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DUFFY KENNEDY
CONSTRUCTIONS PTY LTD

Geotechnical Investigation

1 Veno Street, Heathcote

E26160.G03
26 June 2024

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Revision	Details	Date	Amended By
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1. Introduction

1.1 Background

At the request of Mr. Anthony Vitale on behalf of Duffy Kennedy Constructions Pty Ltd(the Client), EI Australia (EI) has carried out a Geotechnical Investigation (GI) for the proposed development at 1 Veno Street, Heathcote(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 P21721.1_Rev1, dated 14th September 2023, and with the Client's signed authorisation to proceed, dated 15th September 2023.

1.2 Proposed Development

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

- Draft Architectural Drawings prepared by Dickson Rothchild Architects, Project No. 23-049, Drawing No. DA-0-001, DA-0-210 to DA-0-217, DA-0-401, revision D, dated 27 September 2023; issued for review, and
- Site survey plan prepared by Boxall – Drawing No. 11260-001-A, Revision A, dated 8 September 2021. The datum in the survey plan is in Australian Height Datum (AHD), hence all Reduced Levels (RL) mentioned in this report are henceforth in AHD.

Based on the provided documents, EI understands that the proposed development involves the demolition of the existing site structures and the construction of a mixed-use development (residential, retail and hotel) comprising three buildings of five to six-storey high above ground each, across two adjacent allotments (Lots 1 and 2). The two buildings on Lot 2 (denoted in the architectural drawings as building S2 and S2-H) overlie a common two-level basement and shares a common ground floor level. The building on Lot 1 (denoted in the architectural drawings as building S1) overlie an individual two-level basement. EI notes that the site is located on sloping land, and as such, the lowest basement levels may only be a partial basement depending on the location in the site.

The lowest basement level of Building S1 is proposed to have a Finished Floor Level (FFL) of RL182.65m AHD. The ground floor level with FFL of RL185.8m AHD transitions to below ground in the southern portion of the building S1 footprint.

The lowest common basement level of Buildings S2 / S2-H is proposed to have a FFL of RL185.25m AHD. Vehicular access into the basement is off Veno Street.

A Bulk Excavation Level (BEL) of RL182.35m AHD for building S1 and RL184.95m AHD for Building S2 / S2-H is assumed, which includes allowance for the construction of the basement slab. To achieve the BEL, excavation depths of between 3.5m to 7m Below Existing Ground Level (BEGL) within the basement footprint of Building S1, and between 5.3m to 7.6m BEGL within the basement footprint of Building S2 / S2-H have been estimated. Locally deeper excavations may be required for footings, lift overrun pits, crane pads, and service trenches.

Building S1 basement is proposed to be set back 6m from the western and eastern site boundaries and set back 7.5m from the Strickland Street frontage.

Building S2 / S2-H basement is set back about 6m from the western site boundary, and set back about 4m from the Veno Street and Princes Highway frontages. The closest distance between Building S1 basement and Building S2 basement is about 12m.

1.3 Objectives

The objective of the GI was to assess site surface and subsurface conditions at ten (10) borehole locations, and to provide geotechnical advice and recommendations to assist in the design of the proposed development.

1.4 Fieldwork Methodology

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 ten boreholes (BH1, BH2M, BH3, BH4, BH5, BH6, BH7M, BH8, BH9M, and BH10M) by a track-mounted drill rig using solid flight augers equipped with a 'Tungsten-Carbide' (T-C) bit. The boreholes were auger drilled to depths as shown in **Table 1-1** below;
- 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;
- Continuation of all boreholes using NMLC diamond coring techniques to termination depths shown below in **Table 1-1**. The rock core photographs are presented in **Appendix A**;

Table 1-1 Augering and Rock Coring Depths

Borehole ID	Surface RL (m AHD)	Well Depth (m BEGL)	Augering		Rock Coring	
			Termination Depth (m)	Termination RL (m AHD)	Termination Depth (m)	Termination RL (m AHD)
BH1	185.5	-	1.20	184.31	9.15	176.36
BH2M	185.8	9.2	1.30	184.51	9.20	176.61
BH3	188.0	-	3.20	184.80	9.10	178.90
BH4	189.7	-	2.40	187.30	9.19	180.51
BH5	190.4	-	2.54	187.90	9.03	181.41
BH6	190.0	-	3.70	186.33	10.00	180.03
BH7M	190.9	8.9	4.10	186.75	9.00	181.85
BH8	190.9	-	3.79	187.15	9.57	181.37
BH9M	191.9	6.1	6.09	185.82	9.97	181.94
BH10M	191.4	9.0	5.45	185.92	9.00	182.37

- Measurements of groundwater seepage/levels, where possible, in the augered sections of the boreholes during and shortly after completion of auger drilling;

- 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**;
- Borehole BH2M, BH7M, BH9M and BH10M were converted into groundwater monitoring wells with screen depths starting from 1.20m to 9.20m BEGL (RL184.61m to 176.61m AHD) in BH2M, from 5.90m to 8.90m BEGL (RL184.95m to 181.95m AHD) in BH7M, from 3.10m to 6.10m BEGL (RL188.81m to 185.81m AHD) in BH9M, and from 6.00m to 9.00m (RL185.37m to 182.37m AHD) in BH10M to allow for long-term groundwater monitoring. The surfacing was reinstated with a metal gatic cover to make flush with the surround ground surface and facilitates for future access to the groundwater monitoring wells;
- Boreholes BH1, BH3, BH4, BH5, BH6, and BH8 were backfilled with drilling spoils and capped with concrete upon completion;
- Rock cores were carefully boxed on site and photographed before transporting off site;
- Soil and rock core samples were sent to STS Geotechnics Pty Ltd (STS) and SGS Australia (SGS), which are National Australian Testing Authority (NATA) accredited laboratories, for testing and storage;
- Preparation of this GI report.

EI's 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, and provided guidance on the installation of the groundwater monitoring wells.

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 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 and groundwater 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.** An aerial photograph of the site is presented in **Plate 1** below.

Table 2-1 Summary of Site Information

Information	Detail
Street Address	1 Veno Street, Heathcote
Lot and Deposited Plan (DP) Identification	Lot 1, 2, and 3 in DP455292, Lots 9, 10, 23 and 24 Sec A in DP2499
Brief Site Description	At the time of our investigation, the site was occupied by a series of one-storey commercial buildings with a motel 'Heathcote Inn' located within the western portion of the site. The remainder of the site is open space at grade bitumen surfaced carpark.
Site Area	The total site area is approximately 7245m^2 (based on the provided survey plan referenced above).

Plate 1: Aerial photograph of the site (source: SixMaps, accessed 25/9/2023)

2.2 Local Land Use

The site is situated within an area of commercial and residential use. Current uses on surrounding land at the time of our presence on site are described in **Table 2-2** below. For the purposes of this report, the site boundary adjacent to Strickland 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	Strickland Street, a two lane, asphalt-paved unmark road with kerb side parking along the road. Nos. 1317-1321 Princes Highway, a three-storey brick residential apartment with at least one basement level. The building is offset about 2m from the site boundary. Nos.2-4 Strickland Street, a townhouse complex of single-storey brick dwellings. The main building is offset about 4m from the site boundary.
East	Princes Highway, a six lane, asphalt-paved road. Princes Highway is a TfNSW asset. Further east of Princes Highway comprises the railway corridor.
South	Veno Street, a two lane, asphalt-paved road with a dedicated parking lane to the south of the roadway and kerb side parking on the north side of the roadway. Beyond this is a local park (Veno Street Reserve) with scattered mature trees.
West	Property at No.5 Veno Street is a two-storey brick and brick rendered mixed use building with at least one basement level. Property at Nos.10-12 Strickland Street comprise two-storey residential villas with a central driveway leading to at-grade car spaces and garages.

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 low north side of Veno Street within gently (0° to 4°) north dipping topography with site levels varying from about RL192.9m AHD along the Veno Street frontage to about RL184.68m AHD at the northwest site corner.
Regional Geology	Information on regional sub-surface conditions, referenced from the Department of Mineral Resources Geological Map Wollongong-Port Hacking 1:100,000 Geological Series Sheet 9029-9129 (DMR 1985) indicates the site to be underlain by the (Rhs) subgroup of Hawkesbury Sandstone, which typically comprises of claystone, siltstone, and laminite (“Shale lenses”). EI notes that the site lies on the boundary between Rhs and Hawkesbury Sandstone (Rh) group, Hawkesbury Sandstone (Rh) is described typically as comprising medium to coarse-grained quartz sandstone with very minor shale and laminite lenses.

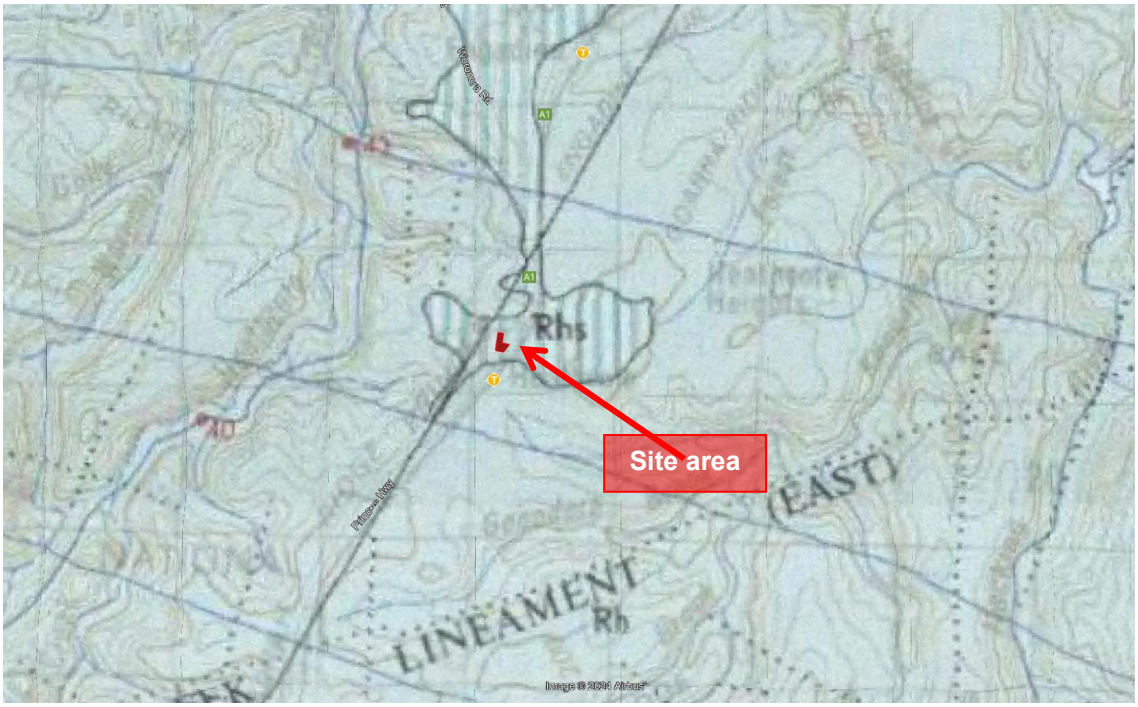

Plate 2: Excerpt of geological map showing location of site.

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 five 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	**Topsoil/Fill**	0.00	185.51 to 191.91	0.2 to 0.95	Asphalt pavements of 200mm thickness, underlain by Sandy Clay, Silty Clay, Clayey Sand fill with traces of fine to medium, sub-angular to angular gravels. Fill was assessed, based on our observations during drilling and SPT N Values to be variably compacted.
2	**Residual Soil**	0.2 to 0.6	187.5 to 191.51	0.9 to 4.1	Medium plasticity, firm to very stiff silty/sandy silty clay with trace indurated gravels bands, grading into weathered sandstone with depth. SPT values ranged from 8 to 27. Significant weathering of the underlying bedrock resulted in residual soils of hard consistency transitioning into extremely weathered rock towards the lower portion of the residual profile.
3	**Class V Sandstone**	0.52 to 4.5	184.56 to 188.94	0.59 to 1.7	Extremely to distinctly weathered, very low to low strength sandstone. SPT hammer bounce was encountered in this material. Defects include extremely weathered seams and clay zones.
4	**Class IV Sandstone**	1.3 to 3.79	184.31 to 187.90	0.80 to 2.11	Distinctly weathered, low to medium strength sandstone. Defects within this material consist of thinly spaced sub-horizontal bedding parting and sub-horizontal joints. Core loss was encountered in some boreholes.
5	**Class III Sandstone**	1.2 to 6.09	183.11 to 186.75	-[3]	Slight weathered to fresh, medium to high strength sandstone. Defects within this material are medium to widely spaced, and consist of moderately spaced sub-horizontal

Unit	Material[2]	Depth to Top of Unit (m BEGL)[1]	RL of Top of Unit (m AHD)[1]	Observed Thickness (m)	Comments
					bedding partings, sub-vertical joints, and fractured/decomposed zones. Core loss was encountered in BH1 between depths of 4.86m and 5.08m.

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.

The depths to the various rock units within the Building S1 footprint are presented in **Table 3-2**.

Table 3-2 Depth to Various Rock Units – Building S1 Footprint

Unit	Depth to Bedrock (m BEGL) *RL of top of Bedrock (m AHD)*			
	BH1	BH2M	BH3	BH4
Class V Sandstone	0.95 184.56	0.52 185.29	1.50 186.50	1.50 188.20
Class IV Sandstone	NE	1.30 184.51	3.20 184.80	3.05 186.65
Class III Sandstone	1.20 184.31	2.70 183.11	4.00 184.00	5.00 184.70

Note 1 NE – Not Encountered
Note 2 mBEGL – metres below existing ground level
Note 3 mAHD – meters Australian Height Datum

The depths to the various rock units within the Building S2 / S2-H footprint are presented in **Table 3-3**.

Table 3-3 Depth to Various Rock Units – Building S2 / S2-H Footprint

Unit	Depth to Bedrock (m BEGL) *RL of top of Bedrock (m AHD)*					
	BH5	BH6	BH7M	BH8	BH9M	BH10M
Class V Sandstone	1.50 188.94	3.00 187.03	3.00 187.85	3.20 187.74	4.50 187.41	4.50 186.87
Class IV Sandstone	2.54 187.9	3.7 186.33	NE	3.79 187.15	NE	NE
Class III Sandstone	4.65 185.79	5.65 184.38	4.10 186.75	5.70 185.24	6.09 185.82	5.45 185.92

Note 1 NE – Not Encountered
Note 2 mBEGL – metres below existing ground level
Note 3 mAHD – meters Australian Height Datum

3.2 Groundwater Observations

Following completion of auger drilling, the boreholes were left open and free standing groundwater levels were then measured within the boreholes after a period of time. No groundwater or significant seepage was observed during or after auger drilling of the boreholes, though some seepage was observed in BH9M and BH10M towards the interface between the soil and the rock. Water re-circulation as is required for rock coring within the boreholes prevented further observations of groundwater levels within all boreholes. We note that the groundwater levels may not have become evident or stabilised in the augered boreholes within the limited observation period.

Following their completion, groundwater monitoring wells were installed in BH2M, BH7M, BH9M and BH10M and bailed dry. The groundwater levels were then measured within the monitoring wells as per **Table 3-4** below.

Table 3-4 Groundwater Levels

Borehole ID	Measurement Date	Groundwater Level After Well Development		Assumed BEL (m AHD)
		m BEGL	RL (m AHD)	
BH2M	20/10/23	3.70	182.11	182.35 (Building S1)
	26/10/23	3.23	182.58	
BH7M	20/10/23	2.20	188.70	184.95 (Building S2 / S2-H)
	26/10/23	2.09	188.81	
BH9M	19/10/23	4.20	187.71	
	26/10/23	3.37	188.54	
BH10M	26/10/23	4.43	186.97	

3.3 Test Results

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

- Atterberg Limits and Linear Shrinkage
- Soil aggressivity (pH, chloride and sulfate content and electrical conductivity).

A summary of the soil test results is provided in **Table 3-5** below. Laboratory test certificates are presented in **Appendix B**.

