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Our Ref: PSM3750-006L

14 February 2019

School Infrastructure NSW (SINSW)
c/-APP
Level 7, 116 Miller Street
NORTH SYDNEY NSW 2060

Attention: Satya Mandalika
By email: Satya.Mandalika@app.com.au

Dear Satya

RE: SCHOOL INFRASTRUCTRE NSW (SINSW)
RESULTS OF GEOTECHNICAL INVESTIGATION ON LANDCOM 6.0 HA LAND

1. Introduction

This letter presents the results of geotechnical investigation undertaken by Pells Sullivan Meynink (PSM) at Lot 375 Edmondson Park. The work has been undertaken in accordance with the PSM proposal PSM3750-002L dated 4 December 2018. The land size for geotechnical investigation was changed from 8.06 ha to 6.0 ha based on Satya Mandalika (APP)'s email on 7 January 2019.

2. Background

To assist in the geotechnical investigation, we were provided with and reviewed the following documents:

- A plan showing the proposed 6.0 ha subdivision of the site, drawing no. 17104PS, provided in an email by Satya Mandalika on 7 January 2019
- A survey plan with areal imagery for the subject site, drawing no. *23916-DETAIL1,* dated 17 January 2019

We understand that SINSW's proposed development for this stage may comprise a 6 to 9 storey building. There is currently a large stockpile (approximately 30,000 m^3 and 9 m high) on the western portion of the property that is planned to be removed prior to the development. Details of the proposed development (eg. basement, finish surface levels, building loads, earthworks, etc.) are not known to PSM at this stage. We assume no basement is proposed.

3. Geotechnical Investigation

As requested by APP, PSM have completed a geotechnical investigation for the area.

3.1 Field Work

The fielwork was undertaken on 21 and 22 January 2019 under the full-time supervision of a PSM geotechnical engineer, who undertook the following tasks:

- Directing the testing locations and drilling
- Preparing engineering logs of the material encountered
- Collection of disturbed soil samples for further testing

The test locations were recorded with a hand-held GPS unit with a horizontal accuracy of approximately +/- 5 m. Figure 1 presents the test locations.

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

A total of five (5) boreholes (BH01 to BH05) were drilled using a 6.5 tonne track mounted drill rig. Augering through soil was undertaken using a V-bit to refusal depth and continued with a TC-bit in rock until refusal. Bulk soil samples were taken directly from the auger and from areas immediately adjacent to the borehole using a shovel when necessary. Furthermore, BH01 and BH03 were cored in rock from the depth of TC-bit refusal to final depths of 8.5 m and 7.4 m respectively. Two standpipe peizometers (monitoring wells) were installed in BH01 and BH03. The standpipe peizometer at BH01 also contains a water level logger which records the water level at regular intervals of 30 minutes. Attachment A presents geotechnical engineering borehole logs.

At the completion of the fieldwork, the boreholes were backilled with excavated spoil and lightly tamped with a shovel. Figures 2 and 3 presents selected photos of this fieldwork.

3.2 Geotechnial Laboratory Results

3.2.1 Point load Testing

Point load tests on the core were performed at approximately one metre intervals. Results are tabulated in Attachment B.

3.2.2 California Bearing Ratio (CBR)

Three (3) bulk soil samples were recovered for the California Bearing Ration (CBR) testing.

The following sample preparation was undertaken prior to CBR testing:

- Compact to 98% standard MDD, at optimum moisture content (OMC);
- Four (4) day soaked sample; and
- 4.5 kg surcharge.

Table 1 - CBR Test Results

presents a summary of the CBR test results. The test results are included as Attachment C.

Table 1 - CBR Test Results

Sample ID (depth)	Material Description	Soaked CBR (%)	OMC (%)	Standard Maximum Dry Density (t/m^3)	Swell (%)
BH01 (0.1 - 1.5m)	CLAY	0.5*	17.8	1.70	5.5
BH03 (0.1 - 1.5m)	CLAY	2.0*	20.0	1.67	1.0
BH05 (0.1 -1.5m)	CLAY	3.0*	21.1	1.58	1.5

Note: * Indicates Soaked CBR value at 2.5mm penetration

3.2.3 Atterberg Limit Test

Three (3) soil samples in total were recovered from BH01, BH03 and BH04 ranging from depths of 0.2 m to 2.5 m for Atterberg limit tests. Table 2 presents a summary of the test results.

Table 2 - Atterberg Limits Test Results

Sample Description	Atterberg Limits		
	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)
Red, Grey Silty CLAY	41	16	25
Grey Brown, Silty CLAY with gravel	27	14	13
Brown Silty CLAY	34	15	19

Figure 4 presents the test results plotted on the plasticity chart. All the geotechnical test results are included as Attachment D.

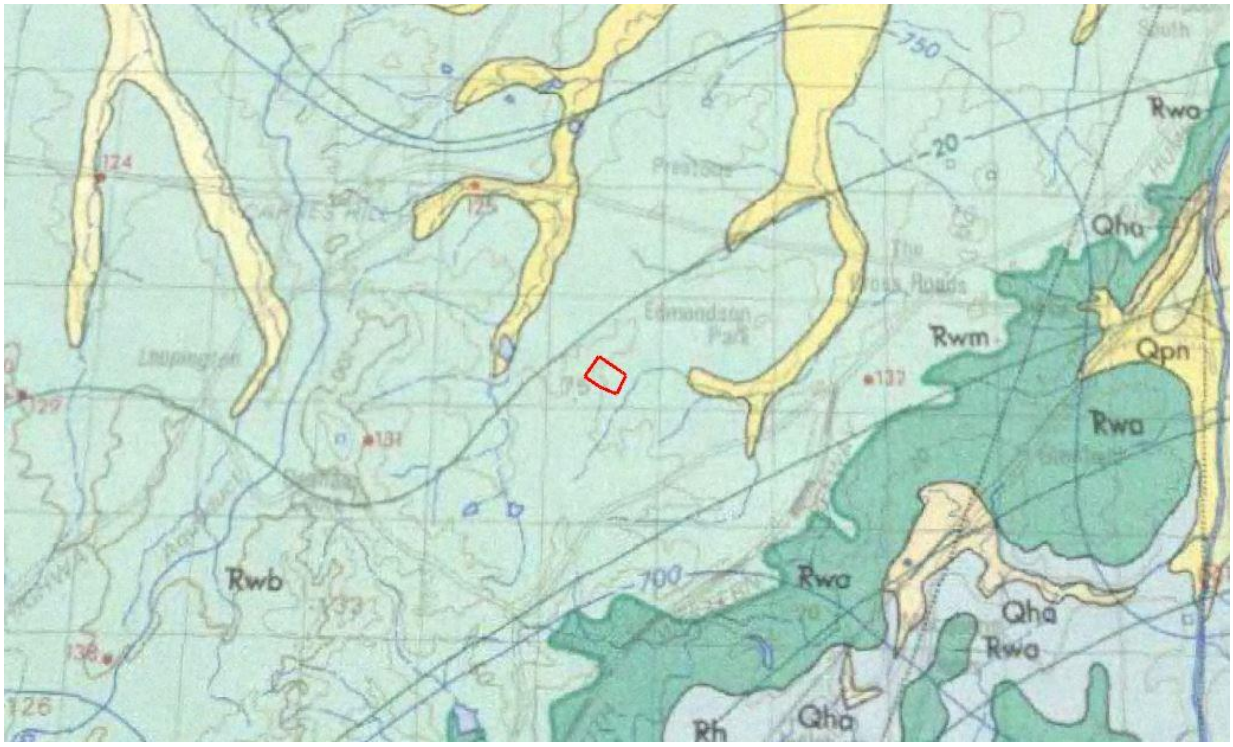
4. Site Conditions

4.1 Geological Setting

The 1:100,000 Geological Map for Penrith indicates that the site is underlain by the following units:

- (Rwb) Bringelly Shale of the Wianamatta Group consisting of shale, carbonaceous claystone, claystone, laminite, fine to medium-grained lithic sandstone, rare coal and tuff.

Inset 1 presents the geological map of the site.



Inset 1: 1:100,000 Geological Map for Penrith (red rectangle marks the approximate site location)

4.2 Surface Conditions

The site is located at Lot 375, Edmondson Park. The site is approximately 6.0 ha in area, and it is bounded by Faulkner Way to the west, railway lines to the south and rural land to the north and east.

The ground is generally sloping towards the east and has a large 9.0 m high stock pile located in the southwest corner. The majority of the ground surface was grassed with tall bushes and trees covering the central, southern and eastern portions of the site. There are a few dirt roads previously used by trucks.

At the time of fieldwork, the surface was wet from rain that had occurred on the previous day and during the fieldwork.

Inset 2: Nearmap aerial photograph of site condition on 28 December 2018

4.3 Subsurface Conditions

Table 3 shows the approximate depth to the top of the inferred geotechnical units encountered at the test locations.

Table 3 - Summary of inferred subsurface conditions encountered in test locations

Inferred Unit	Inferred top of unit depth below ground surface (m)	Description
TOPSOIL	0.0	Silty CLAY; trace of gravel; low plasticity, pale to dark brown, coarse grained sand, firm to stiff consistency, dry to moist. Roots, rootlets and grasses observed throughout.
FILL	0.0 to 0.1	CLAY; generally low plasticity, pale brown and orange, stiff to very stiff consistency, dry. Occasional roots and rootlets observed.
NATURAL SOIL	0.1 to 1.5	CLAY and Silty CLAY; low to medium plasticity, pale brown, red, orange and grey, stiff to very stiff consistency, stiffness increases with depth reaching hard consistency in some areas, mostly dry.
BEDROCK	2.0 to 4.9	SILTSTONE: Orange and brown, distinct fine-grained sandstone laminations and well developed, extremely low to low strength. LAMINITE: dark grey and grey 50%-70% sandstone and 30% - 50% shale, fine grained, rock fabric visible, developed bedding, very low to high strength.

