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HIGH 618 PTY LTD

Geotechnical Investigation

614-632 High Street, Penrith

E24300.G03
9 August 2019

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1. Introduction

1.1 Background

At the request of David Kamel of High 618 Pty Ltd (the Client), EI Australia (EI) has carried out a Geotechnical Investigation (GI) for the proposed development at 614-632 High Street, Penrith (the Site).

This GI report has been prepared to provide advice and recommendations to assist in the preparation of designs for the proposed development. The investigation has been carried out in accordance with the agreed scope of works outlined in EI's proposal referenced P17400.2, dated 11 July 2019, and with the Client's signed authorisation to proceed, dated 16 July 2019.

1.2 Proposed Development

The following documents, supplied by the Client, were used to assist with the preparation of this GI report:

- Preliminary Architectural Drawings prepared by DKO Architecture (NSW) Pty Ltd, Project No. 12012, Drawing Nos. DA200 to DA209 & DA500 to DA509, Rev P1, dated 5 July 2019;
- Scope of work for Geotechnical Services prepared by Urban Apartments, Issue 1, dated 8 July 2019;
- Test holes marked up on site plan; and
- Perspective images showing Facade arrangements of the proposed development.

No Survey drawings were available at the time of writing this report therefore, all height references are Below Existing Ground Level (BEGL).

Based on the provided documents, EI understands that the proposed development involves demolition of the existing asphalt pavement and the construction of two, 7 and 44 levels tower buildings (Tower A and B) overlying a common five-level above ground basement carpark and podium. To achieve the Bulk Excavation Level (BEL), minor excavation depth of about 0.5m to 1.0m BEGL is expected. Locally deeper excavations may be required for footings, service trenches, crane pads, and lift overrun pits.

1.3 Investigation Objectives

The objective of the GI was to assess the existing site surface and subsurface conditions at six borehole locations, and to provide geotechnical advice and recommendations addressing the following:

- Dilapidation Surveys;
- Building foundation options, including;
  - Design parameters.
  - Earthquake loading factor in accordance with AS1170.4:2007.
- The requirement for additional geotechnical works.

1.4 Scope of Works

The scope of works for the GI included:

- Preparation of a Work Health and Safety Plan;
- Review of the relevant geological maps for the project area;
- Site walkover inspection by a Geotechnical Engineer to assess topographical features and site conditions;
- Scanning of proposed borehole locations for buried conductive services using a licensed service locator with reference to Dial Before You Dig (DBYD) plans;
- Auger drilling of six boreholes (BH1M, BH2, BH3M, BH4, BH5 and BH6) by a track-mounted drill rig using solid flight augers equipped with a 'Tungsten-Carbide' (T-C) bit. Boreholes, BH1M, BH2, BH3M, BH4, BH5 and BH6, were auger drilled to depths of about 3.20m, 2.40m, 3.30m, 3.50m, 2.30m and 2.30m BEGL, respectively. Approximate borehole locations are shown on **Figure 2**;
  - Standard Penetration Testing (SPT) was carried out (as per AS 1289.6.3.1-2004), where possible, during auger drilling of the boreholes to assess soil strength/relative densities.
- Once augers reached refusal depth, boreholes (BH1M, BH2, BH3M, BH4, BH5 and BH6) were advanced using rotary tricone roller bits to depths of about 13.10m, 12.70m, 12.80m, 12.80m, 13.00m and 12.80m BEGL, respectively;
- Continuation of boreholes, BH1M, BH2, BH3M, BH4, BH5 and BH6, with NMLC diamond coring techniques to termination depths of about 19.58m, 19.29m, 19.00m, 18.48m, 19.60m and 18.20m BEGL, respectively;
- Rock cores recovered from the boreholes were boxed, logged, photographed and sent to Macquarie for point load strength index and uniaxial compressive strength testing and storage. The test results are presented in **Appendix B**, and the rock core photographs are presented in **Appendix A**;
- Borehole BH1M and BH3M were converted into groundwater monitoring wells with depths of 12.6m and 12.6m BEGL, respectively, to allow for long-term groundwater monitoring.
- Measurements of groundwater seepage/levels, where possible, in the augered sections of the boreholes during and shortly after completion of auger drilling. Long term groundwater monitoring was not carried out as this was not allowed for as part of this investigation; and
- Preparation of this GI report.

An EI Geotechnical Engineer was present full-time onsite to set out the borehole locations, direct the testing and sampling, log the subsurface conditions and record groundwater levels.

1.5 Constraints

The GI was limited by the intent of the investigation. The discussions and advice presented in this report are intended to assist in the preparation of designs for the proposed development. Further geotechnical inspections should be carried out during construction to confirm the geotechnical models, and the design parameters provided in this report.

2. Site Description

2.1 Site Description and Identification

The site identification details and associated information are presented in **Table 2-1** below while the site locality is shown on **Figure 1.**

Table 2-1 Summary of Site Information

Information	Detail
Street Address	614-632 High Street, Penrith
Lot and Deposited Plan (DP) Identification	Lot 10 in DP 1162271 Penrith City Council
Brief Site Description	At the time of our investigation, the site was concrete paved with areas covered with grass and bushes. Two billboard structures were located within the north-western corner with a few trees around the site boundaries.
Site Area	The site area is approximately 4730m^2 (based on NSW Six Maps). (No survey drawings were available)

2.2 Local Land Use

The site is situated within an area of residential and commercial use. Current uses on surrounding land at the time of our presence on site are described in **Table 2-2** below. For the sake of this report, the site boundary nearest to High Street shall be adopted as the northern site boundary.

Table 2-2 Summary of Local Land Use

Direction Relative to Site	Land Use Description
North	High Street, a four-lane asphalt-paved RMS road set back 4m from the northern site boundary.
East	No. 612 High Street, an actively used concrete-paved carpark with disused concrete block garage with metal shelter. The garage and carpark abut the eastern site boundary.
South	Union Lane, a two-lane asphalt-paved road set back <1.0m from the southern site boundary. Beyond this are properties at 83-85 Union Road, an eight-storey apartment building with at least one basement, 81-79 Union Road, a five-storey apartment building with at least one basement, and 77 Union Road, a single-storey brick commercial building with asphalt-paved car-park.
West	No. 634-638 High Street, a single-storey car service station consisting of a metal workshop building, petrol bowser, disused asphalt-paved carpark, grassed and concrete-paved areas. The building is set back approximately 15m from the western site boundary.

2.3 Regional Setting

The site topography and geological information for the locality is summarised in **Table 2-3** below**.**

Table 2-3 Topographic and Geological Information

Attribute	Description
Topography	Based on NSW Six Maps, the site is located within a flat topography in general.
Regional Geology	Information on regional sub-surface conditions, referenced from the Department of Mineral Resources Geological Map Penrith 1:100,000 Geological Series Sheet 9030 (DMR 1991) indicates the site to be underlain by the Cranebrook Formation (Qpc). The Cranebrook Formation is of fluvial origin consisting of gravel (commonly known as 'Penrith Gravels'), sand, silt, and clay. Based on the geology, the Cranebrook Formation is likely to be further underlain by Wianamatta Group shale and sandstone. An excerpt from the geological map is shown below in **Figure 1.**

Figure 1 Excerpt of geological map showing location of site

3. Investigation Results

3.1 Stratigraphy

For the development of a site-specific geotechnical model, the stratigraphy observed in the GI has been grouped into four lithological units. A summary of the subsurface conditions across the site, interpreted from the assessment results, is presented in **Table 3-1** below. More detailed descriptions of subsurface conditions at each borehole location are available on the borehole logs presented in **Appendix A**. The details of the method of soil and rock classification, explanatory notes and abbreviations adopted on the borehole logs are also presented in **Appendix A.**

Table 3-1 Summary of Subsurface Conditions

Unit	Material[2]	Depth to Top of Unit (m BEGL)[1]	Observed Thickness (m)	Comments
1	Fill	Surface	0.2 to 1.2	Silty sand Fill, usually with fine to medium gravels and rootlets. Fill within BH3M & BH6 was overlain by concrete pavement of 30mm thickness. Fill was assessed based on our observations during drilling to be poorly compacted.
2a	Fluvial Soil (Silty Sand / Sandy Silt)	0.2 to 1.2	1.9 to 3.0	Fine to medium grained silty sand and low plasticity silt / sandy silt. SPT values ranged from 4 to 11.
2b	Fluvial Soil (Sandy GRAVEL)	2.3 to 3.5	9.4 to 10.7	Sandy Gravels, medium to coarse, sub-angular to sub-rounded, with silt.
3	Low to Medium Strength Shale	12.9 to 13.0	2.1 to 3.2	Low to medium strength slightly weathered to fresh shale. Unit 4 was overlain by up to 350mm of distinctly weathered, very low to low strength shale.
4	High Strength Shale	15.0 to 16.2	-[3]	High strength, fresh Shale

Note 1 Approximate depth and level at the time of our assessment. Depths and levels may vary across the site.
Note 2 For more detailed descriptions of the subsurface conditions, reference should be made to the borehole logs attached to **Appendix A.**
Note 3 Observed up to termination depth in all boreholes.

3.2 Groundwater Observations

Following completion of boreholes BH1M and BH3M, groundwater monitoring wells were installed and all drilling water bailed out. The groundwater levels were then measured within the monitoring wells as per **Table 3.2** below:

Table 3-2 Groundwater Measurement

Borehole ID	Well Development Date	Measurement Date	Depth to Groundwater (m BEGL)
BH1M	22/7/2019	25/7/19	8.0
BH3M	24/7/2019	25/7/19	7.5

Water circulation due to rock coring within the remaining boreholes prevented observations of groundwater levels within the boreholes. We note that no long term groundwater monitoring was carried out.

3.3 Test Results

Two soil samples and one water sample were selected for laboratory testing to assess aggressivity (pH, Chloride and Sulfate content and electrical conductivity).

A summary of the soil test results is provided in **Table 3-3** below. Laboratory test certificates are presented in **Appendix B**.

Table 3-3 Summary of Soil Laboratory Test Results

Test/ Sample ID		BH1M_2.4-2.6	BH3M_3.0-3.3	BH3M
Unit		2	2	-
Material Description [1]		Silty SAND	Sandy SILT	Groundwater
Aggressivity	Chloride Cl (ppm)	1.9	2.5	350
	Sulfate SO_4 (ppm)	23	59	38
	pH	6.4	7.8	7.7
	Electrical Conductivity (µS/cm)	19	70	1500
	Moisture Content (%)	8.9	12.7	-

Note 1 More detailed descriptions of the subsurface conditions at each borehole location are available on the borehole logs presented in **Appendix A**.

The assessment indicated high permeability soil was present in groundwater table. In accordance with Tables 6.4.2(C) and 6.5.2(C) of AS 2159:2009 'Piling – Design and Installation', the results of the pH, chloride and sulfate content and electrical conductivity of the soil provided the following exposure classifications:

- 'Mild' for buried concrete structural elements; and
- 'Non-Aggressive' for buried steel structural elements.

In accordance with Table 4.8.1 of AS3600-2009 'Concrete Structures' these soils would be classified as exposure classification 'A2' for concrete in sulfate soils.

To assist with rock strength assessment, 36 selected rock core samples were tested by Macquarie to estimate the Point Load Strength Index (Is_{50}) values, as well as 12 rock core samples to estimate the Uniaxial Compressive Strength. The results of the testing are summarised on the attached borehole logs.

The point load strength index tests correlated reasonably well with our field assessments of rock strength. The approximate Unconfined Compressive Strength (UCS) of the rock core, estimated from correlations with the point load strength index test results, varied from 9 MPa to 90 MPa. These were confirmed by the results of the Uniaxial Compressive Strength testing, which yielded UCS values from 15 MPa to 52MPa.

4. Recommendations

4.1 Geotechnical Issues

Based on the results of the assessment, we consider the following to be the main geotechnical issues for the proposed development:

- Presence of the Penrith Gravels;
- Depth to bedrock; and
- Foundation design for building loads.

4.2 Dilapidation Surveys

Prior to any excavation and construction, we recommend that detailed dilapidation surveys be carried out on all structures and infrastructures surrounding the site that falls within the zone of influence of the excavation to allow assessment of the recommended vibration limits and protect the client against spurious claims of damage. The zone of influence of the excavation is defined by a distance back from the excavation perimeter of twice the total depth of the excavation. The reports would provide a record of existing conditions prior to commencement of the work. A copy of each report should be provided to the adjoining property owner who should be asked to confirm that it represents a fair assessment of existing conditions. The reports should be carefully reviewed prior to demolition and construction.

4.3 Excavation Methodology

EI considers that the proposed development will not require deep excavation as the proposed development does not include any below ground basement construction. Based on above, an excavation depth of 0.5m to 1.0m BEGL is anticipated to be required to remove asphalt pavements and existing fill prior to development commencement. Locally deeper excavations for footings, service trenches, crane pads and lifts overrun pits may be required.

Prior to any excavation commencing, we recommend that reference be made to the Safe Work Australia Excavation Work Code of Practice, dated October 2018.

Based on the borehole logs, any excavations will therefore extend through Unit 1 or up to Unit 2 as outlined in **Table 3-1** above. These shallow excavations can be carried out safely with temporary batters of 1H:1V, depending on the setback from the site boundaries or any other existing structure.

Units 1 and 2 could be excavated using buckets of large earthmoving Hydraulic Excavators.

Furthermore, any existing buried services, which run below the site, will require diversion prior to the commencement of excavation or alternatively be temporarily supported during excavation, subject to permission or other instructions from the relevant service authorities. Enquiries should also be made for further information and details, such as invert levels, on the buried services.

4.4 Excavation Retention

From a geotechnical perspective, it is critical to maintain the stability of all adjacent structures and infrastructures during demolition, excavation and construction works.

Battering of the excavation could be considered where set-backs from the site boundaries permit batters at 2 Horizontal (H): 1 Vertical (V) to be formed and provided surcharge and footing loadings are kept well away from the crest of the batters. Unsupported vertical cuts of the soil are not recommended for this site as these carry the risk of potential collapse especially after a period of wet weather. Collapse of the material may result in injury to personnel and/or damage to nearby structures/infrastructures and equipment.

Any deep excavation (>1.0m) closer to site boundary will require a suitable retention system for the support of the entire depth of the excavation. Further advice should be sought from a Geotechnical Engineer if such situation arises.

Geotechnical parameters presented in **Table 4-1** can be considered for retention system, if required, and for the design of foundation:

Table 4-1 Geotechnical Design Parameters

Material [1]		Unit 1 Fill	Unit 2a Silty Sand / Sandy Silt	Unit 2b Sandy Gravel	Unit 3 Low to Medium strength Shale	Unit 4 High Strength Shale
Depth to Top of Unit (m) [2]		Surface	0.2 to 1.2	2.3 to 3.5	12.9 to 13.0	15.0 to 16.2
Bulk Unit Weight (kN/m^3)		17	17	20	24	25
Friction Angle, ϕ' (°)		25	25	38	40	45
Earth Pressure Coefficients	At rest, K_o [3]	0.58	0.58	-	-	-
	Active, K_a [3]	0.41	0.41	-	-	-
	Passive, K_p [3]	-	2.46	-	-	-
Allowable Bearing Pressure (kPa) [5]		-	-	250	1500	7500
Allowable Shaft Adhesion (kPa) [4, 5]	in Compression	-	-	25	150	750
	in Uplift	-	-	10	75	375
Earthquake Site Risk Classification		▪ AS 1170.4:2007 indicates an earthquake subsoil class of Class C_e.(Shallow Soil) ▪ AS 1170.4:2007 indicates that the hazard factor (z) for Sydney is 0.08.				

Notes:

1 More detailed descriptions of subsurface conditions are available on the borehole logs presented iin **Appendix A.**
2 Approximate depth of top of unit at the time of our investigation. Levels may vary across the site.
3 Earth pressures are provided on the assumption that the ground behind the retaining walls is horizontal.
4 Side adhesion values given assume there is intimate contact between the pile and foundation material and should achieve a clean socket roughness category R2 or better. Design engineer to check both 'piston pull-out' and 'cone liftout' mechanics in accordance with AS4678-2002 Earth Retaining Structures.
5 To adopt these parameters we have assumed that:
- Footings have a nominal socket of at least 0.3m, into the relevant founding material;
- For piles, there is intimate contact between the pile and foundation material (a clean socket roughness category of R2 or better);
- Potential soil and groundwater aggressivity will be considered in the design of piles and footings;
- Piles should be drilled in the presence of a Geotechnical Engineer prior to pile construction to verify that ground conditions meet design assumptions. Where groundwater ingress is encountered during pile excavation, concrete is to be placed as soon as possible upon completion of pile excavation. Pile excavations should be pumped dry of water prior to pouring concrete, or alternatively a tremmie system could be used;
- The bases of all pile, pad and strip footing excavations are cleaned of loose and softened material and water is pumped out prior to placement of concrete;
- The concrete is poured on the same day as drilling, inspection and cleaning.
- The allowable bearing pressures given above are based on serviceability criteria of settlements at the footing base/pile toe of less than or equal to 1% of the minimum footing dimension (or pile diameter).

