geotechnical Investigation

BOREHOLES CORE PHOTO

BH03 From 12.0 m to 15.0 m

PSM2808-005R	**Appendix C**

Appendix D
Point Load Index Tests

Pells Sullivan Meynink

POINT LOAD STRENGTH INDEX TEST RESULTS

Job No. ***PSM1541*** **Sheet 1 of 1**

Project ***1-3 Burrows Rd - St Peters***

Test Method	*AS 4133.4.1 - 1993 Methods of Testing Rocks for Engineering Purposes, Determination of Point Load Strength Index*	Sampling Technique	*NLMC*	Sampling Date	*23-24/04/2019*
Test Machine	*GSA 6500*	Storage History	*North Ryde office indoor core storage area*	Testing Date	*04/2019*
Calibration Date	*16/8/2018*	Moisture Condition	*Natural*	Tested By	*JsR*
		Loading Rate	*< 30 seconds*		

Rock Type	Location	Depth	Diametral Tests					Axial, Block, and Irregular Lump Tests							AS 1726 Strength Class
		(m)	D (mm)	L (mm)	P (kN)	$I_{s(50)}$ (MPa)	Failure Mode	W (mm)	D (mm)	L (mm)	P (kN)	I_s (MPa)	$I_{s(50)}$ (MPa)	Failure Mode	
Shale	***BH01***	***11.05***	*50*	*62*	*0*	***0***	*Parallel to bedding*	*50*	*44*		*0*	*0*	***0***	*Through substance*	
Shale	***BH01***	***11.95***	*50*	*100*	*0.1*	***0***	*Parallel to bedding*	*50*	*46*		*1*	*0.3*	***0.3***	*Through substance*	***VL / M***
Shale	***BH01***	***13.05***	*50*	*101*	*0.5*	***0.2***	*Parallel to bedding*	*50*	*48*		*0.9*	*0.3*	***0.3***	*Bad break*	***L***
Shale	***BH01***	***13.95***	*50*	*96*	*0.2*	***0.1***	*Parallel to bedding*	*50*	*43*		*1*	*0.4*	***0.4***	*Bad break*	***VL / M***
Shale	***BH01***	***14.90***					*Parallel to bedding*	*50*	*45*		*1.2*	*0.4*	***0.4***	*Through substance*	***M***
Shale	***BH02***	***14.35***	*50*	*82*	*0.1*	***0***	*Parallel to bedding*	*50*	*50*		*0.2*	*0*	***0***	*Through substance*	***VL***
Shale	***BH02***	***15.05***	*50*	*121*	*0.2*	***0.1***	*Parallel to bedding*	*50*	*50*		*0.2*	*0.1*	***0.1***	*Through substance*	***VL***
Shale	***BH03***	***12.95***	*50*	*76*	*0.2*	***0.1***	*Parallel to bedding*	*50*	*42*		*0.3*	*0.1*	***0.1***	*Through substance*	***VL / L***
Shale	***BH03***	***13.96***	*50*	*70*	*0.8*	***0.3***	*Parallel to bedding*	*50*	*40*		*0.8*	*0.3*	***0.3***	*Through substance*	***M***
Shale	***BH03***	***14.94***	*50*	*74*	*0.4*	***0.1***	*Parallel to bedding*	*50*	*46*		*0.4*	*0.2*	***0.2***	*Bad break*	***L***

By: ***JsR*** **Checked:** **Date:** ***1/5/2019***

Appendix E
Piezometer Construction Records

Pells Sullivan Meynink
Engineering Consultants
Rock - Soil - Water

JOB no.: PSM2808

PROJECT: **Burrows Road**

PIEZOMETER CONSTRUCTION RECORD

HOLE NUMBER:	BH01	DRILLING CONTRACTOR:	Rockwell Drilling
PIEZOMETER:		DRILLING RIG:	Hanjin
COLLAR EASTING:	331557	DEPTH OF HOLE (m):	15 m
COLLAR NORTHING:	6245383	BOREHOLE INCLINATION:	Vertical
COLLAR RL(m):	2.1	PIEZO INSTALLATION DATE:	23/04/2019
DATUM:	MGA 56	SUPERVISED BY:	JsR

