Douglas Partners
Geotechnics / Environment / Groundwater

Integrated Practical Solutions

Report on
Geotechnical Investigation

Trinity Grammar School
113-119 Prospect Road, Summer Hill

Prepared for
Bloompark Consulting Pty Ltd

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Douglas Partners
Geotechnics / Environment / Groundwater

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The undersigned, on behalf of Douglas Partners Pty Ltd, confirm that this document and all attached drawings, logs and test results have been checked and reviewed for errors, omissions and inaccuracies.

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Geotechnics / Environment / Groundwater

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Report on Geotechnical Investigation
Trinity Grammar School
113-119 Prospect Road, Summer Hill

1. Introduction

This report presents the results of a geotechnical investigation undertaken for a proposed redevelopment at Trinity Grammar School, 113-119 Prospect Road, Summer Hill. The investigation was undertaken for Trinity Grammar School in consultation with Bloompark Consulting Pty Ltd, project managers. The work was completed in accordance with Douglas Partners' proposal SYD190691 dated 5 July 2019.

It is understood that the development is likely to include the construction of new buildings at several locations on the site, although details are yet to be finalised.

The investigation included the drilling of eleven cored and one auger drilled borehole, the installation of two groundwater wells and laboratory testing of selected samples. Details of the field work are presented in this report, together with comments and recommendations relevant to the design and construction.

A preliminary contamination assessment was undertaken at the same time as the geotechnical investigation and is reported separately.

2. Site Description

Trinity Grammar School is located on a near rectangular block bounded by Seaview Street to the north, Prospect Road to the east, Yeo Park to the south and Victoria Street to the west. Several residential properties along Seaview Street are also included within the block.

The site is located towards the top of a low ridge that runs in an east-west direction. The ground surface slopes downwards to the north-east and south-east which changes in elevation from about RL 52 m AHD adjacent to Victoria Street to about RL 42 m AHD at the north eastern corner of the site. There are numerous terraced fields on the site that have been formed during previous developments.

The *Sydney 1:100 000 Geological Series Sheet* indicates that the site is underlain by Ashfield Shale which typically comprises a residual clay profile overlying variably weathered dark grey shale, laminite and siltstone. An extract from the geological map overlain by 2 m surface contours is shown in Figure 1.

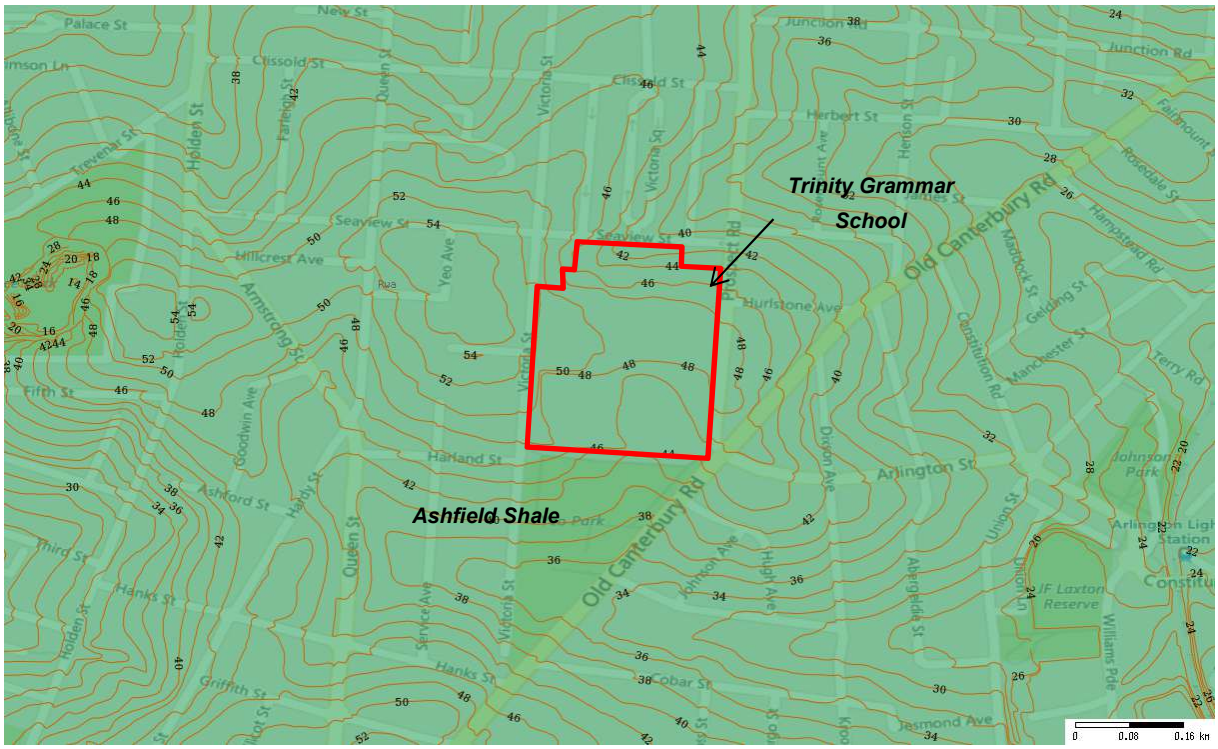

Figure 1: Extract from geological map overlain by 2 m surface contours

3. Field Work Methods

The field work included the drilling of one auger drilled borehole (BH1) to a depth of 8.6m and eleven rock-cored boreholes (BH02 to BH12) to depths of between 10.2 m and 13.4 m using track-mounted Hanjin DB8 drilling rigs. The boreholes were commenced using solid flight augers until bedrock was encountered. Standard penetration tests (SPTs) were carried out at regular intervals and soil samples were collected for laboratory testing in each borehole. Boreholes BH02 to BH12 were then extended into bedrock using NMLC diamond core drilling techniques to obtain continuous core samples of the bedrock.

Two boreholes (BH02 and BH04) were converted into groundwater monitoring wells by installing Class 18 uPVC screen and casing.

The locations of the boreholes are shown on Drawing G1 in Appendix B.