4.5 Foundations

Based on size of the proposed development, the most competent foundation stratum at the site is Unit 4, 'High Strength Shale'.

It is recommended that all piles for the building be founded within material of similar strength to provide uniform support and reduce the potential for differential settlements. Based on our investigation, following bedrock depths presented in **Table 4-2** are suitable for placing the foundations within High Strength Shale bedrock.

Table 4-2 Suitable High Strength Bedrock Depths

Borehole ID	BH1M	BH2	BH3M	BH4	BH5	BH6
Depth to Suitable High Strength Bedrock (BEGL)	17.0	15.0	15.8	15.0	15.2	15.8

Based on above depths given in **Table 4-2** , for piles socketed within the Unit 4, 'High Strength Shale', an allowable end bearing pressure of 7,500kPa can be adopted, based on serviceability. Allowable shaft adhesion value of the bedrock may be designed as 10% of the allowable end bearing pressure in compression, and 5% in uplift.

All piles must be designed in accordance with the Australian Standard AS2159-2009 Piling – Design and installation.

Based on the encountered subsurface material, grout injected, CFA piles are best suited for this site. Bored piers are not recommended. We note that due to the presence of cobbles and boulder sized gravel, relatively large piling rig will be required.

At least the initial stages of pile installation should be observed by a geotechnical engineer to ascertain that the recommended foundation material and depth has been reached and to check initial assumptions about foundation conditions and possible variations that may occur between test locations. The need for further inspections can be assessed following the initial visit.

4.6 Ground Floor Slab

Following removal of Unit 1, 'Fill', silty sand (Unit 2) is expected to be exposed at the ground floor Bulk Excavation Level (BEL).

Following the removal of all loose and softened materials, we recommend that underfloor drainage be provided and should comprise a strong, durable, single sized washed aggregate such as 'blue metal gravel'. Joints in the concrete floor slab should be designed to accommodate shear forces but not bending moments by using dowelled and keyed joints. The basement floor slab should be isolated from columns. The completed excavation should be inspected by the hydraulic engineer to confirm the extent of the drainage required.

In addition, a system of sub-soil drains comprising a durable single sized aggregate with perforated drains/pipes leading to sumps should be provided. The basement floor slab should be isolated from columns.

Permission may need to be obtained from the NSW Department of Primary Industries (DPI) and possibly Council for any permanent discharge of seepage into the drainage system. Given the subsurface conditions, we expect that seepage volumes would be low and within the DPI limits. However, if permission for discharge is not obtained, the basement may need to be designed as a tanked basement.

4.7 Subgrade Preparation and Engineered Fill

4.7.1 Subgrade Preparation

Earthworks recommendations provided in this report should be complemented by reference to AS3798.

3 Fill should be fully excavated down to surface of the fluvial soils, and stockpiled separately since these materials are not suitable for re-use as engineered fill.

4 The exposed subgrade at the base of the excavation should be proof rolled with a smooth drum roller (say 12 tonne) used in static or non-vibratory mode of operation. Caution is required when proof rolling near existing infrastructures and utilities (where present). The purpose of the proof rolling is to detect any soft or heaving areas, and to allow for some further improvement in strength or compaction.

5 The final pass should be undertaken in the presence of an experienced geotechnician or geotechnical engineer, to detect any unstable or soft subgrade areas, and to allow for some further improvement in strength/compaction.

6 If dry conditions prevail at the time of construction then any exposed residual clay subgrade may become desiccated or have shrinkage cracks prior to pouring any concrete slabs. If this occurs, the subgrade must be watered and rolled until the cracks disappear.

7 Unstable subgrade detected during proof rolling should be locally excavated down to a sound base and replaced with engineered fill or further advice should be sought. Any fill placed to raise site levels should also be engineered fill, as per the specifications below.

If suspended ground floor slabs are designed, then it would be unnecessary to complete any particular subgrade preparation other than stripping of root affected soils from the footprint of the proposed building structures and replaced with surface levelling compacted fill for the floor slab formwork.

4.7.2 Engineered Fill Specifications

Any fill used to backfill unstable subgrade areas, raise surface levels or backfill service trenches should be engineered fill. Materials preferred for use as engineered fill are well-graded granular materials, such as ripped or crushed sandstone, free of deleterious substances and having a maximum particle size not exceeding 75 mm. such fill should be compacted in layers not greater than 200 mm loose thickness, to a minimum density of 98% of SMDD.

Density tests should be regularly carried out on the fill to confirm the above specifications are achieved. The frequency of density testing should be at least one test per layer per 500 m^2 or three tests per visit, whichever requires the most tests. We recommend that at least Level 2 control of fill compaction, as defined in AS3798-2007, be adhered to on this Site. Preferably, the geotechnical testing authority (GTA) should be engaged directly on behalf of the client and not by the earthworks subcontractor.

During construction of the fill, platform runoff should be enhanced by providing suitable falls to reduce ponding of water on the surface of the fill. Ponding of water may lead to softening of the fill and subsequent delays in the earthworks program.

5. Further Geotechnical Inputs

Below is a summary of the recommended additional work that needs to be carried out:

- Dilapidation surveys;
- Design of working platforms for construction plant by an experienced and qualified geotechnical engineer;
- Classification of all excavated material transported off site; and
- Geotechnical inspections of foundations;

We recommend that a meeting be held after initial structural design has been completed to confirm that our recommendations have been correctly interpreted. We also recommend a meeting at the commencement of construction to discuss the primary geotechnical issues and inspection requirements.

6. Statement of Limitations

This report has been prepared for the exclusive use of David Kamel and High 618 Pty Ltd who is the only intended beneficiary of EI's work. The scope of the assessment carried out for the purpose of this report is limited to those agreed with David Kamel and High 618 Pty Ltd

No other party should rely on the document without the prior written consent of EI, and EI undertakes no duty, or accepts any responsibility or liability, to any third party who purports to rely upon this document without EI's approval.

EI has used a degree of care and skill ordinarily exercised in similar investigations by reputable members of the geotechnical industry in Australia as at the date of this document. No other warranty, expressed or implied, is made or intended. Each section of this report must be read in conjunction with the whole of this report, including its appendices and attachments.

The conclusions presented in this report are based on a limited investigation of conditions, with specific sampling and test locations chosen to be as representative as possible under the given circumstances.

EI's professional opinions are reasonable and based on its professional judgment, experience, training and results from analytical data. EI may also have relied upon information provided by the Client and other third parties to prepare this document, some of which may not have been verified by EI.

EI's professional opinions contained in this document are subject to modification if additional information is obtained through further investigation, observations, or validation testing and analysis during construction. In some cases, further testing and analysis may be required, which may result in a further report with different conclusions.

We draw your attention to the document "Important Information", which is included in **Appendix C** of this report. The statements presented in this document are intended to advise you of what your realistic expectations of this report should be. The document is not intended to reduce the level of responsibility accepted by EI, but rather to ensure that all parties who may rely on this report are aware of the responsibilities each assumes in so doing.

Should you have any queries regarding this report, please do not hesitate to contact EI.

References

AS1289.6.3.1:2004, *Methods of Testing Soils for Engineering Purposes,* Standards Australia

AS1726:2017, *Geotechnical Site Investigations*, Standards Australia.

AS2159:2009, *Piling – Design and Installation*, Standards Australia.

AS3600:2009, *Concrete Structures,* Standards Australia

Safe Work Australia Excavation Work Code of Practice, dated October 2018 – WorkCover NSW

NSW Department of Finance and Service, Spatial Information Viewer, maps.six.nsw.gov.au.

NSW Department of Mineral Resources (1983) Penrith 1:100,000 Geological Series Sheet 9030 (DMR 1991). Geological Survey of New South Wales, Department of Mineral Resources.

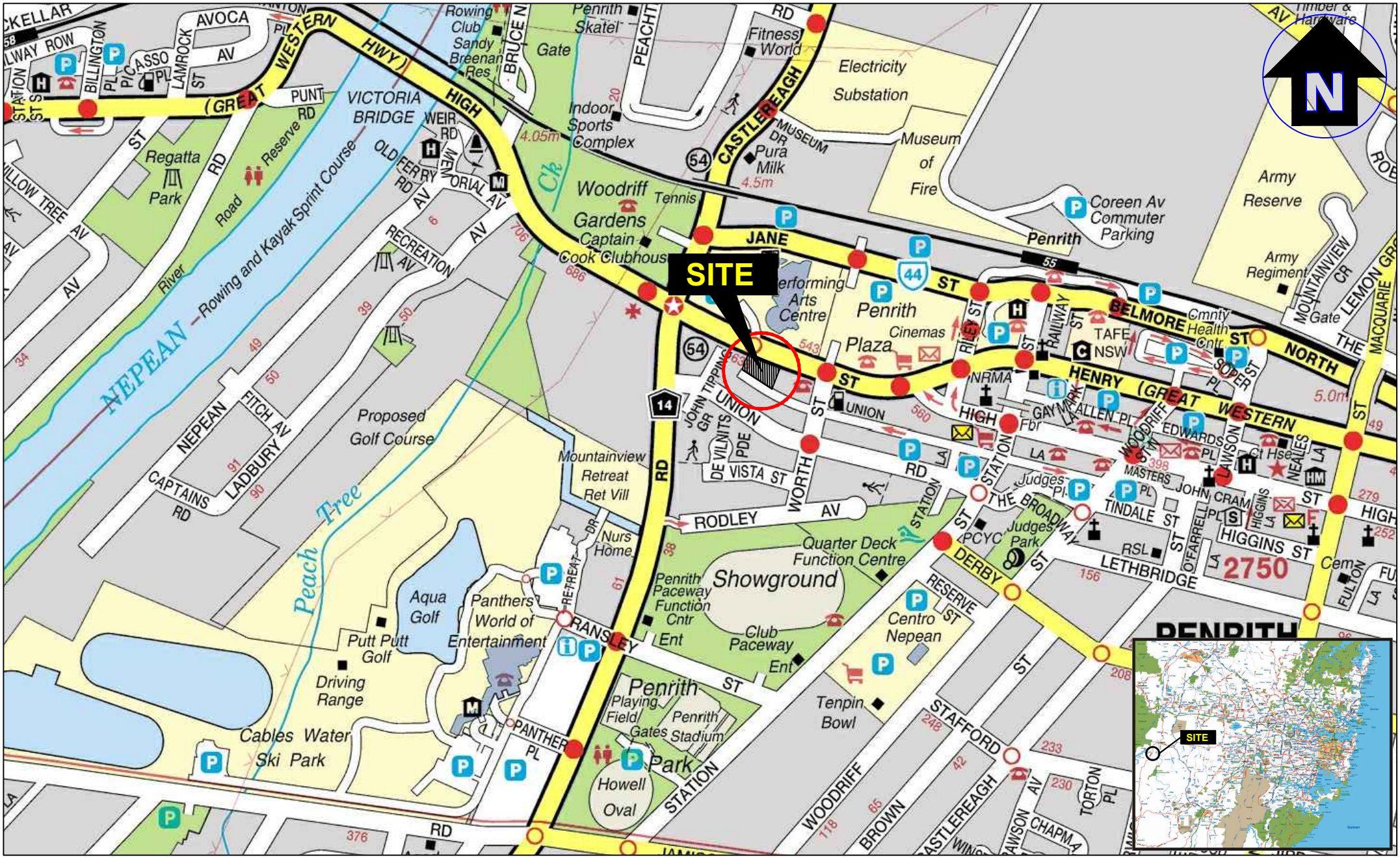
Abbreviations

AHD	Australian Height Datum
AS	Australian Standard
BEL	Bulk Excavation Level
BEGL	Below Existing Ground Level
BH	Borehole
DBYD	Dial Before You Dig
DP	Deposited Plan
EI	EI Australia
GI	Geotechnical Investigation
NATA	National Association of Testing Authorities, Australia
RL	Reduced Level
SPT	Standard Penetration Test
T-C	Tungsten-Carbide
UCS	Unconfined Compressive Strength

Figures

Figure 1 Site Locality Plan

Figure 2 Borehole Location Plan



eiaustralia Contamination | Remediation | Geotechnical	Drawn:	AM.H.	**High 618 Pty Ltd** Geotechnical Investigation 614-632 High Street, Penrith NSW Site Locality Plan
	Approved:	N.J.	
	Date:	09-08-19	
	Scale:	Not To Scale	

Figure: 1

Project: E24300.G03

Suite 6.01, 55 Miller Street, PYRMONT 2009
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Map Source: DKO Architecture Pty Ltd, Project No: 00012012, DWG No: DA200, Rev: P1, Dated on: 05/07/2019

LEGEND

- Approximate site boundary
- Approximate borehole location
- Approximate borehole/monitoring well location

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Drawn:	AM.H.
Approved:	N.J.
Date:	09-08-19

High 618 Pty Ltd
Geotechnical Investigation
614-632 High Street, Penrith NSW
Sampling Location Plan

Figure: 2

Project: E24300.G03

Appendix A – Borehole Logs And Explanatory Notes

BOREHOLE LOG

BH NO. BH1M

Project	Proposed Mixed Use Development	**Sheet**	1 of 3
Location	614-632 High Street, Penrith NSW	**Date Started**	22/07/2019
Position	Refer to Figure 2	**Date Completed**	22/07/2019
Job No.	E24300.G03	**Logged By** DS	**Date** 22/07/2019
Client	High 618 Pty Ltd	**Reviewed By** NJ	**Date** 07/08/2019

Drilling Contactor Geosense Drilling
Drill Rig Hanjin D&B 8D **Inclination** -90°

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY REL. DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
AD/T	-	22/07/19 ▽	0					-	FILL: Silty SAND; fine to medium grained, brown, with rootlets and dark grey ash.	M	-	FILL
				0.50	BH1M_0.3-0.4 DS 0.30-0.40 m			SM	Silty SAND; fine grained, red-brown, trace fine to coarse, sub-angular to sub-rounded gravels.		MD	FLUVIAL SOIL
			1		BH1M_0.5-0.95 SPT 0.50-0.95 m 4,5,6 N=11							
				1.80	BH1M_1.5-1.95 SPT 1.50-1.95 m 4,3,4 N=7				From 1.8 m, orange-brown.	M	L	
			2		BH1M_2.4-2.6 DS 2.40-2.60 m							
			3	3.20	BH1M_3.0-3.21 SPT 3.00-3.36 m 7,8/60mm N>50			GP	Sandy GRAVEL; medium to coarse, pale grey to grey, sub-angular to sub-rounded gravels, with silt, cobbles and boulders in places, sand is fine to coarse grained.			
RR			4							-	-	
			5									
			6									
			7									
			8									
			9									
			10									

This borehole log should be read in conjunction with EI Australia's accompanying standard notes.

BOREHOLE LOG

BH NO. BH1M

Project	Proposed Mixed Use Development	**Sheet**	2 of 3
Location	614-632 High Street, Penrith NSW	**Date Started**	22/07/2019
Position	Refer to Figure 2	**Date Completed**	22/07/2019
Job No.	E24300.G03	**Logged By** DS	**Date** 22/07/2019
Client	High 618 Pty Ltd	**Reviewed By** NJ	**Date** 07/08/2019

Drilling Contactor Geosense Drilling
Drill Rig Hanjin D&B 8D **Inclination** -90°

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY REL. DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
RR	-		10					GP	Sandy GRAVEL; medium to coarse, pale grey to grey, sub-angular to sub-rounded gravels, with silt, cobbles and boulders in places, sand is fine to coarse grained.	-	-	FLUVIAL SOIL
			11									
			12									
			13	13.00				-	SHALE; dark grey, medium strength, distinctly weathered. Continued as Cored Borehole	-	-	BEDROCK
			14									
			15									
			16									
			17									
			18									
			19									
			20									

This borehole log should be read in conjunction with EI Australia's accompanying standard notes.

