APPENDIX L

Geotechnical Investigation

Queanbeyan Palerang Regional Sports Complex

50520049

Prepared for

Queanbeyan Palerang Regional Council

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Cardno

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1 Introduction

Cardno (NSW/ACT) Pty Ltd (Cardno) has been commissioned by Queanbeyan Palerang Regional Council (QPRC) to undertake a geotechnical investigation at the proposed QPRC Regional Sports Complex (herein referred to as the Site). The site is a master planned sporting complex, approximately 17ha in area. The site is located between the suburbs of Hume to the west and Jerrabomberra to the east, within Environa, the site legally defined Lot 6, Plan DP239080. At the time of undertaking this geotechnical investigation it was understood that the site would be developed as follows:

> Six (6) multipurpose playing fields

> Four (4) soccer fields

> Two (2) hockey fields

> Four (4) basketball courts

> A fifty (50) metre and twenty five (25) metre swimming pool

> Other supporting infrastructure including pavement, lighting towers, stormwater drainage, bridges and buildings.

The current aerial image of the site is provided in Figure 1-1 and proposed master plan is provided in Figure 1-2.

Figure 1-1 Aerial image of the site

Figure 1-2 Proposed site Master Plan

1.2 Objectives

The purpose of the geotechnical investigation to assist with the detailed design of the development and preparation of tender documentation for construction. The objective of the investigation to:

> Assess the subsurface profile and identify presence and extent of topsoil/fill or other deleterious material;

> Excavatability characteristics;

> Groundwater;

> Provide engineering assessment discussing the following:

Site classifications of the proposed new playing fields and buildings;

- Allowable bearing capacity (Vertical/Lateral) for structures including buildings and large lighting towers;
- Shallow and deep foundation design parameters for structures, incl. buildings, lighting towers and three (3) bridges
- Durability (exposure classification) of soils/groundwater to steel and concrete piles;
- Anticipated behaviour of soil during construction and during wet and dry periods;
- Determination of excavatability characteristics of encountered soil/rock;
- Dispersion/erodibility;
- Pavement design parameters for roads and carparks;
- Design of up to two (2) suitable pavement profiles, including brief to inform construction methodologies and discussion of site conditions pertaining to management of subsurface water. Pavement design to allow for Design Traffic Loadings of $1x10^5$ ESA and $1x10^6$ ESA; and
- Geotechnical design parameters pertaining to retaining wall design for cantilevered retaining walls up to 2m high.

The field investigations and laboratory testing were undertaken with reference to the following documentation:

> Australian Standard AS1726:2017 “Geotechnical Site Investigations”; and,

> Australian Standard AS1289:2014 “Methods of Testing Soil for Engineering Purposes”.

Geotechnical interpretation and discussion of the report findings has been undertaken with reference to the following documentation:

> Australian Standard AS2870:2011 “Residential slabs and footings”

> Australian Standard AS2159:2009 “Piling-Design and Installation”; and,

> Australian Standard AS3798:2007 “Guidelines on earthworks for commercial and residential developments”

2 Scope of work

2.1 Desktop Study

Cardno reviewed publicly available information including soil landscape maps, geological maps and reports provided by the Client to gain an understanding of the expected ground and site conditions. The field investigation was developed based on the proposed development layout, survey information and limited information regarding proposed cut/fill exercise available at the time.

2.2 Field Investigation

The proposed site investigation regime was provided as part of the brief nominating the fieldwork methodology, test locations and target depths.

The field investigation comprised of the excavation of twenty two (22) test pits and twenty two (22) bore holes, insitu testing and sampling of the encountered materials. Dynamic Cone Penetrometer (DCP) testing was undertaken to AS1289.6.3.2. DCP results were recorded and assessed in terms of insitu relative density/consistency of the soils and are presented on the relevant descriptive engineering log.

Test pits were excavated by a 5t track mounted excavator using 300mm general purpose (GP) standard toothed buckets by AJD Civil and Demolition. The boreholes were drilled by a Gemco 210B trailed mounted driller using 120mm TC Bit auger by GE Drilling.

Materials encountered during the investigation were classified based on visual and tactile properties and logged on site by an experienced Geotechnical Engineer/Engineering Geologist from Cardno with reference to AS1726:2017.

Selected representative samples of the encountered subsurface material were recovered and transported to a NATA accredited laboratory for testing. A site plan identifying the location of test pits and boreholes are presented in Appendix A. The descriptive engineering logs are presented in Appendix B. Site photographs are presented in Appendix D.

2.3 Laboratory Testing

2.3.1 Classification

Laboratory testing of selected samples was undertaken to provide geomechanical data for engineering assessment and to validate the material properties logged during the field investigation in the descriptive engineering logs. Soil characteristics such as composition, strength and mechanical properties are evaluated through a range of laboratory testing.

Selected samples recovered from the test pits and boreholes at the time of the field investigation were submitted for the following laboratory tests:

- Moisture Content - AS1289.2.1.1
- Particle Size Distribution - AS1289.3.6.1
- Atterbergs Limits - AS1289.3.1.1, 3.1.2, 3.2.1, 3.3.1
- Shrink Swell Index - AS1289.7.1.1

- Emerson Classification - AS1289.3.8.1
- Durability (for concrete and steel piles) - AS2159:2009
- Maximum dry density/optimum moisture content relationship - AS1289.5.1.1
- California Bearing Ratio - AS1289.6.1.1

The geomechanical testing was carried out at Construction Sciences Pty Ltd, a NATA accredited geotechnical laboratory (Fyshwick, NATA Accreditation No. 1986, Corporate Site 455) to the relevant Australian Standards. Laboratory reports are presented in Appendix C.

2.3.2 Durability

Selected samples were submitted for chemical analysis from eight (8) locations and analysed for pH, electrical conductivity, chloride and sulphate content for exposure classification in accordance with AS 2159:2009 “Piling - Design and Installation”, for concrete and steel pile durability.

The soil corrosion potential should be taken into consideration when designing for durability for concrete and steel foundations.

3 Site Description

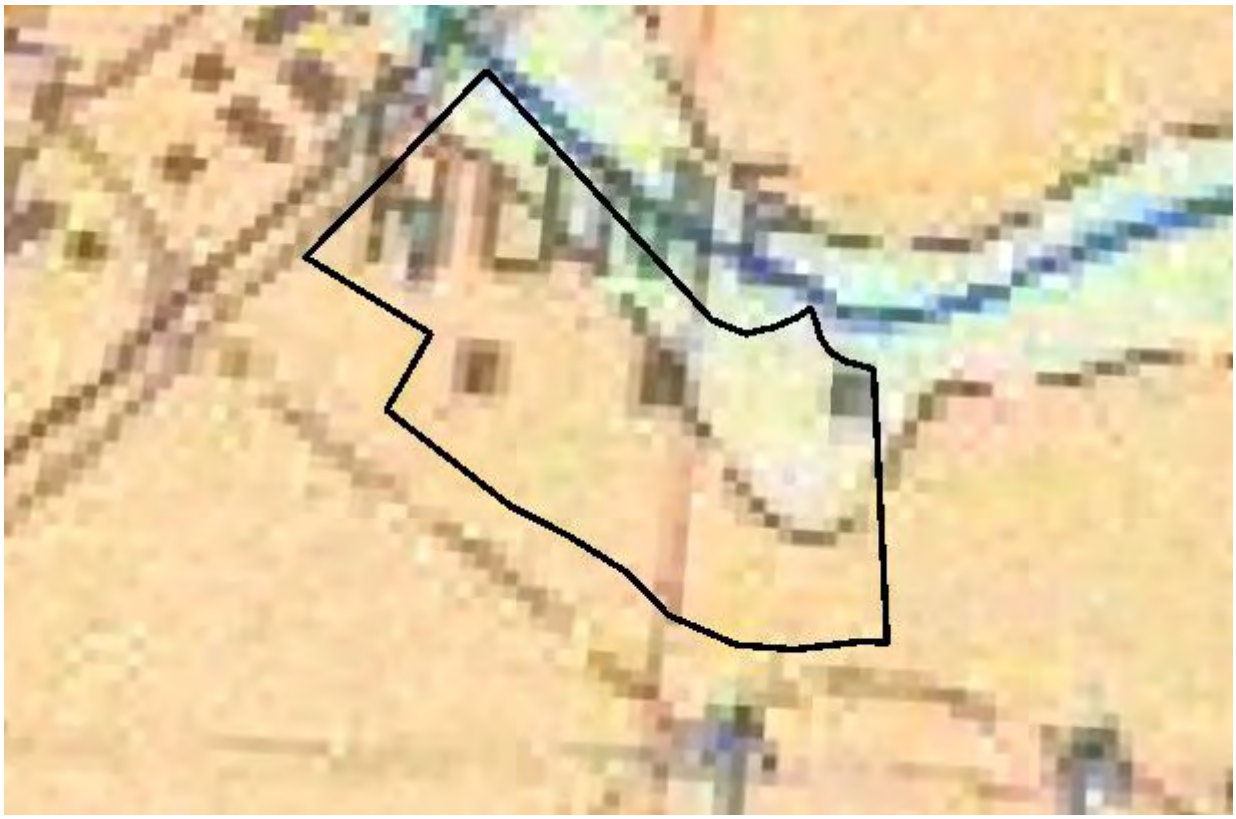
3.1 Site Location and Topography

The proposed Queanbeyan-Palerang Regional Sports Complex’s (QPRSC) subject site is located within South Jerrabomberra, in between Hume and Jerrabomberra. The existing site is situated on open landscape characterised by the Jerrabomberra Creek corridor, and mounding related to the former Tralee Speedway/Fraser Park Raceway and 1/2 Mile Speedway. Additionally there is a basin located in the north east of the site and minor stockpiles and fill mounds located around the site. The site is bound to the north and east by the Jerrabomberra Creek and to the west by the ACT/NSW border and Hume industrial estate. South of the site, it is understood that the construction of a new road has commenced that will provide access to the future Environa and South Tralee residential developments (south) and the Queanbeyan-Palerang Regional Sports Complex from Thompsitt Drive to the east and Isabella Drive to the west.

3.2 Regional Geology

The Canberra 1:100,000 Geological Map (Sheet 8727, BMR Canberra) indicates the immidiate area of the site is underlain by the Deakin Volcanics. The Deakin Volcanics is characterised by deposits including rhyodacitic ignimbrite and minor volcaniclastic and argillaceous sediments. To the northeast of the site are quaternary alluvium deposits (gravel, sand, silty clay and organic clay).

Figure 1-1 Geological map of the QPRSC area



3.3 Soils

Review of the Canberra 1:100,000 Soil Landscape maps indicate that the site is situated on the boundary between the Williamsdale and Ginninderra Creek landscapes. The Williamsdale transferral landscape is characterised by undulating rises, fans, valley flats and depressions on Silurian Volcanics. Soils are moderately deep, moderately well-drained yellow chromosols (yellow podzolic soils) on red and brown kandosols (red and yellow earths) on upper rises and fan elements. The Ginninderra Creek landscape characterised by gently undulating floodplain on Quaternary alluvium. Local relief <10 m; elevation 540 - 680 m; slopes generally <3%. Many imperfectly drained areas. Extensively cleared riparian woodland. Soils are deep (>100 cm), imperfectly drained Sodic Brown Chromosols (Brown and Yellow Podzolic Soils) on margins of the unit. Deep (>100 cm), poorly drained Stratic Rudosols (Alluvial Soils) on floodplain elements.

4 Fieldwork

Fieldwork was undertaken between 15th January and 17th January 2020. Works were carried out in accordance with Cardno procedures.

Twenty two (22) test pits were excavated within the site using a 5t track mounted excavator using 300mm general purpose (GP) standard toothed buckets supplied and operated by AJD Civil and Demolition. The test pits were denoted in accordance with the design feature to be investigated as follows:

> 100 series (total of eleven (11) test pits) – Playing fields with a target depth of 1.0 m;

> 200 series (total of three (3) test pits) – Underground utilities with a target depth of 1.5 m;

> 400 series (total of eight (8) test pits) – Pavement design with a target depth of 1.0 m.

Twenty two (22) boreholes (denoted series 300 for infrastructure including buildings and lighting towers) were drilled within the site using a Gemco 210B trailed mounted driller using 120mm TC Bit auger supplied and operated by GE Drilling. Test pits were excavated to depths ranging from 1.0 m to 1.5 m below ground level (mbgl). Boreholes were drilled to depths ranging from 2.72 m to 6.6 m below ground level (mbgl). The encountered materials were logged by an experienced Geotechnical Engineer/Engineering Geologist form Cardno. Soil descriptions were made by observing the visual and tactile properties in accordance with AS1726-2017.

Test pit and borehole locations and termination depths with the descriptive engineering logs are presented in Appendix B, and photographic plates in Appendix D.

Dynamic Cone Penetrometer (DCP) testing was undertaken to AS1289.6.3.2. DCP results were recorded and assessed in terms of insitu relative density/consistency of the soils and are presented on the relevant descriptive engineering log in Appendix B.

5 Results

5.1 Subsurface Conditions

The subsurface profile encountered was considered consistent with geological maps, a summary of the encountered strata and thicknesses of those strata are presented in Tables 5-1 and 5-2 below. The detailed descriptions of encountered materials are contained in the descriptive engineering logs in Appendix B.

In summary, subsurface conditions encountered that may result in problematic ground conditions for development include:

> Potential high to very high strength rock horizon with minimal weathering profile limiting ability for piles to socket within rock unit using conventional pile installation equipment;

> Isolated section of high shrink/swell potential material;

> Very loose to loose sand unit at depth encountered within BH301, BH302, BH303, BH306, BH315, BH317, BH319 encountered at depths from 2.0 m to 3.2 m below ground level and up to 4.3 m in thickness directly above the weathered rock horizon.

Table 5-1 Inferred Geotechnical Model, TP101 – TP110, TP201 – TP203, TP401 – TP408

Unit	Depth to base (mbgl)	Thickness (m)	Description
Unit 1 – Topsoil/Fill	0.1 – 0.35	0.0 – 0.35	Silty SAND and clayey silty SAND: fine to coarse grained, light brown, grey, light grey, medium plasticity clay, trace fine to medium, sub-angular gravel, frequent rootlets (<2mm) Sandy SILT: low plasticity, brown, light brown, fine to course sand, trace fine, sub-angular gravel, frequent rootlets (<2mm) Sandy GRAVEL: fine to coarse, sub-rounded to sub-angular, light yellowish brownish grey, fine to coarse sand, with medium plasticity clay, occasional rootlets (<2mm)
Unit 2 – Alluvium	0.35 – 1.5	0.65 – 1.38	Sandy SILT and clayey SILT: low to medium plasticity, brown, light brown, fine to medium sand SAND, Silty SAND and clayey SAND: fine to coarse grained, brown, light brown, yellowish brown, grey, dark grey/black, white, medium to high plasticity clay, trace fine to coarse, sub-rounded gravel, frequent rootlets (<2mm) Sandy GRAVEL: fine to medium, light brown Silty CLAY and sandy CLAY: medium to high plasticity, dark brown, grey, dark grey mottled red and orange, trace/with fine to medium sand

Table 5-2 Inferred Geotechnical Model, BH301 – BH322

Unit	Depth to base (mbgl)	Thickness (m)	Description
Unit 1 – Topsoil/Fill/ Pavement	0.1 – 0.8	0.0 – 0.8	Sandy SILT: low plasticity, light grey, light brown, brown, fine to coarse sand, trace fine, sub-rounded gravel Silty SAND and clayey SAND: fine to coarse grained, brown, light brown, grey, light grey, mottled red and yellow, trace/with fine, sub-rounded to sub-angular gravel, frequent rootlets (<2mm) Silty Sandy GRAVEL: fine to coarse, sub-rounded, sub-angular to angular, light yellowish grey locally light reddish brown, fine to coarse sand, frequent rootlets (<2mm) SPRAY SEAL
Unit 2 – Alluvium	1.2 – 6.3	1.0 – 6.0	Sandy SILT and clayey SILT: low to medium plasticity, brown, light brown, grey, dark grey, fine to coarse sand, trace/with fine sub-rounded gravel CLAY, silty CLAY, sandy CLAY and sandy silty CLAY: medium to high plasticity, brown, grey, dark grey/black, mottled orange, yellow and grey, trace/with fine to coarse sand, trace fine, sub-rounded gravel, occasional rootlets (<2mm) SAND, Silty SAND, clayey SAND and silty clayey SAND: fine to coarse grained, brown, red brown, light brown, dark brown, light grey, dark grey, mottled yellow and orange, trace/with medium plasticity clay, trace/with fine sub-rounded to sub-angular gravel, occasional relic organic material
Unit 3 – Residual Soil	3.6 – 6.4	0.95 – 2.6	SAND, clayey SAND, clayey Gravelly SAND : fine to coarse grained, grey, brown, mottled orangish brown and yellowish brown, greenish grey mottled light green, medium to high plasticity clay, fine to coarse, sub-angular to sub-rounded gravel
Unit 4 – Rock/Weathered Rock	Not encountered	N/A	DACITE: orange brown, yellow brown, grey, greyish green, blueish green, very low to low strength, highly weathered, medium grained

5.2 Laboratory Testing

5.2.1 Atterberg Limits and Particle Size Distribution Results

Atterberg limit and particle size distribution testing was conducted on selected samples to assess plasticity and grading. Table 5-3 below shows the results for liquid limit, plastic limit, and plasticity index, and percentage gravel, sand and clay contents. Laboratory certificates are presented in Appendix C.

Table 5-3 Summary of Atterberg Limits Results

Sample	Depth (m)	Geotechnical Unit	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Gravel Content (%)	Sand Content (%)	Clay/Silt Content (%)
BH306	6.0-6.45	2 – Alluvium/4 - Rock/Weathered Rock	28	20	8	37	50	13
BH321	1.8-2.3	2 – Alluvium	30	18	12	2	25	73
TP101	0.2-0.3	2 – Alluvium	22	21	1	1	54	45
TP101	0.7-0.8	2 – Alluvium	33	27	6	0	8	92
TP105A	0.3-0.4	2 – Alluvium	25	18	7	2	41	57
TP406	0.6-0.8	2 – Alluvium	19	16	3	4	50	46

5.2.2 Shrink-Swell Index Results

Shrink-Swell testing was conducted on selected samples to assess the site classifications for the proposed playing fields and buildings. Table 5-4 below shows the results for the Shrink-Swell Index. Laboratory certificates are presented in Appendix C.

Table 5-4 Summary of Shrink Swell Index Results

Sample	Depth (m)	Geotechnical Unit	Shrink-Swell Index
BH307	4.5-4.95	2 - Alluvium	1.2
BH309	3.0-3.45	2 - Alluvium	2.2
TP102	0.4-0.5	2 - Alluvium	0.9
TP104	0.2-0.3	2 - Alluvium	0.8
TP107	0.2-0.3	2 - Alluvium	1.5
TP110	0.7-0.8	2 - Alluvium	1.0

5.2.3 California Bearing Ratio Results

Standard compaction (95%) and CBR testing was conducted on selected samples to allow assessment of subgrade conditions for pavement design and compaction properties. Table 5-5 below shows the results for the maximum dry density, optimum moisture content, CBR and CBR swell. Laboratory certificates are presented in Appendix C.

Table 5-5 Summary of CBR Results

Sample	Depth (m)	Geotechnical Unit	Field moisture content (%)	OMC (%)	MDD (t/m^3)	CBR (%)	CBR Swell (%)
TP401	0.6-0.8	2 - Alluvium	13.6	16.0	1.76	10	0.5
TP402	0.6-0.8	2 - Alluvium	8.0	12.0	1.87	8	0.5
TP403	0.6-0.8	2 - Alluvium	6.4	11.0	1.79	3.5	1.0
TP404	0.6-0.8	2 - Alluvium	16.9	17.0	1.73	4.5	1.5
TP405	0.6-0.8	2 - Alluvium	-	15.5	1.45	2.0	5.0
TP406	0.6-0.8	2 - Alluvium	4.0	10.0	1.93	8	0.0
TP407	0.6-0.8	2 - Alluvium	11.0	18.5	1.49	1.5	3.0
TP408	0.6-0.8	2 - Alluvium	10.0	16.5	1.68	3.0	2.5

Notes:

1) *MDD = Maximum Dry Density (t/m3)*
2) *CBR = California Bearing Ratio @ 95% MDD (modified maximum dry density)*
3) *OMC = Optimum moisture content (%)*

5.2.4 Emerson Class Number

Emerson Class Number testing was conducted on selected samples to assess the soils coherence in water, which enables assessment of soil erosion and durability. Table 5-6 below shows the results of the Emerson Class Number. Laboratory certificates are presented in Appendix C.

Table 5-6 Emerson Classification

Sample	Depth (m)	Geotechnical Unit	Emerson Classification
TP101	0.2-0.3	2 - Alluvium	8
TP104	0.2-0.3	2 - Alluvium	5
TP105A	0.3-0.4	2 - Alluvium	2
TP107	0.2-0.3	2 - Alluvium	5
TP110	0.3-0.4	2 - Alluvium	4
TP406	0.6-0.8	2 - Alluvium	6

5.2.5 Exposure Classification

During the field investigation, eight (8) soil samples were collected and analysed for pH, Electrical Conductivity, chloride and sulphate content in terms of aggressivity. The table below provides exposure classification for concrete and steel piles in accordance with AS 2159:2009 Piling – Design and Installation. The assessment has assumed Class A soil conditions for boreholes BH301, BH303 and BH308 as the encountered soils being

located within the water table and Class B for boreholes BH311, BH312 and BH321 as the encountered soils being located above the water table.

The soil corrosion potential should be taken into consideration when designing for durability for concrete and steel foundations. Results are presented in Table 5-7. Certificates of Analysis are presented in Appendix C.

Table 5-7 Summary of Corrosivity Exposure Classification

Sample	Depth (m)	pH	Electrical Conductivity (dS/m)	Resistivity (ohm cm)	Chloride - Cl (mg/kg)	Sulphate - SO_4 (mg/kg)	Exposure Classification – Class A soils		Exposure Classification – Class B soils	
							Concrete	Steel	Concrete	Steel
BH301	4.5-4.95	6.8	0.15	6660	38	314	Mild	Non-aggressive	Non-aggressive	Non-aggressive
BH303	3.0-3.45	7.5	0.05	20000	29	43	Mild	Non-aggressive	Non-aggressive	Non-aggressive
BH308	1.5-1.95	8.2	0.08	12500	28	67	Mild	Non-aggressive	Non-aggressive	Non-aggressive
BH308	3.0-3.45	8.4	0.09	11100	40	64	Mild	Non-aggressive	Non-aggressive	Non-aggressive
BH311	1.5-1.95	8.1	0.03	33300	23	22	Mild	Non-aggressive	Non-aggressive	Non-aggressive
BH312	4.5-4.95	7.6	0.06	16700	35	32	Mild	Non-aggressive	Non-aggressive	Non-aggressive
BH321	1.5-1.95	8.8	0.06	16700	22	76	Mild	Non-aggressive	Non-aggressive	Non-aggressive
BH321	4.5-4.95	8.3	0.04	25000	23	21	Mild	Non-aggressive	Non-aggressive	Non-aggressive

5.3 Groundwater

At the time of the investigation (January – middle of summer), ground water was not encountered in any of the test pits (depths 1.0m-1.5m). Dry to moist soils were encountered in TP101-TP102, TP105A, TP106-TP110, TP201-TP203 and TP401. However, ground water was encountered at depths of 1.2m-5.0m in boreholes BH301-BH304, BH306-BH310, BH312, BH314-BH315, BH317-BH319 and BH321. A summary of the encountered ground water depths are presented in Table 5-8 below.

Table 5-8 Summary of encountered ground water depths

Borehole Location	Ground water Depth (mbgl)
BH301	3.1
BH302	3.9
BH303	3.0
BH304	4.3
BH305	Not Encountered
BH306	1.8
BH307	4.9
BH308	1.2
BH309	2.3
BH310	2.5
BH311	Not Encountered
BH312	4.1
BH313	Not Encountered
BH314	2.7
BH315	2.1
BH316	Not Encountered
BH317	2.6
BH318	2.9
BH319	2.4
BH320	Not Encountered
BH321	5.0
BH322	Not Encountered

Groundwater is expected to fluctuate throughout the year due to seasonal influence. It is likely that groundwater will be locally encountered as a perched water table within Alluvial soils overlying the residual soils/extremely weathered rock or low permeability bedrock, especially after significant and prolonged rainfall events.

6 Engineering Assessment

The engineering assessment presented herein has been based on observations made during the site investigation, the material succession encountered within the test pits, boreholes and insitu and laboratory test results.

6.1 Site Classification

Site classification assessments for the proposed playing fields and buildings has been conducted based on the Shrink Swell Index in accordance with AS2870:2011.

Based on the calculated characteristic ground movements for the proposed playing fields (TP102, TP104, TP107 and TP110) and buildings (BH307 and BH309) within the site is classified as Class M.

This Classification is applicable only for ground conditions encountered at the time of this investigation. If cut or fill earthworks are carried out, then the Site Classification will need to be re-assessed, and possibly changed.

6.2 Shallow Foundations

6.2.1 Allowable Bearing Capacity Recommendations

All footing systems for residential structures should be designed and constructed in accordance with AS2870-2011 for the appropriate classification. Suitable footing systems may comprise pad/strip footing or raft slabs.

An allowable bearing capacity assessment using material descriptions and strengths obtained from the descriptive engineering logs has been carried out for shallow pad foundations, which are presented in Table 6-1 below.

Table 6-1 Preliminary allowable bearing capacities

Geotechnical Unit	Allowable Bearing Capacity[1] *(kPa)*
2 – Alluvium	100
3 – Residual soil	150

Notes:

1) [1]Bearing capacity assessment assuming a 1.0m wide footing and does not account for embedment.

Footings founded on engineered fill may be proportioned for an allowable bearing pressure of 150kPa and 100kPa for pad and strip footing respectively.

These are the assessed design allowable bearing capacities for the site at the time of the investigation at the locations of the investigation holes. Drying of the site or increased soil moisture (subsurface water infiltration) may have an effect on the insitu soil strengths. Due to these factors and the potential for variability within the natural soils across the site, it is considered imperative that the site be inspected by an experienced Geotechnical Consultant at regular intervals during excavation and construction to confirm design allowable bearing pressures across the entire foundation have been achieved.

6.2.2 Settlement

Settlement of spread footings will depend on the size, shape and founding depth of the footings. At the time of preparing this report, details of the footing loads have not been provided. However, based on the allowable bearing pressures presented above, settlements in the range of 15mm to 20mm may be anticipated for spread footings up to 2m wide for preliminary purposes with a proportion of this settlement likely to occur during construction. Particular attention shall be paid to the very loose to loose sand layer that has been encountered which is likely to generate immediate settlements.

A detailed review of settlements should be undertaken once footing layouts and loadings are finalised.

6.3 Deep Foundations

6.3.1 Pile Design Parameters

Deep foundations are expected to be required for the proposed structures including buildings, bridges and large lighting towers and bored piles are considered feasible.

For the design of piles, geotechnical design parameters for ultimate strength limit state are provided in Table 6-2 for bored piles. The design should also include assessment of both strength and serviceability limit states.

Table 6-2 Preliminary Geotechnical Parameters for Bored Piles

Geotechnical Unit	Ultimate Shaft Adhesion (fs) kPa	Working Base Resistance (kPa)	Ultimate End Bearing Resistance (fb) kPa	Elastic Modulus (MPa)
3 – Residual Soil	50	-	-	35
4 – Rock/ Weathered Rock	150	1,000	3,000	80

Notes:

1) *Design parameters for piles in the upper 1.0m of the soil profile across the site should be neglected due to the potential of soil reactivity as a result of seasonal moisture changes.*
2) *Pile parameters are based on a minimum pile embedment depth of 2.0m.*
3) *At allowable/working bearing pressures, pile settlements are expected to be less than 1% foundation width*
4) *Reference should be made to investigation logs for exact material description and depths.*

Piles should be designed for both ultimate and serviceability conditions. Ultimate end bearing and shaft adhesion values are to be used with appropriate load factors and geotechnical strength reduction factors to assess ultimate capacity.

The geotechnical strength reduction factor will depend on various influences such as the level of information available for the rock and the level of construction control. Based on the above influence factors applicable for the site and uncertainty with construction method and quality control etc., an average risk rating, ARR and geotechnical strength reduction factor, Φgb should be calculated. For limit state strength design, a geotechnical strength reduction factor (Φgb) of 0.45 can be applied to the ultimate capacity presented in Table 6-2. Pile testing requirements will be dependent on AS2159-2009. For piles subject to uplift loads, the geotechnical strength should be multiplied by a factor of 0.7 in addition to the geotechnical strength reduction factor.

Whilst bored piles are considered feasible, constructability with a high groundwater level may be problematic and will likely require temporary lining.

Piles should extend a minimum of 2 pile diameters into the founding bedrock. The design values require good construction practices which includes socket cleaning and concreting in a continuous process without delay. It is recommended that an experienced geotechnical engineer or engineering geologist observes pile drilling as well as shaft and mechanical base cleaning to confirm the adequacy of founding strata. Such observations would be undertaken from the piling platform level and would include observation of returned cuttings and drill rig performance, as well as the effectiveness of shaft roughening (if required) and down-hole cleaning.

Piling contractors should be provided with the descriptive engineering logs and be required to make their own assessment of suitability of piling plant and to verify the ultimate load-carrying pile capacities.

Further geotechnical investigation where deep foundations are expected to be required i.e. at the location of large lighting towers, buildings and bridges should be undertaken to confirm the subsurface profile and design parameters prior to design of foundations. These should include proof coring of rock to a minimum depth of 3m below the pile base and Standard Penetration Tests (SPTs) to allow assessment of the in situ strength properties of the encountered materials.

6.4 Lateral Earth Pressures

Retaining walls may be required as part of the development. The design of retaining walls depends upon the type of wall, the ground profile and the sequencing of construction. Detailed soil-structure interaction analyses will be required during the detailed design stage to assess magnitudes of movement.

For detailed design of the retention system, location specific geotechnical profiles should be developed. Recommended preliminary design parameters for the various soil units are presented in Table 6-3.

Table 6-3 Preliminary Design Parameters for Retaining Wall Design

Geotechnical Unit	Bulk Density γ (kN m^3)	Effective Friction Angle ϕ' (degrees)	Active Earth Pressure (Ka)	Passive Earth Pressure (Kp)	At-rest earth Pressure Coefficient (Ko)
2 – Alluvium	17	28	0.36	2.77	0.53
3 – Residual soil	20	30	0.33	3.0	0.5
4 – Weathered Rock	22	30	0.33	3.0	0.5

Notes:
1. *Assuming no sloping ground and area above and below the retaining structure is horizontal*

The above advice assumes level ground above and below the retaining wall and no seismic actions. The design of any retaining structures should make allowance for all applicable surcharge loading including construction activities and ground water conditions.

6.5 Earthworks

6.5.1 Site Preparation

Prior to bulk earthworks, any fill, pavement or structure footings areas shall be cleared of any foreign matter or unsuitable material which includes but may not be limited to the following:

> Vegetation or organic matter including root balls of any larger trees onsite;

> Topsoil or soil significantly affected by roots or root fibres;

> Any scattered waste or dumped materials;

> Loose or low strength (soft) soils or otherwise 'unsuitable' soils.

Deleterious materials that cannot be reused on site shall be disposed of at a licenced waste facility and classified in accordance with the NSW EPA Waste Classification Guidelines. Stripped topsoils shall be stockpiled for re-use where suitable.

6.5.2 Excavatability

Based on the field investigation and testing we can estimate the excavatability using the Kirsten's Classification System presented in Table 6-4. Soil and rock encountered during the investigation are expected to range from Class 2 to 5 and should be able to be excavated using conventional earth moving plant.

Table 6-4 Definition of eight point excavation classification system for soil and rock

Material Type	Material Excavation Classification [1]		Description of Excavatability
	Class	Class Index Boundaries	
Soil	1	N[2] <0.01	Hand spade
	2	0.01<N<0.1	Hand pick and spade
	3	0.1<N<1.0	Power tools
Rock	4	1.0<N<10	Easy ripping
	5	10<N<100	Hard ripping
	6	100<N<1,000	Very hard ripping
	7	1,000<N<10,000	Extremely hard ripping/blasting
	8	N > 10,000	Blasting

Notes:
[1] Kirsten's Classification System
[2] Ripping Index

It is recommended that Contractors are provided with the descriptive engineering logs to review and make their own assessment of the ground conditions.

Rock outcrops were encountered in a number of areas, typically northwest of the site. Where shallow rock is encountered for deep excavation, use of rippers or rock hammers may be required. Due to the lateral confinement present during test pit excavation, it is possible that large scale excavation will experience less problematic excavation conditions than those experienced during this investigation.

Groundwater was not encountered during the investigation in test pits (depths from 1.0m to 1.5m), however is known to fluctuate due to rainfall events. Any excavations within the alluvial soils should be planned during and preceded by dry weather.

6.5.3 Excavation Stability

The materials encountered during the investigation typically comprised alluvium, residual soils, weathered rock/rock.

Excavations deeper than 1m within the soil profile (alluvium and residual soils) should be no steeper than 1V:1H in the short term.

Excavations deeper than 1m within the rock profile (highly weathered dacite) should be no steeper than 2V:1H in the short term. Note that excavation stability in rock is highly influenced by natural and induced defects, as such the stability is controlled by the orientation of the defects with respect to the excavation.

Battering or benching the trenches would be appropriate methods for reducing the batter angle of the trench walls. Should steeper excavations be required, shoring methods such as shields should be used. Surcharge loads should be kept well clear of the crests of excavations. If steeper excavations or surcharge loading is required to be placed close to the crest of the excavation, temporary shoring support or engineering retaining solutions are recommended. Permanent excavations in the residual soils/extremely weathered rock are recommended to have maximum batter of 1V:2H.

All trenching work should be conducted in accordance with WorkSafe ACT, Excavation Work Code of Practice (October 2018) or other relevant document in force at the time of works.

6.5.4 Trafficability

At the time of the investigation, site was covered by grass and some mature trees. Predominantly sandy clay and silty clay soils were encountered beneath a topsoil/fill layer of up to 0.8m.

It is likely that imported road base or recycled road base type material such as crushed brick and concrete will be required to provide a stable surface for temporary access and roadways during or following wet weather.

Following excavation to the proposed subgrade level, or stripping for pavement construction, the subgrade should be proof rolled in accordance with AS3798:2007 “Guidelines on earthworks for commercial and residential developments”. Any areas where excessive heave or deflection is found to occur should be excavated and replaced with appropriate fill.

Consideration should be given to the design of crane pads or working platforms for sensitive plant and equipment should these be a requirement of the project.

6.5.5 Site management

In order to minimise foundation and pavement movement, it is important that proper site management for the existing soil conditions are observed.

We recommend that appropriate drainage be provided around roads, buildings and structures to ensure adequate foundation performance and prevent scouring. It is also recommended that the ground surface around structures or building platforms should slope away at a gradient of 1V:20H for 2m and then fall to the stormwater runoff system. Subsoil drains either side of roads should be incorporated into the design.

The importance of avoiding leakage from underground services and drains near the buildings and structures is stressed. Any leaking services or blocked drains should be remedied promptly. It is advisable to use flexible joints, allowing horizontal and vertical movement where service pipes pass through the foundation structure (floor and slab). The bases of service trenches should fall away from the buildings and structures.

It is recommended that future shrubs and trees be planted away from the buildings and structures, at a distance at least equivalent to their mature height. This reduces the likelihood of those trees influencing shrinkage movement in expansive founding soils. New buildings and structures should also be located away from any existing trees on the site, at a distance equivalent to the tree’s mature height.

6.5.6 Material Reuse

The material encountered across the site and with depth exhibits limited variation in geotechnical properties which will influence the suitability and methodology for reuse during construction.

It is likely that various site won material would require treatment or blending to achieve the best possible outcomes in terms of their engineering properties. This may include wetting/drying to achieve optimum moisture content or blending soils with a higher than required fines content with more coarse material. Any such requirements should be identified in the design.

Highly to moderately weathered rock materials encountered on site are considered suitable for reuse as controlled filling subject to removal or crushing of particles greater than 75mm (least dimension) in size. The Alluvial soils encountered during the investigation are generally considered suitable for reuse.

6.5.7 Fill Placement

Following site preparation works, fill should be placed and compacted in accordance with the following guidelines and specifications:

> AS 3798-2007 Earthworks for Commercial and Residential Development

It is recommended that the following procedures be adopted for subgrade preparation:

> Remove any vegetation from the surface and strip off any topsoil or surficial fill containing significant organic matter or pavement seal.

> To reduce the potential for voids and to provide compaction of the upper fill materials it is recommended that the site be compacted with at least 6 passes of a heavy compactor (say 30 tonne) or similar.

> Any soft, weak or otherwise unsuitable areas identified during the subgrade compaction process that do not respond to further compaction, should then be removed and replaced with select fill in layers not exceeding 200mm loose thickness and should be compacted to achieve a dry density ratio of 98%Modified in accordance with AS1289 5.1.1 and 5.4.1 or 5.7.1. Excavations to remove soft or weak areas should have side slopes battered to no steeper than 1H:1V.

> Further excavate or fill to design subgrade level, as required.

> The exposed subgrade should then be scarified and moisture conditioned to within 2% of Optimum Moisture Content (OMC) and compacted over the top 200mm to achieve a minimum dry density ratio of 98% Modified in accordance with AS1289 5.1.1 and 5.4.1 or 5.7.1.

> Where engineered fill is required to raise the subgrade level, it should be placed and compacted as described above.

The consultant responsible for the Level 1 Inspection and Testing should review the proposed earthworks specification and satisfy themselves that the frequency of inspections and testing is commiserate with AS3798-2017, Section 8.2, with the purpose of the fill placement and with the operations being undertaken.

It is worth noting that moisture content of tested materials ranged in field moisture content of between optimum and 4.7% dry of optimum.

6.5.8 Piling Platform

Depending on final bulk earthworks, a working platform may need to be constructed to allow access and support piling plant. The need and extent of a working platform would need to be assessed once piling plant track/wheel loads are known.

6.6 Pavement Profile Design

Laboratory CBR testing conducted on selected samples reported CBR values of between 1.5% and 10% within test pits TP401 to TP408 across the site. Insitu DCP testing conducted at each test pit indicated insitu CBR values between 2% and >15% in TP401 to TP408 (proposed access road and car park area).

Note that the inferred CBR values from DCP data are unlikely to be achieved where the soils are reused as fill.

It is recommended that a design CBR value of 3% is adopted for the pavement design due to the generally consistent and quality of the encountered alluvium soils.

Where site won fill materials are to be placed for pavement subgrade, a preliminary design CBR of 5% can be adopted. The laboratory CBR values exhibited a high degree of variance (between 1.5% and 10%). As such during fill placement the subgrade CBR should be confirmed by a suitability qualified geotechnical engineer. Where fill materials are unable to achieve the design CBR, soil treatment methods such as the addition of lime may be suitable.

During pavement construction it is recommended that the prepared subgrade is assessed by a suitably experienced geotechnical engineer to confirm the ability of the actual subgrade materials to meet the design subgrade requirements. All topsoil, root affected soils, uncontrolled fill or deleterious material should be removed as part of subgrade preparation.