4. Field Work Results

The subsurface conditions encountered during the investigation are presented in the borehole logs in Appendix C. Notes defining descriptive terms and classification methods are included in Appendix A.

The boreholes encountered:

- FILL – silty clay, clayey sand / sandy clay, igneous gravel and sand with varying proportions of ironstone and shale gravel, silt and ash to depths of between 0.2 m and 4.3 m;
- RESIDUAL SOIL – generally stiff to hard silty clay with varying proportions of ironstone gravel to depths of between 1.7 m and 10.0 m in all boreholes. A layer of firm clay was encountered at limited depths in boreholes BH09, BH11 and BH12;
- BEDROCK – very low to low strength shale from depths of between 1.7 m and 7.5 m, becoming medium and/or high strength with depth. In borehole BH12 rock was not encountered until 10 m depth and was of medium strength. A very high strength (possibly siderite) band was encountered in boreholes BH03, BH04, BH06, BH10 and BH12.

Table 1 summarises the levels at which different materials were encountered in the boreholes. The rock classifications refer to a system developed by Pells, Douglas et al (1978) which classifies rock on the basis of strength, fracturing and defects. Class V rock is typically very low strength and fractured whereas Class I rock is typically high strength and unbroken. Lower classifications may, however, contain strong rock with significant defects and/or fracturing.

Table 1: Summary of Inferred Material Strata Levels

Stratum	Depth and RL of Top of Stratum m / (m, AHD)											
	BH01	BH02	BH03	BH04	BH05	BH06	BH07	BH08	BH09	BH10	BH11	BH12
Fill (Surface)	**0** (46.1)	**0** (47.3)	**0** (49.3)	**0** (47.5)	**0** (47.5)	**0** (48.2)	**0** (47.6)	**0** (48.1)	**0** (47.6)	**0** (45.8)	**0** (45.6)	**0** (45.2)
Firm Residual Clay	NE	NE	NE	NE	NE	NE	NE	NE	**2.5** (45.1)	NE	**2.5** (43.1)	**4.3** (40.9)
Stiff to Hard Residual Clay	**1.0** (45.1)	**0.3** (47.0)	**0.2** (49.1)	**1.2** (46.3)	**1.8** (45.7)	**0.6** (47.6)	**1.6** (46.0)	**0.8** (47.3)	**3.5** (44.1)	**1.1** (44.7)	**3.1** (42.5)	**5.0** (40.2)
Class V Shale	**1.7** (44.4)	**4.3** (43.0)	**2.1** (47.2)	**6.0** (41.5)	**6.0** (41.5)	**2.1** (46.1)	**7.1** (40.5)	**4.7** (43.4)	NE	NE	**7.5** (38.1)	NE
Class IV Shale	**4.5** (41.6)	NE	**4.0** (45.3)	NE	NE	**4.6** (43.6)	**8.4** (39.2)	**7.8** (40.3)	**7.5** (40.1)	**5.5** (40.3)	NE	NE
Class III Shale	-	**5.6** (41.7)	**4.6** (44.7)	**8.0** (39.6)	**7.0** (40.5)	NE	NE	**9.4** (38.7)	**7.9** (39.8)	NE	**8.7** (37.0)	NE
Class II Shale	-	**8.2** (39.1)	**6.5** (42.8)	NE	**8.6** (38.9)	**7.0** (41.2)	**9.3** (38.3)	**9.9** (38.2)	NE	**9.0** (36.8)	**9.9** (35.7)	**10.0** (35.2)
Base of Borehole	**8.6** (37.5)	**10.4** (36.9)	**10.2** (39.1)	**10.5** (37.0)	**10.9** (36.6)	**10.4** (37.8)	**10.2** (37.4)	**11.4** (36.7)	**11.0** (36.6)	**10.8** (35.0)	**11.3** (34.3)	**13.4** (31.8)

Notes: NE = not encountered

Groundwater seepage was observed during auger drilling in boreholes BH01, BH10, BH11 and BH12 at depths of between 2.0 m and 7.5 m. The use of drilling fluid during coring prevented further observations with depth. The levels in the groundwater wells were measured on 23 August 2019 and the results are summarised in Table 2.

Table 2: Groundwater Level Observations (Depth, m and (RL, m AHD))

Date	BH02	BH04
23 August 2019	2.9 (44.4)	2.9 (44.6)

5. Laboratory Testing

5.1 Rock

A total of 62 samples were tested for axial point load strength index (Is_{50}). The results ranged between 0.08 MPa and 7.1 MPa which correspond to very low strength and very high strength rock, respectively. The individual results are shown on the relevant borehole logs in Appendix C.

5.2 Soil

Four samples were sent to a NATA accredited analytical laboratory and were analysed to assess the exposure classification to steel and concrete below ground. The results are summarised in Table 3 and the detailed results are included in Appendix D.

Table 3: Analytical Results for Aggressivity in Soil

Sample/Depth (m)	pH (pH units)	EC (µS/cm)	Cl^- (mg/kg)	SO_4^{2-} (mg/kg)
BH1/1.5-1.95	5.3	24	10	20
BH2/2.5-2.95	5.8	15	<10	<10
BH8/1.0-1.45	4.7	73	10	95
BH12/2.5-2.95	6.6	33	10	27

Notes: EC = electrical conductivity; Cl^- = chloride ion; SO_4^{2-} = sulphate ion

Four samples were also tested for Atterberg limits. The results are summarised in Table 4 and the detailed results are included in Appendix D.

Table 4: Results for Atterberg Limits in Soil

Sample/Depth (m)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Linear Shrinkage (%)	Field Moisture (%)
BH3/0.9-1.0	69	25	44	16.0	23.2
BH4/2.0-2.45	57	21	36	14.0	21.1
BH9/2.5-2.95	66	28	38	16.0	24.9
BH11/2.5-2.95	67	27	40	15.5	33.5

6. Geotechnical Model

The development areas are underlain by varying depths of fill, typically deeper at the southern end of the site where ground levels were likely to have been raised to create a level platform for playing fields. The residual clays are derived from weathering of the Ashfield Shale and are therefore expected to be of high plasticity and moderately to highly reactive. The laboratory testing confirms this.