Tick boxes

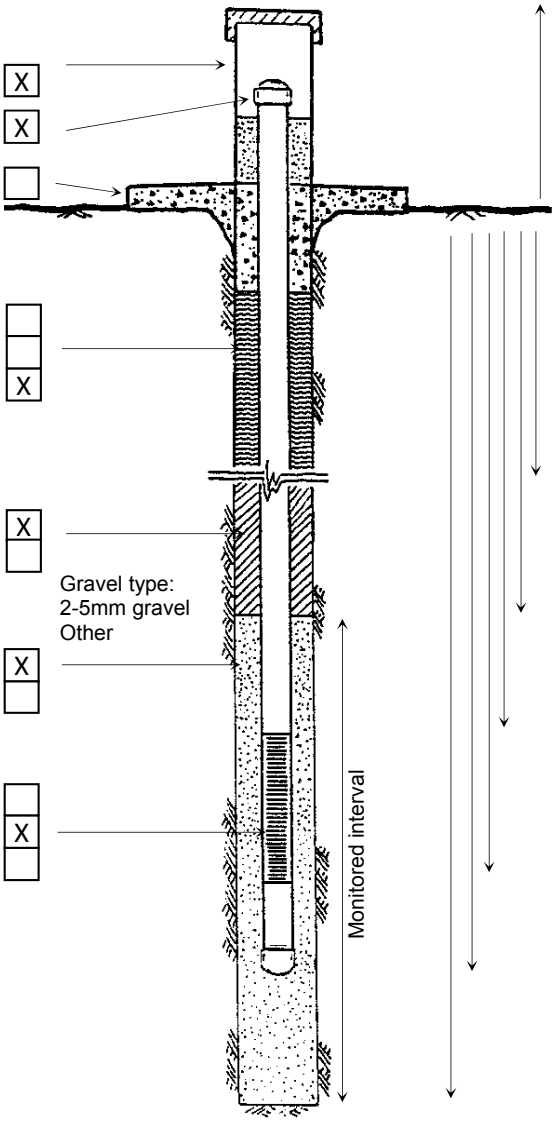
Steel protective **well cover** [X]
PVC cap [X]
Concrete Colar [ ]

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

Seal
Bentonite Pellets [X]
Other [ ]

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	6 m
Depth to base of screen	12 m
Depth to base of piezo	15 m
Depth to base of gravel	15 m

COMMENTS:	Gatic cover were used for the protection

Pells Sullivan Meynink
Engineering Consultants
Rock - Soil - Water

JOB no.: PSM2808

PROJECT: **Burrows Road**

PIEZOMETER CONSTRUCTION RECORD

HOLE NUMBER:	BH02	DRILLING CONTRACTOR:	Rockwell Drilling
PIEZOMETER:		DRILLING RIG:	Hanjin
COLLAR EASTING:	331729	DEPTH OF HOLE (m):	15 m
COLLAR NORTHING:	6245470	BOREHOLE INCLINATION:	Vertical
COLLAR RL(m):	2.3	PIEZO INSTALLATION DATE:	24/04/2019
DATUM:	MGA 56	SUPERVISED BY:	JsR

Tick boxes

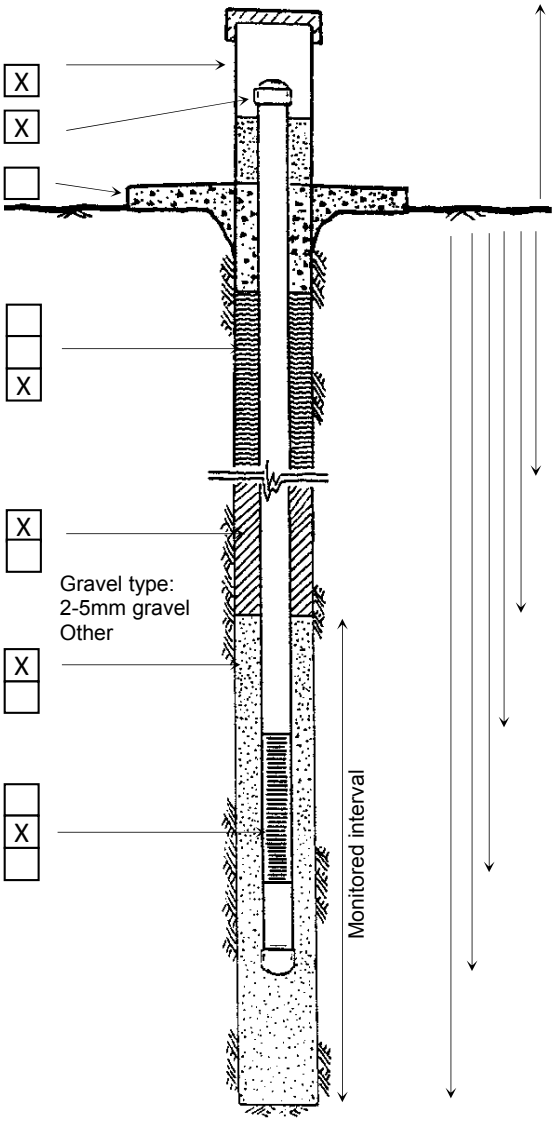
Steel protective **well cover** [X]
PVC cap [X]
Concrete Colar [ ]