6.6.1 Design Basis

The design guides used in the pavement profile designs are:

> Austroads “Guide to Pavement Technology Part 2: Pavement Structural Design dated 2017 (referred to as AGPT02-17)

> Austroads “Guide to Pavement Technology Part 5: Pavement Evaluation and Treatment Design dated 2011 (referred to as AGPT05-11)

> RMS Supplement to Austroads Guide to Pavement Technology Part 2: Pavement Structural Design, Publication No. 11.050 Version 2.2 August 2018 (referred to as RMS11.050)

> RMS QA Specification R44 – Earthworks, Edition 3/Revision 0, dated March 2015 (referred to as R44)

> Queanbeyan Palerang Development Design Specification-D2-Pavement Design, Version 1 – November 2018 HPRM: SF130198

> Queanbeyan Palerang Development Construction Specification-C242-Flexible Pavements, Version 1 – January 2019

6.6.2 Design Traffic Loading

The equivalent standard axles (ESA) of designed traffic loading was assumed as $1x10^5$ and $1x10^6$.

6.6.3 Pavement Profiles

Flexible unbound granular pavement profiles are presented in Table 6-5 and Table 6-6 for the two design ESA values $1x10^5$ and $1x10^6$.

Table 6-5 Unbound Granular Pavement – Subgrade CBR=3%, ESA=$1x10^5$

Layer	Thickness (mm)	Material
Wearing Course	40	AC14 A15E
Base Course	120	DGB20
Sub base Course	100	DGS20
SMZ	120	Select Material Upper 150mm CBR33%, Lower 50mm CBR 19%, Swell ≤1.5%, Plasticity Index ≤15
Total Pavement Thickness	380	
Subgrade	Subgrade min. CBR 3%	

Table 6-6 Unbound Granular Pavement – Subgrade CBR=3%, ESA=$1x10^6$

Layer	Thickness (mm)	Material
Wearing Course	40	AC14 A15E
Base Course	150	DGB20
Sub base Course	100	DGS20
SMZ	230	Select Material Upper 150mm CBR33%, Lower 50mm CBR 19%, Swell ≤1.5%, Plasticity Index ≤15
Total Pavement Thickness	520	
Subgrade	Subgrade min. CBR 3%	

Note:

1. *Basecourse thickness includes 10mm construction tolerance in accordance with RMS supplement to AGPT02-17*
2. *SMZ Only required where CBR Swell ≥2.5% or CBR ≤3.0%*

6.7 Erosion and Sediment Control

Emerson Class Number results of the soils indicated Class 2 to Class 8 dispersion. As such untreated and exposed batters within problematic areas particularly around TP105A will likely be susceptible to erosion. As such it is probable that treatment of the onsite materials by methods such as mixing gypsum, placement of geosynthetic erosion protection products or vegetation would be required on constructed permanent batters. Further testing should be considered to better delineate the boundaries of this problematic material.

It is imperative that during earthworks, erosion and sediment control practices are investigated and put in place to ensure any activities carried out on site will not have a detrimental impact to the neighbouring environment. It is also recommended that during the development of the bulk earthworks specification, consideration is made to the *Urban Stormwater: Soils and Construction,* Landcom 2004 (“the Blue Book”)

Erosion and sediment controls should be incorporated early in any large or small scale development process and be included in budget estimates. In selecting and constructing erosion and sediment control systems, an appreciation of the differences between the two is important.

- Erosion control measures assist in protecting or strengthening the soil’s surface or subsurface from being eroded and diverts runoff in a non-erosive way.
- Sediment control measures capture and remove eroded soil particles from runoff prior to the water leaving the site.

The key to successful erosion and sediment control is planning. Generally control measures are not enough if just considered on their own. There must be a combination of structural controls, good site management and construction practices to achieve effective controls. An Erosion and Sediment Control Plan (ESCP) can assist

in bringing together all of these aspects. These plans should communicate how erosion and sedimentation can be controlled on and off site. The erosion and sediment control measures as outlined in the plan must be installed before any disturbance of the site occurs.

It is best practice to develop an ESCP for any earthworks to be undertaken whether they are subject to statutory requirements or not. Developing a plan helps to identify the overall requirements for drainage and revegetation, assists in determining what level of protection methods may be required and reduces costs for repairs and/or rehabilitation.

7 Closure

We appreciate the opportunity to work collaboratively with you on this project. Our team looks forward to bringing our high level of expertise to deliver successful outcomes in your future projects.

Your attention is drawn to the appended document titled "*Important Information about this Geotechnical Report".* This document is intended to clarify to the reader what the realistic expectations of this report should be, and what is the correct use of the document. Misinterpretation of geotechnical information presents significant risk to projects: The document includes a discussion on general limitations of geotechnical services, which by nature, are based extensively on opinion and judgement.

The statements included in this document are not intended to be exculpatory clauses or to reduce the general responsibility accepted by Cardno, but rather to identify where Cardno and our Client's responsibilities lie. The statements ensure that all parties that may rely on the report are aware of their respective responsibilities.

For further enquiries, please do not hesitate to contact Cardno on the information supplied.

8 References

[1] Abell, R. S.. 1992, Canberra 1:100 000 scale geological map. 8727. 1st Edition, BMR, Canberra Jenkins BR, 2000

[2] Soil Landscapes of the Canberra 1:100,000 Sheet map and report, Department of Land and Water Conservation, Sydney.

[3] Australian Standard AS3798-2007, “Guidelines on Earthworks for Commercial and Residential Structures,” Standards Australia, 2007.

[4] Australian Standard AS2159-2009, “Piling - Design & Installation,” Standards Australia, 2009.

[5] Look, B, "Handbook of Geotechnical investigation and Design Tables", 1st edition

[6] Australian Standard AS1726:2017 Geotechnical Site Investigations

[7] Australian Standard AS1289:2014 “Methods of Testing Soil for Engineering Purposes”

[8] Australian Standard AS2870:2011 “Residential slabs and footings”

[9] Austroads “Guide to Pavement Technology Part 2: Pavement Structural Design dated 2017 (referred to as AGPT02-17)

[10] Austroads “Guide to Pavement Technology Part 5: Pavement Evaluation and Treatment Design dated 2011 (referred to as AGPT05-11)

[11] RMS Supplement to Austroads Guide to Pavement Technology Part 2: Pavement Structural Design, Publication No. 11.050 Version 2.2 August 2018 (referred to as RMS11.050)

[12] RMS QA Specification R44 – Earthworks, Edition 3/Revision 0, dated March 2015 (referred to as R44)

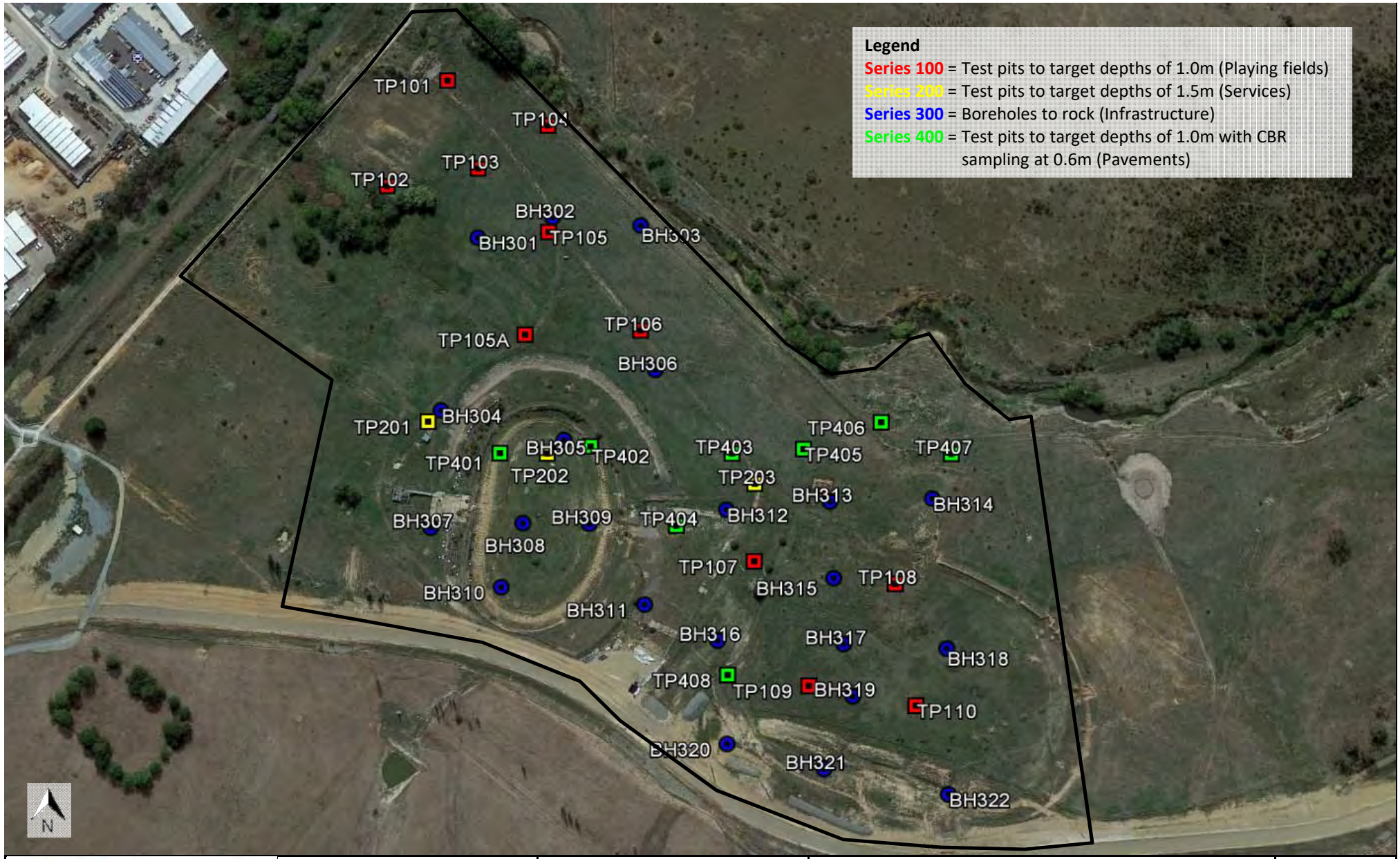
[13] Queanbeyan Palerang Development Design Specification-D2-Pavement Design, Version 1 – November 2018 HPRM: SF130198

[14] Queanbeyan Palerang Development Construction Specification-C242-Flexible Pavements, Version 1 – January 2019

Queanbeyan Palerang Regional Sports Complex

APPENDIX A

SITE PLAN



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Web: www.cardno.com.au

REV	DATE	DRAWN	CHECKED
A	30/01/20	MET	JIA

SITE PLAN

QUEANBEYAN PALERANG REGIONAL SPORTS COMPLEX
Geotechnical Investigation

PROJECT No. 50520049
Drawing No. 50520049_GI_001
SCALE *NTS*

N:\Projects\505\FY20\049_QPRC Sporting Complex\Report\PLANs\[Site Plan.xlsx]Sheet1

Queanbeyan Palerang Regional Sports Complex

APPENDIX B

DESCRIPTIVE ENGINEERING LOGS

BOREHOLE LOG SHEET

Client: QPRC
Project: QPRCSC
Location: QPRCSC, Nr. Hume NSW

Hole No: BH301

Job No: 50520049 **Sheet:** 1 of 1

Position: 55H 697909 6081807 **Angle from Horizontal:** 90° **Surface Elevation:**
Rig Type: Gemco 210B **Mounting:** Trailer **Driller:** JB
Casing Diameter: AUGER/NMLC **Contractor:** GE Drilling
Data Started: 17/1/20 **Date Completed:** 17/1/20 **Logged By:** JIA **Checked By:** DR

Drilling: Method	Drilling: Resistance	Drilling: Casing	Water	Sampling & Testing: Sample or Field Test	Depth (m)	Graphic Log	Classification	Material Description: SOIL TYPE, plasticity or particle characteristic, colour, secondary and minor components ROCK TYPE, grain size and type, colour, fabric & texture, strength, weathering, defects and structure	Moisture Condition	Consistency Relative Density	STRUCTURE & Other Observations
AD/T		AUGER/NMLC	GW encountered at 3.1m		0		ML	Sandy SILT: low plasticity, light grey, fine to coarse sand, trace fine, sub-rounded gravel	D	S to F	TOPSOIL
					0.40m		ML	Sandy SILT: low plasticity, grey, fine to medium sand	D	F to St	ALLUVIUM
					0.90m		Cl	Silty CLAY: medium plasticity, grey, with fine sand, trace fine, sub-rounded gravel	M (<PL)	St	
	E-F			SPT 1.50 - 1.95 m 3, 5, 6 N=11	1						
					2						
					2.00m		CH	Silty CLAY: high plasticity, dark grey, with fine sand, trace fine, sub-rounded gravel	M (<PL)	St to VSt	
					2.40m		SM	Silty SAND: fine to medium grained, light grey, with clay 2.6m: becoming light grey increasing sand content decreasing clay content	M to W	VL to L	
				SPT 3.00 - 3.45 m 1, 0, 1 N=1	3			3.0m: decreasing clay content			
	H-VH			SPT 4.50 - 4.95 m 12, 23, 19 N=42	4			4.0: with fine to medium, sub-angular gravel		MD to D	
					5						
					5.00m			TERMINATED AT 5.00 m EOH: Refusal at 5.0m (on possible dacite) EXCAVATION: Gemco 210B with 120mm diameter TC Bit auger STABILITY: Stable BACKFILL: Arisings compacted and tracked in layers at the surface 0.00-5.3m GROUNDWATER: Encountered at 3.1m PHOTOS: Yes INSITU TESTING: ADDITIONAL NOTES:			

METHOD
EX Excavator bucket
R Ripper
HA Hand auger
PT Push tube
SON Sonic drilling
AH Air hammer
PS Percussion sampler
AS Short spiral auger
AD/V Solid flight auger: V-Bit
AD/T Solid flight auger: TC-Bit
HFA Hollow flight auger
WB Washbore drilling
RR Rock roller

PENETRATION
VE Very Easy (No Resistance)
E Easy
F Firm
H Hard
VH Very Hard (Refusal)

WATER
Water Level on Date shown
water inflow
water outflow

FIELD TESTS
SPT - Standard Penetration Test
HP - Hand/Pocket Penetrometer
DCP - Dynamic Cone Penetrometer
PSP - Perth Sand Penetrometer
MC - Moisture Content
PBT - Plate Bearing Test
IMP - Borehole Impression Test
PID - Photoionisation Detector
VS - Vane Shear; P=Peak, R=Resdual (uncorrected kPa)

SAMPLES
B - Bulk disturbed sample
D - Disturbed sample
ES - Environmental sample
U - Thin wall tube 'undisturbed'

MOISTURE
D - Dry
M - Moist
W - Wet
PL - Plastic limit
LL - Liquid limit
w - Moisture content

SOIL CONSISTENCY
VS - Very Soft
S - Soft
F - Firm
St - Stiff
VSt - Very Stiff
H - Hard

RELATIVE DENSITY
VL - Very Loose
L - Loose
MD - Medium Dense
D - Dense
VD - Very Dense

Refer to explanatory notes for details of abbreviations and basis of descriptions

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BOREHOLE LOG SHEET

Client: QPRC
Project: QPRCSC
Location: QPRCSC, Nr. Hume NSW

Hole No: BH302

Job No: 50520049 **Sheet:** 1 of 1

Position: 55H 697968 6081824 **Angle from Horizontal:** 90° **Surface Elevation:**

Rig Type: Gemco 210B **Mounting:** Trailer **Driller:** JB

Casing Diameter: AUGER/NMLC **Contractor:** GE Drilling

Data Started: 17/1/20 **Date Completed:** 17/1/20 **Logged By:** JIA **Checked By:** DR

Drilling: Method	Drilling: Resistance	Drilling: Casing	Water	Sampling & Testing: Sample or Field Test	Depth (m)	Graphic Log	Classification	Material Description: SOIL TYPE, plasticity or particle characteristic, colour, secondary and minor components ROCK TYPE, grain size and type, colour, fabric & texture, strength, weathering, defects and structure	Moisture Condition	Consistency Relative Density	STRUCTURE & Other Observations
AD/T		AUGER/NMLC	GW encountered at 3.9m		0		SM	0.15m FILL: Silty SAND: fine to coarse grained, brown, with fine, sub-rounded gravel	D	L to MD	FILL
							SM	Silty SAND: fine to coarse grained, brown, with fine, sub-rounded gravel	D	MD to D	ALLUVIUM
					1		SM	0.70m			
							ML	Sandy SILT: low plasticity, dark grey, fine to coarse sand, with fine, sub-rounded gravel	D	F to St	
				SPT 1.50 - 1.95 m 11, 8, 7 N=15			SM	1.30m Silty SAND: fine to coarse grained, light grey, trace fine, sub-rounded gravel	D	MD	
					2		CH	1.90m Silty CLAY: high plasticity, dark grey/black, trace fine sand	M (<PL) to M (≈ PL)	F to St	
							CH	2.40m Silty CLAY: high plasticity, brown mottled orange and white, with fine sand	M (<PL) to M (≈ PL)	F to St	
				SPT 3.00 - 3.45 m 2, 4, 4 N=8	3			3.20m		VS to S	
							SM	Silty SAND: fine to medium grained, red brown	M to W	VL to L	
				SPT 4.50 - 4.95 m 0, 0, 0 N=0	4						
					5			5.30m			
					6			TERMINATED AT 5.30 m EOH: Refusal at 5.30m (on possible dacite) EXCAVATION: Gemco 210B with 120mm diameter TC Bit auger STABILITY: Stable BACKFILL: Arisings compacted and tracked in layers at the surface 0.00-5.0m GROUNDWATER: Encountered at 3.9m PHOTOS: Yes INSITU TESTING: ADDITIONAL NOTES:			
					7						

METHOD
- EX Excavator bucket
- R Ripper
- HA Hand auger
- PT Push tube
- SON Sonic drilling
- AH Air hammer
- PS Percussion sampler
- AS Short spiral auger
- AD/V Solid flight auger: V-Bit
- AD/T Solid flight auger: TC-Bit
- HFA Hollow flight auger
- WB Washbore drilling
- RR Rock roller

PENETRATION
- VE Very Easy (No Resistance)
- E Easy
- F Firm
- H Hard
- VH Very Hard (Refusal)

WATER
- Water Level on Date shown
- water inflow
- water outflow

FIELD TESTS
- SPT - Standard Penetration Test
- HP - Hand/Pocket Penetrometer
- DCP - Dynamic Cone Penetrometer
- PSP - Perth Sand Penetrometer
- MC - Moisture Content
- PBT - Plate Bearing Test
- IMP - Borehole Impression Test
- PID - Photoionisation Detector
- VS - Vane Shear; P=Peak, R=Resdual (uncorrected kPa)

SAMPLES
- B - Bulk disturbed sample
- D - Disturbed sample
- ES - Environmental sample
- U - Thin wall tube 'undisturbed'

MOISTURE
- D - Dry
- M - Moist
- W - Wet
- PL - Plastic limit
- LL - Liquid limit
- *w* - Moisture content

SOIL CONSISTENCY
- VS - Very Soft
- S - Soft
- F - Firm
- St - Stiff
- VSt - Very Stiff
- H - Hard

RELATIVE DENSITY
- VL - Very Loose
- L - Loose
- MD - Medium Dense
- D - Dense
- VD - Very Dense

Refer to explanatory notes for details of abbreviations and basis of descriptions

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BOREHOLE LOG SHEET

Client: QPRC
Project: QPRCSC
Location: QPRCSC, Nr. Hume NSW

Hole No: BH303

Job No: 50520049 **Sheet:** 1 of 1

Position: 55H 698038 6081818 **Angle from Horizontal:** 90° **Surface Elevation:**
Rig Type: Gemco 210B **Mounting:** Trailer **Driller:** JB
Casing Diameter: AUGER/NMLC **Contractor:** GE Drilling
Data Started: 17/1/20 **Date Completed:** 17/1/20 **Logged By:** JIA **Checked By:** DR

Drilling: Method	Drilling: Resistance	Drilling: Casing	Water	Sampling & Testing: Sample or Field Test	Depth (m)	Graphic Log	Classification	Material Description: SOIL TYPE, plasticity or particle characteristic, colour, secondary and minor components ROCK TYPE, grain size and type, colour, fabric & texture, strength, weathering, defects and structure	Moisture Condition	Consistency Relative Density	STRUCTURE & Other Observations
AD/T		AUGER/NMLC	GW encountered at 3.0m		0		ML	Sandy SILT: low plasticity, light brown, fine to coarse sand	D	S to F	TOPSOIL
								0.70m			
							ML	Clayey SILT: low to medium plasticity, grey, with fine to medium sand	D	F to St	ALLUVIUM
					1			1.10m			
				SPT 1.50 - 1.95 m 10, 9, 12 N=21			CL-CI	Sandy CLAY: low to medium plasticity, grey mottled orange, fine to medium sand	D	VSt	
					2			2.40m			
							SM	Silty SAND: fine to coarse grained, grey, trace fine, sub-rounded gravel, trace clay	D	L to MD	
								2.80m			
				SPT 3.00 - 3.45 m 8, 5, 4 N=9	3		SC	Clayey SAND: fine to coarse grained, brown mottled yellow, with fine, sub-rounded gravel	D to M	L to MD	
								3.25m			
							CH	Sandy CLAY: high plasticity, brown mottled yellow and orange, fine to medium sand, trace fine, sub-rounded gravel	M (>PL) to M (<LL)	F to St	
					4			4.0m: becoming brown			
								4.40m			
				SPT 4.50 - 4.95 m 7, 6, 11 N=17			SM	Silty SAND: fine to coarse grained, brown mottled orange and red, with fine to medium, sub-rounded gravel	M to W	MD	
					5			4.8m: becoming gravelly			
								5.10m			
								TERMINATED AT 5.10 m EOH: Refusal at 5.1m (on possible dacite) EXCAVATION: Gemco 210B with 120mm diameter TC Bit auger STABILITY: Stable BACKFILL: Arisings compacted and tracked in layers at the surface 0.00-5.1m GROUNDWATER: Encountered at 3.0m PHOTOS: Yes INSITU TESTING: ADDITIONAL NOTES:			

METHOD
EX Excavator bucket
R Ripper
HA Hand auger
PT Push tube
SON Sonic drilling
AH Air hammer
PS Percussion sampler
AS Short spiral auger
AD/V Solid flight auger: V-Bit
AD/T Solid flight auger: TC-Bit
HFA Hollow flight auger
WB Washbore drilling
RR Rock roller

PENETRATION
VE Very Easy (No Resistance)
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WATER
Water Level on Date shown
water inflow
water outflow

FIELD TESTS
SPT - Standard Penetration Test
HP - Hand/Pocket Penetrometer
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VS - Vane Shear; P=Peak, R=Resdual (uncorrected kPa)

SAMPLES
B - Bulk disturbed sample
D - Disturbed sample
ES - Environmental sample
U - Thin wall tube 'undisturbed'

MOISTURE
D - Dry
M - Moist
W - Wet
PL - Plastic limit
LL - Liquid limit
w - Moisture content

SOIL CONSISTENCY
VS - Very Soft
S - Soft
F - Firm
St - Stiff
VSt - Very Stiff
H - Hard

RELATIVE DENSITY
VL - Very Loose
L - Loose
MD - Medium Dense
D - Dense
VD - Very Dense

Refer to explanatory notes for details of abbreviations and basis of descriptions

CARDNO (NSW/ACT) PTY LTD

Cardno

BOREHOLE LOG SHEET

Client: QPRC
Project: QPRCSC
Location: QPRCSC, Nr. Hume NSW

Hole No: BH304

Job No: 50520049 **Sheet:** 1 of 1

Position: 55H 697883 6081666 **Angle from Horizontal:** 90° **Surface Elevation:**
Rig Type: Gemco 210B **Mounting:** Trailer **Driller:** JB
Casing Diameter: AUGER/NMLC **Contractor:** GE Drilling
Data Started: 17/1/20 **Date Completed:** 17/1/20 **Logged By:** JIA **Checked By:** DR

Drilling: Method	Drilling: Resistance	Drilling: Casing	Water	Sampling & Testing: Sample or Field Test	Depth (m)	Graphic Log	Classification	Material Description: SOIL TYPE, plasticity or particle characteristic, colour, secondary and minor components ROCK TYPE, grain size and type, colour, fabric & texture, strength, weathering, defects and structure	Moisture Condition	Consistency Relative Density	STRUCTURE & Other Observations
AD/T		AUGER/NMLC	GW encountered at 4.3m		0		ML	Sandy SILT: low plasticity, brown, fine to medium sand	D	S to F	TOPSOIL
								0.30m			
							SM	Silty SAND: fine to medium grained, light brown, trace fine, sub-angular gravel	D	L to MD	ALLUVIUM
								0.70m			
					1		SM	Silty SAND: fine to medium grained, brown, trace fine, sub-rounded gravel, trace clay	D	MD	
				SPT 1.50 - 1.95 m 5, 8, 11 N=19				1.80m			
					2		CI	Sandy CLAY: medium plasticity, brown mottled yellow, fine sand	D to M (<PL)	St	
								2.30m			
							CI-CH	Silty CLAY: medium to high plasticity, brown, with fine sand 2.6m: decreasing sand content becoming light grey	M (<PL)	St	
				SPT 3.00 - 3.45 m 4, 5, 6 N=11	3						
					4						
				SPT 4.50 - 4.85 m 3, 23, 6/50mm HB N=R				4.90m		H	
					5			TERMINATED AT 4.90 m EOH: Refusal at 4.9m (on possible dacite) EXCAVATION: Gemco 210B with 120mm diameter TC Bit auger STABILITY: Stable BACKFILL: Arisings compacted and tracked in layers at the surface 0.00-4.9m GROUNDWATER: Encountered at 4.3m PHOTOS: Yes INSITU TESTING: ADDITIONAL NOTES:			

METHOD
EX Excavator bucket
R Ripper
HA Hand auger
PT Push tube
SON Sonic drilling
AH Air hammer
PS Percussion sampler
AS Short spiral auger
AD/V Solid flight auger: V-Bit
AD/T Solid flight auger: TC-Bit
HFA Hollow flight auger
WB Washbore drilling
RR Rock roller

PENETRATION
VE Very Easy (No Resistance)
E Easy
F Firm
H Hard
VH Very Hard (Refusal)

WATER
Water Level on Date shown
water inflow
water outflow

FIELD TESTS
SPT - Standard Penetration Test
HP - Hand/Pocket Penetrometer
DCP - Dynamic Cone Penetrometer
PSP - Perth Sand Penetrometer
MC - Moisture Content
PBT - Plate Bearing Test
IMP - Borehole Impression Test
PID - Photoionisation Detector
VS - Vane Shear; P=Peak, R=Resdual (uncorrected kPa)

SAMPLES
B - Bulk disturbed sample
D - Disturbed sample
ES - Environmental sample
U - Thin wall tube 'undisturbed'

MOISTURE
D - Dry
M - Moist
W - Wet
PL - Plastic limit
LL - Liquid limit
w - Moisture content

SOIL CONSISTENCY
VS - Very Soft
S - Soft
F - Firm
St - Stiff
VSt - Very Stiff
H - Hard

RELATIVE DENSITY
VL - Very Loose
L - Loose
MD - Medium Dense
D - Dense
VD - Very Dense

Refer to explanatory notes for details of abbreviations and basis of descriptions

CARDNO (NSW/ACT) PTY LTD

BOREHOLE LOG SHEET

Client: QPRC
Project: QPRCSC
Location: QPRCSC, Nr. Hume NSW

Hole No: BH305

Job No: 50520049 **Sheet:** 1 of 1

Position: 55H 697980 6081643 **Angle from Horizontal:** 90° **Surface Elevation:**
Rig Type: Gemco 210B **Mounting:** Trailer **Driller:** JB
Casing Diameter: AUGER/NMLC **Contractor:** GE Drilling
Data Started: 17/1/20 **Date Completed:** 17/1/20 **Logged By:** JIA **Checked By:** DR

Drilling: Method	Drilling: Resistance	Drilling: Casing	Water	Sampling & Testing: Sample or Field Test	Depth (m)	Graphic Log	Classification	Material Description: SOIL TYPE, plasticity or particle characteristic, colour, secondary and minor components ROCK TYPE, grain size and type, colour, fabric & texture, strength, weathering, defects and structure	Moisture Condition	Consistency Relative Density	STRUCTURE & Other Observations
AD/T		AUGER/NMLC	Dry		0		SM	Silty SAND: fine to medium grained, light brown, trace fine, sub-rounded gravel	D	L to MD	TOPSOIL
					0.30m		SM	Silty SAND: fine to coarse grained, light brown, trace fine, sub-rounded gravel	D	L to MD	ALLUVIUM
					0.80m		ML	Sandy SILT: low plasticity, brown, fine to medium sand, trace fine, sub-rounded gravel	D	F to St	
	E-F			SPT 1.50 - 1.95 m 3, 4, 6 N=10	1.50m		CI-CH	Silty CLAY: medium to high plasticity, grey, trace fine, sub-rounded gravel	M (≈PL)	St	
					2.20m		CI-CH	Sandy CLAY: medium to high plasticity, brown, fine to medium sand, trace fine, sub-rounded gravel	M (≈PL)	St to VSt	
				SPT 3.00 - 3.45 m 3, 10, 16 N=26	3.10m		SC	Clayey SAND: fine to coarse grained, brown mottled yellow and orange, with fine to medium, sub-rounded gravel	M	MD	
	H-VH				3.30m		GP	DACITE: orange brown, very low strength, highly weathered, medium grained	M		WEATHERED ROCK
					4.40m			TERMINATED AT 4.40 m EOH: Refusal at 4.4m (on possible dacite) EXCAVATION: Gemco 210B with 120mm diameter TC Bit auger STABILITY: Stable BACKFILL: Arisings compacted and tracked in layers at the surface 0.00-4.4m GROUNDWATER: Not Encountered PHOTOS: Yes INSITU TESTING: ADDITIONAL NOTES:			

METHOD
EX Excavator bucket
R Ripper
HA Hand auger
PT Push tube
SON Sonic drilling
AH Air hammer
PS Percussion sampler
AS Short spiral auger
AD/V Solid flight auger: V-Bit
AD/T Solid flight auger: TC-Bit
HFA Hollow flight auger
WB Washbore drilling
RR Rock roller

PENETRATION
VE Very Easy (No Resistance)
E Easy
F Firm
H Hard
VH Very Hard (Refusal)

WATER
Water Level on Date shown
water inflow
water outflow

FIELD TESTS
SPT - Standard Penetration Test
HP - Hand/Pocket Penetrometer
DCP - Dynamic Cone Penetrometer
PSP - Perth Sand Penetrometer
MC - Moisture Content
PBT - Plate Bearing Test
IMP - Borehole Impression Test
PID - Photoionisation Detector
VS - Vane Shear; P=Peak, R=Resdual (uncorrected kPa)

SAMPLES
B - Bulk disturbed sample
D - Disturbed sample
ES - Environmental sample
U - Thin wall tube 'undisturbed'

MOISTURE
D - Dry
M - Moist
W - Wet
PL - Plastic limit
LL - Liquid limit
w - Moisture content

SOIL CONSISTENCY
VS - Very Soft
S - Soft
F - Firm
St - Stiff
VSt - Very Stiff
H - Hard

RELATIVE DENSITY
VL - Very Loose
L - Loose
MD - Medium Dense
D - Dense
VD - Very Dense

Refer to explanatory notes for details of abbreviations and basis of descriptions

CARDNO (NSW/ACT) PTY LTD

Cardno

BOREHOLE LOG SHEET

Client: QPRC
Project: QPRCSC
Location: QPRCSC, Nr. Hume NSW

Hole No: BH306

Job No: 50520049 **Sheet:** 1 of 1

Position: 55H 698061 6081670 **Angle from Horizontal:** 90° **Surface Elevation:**
Rig Type: Gemco 210B **Mounting:** Trailer **Driller:** JB
Casing Diameter: AUGER/NMLC **Contractor:** GE Drilling
Data Started: 17/1/20 **Date Completed:** 17/1/20 **Logged By:** JIA **Checked By:** DR

Drilling: Method	Drilling: Resistance	Drilling: Casing	Water	Sampling & Testing: Sample or Field Test	Depth (m)	Graphic Log	Classification	Material Description: SOIL TYPE, plasticity or particle characteristic, colour, secondary and minor components ROCK TYPE, grain size and type, colour, fabric & texture, strength, weathering, defects and structure	Moisture Condition	Consistency Relative Density	Material Description: STRUCTURE & Other Observations
AD/T			GW encountered at 1.8m		0		ML	Sandy SILT: low plasticity, light grey, fine sand 0.40m	D	S to F	TOPSOIL
							ML	Sandy SILT: low plasticity, dark grey, fine sand 1.10m	D	F to St	ALLUVIUM
				SPT 1.50 - 1.95 m 11, 6, 8 N=14	1		ML	Clayey SILT: low to medium plasticity, dark grey, with fine sand, trace fine, sub-rounded gravel 2.00m	D	St	
	E-F AUGER/NML			SPT 3.00 - 3.45 m 3, 4, 1 N=5	2		SC	Clayey SAND: fine to coarse grained, light grey, with fine, sub-rounded gravel	M	L	
				SPT 4.50 - 4.95 m 2, 2, 3 N=5	3						
				SPT 6.00 - 6.45 m 12, 9, 16 N=25	4						
	H-VH				5		GP	DACITE: grey, very low strength, highly weathered, medium grained 6.60m	M		WEATHERED ROCK
					6			TERMINATED AT 6.60 m EOH: Refusal at 6.6m (on possible dacite) EXCAVATION: Gemco 210B with 120mm diameter TC Bit auger STABILITY: Stable BACKFILL: Arisings compacted and tracked in layers at the surface 0.00-6.6m GROUNDWATER: Encountered at 1.8m PHOTOS: Yes INSITU TESTING: ADDITIONAL NOTES:			
					7						

METHOD
EX Excavator bucket
R Ripper
HA Hand auger
PT Push tube
SON Sonic drilling
AH Air hammer
PS Percussion sampler
AS Short spiral auger
AD/V Solid flight auger: V-Bit
AD/T Solid flight auger: TC-Bit
HFA Hollow flight auger
WB Washbore drilling
RR Rock roller

PENETRATION
VE Very Easy (No Resistance)
E Easy
F Firm
H Hard
VH Very Hard (Refusal)

WATER
Water Level on Date shown
water inflow
water outflow

FIELD TESTS
SPT - Standard Penetration Test
HP - Hand/Pocket Penetrometer
DCP - Dynamic Cone Penetrometer
PSP - Perth Sand Penetrometer
MC - Moisture Content
PBT - Plate Bearing Test
IMP - Borehole Impression Test
PID - Photoionisation Detector
VS - Vane Shear; P=Peak, R=Resdual (uncorrected kPa)

SAMPLES
B - Bulk disturbed sample
D - Disturbed sample
ES - Environmental sample
U - Thin wall tube 'undisturbed'

MOISTURE
D - Dry
M - Moist
W - Wet
PL - Plastic limit
LL - Liquid limit
w - Moisture content

SOIL CONSISTENCY
VS - Very Soft
S - Soft
F - Firm
St - Stiff
VSt - Very Stiff
H - Hard

RELATIVE DENSITY
VL - Very Loose
L - Loose
MD - Medium Dense
D - Dense
VD - Very Dense

Refer to explanatory notes for details of abbreviations and basis of descriptions

CARDNO (NSW/ACT) PTY LTD

BOREHOLE LOG SHEET

Client: QPRC
Project: QPRCSC
Location: QPRCSC, Nr. Hume NSW

Hole No: BH307

Job No: 50520049 **Sheet:** 1 of 1

Position: 55H 697877 6081572 **Angle from Horizontal:** 90° **Surface Elevation:**
Rig Type: Gemco 210B **Mounting:** Trailer **Driller:** JB
Casing Diameter: AUGER/NMLC **Contractor:** GE Drilling
Data Started: 17/1/20 **Date Completed:** 17/1/20 **Logged By:** JIA **Checked By:** DR

Drilling: Method	Drilling: Resistance	Drilling: Casing	Water	Sampling & Testing: Sample or Field Test	Depth (m)	Graphic Log	Classification	Material Description: SOIL TYPE, plasticity or particle characteristic, colour, secondary and minor components ROCK TYPE, grain size and type, colour, fabric & texture, strength, weathering, defects and structure	Moisture Condition	Consistency Relative Density	STRUCTURE & Other Observations
AD/T			GW encountered at 4.9m		0		SM	Silty SAND: fine to medium grained, light brown 0.30m	D	L to MD	TOPSOIL
							SM	Silty SAND: fine to coarse grained, light grey, trace fine, sub-rounded gravel 1.20m	D	L to MD	ALLUVIUM
					1		SM	Silty SAND: fine to coarse grained, brown, with fine, sub-rounded gravel 1.60m	D	D	
				SPT 1.50 - 1.95 m 9, 15, 21 N=35			CH	Silty CLAY: high plasticity, brown mottled grey, trace fine sand 2.40m	D to M (<PL)	H	
	E-F AUGER/NMLC				2			Silty CLAY: medium to high plasticity, brown mottled orange and grey, with fine to medium sand			
				SPT 3.00 - 3.45 m 2, 4, 4 N=8	3						
					4		CI-CH	4.0m: becoming light grey	M (<PL)	F to St	
				SPT 4.50 - 4.95 m 3, 4, 4 N=8	5						
				SPT 6.00 - 6.45 m 10, 15, 21 N=36	6			6.15m			
	H-VH						SC	6.30m Clayey SAND: fine to coarse grained, brown mottled orange, trace fine, sub-rounded gravel	W	D	
						+ · +	GP	6.50m DACITE: orange brown, highly weathered, very low strength, medium grained	W		WEATHERED ROCK
					7			TERMINATED AT 6.50 m EOH: Refusal at 6.5m (on possible dacite) EXCAVATION: Gemco 210B with 120mm diameter TC Bit auger STABILITY: Stable BACKFILL: Arisings compacted and tracked in layers at the surface 0.00-6.5m GROUNDWATER: Encountered at 4.9m PHOTOS: Yes INSITU TESTING: ADDITIONAL NOTES:			

METHOD
EX Excavator bucket
R Ripper
HA Hand auger
PT Push tube
SON Sonic drilling
AH Air hammer
PS Percussion sampler
AS Short spiral auger
AD/V Solid flight auger: V-Bit
AD/T Solid flight auger: TC-Bit
HFA Hollow flight auger
WB Washbore drilling
RR Rock roller

PENETRATION
VE Very Easy (No Resistance)
E Easy
F Firm
H Hard
VH Very Hard (Refusal)

WATER
Water Level on Date shown
water inflow
water outflow

FIELD TESTS
SPT - Standard Penetration Test
HP - Hand/Pocket Penetrometer
DCP - Dynamic Cone Penetrometer
PSP - Perth Sand Penetrometer
MC - Moisture Content
PBT - Plate Bearing Test
IMP - Borehole Impression Test
PID - Photoionisation Detector
VS - Vane Shear; P=Peak, R=Resdual (uncorrected kPa)

SAMPLES
B - Bulk disturbed sample
D - Disturbed sample
ES - Environmental sample
U - Thin wall tube 'undisturbed'

MOISTURE
D - Dry
M - Moist
W - Wet
PL - Plastic limit
LL - Liquid limit
w - Moisture content

SOIL CONSISTENCY
VS - Very Soft
S - Soft
F - Firm
St - Stiff
VSt - Very Stiff
H - Hard

RELATIVE DENSITY
VL - Very Loose
L - Loose
MD - Medium Dense
D - Dense
VD - Very Dense