The clays are underlain by a weathered Ashfield Shale profile which is initially very low to low strength at depths of between 1.7 m and 7.5 m (Class V and Class IV in Table 1). The shale increases to medium strength at depths of between 4.6 m and 10.0 m (Class III and Class II in Table 1) and was observed to the termination depths of the cored boreholes between 10.2 m and 13.4 m.

Groundwater was encountered at depths of 2.9 m (RL 44.4 m and RL 44.6 m AHD) in the monitoring wells, however is considered to be perched seepage rather than the regional groundwater table. The groundwater table is likely to be well below the bedrock surface. Seepage near the rock surface and through joints/partings within the bedrock would be expected to occur.

7. Proposed Development

It is understood that the development is likely to include the construction of new buildings at several locations on the site, although details are yet to be finalised.

The geotechnical issues considered relevant to the proposed development include site preparation, excavation, excavation support, groundwater and foundations. Comments on aggressivity and seismicity are also provided.

8. Comments

8.1 Site Preparation

Any existing fill that is required to support structures and pavements will need to be reworked to reduce the potential for unacceptable settlements associated with poorly or variably compacted fill. New fill will also need to be placed in accordance with an engineering specification.

The following procedure could be followed during earthworks activities:

- Strip organic-rich topsoil from areas of the site in which fill, structures and/or pavements are proposed;
- Excavate existing fill in areas of the site in which fill, structures and/or pavements are proposed;
- Compact the exposed surface and proof-roll using a roller of 10 t deadweight (or equivalent) in the presence of a geotechnical engineer. Any areas exhibiting unacceptable movements during the proof-roll may require further rectification;

- Place fill in maximum 250 mm thick layers and compact to achieve a dry density ratio of between 98% and 102% relative to Standard compaction. The upper 0.5 m of pavement subgrade areas should be compacted to achieve a dry density ratio of between 100% and 102% relative to Standard compaction;
- The moisture content should be within 2% of the Standard optimum moisture content of the material if it exhibits clay-like properties;
- A layer of granular product (e.g. roadbase, recycled crushed concrete etc.) should be considered as the top layer of fill to improve trafficability on site, particularly during and following periods of wet weather;
- Density testing should be undertaken in accordance with the requirements of AS 3798 – 2007 *Guidelines on earthworks for commercial and residential developments*.

The existing fill should be suitable for re-use from a geotechnical perspective provided that any deleterious materials are removed during placement. If fill is imported to the site then the engineering properties (e.g. plasticity, reactivity, CBR etc.) should ideally be equivalent, or superior, to the existing materials on the site.

8.2 Excavation

Excavation of the fill, residual soil and weathered rock encountered in the boreholes should be readily achievable using conventional earthmoving equipment such as excavators. Depending on the excavation depth, low to medium strength shale will likely require heavy ripping or hammering for bulk and detailed excavation. Some bands of very high strength rock are likely to be encountered during excavation through the medium strength shale profile.

Vibrations associated with shallow excavations are unlikely to be an issue due to the weathered nature of the rock profile. However, in the event that advice on vibration limits is required we would recommend that vibrations be limited to a peak component particle velocity (PPVi) of 8 mm/s at the foundation level of adjacent modern buildings and 5 mm/s for heritage or sensitive structures.

8.3 Excavation Support

Vertical excavations in fill, residual clay and weathered shale bedrock are not expected to be stable. Temporary batters of 1(H):1(V) could be used to support the sides of the excavations in these materials for cuts up to 3 m deep. Deeper excavations may need to incorporate intermediate benches to reduce the overall slope angle.

Excavations retained either temporarily or permanently will be subjected to earth pressures. Table 5 outlines material and strength parameters that could be used for the design of excavation support structures.

Table 5: Material and Strength Parameters for Excavation Support Structures

Material	Bulk Density (kN/m^3)	Coefficient of Active Earth Pressure (K_a)	Coefficient of Earth Pressure at Rest (K_o)	Ultimate Passive Earth Pressure (kPa)
Fill	20	0.4	0.6	-
Firm to Stiff Clay	20	0.35	0.5	75
Very Stiff to Hard Clay	20	0.3	0.45	150[1]
Class V/IV Shale	22	0.2	0.3	500[1]
Class III Shale	23	0.1	0.15	2000[1]
Class II Shale	24	10 kPa	10 kPa	6000[1]

Notes: [1]Only below bulk/detailed excavation level

The lateral earth pressure distribution for a wall propped by slabs at the top and bottom could be assumed to be trapezoidal; the maximum lateral earth pressure acting over the central 60% of the wall, decreasing to zero at the top and base. The lateral earth pressure distribution for a cantilevered wall could be assumed to be triangular. Cantilevered walls should not be used to support adjacent structures.

'Active' earth pressure coefficient (K_a) values may be used for walls where some wall movement is acceptable, and 'at rest' earth pressure (K_o) values should be used where the wall movement needs to be reduced (i.e. adjacent to existing structures or utilities). A uniform pressure of 10 kPa should be adopted for the support Class II shale between soldier piles and/or anchors to account for minor joint wedges that may become mobilised.

Lateral pressures due to surcharge loads from adjacent buildings, existing road corridors, sloping ground surfaces and construction machinery should be included where relevant. Hydrostatic pressure acting on the shoring walls should also be included in the design where adequate drainage is not provided behind the full height of the walls.

8.4 Groundwater

Seepage was encountered during the investigation in several locations, however the regional groundwater table is expected to be well below the bedrock surface. Seepage should be expected through the fill and rock, and along strata boundaries. The rate of seepage is likely to vary with climatic conditions.

The subsurface conditions encountered in the boreholes indicate that seepage can probably be controlled using a sub-floor drainage and collection system in any basement levels. A pump or gravity drainage system (if possible) will be required to periodically remove stored water from the lowest part of any basements. A pump may also be needed to remove seepage from footing/pile excavations prior to the placement of concrete.

8.5 Foundations

8.5.1 Spread Footings

The foundation conditions will depend on the level(s) of the proposed footings. The boreholes indicate that substantial column loads will need to be founded within the bedrock, probably with the use of piles unless bulk excavation exposes suitable rock. Where applicable, spread footings could be designed using the parameters outlined in Table 6.