Table 3-5 Summary of Soil Laboratory Test Results

Test/ Sample ID		BH3_1.3-1.5	BH10_M 3.0-3.3	BH1_ 0.9-1.2	BH2M_ 1.0-1.25	BH3_ 3.0-3.21	BH4_ 1.7-2.0	BH5_ 1.0-1.5	BH6_ 1.5-1.95	BH7M_ 1.5-1.95	BH8_ 2.8-3.0	BH9M_ 3.0-3.17	BH10M_ 4.5-4.65
Unit		2	2	3	3	3	2	2	2	2	2	2	2
Material Description [1]		Sandy Silty CLAY	Silty Clay	Weathered Rock	Weathered Rock	Weathered Rock	Silty Clay	Silty Clay	Silty Clay	Silty Clay	Silty Clay	Silty Clay	Silty Clay
Aggressivity	Chloride Cl (ppm)	-	-	16	2.2	48	18	9.5	1000	3.9	29	3.6	190
	Sulfate SO_4 (ppm)	-	-	36	19	130	210	110	20	76	63	97	590
	pH	-	-	6.4	5.8	5.0	5.6	5.1	4.4	4.6	4.8	4.9	4.5
	Electrical Conductivity (µS/cm)	-	-	42	9	69	110	68	690	41	50	50	50
	Moisture Content (%)	11.9	17.0	8.4	9.1	6.0	7.8	5.6	9.4	9.8	8.7	8.2	8.8
Atterberg Limits	Liquid Limit (%)	44	37	-	-	-	-	-	-	-	-	-	-
	Plastic Limit (%)	17	17	-	-	-	-	-	-	-	-	-	-
	Plasticity Index (%)	27	20	-	-	-	-	-	-	-	-	-	-
	Linear Shrinkage (%)	12.0	8.0	-	-	-	-	-	-	-	-	-	-

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 is present at the site. 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' for buried concrete structural elements; and
- 'Non-aggressive' for buried steel structural elements.

87 selected rock core samples were tested by STS Geotechnical to estimate the Point Load Strength Index (Is_{50}) values to assist with rock strength assessment. The results of the testing are presented in the Point Load Strength Index Report, and reproduced on the attached borehole logs.

4. Recommendations

4.1 Geotechnical Overview

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

- Basement excavation and retention to limit lateral deflections;
- Presence of sensitive assets (TfNSW);
- Rock excavation and vibration;
- 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 falls within the zone of influence of the excavation to allow assessment of the recommended vibration limits. 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

4.3.1 Excavation Assessment

Prior to any excavation commencing, we recommend that reference be made to the Safe Work NSW Excavation Work Code of Practice, dated January 2020.

EI assumes that the BEL for the proposed Building S1 basement is RL182.35m AHD, requiring excavation depths of between about 3.5m and 7m BEGL. A BEL of RL184.95m is assumed for Building S2 / S2-H, requiring excavation depths of between about 5.3m and 7.6m 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 to support the overburden profile (Units 1 and 2) and the weathered Class V (Unit 3) and Class IV sandstone bedrock (Unit 4). Class III sandstone (Unit 5) may be allowed to stand vertically unsupported provided the following:

- The excavation face is absent of adversely oriented defects that may result in instability;
- Inspections be carried out by an experienced geotechnical engineer progressively during basement excavations to assess rock quality and absence of adversely oriented defects;
- Where adversely oriented defects are present which may form slip planes, wedges or unstable blocks, such areas be stabilised prior to further excavations.

- Further groundwater measurements, and if required, long term groundwater monitoring be carried out to determine whether the water table is within the depth of proposed excavations and seepage flow rates which if sufficiently high would preclude unsupported cuts in Class III/II sandstone and the potential need for tanking of the basement.

Units 1 and 2 could be excavated using buckets of large earthmoving hydraulic excavators, particularly if fitted with 'Tiger Teeth' for excavations in Unit 3 (Class V sandstone). Excavation of Units 4 (Class IV sandstone) and 5 (Class III Sandstone) may present hard or heavy ripping, or "hard rock" excavation conditions. Ripping would require a high capacity and heavy excavators for effective production. Wear and tear should also be allowed for. The use of a smaller size excavator 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 used for the excavation of the bedrock, excavation should commence away from the adjoining structures and the transmitted vibrations monitored to assess how close the hammer can operate to the adjoining structures while maintaining transmitted vibrations within acceptable limits. To fall within these limits, we recommend that the size of rock hammers do not exceed a medium sized rock hammer, say 900 kg, such as a Krupp 580, and be trialled prior to use. The transmitted vibrations from rock hammers should be measured to determine how close each individual hammer can operate to the adjoining buildings.

The vibration measurements can be carried out using either an attended or an unattended vibration monitoring system. An unattended vibration monitoring system must be fitted with an alarm in the form of a strobe light or siren or alerts sent directly to the site supervisor to make the plant operator aware immediately when the vibration limit is exceeded. The vibration monitor must be set to trigger the alarm when the overall Peak Particle Velocity (PPV) exceeds set limits outlined by a vibration monitoring plan. Reference should be made to **Appendix C** for a guide to acceptable limits of transmitted vibrations.

If it is found that the transmitted vibrations by the use of rock hammers are unacceptable, then it would be necessary to change to a smaller excavator with a smaller rock hammer, or to a rotary grinder, rock saws, jackhammers, ripping hooks, chemical rock splitting and milling machines. Although these are likely to be less productive, they would reduce or possibly eliminate risks of damage to adjoining properties through vibration effects transmitted via the ground. Such equipment would also be required for detailed excavation, such as footings or service trenches, and for trimming of faces. Final trimming of faces may also be completed using a grinder attachment rather than a rock breaker in order to assist in limiting vibrations. The use of rotary grinders generally generates dust and this may be supressed by spraying with water.

To assist in reducing vibrations and over-break of the sandstone, we recommend that initial saw cutting of the excavation perimeters through the bedrock may be provided using rock saw attachments fitted to the excavator. Rock sawing of the excavation perimeter has several advantages as it often reduces the need for rock bolting as the cut faces generally remain more stable and require a lower level of rock support than hammer cut excavations, ground vibrations from rock saws are minimal and the saw cuts will provide a slight increase in buffer distance for use of rock hammers. However, the effectiveness of such approach must be confirmed by the results of vibration monitoring.

Also, there is a potential for poorly oriented defects within the excavated bedrock to result in localized rock slide/topple failure with potential impact to the work site or the adjacent structures. However through selection of suitable excavation equipment, geotechnical inspections and mapping during the excavation works along with the installation of support measures as determined necessary by the inspections, the risk from the proposed works can be maintained within 'Acceptable' levels. In addition, we recommend that only excavation contractors with appropriate insurances and experience on similar projects be used. The contractor should also be provided with a copy of this report to make his own judgement on the most appropriate excavation equipment.

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.

4.3.2 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.

4.4 Groundwater Considerations

Groundwater was observed in all monitoring wells as detailed in **Table 3-4**. Although ground water was measured in the installed groundwater monitoring standpipes at a depth above the proposed basement BEL within the footprint of the proposed Building S2 / S2-H basement, and slightly above the BEL within the footprint of the proposed Building S1 basement shortly after its installation, it may not be a true indication of a groundwater table. The measured water may be remnant drilling fluid from the borehole investigation, and/or an expression of hydrostatic pressure from a perched aquafer, and/or seepage within defects within the bedrock.

Based on the subsurface conditions, water measured within the monitoring wells, and considering that seepage was encountered during auger drilling only within BH8, BH9M and BH10M within the bedrock profile, the measured water in the wells is likely to be water seepage through defects of bedrock. Due to the low permeability of the bedrock profile any seepage 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 some seepage inflows may occur into the excavation along the soil/rock interface and through any defects within the sandstone 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.

Notwithstanding the above, EI recommends a Groundwater Take Assessment be undertaken to estimate the total groundwater inflows into the excavation both for construction and the lifetime of the structure. To facilitate this, additional testing in the form of three months of groundwater monitoring and rising head tests are required to inform the Groundwater Take Assessment.

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.

Permission may need to be obtained from the NSW Department of Planning and Environment (DPIE) 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 DPIE limits. However, if permission for discharge is not obtained, the basement may need to be designed as a tanked basement. Long-term monitoring and seepage analysis may be required to prove to DPIE that a drained basement is feasible.

4.5 Excavation Retention

4.5.1 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 Lot 1 basement outline has a minimum setback of approximately 6.0m from the western and eastern boundary, and 7.5m from the northern boundary, while the Lot 2 basement has a setback of 6.0m from the western site boundary, 4.0m from eastern site boundary, 2.8m from southern site boundary and the northern and southern basement has a setback 12.0m.

Based on the basement set back distances discussed in **Section 1.2**, the encountered subsurface conditions, and the depth of proposed excavations, temporary batters of no steeper than the safe angles shown in **Table 4-1** below, may be feasible where space allows for Unit 1 Fill, Unit 2 Residual Soil, and Unit 3 Class V Sandstone. The temporary batters should remain stable provided that all surcharge loads, including construction loads, are kept at a distance of at least 2h (where 'h' is the height of the batter in metres) from the crest of the batter and above the groundwater table. If steeper batters are to be used, then these must be supported by shotcrete and soil nail system designed by a suitable structural or geotechnical engineer, with typical batter angles of protected slopes shown in **Table 4-1** below. The stability of these batters can be assessed using computer slope stability analysis software such as Slope/W. We can complete such analysis, if commissioned to do so.

Table 4-1 Temporary batter safe slope angles

Material	Exposed	Protected
Fill (Unit 1) and Residual soils (Unit 2)	1.5H:1V	1.25H:1V
Class V Sandstone (Unit 3) and Class IV Sandstone	1H:1V	0.5H:1V

Where batters are used, the space between the batters and the permanent retaining walls will need to be carefully backfilled to reduce future settlement of the backfill. Only light compaction equipment should be used for compaction behind retaining walls so that excessive lateral pressures are not placed on the walls. This will require the backfill to be placed in thin layers, say 100mm loose thickness, appropriate to the compaction equipment being used. The compaction specification for the backfill will depend on whether paving or structures are to be supported on the fill. If the fill is to support paved areas it should be compacted to a density of at least 98% of Standard Maximum Dry Density (SMDD) for granular fill materials, but if it is only to support landscaped areas of lower compaction specification, say 95% of SMDD, may be appropriate, provided the risk of future settlement and maintenance can be accepted. An alternative for backfill would also be to use a uniform granular material, wrapped in a geofabric.

A suitable retention system will be required for the support of Units 1, 2, 3 and 4. For this site, EI recommends an anchored and/or propped soldier pile wall with reinforced shotcrete panels in between the piles be founded into Unit 5 Class III Sandstone, with anchors installed at the toe of the solider pile walls to provide toe restraint should the shoring wall terminate above the basement BEL. Any anchors/props and shotcrete panel must be installed progressively as excavation proceeds. Consideration may be made for some piers, which are not supporting the vertical structural loads of the building, to be terminated at least 0.5m, into Unit 5 material or better, above the base of the bulk excavation levels. Due to the presence of the basement structures adjacent to the site, anchors installation may not be possible and internal props may be required. Details of nearby basements, shoring pile walls and anchors must be obtained prior to final design.

Excavation within Unit 4 Class IV Sandstone and Unit 5 Class III/II Sandstone, should generally be able to be cut vertically and without support, provided an anchor is installed at the toe of the solider pile wall. Anchors/props and shotcrete panel must be installed progressively as excavation proceeds.

For vertical cuts, the excavations must be inspected by a geotechnical engineer at regular depth intervals to check for any inclined joints or weak seams that require stabilisation. Said inclined joints and weak seams were evident in the boreholes, particularly in BH2M, BH3 and BH9M. Such geotechnical inspections should be carried out at depth intervals of no more than 1.5m. If adverse defects are encountered, the stabilisation measures may comprise rock bolts, shotcrete and mesh or dental treatment of thin weak seams using non-shrink grout, and this should be allowed for.

The existence of significant horizontal in-situ stresses in bedrock, particularly in the Sydney basin, is well established. The release of such stresses during the basement excavation may cause adverse impact on the stability of the excavation faces and thus increase the movements. Monitoring of several deep excavations within sandstone and shale in the Sydney region indicates that the lateral displacement at the top of the excavation is generally between 0.5mm to 2mm per meter depth of excavation. As the maximum depth of excavation into sandstone is of about 7.6m, a lateral deflection at the crest of the excavation between 4mm to 15mm can be expected which will reduce in a stepped fashion to zero at the bulk excavation level. Monitoring of the lateral movement as the excavation progresses is recommended. An assessment of such movements and their impact can be carried out using finite element software such as PLAXIS.

Bored piles are considered to be the most suitable for this site. However, relatively large capacity piling rigs will be required for drilling through the sandstone bedrock. Cleaning buckets are to be used to clean the bases of pile holes prior to concrete placement. It is recommended that concrete be placed from the base of the open pile holes using a tremie pipe. Tremie pumps may be required where high groundwater seepage inflows are present during the drilling of the bored piles. 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.

Working platforms may also be required. We can complete the design of the working platform, if commissioned to do so.

4.5.2 Excavation adjacent to TfNSW Assets

Reference should be made to the TfNSW Geotechnical Technical Direction (GTD) 2020/001 dated July 2020, with regards to excavation/shoring adjacent to Princes Highway. This document outlines requirements for excavations adjacent to TfNSW infrastructure and includes the level of geotechnical investigation required, dilapidation surveying, instrumentation and monitoring during construction, trigger levels and contingency plans.

Instrumentation (e.g. inclinometers) and monitoring is typically required where the excavation exceeds 3 m in height (for cantilevered shoring walls) or 6 m in height (for anchored or propped shoring walls). A geotechnical monitoring plan may be required by TfNSW prior to construction for this site.

As the site of the proposed development lies adjacent to an TfNSW asset, the asset owner may require further assessment of the potential impact of the proposed development on their asset. In order to assess the latter, a 2D numerical model using a commercially available computer program, such as WALLAP and/or PLAXIS, will be required. This model will enable the assessment of the potential impact of the proposed development on the TfNSW assets and predict the likely movements in the shoring wall. EI can provide such a service if commissioned to do so.

4.5.3 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, K_0.
- 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.
- 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 4-2** below may be used, subject to the following conditions:
  - 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;
  - Overall stability, including anchor group interaction, is satisfied;
  - 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;
  - If permanent anchors are to be used, these must have appropriate corrosion provisions for longevity.

Table 4-2 Geotechnical Design Parameters

Material [1]		Unit 1 Fill	Unit 2 Residual Soil	Unit 3 Class V Sandstone	Unit 4 Class IV Sandstone	Unit 5 Class III Sandstone
RL of Top of Unit (m AHD) [2]		185.51 to 192.61	187.5 to 192.01	184.56 to 191.11	184.31 to 190.21	182.81 to 187.61
Bulk Unit Weight (kN/m^3)		18	18	22	23	24
Friction Angle, ϕ' (°)		25	27	35	38	40
Earth Pressure Coefficients	At rest, K_o [3]	0.58	0.55	0.43	-	-
	Active, K_a [3]	0.41	0.38	0.27	-	-
	Passive, K_p [3] or Passive pressure	-	-	3.69	1500kPa	3000kPa
Young's Modulus, E' (MPa)		-	15	75	200	500
Cohesion, c' (kPa)		-	2	50	70	200
Poisson's Ratio, v		0.3	0.3	0.3	0.25	0.25
Allowable Bearing Pressure (kPa) [5]		-	-	700	2000	3500
Allowable Shaft Adhesion (kPa) [4, 5]	in Compression	-	-	70	200	350
	in Uplift	-	-	35	100	175
Anchor Bond Stress (kPa)[6]		-	-	250	280	430
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).

6 For anchors in sandstone following the relationship provided in Pells et al., 2019 as: Design Anchor Bond Stress (kPa) = 220kPa + 0.03 x UCS, (note UCS value in kPa).

4.6 Foundations

Following basement excavation to bulk excavation levels, we expect the following materials to be encountered:

- Unit 5 material (Class III Sandstone) to be exposed at BEL (RL182.35m AHD) of Building S1,
- Unit 5 material (Class III Sandstone) to be exposed across the majority of the basement footprint of Building S2 / S2-H at BEL (RL182.35m AHD). There is a potential that Class IV Sandstone (Material unit 4) may be encountered at some locations as observed in BH6.

It is recommended that all footings for the building be founded within the sandstone 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 (Class IV Sandstone) or Unit 5 (Class III Sandstone) may be preliminarily designed for an allowable bearing capacity of 2000kPa or 3500kPa respectively, based on serviceability.

Where piles are required to found into the Class III sandstone bedrock (Unit 5), such as where Class IV sandstone is encountered at the BEL, these must be embedded a minimum of 0.5m into Unit 5, and can be designed for a maximum allowable bearing pressure of 3500kPa. The allowable shaft adhesion in sandstone bedrock may be designed as 10% of the allowable bearing pressure (or 5% for uplift) for the socket length in excess of 0.5m.