Refer to explanatory notes for details of abbreviations and basis of descriptions

CARDNO (NSW/ACT) PTY LTD

Cardno

BOREHOLE LOG SHEET

Client: QPRC
Project: QPRCSC
Location: QPRCSC, Nr. Hume NSW

Hole No: BH308

Job No: 50520049 **Sheet:** 1 of 1

Position: 55H 697949 6081576 **Angle from Horizontal:** 90° **Surface Elevation:**
Rig Type: Gemco 210B **Mounting:** Trailer **Driller:** JB
Casing Diameter: AUGER/NMLC **Contractor:** GE Drilling
Data Started: 17/1/20 **Date Completed:** 17/1/20 **Logged By:** JIA **Checked By:** DR

Drilling: Method	Drilling: Resistance	Drilling: Casing	Water	Sampling & Testing: Sample or Field Test	Depth (m)	Graphic Log	Classification	Material Description: SOIL TYPE, plasticity or particle characteristic, colour, secondary and minor components ROCK TYPE, grain size and type, colour, fabric & texture, strength, weathering, defects and structure	Moisture Condition	Consistency Relative Density	STRUCTURE & Other Observations
AD/T			GW encountered at 1.2m		0		ML	Sandy SILT: low plasticity, brown, fine to coarse sand, trace fine, sub-rounded gravel	D	S to F	TOPSOIL
					0.40m		ML	Sandy SILT: low plasticity, brown, fine to coarse sand	D	S to F	ALLUVIUM
					0.70m		CI-CH	Sandy CLAY: medium to high plasticity, brown mottled light grey, fine to coarse sand	M (≈PL)	F	
	E-F			SPT 1.50 - 1.95 m 3, 4, 3 N=7	1						
	AUGER/NML				1.70m		CH	Silty CLAY: high plasticity, light brown, trace fine sand	M (>PL) to M (<LL)	St to VSt	
				SPT 3.00 - 3.45 m 8, 8, 12 N=20	2						
	H-VH				3						
					3.30m		GP	DACITE: grey, low strength, highly weathered, medium grained	M		WEATHERED ROCK
					3.60m			TERMINATED AT 3.60 m EOH: Refusal at 3.6m (on possible dacite) EXCAVATION: Gemco 210B with 120mm diameter TC Bit auger STABILITY: Stable BACKFILL: Arisings compacted and tracked in layers at the surface 0.00-3.6m GROUNDWATER: Encountered at 1.2m PHOTOS: Yes INSITU TESTING: ADDITIONAL NOTES:			
					4						
					5						

METHOD
EX Excavator bucket
R Ripper
HA Hand auger
PT Push tube
SON Sonic drilling
AH Air hammer
PS Percussion sampler
AS Short spiral auger
AD/V Solid flight auger: V-Bit
AD/T Solid flight auger: TC-Bit
HFA Hollow flight auger
WB Washbore drilling
RR Rock roller

PENETRATION
VE Very Easy (No Resistance)
E Easy
F Firm
H Hard
VH Very Hard (Refusal)

WATER
Water Level on Date shown
water inflow
water outflow

FIELD TESTS
SPT - Standard Penetration Test
HP - Hand/Pocket Penetrometer
DCP - Dynamic Cone Penetrometer
PSP - Perth Sand Penetrometer
MC - Moisture Content
PBT - Plate Bearing Test
IMP - Borehole Impression Test
PID - Photoionisation Detector
VS - Vane Shear; P=Peak, R=Resdual (uncorrected kPa)

SAMPLES
B - Bulk disturbed sample
D - Disturbed sample
ES - Environmental sample
U - Thin wall tube 'undisturbed'

MOISTURE
D - Dry
M - Moist
W - Wet
PL - Plastic limit
LL - Liquid limit
w - Moisture content

SOIL CONSISTENCY
VS - Very Soft
S - Soft
F - Firm
St - Stiff
VSt - Very Stiff
H - Hard

RELATIVE DENSITY
VL - Very Loose
L - Loose
MD - Medium Dense
D - Dense
VD - Very Dense

Refer to explanatory notes for details of abbreviations and basis of descriptions

CARDNO (NSW/ACT) PTY LTD

BOREHOLE LOG SHEET

Client: QPRC
Project: QPRCSC
Location: QPRCSC, Nr. Hume NSW

Hole No: BH309

Job No: 50520049 **Sheet:** 1 of 1

Position: 55H 698001 6081576 **Angle from Horizontal:** 90° **Surface Elevation:**
Rig Type: Gemco 210B **Mounting:** Trailer **Driller:** JB
Casing Diameter: AUGER/NMLC **Contractor:** GE Drilling
Data Started: 17/1/20 **Date Completed:** 17/1/20 **Logged By:** JIA **Checked By:** DR

Drilling: Method	Drilling: Resistance	Drilling: Casing	Water	Sampling & Testing: Sample or Field Test	Depth (m)	Material Description: Graphic Log	Classification	SOIL TYPE, plasticity or particle characteristic, colour, secondary and minor components ROCK TYPE, grain size and type, colour, fabric & texture, strength, weathering, defects and structure	Moisture Condition	Consistency Relative Density	STRUCTURE & Other Observations
AD/T			GW encountered at 2.3m		0		SM	Silty SAND: fine to coarse grained, brown, trace fine, sub-angular gravel	D	L	TOPSOIL
								0.40m			
					1		CI-CH	Silty CLAY: medium to high plasticity, brown mottled yellow, with fine to medium sand	M (<PL)	F to St	ALLUVIUM
								1.20m			
				SPT 1.50 - 1.95 m 4, 5, 5 N=10			CI-CH	Sandy CLAY: medium to high plasticity, brown, fine to coarse sand	M (<PL)	St	
					2			1.90m			
	E-F						CI-CH	Sandy CLAY: medium to high plasticity, brown mottled grey, fine to medium sand	M (≈PL)	F to St	
	AUGER/NMLC			SPT 3.00 - 3.45 m 2, 4, 3 N=7	3						
					4			4.40m			
	H-VH			SPT 4.50 - 4.75 m 19, 20/100mm HB N=R				DACITE: grey, low strength, highly weathered, medium grained	M		WEATHERED ROCK
								4.80m			
					5			TERMINATED AT 4.80 m EOH: Refusal at 4.8m (on possible dacite) EXCAVATION: Gemco 210B with 120mm diameter TC Bit auger STABILITY: Stable BACKFILL: Arisings compacted and tracked in layers at the surface 0.00-4.8m GROUNDWATER: Encountered at 2.3m PHOTOS: Yes INSITU TESTING: ADDITIONAL NOTES:			

METHOD
EX Excavator bucket
R Ripper
HA Hand auger
PT Push tube
SON Sonic drilling
AH Air hammer
PS Percussion sampler
AS Short spiral auger
AD/V Solid flight auger: V-Bit
AD/T Solid flight auger: TC-Bit
HFA Hollow flight auger
WB Washbore drilling
RR Rock roller

PENETRATION
VE Very Easy (No Resistance)
E Easy
F Firm
H Hard
VH Very Hard (Refusal)

WATER
Water Level on Date shown
water inflow
water outflow

FIELD TESTS
SPT - Standard Penetration Test
HP - Hand/Pocket Penetrometer
DCP - Dynamic Cone Penetrometer
PSP - Perth Sand Penetrometer
MC - Moisture Content
PBT - Plate Bearing Test
IMP - Borehole Impression Test
PID - Photoionisation Detector
VS - Vane Shear; P=Peak, R=Resdual (uncorrected kPa)

SAMPLES
B - Bulk disturbed sample
D - Disturbed sample
ES - Environmental sample
U - Thin wall tube 'undisturbed'

MOISTURE
D - Dry
M - Moist
W - Wet
PL - Plastic limit
LL - Liquid limit
w - Moisture content

SOIL CONSISTENCY
VS - Very Soft
S - Soft
F - Firm
St - Stiff
VSt - Very Stiff
H - Hard

RELATIVE DENSITY
VL - Very Loose
L - Loose
MD - Medium Dense
D - Dense
VD - Very Dense

Refer to explanatory notes for details of abbreviations and basis of descriptions

CARDNO (NSW/ACT) PTY LTD

BOREHOLE LOG SHEET

Client: QPRC
Project: QPRCSC
Location: QPRCSC, Nr. Hume NSW

Hole No: BH310

Job No: 50520049 **Sheet:** 1 of 1

Position: 55H 697933 6081525 **Angle from Horizontal:** 90° **Surface Elevation:**
Rig Type: Gemco 210B **Mounting:** Trailer **Driller:** JB
Casing Diameter: AUGER/NMLC **Contractor:** GE Drilling
Data Started: 17/1/20 **Date Completed:** 17/1/20 **Logged By:** JIA **Checked By:** DR

Drilling: Method	Drilling: Resistance	Drilling: Casing	Water	Sampling & Testing: Sample or Field Test	Depth (m)	Graphic Log	Classification	Material Description: SOIL TYPE, plasticity or particle characteristic, colour, secondary and minor components ROCK TYPE, grain size and type, colour, fabric & texture, strength, weathering, defects and structure	Moisture Condition	Consistency Relative Density	STRUCTURE & Other Observations
AD/T			GW encountered at 2.5m				SM	Silty SAND: fine to coarse grained, brown, trace fine, sub-rounded gravel	D	L	TOPSOIL
								0.30m			
					1		SM	Silty SAND: fine to coarse grained, dark brown, trace clay	D to M	L to MD	ALLUVIUM
								1.10m			
							CI-CH	Sandy CLAY: medium to high plasticity, brown, fine to coarse sand	M (≈PL)	St	
				SPT 1.50 - 1.95 m 6, 7, 5 N=12				1.60m			
	E-F				2		SC	Clayey SAND: fine to coarse grained, brown	M	MD	
	AUGER/NML			SPT 3.00 - 3.45 m 12, 10, 9 N=19	3						
								3.60m			
	H-VH				4			DACITE: grey, low strength, highly weathered, medium grained	M		WEATHERED ROCK
								4.10m			
					5			TERMINATED AT 4.10 m EOH: Refusal at 4.1m (on possible dacite) EXCAVATION: Gemco 210B with 120mm diameter TC Bit auger STABILITY: Stable BACKFILL: Arisings compacted and tracked in layers at the surface 0.00-4.1m GROUNDWATER: Encountered at 2.5m PHOTOS: Yes INSITU TESTING: ADDITIONAL NOTES:			

METHOD
EX Excavator bucket
R Ripper
HA Hand auger
PT Push tube
SON Sonic drilling
AH Air hammer
PS Percussion sampler
AS Short spiral auger
AD/V Solid flight auger: V-Bit
AD/T Solid flight auger: TC-Bit
HFA Hollow flight auger
WB Washbore drilling
RR Rock roller

PENETRATION
VE Very Easy (No Resistance)
E Easy
F Firm
H Hard
VH Very Hard (Refusal)

WATER
Water Level on Date shown
water inflow
water outflow

FIELD TESTS
SPT - Standard Penetration Test
HP - Hand/Pocket Penetrometer
DCP - Dynamic Cone Penetrometer
PSP - Perth Sand Penetrometer
MC - Moisture Content
PBT - Plate Bearing Test
IMP - Borehole Impression Test
PID - Photoionisation Detector
VS - Vane Shear; P=Peak, R=Resdual (uncorrected kPa)

SAMPLES
B - Bulk disturbed sample
D - Disturbed sample
ES - Environmental sample
U - Thin wall tube 'undisturbed'

MOISTURE
D - Dry
M - Moist
W - Wet
PL - Plastic limit
LL - Liquid limit
w - Moisture content

SOIL CONSISTENCY
VS - Very Soft
S - Soft
F - Firm
St - Stiff
VSt - Very Stiff
H - Hard

RELATIVE DENSITY
VL - Very Loose
L - Loose
MD - Medium Dense
D - Dense
VD - Very Dense

Refer to explanatory notes for details of abbreviations and basis of descriptions

CARDNO (NSW/ACT) PTY LTD

Cardno

BOREHOLE LOG SHEET

Client: QPRC
Project: QPRCSC
Location: QPRCSC, Nr. Hume NSW

Hole No: BH311

Job No: 50520049 **Sheet:** 1 of 1

Position: 55H 698001 6081503 **Angle from Horizontal:** 90° **Surface Elevation:**
Rig Type: Gemco 210B **Mounting:** Trailer **Driller:** JB
Casing Diameter: AUGER/NMLC **Contractor:** GE Drilling
Data Started: 17/1/20 **Date Completed:** 17/1/20 **Logged By:** JIA **Checked By:** DR

Drilling: Method	Drilling: Resistance	Drilling: Casing	Water	Sampling & Testing: Sample or Field Test	Depth (m)	Graphic Log	Classification	Material Description: SOIL TYPE, plasticity or particle characteristic, colour, secondary and minor components ROCK TYPE, grain size and type, colour, fabric & texture, strength, weathering, defects and structure	Moisture Condition	Consistency Relative Density	STRUCTURE & Other Observations
AD/T					0.10m			SPRAY SEAL	D	VD	PAVEMENT
							SM	Silty SAND: fine to coarse grained, light brown	D	L to MD	
					0.40m		SC	FILL: Clayey SAND: fine to coarse grained, brown mottled red and yellow	D to M	L to MD	FILL
					0.80m			Silty SAND: fine to coarse grained, light grey, trace clay, trace fine, sub-rounded gravel			ALLUVIUM
	E-F	AUGER/NMLC	Dry	SPT 1.50 - 1.88 m 12, 12, 10/80mm HB N=R	1						
					2		SM		D to M	D to VD	
				SPT 3.00 - 3.45 m 11, 14, 18 N=32	3						
					3.70m						
	H-VH				4			DACITE: grey, low strength, highly weathered, medium grained	D to M		WEATHERED ROCK
					4.00m			TERMINATED AT 4.00 m EOH: Refusal at 4m (on possible dacite) EXCAVATION: Gemco 210B with 120mm diameter TC Bit auger STABILITY: Stable BACKFILL: Arisings compacted and tracked in layers at the surface 0.00-4.0m GROUNDWATER: Not Encountered PHOTOS: Yes INSITU TESTING: ADDITIONAL NOTES:			
					5						

METHOD
EX Excavator bucket
R Ripper
HA Hand auger
PT Push tube
SON Sonic drilling
AH Air hammer
PS Percussion sampler
AS Short spiral auger
AD/V Solid flight auger: V-Bit
AD/T Solid flight auger: TC-Bit
HFA Hollow flight auger
WB Washbore drilling
RR Rock roller

PENETRATION
VE Very Easy (No Resistance)
E Easy
F Firm
H Hard
VH Very Hard (Refusal)

WATER
Water Level on Date shown
water inflow
water outflow

FIELD TESTS
SPT - Standard Penetration Test
HP - Hand/Pocket Penetrometer
DCP - Dynamic Cone Penetrometer
PSP - Perth Sand Penetrometer
MC - Moisture Content
PBT - Plate Bearing Test
IMP - Borehole Impression Test
PID - Photoionisation Detector
VS - Vane Shear; P=Peak, R=Resdual (uncorrected kPa)

SAMPLES
B - Bulk disturbed sample
D - Disturbed sample
ES - Environmental sample
U - Thin wall tube 'undisturbed'

MOISTURE
D - Dry
M - Moist
W - Wet
PL - Plastic limit
LL - Liquid limit
w - Moisture content

SOIL CONSISTENCY
VS - Very Soft
S - Soft
F - Firm
St - Stiff
VSt - Very Stiff
H - Hard

RELATIVE DENSITY
VL - Very Loose
L - Loose
MD - Medium Dense
D - Dense
VD - Very Dense

Refer to explanatory notes for details of abbreviations and basis of descriptions

CARDNO (NSW/ACT) PTY LTD

Cardno

BOREHOLE LOG SHEET

Client: QPRC
Project: QPRCSC
Location: QPRCSC, Nr. Hume NSW

Hole No: BH312

Job No: 50520049 **Sheet:** 1 of 1

Position: 55H 698108 6081588 **Angle from Horizontal:** 90° **Surface Elevation:**
Rig Type: Gemco 210B **Mounting:** Trailer **Driller:** JB
Casing Diameter: AUGER/NMLC **Contractor:** GE Drilling
Data Started: 17/1/20 **Date Completed:** 17/1/20 **Logged By:** JIA **Checked By:** DR

Drilling: Method	Drilling: Resistance	Drilling: Casing	Water	Sampling & Testing: Sample or Field Test	Depth (m)	Graphic Log	Classification	Material Description: SOIL TYPE, plasticity or particle characteristic, colour, secondary and minor components ROCK TYPE, grain size and type, colour, fabric & texture, strength, weathering, defects and structure	Moisture Condition	Consistency Relative Density	STRUCTURE & Other Observations
AD/T		AUGER/NML	GW encountered at 4.1m		0		ML	Sandy SILT: low plasticity, light brown, fine to medium sand, frequent rootlets (<2mm)	D	S to F	TOPSOIL
					0.40m		CI-CH	Silty CLAY: medium to high plasticity, grey, trace fine sand	D	F to St	ALLUVIUM
					0.70m		SM	Silty SAND: fine to medium grained, light grey, trace fine, sub-rounded gravel	D	MD	
				SPT 1.50 - 1.95 m 6, 8, 8 N=16	1						
	E-F				1.90m		CI-CH	Silty CLAY: medium to high plasticity, dark grey/black, trace fine sand	M (<PL)	St	
					2.40m		CI-CH	Silty CLAY: medium to high plasticity, brown, with medium to coarse sand	M (≈PL)	St to VSt	
				SPT 3.00 - 3.45 m 8, 11, 14 N=25	3						
					4						
	H-VH			SPT 4.50 - 4.74 m 12, 20/90mm HB N=R	4.10m			DACITE: yellow brown, very low strength, highly weathered, medium grained	M to W		WEATHERED ROCK
					5						
					5.10m			TERMINATED AT 5.10 m EOH: Refusal at 5.1m (on possible dacite) EXCAVATION: Gemco 210B with 120mm diameter TC Bit auger STABILITY: Stable BACKFILL: Arisings compacted and tracked in layers at the surface 0.00-5.1m GROUNDWATER: Encountered at 4.1m PHOTOS: Yes INSITU TESTING: ADDITIONAL NOTES:			

METHOD
EX Excavator bucket
R Ripper
HA Hand auger
PT Push tube
SON Sonic drilling
AH Air hammer
PS Percussion sampler
AS Short spiral auger
AD/V Solid flight auger: V-Bit
AD/T Solid flight auger: TC-Bit
HFA Hollow flight auger
WB Washbore drilling
RR Rock roller

PENETRATION
VE Very Easy (No Resistance)
E Easy
F Firm
H Hard
VH Very Hard (Refusal)

WATER
Water Level on Date shown
water inflow
water outflow

FIELD TESTS
SPT - Standard Penetration Test
HP - Hand/Pocket Penetrometer
DCP - Dynamic Cone Penetrometer
PSP - Perth Sand Penetrometer
MC - Moisture Content
PBT - Plate Bearing Test
IMP - Borehole Impression Test
PID - Photoionisation Detector
VS - Vane Shear; P=Peak, R=Resdual (uncorrected kPa)

SAMPLES
B - Bulk disturbed sample
D - Disturbed sample
ES - Environmental sample
U - Thin wall tube 'undisturbed'

MOISTURE
D - Dry
M - Moist
W - Wet
PL - Plastic limit
LL - Liquid limit
w - Moisture content

SOIL CONSISTENCY
VS - Very Soft
S - Soft
F - Firm
St - Stiff
VSt - Very Stiff
H - Hard

RELATIVE DENSITY
VL - Very Loose
L - Loose
MD - Medium Dense
D - Dense
VD - Very Dense

Refer to explanatory notes for details of abbreviations and basis of descriptions

CARDNO (NSW/ACT) PTY LTD

Cardno

BOREHOLE LOG SHEET

Client: QPRC
Project: QPRCSC
Location: QPRCSC, Nr. Hume NSW

Hole No: BH313

Job No: 50520049 **Sheet:** 1 of 1

Position: 55H 698189 6081596 **Angle from Horizontal:** 90° **Surface Elevation:**
Rig Type: Gemco 210B **Mounting:** Trailer **Driller:** JB
Casing Diameter: AUGER/NMLC **Contractor:** GE Drilling
Data Started: 15/1/20 **Date Completed:** 15/1/20 **Logged By:** MET **Checked By:** DR

Drilling			Water	Sampling & Testing		Depth (m)	Material Description					
Method	Resistance	Casing		Sample or Field Test	DCP (blows per 100 mm) 1 3 6 12		Graphic Log	Classification	SOIL TYPE, plasticity or particle characteristic, colour, secondary and minor components ROCK TYPE, grain size and type, colour, fabric & texture, strength, weathering, defects and structure	Moisture Condition	Consistency Relative Density	STRUCTURE & Other Observations
AD/T	E-F	AUGER/NMLC	Dry	SPT 1.50 - 1.95 m 12, 11, 13 N=24	R	1		SM	Silty SAND: fine to coarse grained, light greyish brown	D	D	TOPSOIL
									0.70m			
								SC	Silty Clayey SAND: fine to medium grained, grey, medium plasticity clay	D	MD to D	ALLUVIUM
									1.10m			
						2		SC	Clayey SAND: fine to coarse grained, grey mottled orangish brown, medium plasticity clay, occasional relic organic material	D	MD	
									2.90m			
	H-VH			SPT 3.00 - 3.06 m 16/60mm HB N=R		3	+ · +	GP	DACITE: greyish green	D		WEATHERED ROCK
									3.10m			
						4			TERMINATED AT 3.10 m EOH: Refusal at 3.1m (on possible rock) EXCAVATION: Gemco 210B with 120mm diameter TC Bit auger STABILITY: Stable BACKFILL: Arisings compacted and tracked in layers at the surface 0.00-3.1m GROUNDWATER: Not Encountered PHOTOS: Yes INSITU TESTING: DCP to refusal (0.00-0.15m) ADDITIONAL NOTES:			
						5						
						6						
						7						

METHOD
EX Excavator bucket
R Ripper
HA Hand auger
PT Push tube
SON Sonic drilling
AH Air hammer
PS Percussion sampler
AS Short spiral auger
AD/V Solid flight auger: V-Bit
AD/T Solid flight auger: TC-Bit
HFA Hollow flight auger
WB Washbore drilling
RR Rock roller

PENETRATION
VE Very Easy (No Resistance)
E Easy
F Firm
H Hard
VH Very Hard (Refusal)

WATER
Water Level on Date shown
water inflow
water outflow

FIELD TESTS
SPT - Standard Penetration Test
HP - Hand/Pocket Penetrometer
DCP - Dynamic Cone Penetrometer
PSP - Perth Sand Penetrometer
MC - Moisture Content
PBT - Plate Bearing Test
IMP - Borehole Impression Test
PID - Photoionisation Detector
VS - Vane Shear; P=Peak, R=Resdual (uncorrected kPa)

SAMPLES
B - Bulk disturbed sample
D - Disturbed sample
ES - Environmental sample
U - Thin wall tube 'undisturbed'

MOISTURE
D - Dry
M - Moist
W - Wet
PL - Plastic limit
LL - Liquid limit
w - Moisture content

SOIL CONSISTENCY
VS - Very Soft
S - Soft
F - Firm
St - Stiff
VSt - Very Stiff
H - Hard

RELATIVE DENSITY
VL - Very Loose
L - Loose
MD - Medium Dense
D - Dense
VD - Very Dense

Refer to explanatory notes for details of abbreviations and basis of descriptions

CARDNO (NSW/ACT) PTY LTD

Cardno

BOREHOLE LOG SHEET

Client: QPRC
Project: QPRCSC
Location: QPRCSC, Nr. Hume NSW

Hole No: BH314

Job No: 50520049 **Sheet:** 1 of 1

Position: 55H 698270 6081598 **Angle from Horizontal:** 90° **Surface Elevation:**
Rig Type: Gemco 210B **Mounting:** Trailer **Driller:** JB
Casing Diameter: AUGER/NMLC **Contractor:** GE Drilling
Data Started: 15/1/20 **Date Completed:** 15/1/20 **Logged By:** MET **Checked By:** DR

Drilling: Method	Drilling: Resistance	Drilling: Casing	Water	Sampling & Testing: Sample or Field Test	Sampling & Testing: DCP (blows per 100 mm) 1 3 6 12	Depth (m)	Graphic Log	Classification	Material Description: SOIL TYPE, plasticity or particle characteristic, colour, secondary and minor components ROCK TYPE, grain size and type, colour, fabric & texture, strength, weathering, defects and structure	Moisture Condition	Consistency Relative Density	Material Description: STRUCTURE & Other Observations
AD/T						0		SM	0.20m Silty SAND: fine to coarse grained, light orangish grey	D	D to VD	TOPSOIL
								SM	Silty SAND: fine to coarse grained, light yellowish orangish grey 0.70m	D	MD to D	ALLUVIUM
						1		SP	SAND: fine to coarse grained, brown mottled yellowish brown, trace silt 1.20m	D	MD to D	
	E-F		GW encountered at 2.7m	SPT 1.50 - 1.95 m 5, 6, 10 N=16	R	2		SC	Clayey SAND: fine to coarse grained, brown mottled orangish brown and yellowish brown, medium to high plasticity clay 1.20m: increase in moisture content 2.70m	M M	MD	RESIDUAL SOIL
	AUGER/NML			SPT 3.00 - 3.45 m 8, 15, 16 N=31		3		SC	Clayey SAND: fine to coarse grained, yellowish brown, grey and brown, medium plasticity clay 3.60m	M to W	D	
	H-VH					4		SP	DACITE: greyish green 4.10m	M		WEATHERED ROCK
						5			TERMINATED AT 4.10 m EOH: Refusal at 4.1m (on possible dacite) EXCAVATION: Gemco 210B with 120mm diameter TC Bit auger STABILITY: Stable BACKFILL: Arisings compacted and tracked in layers at the surface 0.00-4.1m GROUNDWATER: Encountered at 2.7m PHOTOS: Yes INSITU TESTING: DCP to refusal (0.00-1.39m) ADDITIONAL NOTES:			
						6						
						7						

METHOD
EX Excavator bucket
R Ripper
HA Hand auger
PT Push tube
SON Sonic drilling
AH Air hammer
PS Percussion sampler
AS Short spiral auger
AD/V Solid flight auger: V-Bit
AD/T Solid flight auger: TC-Bit
HFA Hollow flight auger
WB Washbore drilling
RR Rock roller

PENETRATION
VE Very Easy (No Resistance)
E Easy
F Firm
H Hard
VH Very Hard (Refusal)

WATER
Water Level on Date shown
water inflow
water outflow

FIELD TESTS
SPT - Standard Penetration Test
HP - Hand/Pocket Penetrometer
DCP - Dynamic Cone Penetrometer
PSP - Perth Sand Penetrometer
MC - Moisture Content
PBT - Plate Bearing Test
IMP - Borehole Impression Test
PID - Photoionisation Detector
VS - Vane Shear; P=Peak, R=Resdual (uncorrected kPa)

SAMPLES
B - Bulk disturbed sample
D - Disturbed sample
ES - Environmental sample
U - Thin wall tube 'undisturbed'

MOISTURE
D - Dry
M - Moist
W - Wet
PL - Plastic limit
LL - Liquid limit
w - Moisture content

SOIL CONSISTENCY
VS - Very Soft
S - Soft
F - Firm
St - Stiff
VSt - Very Stiff
H - Hard

RELATIVE DENSITY
VL - Very Loose
L - Loose
MD - Medium Dense
D - Dense
VD - Very Dense

Refer to explanatory notes for details of abbreviations and basis of descriptions

CARDNO (NSW/ACT) PTY LTD

Cardno

BOREHOLE LOG SHEET

Client: QPRC
Project: QPRCSC
Location: QPRCSC, Nr. Hume NSW

Hole No: BH315

Job No: 50520049 **Sheet:** 1 of 1

Position: 55H 698193 6081535 **Angle from Horizontal:** 90° **Surface Elevation:**
Rig Type: Gemco 210B **Mounting:** Trailer **Driller:** JB
Casing Diameter: AUGER/NMLC **Contractor:** GE Drilling
Data Started: 15/1/20 **Date Completed:** 15/1/20 **Logged By:** MET **Checked By:** DR

Drilling			Water	Sampling & Testing		Depth (m)	Material Description					
Method	Resistance	Casing		Sample or Field Test	DCP (blows per 100 mm) 1 3 6 12		Graphic Log	Classification	SOIL TYPE, plasticity or particle characteristic, colour, secondary and minor components ROCK TYPE, grain size and type, colour, fabric & texture, strength, weathering, defects and structure	Moisture Condition	Consistency Relative Density	STRUCTURE & Other Observations
AD/T	E-F	AUGER/NMLC	GW encountered at 2.1m	SPT 1.50 - 1.95 m 10, 18, 22 N=40	HB	1		SM	Silty SAND: fine to coarse grained, light grey localy light orangish grey, with fine to medium, sub-angular to sub-rounded gravel, frequent rootlets (<2mm) 0.30m	D	MD	TOPSOIL
								SC	Silty Clayey SAND: fine to coarse grained, grey, medium plasticity clay 0.60m	D	MD	ALLUVIUM
						2		SC	Clayey SAND: fine to medium grained, greyish brown, medium to high plasticity clay	D to M		
				SPT 3.00 - 3.45 m 0, 0, 2 N=2		3		SC	1.20m: dark greyish brown with trace gravels fine to coarse, sub-angular to sub-rounded 2.10m	M	D	
						4		SP	SAND: fine to coarse grained, grey, with high plasticity clay 4.70m	W	VL	
	VH			SPT 4.50 - 4.82 m 1, 9, 15/20mm N=R		5		GP	4.80m DACITE: greyish green	M		ROCK
									TERMINATED AT 4.80 m EOH: Refusal at 4.8m (on possible rock) EXCAVATION: Gemco 210B with 120mm diameter TC Bit auger STABILITY: Stable BACKFILL: Arisings compacted and tracked in layers at the surface 0.00-4.8m GROUNDWATER: Encountered at 2.1m PHOTOS: Yes INSITU TESTING: DCP to refusal (0.00-0.27m) ADDITIONAL NOTES:			

METHOD
EX Excavator bucket
R Ripper
HA Hand auger
PT Push tube
SON Sonic drilling
AH Air hammer
PS Percussion sampler
AS Short spiral auger
AD/V Solid flight auger: V-Bit
AD/T Solid flight auger: TC-Bit
HFA Hollow flight auger
WB Washbore drilling
RR Rock roller

PENETRATION
VE Very Easy (No Resistance)
E Easy
F Firm
H Hard
VH Very Hard (Refusal)

WATER
Water Level on Date shown
water inflow
water outflow

FIELD TESTS
SPT - Standard Penetration Test
HP - Hand/Pocket Penetrometer
DCP - Dynamic Cone Penetrometer
PSP - Perth Sand Penetrometer
MC - Moisture Content
PBT - Plate Bearing Test
IMP - Borehole Impression Test
PID - Photoionisation Detector
VS - Vane Shear; P=Peak, R=Resdual (uncorrected kPa)

SAMPLES
B - Bulk disturbed sample
D - Disturbed sample
ES - Environmental sample
U - Thin wall tube 'undisturbed'

MOISTURE
D - Dry
M - Moist
W - Wet
PL - Plastic limit
LL - Liquid limit
w - Moisture content

SOIL CONSISTENCY
VS - Very Soft
S - Soft
F - Firm
St - Stiff
VSt - Very Stiff
H - Hard

RELATIVE DENSITY
VL - Very Loose
L - Loose
MD - Medium Dense
D - Dense
VD - Very Dense

Refer to explanatory notes for details of abbreviations and basis of descriptions

CARDNO (NSW/ACT) PTY LTD

BOREHOLE LOG SHEET

Client: QPRC
Project: QPRCSC
Location: QPRCSC, Nr. Hume NSW

Hole No: BH316

Job No: 50520049 **Sheet:** 1 of 1

Position: 55H 698102 6081485 **Angle from Horizontal:** 90° **Surface Elevation:**

Rig Type: Gemco 210B **Mounting:** Trailer **Driller:** JB

Casing Diameter: AUGER/NMLC **Contractor:** GE Drilling

Data Started: 15/1/20 **Date Completed:** 15/1/20 **Logged By:** MET **Checked By:** DR

Drilling			Water	Sampling & Testing		Depth (m)	Material Description					
Method	Resistance	Casing		Sample or Field Test	DCP (blows per 100 mm) 1 3 6 12		Graphic Log	Classification	SOIL TYPE, plasticity or particle characteristic, colour, secondary and minor components ROCK TYPE, grain size and type, colour, fabric & texture, strength, weathering, defects and structure	Moisture Condition	Consistency Relative Density	STRUCTURE & Other Observations
AD/T	E-F	AUGER/NMLC	Dry	D 0.50 - 0.70 m		0		SM	Silty SAND: fine to coarse grained, light grey locally light orangish grey, frequent rootlets (<2mm)	D	D to VD	TOPSOIL
									0.40m			
								SC	Silty Clayey SAND: fine to coarse grained, brown, medium plasticity clay	M (<PL)	St	ALLUVIUM
				D 0.90 - 1.10 m					0.80m			
						1		SC	Silty Clayey SAND: fine to medium grained, light brown, medium to high plasticity clay	M (<PL)	St	
									1.20m			
				SPT 1.50 - 1.95 m 4, 5, 7 N=12				CI-CH	Silty CLAY: medium to high plasticity, brown locally orangish brown and grey, with fine to medium sand, interbedded sandy clay and clayey sand layers 1.20-2.10m: becoming moist with occasional fine to coiarse, angular to sub-rounded gravels	M (<PL)	St	
						2						
									2.50m			
								SP	SAND: fine to coarse grained, grey mottled orangish brown, with medium to high plasticity clay	M	D	
				SPT 3.00 - 3.45 m 5, 11, 30 N=41		3						
									3.40m			
	H						+ · + · + · + · +	GP	DACITE: blueish green mottled green	M		WEATHERED ROCK
									3.70m			
						4			TERMINATED AT 3.70 m EOH: Refusal at 3.7m (on possible dacite) EXCAVATION: Gemco 210B with 120mm diameter TC Bit auger STABILITY: Stable BACKFILL: Arisings compacted and tracked in layers at the surface 0.00-3.7m GROUNDWATER: Not Encountered PHOTOS: Yes INSITU TESTING: DCP to termination (0.00-1.5m) ADDITIONAL NOTES:			
						5						

METHOD
- EX Excavator bucket
- R Ripper
- HA Hand auger
- PT Push tube
- SON Sonic drilling
- AH Air hammer
- PS Percussion sampler
- AS Short spiral auger
- AD/V Solid flight auger: V-Bit
- AD/T Solid flight auger: TC-Bit
- HFA Hollow flight auger
- WB Washbore drilling
- RR Rock roller

PENETRATION
- VE Very Easy (No Resistance)
- E Easy
- F Firm
- H Hard
- VH Very Hard (Refusal)

WATER
- Water Level on Date shown
- water inflow
- water outflow

FIELD TESTS
- SPT - Standard Penetration Test
- HP - Hand/Pocket Penetrometer
- DCP - Dynamic Cone Penetrometer
- PSP - Perth Sand Penetrometer
- MC - Moisture Content
- PBT - Plate Bearing Test
- IMP - Borehole Impression Test
- PID - Photoionisation Detector
- VS - Vane Shear; P=Peak, R=Resdual (uncorrected kPa)

SAMPLES
- B - Bulk disturbed sample
- D - Disturbed sample
- ES - Environmental sample
- U - Thin wall tube 'undisturbed'

MOISTURE
- D - Dry
- M - Moist
- W - Wet
- PL - Plastic limit
- LL - Liquid limit
- *w* - Moisture content

SOIL CONSISTENCY
- VS - Very Soft
- S - Soft
- F - Firm
- St - Stiff
- VSt - Very Stiff
- H - Hard

RELATIVE DENSITY
- VL - Very Loose
- L - Loose
- MD - Medium Dense
- D - Dense
- VD - Very Dense

Refer to explanatory notes for details of abbreviations and basis of descriptions

CARDNO (NSW/ACT) PTY LTD

BOREHOLE LOG SHEET

Hole No: BH317

Sheet: 1 of 1

Client: QPRC			
Project: QPRCSC			
Location: QPRCSC, Nr. Hume NSW	**Job No:** 50520049		
Position: 55H 698200 6081482	**Angle from Horizontal:** 90°	**Surface Elevation:**	
Rig Type: Gemco 210B	**Mounting:** Trailer	**Driller:** JB	
Casing Diameter: AUGER/NMLC		**Contractor:** GE Drilling	
Data Started: 15/1/20	**Date Completed:** 15/1/20	**Logged By:** MET	**Checked By:** DR

Drilling			Water	Sampling & Testing		Depth (m)	Material Description					
Method	Resistance	Casing		Sample or Field Test	DCP (blows per 100 mm) 1 3 6 12		Graphic Log	Classification	SOIL TYPE, plasticity or particle characteristic, colour, secondary and minor components ROCK TYPE, grain size and type, colour, fabric & texture, strength, weathering, defects and structure	Moisture Condition	Consistency Relative Density	STRUCTURE & Other Observations
AD/T			GW encountered at 2.6m		HB	0		GM	FILL: Silty Sandy GRAVEL: fine to coarse, sub-angular to angular, light yellowish grey locally light reddish brown, fine to coarse sand, frequent rootlets (<2mm)	D	VD	FILL
									0.30m			
								CI	Sandy Silty CLAY: medium plasticity, light greyish brown, fine to medium sand, occasional rootlets (<2mm)	D	F to St	ALLUVIUM
									0.70-0.9m: increase in moisture content, becoming greyish brown	M (<PL)		
						0.90m						
						1		CI-CH	CLAY: medium to high plasticity, dark grey, with silt, with fine to medium sand	M (<PL)	F to St	
				SPT 1.50 - 1.95 m 4, 8, 11 N=19								
				D 1.80 - 2.20 m					1.80-2.60m: increase in moisture content	M (≈PL)		
	E-F					2						
		AUGER/NMLC										
									2.60m			
									SAND: fine to coarse grained, grey, interbedded sand and clayey sand layers			
				SPT 3.00 - 3.45 m 0, 1, 2 N=3		3		SP		W	VL to L	
						4						
									4.20m			
	F-H							SP	Gravelly SAND: fine to coarse grained, greyish green locally mottled green, fine to coarse, angular to sub-angular gravel, with medium plasticity clay	W	D to VD	WEATHERED ROCK
				SPT 4.50 - 4.75 m 6, 14/100mm HB N=R					4.70m			
	VH			D 4.70 - 4.75 m				GP	4.75m DACITE: blueish green mottled green	M		ROCK
						5			TERMINATED AT 4.75 m EOH: Refusal at 4.75m (on possible dacite) EXCAVATION: Gemco 210B with 120mm diameter TC Bit auger STABILITY: Stable BACKFILL: Arisings compacted and tracked in layers at the surface 0.00-4.75m GROUNDWATER: Encountered at 2.6m PHOTOS: Yes INSITU TESTING: DCP to refusal (0.00-0.28m) ADDITIONAL NOTES:			

METHOD

EX	Excavator bucket
R	Ripper
HA	Hand auger
PT	Push tube
SON	Sonic drilling
AH	Air hammer
PS	Percussion sampler
AS	Short spiral auger
AD/V	Solid flight auger: V-Bit
AD/T	Solid flight auger: TC-Bit
HFA	Hollow flight auger
WB	Washbore drilling
RR	Rock roller