CORED BOREHOLE LOG

BH NO. BH1M

Project	Proposed Mixed Use Development	**Sheet**	3 OF 3
Location	614-632 High Street, Penrith NSW	**Date Started**	22/07/2019
Position	Refer to Figure 2	**Date Completed**	22/07/2019
Job No.	E24300.G03	**Logged By** DS	**Date** 22/07/2019
Client	High 618 Pty Ltd	**Reviewed By** NJ	**Date** 07/08/2019

Drilling Contactor Geosense Drilling
Drill Rig Hanjin D&B 8D **Inclination** -90°

Drilling						Field Material Description			Defect Information	
METHOD	WATER	TCR	RQD (SCR)	DEPTH (metres)	DEPTH RL	GRAPHIC LOG	ROCK / SOIL MATERIAL DESCRIPTION	WEATHERING	INFERRED STRENGTH $Is_{(50)}$ MPa (VL 0.1, L 0.3, M 1, H 3, VH 10, EH)	DEFECT DESCRIPTION & Additional Observations	Average Defect Spacing (mm) (30, 100, 300, 1000, 3000)
				10							
				11							
				12							
				13			Continuation from non-cored borehole				
NMLC	85% RETURN	100	80	14			SHALE; dark grey, trace pale grey siltstone and sandstone laminations bedded at 0 to 5° .	SW		13.15: JT, 5°, CN, PR, RF 13.31: BP, 5°, Clay VNR, PR, SM 13.33: BP, 5°, Clay VNR, PR, SM 13.75: BP, 0°, Clay VNR, PR, SM 13.78: BP, 0°, Clay VNR, PR, SM 13.81: BP, 0°, Clay VNR, PR, SM 13.83: BP, 0°, Clay VNR, PR, SM 13.88: BP, 0°, CN, PR, SM 14.05: XWS, 5 mm 14.14: XWS, 10 mm 14.18: XWS, 20 mm 14.33: BP, 0°, CN, PR, RF 14.46-14.58: JT, 70°, CN, PR, RF 14.63: BP, 0°, CN, PR, RF	
		100	29	15				DW		14.72: BP, 0°, CN, PR, RF 14.79: BP, 0°, CN, PR, RF 14.86: XWS, 10 mm 14.90: JT, 5°, CN, PR, RF 15.02-15.05: JT, 10 - 45°, CN, CU, RF 15.09: XWS, 40 mm 15.14: XWS, 30 mm 15.23: XWS, 10 mm 15.26: XWS, 30 mm 15.32: XWS, 5 mm 15.34: XWS, 5 mm	
				16				FR		15.36: XWS, 10 mm 15.40: XWS, 20 mm 15.43: XWS, 5 mm 15.45: XWS, 5 mm 15.54: JT, 5°, Clay VNR, PR, SM 15.62: XWS, 20 mm 15.66: BP, 0°, Clay VNR, PR, SM 15.69: BP, 0°, Clay VNR, PR, SM 15.72: BP, 0°, Clay VNR, PR, SM 15.76: XWS, 5 mm 15.79: XWS, 20 mm 15.93-16.20: BPx7, 0 - 5°, CN, PR, RF 16.26-16.98: BPx6, 0 - 5°, CN, PR, RF 17.10: BP, 0°, CN, PR, RF	
				17	*17.10*		17.1-17.35: UCS = 22 MPa			17.34: BP, 0°, CN, PR, RF 17.55: BP, 0°, CN, PR, RF 17.83: BP, 0°, CN, PR, RF 17.96: BP, 0°, CN, PR, RF 18.12: XWS, 10 mm 18.27: BP, 0°, CN, PR, RF	
		100	100	18	*18.35*		18.35-18.6: UCS = 17 MPa				
				19	*19.58*					19.40: BP, 0°, CN, PR, RF	
				20			Hole Terminated at 19.58 m				

This borehole log should be read in conjunction with EI Australia's accompanying standard notes.

MONITORING WELL LOG

MW NO. BH1M

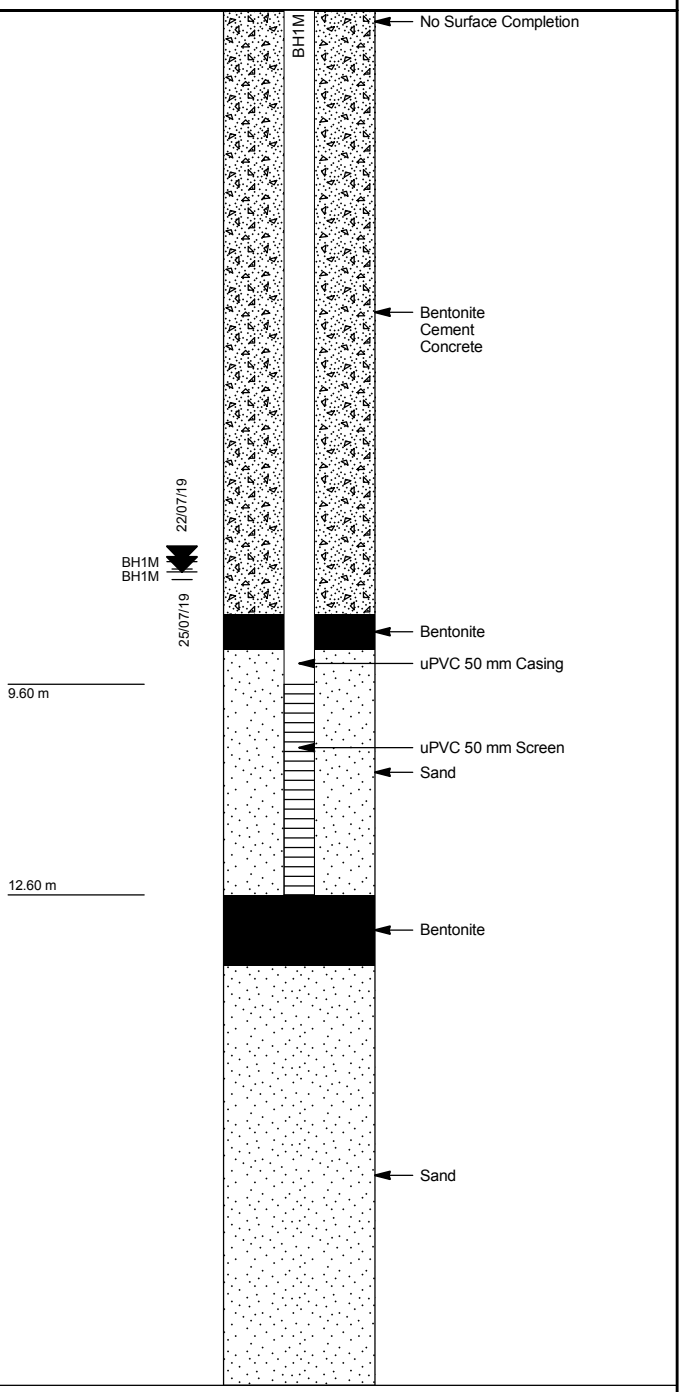
Project	Proposed Mixed Use Development	**Sheet**	1 of 2
Location	614-632 High Street, Penrith NSW	**Date Started**	22/07/2019
Position	Refer to Figure 2	**Date Completed**	22/07/2019
Job No.	E24300.G03	**Logged By** DS	**Date** 22/07/2019
Client	High 618 Pty Ltd	**Reviewed By** NJ	**Date** 07/08/2019

Drilling Contactor Geosense Drilling
Drill Rig Hanjin D&B 8D **Inclination** -90°

METHOD	WATER	DEPTH (m)	RL (m AHD)	GRAPHIC LOG	SOIL/ROCK MATERIAL DESCRIPTION
AD/T		0			FILL: Silty SAND; fine to medium grained, brown, with rootlets and dark grey ash.
					Silty SAND; fine grained, red-brown, trace fine to coarse, sub-angular to sub-rounded gravels.
		2			From 1.8 m, orange-brown.
RR		4			Sandy GRAVEL; medium to coarse, pale grey to grey, sub-angular to sub-rounded gravels, with silt, cobbles and boulders in places, sand is fine to coarse grained.
		6			
		8			
		10			
		12			
NMLC	85% RETURN				SHALE; dark grey, medium strength, distinctly weathered.
		14			SHALE; dark grey, trace pale grey siltstone and sandstone laminations bedded at 0 to 5° .
		16			
		18			
		20			Hole Terminated at 19.58 m

PIEZOMETER CONSTRUCTION DETAILS

ID	Type	Stick Up & RL	Tip Depth & RL	Installation Date	Static Water Level
BH1M	Standpipe	-1.05 m	12.60 m		



This well log should be read in conjunction with EI Australia's accompanying standard notes.

CORE PHOTOGRAPH OF BOREHOLE: BH1M

Project	Proposed Mixed Use Development			**Depth Range**	13.05m to 19.58m BEGL		
Location	614-632 High Street, Penrith NSW			**Contractor**	Geosense Drilling Engineers Pty Ltd		
Position	See Figure 2			**Drill Rig**	Hanjin D&B 8D		
Job No.	E24300.G03	**Inclination**	-90°	**Logged**	DS	**Date**	22 / 07 / 2019
Client	High 618 Pty Ltd	**Box**	1-2 of 2	**Checked**	NJ	**Date**	07 / 08 / 2019

BOREHOLE LOG

BH NO. BH2

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Project	Proposed Mixed Use Development	**Sheet**	1 of 3
Location	614-632 High Street, Penrith NSW	**Date Started**	23/07/2019
Position	Refer to Figure 2	**Date Completed**	23/07/2019
Job No.	E24300.G03	**Logged By** DS	**Date** 23/07/2019
Client	High 618 Pty Ltd	**Reviewed By** NJ	**Date** 07/08/2019

Drilling Contactor Geosense Drilling
Drill Rig Hanjin D&B 8D **Inclination** -90°

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY REL. DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
AD/T	-	GWNE	0	0.50	BH2_0.3-0.4 DS 0.30-0.40 m			-	FILL: Silty SAND; fine to medium grained, brown, trace slag cobbles.	M	-	FILL
			1		BH2_0.5-0.95 SPT 0.50-0.95 m 2,3,2 N=5			SM	Silty SAND; fine grained, red-brown.	M	L	FLUVIAL SOIL
					BH2_1.5-1.95 SPT 1.50-1.95 m 1,1,1 N=2							
			2	2.10				ML	SILT; low plasticity, orange-brown, with fine grained sand.	M (>PL)	S	
RR				2.40				GP	Sandy GRAVEL; medium to coarse, pale grey to grey, sub-angular to sub-rounded gravels, with silt, cobbles and boulders in places, sand is fine to coarse grained.			
			3									
			4									
			5									
NMLC			6							-	-	
RR			7									
			8									
			9									
			10									

This borehole log should be read in conjunction with EI Australia's accompanying standard notes.

BOREHOLE LOG

BH NO. BH2

Project	Proposed Mixed Use Development	**Sheet**	2 of 3
Location	614-632 High Street, Penrith NSW	**Date Started**	23/07/2019
Position	Refer to Figure 2	**Date Completed**	23/07/2019
Job No.	E24300.G03	**Logged By** DS	**Date** 23/07/2019
Client	High 618 Pty Ltd	**Reviewed By** NJ	**Date** 07/08/2019

Drilling Contactor Geosense Drilling
Drill Rig Hanjin D&B 8D **Inclination** -90°

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY REL. DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
RR			10					GP	Sandy GRAVEL; medium to coarse, pale grey to grey, sub-angular to sub-rounded gravels, with silt, cobbles and boulders in places, sand is fine to coarse grained.			FLUVIAL SOIL
NMLC	-	GWNE	11							-	-	
			12	12.73								
									Continued as Cored Borehole			
			13									
			14									
			15									
			16									
			17									
			18									
			19									
			20									

This borehole log should be read in conjunction with EI Australia's accompanying standard notes.

CORED BOREHOLE LOG

BH NO. BH2

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Project	Proposed Mixed Use Development	**Sheet**	3 OF 3
Location	614-632 High Street, Penrith NSW	**Date Started**	23/07/2019
Position	Refer to Figure 2	**Date Completed**	23/07/2019
Job No.	E24300.G03	**Logged By** DS	**Date** 23/07/2019
Client	High 618 Pty Ltd	**Reviewed By** NJ	**Date** 07/08/2019

Drilling Contactor Geosense Drilling
Drill Rig Hanjin D&B 8D **Inclination** -90°

Drilling						Field Material Description				Defect Information	
METHOD	WATER	TCR	RQD (SCR)	DEPTH (metres)	DEPTH RL	GRAPHIC LOG	ROCK / SOIL MATERIAL DESCRIPTION	WEATHERING	INFERRED STRENGTH $Is_{(50)}$ MPa (VL 0.1, L 0.3, M 1, H 3, VH 10, EH)	DEFECT DESCRIPTION & Additional Observations	Average Defect Spacing (mm) (30, 100, 300, 1000, 3000)
				10							
				11							
				12							
					12.73		Continuation from non-cored borehole				
NMLC	90% RETURN	100	40	13			SHALE; dark grey, with pale grey siltstone laminations bedded at 0 to 5°.	DW		12.74: XWZ, 190 mm	
								SW		13.08: XWS, 10 mm 13.13: XWS, 40 mm 13.26: BP, 5°, Clay VNR, PR, RF 13.34: BP, 5°, Clay VNR, PR, RF 13.51: BP, 0 - 5°, Clay VNR, PR, SM	
					13.55		13.55-13.75: UCS = 15 MPa			13.77: BP, 0 - 5°, Clay VNR, PR, SM	
				14						13.92: BP, 0 - 5°, CN, PR, RF 14.18: BP, 0 - 5°, CN, PR, RF 14.31: BP, 0 - 5°, CN, PR, RF 14.46: BP, 0 - 5°, CN, PR, RF 14.53: BP, 0 - 5°, CN, PR, RF 14.70: BP, 0 - 5°, CN, PR, RF	
		100	95	15						14.91: BP, 0 - 5°, CN, PR, RF 15.10: BP, 0 - 5°, CN, PR, RF	
								FR		15.16: JT, 0 - 20°, CN, CU, RF 15.29: JT, 10°, Clay VNR, PR, SM 15.43-15.49: JT, 45°, CN, PR, RF	
				16	*16.40*		16.4-16.65: UCS = 31 MPa			16.34: BP, 0°, CN, PR, RF 16.36: BP, 0°, CN, PR, RF	
				17						16.68-16.77: JT, 70 - 80°, CN, PR, RF 16.78: JT, 5 - 20°, Clay VNR, CU, RF	
		100	94							17.42: BP, 0°, CN, PR, RF	
				18						18.24: BP, 0°, CN, PR, RF 18.42: BP, 0°, CN, PR, RF 18.48: JT, 20°, CN, PR, RF	
				19						18.72: JT, 30°, CN, PR, RF	
					19.29					19.16: BP, 0°, CN, PR, RF	
				20			Hole Terminated at 19.29 m				

This borehole log should be read in conjunction with EI Australia's accompanying standard notes.

CORE PHOTOGRAPH OF BOREHOLE: BH2

Project	Proposed Mixed Use Development			**Depth Range**	12.73m to 19.29m BEGL		
Location	614-632 High Street, Penrith NSW			**Contractor**	Geosense Drilling Engineers Pty Ltd		
Position	See Figure 2			**Drill Rig**	Hanjin D&B 8D		
Job No.	E24300.G03	**Inclination**	-90°	**Logged**	DS	**Date**	23 / 07 / 2019
Client	High 618 Pty Ltd	**Box**	1-2 of 2	**Checked**	NJ	**Date**	07 / 08 / 2019

BOREHOLE LOG

BH NO. BH3M

Project	Proposed Mixed Use Development	**Sheet**	1 of 3
Location	614-632 High Street, Penrith NSW	**Date Started**	24/07/2019
Position	Refer to Figure 2	**Date Completed**	24/07/2019
Job No.	E24300.G03	**Logged By** DS	**Date** 24/07/2019
Client	High 618 Pty Ltd	**Reviewed By** NJ	**Date** 07/08/2019

Drilling Contactor Geosense Drilling
Drill Rig Hanjin D&B 8D **Inclination** -90°

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY REL. DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
AD/T			0					-	CONCRETE; 30 mm thick.	-	-	CONCRETE
				0.30				-	FILL: Silty SAND; fine to medium grained, dark brown, trace fine to medium gravels.	M	-	FILL
			1		BH3M_0.5-0.95 SPT 0.50-0.95 m 2,2,2 N=4			ML	SILT; low plasticity, red-brown, with fine grained sand.			FLUVIAL SOIL
			2		BH3M_1.5-1.95 SPT 1.50-1.95 m 4,2,3 N=5					M (<PL)	F	
			3	3.00								
				3.30	BH3M_3.0-3.3 SPT 3.00-3.45 m 3,4/150mm HB N>50			ML	Sandy SILT; low plasticity, orange-brown, sand is fine to medium grained.	M (>PL)	F	
RR			4					GP	Sandy GRAVEL; medium to coarse, pale grey to grey, sub-angular to sub-rounded gravels, with silt, cobbles and boulders in places, sand is fine to coarse grained.			
NMLC	-		5									
			6							-	-	
RR		25/07/19	7									
			8									
			9									
			10									

This borehole log should be read in conjunction with EI Australia's accompanying standard notes.