At least the initial drilling of piles should be completed in the presence of a geotechnical engineer 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 cleaned using a cleaning bucket, and pumped dry of water prior to pouring concrete. Concrete should be placed from the base of open pile holes using a tremie pipe. Concrete must be poured on the same day as drilling, inspection and drilling.

The aggressivity of natural soils and groundwater (if encountered) should be taken into consideration in the design.

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.

4.7 Basement Floor Slab

Following bulk excavations for the proposed basement, sandstone 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 recommended additional work that needs to be carried out:

- Dilapidation surveys;
- Long term groundwater monitoring and seepage modelling;
- Stability assessment of temporary batters using computer modelling, if required;
- Design of working platforms (if required) for construction plant by an experienced and qualified geotechnical engineer;
- Classification of all excavated material transported off site;
- If directed by TfNSW or any other asset owners, carry out specialist engineering assessment, further geotechnical investigations, monitoring equipment installs and/or subsequent monitoring;
- Witnessing installation of support measures and proof-testing of anchors (if required).
- Geotechnical inspections of unsupported vertical excavations in bedrock during excavation by experience geotechnical professional at depth of no greater than 1.5m within medium to high strength bedrock, if vertical cut are adopted;
- Geotechnical inspections of all new shoring piles, and 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 Mr. Anthony Vitale and Duffy Kennedy Constructions Pty Ltdwho 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 Mr. Anthony Vitale and Duffy Kennedy Constructions 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.

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

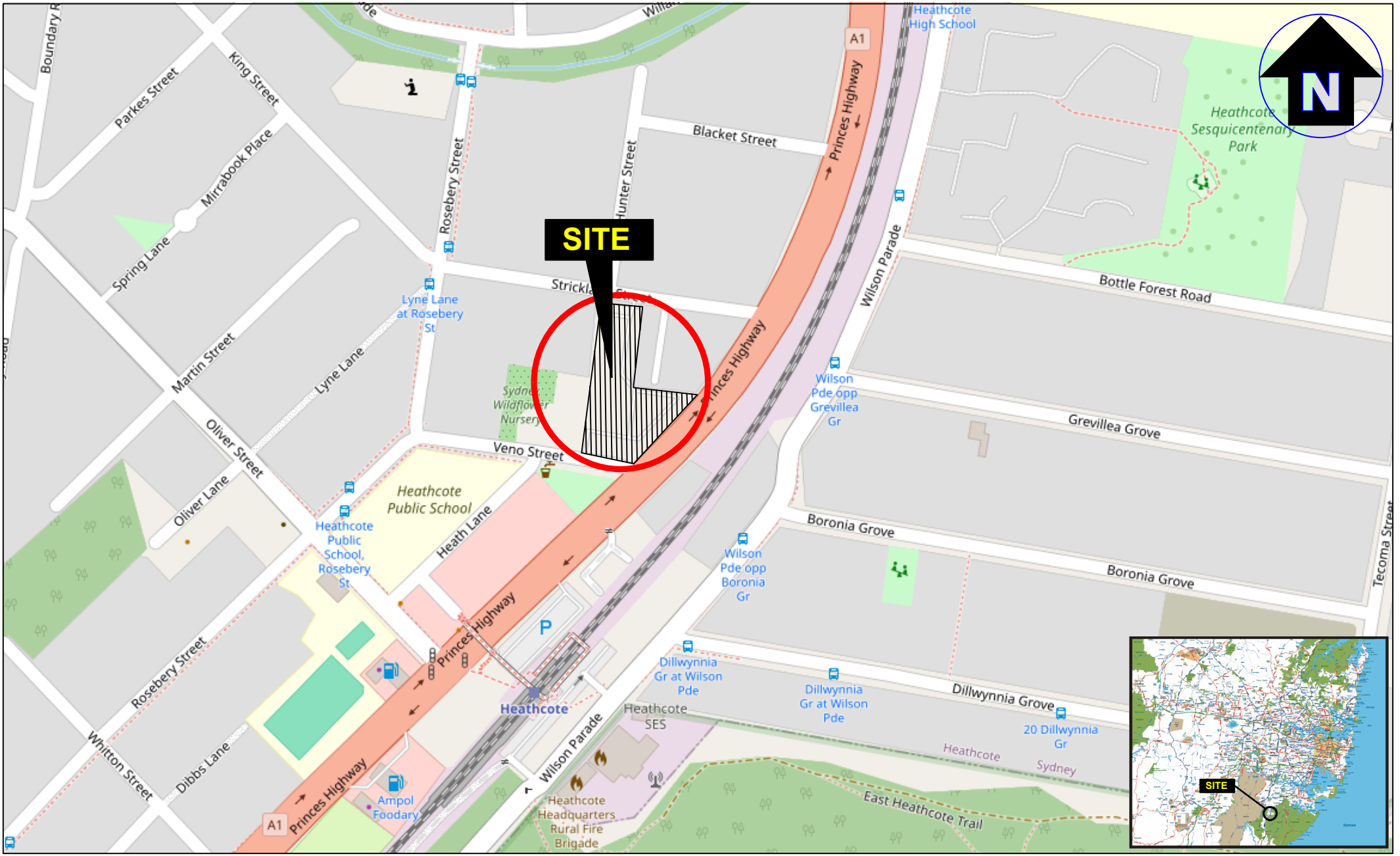
NSW Department of Mineral Resources Geological Map Wollongong-Port Hacking 1:100,000 Geological Series Sheet 9029-9129 (DMR 1985). Geological Survey of New South Wales, Department of Mineral Resources.

Transport for NSW (TfNSW) Technical Direction – Geotechnology GTD 2020/001, Version No. 01, dated on 2 July 2020

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

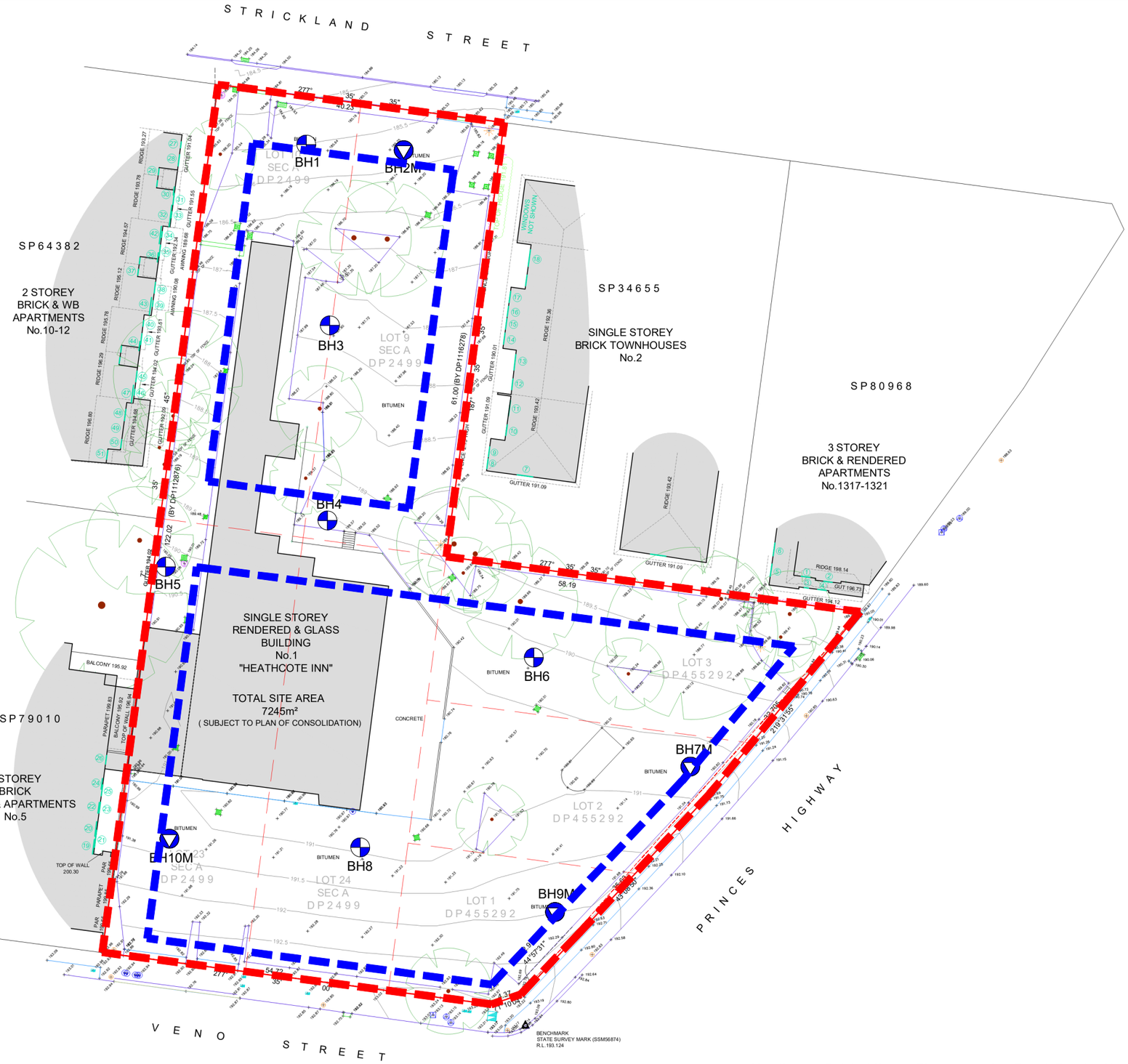
Figures



eiaustralia Practical Solutions for Built Environments Suite 6.01, 55 Miller Street, PYRMONT 2009 Ph (02) 9516 0722 Fax (02) 9518 5088	Drawn:	K.P.	**Duffy Kennedy Constructions Pty Ltd** Geotechnical Investigation 1 Veno Street, Heathcote, NSW Site Locality Plan
	Approved:	M.L.	
	Date:	24-06-24	
	Scale:	Not To Scale	

Figure: 1

Project: E26160.G03



Map Source: Detailed Survey Plan prepared by Boxall, Drawing No. 11260-001-A, Rev A. dated 8 September 2021

LEGEND (All Locations are Approximate)

- Site boundary
- Basement boundary
- Borehole location (EI Australia, 2023)
- Monitoring well location (EI Australia, 2023)

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Approved:	M.L.
Date:	24-06-24

Duffy Kennedy Construction Pty Ltd
Geotechnical Investigation
1 Veno Street, Heathcote, NSW

Borehole Location Plan

Figure: 2

Project: E26160.G03

Appendix A – Borehole Logs And Explanatory Notes

BOREHOLE LOG

BH ID: BH1

Location	1 Veno Street, Heathcote, NSW			**Started**	16 October 2023
Client	Duffy Kennedy Constructions			**Completed**	16 October 2023
Job No.	E26160.G03			**Logged By**	KP **Date** 16 October 2023
Sheets	1 of 2			**Review By**	JS **Date** 07 November 2023
Drilling Contractor	Geosense Drilling and Engineering Pty Ltd	**Surface RL**	≈185.50 m (AHD)	**Northing**	6226616.8570 (MGA 2020 Zone 56)
Plant	Comacchio Geo 205	**Inclination**	90°	**Easting**	316297.1206 (MGA 2020 Zone 56)

METHOD	GROUND WATER LEVELS	SAMPLES & FIELD TESTS	SAMPLE RECOVERY	DEPTH (m)	GRAPHIC LOG	RL (m AHD)	MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY / REL. DENSITY	MATERIAL ORIGIN & OBSERVATIONS
				0		185.50				
				0.00			ASPHALT: 200mm thick	-	-	ASPHALT
				0.20		185.30				
AD/T	GWNE	BH1_0.50-0.95 SPT 0.50-0.95 1,2,7 HB N=9					FILL: Sandy CLAY: low plasticity, dark brown, sand is fine to medium grained trace with fine to medium, angular to sub-angular gravels	M	-	FILL
						184.55				
				0.95			SANDSTONE: fine to medium grained, pale grey / brown, extremely weathered, very low to low strength	-	-	WEATHERED ROCK
						184.30				
				1.20			*Log continued on next page.*			
				2						
				3						
				4						
				5						
				6						
				7						
				8						
				9						
				10						

BOREHOLE CORE LOG

BH ID: BH1

Location	1 Veno Street, Heathcote, NSW			**Started**	16 October 2023
Client	Duffy Kennedy Constructions			**Completed**	16 October 2023
Job No.	E26160.G03			**Logged By**	KP **Date** 16 October 2023
Sheets	2 of 2			**Review By**	JS **Date** 07 November 2023
Drilling Contractor	Geosense Drilling and Engineering Pty Ltd	**Surface RL**	≈185.50 m (AHD)	**Northing**	6226616.8570 (MGA 2020 Zone 56)
Plant	Comacchio Geo 205	**Inclination**	90°	**Easting**	316297.1206 (MGA 2020 Zone 56)

METHOD	Flush Return	TCR %	RQD %	DEPTH (m)	GRAPHIC LOG	RL (m AHD)	MATERIAL DESCRIPTION	WEATHERING	ESTIMATED STRENGTH Is(50) ▼ - Axial ▽ - Diametral (VL 0-1, L 0-3, M 1, H 3, VH 10, EH)	DISCONTINUITIES & ADDITIONAL DATA	FRACTURE SPACING (30, 100, 300, 1000, 3000)
				0			*Log continued from previous page.*				
				1							
NMLC	100%	100	98	2			SANDSTONE: fine to medium grained, orange-pale grey, thinly to medium bedded			1.36: JT 10° PR RO CN 1.90: Manual Breaking 2.14: BP CU RO OP	
				3		182.50	From 3.00m, siltstone lamination, medium bedded	SW			
				4						3.98-4.00: CS	
				4.50		181.00	From 4.50m, pale grey				
				4.86		180.64	NO CORE: 220mm thick	-			
		93	88	5		180.42	SANDSTONE: fine to medium grained, pale grey, thinly to medium bedded			5.32: JT 2° CU RO CN 5.79: JT 25° PR RO CN	
				6						6.60-6.64: XWS Clay 6.74-6.80: XWS Clay	
				7				FR			
		100	83	8						7.41-7.44: XWS Clay 8.33: JT 5° UN RO Clay VN	
				9						8.75: JT 5° PR RO CN	
				10		176.35	Terminated at 9.15m. Target Depth Reached.				