PENETRATION

VE	Very Easy (No Resistance)
E	Easy
F	Firm
H	Hard
VH	Very Hard (Refusal)

WATER

- Water Level on Date shown
- water inflow
- water outflow

FIELD TESTS

SPT	-	Standard Penetration Test
HP	-	Hand/Pocket Penetrometer
DCP	-	Dynamic Cone Penetrometer
PSP	-	Perth Sand Penetrometer
MC	-	Moisture Content
PBT	-	Plate Bearing Test
IMP	-	Borehole Impression Test
PID	-	Photoionisation Detector
VS	-	Vane Shear; P=Peak, R=Resdual (uncorrected kPa)

SAMPLES

B	-	Bulk disturbed sample
D	-	Disturbed sample
ES	-	Environmental sample
U	-	Thin wall tube 'undisturbed'

MOISTURE

D	-	Dry
M	-	Moist
W	-	Wet
PL	-	Plastic limit
LL	-	Liquid limit
w	-	Moisture content

SOIL CONSISTENCY

VS	-	Very Soft
S	-	Soft
F	-	Firm
St	-	Stiff
VSt	-	Very Stiff
H	-	Hard

RELATIVE DENSITY

VL	-	Very Loose
L	-	Loose
MD	-	Medium Dense
D	-	Dense
VD	-	Very Dense

Refer to explanatory notes for details of abbreviations and basis of descriptions

CARDNO (NSW/ACT) PTY LTD

BOREHOLE LOG SHEET

Client: QPRC
Project: QPRCSC
Location: QPRCSC, Nr. Hume NSW

Hole No: BH318

Job No: 50520049 **Sheet:** 1 of 1

Position: 55H 698281 6081479 **Angle from Horizontal:** 90° **Surface Elevation:**
Rig Type: Gemco 210B **Mounting:** Trailer **Driller:** JB
Casing Diameter: AUGER/NMLC **Contractor:** GE Drilling
Data Started: 15/1/20 **Date Completed:** 15/1/20 **Logged By:** MET **Checked By:** DR

Drilling: Method	Drilling: Resistance	Drilling: Casing	Water	Sampling & Testing: Sample or Field Test	Sampling & Testing: DCP (blows per 100 mm) 1 3 6 12	Depth (m)	Graphic Log	Classification	Material Description: SOIL TYPE, plasticity or particle characteristic, colour, secondary and minor components ROCK TYPE, grain size and type, colour, fabric & texture, strength, weathering, defects and structure	Moisture Condition	Consistency Relative Density	STRUCTURE & Other Observations
AD/T	E-F	AUGER/NMLC	GW encountered at 2.9m			0		SM	Silty SAND: fine to medium grained, grey, frequent rootlets (<2mm)	D	VSt	TOPSOIL
									0.30m			
								SC	Clayey SAND: fine to coarse grained, grey, medium plasticity clay	D	D	ALLUVIUM
						1			0.8-1.2m: increase in moisture content, becoming darker grey	M		
									1.20m			
				SPT 1.50 - 1.95 m 3, 5, 7 N=12				SC	Clayey SAND: fine to coarse grained, dark grey mottled grey and light grey locally light grey mottled dark grey, medium plasticity clay	M	MD	
						2			2.30m			
				D 2.40 - 2.80 m				SC	Clayey SAND: fine to coarse grained, grey mottled light grey and brown, medium plasticity clay	M	MD to D	
									2.90m			
				SPT 3.00 - 3.45 m 3, 3, 4 N=7		3		CI-CH	Sandy CLAY: medium to high plasticity, dark grey mottled light grey and brown, fine to coarse sand, interbedded sandy clay and clayey sand layers	M (➡PL) and W	F	
									3.70m			
								SP	SAND: fine to coarse grained, greenish grey mottled light green, with medium plasticity clay	W	MD to D	RESIDUAL SOIL
				SPT 4.50 - 4.95 m 10, 17, 17 N=34		4			4.65m			
	H-VH							GP	DACITE: extremely weathered, greyish green	M		WEATHERED ROCK
									4.95m			
						5			TERMINATED AT 4.95 m EOH: Refusal at 4.95m (on possible dacite) EXCAVATION: Gemco 210B with 120mm diameter TC Bit auger STABILITY: Stable BACKFILL: Arisings compacted and tracked in layers at the surface 0.00-4.95m GROUNDWATER: Encountered at 2.9m PHOTOS: Yes INSITU TESTING: DCP to termination (0.00-1.4m) ADDITIONAL NOTES:			

METHOD
EX Excavator bucket
R Ripper
HA Hand auger
PT Push tube
SON Sonic drilling
AH Air hammer
PS Percussion sampler
AS Short spiral auger
AD/V Solid flight auger: V-Bit
AD/T Solid flight auger: TC-Bit
HFA Hollow flight auger
WB Washbore drilling
RR Rock roller

PENETRATION
VE Very Easy (No Resistance)
E Easy
F Firm
H Hard
VH Very Hard (Refusal)

WATER
Water Level on Date shown
water inflow
water outflow

FIELD TESTS
SPT - Standard Penetration Test
HP - Hand/Pocket Penetrometer
DCP - Dynamic Cone Penetrometer
PSP - Perth Sand Penetrometer
MC - Moisture Content
PBT - Plate Bearing Test
IMP - Borehole Impression Test
PID - Photoionisation Detector
VS - Vane Shear; P=Peak, R=Resdual (uncorrected kPa)

SAMPLES
B - Bulk disturbed sample
D - Disturbed sample
ES - Environmental sample
U - Thin wall tube 'undisturbed'

MOISTURE
D - Dry
M - Moist
W - Wet
PL - Plastic limit
LL - Liquid limit
w - Moisture content

SOIL CONSISTENCY
VS - Very Soft
S - Soft
F - Firm
St - Stiff
VSt - Very Stiff
H - Hard

RELATIVE DENSITY
VL - Very Loose
L - Loose
MD - Medium Dense
D - Dense
VD - Very Dense

Refer to explanatory notes for details of abbreviations and basis of descriptions

CARDNO (NSW/ACT) PTY LTD

Cardno

BOREHOLE LOG SHEET

Client: QPRC
Project: QPRCSC
Location: QPRCSC, Nr. Hume NSW

Hole No: BH319

Job No: 50520049 **Sheet:** 1 of 1

Position: 55H 698208 6081441 **Angle from Horizontal:** 90° **Surface Elevation:**
Rig Type: Gemco 210B **Mounting:** Trailer **Driller:** JB
Casing Diameter: AUGER/NMLC **Contractor:** GE Drilling
Data Started: 15/1/20 **Date Completed:** 15/1/20 **Logged By:** MET **Checked By:** DR

Drilling: Method	Drilling: Resistance	Drilling: Casing	Water	Sampling & Testing: Sample or Field Test	Sampling & Testing: DCP (blows per 100 mm) 1 3 6 12	Depth (m)	Graphic Log	Classification	Material Description: SOIL TYPE, plasticity or particle characteristic, colour, secondary and minor components ROCK TYPE, grain size and type, colour, fabric & texture, strength, weathering, defects and structure	Moisture Condition	Consistency Relative Density	STRUCTURE & Other Observations
AD/T	E-F	AUGER/NMLC	GW encountered at 2.4m		R	0		SM	0.20m Silty SAND: fine to medium grained, grey, frequent rootlets (<2mm)	D	MD to D	TOPSOIL
								SM	0.90m Silty SAND: fine to medium grained, dark grey, trace medium plasticity clay	D	D to VD	ALLUVIUM
				SPT 1.50 - 1.95 m 4, 7, 9 N=16		1		SC	2.40m Clayey SAND: fine to medium grained, dark brownish grey, medium plasticity clay	M	MD	
	F-H			SPT 3.00 - 3.45 m 2, 2, 3 N=5		2		SC	4.00m Clayey SAND: fine to coarse grained, grey mottled orangish brown and orange, medium plasticity clay	M / W	L	
						3		GP	4.20m DACITE: extremely weathered, greyish green	M		WEATHERED ROCK
						4			TERMINATED AT 4.20 m EOH: Refusal at 4.2m (on possible rock) EXCAVATION: Gemco 210B with 120mm diameter TC Bit auger STABILITY: Stable BACKFILL: Arisings compacted and tracked in layers at the surface 0.00-4.2m GROUNDWATER: Encountered at 2.4m PHOTOS: Yes INSITU TESTING: DCP to refusal (0.00-0.35m) ADDITIONAL NOTES:			
						5						

METHOD
EX Excavator bucket
R Ripper
HA Hand auger
PT Push tube
SON Sonic drilling
AH Air hammer
PS Percussion sampler
AS Short spiral auger
AD/V Solid flight auger: V-Bit
AD/T Solid flight auger: TC-Bit
HFA Hollow flight auger
WB Washbore drilling
RR Rock roller

PENETRATION
VE Very Easy (No Resistance)
E Easy
F Firm
H Hard
VH Very Hard (Refusal)

WATER
Water Level on Date shown
water inflow
water outflow

FIELD TESTS
SPT - Standard Penetration Test
HP - Hand/Pocket Penetrometer
DCP - Dynamic Cone Penetrometer
PSP - Perth Sand Penetrometer
MC - Moisture Content
PBT - Plate Bearing Test
IMP - Borehole Impression Test
PID - Photoionisation Detector
VS - Vane Shear; P=Peak, R=Resdual (uncorrected kPa)

SAMPLES
B - Bulk disturbed sample
D - Disturbed sample
ES - Environmental sample
U - Thin wall tube 'undisturbed'

MOISTURE
D - Dry
M - Moist
W - Wet
PL - Plastic limit
LL - Liquid limit
w - Moisture content

SOIL CONSISTENCY
VS - Very Soft
S - Soft
F - Firm
St - Stiff
VSt - Very Stiff
H - Hard

RELATIVE DENSITY
VL - Very Loose
L - Loose
MD - Medium Dense
D - Dense
VD - Very Dense

Refer to explanatory notes for details of abbreviations and basis of descriptions

CARDNO (NSW/ACT) PTY LTD

Cardno

BOREHOLE LOG SHEET

Client: QPRC
Project: QPRCSC
Location: QPRCSC, Nr. Hume NSW

Hole No: BH320

Job No: 50520049 **Sheet:** 1 of 1

Position: 55H 698111 6081403 **Angle from Horizontal:** 90° **Surface Elevation:**
Rig Type: Gemco 210B **Mounting:** Trailer **Driller:** JB
Casing Diameter: AUGER/NMLC **Contractor:** GE Drilling
Data Started: 15/1/20 **Date Completed:** 15/1/20 **Logged By:** MET **Checked By:** DR

Drilling: Method	Drilling: Resistance	Drilling: Casing	Water	Sampling & Testing: Sample or Field Test	Sampling & Testing: DCP (blows per 100 mm) 1 3 6 12	Depth (m)	Graphic Log	Classification	Material Description: SOIL TYPE, plasticity or particle characteristic, colour, secondary and minor components ROCK TYPE, grain size and type, colour, fabric & texture, strength, weathering, defects and structure	Moisture Condition	Consistency Relative Density	STRUCTURE & Other Observations
AD/T		AUGER/NMLC	Dry		R	0		GP	FILL: Sandy GRAVEL: fine to coarse, sub-rounded to sub-angular, light grey, fine to coarse sand	D	VD	FILL
						0.60m						
						1		CI	Sandy CLAY: medium plasticity, light brown, fine to coarse sand	D	MD to D	ALLUVIUM
						1.30m						
	E-F			SPT 1.50 - 1.95 m 7, 12, 18 N=30		2		SC	Clayey SAND: fine to medium grained, brown mottled grey and orange, medium plasticity clay 1.60-2.50m: increase in moisture content	D to M	MD to D	
						2.50m						
				SPT 3.00 - 3.45 m 5, 13, 12 N=25		3		SC	Clayey SAND: fine to medium grained, dark brown and grey, medium plasticity clay 2.50-3.80m: increase in moisture content	M	MD	
						3.80m						
	F-H			SPT 4.50 - 4.95 m 11, 16, 26 N=42		4		SC	Clayey Gravelly SAND: fine to coarse grained, dark brown and grey, fine to coarse, sub-angular to sub-rounded gravel, medium plasticity clay	M	D to VD	RESIDUAL SOIL
				SPT 6.00 - 6.28 m 10, 30/130mm HB N=R		6.40m						
						7			TERMINATED AT 6.40 m EOH: Refusal at 6.4m (on possible rock) EXCAVATION: Gemco 210B with 120mm diameter TC Bit auger STABILITY: Stable BACKFILL: Arisings compacted and tracked in layers at the surface 0.00-6.4m GROUNDWATER: Not Encountered PHOTOS: Yes INSITU TESTING: DCP to refusal (0.00-0.16m) ADDITIONAL NOTES:			

METHOD
EX Excavator bucket
R Ripper
HA Hand auger
PT Push tube
SON Sonic drilling
AH Air hammer
PS Percussion sampler
AS Short spiral auger
AD/V Solid flight auger: V-Bit
AD/T Solid flight auger: TC-Bit
HFA Hollow flight auger
WB Washbore drilling
RR Rock roller

PENETRATION
VE Very Easy (No Resistance)
E Easy
F Firm
H Hard
VH Very Hard (Refusal)

WATER
Water Level on Date shown
water inflow
water outflow

FIELD TESTS
SPT - Standard Penetration Test
HP - Hand/Pocket Penetrometer
DCP - Dynamic Cone Penetrometer
PSP - Perth Sand Penetrometer
MC - Moisture Content
PBT - Plate Bearing Test
IMP - Borehole Impression Test
PID - Photoionisation Detector
VS - Vane Shear; P=Peak, R=Resdual (uncorrected kPa)

SAMPLES
B - Bulk disturbed sample
D - Disturbed sample
ES - Environmental sample
U - Thin wall tube 'undisturbed'

MOISTURE
D - Dry
M - Moist
W - Wet
PL - Plastic limit
LL - Liquid limit
w - Moisture content

SOIL CONSISTENCY
VS - Very Soft
S - Soft
F - Firm
St - Stiff
VSt - Very Stiff
H - Hard

RELATIVE DENSITY
VL - Very Loose
L - Loose
MD - Medium Dense
D - Dense
VD - Very Dense

Refer to explanatory notes for details of abbreviations and basis of descriptions

CARDNO (NSW/ACT) PTY LTD

BOREHOLE LOG SHEET

Client: QPRC
Project: QPRCSC
Location: QPRCSC, Nr. Hume NSW

Hole No: BH321

Job No: 50520049 **Sheet:** 1 of 1

Position: 55H 698186 6081385 **Angle from Horizontal:** 90° **Surface Elevation:**
Rig Type: Gemco 210B **Mounting:** Trailer **Driller:** JB
Casing Diameter: AUGER/NMLC **Contractor:** GE Drilling
Data Started: 15/1/20 **Date Completed:** 15/1/20 **Logged By:** MET **Checked By:** DR

Drilling: Method	Drilling: Resistance	Drilling: Casing	Water	Sampling & Testing: Sample or Field Test	Sampling & Testing: DCP (blows per 100 mm) 1 3 6 12	Depth (m)	Graphic Log	Classification	Material Description: SOIL TYPE, plasticity or particle characteristic, colour, secondary and minor components ROCK TYPE, grain size and type, colour, fabric & texture, strength, weathering, defects and structure	Moisture Condition	Consistency Relative Density	STRUCTURE & Other Observations
AD/T					R	0		SM	Silty SAND: fine to medium grained, light grey, frequent rootlets (<2mm)	D	VD	TOPSOIL
						0.40m						
						1		SC	Clayey Silty SAND: fine to coarse grained, brown mottled light grey and orangish brown, medium plasticity clay	D	MD to D	ALLUVIUM
									1.00-1.40m: increase in moisture content, darkening in colour	M		
						1.40m						
				SPT 1.50 - 1.95 m 9, 12, 14 N=26				CL	Sandy CLAY: low plasticity, light greyish brown mottled orangish brown, fine to medium sand	D to M	MD to D	
				D 1.80 - 2.30 m		2						
	E-F											
						2.40m						
								SP	Clayey SAND: fine to medium grained, dark brown mottled orangish brown and grey, medium plasticity clay	D to M	D to VD	
				SPT 3.00 - 3.38 m 23, 23, 14/75mm HB N=R		3						
	AUGER/NMLC		Possible GW from approximately 5.0m									
						3.20m						
								SC	Clayey Gravelly SAND: fine to coarse grained, grey mottled brown and orangish brown, fine to medium, sub-angular to sub-rounded gravel, medium plasticity clay	D to M	MD to D	RESIDUAL SOIL
						4			4.2-5.0m: trace gravels			
				SPT 4.50 - 4.95 m 3, 8, 13 N=21								
						5						
						5.00m						
	F-H							GP	DACITE: extremely weathered, grey mottled yellowish brown and brown	M to W		WEATHERED ROCK
				SPT 6.00 - 6.30 m 18, 25 HB N=R		6						
						6.40m						
						7			TERMINATED AT 6.40 m EOH: Refusal at 6.4m (on possible rock) EXCAVATION: Gemco 210B with 120mm diameter TC Bit auger STABILITY: Stable BACKFILL: Arisings compacted and tracked in layers at the surface 0.00-6.4m GROUNDWATER: Encountered possibly at 5.0m PHOTOS: Yes INSITU TESTING: DCP to refusal (0.00-0.09m) ADDITIONAL NOTES:			

METHOD
EX Excavator bucket
R Ripper
HA Hand auger
PT Push tube
SON Sonic drilling
AH Air hammer
PS Percussion sampler
AS Short spiral auger
AD/V Solid flight auger: V-Bit
AD/T Solid flight auger: TC-Bit
HFA Hollow flight auger
WB Washbore drilling
RR Rock roller

PENETRATION
VE Very Easy (No Resistance)
E Easy
F Firm
H Hard
VH Very Hard (Refusal)

WATER
Water Level on Date shown
water inflow
water outflow

FIELD TESTS
SPT - Standard Penetration Test
HP - Hand/Pocket Penetrometer
DCP - Dynamic Cone Penetrometer
PSP - Perth Sand Penetrometer
MC - Moisture Content
PBT - Plate Bearing Test
IMP - Borehole Impression Test
PID - Photoionisation Detector
VS - Vane Shear; P=Peak, R=Resdual (uncorrected kPa)

SAMPLES
B - Bulk disturbed sample
D - Disturbed sample
ES - Environmental sample
U - Thin wall tube 'undisturbed'

MOISTURE
D - Dry
M - Moist
W - Wet
PL - Plastic limit
LL - Liquid limit
w - Moisture content

SOIL CONSISTENCY
VS - Very Soft
S - Soft
F - Firm
St - Stiff
VSt - Very Stiff
H - Hard

RELATIVE DENSITY
VL - Very Loose
L - Loose
MD - Medium Dense
D - Dense
VD - Very Dense

Refer to explanatory notes for details of abbreviations and basis of descriptions

CARDNO (NSW/ACT) PTY LTD

Cardno

BOREHOLE LOG SHEET

Client: QPRC
Project: QPRCSC
Location: QPRCSC, Nr. Hume NSW

Hole No: BH322

Job No: 50520049 **Sheet:** 1 of 1

Position: 55H 698282 6081366 **Angle from Horizontal:** 90° **Surface Elevation:**
Rig Type: Gemco 210B **Mounting:** Trailer **Driller:** JB
Casing Diameter: AUGER/NMLC **Contractor:** GE Drilling
Data Started: 15/1/20 **Date Completed:** 15/1/20 **Logged By:** MET **Checked By:** DR

Drilling			Water	Sampling & Testing		Depth (m)	Material Description					
Method	Resistance	Casing		Sample or Field Test	DCP (blows per 100 mm) 1 3 6 12		Graphic Log	Classification	SOIL TYPE, plasticity or particle characteristic, colour, secondary and minor components ROCK TYPE, grain size and type, colour, fabric & texture, strength, weathering, defects and structure	Moisture Condition	Consistency Relative Density	STRUCTURE & Other Observations
AD/T		AUGER/NMLC	Dry		R	0		SM	0.10m Silty SAND: fine to medium grained, light grey, frequent rootlets (<2mm)	D	VD	TOPSOIL
								ML	Sandy SILT: low plasticity, light brown, fine to coarse sand 0.40m	D	MD to D	ALLUVIUM
								SC	0.60m Clayey SAND: fine to coarse grained, yellowish brown mottled light grey, medium top high plasticity clay	M	MD to D	
								CI	Sandy CLAY: medium plasticity, greyish brown mottled grey, fine to medium sand 1.10m	M (<PL)	St	
				SPT 1.50 - 1.95 m 5, 8, 13 N=21		1		SC	Clayey SAND: fine to medium grained, greyish brown mottled brown, medium plasticity clay	M	MD	
						2			2.70m			
	VH							GP	2.72m DACITE: greyish green TERMINATED AT 2.72 m EOH: Refusal at 2.7m (on possible rock) EXCAVATION: Gemco 210B with 120mm diameter TC Bit auger STABILITY: Stable BACKFILL: Arisings compacted and tracked in layers at the surface 0.00-2.7m GROUNDWATER: Not Encountered PHOTOS: Yes INSITU TESTING: DCP to refusal (0.00-0.09m) ADDITIONAL NOTES:	D		ROCK
						3						
						4						
						5						

METHOD
EX Excavator bucket
R Ripper
HA Hand auger
PT Push tube
SON Sonic drilling
AH Air hammer
PS Percussion sampler
AS Short spiral auger
AD/V Solid flight auger: V-Bit
AD/T Solid flight auger: TC-Bit
HFA Hollow flight auger
WB Washbore drilling
RR Rock roller

PENETRATION
VE Very Easy (No Resistance)
E Easy
F Firm
H Hard
VH Very Hard (Refusal)

WATER
Water Level on Date shown
water inflow
water outflow

FIELD TESTS
SPT - Standard Penetration Test
HP - Hand/Pocket Penetrometer
DCP - Dynamic Cone Penetrometer
PSP - Perth Sand Penetrometer
MC - Moisture Content
PBT - Plate Bearing Test
IMP - Borehole Impression Test
PID - Photoionisation Detector
VS - Vane Shear; P=Peak, R=Resdual (uncorrected kPa)

SAMPLES
B - Bulk disturbed sample
D - Disturbed sample
ES - Environmental sample
U - Thin wall tube 'undisturbed'

MOISTURE
D - Dry
M - Moist
W - Wet
PL - Plastic limit
LL - Liquid limit
w - Moisture content

SOIL CONSISTENCY
VS - Very Soft
S - Soft
F - Firm
St - Stiff
VSt - Very Stiff
H - Hard

RELATIVE DENSITY
VL - Very Loose
L - Loose
MD - Medium Dense
D - Dense
VD - Very Dense

Refer to explanatory notes for details of abbreviations and basis of descriptions

CARDNO (NSW/ACT) PTY LTD

TEST PIT LOG SHEET

Client: QPRC
Project: QPRCSC
Location: QPRCSC, Nr. Hume NSW

Hole No: TP101

Job No: 50520049 **Sheet:** 1 of 1

Position: 55H 697882 6081937 **Angle from Horizontal:** 90° **Surface Elevation:**

Machine Type: 5t CAT Excavator **Excavation Method:** 300mm Standard tooth bucket

Excavation Dimensions: 2.00m LONG AND 0.40m WIDE **DIRECTION :** 090° **Contractor:** AJD C&D

Date Excavated: 15/1/20 **Logged By:** JIA **Checked By:** DR

Excavation: Method	Resistance	Stability	Water	Sampling & Testing: Sample or Field Test	DCP (blows per 100 mm) 1 3 6 12	Depth (m)	Graphic Log	Classification	Material Description: SOIL TYPE, plasticity or particle characteristic, colour, secondary and minor components ROCK TYPE, grain size and type, colour, fabric & texture, strength, weathering, defects and structure	Moisture Condition	Consistency Relative Density	STRUCTURE & Other Observations
EX	E-F	Stable	Dry		R	0		SM	0.10m Silty SAND: fine to coarse grained, light brown, trace fine, sub-angular gravel, frequent rootlets (<2mm)	D	D to VD	TOPSOIL
				D 0.20 - 0.30 m				ML	Sandy SILT: low plasticity, light brown, fine to medium sand 0.40m	D	VSt to H	ALLUVIUM
						0.5		SM	Silty SAND: fine to coarse grained, brown 0.65m	D to M	MD to D	
				D 0.70 - 0.80 m				CI	Silty CLAY: medium plasticity, dark brown mottled red and orange 1.00m	M (<PL)	St to VSt	
						1.0			TERMINATED AT 1.00 m EOH: Terminated at 1.00m (target depth) EXCAVATION: CAT 305C Excavator with 300mm standard tooth bucket STABILITY: Stable BACKFILL: Arisings compacted in layers with nominal bucket pressure and tracked in at the surface 0.00-1.00m GROUNDWATER: Not Encountered PHOTOS: Yes INSITU TESTING: DCP to refusal (0.00-0.10m) ADDITIONAL NOTES:			
						1.5						
						2.0						
						2.5						

METHOD
- EX Excavator bucket
- R Ripper
- HA Hand auger
- PT Push tube
- SON Sonic drilling
- AH Air hammer
- PS Percussion sampler
- AS Short spiral auger
- AD/V Solid flight auger: V-Bit
- AD/T Solid flight auger: TC-Bit
- HFA Hollow flight auger
- WB Washbore drilling
- RR Rock roller

PENETRATION
- VE Very Easy (No Resistance)
- E Easy
- F Firm
- H Hard
- VH Very Hard (Refusal)

WATER
- Water Level on Date shown
- water inflow
- water outflow

FIELD TESTS
- SPT - Standard Penetration Test
- HP - Hand/Pocket Penetrometer
- DCP - Dynamic Cone Penetrometer
- PSP - Perth Sand Penetrometer
- MC - Moisture Content
- PBT - Plate Bearing Test
- IMP - Borehole Impression Test
- PID - Photoionisation Detector
- VS - Vane Shear; P=Peak, R=Resdual (uncorrected kPa)

SAMPLES
- B - Bulk disturbed sample
- D - Disturbed sample
- ES - Environmental sample
- U - Thin wall tube 'undisturbed'

MOISTURE
- D - Dry
- M - Moist
- W - Wet
- PL - Plastic limit
- LL - Liquid limit
- *w* - Moisture content

SOIL CONSISTENCY
- VS - Very Soft
- S - Soft
- F - Firm
- St - Stiff
- VSt - Very Stiff
- H - Hard

RELATIVE DENSITY
- VL - Very Loose
- L - Loose
- MD - Medium Dense
- D - Dense
- VD - Very Dense

Refer to explanatory notes for details of abbreviations and basis of descriptions

CARDNO (NSW/ACT) PTY LTD

TEST PIT LOG SHEET

Client: QPRC
Project: QPRCSC
Location: QPRCSC, Nr. Hume NSW

Hole No: TP102

Job No: 50520049 **Sheet:** 1 of 1

Position: 55H 697836 6081849 **Angle from Horizontal:** 90° **Surface Elevation:**

Machine Type: 5t CAT Excavator **Excavation Method:** 300mm Standard tooth bucket

Excavation Dimensions: 2.10m LONG AND 0.40m WIDE **DIRECTION :** 090° **Contractor:** AJD C&D

Date Excavated: 15/1/20 **Logged By:** JIA **Checked By:** DR

Excavation			Water	Sampling & Testing		Depth (m)	Material Description					
Method	Resistance	Stability		Sample or Field Test	DCP (blows per 100 mm) 1 3 6 12		Graphic Log	Classification	SOIL TYPE, plasticity or particle characteristic, colour, secondary and minor components ROCK TYPE, grain size and type, colour, fabric & texture, strength, weathering, defects and structure	Moisture Condition	Consistency Relative Density	STRUCTURE & Other Observations
EX	E-F	Stable	Dry	D 0.40 - 0.50 m	R	0.5		ML	0.10m Sandy SILT: low plasticity, light brown, fine to course sand, trace fine, sub-angular gravel, frequent rootlets (<2mm)	D	F to St	TOPSOIL
								SM	Silty SAND: fine to coarse grained, light brown/white	D	D to VD	ALLUVIUM
									0.40m			
								Cl-CH	Silty CLAY: medium to high plasticity, dark grey mottled orange, with medium to coarse sand	D to M	St to VSt	
						1.0			1.00m			
						1.5			TERMINATED AT 1.00 m EOH: Terminated at 1.00m (target depth) EXCAVATION: CAT 305C Excavator with 300mm standard tooth bucket STABILITY: Stable BACKFILL: Arisings compacted in layers with nominal bucket pressure and tracked in at the surface 0.00-1.00m GROUNDWATER: Not Encountered PHOTOS: Yes INSITU TESTING: DCP to refusal (0.00-0.18m) ADDITIONAL NOTES:			
						2.0						
						2.5						

METHOD
EX Excavator bucket
R Ripper
HA Hand auger
PT Push tube
SON Sonic drilling
AH Air hammer
PS Percussion sampler
AS Short spiral auger
AD/V Solid flight auger: V-Bit
AD/T Solid flight auger: TC-Bit
HFA Hollow flight auger
WB Washbore drilling
RR Rock roller

PENETRATION
VE Very Easy (No Resistance)
E Easy
F Firm
H Hard
VH Very Hard (Refusal)

WATER
Water Level on Date shown
water inflow
water outflow

FIELD TESTS
SPT - Standard Penetration Test
HP - Hand/Pocket Penetrometer
DCP - Dynamic Cone Penetrometer
PSP - Perth Sand Penetrometer
MC - Moisture Content
PBT - Plate Bearing Test
IMP - Borehole Impression Test
PID - Photoionisation Detector
VS - Vane Shear; P=Peak, R=Resdual (uncorrected kPa)

SAMPLES
B - Bulk disturbed sample
D - Disturbed sample
ES - Environmental sample
U - Thin wall tube 'undisturbed'

MOISTURE
D - Dry
M - Moist
W - Wet
PL - Plastic limit
LL - Liquid limit
w - Moisture content

SOIL CONSISTENCY
VS - Very Soft
S - Soft
F - Firm
St - Stiff
VSt - Very Stiff
H - Hard

RELATIVE DENSITY
VL - Very Loose
L - Loose
MD - Medium Dense
D - Dense
VD - Very Dense

Refer to explanatory notes for details of abbreviations and basis of descriptions

CARDNO (NSW/ACT) PTY LTD

TEST PIT LOG SHEET

Client: QPRC
Project: QPRCSC
Location: QPRCSC, Nr. Hume NSW

Hole No: TP103

Job No: 50520049 **Sheet:** 1 of 1

Position: 55H 697908 6081864 **Angle from Horizontal:** 90° **Surface Elevation:**

Machine Type: 5t CAT Excavator **Excavation Method:** 300mm Standard tooth bucket

Excavation Dimensions: 1.80m LONG AND 0.40m WIDE **DIRECTION :** 090° **Contractor:** AJD C&D

Date Excavated: 15/1/20 **Logged By:** JIA **Checked By:** DR

Excavation			Water	Sampling & Testing		Depth (m)	Material Description					
Method	Resistance	Stability		Sample or Field Test	DCP (blows per 100 mm) 1 3 6 12		Graphic Log	Classification	SOIL TYPE, plasticity or particle characteristic, colour, secondary and minor components ROCK TYPE, grain size and type, colour, fabric & texture, strength, weathering, defects and structure	Moisture Condition	Consistency Relative Density	STRUCTURE & Other Observations
EX	E-F	Stable	Dry	D 0.20 - 0.30 m	R	0.10m		ML	Sandy SILT: low plasticity, light brown, fine to coarse sand, frequent rootlets (<2mm)	D	F to St	TOPSOIL
						0.40m		ML	Sandy SILT: low plasticity, light brown, fine to medium sand	D	St to VSt	ALLUVIUM
				D 0.50 - 0.60 m		0.50m		SM	Silty SAND: fine to coarse grained, brown	D	MD to D	
						1.00m		CI-CH	Silty CLAY: medium to high plasticity, dark grey	D	St to VSt	
						1.0			TERMINATED AT 1.00 m EOH: Terminated at 1.00m (target depth) EXCAVATION: CAT 305C Excavator with 300mm standard tooth bucket STABILITY: Stable BACKFILL: Arisings compacted in layers with nominal bucket pressure and tracked in at the surface 0.00-1.00m GROUNDWATER: Not Encountered PHOTOS: Yes INSITU TESTING: DCP to refusal (0.00-0.22m) ADDITIONAL NOTES:			
						1.5						
						2.0						
						2.5						

METHOD
- EX Excavator bucket
- R Ripper
- HA Hand auger
- PT Push tube
- SON Sonic drilling
- AH Air hammer
- PS Percussion sampler
- AS Short spiral auger
- AD/V Solid flight auger: V-Bit
- AD/T Solid flight auger: TC-Bit
- HFA Hollow flight auger
- WB Washbore drilling
- RR Rock roller

PENETRATION
- VE Very Easy (No Resistance)
- E Easy
- F Firm
- H Hard
- VH Very Hard (Refusal)

WATER
- Water Level on Date shown
- water inflow
- water outflow

FIELD TESTS
- SPT - Standard Penetration Test
- HP - Hand/Pocket Penetrometer
- DCP - Dynamic Cone Penetrometer
- PSP - Perth Sand Penetrometer
- MC - Moisture Content
- PBT - Plate Bearing Test
- IMP - Borehole Impression Test
- PID - Photoionisation Detector
- VS - Vane Shear; P=Peak, R=Resdual (uncorrected kPa)

SAMPLES
- B - Bulk disturbed sample
- D - Disturbed sample
- ES - Environmental sample
- U - Thin wall tube 'undisturbed'

MOISTURE
- D - Dry
- M - Moist
- W - Wet
- PL - Plastic limit
- LL - Liquid limit
- *w* - Moisture content

SOIL CONSISTENCY
- VS - Very Soft
- S - Soft
- F - Firm
- St - Stiff
- VSt - Very Stiff
- H - Hard

RELATIVE DENSITY
- VL - Very Loose
- L - Loose
- MD - Medium Dense
- D - Dense
- VD - Very Dense

Refer to explanatory notes for details of abbreviations and basis of descriptions

CARDNO (NSW/ACT) PTY LTD

TEST PIT LOG SHEET

Client: QPRC
Project: QPRCSC
Location: QPRCSC, Nr. Hume NSW

Hole No: TP104

Job No: 50520049 **Sheet:** 1 of 1

Position: 55H 697963 6081900 **Angle from Horizontal:** 90° **Surface Elevation:**

Machine Type: 5t CAT Excavator **Excavation Method:** 300mm Standard tooth bucket

Excavation Dimensions: 2.10m LONG AND 0.40m WIDE **DIRECTION :** 090° **Contractor:** AJD C&D

Date Excavated: 15/1/20 **Logged By:** JIA **Checked By:** DR

Excavation			Water	Sampling & Testing		Depth (m)	Material Description					
Method	Resistance	Stability		Sample or Field Test	DCP (blows per 100 mm) 1 3 6 12		Graphic Log	Classification	SOIL TYPE, plasticity or particle characteristic, colour, secondary and minor components ROCK TYPE, grain size and type, colour, fabric & texture, strength, weathering, defects and structure	Moisture Condition	Consistency Relative Density	STRUCTURE & Other Observations
EX	E-F	Stable	Dry			0.0		ML	0.10m Sandy SILT: low plasticity, brown, fine to medium sand, frequent rootlets (<2mm)	D	F to St	TOPSOIL
				D 0.20 - 0.30 m				ML	Sandy SILT: low plasticity, brown, fine to coarse sand	D	St to VSt	ALLUVIUM
						0.5		SM	0.45m Silty SAND: fine to coarse grained, brown mottled orange 0.60m	D	MD to D	
				D 0.60 - 0.70 m				CI-CH	Silty CLAY: medium to high plasticity, grey/dark grey 1.00m	D	F to St	
						1.0			TERMINATED AT 1.00 m EOH: Terminated at 1.00m (target depth) EXCAVATION: CAT 305C Excavator with 300mm standard tooth bucket STABILITY: Stable BACKFILL: Arisings compacted in layers with nominal bucket pressure and tracked in at the surface 0.00-1.00m GROUNDWATER: Not Encountered PHOTOS: Yes INSITU TESTING: DCP to termination (0.00-1.00m) ADDITIONAL NOTES:			
						1.5						
						2.0						
						2.5						

METHOD
- EX Excavator bucket
- R Ripper
- HA Hand auger
- PT Push tube
- SON Sonic drilling
- AH Air hammer
- PS Percussion sampler
- AS Short spiral auger
- AD/V Solid flight auger: V-Bit
- AD/T Solid flight auger: TC-Bit
- HFA Hollow flight auger
- WB Washbore drilling
- RR Rock roller

PENETRATION
- VE Very Easy (No Resistance)
- E Easy
- F Firm
- H Hard
- VH Very Hard (Refusal)

WATER
- Water Level on Date shown
- water inflow
- water outflow

FIELD TESTS
- SPT - Standard Penetration Test
- HP - Hand/Pocket Penetrometer
- DCP - Dynamic Cone Penetrometer
- PSP - Perth Sand Penetrometer
- MC - Moisture Content
- PBT - Plate Bearing Test
- IMP - Borehole Impression Test
- PID - Photoionisation Detector
- VS - Vane Shear; P=Peak, R=Resdual (uncorrected kPa)

SAMPLES
- B - Bulk disturbed sample
- D - Disturbed sample
- ES - Environmental sample
- U - Thin wall tube 'undisturbed'

MOISTURE
- D - Dry
- M - Moist
- W - Wet
- PL - Plastic limit
- LL - Liquid limit
- *w* - Moisture content

SOIL CONSISTENCY
- VS - Very Soft
- S - Soft
- F - Firm
- St - Stiff
- VSt - Very Stiff
- H - Hard

RELATIVE DENSITY
- VL - Very Loose
- L - Loose
- MD - Medium Dense
- D - Dense
- VD - Very Dense

Refer to explanatory notes for details of abbreviations and basis of descriptions

CARDNO (NSW/ACT) PTY LTD

TEST PIT LOG SHEET

Client: QPRC
Project: QPRCSC
Location: QPRCSC, Nr. Hume NSW

Hole No: TP105

Job No: 50520049 **Sheet:** 1 of 1

Position: 55H 697965 6081812 **Angle from Horizontal:** 90° **Surface Elevation:**

Machine Type: 5t CAT Excavator **Excavation Method:** 300mm Standard tooth bucket

Excavation Dimensions: 2.00m LONG AND 0.40m WIDE **DIRECTION :** 090° **Contractor:** AJD C&D

Date Excavated: 15/1/20 **Logged By:** JIA **Checked By:** DR

Excavation			Water	Sampling & Testing	Depth (m)	Material Description					
Method	Resistance	Stability		Sample or Field Test		Graphic Log	Classification	SOIL TYPE, plasticity or particle characteristic, colour, secondary and minor components ROCK TYPE, grain size and type, colour, fabric & texture, strength, weathering, defects and structure	Moisture Condition	Consistency Relative Density	STRUCTURE & Other Observations
EX	E-F	Stable	Dry		0		ML	Sandy SILT: low plasticity, brown, fine to coarse sand	D	F to St	TOPSOIL
					0.10m		SM	Silty SAND: fine to coarse grained, brown, trace medium to coarse, sub-rounded gravel	D	MD to D	ALLUVIUM
				D 0.30 - 0.40 m	0.25m		Cl	Silty CLAY: medium plasticity, dark brown/grey mottled orange, trace fine sand	D	St to VSt	
				D 0.50 - 0.60 m	0.5		Cl-CH	Silty CLAY: medium to high plasticity, dark grey, trace fine to medium sand	D	St to VSt	
					0.50m						
					1.00m			TERMINATED AT 1.00 m EOH: Terminated at 1.00m (target depth) EXCAVATION: CAT 305C Excavator with 300mm standard tooth bucket STABILITY: Stable BACKFILL: Arisings compacted in layers with nominal bucket pressure and tracked in at the surface 0.00-1.00m GROUNDWATER: Not Encountered PHOTOS: Yes INSITU TESTING: DCP not undertaken ADDITIONAL NOTES:			
					1.0						
					1.5						
					2.0						
					2.5						