The subsurface conditions encountered within the test locations are summarised in Table 4

Table 4 - Elevation to top of inferred geotechnical units encountered in test locations

Test ID	Elevation to top of inferred geotechnical units (RL m AHD)				
	Topsoil	Fill	Natural Soil	Bedrock	EOH
BH01	60.0	N/E	59.9	55.1	51.5
BH02	57.0	N/E	56.8	54.0	52.9
BH03	59.0	N/E	58.9	56.0	51.6
BH04	N/E	60.5	60.3	58.5	57.1
BH05	60.5	0.1	59.0	57.8	57.5

Note: EOH = End of Hole
N/E = Not Encountered

4.4 Groundwater

No groundwater seepage was observed during the borehole drilling (augering), though it is noted that the drilling water used in the cored boreholes (BH01 and BH03) would have prevented any groundwater from being observed. Standpipe piezometers (monitoring wells) were installed in BH01 and BH03. A water logger was installed in BH01 to measure water levels at regular 30 minute intervals. Attachement E includes the piezometer construction records. Water was observed in the wells immediately after wells were completed.

A PSM geotechnical engineer visited the site on 12 February 2019 to take measurements of the water levels in BH01 and BH03. The monitoring data from the well is presented in Figure 5. The water level in BH03 was measured using a tape measure with a water whistle attached at the end. From these measurements the water level elevation is between between RL 54.9 m and RL 55.8 m, i.e 5.1 m and 3.2 m depth below the existing surface in BH01 and BH03 respectively. We note this may be affected by the water introduced during drilling / coring that potentially still remains in the monitoring wells, eg. not actual ground water. PSM should be requested to return to site to re-measure the groundwater level and download the data from the logger.

5. Soil Salinity and Aggressivity Investigation

A total of eight (8) disturbed soil samples were collected by a PSM Geotechnical Engineer for testing in an environmental laboratory.

5.1 Laboratory Results

The disturbed soil samples were sent to a NATA accredited environmental laboratory and the following tests were undertaken:

- Cation Exchange Capacity (CEC) of calcium, magnesium, potassium and sodium
- Exchange sodium percentage
- Salinity (EC 1:5, one part soil to five parts water)
- Soil pH
- Chlorides
- Sulphates
- Resistivty
- Moisture content

Table 5 presents a summary of the results. The laboratory reports are presented in Attachment F.

Table 5 - Laboratory Testing Results

Sample ID	pH	Electrical Conductivity [µS/cm]	Moisture Content [%]	Resistivity at 25 °C [ohm.cm]	Chloride By Discrete Analyser [mg/kg]	Soluble Sulfate by ICPAES [mg/kg]	Exchangeable Cations [meq/100g]					ESP [%]
							Ca	Mg	K	Na	CEC	
BH05-1.5m	5.5	216	9.3	4630	230	150	<0.1	7.2	0.3	3.0	10.5	28.6
BH05-3.0m	5.8	300	8.0	3330	280	230	0.1	7.4	0.5	3.2	11.2	28.8
BH03-2.0m	5.8	142	5.8	7040	160	30	<0.1	3.9	0.2	1.8	6.0	30.7
BH04-0.5m	5.5	94	12.1	10600	80	80	0.8	4.6	0.2	1.0	6.6	15.0
BH01-2.0m	5.2	553	11.8	1810	660	180	<0.1	7.9	0.2	4.0	12.2	33.4
BH03-1.5m	5.8	145	6.3	6900	120	90	<0.1	4.6	0.3	1.8	6.8	26.7
BH02-4.0m	7.1	82	14.4	12200	70	20	0.8	5.6	0.4	3.6	10.3	34.4
BH01-1.0m	4.9	526	13.7	1900	410	290	<0.1	4.7	0.1	1.9	6.8	28.4

5.1.1 Soil chemistry

The salinity test results, summarised in Table 5 indicate the following:

- pH of the soil samples analysed was in the range of 4.9 to 7.1, with an average of 5.7
- The 1:5 soil to water extraction and subsequent electrical conductivity ($EC_{1:5}$) of the soil samples analysed to be in the range of 82 µS/cm to 553 µS/cm
- Resistivity of samples at 25 °C analysed was in the range of 1810 ohm.cm to 12200 ohm.cm
- Concentrations of chlorides in samples analysed was in the range of 70 mg/kg to 660 mg/kg
- Concentrations of soluble sulfate in samples analysed was in the range of 20 mg/kg to 290 mg/kg
- Cation Exchange Capacity (CEC) in samples analysed was in the range 6.0 meq/100g to 12.2 meq/100g
- Exchange Sodium Percentage (ESP) in samples analysed was in the range of 15.0% to 34.4%.

6. Salinity Assessment

6.1 Salinity

Site Investigations for Urban Salinity (DLWC 2002) classify soil salinity based on electrical conductivity (ECe). The method of conversion from EC1:5 to ECe (electrical conductivity of saturated extract) is based on DLWC (2002) and given by ECe = EC1:5 x M, where M is the multiplication factor based on "Soil Texture Group".

The "Soil Texture Group" of the samples tested were assessed during our investigation. The salinity classification for the soil samples that were tested are presented in Table 6.

Table 6 - Salinity Classification

Sample ID	$EC_{1:5}$ (dS/m)	Soil Type	M	EC_e (dS/m)	Salinity Class
BH05 - 1.5m	0.216	Heavy Clay	6	1.296	Non-saline
BH05 - 3.0m	0.300	Light Medium Clay	8	2.400	Slightly saline
BH03 - 2.0m	0.142	Medium Clay	7	0.994	Non-saline
BH04 - 0.5m	0.094	Heavy Clay	6	0.564	Non-saline
BH01 - 2.0m	0.553	Clay Loam	9	4.977	Moderately Saline
BH03 - 1.5m	0.145	Light Medium Clay	8	1.160	Non-saline
BH02-4.0m	0.082	Light Medium Clay	8	0.656	Non-saline
BH01-1.0m	0.526	Light Medium Clay	8	4.208	Moderately Saline

It is assessed that the majority of the soils on site are classified as "non-saline to moderately saline". We have referred to Clause 4.8.2 of Australian Standard AS3600-2009 "Concrete Structures" and note that the assessed soil electrical conductivity (EC_e) is less than the upper limit of the "A2" exposure classification.

6.2 Corrosivity / Aggressivity

Table 4.8.1 of AS3600-2009 “Concrete Structures” provides criteria for exposure classification for concrete in sulphate soils based on sulphates in soil and groundwater, and pH of soil. On the basis of the sulphate and pH testing completed we assess the exposure classification for concrete in sulphate soils to be “A2”.

Table 6.4.2(C) of Australian Standard AS2159:2009, Piling – Design and Installation provides criteria for exposure classification for concrete piles based on sulfates in the soil and groundwater, soil and groundwater pH, and chlorides in groundwater. On the basis of the soil sulfates and pH testing completed we assess the exposure classification for concrete piles in the soil to be mild.

Table 6.5.2(C) of Australian Standard AS2159:2009, Piling – Design and Installation provides criteria for exposure classification for steel piles based on resistivity, soil and groundwater pH, and chlorides in soil and groundwater. On the basis of soil chlorides, resistivity and pH testing completed we assess the exposure classification for steel piles in the soil to be mild.

6.3 Sodicity

Sodicity provides a measure of the likely dispersion on wetting and to shrink/swell properties of a soil. Soil sodicity is classified based on the Exchangeable Sodium Percentage (ESP) which is the amount of exchangeable sodium as a percentage of the Cation Exchange Capacity (DLWC, 2002).

The Exchangeable Sodium Percentages calculated from these laboratory results, ranging from 15.0% to 34.4%, indicates that the soils on site are highly sodic when compared to criteria listed in “Site Investigations for Urban Salinity”, DLWC (2002).

7. Discussion

7.1 Excavation Conditions

Excavation in the Topsoil, Fill, and Natural Soil units is expected to be achievable using conventional earth moving equipment. Excavation in Bedrock unit may require some rock breaking. It is our experience that excavatability is heavily dependent on both the operator and the plant used. Any earthworks contractor should satisfy itself with regard to excavatability especially in the bedrock unit.

Please note that the 6.5 tonne drill rig encountered TC bit practical refusal (or slow advance) in all broeholes at depths ranging form 3.0 m to 4.9 m.

Although aerial imagey of the site shows there is a dam towards the northern boundary of the site, we did not observe the dam at the time of the fieldwork.

Inset 3: Location of backfilled dam

7.2 Earthworks

Due to previous site activities, we consider the existing fill (including the stockpiles) on site may not be engineered / controlled fill. Thus, we consider it shall be removed and replaced. Any structures should not be founded on the existing fill.

At this stage we are not aware if any earthworks will be required for the proposed development. We consider that topsoil is not suited for reuse as engineered fill. It may be reused for landscaping purposes. It is our opinion that most of the remaining cut material would be suitable for reuse on the site as engineered fill.

We envisage that the earthworks proposed at the site will require the preparation of a detailed fill specification developed following the guidelines in AS 3798 (2007), "*Guidelines on earthworks for commercial and residential developments*". Preparation of this fill specification is outside the scope of this report. We consider, however, that the fill specification should address at least the following:

1. Subgrade preparation and base geometry requirements.
2. Material requirements, including a clear definition of:
   a. Suitable and unsuitable material.
   b. Grading or maximum particle size requirements. We note that a conservative definition of maximum particle size may result in some of the materials on site being excluded from reuse as engineered fill. It is our opinion that this restriction may not significantly benefit fill performance.
3. Fill placement requirements, including a clear definition of compacted layer thickness, we suggest 300 mm.
4. Compaction requirements. We suggest that a minimum and maximum density ratio be adopted to control any potential shrink swell of the clayey fill material and to limit the effect of fill material variability on the fill performance, we suggest 98 to 102 % standard.
5. Moisture control requirements. We consider that control on placement moisture variation should be adopted to control any potential shrink swell of the clayey fill material, we suggest moisture variation of +- 2%.

6. Inspection and testing requirements, including a clear definition of:
   a. Level of control testing, e.g. Level 1 as per AS3798.
   b. Lot testing, this is an important aspect of earthworks control but often ignored in acceptance of the works.
   c. Testing methodology.
   d. Testing frequency.
7. Responsibilities of the contractor. We envisage that such responsibilities would include:
   a. Undertake the earthworks in accordance with fill specification.
   b. Seek approvals by the GITA as required by the fill specification, in particular prior to placing any new fill.
   c. Responsibilities of the Geotechnical Inspection and Testing Authority (GITA). The fill specification should define:
   d. The inspection and testing responsibilities of the GITA.
   e. The reporting responsibilities of the GITA.