CORE PHOTOGRAPH OF BOREHOLE: BH1

Project	Proposed Mixed Use Development	**East**	316297.1206	**Depth Range**	1.2m to 9.15m BEGL		
Location	1 Veno Street,Heathcote, NSW	**North**	6226616.8570	**Contractor**	Geosense Drilling & Engineering Pty Ltd		
Position	See Figure 2	**Surface RL**	≈ 185.5m	**Drill Rig**	Comacchio Geo 205		
Job No.	E26160.G03	**Inclination**	-90°	**Logged**	KP	**Date**	16/10/2023
Client	Duffy Kennedy Constructions	**Box**	1 & 2 of 2	**Checked**	JS	**Date**	07/11/2023

BOREHOLE LOG

BH ID: BH2M

Location	1 Veno Street, Heathcote, NSW			**Started**	16 October 2023
Client	Duffy Kennedy Constructions			**Completed**	16 October 2023
Job No.	E26160.G03			**Logged By**	KP **Date** 16 October 2023
Sheets	1 of 2			**Review By**	JS **Date** 07 November 2023
Drilling Contractor	Geosense Drilling and Engineering Pty Ltd	**Surface RL**	≈185.80 m (AHD)	**Northing**	6226616.1632 (MGA 2020 Zone 56)
Plant	Comacchio Geo 205	**Inclination**	90°	**Easting**	316311.1692 (MGA 2020 Zone 56)

METHOD	GROUND WATER LEVELS	SAMPLES & FIELD TESTS	SAMPLE RECOVERY	DEPTH (m)	GRAPHIC LOG	RL (m AHD)	MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY / REL. DENSITY	MATERIAL ORIGIN & OBSERVATIONS
				0.00		185.80	ASPHALT: 200mm thick	-	-	ASPHALT
				0.20		185.60	FILL: Silty CLAY: low plasticity, brown / orange, trace with fine to medium, sub-angular to angular gravels	M	-	FILL
AD/T	GWNE	BH2M_0.50-0.52 SPT 0.50-0.52 4/20 mm HB N=R		0.52		185.28	SANDSTONE: fine to medium grained, yellow brown, extremely weathered, very low to low strength	-	-	WEATHERED ROCK
				1.00		184.80	From 1.00m, pale grey			
				1.30		184.50	*Log continued on next page.*			

BOREHOLE CORE LOG

BH ID: BH2M

Location	1 Veno Street, Heathcote, NSW			**Started**	16 October 2023
Client	Duffy Kennedy Constructions			**Completed**	16 October 2023
Job No.	E26160.G03			**Logged By**	KP **Date** 16 October 2023
Sheets	2 of 2			**Review By**	JS **Date** 07 November 2023
Drilling Contractor	Geosense Drilling and Engineering Pty Ltd	**Surface RL**	≈185.80 m (AHD)	**Northing**	6226616.1632 (MGA 2020 Zone 56)
Plant	Comacchio Geo 205	**Inclination**	90°	**Easting**	316311.1692 (MGA 2020 Zone 56)

METHOD	Flush Return	TCR %	RQD %	DEPTH (m)	RL (m AHD)	MATERIAL DESCRIPTION	WEATHERING	DISCONTINUITIES & ADDITIONAL DATA
				0		*Log continued from previous page.*		
NMLC	100%	92	80	2.47	183.33	SANDSTONE: fine to medium grained, orange brown / pale grey, thinly to medium bedded	DW	1.36: JT 15° CU RO OP 1.40: JT 10° PR RO Fe SN 1.53: JT 5° PR RO Fe SN 2.05: BP PR RO Clay VN 2.19: JT 2° PR RO Clay VN 2.30-2.38: XWS clay 2.43: JT 30° IR RO OP
				2.69	183.11	NO CORE: 220mm thick	-	
				4.10	181.70	SANDSTONE: fine to medium grained, pale grey, medium bedded	SW	
		100	72			From 4.10m, thinly to medium bedded		4.34: JT 10° CU RO OP 4.44-4.46: XWS clay 4.63-4.64: clay seam 4.80-4.82: XWS clay 4.90-4.94: XWS clay 5.03: JT 2° PR RO Clay VN 5.38-5.39: clay seam 6.41-6.44: XWS clay 6.80: BP 15° PR RO Clay VN 6.89: JT 45° PR RO CN
		100	86				FR	7.50-7.52: XWS clay 8.03-8.07: XWS clay 8.18: JT PR RO OP 8.34: JT 5° PR RO CN
				9.20	176.60	Terminated at 9.20m. Target Depth Reached.		

ESTIMATED STRENGTH Is(50) ▼ - Axial ▽ - Diametral: VL 0-1, L 0-3, M 1, H 3, VH 10, EH

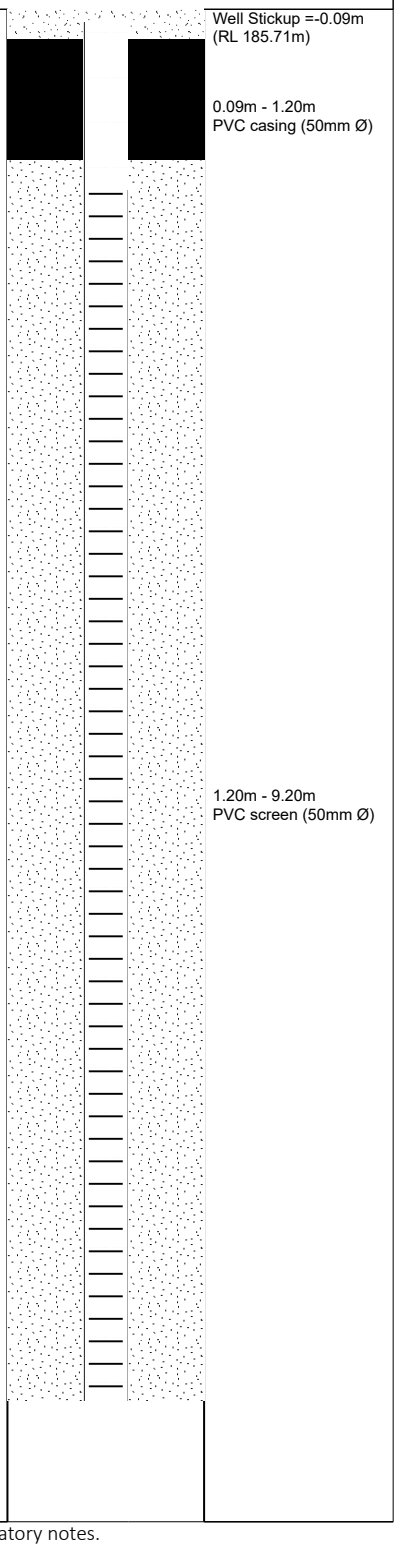
FRACTURE SPACING: 30, 100, 300, 1000, 3000

MONITORING WELL LOG

BH ID: BH2M

Location	1 Veno Street, Heathcote, NSW			**Started**	16 October 2023
Client	Duffy Kennedy Constructions			**Completed**	16 October 2023
Job No.	E26160.G03			**Logged By**	KP **Date** 16 October 2023
Sheets	1 of 1			**Review By**	JS **Date** 07 November 2023
Drilling Contractor	Geosense Drilling and Engineering Pty Ltd	**Surface RL**	≈185.80 m (AHD)	**Northing**	6226616.1632 (MGA 2020 Zone 56)
Plant	Comacchio Geo 205	**Inclination**	90°	**Easting**	316311.1692 (MGA 2020 Zone 56)

WATER	SAMPLES & FIELD TESTS	DEPTH (m)	RL (m AHD)	MATERIAL DESCRIPTION	MOISTURE CONDITION
		0			
		0.00	185.80	ASPHALT: 200mm thick	-
		0.20	185.60	FILL: Silty CLAY: low plasticity, brown / orange, trace with fine to medium, sub-angular to angular gravels	M
GWNE	BH2M_0.50-0.52 SPT 0.50-0.52 4/20 mm HB N=R	0.52	185.28	SANDSTONE: fine to medium grained, yellow brown, extremely weathered, very low to low strength	-
		1			
		1.00	184.80	From 1.00m, pale grey	
		1.30	184.50	SANDSTONE: fine to medium grained, orange brown / pale grey, thinly to medium bedded	
		2			
		2.47	183.33	NO CORE: 220mm thick	
		2.69	183.11	SANDSTONE: fine to medium grained, pale grey, medium bedded	
		3			
		4			
		4.10	181.70	From 4.10m, thinly to medium bedded	
100%		5			
		6			
		7			
		8			
		9			
		176.60		Terminated at 9.20m. Target Depth Reached.	
		10			



CORE PHOTOGRAPH OF BOREHOLE: BH2M

Project	Proposed Mixed Use Development	**East**	316311.1692	**Depth Range**	1.3m to 9.2m BEGL		
Location	1 Veno Street,Heathcote, NSW	**North**	6226616.1632	**Contractor**	Geosense Drilling & Engineering Pty Ltd		
Position	See Figure 2	**Surface RL**	≈ 185.8m	**Drill Rig**	Comacchio Geo 205		
Job No.	E26160.G03	**Inclination**	-90°	**Logged**	KP	**Date**	16/10/2023
Client	Duffy Kennedy Constructions	**Box**	1 & 2 of 2	**Checked**	JS	**Date**	07/11/2023

BOREHOLE LOG

BH ID: BH3

Location	1 Veno Street, Heathcote, NSW	**Started**	17 October 2023
Client	Duffy Kennedy Constructions	**Completed**	17 October 2023
Job No.	E26160.G03	**Logged By**	KP **Date** 17 October 2023
Sheets	1 of 2	**Review By**	JS **Date** 07 November 2023
Drilling Contractor	Geosense Drilling and Engineering Pty Ltd	**Surface RL**	≈188.00 m (AHD)
Plant	Comacchio Geo 205	**Inclination**	90°
Northing	6226591.4992 (MGA 2020 Zone 56)		
Easting	316301.2868 (MGA 2020 Zone 56)		

METHOD	GROUND WATER LEVELS	SAMPLES & FIELD TESTS	SAMPLE RECOVERY	DEPTH (m)	GRAPHIC LOG	RL (m AHD)	MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY / REL. DENSITY	MATERIAL ORIGIN & OBSERVATIONS
AD/T	GWNE			0.00		188.00	ASPHALT: 200mm thick	-	-	ASPHALT
				0.20		187.80	FILL: Silty CLAY: low plasticity, brown trace with fine to medium, angular to sub-angular gravels	M	-	FILL
		BH3_0.50-0.95 SPT 0.50-0.95 4,6,6 N=12		0.50		187.50	Silty CLAY: medium plasticity, orange brown,	M < PL	VSt	RESIDUAL SOIL
				1.20		186.80	From 1.20m, grading into weathered Sandstone			
		BH3_1.50-1.62 SPT 1.50-1.62 5/120 mm HB N=R		1.50		186.50	SANDSTONE: fine to medium grained, orange-red/pale grey, extremely weathered, extremely low to very low strength, indurated gravels bands	-	-	WEATHERED ROCK
		BH3_3.00-3.21 SPT 3.00-3.21 7,4,60 mm HB N=R		3.20		184.80	*Log continued on next page.*			

BOREHOLE CORE LOG

BH ID: BH3

Location	1 Veno Street, Heathcote, NSW			**Started**	17 October 2023
Client	Duffy Kennedy Constructions			**Completed**	17 October 2023
Job No.	E26160.G03			**Logged By**	KP **Date** 17 October 2023
Sheets	2 of 2			**Review By**	JS **Date** 07 November 2023
Drilling Contractor	Geosense Drilling and Engineering Pty Ltd	**Surface RL**	≈188.00 m (AHD)	**Northing**	6226591.4992 (MGA 2020 Zone 56)
Plant	Comacchio Geo 205	**Inclination**	90°	**Easting**	316301.2868 (MGA 2020 Zone 56)

METHOD	Flush Return	TCR %	RQD %	DEPTH (m)	GRAPHIC LOG	RL (m AHD)	MATERIAL DESCRIPTION	WEATHERING	ESTIMATED STRENGTH Is(50) ▼ - Axial ▽ - Diametral VL 0-1, L 0-3, M 1, H 3, VH 10, EH	DISCONTINUITIES & ADDITIONAL DATA	FRACTURE SPACING 30, 100, 300, 1000, 3000
				0			*Log continued from previous page.*				
				1							
				2							
				3							
NMLC	90%	89	72	3.63		184.37	SANDSTONE: fine to medium grained, red-orange, thinly to medium bedded	DW		3.42-3.46: XWS clay 3.47: JT 25° PR RO Fe SN 3.61-3.63: clay seam	
				3.98		184.07	NO CORE: 300mm thick	-			
				5			SANDSTONE: fine to medium grained, orange-dark orange, thinly to medium bedded	SW		4.28: JT 2° UN RO SN 5.02: manual break	
		100	95	5.35		182.65	From 5.35m, pale grey with siltstone laminations	FR		5.25: JT 25° PR RO CN 5.36: JT 2° PR RO CN 5.43: BP 5° PR RO Clay VN 5.51: JT 5° CU RO OP 5.77: JT UN RO Clay VN 5.83: JT PR RO CN 7.24-7.25: clay seam 7.61: JT 35° PR RO CN 8.34-8.35: clay seam 8.56: JT UN RO CN 8.75-8.76: clay seam	
				9		178.90	Terminated at 9.10m. Target Depth Reached.				
				10							

CORE PHOTOGRAPH OF BOREHOLE: BH3

Project	Proposed Mixed Use Development	**East**	316301.2868	**Depth Range**	3.2m to 9.1m BEGL		
Location	1 Veno Street,Heathcote, NSW	**North**	6226591.4992	**Contractor**	Geosense Drilling & Engineering Pty Ltd		
Position	See Figure 2	**Surface RL**	≈ 188.00m	**Drill Rig**	Comacchio Geo 205		
Job No.	E26160.G03	**Inclination**	-90°	**Logged**	KP	**Date**	17/10/2023
Client	Duffy Kennedy Constructions	**Box**	1 & 2 of 2	**Checked**	JS	**Date**	07/11/2023

BOREHOLE LOG

BH ID: BH4

Location	1 Veno Street, Heathcote, NSW	**Started**	18 October 2023
Client	Duffy Kennedy Constructions	**Completed**	18 October 2023
Job No.	E26160.G03	**Logged By**	KP **Date** 18 October 2023
Sheets	1 of 2	**Review By**	JS **Date** 07 November 2023
Drilling Contractor	Geosense Drilling and Engineering Pty Ltd	**Surface RL**	≈189.70 m (AHD)
Plant	Comacchio Geo 205	**Inclination**	90°
Northing	6226561.9038 (MGA 2020 Zone 56)		
Easting	316300.0181 (MGA 2020 Zone 56)		

METHOD	GROUND WATER LEVELS	SAMPLES & FIELD TESTS	SAMPLE RECOVERY	DEPTH (m)	GRAPHIC LOG	RL (m AHD)	MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY / REL. DENSITY	MATERIAL ORIGIN & OBSERVATIONS
AD/T	GWNE	BH4_0.50-0.95 SPT 0.50-0.95 5,5,3 N=8		0.00		189.70	ASPHALT: 200mm thick	-	-	ASPHALT
				0.20		189.50	FILL: Clayey SAND: fine to medium grained, dark grey traced with fine to coarse, sub-angular to sub-rounded gravels	M	-	FILL
				0.60		189.10	Silty CLAY: medium plasticity, orange mottled red, trace with fine to medium, angular to sub-angular indurated gravels		F	RESIDUAL SOIL
		BH4_1.50-1.69 SPT 1.50-1.69 8,5/40 mm N=R		1.50		188.20	From 1.50m, grading into extremely weathered Sandstone	M < PL	H	
				2.40		187.30	*Log continued on next page.*			

BOREHOLE CORE LOG

BH ID: BH4

Location	1 Veno Street, Heathcote, NSW			**Started**	18 October 2023
Client	Duffy Kennedy Constructions			**Completed**	18 October 2023
Job No.	E26160.G03			**Logged By**	KP **Date** 18 October 2023
Sheets	2 of 2			**Review By**	JS **Date** 07 November 2023
Drilling Contractor	Geosense Drilling and Engineering Pty Ltd	**Surface RL**	≈189.70 m (AHD)	**Northing**	6226561.9038 (MGA 2020 Zone 56)
Plant	Comacchio Geo 205	**Inclination**	90°	**Easting**	316300.0181 (MGA 2020 Zone 56)

METHOD	Flush Return	TCR %	RQD %	DEPTH (m)	GRAPHIC LOG	RL (m AHD)	MATERIAL DESCRIPTION	WEATHERING	ESTIMATED STRENGTH Is(50) ▼ - Axial ▽ - Diametral (VL 0-1, L 0-3, M 1, H 3, VH 10, EH)	DISCONTINUITIES & ADDITIONAL DATA	FRACTURE SPACING (30, 100, 300, 1000, 3000)
				0			*Log continued from previous page.*				
				1							
				2							
NMLC	95%	88	48	2.68		187.02	SANDSTONE: fine to medium grained, dark red / orange-pale grey, thinly bedded	DW		2.59: JT 35° PR RO Fe SN 2.65-2.68: XWS clay	
				3		186.67	NO CORE: 350mm thick	-			
				3.03			SANDSTONE: fine to medium grained, dark red / orange-pale grey, thinly to medium bedded			3.20-3.22: CS 3.22-3.24: XWS clay 3.33-3.35: XWS clay 3.54-3.74: XWZ clay	
				4				DW		3.83-3.87: XWS clay	
										4.43: JT UN RO Fe SN	
										4.74: JT 5° PR RO Fe SN 4.87-4.89: XWS clay	
				5.00		184.70	From 5.00m, pale grey with siltstone laminations				
				6							
		100	89							6.43: JT 10° CU RO OP	
				7				FR			
										7.72-7.74: CS	
				8						8.21-8.22: CS 8.35: JT 5° CU RO Fe SN 8.50: JT 5° PR RO CN 8.58-8.59: Clay seam	
		100	57	8.75		180.95	From 8.75m, orange brown				
				9		180.51	Terminated at 9.19m. Target Depth Reached.				
				10							

CORE PHOTOGRAPH OF BOREHOLE: BH4

Project	Proposed Mixed Use Development	**East**	316300.0181	**Depth Range**	2.4m to 9.19m BEGL		
Location	1 Veno Street,Heathcote, NSW	**North**	6226561.9038	**Contractor**	Geosense Drilling & Engineering Pty Ltd		
Position	See Figure 2	**Surface RL**	≈ 189.7m	**Drill Rig**	Comacchio Geo 205		
Job No.	E26160.G03	**Inclination**	-90°	**Logged**	KP	**Date**	18/10/2023
Client	Duffy Kennedy Constructions	**Box**	1 & 2 of 2	**Checked**	JS	**Date**	07/11/2023

