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DEICORP PROJECTS (ASHFIELD) PTY LTD

Geotechnical Investigation

73-75 Norton Street, Ashfield

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Revision	Details	Date	Amended By
	Original	1 June 2020	
1	Updated survey plan	12 June 2020	JW
2	Updated Drawings	23 June 2020	BL

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1. Introduction

1.1 Background

At the request of Deicorp Projects (Ashfield) Pty Ltd (the Client), EI Australia (EI) has carried out a Geotechnical Investigation (GI) for the proposed development at 73-75 Norton Street, Ashfield (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 P18082.1, dated 8 April 2020, and with the Client's signed authorisation to proceed, dated 14 April 2020.

1.2 Proposed Development

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

- Architectural drawings prepared by NORDON JAGO Architects – Job No. DEI00619, Drawing Nos.: DA.100A to DA.112A, Revision A, dated 22 June 2020; and
- Site survey plan prepared by Daw & Walton – Job No. 4800-19, Sheet 1 to 4 of 4, Revision 5, dated 27 May 2020.

Based on the provided documents, EI understands that the proposed development involves demolition of the existing structures and construction of an eight storey residential flat building with a club at ground level overlying a three-level basement car park. The lowest basement level (B3) is proposed to have a finished floor level (FFL) of RL 26.69m. A Bulk Excavation Level (BEL) of RL 26.39m is assumed, which includes allowance for the construction of the basement slab. To achieve the BEL, excavation depths from about 10.1m to 12.4m Below Existing Ground Level (BEGL) have been estimated. Locally deeper excavations may be required for footings, service trenches, crane pads and lift overrun pits. The basement extends up to the eastern, western and southern boundaries, and is setback about 6.0m from the northern site boundary.

1.3 Objectives

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

- Dilapidation Surveys;
- Excavation methodologies and monitoring requirements;
- Groundwater considerations;
- Vibration considerations;
- Excavation support requirements, including preliminary geotechnical design parameters for retaining walls and shoring systems;
- Building foundation options, including;
  - Preliminary 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 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 four boreholes (BH1M, BH2M, BH3M and BH4) by a track-mounted drill rig using solid flight augers equipped with a 'Tungsten-Carbide' (T-C) bit. BH1M, BH2M, BH3M and BH4 were auger drilled to depths of about 7.4m BEGL (RL of about 30.37m), 6.5m BEGL (RL of about 29.56m), 6.2m BEGL (RL of about 32.3m) and 9.0m BEGL (RL of about 27.5m), respectively.
  - 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;
  - Measurements of groundwater seepage/levels, where possible, in the augered sections of the boreholes during and shortly after completion of auger drilling;
  - The strength of the bedrock in the augered sections of the boreholes was assessed by observation of the auger penetration resistance using a T-C drill bit and examination of the recovered rock cuttings. It should be noted that rock strengths assessed from augered boreholes are approximate and strength variances can be expected;
  - The approximate surface levels shown on the borehole logs were interpolated from spot levels shown on the supplied survey plan. Approximate borehole locations are shown on **Figure 2**;
- Continuation of BH1M, BH2M, BH3M and BH4 using NMLC diamond coring techniques to termination depths of about 12.9m BEGL (RL of about 24.9m), 12.2m BEGL (RL of about 23.9m), 12.5m BEGL (RL of about 26.1m) and 12.0m BEGL (RL of about 24.5m), respectively. The rock core photographs are presented in **Appendix A**;
- Boreholes BH1M, BH2M and BH3M were converted into groundwater monitoring wells with depths of about 9.1m BEGL (RL of about 28.7m), 9.1m BEGL (RL of about 27.0) and 11.5m BEGL (RL of about 27.0m), respectively to allow for long-term groundwater monitoring;
  - A pump-out test was carried out within monitoring well BH1M one week after installation of the monitoring well to determine the groundwater inflows of the surrounding material;
- Borehole BH4 was backfilled with drilling spoils and capped with concrete upon completion;
- Soil and rock samples were sent to Macquarie Geotechnical Pty Ltd (Macquarie) and SGS Australia (SGS), which are National Australian Testing Authority (NATA) accredited laboratories, for testing and storage.
- 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 and the presence of existing site structures. The discussions and advice presented in this report are preliminary and intended to assist in the preparation of initial designs for the proposed development. Further geotechnical inspections should be carried out during construction to confirm the geotechnical and groundwater models, and the preliminary 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.** An aerial photograph of the site is presented in **Plate 1** below.

Table 2-1 Summary of Site Information

Information	Detail
Street Address	73-75 Norton Street, Ashfield
Lot and Deposited Plan (DP) Identification	Lot B in DP 336541; Lot 1 in DP 180145; Lot 12 in DP 592302; Lot 1 in DP 170305
Brief Site Description	At the time of our investigation the site was occupied by the Polish Club which comprises two separate, two-storey brick buildings (one at No. 73 Norton Street, and one at No. 75 Norton Street). The western portion of the site comprises a bitumen and concrete paved car park accessed from Norton Street and extending to the rear north of the building at No. 75 Norton Street where it can also be accessed from a lane-way leading from Liverpool Road. A concrete paved parking area is also present at the front south of the building at No. 73 Norton Street. The front south of No. 75 Norton Street comprises a grassy area with medium sized trees along the southern site boundary, and is retained by an approx. 0.5m high brick retaining wall. The building at No. 75 appears to be in poor condition with stepped cracks apparent in the brickwork and render, as well as in the retaining wall, and a dilapidated roof. The building at No. 73 appears to be in fair condition.
Site Area	The site area is approximately 3108 m^2 (based on the provided survey plan referenced above).

Plate 1: Aerial photograph of the site (source: Six Maps NSW Spatial Viewer, accessed 25/5/20)

2.2 Local Land Use

The site is situated within an area of mixed commercial & residential 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 adjacent to Norton Street shall be adopted as the southern site boundary.

Table 2-2 Summary of Local Land Use

Direction Relative to Site	Land Use Description
North	The rear of multiple one to two storey terrace buildings which front Liverpool Road are present along the western portion of the northern boundary and are setback at least 3m from the northern site boundary, and the rear of a two storey brick building at No. 182 Liverpool Road (Polish House) is present along the eastern portion of the northern site boundary and is setback at least 3m from the northern site boundary. A lane-way providing access to the rear of the Polish Club from Liverpool Road runs between the terrace buildings and No. 182 Liverpool Road.
East	No. 65 Norton Street and No. 180 Liverpool Road. No. 65 Norton Street is located at the southern portion of the eastern site boundary and comprises a three storey brick residential flat building overlying street level parking. The garage level extends to the eastern site boundary, and the flat building is setback about 3m from the eastern site boundary. No 180 Liverpool Road is located at the northern portion of the eastern site boundary and comprises a number of buildings associated with the Exodus Foundation. A three storey building abuts the eastern site boundary. It is unknown if any basement levels are present.
South	Norton Street, a two-lane asphalt paved road, followed by (from east to west) a two storey residential flat building overlying street-level parking, Joseph Street, a two-lane asphalt paved road which runs perpendicular to Norton Street., and a two-storey brick residential building.
West	No. 81 Norton Street which comprises a dilapidated single storey residential building setback within 1m from the southern portion of the western site boundary, as well as a two storey brick building which abuts the northern portion of 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	The site is located on the high north side of the road within gently south-west dipping topography with site levels varying from R.L. 38.6m at the north eastern site corner to R.L. 35.8m at the south-western site corner.
Regional Geology	Information on regional sub-surface conditions, referenced from the Department of Mineral Resources Geological Map Sydney 1:100,000 Geological Series Sheet 9130 (DMR 1983) indicates the site to be underlain by Ashfield Shale (Rwa), which consists of black to dark grey shale and laminite.

Plate 2: Excerpt of geological map showing location of site.

3. Assessment Results

3.1 Stratigraphy

For the development of a site-specific geotechnical model, the stratigraphy observed in the GI has been grouped into four geotechnical 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 methods of soil and rock classifications, 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]	RL of Top of Unit (m AHD)[1]	Observed Thickness (m)	Comments
1	**Pavement/ Fill**	Surface	36.1 to 38.5	0.5 to 1.1	Concrete pavements of 100mm to 120mm thickness, or asphalt pavement of 40mm thickness, underlain by gravelly sand or sand, underlain by low plasticity silty clay with gravels. Fill was assessed, based on our observations during drilling and SPT N Values, to be poorly compacted;
2	**Residual Soil**	0.5 to 1.1	35.5 to 37.6	5 to 5.6	Medium plasticity, stiff to hard silty clay with ironstone gravels, grading to extremely weathered shale. SPT values range from 10 to refusal indicated by hammer bounce;
3	**Very Low to Low Strength Shale**	6 to 6.2	30 to 32.3	2.2 to 3.4	Very low to low strength, distinctly to slightly weathered, laminated to thinly bedded shale with fine grained sandstone laminations, and with extremely weathered seams in places;
4	**Medium Strength Shale**	8.3 to 9.4	27.1 to 29.3	-[3]	Medium strength, distinctly weathered to fresh, very thinly to medium bedded shale with fine grained sandstone laminations.

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 their completion, groundwater monitoring wells were installed in BH1M, BH2M, and BH3M and bailed dry. The groundwater levels were then measured within the monitoring wells as per **Table 3-2** below.