METHOD
- EX Excavator bucket
- R Ripper
- HA Hand auger
- PT Push tube
- SON Sonic drilling
- AH Air hammer
- PS Percussion sampler
- AS Short spiral auger
- AD/V Solid flight auger: V-Bit
- AD/T Solid flight auger: TC-Bit
- HFA Hollow flight auger
- WB Washbore drilling
- RR Rock roller

PENETRATION
- VE Very Easy (No Resistance)
- E Easy
- F Firm
- H Hard
- VH Very Hard (Refusal)

WATER
- Water Level on Date shown
- water inflow
- water outflow

FIELD TESTS
- SPT - Standard Penetration Test
- HP - Hand/Pocket Penetrometer
- DCP - Dynamic Cone Penetrometer
- PSP - Perth Sand Penetrometer
- MC - Moisture Content
- PBT - Plate Bearing Test
- IMP - Borehole Impression Test
- PID - Photoionisation Detector
- VS - Vane Shear; P=Peak, R=Resdual (uncorrected kPa)

SAMPLES
- B - Bulk disturbed sample
- D - Disturbed sample
- ES - Environmental sample
- U - Thin wall tube 'undisturbed'

MOISTURE
- D - Dry
- M - Moist
- W - Wet
- PL - Plastic limit
- LL - Liquid limit
- *w* - Moisture content

SOIL CONSISTENCY
- VS - Very Soft
- S - Soft
- F - Firm
- St - Stiff
- VSt - Very Stiff
- H - Hard

RELATIVE DENSITY
- VL - Very Loose
- L - Loose
- MD - Medium Dense
- D - Dense
- VD - Very Dense

Refer to explanatory notes for details of abbreviations and basis of descriptions

CARDNO (NSW/ACT) PTY LTD

TEST PIT LOG SHEET

Client: QPRC
Project: QPRCSC
Location: QPRCSC, Nr. Hume NSW

Hole No: TP105A

Job No: 50520049 **Sheet:** 1 of 1

Position: 55H 697948 6081728 **Angle from Horizontal:** 90° **Surface Elevation:**

Machine Type: 5t CAT Excavator **Excavation Method:** 300mm Standard tooth bucket

Excavation Dimensions: 2.10m LONG AND 0.40m WIDE **DIRECTION :** 090° **Contractor:** AJD C&D

Date Excavated: 16/1/20 **Logged By:** JIA **Checked By:** DR

Excavation			Water	Sampling & Testing		Depth (m)	Material Description					
Method	Resistance	Stability		Sample or Field Test	DCP (blows per 100 mm) 1 3 6 12		Graphic Log	Classification	SOIL TYPE, plasticity or particle characteristic, colour, secondary and minor components ROCK TYPE, grain size and type, colour, fabric & texture, strength, weathering, defects and structure	Moisture Condition	Consistency Relative Density	STRUCTURE & Other Observations
EX	E-F	Stable	Dry	D 0.30 - 0.40 m	R	0.12m		SM	Silty SAND: fine to coarse grained, light brown, frequent rootlets (<2mm)	D	MD to D	TOPSOIL
						0.30m		SM	Silty SAND: fine to coarse grained, brown	D	D to VD	ALLUVIUM
				D 0.70 - 0.80 m		0.50m		ML	Sandy SILT: low plasticity, brown, fine to medium sand	D to M (<PL)	St to VSt	
						1.00m		CI-CH	Silty CLAY: medium to high plasticity, dark brown mottled orange, trace fine sand	M (<PL)	St to VSt	
						1.0			TERMINATED AT 1.00 m EOH: Terminated at 1.00m (target depth) EXCAVATION: CAT 305C Excavator with 300mm standard tooth bucket STABILITY: Stable BACKFILL: Arisings compacted in layers with nominal bucket pressure and tracked in at the surface 0.00-1.00m GROUNDWATER: Not Encountered PHOTOS: Yes INSITU TESTING: DCP to refusal (0.00-0.13m) ADDITIONAL NOTES:			
						0.5						
						1.5						
						2.0						
						2.5						

METHOD
- EX Excavator bucket
- R Ripper
- HA Hand auger
- PT Push tube
- SON Sonic drilling
- AH Air hammer
- PS Percussion sampler
- AS Short spiral auger
- AD/V Solid flight auger: V-Bit
- AD/T Solid flight auger: TC-Bit
- HFA Hollow flight auger
- WB Washbore drilling
- RR Rock roller

PENETRATION
- VE Very Easy (No Resistance)
- E Easy
- F Firm
- H Hard
- VH Very Hard (Refusal)

WATER
- Water Level on Date shown
- water inflow
- water outflow

FIELD TESTS
- SPT - Standard Penetration Test
- HP - Hand/Pocket Penetrometer
- DCP - Dynamic Cone Penetrometer
- PSP - Perth Sand Penetrometer
- MC - Moisture Content
- PBT - Plate Bearing Test
- IMP - Borehole Impression Test
- PID - Photoionisation Detector
- VS - Vane Shear; P=Peak, R=Resdual (uncorrected kPa)

SAMPLES
- B - Bulk disturbed sample
- D - Disturbed sample
- ES - Environmental sample
- U - Thin wall tube 'undisturbed'

MOISTURE
- D - Dry
- M - Moist
- W - Wet
- PL - Plastic limit
- LL - Liquid limit
- *w* - Moisture content

SOIL CONSISTENCY
- VS - Very Soft
- S - Soft
- F - Firm
- St - Stiff
- VSt - Very Stiff
- H - Hard

RELATIVE DENSITY
- VL - Very Loose
- L - Loose
- MD - Medium Dense
- D - Dense
- VD - Very Dense

Refer to explanatory notes for details of abbreviations and basis of descriptions

CARDNO (NSW/ACT) PTY LTD

TEST PIT LOG SHEET

Client: QPRC
Project: QPRCSC
Location: QPRCSC, Nr. Hume NSW

Hole No: TP106

Job No: 50520049 **Sheet:** 1 of 1

Position: 55H 698039 6081732 **Angle from Horizontal:** 90° **Surface Elevation:**

Machine Type: 5t CAT Excavator **Excavation Method:** 300mm Standard tooth bucket

Excavation Dimensions: 2.20m LONG AND 0.40m WIDE **DIRECTION :** 090° **Contractor:** AJD C&D

Date Excavated: 15/1/20 **Logged By:** JIA **Checked By:** DR

Excavation			Water	Sampling & Testing		Depth (m)	Material Description					
Method	Resistance	Stability		Sample or Field Test	DCP (blows per 100 mm) 1 3 6 12		Graphic Log	Classification	SOIL TYPE, plasticity or particle characteristic, colour, secondary and minor components ROCK TYPE, grain size and type, colour, fabric & texture, strength, weathering, defects and structure	Moisture Condition	Consistency Relative Density	STRUCTURE & Other Observations
EX	E-F	Stable	Dry					SM	Silty SAND: fine to coarse grained, brown, frequent rootlets (<2mm) 0.10m	D	MD to D	TOPSOIL
								SM	Silty SAND: fine to coarse grained, brown, trace fine, sub-rounded gravel 0.30m	D	D to VD	ALLUVIUM
				D 0.30 - 0.40 m		0.5		ML	Clayey SILT: low plasticity, dark brown/grey, trace fine sand 0.60m	D	VSt	
				D 0.70 - 0.80 m				CI-CH	Silty CLAY: medium to high plasticity, dark grey, with fine to medium sand 1.00m	D to M	VSt	
						1.0			TERMINATED AT 1.00 m EOH: Terminated at 1.00m (target depth) EXCAVATION: CAT 305C Excavator with 300mm standard tooth bucket STABILITY: Stable BACKFILL: Arisings compacted in layers with nominal bucket pressure and tracked in at the surface 0.00-1.00m GROUNDWATER: Not Encountered PHOTOS: Yes INSITU TESTING: DCP to termination (0.00-1.00m) ADDITIONAL NOTES:			
						1.5						
						2.0						
						2.5						

METHOD
- EX Excavator bucket
- R Ripper
- HA Hand auger
- PT Push tube
- SON Sonic drilling
- AH Air hammer
- PS Percussion sampler
- AS Short spiral auger
- AD/V Solid flight auger: V-Bit
- AD/T Solid flight auger: TC-Bit
- HFA Hollow flight auger
- WB Washbore drilling
- RR Rock roller

PENETRATION
- VE Very Easy (No Resistance)
- E Easy
- F Firm
- H Hard
- VH Very Hard (Refusal)

WATER
- Water Level on Date shown
- water inflow
- water outflow

FIELD TESTS
- SPT - Standard Penetration Test
- HP - Hand/Pocket Penetrometer
- DCP - Dynamic Cone Penetrometer
- PSP - Perth Sand Penetrometer
- MC - Moisture Content
- PBT - Plate Bearing Test
- IMP - Borehole Impression Test
- PID - Photoionisation Detector
- VS - Vane Shear; P=Peak, R=Resdual (uncorrected kPa)

SAMPLES
- B - Bulk disturbed sample
- D - Disturbed sample
- ES - Environmental sample
- U - Thin wall tube 'undisturbed'

MOISTURE
- D - Dry
- M - Moist
- W - Wet
- PL - Plastic limit
- LL - Liquid limit
- *w* - Moisture content

SOIL CONSISTENCY
- VS - Very Soft
- S - Soft
- F - Firm
- St - Stiff
- VSt - Very Stiff
- H - Hard

RELATIVE DENSITY
- VL - Very Loose
- L - Loose
- MD - Medium Dense
- D - Dense
- VD - Very Dense

Refer to explanatory notes for details of abbreviations and basis of descriptions

CARDNO (NSW/ACT) PTY LTD

TEST PIT LOG SHEET

Client: QPRC
Project: QPRCSC
Location: QPRCSC, Nr. Hume NSW

Hole No: TP107

Job No: 50520049 **Sheet:** 1 of 1

Position: 55H 698130 6081547 **Angle from Horizontal:** 90° **Surface Elevation:**

Machine Type: 5t CAT Excavator **Excavation Method:** 300mm Standard tooth bucket

Excavation Dimensions: 1.80m LONG AND 0.40m WIDE **DIRECTION :** 090° **Contractor:** AJD C&D

Date Excavated: 15/1/20 **Logged By:** JIA **Checked By:** DR

Excavation			Water	Sampling & Testing		Depth (m)	Material Description					
Method	Resistance	Stability		Sample or Field Test	DCP (blows per 100 mm) 1 3 6 12		Graphic Log	Classification	SOIL TYPE, plasticity or particle characteristic, colour, secondary and minor components ROCK TYPE, grain size and type, colour, fabric & texture, strength, weathering, defects and structure	Moisture Condition	Consistency Relative Density	STRUCTURE & Other Observations
EX	E-F	Stable	Dry	D 0.20 - 0.30 m	R	0.5		SM	0.08m Silty SAND: fine to coarse grained, brown, frequent rootlets (<2mm)	D	L to MD	TOPSOIL
								GM	0.18m Sandy GRAVEL: fine to medium, light brown	D	MD to D	ALLUVIUM
								CI-CH	Silty CLAY: medium to high plasticity, dark grey, trace fine to medium sand	D	St to VSt	
								SM	0.60m Silty SAND: fine to medium grained, grey mottled white 0.70m	D	D to MD	
				D 0.80 - 1.00 m		1.0		CI-CH	Silty CLAY: medium to high plasticity, dark grey, with fine to medium sand 1.00m	D to M	St to VSt	
						1.5			TERMINATED AT 1.00 m EOH: Terminated at 1.00m (target depth) EXCAVATION: CAT 305C Excavator with 300mm standard tooth bucket STABILITY: Stable BACKFILL: Arisings compacted in layers with nominal bucket pressure and tracked in at the surface 0.00-1.00m GROUNDWATER: Not Encountered PHOTOS: Yes INSITU TESTING: DCP to refusal (0.00-0.15m) ADDITIONAL NOTES:			
						2.0						
						2.5						

METHOD
- EX Excavator bucket
- R Ripper
- HA Hand auger
- PT Push tube
- SON Sonic drilling
- AH Air hammer
- PS Percussion sampler
- AS Short spiral auger
- AD/V Solid flight auger: V-Bit
- AD/T Solid flight auger: TC-Bit
- HFA Hollow flight auger
- WB Washbore drilling
- RR Rock roller

PENETRATION
- VE Very Easy (No Resistance)
- E Easy
- F Firm
- H Hard
- VH Very Hard (Refusal)

WATER
- Water Level on Date shown
- water inflow
- water outflow

FIELD TESTS
- SPT - Standard Penetration Test
- HP - Hand/Pocket Penetrometer
- DCP - Dynamic Cone Penetrometer
- PSP - Perth Sand Penetrometer
- MC - Moisture Content
- PBT - Plate Bearing Test
- IMP - Borehole Impression Test
- PID - Photoionisation Detector
- VS - Vane Shear; P=Peak, R=Resdual (uncorrected kPa)

SAMPLES
- B - Bulk disturbed sample
- D - Disturbed sample
- ES - Environmental sample
- U - Thin wall tube 'undisturbed'

MOISTURE
- D - Dry
- M - Moist
- W - Wet
- PL - Plastic limit
- LL - Liquid limit
- *w* - Moisture content

SOIL CONSISTENCY
- VS - Very Soft
- S - Soft
- F - Firm
- St - Stiff
- VSt - Very Stiff
- H - Hard

RELATIVE DENSITY
- VL - Very Loose
- L - Loose
- MD - Medium Dense
- D - Dense
- VD - Very Dense

Refer to explanatory notes for details of abbreviations and basis of descriptions

CARDNO (NSW/ACT) PTY LTD

Cardno

TEST PIT LOG SHEET

Client: QPRC
Project: QPRCSC
Location: QPRCSC, Nr. Hume NSW

Hole No: TP108

Job No: 50520049 **Sheet:** 1 of 1

Position: 55H 698240 6081530 **Angle from Horizontal:** 90° **Surface Elevation:**

Machine Type: 5t CAT Excavator **Excavation Method:** 300mm Standard tooth bucket

Excavation Dimensions: 1.80m LONG AND 0.40m WIDE **DIRECTION :** 090° **Contractor:** AJD C&D

Date Excavated: 15/1/20 **Logged By:** JIA **Checked By:** DR

Excavation			Water	Sampling & Testing		Depth (m)	Material Description					
Method	Resistance	Stability		Sample or Field Test	DCP (blows per 100 mm) 1 3 6 12		Graphic Log	Classification	SOIL TYPE, plasticity or particle characteristic, colour, secondary and minor components ROCK TYPE, grain size and type, colour, fabric & texture, strength, weathering, defects and structure	Moisture Condition	Consistency Relative Density	STRUCTURE & Other Observations
EX	E-F	Stable	Dry	D 0.20 - 0.30 m	R	0.1		ML	0.10m Sandy SILT: low plasticity, brown, fine to medium sand	D	F to St	TOPSOIL
								ML	Sandy SILT: low plasticity, brown, fine to medium sand 0.30m	D	St to VSt	ALLUVIUM
								SC	0.40m Clayey SAND: fine to coarse grained, dark grey/black, medium plasticity clay	D to M	MD to D	
				D 0.80 - 1.00 m		0.5		CI-CH	Silty CLAY: medium to high plasticity, grey/black, with fine sand 0.8m: Becoming brown mottled yellow 1.00m	D to M	F to St	
						1.0			TERMINATED AT 1.00 m EOH: Terminated at 1.00m (target depth) EXCAVATION: CAT 305C Excavator with 300mm standard tooth bucket STABILITY: Stable BACKFILL: Arisings compacted in layers with nominal bucket pressure and tracked in at the surface 0.00-1.00m GROUNDWATER: Not Encountered PHOTOS: Yes INSITU TESTING: DCP to refusal (0.00-0.18m) ADDITIONAL NOTES:			
						1.5						
						2.0						
						2.5						

METHOD
EX Excavator bucket
R Ripper
HA Hand auger
PT Push tube
SON Sonic drilling
AH Air hammer
PS Percussion sampler
AS Short spiral auger
AD/V Solid flight auger: V-Bit
AD/T Solid flight auger: TC-Bit
HFA Hollow flight auger
WB Washbore drilling
RR Rock roller

PENETRATION
VE Very Easy (No Resistance)
E Easy
F Firm
H Hard
VH Very Hard (Refusal)

WATER
Water Level on Date shown
water inflow
water outflow

FIELD TESTS
SPT - Standard Penetration Test
HP - Hand/Pocket Penetrometer
DCP - Dynamic Cone Penetrometer
PSP - Perth Sand Penetrometer
MC - Moisture Content
PBT - Plate Bearing Test
IMP - Borehole Impression Test
PID - Photoionisation Detector
VS - Vane Shear; P=Peak, R=Resdual (uncorrected kPa)

SAMPLES
B - Bulk disturbed sample
D - Disturbed sample
ES - Environmental sample
U - Thin wall tube 'undisturbed'

MOISTURE
D - Dry
M - Moist
W - Wet
PL - Plastic limit
LL - Liquid limit
w - Moisture content

SOIL CONSISTENCY
VS - Very Soft
S - Soft
F - Firm
St - Stiff
VSt - Very Stiff
H - Hard

RELATIVE DENSITY
VL - Very Loose
L - Loose
MD - Medium Dense
D - Dense
VD - Very Dense

Refer to explanatory notes for details of abbreviations and basis of descriptions

CARDNO (NSW/ACT) PTY LTD

TEST PIT LOG SHEET

Client: QPRC
Project: QPRCSC
Location: QPRCSC, Nr. Hume NSW

Hole No: TP109

Job No: 50520049 **Sheet:** 1 of 1

Position: 55H 698173 6081449 **Angle from Horizontal:** 90° **Surface Elevation:**

Machine Type: 5t CAT Excavator **Excavation Method:** 300mm Standard tooth bucket

Excavation Dimensions: 1.90m LONG AND 0.40m WIDE **DIRECTION :** 090° **Contractor:** AJD C&D

Date Excavated: 15/1/20 **Logged By:** JIA **Checked By:** DR

Excavation			Water	Sampling & Testing		Depth (m)	Material Description					
Method	Resistance	Stability		Sample or Field Test	DCP (blows per 100 mm) 1 3 6 12		Graphic Log	Classification	SOIL TYPE, plasticity or particle characteristic, colour, secondary and minor components ROCK TYPE, grain size and type, colour, fabric & texture, strength, weathering, defects and structure	Moisture Condition	Consistency Relative Density	STRUCTURE & Other Observations
EX	E-F	Stable	Dry	D 0.20 - 0.30 m		0.5		ML	Sandy SILT: low plasticity, brown, fine to coarse sand, frequent rootlets (<2mm) 0.12m	D	F to St	TOPSOIL
								ML	Sandy SILT: low to medium plasticity, brown, fine to coarse sand 0.30m	D	St to VSt	ALLUVIUM
								SM	Silty SAND: fine to coarse grained, brown mottled orange 0.60m	D	MD to D	
						1.0		CI-CH	Silty CLAY: medium to high plasticity, dark grey/black, trace fine to medium sand 1.00m	D to M (<PL)	VSt	
									TERMINATED AT 1.00 m EOH: Terminated at 1.00m (target depth) EXCAVATION: CAT 305C Excavator with 300mm standard tooth bucket STABILITY: Stable BACKFILL: Arisings compacted in layers with nominal bucket pressure and tracked in at the surface 0.00-1.00m GROUNDWATER: Not Encountered PHOTOS: Yes INSITU TESTING: DCP to termination (0.00-1.00m) ADDITIONAL NOTES:			
						1.5						
						2.0						
						2.5						

METHOD
- EX Excavator bucket
- R Ripper
- HA Hand auger
- PT Push tube
- SON Sonic drilling
- AH Air hammer
- PS Percussion sampler
- AS Short spiral auger
- AD/V Solid flight auger: V-Bit
- AD/T Solid flight auger: TC-Bit
- HFA Hollow flight auger
- WB Washbore drilling
- RR Rock roller

PENETRATION
- VE Very Easy (No Resistance)
- E Easy
- F Firm
- H Hard
- VH Very Hard (Refusal)

WATER
- Water Level on Date shown
- water inflow
- water outflow

FIELD TESTS
- SPT - Standard Penetration Test
- HP - Hand/Pocket Penetrometer
- DCP - Dynamic Cone Penetrometer
- PSP - Perth Sand Penetrometer
- MC - Moisture Content
- PBT - Plate Bearing Test
- IMP - Borehole Impression Test
- PID - Photoionisation Detector
- VS - Vane Shear; P=Peak, R=Resdual (uncorrected kPa)

SAMPLES
- B - Bulk disturbed sample
- D - Disturbed sample
- ES - Environmental sample
- U - Thin wall tube 'undisturbed'

MOISTURE
- D - Dry
- M - Moist
- W - Wet
- PL - Plastic limit
- LL - Liquid limit
- *w* - Moisture content

SOIL CONSISTENCY
- VS - Very Soft
- S - Soft
- F - Firm
- St - Stiff
- VSt - Very Stiff
- H - Hard

RELATIVE DENSITY
- VL - Very Loose
- L - Loose
- MD - Medium Dense
- D - Dense
- VD - Very Dense

Refer to explanatory notes for details of abbreviations and basis of descriptions

CARDNO (NSW/ACT) PTY LTD

TEST PIT LOG SHEET

Client: QPRC
Project: QPRCSC
Location: QPRCSC, Nr. Hume NSW

Hole No: TP110

Job No: 50520049 **Sheet:** 1 of 1

Position: 55H 698256 6081434 **Angle from Horizontal:** 90° **Surface Elevation:**

Machine Type: 5t CAT Excavator **Excavation Method:** 300mm Standard tooth bucket

Excavation Dimensions: 2.00m LONG AND 0.40m WIDE **DIRECTION :** 090° **Contractor:** AJD C&D

Date Excavated: 15/1/20 **Logged By:** JIA **Checked By:** DR

Excavation			Water	Sampling & Testing		Depth (m)	Material Description					
Method	Resistance	Stability		Sample or Field Test	DCP (blows per 100 mm) 1 3 6 12		Graphic Log	Classification	SOIL TYPE, plasticity or particle characteristic, colour, secondary and minor components ROCK TYPE, grain size and type, colour, fabric & texture, strength, weathering, defects and structure	Moisture Condition	Consistency Relative Density	STRUCTURE & Other Observations
EX	E-F	Stable	Dry			0		ML	Sandy SILT: low plasticity, brown, fine to coarse sand, frequent rootlets (<2mm)	D	S to F	TOPSOIL
						0.12m		ML	Clayey SILT: low to medium plasticity, dark brown, trace fine sand	D	St to VSt	ALLUVIUM
				D 0.30 - 0.40 m		0.40m						
				0.70 - 0.80 m		0.5		CH	Silty CLAY: high plasticity, dark grey, trace fine sand	M (<PL)	St to VSt	
						1.00m			TERMINATED AT 1.00 m EOH: Terminated at 1.00m (target depth) EXCAVATION: CAT 305C Excavator with 300mm standard tooth bucket STABILITY: Stable BACKFILL: Arisings compacted in layers with nominal bucket pressure and tracked in at the surface 0.00-1.00m GROUNDWATER: Not Encountered PHOTOS: Yes INSITU TESTING: DCP to termination (0.00-1.00m) ADDITIONAL NOTES:			
						1.0						
						1.5						
						2.0						
						2.5						

METHOD
- EX Excavator bucket
- R Ripper
- HA Hand auger
- PT Push tube
- SON Sonic drilling
- AH Air hammer
- PS Percussion sampler
- AS Short spiral auger
- AD/V Solid flight auger: V-Bit
- AD/T Solid flight auger: TC-Bit
- HFA Hollow flight auger
- WB Washbore drilling
- RR Rock roller

PENETRATION
- VE Very Easy (No Resistance)
- E Easy
- F Firm
- H Hard
- VH Very Hard (Refusal)

WATER
- Water Level on Date shown
- water inflow
- water outflow

FIELD TESTS
- SPT - Standard Penetration Test
- HP - Hand/Pocket Penetrometer
- DCP - Dynamic Cone Penetrometer
- PSP - Perth Sand Penetrometer
- MC - Moisture Content
- PBT - Plate Bearing Test
- IMP - Borehole Impression Test
- PID - Photoionisation Detector
- VS - Vane Shear; P=Peak, R=Resdual (uncorrected kPa)

SAMPLES
- B - Bulk disturbed sample
- D - Disturbed sample
- ES - Environmental sample
- U - Thin wall tube 'undisturbed'

MOISTURE
- D - Dry
- M - Moist
- W - Wet
- PL - Plastic limit
- LL - Liquid limit
- *w* - Moisture content

SOIL CONSISTENCY
- VS - Very Soft
- S - Soft
- F - Firm
- St - Stiff
- VSt - Very Stiff
- H - Hard

RELATIVE DENSITY
- VL - Very Loose
- L - Loose
- MD - Medium Dense
- D - Dense
- VD - Very Dense

Refer to explanatory notes for details of abbreviations and basis of descriptions

CARDNO (NSW/ACT) PTY LTD

TEST PIT LOG SHEET

Client: QPRC
Project: QPRCSC
Location: QPRCSC, Nr. Hume NSW

Hole No: TP201

Job No: 50520049 **Sheet:** 1 of 1

Position: 55H 697873 6081657 **Angle from Horizontal:** 90° **Surface Elevation:**

Machine Type: 5t CAT Excavator **Excavation Method:** 300mm Standard tooth bucket

Excavation Dimensions: 2.30m LONG AND 0.40m WIDE **DIRECTION :** 090° **Contractor:** AJD C&D

Date Excavated: 16/1/20 **Logged By:** JIA **Checked By:** DR

Excavation: Method	Excavation: Resistance	Excavation: Stability	Water	Sampling & Testing: Sample or Field Test	Depth (m)	Graphic Log	Classification	Material Description: SOIL TYPE, plasticity or particle characteristic, colour, secondary and minor components ROCK TYPE, grain size and type, colour, fabric & texture, strength, weathering, defects and structure	Moisture Condition	Consistency Relative Density	STRUCTURE & Other Observations
EX	E-F	Stable	Dry		0		ML	Sandy SILT: low plasticity, light brown, fine to medium sand, frequent rootlets (<2mm)	D	S to F	TOPSOIL
					0.13m						
				D 0.20 - 0.30 m			ML	Sandy SILT: low to medium plasticity, light brown, fine to medium sand	D	F to St	ALLUVIUM
					0.50m						
				D 0.60 - 0.70 m	0.5		CI	Silty CLAY: medium plasticity, dark brown, with fine sand	D to M (<PL)	St to VSt	
					1.0						
					1.50m						
					1.5			TERMINATED AT 1.50 m EOH: Terminated at 1.50m (target depth) EXCAVATION: CAT 305C Excavator with 300mm standard tooth bucket STABILITY: Stable BACKFILL: Arisings compacted in layers with nominal bucket pressure and tracked in at the surface 0.00-1.50m GROUNDWATER: Not Encountered PHOTOS: Yes INSITU TESTING: DCP not undertaken ADDITIONAL NOTES: Proposed service line			
					2.0						
					2.5						

METHOD
- EX Excavator bucket
- R Ripper
- HA Hand auger
- PT Push tube
- SON Sonic drilling
- AH Air hammer
- PS Percussion sampler
- AS Short spiral auger
- AD/V Solid flight auger: V-Bit
- AD/T Solid flight auger: TC-Bit
- HFA Hollow flight auger
- WB Washbore drilling
- RR Rock roller

PENETRATION
- VE Very Easy (No Resistance)
- E Easy
- F Firm
- H Hard
- VH Very Hard (Refusal)

WATER
- Water Level on Date shown
- water inflow
- water outflow

FIELD TESTS
- SPT - Standard Penetration Test
- HP - Hand/Pocket Penetrometer
- DCP - Dynamic Cone Penetrometer
- PSP - Perth Sand Penetrometer
- MC - Moisture Content
- PBT - Plate Bearing Test
- IMP - Borehole Impression Test
- PID - Photoionisation Detector
- VS - Vane Shear; P=Peak, R=Resdual (uncorrected kPa)

SAMPLES
- B - Bulk disturbed sample
- D - Disturbed sample
- ES - Environmental sample
- U - Thin wall tube 'undisturbed'

MOISTURE
- D - Dry
- M - Moist
- W - Wet
- PL - Plastic limit
- LL - Liquid limit
- *w* - Moisture content

SOIL CONSISTENCY
- VS - Very Soft
- S - Soft
- F - Firm
- St - Stiff
- VSt - Very Stiff
- H - Hard

RELATIVE DENSITY
- VL - Very Loose
- L - Loose
- MD - Medium Dense
- D - Dense
- VD - Very Dense

Refer to explanatory notes for details of abbreviations and basis of descriptions

CARDNO (NSW/ACT) PTY LTD

TEST PIT LOG SHEET

Client: QPRC
Project: QPRCSC
Location: QPRCSC, Nr. Hume NSW

Hole No: TP202

Job No: 50520049 **Sheet:** 1 of 1

Position: 55H 697967 6081632 **Angle from Horizontal:** 90° **Surface Elevation:**

Machine Type: 5t CAT Excavator **Excavation Method:** 300mm Standard tooth bucket

Excavation Dimensions: 2.10m LONG AND 0.40m WIDE **DIRECTION :** 090° **Contractor:** AJD C&D

Date Excavated: 16/1/20 **Logged By:** JIA **Checked By:** DR

Excavation: Method	Excavation: Resistance	Excavation: Stability	Water	Sampling & Testing: Sample or Field Test	Depth (m)	Graphic Log	Classification	Material Description: SOIL TYPE, plasticity or particle characteristic, colour, secondary and minor components ROCK TYPE, grain size and type, colour, fabric & texture, strength, weathering, defects and structure	Moisture Condition	Consistency Relative Density	STRUCTURE & Other Observations
EX	E-F	Stable	Dry		0		ML	Sandy SILT: low plasticity, brown, fine to coarse sand, frequent rootlets (<2mm)	D	S to F	TOPSOIL
					0.12m		SM	Silty SAND: fine to coarse grained, brown	D	L to MD	ALLUVIUM
				D 0.30 - 0.40 m	0.25m		ML	Sandy SILT: low plasticity, yellow brown, fine sand	D to M	St to VSt	
				D 0.80 - 0.90 m	0.5						
					0.70m		Cl-CH	Silty CLAY: medium to high plasticity, grey, with fine sand 1.0m: becoming orange brown	M (<PL)	St to VSt	
					1.0						
					1.50m			TERMINATED AT 1.50 m EOH: Terminated at 1.50m (target depth) EXCAVATION: CAT 305C Excavator with 300mm standard tooth bucket STABILITY: Stable BACKFILL: Arisings compacted in layers with nominal bucket pressure and tracked in at the surface 0.00-1.50m GROUNDWATER: Not Encountered PHOTOS: Yes INSITU TESTING: DCP not undertaken ADDITIONAL NOTES: Proposed service line			
					1.5						
					2.0						
					2.5						

METHOD
- EX Excavator bucket
- R Ripper
- HA Hand auger
- PT Push tube
- SON Sonic drilling
- AH Air hammer
- PS Percussion sampler
- AS Short spiral auger
- AD/V Solid flight auger: V-Bit
- AD/T Solid flight auger: TC-Bit
- HFA Hollow flight auger
- WB Washbore drilling
- RR Rock roller

PENETRATION
- VE Very Easy (No Resistance)
- E Easy
- F Firm
- H Hard
- VH Very Hard (Refusal)

WATER
- Water Level on Date shown
- water inflow
- water outflow

FIELD TESTS
- SPT - Standard Penetration Test
- HP - Hand/Pocket Penetrometer
- DCP - Dynamic Cone Penetrometer
- PSP - Perth Sand Penetrometer
- MC - Moisture Content
- PBT - Plate Bearing Test
- IMP - Borehole Impression Test
- PID - Photoionisation Detector
- VS - Vane Shear; P=Peak, R=Resdual (uncorrected kPa)

SAMPLES
- B - Bulk disturbed sample
- D - Disturbed sample
- ES - Environmental sample
- U - Thin wall tube 'undisturbed'

MOISTURE
- D - Dry
- M - Moist
- W - Wet
- PL - Plastic limit
- LL - Liquid limit
- *w* - Moisture content

SOIL CONSISTENCY
- VS - Very Soft
- S - Soft
- F - Firm
- St - Stiff
- VSt - Very Stiff
- H - Hard

RELATIVE DENSITY
- VL - Very Loose
- L - Loose
- MD - Medium Dense
- D - Dense
- VD - Very Dense

Refer to explanatory notes for details of abbreviations and basis of descriptions

CARDNO (NSW/ACT) PTY LTD

Cardno

TEST PIT LOG SHEET

Client: QPRC
Project: QPRCSC
Location: QPRCSC, Nr. Hume NSW

Hole No: TP203

Job No: 50520049 **Sheet:** 1 of 1

Position: 55H 698130 6081609 **Angle from Horizontal:** 90° **Surface Elevation:**

Machine Type: 5t CAT Excavator **Excavation Method:** 300mm Standard tooth bucket

Excavation Dimensions: 2.10m LONG AND 0.40m WIDE **DIRECTION :** 090° **Contractor:** AJD C&D

Date Excavated: 16/1/20 **Logged By:** JIA **Checked By:** DR

Excavation: Method	Excavation: Resistance	Excavation: Stability	Water	Sampling & Testing: Sample or Field Test	Depth (m)	Graphic Log	Classification	Material Description: SOIL TYPE, plasticity or particle characteristic, colour, secondary and minor components ROCK TYPE, grain size and type, colour, fabric & texture, strength, weathering, defects and structure	Moisture Condition	Consistency Relative Density	STRUCTURE & Other Observations
EX	E-F	Stable	Dry		0		SM	Silty SAND: fine to coarse grained, brown, frequent rootlets (<2mm)	D	L to MD	TOPSOIL
					0.13m						
				D 0.30 - 0.40 m	0.5		CI-CH	Silty CLAY: medium to high plasticity, dark grey/black, trace fine sand 0.6m: increasing sand content	M (<PL)	F to St	ALLUVIUM
					0.80m						
				D 0.80 - 0.90 m	1.0		CI-CH	Sandy CLAY: medium to high plasticity, dark grey, fine to coarse sand	M (<PL)	St	
					1.10m						
							SM	Silty SAND: fine to coarse grained, brown mottled red and yellow, trace fine sub-rounded gravel	M	MD to D	
				D 1.40 - 1.50 m	1.5						
					1.50m			TERMINATED AT 1.50 m EOH: Terminated at 1.50m (target depth) EXCAVATION: CAT 305C Excavator with 300mm standard tooth bucket STABILITY: Stable BACKFILL: Arisings compacted in layers with nominal bucket pressure and tracked in at the surface 0.00-1.50m GROUNDWATER: Not Encountered PHOTOS: Yes INSITU TESTING: DCP not undertaken ADDITIONAL NOTES: Proposed service line			
					2.0						
					2.5						

METHOD
EX Excavator bucket
R Ripper
HA Hand auger
PT Push tube
SON Sonic drilling
AH Air hammer
PS Percussion sampler
AS Short spiral auger
AD/V Solid flight auger: V-Bit
AD/T Solid flight auger: TC-Bit
HFA Hollow flight auger
WB Washbore drilling
RR Rock roller

PENETRATION
VE Very Easy (No Resistance)
E Easy
F Firm
H Hard
VH Very Hard (Refusal)

WATER
Water Level on Date shown
water inflow
water outflow

FIELD TESTS
SPT - Standard Penetration Test
HP - Hand/Pocket Penetrometer
DCP - Dynamic Cone Penetrometer
PSP - Perth Sand Penetrometer
MC - Moisture Content
PBT - Plate Bearing Test
IMP - Borehole Impression Test
PID - Photoionisation Detector
VS - Vane Shear; P=Peak, R=Resdual (uncorrected kPa)

SAMPLES
B - Bulk disturbed sample
D - Disturbed sample
ES - Environmental sample
U - Thin wall tube 'undisturbed'

MOISTURE
D - Dry
M - Moist
W - Wet
PL - Plastic limit
LL - Liquid limit
w - Moisture content

SOIL CONSISTENCY
VS - Very Soft
S - Soft
F - Firm
St - Stiff
VSt - Very Stiff
H - Hard

RELATIVE DENSITY
VL - Very Loose
L - Loose
MD - Medium Dense
D - Dense
VD - Very Dense

Refer to explanatory notes for details of abbreviations and basis of descriptions

CARDNO (NSW/ACT) PTY LTD

Cardno

TEST PIT LOG SHEET

Client: QPRC
Project: QPRCSC
Location: QPRCSC, Nr. Hume NSW

Hole No: TP401

Job No: 50520049 **Sheet:** 1 of 1

Position: 55H 697931 6081633 **Angle from Horizontal:** 90° **Surface Elevation:**

Machine Type: 5t CAT Excavator **Excavation Method:** 300mm Standard tooth bucket

Excavation Dimensions: 1.90m LONG AND 0.40m WIDE **DIRECTION :** 090° **Contractor:** AJD C&D

Date Excavated: 16/1/20 **Logged By:** MET **Checked By:** DR

Excavation			Water	Sampling & Testing		Depth (m)	Material Description					
Method	Resistance	Stability		Sample or Field Test	DCP (blows per 100 mm) 1 3 6 12		Graphic Log	Classification	SOIL TYPE, plasticity or particle characteristic, colour, secondary and minor components ROCK TYPE, grain size and type, colour, fabric & texture, strength, weathering, defects and structure	Moisture Condition	Consistency Relative Density	STRUCTURE & Other Observations
EX	E-F	Stable	Dry	B 0.60 - 0.80 m	R	0.5		SM	Silty SAND: fine to coarse grained, light grey, trace fine to medium, sub-rounded to angular gravel, frequent rootlets (<2mm) 0.22m	D	D to VD	TOPSOIL
								SM	Silty SAND: fine to medium grained, light yellowish grey 0.50m	D to M	MD to D	ALLUVIUM
						1.0		SM	Silty SAND: fine to coarse grained, orangish brown mottled grey and brown, with medium plasticity clay, trace fine to medium, sub-rounded gravel 1.30m	D	MD to D	
						1.5			TERMINATED AT 1.30 m EOH: Terminated at 1.30m (target strata, natural) EXCAVATION: CAT 305C CK 5t Excavator with 300mm standard tooth bucket STABILITY: Stable BACKFILL: Arisings compacted in layers with nominal bucket pressure and tracked in at the surface 0.00-1.30m GROUNDWATER: Not Encountered PHOTOS: Yes INSITU TESTING: 2 x DCP, firstly to refusal (0.00-0.06m), secondly to termination (0.20-1.60m) ADDITIONAL NOTES: No ripper required			
						2.0						
						2.5						

METHOD
- EX Excavator bucket
- R Ripper
- HA Hand auger
- PT Push tube
- SON Sonic drilling
- AH Air hammer
- PS Percussion sampler
- AS Short spiral auger
- AD/V Solid flight auger: V-Bit
- AD/T Solid flight auger: TC-Bit
- HFA Hollow flight auger
- WB Washbore drilling
- RR Rock roller