BOREHOLE LOG

BH ID: BH5

Location	1 Veno Street, Heathcote, NSW	**Started**	16 October 2023
Client	Duffy Kennedy Constructions	**Completed**	17 October 2023
Job No.	E26160.G03	**Logged By**	KP **Date** 17 October 2023
Sheets	1 of 2	**Review By**	JS **Date** 07 November 2023
Drilling Contractor	Geosense Drilling and Engineering Pty Ltd	**Surface RL**	≈190.40 m (AHD)
Plant	Comacchio Geo 205	**Inclination**	90°
Northing	6226559.0172 (MGA 2020 Zone 56)		
Easting	316278.2197 (MGA 2020 Zone 56)		

METHOD	GROUND WATER LEVELS	SAMPLES & FIELD TESTS	SAMPLE RECOVERY	DEPTH (m)	GRAPHIC LOG	RL (m AHD)	MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY / REL. DENSITY	MATERIAL ORIGIN & OBSERVATIONS
AD/T	GWNE	BH5_1.50-1.65 SPT 1.50-1.65 21/150 mm HB N=R		0 0.00		190.40	ASPHALT: 200mm thick	-	-	ASPHALT
				0.20		190.20	FILL: Clayey SAND: fine grained, pale brown, trace with fine to medium, sub-angular to angular gravels	D	-	FILL
				0.50		189.90	Silty CLAY: medium plasticity, pale red, trace with fine to medium, sub-angular to angular indurated gravels	M < PL	St	RESIDUAL SOIL The soil appears to be firm to stiff
				0.80		189.60	From 0.80m, Grading into weathered Sandstone			
				1.50		188.90	SANDSTONE: fine to medium grained, red/pale, extremely weathered, very low strength	-	-	WEATHERED ROCK
				2.54		187.86	*Log continued on next page.*			

BOREHOLE CORE LOG

BH ID: BH5

Location	1 Veno Street, Heathcote, NSW			**Started**	16 October 2023
Client	Duffy Kennedy Constructions			**Completed**	17 October 2023
Job No.	E26160.G03			**Logged By**	KP **Date** 17 October 2023
Sheets	2 of 2			**Review By**	JS **Date** 07 November 2023
Drilling Contractor	Geosense Drilling and Engineering Pty Ltd	**Surface RL**	≈190.40 m (AHD)	**Northing**	6226559.0172 (MGA 2020 Zone 56)
Plant	Comacchio Geo 205	**Inclination**	90°	**Easting**	316278.2197 (MGA 2020 Zone 56)

METHOD	Flush Return	TCR %	RQD %	DEPTH (m)	GRAPHIC LOG	RL (m AHD)	MATERIAL DESCRIPTION	WEATHERING	ESTIMATED STRENGTH Is(50) ▼ - Axial ▽ - Diametral (VL 0-1, L 0-3, M 1, H 3, VH 10, EH)	DISCONTINUITIES & ADDITIONAL DATA	FRACTURE SPACING (30, 100, 300, 1000, 3000)
				0			*Log continued from previous page.*				
NMLC	80%	100	62	3			SANDSTONE: fine to medium grained, red-pale grey, thinly bedded	DW		2.62-2.70: CS 2.74-2.76: XWS clay 2.77-2.79: XWS 2.84: JT 20° UN RO CN 2.85-2.90: XWS 2.85: Manual break 3.16-3.17: IS clay 3.23-3.24: IS clay 3.66-3.69: XWS 3.73-3.79: XWS 4.04: JT 15° UN RO CN 4.23-4.26: XWS clay 4.55: JT 5° ST RO OP	
	70%	100	91	5.50		184.90	From 5.50m, pale grey, siltstone laminations, thinly to medium bedded	SW			
	60%	100	95	9		181.37	Terminated at 9.03m. Target Depth Reached.	FR		6.66: JT 10° PR RO CN 7.18: JT PR RO OP 7.22: JT 2° ST RO OP 8.24: JT PR RO CN 8.57: JT PR RO OP	

CORE PHOTOGRAPH OF BOREHOLE: BH5

Project	Proposed Mixed Use Development	**East**	316278.2197	**Depth Range**	2.54m to 9.03m BEGL		
Location	1 Veno Street,Heathcote, NSW	**North**	6226559.0172	**Contractor**	Geosense Drilling & Engineering Pty Ltd		
Position	See Figure 2	**Surface RL**	≈ 190.4m	**Drill Rig**	Comacchio Geo 205		
Job No.	E26160.G03	**Inclination**	-90°	**Logged**	KP	**Date**	17/10/2023
Client	Duffy Kennedy Constructions	**Box**	1 & 2 of 2	**Checked**	JS	**Date**	07/11/2023

BOREHOLE LOG

BH ID: BH6

Location	1 Veno Street, Heathcote, NSW			**Started**	18 October 2023
Client	Duffy Kennedy Constructions			**Completed**	18 October 2023
Job No.	E26160.G03			**Logged By**	KP **Date** 18 October 2023
Sheets	1 of 3			**Review By**	JS **Date** 07 November 2023
Drilling Contractor	Geosense Drilling and Engineering Pty Ltd	**Surface RL**	≈190.00 m (AHD)	**Northing**	6226546.5107 (MGA 2020 Zone 56)
Plant	Comacchio Geo 205	**Inclination**	90°	**Easting**	316329.2122 (MGA 2020 Zone 56)

METHOD	GROUND WATER LEVELS	SAMPLES & FIELD TESTS	SAMPLE RECOVERY	DEPTH (m)	GRAPHIC LOG	RL (m AHD)	MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY / REL. DENSITY	MATERIAL ORIGIN & OBSERVATIONS
AD/T	GWNE	BH6_0.50-0.95 SPT 0.50-0.95 4,5,8 N=13		0.00		190.00	ASPHALT: 200mm thick	-	-	ASPHALT
				0.20		189.80	FILL: Silty CLAY: low plasticity, brown	M	-	FILL
				0.40		189.60	Gravelly CLAY: medium plasticity, pale brown trace with fine to medium, angular to sub-angular indurated gravels	M < PL	St	RESIDUAL SOIL
		BH6_1.50-1.95 SPT 1.50-1.95 7,14,11 N=25		1.00		189.00	Silty CLAY: medium plasticity, pale grey-mottled red	M < PL	VSt	
		BH6_3.00-3.08 SPT 3.00-3.08 6/80 mm HB N=R		3.00		187.00	From 3.00m, grading into extremely weathered Sandstone		H	
				3.70		186.30	*Log continued on next page.*			

BOREHOLE CORE LOG

BH ID: BH6

Location	1 Veno Street, Heathcote, NSW			**Started**	18 October 2023
Client	Duffy Kennedy Constructions			**Completed**	18 October 2023
Job No.	E26160.G03			**Logged By**	KP **Date** 18 October 2023
Sheets	2 of 3			**Review By**	JS **Date** 07 November 2023
Drilling Contractor	Geosense Drilling and Engineering Pty Ltd	**Surface RL**	≈190.00 m (AHD)	**Northing**	6226546.5107 (MGA 2020 Zone 56)
Plant	Comacchio Geo 205	**Inclination**	90°	**Easting**	316329.2122 (MGA 2020 Zone 56)

METHOD	Flush Return	TCR %	RQD %	DEPTH (m)	GRAPHIC LOG	RL (m AHD)	MATERIAL DESCRIPTION	WEATHERING	ESTIMATED STRENGTH Is(50) ▼ - Axial ▽ - Diametral (VL 0-1, L 0-3, M 1, H 3, VH 10, EH)	DISCONTINUITIES & ADDITIONAL DATA	FRACTURE SPACING (30, 100, 300, 1000, 3000)
				0			*Log continued from previous page.*				
				1							
				2							
				3							
NMLC	90%	100	24	4			SANDSTONE: fine to medium grained, dark red-pale grey, very thinly to thinly bedded	DW		3.93-3.95: XWS clay 3.96-4.00: XWS clay 4.04-4.06: XWS clay 4.07-4.12: XWS clay 4.15: JT 10° UN RO Fe SN 4.22-4.28: CS 4.42: JT 75° PR RO clay Fe SN 4.56: JT 80° IR RO Fe SN 4.59-4.66: XWS	
				4.78		185.22					
				5			NO CORE: 310mm thick	-			
				5.09		184.91					
		87	58				SANDSTONE: fine to medium grained, orange / pale grey, thinly bedded	SW		5.24-5.25: clay seam 5.32-5.33: clay seam 5.52-5.54: XWS clay 5.66: JT 5° CU RO OP	
				5.75		184.25					
				6			SANDSTONE: pale grey with siltstone lamination, thinly to medium bedded			5.80: JT 5° CU RO OP 6.47: JT 5° PR RO OP 6.53: JT CU RO Clay VN	
				7							
				8				FR			
		100	87	9						8.59: JT PR RO CN	
				10		180.00	Terminated at 10.00m. Target Depth Reached.			9.67-9.69: XWS clay	

CORE PHOTOGRAPH OF BOREHOLE: BH6

Project	Proposed Mixed Use Development	**East**	316329.2122	**Depth Range**	3.70m to 10.00m BEGL		
Location	1 Veno Street,Heathcote, NSW	**North**	6226546.5107	**Contractor**	Geosense Drilling & Engineering Pty Ltd		
Position	See Figure 2	**Surface RL**	≈ 190.00m	**Drill Rig**	Comacchio Geo 205		
Job No.	E26160.G03	**Inclination**	-90°	**Logged**	KP	**Date**	18/10/2023
Client	Duffy Kennedy Constructions	**Box**	1 & 2 of 2	**Checked**	JS	**Date**	07/11/2023

BOREHOLE LOG

BH ID: BH7M

Location	1 Veno Street, Heathcote, NSW			**Started**	18 October 2023	
Client	Duffy Kennedy Constructions			**Completed**	18 October 2023	
Job No.	E26160.G03			**Logged By**	KP	**Date** 18 October 2023
Sheets	1 of 2			**Review By**	JS	**Date** 07 November 2023
Drilling Contractor	Macquarie Drilling Pty Ltd	**Surface RL**	≈190.90 m (AHD)	**Northing**	6226529.1240 (MGA 2020 Zone 56)	
Plant	Edson 100 series	**Inclination**	90°	**Easting**	316351.9833 (MGA 2020 Zone 56)	

METHOD	GROUND WATER LEVELS	SAMPLES & FIELD TESTS	SAMPLE RECOVERY	DEPTH (m)	GRAPHIC LOG	RL (m AHD)	MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY / REL. DENSITY	MATERIAL ORIGIN & OBSERVATIONS
AD/T	GWNE			0.00		190.90	ASPHALT: 200mm thick	-	-	ASPHALT
				0.20		190.70	FILL: Silty CLAY: low plasticity, brown, trace with fine to coarse, angular to sub-angular gravels	M	-	FILL
		BH7M_0.50-0.95 SPT 0.50-0.95 4,6,11 N=17		0.50		190.40	Silty CLAY: medium plasticity, orange brown-mottled red trace with fine to coarse, angular to sub-angular indurated gravels	M < PL	VSt	RESIDUAL SOIL
		BH7M_1.50-1.95 SPT 1.50-1.95 5,11,16 N=27		1.50		189.40	From 1.50m, pale grey mottled red			
		BH7M_3.00-3.24 SPT 3.00-3.24 11,7/90 mm HB N=R		3.00		187.90	From 3.00m, grey-red, grading into weathered Sandstone		H	
				4.10		186.80	*Log continued on next page.*			

BOREHOLE CORE LOG

BH ID: BH7M

Location	1 Veno Street, Heathcote, NSW			**Started**	18 October 2023
Client	Duffy Kennedy Constructions			**Completed**	18 October 2023
Job No.	E26160.G03			**Logged By**	KP **Date** 18 October 2023
Sheets	2 of 2			**Review By**	JS **Date** 07 November 2023
Drilling Contractor	Macquarie Drilling Pty Ltd	**Surface RL**	≈190.90 m (AHD)	**Northing**	6226529.1240 (MGA 2020 Zone 56)
Plant	Edson 100 series	**Inclination**	90°	**Easting**	316351.9833 (MGA 2020 Zone 56)

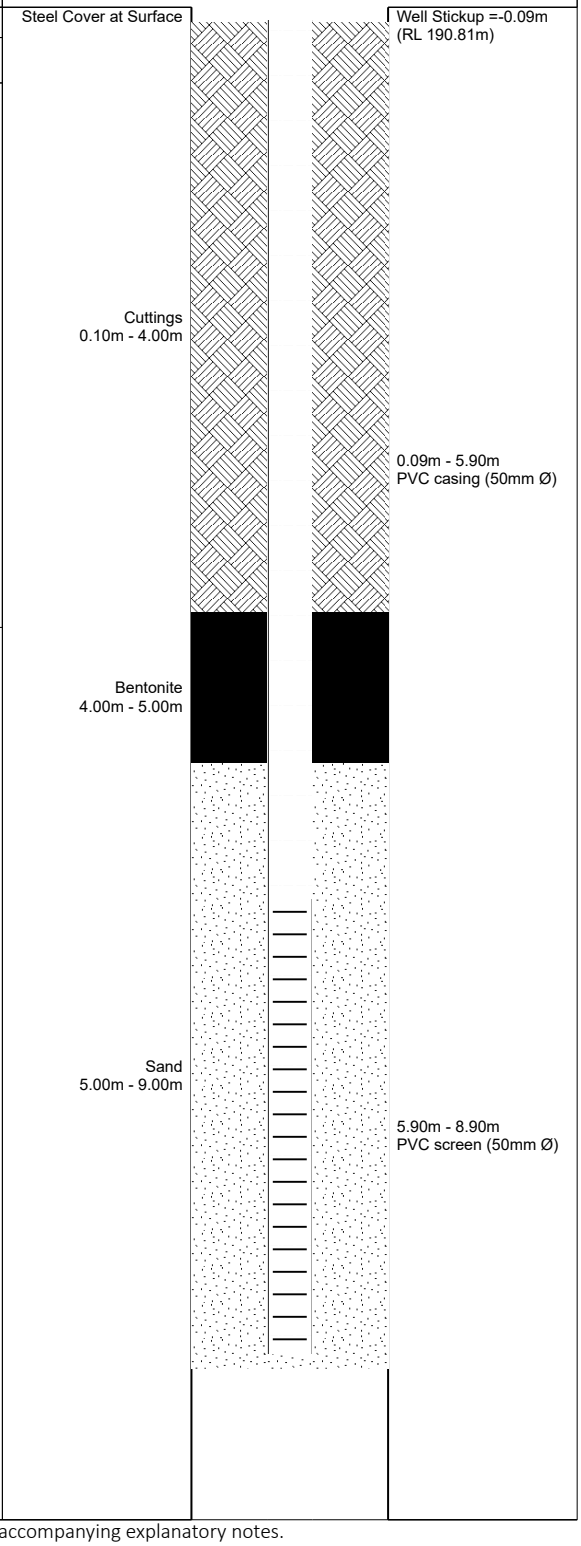
METHOD	Flush Return	TCR %	RQD %	DEPTH (m)	RL (m AHD)	MATERIAL DESCRIPTION	WEATHERING	ESTIMATED STRENGTH Is(50) ▼ - Axial ▽ - Diametral	DISCONTINUITIES & ADDITIONAL DATA	FRACTURE SPACING
				0		*Log continued from previous page.*				
				1						
				2						
				3						
				4						
NMLC	95%	100	57	5		SANDSTONE: fine to medium grained, orange red-pale grey thinly to medium bedded	SW		4.20: JT 15° PR RO CN	
				5.40	185.50	SANDSTONE: pale grey, medium bedded	FR		5.65: BP PR RO clay Fe SN 5.86-5.89: CS	
				6						
				7					6.58: BP PR RO clay Fe SN 6.75: BP PR RO OP	
		100	100	8						
				9	181.90	Terminated at 9.00m. Target Depth Reached.				
				10						

MONITORING WELL LOG

BH ID: BH7M

Location	1 Veno Street, Heathcote, NSW			**Started**	18 October 2023
Client	Duffy Kennedy Constructions			**Completed**	18 October 2023
Job No.	E26160.G03			**Logged By**	KP **Date** 18 October 2023
Sheets	1 of 1			**Review By**	JS **Date** 07 November 2023
Drilling Contractor	Macquarie Drilling Pty Ltd	**Surface RL**	≈190.90 m (AHD)	**Northing**	6226529.1240 (MGA 2020 Zone 56)
Plant	Edson 100 series	**Inclination**	90°	**Easting**	316351.9833 (MGA 2020 Zone 56)

WATER	SAMPLES & FIELD TESTS	DEPTH (m)	RL (m AHD)	MATERIAL DESCRIPTION	MOISTURE CONDITION
GWNE		0.00	190.9	ASPHALT: 200mm thick	-
		0.20	190.7	FILL: Silty CLAY: low plasticity, brown, trace with fine to coarse, angular to sub-angular gravels	M
	BH7M_0.50-0.95 SPT 0.50-0.95 4,6,11 N=17	0.50	190.4	Silty CLAY: medium plasticity, orange brown-mottled red trace with fine to coarse, angular to sub-angular indurated gravels	
	BH7M_1.50-1.95 SPT 1.50-1.95 5,11,16 N=27	1.50	189.4	From 1.50m, pale grey mottled red	M < PL
	BH7M_3.00-3.24 SPT 3.00-3.24 11,7/90 mm HB N=R	3.00	187.9	From 3.00m, grey-red, grading into weathered Sandstone	
95%		4.10	186.8	SANDSTONE: fine to medium grained, orange red-pale grey thinly to medium bedded	
		5.40	185.5	SANDSTONE: pale grey, medium bedded	
		9	181.9	Terminated at 9.00m. Target Depth Reached.	