Table 3-2 Groundwater Levels

Borehole ID	Measurement Date	Depth to Groundwater (m BEGL)	Groundwater RL (m AHD)
BH1M	11/5/20	2.8	35.0
BH2M	11/5/20	2.3	33.8
BH3M	11/5/20	3.2	35.3

3.2.1 Permeability Test

A permeability test using the Rising Head Test method was completed on 11 May 2020 in the monitoring well installed in BH1M. The following procedure was adopted:

- The groundwater level within the well was initially recorded;
- The well was purged using a PVC bailer; and
- The rising groundwater level within the well was measured at various time intervals for 1 hour.

The results were then used to estimate the permeability of the shale bedrock using the Hvorslev Method based on the borehole geometry. The estimated permeability of the shale bedrock is calculated to be 1.5×10^{-7} m/s.

3.3 Test Results

Three soil samples were selected for laboratory testing to assess the following:

- Atterberg Limits and Linear Shrinkage; and
- Soil 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_1.5-1.95	BH2M_1.5-1.95	BH4_3.0-3.45
Unit		2	2	2
Material Description [1]		Silty CLAY	Silty CLAY	Silty CLAY
Aggressivity	Chloride Cl (ppm)	-	5.3	2.2
	Sulfate SO_4 (ppm)	-	75	22
	pH	-	4.4	5.3
	Electrical Conductivity (µS/cm)	-	65	20
	Moisture Content (%)	16.4	21.3	12.6
Attergerg Limits	Liquid Limit (%)	44	-	-
	Plastic Limit (%)	23	-	-
	Plasticity Index (%)	21	-	-
	Linear Shrinkage (%)	10.0	-	-

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

The Atterberg Limits result on the selected clay sample indicated clays to be of medium plasticity and of moderate shrink-swell potential.

The assessment indicated low permeability soil was present above the 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:

- 'Moderate' to 'Mild' to 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 'B1' to 'A2' for concrete in sulfate soils.

21 selected rock core samples were tested by Macquarie to estimate the Point Load Strength Index (Is_{50}) values to assist with rock strength assessment. 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 <3 MPa to 25 MPa.

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:

- Basement excavation and retention to limit lateral deflections and ground loss as a result of excavations, resulting in damage to nearby structures;
- Rock excavation;
- Groundwater within the depth of the excavation;
- Existing footings of neighbouring properties; and
- Foundation design for building loads.

4.2 Dilapidation Surveys

Prior to excavation and construction, we recommend that detailed dilapidation surveys be carried out on all structures and infrastructures surrounding the site that fall 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 Existing Footings

Prior to any excavation, we recommend that at a number of test pits be excavated adjacent to the existing neighbouring footings and be inspected by the geotechnical and structural engineers to inspect and assess the in-situ ground conditions at the founding level and footing details. The purpose of these test pits is to assess the requirement of underpinning of these neighbouring footings adjoining the site.

4.4 Excavation Methodology

4.4.1 Excavation Assessment

Prior to any excavation commencing, we recommend that reference be made to the Safe Work Australia Excavation Work Code of Practice, dated August 2019.

EI assumes that the proposed development will require a BEL of RL 26.39m for the basement, or an excavation depth of between about 10.1m and 12.4m BEGL. Locally deeper excavations for footings, service trenches, crane pads and lifts overrun pits may be required.

Based on the borehole logs, the proposed basement excavations will therefore extend through all units as outlined in **Table 3-1** above. As such, an engineered retention system must be installed prior to excavation commencing.

Units 1 and 2 could be excavated using buckets of large earthmoving Hydraulic Excavators, particularly if fitted with ‘Tiger Teeth’. Excavation of Units 3 and 4 may present hard or heavy ripping, or “hard rock” excavation conditions. Ripping would require a high capacity and heavy bulldozer for effective production. Wear and tear should also be allowed for. The use of a

smaller size bulldozer will result in lower productivity and higher wear and tear, and this should be allowed for. Alternatively, hydraulic rock breakers, rock saws, ripping hooks or rotary grinders could be used, though productivity would be lower and equipment wear increased, and this should be allowed for.

Should rock hammers be required for the excavation of the medium strength bedrock, further advice should be sought from EI regarding vibration mitigation and monitoring.

Groundwater seepage monitoring should be carried out during bulk excavation works and prior to finalising the design of a pump out facility. Outlets into the stormwater system will require Council approval.

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.

4.4.2 Excavation Monitoring

Consideration should be made to the impact of the proposed development upon neighbouring structures, roadways and services. Basement excavation retention systems should be designed so as to limit lateral deflections.

Contractors should also consider the following limits associated with carrying out excavation and construction activities:

- Limit lateral deflection of temporary or permanent retaining structures;
- Limit vertical settlements of ground surface at common property boundaries and services easement; and
- Limit Peak Particle Velocities (PPV) from vibrations, caused by construction equipment or excavation, experienced by any nearby structures and services.

Monitoring of deflections of retaining structures and surface settlements should be carried out by a registered surveyor at agreed points along the excavation boundaries and along existing building foundations / services/ pavements and other structures located within or near the zone of influence of the excavation. Owners of existing services adjacent to the site should be consulted to assess appropriate deflection limits for their infrastructures. Measurements should be taken in the following sequence:

- Before commencing installation of retaining structures where appropriate to determine the baseline readings. Two independent sets of measurements must be taken confirming measurement consistency;
- After installation of the retaining structures, but before commencement of excavation;
- After excavation to the first row of supports or anchors, but prior to installation of these supports or anchors;
- After excavation to any subsequent rows of supports or anchors, but prior to installation of these supports or anchors;
- After excavation to the base of the excavation;
- After de-stressing and removal of any rows of supports or anchors; and

- One month after completion of the permanent retaining structure or after three consecutive measurements not less than a week apart showing no further movements, whichever is the latter.

4.5 Groundwater Considerations

Groundwater was observed in all monitoring wells as detailed in **Table 3-2**, all of which are above the assumed BEL of RL 26.39m.

Based on the results of the permeability analysis by EI, any groundwater inflows into the excavation should not have an adverse impact on the proposed development or on the neighbouring sites and should be manageable. However, we expect that some groundwater inflows into the excavation along the soil/rock interface and through any defects within the shale bedrock (such as jointing, and bedding planes, etc.) particularly following a period of heavy rainfall. The initial flows into the excavation may be locally high, but would be expected to decrease considerably with time as the bedding seams/joints are drained. We recommend that monitoring of seepage be implemented during the excavation works to confirm the capacity of the drainage system.

We expect that any seepage that does occur will be able to be controlled by a conventional sump and pump system. We recommend that a sump-and-pump system be used both during construction and for permanent groundwater control below the basement floor slab.

In the long term, drainage should be provided behind all basement retaining walls, around the perimeter of the basement and below the basement slab. The completed excavation should be inspected by the hydraulic engineer to confirm that adequate drainage has been allowed for. Drainage should be connected to the sump-and-pump system and discharging into the stormwater system. The permanent groundwater control system should take into account any possible soluble substances in the groundwater which may dictate whether or not groundwater can be pumped into the stormwater system.

The design of drainage and pump systems should take the above issues into account along with careful ongoing inspections and maintenance programs.

4.6 Excavation Retention

4.6.1 Support Systems

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

Based on the provided architectural plans, the proposed basement extends up to the eastern, western and southern boundaries, and is setback about 6m from the northern site boundary. Based on the above, the close proximity of the surrounding buildings, the encountered subsurface conditions, the shallow groundwater, and the required excavation depth, temporary batters are not recommended for this site. 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.

A suitable retention system will be required for the support of the entire depth of the excavation. For this site, we consider that an anchored and/or propped soldier pile wall with mass concrete in between the piles installed to below BEL to be the most suitable. Anchors/props and mass concrete must be installed progressively as excavation proceeds.

Bored piles are considered to be the most suitable for this site. Tremie pumps may be required where high groundwater seepage inflows are present during the drilling of the bored piles.

However, relatively large capacity piling rigs will be required for drilling through the shale bedrock. The proposed pile locations should take into account the presence of buried services. Further advice should be sought from prospective piling contractors who should be provided with a copy of this report.

4.6.2 Retaining Wall Design Parameters

The following parameters may be used for static design of temporary and permanent retaining walls at the subject site:

- For progressively anchored or propped walls where minor movements can be tolerated (provided there are no buried movement sensitive services), we recommend the use of a trapezoidal earth pressure distribution of 5H kPa for soil, where H is the retained height in meters. These pressures should be assumed to be uniform over the central 50% of the support system, tapering to nil at top and bottom;
- For progressively anchored or propped walls which support areas which are highly sensitive to movement (such as areas where movement sensitive structures or infrastructures or buried services are located in close proximity), we recommend the use of a trapezoidal earth pressure distribution of 8H kPa for soil, where 'H' is the retained height in meters. These pressures should be assumed to be uniform over the central 50% of the support system, tapering to nil at top and bottom;
- All surcharge loading affecting the walls (including from construction equipment, construction loads, adjacent high level footings, etc.) should be adopted in the retaining wall design as an additional surcharge using an 'at rest' earth pressure coefficient, Ko, of 0.58;
- The retaining walls should be designed as drained and measures are to be taken to provide complete and permanent drainage behind the walls. Strip drains protected with a non-woven geotextile fabric should be used behind the shotcrete infill panels for soldier pile walls;
- For piles embedded into Unit 4 or better, the allowable lateral toe resistance values outlined in **Table 4-1** below may be adopted. These values assume excavation is not carried out within the zone of influence of the wall toe and the rock does not contain adverse defects etc. The upper 0.3m depth of the socket should not be taken into account to allow for tolerance and disturbance effects during excavation.
- If temporary anchors extend beyond the site boundaries, then permission from the neighbouring properties would need to be obtained prior to installation. Also, the presence of neighbouring basements and/or services and their levels must be confirmed prior to finalising anchor design**.**
- Anchors should have their bond length within Unit 3 or better. For the design of anchors bonded into Unit 3 or better, the allowable bond stress value outlined in **Table 4-1** below may be used, subject to the following conditions:

    1. Anchor bond lengths of at least 3m behind the 'active' zone of the excavation (taken as a 45 degree zone above the base of the excavation) is provided;
    2. Overall stability, including anchor group interaction, is satisfied;
    3. All anchors should be proof loaded to at least 1.33 times the design working load before locked off at working load. Such proof loading is to be witnessed by and engineer independent of the anchoring contractor. We recommend that only experienced contractors be considered for anchor installation with appropriate insurances;

4. If permanent anchors are to be used, these must have appropriate corrosion provisions for longevity.

Table 4-1 Geotechnical Design Parameters

Material [1]		Unit 1 Fill	Unit 2 Residual Soil	Unit 3 Very Low to Low Strength Shale	Unit 4 Medium Strength Shale
RL of Top of Unit (m AHD) [2]		36.1 to 38.5	35.5 to 37.6	30 to 32.3	27.1 to 29.3
Bulk Unit Weight (kN/m^3)		18	20	23	24
Friction Angle, ϕ' (°)		25	25		
Earth Pressure Coefficients	At rest, K_o [3]	0.58	0.58	0.43	-
	Active, K_a [3]	0.41	0.41	0.27	-
	Passive, K_p [3]	-	-	3.69	-
Allowable Bearing Pressure (kPa) [5]		-	-	-	3500
Allowable Shaft Adhesion (kPa) [4, 5]	in Compression	-	-	70	350
	in Uplift	-	-	35	75
Allowable Toe Resistance (kPa)		-	-	-	350
Allowable Bond Stress (kPa)		-	-	50	700
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 in **Appendix A.**
2 Approximate levels 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).

4.7 Foundations

The most competent foundation stratum at the site is the Unit 4 shale and in view of the depth of excavation, we recommend that building is supported on shallow footings in Unit 4 shale.

4.7.1 Shallow Footings in Rock

Following bulk excavation to RL 26.39m, we expect Unit 4 material to be exposed at BEL.

It is recommended that all footings for the building be founded within the shale bedrock of similar strength of at least Unit 4 or better to provide uniform support and reduce the potential for differential settlements.

Pad or strip footings founded within Unit 4 may be preliminarily designed for an allowable bearing capacity of 3500kPa, based on serviceability.

Geotechnical inspections of foundations are recommended to determine that the required bearing capacity has been achieved and to determine any variations that may occur between the boreholes and inspected locations.

4.8 Basement Floor Slab

Following bulk excavations for the proposed basement, Unit 4 shale bedrock is expected to be exposed at the basement floor 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.

5. Further Geotechnical Inputs

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

- Classification of all excavated material transported off site;
- Witnessing installation of support measures and proof-testing of anchors (if required).
- Geotechnical inspections of all new footings/piles by an experienced geotechnical professional before concrete or steel are placed to verify their bearing capacity and the in-situ nature of the founding strata; and
- Ongoing monitoring of groundwater inflows into the bulk excavation.

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 Greg Colbran and Deicorp Projects (Ashfield) 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 Greg Colbran and Deicorp Projects (Ashfield) 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 August 2019 – WorkCover NSW

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

NSW Department of Mineral Resources (1983) Sydney 1:100,000 Geological Series Sheet 9130 (Edition 1). 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

eiaustralia Contamination | Remediation | Geotechnical	Drawn:	J.W.	**Deicorp Projects (Ashfield) Pty Ltd** Geotechnical Investigation 73-75 Norton Street, Ashfield NSW Site Locality Plan
	Approved:	S.K.	
	Date:	12-06-20	
	Scale:	Not To Scale	

Figure: 1

Project: E24659.G03_Rev2

Suite 6.01, 55 Miller Street, PYRMONT 2009
PH (02) 9516 0722 Fax (02) 9518 5088

LEGEND

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

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Ph (02) 9516 0722 Fax (02) 9518 5088

Drawn:	J.W.
Approved:	S.K.
Date:	12/06/20

Deicorp Projects (Ashfield) Pty Ltd
Geotechnical Investigation
73-75 Norton Street, Ashfield NSW
Borehole Location Plan

Figure: 2

Project: E24659.G03_Rev2

Appendix A – Borehole Logs And Explanatory Notes

BOREHOLE LOG

BH NO. BH1M

Project	Geotechnical Investigation	**Sheet**	1 of 3
Location	73-75 Norton Street, Ashfield NSW	**Date Started**	30/04/2020
Position	Refer to Figure 2	**Date Completed**	30/04/2020
Job No.	E24659.G03	**Logged By** BK	**Date** 30/04/2020
Client	Deicorp Projects (Ashfield) Pty Ltd	**Reviewed By** SR	**Date** 27/05/2020

Drilling Contactor	Geosense Drilling	**Surface RL**	≈37.77 m AHD
Drill Rig	Hanjin DB8	**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	-	11/05/20	0	0.10 0.20 37.57				-	CONCRETE; 100 mm thick.	-	-	PAVEMENT
								-	FILL: Gravelly SAND; medium grained, dark grey, with fine to medium, rounded to sub-rounded gravels.	M	-	FILL
					SPT 0.50-0.95 m 1,1,2 N=3			-	FILL: Silty CLAY; low plasticity, dark brown, with fine grained sand, fine to medium, rounded to sub-rounded gravels, black mineral.	M (<PL)	-	
			1	1.10 36.67				Cl	Silty CLAY; medium plasticity, pale grey mottled red-brown to orange, with fine to medium, angular to sub-angular ironstone gravels, grading to extremely weathered shale.		-	RESIDUAL SOIL
			2		SPT 1.50-1.95 m 1,9,13 N=22						VSt	
			3	3.00 34.77	SPT 3.00-3.1 m 20/100mm HB N>30				From 3.0 m, with fine to coarse, angular to sub-angular ironstone gravels.			
				3.50 34.27					From 3.5 m, becoming pale brown-pale grey, with extremely weathered material.	M (<PL)		
			4		SPT 4.50-4.95 m 16,20,25 N=45						H	
			5	5.50 32.27					From 5.5 m, extremely weathered shale recovered as silty clay, with very low strength shale bands and irostone bands, pale brown-dark grey.			
			6	6.10 31.67				-	SHALE; very low to low strength, dark grey, distinctly weathered.	-	-	BEDROCK
	L-M		7	7.35								
									Continued as Cored Borehole			
			8									
			9									
			10									

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

CORED BOREHOLE LOG

BH NO. BH1M

Project	Geotechnical Investigation	**Sheet**	2 OF 3
Location	73-75 Norton Street, Ashfield NSW	**Date Started**	30/04/2020
Position	Refer to Figure 2	**Date Completed**	30/04/2020
Job No.	E24659.G03	**Logged By** BK	**Date** 30/04/2020
Client	Deicorp Projects (Ashfield) Pty Ltd	**Reviewed By** SR	**Date** 27/05/2020

Drilling Contactor	Geosense Drilling	**Surface RL**	≈37.77 m AHD
Drill Rig	Hanjin DB8	**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)
				0							
				1							
				2							
				3							
				4							
				5							
				6							
				7							
					7.35		Continuation from non-cored borehole				
NMLC	100% RETURN	100	58	8	30.42		SHALE; dark grey, with fine grained, pale grey sandstone lamination, laminated to very thinly bedded.	DW		7.44-7.46: XWS, Clay 7.50-7.51: XWS, Clay 7.51: JT, 90°, SN, CU, SM, 20 mm 7.65-7.67: XWS, Clay 7.67: JT, 90°, SN, IR, SM, 30 mm 7.69-7.71: XWS, Clay 7.73-7.74: XWS, Clay 7.82: JT, 60°, SN, ST, SM, 10 mm 7.83-7.87: XWS, Clay 7.92-7.94: XWS, Clay 7.96-7.98: XWS, Clay 8.02-8.11: XWS, Clay 8.17-8.19: XWS, Clay 8.25-8.30: XWS, Clay 8.30-8.33: CS 8.42-8.44: CS 8.44: JT, 80°, CN, PR, SM, 20 mm	
					8.46						
				9	29.31		From 8.46 m, medium bedded.	FR			
					9.95						
				10							

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

CORED BOREHOLE LOG

BH NO. BH1M

Project	Geotechnical Investigation	**Sheet**	3 OF 3
Location	73-75 Norton Street, Ashfield NSW	**Date Started**	30/04/2020
Position	Refer to Figure 2	**Date Completed**	30/04/2020
Job No.	E24659.G03	**Logged By** BK	**Date** 30/04/2020
Client	Deicorp Projects (Ashfield) Pty Ltd	**Reviewed By** SR	**Date** 27/05/2020