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

Seal
Bentonite Pellets [X]
Other [ ]

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	6 m
Depth to base of screen	12 m
Depth to base of piezo	15 m
Depth to base of gravel	15 m

COMMENTS:	Gatic cover were used for the protection

Pells Sullivan Meynink
Engineering Consultants
Rock - Soil - Water

JOB no.: PSM2808

PROJECT: **Burrows Road**

PIEZOMETER CONSTRUCTION RECORD

HOLE NUMBER:	BH03	DRILLING CONTRACTOR:	Rockwell Drilling
PIEZOMETER:		DRILLING RIG:	Hanjin
COLLAR EASTING:	331680	DEPTH OF HOLE (m):	15 m
COLLAR NORTHING:	6245385	BOREHOLE INCLINATION:	Vertical
COLLAR RL(m):	3.5	PIEZO INSTALLATION DATE:	24/04/2019
DATUM:	MGA 56	SUPERVISED BY:	JsR

Tick boxes

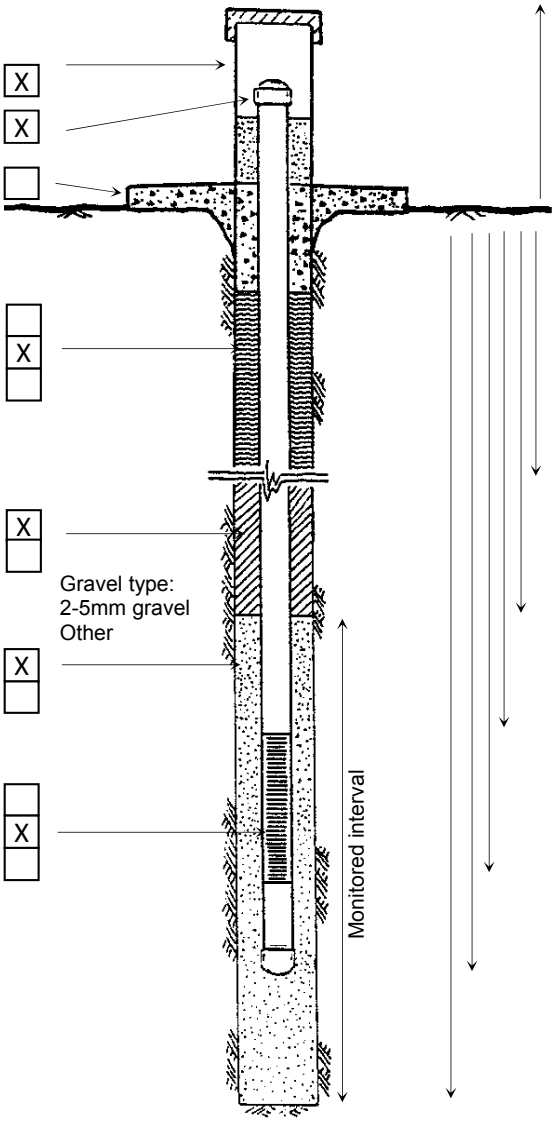
Steel protective **well cover** [X]
PVC cap [X]
Concrete Colar [ ]

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

Seal
Bentonite Pellets [X]
Other [ ]

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	5 m
Depth to top of gravel pack	7 m
Depth to top of screen	9 m
Depth to base of screen	15 m
Depth to base of piezo	15 m
Depth to base of gravel	15 m

COMMENTS:	Gatic cover were used for the protection

Appendix F
Bulk Earthworks Specification

Bulk Earthworks Specification

1 - 3 Burrows Road, St Peters

PSM2808-023S 25 September 2024

Goodman Property Services (Aust) Pty Ltd

Table of Contents

List of Tables

List of Appendices

1. Scope

This specification details the requirements for bulk earthworks to be undertaken for the proposed industrial warehouse development at 1 – 3 Burrows Road, St Peters. The area where this specification is applicable is shown in Appendix A. This includes areas where material is filled or cut to bulk earthworks level (BEL) within the extent of earthworks 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 or additional regulatory/approval requirements (e.g. Council Consent Conditions) associated with the earthworks.