BOREHOLE LOG

BH NO. BH3M

Project	Proposed Mixed Use Development	**Sheet**	2 of 3
Location	614-632 High Street, Penrith NSW	**Date Started**	24/07/2019
Position	Refer to Figure 2	**Date Completed**	24/07/2019
Job No.	E24300.G03	**Logged By** DS	**Date** 24/07/2019
Client	High 618 Pty Ltd	**Reviewed By** NJ	**Date** 07/08/2019

Drilling Contactor Geosense Drilling
Drill Rig Hanjin D&B 8D **Inclination** -90°

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY REL. DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
NMLC	-		10					GP	Sandy GRAVEL; medium to coarse, pale grey to grey, sub-angular to sub-rounded gravels, with silt, cobbles and boulders in places, sand is fine to coarse grained.	-	-	FLUVIAL SOIL
			11									
			12	12.80								
			13						Continued as Cored Borehole			
			14									
			15									
			16									
			17									
			18									
			19									
			20									

This borehole log should be read in conjunction with EI Australia's accompanying standard notes.

CORED BOREHOLE LOG

BH NO. BH3M

Project	Proposed Mixed Use Development	**Sheet**	3 OF 3
Location	614-632 High Street, Penrith NSW	**Date Started**	24/07/2019
Position	Refer to Figure 2	**Date Completed**	24/07/2019
Job No.	E24300.G03	**Logged By** DS	**Date** 24/07/2019
Client	High 618 Pty Ltd	**Reviewed By** NJ	**Date** 07/08/2019

Drilling Contactor Geosense Drilling
Drill Rig Hanjin D&B 8D **Inclination** -90°

Drilling						Field Material Description				Defect Information	
METHOD	WATER	TCR	RQD (SCR)	DEPTH (metres)	DEPTH RL	GRAPHIC LOG	ROCK / SOIL MATERIAL DESCRIPTION	WEATHERING	INFERRED STRENGTH $Is_{(50)}$ MPa (VL 0.1, L 0.3, M 1, H 3, VH 10, EH)	DEFECT DESCRIPTION & Additional Observations	Average Defect Spacing (mm) (30, 100, 300, 1000, 3000)
				10							
				11							
				12							
					12.80		Continuation from non-cored borehole				
NMLC	90% RETURN	100	75	13			SHALE; dark grey, with pale grey siltstone and fine grained sandstone laminations bedded at 0 to 10°.	DW / SW		12.80: XWZ, 100 mm 12.95-13.00: JT, 90°, CN, PR, RF 13.08: BP, 0°, Clay VNR, PR, SM 13.14: BP, 0°, Clay VNR, PR, SM 13.14-13.17: JT, 45 - 90°, Clay VNR, CU, SM 13.20: BP, 0°, Clay VNR, PR, SM 13.34: BP, 0°, Clay VNR, PR, SM 13.36: BP, 0°, Clay VNR, PR, SM	
					13.82						
				14			13.82-14.0: UCS = 27 MPa				
		100	96	15						14.82: BP, 0°, Clay VNR, PR, SM	
				16				FR		15.64: BP, 0°, CN, PR, RF 15.82: BP, 0°, CN, PR, RF 16.15: BP, 0°, CN, PR, RF 16.34: BP, 0°, CN, PR, RF 16.62: BP, 0°, CN, PR, RF 16.70: BP, 0°, CN, PR, RF	
		100	97	17						16.93: BP, 0°, CN, PR, RF 17.14: BP, 10°, CN, PR, RF 17.66: BP, 0°, Clay VNR, PR, RF 17.75: BP, 0°, Clay VNR, PR, RF	
				18							
					18.29		18.29-18.55: UCS = 31 MPa				
				19	19.00		Hole Terminated at 19.00 m			18.91: BP, 0°, CN, PR, RF	
				20							

This borehole log should be read in conjunction with EI Australia's accompanying standard notes.

MONITORING WELL LOG

MW NO. BH3M

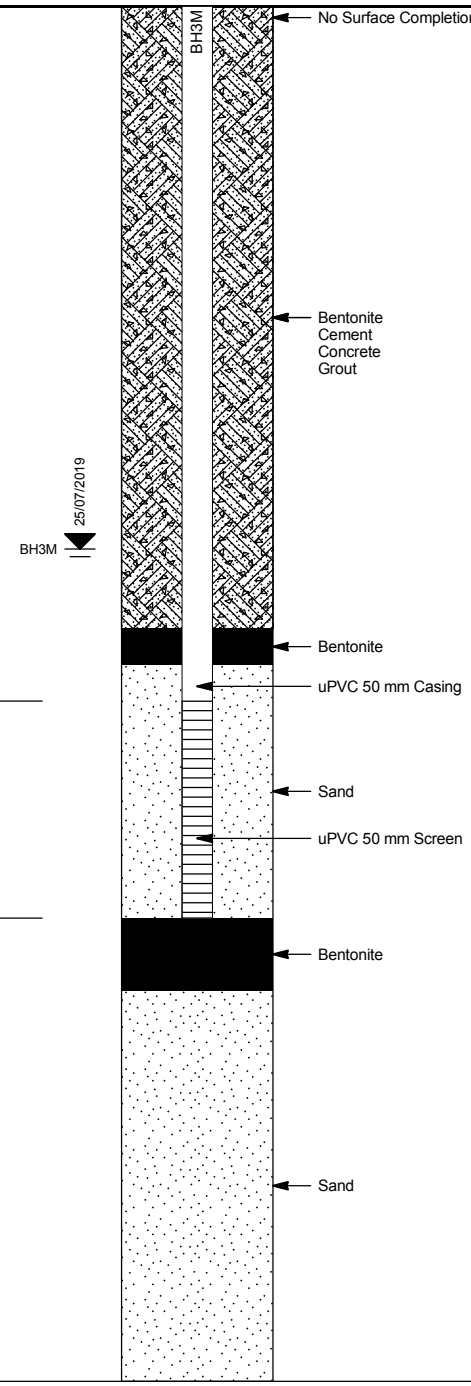
Project	Proposed Mixed Use Development	**Sheet**	1 of 2
Location	614-632 High Street, Penrith NSW	**Date Started**	24/07/2019
Position	Refer to Figure 2	**Date Completed**	24/07/2019
Job No.	E24300.G03	**Logged By** DS	**Date** 24/07/2019
Client	High 618 Pty Ltd	**Reviewed By** NJ	**Date** 07/08/2019

Drilling Contactor Geosense Drilling
Drill Rig Hanjin D&B 8D **Inclination** -90°

METHOD	WATER	DEPTH (m)	RL (m AHD)	GRAPHIC LOG	SOIL/ROCK MATERIAL DESCRIPTION
AD/T		0			CONCRETE; 30 mm thick.
					FILL: Silty SAND; fine to medium grained, dark brown, trace fine to medium gravels.
		2			SILT; low plasticity, red-brown, with fine grained sand.
RR					Sandy SILT; low plasticity, orange-brown, sand is fine to medium grained.
		4			Sandy GRAVEL; medium to coarse, pale grey to grey, sub-angular to sub-rounded gravels, with silt, cobbles and boulders in places, sand is fine to coarse grained.
NMLC		6			
RR	25/07/19	8			
		10			
NMLC		12			
NMLC	90% RETURN	14			SHALE; dark grey, with pale grey siltstone and fine grained sandstone laminations bedded at 0 to 10°.
		16			
		18			
		20			Hole Terminated at 19.00 m

PIEZOMETER CONSTRUCTION DETAILS

ID	Type	Stick Up & RL	Tip Depth & RL	Installation Date	Static Water Level
BH3M	Standpipe	-0.50 m	12.60 m		



This well log should be read in conjunction with EI Australia's accompanying standard notes.

EIA 2.00.3 LIB.GLB Log EIA PIEZOMETER INSTALLATION LOG E24300.G03 BOREHOLE LOGS.GPJ <<DrawingFile>> 07/08/2019 17:25 10.0.000 Datgel Lab and In Situ Tool - DGD | Lib: EIA 2.00.3 2017-11-21 Prj: EIA 2.00.1 2017-09-26

CORE PHOTOGRAPH OF BOREHOLE: BH3M

Project	Proposed Mixed Use Development			**Depth Range**	12.8m to 19.0m BEGL		
Location	614-632 High Street, Penrith NSW			**Contractor**	Geosense Drilling Engineers Pty Ltd		
Position	See Figure 2			**Drill Rig**	Hanjin D&B 8D		
Job No.	E24300.G03	**Inclination**	-90°	**Logged**	DS	**Date**	24 / 07 / 2019
Client	High 618 Pty Ltd	**Box**	1-2 of 2	**Checked**	NJ	**Date**	07 / 08 / 2019

BOREHOLE LOG

BH NO. BH4

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Project	Proposed Mixed Use Development	**Sheet**	1 of 3
Location	614-632 High Street, Penrith NSW	**Date Started**	25/07/2019
Position	Refer to Figure 2	**Date Completed**	25/07/2019
Job No.	E24300.G03	**Logged By** DS	**Date** 25/07/2019
Client	High 618 Pty Ltd	**Reviewed By** NJ	**Date** 07/08/2019

Drilling Contactor Geosense Drilling
Drill Rig Hanjin D&B 8D **Inclination** -90°

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY REL. DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
AD/T	-	GWNE	0					-	FILL: Silty SAND; fine to medium grained, brown, with fine to medium gravels.			FILL
				0.60	BH4_0.5-0.95 SPT 0.50-0.95 m 5,3,2 N=5				From 0.6 m, no gravels.	M	-	
			1	*1.20*				SM	Silty SAND; fine to medium grained, red-brown.			FLUVIAL SOIL
					BH4_1.5-1.95 SPT 1.50-1.95 m 2,2,1 N=3					M	L	
			2	*2.90*								
			3		BH4_3.0-3.45 SPT 3.00-3.45 m 4,3,5 N=8			ML	Sandy SILT; low plasticity, orange-brown, trace fine to coarse granite gravels, sand is fine to medium grained.	M (>PL)	F	
				3.50				GP	Sandy GRAVEL; medium to coarse, pale grey to grey, sub-angular to sub-rounded gravels, with silt, cobbles and boulders in places, sand is fine to coarse grained.			
RR			4									
			5									
NMLC			6									
			7							-	-	
RR			8									
			9									
			10									

This borehole log should be read in conjunction with EI Australia's accompanying standard notes.

BOREHOLE LOG

BH NO. BH4

Project	Proposed Mixed Use Development	**Sheet**	2 of 3
Location	614-632 High Street, Penrith NSW	**Date Started**	25/07/2019
Position	Refer to Figure 2	**Date Completed**	25/07/2019
Job No.	E24300.G03	**Logged By** DS	**Date** 25/07/2019
Client	High 618 Pty Ltd	**Reviewed By** NJ	**Date** 07/08/2019

Drilling Contactor Geosense Drilling
Drill Rig Hanjin D&B 8D **Inclination** -90°

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY REL. DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
RR	-	GWNE	10					GP	Sandy GRAVEL; medium to coarse, pale grey to grey, sub-angular to sub-rounded gravels, with silt, cobbles and boulders in places, sand is fine to coarse grained.	-	-	FLUVIAL SOIL
NMLC			11									
RR			12	12.70 12.80				-	SHALE; dark grey, very low strength, distinctly weathered.	-	-	BEDROCK
			13						Continued as Cored Borehole			
			14									
			15									
			16									
			17									
			18									
			19									
			20									

This borehole log should be read in conjunction with EI Australia's accompanying standard notes.

CORED BOREHOLE LOG

BH NO. BH4

Project	Proposed Mixed Use Development	**Sheet**	3 OF 3
Location	614-632 High Street, Penrith NSW	**Date Started**	25/07/2019
Position	Refer to Figure 2	**Date Completed**	25/07/2019
Job No.	E24300.G03	**Logged By** DS	**Date** 25/07/2019
Client	High 618 Pty Ltd	**Reviewed By** NJ	**Date** 07/08/2019

Drilling Contactor Geosense Drilling
Drill Rig Hanjin D&B 8D **Inclination** -90°

Drilling						Field Material Description				Defect Information	
METHOD	WATER	TCR	RQD (SCR)	DEPTH (metres)	DEPTH RL	GRAPHIC LOG	ROCK / SOIL MATERIAL DESCRIPTION	WEATHERING	INFERRED STRENGTH $Is_{(50)}$ MPa (VL 0.1, L 0.3, M 1, H 3, VH 10, EH)	DEFECT DESCRIPTION & Additional Observations	Average Defect Spacing (mm) (30, 100, 300, 1000, 3000)
				10							
				11							
				12							
					12.80		Continuation from non-cored borehole				
NMLC	85% RETURN			13			SHALE; dark grey, with pale grey siltstone and fine grained sandstone laminations bedded at 0 to 5°.	DW SW		13.02: XWS, 30 mm 13.14: XWS, 40 mm	
					13.64		13.64-13.87: UCS = 26 MPa				
		100	92	14						13.88: BP, 0°, CN, PR, RF 13.91: BP, 0°, CN, PR, RF 14.13: BP, 0°, CN, PR, RF 14.28: XWS, 30 mm	
				15						14.81: BP, 0°, CN, PR, RF 14.90: XWS, 10 mm	
								FR		15.35: BP, 0°, CN, PR, RF 15.51: BP, 0°, CN, PR, RF	
				16	*16.15*		16.15-16.29: UCS = 47 MPa			15.85: BP, 0°, CN, PR, RF	
		100	95	17						16.39: BP, 0°, CN, PR, RF 16.53: BP, 0°, CN, PR, RF 16.69: BP, 0°, Clay VNR, PR, RF 16.81: BP, 0°, Clay VNR, PR, RF 16.96: BP, 0°, Clay VNR, PR, RF	
				18						17.70: BP, 0°, CN, PR, RF	
					18.48					18.29-18.34: JT, 50°, Clay VNR, PR, RF 18.35-18.43: JTx2, 50°, Clay VNR, PR, RF	
				19			Hole Terminated at 18.48 m				
				20							

This borehole log should be read in conjunction with EI Australia's accompanying standard notes.

CORE PHOTOGRAPH OF BOREHOLE: BH4

Project	Proposed Mixed Use Development			**Depth Range**	12.8m to 18.48m BEGL		
Location	614-632 High Street, Penrith NSW			**Contractor**	Geosense Drilling Engineers Pty Ltd		
Position	See Figure 2			**Drill Rig**	Hanjin D&B 8D		
Job No.	E24300.G03	**Inclination**	-90°	**Logged**	DS	**Date**	25 / 07 / 2019
Client	High 618 Pty Ltd	**Box**	1-2 of 2	**Checked**	NJ	**Date**	07 / 08 / 2019

BOREHOLE LOG

BH NO. BH5

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Project	Proposed Mixed Use Development	**Sheet**	1 of 3
Location	614-632 High Street, Penrith NSW	**Date Started**	26/07/2019
Position	Refer to Figure 2	**Date Completed**	26/07/2019
Job No.	E24300.G03	**Logged By** DS	**Date** 26/07/2019
Client	High 618 Pty Ltd	**Reviewed By** NJ	**Date** 07/08/2019

Drilling Contactor Geosense Drilling
Drill Rig Hanjin D&B 8D **Inclination** -90°

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY REL. DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
AD/T	-	GWNE	0	0.20				-	FILL: Silty SAND; fine to medium grained, brown, with rootlets	M	-	FILL
					BH5_0.5-0.95 SPT 0.50-0.95 m 8,7,6 N=13			SM	Silty SAND; fine to medium grained, red-brown.	M	MD	FLUVIAL SOIL
			1	1.30				ML	Sandy SILT; low plasticity, orange-brown, trace fine to coarse gravels, sand is fine to medium grained.	M (>PL)	St	
					BH5_1.5-1.95 SPT 1.50-1.95 m 8,7,7 N=14							
			2	2.30				GP	Sandy GRAVEL; medium to coarse, pale grey to grey, sub-angular to sub-rounded gravels, with silt, cobbles and boulders in places, sand is fine to coarse grained.			
NMLC			3									
NMLC			4									
RR			5									
			6							-	-	
			7									
			8									
			9									
			10									

This borehole log should be read in conjunction with EI Australia's accompanying standard notes.