The final certification responsibilities of the GITA. We note that the specification should require the GITA to certify that "all the earthworks have been documented and have been undertaken in accordance with the relevant fill specification". It is not adequate just to refer to AS3798 Level 1.

7.3 Permanent and Temporary Batters

The batter slope angles shown in Table 7 are recommended for the design of batters up to 5 m height subject to the following recommendations:

- The batters shall be protected from erosion. Permanent batters will need face support such as vegetation or shotcrete
- Permanent batters shall be drained for a distance behind the faces at least equal to the height.
- Temporary batters shall not be left unsupported for more than a month without further advice, and inspection by a geotechnical engineer should be undertaken following significant rain events
- No buildings, loads or services should be located within 1 batter height of the crest.

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

Where Fill is not engineered/controlled fill, batter slope angles should be assessed by a geotechnical engineer.

Table 7 - Batter Slope Angles

Unit	Temporary	Permanent
ENGINEERED FILL	1.5H : 1V	2H : 1V
NATURAL SOIL	1.5H : 1V	2H : 1V
BEDROCK*	1H : 1V	1.5H : 1V

Note: *: See the requirements below regarding inspections.

The batters should be inspected by an experienced geotechnical engineer or engineering geologist during excavation to confirm the batter advice provided and assess the need for localised support, such as rock bolting to control the adverse jointing and mesh and/or shotcreting for overall face support.

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

Steeper batters may be possibly subject to further advice, probably including inspection during construction and possible shortcreting, spot bolting etc.

7.4 Retaining Walls

Cuts in the Fill, Natural Soil and Bedrock units steeper than the recommended permanent batter slopes in Table 7 will need to be supported by some form of retaining structure or ground reinforcements.

The selection of the appropriate retention system is a matter of design. The designer should consider the following factors in making its selection:

- Technical factors
  - Performance
  - Ground conditions (this is addressed below with the design parameters)
  - Surcharge loading and
  - Proximity of structures, buildings and roads, etc.
- Non- technical factors
  - Cost (to build and to maintain)
  - Other constraints such as real estate, neighbouring site / boundary, aesthetics, legislation, etc.

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

- Effective soil strength parameters in Table 8
- A lateral pressure of 10 kPa for vertical cuts in the BEDROCK units. This is to allow for blocks and rock wedges formed due to adverse defects that may exist within the unit.
- Water pressure (depending on the type of structure).

Note that design of retention systems may be based on either K_a or K_o earth pressures. Design using active earth pressures 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 do not, of themselves, 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.

Table 8 - Engineering Parameters of Inferred Geotechnical Units

Inferred Unit	Bulk Unit Weight (kN/m^3)	Soil Effective Strength Parameters		Ultimate Bearing Pressure under Vertical Centric Loading (kPa)	Allowable Bearing Pressure under Vertical Centric Loading (kPa)	Ultimate Shaft Adhesion (kPa)	Elastic Parameters	
		c' (kPa)	Φ' (deg)				Young's Modulus (MPa)	Poisson's Ratio
Engineered Fill	18	0	30	400[1]	150[1]	N.A.	10	0.3
Natural Soil	18	0	30	400[1]	150[1]	N.A.	10	0.3
Bedrock	22	N.A.	N.A.	3000[2]	1000[3]	50	100	0.25

Note: 1. Minimum plan dimension of 1.0 m and a minimum embedment depth of 0.5 m.
2. Ultimate bearing pressure for bedrock assumes a settlement of approximately 5% of the least footing dimension for footings in rock.
3. Allowable bearing pressure assumes a settlement of approximately 1% of the least footing dimension for footings in rock.

7.5 Foundations

7.5.1 Shallow Footings

Pad footings can be proportioned on the basis of an allowable bearing pressure (ABP) for centric vertical loads provided in Table 8.

We 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 rapidly, as the load gains eccentricity or becomes inclined, the capacity reduces rapidly.

Settlements in the Natural Soil unit can be estimated using the elastic moduli provided in Table 8. When assessing the settlement of the shallow footings, the designer needs to consider the additional ground settlement due to the total building load on both shallow and deeper units. The differential settlement due to the building load shall also be assessed.

Foundations conditions at the proposed shallow pad footings locations should be inspected by a suitable qualified geotechnical engineer prior to the pouring of concrete.

7.5.2 Piles

We envisage that piles would be founded within the Bedrock unit.

Piles should be designed in accordance with the requirements in AS 2159 (2009), Piling – Design and Installation. The parameters provided in Table 8 may be adopted in the design of piles founded in Bedrock unit.

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

- The ABP needs to be confirmed by a geotechnical engineer during a pile inspection
- Under permanent load, the contribution of side adhesion for soils including Fill and Natural Soil should be ignored
- Deflection needs to be checked using the recommended elastic parameters in Table 8.

The bearing capacities provided are contingent on piles or footings being vertically and centrally loaded. Further advice should be sought if the footings are not vertically centrically loaded. Should higher bearing capacities be required in Bedrock, this may be available subject to further advice.

With regards to the pile design we recommend that:

- A geotechnical strength reduction factor, Φ_g = 0.60 (AS2159 CL. 4.3.2) be adopted for a high redundancy system for an assessed average risk rating (ARR) between 2.5 and 3.0. This should be reviewed to suit the specific design and appropriate pile testing proposed by the structural designers in accord with the requirements of AS2159
- It may be possible to increase the pile reduction factors, if the details of the proposed pile installation procedures indicate a high level of quality control with regards to concrete placement, base cleanliness, etc.
- If a geotechnical strength reduction factor, Φ_g = 0.40 is adopted then no pile testing will be required (AS2159 Clause 8.2.4 (b)).

7.6 Pavements

Subgrade CBR for pavement design depends on the material at the finished subgrade levels. The CBR tests undertaken by PSM (refer to Table 1) indicates a CBR value between 0.5% and 3%. Based on the testing, we recommend a design subgrade value of 2.0% be adopted.

We note that one of the samples tested has a very low CBR associated with a very high swell; this indicates a potential problem subgrade and it is not easy, and may be impossible, to visually distinguish this soil at subgrade level from other less problematic soils. We recommend that specific CBR testing be undertaken at finished subgrade level when pavement layouts are finalised.

8. General

If at any time, the conditions are found to vary from those decribed in this report, further advice should be sought.

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

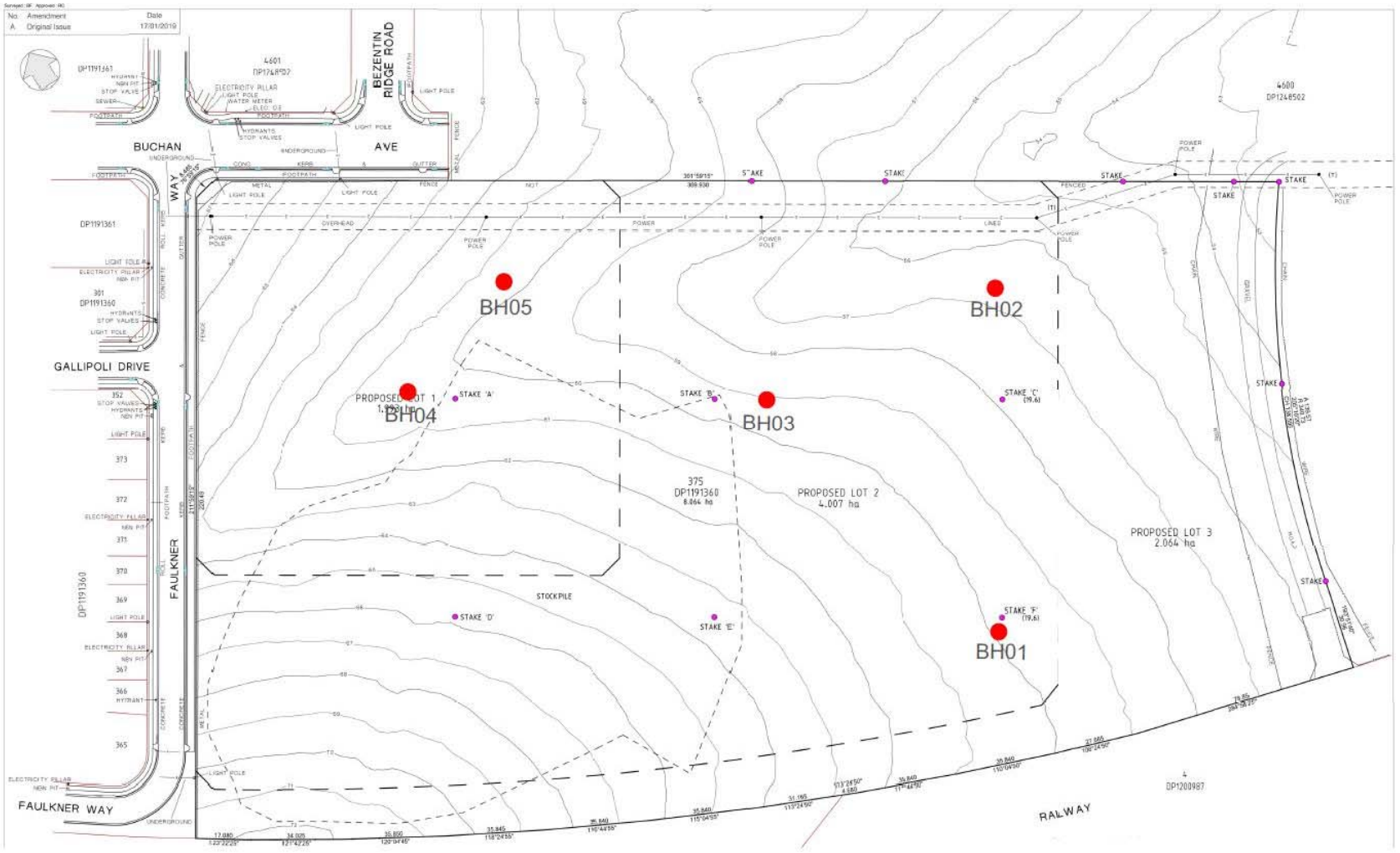
For and on behalf of
PELLS SULLIVAN MEYNINK

MATIAS BRAGA
GEOTECHNICAL ENGINEER

AGUSTRIA SALIM
PRINCIPAL

Encl.