There is a **HOLD POINT** on placing fill in Section 3.4 of this Specification.

2. Site Preparation Works

The following tasks shall be undertaken as part of the Site Preparation Works:

1. To prepare the site for the earthworks:
    a. Removal of stockpiles and mounds
    b. Clearing of the area including removal and disposal of all trees, stumps, roots, bush, other organic material, all vegetation both living and dead, all minor man-made structures (e.g. fences) and all rubbish
    c. All trees and stumps, on or within the limits of clearing, unable to be removed by the clearing methods used by the Contractor shall be removed by grubbing
    d. Stripping of topsoil
    e. Demolition of structures as directed by the Principal. Extent of demolition works are not addressed by this Specification
    f. Decommissioning the services from the pre-existing infrastructure. This is to include backfilling any voids such that they do not collapse or undergo excessive settlement under the weight of the filling and building loads. Backfilling is to be undertaken with one of the following materials:
        i. Cement stabilised sand (min. 3% cement) placed in accordance with the supplier requirements or
        ii. Mass concrete or grout as approved by PSM.
        iii. Engineered fill placed in accordance with Clauses 3.5 and 3.6 of the Specification.

    Where any excavation is required to complete the above tasks, the surface exposed at completion of the excavation shall be treated in accordance with the Subgrade Preparation requirements in Clause 3.1.

3. Filling Works

3.1 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 AND of at least stiff consistency.
4. Other materials as approved by PSM, e.g. existing fill, existing pavement intended to be left in place.

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.

3.1.1 Subgrade - Existing Fill

The existing fill within the site can be approved by PSM as subgrade for filling following heavy proof rolling using an 825 compactor (or approved alternative by PSM) under the supervision of PSM. Where excessive deflection under the proof roll is observed the fill will require remediation i.e. remove and replace with engineered fill.

Additional inspections and testing of the in-situ existing fill may be required as directed by PSM, including plate load testing. The contractor is to make a suitable reaction (e.g. 20 tonne excavator) available for the plate load testing.

3.1.2 Subgrade - Existing Pavement

Existing pavement comprising asphalt, road base and concrete can be approved by PSM as subgrade for filling if it satisfies all of the following requirements:

1. The pavement is located at least 1 m below the bulk earthworks levels (BELs).
2. The pavement has been proof-rolled using an 825 compactor (or approved alternative by PSM) under PSM supervision.

Core holes will need to be drilled through concrete pavements that are to be left in place at the direction of PSM to investigate voids underneath the concrete prior to approval as subgrade for filling.

Where the existing pavements are located within 1 m of the BEL, or are not approved by PSM, then the pavement shall be removed. It can be crushed and re-used as Engineered Fill if it meets the requirements in Clause 3.5 and 3.6 of this Specification.

3.2 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.

3.3 Material

3.3.1 Site Won Material

Site Won Material is to meet the requirements of All Fill in Section 3.3.5 of this Specification. Site Won Material comprises either natural material or existing fill won from cut areas of excavations on site.

3.3.2 Imported Fill

Imported Engineered Fill is to conform to 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 (eg 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 under Clause 93 of the Protection of the Environment Operations (Waste) Regulation 2014:

   "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.

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."

3.3.3 All Fill

The Engineered Fill shall be approved by the GITA as suitable for use in a structural fill.

Engineered Fill shall not comprise unsuitable material that includes:

- Organic soils, such as many topsoils, severely root-affected subsoils and peat;
- Silts, or materials that have the deleterious engineering properties of silt;
- Other materials with properties that are unsuitable for the forming of structural fill; unless it is approved by PSM.

The GITA shall assess that the proportion of deleterious material in each Lot is not greater than 0.5% by weight. Deleterious material is defined by Table 3015.6 of the RMS QA Specification 3051 (Edition 7 June 2020) as:

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.