Table 6: Allowable Footing Design Parameters for Spread Footings

Material	Allowable Bearing Pressure (kPa)
Existing Fill	0
Firm to Stiff	100
Very Stiff to Hard Clay	200
Class V Shale	700
Class IV Shale	1000
Class III Shale	3500
Class II Shale	6000

Settlement of a spread footing is dependent on the loads applied to the footing and the foundation conditions below the footing. The total settlement of a spread footing designed using the parameters provided in this report may be in the order of 1% of the width of the footing upon application of the working load. Differential settlements between footings may be in the order of 50% of the value of total settlement.

Spread footings will not be able to be used within the zone of influence of any existing batters, retaining walls or existing/proposed excavations. The zone of influence can be described as a line drawn up at 2(H):1(V) from the base of the batter/wall.

Spoon testing will be required in at least 50% of pad footings that are designed for an allowable end bearing pressure of more than 3,500 kPa.

All spread footing excavations should be inspected by an experienced geotechnical professional to check the adequacy of the foundation material.

The residual clays on the site are likely to be equivalent to clay soils on a Class M site as defined in Australian Standard AS 2870 – 2011 *Residential slabs and footings*. Differential movements between structures founded in bedrock and structures founded in the clays could therefore occur and it may be prudent to found all structures within bedrock. The presence of trees should also be taken into account when assessing soil reactivity.

8.5.2 Piles

Bored piles could be used to support significant column loads and could be designed using the parameters provided in Table 7.

Table 7: Design Parameters for Bored Piles

Material	Allowable End-Bearing Pressure (kPa)	Allowable Shaft Adhesion (kPa)[1]	Ultimate End-Bearing Pressure (kPa)	Ultimate Shaft Adhesion (kPa)[1]	Young's Modulus (MPa)
Class V Shale	700	50	1,500	100	75
Class IV Shale	1,000	100	3,000	150	150
Class III Shale	3,500	350	10,000	700	500
Class II Shale	6,000	600	30,000	1,000	1,500

Notes: [1]Pile socket should be clean and roughened to achieve these shaft adhesion values

It should be noted that the serviceability limit-state is likely to govern the design of the piles and the ultimate bearing pressures provided in Table 7 are unlikely to be able to be achieved in practice. An appropriate geotechnical strength reduction factor should be applied when using the limit-state approach as outlined in AS 2159 – 2009 *Piling – Design and installation*. An initial value of 0.4 could be assumed in the first instance.

Settlement of a pile is dependent on the loads applied to the pile and the foundation conditions below the pile toe and within the socket zone. The total settlement of a pile designed using the allowable parameters provided in this report may be in the order of 1% of the diameter of the pile. Differential settlements between piles may be in the order of 50% of the value of total settlement. Serviceability analysis should be undertaken when using the ultimate (limit-state) parameters.

All bored pile excavations should be inspected by an experienced geotechnical professional to check the adequacy of the foundation material and socket roughness/cleanliness.

8.6 Pavements

On the basis of the subsurface conditions encountered on the site and our previous experience in the area, it is recommended that a design subgrade CBR of 3% be adopted. This assumes that the site preparation recommendations provided in Section 8.1 of this report are adopted.

8.7 Aggressivity

The laboratory test results indicate mild conditions for concrete and non-aggressive conditions for steel as outlined in Australian Standard AS 2159 – 2009 *Piling – Design and installation*.

8.8 Seismicity

A Hazard Factor (*Z*) of 0.08 would be appropriate for the development site in accordance with Australian Standard AS 1170.4 – 2007 *Structural design actions – Part 4: Earthquake actions in Australia*. The site sub-soil class would be Class C_e.

9. Limitations

Douglas Partners Pty Ltd (DP) has prepared this report for a project at Trinity Grammar School at 113-119 Prospect Road, Summer Hill, in accordance with DPs proposal dated 5 July 2019 and subsequent acceptance received from the client. The report is provided for the use of Trinity Grammar School for this project only and for the purpose(s) described in the report. It should not be used for other projects or by a third party.

The results provided in the report are indicative of the sub-surface conditions only at the specific sampling or testing locations, and then only to the depths investigated and at the time the work was carried out. Subsurface conditions can change abruptly due to variable geological processes and also as a result of anthropogenic influences. Such changes may occur after DPs field testing has been completed.

DPs advice is based upon the conditions encountered during this investigation. The accuracy of the advice provided by DP in this report may be limited by undetected variations in ground conditions between sampling locations. In preparing this report DP has necessarily relied upon information provided by the client and/or their agents.

This report must be read in conjunction with all of the attached notes and should be kept in its entirety without separation of individual pages or sections. DP cannot be held responsible for interpretations or conclusions made by others unless they are supported by an expressed statement, interpretation, outcome or conclusion given in this report.

This report, or sections from this report, should not be used as part of a specification for a project, without review and agreement by DP. This is because this report has been written as advice and opinion rather than instructions for construction.

The contents of this report do not constitute formal design components such as are required, by the Health and Safety Legislation and Regulations, to be included in a Safety Report specifying the hazards likely to be encountered during construction and the controls required to mitigate risk.

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Appendix A

About This Report

About this Report

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Introduction

These notes have been provided to amplify DP's report in regard to classification methods, field procedures and the comments section. Not all are necessarily relevant to all reports.

DP's reports are based on information gained from limited subsurface excavations and sampling, supplemented by knowledge of local geology and experience. For this reason, they must be regarded as interpretive rather than factual documents, limited to some extent by the scope of information on which they rely.

Copyright

Borehole and Test Pit Logs

The borehole and test pit logs presented in this report are an engineering and/or geological interpretation of the subsurface conditions, and their reliability will depend to some extent on frequency of sampling and the method of drilling or excavation. Ideally, continuous undisturbed sampling or core drilling will provide the most reliable assessment, but this is not always practicable or possible to justify on economic grounds. In any case the boreholes and test pits represent only a very small sample of the total subsurface profile.

Interpretation of the information and its application to design and construction should therefore take into account the spacing of boreholes or pits, the frequency of sampling, and the possibility of other than 'straight line' variations between the test locations.