Figure 1	Test Locations
Figure 2	Selected Photos (1 of 2)
Figure 3	Selected Photos (2 of 2)
Figure 4	Atterberg Limits Graph
Figure 5	Water Monitoring Results
Attachment A	Geotechnical Engineering Borehole Logs
Attachment B	Point Load Test Results
Attachment C	CBR Testing Results
Attachment D	Atterberg Limit Test Results
Attachment E	Piezometer Construction Records
Attachment F	Environmental Testing Results



LEGEND

PSM borehole

NOTES:

1. Borehole locations are approximate.

Pells Sullivan Meynink

APP Corportation

School Infrastructure NSW

Lot 375 Edmondson Park, NSW

LOCALITY PLAN & BOREHOLE LOCATIONS

PSM3750-006L	Figure 1

Photo 1 - General site conditions facing south at the strockpile

Photo 2 - General site conditions at the Western side of the site

APP Corporation

School Infrastructure NSW

Lot 375 Edmonson Park, NSW

SELECTED SITE PHOTOGRAPHS

[1 OF 2]

Pells Sullivan Meynink

PSM3750-006L	**Figure 2**

Photo 1 - Typical drill rig setup during augering (BH01)

Photo 2 - Typical Standpipe piezometer (monitoring well) setup (BH03)

APP Corporation

School Infrastructure NSW

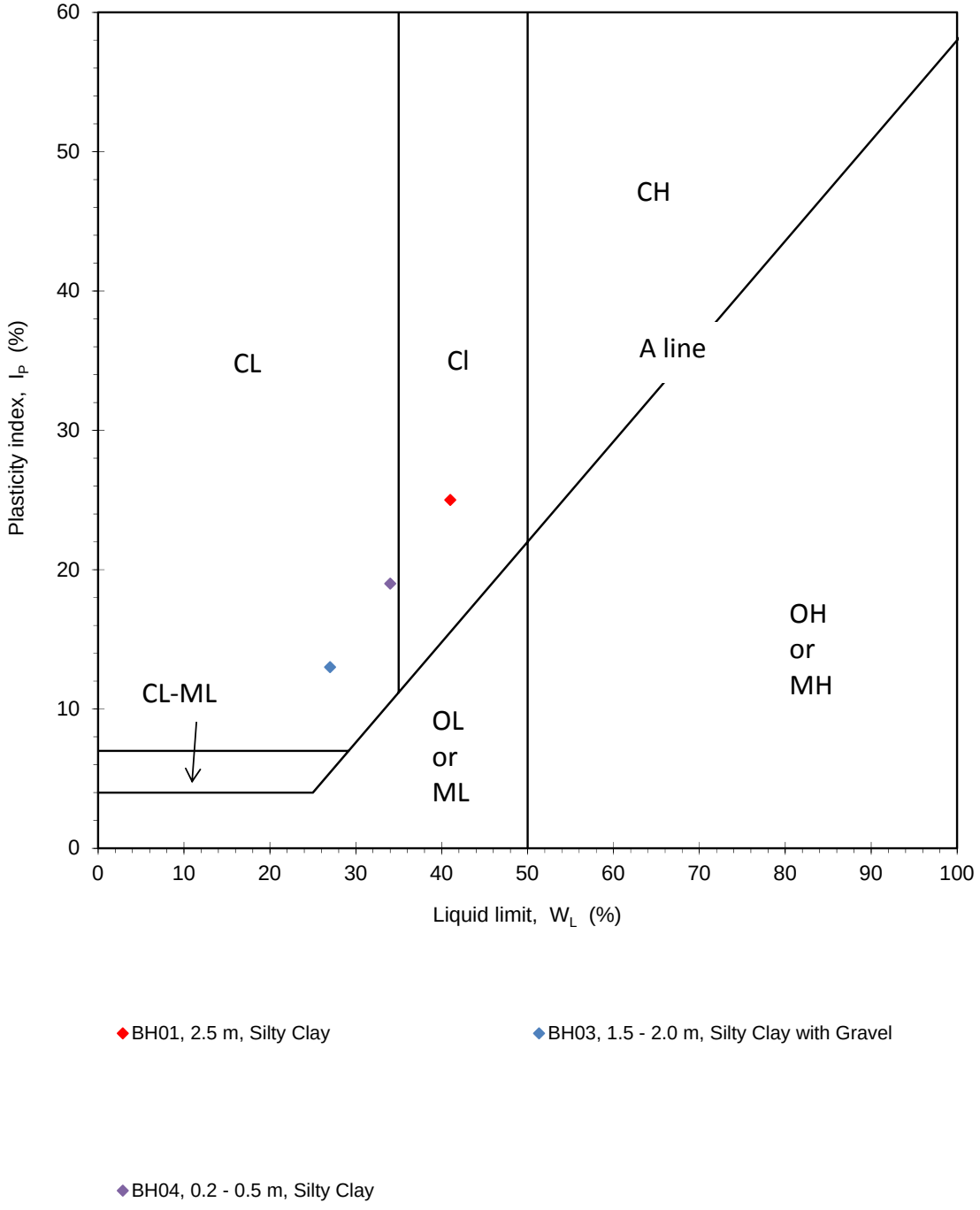
Lot 375 Edmonson Park, NSW

SELECTED SITE PHOTOGRAPHS

[2 OF 2]

Pells Sullivan Meynink

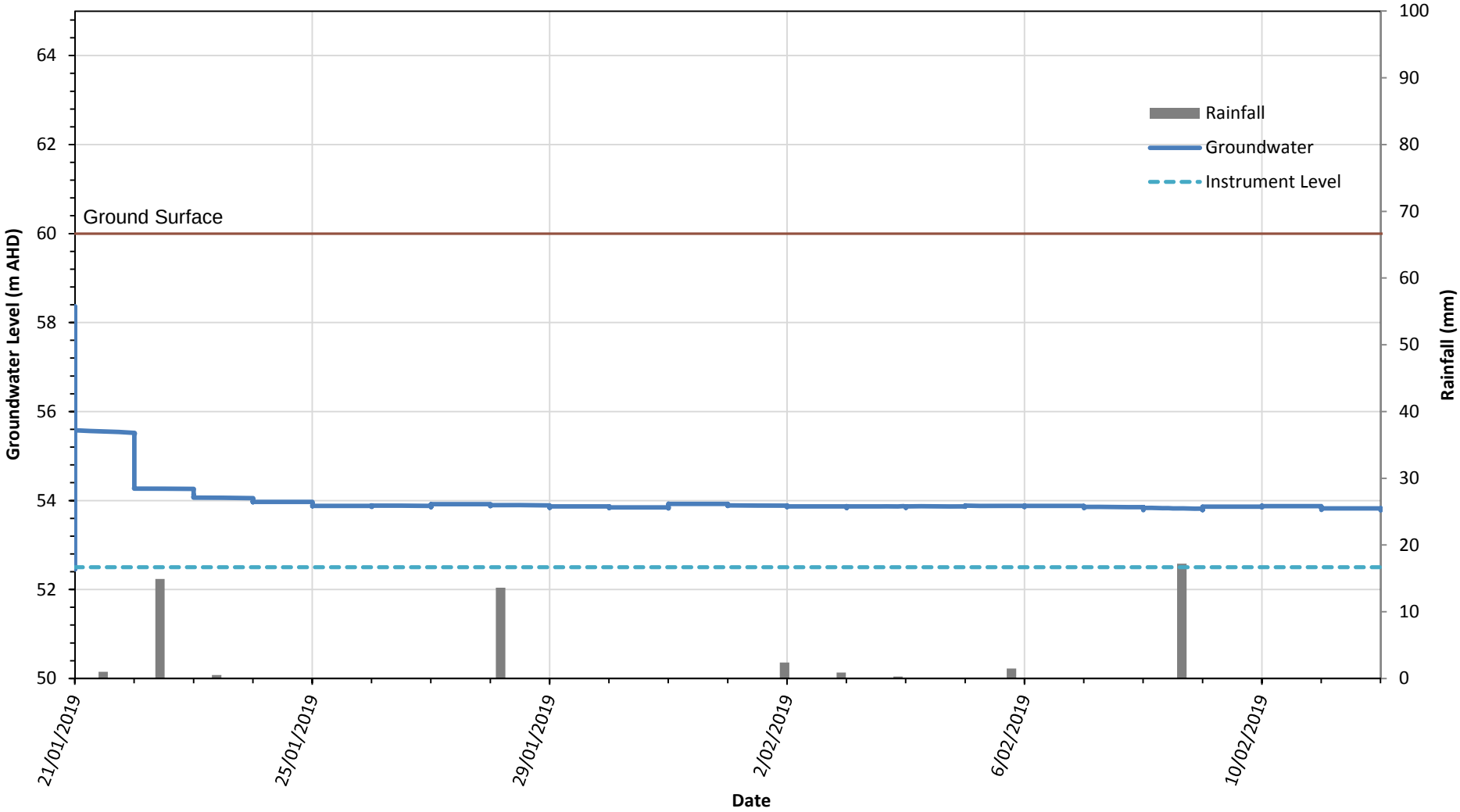
PSM3750-006L	Figure 3



APP Corporation
School Infrastructure NSW
Lot 375 Edmondson Park, NSW

ATTERBERG LIMITS
PLASTICITY CHART

Pells Sullivan Meynink	**PSM3750-006L**	**Figure 4**



Notes:

1. Instrument depth (m AHD): 52.5
2. Rainfall data source: Bureau of Meteorology, Penrith Lakes AWS (station number: 067097)

   Measured water level on 12/02/2019.
4. Data logger installed on 21/01/2019.
5. RL's taken from Plan No: 23916-Detail 1

Pells Sullivan Meynink

APP Corporation
School Infrastructure NSW
Lot 375 Edmondson Park, NSW
GROUNDWATER MONITORING
BH01

PSM3750-006L	Figure 5

Attachment A
Geotechnical Engineering Borehole Logs

Borehole ID

BH01

Page 1 of 3

Engineering Log - Non Cored Borehole

Project No.: PSM3750

Client:	SINSW	Commenced:	21/01/2019
Project Name:	Geotechnical Investigation on Landcom 6.0 Ha Land	Completed:	21/01/2019
Hole Location:	Lot 375 Edmondson Park	Logged By:	MB
Hole Position:	301756.0 m E 6239364.0 m N	Checked By:	YB