Drilling Contactor	Geosense Drilling	**Surface RL**	≈37.77 m AHD
Drill Rig	Hanjin DB8	**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)
NMLC	100% RETURN	100	37	10	27.82		From 9.95 m, thinly bedded.	FR		10.45: JT, 80°, CN, IR, SM, 380 mm	
					10.83 26.94		From 10.83 m, very thinly bedded.	SW			
		100	37	11						11.35-11.36: XWS, Clay 11.45-11.46: XWS, Clay 11.53: JT, 90°, CN, PR, SM, 30 mm 11.60: JT, 45°, CN, IR, RF, 20 mm 11.71-11.73: CS 11.87: JT, 90°, CN, PR, RF, 20 mm, Healed 12.00: JT, 90°, CN, PR, SM, 70 mm, Healed 12.09: JT, 90°, CN, PR, SM, 220 mm	
					11.88 25.89		From 11.88 m, thinly bedded.	FR			
				12	*12.90* 24.87		Borehole Terminated at 12.90 m, Target Deph Reached.			12.49: JT, 90°, CN, PR, SM, 10 mm	
				13							
				14							
				15							
				16							
				17							
				18							
				19							
				20							

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

MONITORING WELL LOG

MW NO. BH1M

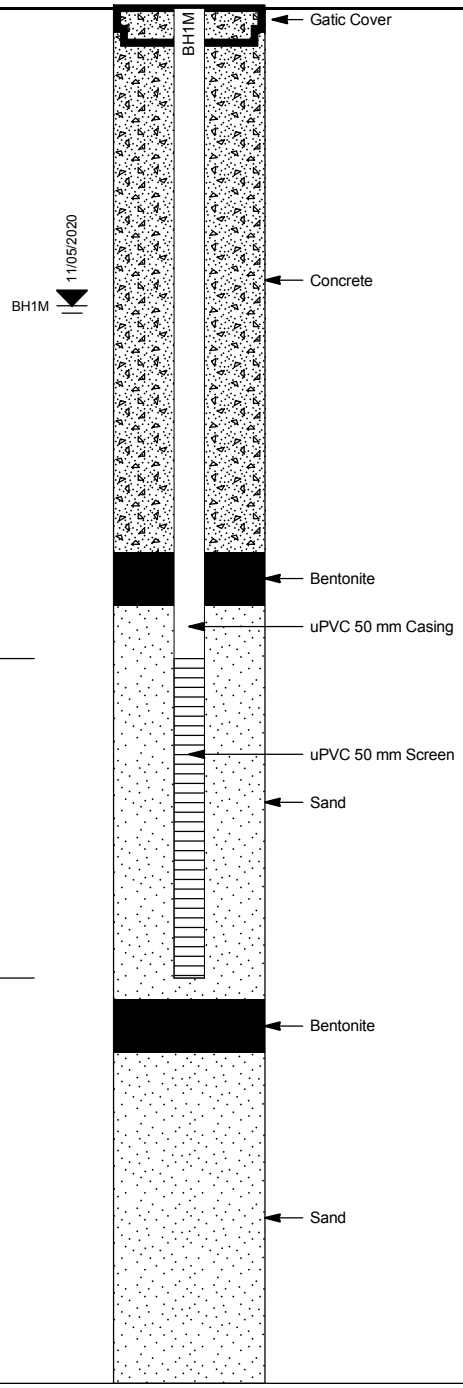
Project	Geotechnical Investigation	**Sheet**	1 of 2
Location	73-75 Norton Street, Ashfield NSW	**Date Started**	30/04/2020
Position	Refer to Figure 2	**Date Completed**	30/04/2020
Job No.	E24659.G03	**Logged By** BK	**Date** 30/04/2020
Client	Deicorp Projects (Ashfield) Pty Ltd	**Reviewed By** SR	**Date** 27/05/2020

Drilling Contactor	Geosense Drilling	**Surface RL**	≈37.77 m AHD
Drill Rig	Hanjin DB8	**Inclination**	-90°

METHOD	WATER	DEPTH (m)	RL (m AHD)	GRAPHIC LOG	SOIL/ROCK MATERIAL DESCRIPTION
AD/T	11/05/20	0			CONCRETE; 100 mm thick.
					FILL: Gravelly SAND; medium grained, dark grey, with fine to medium, rounded to sub-rounded gravels.
					FILL: Silty CLAY; low plasticity, dark brown, with fine grained sand, fine to medium, rounded to sub-rounded gravels, black mineral.
					Silty CLAY; medium plasticity, pale grey mottled red-brown to orange, with fine to medium, angular to sub-angular ironstone gravels, grading to extremely weathered shale.
		2	36		
					From 3.0 m, with fine to coarse, angular to sub-angular ironstone gravels.
		4	34		From 3.5 m, becoming pale brown-pale grey, with extremely weathered material.
					From 5.5 m, extremely weathered shale recovered as silty clay, with very low strength shale bands and irostone bands, pale brown-dark grey.
		6	32		SHALE; very low to low strength, dark grey, distinctly weathered.
NMLC	100% RETURN				SHALE; dark grey, with fine grained, pale grey sandstone lamination, laminated to very thinly bedded.
		8	30		From 8.46 m, medium bedded.
		10	28		From 9.95 m, thinly bedded.
					From 10.83 m, very thinly bedded.
		12	26		From 11.88 m, thinly bedded.
		14	24		Borehole Terminated at 12.90 m, Target Deph Reached.

PIEZOMETER CONSTRUCTION DETAILS

ID	Type	Stick Up & RL	Tip Depth & RL	Installation Date	Static Water Level
BH1M	Standpipe		9.10 m 28.67 m		



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

CORE PHOTOGRAPH OF BOREHOLE: BH1M

Project	Proposed Development			**Depth Range**	7.35m to 12.9m BEGL		
Location	73-75 Norton Street, Ashfield NSW			**Contractor**	Geosense Drilling Engineers Pty Ltd		
Position	See Figure 2	**Surface RL**	≈ 37.77m	**Drill Rig**	Hanjin D&B 8D		
Job No.	E24659.G03	**Inclination**	-90°	**Logged**	BK	**Date**	30 / 04 / 2020
Client	Deicorp Projects (Ashfield) Pty Ltd	**Box**	1-2 of 2	**Checked**	SR	**Date**	27 / 05 / 2020

BOREHOLE LOG

BH NO. BH2M

Project	Geotechnical Investigation	**Sheet**	1 of 3
Location	73-75 Norton Street, Ashfield NSW	**Date Started**	30/04/2020
Position	Refer to Figure 2	**Date Completed**	30/04/2020
Job No.	E24659.G03	**Logged By** BK	**Date** 30/04/2020
Client	Deicorp Projects (Ashfield) Pty Ltd	**Reviewed By** SR	**Date** 27/05/2020

Drilling Contactor	Geosense Drilling	**Surface RL**	≈36.06 m AHD
Drill Rig	Hanjin DB8	**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
			0	0.20 35.86				-	ASPHALT; 40 mm thick.	-	-	PAVEMENT
				0.50 35.56				-	FILL: Gravelly SAND; medium grained, dark grey-red, with fine to coarse, rounded to sub-rounded gravels.	M	-	FILL
								-		M (<PL)	-	
					SPT 0.50-0.95 m 2,4,6 N=10			Cl	FILL: Silty CLAY; low plasticity, dark brown, with fine grained sand, fine to medium, rounded to sub-rounded gravels.			RESIDUAL SOIL
			1	1.00 35.06					Silty CLAY; medium plasticity, brown mottled red, with fine to medium, angular to sub-angular ironstone gravels.		St	
									From 1.0 m, pale grey mottled red-brown to orange, grading to extremely weathered shale.			
		11/05/20	2		SPT 1.50-1.95 m 4,6,22 N=28						VSt	
				2.50 33.56					From 2.5 m, with fine to coarse, angular to sub-angular ironstone gravels			
AD/T	-		3		SPT 3.00-3.04 m 9/40mm HB N>30					M (<PL)		
				3.50 32.56					From 3.5 m, becoming pale brown-pale grey, with extremely weathered material.			
			4									
				4.60 31.46	SPT 4.50-4.90 m 18,21,26/100mm HB N>30				From 4.6 m, extremely weathered shale revovered as silty clay, with vey low strength shale bands and ironstone bands, pale brown-dark grey.		H	
			5									
			6	6.10 29.96								
	L-M			6.50	SPT 6.00-6.31 m 10,26,8/10mm HB N>30			-	SHALE; vey low to low strength, dark grey, distinctly weathered.	-	-	BEDROCK
									Continued as Cored Borehole			
			7									
			8									
			9									
			10									

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

CORED BOREHOLE LOG

BH NO. BH2M

Project	Geotechnical Investigation	**Sheet**	2 OF 3
Location	73-75 Norton Street, Ashfield NSW	**Date Started**	30/04/2020
Position	Refer to Figure 2	**Date Completed**	30/04/2020
Job No.	E24659.G03	**Logged By** BK	**Date** 30/04/2020
Client	Deicorp Projects (Ashfield) Pty Ltd	**Reviewed By** SR	**Date** 27/05/2020