CORE PHOTOGRAPH OF BOREHOLE: BH7M

Project	Proposed Mixed Use Development	**East**	316351.9833	**Depth Range**	4.1m to 9.00m BEGL		
Location	1 Veno Street,Heathcote, NSW	**North**	6226529.1240	**Contractor**	Macquarie Drilling Pty Ltd		
Position	See Figure 2	**Surface RL**	≈ 190.9m	**Drill Rig**	Edson 100 Series		
Job No.	E26160.G03	**Inclination**	-90°	**Logged**	KP	**Date**	18/10/2023
Client	Duffy Kennedy Constructions	**Box**	1 & 2 of 2	**Checked**	JS	**Date**	07/11/2023

BOREHOLE LOG

BH ID: BH8

Location	1 Veno Street, Heathcote, NSW			**Started**	20 October 2023
Client	Duffy Kennedy Constructions			**Completed**	20 October 2023
Job No.	E26160.G03			**Logged By**	KP **Date** 20 October 2023
Sheets	1 of 2			**Review By**	JS **Date** 07 November 2023
Drilling Contractor	Geosense Drilling and Engineering Pty Ltd	**Surface RL**	≈190.90 m (AHD)	**Northing**	6226518.8532 (MGA 2020 Zone 56)
Plant	Comacchio Geo 205	**Inclination**	90°	**Easting**	316305.2038 (MGA 2020 Zone 56)

METHOD	GROUND WATER LEVELS	SAMPLES & FIELD TESTS	SAMPLE RECOVERY	DEPTH (m)	GRAPHIC LOG	RL (m AHD)	MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY / REL. DENSITY	MATERIAL ORIGIN & OBSERVATIONS
AD/T	▽			0.00		190.90	ASPHALT: 200mm thick	-	-	ASPHALT
				0.20		190.70	Silty CLAY: medium plasticity, pale grey mottled red	M < PL	St	RESIDUAL SOIL The soil appears to be stiff to very stiff
				1.50		189.40	From 1.50m, medium plasticity, trace with fine to coarse, angular to sub-angular indurated gravels		VSt	
				3.00		187.90	From 3.00m, grading weathered Sandstone			
				3.20		187.70	SANDSTONE: fine to medium grained, pale grey / red, very low strength, extremely weathered sandstone	-	-	WEATHERED ROCK
				3.79		187.11	*Log continued on next page.*			

BOREHOLE CORE LOG

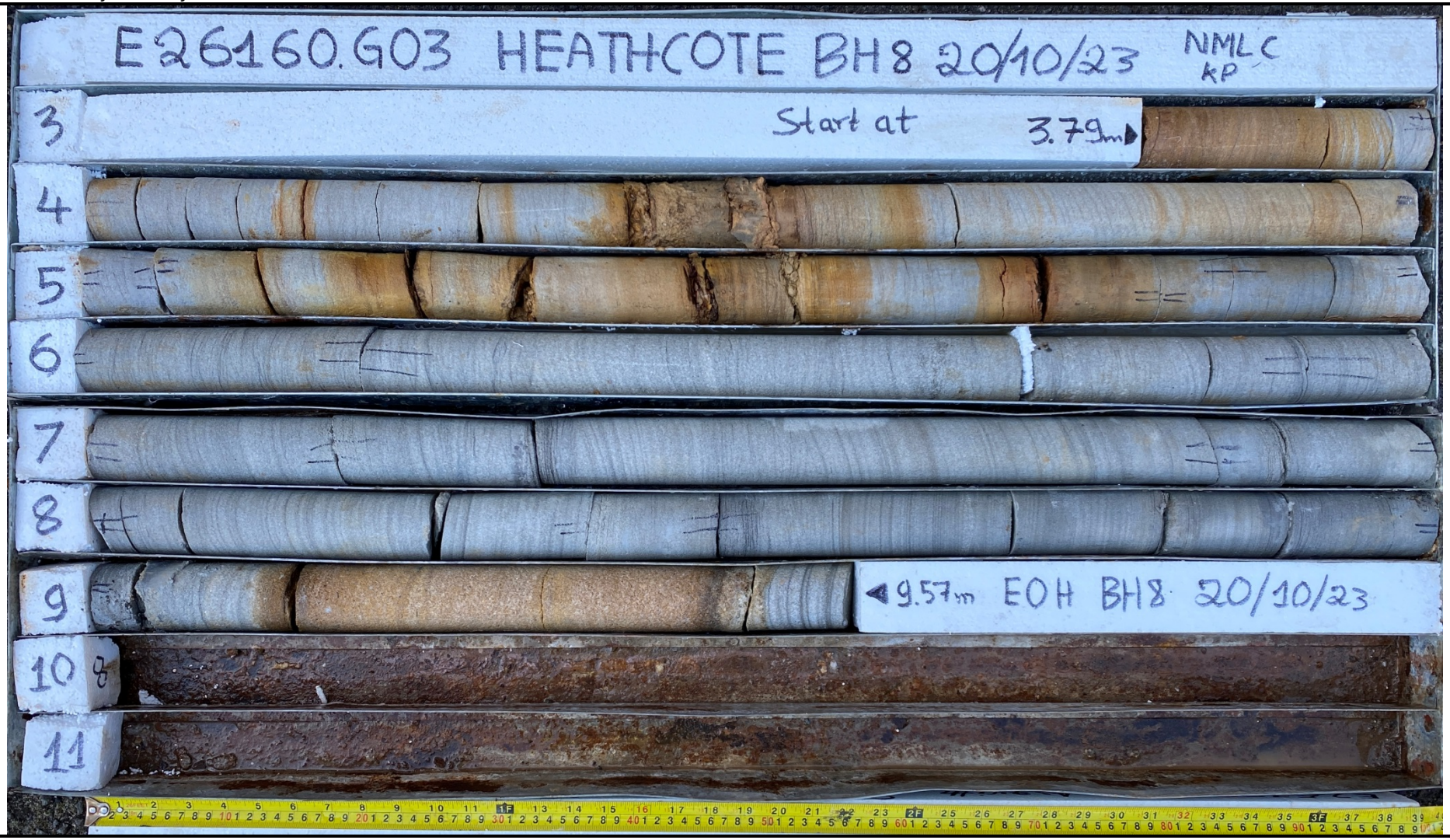
BH ID: BH8

Location	1 Veno Street, Heathcote, NSW			**Started**	20 October 2023
Client	Duffy Kennedy Constructions			**Completed**	20 October 2023
Job No.	E26160.G03			**Logged By**	KP **Date** 20 October 2023
Sheets	2 of 2			**Review By**	JS **Date** 07 November 2023
Drilling Contractor	Geosense Drilling and Engineering Pty Ltd	**Surface RL**	≈190.90 m (AHD)	**Northing**	6226518.8532 (MGA 2020 Zone 56)
Plant	Comacchio Geo 205	**Inclination**	90°	**Easting**	316305.2038 (MGA 2020 Zone 56)

METHOD	Flush Return	TCR %	RQD %	DEPTH (m)	GRAPHIC LOG	RL (m AHD)	MATERIAL DESCRIPTION	WEATHERING	ESTIMATED STRENGTH Is(50) ▼ - Axial ▽ - Diametral (VL 0-1, L 0-3, M 1, H 3, VH 10, EH)	DISCONTINUITIES & ADDITIONAL DATA	FRACTURE SPACING (30, 100, 300, 1000, 3000)
				0			*Log continued from previous page.*				
				1							
				2							
				3							
NMLC	80%	100	81	4			SANDSTONE: fine to medium grained, orange brown / pale grey, thinly bedded	SW		4.30: BP CU RO OP 4.40-4.51: XWZ clay 4.64: JT 10° PR RO CN	
				5						5.24: JT 10° PR RO Fe SN 5.32: JT 15° PR RO clay OP 5.44-5.46: CS 5.52-5.53: CS 5.68: JT UN RO Fe SN 5.71: JT 5° CU RO OP	
				5.80		185.10	From 5.80m, pale grey, medium bedded with siltstone laminations				
				6							
				7				FR			
		100	95	8						7.88: JT PR RO Clay VN 8.26: JT 5° IR RO OP	
				9						8.80: BP 5° PR RO Clay VN 9.05-9.07: XWS clay 9.15: JT CU RO OP	
				9.13		181.77	From 9.13m, orange brown				
						181.33	Terminated at 9.57m. Target Depth Reached.			9.48: JT 5° PR RO CN	
				10							

CORE PHOTOGRAPH OF BOREHOLE: BH8

Project	Proposed Mixed Use Development	**East**	316305.2038	**Depth Range**	3.79m to 9.57m BEGL		
Location	1 Veno Street,Heathcote, NSW	**North**	6226518.8532	**Contractor**	Geosense Drilling & Engineering Pty Ltd		
Position	See Figure 2	**Surface RL**	≈ 190.9m	**Drill Rig**	Comacchio Geo 205		
Job No.	E26160.G03	**Inclination**	-90°	**Logged**	KP	**Date**	20/10/2023
Client	Duffy Kennedy Constructions	**Box**	1 & 2 of 2	**Checked**	JS	**Date**	07/11/2023



BOREHOLE LOG

BH ID: BH9M

Location	1 Veno Street, Heathcote, NSW	**Started**	19 October 2023
Client	Duffy Kennedy Constructions	**Completed**	19 October 2023
Job No.	E26160.G03	**Logged By**	KP **Date** 19 October 2023
Sheets	1 of 3	**Review By**	JS **Date** 07 November 2023
Drilling Contractor	Geosense Drilling and Engineering Pty Ltd	**Surface RL**	≈191.90 m (AHD)
Plant	Comacchio Geo 205	**Inclination**	90°
Northing	6226511.5868 (MGA 2020 Zone 56)		
Easting	316331.0335 (MGA 2020 Zone 56)		

METHOD	GROUND WATER LEVELS	SAMPLES & FIELD TESTS	SAMPLE RECOVERY	DEPTH (m)	GRAPHIC LOG	RL (m AHD)	MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY / REL. DENSITY	MATERIAL ORIGIN & OBSERVATIONS
AD/T	▽	BH9_0.50-0.95 SPT 0.50-0.95 4,5,10 N=15		0.00		191.90	ASPHALT: 200mm thick	-	-	ASPHALT
				0.20		191.70	FILL: Silty CLAY: low plasticity, brown, trace with fine to medium, angular to sub-angular gravels	M	-	FILL
				0.40		191.50	Silty CLAY: medium plasticity, orange brown, trace with fine to medium, angular to sub-angular gravels	M < PL	St	RESIDUAL SOIL
				0.50		191.40	From 0.50m, trace with medium to coarse, angular to sub-angular indurated gravels			
				1.00		190.90	From 1.00m, pale grey mottled red			
		BH9_1.50-1.81 SPT 1.50-1.81 11,11,3/10 mm HB N=R		1.50		190.40	From 1.50m, red, grading into weathered Sandstone		H	
		BH9_3.00-3.17 SPT 3.00-3.17 7,3/20 mm N=R		4.50		187.40	SANDSTONE: fine to medium grained, pale grey / orange brown, very low strength, extremely weathered sandstone	-	-	WEATHERED ROCK
		BH9_4.50-4.75 SPT 4.50-4.75 6,7/100 mm N=R		6.09		185.81	*Log continued on next page.*			

BOREHOLE CORE LOG

BH ID: BH9M

Location	1 Veno Street, Heathcote, NSW			**Started**	19 October 2023
Client	Duffy Kennedy Constructions			**Completed**	19 October 2023
Job No.	E26160.G03			**Logged By**	KP **Date** 19 October 2023
Sheets	2 of 3			**Review By**	JS **Date** 07 November 2023
Drilling Contractor	Geosense Drilling and Engineering Pty Ltd	**Surface RL**	≈191.90 m (AHD)	**Northing**	6226511.5868 (MGA 2020 Zone 56)
Plant	Comacchio Geo 205	**Inclination**	90°	**Easting**	316331.0335 (MGA 2020 Zone 56)

METHOD	Flush Return	TCR %	RQD %	DEPTH (m)	GRAPHIC LOG	RL (m AHD)	MATERIAL DESCRIPTION	WEATHERING	ESTIMATED STRENGTH Is(50) ▼ - Axial ▽ - Diametral (VL 0-1, L 0-3, M 1, H 3, VH 10, EH)	DISCONTINUITIES & ADDITIONAL DATA	FRACTURE SPACING (30, 100, 300, 1000, 3000)
				0			*Log continued from previous page.*				
				1							
				2							
				3							
				4							
				5							
				6							
NMLC	80%	100	72	7			SANDSTONE: fine to medium grained, pale grey with siltstone laminations, thinly bedded	FR		6.20: JT CU RO OP 6.64: JT CU RO OP 6.80-6.82: CS 7.29: JT 5° ST RO CN 7.67-7.71: CS	
	70%	100	57	8							
				8.40		183.50	From 8.40m, medium bedded				
				9						9.50: JT 10° PR RO CN 9.54: JT UN RO CN 9.80: JT PR RO OP 9.92: JT PR RO Clay VN	
				10		181.90	Terminated at 9.97m. Target Depth Reached.				

MONITORING WELL LOG

BH ID: BH9M

Location	1 Veno Street, Heathcote, NSW			**Started**	19 October 2023
Client	Duffy Kennedy Constructions			**Completed**	19 October 2023
Job No.	E26160.G03			**Logged By**	KP **Date** 19 October 2023
Sheets	1 of 2			**Review By**	JS **Date** 07 November 2023
Drilling Contractor	Geosense Drilling and Engineering Pty Ltd	**Surface RL**	≈191.90 m (AHD)	**Northing**	6226511.5868 (MGA 2020 Zone 56)
Plant	Comacchio Geo 205	**Inclination**	90°	**Easting**	316331.0335 (MGA 2020 Zone 56)

WATER	SAMPLES & FIELD TESTS	DEPTH (m)	RL (m AHD)	MATERIAL DESCRIPTION	MOISTURE CONDITION
		0.00	191.9	ASPHALT: 200mm thick	-
		0.20	191.7	FILL: Silty CLAY: low plasticity, brown, trace with fine to medium, angular to sub-angular gravels	M
	BH9_0.50-0.95 SPT 0.50-0.95 4,5,10 N=15	0.40 0.50	191.5 191.4	Silty CLAY: medium plasticity, orange brown, trace with fine to medium, angular to sub-angular gravels From 0.50m, trace with medium to coarse, angular to sub-angular indurated gravels	
		1.00	190.9	From 1.00m, pale grey mottled red	
	BH9_1.50-1.81 SPT 1.50-1.81 11,11,3/10 mm HB N=R	1.50	190.4	From 1.50m, red, grading into weathered Sandstone	M < PL
	BH9_3.00-3.17 SPT 3.00-3.17 7,3/20 mm N=R				
	BH9_4.50-4.75 SPT 4.50-4.75 6,7/100 mm N=R	4.50	187.4	SANDSTONE: fine to medium grained, pale grey / orange brown, very low strength, extremely weathered sandstone	-
80%		6.09	185.8	SANDSTONE: fine to medium grained, pale grey with siltstone laminations, thinly bedded	
70%		8.40	183.5	From 8.40m, medium bedded	
		10	181.9	Terminated at 9.97m. Target Depth Reached.	