BOREHOLE LOG

BH NO. BH5

Project	Proposed Mixed Use Development	**Sheet**	2 of 3
Location	614-632 High Street, Penrith NSW	**Date Started**	26/07/2019
Position	Refer to Figure 2	**Date Completed**	26/07/2019
Job No.	E24300.G03	**Logged By** DS	**Date** 26/07/2019
Client	High 618 Pty Ltd	**Reviewed By** NJ	**Date** 07/08/2019

Drilling Contactor Geosense Drilling
Drill Rig Hanjin D&B 8D **Inclination** -90°

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY REL. DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
RR	-	GWNE	10					GP	Sandy GRAVEL; medium to coarse, pale grey to grey, sub-angular to sub-rounded gravels, with silt, cobbles and boulders in places, sand is fine to coarse grained.	-	-	FLUVIAL SOIL
			11									
			12									
				12.80				-	SHALE; dark grey, low strength, distinctly weathered.	-	-	BEDROCK
			13	13.00					Continued as Cored Borehole			
			14									
			15									
			16									
			17									
			18									
			19									
			20									

This borehole log should be read in conjunction with EI Australia's accompanying standard notes.

CORED BOREHOLE LOG

BH NO. BH5

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Project	Proposed Mixed Use Development	**Sheet**	3 OF 3
Location	614-632 High Street, Penrith NSW	**Date Started**	26/07/2019
Position	Refer to Figure 2	**Date Completed**	26/07/2019
Job No.	E24300.G03	**Logged By** DS	**Date** 26/07/2019
Client	High 618 Pty Ltd	**Reviewed By** NJ	**Date** 07/08/2019

Drilling Contactor Geosense Drilling
Drill Rig Hanjin D&B 8D **Inclination** -90°

Drilling						Field Material Description				Defect Information	
METHOD	WATER	TCR	RQD (SCR)	DEPTH (metres)	DEPTH RL	GRAPHIC LOG	ROCK / SOIL MATERIAL DESCRIPTION	WEATHERING	INFERRED STRENGTH $Is_{(50)}$ MPa (VL 0.1, L 0.3, M 1, H 3, VH 10, EH)	DEFECT DESCRIPTION & Additional Observations	Average Defect Spacing (mm) (30, 100, 300, 1000, 3000)
				10							
				11							
				12							
				13	13.00		Continuation from non-cored borehole				
NMLC	85% RETURN	100	27	13			SHALE; dark grey, with pale grey siltstone and fine grained sandstone laminations bedded at 0 to 5°.	DW		13.00-13.53: XWSx14, 10-30mm	
								SW		13.61: BP, 0°, Clay VNR, PR, SM 13.80: BP, 0°, Clay VNR, PR, SM	
				14				DW		14.00-14.46: XWSx11, 10-20mm 14.46-15.00: XWSx17, 5-10mm	
		100	57	15	15.26		15.26-15.49: UCS = 28 MPa	FR		15.01: XWS, 10 mm 15.07: XWS, 10 mm 15.12: BP, 0°, Clay VNR, PR, SM 15.17: JT, 10°, Clay VNR, PR, SM 15.20: JT, 10°, Clay VNR, PR, SM 15.50: BP, 0°, Clay VNR, PR, SM 15.54: BP, 0°, Clay VNR, PR, SM 15.63: BP, 0°, Clay VNR, PR, SM 15.85: BP, 0°, Clay VNR, PR, SM	
				16						16.14: BP, 0°, Clay VNR, PR, SM	
										16.59: JT, 0 - 10°, CN, CU, RF	
				17						17.25: BP, 0°, CN, PR, RF 17.33: BP, 0°, CN, PR, RF 17.35: BP, 0°, CN, PR, RF 17.36: BP, 0°, CN, PR, RF 17.37: BP, 0°, CN, PR, RF	
		100	95	18	18.38		18.38-18.56: UCS = 15 MPa			18.16: XWS, 10 mm	
				19	19.60					18.80: JT, 15°, CN, PR, RF 18.82: JT, 10°, CN, PR, RF	
							Hole Terminated at 19.60 m				
				20							

This borehole log should be read in conjunction with EI Australia's accompanying standard notes.

CORE PHOTOGRAPH OF BOREHOLE: BH5

Project	Proposed Mixed Use Development			**Depth Range**	13.0m to 19.6m BEGL		
Location	614-632 High Street, Penrith NSW			**Contractor**	Geosense Drilling Engineers Pty Ltd		
Position	See Figure 2			**Drill Rig**	Hanjin D&B 8D		
Job No.	E24300.G03	**Inclination**	-90°	**Logged**	DS	**Date**	26 / 07 / 2019
Client	High 618 Pty Ltd	**Box**	1-2 of 2	**Checked**	NJ	**Date**	07 / 08 / 2019

BOREHOLE LOG

BH NO. BH6

Project	Proposed Mixed Use Development	**Sheet**	1 of 3
Location	614-632 High Street, Penrith NSW	**Date Started**	27/07/2019
Position	Refer to Figure 2	**Date Completed**	27/07/2019
Job No.	E24300.G03	**Logged By** DS	**Date** 27/07/2019
Client	High 618 Pty Ltd	**Reviewed By** NJ	**Date** 07/08/2019

Drilling Contactor Geosense Drilling
Drill Rig Hanjin D&B 8D **Inclination** -90°

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY REL. DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
AD/T	-	GWNE	0					-	CONCRETE; 30 mm thick.	-	-	CONCRETE
				0.40				-	FILL: Silty SAND; fine to medium grained, dark brown, trace fine to medium gravels.	M	-	FILL
					BH6_0.5-0.95 SPT 0.50-0.95 m 2,2,2 N=4			SM	Silty SAND; fine to medium grained, red-brown.			FLUVIAL SOIL
			1							M	L	
					BH6_1.5-1.95 SPT 1.50-1.95 m 2,1,1 N=2							
			2	2.00				ML	Sandy SILT; low plasticity, orange-brown, trace fine to coarse granite gravels, sand is fine to medium grained.	M (>PL)	S	
				2.30				GP	Sandy GRAVEL; medium to coarse, pale grey to grey, sub-angular to sub-rounded gravels, with silt, cobbles and boulders in places, sand is fine to coarse grained.			
NMLC			3									
NMLC RR			4									
			5									
			6							-	-	
RR			7									
			8									
			9									
			10									

This borehole log should be read in conjunction with EI Australia's accompanying standard notes.

BOREHOLE LOG

BH NO. BH6

Project	Proposed Mixed Use Development	**Sheet**	2 of 3
Location	614-632 High Street, Penrith NSW	**Date Started**	27/07/2019
Position	Refer to Figure 2	**Date Completed**	27/07/2019
Job No.	E24300.G03	**Logged By** DS	**Date** 27/07/2019
Client	High 618 Pty Ltd	**Reviewed By** NJ	**Date** 07/08/2019

Drilling Contactor Geosense Drilling
Drill Rig Hanjin D&B 8D **Inclination** -90°

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY REL. DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
RR	-	GWNE	10					GP	Sandy GRAVEL; medium to coarse, pale grey to grey, sub-angular to sub-rounded gravels, with silt, cobbles and boulders in places, sand is fine to coarse grained.	-	-	FLUVIAL SOIL
			11									
			12	12.60								
				12.80				-	SHALE; dark grey, very low strength, distinctly weathered.	-	-	BEDROCK
			13						Continued as Cored Borehole			
			14									
			15									
			16									
			17									
			18									
			19									
			20									

This borehole log should be read in conjunction with EI Australia's accompanying standard notes.

CORED BOREHOLE LOG

BH NO. BH6

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Project	Proposed Mixed Use Development	**Sheet**	3 OF 3
Location	614-632 High Street, Penrith NSW	**Date Started**	27/07/2019
Position	Refer to Figure 2	**Date Completed**	27/07/2019
Job No.	E24300.G03	**Logged By** DS	**Date** 27/07/2019
Client	High 618 Pty Ltd	**Reviewed By** NJ	**Date** 07/08/2019

Drilling Contactor Geosense Drilling
Drill Rig Hanjin D&B 8D **Inclination** -90°

Drilling						Field Material Description				Defect Information	
METHOD	WATER	TCR	RQD (SCR)	DEPTH (metres)	DEPTH RL	GRAPHIC LOG	ROCK / SOIL MATERIAL DESCRIPTION	WEATHERING	INFERRED STRENGTH $Is_{(50)}$ MPa (VL 0.1, L 0.3, M 1, H 3, VH 10, EH)	DEFECT DESCRIPTION & Additional Observations	Average Defect Spacing (mm) (30, 100, 300, 1000, 3000)
				10							
				11							
				12							
					12.80		Continuation from non-cored borehole				
NMLC	85% RETURN	100	66	13			SHALE; dark grey, with pale grey siltstone and fine grained sandstone laminations bedded at 0 to 5°.	DW SW		12.80: XWS, 80 mm 13.12: XWS, 5 mm 13.16: XWS, 10 mm 13.24: XWS, 5 mm 13.28: XWS, 5 mm 13.41: JT, 0 - 10°, CN, CU, RF 13.53: BP, 0°, CN, PR, RF 13.70: BP, 0°, CN, PR, RF 13.78: BP, 0°, CN, PR, RF 13.87: BP, 0°, CN, PR, RF 13.98: BP, 0°, CN, PR, RF 14.22: BP, 0°, CN, PR, RF 14.33: XWS, 20 mm 14.36: XWS, 20 mm 14.45: XWS, 20 mm 14.65: BP, 0°, CN, PR, RF 14.71: BP, 0°, CN, PR, RF 14.77: BP, 0°, CN, PR, RF 14.86: BP, 0°, CN, PR, RF 15.10: BP, 0°, CN, PR, RF	
					13.58		13.58-13.69: UCS = 19 MPa				
		100	94	14							
				15							
				16				FR		15.61: JT, 5 - 15°, CN, CU, RF 15.63: JT, 5 - 15°, CN, CU, RF	
										16.47: BP, 0°, CN, PR, RF	
				17	17.02		17.02-17.17: UCS = 51.7 MPa			17.01: BP, 0°, CN, PR, RF 17.18: BP, 0°, CN, PR, RF	
		100	100	18	18.20						
							Hole Terminated at 18.20 m				
				19							
				20							

This borehole log should be read in conjunction with EI Australia's accompanying standard notes.

CORE PHOTOGRAPH OF BOREHOLE: BH6

Project	Proposed Mixed Use Development			**Depth Range**	12.8m to 18.2m BEGL		
Location	614-632 High Street, Penrith NSW			**Contractor**	Geosense Drilling Engineers Pty Ltd		
Position	See Figure 2			**Drill Rig**	Hanjin D&B 8D		
Job No.	E24300.G03	**Inclination**	-90°	**Logged**	DS	**Date**	27 / 07 / 2019
Client	High 618 Pty Ltd	**Box**	1-2 of 2	**Checked**	NJ	**Date**	07 / 08 / 2019

EXPLANATION OF NOTES, ABBREVIATIONS & TERMS USED ON BOREHOLE AND TEST PIT LOGS

DRILLING/EXCAVATION METHOD

HA	Hand Auger	**RD**	Rotary blade or drag bit	**NQ**	Diamond Core - 47 mm
DT	Diatube Coring	**RT**	Rotary Tricone bit	**NMLC**	Diamond Core - 52 mm
NDD	Non-destructive digging	**RAB**	Rotary Air Blast	**HQ**	Diamond Core - 63 mm
AS*	Auger Screwing	**RC**	Reverse Circulation	**HMLC**	Diamond Core - 63 mm
AD*	Auger Drilling	**PT**	Push Tube	**BH**	Tractor Mounted Backhoe
***V**	V-Bit	**CT**	Cable Tool Rig	**EX**	Tracked Hydraulic Excavator
***T**	TC-Bit, e.g. AD/T	**JET**	Jetting	**EE**	Existing Excavation
ADH	Hollow Auger	**WB**	Washbore or Bailer	**HAND**	Excavated by Hand Methods

PENETRATION RESISTANCE

L	**Low Resistance**	Rapid penetration/ excavation possible with little effort from equipment used.
M	**Medium Resistance**	Penetration/ excavation possible at an acceptable rate with moderate effort from equipment used.
H	**High Resistance**	Penetration/ excavation is possible but at a slow rate and requires significant effort from equipment used.
R	**Refusal/Practical Refusal**	No further progress possible without risk of damage or unacceptable wear to equipment used.

These assessments are subjective and are dependent on many factors, including equipment power and weight, condition of excavation or drilling tools and experience of the operator.

WATER

Standing Water Level

Partial water loss

Water Seepage

Complete Water Loss

GWNO	GROUNDWATER NOT OBSERVED - Observation of groundwater, whether present or not, was not possible due to drilling water, surface seepage or cave-in of the borehole/ test pit.
GWNE	GROUNDWATER NOT ENCOUNTERED - Borehole/ test pit was dry soon after excavation. However, groundwater could be present in less permeable strata. Inflow may have been observed had the borehole/ test pit been left open for a longer period.

SAMPLING AND TESTING

SPT	Standard Penetration Test to AS1289.6.3.1-2004
4,7,11 N=18	4,7,11 = Blows per 150mm. N = Blows per 300mm penetration following a 150mm seating drive
30/80mm	Where practical refusal occurs, the blows and penetration for that interval are reported
RW	Penetration occurred under the rod weight only
HW	Penetration occurred under the hammer and rod weight only
HB	Hammer double bouncing on anvil
Sampling	
DS	Disturbed Sample
ES	Sample for environmental testing
BDS	Bulk disturbed Sample
GS	Gas Sample
WS	Water Sample
U50	Thin walled tube sample - number indicates nominal sample diameter in millimetres
Testing	
FP	Field Permeability test over section noted
FVS	Field Vane Shear test expressed as uncorrected shear strength (sv= peak value, sr= residual value)
PID	Photoionisation Detector reading in ppm
PM	Pressuremeter test over section noted
PP	Pocket Penetrometer test expressed as instrument reading in kPa
WPT	Water Pressure tests
DCP	Dynamic Cone Penetrometer test
CPT	Static Cone Penetration test
CPTu	Static Cone Penetration test with pore pressure (u) measurement

ROCK CORE RECOVERY

TCR=Total Core Recovery (%)

$$= \frac{Length\ of\ core\ recovered}{Length\ of\ core\ run} \times 100$$

SCR=Solid Core Recovery (%)

$$= \frac{\sum Length\ of\ cylindrical\ core\ recovered}{Length\ of\ core\ run} \times 100$$

RQD = Rock Quality Designation (%)

$$= \frac{\sum Axial\ lengths\ of\ core > 100mm}{Length\ of\ core\ run} \times 100$$

GEOLOGICAL BOUNDARIES

———— = Observed Boundary (position known)

– – – – – – – – – – = Observed Boundary (position approximate)

– –?– –?– –?– – = Boundary (interpreted or inferred)

METHOD OF SOIL DESCRIPTION USED ON BOREHOLE AND TEST PIT LOGS

	FILL		ORGANIC SOILS (OL, OH or Pt)		CLAY (CL, CI or CH)
	COUBLES or BOULDERS		SILT (ML or MH)		SAND (SP or SW)
	GRAVEL (GP or GW)	Combinations of these basic symbols may be used to indicate mixed materials such as sandy clay			

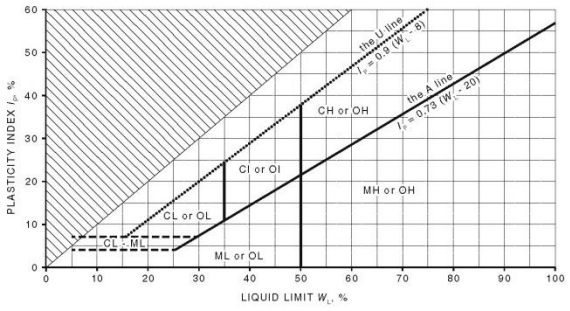
CLASSIFICATION AND INFERRED STRATIGRAPHY

Soil is broadly classified and described in Borehole and Test Pit Logs using the preferred method given in AS 1726:2017, Section 6.1 – Soil description and classification.