3.4 Fill Zonation and Placement

HOLD POINT

Process held	Placing of fill
Submission detail	The Contractor / GITA submit to PSM a Weekly Certificate as defined in Clause 7.2.1 of this specification for the earthworks completed to the previous Saturday no later than 5 pm of the subsequent Wednesday.
Release of Hold Point	PSM to confirm receipt of Weekly Certificate and recommend release of Hold Point if initial assessment of the Weekly Certificate indicates it complies with requirements of this specification. The contract superintendent should then release the Hold Point if it considers appropriate.

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 as per Table 1.

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

3.5 Compaction

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

The insitu density shall be measured over the full depth of each layer placed.

3.6 Moisture Control

The placement moisture variation or Hilf moisture variation shall be in accordance with Table 1 requirements.

Placement moisture content of the Engineered Fill shall be measured.

Table 1 - Requirements for Layer Thickness, Compaction and Moisture Variation

Fill Type	Compacted Layer Thickness (mm)	Compaction Ratio	Moisture Variation
		AS1289.5.1.1 and AS1289.5.4.1 or AS1289.5.7.1	AS1289.5.1.1 and AS1289.5.4.1 or AS1289.5.7.1
Site Won Material or Imported Fill	300	Between 98% and 102%	Between 2% Dry and 2% Wet Std Comp

Note:

1 A single pass is defined as a forward and backwards in the same track.

2 A Cat825 shall be used or other plant approved by PSM.

3 Compaction trials shall be undertaken onsite to confirm optimum number of passes:
   a. In situ wet density measured after 4, 6, 8, 10 passes of Cat825.
   b. Lab compactions to assess SMDD and OMC once 10 passes are completed.
   c. GITA shall undertake a test roll with a 12 tonne smooth roller or PSM approved equivalent to confirm that no significant deformation/springing occurs.
   d. Results shall be submitted to PSM for review and assessment.

4 Each lot placed shall be tested as follows:
   a. In situ wet density and moisture content measured at frequency as specified in Cl. 6.4 after nominated number of passes using the Nuclear Densometer.
   b. 1 laboratory moisture content test shall be undertaken per lot using a small sample and strict protocols.
   c. GITA shall undertake a test roll with a 12 tonne smooth drum roller or PSM approved equivalent on each completed Lot to confirm that no significant deformation/springing occurs and record this on the Lot Approval report. Should significant deformation/springing occur the layer may need additional compaction or moisture conditioning (typically drying).
   d. Results reported as part of the Lot Approval Report and submitted to PSM.
   e. GITA shall confirm in Lot Approval Report that minimum number of passes have been undertaken, confirm test roll indicates no significant deformation/springing, and report the in situ wet density test results.

4. Cutting

4.1 Subgrade Condition

The subgrade is to comprise one of the following materials:

1. Bedrock.
2. Natural insitu material of at least stiff consistency.
3. Other materials as approved by PSM, e.g. existing fill intended to be left in place.

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

In areas of cut, any existing fill should be removed to a depth such that a minimum 1 m of engineered fill is to be placed on top of the existing fill to achieve the BEL.

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.

5. Survey

5.1 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. The area subject to approval shall be assessed and shown on a plan drawing to an accuracy of at least +/- 5 m in plan.
2. The Lot boundaries shall be assessed and shown on a plan drawing to an accuracy of at least +/- 5 m in plan.
3. The location of the field density tests shall be assessed and shown on the Lot boundary plan drawing to an accuracy of at least +/-5 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.

5.2 Cutting Areas

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

6. Inspection and testing

6.1 Role of the GITA

A NATA accredited 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.

6.2 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 top soil
> – 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 6.3 of this specification.
2. A frequency of compaction testing not less than that specified in Clause 6.4 of this specification.
3. The GITA documenting and reporting its activity in the terms required by Clause 7 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 7 of this specification.

6.3 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 (both moisture conditioning and compaction) and that represents no more than one day's work.

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.

6.4 Testing Frequency (Compaction Testing)

The frequency of compaction testing for each lot shall not be less than the greater of:

1. 1 test per 500 m^3 of material placed.
2. 3 tests per lot.

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

Test locations shall be selected randomly by the GITA.