PENETRATION
- VE Very Easy (No Resistance)
- E Easy
- F Firm
- H Hard
- VH Very Hard (Refusal)

WATER
- Water Level on Date shown
- water inflow
- water outflow

FIELD TESTS
- SPT - Standard Penetration Test
- HP - Hand/Pocket Penetrometer
- DCP - Dynamic Cone Penetrometer
- PSP - Perth Sand Penetrometer
- MC - Moisture Content
- PBT - Plate Bearing Test
- IMP - Borehole Impression Test
- PID - Photoionisation Detector
- VS - Vane Shear; P=Peak, R=Resdual (uncorrected kPa)

SAMPLES
- B - Bulk disturbed sample
- D - Disturbed sample
- ES - Environmental sample
- U - Thin wall tube 'undisturbed'

MOISTURE
- D - Dry
- M - Moist
- W - Wet
- PL - Plastic limit
- LL - Liquid limit
- *w* - Moisture content

SOIL CONSISTENCY
- VS - Very Soft
- S - Soft
- F - Firm
- St - Stiff
- VSt - Very Stiff
- H - Hard

RELATIVE DENSITY
- VL - Very Loose
- L - Loose
- MD - Medium Dense
- D - Dense
- VD - Very Dense

Refer to explanatory notes for details of abbreviations and basis of descriptions

CARDNO (NSW/ACT) PTY LTD

TEST PIT LOG SHEET

Client: QPRC
Project: QPRCSC
Location: QPRCSC, Nr. Hume NSW

Hole No: TP402

Job No: 50520049 **Sheet:** 1 of 1

Position: 55H 698002 6081639 **Angle from Horizontal:** 90° **Surface Elevation:**

Machine Type: 5t CAT Excavator **Excavation Method:** 300mm Standard tooth bucket

Excavation Dimensions: 1.90m LONG AND 0.40m WIDE **DIRECTION :** 090° **Contractor:** AJD C&D

Date Excavated: 16/1/20 **Logged By:** MET **Checked By:** DR

Excavation			Water	Sampling & Testing		Depth (m)	Material Description					
Method	Resistance	Stability		Sample or Field Test	DCP (blows per 100 mm) 1 3 6 12		Graphic Log	Classification	SOIL TYPE, plasticity or particle characteristic, colour, secondary and minor components ROCK TYPE, grain size and type, colour, fabric & texture, strength, weathering, defects and structure	Moisture Condition	Consistency Relative Density	STRUCTURE & Other Observations
EX	E-F	Stable	Dry		R	0.5		GP	FILL: Sandy GRAVEL: fine to coarse, sub-rounded to sub-angular, light yellowish brownish grey, fine to coarse sand, with medium plasticity clay, occasional rootlets (<2mm)	D	VD	FILL
									0.20m			
	H-VH							SM	Silty SAND: fine to coarse grained, light yellowish brown and brown, with medium plasticity clay	D	D	ALLUVIUM
									0.60m			
				B 0.60 - 0.80 m								
	F-H					1.0		SM	Silty SAND: fine to coarse grained, orangish brown mottled grey and brown, with medium plasticity clay, trace fine to medium, sub-rounded gravel	D	D to VD	
									1.10m			
						1.5			TERMINATED AT 1.10 m EOH: Terminated at 1.10m (target strata, natural) EXCAVATION: CAT 305C CK 5t Excavator with 300mm standard tooth bucket and ripper STABILITY: Stable BACKFILL: Arisings compacted in layers with nominal bucket pressure and tracked in at the surface 0.00-1.10m GROUNDWATER: Not Encountered PHOTOS: Yes INSITU TESTING: 2 x DCP, firstly to refusal (0.00-0.11m), secondly to termination (0.60-1.0m) ADDITIONAL NOTES: Ripper required (0.20-0.60m)			
						2.0						
						2.5						

METHOD
- EX Excavator bucket
- R Ripper
- HA Hand auger
- PT Push tube
- SON Sonic drilling
- AH Air hammer
- PS Percussion sampler
- AS Short spiral auger
- AD/V Solid flight auger: V-Bit
- AD/T Solid flight auger: TC-Bit
- HFA Hollow flight auger
- WB Washbore drilling
- RR Rock roller

PENETRATION
- VE Very Easy (No Resistance)
- E Easy
- F Firm
- H Hard
- VH Very Hard (Refusal)

WATER
- Water Level on Date shown
- water inflow
- water outflow

FIELD TESTS
- SPT - Standard Penetration Test
- HP - Hand/Pocket Penetrometer
- DCP - Dynamic Cone Penetrometer
- PSP - Perth Sand Penetrometer
- MC - Moisture Content
- PBT - Plate Bearing Test
- IMP - Borehole Impression Test
- PID - Photoionisation Detector
- VS - Vane Shear; P=Peak, R=Resdual (uncorrected kPa)

SAMPLES
- B - Bulk disturbed sample
- D - Disturbed sample
- ES - Environmental sample
- U - Thin wall tube 'undisturbed'

MOISTURE
- D - Dry
- M - Moist
- W - Wet
- PL - Plastic limit
- LL - Liquid limit
- *w* - Moisture content

SOIL CONSISTENCY
- VS - Very Soft
- S - Soft
- F - Firm
- St - Stiff
- VSt - Very Stiff
- H - Hard

RELATIVE DENSITY
- VL - Very Loose
- L - Loose
- MD - Medium Dense
- D - Dense
- VD - Very Dense

Refer to explanatory notes for details of abbreviations and basis of descriptions

CARDNO (NSW/ACT) PTY LTD

TEST PIT LOG SHEET

Client: QPRC
Project: QPRCSC
Location: QPRCSC, Nr. Hume NSW

Hole No: TP403

Job No: 50520049 **Sheet:** 1 of 1

Position: 55H 698112 6081634 **Angle from Horizontal:** 90° **Surface Elevation:**

Machine Type: 5t CAT Excavator **Excavation Method:** 300mm Standard tooth bucket

Excavation Dimensions: 1.90m LONG AND 0.40m WIDE **DIRECTION :** 090° **Contractor:** AJD C&D

Date Excavated: 16/1/20 **Logged By:** MET **Checked By:** DR

Excavation			Water	Sampling & Testing		Depth (m)	Material Description					
Method	Resistance	Stability		Sample or Field Test	DCP (blows per 100 mm) 1 3 6 12		Graphic Log	Classification	SOIL TYPE, plasticity or particle characteristic, colour, secondary and minor components ROCK TYPE, grain size and type, colour, fabric & texture, strength, weathering, defects and structure	Moisture Condition	Consistency Relative Density	STRUCTURE & Other Observations
EX	F	Stable	Dry	B 0.60 - 0.80 m	R R	0.5		SC	Clayey Silty SAND: fine to coarse grained, grey, medium plasticity clay, frequent rootlets (<2mm) 0.20m	D	D to VD	TOPSOIL
								SC	Clayey Silty SAND: fine to coarse grained, grey, medium plasticity clay 0.90m	D	MD to D	ALLUVIUM
						1.0		SC	Clayey Silty SAND: fine to coarse grained, dark grey locally orangish brown, medium plasticity clay 1.00m	D	D to VD	
									TERMINATED AT 1.00 m EOH: Terminated at 1.30m (target strata, natural) EXCAVATION: CAT 305C CK 5t Excavator with 300mm standard tooth bucket STABILITY: Stable BACKFILL: Arisings compacted in layers with nominal bucket pressure and tracked in at the surface 0.00-1.30m GROUNDWATER: Not Encountered PHOTOS: Yes INSITU TESTING: 2 x DCP, to refusal (0.00-0.12m and 0.40-0.79m) ADDITIONAL NOTES: No ripper required			
						1.5						
						2.0						
						2.5						

METHOD
- EX Excavator bucket
- R Ripper
- HA Hand auger
- PT Push tube
- SON Sonic drilling
- AH Air hammer
- PS Percussion sampler
- AS Short spiral auger
- AD/V Solid flight auger: V-Bit
- AD/T Solid flight auger: TC-Bit
- HFA Hollow flight auger
- WB Washbore drilling
- RR Rock roller

PENETRATION
- VE Very Easy (No Resistance)
- E Easy
- F Firm
- H Hard
- VH Very Hard (Refusal)

WATER
- Water Level on Date shown
- water inflow
- water outflow

FIELD TESTS
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- MC - Moisture Content
- PBT - Plate Bearing Test
- IMP - Borehole Impression Test
- PID - Photoionisation Detector
- VS - Vane Shear; P=Peak, R=Resdual (uncorrected kPa)

SAMPLES
- B - Bulk disturbed sample
- D - Disturbed sample
- ES - Environmental sample
- U - Thin wall tube 'undisturbed'

MOISTURE
- D - Dry
- M - Moist
- W - Wet
- PL - Plastic limit
- LL - Liquid limit
- *w* - Moisture content

SOIL CONSISTENCY
- VS - Very Soft
- S - Soft
- F - Firm
- St - Stiff
- VSt - Very Stiff
- H - Hard

RELATIVE DENSITY
- VL - Very Loose
- L - Loose
- MD - Medium Dense
- D - Dense
- VD - Very Dense

Refer to explanatory notes for details of abbreviations and basis of descriptions

CARDNO (NSW/ACT) PTY LTD

Cardno

TEST PIT LOG SHEET

Client: QPRC
Project: QPRCSC
Location: QPRCSC, Nr. Hume NSW

Hole No: TP404

Job No: 50520049 **Sheet:** 1 of 1

Position: 55H 698070 6081575 **Angle from Horizontal:** 90° **Surface Elevation:**

Machine Type: 5t CAT Excavator **Excavation Method:** 300mm Standard tooth bucket

Excavation Dimensions: 1.90m LONG AND 0.40m WIDE **DIRECTION :** 090° **Contractor:** AJD C&D

Date Excavated: 16/1/20 **Logged By:** MET **Checked By:** DR

Excavation			Water	Sampling & Testing		Depth (m)	Material Description					
Method	Resistance	Stability		Sample or Field Test	DCP (blows per 100 mm) 1 3 6 12		Graphic Log	Classification	SOIL TYPE, plasticity or particle characteristic, colour, secondary and minor components ROCK TYPE, grain size and type, colour, fabric & texture, strength, weathering, defects and structure	Moisture Condition	Consistency Relative Density	STRUCTURE & Other Observations
EX	E-F	Stable	Dry					SM	Silty SAND: fine to coarse grained, light grey, trace fine to medium, sub-rounded to angular gravel, frequent rootlets (<2mm)	D	D to VD	TOPSOIL
									0.20m			
	H-VH							SM	Silty SAND: fine to coarse grained, light yellowish brown and brown, with medium plasticity clay	D	D to VD	ALLUVIUM
				B 0.60 - 0.80 m		0.5			0.40m			
								SM	Silty SAND: fine to coarse grained, dark grey locally mottled orangish brown, with medium plasticity clay	D	MD to D	
						1.0			1.10m			
									TERMINATED AT 1.10 m EOH: Terminated at 1.10m (target strata, natural) EXCAVATION: CAT 305C CK 5t Excavator with 300mm standard tooth bucket STABILITY: Stable BACKFILL: Arisings compacted in layers with nominal bucket pressure and tracked in at the surface 0.00-1.10m GROUNDWATER: Not Encountered PHOTOS: Yes INSITU TESTING: DCP to termination (0.30-1.20m) ADDITIONAL NOTES: No riipper required			
						1.5						
						2.0						
						2.5						

METHOD
- EX Excavator bucket
- R Ripper
- HA Hand auger
- PT Push tube
- SON Sonic drilling
- AH Air hammer
- PS Percussion sampler
- AS Short spiral auger
- AD/V Solid flight auger: V-Bit
- AD/T Solid flight auger: TC-Bit
- HFA Hollow flight auger
- WB Washbore drilling
- RR Rock roller

PENETRATION
- VE Very Easy (No Resistance)
- E Easy
- F Firm
- H Hard
- VH Very Hard (Refusal)

WATER
- Water Level on Date shown
- water inflow
- water outflow

FIELD TESTS
- SPT - Standard Penetration Test
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- DCP - Dynamic Cone Penetrometer
- PSP - Perth Sand Penetrometer
- MC - Moisture Content
- PBT - Plate Bearing Test
- IMP - Borehole Impression Test
- PID - Photoionisation Detector
- VS - Vane Shear; P=Peak, R=Resdual (uncorrected kPa)

SAMPLES
- B - Bulk disturbed sample
- D - Disturbed sample
- ES - Environmental sample
- U - Thin wall tube 'undisturbed'

MOISTURE
- D - Dry
- M - Moist
- W - Wet
- PL - Plastic limit
- LL - Liquid limit
- *w* - Moisture content

SOIL CONSISTENCY
- VS - Very Soft
- S - Soft
- F - Firm
- St - Stiff
- VSt - Very Stiff
- H - Hard

RELATIVE DENSITY
- VL - Very Loose
- L - Loose
- MD - Medium Dense
- D - Dense
- VD - Very Dense

Refer to explanatory notes for details of abbreviations and basis of descriptions

CARDNO (NSW/ACT) PTY LTD

TEST PIT LOG SHEET

Client: QPRC
Project: QPRCSC
Location: QPRCSC, Nr. Hume NSW

Hole No: TP405

Job No: 50520049 **Sheet:** 1 of 1

Position: 55H 698169 6081637 **Angle from Horizontal:** 90° **Surface Elevation:**

Machine Type: 5t CAT Excavator **Excavation Method:** 300mm Standard tooth bucket

Excavation Dimensions: 1.90m LONG AND 0.40m WIDE **DIRECTION :** 090° **Contractor:** AJD C&D

Date Excavated: 16/1/20 **Logged By:** MET **Checked By:** DR

Excavation			Water	Sampling & Testing		Depth (m)	Material Description					
Method	Resistance	Stability		Sample or Field Test	DCP (blows per 100 mm) 1 3 6 12		Graphic Log	Classification	SOIL TYPE, plasticity or particle characteristic, colour, secondary and minor components ROCK TYPE, grain size and type, colour, fabric & texture, strength, weathering, defects and structure	Moisture Condition	Consistency Relative Density	STRUCTURE & Other Observations
EX	E-F	Stable	Dry			0		SC	Clayey Silty SAND: fine to coarse grained, grey, medium plasticity clay, frequent rootlets (<2mm)	D	D	TOPSOIL
						0.20m						
	H-VH			B 0.60 - 0.80 m		0.5		SC	Clayey Silty SAND: fine to coarse grained, dark grey, medium plasticity clay	D	MD to D	ALLUVIUM
						0.90m		SC	Clayey Silty SAND: fine to coarse grained, dark grey locally orangish brown, medium plasticity clay	D	D	
						1.00m			TERMINATED AT 1.00 m EOH: Terminated at 1.00m (target strata, natural) EXCAVATION: CAT 305C CK 5t Excavator with 300mm standard tooth bucket and ripper STABILITY: Stable BACKFILL: Arisings compacted in layers with nominal bucket pressure and tracked in at the surface 0.00-1.00m GROUNDWATER: Not Encountered PHOTOS: Yes INSITU TESTING: DCP to termination (0.00-1.00m) ADDITIONAL NOTES: Ripper required (0.20-1.00m)			
						1.0						
						1.5						
						2.0						
						2.5						

METHOD
- EX Excavator bucket
- R Ripper
- HA Hand auger
- PT Push tube
- SON Sonic drilling
- AH Air hammer
- PS Percussion sampler
- AS Short spiral auger
- AD/V Solid flight auger: V-Bit
- AD/T Solid flight auger: TC-Bit
- HFA Hollow flight auger
- WB Washbore drilling
- RR Rock roller

PENETRATION
- VE Very Easy (No Resistance)
- E Easy
- F Firm
- H Hard
- VH Very Hard (Refusal)

WATER
- Water Level on Date shown
- water inflow
- water outflow

FIELD TESTS
- SPT - Standard Penetration Test
- HP - Hand/Pocket Penetrometer
- DCP - Dynamic Cone Penetrometer
- PSP - Perth Sand Penetrometer
- MC - Moisture Content
- PBT - Plate Bearing Test
- IMP - Borehole Impression Test
- PID - Photoionisation Detector
- VS - Vane Shear; P=Peak, R=Resdual (uncorrected kPa)

SAMPLES
- B - Bulk disturbed sample
- D - Disturbed sample
- ES - Environmental sample
- U - Thin wall tube 'undisturbed'

MOISTURE
- D - Dry
- M - Moist
- W - Wet
- PL - Plastic limit
- LL - Liquid limit
- *w* - Moisture content

SOIL CONSISTENCY
- VS - Very Soft
- S - Soft
- F - Firm
- St - Stiff
- VSt - Very Stiff
- H - Hard

RELATIVE DENSITY
- VL - Very Loose
- L - Loose
- MD - Medium Dense
- D - Dense
- VD - Very Dense

Refer to explanatory notes for details of abbreviations and basis of descriptions

CARDNO (NSW/ACT) PTY LTD

TEST PIT LOG SHEET

Client: QPRC
Project: QPRCSC
Location: QPRCSC, Nr. Hume NSW

Hole No: TP406

Job No: 50520049 **Sheet:** 1 of 1

Position: 55H 698229 6081660 **Angle from Horizontal:** 90° **Surface Elevation:**

Machine Type: 5t CAT Excavator **Excavation Method:** 300mm Standard tooth bucket

Excavation Dimensions: 1.90m LONG AND 0.40m WIDE **DIRECTION :** 090° **Contractor:** AJD C&D

Date Excavated: 16/1/20 **Logged By:** MET **Checked By:** DR

Excavation			Water	Sampling & Testing		Depth (m)	Material Description					
Method	Resistance	Stability		Sample or Field Test	DCP (blows per 100 mm) 1 3 6 12		Graphic Log	Classification	SOIL TYPE, plasticity or particle characteristic, colour, secondary and minor components ROCK TYPE, grain size and type, colour, fabric & texture, strength, weathering, defects and structure	Moisture Condition	Consistency Relative Density	STRUCTURE & Other Observations
EX	E-F	Stable	Dry			0		SM	SAND: light greyish brown, frequent rootlets (<2mm)	D	VD	TOPSOIL
						0.20m						
	H-VH			B 0.60 - 0.80 m	R	0.5		SC	Clayey SAND: fine to coarse grained, light yellowish grey, medium plasticity clay, with silt, frequent rootlets (<2mm)	D	VD	ALLUVIUM
						0.80m		SP	SAND: fine to coarse grained, light yellowish brown, with medium plasticity clay, with silt	D	VD	
						1.00m						
						1.0			TERMINATED AT 1.00 m EOH: Terminated at 1.00m (target strata, natural) EXCAVATION: CAT 305C CK 5t Excavator with 300mm standard tooth bucket and ripper STABILITY: Stable BACKFILL: Arisings compacted in layers with nominal bucket pressure and tracked in at the surface 0.00-1.00m GROUNDWATER: Not Encountered PHOTOS: Yes INSITU TESTING: DCP to termination (0.00-0.38m) ADDITIONAL NOTES: Ripper required (0.20-1.00m)			
						1.5						
						2.0						
						2.5						

METHOD
- EX Excavator bucket
- R Ripper
- HA Hand auger
- PT Push tube
- SON Sonic drilling
- AH Air hammer
- PS Percussion sampler
- AS Short spiral auger
- AD/V Solid flight auger: V-Bit
- AD/T Solid flight auger: TC-Bit
- HFA Hollow flight auger
- WB Washbore drilling
- RR Rock roller

PENETRATION
- VE Very Easy (No Resistance)
- E Easy
- F Firm
- H Hard
- VH Very Hard (Refusal)

WATER
- Water Level on Date shown
- water inflow
- water outflow

FIELD TESTS
- SPT - Standard Penetration Test
- HP - Hand/Pocket Penetrometer
- DCP - Dynamic Cone Penetrometer
- PSP - Perth Sand Penetrometer
- MC - Moisture Content
- PBT - Plate Bearing Test
- IMP - Borehole Impression Test
- PID - Photoionisation Detector
- VS - Vane Shear; P=Peak, R=Resdual (uncorrected kPa)

SAMPLES
- B - Bulk disturbed sample
- D - Disturbed sample
- ES - Environmental sample
- U - Thin wall tube 'undisturbed'

MOISTURE
- D - Dry
- M - Moist
- W - Wet
- PL - Plastic limit
- LL - Liquid limit
- *w* - Moisture content

SOIL CONSISTENCY
- VS - Very Soft
- S - Soft
- F - Firm
- St - Stiff
- VSt - Very Stiff
- H - Hard

RELATIVE DENSITY
- VL - Very Loose
- L - Loose
- MD - Medium Dense
- D - Dense
- VD - Very Dense

Refer to explanatory notes for details of abbreviations and basis of descriptions

CARDNO (NSW/ACT) PTY LTD

TEST PIT LOG SHEET

Client: QPRC
Project: QPRCSC
Location: QPRCSC, Nr. Hume NSW

Hole No: TP407

Job No: 50520049 **Sheet:** 1 of 1

Position: 55H 698285 6081634 **Angle from Horizontal:** 90° **Surface Elevation:**

Machine Type: 5t CAT Excavator **Excavation Method:** 300mm Standard tooth bucket

Excavation Dimensions: 1.90m LONG AND 0.40m WIDE **DIRECTION :** 090° **Contractor:** AJD C&D

Date Excavated: 16/1/20 **Logged By:** MET **Checked By:** DR

Excavation			Water	Sampling & Testing		Depth (m)	Material Description					
Method	Resistance	Stability		Sample or Field Test	DCP (blows per 100 mm) 1 3 6 12		Graphic Log	Classification	SOIL TYPE, plasticity or particle characteristic, colour, secondary and minor components ROCK TYPE, grain size and type, colour, fabric & texture, strength, weathering, defects and structure	Moisture Condition	Consistency Relative Density	STRUCTURE & Other Observations
EX	E-F	Stable	Dry	B 0.60 - 0.80 m		0.5		SC	Clayey Silty SAND: fine to coarse grained, grey, medium plasticity clay, frequent rootlets (<2mm) 0.35m	D	D	TOPSOIL
								SC	Clayey Silty SAND: fine to coarse grained, grey, medium plasticity clay 0.80m	D	D	ALLUVIUM
						1.0		SC	Clayey Silty SAND: fine to coarse grained, dark grey locally orangish brown, medium plasticity clay 1.00m	D	D	
									TERMINATED AT 1.00 m EOH: Terminated at 1.00m (target strata, natural) EXCAVATION: CAT 305C CK 5t Excavator with 300mm standard tooth bucket STABILITY: Stable BACKFILL: Arisings compacted in layers with nominal bucket pressure and tracked in at the surface 0.00-1.00m GROUNDWATER: Not Encountered PHOTOS: Yes INSITU TESTING: DCP to refusal (0.00-1.00m) ADDITIONAL NOTES: No ripper required			
						1.5						
						2.0						
						2.5						

METHOD
- EX Excavator bucket
- R Ripper
- HA Hand auger
- PT Push tube
- SON Sonic drilling
- AH Air hammer
- PS Percussion sampler
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- AD/V Solid flight auger: V-Bit
- AD/T Solid flight auger: TC-Bit
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- WB Washbore drilling
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PENETRATION
- VE Very Easy (No Resistance)
- E Easy
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WATER
- Water Level on Date shown
- water inflow
- water outflow

FIELD TESTS
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- VS - Vane Shear; P=Peak, R=Resdual (uncorrected kPa)

SAMPLES
- B - Bulk disturbed sample
- D - Disturbed sample
- ES - Environmental sample
- U - Thin wall tube 'undisturbed'

MOISTURE
- D - Dry
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- PL - Plastic limit
- LL - Liquid limit
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SOIL CONSISTENCY
- VS - Very Soft
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RELATIVE DENSITY
- VL - Very Loose
- L - Loose
- MD - Medium Dense
- D - Dense
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Refer to explanatory notes for details of abbreviations and basis of descriptions

CARDNO (NSW/ACT) PTY LTD

TEST PIT LOG SHEET

Client: QPRC
Project: QPRCSC
Location: QPRCSC, Nr. Hume NSW

Hole No: TP408

Job No: 50520049 **Sheet:** 1 of 1

Position: 55H 698111 6081457 **Angle from Horizontal:** 90° **Surface Elevation:**

Machine Type: 5t CAT Excavator **Excavation Method:** 300mm Standard tooth bucket

Excavation Dimensions: 1.90m LONG AND 0.40m WIDE **DIRECTION :** 090° **Contractor:** AJD C&D

Date Excavated: 16/1/20 **Logged By:** MET **Checked By:** DR

Excavation			Water	Sampling & Testing		Depth (m)	Material Description					
Method	Resistance	Stability		Sample or Field Test	DCP (blows per 100 mm) 1 3 6 12		Graphic Log	Classification	SOIL TYPE, plasticity or particle characteristic, colour, secondary and minor components ROCK TYPE, grain size and type, colour, fabric & texture, strength, weathering, defects and structure	Moisture Condition	Consistency Relative Density	STRUCTURE & Other Observations
EX	E-F	Stable	Dry		R	0.0		SM	Silty SAND: fine to coarse grained, light grey locally light orangish grey, frequent rootlets (<2mm)	D	VD	TOPSOIL
									0.30m			
	H-VH			B 0.60 - 0.80 m		0.5		SC	Silty Clayey SAND: fine to coarse grained, brown, medium plasticity clay	D	D to VD	ALLUVIUM
									0.80m			
								SC	Silty Clayey SAND: fine to medium grained, light brown, medium to high plasticity clay	D	D to VD	
						1.0			1.00m			
									TERMINATED AT 1.00 m EOH: Terminated at 1.00m (target strata, natural) EXCAVATION: CAT 305C CK 5t Excavator with 300mm standard tooth bucket and ripper STABILITY: Stable BACKFILL: Arisings compacted in layers with nominal bucket pressure and tracked in at the surface 0.00-1.00m GROUNDWATER: Not Encountered PHOTOS: Yes INSITU TESTING: DCP to termination (0.00-0.18m) ADDITIONAL NOTES: Ripper required (0.30-1.00m)			
						1.5						
						2.0						
						2.5						

METHOD
- EX Excavator bucket
- R Ripper
- HA Hand auger
- PT Push tube
- SON Sonic drilling
- AH Air hammer
- PS Percussion sampler
- AS Short spiral auger
- AD/V Solid flight auger: V-Bit
- AD/T Solid flight auger: TC-Bit
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- WB Washbore drilling
- RR Rock roller

PENETRATION
- VE Very Easy (No Resistance)
- E Easy
- F Firm
- H Hard
- VH Very Hard (Refusal)

WATER
- Water Level on Date shown
- water inflow
- water outflow

FIELD TESTS
- SPT - Standard Penetration Test
- HP - Hand/Pocket Penetrometer
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- MC - Moisture Content
- PBT - Plate Bearing Test
- IMP - Borehole Impression Test
- PID - Photoionisation Detector
- VS - Vane Shear; P=Peak, R=Resdual (uncorrected kPa)

SAMPLES
- B - Bulk disturbed sample
- D - Disturbed sample
- ES - Environmental sample
- U - Thin wall tube 'undisturbed'

MOISTURE
- D - Dry
- M - Moist
- W - Wet
- PL - Plastic limit
- LL - Liquid limit
- *w* - Moisture content

SOIL CONSISTENCY
- VS - Very Soft
- S - Soft
- F - Firm
- St - Stiff
- VSt - Very Stiff
- H - Hard

RELATIVE DENSITY
- VL - Very Loose
- L - Loose
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- D - Dense
- VD - Very Dense

Refer to explanatory notes for details of abbreviations and basis of descriptions

CARDNO (NSW/ACT) PTY LTD

Queanbeyan Palerang Regional Sports Complex

APPENDIX C

LABORATORY REPORTS

Construction Sciences

Construction Sciences Pty Ltd
ABN: 74 128 806 735

Address:
Unit 3/180 Gladstone Street,
Fyshwick ACT 2609

Laboratory: **Fyshwick Laboratory**
Phone: 02 6285 5314
Fax:
Email: Canberra@constructionsciences.net

PARTICLE SIZE DISTRIBUTION REPORT

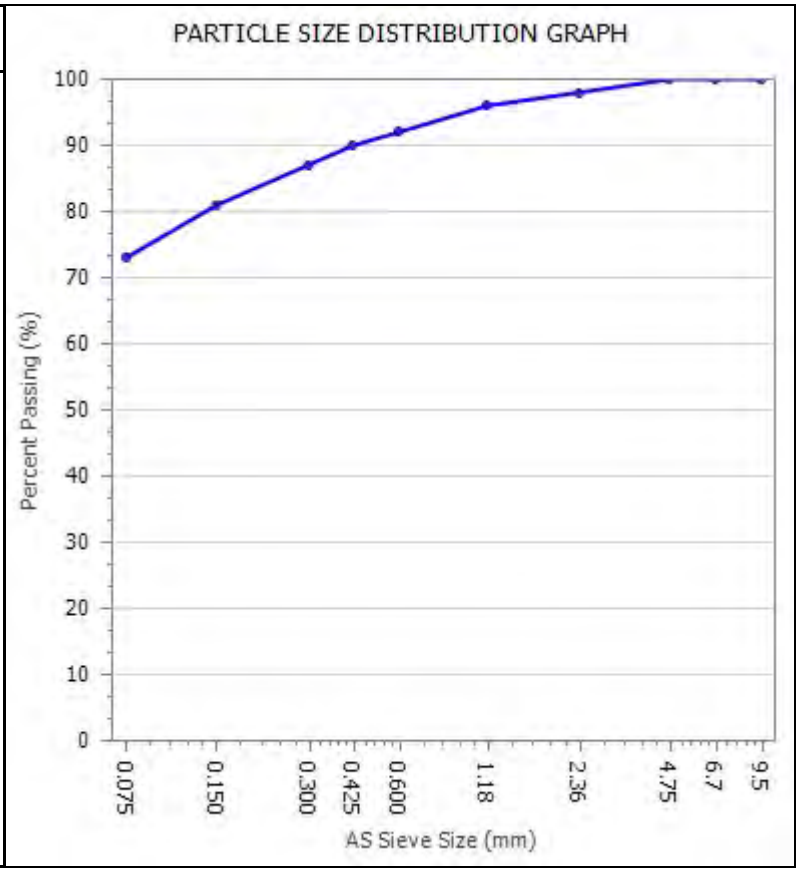
Client:	Cardno ACT	Report Number:	455/R/22202-1
Client Address:	2/14-16 Wormald Street, Symonston	Project Number:	455/P/137
Project:	QPRC - Sporting complex	Lot Number:	
Location:	HUME	Internal Test Request:	455/T/13942
Supplied To:	Cardno ACT	Client Reference/s:	50520049
Area Description:		Report Date / Page:	10/02/2020 Page 1 of 6

Test Procedures:	AS1289.3.6.1
Sample Number	455/S/89613
Sampling Method	Tested As Received
Date Sampled	17/01/2020
Sampled By	Client Sampled
Date Tested	31/01/2020
Material Source	Not Specified

Sample Location

Client Supplied	BH321
	1.8-2.3m
Material Type	Not Supplied (Not Supplied)

AS Sieve (mm)	Specification Minimum	**Percent Passing (%)**	Specification Maximum
9.5		**100**	
6.7		**100**	
4.75		**100**	
2.36		**98**	
1.18		**96**	
0.600		**92**	
0.425		**90**	
0.300		**87**	
0.150		**81**	
0.075		**73**	



Remarks	Results apply to the sample/s as received.

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Accredited for compliance with ISO/IEC 17025 - Testing

Accreditation Number: 1986
Corporate Site Number: 455

Approved Signatory: Kevin Spicer
Form ID: W9Rep Rev 2

Construction Sciences

Construction Sciences Pty Ltd
ABN: 74 128 806 735

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Laboratory: **Fyshwick Laboratory**
Phone: 02 6285 5314
Fax:
Email: Canberra@constructionsciences.net

PARTICLE SIZE DISTRIBUTION REPORT

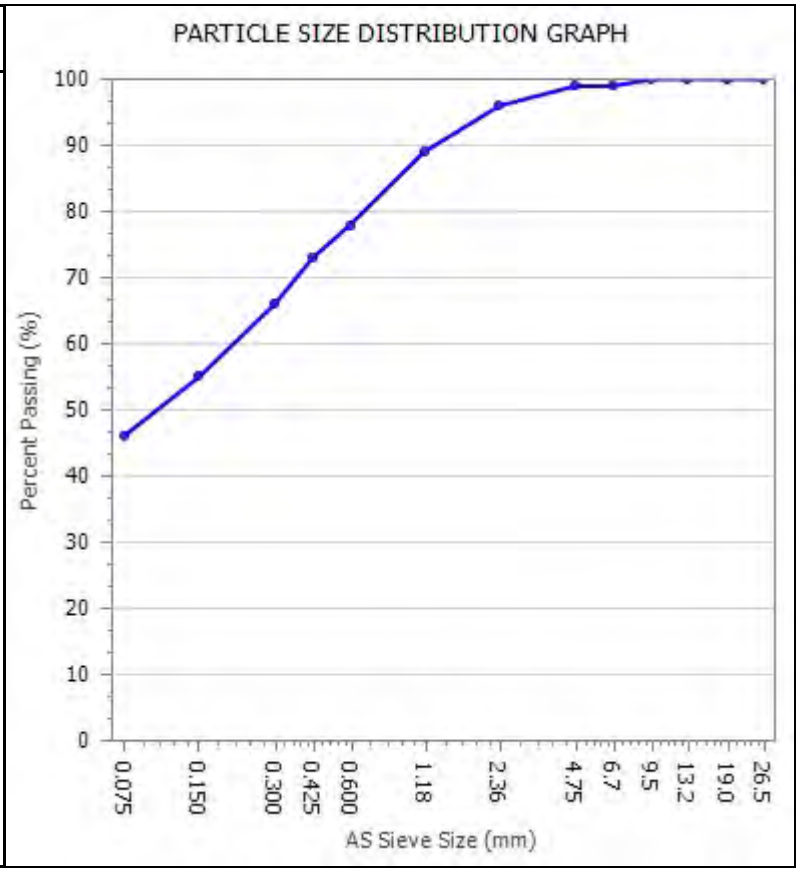
Client:	Cardno ACT	Report Number:	455/R/22202-1
Client Address:	2/14-16 Wormald Street, Symonston	Project Number:	455/P/137
Project:	QPRC - Sporting complex	Lot Number:	
Location:	HUME	Internal Test Request:	455/T/13942
Supplied To:	Cardno ACT	Client Reference/s:	50520049
Area Description:		Report Date / Page:	10/02/2020 Page 2 of 6

Test Procedures:	AS1289.3.6.1
Sample Number	455/S/89619
Sampling Method	Tested As Received
Date Sampled	17/01/2020
Sampled By	Client Sampled
Date Tested	31/01/2020
Material Source	Not Specified

Sample Location

Client Supplied	TP406
	0.6-0.8m
Material Type	Not Supplied (Not Supplied)

AS Sieve (mm)	Specification Minimum	**Percent Passing (%)**	Specification Maximum
26.5		**100**	
19.0		**100**	
13.2		**100**	
9.5		**100**	
6.7		**99**	
4.75		**99**	
2.36		**96**	
1.18		**89**	
0.600		**78**	
0.425		**73**	
0.300		**66**	
0.150		**55**	
0.075		**46**	



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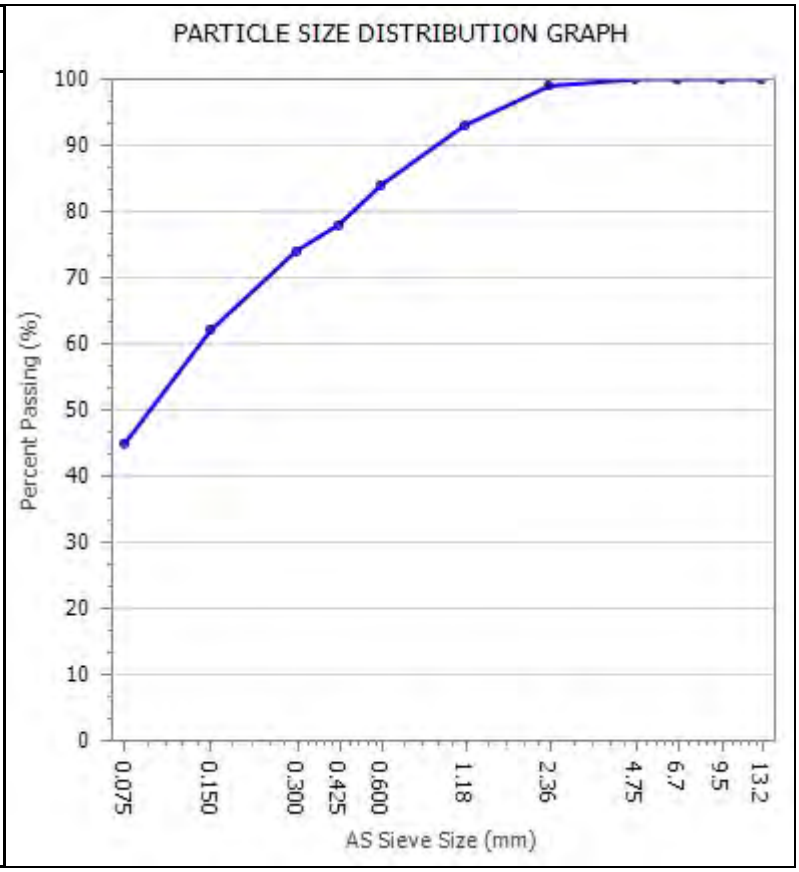
PARTICLE SIZE DISTRIBUTION REPORT

Client:	Cardno ACT	Report Number:	455/R/22202-1
Client Address:	2/14-16 Wormald Street, Symonston	Project Number:	455/P/137
Project:	QPRC - Sporting complex	Lot Number:	
Location:	HUME	Internal Test Request:	455/T/13942
Supplied To:	Cardno ACT	Client Reference/s:	50520049
Area Description:		Report Date / Page:	10/02/2020 Page 3 of 6

Test Procedures:	AS1289.3.6.1

Sample Number	455/S/89891		Sample Location
Sampling Method	Tested As Received	Client Supplied	TP101
Date Sampled	17/01/2020		0.2-0.3m
Sampled By	Client Sampled		
Date Tested	10/02/2020		
Material Source	Not Supplied	Material Type	Not Supplied (Not Supplied)

AS Sieve (mm)	Specification Minimum	**Percent Passing (%)**	Specification Maximum
13.2		**100**	
9.5		**100**	
6.7		**100**	
4.75		**100**	
2.36		**99**	
1.18		**93**	
0.600		**84**	
0.425		**78**	
0.300		**74**	
0.150		**62**	
0.075		**45**	



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PARTICLE SIZE DISTRIBUTION REPORT