Drilling Contactor	Geosense Drilling	**Surface RL**	≈36.06 m AHD
Drill Rig	Hanjin DB8	**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)
				0							
				1							
				2							
				3							
				4							
				5							
				6							
					6.50		Continuation from non-cored borehole				
NMLC	100% RETURN	100	11	7	29.56		SHALE; dark grey, with laminated fine grained, pale grey sandstone lamination, very thinly bedded.	DW		6.63-6.69: CS 6.69-6.71: XWS, Clay 6.94: JT, 90°, CN, IR, SM, 50 mm 7.04-7.05: XWS, Clay	
								SW		7.47: JT, 80°, SN, PR, SM, 40 mm 7.54: JT, 90°, SN, IR, SM, 50 mm, Healed 7.65: JT, 80°, SN, IR, SM, 110 mm	
				8				DW		7.93: JT, 80°, SN, PR, RF, 70 mm 8.00-8.02: XWS, Clay	
								SW		8.02: JT, 80°, SN, PR, SM, 200 mm 8.27-8.28: XWS, Clay 8.29-8.30: XWS, Clay 8.30: JT, 80°, SN, IR, SM, 130 mm 8.49: JT, 80°, SN, IR, SM, 140 mm 8.63: JT, 80°, SN, IR, SM, 30 mm 8.68: JT, 90°, SN, IR, SM, 240 mm	
				9	*9.13* 26.93		From 9.13 m, thinly bedded.			9.09: JT, 90°, SN, IR, SM, 10 mm	
		100	58					FR		9.44: JT, 50°, SN, IR, SM, 30 mm 9.57: JT, 80°, SN, IR, SM, 10 mm	
				10							

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

CORED BOREHOLE LOG

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Contamination | Remediation | Geotechnical

BH NO. BH2M

Project	Geotechnical Investigation	**Sheet**	3 OF 3
Location	73-75 Norton Street, Ashfield NSW	**Date Started**	30/04/2020
Position	Refer to Figure 2	**Date Completed**	30/04/2020
Job No.	E24659.G03	**Logged By** BK	**Date** 30/04/2020
Client	Deicorp Projects (Ashfield) Pty Ltd	**Reviewed By** SR	**Date** 27/05/2020

Drilling Contactor	Geosense Drilling	**Surface RL**	≈36.06 m AHD
Drill Rig	Hanjin DB8	**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)
NMLC	100% RETURN	100	58	10	*10.20* 25.86		From 10.2 m, very thinly bedded.	FR		10.03: JT, 60°, CN, PR, SM, 50 mm 10.19: JT, 90°, CN, PR, SM, 10 mm 10.37-10.39: XWS, Clay 10.58-10.60: XWS, Clay 10.60: JT, 70°, CN, IR, SM, 30 mm 10.67: JT, 90°, CN, IR, SM, 40 mm 10.72: JT, 50°, CN, IR, SM, 10 mm 10.84: JT, 90°, CN, PR, SM, 30 mm 10.91: JT, 90°, CN, IR, SM, 60 mm	
				11	*11.00* 25.06		From 11.0 m thinly bedded.			11.63: JT, 60°, CN, IR, SM, 10 mm	
				12	*12.19* 23.87		Borehole Terminated at 12.19 m, Target Deph Reached.				
				13							
				14							
				15							
				16							
				17							
				18							
				19							
				20							

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

MONITORING WELL LOG

MW NO. BH2M

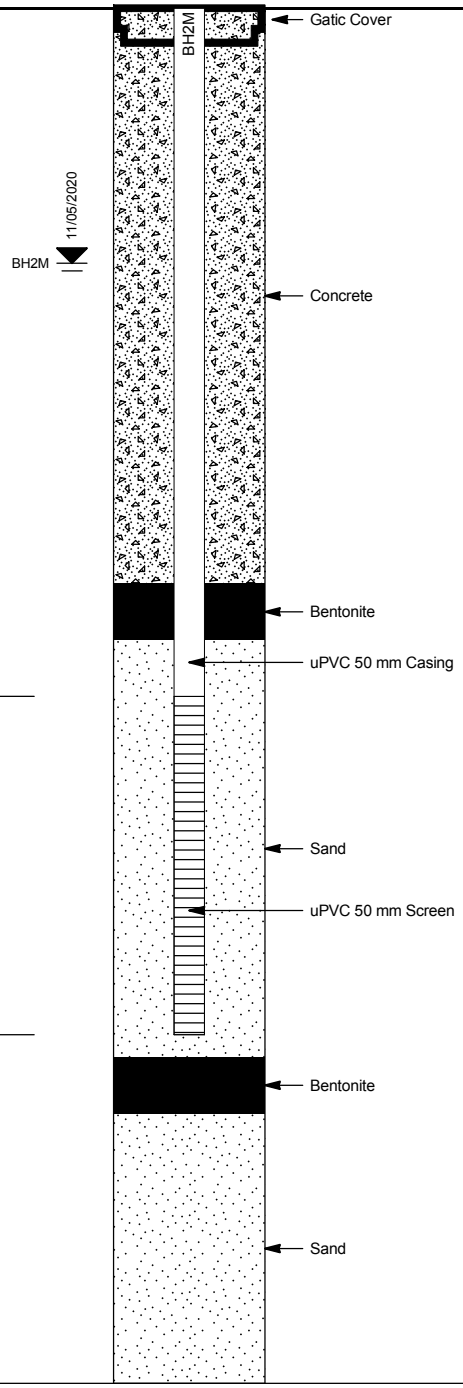
Project	Geotechnical Investigation	**Sheet**	1 of 2
Location	73-75 Norton Street, Ashfield NSW	**Date Started**	30/04/2020
Position	Refer to Figure 2	**Date Completed**	30/04/2020
Job No.	E24659.G03	**Logged By** BK	**Date** 30/04/2020
Client	Deicorp Projects (Ashfield) Pty Ltd	**Reviewed By** SR	**Date** 27/05/2020

Drilling Contactor	Geosense Drilling	**Surface RL**	≈36.06 m AHD
Drill Rig	Hanjin DB8	**Inclination**	-90°

METHOD	WATER	DEPTH (m)	RL (m AHD)	SOIL/ROCK MATERIAL DESCRIPTION
AD/T	11/05/20	0	36	ASPHALT; 40 mm thick.
				FILL: Gravelly SAND; medium grained, dark grey-red, with fine to coarse, rounded to sub-rounded gravels.
				FILL: Silty CLAY; low plasticity, dark brown, with fine grained sand, fine to medium, rounded to sub-rounded gravels.
				Silty CLAY; medium plasticity, brown mottled red, with fine to medium, angular to sub-angular ironstone gravels.
				From 1.0 m, pale grey mottled red-brown to orange, grading to extremely weathered shale.
		2	34	From 2.5 m, with fine to coarse, angular to sub-angular ironstone gravels
				From 3.5 m, becoming pale brown-pale grey, with extremely weathered material.
		4	32	From 4.6 m, extremely weathered shale revovered as silty clay, with vey low strength shale bands and ironstone bands, pale brown-dark grey.
		6	30	SHALE; vey low to low strength, dark grey, distinctly weathered.
NMLC	100% RETURN			SHALE; dark grey, with laminated fine grained, pale grey sandstone lamination, very thinly bedded.
		8	28	From 9.13 m, thinly bedded.
		10	26	From 10.2 m, very thinly bedded.
				From 11.0 m thinly bedded.
		12	24	Borehole Terminated at 12.19 m, Target Deph Reached.

PIEZOMETER CONSTRUCTION DETAILS

ID	Type	Stick Up & RL	Tip Depth & RL	Installation Date	Static Water Level
BH2M	Standpipe		9.10 m 26.96 m		



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

CORE PHOTOGRAPH OF BOREHOLE: BH2M

Project	Proposed Development			**Depth Range**	6.5m to 12.19m BEGL		
Location	73-75 Norton Street, Ashfield NSW			**Contractor**	Geosense Drilling Engineers Pty Ltd		
Position	See Figure 2	**Surface RL**	≈ 36.06m	**Drill Rig**	Hanjin D&B 8D		
Job No.	E24659.G03	**Inclination**	-90°	**Logged**	BK	**Date**	30 / 04 / 2020
Client	Deicorp Projects (Ashfield) Pty Ltd	**Box**	1-2 of 2	**Checked**	SR	**Date**	27 / 05 / 2020

BOREHOLE LOG

BH NO. BH3M

Project	Geotechnical Investigation	**Sheet**	1 of 3
Location	73-75 Norton Street, Ashfield NSW	**Date Started**	01/05/2020
Position	Refer to Figure 2	**Date Completed**	01/05/2020
Job No.	E24659.G03	**Logged By**	JW/BK **Date** 01/05/2020
Client	Deicorp Projects (Ashfield) Pty Ltd	**Reviewed By**	SR **Date** 27/05/2020

Drilling Contactor	Geosense Drilling	**Surface RL**	≈38.50 m AHD
Drill Rig	Hanjin DB8	**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
			0	0.12				-	CONCRETE; 120 mm thick.	-	-	PAVEMENT
				38.30				-	FILL: SAND; medium grained, brown, with fine, rounded to sub-rounded gravels.	W	-	FILL
					SPT 0.50-0.95 m 1,1,2 N=3			-	FILL: Silty CLAY; low plasticity, dark brown, with fine to medium, rounded to sub-rounded gravels, tiles.	M (<PL)	-	
			1	0.90 37.60				CI	Silty CLAY; medium plasticity, pale grey mottled red-brown to orange, with fine to medium, angular to sub-angular ironstone gravels, grading to extremely weathered shale.		-	RESIDUAL SOIL
					SPT 1.50-1.65 m 12/150mm HB N>30							
			2									
AD/T	-	11/05/20	3		SPT 3.00-3.1 m 16/100mm HB N>30					M (<PL)	H	
			4	4.50 34.00					From 4.5 m, extremely weathered shale recovered as silty clay, with very low strength shale bands, ironstone bands pale brown-dark grey.			
			5		SPT 4.50-4.95 m 16,26,23 N=49							
			6	6.20	SPT 6.00-6.2 m 20,15/50mm HB N>30				Continued as Cored Borehole			
			7									
			8									
			9									
			10									