PARTICLE SIZE CHARACTERISTICS

Fraction	Components	Sub Division	Size mm
Oversize	BOULDERS		>200
	COBBLES		63 to 200
Coarse grained soil	GRAVEL	Coarse	19 to 63
		Medium	6.7 to 19
		Fine	2.36 to 6.7
	SAND	Coarse	0.6 to 2.36
		Medium	0.21 to 0.6
		Fine	0.075 to 0.21
Fine grained soil	SILT		0.002 to 0.075
	CLAY		<0.002

PLASTICITY PROPERTIES



GROUP SYMBOLS

Major Divisions		Symbol	Description
COARSE GRAINED SOILS More than 65% of soil excluding oversize fraction is greater than 0.075mm	GRAVEL More than 50% of coarse fraction is >2.36mm	GW	Well graded gravel and gravel-sand mixtures, little or no fines.
		GP	Poorly graded gravel and gravel-sand mixtures, little or no fines.
		GM	Silty gravel, gravel-sand-silt mixtures.
		GC	Clayey gravel, gravel-sand-clay mixtures.
	SAND More than 50% of coarse fraction is <2.36 mm	SW	Well graded sand and gravelly sand, little or no fines.
		SP	Poorly graded sand and gravelly sand, little or no fines.
		SM	Silty sand, sand-silt mixtures.
		SC	Clayey sand, sandy-clay mixtures.
FINE GRAINED SOILS More than 35% of soil excluding oversized fraction is less than 0.075mm	Liquid Limit less < 50%	ML	Inorganic silts of low plasticity, very fine sands, rock flour, silty or clayey fine sands.
		CL, CI	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays.
		OL	Organic silts and organic silty clays of low plasticity.
	Liquid Limit > than 50%	MH	Inorganic silts of high plasticity.
		CH	Inorganic clays of high plasticity.
		OH	Organic clays of medium to high plasticity.
	Highly Organic soil	PT	Peat muck and other highly organic soils.

MOISTURE CONDITION

Symbol	Term	Description
D	Dry	Non- cohesive and free-running.
M	Moist	Soils feel cool, darkened in colour. Soil tends to stick together.
W	Wet	Soils feel cool, darkened in colour. Soil tends to stick together, free water forms when handling.

Moisture content of cohesive soils shall be described in relation to plastic limit (PL) or liquid limit (LL) for soils with higher moisture content as follows: Moist, dry of plastic limit (w < PL); Moist, near plastic limit (w ≈ PL); Moist, wet of plastic limit (w < PL); Wet, near liquid limit (w ≈ LL), Wet, wet of liquid limit (w > LL),

CONSISTENCY

Symbol	Term	Undrained Shear Strength (kPa)	SPT "N" #
VS	Very Soft	≤ 12	≤ 2
S	Soft	>12 to ≤ 25	>2 to ≤ 4
F	Firm	>25 to ≤ 50	>4 to 8
St	Stiff	>50 to ≤ 100	>8 to 15
VSt	Very Stiff	>100 to ≤ 200	>15 to 30
H	Hard	>200	>30
Fr	Friable	-	

DENSITY

Symbol	Term	Density Index %	SPT "N" #
VL	Very Loose	≤ 15	0 to 4
L	Loose	>15 to ≤ 35	4 to 10
MD	Medium Dense	>35 to ≤ 65	10 to 30
D	Dense	>65 to ≤ 85	30 to 50
VD	Very Dense	>85	Above 50

In the absence of test results, consistency and density may be assessed from correlations with the observed behaviour of the material.
SPT correlations are not stated in AS1726:2017, and may be subject to corrections for overburden pressure and equipment type.

MINOR COMPONENTS

Term	Assessment Guide	Proportion by Mass
Trace	Presence just detectable by feel or eye but soil properties little or no different to general properties of primary component	Coarse grained soils: ≤ 5% Fine grained soil: ≤ 15%
With	Presence easily detectable by feel or eye but soil properties little or no different to general properties of primary component	Coarse grained soils: 5 - 12% Fine grained soil: 15 - 30%
Prefix	Presence easily detectable by feel or eye in conjunction with the general properties of primary component	Coarse grained soils: >12% Fine grained soil: >30%

TERMS FOR ROCK MATERIAL STRENGTH AND WEATHERING

CLASSIFICATION AND INFERRED STRATIGRAPHY

Rock is broadly classified and described in Borehole and Test Pit Logs using the preferred method given in AS1726 – 2017, Section 6.2 – Rock identification, description and classification.

ROCK MATERIAL STRENGTH CLASSIFICATION

Symbol	Term	Point Load Index, $Is_{(50)}$ (MPa) #	Field Guide
VL	Very Low	0.03 to 0.1	Material crumbles under firm blows with sharp end of pick; can be peeled with knife; too hard to cut a triaxial sample by hand. Pieces up to 30 mm can be broken by finger pressure.
L	Low	0.1 to 0.3	Easily scored with a knife; indentations 1 mm to 3 mm show in the specimen with firm blows of pick point; has dull sound under hammer. A piece of core 150 mm long by 50 mm diameter may be broken by hand. Sharp edges of core may be friable and break during handling.
M	Medium	0.3 to 1	Readily scored with a knife; a piece of core 150 mm long by 50 mm diameter can be broken by hand with difficulty.
H	High	1 to 3	A piece of core 150 mm long by 50 mm diameter cannot be broken by hand but can be broken with pick with a single firm blow; rock rings under hammer.
VH	Very High	3 to 10	Hand specimen breaks with pick after more than one blow; rock rings under hammer.
EH	Extremely High	>10	Specimen requires many blows with geological pick to break through intact material; rock rings under hammer.

 # Rock Strength Test Results

▼ Point Load Strength Index, $Is_{(50)}$, Axial test (MPa)

● Point Load Strength Index, $Is_{(50)}$, Diametral test (MPa)

Relationship between rock strength test result ($Is_{(50)}$) and unconfined compressive strength (UCS) will vary with rock type and strength, and should be determined on a site-specific basis. However UCS is typically 20 x $Is_{(50)}$.

ROCK MATERIAL WEATHERING CLASSIFICATION

Symbol		Term	Field Guide
RS		Residual Soil	Soil developed on extremely weathered rock; the mass structure and substance fabric are no longer evident; there is a large change in volume but the soil has not been significantly transported.
XW		Extremely Weathered	Rock is weathered to such an extent that it has soil properties - i.e. it either disintegrates or can be remoulded, in water.
DW	HW	Distinctly Weathered	Rock strength usually changed by weathering. The rock may be highly discoloured, usually by iron staining. Porosity may be increased by leaching, or may be decreased due to deposition of weathering products in pores. In some environments it is convenient to subdivide into Highly Weathered and Moderately Weathered, with the degree of alteration typically less for MW.
	MW		
SW		Slightly Weathered	Rock slightly discoloured but shows little or no change of strength relative to fresh rock.
FR		Fresh	Rock shows no sign of decomposition or staining.

ABBREVIATIONS AND DESCRIPTIONS FOR ROCK MATERIAL AND DEFECTS

CLASSIFICATION AND INFERRED STRATIGRAPHY
Rock is broadly classified and described in Borehole and Test Pit Logs using the preferred method given in AS1726 – 2017, Section 6.2 – Rock identification, description and classification.

ROCK MATERIAL DESCRIPTION

Layering	
Term	**Description**
Massive	No layering apparent
Indistinct	Layering just visible; little effect on properties
Distinct	Layering (bedding, foliation, cleavage) distinct; rock breaks more easily parallel to layering

Structure	
Term	**Spacing (mm)**
Thinly laminated	<6
Laminated	6 – 20
Very thinly bedded	20 – 60
Thinly bedded	60 – 200
Medium bedded	200 – 600
Thickly bedded	600 – 2,000
Very thickly bedded	> 2,000

ABBREVIATIONS AND DESCRIPTIONS FOR DEFECT TYPES

Defect Type	**Abbr.**	**Description**
Joint	JT	Surface of a fracture or parting, formed without displacement, across which the rock has little or no tensile strength. May be closed or filled by air, water or soil or rock substance, which acts as cement.
Bedding Parting	BP	Surface of fracture or parting, across which the rock has little or no tensile strength, parallel or sub-parallel to layering/ bedding. Bedding refers to the layering or stratification of a rock, indicating orientation during deposition, resulting in planar anisotropy in the rock material.
Foliation	FL	Repetitive planar structure parallel to the shear direction or perpendicular to the direction of higher pressure, especially in metamorphic rock, e.g. Schistosity (SH) and Gneissosity.
Contact	CO	The surface between two types or ages of rock.
Cleavage	CL	Cleavage planes appear as parallel, closely spaced and planar surfaces resulting from mechanical fracturing of rock through deformation or metamorphism, independent of bedding.
Sheared Surface	SSU	A near planar, curved or undulating surface which is usually smooth, polished or slickensided.
Sheared Seam/ Zone (Fault)	SS/SZ	Seam or zone with roughly parallel almost planar boundaries of rock substance cut by closely spaced (often <50 mm) parallel and usually smooth or slickensided joints or cleavage planes.
Crushed Seam/ Zone (Fault)	CS/CZ	Seam or zone composed of disoriented usually angular fragments of the host rock substance, with roughly parallel near-planar boundaries. The brecciated fragments may be of clay, silt, sand or gravel sizes or mixtures of these.
Extremely Weathered Seam/ Zone	XWS/ XWZ	Seam of soil substance, often with gradational boundaries, formed by weathering of the rock material in places.
Infilled Seam	IS	Seam of soil substance, usually clay or clayey, with very distinct roughly parallel boundaries, formed by soil migrating into joint or open cavity.
Schistocity	SH	The foliation in schist or other coarse grained crystalline rock due to the parallel arrangement of platy or prismatic mineral grains, such as mica.
Vein	VN	Distinct sheet-like body of minerals crystallised within rock through typically open-space filling or crack-seal growth.

ABBREVIATIONS AND DESCRIPTIONS FOR DEFECT SHAPE AND ROUGHNESS

Shape	**Abbr.**	**Description**	**Roughness**	**Abbr.**	**Description**
Planar	PR	Consistent orientation	Polished	POL	Shiny smooth surface
Curved	CU	Gradual change in orientation	Slickensided	SL	Grooved or striated surface, usually polished
Undulating	UN	Wavy surface	Smooth	SM	Smooth to touch. Few or no surface irregularities
Stepped	ST	One or more well defined steps	Rough	RO	Many small surface irregularities (amplitude generally <1mm). Feels like fine to coarse sandpaper
Irregular	IR	Many sharp changes in orientation	Very Rough	VR	Many large surface irregularities, amplitude generally >1mm. Feels like very coarse sandpaper

Orientation: **Vertical Boreholes –** The dip (inclination from horizontal) of the defect.
Inclined Boreholes – The inclination is measured as the acute angle to the core axis.

ABBREVIATIONS AND DESCRIPTIONS FOR DEFECT COATING

Coating	**Abbr.**	**Description**
Clean	CN	No visible coating or infilling
Stain	SN	No visible coating but surfaces are discoloured by staining, often limonite (orange-brown)
Veneer	VNR	A visible coating of soil or mineral substance, usually too thin to measure (< 1 mm); may be patchy

DEFECT APERTURE

Aperture	**Abbr.**	**Description**
Closed	-	Closed.
Open	OP	Without any infill material.
Infilled	-	Soil or rock i.e. clay, talc, pyrite, quartz, etc.

Appendix B - Laboratory Certificates

POINT LOAD STRENGTH INDEX REPORT

Client:	EI Australia	**Moisture Content Condition:**	As received
Address:	Suite 6.01, 55 Miller Street, Pyrmont, NSW 2009	**Storage History:**	Core boxes
Project:	614-632 High Street Penrith NSW (E24300 G03)	**Report No:**	S50950-PL
Job No:	S19360	**Date Tested:**	1/08/2019

Test Procedure: ☑ AS4133 4.1 Rock strength tests - Determination of point load strength index

Sampling: Sampled by Client **Date Sampled:** 22-23/07/2019

Preparation: Prepared in accordance with the test method

Sample Number	Sample Source	Sample Description	Test Type	Average Width (mm)	Platen Separation (mm)	Failure Load (kN)	Point Load Index Is (MPa)	Point Load Index $Is_{(50)}$ (MPa)	Failure Mode
S50950	BH1M 13.15 - 13.24m	Shale							
			Axial	51.5	27.0	1.41	0.80	0.74	1
S50951	BH1M 14.21 - 14.32m	Shale							
			Axial	51.7	32.0	1.03	0.49	0.47	1
S50952	BH1M 15.82 - 15.93m	Shale							
			Axial	51.7	36.0	3.17	1.34	1.32	1
S50953	BH1M 16.73 - 16.83m	Shale							
			Axial	51.8	35.0	2.76	1.20	1.17	1
S50954	BH1M 17.09 - 17.19m	Shale							
			Axial	51.6	33.0	6.19	2.86	2.77	1
S50955	BH1M 19.40 - 19.48m	Shale							
			Axial	51.8	40.0	2.68	1.02	1.03	4
S50958	BH2 13.77 - 13.85m	Shale							
			Axial	51.8	30.0	2.14	1.08	1.03	1
S50959	BH2 14.58 - 14.67m	Shale							
			Axial	52.0	31.0	1.51	0.74	0.70	1
S50960	BH2 15.70 - 15.81m	Shale							
			Axial	51.8	28.0	3.93	2.13	1.99	1
S50961	BH2 16.84 - 16.94m	Shale							
			Axial	51.8	31.0	4.40	2.15	2.06	1

Failure Modes

1 - Fracture through fabric of specimen oblique to bedding, not influenced by weak planes.

2 - Fracture along bedding.

3 - Fracture influenced by pre-existing plane, microfracture, vein or chemical alteration.

4 - Chip or partial fracture.

NATA

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NATA Accredited Laboratory Number: 14874

Authorised Signatory:

Chris Lloyd

6/08/2019

Date

MACQUARIE GEOTECH

Macquarie Geotechn
U7/8 10 Bradford Street
Alexandria NSW

POINT LOAD STRENGTH INDEX REPORT

Client:	EI Australia	**Moisture Content Condition:**	As received
Address:	Suite 6.01, 55 Miller Street, Pyrmont, NSW 2009	**Storage History:**	Core boxes
Project:	614-632 High Street Penrith NSW (E24300 G03)	**Report No:**	S50962-PL
Job No:	S19360	**Date Tested:**	1/08/2019

Test Procedure: ☑ AS4133 4.1 Rock strength tests - Determination of point load strength index

Sampling: Sampled by Client **Date Sampled:** 22-23/07/2019

Preparation: Prepared in accordance with the test method

Sample Number	Sample Source	Sample Description	Test Type	Average Width (mm)	Platen Separation (mm)	Failure Load (kN)	Point Load Index Is (MPa)	Point Load Index $Is_{(50)}$ (MPa)	Failure Mode
S50962	BH2 17.61 - 17.71m	Shale							
			Axial	51.8	31.0	2.46	1.20	1.15	1
S50963	BH2 18.54 - 18.63m	Shale							
			Axial	51.7	30.0	2.85	1.44	1.37	1

Failure Modes

1 - Fracture through fabric of specimen oblique to bedding, not influenced by weak planes.

2 - Fracture along bedding.

3 - Fracture influenced by pre-existing plane, microfracture, vein or chemical alteration.

4 - Chip or partial fracture.

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6/08/2019

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POINT LOAD STRENGTH INDEX REPORT

Client:	EI Australia	**Moisture Content Condition:**	As received
Address:	Suite 6.01, 55 Miller Street, Pyrmont, NSW 2009	**Storage History:**	Core boxes
Project:	614-632 High Street Penrith NSW (E24300 G03)	**Report No:**	S51283-PL
Job No:	S19360	**Date Tested:**	6/08/2019

Test Procedure: ☑ AS4133 4.1 Rock strength tests - Determination of point load strength index

Sampling: Sampled by Client **Date Sampled:** 26-27/7/19

Preparation: Prepared in accordance with the test method

Sample Number	Sample Source	Sample Description	Test Type	Average Width (mm)	Platen Separation (mm)	Failure Load (kN)	Point Load Index Is (MPa)	Point Load Index $Is_{(50)}$ (MPa)	Failure Mode
S51283	BH5 13.73 - 13.84m	Shale							
			Axial	51.3	30.0	1.41	0.72	0.68	1
S51284	BH5 14.74 - 14.82m	Shale							
			Axial	51.7	30.0	1.96	0.99	0.94	1
S51285	BH5 15.52 - 15.59m	Shale							
			Axial	51.9	30.0	4.19	2.11	2.01	1
S51286	BH5 16.71 - 16.81m	Shale							
			Axial	51.8	32.0	3.97	1.88	1.81	1
S51287	BH5 17.75 - 17.86m	Shale							
			Axial	51.9	30.0	3.83	1.93	1.83	1
S51288	BH5 18.85 - 18.94m	Shale							
			Axial	51.9	28.0	3.33	1.80	1.68	1
S51291	BH6 13.40 - 13.49m	Shale							
			Axial	51.8	29.0	1.45	0.76	0.71	1
S51292	BH6 14.27 - 14.31m	Shale							
			Axial	51.9	24.0	1.52	0.96	0.87	1
S51293	BH6 15.33 - 15.39m	Shale							
			Axial	51.7	23.0	1.63	1.08	0.96	1
S51294	BH6 16.24 - 16.34m	Shale							
			Axial	51.8	31.0	2.91	1.42	1.36	1

Failure Modes

1 - Fracture through fabric of specimen oblique to bedding, not influenced by weak planes.