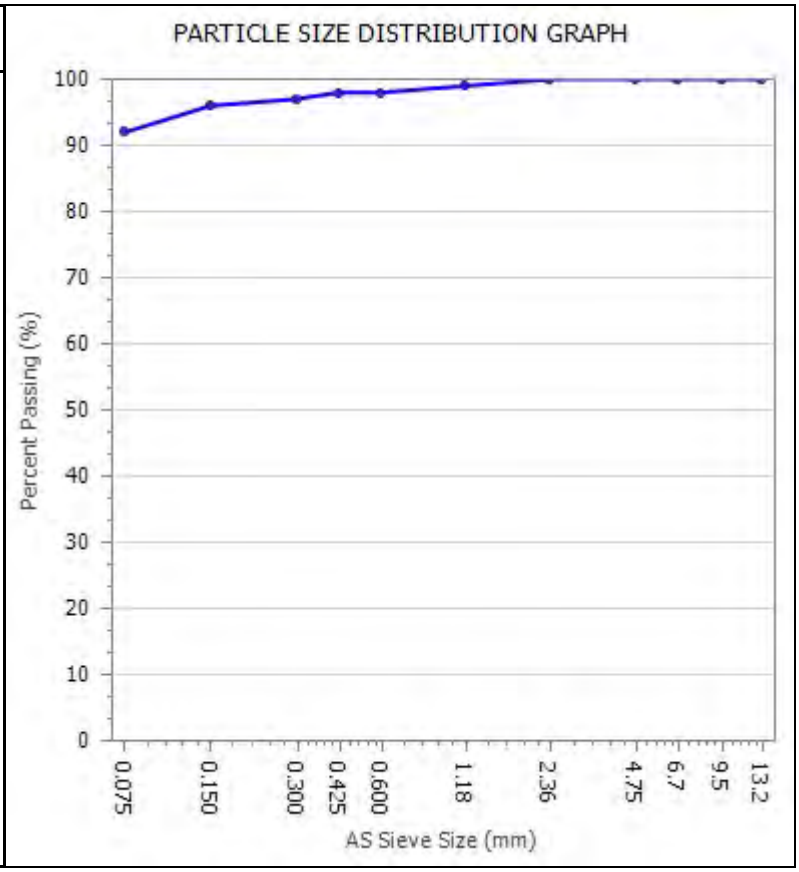
Client:	Cardno ACT	Report Number:	455/R/22202-1
Client Address:	2/14-16 Wormald Street, Symonston	Project Number:	455/P/137
Project:	QPRC - Sporting complex	Lot Number:	
Location:	HUME	Internal Test Request:	455/T/13942
Supplied To:	Cardno ACT	Client Reference/s:	50520049
Area Description:		Report Date / Page:	10/02/2020 Page 4 of 6

Test Procedures:	AS1289.3.6.1
Sample Number	455/S/89892
Sampling Method	Tested As Received
Date Sampled	17/01/2020
Sampled By	Client Sampled
Date Tested	10/02/2020
Material Source	Not Supplied

Sample Location

Client Supplied	TP101
	0.7-0.8m
Material Type	Not Supplied (Not Supplied)

AS Sieve (mm)	Specification Minimum	**Percent Passing (%)**	Specification Maximum
13.2		**100**	
9.5		**100**	
6.7		**100**	
4.75		**100**	
2.36		**100**	
1.18		**99**	
0.600		**98**	
0.425		**98**	
0.300		**97**	
0.150		**96**	
0.075		**92**	



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PARTICLE SIZE DISTRIBUTION REPORT

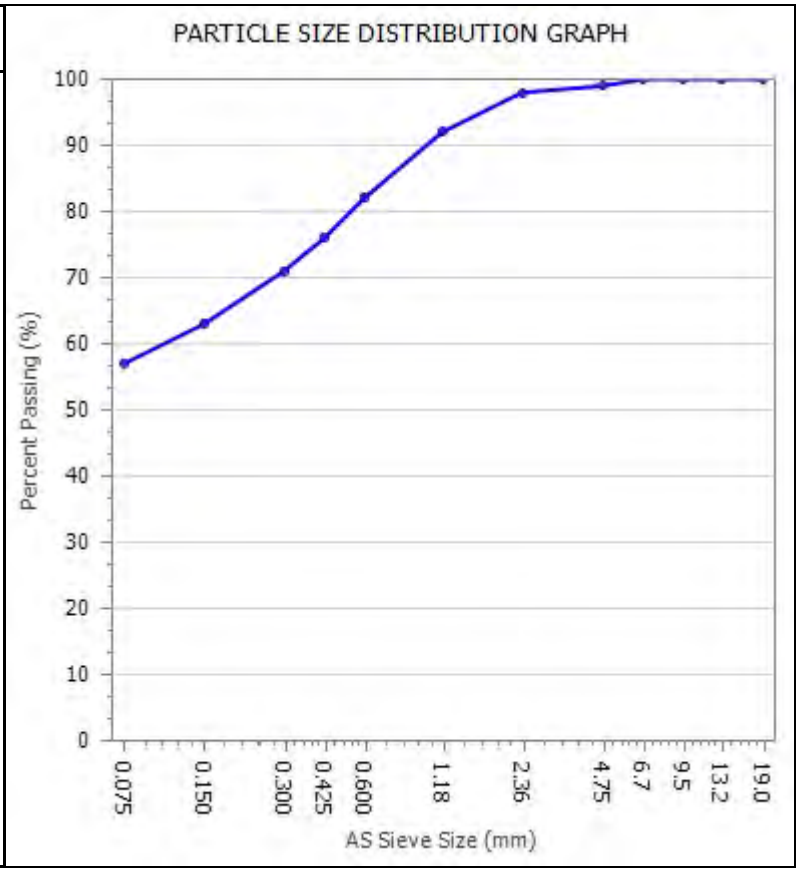
Client:	Cardno ACT	Report Number:	455/R/22202-1
Client Address:	2/14-16 Wormald Street, Symonston	Project Number:	455/P/137
Project:	QPRC - Sporting complex	Lot Number:	
Location:	HUME	Internal Test Request:	455/T/13942
Supplied To:	Cardno ACT	Client Reference/s:	50520049
Area Description:		Report Date / Page:	10/02/2020 Page 5 of 6

Test Procedures:	AS1289.3.6.1
Sample Number	455/S/89895
Sampling Method	Tested As Received
Date Sampled	17/01/2020
Sampled By	Client Sampled
Date Tested	10/02/2020
Material Source	Not Supplied

Sample Location

Client Supplied	TP105A
	0.3-0.4m
Material Type	Not Supplied (Not Supplied)

AS Sieve (mm)	Specification Minimum	**Percent Passing (%)**	Specification Maximum
19.0		**100**	
13.2		**100**	
9.5		**100**	
6.7		**100**	
4.75		**99**	
2.36		**98**	
1.18		**92**	
0.600		**82**	
0.425		**76**	
0.300		**71**	
0.150		**63**	
0.075		**57**	



Remarks	Results apply to the sample/s as received.

NATA

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Accreditation Number: 1986
Corporate Site Number: 455

Approved Signatory: Kevin Spicer
Form ID: W9Rep Rev 2

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PARTICLE SIZE DISTRIBUTION REPORT

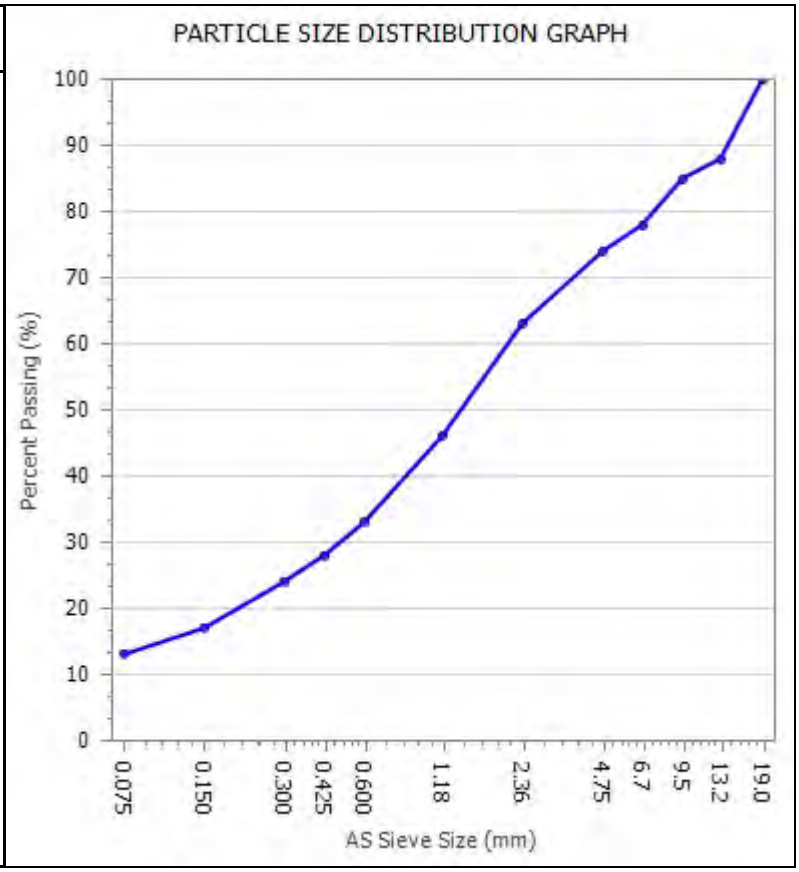
Client:	Cardno ACT	Report Number:	455/R/22202-1
Client Address:	2/14-16 Wormald Street, Symonston	Project Number:	455/P/137
Project:	QPRC - Sporting complex	Lot Number:	
Location:	HUME	Internal Test Request:	455/T/13942
Supplied To:	Cardno ACT	Client Reference/s:	50520049
Area Description:		Report Date / Page:	10/02/2020 Page 6 of 6

Test Procedures:	AS1289.3.6.1
Sample Number	455/S/89899
Sampling Method	Tested As Received
Date Sampled	17/01/2020
Sampled By	Client Sampled
Date Tested	10/02/2020
Material Source	Not Supplied

Sample Location

Client Supplied	BH306
	6.0-6.45m
Material Type	Not Supplied (Not Supplied)

AS Sieve (mm)	Specification Minimum	**Percent Passing (%)**	Specification Maximum
19.0		**100**	
13.2		**88**	
9.5		**85**	
6.7		**78**	
4.75		**74**	
2.36		**63**	
1.18		**46**	
0.600		**33**	
0.425		**28**	
0.300		**24**	
0.150		**17**	
0.075		**13**	



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ATTERBERG LIMITS REPORT

Client:	Cardno ACT	Report Number:	455/R/22235-1
Client Address:	2/14-16 Wormald Street, Symonston	Project Number:	455/P/137
Project:	QPRC - Sporting complex	Lot Number:	
Location:	HUME	Internal Test Request:	455/T/13942
Supplied To:	Cardno ACT	Client Reference/s:	50520049
Area Description:		Report Date / Page:	11/02/2020 Page 1 of 6

Test Procedures:	AS1289.3.1.2, AS 1289.3.3.1, AS1289.3.2.1, AS1289.2.1.1		
Sample Number	455/S/89613	Sample Location	
Sampling Method	Tested As Received	Client Supplied	BH321
Date Sampled	17/01/2020		1.8-2.3m
Sampled By	Client Sampled		
Date Tested	10/02/2020		
Att. Drying Method	Oven Dried	Material Source	Not Specified
Atterberg Preparation	Dry Sieved	Material Type	Not Supplied (Not Supplied)
Material Description	(CI) Silty SLAY		

Atterberg Limits Results

Atterberg Limit	Specification Minimum	Test Result	Specification Maximum
Liquid Limit (%)		**30**	
Plastic Limit (%)		**18**	
Plasticity Index (%)		**12**	
Linear Shrinkage (%)			
Linear Shrinkage Defects:			

Remarks	Results apply to the sample/s as received.

NATA

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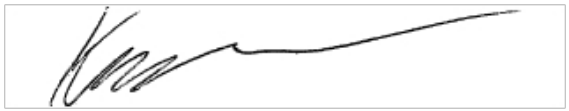
Accreditation Number: 1986
Corporate Site Number: 455



Approved Signatory: Kevin Spicer
Form ID: W11bRep Rev 1

Construction Sciences

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Email: Canberra@constructionsciences.net

ATTERBERG LIMITS REPORT

Client:	Cardno ACT	Report Number:	455/R/22235-1
Client Address:	2/14-16 Wormald Street, Symonston	Project Number:	455/P/137
Project:	QPRC - Sporting complex	Lot Number:	
Location:	HUME	Internal Test Request:	455/T/13942
Supplied To:	Cardno ACT	Client Reference/s:	50520049
Area Description:		Report Date / Page:	11/02/2020 Page 2 of 6

Test Procedures:	AS1289.3.1.2, AS 1289.3.3.1, AS1289.3.2.1, AS1289.2.1.1		
Sample Number	455/S/89619	Sample Location	
Sampling Method	Tested As Received	Client Supplied	TP406
Date Sampled	17/01/2020		0.6-0.8m
Sampled By	Client Sampled		
Date Tested	10/02/2020		
Att. Drying Method	Oven Dried	Material Source	Not Specified
Atterberg Preparation	Dry Sieved	Material Type	Not Supplied (Not Supplied)
Material Description	Gravelly Silty Sand		

Atterberg Limits Results

Atterberg Limit	Specification Minimum	Test Result	Specification Maximum
Liquid Limit (%)		**19**	
Plastic Limit (%)		**16**	
Plasticity Index (%)		**3**	
Linear Shrinkage (%)			
Linear Shrinkage Defects:			

Remarks	Results apply to the sample/s as received.

NATA

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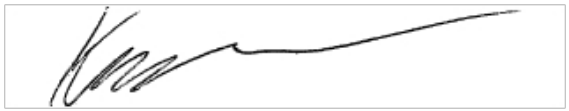
Accreditation Number: 1986
Corporate Site Number: 455



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ATTERBERG LIMITS REPORT

Client:	Cardno ACT	Report Number:	455/R/22235-1
Client Address:	2/14-16 Wormald Street, Symonston	Project Number:	455/P/137
Project:	QPRC - Sporting complex	Lot Number:	
Location:	HUME	Internal Test Request:	455/T/13942
Supplied To:	Cardno ACT	Client Reference/s:	50520049
Area Description:		Report Date / Page:	11/02/2020 Page 3 of 6

Test Procedures:	AS1289.3.1.2, AS 1289.3.3.1, AS1289.3.2.1, AS1289.2.1.1		
Sample Number	455/S/89891	Sample Location	
Sampling Method	Tested As Received	Client Supplied	TP101
Date Sampled	17/01/2020		0.2-0.3m
Sampled By	Client Sampled		
Date Tested	10/02/2020		
Att. Drying Method	Oven Dried	Material Source	Not Supplied
Atterberg Preparation	Dry Sieved	Material Type	Not Supplied (Not Supplied)
Material Description	Silty SAND		

Atterberg Limits Results

Atterberg Limit	Specification Minimum	Test Result	Specification Maximum
Liquid Limit (%)		**22**	
Plastic Limit (%)		**21**	
Plasticity Index (%)		**1**	
Linear Shrinkage (%)			
Linear Shrinkage Defects:			

Remarks	Results apply to the sample/s as received.

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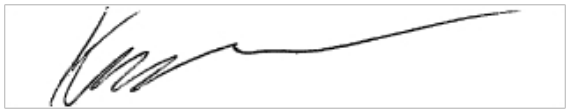

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ATTERBERG LIMITS REPORT

Client:	Cardno ACT	Report Number:	455/R/22235-1
Client Address:	2/14-16 Wormald Street, Symonston	Project Number:	455/P/137
Project:	QPRC - Sporting complex	Lot Number:	
Location:	HUME	Internal Test Request:	455/T/13942
Supplied To:	Cardno ACT	Client Reference/s:	50520049
Area Description:		Report Date / Page:	11/02/2020 Page 4 of 6

Test Procedures:	AS1289.3.1.2, AS 1289.3.3.1, AS1289.3.2.1, AS1289.2.1.1		
Sample Number	455/S/89892	Sample Location	
Sampling Method	Tested As Received	Client Supplied	TP101
Date Sampled	17/01/2020		0.7-0.8m
Sampled By	Client Sampled		
Date Tested	10/02/2020		
Att. Drying Method	Oven Dried	Material Source	Not Supplied
Atterberg Preparation	Dry Sieved	Material Type	Not Supplied (Not Supplied)
Material Description	Silty CLAY		

Atterberg Limits Results

Atterberg Limit	Specification Minimum	Test Result	Specification Maximum
Liquid Limit (%)		**33**	
Plastic Limit (%)		**27**	
Plasticity Index (%)		**6**	
Linear Shrinkage (%)			
Linear Shrinkage Defects:			

Remarks	Results apply to the sample/s as received.

NATA

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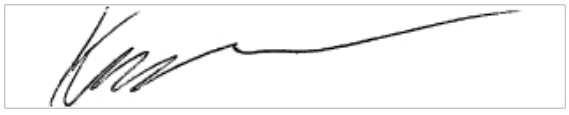

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ATTERBERG LIMITS REPORT

Client:	Cardno ACT	Report Number:	455/R/22235-1
Client Address:	2/14-16 Wormald Street, Symonston	Project Number:	455/P/137
Project:	QPRC - Sporting complex	Lot Number:	
Location:	HUME	Internal Test Request:	455/T/13942
Supplied To:	Cardno ACT	Client Reference/s:	50520049
Area Description:		Report Date / Page:	11/02/2020 Page 5 of 6

Test Procedures:	AS1289.3.1.2, AS 1289.3.3.1, AS1289.3.2.1, AS1289.2.1.1		
Sample Number	455/S/89895	Sample Location	
Sampling Method	Tested As Received	Client Supplied	TP105A
Date Sampled	17/01/2020		0.3-0.4m
Sampled By	Client Sampled		
Date Tested	10/02/2020		
Att. Drying Method	Oven Dried	Material Source	Not Supplied
Atterberg Preparation	Dry Sieved	Material Type	Not Supplied (Not Supplied)
Material Description	Sandy Silty CLAY		

Atterberg Limits Results

Atterberg Limit	Specification Minimum	Test Result	Specification Maximum
Liquid Limit (%)		**25**	
Plastic Limit (%)		**18**	
Plasticity Index (%)		**7**	
Linear Shrinkage (%)			
Linear Shrinkage Defects:			

Remarks	Results apply to the sample/s as received.

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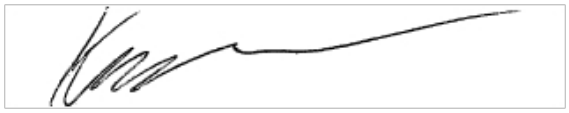

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ATTERBERG LIMITS REPORT

Client:	Cardno ACT	Report Number:	455/R/22235-1
Client Address:	2/14-16 Wormald Street, Symonston	Project Number:	455/P/137
Project:	QPRC - Sporting complex	Lot Number:	
Location:	HUME	Internal Test Request:	455/T/13942
Supplied To:	Cardno ACT	Client Reference/s:	50520049
Area Description:		Report Date / Page:	11/02/2020 Page 6 of 6

Test Procedures:	AS1289.3.1.2, AS 1289.3.3.1, AS1289.3.2.1, AS1289.2.1.1		
Sample Number	455/S/89899	Sample Location	
Sampling Method	Tested As Received	Client Supplied	BH306
Date Sampled	17/01/2020		6.0-6.45m
Sampled By	Client Sampled		
Date Tested	10/02/2020		
Att. Drying Method	Oven Dried	Material Source	Not Supplied
Atterberg Preparation	Dry Sieved	Material Type	Not Supplied (Not Supplied)
Material Description	Gravelly SAND		

Atterberg Limits Results

Atterberg Limit	Specification Minimum	Test Result	Specification Maximum
Liquid Limit (%)		**28**	
Plastic Limit (%)		**20**	
Plasticity Index (%)		**8**	
Linear Shrinkage (%)			
Linear Shrinkage Defects:			

Remarks	Results apply to the sample/s as received.

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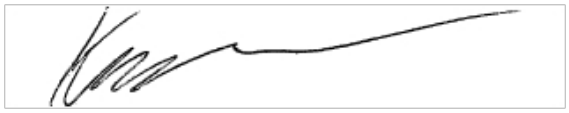

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Email: wollongong@constructionsciences.net

SHRINK SWELL INDEX

Client:	Construction Sciences Fyshwick	Report Number:	10848/R/18282-1
Client Address:	Unit 3/180 Gladstone Street, Fyshwick	Project Number:	10848/P/25
Project:	Inter BU testing	Lot Number:	
Location:	Fyshwick NSW	Internal Test Request:	10848/T/11295
Supplied To:	Construction Sciences Fyshwick	Client Reference/s:	
Area Description:		Report Date / Page:	13/02/2020 Page 1 of 6

Test Procedures:	AS1289.7.1.1, AS1289.2.1.1	Client Sample ID	TP102
Sample Number	10848/S/50464		0.4-0.5m
Sampling Method	Tested As Received		455/S/89893
Date Sampled	17/01/2020		QPRC- Sporting Complex
Sampled By	Client Sampled	Material Source	-
Date Tested	11/02/2020	Material Type	-

Soil Description:	(CH) Silty CLAY Black high plasticity		
Cracking / Crumbling:	nil		
Estimated Inert Inclusions (%):	0.00	Swell Pre-Soak Moisture Content (%)	20.4
Shrinkage Moisture Content (%):	19.8	Swell Post-Soak Moisture Content (%)	29.1

Shrinkage Strain (%)	1.6	Shrink / Swell Index	0.9
Swell Strain (%)	0.1		

Remarks	Shrink/Swell Samples Remoulded And Moisture Added Before Compaction Results apply to the sample/s as received.

NATA

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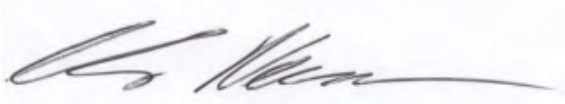

Approved Signatory: Chris Newman
Form ID: W21Rep Rev 1

Construction Sciences

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SHRINK SWELL INDEX

Client:	Construction Sciences Fyshwick	Report Number:	10848/R/18282-1
Client Address:	Unit 3/180 Gladstone Street, Fyshwick	Project Number:	10848/P/25
Project:	Inter BU testing	Lot Number:	
Location:	Fyshwick NSW	Internal Test Request:	10848/T/11295
Supplied To:	Construction Sciences Fyshwick	Client Reference/s:	
Area Description:		Report Date / Page:	13/02/2020 Page 2 of 6

Test Procedures:	AS1289.7.1.1, AS1289.2.1.1	Client Sample ID	TP104
Sample Number	10848/S/50465		0.2-0.3m
Sampling Method	Tested As Received		455/S/89894
Date Sampled	17/01/2020		QPRC- Sporting Complex
Sampled By	Client Sampled	Material Source	-
Date Tested	11/02/2020	Material Type	-

Soil Description:	(CL) Sandy CLAY Brown low plasticty		
Cracking / Crumbling:	Nil		
Estimated Inert Inclusions (%):	0.00	Swell Pre-Soak Moisture Content (%)	17.1
Shrinkage Moisture Content (%):	17.7	Swell Post-Soak Moisture Content (%)	17.0

Shrinkage Strain (%)	1.4	Shrink / Swell Index	0.8
Swell Strain (%)	0.0		

Remarks	Shrink/Swell Samples Remoulded And Moisture Added Before Compaction Results apply to the sample/s as received.

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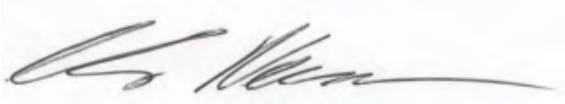

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SHRINK SWELL INDEX

Client:	Construction Sciences Fyshwick	Report Number:	10848/R/18282-1
Client Address:	Unit 3/180 Gladstone Street, Fyshwick	Project Number:	10848/P/25
Project:	Inter BU testing	Lot Number:	
Location:	Fyshwick NSW	Internal Test Request:	10848/T/11295
Supplied To:	Construction Sciences Fyshwick	Client Reference/s:	
Area Description:		Report Date / Page:	13/02/2020 Page 3 of 6

Test Procedures:	AS1289.7.1.1, AS1289.2.1.1	Client Sample ID	TP107
Sample Number	10848/S/50467		0.2-0.3m
Sampling Method	Tested As Received		455/S/89896
Date Sampled	17/01/2020		QPRC- Sporting Complex
Sampled By	Client Sampled	Material Source	-
Date Tested	11/02/2020	Material Type	-

Soil Description:	(CH) Silty CLAY black high plasticity		
Cracking / Crumbling:	Nil		
Estimated Inert Inclusions (%):	0.00	Swell Pre-Soak Moisture Content (%)	17.1
Shrinkage Moisture Content (%):	17.2	Swell Post-Soak Moisture Content (%)	19.6

Shrinkage Strain (%)	2.8	Shrink / Swell Index	1.5
Swell Strain (%)	0.0		

Remarks	Shrink/Swell Samples Remoulded And Moisture Added Before Compaction Results apply to the sample/s as received.

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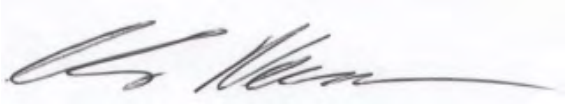

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SHRINK SWELL INDEX

Client:	Construction Sciences Fyshwick	Report Number:	10848/R/18282-1
Client Address:	Unit 3/180 Gladstone Street, Fyshwick	Project Number:	10848/P/25
Project:	Inter BU testing	Lot Number:	
Location:	Fyshwick NSW	Internal Test Request:	10848/T/11295
Supplied To:	Construction Sciences Fyshwick	Client Reference/s:	
Area Description:		Report Date / Page:	13/02/2020 Page 4 of 6

Test Procedures:	AS1289.7.1.1, AS1289.2.1.1	Client Sample ID	TP110
Sample Number	10848/S/50469		0.7-0.8m
Sampling Method	Tested As Received		455/S/89898
Date Sampled	17/01/2020		QPRC- Sporting Complex
Sampled By	Client Sampled	Material Source	-
Date Tested	11/02/2020	Material Type	-

Soil Description:	(CH) Silty CLAY high plasticity black		
Cracking / Crumbling:	Nil		
Estimated Inert Inclusions (%):	0.00	Swell Pre-Soak Moisture Content (%)	17.8
Shrinkage Moisture Content (%):	18.3	Swell Post-Soak Moisture Content (%)	30.9

Shrinkage Strain (%)	1.7	Shrink / Swell Index	1.0
Swell Strain (%)	0.0		

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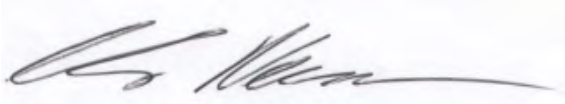

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SHRINK SWELL INDEX

Client:	Construction Sciences Fyshwick	Report Number:	10848/R/18282-1
Client Address:	Unit 3/180 Gladstone Street, Fyshwick	Project Number:	10848/P/25
Project:	Inter BU testing	Lot Number:	
Location:	Fyshwick NSW	Internal Test Request:	10848/T/11295
Supplied To:	Construction Sciences Fyshwick	Client Reference/s:	
Area Description:		Report Date / Page:	13/02/2020 Page 5 of 6

Test Procedures:	AS1289.7.1.1, AS1289.2.1.1	Client Sample ID	BH307
Sample Number	10848/S/50470		4.5-4.95m
Sampling Method	Tested As Received		455/S/89900
Date Sampled	17/01/2020		QPRC- Sporting Complex
Sampled By	Client Sampled	Material Source	-
Date Tested	11/02/2020	Material Type	-

Soil Description:	(CI) Sandy CLAY low plasticity light brown		
Cracking / Crumbling:	Nil		
Estimated Inert Inclusions (%):	0.00	Swell Pre-Soak Moisture Content (%)	22.4
Shrinkage Moisture Content (%):	21.8	Swell Post-Soak Moisture Content (%)	24.2

Shrinkage Strain (%)	2.2	Shrink / Swell Index	1.2
Swell Strain (%)	0.0		

Remarks	Shrink/Swell Samples Remoulded And Moisture Added Before Compaction Results apply to the sample/s as received.

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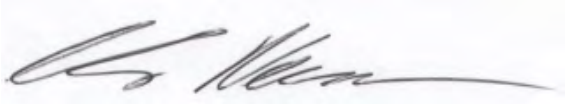

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SHRINK SWELL INDEX

Client:	Construction Sciences Fyshwick	Report Number:	10848/R/18282-1
Client Address:	Unit 3/180 Gladstone Street, Fyshwick	Project Number:	10848/P/25
Project:	Inter BU testing	Lot Number:	
Location:	Fyshwick NSW	Internal Test Request:	10848/T/11295
Supplied To:	Construction Sciences Fyshwick	Client Reference/s:	
Area Description:		Report Date / Page:	13/02/2020 Page 6 of 6

Test Procedures:	AS1289.7.1.1, AS1289.2.1.1	Client Sample ID	BH309
Sample Number	10848/S/50471		3.0-3.45m
Sampling Method	Tested As Received		455/S/89901
Date Sampled	17/01/2020		QPRC- Sporting Complex
Sampled By	Client Sampled	Material Source	-
Date Tested	11/02/2020	Material Type	-

Soil Description:	(CI) Sandy CLAY medium/low plasticity brown		
Cracking / Crumbling:	Nil		
Estimated Inert Inclusions (%):	0.00	Swell Pre-Soak Moisture Content (%)	21.3
Shrinkage Moisture Content (%):	22.5	Swell Post-Soak Moisture Content (%)	22.0

Shrinkage Strain (%)	4.0	Shrink / Swell Index	2.2
Swell Strain (%)	0.0		

Remarks	Shrink/Swell Samples Remoulded And Moisture Added Before Compaction Results apply to the sample/s as received.

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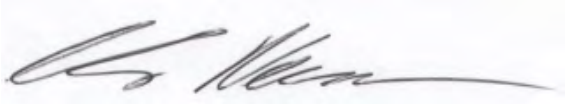

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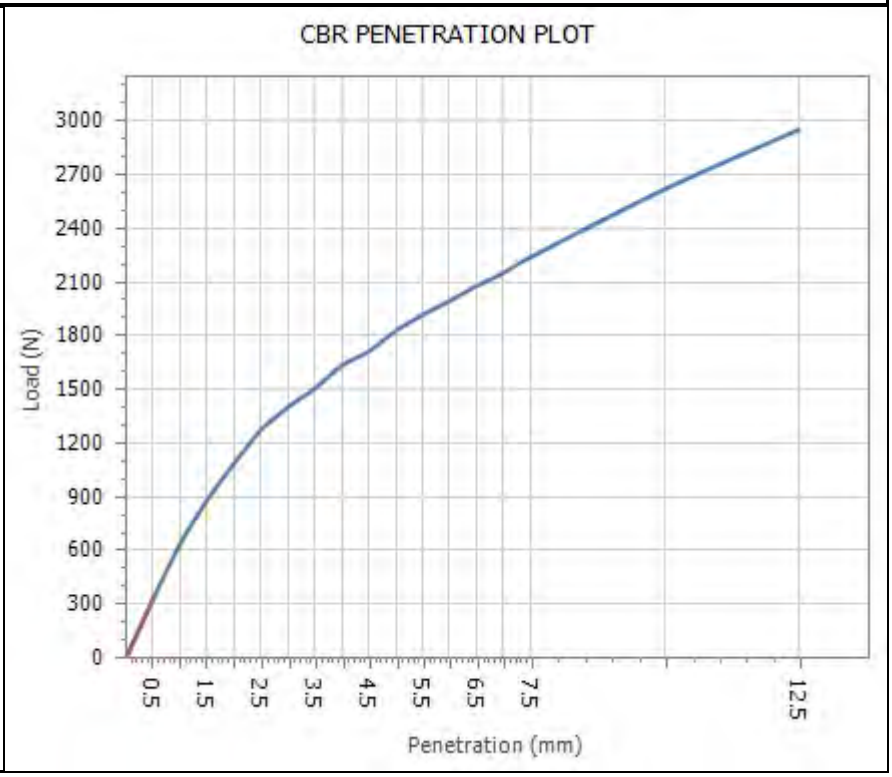
CALIFORNIA BEARING RATIO REPORT

Client:	Cardno ACT	Report Number:	455/R/22234-1
Client Address:	2/14-16 Wormald Street, Symonston	Project Number:	455/P/137
Project:	QPRC - Sporting complex	Lot Number:	
Location:	HUME	Internal Test Request:	455/T/13942
Supplied To:	Cardno ACT	Client Reference/s:	50520049
Area Description:		Report Date / Page:	11/02/2020 Page 1 of 8

Test Procedures	AS1289.6.1.1, AS1289.5.1.1, AS1289.2.1.1

Sample Number	455/S/89614	Sample Location	
Sampling Method	Tested As Received	Client Supplied	TP401
Date Sampled	17/01/2020		0.6-0.8m
Sampled By	Client Sampled		
Date Tested	8/02/2020		
Material Source	Not Specified	Material Limit Start	-
Material Type	Not Supplied (Not Supplied)	Material Limit End	-
Client Reference	-	Compactive Effort	Standard
Material Description	Silty Sand		

Maximum Dry Density (t/m³):	1.76
Optimum Moisture Content (%):	16.0
Field Moisture Content (%):	13.6
Sample Percent Oversize (%)	0.0
Oversize Included / Excluded	Excluded
Target Density Ratio (%):	95
Target Moisture Ratio (%):	100
Placement Dry Density (t/m³):	1.69
Placement Dry Density Ratio (%):	96.0
Placement Moisture Content (%):	15.4
Placement Moisture Ratio (%):	96.0
Test Condition / Soaking Period:	Soaked / 4 Days
CBR Surcharge (kg)	4.5
Dry Density After Soak (t/m³):	1.68
Total Curing Time (hrs)	n/a
Liquid Limit Method	n/a
Moisture (top 30mm) After Soak (%)	79.5
Moisture (remainder) After Soak (%)	18.7
CBR Swell (%):	0.5
Minimum CBR Specification (%):	-
CBR Value @ 2.5mm (%):	**10**



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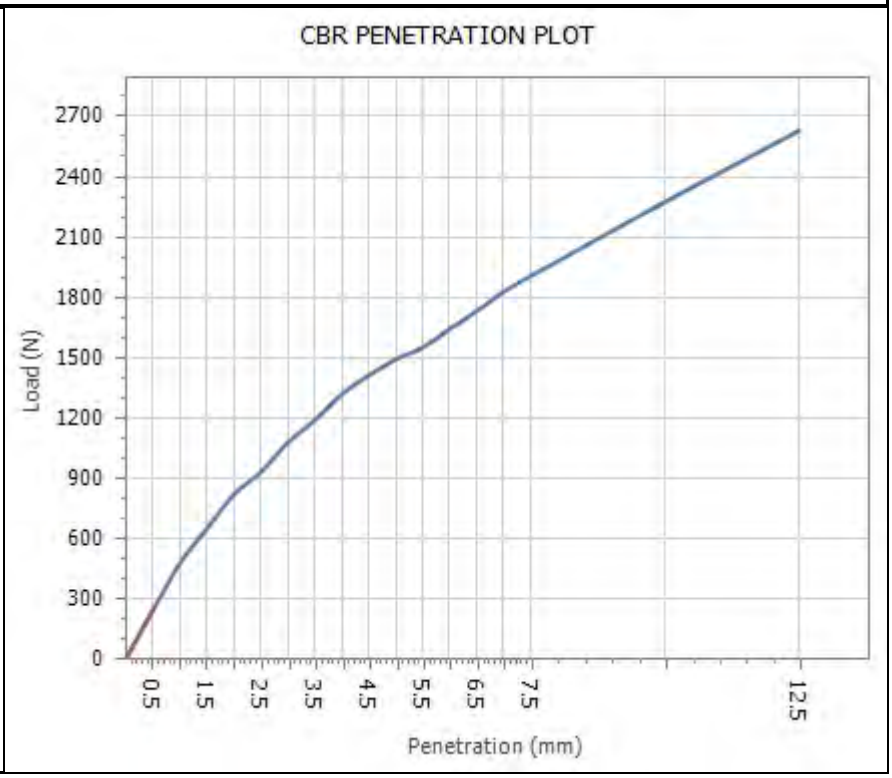
CALIFORNIA BEARING RATIO REPORT

Client:	Cardno ACT	Report Number:	455/R/22234-1
Client Address:	2/14-16 Wormald Street, Symonston	Project Number:	455/P/137
Project:	QPRC - Sporting complex	Lot Number:	
Location:	HUME	Internal Test Request:	455/T/13942
Supplied To:	Cardno ACT	Client Reference/s:	50520049
Area Description:		Report Date / Page:	11/02/2020 Page 2 of 8

Test Procedures	AS1289.6.1.1, AS1289.5.1.1, AS1289.2.1.1

Sample Number	455/S/89615	Sample Location	
Sampling Method	Tested As Received	Client Supplied	TP402
Date Sampled	17/01/2020		0.6-0.8m
Sampled By	Client Sampled		
Date Tested	8/02/2020		
Material Source	Not Specified	Material Limit Start	-
Material Type	Not Supplied (Not Supplied)	Material Limit End	-
Client Reference	-	Compactive Effort	Standard
Material Description	Gravelly Silty Sand		

Maximum Dry Density (t/m³):	1.87
Optimum Moisture Content (%):	12.0
Field Moisture Content (%):	8.0
Sample Percent Oversize (%)	0.0
Oversize Included / Excluded	Excluded
Target Density Ratio (%):	95
Target Moisture Ratio (%):	100
Placement Dry Density (t/m³):	1.77
Placement Dry Density Ratio (%):	94.5
Placement Moisture Content (%):	12.0
Placement Moisture Ratio (%):	99.0
Test Condition / Soaking Period:	Soaked / 4 Days
CBR Surcharge (kg)	4.5
Dry Density After Soak (t/m³):	1.76
Total Curing Time (hrs)	n/a
Liquid Limit Method	n/a
Moisture (top 30mm) After Soak (%)	17.1
Moisture (remainder) After Soak (%)	14.2
CBR Swell (%):	0.5
Minimum CBR Specification (%):	-
CBR Value @ 5.0mm (%):	**8**



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Client:	Cardno ACT	Report Number:	455/R/22234-1
Client Address:	2/14-16 Wormald Street, Symonston	Project Number:	455/P/137
Project:	QPRC - Sporting complex	Lot Number:	
Location:	HUME	Internal Test Request:	455/T/13942
Supplied To:	Cardno ACT	Client Reference/s:	50520049
Area Description:		Report Date / Page:	11/02/2020 Page 3 of 8

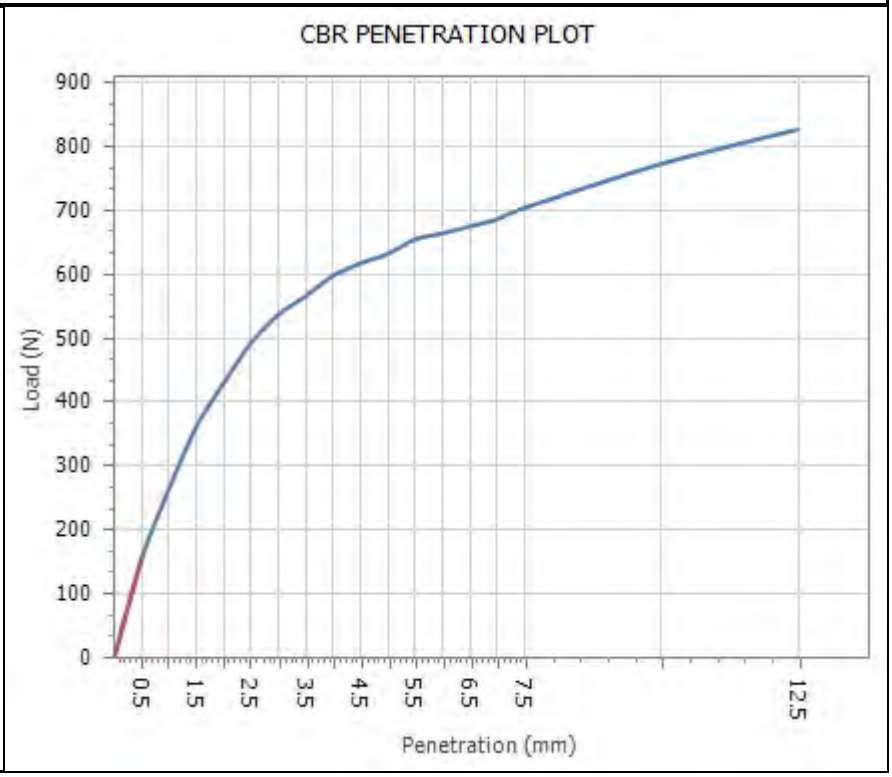
Test Procedures	AS1289.6.1.1, AS1289.5.1.1, AS1289.2.1.1
Sample Number	455/S/89616
Sampling Method	Tested As Received
Date Sampled	17/01/2020
Sampled By	Client Sampled
Date Tested	8/02/2020
Material Source	Not Specified
Material Type	Not Supplied (Not Supplied)
Client Reference	-