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

CORED BOREHOLE LOG

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Contamination | Remediation | Geotechnical

BH NO. BH3M

Project	Geotechnical Investigation	**Sheet**	2 OF 3
Location	73-75 Norton Street, Ashfield NSW	**Date Started**	01/05/2020
Position	Refer to Figure 2	**Date Completed**	01/05/2020
Job No.	E24659.G03	**Logged By**	JW/BK **Date** 01/05/2020
Client	Deicorp Projects (Ashfield) Pty Ltd	**Reviewed By**	SR **Date** 27/05/2020

Drilling Contactor	Geosense Drilling	**Surface RL**	≈38.50 m AHD
Drill Rig	Hanjin DB8	**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)
				0							
				1							
				2							
				3							
				4							
				5							
				6	*6.20*		Continuation from non-cored borehole				
NMLC	100% RETURN	93	0	7	32.30		SHALE; dark grey-pale brown, with pale grey sandstone lamination, very thinly bedded.	DW		6.20-6.24: XWS, Clay 6.28: JT, 80°, CN, IR, SM, 90 mm 6.40-6.86: XWZ, Clay	
								XW			
								DW		6.88: JT, 80°, SN, IR, RF, 130 mm 7.01-7.23: XWZ, Clay	
								XW			
								DW		7.23: JT, 90°, SN, IR, SM, 160 mm 7.39-7.50: XWS, Clay	
					7.50						
				8	31.00		From 7.5 m, dark grey, very thinly to thinly bedded.	XW		7.83-8.26: XWS, Clay	
								DW		8.43-8.48: XWS, Clay 8.55-8.57: XWS, Clay 8.60-8.61: XWS, Clay 8.70-8.76: XWS, Clay 8.90-8.91: CS	
		104	35	9	*9.00*						
					29.50		From 9.0 m, thinly bedded.			9.12-9.15: XWS, Clay 9.28-9.35: XWS, Clay	
				10							

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

CORED BOREHOLE LOG

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BH NO. BH3M

Project	Geotechnical Investigation	**Sheet**	3 OF 3
Location	73-75 Norton Street, Ashfield NSW	**Date Started**	01/05/2020
Position	Refer to Figure 2	**Date Completed**	01/05/2020
Job No.	E24659.G03	**Logged By**	JW/BK **Date** 01/05/2020
Client	Deicorp Projects (Ashfield) Pty Ltd	**Reviewed By**	SR **Date** 27/05/2020

Drilling Contactor	Geosense Drilling	**Surface RL**	≈38.50 m AHD
Drill Rig	Hanjin DB8	**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)
NMLC	100% RETURN	104	35	10				DW			
								FR		10.40: JT, 40°, CN, IR, SM, 20 mm	
		100	81	11						11.12: JT, 90°, CN, PR, SM, 20 mm 11.21: JT, 50°, CN, IR, SM, 50 mm 11.26-11.28: CS 11.53-11.54: CS 11.76: JT, 50°, CN, PR, SM, 50 mm 11.90: JT, 80°, CN, IR, SM, 230 mm	
				12	*12.45* 26.05		Borehole Terminated at 12.45 m, Target Deph Reached.				
				13							
				14							
				15							
				16							
				17							
				18							
				19							
				20							

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

MONITORING WELL LOG

MW NO. BH3M

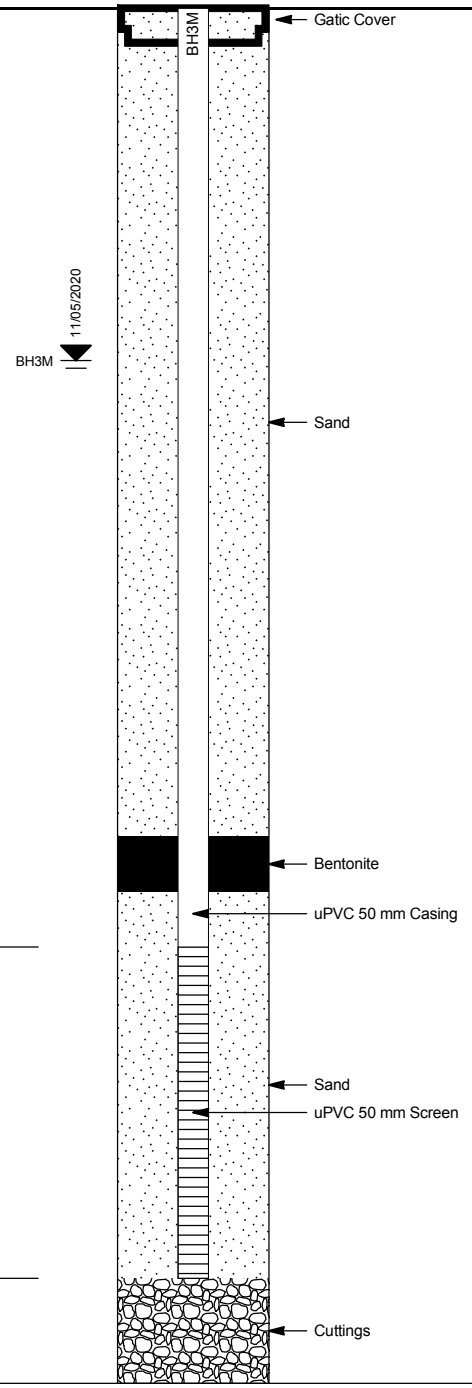
Project	Geotechnical Investigation	**Sheet**	1 of 2
Location	73-75 Norton Street, Ashfield NSW	**Date Started**	01/05/2020
Position	Refer to Figure 2	**Date Completed**	01/05/2020
Job No.	E24659.G03	**Logged By**	JW/BK **Date** 01/05/2020
Client	Deicorp Projects (Ashfield) Pty Ltd	**Reviewed By**	SR **Date** 27/05/2020

Drilling Contactor	Geosense Drilling	**Surface RL**	≈38.50 m AHD
Drill Rig	Hanjin DB8	**Inclination**	-90°

METHOD	WATER	DEPTH (m)	RL (m AHD)	GRAPHIC LOG	SOIL/ROCK MATERIAL DESCRIPTION
AD/T	11/05/20	0	38		CONCRETE; 120 mm thick.
					FILL: SAND; medium grained, brown, with fine, rounded to sub-rounded gravels.
					FILL: Silty CLAY; low plasticity, dark brown, with fine to medium, rounded to sub-rounded gravels, tiles.
		2	36		Silty CLAY; medium plasticity, pale grey mottled red-brown to orange, with fine to medium, angular to sub-angular ironstone gravels, grading to extremely weathered shale.
		4	34		From 4.5 m, extremely weathered shale recovered as silty clay, with very low strength shale bands, ironstone bands pale brown-dark grey.
NMLC	100% RETURN	6	32		SHALE; dark grey-pale brown, with pale grey sandstone lamination, very thinly bedded.
		8	30		From 7.5 m, dark grey, very thinly to thinly bedded.
		10	28		From 9.0 m, thinly bedded.
		12	26		Borehole Terminated at 12.45 m, Target Deph Reached.

PIEZOMETER CONSTRUCTION DETAILS

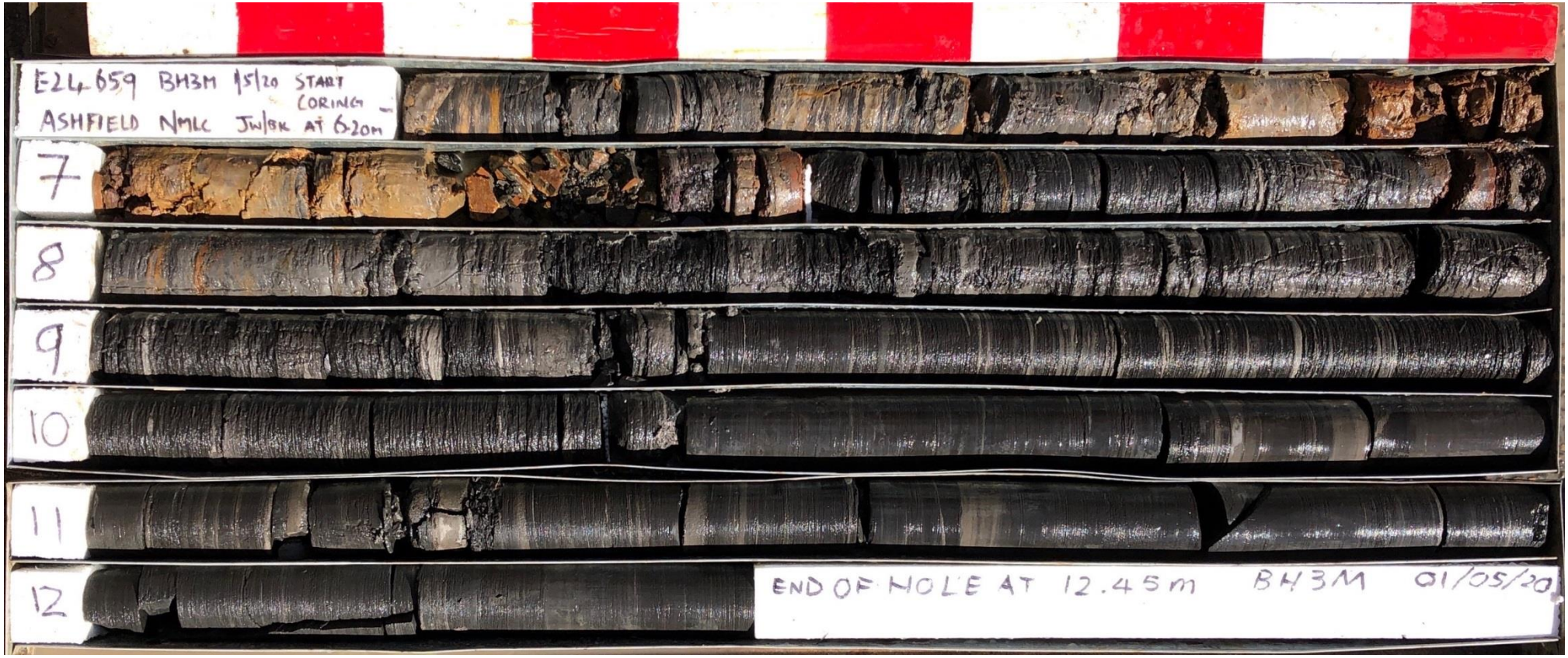
ID	Type	Stick Up & RL	Tip Depth & RL	Installation Date	Static Water Level
BH3M	Standpipe	0.09 m 38.41 m	11.50 m 27.00 m		