Groundwater

Where groundwater levels are measured in boreholes there are several potential problems, namely:

- In low permeability soils groundwater may enter the hole very slowly or perhaps not at all during the time the hole is left open;
- A localised, perched water table may lead to an erroneous indication of the true water table;
- Water table levels will vary from time to time with seasons or recent weather changes. They may not be the same at the time of construction as are indicated in the report; and
- The use of water or mud as a drilling fluid will mask any groundwater inflow. Water has to be blown out of the hole and drilling mud must first be washed out of the hole if water measurements are to be made.

More reliable measurements can be made by installing standpipes which are read at intervals over several days, or perhaps weeks for low permeability soils. Piezometers, sealed in a particular stratum, may be advisable in low permeability soils or where there may be interference from a perched water table.

Reports

The report has been prepared by qualified personnel, is based on the information obtained from field and laboratory testing, and has been undertaken to current engineering standards of interpretation and analysis. Where the report has been prepared for a specific design proposal, the information and interpretation may not be relevant if the design proposal is changed. If this happens, DP will be pleased to review the report and the sufficiency of the investigation work.

Every care is taken with the report as it relates to interpretation of subsurface conditions, discussion of geotechnical and environmental aspects, and recommendations or suggestions for design and construction. However, DP cannot always anticipate or assume responsibility for:

- Unexpected variations in ground conditions. The potential for this will depend partly on borehole or pit spacing and sampling frequency;
- Changes in policy or interpretations of policy by statutory authorities; or
- The actions of contractors responding to commercial pressures.

If these occur, DP will be pleased to assist with investigations or advice to resolve the matter.

About this Report

Site Anomalies

In the event that conditions encountered on site during construction appear to vary from those which were expected from the information contained in the report, DP requests that it be immediately notified. Most problems are much more readily resolved when conditions are exposed rather than at some later stage, well after the event.

Information for Contractual Purposes

Where information obtained from this report is provided for tendering purposes, it is recommended that all information, including the written report and discussion, be made available. In circumstances where the discussion or comments section is not relevant to the contractual situation, it may be appropriate to prepare a specially edited document. DP would be pleased to assist in this regard and/or to make additional report copies available for contract purposes at a nominal charge.

Site Inspection

The company will always be pleased to provide engineering inspection services for geotechnical and environmental aspects of work to which this report is related. This could range from a site visit to confirm that conditions exposed are as expected, to full time engineering presence on site.

Sampling Methods

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Sampling

Sampling is carried out during drilling or test pitting to allow engineering examination (and laboratory testing where required) of the soil or rock.

Disturbed samples taken during drilling provide information on colour, type, inclusions and, depending upon the degree of disturbance, some information on strength and structure.

Undisturbed samples are taken by pushing a thin-walled sample tube into the soil and withdrawing it to obtain a sample of the soil in a relatively undisturbed state. Such samples yield information on structure and strength, and are necessary for laboratory determination of shear strength and compressibility. Undisturbed sampling is generally effective only in cohesive soils.

Test Pits

Test pits are usually excavated with a backhoe or an excavator, allowing close examination of the in-situ soil if it is safe to enter into the pit. The depth of excavation is limited to about 3 m for a backhoe and up to 6 m for a large excavator. A potential disadvantage of this investigation method is the larger area of disturbance to the site.

Large Diameter Augers

Boreholes can be drilled using a rotating plate or short spiral auger, generally 300 mm or larger in diameter commonly mounted on a standard piling rig. The cuttings are returned to the surface at intervals (generally not more than 0.5 m) and are disturbed but usually unchanged in moisture content. Identification of soil strata is generally much more reliable than with continuous spiral flight augers, and is usually supplemented by occasional undisturbed tube samples.

Continuous Spiral Flight Augers

The borehole is advanced using 90-115 mm diameter continuous spiral flight augers which are withdrawn at intervals to allow sampling or in-situ testing. This is a relatively economical means of drilling in clays and sands above the water table. Samples are returned to the surface, or may be collected after withdrawal of the auger flights, but they are disturbed and may be mixed with soils from the sides of the hole. Information from the drilling (as distinct from specific sampling by SPTs or undisturbed samples) is of relatively low reliability, due to the remoulding, possible mixing or softening of samples by groundwater.

Non-core Rotary Drilling

The borehole is advanced using a rotary bit, with water or drilling mud being pumped down the drill rods and returned up the annulus, carrying the drill cuttings. Only major changes in stratification can be determined from the cuttings, together with some information from the rate of penetration. Where drilling mud is used this can mask the cuttings and reliable identification is only possible from separate sampling such as SPTs.

Continuous Core Drilling

A continuous core sample can be obtained using a diamond tipped core barrel, usually with a 50 mm internal diameter. Provided full core recovery is achieved (which is not always possible in weak rocks and granular soils), this technique provides a very reliable method of investigation.

Standard Penetration Tests

Standard penetration tests (SPT) are used as a means of estimating the density or strength of soils and also of obtaining a relatively undisturbed sample. The test procedure is described in Australian Standard 1289, Methods of Testing Soils for Engineering Purposes - Test 6.3.1.

The test is carried out in a borehole by driving a 50 mm diameter split sample tube under the impact of a 63 kg hammer with a free fall of 760 mm. It is normal for the tube to be driven in three successive 150 mm increments and the 'N' value is taken as the number of blows for the last 300 mm. In dense sands, very hard clays or weak rock, the full 450 mm penetration may not be practicable and the test is discontinued.

The test results are reported in the following form.

- In the case where full penetration is obtained with successive blow counts for each 150 mm of, say, 4, 6 and 7 as:

  4,6,7
  N=13

- In the case where the test is discontinued before the full penetration depth, say after 15 blows for the first 150 mm and 30 blows for the next 40 mm as:

  15, 30/40 mm

The results of the SPT tests can be related empirically to the engineering properties of the soils.