Sample Location	
Client Supplied	TP403
	0.6-0.8m

Material Limit Start	-
Material Limit End	-
Compactive Effort	Standard

Material Description	Silty CLAY

Maximum Dry Density (t/m³):	1.79
Optimum Moisture Content (%):	11.0
Field Moisture Content (%):	6.4
Sample Percent Oversize (%)	0.0
Oversize Included / Excluded	Excluded
Target Density Ratio (%):	95
Target Moisture Ratio (%):	100
Placement Dry Density (t/m³):	1.70
Placement Dry Density Ratio (%):	95.0
Placement Moisture Content (%):	10.1
Placement Moisture Ratio (%):	91.0
Test Condition / Soaking Period:	Soaked / 4 Days
CBR Surcharge (kg)	4.5
Dry Density After Soak (t/m³):	1.68
Total Curing Time (hrs)	n/a
Liquid Limit Method	n/a
Moisture (top 30mm) After Soak (%)	19.4
Moisture (remainder) After Soak (%)	18.4
CBR Swell (%):	1.0
Minimum CBR Specification (%):	-
CBR Value @ 2.5mm (%):	**3.5**



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Client Address:	2/14-16 Wormald Street, Symonston	Project Number:	455/P/137
Project:	QPRC - Sporting complex	Lot Number:	
Location:	HUME	Internal Test Request:	455/T/13942
Supplied To:	Cardno ACT	Client Reference/s:	50520049
Area Description:		Report Date / Page:	11/02/2020 Page 4 of 8

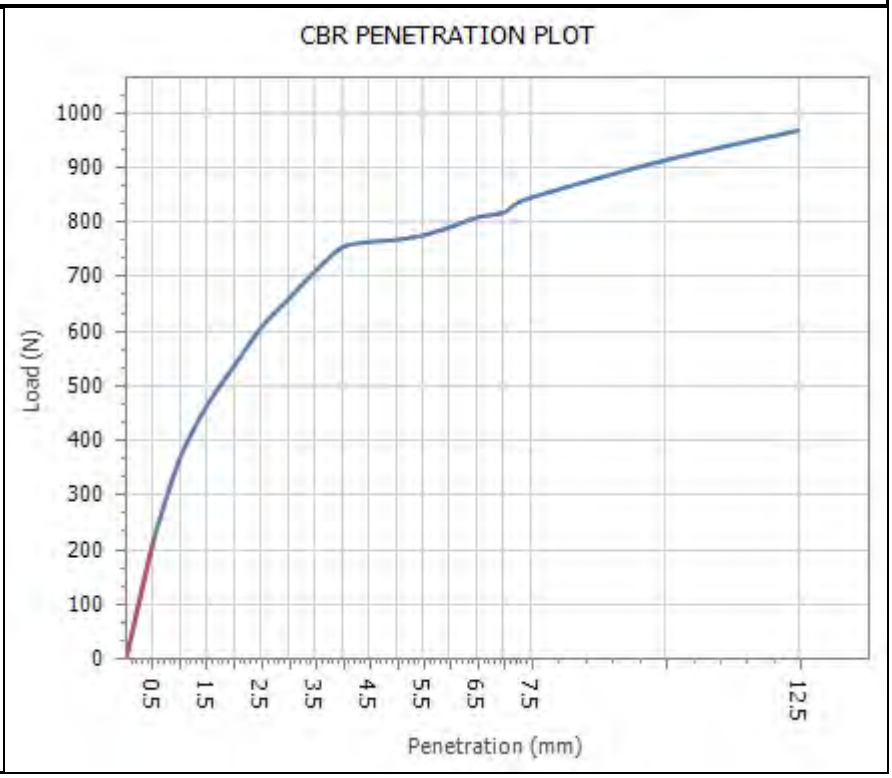
Test Procedures	AS1289.6.1.1, AS1289.5.1.1, AS1289.2.1.1
Sample Number	455/S/89617
Sampling Method	Tested As Received
Date Sampled	17/01/2020
Sampled By	Client Sampled
Date Tested	8/02/2020
Material Source	Not Specified
Material Type	Not Supplied (Not Supplied)
Client Reference	-

Sample Location	
Client Supplied	TP404
	0.6-0.8m

Material Limit Start	-
Material Limit End	-
Compactive Effort	Standard

Material Description	Silty CLAY

Maximum Dry Density (t/m³):	1.73
Optimum Moisture Content (%):	17.0
Field Moisture Content (%):	16.9
Sample Percent Oversize (%)	0.0
Oversize Included / Excluded	Excluded
Target Density Ratio (%):	95
Target Moisture Ratio (%):	100
Placement Dry Density (t/m³):	1.64
Placement Dry Density Ratio (%):	95.0
Placement Moisture Content (%):	17.5
Placement Moisture Ratio (%):	101.5
Test Condition / Soaking Period:	Soaked / 4 Days
CBR Surcharge (kg)	4.5
Dry Density After Soak (t/m³):	1.62
Total Curing Time (hrs)	n/a
Liquid Limit Method	n/a
Moisture (top 30mm) After Soak (%)	23.7
Moisture (remainder) After Soak (%)	20.7
CBR Swell (%):	1.5
Minimum CBR Specification (%):	-
CBR Value @ 2.5mm (%):	**4.5**



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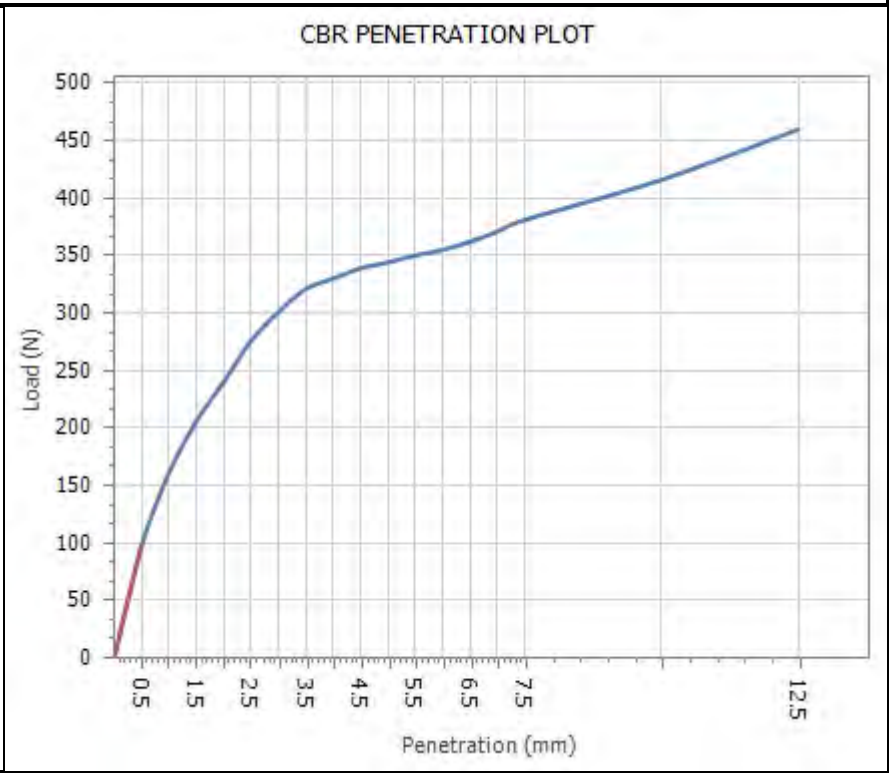
Project:	QPRC - Sporting complex	Lot Number:	
Location:	HUME	Internal Test Request:	455/T/13942
Supplied To:	Cardno ACT	Client Reference/s:	50520049
Area Description:		Report Date / Page:	11/02/2020 Page 5 of 8

Test Procedures	AS1289.6.1.1, AS1289.5.1.1, AS1289.2.1.1

Sample Number	455/S/89618	Sample Location	
Sampling Method	Tested As Received	Client Supplied	TP405
Date Sampled	17/01/2020		0.6-0.8m
Sampled By	Client Sampled		
Date Tested	8/02/2020		
Material Source	Not Specified	Material Limit Start	-
Material Type	Not Supplied (Not Supplied)	Material Limit End	-
Client Reference	-	Compactive Effort	Standard
Material Description	gravely sand		

Maximum Dry Density (t/m³):	1.45
Optimum Moisture Content (%):	15.5
Field Moisture Content (%):	-
Sample Percent Oversize (%)	0.0
Oversize Included / Excluded	-
Target Density Ratio (%):	95
Target Moisture Ratio (%):	100
Placement Dry Density (t/m³):	1.39
Placement Dry Density Ratio (%):	96.0
Placement Moisture Content (%):	16.1
Placement Moisture Ratio (%):	103.0
Test Condition / Soaking Period:	Soaked / 4 Days
CBR Surcharge (kg)	9.0
Dry Density After Soak (t/m³):	1.32
Total Curing Time (hrs)	n/a
Liquid Limit Method	n/a
Moisture (top 30mm) After Soak (%)	33.3
Moisture (remainder) After Soak (%)	30.0
CBR Swell (%):	5.0
Minimum CBR Specification (%):	-
CBR Value @ 2.5mm (%):	**2.0**



Remarks	Sample S/13942 Shear failure recorded Results apply to the sample/s as received.

NATA

The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.
Accredited for compliance with ISO/IEC 17025 - Testing

Accreditation Number: 1986
Corporate Site Number: 455

Approved Signatory: Kevin Spicer
Form ID: W2ASRep Rev2

Construction Sciences

Construction Sciences Pty Ltd
ABN: 74 128 806 735

Address:
Unit 3/180 Gladstone Street,
Fyshwick ACT 2609

Laboratory: Fyshwick Laboratory
Phone: 02 6285 5314
Fax:
Email: Canberra@constructionsciences.net

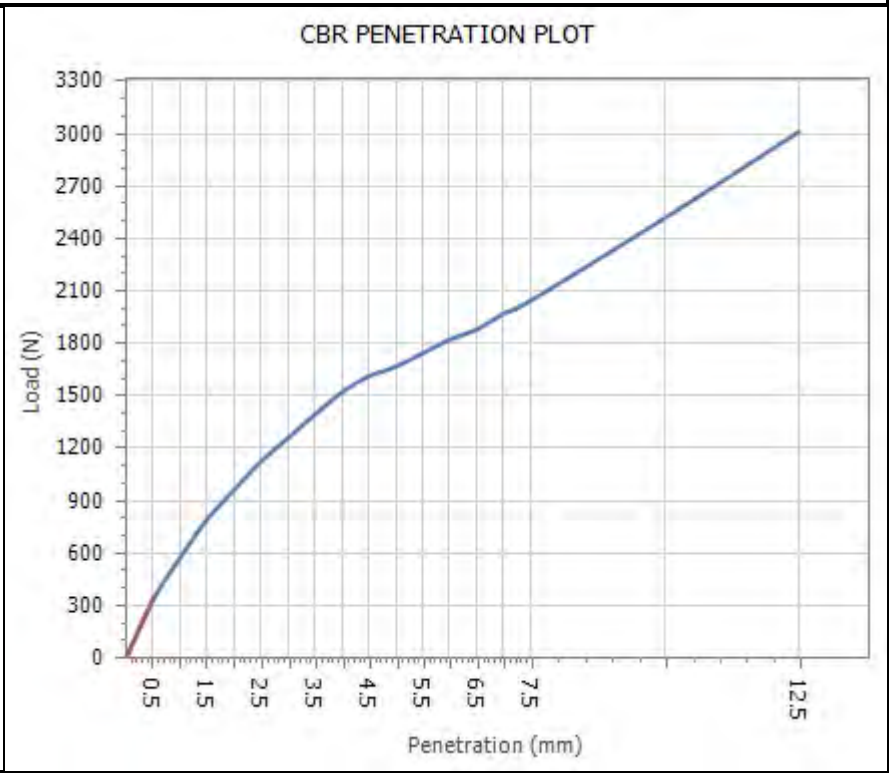
CALIFORNIA BEARING RATIO REPORT

Client:	Cardno ACT	Report Number:	455/R/22234-1
Client Address:	2/14-16 Wormald Street, Symonston	Project Number:	455/P/137
Project:	QPRC - Sporting complex	Lot Number:	
Location:	HUME	Internal Test Request:	455/T/13942
Supplied To:	Cardno ACT	Client Reference/s:	50520049
Area Description:		Report Date / Page:	11/02/2020 Page 6 of 8

Test Procedures	AS1289.6.1.1, AS1289.5.1.1, AS1289.2.1.1

Sample Number	455/S/89619	Sample Location	
Sampling Method	Tested As Received	Client Supplied	TP406
Date Sampled	17/01/2020		0.6-0.8m
Sampled By	Client Sampled		
Date Tested	8/02/2020		
Material Source	Not Specified	Material Limit Start	-
Material Type	Not Supplied (Not Supplied)	Material Limit End	-
Client Reference	-	Compactive Effort	Standard
Material Description	Gravelly Silty Sand		

Maximum Dry Density (t/m³):	1.93
Optimum Moisture Content (%):	10.0
Field Moisture Content (%):	4.0
Sample Percent Oversize (%)	0.0
Oversize Included / Excluded	Excluded
Target Density Ratio (%):	95
Target Moisture Ratio (%):	100
Placement Dry Density (t/m³):	1.85
Placement Dry Density Ratio (%):	96.0
Placement Moisture Content (%):	10.6
Placement Moisture Ratio (%):	105.0
Test Condition / Soaking Period:	Soaked / 4 Days
CBR Surcharge (kg)	4.5
Dry Density After Soak (t/m³):	1.85
Total Curing Time (hrs)	n/a
Liquid Limit Method	n/a
Moisture (top 30mm) After Soak (%)	15.0
Moisture (remainder) After Soak (%)	12.2
CBR Swell (%):	0.0
Minimum CBR Specification (%):	-
CBR Value @ 2.5mm (%):	**8**



Remarks	Sample S/13942 Shear failure recorded Results apply to the sample/s as received.

NATA

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Approved Signatory: Kevin Spicer
Form ID: W2ASRep Rev2

Construction Sciences

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Fax:
Email: Canberra@constructionsciences.net

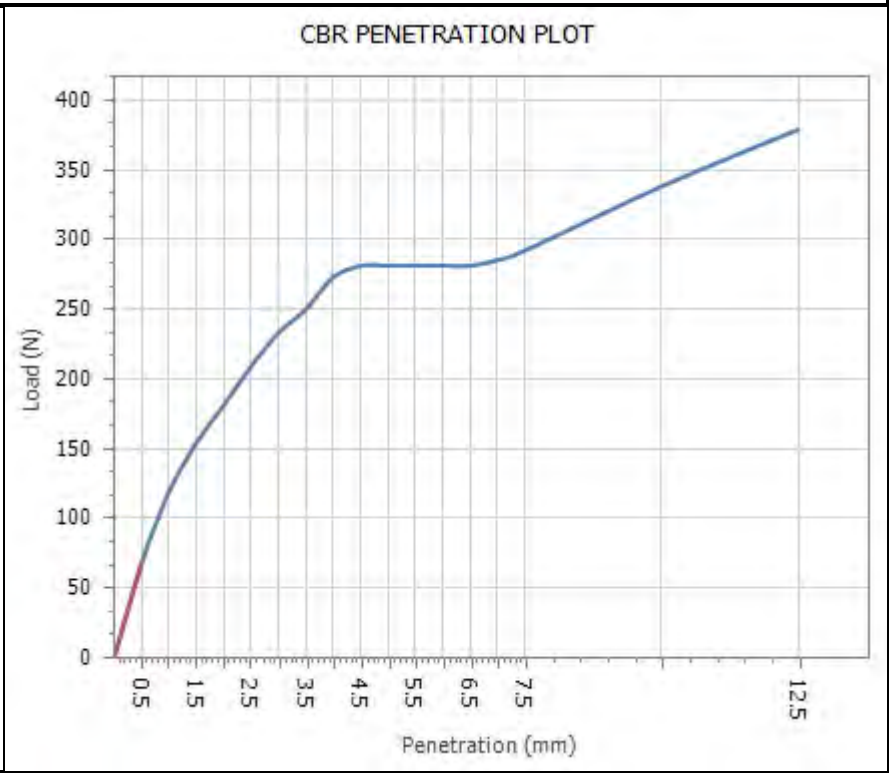
CALIFORNIA BEARING RATIO REPORT

Client:	Cardno ACT	Report Number:	455/R/22234-1
Client Address:	2/14-16 Wormald Street, Symonston	Project Number:	455/P/137
Project:	QPRC - Sporting complex	Lot Number:	
Location:	HUME	Internal Test Request:	455/T/13942
Supplied To:	Cardno ACT	Client Reference/s:	50520049
Area Description:		Report Date / Page:	11/02/2020 Page 7 of 8

Test Procedures	AS1289.6.1.1, AS1289.5.1.1, AS1289.2.1.1

Sample Number	455/S/89620	Sample Location	
Sampling Method	Tested As Received	Client Supplied	TP407
Date Sampled	17/01/2020		0.6-0.8m
Sampled By	Client Sampled		
Date Tested	8/02/2020		
Material Source	Not Specified	Material Limit Start	-
Material Type	Not Supplied (Not Supplied)	Material Limit End	-
Client Reference	-	Compactive Effort	Standard
Material Description	Clayey Silt		

Maximum Dry Density (t/m³):	1.49
Optimum Moisture Content (%):	18.5
Field Moisture Content (%):	11.0
Sample Percent Oversize (%)	0.0
Oversize Included / Excluded	Excluded
Target Density Ratio (%):	95
Target Moisture Ratio (%):	100
Placement Dry Density (t/m³):	1.43
Placement Dry Density Ratio (%):	95.5
Placement Moisture Content (%):	17.4
Placement Moisture Ratio (%):	95.0
Test Condition / Soaking Period:	Soaked / 4 Days
CBR Surcharge (kg)	4.5
Dry Density After Soak (t/m³):	1.38
Total Curing Time (hrs)	n/a
Liquid Limit Method	n/a
Moisture (top 30mm) After Soak (%)	31.8
Moisture (remainder) After Soak (%)	29.4
CBR Swell (%):	3.0
Minimum CBR Specification (%):	-
CBR Value @ 2.5mm (%):	**1.5**



Remarks	Sample S/13942 Shear failure recorded Results apply to the sample/s as received.

NATA

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Accredited for compliance with ISO/IEC 17025 - Testing

Accreditation Number: 1986
Corporate Site Number: 455

Approved Signatory: Kevin Spicer
Form ID: W2ASRep Rev2

Construction Sciences

Construction Sciences Pty Ltd
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Fyshwick ACT 2609

Laboratory: **Fyshwick Laboratory**
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Fax:
Email: Canberra@constructionsciences.net

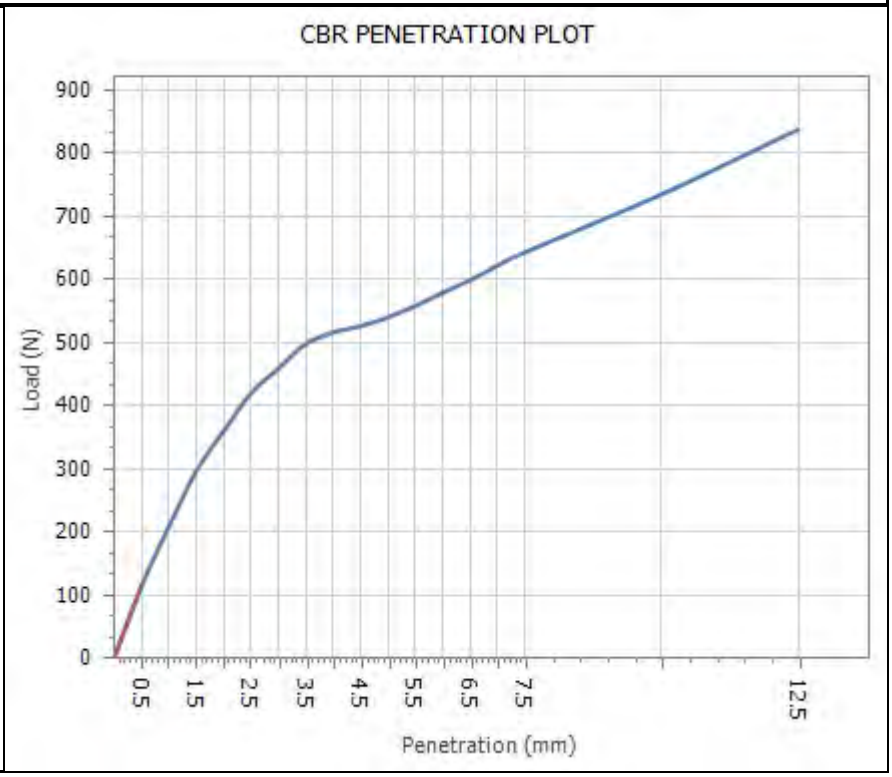
CALIFORNIA BEARING RATIO REPORT

Client:	Cardno ACT	Report Number:	455/R/22234-1
Client Address:	2/14-16 Wormald Street, Symonston	Project Number:	455/P/137
Project:	QPRC - Sporting complex	Lot Number:	
Location:	HUME	Internal Test Request:	455/T/13942
Supplied To:	Cardno ACT	Client Reference/s:	50520049
Area Description:		Report Date / Page:	11/02/2020 Page 8 of 8

Test Procedures	AS1289.6.1.1, AS1289.5.1.1, AS1289.2.1.1

Sample Number	455/S/89621	Sample Location	
Sampling Method	Tested As Received	Client Supplied	TP408
Date Sampled	17/01/2020		0.6-0.8m
Sampled By	Client Sampled		
Date Tested	8/02/2020		
Material Source	Not Specified	Material Limit Start	-
Material Type	Not Supplied (Not Supplied)	Material Limit End	-
Client Reference	-	Compactive Effort	Standard
Material Description	Clayey Silt		

Maximum Dry Density (t/m³):	1.68
Optimum Moisture Content (%):	16.5
Field Moisture Content (%):	10.0
Sample Percent Oversize (%)	0.0
Oversize Included / Excluded	Excluded
Target Density Ratio (%):	95
Target Moisture Ratio (%):	100
Placement Dry Density (t/m³):	1.61
Placement Dry Density Ratio (%):	96.0
Placement Moisture Content (%):	17.2
Placement Moisture Ratio (%):	103.5
Test Condition / Soaking Period:	Soaked / 4 Days
CBR Surcharge (kg)	4.5
Dry Density After Soak (t/m³):	1.56
Total Curing Time (hrs)	n/a
Liquid Limit Method	n/a
Moisture (top 30mm) After Soak (%)	25.0
Moisture (remainder) After Soak (%)	20.7
CBR Swell (%):	2.5
Minimum CBR Specification (%):	-
CBR Value @ 2.5mm (%):	**3.0**



Remarks	Sample S/13942 Shear failure recorded Results apply to the sample/s as received.

NATA

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Accredited for compliance with ISO/IEC 17025 - Testing

Accreditation Number: 1986
Corporate Site Number: 455

Approved Signatory: Kevin Spicer
Form ID: W2ASRep Rev2

Construction Sciences

Construction Sciences Pty Ltd
ABN: 74 128 806 735

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Laboratory: **Wollongong Laboratory**
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Fax: 02 4257 4463
Email: wollongong@constructionsciences.net

EMERSON CLASS NUMBER REPORT

Client:	Construction Sciences Fyshwick	Report Number:	10848/R/18372-1
Client Address:	Unit 3/180 Gladstone Street, Fyshwick	Project Number:	10848/P/25
Project:	Inter BU testing	Lot Number:	
Location:	Fyshwick NSW	Internal Test Request:	10848/T/11295
Supplied To:	Construction Sciences Fyshwick	Client Reference/s:	
Area Description:		Report Date / Page:	18/02/2020 Page 1 of 2

Test Procedures:	AS1289.3.8.1

Sample Number	10848/S/50462	10848/S/50463	10848/S/50465	10848/S/50466
ID / Client ID	455/S/89619	455/S/89891	455/S/89894	455/S/89895
Lot Number	-	-	-	-
Date / Time Sampled	17/01/2020	17/01/2020	17/01/2020	17/01/2020
Date Tested	17/02/2020	17/02/2020	17/02/2020	17/02/2020
Material Source	-	-	-	-
Material Type	-	-	-	-
Sampling Method	Tested As Received	Tested As Received	Tested As Received	Tested As Received
Water Type	Distilled	distilled	distilled	distilled
Water Temperature (C°)	22	22	22	22
Client Sample ID	TP406	TP101	TP104	TP105A
	0.6-0.8m	0.2-0.3m	0.2-0.3m	0.3-0.4m
	455/S/89619	455/S/89891	455/S/89894	455/S/89895
	QPRC- Sporting Complex	QPRC- Sporting Complex	QPRC- Sporting Complex	QPRC- Sporting Complex
Soil Description	-	-	(CL) Sandy CLAY Brown low plast	-
Emerson Class Number	**6**	**8**	**5**	**2**

Remarks	Results apply to the sample/s as received.

NATA

The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.
Accredited for compliance with ISO/IEC 17025 - Testing

Accreditation Number: 1986
Corporate Site Number: 10848

Approved Signatory: Tim Mathie
Form ID: W34Rep Rev 2

Construction Sciences

Construction Sciences Pty Ltd
ABN: 74 128 806 735

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Oak Flats NSW 2529

Laboratory: **Wollongong Laboratory**
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Fax: 02 4257 4463
Email: wollongong@constructionsciences.net

EMERSON CLASS NUMBER REPORT

Client:	Construction Sciences Fyshwick	Report Number:	10848/R/18372-1
Client Address:	Unit 3/180 Gladstone Street, Fyshwick	Project Number:	10848/P/25
Project:	Inter BU testing	Lot Number:	
Location:	Fyshwick NSW	Internal Test Request:	10848/T/11295
Supplied To:	Construction Sciences Fyshwick	Client Reference/s:	
Area Description:		Report Date / Page:	18/02/2020 Page 2 of 2

Test Procedures:	AS1289.3.8.1

Sample Number	10848/S/50467	10848/S/50468		
ID / Client ID	455/S/89896	455/S/89897		
Lot Number	-	-		
Date / Time Sampled	17/01/2020	17/01/2020		
Date Tested	17/02/2020	17/02/2020		
Material Source	-	-		
Material Type	-	-		
Sampling Method	Tested As Received	Tested As Received		
Water Type	distilled	distilled		
Water Temperature (C°)	22	22		
Client Sample ID	TP107	TP110		
	0.2-0.3m	0.3-0.4m		
	455/S/89896	455/S/89897		
	QPRC- Sporting Complex	QPRC- Sporting Complex		
Soil Description	(CH) Silty CLAY black high plastici	-		
Emerson Class Number	**5**	**4**		

Remarks	Results apply to the sample/s as received.

The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.
Accredited for compliance with ISO/IEC 17025 - Testing

Accreditation Number: 1986
Corporate Site Number: 10848

Approved Signatory: Tim Mathie
Form ID: W34Rep Rev 2

ALS Water

CERTIFICATE OF ANALYSIS

Work Order	: **CA2000580**	Page	: 1 of 4
Client	: **CARDNO**	Laboratory	: ALS Water Resources Group
Contact	: Mr Matthew Thorogood	Contact	: Client Services
Address	: PO Box 40 Fyshwick Canberra ACT 2609	Address	: 16B Lithgow Street Fyshwick ACT Australia 2609
Telephone	: ----	Telephone	: +61 2 6202 5404
Project	: 50520049	Date Samples Received	: 22-Jan-2020 15:00
Order number	: ----	Date Analysis Commenced	: 04-Feb-2020
C-O-C number	: ----	Issue Date	: 12-Feb-2020 16:23
Sampler	: ----		
Site	: ----		
Quote number	: ----		
No. of samples received	: 8		
No. of samples analysed	: 8		

Accreditation No. 992
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*
Geetha Ramasundara	Chemistry Teamleader	Inorganics, Fyshwick, ACT

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.

- **For samples collected by ALS WRG, sampling was carried out in accordance with Procedure EN67**

Analytical Results

Sub-Matrix: SOLID (Matrix: SOLID)			Client sample ID	---- BH301 4.5-4.95m	---- BH0303 3.0-3.45m	---- BH0308 1.50-1.95m	---- BH0308 3.0-3.45m	---- BH0311 1.5-1.95m
			Client sampling date / time	16-Jan-2020 00:00	16-Jan-2020 00:00	16-Jan-2020 00:00	16-Jan-2020 00:00	16-Jan-2020 00:00
Compound	CAS Number	LOR	Unit	CA2000580-001	CA2000580-002	CA2000580-003	CA2000580-004	CA2000580-005
				Result	Result	Result	Result	Result
EA002 : pH (Soils)								
ø **pH Value**	----	0.1	pH Unit	----	**7.5**	**8.2**	**8.4**	**8.1**
EA010: Conductivity								
ø **Electrical Conductivity @ 25°C**	----	0.01	dS/m	----	**0.05**	**0.08**	**0.09**	**0.03**
EA002CA: pH in Soil								
ø **pH Value**	----	0.1	pH Unit	**6.8**	----	----	----	----
EA010CA: Conductivity								
ø **Electrical Conductivity @ 25°C**	----	0.01	dS/m	**0.15**	----	----	----	----
EA080CA: Resistivity								
Resistivity at 25°C	----	1	ohm cm	**6660**	**20000**	**12500**	**11100**	**33300**
ED009CA: Anions								
Chloride	16887-00-6	1	mg/kg	**38**	**29**	**28**	**40**	**23**
Sulfate	14808-79-8	2	mg/kg	**314**	**43**	**67**	**64**	**22**

Analytical Results

Sub-Matrix: SOLID (Matrix: SOLID)				Client sample ID	---- BH312 4.5-4.95m	---- BH321 1.5-1.95m	---- BH321 4.5-4.95m	----	----
				Client sampling date / time	16-Jan-2020 00:00	16-Jan-2020 00:00	16-Jan-2020 00:00	----	----
Compound	CAS Number	LOR	Unit		CA2000580-006	CA2000580-007	CA2000580-008	--------	--------
					Result	Result	Result	----	----
EA002 : pH (Soils)									
ø **pH Value**	----	0.1	pH Unit		**7.6**	**8.8**	**8.3**	**----**	**----**
EA010: Conductivity									
ø **Electrical Conductivity @ 25°C**	----	0.01	dS/m		**0.06**	**0.06**	**0.04**	**----**	**----**
EA080CA: Resistivity									
Resistivity at 25°C	----	1	ohm cm		**16700**	**16700**	**25000**	**----**	**----**
ED009CA: Anions									
Chloride	16887-00-6	1	mg/kg		**35**	**22**	**23**	**----**	**----**
Sulfate	14808-79-8	2	mg/kg		**32**	**76**	**21**	**----**	**----**

Queanbeyan Palerang Regional Sports Complex

APPENDIX D

SITE PHOTOGRAPHS

Plate 1: TP101

Plate 2: TP102

Client:	Queanbeyan Palerang Regional Council
Project:	Queanbeyan Palerang Regional Sports Complex
Cardno Reference:	50520049
Title:	Test Pit Photo Log
Size:	A4

Plate 3: TP103

Plate 4: TP104

Plate 5: TP105

Plate 6: TP105A

Client:	Queanbeyan Palerang Regional Council
Project:	Queanbeyan Palerang Regional Sports Complex
Cardno Reference:	50520049
Title:	Test Pit Photo Log
Size:	A4

Plate 7: TP106

Plate 8: TP107

Plate 9: TP108

Plate 10: TP109

Plate 11: TP110

Plate 12: TP201

Client:	Queanbeyan Palerang Regional Council
Project:	Queanbeyan Palerang Regional Sports Complex
Cardno Reference:	50520049
Title:	Test Pit Photo Log
Size:	A4

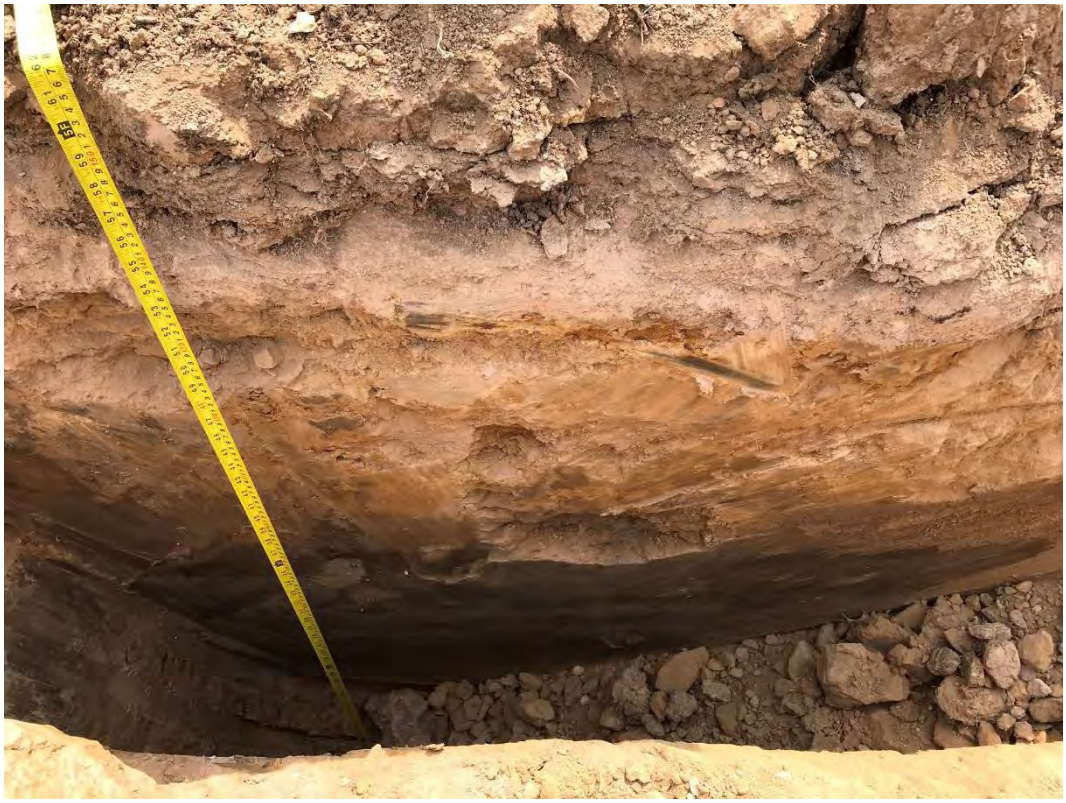

Plate 13: TP202

Plate 14: TP203

Plate 15: TP401

Plate 16: TP402

Client:	Queanbeyan Palerang Regional Council
Project:	Queanbeyan Palerang Regional Sports Complex
Cardno Reference:	50520049
Title:	Test Pit Photo Log
Size:	A4

Plate 17: TP403

Plate 18: TP404

Plate 19: TP406

Plate 20: TP407

Plate 21: northern area of the site looking to the northwest

Plate 22: existing rock outcrops near the northwest boundary of the site

Client:	Queanbeyan Palerang Regional Council
Project:	Queanbeyan Palerang Regional Sports Complex
Cardno Reference:	50520049
Title:	Site Photo
Size:	A4

Plate 23: existing well near the northeast boundary of the site

Plate 24: drilling arrangements used at the site

Client:	Queanbeyan Palerang Regional Council
Project:	Queanbeyan Palerang Regional Sports Complex
Cardno Reference:	50520049
Title:	Site Photo
Size:	A4

Queanbeyan Palerang Regional Sports Complex

APPENDIX E

IMPORTANT INFORMATION

Important Information about this Geotechnical Report

Scope of Work

The purpose of this report and any associated documentation is expressly stated in the document. This document does not form a complete assessment of the site, and no implicit determinations about Cardno's scope can be taken if not specifically referenced. Whilst this report is intended to reduce geotechnical risk, no level of detail or scope of work can entirely eliminate risk.

The nature of geotechnical data typically precludes auxiliary environmental assessment without undertaking specific methods in the investigation. Therefore, unless it is explicitly stated in the scope of work, this report does not provide any contamination or environmental assessment of the site or adjacent sites, nor can it be inferred or implied from any component of the document.

The scope of work, geotechnical information, and assessments made by Cardno may be summarised in the report; however, all aspects of the document, including associated data and limitations should be reviewed in its entirety.

Standard of care

Cardno have undertaken investigations, performed consulting services, and prepared this report based on the Client's specific requirements, data that was available or was collected, and previous experience.

Cardno's findings and assessment represent its reasonable judgment, diligence, skill, with sound professional standards, within the time and budget constraints of its commission. No warranty, expressed or implied, is made as to the professional advice included in this report.

Data sources

In preparing this document, or providing any consulting services during the commission, Cardno may have relied on information from third parties including, but not limited to; sub-consultants, published data, and the Client including its employees or representatives. This data may not be verified and Cardno assumes no responsibility for the adequacy, incompleteness, inaccuracies, or reliability of this information.

Cardno does not assume any responsibility for assessments made partly, or entirely based on information provided by third parties.

Variability in conditions and limitations of data

Subsurface conditions are complex and can be highly variable; they cannot be accurately defined by discrete investigations. Geotechnical data is based on investigation locations which are explicitly representative of the specific sample or test points. Interpretation of conditions between such points cannot be assumed to represent actual subsurface information and there are unknowns or variations in ground conditions between test locations that cannot be inferred or predicted.

The precision and reliability of interpretive assessment between discrete points is dependent on the uniformity of the subsurface strata, as well as the frequency, detail, and method of sampling or testing.

Subsurface conditions are formed by various natural and anthropogenic processes and therefore are subject to change over time. This is particularly relevant with changes to the site ownership or usage, site boundary or layout, and design or planning modifications. Aspects of the site may also not be able to be determined due to physical or project related constraints and any information provided by Cardno cannot apply following modification to the site, regulations, standards, or the development itself.

It is important to appreciate that no level of detail in investigation, or diligence in assessment, can eliminate uncertainty related to subsurface conditions and thus, geotechnical risk. Cardno cannot and does not provide unqualified warranties nor does it assume any liability for site conditions not observed or accessible during the investigations.

Verification of opinions and recommendations

Geotechnical information, by nature, represents an opinion and is based extensively on judgment of both data and interpretive assessments or observation. This report and its associated documentation are provided explicitly based on Cardno's opinion of the site at the time of inspection, and cannot be extended beyond this.

Any recommendations or design are provided as preliminary until verified on site during project implementation or construction. Inspection and verification on site shall be conducted by a suitably qualified geotechnical consultant or engineer, and where subsurface conditions or interpretations differ from those provided in this document or otherwise anticipated, Cardno must be notified and be provided with an opportunity to review the recommendations.

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