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

CORE PHOTOGRAPH OF BOREHOLE: BH3M

Project	Proposed Development			**Depth Range**	6.2m to 12.45m BEGL		
Location	73-75 Norton Street, Ashfield NSW			**Contractor**	Geosense Drilling Engineers Pty Ltd		
Position	See Figure 2	**Surface RL**	≈38.5m	**Drill Rig**	Hanjin D&B 8D		
Job No.	E24659.G03	**Inclination**	-90°	**Logged**	BK	**Date**	01 / 05 / 2020
Client	Deicorp Projects (Ashfield) Pty Ltd	**Box**	1-2 of 2	**Checked**	SR	**Date**	27 / 05 / 2020



BOREHOLE LOG

BH NO. BH4

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Project	Geotechnical Investigation	**Sheet**	1 of 3
Location	73-75 Norton Street, Ashfield NSW	**Date Started**	01/05/2020
Position	Refer to Figure 2	**Date Completed**	01/05/2020
Job No.	E24659.G03	**Logged By**	JW/BK **Date** 01/05/2020
Client	Deicorp Projects (Ashfield) Pty Ltd	**Reviewed By**	SR **Date** 27/05/2020

Drilling Contactor	Geosense Drilling	**Surface RL**	≈36.50 m AHD
Drill Rig	Hanjin DB8	**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	-	01/05/20	0	0.11				-	CONCRETE; 110 mm thick.	-	-	PAVEMENT
				0.30				-	FILL: Gravelly SAND; medium grained, dark grey, with fine to medium, rounded to sub-rounded gravels.	M	-	FILL
				36.20				-	FILL: Silty CLAY; low plasticity, dark brown mottled orange, with fine to medium, rounded to sub-rounded gravels.	M	-	
			1	1.00	SPT 0.50-0.95 m 1,1,3 N=4 BH4_0.9-1.0 DS			Cl	Silty CLAY; medium plasticity, pale grey mottled red-brown to orange, with fine to coarse, angular to sub-angular ironstone gravels.		-	RESIDUAL SOIL
				35.50	SPT 1.50-1.60 m 10/100mm HB N>30							
			2	2.00					From 2.0 m, becoming pale grey, grading to extremely weathered shale.		H	
				34.50								
			3		SPT 3.00-3.45 m 8,11,15 N=26					M (<PL)		
			4								VSt	
			5	5.00					From 5.0 m, becoming pale brown-pale grey.			
				31.50								
	L-M		6	6.00				-	SHALE; very low to low strength, dark grey, distinctly weathered.			BEDROCK
				30.50								
			7	7.00					From 7.0 m, with some clay seams.			
				29.50						-	-	
	H	01/05/20		7.60					From 7.6 m, low strength.			
			8	28.90								
			9	9.00					Continued as Cored Borehole			
			10									

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

CORED BOREHOLE LOG

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BH NO. BH4

Project	Geotechnical Investigation	**Sheet**	2 OF 3
Location	73-75 Norton Street, Ashfield NSW	**Date Started**	01/05/2020
Position	Refer to Figure 2	**Date Completed**	01/05/2020
Job No.	E24659.G03	**Logged By**	JW/BK **Date** 01/05/2020
Client	Deicorp Projects (Ashfield) Pty Ltd	**Reviewed By**	SR **Date** 27/05/2020

Drilling Contactor	Geosense Drilling	**Surface RL**	≈36.50 m AHD
Drill Rig	Hanjin DB8	**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)
				0							
				1							
				2							
				3							
				4							
				5							
				6							
				7							
				8							
				9	*9.00*		Continuation from non-cored borehole				
NMLC	100% RETURN	100	0		27.50		SHALE; dark grey laminated bedding.	-		9.07-9.40: CS	
					9.40 27.10		From 9.4 m, very thinly bedded.	DW		9.21-9.28: CS 9.28: JT, 40°, Clay SN, IR, SM, 120 mm 9.40: JT, 90°, SN, IR, SM, 110 mm 9.64: JT, 50°, CN, PR, SM, 20 mm 9.74: JT, 70°, SN, IR, SM, 30 mm 9.91: JT, 50°, SN, IR, SM, 90 mm	
				10	*10.00*						

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

CORED BOREHOLE LOG

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BH NO. BH4

Project	Geotechnical Investigation	**Sheet**	3 OF 3
Location	73-75 Norton Street, Ashfield NSW	**Date Started**	01/05/2020
Position	Refer to Figure 2	**Date Completed**	01/05/2020
Job No.	E24659.G03	**Logged By**	JW/BK **Date** 01/05/2020
Client	Deicorp Projects (Ashfield) Pty Ltd	**Reviewed By**	SR **Date** 27/05/2020

Drilling Contactor	Geosense Drilling	**Surface RL**	≈36.50 m AHD
Drill Rig	Hanjin DB8	**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)
NMLC	100% RETURN	100	0	10	26.50		From 10.0 m, laminated bedding.	DW		10.00-10.05: XWS, Clay	
					10.30		From 10.3 m, very thinly bedded.			10.05-10.20: CS	
					26.20					10.30: JT, 90°, CN, IR, SM, 200 mm	
										10.50: JT, 90°, CN, IR, SM, 210 mm	
				11						10.77: JT, 80°, CN, IR, SM, 80 mm	
										10.89: JT, 80°, CN, IR, SM, 110 mm	
										11.06: JT, 90°, CN, IR, SM, 300 mm	
										11.53: JT, 90°, CN, IR, SM, 220 mm	
					11.97						
				12	24.53		Borehole Terminated at 11.97 m, Target Deph Reached.				
				13							
				14							
				15							
				16							
				17							
				18							
				19							
				20							

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

CORE PHOTOGRAPH OF BOREHOLE: BH4

Project	Proposed Development			**Depth Range**	9.0m to 11.97m BEGL		
Location	73-75 Norton Street, Ashfield NSW			**Contractor**	Geosense Drilling Engineers Pty Ltd		
Position	See Figure 2	**Surface RL**	≈36.5m	**Drill Rig**	Hanjin D&B 8D		
Job No.	E24659.G03	**Inclination**	-90°	**Logged**	BK	**Date**	01 / 05 / 2020
Client	Deicorp Projects (Ashfield) Pty Ltd	**Box**	1 of 1	**Checked**	SR	**Date**	27 / 05 / 2020

Appendix B - Laboratory Certificates

MOISTURE CONTENT TEST REPORT

Client:	EI Australia	**Job No:**	S20208-1
Address:	Suite 6.01, 55 Miller Street, Pyrmont, NSW 2009	**Report No:**	S59868-MC
Project:	73-75 Norton St Ashfield (E24659 G03)		

Test Procedure:

- ☑ AS 1289 2.1.1 Soil moisture content tests - Determination of the moisture content of a soil - Oven drying method (Standard method).
- ☐ AS4133 1.1.1 Rock moisture content tests - Determination of the moisture content of rock - Oven drying method (standard method)
- ☐ RMS T120 Moisture content of road construction materials (Standard method)
- ☐ RMS T262 Determination of moisture content of aggregates (Standard method)

Sampling:	Sampled by Client - results apply to the sample as received	**Date Sampled:**	30/04/20-01/05/20
Preparation:	Prepared in accordance with the test method		

Sample No.	Source	Sample Description	Moisture Content %
S59868	BH1M 1.5-1.95m	Silty CLAY	**16.4**

Notes:

NATA

Accredited for compliance with ISO/IEC 17025 - Testing.

The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards. This document shall not be reproduced, except in full.