6.5 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 the direction of PSM at final bulk earthworks level (BEL). Expected test frequency is approximately a day of testing for each building pad. The contractor is to make a suitable reaction (eg 20 tonne excavator) available for the tests.

6.6 Inspection, Testing and Survey

The GITA shall at least undertake the following tasks:

Cut areas

1. Identify the subgrade as one of the three (3) subgrade types listed in Clause 4.1 of this specification and assess that the subgrade condition of cut areas is in accordance with the subgrade condition requirements of Clause 4.1 of this specification. Should the subgrade material comprise "*Other materials as approved by PSM, eg. existing fill intended to be left in place*.", PSM should be requested to inspect and provide approval.
2. Should Engineered Fill be required to fill overcut areas, assess that filling has been placed in accordance with this specification.

Fill areas

3. For fill areas, identify the subgrade as one of the four (4) subgrade types listed in Clause 3.1 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 3.1 of this specification. Should the subgrade material comprise "*Other materials as approved by PSM, eg. existing fill intended to be left in place.*", PSM should be requested to inspect and provide approval prior to filling.
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 3.2 of this specification.

5. Assess that the material placed is in accordance with the fill material requirements of Clause 3.3 of this specification.
6. Assess that the Engineered Fill has been placed in accordance with the requirements for fill zonation and placement of Clause 3.4 of this specification.
7. Assess that each Lot as presented for approval by the contractor is in accordance with the requirements for Lot definition of Clause 6.3 of this specification.
8. Ensure that the survey requirements in Clause 5 of this specification have been completed.
9. Estimate the approximate volume of Engineered Fill placed in each Lot presented for approval.
10. Conduct Lot testing in accordance with the construction control testing requirements of Clauses 6.3 and 6.4 of this specification.
11. Assess that the compaction of each Lot is in accordance with the requirements of Clause 3.5 of this specification. The GITA shall select a depth of insitu density tests that allows the density of the full layer to be assessed.
12. Assess that the moisture variation of each Lot is in accordance with the requirements for moisture control in Clause 3.6 of this specification.
13. Conduct material property testing in accordance with the material testing requirements in this specification.

7. Reporting and Certification

7.1 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 6.6 including reporting the subgrade type.
   - Document the subgrade survey that has been undertaken.
   - Approve or reject the subgrade condition and base geometry for filling, based on tasks 3 and 4 of Clause 6.6.
   - Approve or reject the subgrade condition for cut areas based on task 1.
2. *Lot Approval Reports* (a sample is attached). Such a report shall:
   - Document assessments, testing and survey undertaken for tasks 3 to 13 of Clause 6.6.
   - Report the results of testing undertaken for task 10 of Clause 6.6.
   - Approve or reject lots based on tasks 11 and 12 of Clause 6.6.
3. Material Testing Reports. Such a report shall:
   - Report the results of material property testing undertaken for task 13 of Clause 6.6.
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 8 of Clause 6.6 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.)

7.2 Certification

7.2.1 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 property 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
- Provide an Excel spreadsheet presenting the results of the week's acceptance testing completed by the GITA.

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. PSM4828-003S REV3)".

7.2.2 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. PSM2808-023S REVX)."*

Brisbane

Level 6, 500 Queen Street
GPO Box 3244
Brisbane QLD 4000
+61 7 3220 8300

Sydney

G3-56 Delhi Road
North Ryde NSW 2113
+61 2 9812 5000

Perth

Level 3 22 Delhi Street
West Perth WA 6005
+61 8 9462 8400

Appendix A
Site Locality Plan

These designs, plans & specifications and the copyright therein are the property of the Architect and must not be used, reproduced or copied wholly or in part without the written permission of this office.

Figured dimensions to be used in preference to scaling. All dimensions to be checked on site.

This document is not to be used for construction unless signed & issued for construction