Dynamic Cone Penetrometer Tests / Perth Sand Penetrometer Tests

Dynamic penetrometer tests (DCP or PSP) are carried out by driving a steel rod into the ground using a standard weight of hammer falling a specified distance. As the rod penetrates the soil the number of blows required to penetrate each successive 150 mm depth are recorded. Normally there is a depth limitation of 1.2 m, but this may be extended in certain conditions by the use of extension rods. Two types of penetrometer are commonly used.

- Perth sand penetrometer - a 16 mm diameter flat ended rod is driven using a 9 kg hammer dropping 600 mm (AS 1289, Test 6.3.3). This test was developed for testing the density of sands and is mainly used in granular soils and filling.
- Cone penetrometer - a 16 mm diameter rod with a 20 mm diameter cone end is driven using a 9 kg hammer dropping 510 mm (AS 1289, Test 6.3.2). This test was developed initially for pavement subgrade investigations, and correlations of the test results with California Bearing Ratio have been published by various road authorities.

Soil Descriptions

Douglas Partners

Description and Classification Methods

The methods of description and classification of soils and rocks used in this report are based on Australian Standard AS 1726-1993, Geotechnical Site Investigations Code. In general, the descriptions include strength or density, colour, structure, soil or rock type and inclusions.

Soil Types

Soil types are described according to the predominant particle size, qualified by the grading of other particles present:

Type	Particle size (mm)
Boulder	>200
Cobble	63 - 200
Gravel	2.36 - 63
Sand	0.075 - 2.36
Silt	0.002 - 0.075
Clay	<0.002

The sand and gravel sizes can be further subdivided as follows:

Type	Particle size (mm)
Coarse gravel	20 - 63
Medium gravel	6 - 20
Fine gravel	2.36 - 6
Coarse sand	0.6 - 2.36
Medium sand	0.2 - 0.6
Fine sand	0.075 - 0.2

The proportions of secondary constituents of soils are described as:

Term	Proportion	Example
And	Specify	Clay (60%) and Sand (40%)
Adjective	20 - 35%	Sandy Clay
Slightly	12 - 20%	Slightly Sandy Clay
With some	5 - 12%	Clay with some sand
With a trace of	0 - 5%	Clay with a trace of sand

Definitions of grading terms used are:

- Well graded - a good representation of all particle sizes
- Poorly graded - an excess or deficiency of particular sizes within the specified range
- Uniformly graded - an excess of a particular particle size
- Gap graded - a deficiency of a particular particle size with the range

Cohesive Soils

Cohesive soils, such as clays, are classified on the basis of undrained shear strength. The strength may be measured by laboratory testing, or estimated by field tests or engineering examination. The strength terms are defined as follows:

Description	Abbreviation	Undrained shear strength (kPa)
Very soft	vs	<12
Soft	s	12 - 25
Firm	f	25 - 50
Stiff	st	50 - 100
Very stiff	vst	100 - 200
Hard	h	>200

Cohesionless Soils

Cohesionless soils, such as clean sands, are classified on the basis of relative density, generally from the results of standard penetration tests (SPT), cone penetration tests (CPT) or dynamic penetrometers (PSP). The relative density terms are given below:

Relative Density	Abbreviation	SPT N value	CPT qc value (MPa)
Very loose	vl	<4	<2
Loose	l	4 - 10	2 -5
Medium dense	md	10 - 30	5 - 15
Dense	d	30 - 50	15 - 25
Very dense	vd	>50	>25

Soil Descriptions

Soil Origin

It is often difficult to accurately determine the origin of a soil. Soils can generally be classified as:

- Residual soil - derived from in-situ weathering of the underlying rock;
- Transported soils - formed somewhere else and transported by nature to the site; or
- Filling - moved by man.

Transported soils may be further subdivided into:

- Alluvium - river deposits
- Lacustrine - lake deposits
- Aeolian - wind deposits
- Littoral - beach deposits
- Estuarine - tidal river deposits
- Talus - scree or coarse colluvium
- Slopewash or Colluvium - transported downslope by gravity assisted by water. Often includes angular rock fragments and boulders.

Rock Strength

Rock strength is defined by the Point Load Strength Index ($Is_{(50)}$) and refers to the strength of the rock substance and not the strength of the overall rock mass, which may be considerably weaker due to defects. The test procedure is described by Australian Standard 4133.4.1 - 2007. The terms used to describe rock strength are as follows:

Term	Abbreviation	Point Load Index $Is_{(50)}$ MPa	Approximate Unconfined Compressive Strength MPa*
Extremely low	EL	<0.03	<0.6
Very low	VL	0.03 - 0.1	0.6 - 2
Low	L	0.1 - 0.3	2 - 6
Medium	M	0.3 - 1.0	6 - 20
High	H	1 - 3	20 - 60
Very high	VH	3 - 10	60 - 200
Extremely high	EH	>10	>200

* Assumes a ratio of 20:1 for UCS to $Is_{(50)}$. It should be noted that the UCS to $Is_{(50)}$ ratio varies significantly for different rock types and specific ratios should be determined for each site.

Degree of Weathering

The degree of weathering of rock is classified as follows:

Term	Abbreviation	Description
Extremely weathered	EW	Rock substance has soil properties, i.e. it can be remoulded and classified as a soil but the texture of the original rock is still evident.
Highly weathered	HW	Limonite staining or bleaching affects whole of rock substance and other signs of decomposition are evident. Porosity and strength may be altered as a result of iron leaching or deposition. Colour and strength of original fresh rock is not recognisable
Moderately weathered	MW	Staining and discolouration of rock substance has taken place
Slightly weathered	SW	Rock substance is slightly discoloured but shows little or no change of strength from fresh rock
Fresh stained	Fs	Rock substance unaffected by weathering but staining visible along defects
Fresh	Fr	No signs of decomposition or staining

Degree of Fracturing

The following classification applies to the spacing of natural fractures in diamond drill cores. It includes bedding plane partings, joints and other defects, but excludes drilling breaks.