BACKFILL DETAILS	STANDPIPE DETAILS
Steel Cover at Surface	Well Stickup =-0.09m (RL 191.81m)
Cuttings 0.00m - 1.90m	
Bentonite 1.90m - 2.40m	0.09m - 3.10m PVC casing (50mm Ø)
Sand 2.40m - 6.10m	3.10m - 6.10m PVC screen (50mm Ø)
Bentonite 6.10m - 6.30m	
Sand 6.30m - 9.97m	

CORE PHOTOGRAPH OF BOREHOLE: BH9M

Project	Proposed Mixed Use Development	**East**	316331.0335	**Depth Range**	6.09m to 9.97m BEGL		
Location	1 Veno Street,Heathcote, NSW	**North**	6226511.5868	**Contractor**	Geosense Drilling & Engineering Pty Ltd		
Position	See Figure 2	**Surface RL**	≈ 191.9m	**Drill Rig**	Comacchio Geo 205		
Job No.	E26160.G03	**Inclination**	-90°	**Logged**	KP	**Date**	19/10/2023
Client	Duffy Kennedy Constructions	**Box**	1 of 1	**Checked**	JS	**Date**	07/11/2023

BOREHOLE LOG

BH ID: BH10M

Location	1 Veno Street, Heathcote, NSW	**Started**	19 October 2023
Client	Duffy Kennedy Constructions	**Completed**	19 October 2023
Job No.	E26160.G03	**Logged By**	KP **Date** 19 October 2023
Sheets	1 of 2	**Review By**	JS **Date** 07 November 2023
Drilling Contractor	Geosense Drilling and Engineering Pty Ltd	**Surface RL**	≈191.40 m (AHD)
Plant	Comacchio Geo 205	**Inclination**	90°
Northing	6226519.3167 (MGA 2020 Zone 56)		
Easting	316278.7709 (MGA 2020 Zone 56)		

METHOD	GROUND WATER LEVELS	SAMPLES & FIELD TESTS	SAMPLE RECOVERY	DEPTH (m)	GRAPHIC LOG	RL (m AHD)	MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY / REL. DENSITY	MATERIAL ORIGIN & OBSERVATIONS
AD/T	▷			0.00		191.40	ASPHALT: 200mm thick	-	-	ASPHALT
				0.20		191.20	FILL: Clayey SAND: fine to medium grained, brown	M	-	FILL
		BH10_0.50-0.95 SPT 0.50-0.95 3,3,5 N=8		0.40		191.00	Silty CLAY: medium plasticity, orange brown-pale grey mottled red trace with fine to medium, angular to sub-angular indurated gravels	M < PL	F	RESIDUAL SOIL
		BH10_1.50-1.82 SPT 1.50-1.82 6,12,3/20 mm HB N=R		1.50		189.90	From 1.50m, grey / red, grading into extremely weathered Sandstone		H	
		BH10_3.00-3.30 SPT 3.00-3.30 10,19/150 mm N=R								
		BH10_4.50-4.65 SPT 4.50-4.65 20/150 mm HB N=R		4.50		186.90	SANDSTONE: fine to medium grained, orange brown, extremely low to very low strength	-	-	WEATHERED ROCK
				5.45		185.95	*Log continued on next page.*			

BOREHOLE CORE LOG

BH ID: BH10M

Location	1 Veno Street, Heathcote, NSW			**Started**	19 October 2023
Client	Duffy Kennedy Constructions			**Completed**	19 October 2023
Job No.	E26160.G03			**Logged By**	KP **Date** 19 October 2023
Sheets	2 of 2			**Review By**	JS **Date** 07 November 2023
Drilling Contractor	Geosense Drilling and Engineering Pty Ltd	**Surface RL**	≈191.40 m (AHD)	**Northing**	6226519.3167 (MGA 2020 Zone 56)
Plant	Comacchio Geo 205	**Inclination**	90°	**Easting**	316278.7709 (MGA 2020 Zone 56)

METHOD	Flush Return	TCR %	RQD %	DEPTH (m)	GRAPHIC LOG	RL (m AHD)	MATERIAL DESCRIPTION	WEATHERING	ESTIMATED STRENGTH Is(50) ▼ - Axial ▽ - Diametral (VL 0-1, L 0-3, M 1, H 3, VH 10, EH)	DISCONTINUITIES & ADDITIONAL DATA	FRACTURE SPACING (30, 100, 300, 1000, 3000)
				0			*Log continued from previous page.*				
				1							
				2							
				3							
				4							
				5							
NMLC	95%	100	81	5.82		185.58	SANDSTONE: fine to medium grained, orange brown, thinly bedded	SW			
				6			From 5.82m, pale grey with siltstone laminations, thinly to medium bedded			6.15-6.16: Clay seam	
				7						6.73: JT CU RO OP	
				7.40		184.00	From 7.40m, thinly bedded	FR		7.41: JT CU RO OP 7.50: BP PR RO Clay VN 7.73: JT ST RO CN 7.91-7.93: XWS clay	
		100	61	8							
				9		182.40	Terminated at 9.00m. Target Depth Reached.				
				10							

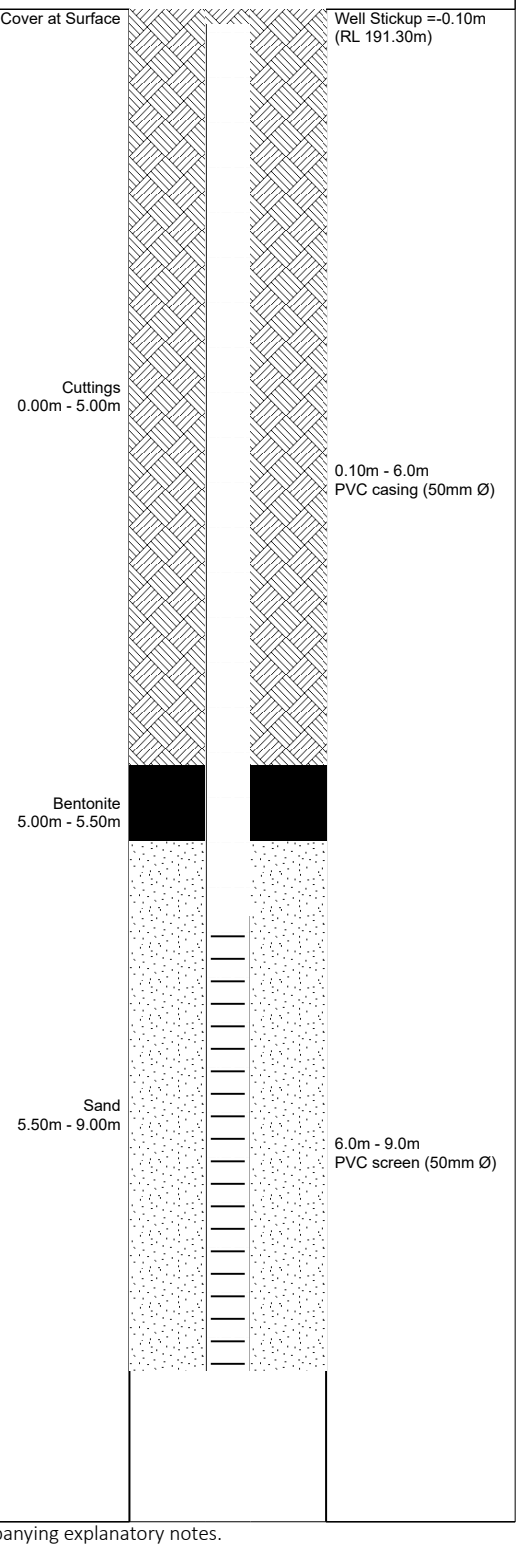
MONITORING WELL LOG

BH ID: BH10M

Location	1 Veno Street, Heathcote, NSW	**Started**	19 October 2023		
Client	Duffy Kennedy Constructions	**Completed**	19 October 2023		
Job No.	E26160.G03	**Logged By**	KP	**Date**	19 October 2023
Sheets	1 of 1	**Review By**	JS	**Date**	07 November 2023

Drilling Contractor	Geosense Drilling and Engineering Pty Ltd	**Surface RL**	≈191.40 m (AHD)	**Northing**	6226519.3167 (MGA 2020 Zone 56)
Plant	Comacchio Geo 205	**Inclination**	90°	**Easting**	316278.7709 (MGA 2020 Zone 56)

WATER	SAMPLES & FIELD TESTS	DEPTH (m)	RL (m AHD)	MATERIAL DESCRIPTION	MOISTURE CONDITION
		0.00	191.40	ASPHALT: 200mm thick	-
		0.20	191.20	FILL: Clayey SAND: fine to medium grained, brown	M
	BH10_0.50-0.95 SPT 0.50-0.95 3,3,5 N=8	0.40	191.00	Silty CLAY: medium plasticity, orange brown-pale grey mottled red trace with fine to medium, angular to sub-angular indurated gravels	
	BH10_1.50-1.82 SPT 1.50-1.82 6,12,3/20 mm HB N=R	1.50	189.90	From 1.50m, grey / red, grading into extremely weathered Sandstone	M < PL
	BH10_3.00-3.30 SPT 3.00-3.30 10,19/150 mm N=R				
	BH10_4.50-4.65 SPT 4.50-4.65 20/150 mm HB N=R	4.50	186.90	SANDSTONE: fine to medium grained, orange brown, extremely low to very low strength	-
▷		5.45	185.95	SANDSTONE: fine to medium grained, orange brown, thinly bedded	
95%		5.82	185.58	From 5.82m, pale grey with siltstone laminations, thinly to medium bedded	
		7.40	184.00	From 7.40m, thinly bedded	
		9.00	182.40	Terminated at 9.00m. Target Depth Reached.	



CORE PHOTOGRAPH OF BOREHOLE: BH10M

Project	Proposed Mixed Use Development	**East**	316278.7709	**Depth Range**	5.45m to 9.00m BEGL		
Location	1 Veno Street,Heathcote, NSW	**North**	6226519.3167	**Contractor**	Geosense Drilling & Engineering Pty Ltd		
Position	See Figure 2	**Surface RL**	≈ 191.4m	**Drill Rig**	Comacchio Geo 205		
Job No.	E26160.G03	**Inclination**	-90°	**Logged**	KP	**Date**	20/10/2023
Client	Duffy Kennedy Constructions	**Box**	1 of 1	**Checked**	JS	**Date**	07/11/2023

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

DRILLING/EXCAVATION METHOD

HA	Hand Auger	**ADH**	Hollow Auger	**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
AD*	Auger Drilling	**RC**	Reverse Circulation	**HMLC**	Diamond Core - 63 mm
***V**	V-Bit	**PT**	Push Tube	**EX**	Tracked Hydraulic Excavator
***T**	TC-Bit, e.g. AD/T	**WB**	Washbore	**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, N is not reported
RW	Penetration occurred under the rod weight only, N<1
HW	Penetration occurred under the hammer and rod weight only, N<1
HB	Hammer double bouncing on anvil, N is not reported
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

GEOLOGICAL BOUNDARIES

———— = Observed Boundary (position known)

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

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

ROCK CORE RECOVERY

TCR=Total Core Recovery (%)

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

RQD = Rock Quality Designation (%)

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

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			

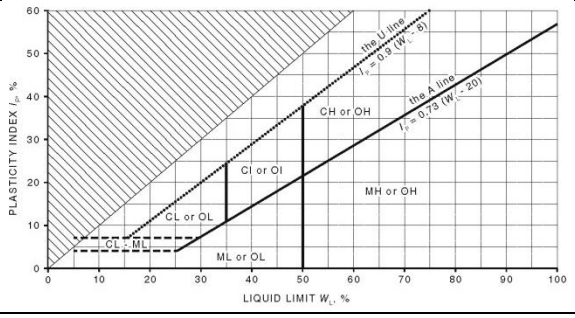
CLASSIFICATION AND INFERRED STRATIGRAPHY

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, no dry strength.
		GP	Poorly graded gravel and gravel-sand mixtures, little or no fines, no dry strength.
		GM	Silty gravel, gravel-sand-silt mixtures, zero to medium dry strength.
		GC	Clayey gravel, gravel-sand-clay mixtures, medium to high dry strength.
	SAND More than 50% of coarse fraction is <2.36 mm	SW	Well graded sand and gravelly sand, little or no fines, no dry strength.
		SP	Poorly graded sand and gravelly sand, little or no fines, no dry strength.
		SM	Silty sand, sand-silt mixtures, zero to medium dry strength.
		SC	Clayey sand, sandy-clay mixtures, medium to high dry strength.
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, zero to medium dry strength.
		CL, CI	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, medium to high dry strength.
		OL	Organic silts and organic silty clays of low plasticity, low to medium dry strength.
	Liquid Limit > than 50%	MH	Inorganic silts of high plasticity, high to very high dry strength.
		CH	Inorganic clays of high plasticity, high to very high dry strength.
		OH	Organic clays of medium to high plasticity, medium to high dry strength.
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, moisture content of the soil, and equipment type.

MINOR COMPONENTS

Term	Assessment Guide	Proportion by Mass
Add '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%
Add '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 soil name	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.

DETAILED ROCK DEFECT SPACING

Defect Spacing

Spacing/width (mm)	Descriptor	Symbol
<20	Extremely Close	EC
20-60	Very Close	VC
60-200	Close	C
200-600	Medium	M
600-2000	Wide	W
2000-6000	Very Wide	VW

Bedding Thickness (Stratification)

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.
Contact	CO	The surface between two types or ages of rock.
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.
Vein	VN	Distinct sheet-like body of minerals crystallised within rock through typically open-space filling or crack-seal growth.

NOTE: Defects size of <100mm SS, CS and XWS. Defects size of >100mm SZ, CZ and XWZ.

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	CL	Closed.
Open	OP	Without any infill material.
Infilled	-	Soil or rock i.e. clay, silt, talc, pyrite, quartz, etc.

Appendix B – Laboratory Certificates

STS GEOTECHNICS PTY LTD
CONSULTING GEOTECHNICAL ENGINEERS

STS Geotechnics Pty Ltd
14/1 Cowpasture Place, Wetherill Park NSW 2164
Phone: (02)9756 2166 | Email: enquiries@stsgeo.com.au

Moisture Content of Soil and Aggregate Samples

Project: E26160.G03, 1 Veno Street, HEATHCOTE, NSW — Project No.: 31380

Client: EI AUSTRALIA — Report No.: 23/3665

Address: Suite 6.01, 55 Miller Street, Pyrmont NSW 2009 — Report Date: 1/11/2023

Test Method: AS1289.2.1.1 — Page: 2 OF 2

Sampling Procedure: Samples Supplied By Client (Not covered under NATA Scope of Accreditation)

STS / Sample No.	8167D-L/1	8167D-L/2				
Sample Location	Borehole 3	Borehole 10M				
Material Description	Sandy Silty Clay, yellow brown (CI)	Silty Clay, red grey, trace of gravel/sand (CI)				
Depth (mm)	1.30 - 1.50	3.00 - 3.30				
Sample Date	22/10/2023	22/10/2023				
Moisture Content (%)	**11.9**	**17.0**				

Remarks:

Approved Signatory.....

Technician: DH — Orlando Mendoza - Laboratory Manager

STS GEOTECHNICS PTY LTD
CONSULTING GEOTECHNICAL ENGINEERS

STS Geotechnics Pty Ltd
14/1 Cowpasture Place, Wetherill Park NSW 2164
Phone: (02)9756 2166 | Email: enquiries@stsgeo.com.au

Atterberg Limits and Linear Shrinkage Report

Project: E26160.G03, 1 Veno Street, HEATHCOTE, NSW — Project No.: 31380

Client: EI AUSTRALIA — Report No.: 23/3665

Address: Suite 6.01, 55 Miller Street, Pyrmont NSW 2009 — Report Date: 1/11/2023

Test Method: AS1289.3.1.2,3.2.1,3.4.1,2.1.1 — Page: 1 OF 2

Sampling Procedure: Samples Supplied By Client (Not covered under NATA Scope of Accreditation)

STS / Sample No.	8167D-L/1	8167D-L/2				
Sample Location	Borehole 3	Borehole 10M				
Material Description	Sandy Silty CLAY, yellow brown (CI)	Silty CLAY, red grey, trace of gravel/sand (CI)				
Depth (m)	1.30 - 1.50	3.00 - 3.30				
Sample Date	22/10/2023	22/10/2023				
Sample History	Oven Dried	Oven Dried				
Method of Preparation	Dry Sieved	Dry Sieved				
Liquid Limit (%)	**44**	**37**				
Plastic Limit (%)	**17**	**17**				
Plasticity Index	**27**	**20**				
Linear Shrinkage (%)	**12.0**	**8.0**				
Mould Size (mm)	127	127				
Crumbing	N	N				
Curling	N	N				

Remarks:

Approved Signatory.....