Drill Model and Mounting:	Hanjin Track Mounted	Inclination:	-90°	RL Surface:	60.00 m		
Hole Diameter:	110 mm	Bearing:		Datum:	AHD	Operator:	B&G Drilling

Drilling Information								Soil Description				Observations
Method	Penetration	Support	Water	Samples Tests Remarks	Recovery	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description SOIL NAME: Colour, structure, plasticity, additional	Moisture Condition	Consistency / Relative Density / Hand Penetrometer UCS (kPa) 100 200 300 400 500	Structure and Additional Observations
AD/V		N	Not Observed	CBR 0.00-1.50 m					CL-ML / CI	SILTY CLAY: pale brown and orange, low plasticity, trace sand coarse grained up to 2mm, roots and rootlets observed.		F	0.00: Topsoil 0.10: Inferred Natural Soil
										CLAY: mottled red, orange and grey, low plasticity		F to St	
				ES 1.00 m PP 1.00 m =300 kPa		59.0	1						
				ES 2.00 m PP 2.00 m =300 kPa		58.0	2		CL	SANDY CLAY: red and grey, low plasticity, sand fine grained.			
				Atterberg 2.50 m						Becomes medium to coarse grained at 2.5 m.	D	St	
						57.0	3						
AD/T		N				56.0	4		CL-ML	SILTY CLAY: dark brown, medium plasticity		VSt	3.50: Shale fragments observed 4.00: V-bit refusal
										Becomes pale brown at 4.5 m.			
										Continued on cored borehole sheet			4.89: TC-bit refusal

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

Classification symbols and soil descriptions based on Unified Soil Classification System

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.

Engineering Log - Cored Borehole

Project No.: PSM3750

Client:	SINSW	Commenced:	21/01/2019
Project Name:	Geotechnical Investigation on Landcom 6.0 Ha Land	Completed:	21/01/2019
Hole Location:	Lot 375 Edmondson Park	Logged By:	MB
Hole Position:	301756.0 m E 6239364.0 m N	Checked By:	YB

Drill Model and Mounting:	Hanjin Track Mounted	Inclination:	-90°	RL Surface:	60.00 m		
Barrel Type and Length:	Triple Tube 100mm	Bearing:		Datum:	AHD	Operator:	B&G Drilling

Drilling Information							***Rock Substance***															***Rock Mass Defects***		
Method	Water	TCR (%)	RQD (%)	SAMPLES & FIELD TESTS	RL (m)	Depth (m)	Graphic Log	Material Description ROCK TYPE: Colour, grain size, structure (texture, fabric, mineral composition, hardness, alteration, cementation, etc as applicable)	Weathering EW	HW	MW	SW	F	Strength Is(50) ● - Axial ○ - Diametral EL <0.03	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
					59.0	1																				
					58.0	2																				
					57.0	3																				
					56.0	4																				
			90					Continued from non-cored borehole sheet																		

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
- EW - Extremely Weathered
- HW - Highly Weathered
- MW - Moderately Weathered
- SW - Slightly Weathered
- F - Fresh

Strength
- EL - Extremely Low
- 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.: PSM3750

Client:	SINSW	Commenced:	21/01/2019
Project Name:	Geotechnical Investigation on Landcom 6.0 Ha Land	Completed:	21/01/2019
Hole Location:	Lot 375 Edmondson Park	Logged By:	MB
Hole Position:	301756.0 m E 6239364.0 m N	Checked By:	YB

Drill Model and Mounting:	Hanjin Track Mounted	Inclination:	-90°	RL Surface:	60.00 m		
Barrel Type and Length:	Triple Tube 100mm	Bearing:		Datum:	AHD	Operator:	B&G Drilling

Drilling Information							Rock Substance				Rock Mass Defects	
Method	Water	TCR (%)	RQD (%)	SAMPLES & FIELD TESTS	RL (m)	Depth (m)	Graphic Log	Material Description ROCK TYPE: Colour, grain size, structure (texture, fabric, mineral composition, hardness, alteration, cementation, etc as applicable)	Weathering EW HW MW SW F	Strength Is(50) ● - Axial ○ - Diametral EL <0.03 VL 0.1 L 0.3 M 1 H 3 VH 10 EH	Defect Spacing (mm) <20 60 200 600 1000	Defect Descriptions / Comments Description, alpha/beta, infilling or coating, shape, roughness, thickness, other
NMLC	Not Observed	100	90	5.36m Is(50) d=3.92 a=10.64 MPa	54.0	6		SILTSTONE: Orange and brown, varying from extremely weathered rock to hard clay.*(continued)* Becomes black and grey, fine-grained and well developed.				BP 15° CL VN UN RF BP 5° CL CO UN RF 2 mm BP 0° FE SN CU RF
								Becomes orange and grey, rock fabric visible, developed laminations.				SM 0° CL CU S 20 mm BP 0° CL CO PR RF 2 mm BP 5° CL VN PR RF 1 mm SM 0° CL CO ST RF 10 mm
				6.40m Is(50) d=0.46 a=2.37 MPa								BP 0° CL VN PR RF BP 0° CL VN PR RF BP 2° CN PR RF 6.72: DB 6.84: DB 6.90: DB
		100	97	7.51m Is(50) d=0.05 a=0.65 MPa	53.0	7		Becomes dark grey and grey, rock fabric visible, well developed laminations.				SM 15° CL UN S 10 mm JT 40° CL CO UN RF 5 mm JT 60° CN PR RF BP 0° CL VN CU RF BP 15° CN ST RF 7.50: HOBO water monitoring device installed
				8.45m Is(50) d=0.13 a=0.23 MPa	52.0	8						
					51.0	9		Hole Terminated at 8.50 m Standpipe installed				

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
EW - Extremely Weathered
HW - Highly Weathered
MW - Moderately Weathered
SW - Slightly Weathered
F - Fresh

Strength
EL - Extremely Low
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.

JOB No.: PSM 3750 BH ID: BH 01

PROJECT: Landcom 6.0 HA Land

LOCATION: Lot 375 Edmondson Park

FROM: 4.9m TO: 8.5m DATE: 21/1/19

APP Corportation

School Infrastructure NSW

Lot 375 Edmondson Park, NSW

CORE PHOTO BH01 - 4.9m to 8.5m

Pells Sullivan Meynink **PSM3750-006L Attachment A** **Figure 1**

Borehole ID

BH02

Page 1 of 1

Engineering Log - Non Cored Borehole

Project No.: PSM3750

Client:	SINSW	Commenced:	22/01/2019
Project Name:	Geotechnical Investigation on Landcom 6.0 Ha Land	Completed:	22/01/2019
Hole Location:	Lot 375 Edmondson Park	Logged By:	MB
Hole Position:	301776.0 m E 6239489.0 m N	Checked By:	YB

Drill Model and Mounting:	Hanjin Track Mounted	Inclination:	-90°	RL Surface:	57.00 m		
Hole Diameter:	110 mm	Bearing:		Datum:	AHD	Operator:	B&G Drilling

Drilling Information							Soil Description					Observations
Method	Penetration	Support	Water	Samples Tests Remarks	Recovery	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description SOIL NAME: Colour, structure, plasticity, additional	Moisture Condition	Consistency / Relative Density	Hand Penetrometer UCS (kPa)	Structure and Additional Observations
AD/V		N	Not Observed	SPT 1.00 - 1.45 m 4, 7, 10 N = 17 PP 1.00 m =300 kPa		56.0	1		CL	SILTY CLAY: dark brown, low to no plasticity.	M	S	100 200 300 400 500	0.00: Topsoil - roots and rootlets observed.
									CL	CLAY: orange, brown and grey, low plasticity.				0.20: Inferred Natural Soil.
												F to St	×	1.00: SPT recovered: 0.45 m
									CH	CLAY: red and grey, medium to high plasticity.				1.70: Drill resistance increases.
				PP 2.00 m =400 kPa		55.0	2						×	1.90: V-bit refusal.
												VSt		2.50: SPT recovered: 0.45 m
AD/T		N		SPT 2.50 - 2.95 m 8, 11, 17 N = 28		54.0	3				D			2.70: Extremely weathered shale fragments observed, up to 5mm.
										SILTSTONE: Pale brown, extremely weathered, extremely low strength.				3.00: Inferred Bedrock, strength and weathering inferred from cuttings.
				ES 4.00 m		53.0	4							4.00: TC-bit refusal SPT recovered: 0.10m
				SPT 4.00 - 4.10 m Refusal						Hole Terminated at 4.10 m Refusal				

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

Classification symbols and soil descriptions based on Unified Soil Classification System

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.

Borehole ID

BH03

Engineering Log - Non Cored Borehole

Project No.: PSM3750

Client:	SINSW	Commenced:	21/01/2019
Project Name:	Geotechnical Investigation on Landcom 6.0 Ha Land	Completed:	21/01/2019
Hole Location:	Lot 375 Edmondson Park	Logged By:	MB
Hole Position:	301718.0 m E 6239491.0 m N	Checked By:	YB

Drill Model and Mounting:	Hanjin Track Mounted	Inclination:	-90°	RL Surface:	59.00 m		
Hole Diameter:	110 mm	Bearing:		Datum:	AHD	Operator:	B&G Drilling

Drilling Information							Soil Description					Observations
Method	Penetration	Support	Water	Samples Tests Remarks	Recovery	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description SOIL NAME: Colour, structure, plasticity, additional	Moisture Condition	Consistency / Relative Density	Hand Penetrometer UCS (kPa)	Structure and Additional Observations
AD/V		N	Not Observed	CBR 0.00-1.50 m		58.0	1		CL CL	SILTY CLAY: pale brown, low plasticity, trace sand coarse grained up to 1mm, roots and rootlets observed.		F		0.00: Topsoil 0.10: Inferred Natural Soil.
										CLAY: red and grey, low plasticity.		St to VSt	×	
				PP 1.20 m =350 kPa										
AD/T		N		ES 1.50 m Atterberg 1.50-2.00 m					CL	SILTY CLAY: pale brown, medium plasticity, trace gravel sub-rounded to sub-angular up to 5mm.	D			1.50: V-bit refusal.
				ES 2.00 m		57.0	2			Becomes red and very stiff to hard at 2.0 m.		VSt		
						56.0	3			LAMINITE: black, orange and red, extremely low strength, extremely weathered.				3.00: Inferred Bedrock - strength and weathering inferred from cuttings.
										Continued on cored borehole sheet				3.29: TC-bit refusal.
						55.0	4							

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

Classification symbols and soil descriptions based on Unified Soil Classification System

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.