Term	Description
Fragmented	Fragments of <20 mm
Highly Fractured	Core lengths of 20-40 mm with some fragments
Fractured	Core lengths of 40-200 mm with some shorter and longer sections
Slightly Fractured	Core lengths of 200-1000 mm with some shorter and longer sections
Unbroken	Core lengths mostly > 1000 mm

Rock Descriptions

Rock Quality Designation

The quality of the cored rock can be measured using the Rock Quality Designation (RQD) index, defined as:

$$\text{RQD \%} = \frac{\text{cumulative length of 'sound' core sections} \geq 100 \text{ mm long}}{\text{total drilled length of section being assessed}}$$

where 'sound' rock is assessed to be rock of low strength or better. The RQD applies only to natural fractures. If the core is broken by drilling or handling (i.e. drilling breaks) then the broken pieces are fitted back together and are not included in the calculation of RQD.

Stratification Spacing

For sedimentary rocks the following terms may be used to describe the spacing of bedding partings:

Term	Separation of Stratification Planes
Thinly laminated	< 6 mm
Laminated	6 mm to 20 mm
Very thinly bedded	20 mm to 60 mm
Thinly bedded	60 mm to 0.2 m
Medium bedded	0.2 m to 0.6 m
Thickly bedded	0.6 m to 2 m
Very thickly bedded	> 2 m

Symbols & Abbreviations

Douglas Partners

Introduction

These notes summarise abbreviations commonly used on borehole logs and test pit reports.

Drilling or Excavation Methods

C	Core drilling
R	Rotary drilling
SFA	Spiral flight augers
NMLC	Diamond core - 52 mm dia
NQ	Diamond core - 47 mm dia
HQ	Diamond core - 63 mm dia
PQ	Diamond core - 81 mm dia

Water

▷	Water seep
▽	Water level

Sampling and Testing

A	Auger sample
B	Bulk sample
D	Disturbed sample
E	Environmental sample
U_{50}	Undisturbed tube sample (50mm)
W	Water sample
pp	Pocket penetrometer (kPa)
PID	Photo ionisation detector
PL	Point load strength Is(50) MPa
S	Standard Penetration Test
V	Shear vane (kPa)

Description of Defects in Rock

The abbreviated descriptions of the defects should be in the following order: Depth, Type, Orientation, Coating, Shape, Roughness and Other. Drilling and handling breaks are not usually included on the logs.

Defect Type

B	Bedding plane
Cs	Clay seam
Cv	Cleavage
Cz	Crushed zone
Ds	Decomposed seam
F	Fault
J	Joint
Lam	Lamination
Pt	Parting
Sz	Sheared Zone
V	Vein

Orientation

The inclination of defects is always measured from the perpendicular to the core axis.

h	horizontal
v	vertical
sh	sub-horizontal
sv	sub-vertical

Coating or Infilling Term

cln	clean
co	coating
he	healed
inf	infilled
stn	stained
ti	tight
vn	veneer

Coating Descriptor

ca	calcite
cbs	carbonaceous
cly	clay
fe	iron oxide
mn	manganese
slt	silty

Shape

cu	curved
ir	irregular
pl	planar
st	stepped
un	undulating

Roughness

po	polished
ro	rough
sl	slickensided
sm	smooth
vr	very rough

Other

fg	fragmented
bnd	band
qtz	quartz

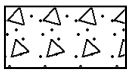
Symbols & Abbreviations

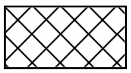
Graphic Symbols for Soil and Rock

General

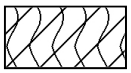

Asphalt

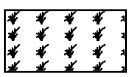

Road base

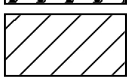

Concrete


Filling

Soils


Topsoil

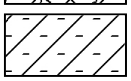

Peat


Clay


Silty clay

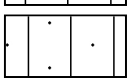

Sandy clay

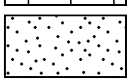

Gravelly clay

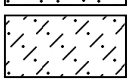

Shaly clay

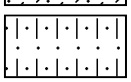

Silt


Clayey silt


Sandy silt

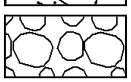

Sand


Clayey sand


Silty sand


Gravel

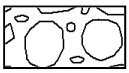

Sandy gravel


Cobbles, boulders

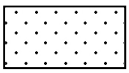

Talus

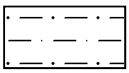
Sedimentary Rocks

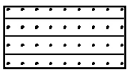

Boulder conglomerate

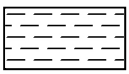

Conglomerate


Conglomeratic sandstone

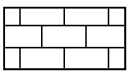

Sandstone


Siltstone

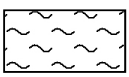

Laminite

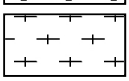

Mudstone, claystone, shale

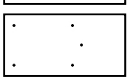

Coal


Limestone

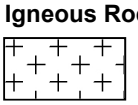
Metamorphic Rocks

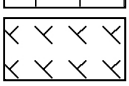

Slate, phyllite, schist

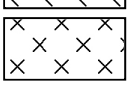

Gneiss

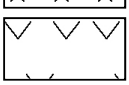

Quartzite

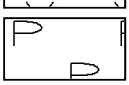
Igneous Rocks


Granite


Dolerite, basalt, andesite


Dacite, epidote


Tuff, breccia


Porphyry

Appendix B

Drawing

0 5 10 20 30 40 50 75 100 125m

1:1250 @ A3

Locality Plan

NOTE:
1: Base image from Nearmap.com
(Dated 1.7.2019)

LEGEND

Borehole location

Douglas Partners Geotechnics / Environment / Groundwater	CLIENT: Trinity Grammar School	TITLE: **Borehole Location Plan** **Proposed Redevelopment** **Prospect Road, SUMMER HILL**	PROJECT No: 86861.00
	OFFICE: Sydney / DRAWN BY: PSCH		DRAWING No: G1
	SCALE: 1:1250 @ A3 / DATE: 20.8.2019		REVISION: 0

Appendix C

Results of Field Work

BOREHOLE LOG

CLIENT: Trinity Grammar School
PROJECT: Proposed Redevelopment
LOCATION: 113-119 Prospect Road, Summer Hill