2 - Fracture along bedding.

3 - Fracture influenced by pre-existing plane, microfracture, vein or chemical alteration.

4 - Chip or partial fracture.

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POINT LOAD STRENGTH INDEX REPORT

Client:	EI Australia	**Moisture Content Condition:**	As received
Address:	Suite 6.01, 55 Miller Street, Pyrmont, NSW 2009	**Storage History:**	Core boxes
Project:	614-632 High Street Penrith NSW (E24300 G03)	**Report No:**	S51295-PL
Job No:	S19360	**Date Tested:**	5/08/2019

Test Procedure: ☑ AS4133 4.1 Rock strength tests - Determination of point load strength index

Sampling: Sampled by Client **Date Sampled:** 26-27/7/19

Preparation: Prepared in accordance with the test method

Sample Number	Sample Source	Sample Description	Test Type	Average Width (mm)	Platen Separation (mm)	Failure Load (kN)	Point Load Index Is (MPa)	Point Load Index $Is_{(50)}$ (MPa)	Failure Mode
S51295	BH6 17.35 - 17.46m	Shale							
			Axial	51.7	28.0	5.31	2.88	2.69	1
S51296	BH6 18.04 - 18.12m	Shale							
			Axial	51.9	26.0	3.30	1.92	1.77	1

Failure Modes

1 - Fracture through fabric of specimen oblique to bedding, not influenced by weak planes.

2 - Fracture along bedding.

3 - Fracture influenced by pre-existing plane, microfracture, vein or chemical alteration.

4 - Chip or partial fracture.

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POINT LOAD STRENGTH INDEX REPORT

Client:	EI Australia	**Moisture Content Condition:**	As received
Address:	Suite 6.01, 55 Miller Street, Pyrmont, NSW 2009	**Storage History:**	Core boxes
Project:	614-632 High Street Penrith NSW (E24300 G03)	**Report No:**	S51312-PL
Job No:	S19360	**Date Tested:**	6/08/2019

Test Procedure: ☑ AS4133 4.1 Rock strength tests - Determination of point load strength index

Sampling: Sampled by Client **Date Sampled:** 25/07/2019

Preparation: Prepared in accordance with the test method

Sample Number	Sample Source	Sample Description	Test Type	Average Width (mm)	Platen Separation (mm)	Failure Load (kN)	Point Load Index Is (MPa)	Point Load Index $Is_{(50)}$ (MPa)	Failure Mode
S51312	BH3M 13.28 - 13.35m	Shale							
			Axial	51.8	34.0	3.09	1.38	1.34	1
S51313	BH3M 14.37 - 14.43m	Shale							
			Axial	51.8	26.0	1.47	0.86	0.79	1
S51314	BH3M 15.18 - 15.24m	Shale							
			Axial	51.8	28.0	1.73	0.94	0.88	1
S51315	BH3M 16.22 - 16.29m	Shale							
			Axial	51.9	28.0	8.40	4.54	4.24	1
S51316	BH3M 17.19 - 17.27m	Shale							
			Axial	51.8	28.0	3.55	1.92	1.80	1
S51317	BH3M 18.20 - 18.29m	Shale							
			Axial	51.6	38.0	4.40	1.76	1.76	1
S51320	BH4 13.36 - 13.48m	Shale							
			Axial	51.8	31.0	2.09	1.02	0.98	1
S51321	BH4 14.40 - 14.48m	Shale							
			Axial	51.8	40.0	2.67	1.01	1.02	1
S51322	BH4 15.36 - 15.47m	Shale							
			Axial	51.8	24.0	2.45	1.55	1.40	1
S51323	BH4 16.46 - 16.53m	Shale							
			Axial	51.8	35.0	8.29	3.59	3.53	1

Failure Modes

1 - Fracture through fabric of specimen oblique to bedding, not influenced by weak planes.

2 - Fracture along bedding.

3 - Fracture influenced by pre-existing plane, microfracture, vein or chemical alteration.

4 - Chip or partial fracture.

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POINT LOAD STRENGTH INDEX REPORT

Client:	EI Australia	**Moisture Content Condition:**	As received
Address:	Suite 6.01, 55 Miller Street, Pyrmont, NSW 2009	**Storage History:**	Core boxes
Project:	614-632 High Street Penrith NSW (E24300 G03)	**Report No:**	S51324-PL
Job No:	S19360	**Date Tested:**	5/08/2019

Test Procedure: ☑ AS4133 4.1 Rock strength tests - Determination of point load strength index

Sampling: Sampled by Client **Date Sampled:** 25/07/2019

Preparation: Prepared in accordance with the test method

Sample Number	Sample Source	Sample Description	Test Type	Average Width (mm)	Platen Separation (mm)	Failure Load (kN)	Point Load Index Is (MPa)	Point Load Index $Is_{(50)}$ (MPa)	Failure Mode
S51324	BH4 17.58 - 17.67m	Shale	Diametral	-	49.0	6.36	2.65	2.62	1
			Axial	51.8	29.0	9.17	4.79	4.51	1
S51325	BH4 18.13 - 18.21m	Shale	Diametral	-	50.0	3.66	1.46	1.46	1
			Axial	51.8	39.0	5.38	2.09	2.11	1

Failure Modes

1 - Fracture through fabric of specimen oblique to bedding, not influenced by weak planes.

2 - Fracture along bedding.

3 - Fracture influenced by pre-existing plane, microfracture, vein or chemical alteration.

4 - Chip or partial fracture.

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6/08/2019

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Alexandria NSW

Uniaxial Compressive Strength

Client:	EI Australia	**Sample Source:**	BH1M 17.1-17.35m
Address:	Suite 6.01, 55 Miller Street, Pyrmont, NSW 2009	**Sample Description:**	Shale
Project:	614-632 High Street Penrith NSW (E24300 G03)	**Report No.:**	S50956-UCS
Job No.:	S19360	**Lab No.:**	S50956
Test Procedure:	AS 4133.4.2.2 Determination of uniaxial compressive strength-Rock strength less than 50 MPa		
Testing Machine:	Matest 2000 kN Compression Machine	**Sample Curing:**	-
Sampling Method:	Sampled by Client	**Date Sampled:**	22-23/07/2019
Storage History:	Sealed	**Storage Environment:**	Sealed at as received moisture condition

Uniaxial Compressive Strength 22 MPa

Date Tested:	5/08/2019		Moisture Content:	2.5	%
Specimen Height:	105.0	mm	Duration of Test:	622	seconds
Average Specimen Diameter:	51.6	mm	Rate of Displacement:	< 0.1	mm/min
Failure Type:	Mixed mode				
Other Pertinent Observations:					
Deviation from Standard:	Test specimen length to diameter ratio falls outside of standard limitations of 2.5-3.0.				

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Chris Lloyd

NATA Accredited Laboratory Number: 14874

Date: 6/08/2019

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Alexandria NSW 2015

Uniaxial Compressive Strength

Client:	EI Australia	**Sample Source:**	BH1M 18.35-18.60m
Address:	Suite 6.01, 55 Miller Street, Pyrmont, NSW 2009	**Sample Description:**	Shale
Project:	614-632 High Street Penrith NSW (E24300 G03)	**Report No.:**	S50957-UCS
Job No.:	S19360	**Lab No.:**	S50957
Test Procedure:	AS 4133.4.2.2 Determination of uniaxial compressive strength-Rock strength less than 50 MPa		
Testing Machine:	Matest 2000 kN Compression Machine	**Sample Curing:**	-
Sampling Method:	Sampled by Client	**Date Sampled:**	22-23/07/2019
Storage History:	Sealed	**Storage Environment:**	Sealed at as received moisture condition

Uniaxial Compressive Strength 17 MPa

Date Tested:	5/08/2019		Moisture Content:	2.6	%
Specimen Height:	119.4	mm	Duration of Test:	615	seconds
Average Specimen Diameter:	51.8	mm	Rate of Displacement:	< 0.1	mm/min
Failure Type:	Mixed mode				
Other Pertinent Observations:					
Deviation from Standard:	Test specimen length to diameter ratio falls outside of standard limitations of 2.5-3.0.				

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Authorised Signatory:

Chris Lloyd

NATA Accredited Laboratory Number: 14874

Date: 6/08/2019

MACQUARIE GEOTECH

Macquarie Geotechnical
U7/8 10 Bradford Street
Alexandria NSW 2015

Uniaxial Compressive Strength

Client:	EI Australia	**Sample Source:**	BH2 13.55-13.75m
Address:	Suite 6.01, 55 Miller Street, Pyrmont, NSW 2009	**Sample Description:**	Shale
Project:	614-632 High Street Penrith NSW (E24300 G03)	**Report No.:**	S50964-UCS
Job No.:	S19360	**Lab No.:**	S50964
Test Procedure:	AS 4133.4.2.2 Determination of uniaxial compressive strength-Rock strength less than 50 MPa		
Testing Machine:	Matest 2000 kN Compression Machine	**Sample Curing:**	-
Sampling Method:	Sampled by Client	**Date Sampled:**	22-23/07/2019
Storage History:	Sealed	**Storage Environment:**	Sealed at as received moisture condition

Uniaxial Compressive Strength 15 MPa

Date Tested:	6/08/2019		Moisture Content:	3.1	%
Specimen Height:	124.0	mm	Duration of Test:	629	seconds
Average Specimen Diameter:	51.8	mm	Rate of Displacement:	< 0.1	mm/min
Failure Type:	Tensile dominated				
Other Pertinent Observations:					
Deviation from Standard:	Test specimen length to diameter ratio falls outside of standard limitations of 2.5-3.0.				

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MACQUARIE GEOTECH

Macquarie Geotechnical
U7/8 10 Bradford Street
Alexandria NSW 2015

Uniaxial Compressive Strength

Client:	EI Australia	**Sample Source:**	BH2 16.40-16.65m
Address:	Suite 6.01, 55 Miller Street, Pyrmont, NSW 2009	**Sample Description:**	Shale
Project:	614-632 High Street Penrith NSW (E24300 G03)	**Report No.:**	S50965-UCS
Job No.:	S19360	**Lab No.:**	S50965
Test Procedure:	AS 4133.4.2.2 Determination of uniaxial compressive strength-Rock strength less than 50 MPa		
Testing Machine:	Matest 2000 kN Compression Machine	**Sample Curing:**	-
Sampling Method:	Sampled by Client	**Date Sampled:**	22-23/07/2019
Storage History:	Sealed	**Storage Environment:**	Sealed at as received moisture condition

Uniaxial Compressive Strength 31 MPa

Date Tested:	5/08/2019		Moisture Content:	2.3	%
Specimen Height:	143.9	mm	Duration of Test:	659	seconds
Average Specimen Diameter:	51.7	mm	Rate of Displacement:	< 0.1	mm/min
Failure Type:	Mixed mode				
Other Pertinent Observations:					

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NATA Accredited Laboratory Number: 14874

Date: 6/08/2019

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U7/8 10 Bradford Street
Alexandria NSW 2015

Uniaxial Compressive Strength

Client:	EI Australia	**Sample Source:**	BH3M 13.82 - 14.0m
Address:	Suite 6.01, 55 Miller Street, Pyrmont, NSW 2009	**Sample Description:**	Shale
Project:	614-632 High Street Penrith NSW (E24300 G03)	**Report No.:**	S51318-UCS
Job No.:	S19360	**Lab No.:**	S51318
Test Procedure:	AS 4133.4.2.2 Determination of uniaxial compressive strength-Rock strength less than 50 MPa		
Testing Machine:	Matest 2000 kN Compression Machine	**Sample Curing:**	-
Sampling Method:	Sampled by Client	**Date Sampled:**	25/07/2019
Storage History:	Sealed	**Storage Environment:**	Sealed at as received moisture condition

Uniaxial Compressive Strength 27 MPa

Date Tested:	5/08/2019		Moisture Content:	2.7	%
Specimen Height:	144.5	mm	Duration of Test:	655	seconds
Average Specimen Diameter:	51.8	mm	Rate of Displacement:	< 0.1	mm/min
Failure Type:	Mixed mode				
Other Pertinent Observations:					

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NATA Accredited Laboratory Number: 14874

Date: 7/08/2019

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U7/8 10 Bradford Street
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Uniaxial Compressive Strength

Client:	EI Australia	**Sample Source:**	BH3M 18.29 - 18.55m
Address:	Suite 6.01, 55 Miller Street, Pyrmont, NSW 2009	**Sample Description:**	Shale
Project:	614-632 High Street Penrith NSW (E24300 G03)	**Report No.:**	S51319-UCS
Job No.:	S19360	**Lab No.:**	S51319
Test Procedure:	AS 4133.4.2.2 Determination of uniaxial compressive strength-Rock strength less than 50 MPa		
Testing Machine:	Matest 2000 kN Compression Machine	**Sample Curing:**	-
Sampling Method:	Sampled by Client	**Date Sampled:**	25/07/2019
Storage History:	Sealed	**Storage Environment:**	Sealed at as received moisture condition

Uniaxial Compressive Strength 31 MPa

Date Tested:	5/08/2019		Moisture Content:	2.5	%
Specimen Height:	144.2	mm	Duration of Test:	679	seconds
Average Specimen Diameter:	51.6	mm	Rate of Displacement:	< 0.1	mm/min
Failure Type:	Mixed mode				
Other Pertinent Observations:					

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Date: 7/08/2019

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Alexandria NSW 2015

Uniaxial Compressive Strength

Client:	EI Australia	**Sample Source:**	BH4 13.64 - 13.87m
Address:	Suite 6.01, 55 Miller Street, Pyrmont, NSW 2009	**Sample Description:**	Shale
Project:	614-632 High Street Penrith NSW (E24300 G03)	**Report No.:**	S51326-UCS
Job No.:	S19360	**Lab No.:**	S51326
Test Procedure:	AS 4133.4.2.2 Determination of uniaxial compressive strength-Rock strength less than 50 MPa		
Testing Machine:	Matest 2000 kN Compression Machine	**Sample Curing:**	-
Sampling Method:	Sampled by Client	**Date Sampled:**	25/07/2019
Storage History:	Sealed	**Storage Environment:**	Sealed at as received moisture condition

Uniaxial Compressive Strength 26 MPa

Date Tested:	5/08/2019		Moisture Content:	2.8	%
Specimen Height:	143.6	mm	Duration of Test:	681	seconds
Average Specimen Diameter:	51.8	mm	Rate of Displacement:	< 0.1	mm/min
Failure Type:	Mixed mode				
Other Pertinent Observations:					

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Uniaxial Compressive Strength

Client:	EI Australia	**Sample Source:**	BH4 16.15 - 16.29m
Address:	Suite 6.01, 55 Miller Street, Pyrmont, NSW 2009	**Sample Description:**	Shale
Project:	614-632 High Street Penrith NSW (E24300 G03)	**Report No.:**	S51327-UCS
Job No.:	S19360	**Lab No.:**	S51327
Test Procedure:	AS 4133.4.2.2 Determination of uniaxial compressive strength-Rock strength less than 50 MPa		
Testing Machine:	Matest 2000 kN Compression Machine	**Sample Curing:**	-
Sampling Method:	Sampled by Client	**Date Sampled:**	25/07/2019
Storage History:	Sealed	**Storage Environment:**	Sealed at as received moisture condition

Uniaxial Compressive Strength 47 MPa

Date Tested:	5/08/2019		Moisture Content:	2.4	%
Specimen Height:	142.3	mm	Duration of Test:	881	seconds
Average Specimen Diameter:	51.8	mm	Rate of Displacement:	< 0.1	mm/min
Failure Type:	Mixed mode				
Other Pertinent Observations:					

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Date: 7/08/2019

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Alexandria NSW 2015

Uniaxial Compressive Strength

Client:	EI Australia	**Sample Source:**	BH5 15.26 - 15.49m
Address:	Suite 6.01, 55 Miller Street, Pyrmont, NSW 2009	**Sample Description:**	Shale
Project:	614-632 High Street Penrith NSW (E24300 G03)	**Report No.:**	S51289-UCS
Job No.:	S19360	**Lab No.:**	S51289
Test Procedure:	AS 4133.4.2.2 Determination of uniaxial compressive strength-Rock strength less than 50 MPa		
Testing Machine:	Matest 2000 kN Compression Machine	**Sample Curing:**	-
Sampling Method:	Sampled by Client	**Date Sampled:**	26-27/7/19
Storage History:	Sealed	**Storage Environment:**	Sealed at as received moisture condition

Uniaxial Compressive Strength 28 MPa

Date Tested:	6/08/2019		Moisture Content:	2.6	%
Specimen Height:	142.3	mm	Duration of Test:	665	seconds
Average Specimen Diameter:	51.8	mm	Rate of Displacement:	< 0.1	mm/min
Failure Type:	Tensile dominated				
Other Pertinent Observations:					

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Uniaxial Compressive Strength

Client:	EI Australia	**Sample Source:**	BH5 18.38 - 18.56m
Address:	Suite 6.01, 55 Miller Street, Pyrmont, NSW 2009	**Sample Description:**	Shale
Project:	614-632 High Street Penrith NSW (E24300 G03)	**Report No.:**	S51290-UCS
Job No.:	S19360	**Lab No.:**	S51290
Test Procedure:	AS 4133.4.2.2 Determination of uniaxial compressive strength-Rock strength less than 50 MPa		
Testing Machine:	Matest 2000 kN Compression Machine	**Sample Curing:**	-
Sampling Method:	Sampled by Client	**Date Sampled:**	26-27/7/19
Storage History:	Sealed	**Storage Environment:**	Sealed at as received moisture condition

Uniaxial Compressive Strength 15 MPa

Date Tested:	6/08/2019		Moisture Content:	3.0	%
Specimen Height:	119.2	mm	Duration of Test:	620	seconds
Average Specimen Diameter:	51.6	mm	Rate of Displacement:	< 0.1	mm/min
Failure Type:	Tensile dominated				
Other Pertinent Observations:					
Deviation from Standard:	Test specimen length to diameter ratio falls outside of standard limitations of 2.5-3.0.				