NATA Accredited Laboratory Number: 14874

Authorised Signatory:

Chris Lloyd

7/05/2020

Date:

MACQUARIE GEOTECH

Macquarie Geotechnical
U7/8 10 Bradford Street
Alexandria NSW 2015

SOIL CLASSIFICATION REPORT

Client	EI Australia	**Source**	BH1M 1.5-1.95m
Address	Suite 6.01, 55 Miller Street, Pyrmont, NSW 2009	**Sample Description**	Silty CLAY
Project	73-75 Norton St Ashfield (E24659 G03)	**Report No**	S59868-PI
Job No	S20208-1	**Lab No**	S59868

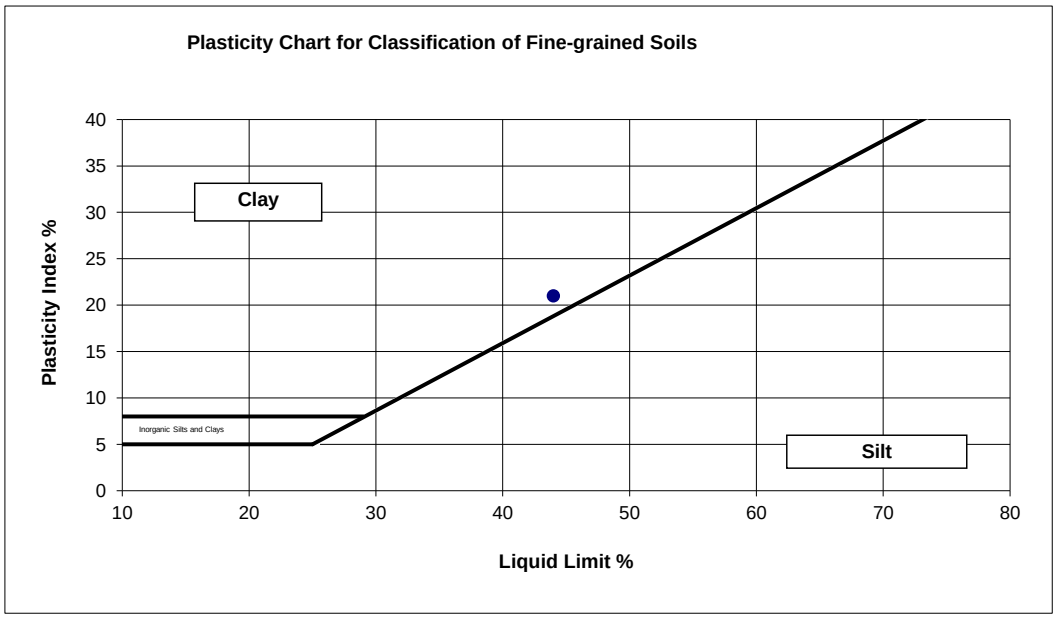
Test Procedure:

- ☐ AS1289 2.1.1 Soil moisture content tests (Oven drying method)
- ☑ AS1289 3.1.1 Soil classification tests - Determination of the liquid limit of a soil - Four point casagrande method
- ☐ AS1289 3.1.2 Soil classification tests - Determination of the liquid limit if a soil - One point Casagrande method (subsidiary method)
- ☑ AS1289 3.2.1 Soil classification tests - Determination of the plastic limit of a soil - Standard method
- ☑ AS1289 3.3.1 Soil classification tests - Calculation of the plasticity Index of a soil
- ☑ AS1289 3.4.1 Soil classification tests - Determination of the linear shrinkage of a soil - Standard method

Sampling: Sampled by Client - results apply to the sample as received **Date Sampled:** 30/04/20-01/05/20

Preparation: Prepared in accordance with the test method

Liquid Limit (%)	44	**Linear Shrinkage (%)**	10.0
Plastic Limit (%)	23	**Plasticity Index**	21



Soil Preparation Method: Dry Sieved
Soil History: Oven Dried
Soil Condition: Linear

Notes

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NATA Accredited Laboratory Number: 14874

Authorised Signatory:

Chris Lloyd

11/05/2020

Date:

MACQUARIE GEOTECH
Macquarie Geotechnical
U7/8 10 Bradford Street
Alexandria NSW 2015

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:	73-75 Norton St Ashfield (E24659 G03)	**Report No:**	S59869-PL
Job No:	S20208-1	**Date Tested:**	7/05/2020

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

Sampling: Sampled by Client - results apply to the sample as received **Date Sampled:** 30/04/20-01/05/20

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
S59869	BH1M 7.51 - 7.56m	Shale							
			Axial	52.2	41.0	0.47	0.17	0.18	1
S59870	BH1M 8.46 - 8.56m	Shale							
			Axial	52.0	36.0	0.78	0.33	0.32	1
S59871	BH1M 9.43 - 9.53m	Shale							
			Axial	52.3	47.0	1.49	0.48	0.50	1
S59872	BH1M 10.24 - 10.34m	Shale							
			Axial	51.9	32.0	1.14	0.54	0.52	1
S59873	BH1M 11.73 - 11.82m	Shale							
			Axial	52.0	37.0	0.81	0.33	0.33	1
S59874	BH1M 12.82 - 12.90m	Shale							
			Axial	52.3	45.0	1.58	0.53	0.55	1
S59875	BH2M 6.80 - 6.85m	Shale							
			Axial	52.2	32.0	0.61	0.29	0.28	1
S59876	BH2M 7.82 - 7.88m	Shale							
			Axial	5.1	30.0	0.44	2.26	1.27	1
S59877	BH2M 8.18 - 8.23m	Shale							
			Axial	52.2	30.0	0.45	0.23	0.21	1
S59878	BH2M 9.32 - 9.42m	Shale							
			Axial	52.2	40.0	1.77	0.67	0.68	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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NATA Accredited Laboratory Number: 14874

Authorised Signatory:

Chris Lloyd

8/05/2020

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:	73-75 Norton St Ashfield (E24659 G03)	**Report No:**	S59879-PL
Job No:	S20208-1	**Date Tested:**	7/05/2020

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

Sampling: Sampled by Client - results apply to the sample as received **Date Sampled:** 30/04/20-01/05/20

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
S59879	BH2M 10.43 - 10.48m	Shale							
			Axial	51.8	43.0	1.12	0.40	0.41	1
S59880	BH2M 12.04 - 12.14m	Shale							
			Axial	51.9	33.0	1.47	0.67	0.65	1
S59881	BH3M 7.69 - 7.73m	Shale							
			Axial	51.0	32.0	0.55	0.26	0.25	3
S59882	BH3M 8.76 - 8.82m	Shale							
			Axial	51.4	33.0	0.31	0.14	0.14	1
S59883	BH3M 9.44 - 9.52m	Shale							
			Axial	52.1	34.0	2.09	0.93	0.91	1
S59884	BH3M 10.10 - 10.14m	Shale							
			Axial	51.8	37.0	1.43	0.59	0.58	1
S59885	BH3M 10.40 - 10.46m	Shale							
			Axial	51.7	31.0	1.32	0.65	0.62	1
S59886	BH3M 12.32 - 12.38m	Shale							
			Axial	52.1	32.0	2.00	0.94	0.91	1
S59887	BH4 9.52 - 9.59m	Shale							
			Axial	52.1	32.0	0.85	0.40	0.39	1
S59888	BH4 11.38 - 11.46m	Shale							
			Axial	51.8	42.0	2.54	0.92	0.94	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

8/05/2020

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:	73-75 Norton St Ashfield (E24659 G03)	**Report No:**	S59889-PL
Job No:	S20208-1	**Date Tested:**	7/05/2020

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

Sampling: Sampled by Client - results apply to the sample as received **Date Sampled:** 30/04/20-01/05/20

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
S59889	BH4 11.84 - 11.92m	Shale							
			Axial	51.4	37.0	1.10	0.45	0.45	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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Authorised Signatory:

Chris Lloyd

8/05/2020

Date

MACQUARIE GEOTECH

Macquarie Geotechn
U7/8 10 Bradford Street
Alexandria NSW

ANALYTICAL REPORT

Accreditation No. 2562

CLIENT DETAILS

Contact	Barath Kumar
Client	EI AUSTRALIA
Address	SUITE 6.01 55 MILLER STREET PYRMONT NSW 2009
Telephone	61 2 95160722
Facsimile	(Not specified)
Email	barath.kumar@eiaustralia.com.au
Project	**E24659.G03 73-75 Norton Street,Ashfield**
Order Number	**E24659.G03**
Samples	2

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	**SE205917 R0**
Date Received	6/5/2020
Date Reported	13/5/2020

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: 11/5/2020

PARAMETER	UOM	LOR	BH2M_1.5-1.95 SOIL - 30/4/2020 SE205917.001	BH4_3.0-3.45 SOIL - 1/5/2020 SE205917.002
Chloride	mg/kg	0.25	**5.3**	**2.2**
Sulfate	mg/kg	5	**75**	**22**

pH in soil (1:5) [AN101] Tested: 11/5/2020

PARAMETER	UOM	LOR	BH2M_1.5-1.95 SOIL - 30/4/2020 SE205917.001	BH4_3.0-3.45 SOIL - 1/5/2020 SE205917.002
pH	pH Units	0.1	**4.4**	**5.3**

Conductivity and TDS by Calculation - Soil [AN106] Tested: 11/5/2020

PARAMETER	UOM	LOR	BH2M_1.5-1.95 SOIL - 30/4/2020 SE205917.001	BH4_3.0-3.45 SOIL - 1/5/2020 SE205917.002
Conductivity of Extract (1:5 dry sample basis)	µS/cm	1	**65**	**20**

Moisture Content [AN002] Tested: 11/5/2020

PARAMETER	UOM	LOR	BH2M_1.5-1.95 SOIL - 30/4/2020 SE205917.001	BH4_3.0-3.45 SOIL - 1/5/2020 SE205917.002
% Moisture	%w/w	1	**21.3**	**12.6**

METHOD SUMMARY

SE205917 R0

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 of as received sample 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.
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/en-gb/environment-health-and-safety.

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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.