Engineering Log - Cored Borehole

Project No.: PSM3750

Client:	SINSW	Commenced:	21/01/2019
Project Name:	Geotechnical Investigation on Landcom 6.0 Ha Land	Completed:	21/01/2019
Hole Location:	Lot 375 Edmondson Park	Logged By:	MB
Hole Position:	301718.0 m E 6239491.0 m N	Checked By:	YB

Drill Model and Mounting:	Hanjin Track Mounted	Inclination:	-90°	RL Surface:	59.00 m		
Barrel Type and Length:	Triple Tube 100mm	Bearing:		Datum:	AHD	Operator:	B&G Drilling

Drilling Information							Rock Substance																		Rock Mass Defects		
Method	Water	TCR (%)	RQD (%)	SAMPLES & FIELD TESTS	RL (m)	Depth (m)	Graphic Log	Material Description ROCK TYPE: Colour, grain size, structure (texture, fabric, mineral composition, hardness, alteration, cementation, etc as applicable)	Weathering EW	HW	MW	SW	F	Strength Is(50) ● - Axial ○ - Diametral EL	<0.03	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
					58.0	1																									
					57.0	2																									
					56.0	3		Continued from non-cored borehole sheet																							
NMLC	Not Observed	100	92	3.65m Is(50) d=0.1 a=1.06 MPa	55.0	4		LAMINITE: Orange, black and grey, parent rock fabric faint, some hard clay.																							BP 1° CL VN UN S BP 5° Fe Clay VN PR RF 1 mm BP 2° CL VN PR RF 1 mm
								Becoming grey, 70% sandstone and 30% shale, fine to medium grained, rock fabric visble, developed bedding.																						BP 0° CL VN PR RF 1 mm
				4.51m Is(50) d=1.73 a=1.28 MPa				Becoming dark grey and grey 50% sandstone and 50% shale, fine grained, rock fabric visble, developed bedding.																						BP 0° CL CO PR RF 2 mm BP 7° CL VN PR RF 1 mm

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
EW - Extremely Weathered
HW - Highly Weathered
MW - Moderately Weathered
SW - Slightly Weathered
F - Fresh

Strength
EL - Extremely Low
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.: PSM3750

Client:	SINSW	Commenced:	21/01/2019
Project Name:	Geotechnical Investigation on Landcom 6.0 Ha Land	Completed:	21/01/2019
Hole Location:	Lot 375 Edmondson Park	Logged By:	MB
Hole Position:	301718.0 m E 6239491.0 m N	Checked By:	YB

Drill Model and Mounting:	Hanjin Track Mounted	Inclination:	-90°	RL Surface:	59.00 m		
Barrel Type and Length:	Triple Tube 100mm	Bearing:		Datum:	AHD	Operator:	B&G Drilling

Drilling Information							Rock Substance				Rock Mass Defects	
Method	Water	TCR (%)	RQD (%)	SAMPLES & FIELD TESTS	RL (m)	Depth (m)	Graphic Log	Material Description ROCK TYPE: Colour, grain size, structure (texture, fabric, mineral composition, hardness, alteration, cementation, etc as applicable)	Weathering EW HW MW SW F	Strength Is(50) ● - Axial ○ - Diametral EL <0.03 VL 0.1 L 0.3 M 1 H 3 VH 10 EH	Defect Spacing (mm) <20 60 200 600 1000	Defect Descriptions / Comments Description, alpha/beta, infilling or coating, shape, roughness, thickness, other
NMLC	Not Observed	100	92					LAMINITE: dark grey and grey 50% sandstone and 50% shale, fine grained, rock fabric visble, developed bedding.				BP 10° CL VN ST RF BP 2° CL VN ST RF
				5.53m Is(50) d=2.25 a=1.83 MPa								BP 2° CN UN RF BP 5° CN CU RF
		100	97		53.0	6						BP 0° CL VN ST RF 1 mm BP 0° CN PR RF BP 2° CN PR RF
				6.41m Is(50) d=1.67 a=0.82 MPa				Becoming 70% sandstone and 30% shale, fine to medium grained, rock fabric visible, well developed bedding.				BP 5° CN UN RF
				7.29m Is(50) d=8.59 a=2.75 MPa	52.0	7						BP 2° CN CU RF
								Hole Terminated at 7.40 m Standpipe installed				
					51.0	8						
					50.0	9						

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
EW - Extremely Weathered
HW - Highly Weathered
MW - Moderately Weathered
SW - Slightly Weathered
F - Fresh

Strength
EL - Extremely Low
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

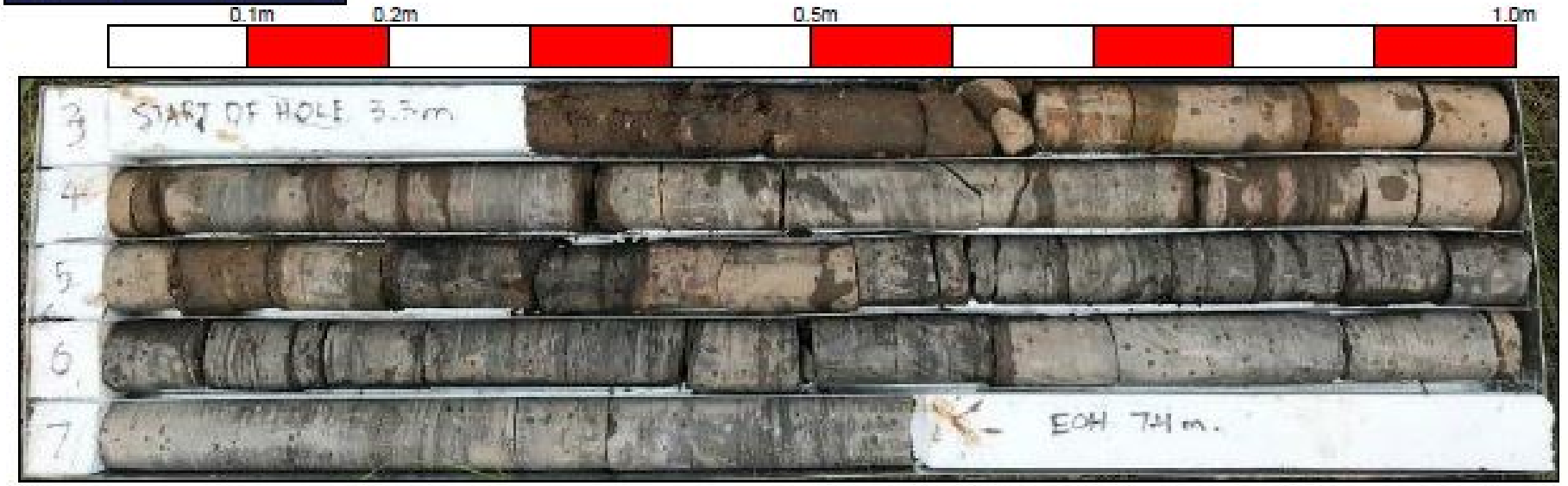
See Explanatory Notes for details of abbreviations and basis of descriptions.

JOB No.: PSM 3750 BH ID: BH 03

PROJECT: Landcom 6.0 HA Land

LOCATION: Lot 375 Edmondson Park

FROM: 3.3m TO: 7.4m DATE: 21/1/19



APP Corportation

School Infrastructure NSW

Lot 375 Edmondson Park, NSW

CORE PHOTO BH03 - 3.3m to 7.4m

Pells Sullivan Meynink **PSM3750-006L Attachment A Figure 1**

Borehole ID

BH04

Page 1 of 1

Engineering Log - Non Cored Borehole

Project No.: PSM3750

Client:	SINSW	Commenced:	22/01/2019
Project Name:	Geotechnical Investigation on Landcom 6.0 Ha Land	Completed:	22/01/2019
Hole Location:	Lot 375 Edmondson Park	Logged By:	MB
Hole Position:	301622.0 m E 6239539.0 m N	Checked By:	YB

Drill Model and Mounting:	Hanjin Track Mounted	Inclination:	-90°	RL Surface:	60.50 m		
Hole Diameter:	110 mm	Bearing:		Datum:	AHD	Operator:	B&G Drilling

Drilling Information							Soil Description					Observations
Method	Penetration	Support	Water	Samples Tests Remarks	Recovery	RL (m) / Depth (m)	Graphic Log	Classification Symbol	Material Description SOIL NAME: Colour, structure, plasticity, additional	Moisture Condition	Consistency / Relative Density / Hand Penetrometer UCS (kPa)	Structure and Additional Observations
AD/V		N		Atterberg 0.20-0.50 m				CL	CLAY: pale brown and orange, low plasticity, roots and rootlets observed.		St	0.00: Topsoil
								CL	CLAY: pale brown, medium to high plasticity.			0.30: V-bit refusal.
				ES 0.50 m								
AD/T		N	Not Observed	SPT 1.00 - 1.45 m 4, 11, 14 N = 25		59.5 / 1				D	VSt	1.00: SPT recovered: 0.45 m
						58.5 / 2			SILTSTONE: Grey and orange, extremely low strength, extremely weathered.			2.00: Inferred Bedrock, strength and weathering inferred from cuttings.
				SPT 2.50 - 2.90 m 13, 19, Refusal		57.5 / 3						2.50: SPT recovered: 0.40 m
						56.5 / 4			Hole Terminated at 3.40 m Refusal			3.40: TC-bit refusal.

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

Classification symbols and soil descriptions based on Unified Soil Classification System

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.