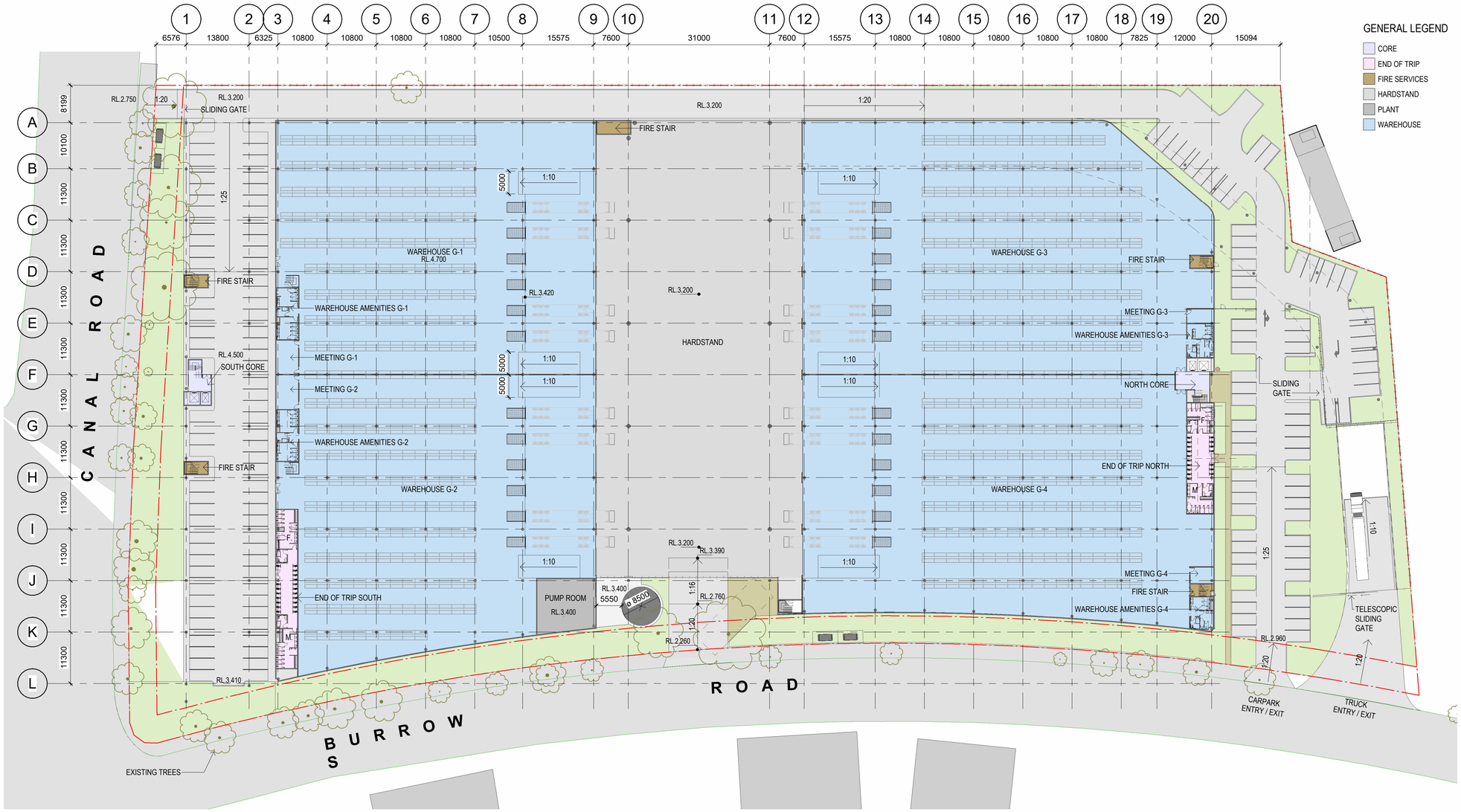
NORTH

REVISION

REV	DESCRIPTION	DATE
1	ISSUED FOR INFORMATION Grid 18-20 revised Fencing & Gates added	02/07/2024
2	ISSUE FOR REVIEW	11/07/2024
3	ISSUE FOR REVIEW	23/07/2024
4	ISSUED FOR REVIEW	29/07/2024

GENERAL LEGEND

- CORE
- END OF TRIP
- FIRE SERVICES
- HARDSTAND
- PLANT
- WAREHOUSE



ARCHITECT

sba

p: 02 9929 9988 e info@sba.au w: www.sba.au

CLIENT

Goodman

PROJEC

Multilevel Industrial Facility

1-3 Burrows Road, Alexandria

TITLE

Site & Ground Floor Plan

SCALE 1 : 500 @ A1

PROJECT NO	DRAWING NO	REV
24132	DA200	4

29/07/2024 4:39:40 PM

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:

SAMPLE ONLY

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:

SAMPLE ONLY

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:

SAMPLE ONLY

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. PSM2808-023S, 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

SAMPLE ONLY