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Uniaxial Compressive Strength

Client:	EI Australia	**Sample Source:**	BH6 13.58 - 13.69m
Address:	Suite 6.01, 55 Miller Street, Pyrmont, NSW 2009	**Sample Description:**	Shale
Project:	614-632 High Street Penrith NSW (E24300 G03)	**Report No.:**	S51297-UCS
Job No.:	S19360	**Lab No.:**	S51297
Test Procedure:	AS 4133.4.2.2 Determination of uniaxial compressive strength-Rock strength less than 50 MPa		
Testing Machine:	Matest 2000 kN Compression Machine	**Sample Curing:**	-
Sampling Method:	Sampled by Client	**Date Sampled:**	26-27/7/19
Storage History:	Sealed	**Storage Environment:**	Sealed at as received moisture condition

Uniaxial Compressive Strength 19 MPa

Date Tested:	6/08/2019		Moisture Content:	3.0	%
Specimen Height:	103.3	mm	Duration of Test:	688	seconds
Average Specimen Diameter:	51.8	mm	Rate of Displacement:	< 0.1	mm/min
Failure Type:	Tensile dominated				
Other Pertinent Observations:					
Deviation from Standard:	Test specimen length to diameter ratio falls outside of standard limitations of 2.5-3.0.				

Authorised Signatory:

Chris Lloyd

NATA Accredited Laboratory Number: 14874

Date: 7/08/2019

Macquarie Geotechnical

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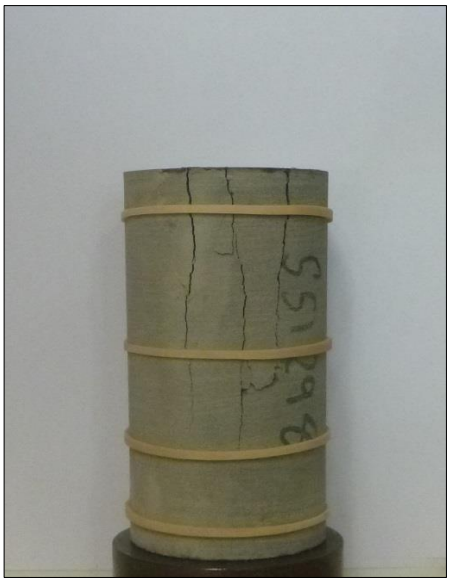
Alexandria NSW 2015

Uniaxial Compressive Strength

Client:	EI Australia	**Sample Source:**	BH6 17.02 - 17.17m
Address:	Suite 6.01, 55 Miller Street, Pyrmont, NSW 2009	**Sample Description:**	Shale
Project:	614-632 High Street Penrith NSW (E24300 G03)	**Report No.:**	S51298-UCS
Job No.:	S19360	**Lab No.:**	S51298
Test Procedure:	AS 4133.4.2.2 Determination of uniaxial compressive strength-Rock strength less than 50 MPa		
Testing Machine:	Matest 2000 kN Compression Machine	**Sample Curing:**	-
Sampling Method:	Sampled by Client	**Date Sampled:**	26-27/7/19
Storage History:	Sealed	**Storage Environment:**	Sealed at as received moisture condition



Uniaxial Compressive Strength 51.7 MPa

Date Tested:	6/08/2019		Moisture Content:	2.0	%
Specimen Height:	111.5	mm	Duration of Test:	726	seconds
Average Specimen Diameter:	51.8	mm	Rate of Displacement:	< 0.1	mm/min
Failure Type:	Tensile dominated				
Other Pertinent Observations:					
Deviation from Standard:	Test specimen length to diameter ratio falls outside of standard limitations of 2.5-3.0.				

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Chris Lloyd

NATA Accredited Laboratory Number: 14874

Date: 7/08/2019

MACQUARIE GEOTECH

Macquarie Geotechnical
U7/8 10 Bradford Street
Alexandria NSW 2015

ANALYTICAL REPORT

Accreditation No. 2562

CLIENT DETAILS

Contact	David Saw
Client	EI AUSTRALIA
Address	SUITE 6.01 55 MILLER STREET PYRMONT NSW 2009
Telephone	61 2 9516 0722
Facsimile	(Not specified)
Email	david.saw@eiaustralia.com.au
Project	**E24300.G03 614-632 High Street, Penrith**
Order Number	**E24300.G03**
Samples	3

LABORATORY DETAILS

Manager	Huong Crawford
Laboratory	SGS Alexandria Environmental
Address	Unit 16, 33 Maddox St Alexandria NSW 2015
Telephone	+61 2 8594 0400
Facsimile	+61 2 8594 0499
Email	au.environmental.sydney@sgs.com
SGS Reference	**SE195763 R0**
Date Received	26/7/2019
Date Reported	2/8/2019

COMMENTS

Accredited for compliance with ISO/IEC 17025 - Testing. NATA accredited laboratory 2562(4354).

SIGNATORIES

Dong Liang
Metals/Inorganics Team Leader

Shane McDermott
Inorganic/Metals Chemist

Soluble Anions (1:5) in Soil by Ion Chromatography [AN245] Tested: 1/8/2019

PARAMETER	UOM	LOR	BH3M_3.0-3.3 SOIL - 24/7/2019 SE195763.002	BH1M_2.4-2.6 SOIL - 24/7/2019 SE195763.003
Chloride	mg/kg	0.25	**2.5**	**1.9**
Sulfate	mg/kg	5	**59**	**23**

pH in soil (1:5) [AN101] Tested: 31/7/2019

PARAMETER	UOM	LOR	BH3M_3.0-3.3 SOIL - 24/7/2019 SE195763.002	BH1M_2.4-2.6 SOIL - 24/7/2019 SE195763.003
pH	pH Units	0.1	**7.8**	**6.4**

Conductivity and TDS by Calculation - Soil [AN106] Tested: 31/7/2019

PARAMETER	UOM	LOR	BH3M_3.0-3.3 SOIL - 24/7/2019 SE195763.002	BH1M_2.4-2.6 SOIL - 24/7/2019 SE195763.003
Conductivity of Extract (1:5 as received)	µS/cm	1	**62**	**18**
Conductivity of Extract (1:5 dry sample basis)	µS/cm	1	**70**	**19**

Moisture Content [AN002] Tested: 31/7/2019

PARAMETER	UOM	LOR	BH3M_3.0-3.3 SOIL - 24/7/2019 SE195763.002	BH1M_2.4-2.6 SOIL - 24/7/2019 SE195763.003
% Moisture	%w/w	1	**12.7**	**8.9**

Anions by Ion Chromatography in Water [AN245] Tested: 30/7/2019

PARAMETER	UOM	LOR	BH3M WATER - 25/7/2019 SE195763.001
Chloride	mg/L	1	**350**
Sulfate, SO4	mg/L	1	**38**

pH in water [AN101] Tested: 29/7/2019

PARAMETER	UOM	LOR	BH3M WATER - 25/7/2019 SE195763.001
pH**	No unit	-	**7.7**

Conductivity and TDS by Calculation - Water [AN106] Tested: 29/7/2019

PARAMETER	UOM	LOR	BH3M WATER - 25/7/2019 SE195763.001
Conductivity @ 25 C	µS/cm	2	**1500**

METHOD	METHODOLOGY SUMMARY
AN002	The test is carried out by drying (at either 40°C or 105°C) a known mass of sample in a weighed evaporating basin. After fully dry the sample is re-weighed. Samples such as sludge and sediment having high percentages of moisture will take some time in a drying oven for complete removal of water.
AN101	pH in Soil Sludge Sediment and Water: pH is measured electrometrically using a combination electrode and is calibrated against 3 buffers purchased commercially. For soils, sediments and sludges, an extract with water (or 0.01M CaCl2) is made at a ratio of 1:5 and the pH determined and reported on the extract. Reference APHA 4500-H+.
AN106	Conductivity and TDS by Calculation: Conductivity is measured by meter with temperature compensation and is calibrated against a standard solution of potassium chloride. Conductivity is generally reported as µmhos /cm or µS/cm @ 25°C. For soils, an extract with water is made at a ratio of 1:5 and the EC determined and reported on the extract, or calculated back to the as-received sample. Salinity can be estimated from conductivity using a conversion factor, which for natural waters, is in the range 0.55 to 0.75. Reference APHA 2510 B.
AN106	Salinity may be calculated in terms of NaCl from the sample conductivity. This assumes all soluble salts present , measured by the conductivity, are present as NaCl.
AN245	Anions by Ion Chromatography: A water sample is injected into an eluent stream that passes through the ion chromatographic system where the anions of interest ie Br, Cl, NO2, NO3 and SO4 are separated on their relative affinities for the active sites on the column packing material. Changes to the conductivity and the UV-visible absorbance of the eluent enable identification and quantitation of the anions based on their retention time and peak height or area. APHA 4110 B

FOOTNOTES

*	NATA accreditation does not cover the performance of this service.	-	Not analysed.	UOM	Unit of Measure.
		NVL	Not validated.	LOR	Limit of Reporting.
**	Indicative data, theoretical holding time exceeded.	IS	Insufficient sample for analysis.	↑↓	Raised/lowered Limit of Reporting.
		LNR	Sample listed, but not received.		

Unless it is reported that sampling has been performed by SGS, the samples have been analysed as received.
Solid samples expressed on a dry weight basis.

Where "Total" analyte groups are reported (for example, Total PAHs, Total OC Pesticides) the total will be calculated as the sum of the individual analytes, with those analytes that are reported as <LOR being assumed to be zero. The summed (Total) limit of reporting is calculated by summing the individual analyte LORs and dividing by two. For example, where 16 individual analytes are being summed and each has an LOR of 0.1 mg/kg, the "Totals" LOR will be 1.6 / 2 (0.8 mg/kg). Where only 2 analytes are being summed, the " Total" LOR will be the sum of those two LORs.

Some totals may not appear to add up because the total is rounded after adding up the raw values.

If reported, measurement uncertainty follow the ± sign after the analytical result and is expressed as the expanded uncertainty calculated using a coverage factor of 2, providing a level of confidence of approximately 95%, unless stated otherwise in the comments section of this report.

Results reported for samples tested under test methods with codes starting with ARS-SOP, radionuclide or gross radioactivity concentrations are expressed in becquerel (Bq) per unit of mass or volume or per wipe as stated on the report. Becquerel is the SI unit for activity and equals one nuclear transformation per second.
Note that in terms of units of radioactivity:

a. 1 Bq is equivalent to 27 pCi
b. 37 MBq is equivalent to 1 mCi

For results reported for samples tested under test methods with codes starting with ARS-SOP, less than (<) values indicate the detection limit for each radionuclide or parameter for the measurement system used. The respective detection limits have been calculated in accordance with ISO 11929.

The QC and MU criteria are subject to internal review according to the SGS QAQC plan and may be provided on request or alternatively can be found here: www.sgs.com.au.pv.sgsvr/en-gb/environment.

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Appendix C – Important Information

Important Information

SCOPE OF SERVICES

The geotechnical report ("the report") has been prepared in accordance with the scope of services as set out in the contract, or as otherwise agreed, between the Client And EI Australia ("EI"). The scope of work may have been limited by a range of factors such as time, budget, access and/or site disturbance constraints.

RELIANCE ON DATA

EI has relied on data provided by the Client and other individuals and organizations, to prepare the report. Such data may include surveys, analyses, designs, maps and plans. EI has not verified the accuracy or completeness of the data except as stated in the report. To the extent that the statements, opinions, facts, information, conclusions and/or recommendations ("conclusions") are based in whole or part on the data, EI will not be liable in relation to incorrect conclusions should any data, information or condition be incorrect or have been concealed, withheld, misrepresented or otherwise not fully disclosed to EI.

GEOTECHNICAL ENGINEERING

Geotechnical engineering is based extensively on judgment and opinion. It is far less exact than other engineering disciplines. Geotechnical engineering reports are prepared for a specific client, for a specific project and to meet specific needs, and may not be adequate for other clients or other purposes (e.g. a report prepared for a consulting civil engineer may not be adequate for a construction contractor). The report should not be used for other than its intended purpose without seeking additional geotechnical advice. Also, unless further geotechnical advice is obtained, the report cannot be used where the nature and/or details of the proposed development are changed.

LIMITATIONS OF SITE INVESTIGATION

The investigation programme undertaken is a professional estimate of the scope of investigation required to provide a general profile of subsurface conditions. The data derived from the site investigation programme and subsequent laboratory testing are extrapolated across the site to form an inferred geological model, and an engineering opinion is rendered about overall subsurface conditions and their likely behaviour with regard to the proposed development. Despite investigation, the actual conditions at the site might differ from those inferred to exist, since no subsurface exploration program, no matter how comprehensive, can reveal all subsurface details and anomalies. The engineering logs are the subjective interpretation of subsurface conditions at a particular location and time, made by trained personnel. The actual interface between materials may be more gradual or abrupt than a report indicates.

SUBSURFACE CONDITIONS ARE TIME DEPENDENT

Subsurface conditions can be modified by changing natural forces or man-made influences. The report is based on conditions that existed at the time of subsurface exploration. Construction operations adjacent to the site, and natural events such as floods, or ground water fluctuations, may also affect subsurface conditions, and thus the continuing adequacy of a geotechnical report. EI should be kept appraised of any such events, and should be consulted to determine if any additional tests are necessary.

VERIFICATION OF SITE CONDITIONS

Where ground conditions encountered at the site differ significantly from those anticipated in the report, either due to natural variability of subsurface conditions or construction activities, it is a condition of the report that EI be notified of any variations and be provided with an opportunity to review the recommendations of this report. Recognition of change of soil and rock conditions requires experience and it is recommended that a suitably experienced geotechnical engineer be engaged to visit the site with sufficient frequency to detect if conditions have changed significantly.

REPRODUCTION OF REPORTS

 Where information from the accompanying report is to be included in contract documents or engineering specification for the project, the entire report should be included in order to minimize the likelihood of misinterpretation from logs.

REPORT FOR BENEFIT OF CLIENT

The report has been prepared for the benefit of the Client and no other party. EI assumes no responsibility and will not be liable to any other person or organisation for or in relation to any matter dealt with or conclusions expressed in the report, or for any loss or damage suffered by any other person or organisation arising from matters dealt with or conclusions expressed in the report (including without limitation matters arising from any negligent act or omission of EI or for any loss or damage suffered by any other party relying upon the matters dealt with or conclusions expressed in the report). Other parties should not rely upon the report or the accuracy or completeness of any conclusions and should make their own inquiries and obtain independent advice in relation to such matters.

OTHER LIMITATIONS

EI will not be liable to update or revise the report to take into account any events or emergent circumstances or fact occurring or becoming apparent after the date of the report.