Borehole ID

BH05

Page 1 of 1

Engineering Log - Non Cored Borehole

Project No.: PSM3750

Client:	SINSW	Commenced:	22/01/2019
Project Name:	Geotechnical Investigation on Landcom 6.0 Ha Land	Completed:	22/01/2019
Hole Location:	Lot 375 Edmondson Park	Logged By:	MB
Hole Position:	301677.0 m E 6239566.0 m N	Checked By:	YB

Drill Model and Mounting:	Hanjin Track Mounted	Inclination:	-90°	RL Surface:	60.50 m		
Hole Diameter:	110 mm	Bearing:		Datum:	AHD	Operator:	B&G Drilling

Drilling Information								Soil Description					Observations
Method	Penetration	Support	Water	Samples Tests Remarks	Recovery	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description SOIL NAME: Colour, structure, plasticity, additional	Moisture Condition	Consistency / Relative Density	Hand Penetrometer UCS (kPa) 100 200 300 400 500	Structure and Additional Observations
AD/V		N	Not Observed	CBR 0.00-1.50 m					CL	SILTY CLAY: pale brown, low plasticity, roots and rootlets observed.	D to M	St		0.00: Topsoil 0.10: Inferred Natural Soil.
									CL	CLAY: grey and red, low plasticity.				
						59.5	1					VSt		
				SPT 1.00 - 1.45 m 6, 8, 17 N = 25										1.00: SPT recovered: 0.45 m
				ES 1.50 m					CI-CH	CLAY: pale brown and grey, medium to high plasticity.	D			
						58.5	2					H		
AD/T		N		SPT 2.50 - 2.75 m 5, Refusal										2.20: V-bit refusal. 2.50: SPT recovered: 0.25 m
										SILTSTONE: Grey and orange, extremely low strength, extremely weathered				2.70: Inferred Bedrock, strength and weathering inferred from drill cuttings.
				ES 3.00 m		57.5	3			Hole Terminated at 3.00 m Refusal				3.00: TC-bit refusal.
						56.5	4							

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

Classification symbols and soil descriptions based on Unified Soil Classification System

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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.

Attachment B
Point Load Test Results

Pells Sullivan Meynink

POINT LOAD STRENGTH INDEX TEST RESULTS

Job No. ***PSM3750*** **Sheet 1 of 1**

Project ***Landcom 6.0 HA Land, Lot 375 Edmondson Park***

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	*21/1/2019*
		Storage History	*North Ryde office indoor core storage area*	Testing Date	*25/01/2019*
Test Machine	*GSA 6500*	Moisture Condition	*Natural*	Tested By	*MB*
Calibration Date	*3/12/2012*	Loading Rate	*< 30 seconds*		

Rock Type	Location	Depth	Diametral Tests					Axial, Block, and Irregular Lump Tests							AS 1726 Strength Class
			D	L	P	$I_{s(50)}$	Failure Mode	W	D	L	P	I_s	$I_{s(50)}$	Failure Mode	
		(m)	(mm)	(mm)	(kN)	(MPa)		(mm)	(mm)	(mm)	(kN)	(MPa)	(MPa)		
Siltstone	***BH01***	***5.36***	*50*	*50*	*3.9*	***1.6***	*Parallel to bedding*	*50*	*34*		*10.6*	*4.9*	***4.8***	*Through substance*	***H / VH***
Siltstone	***BH01***	***6.40***	*50*	*58*	*0.5*	***0.2***	*Along defect*	*50*	*32*		*2.4*	*1.2*	***1.1***	*Through substance*	***L / H***
Siltstone	***BH01***	***7.51***	*50*	*63*	*0.1*	***0***	*Parallel to bedding*	*50*	*29*		*0.7*	*0.4*	***0.3***	*Through substance*	***M***
Siltstone	***BH01***	***8.45***	*50*	*55*	*0.1*	***0.1***	*Parallel to bedding*	*50*	*45*		*0.2*	*0.1*	***0.1***	*Through substance*	***VL***
Laminite	***BH03***	***3.09***	*50*	*65*	*0.1*	***0***	*Parallel to bedding*	*50*	*25*		*1.1*	*0.7*	***0.6***	*Through substance*	***VL / M***
Laminite	***BH03***	***4.51***	*50*	*80*	*1.7*	***0.7***	*Parallel to bedding*	*50*	*41*		*1.3*	*0.5*	***0.5***	*Through substance*	***M***
Laminite	***BH03***	***5.53***	*50*	*55*	*2.3*	***0.9***	*Parallel to bedding*	*50*	*27*		*1.8*	*1.1*	***1***	*Through substance*	***M***
Laminite	***BH03***	***6.41***	*50*	*72*	*1.7*	***0.7***	*Parallel to bedding*	*50*	*30*		*0.8*	*0.4*	***0.4***	*Through substance*	***M***
Laminite	***BH03***	***7.29***	*50*	*65*	*8.6*	***3.4***	*Parallel to bedding*	*50*	*22*		*2.8*	*2*	***1.7***	*Through substance*	

By: ***MB*** **Checked:** ***YB*** **Date:** ***1/2/2019***

Attachment C
CBR Testing Results

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

SOIL TEST SERVICES
ABN 43 002 145 173

FOUR DAY SOAKED CALIFORNIA BEARING RATIO TEST REPORT

Client: Pells Sullivan Meynink
PSM Job No.: PSM3750

Ref No: L4245E
Report: 1
Report Date: 6/02/2019
Page 1 of 1

BOREHOLE NUMBER	BH 1	BH 3	BH 5
DEPTH (m)	0.00 - 1.50	0.00 - 1.50	0.10 - 0.50
Surcharge (kg)	4.5	4.5	4.5
Maximum Dry Density (t/m^3)	1.70 STD	1.67 STD	1.58 STD
Optimum Moisture Content (%)	17.8	20.0	21.1
Moulded Dry Density (t/m^3)	1.66	1.63	1.55
Sample Density Ratio (%)	98	98	98
Sample Moisture Ratio (%)	101	102	102
Moisture Contents			
Insitu (%)	16.4	17.7	19.2
Moulded (%)	18.0	20.3	21.6
After soaking and			
After Test, Top 30mm(%)	33.3	27.4	31.6
Remaining Depth (%)	22.8	22.4	25.0
Material Retained on 19mm Sieve (%)	0	0	1*
Swell (%)	5.5	1.0	1.5
C.B.R. value: @2.5mm penetration	0.5	2.0	3.0

NOTES:

- Refer to appropriate Borehole logs for soil descriptions
- Test Methods : AS 1289 6.1.1, 5.1.1 & 2.1.1.
- Date of receipt of sample: 25/01/2019.
- Sampled and supplied by client.
- * Denotes not used in test sample.

NATA
NATA Accredited Laboratory Number:1327

Authorised Signature / Date (D. Treweek) 6/2/19

Attachment D
Atterberg Limit Test Results

GROUND TECHNOLOGIES

Geotechnical . Environmental . Laboratories

Ground Technologies Pty Ltd
ABN 25 089 213 294
19 Bernera Road, Prestons NSW 2170
PO Box 1121 Green Valley NSW 2168

Test Results - Atterberg Limits

Client:	**PSM**	Job No.:	**GT3023**
Project:	**Material Testing**	Report No.:	**GTR3023-L6**
Location:	**Edmondson Park**	Test Date:	**05-Feb-19**
Contact:	**Yun Bai**	Client Ref No:	**PSM3750**

Sample Location		**BH01 (2.5m)**	**BH03 (1.5 - 2.0m)**	**BH04 (0.2 - 0.5m)**
Sample Number		**L12**	**L13**	**L14**
Test Procedure		AS1289 3.1.2,3.2.1,3.3.1,3.4.1, 2.1.1		
ATTERBERG LIMITS				
Liquid Limit	%	**41**	**27**	**34**
Plastic Limit	%	**16**	**14**	**15**
Plasticity Index	%	**25**	**13**	**19**
Linear Shrinkage	%	**ND**	**ND**	**ND**
Curling/ Crumbling/ Cracking		**None**	**None**	**None**
Sample History		Low Temperature Oven Dried, Dry Sieved	Low Temperature Oven Dried, Dry Sieved	Low Temperature Oven Dried, Dry Sieved
Sample Description		**Red Grey Silty Clay**	**Grey Brown Silty Clay with Gravel**	**Brown Silty Clay**

Comments: Sampling Method: Sample supplied by Client
Date Sampled: Sample supplied by Client

NATA Accredited Laboratory No. 14343
Accredited for compliance with ISO/IEC 17025-Testing
The results of the tests, calibrations and/or measurements in this document are traceable to Australian/National Standards

Mahamood Firoz

Approved Signatory

Date of issue 6/02/2019

Attachment E
Piezometer Construction Records

Pells Sullivan Meynink
Engineering Consultants
Rock - Soil - Water

JOB no.: PSM3750

PROJECT: Edmondson Park

PIEZOMETER CONSTRUCTION RECORD

HOLE NUMBER: BH01
PIEZOMETER: 01
COLLAR EASTING: 301756 m E
COLLAR NORTHING: 6239364 m N
COLLAR RL(m): 60.00
DATUM: AHD

DRILLING CONTRACTOR: BG Drilling
RIG: Rig 6
DEPTH OF HOLE (m): 8.60
BOREHOLE INCLINATION: -90
PIEZO INSTALLATION DATE: 21/01/2019
SUPERVISED BY: MB

Tick boxes

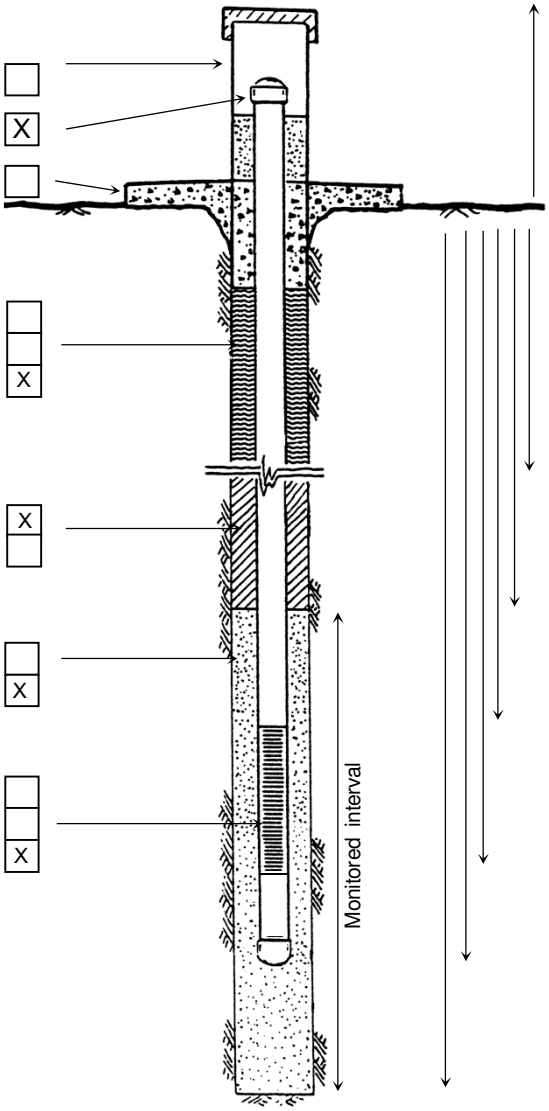
Steel protective well cover [ ]
PVC cap [X]
Concrete colar [ ]