Technician: AW

Orlando Mendoza - Laboratory Manager

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CONSULTING GEOTECHNICAL ENGINEERS

STS Geotechnics Pty Ltd
14/1 Cowpasture Place, Wetherill Park NSW 2164
Phone: (02)9756 2166 | Email: enquiries@stsgeo.com.au

NATA Accredited for Compliance with ISO/IEC 17025 - Testing No. 2750

Point Load Strength Index Report

Project: E26160.G03, 1 Veno Street, HEATHCOTE, NSW
Client: EI Australia
Address: Suite 6.01, 55 Miller St PYRMONT NSW
Test Method: AS 4133.4.1
Sampling Procedure: Samples Supplied By Client (Not covered under NATA Scope of Accreditation)

Project No.: 31380/8167D-L
Report No.: 23/3630
Report Date: 31/10/2023

Borehole / Sample No.	Depth (m)	Date Sampled	Date Tested	Test Type	Is (MPa)	$Is_{(50)}$ (MPa)	Rock Type	Failure Type	Moisture
BH1	3.81	22/10/2023	30/10/2023	A	**0.86**	**0.88**	SS	3	M
BH1	4.69	22/10/2023	30/10/2023	A	**0.93**	**0.94**	SS	3	M
BH1	5.43	22/10/2023	30/10/2023	A	**0.85**	**0.84**	SS	3	M
BH1	6.27	22/10/2023	30/10/2023	A	**1.8**	**1.9**	SS	3	M
BH1	6.85	22/10/2023	30/10/2023	A	**1.4**	**1.4**	SS	3	M
BH1	7.17	22/10/2023	30/10/2023	A	**1.9**	**2**	SS	3	M
BH1	7.79	22/10/2023	30/10/2023	A	**0.87**	**0.85**	SS	3	M
BH1	8.39	22/10/2023	30/10/2023	A	**1.1**	**1.1**	SS	3	M
BH1	8.86	22/10/2023	30/10/2023	A	**0.84**	**0.86**	SS	3	M
BH2M	2.80	22/10/2023	30/10/2023	A	**0.28**	**0.29**	SS	3	M
BH2M	3.19	22/10/2023	30/10/2023	A	**0.46**	**0.48**	SS	3	M
BH2M	3.87	22/10/2023	30/10/2023	A	**0.58**	**0.6**	SS	3	M
BH2M	4.20	22/10/2023	30/10/2023	A	**0.35**	**0.35**	SS	3	M
BH2M	5.66	22/10/2023	30/10/2023	A	**0.89**	**0.9**	SS	3	M
BH2M	6.17	22/10/2023	30/10/2023	A	**1.3**	**1.4**	SS	3	M
BH2M	7.70	22/10/2023	30/10/2023	A	**0.7**	**0.71**	SS	3	M
BH2M	8.37	22/10/2023	30/10/2023	A	**0.76**	**0.79**	SS	3	M
BH2M	8.82	22/10/2023	30/10/2023	A	**0.3**	**0.3**	SS	3	M
BH2M	9.07	22/10/2023	30/10/2023	A	**0.69**	**0.67**	SS	3	M

Failure Type
1 = Fracture through bedding or weak plane
2 = Fracture along bedding
3 = Fracture through rock mass
4 = Fracture influenced by natural defect or drilling
5 = Partial fracture or chip (invalid result)

Test Type
A = Axial
D = Diametrial
I = Irregular
C = Cube

Moisure Condition
W = Wet
M = Moist
D = Dry

Rock Type
SS = Sandstone
ST = Siltstone
SH = Shale
YS = Claystone
IG = Igneous

Remarks:

Approved Signatory.....
Fernando Velasquez Senior Geotechnician

Technician: FV

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STS Geotechnics Pty Ltd
14/1 Cowpasture Place, Wetherill Park NSW 2164
Phone: (02)9756 2166 | Email: enquiries@stsgeo.com.au

Point Load Strength Index Report

Project: E26160.G03, 1 Veno Street, HEATHCOTE, NSW
Client: EI Australia
Address: Suite 6.01, 55 Miller St PYRMONT NSW
Test Method: AS 4133.4.1
Sampling Procedure: Samples Supplied By Client (Not covered under NATA Scope of Accreditation)

Project No.: 31380/8167D-L
Report No.: 23/3630
Report Date: 31/10/2023

Borehole / Sample No.	Depth (m)	Date Sampled	Date Tested	Test Type	Is (MPa)	$Is_{(50)}$ (MPa)	Rock Type	Failure Type	Moisture
BH3	4.10	22/10/2023	30/10/2023	A	1	1	SS	3	M
BH3	4.68	22/10/2023	30/10/2023	A	0.99	1	SS	3	M
BH3	5.10	22/10/2023	30/10/2023	A	0.73	0.71	SS	3	M
BH3	6.09	22/10/2023	30/10/2023	A	1.2	1.2	SS	3	M
BH3	6.73	22/10/2023	30/10/2023	A	1.2	1.1	SS	3	M
BH3	7.41	22/10/2023	30/10/2023	A	1.3	1.3	SS	3	M
BH3	8.09	22/10/2023	30/10/2023	A	1.5	1.6	SS	3	M
BH3	8.91	22/10/2023	30/10/2023	A	1.6	1.6	SS	3	M
BH4	4.19	22/10/2023	30/10/2023	A	0.65	0.65	SS	3	M
BH4	4.76	22/10/2023	30/10/2023	A	0.3	0.29	SS	3	M
BH4	5.16	22/10/2023	30/10/2023	A	1.7	1.7	SS	3	D
BH4	5.77	22/10/2023	30/10/2023	A	2.2	2.3	SS	3	D
BH4	6.08	22/10/2023	30/10/2023	A	1.2	1.2	SS	3	M
BH4	6.64	22/10/2023	30/10/2023	A	1.2	1.2	SS	3	M
BH4	7.52	22/10/2023	30/10/2023	A	1.4	1.4	SS	3	M
BH4	8.15	22/10/2023	30/10/2023	A	0.79	0.79	SS	3	M
BH4	8.78	22/10/2023	30/10/2023	A	1.6	1.7	SS	3	M
BH5	3.83	22/10/2023	30/10/2023	A	0.83	0.86	SS	3	M
BH5	4.17	22/10/2023	30/10/2023	A	0.77	0.79	SS	3	M
BH5	4.76	22/10/2023	30/10/2023	A	1.5	1.6	SS	3	M
BH5	5.19	22/10/2023	30/10/2023	A	1.1	1.1	SS	3	M
BH5	5.73	22/10/2023	30/10/2023	A	0.55	0.57	SS	3	M
BH5	6.11	22/10/2023	30/10/2023	A	1.2	1.3	SS	3	M
BH5	6.85	22/10/2023	30/10/2023	A	1	1.1	SS	3	M
BH5	7.62	22/10/2023	30/10/2023	A	0.83	0.85	SS	3	M
BH5	8.11	22/10/2023	30/10/2023	A	1.4	1.4	SS	3	M
BH5	8.84	22/10/2023	30/10/2023	A	1.7	1.7	SS	3	M

Failure Type
1 = Fracture through bedding or weak plane
2 = Fracture along bedding
3 = Fracture through rock mass
4 = Fracture influenced by natural defect or drilling
5 = Partial fracture or chip (invalid result)

Test Type
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D = Dry

Rock Type
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SH = Shale
YS = Claystone
IG = Igneous

Remarks:

Approved Signatory.....
Fernando Velasquez Senior Geotechnician

Technician: FV

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Point Load Strength Index Report

Project: E26160.G03, 1 Veno Street, HEATHCOTE, NSW
Client: EI Australia
Address: Suite 6.01, 55 Miller St PYRMONT NSW
Test Method: AS 4133.4.1
Sampling Procedure: Samples Supplied By Client (Not covered under NATA Scope of Accreditation)

Project No.: 31380/8167D-L
Report No.: 23/3630
Report Date: 31/10/2023

Borehole / Sample No.	Depth (m)	Date Sampled	Date Tested	Test Type	Is (MPa)	$Is_{(50)}$ (MPa)	Rock Type	Failure Type	Moisture
BH6	5.17	22/10/2023	30/10/2023	A	**0.89**	**0.91**	SS	3	M
BH6	5.83	22/10/2023	30/10/2023	A	**1.4**	**1.4**	SS	3	M
BH6	6.60	22/10/2023	30/10/2023	A	**2.1**	**2.1**	SS	3	M
BH6	7.14	22/10/2023	30/10/2023	A	**1.7**	**1.6**	SS	3	M
BH6	7.71	22/10/2023	30/10/2023	A	**1.9**	**1.8**	SS	3	M
BH6	8.07	22/10/2023	30/10/2023	A	**1.8**	**1.8**	SS	3	M
BH6	8.74	22/10/2023	30/10/2023	A	**2.3**	**2.3**	SS	3	M
BH6	9.26	22/10/2023	30/10/2023	A	**1.7**	**1.7**	SS	3	M
BH6	9.79	22/10/2023	30/10/2023	A	**1.4**	**1.5**	SS	3	M
BH7M	4.27	22/10/2023	30/10/2023	A	**1.1**	**1**	SS	3	D
BH7M	4.78	22/10/2023	30/10/2023	A	**0.66**	**0.67**	SS	3	D
BH7M	5.12	22/10/2023	30/10/2023	A	**1.3**	**1.3**	SS	3	D
BH7M	5.86	22/10/2023	30/10/2023	A	**2.1**	**2.1**	SS	3	D
BH7M	6.25	22/10/2023	30/10/2023	A	**1.6**	**1.7**	SS	3	D
BH7M	7.87	22/10/2023	30/10/2023	A	**2**	**2.1**	SS	3	D
BH7M	8.08	22/10/2023	30/10/2023	A	**1.4**	**1.4**	SS	3	D
BH7M	8.76	22/10/2023	30/10/2023	A	**1.2**	**1.2**	SS	3	D
BH8	3.83	22/10/2023	30/10/2023	A	**1**	**1**	SS	3	M
BH8	4.22	22/10/2023	30/10/2023	A	**0.56**	**0.57**	SS	3	M
BH8	4.81	22/10/2023	30/10/2023	A	**0.67**	**0.65**	SS	3	M
BH8	5.38	22/10/2023	30/10/2023	A	**1**	**1.1**	SS	3	M
BH8	6.37	22/10/2023	30/10/2023	A	**1.6**	**1.6**	SS	3	M
BH8	7.52	22/10/2023	30/10/2023	A	**1.3**	**1.3**	SS	3	M
BH8	8.15	22/10/2023	30/10/2023	A	**1.7**	**1.7**	SS	3	M
BH8	8.75	22/10/2023	30/10/2023	A	**1.4**	**1.4**	SS	3	M
BH8	9.25	22/10/2023	30/10/2023	A	**1.5**	**1.5**	SS	3	M

Failure Type
1 = Fracture through bedding or weak plane
2 = Fracture along bedding
3 = Fracture through rock mass
4 = Fracture influenced by natural defect or drilling
5 = Partial fracture or chip (invalid result)

Test Type
A = Axial
D = Diametrial
I = Irregular
C = Cube

Moisure Condition
W = Wet
M = Moist
D = Dry

Rock Type
SS = Sandstone
ST = Siltstone
SH = Shale
YS = Claystone
IG = Igneous

Remarks:

Approved Signatory.....
Fernando Velasquez Senior Geotechnician

Technician: FV

STS GEOTECHNICS PTY LTD
CONSULTING GEOTECHNICAL ENGINEERS

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NATA Accredited for Compliance with ISO/IEC 17025 - Testing No. 2750

Point Load Strength Index Report

Project: E26160.G03, 1 Veno Street, HEATHCOTE, NSW
Client: EI Australia
Address: Suite 6.01, 55 Miller St PYRMONT NSW
Test Method: AS 4133.4.1
Sampling Procedure: Samples Supplied By Client (Not covered under NATA Scope of Accreditation)

Project No.: 31380/8167D-L
Report No.: 23/3630
Report Date: 31/10/2023
Page: 4 of 4

Borehole / Sample No.	Depth (m)	Date Sampled	Date Tested	Test Type	Is (MPa)	$Is_{(50)}$ (MPa)	Rock Type	Failure Type	Moisture
BH9M	6.23	22/10/2023	30/10/2023	A	**0.83**	**0.84**	SS	3	M
BH9M	6.87	22/10/2023	30/10/2023	A	**1.4**	**1.4**	SS	3	M
BH9M	7.06	22/10/2023	30/10/2023	A	**1.2**	**1.2**	SS	3	M
BH9M	7.57	22/10/2023	30/10/2023	A	**0.73**	**0.7**	SS	3	M
BH9M	8.12	22/10/2023	30/10/2023	A	**0.84**	**0.87**	SS	3	M
BH9M	8.69	22/10/2023	30/10/2023	A	**1**	**1**	SS	3	M
BH9M	9.12	22/10/2023	30/10/2023	A	**1.1**	**1.1**	SS	3	M
BH9M	9.80	22/10/2023	30/10/2023	A	**0.6**	**0.6**	SS	3	M
BH10M	5.65	22/10/2023	30/10/2023	A	**0.93**	**0.94**	SS	3	M
BH10M	6.23	22/10/2023	30/10/2023	A	**0.91**	**0.95**	SS	3	M
BH10M	6.80	22/10/2023	30/10/2023	A	**1.1**	**1.1**	SS	3	M
BH10M	7.06	22/10/2023	30/10/2023	A	**0.84**	**0.87**	SS	3	M
BH10M	7.80	22/10/2023	30/10/2023	A	**1.2**	**1.2**	SS	3	M
BH10M	8.07	22/10/2023	30/10/2023	A	**1.2**	**1.2**	SS	3	M
BH10M	8.89	22/10/2023	30/10/2023	A	**1.4**	**1.4**	SS	3	M

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Test Type
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SH = Shale
YS = Claystone
IG = Igneous

Remarks:

Approved Signatory.....
Fernando Velasquez Senior Geotechnician

Technician: FV

Appendix C – Vibration Limits

German Standard DIN 4150 – Part 3: 1999 provides guideline levels of vibration velocity for evaluating the effects of vibration in structures. The limits presented in this standard are generally considered to be conservative.

The DIN 4150 values (maximum levels measured in any direction at the foundation, OR, maximum levels measured in (x) or (y) directions, in the plane of the uppermost floor), are summarised in **Table A** below.

It should be noted that peak vibration velocities higher than the minimum figures in **Table A** for low frequencies may be quite 'safe', depending on the frequency content of the vibration and the actual conditions of the structures.

It should also be noted that these levels are 'safe limits', up to which no damage due to vibration effects has been observed for the particular class of building. 'Damage' is defined by DIN 4150 to include even minor non-structural cracking in cement render, the enlargement of cracks already present, and the separation of partitions or intermediate walls from load bearing walls. Should damage be observed at vibration levels lower than the 'safe limits', then it may be attributed to other causes. DIN 4150 also states that when vibration levels higher than the 'safe limits' are present, it does not necessarily follow that damage will occur. Values given are only a broad guide.

Table A DIN 4150 – Structural Damage – Safe Limits for Building Vibration

Group	Type of Structure	Peak Vibration Velocity (mm/s)			
		At Foundation Level at a Frequency of:			Plane of Floor of Uppermost Storey
		Less than 10 Hz	10 Hz to 50 Hz	50 Hz to 100 Hz	All Frequencies
1	Buildings used for commercial purposes, industrial buildings and buildings of similar design	20	20 to 40	40 to 50	40
2	Dwellings and buildings of similar design and/or use	5	5 to 15	15 to 20	15
3	Structures that because of their particular sensitivity to vibration, do not correspond to those listed in Group 1 and 2 and have intrinsic value (e.g. buildings that are under a preservation order)	3	3 to 8	8 to 10	8

Note: For frequencies above 100 Hz, the higher values in the 50 Hz to 100 Hz column should be used.

Appendix D – 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.