Back fill type:
Cement bentonite [ ]
Soil [ ]
None [X]

Seal:
Bentonite pellets [X]
Other [ ]

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

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



Complete dimensions if appropriate

Height of stickup (m)	0.5
Diameter of PVC (mm)	50
Depth to top of seal	0.0 m
Depth to top of gravel pack	0.0 m
Depth to top of screen	1.0 m
Depth to base of screen	8.6 m
Depth to base of piezo	8.6 m
Depth to base of gravel	8.6 m

COMMENTS:

Pells Sullivan Meynink
Engineering Consultants
Rock - Soil - Water

JOB no.: PSM3750

PROJECT: Edmondson Park

PIEZOMETER CONSTRUCTION RECORD

HOLE NUMBER: BH03
PIEZOMETER: 02
COLLAR EASTING: 301718 m E
COLLAR NORTHING: 6239491 m N
COLLAR RL(m): 59.00
DATUM: AHD

DRILLING CONTRACTOR: BG Drilling
RIG: Rig 6
DEPTH OF HOLE (m): 8.60
BOREHOLE INCLINATION: -90
PIEZO INSTALLATION DATE: 21/01/2019
SUPERVISED BY: MB

Tick boxes

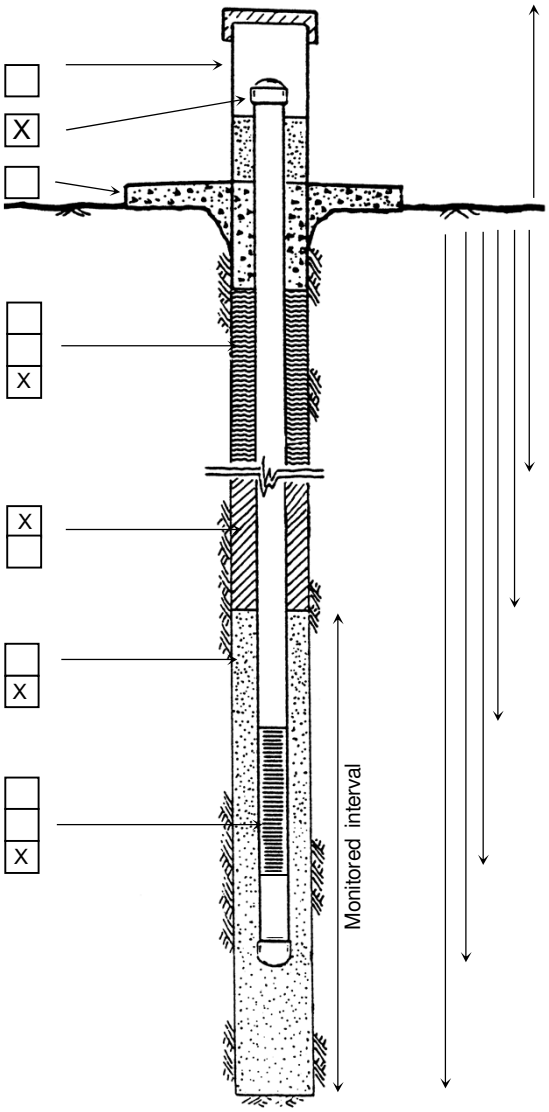
Steel protective well cover: [ ]
PVC cap: [X]
Concrete colar: [ ]

Back fill type:
Cement bentonite: [ ]
Soil: [ ]
None: [X]

Seal:
Bentonite pellets: [X]
Other: [ ]

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

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



Complete dimensions if appropriate

Height of stickup (m)	0.5
Diameter of PVC (mm)	50
Depth to top of seal	0.0 m
Depth to top of gravel pack	0.0 m
Depth to top of screen	1.0 m
Depth to base of screen	6.2 m
Depth to base of piezo	6.2 m
Depth to base of gravel	6.2 m

COMMENTS:

Attachment F
Environmental Testing Results

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **ES1902196**	Page	: 1 of 4
Client	: **PELLS SULLIVAN MEYNINK T/A PSM Admin PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: YUN BAI	Contact	: Customer Services ES
Address	: G3, 56 DELHI ROAD NORTH RYDE NSW, AUSTRALIA 2113	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: +61 02 9812 5000	Telephone	: +61-2-8784 8555
Project	: Edmonson Park	Date Samples Received	: 22-Jan-2019 12:30
Order number	:	Date Analysis Commenced	: 24-Jan-2019
C-O-C number	: ----	Issue Date	: 30-Jan-2019 12:12
Sampler	: ----		
Site	: ----		
Quote number	: EN/333		
No. of samples received	: 8		
No. of samples analysed	: 8		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Ankit Joshi	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW
Celine Conceicao	Senior Spectroscopist	Sydney Inorganics, Smithfield, NSW
Dian Dao		Sydney Inorganics, Smithfield, NSW
Wisam Marassa	Inorganics Coordinator	Sydney Inorganics, Smithfield, NSW

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- ED007 and ED008: When Exchangeable Al is reported from these methods, it should be noted that Rayment & Lyons (2011) suggests Exchange Acidity by 1M KCl - Method 15G1 (ED005) is a more suitable method for the determination of exchange acidity (H+ + Al3+).

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	BH05-1.5m	BH05-3.0m	BH03-2.0m	BH04-0.5m	BH01-2.0m
			Client sampling date / time	22-Jan-2019 09:00	22-Jan-2019 09:15	21-Jan-2019 13:30	22-Jan-2019 09:50	21-Jan-2019 09:30
Compound	CAS Number	LOR	Unit	ES1902196-001	ES1902196-002	ES1902196-003	ES1902196-004	ES1902196-005
				Result	Result	Result	Result	Result
EA002: pH 1:5 (Soils)								
pH Value	----	0.1	pH Unit	5.5	5.8	5.8	5.5	5.2
EA010: Conductivity (1:5)								
Electrical Conductivity @ 25°C	----	1	µS/cm	216	300	142	94	553
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	1.0	%	9.3	8.0	5.8	12.1	11.8
EA080: Resistivity								
Resistivity at 25°C	----	1	ohm cm	4630	3330	7040	10600	1810
ED007: Exchangeable Cations								
Exchangeable Calcium	----	0.1	meq/100g	<0.1	0.1	<0.1	0.8	----
Exchangeable Magnesium	----	0.1	meq/100g	7.2	7.4	3.9	4.6	----
Exchangeable Potassium	----	0.1	meq/100g	0.3	0.5	0.2	0.2	----
Exchangeable Sodium	----	0.1	meq/100g	3.0	3.2	1.8	1.0	----
Cation Exchange Capacity	----	0.1	meq/100g	10.5	11.2	6.0	6.6	----
Exchangeable Sodium Percent	----	0.1	%	28.6	28.8	30.7	15.0	----
ED008: Exchangeable Cations								
Exchangeable Calcium	----	0.1	meq/100g	----	----	----	----	<0.1
Exchangeable Magnesium	----	0.1	meq/100g	----	----	----	----	7.9
Exchangeable Potassium	----	0.1	meq/100g	----	----	----	----	0.2
Exchangeable Sodium	----	0.1	meq/100g	----	----	----	----	4.0
Cation Exchange Capacity	----	0.1	meq/100g	----	----	----	----	12.2
Exchangeable Sodium Percent	----	0.1	%	----	----	----	----	33.4
ED040S : Soluble Sulfate by ICPAES								
Sulfate as SO4 2-	14808-79-8	10	mg/kg	150	230	30	80	180
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	10	mg/kg	230	280	160	80	660

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	BH03-1.5m	BH02-4.0m	BH01-1.0m	----	----
			Client sampling date / time	22-Jan-2019 13:30	22-Jan-2019 08:13	21-Jan-2019 09:15	----	----
Compound	CAS Number	LOR	Unit	ES1902196-006	ES1902196-007	ES1902196-008	--------	--------
				Result	Result	Result	----	----
EA002: pH 1:5 (Soils)								
pH Value	----	0.1	pH Unit	5.8	7.1	4.9	----	----
EA010: Conductivity (1:5)								
Electrical Conductivity @ 25°C	----	1	µS/cm	145	82	526	----	----
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	1.0	%	6.3	14.4	13.7	----	----
EA080: Resistivity								
Resistivity at 25°C	----	1	ohm cm	6900	12200	1900	----	----
ED007: Exchangeable Cations								
Exchangeable Calcium	----	0.1	meq/100g	<0.1	0.8	----	----	----
Exchangeable Magnesium	----	0.1	meq/100g	4.6	5.6	----	----	----
Exchangeable Potassium	----	0.1	meq/100g	0.3	0.4	----	----	----
Exchangeable Sodium	----	0.1	meq/100g	1.8	3.6	----	----	----
Cation Exchange Capacity	----	0.1	meq/100g	6.8	10.3	----	----	----
Exchangeable Sodium Percent	----	0.1	%	26.7	34.4	----	----	----
ED008: Exchangeable Cations								
Exchangeable Calcium	----	0.1	meq/100g	----	----	<0.1	----	----
Exchangeable Magnesium	----	0.1	meq/100g	----	----	4.7	----	----
Exchangeable Potassium	----	0.1	meq/100g	----	----	0.1	----	----
Exchangeable Sodium	----	0.1	meq/100g	----	----	1.9	----	----
Cation Exchange Capacity	----	0.1	meq/100g	----	----	6.8	----	----
Exchangeable Sodium Percent	----	0.1	%	----	----	28.4	----	----
ED040S : Soluble Sulfate by ICPAES								
Sulfate as SO4 2-	14808-79-8	10	mg/kg	90	20	290	----	----
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	10	mg/kg	120	70	410	----	----