SURFACE LEVEL: 46.1 AHD
EASTING: 327126
NORTHING: 6247581
DIP/AZIMUTH: 90°/--

BORE No: BH01
PROJECT No: 86861.00
DATE: 24/7/2019
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
46	0.25	FILL/GRAVEL: fine to medium, subangular to angular, igneous, red-brown, dry, apparently poorly compacted, fill. 0.07m: plastic		A/E	0.25 0.35				
		FILL/GRAVEL: fine to medium, subangular, igneous, dark grey, with fine to medium grained sand, dry, apparently well compacted, fill.		A/E	0.5 0.6				
45	1.0	Silty CLAY CI-CH: medium to high plasticity, pale grey mottled orange brown, trace fine to medium subangular ironstone gravel, w<PL, very stiff to hard, residual soil.		A	1.0 1.05				
					1.5				
	1.7	SHALE: pale grey and brown, very low strength.		S	1.94		10,21,25/140 refusal Hammer Bouncing		
44	2								
43	3			S	3.0 3.37		9,21,15/70 refusal Hammer Bouncing		
42	4	4.5m: dark grey very low strength							
41	5								
40	6	6.0m: low strength							
39	7								
38	8								
	8.6	8.5m: medium strength							
37	9	Bore discontinued at 8.6m TC bit refusal.							

RIG: Hanjin DB8 **DRILLER:** BG Drilling **LOGGED:** LS **CASING:** Uncased

TYPE OF BORING: Hand auger to 1.05m, solid flight auger (TC) to 8.6m.

WATER OBSERVATIONS: Groundwater seepage observed at 7.5m.

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Trinity Grammar School
PROJECT: Proposed Redevelopment
LOCATION: 113-119 Prospect Road, Summer Hill

SURFACE LEVEL: 47.3 AHD
EASTING: 327232
NORTHING: 6247497
DIP/AZIMUTH: 90°/--

BORE No: BH02
PROJECT No: 86861.00
DATE: 24/7/2019
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering	Graphic Log	Rock Strength	Water	Fracture Spacing (m)	Discontinuities	Type	Core Rec. %	RQD %	Test Results & Comments
			EW HW MW SW FS FR		Ex Low Very Low Low Medium High Very High Ex High		0.01 0.05 0.10 0.50 1.00	B - Bedding J - Joint S - Shear F - Fault				
47	0.16	CONCRETE: 160mm thick.							A/E			
	0.3	FILL/Sandy CLAY: low to medium plasticity, dark grey, sand is fine to medium grained, with fine to medium subangular igneous gravel, w<PL, fill.							A/E			
46	1	Silty CLAY CI-CH: medium to high plasticity, pale grey mottled orange brown, w>PL, residual soil. 0.7m: pale grey mottled orange brown, with fine subangular ironstone gravel, w<PL, very stiff to hard, grading into weathered rock.							S			14,10/50 refusal
45	2								S			8,13,16 N = 29
44	3											
43	4								S			5,20,22 N = 42
	4.3	SHALE: pale grey with orange brown iron staining, very low strength.										
42	5											
	5.5	SHALE: dark grey with orange brown iron-staining, low to medium strength with very low strength bands, slightly weathered, fractured and slightly fractured with fine grained pale grey sandstone laminations.						5.63-5.67m: J(x3) 20°-30°, pl, ti, fe 5.83-5.87m: Cs 50mm 5.89m: J 85°, ti, fe 6.10-6.12m: J(x2) 30-45°, pl, ti, fe 6.57-6.6m: Cs 30mm 6.68m: B 0°, pl, ro, cly 4mm/fe 6.89m: J 30°, pl, ro, fe/cly 3mm 6.91m: J 70-80°, un, ro, cly 3mm 6.97-7.05m: 50°, pl, ro, fe cly 3mm 7.19-7.23m: Cs 40mm 7.27m: J 85°, st, ro, fe 7.52m: B 0°, pl, ro, cly 5mm 7.6-7.84m: B(x4) 0°, pl, ro 7.38-7.4m: Cs 20mm 7.9m: J 45°, pl, ro, cly 2mm 8.03-8.07m: B(x4) 0°, pl, ro, un/st cly 8.11-8.15m: J(x2) 30-40°, pl, ro, cly 1mm 9.23m: J 45°, pl, ro, cly, vn 9.6-9.64m: J(x2)	C	100	84	PL(A) = 0.3 PL(A) = 0.3
41	6											
40	7											PL(A) = 0.3
	7.93	SHALE: dark grey with 5% pale grey sandstone laminations, medium strength, fresh, slightly fractured and unbroken.										PL(A) = 0.8
39	8								C	100	84	PL(A) = 0.6
38	9											PL(A) = 0.6

RIG: Hanjin DB8 **DRILLER:** BG Drilling **LOGGED:** LS/SI **CASING:** HW to 5.5m

TYPE OF BORING: Diatube to 0.16m, solid flight auger (TC) to 5.5m, NMLC core to 10.36m.

WATER OBSERVATIONS: No free groundwater observed whilst augering.

REMARKS: Piezometer construction: (screen to 10.3m, blank to 4.3); Backfill: (sand to 3.8m, bentonite to 3.3m, sand to 0.2m concrete to surface); Gatic surface completion.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Trinity Grammar School
PROJECT: Proposed Redevelopment
LOCATION: 113-119 Prospect Road, Summer Hill

SURFACE LEVEL: 47.3 AHD
EASTING: 327232
NORTHING: 6247497
DIP/AZIMUTH: 90°/--

BORE No: BH02
PROJECT No: 86861.00
DATE: 24/7/2019
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
37								20°-40°, pl, ti,/fs 10m: J 75-85°, pl, ro, cln	C	100	84	PL(A) = 0.6
	10.36	Bore discontinued at 10.36m										
36	11											
35	12											
34	13											
33	14											
32	15											
31	16											
30	17											
29	18											
28	19											

RIG: Hanjin DB8 **DRILLER:** BG Drilling **LOGGED:** LS/SI **CASING:** HW to 5.5m

TYPE OF BORING: Diatube to 0.16m, solid flight auger (TC) to 5.5m, NMLC core to 10.36m.

WATER OBSERVATIONS: No free groundwater observed whilst augering.

REMARKS: Piezometer construction: (screen to 10.3m, blank to 4.3); Backfill: (sand to 3.8m, bentonite to 3.3m, sand to 0.2m concrete to surface); Gatic surface completion.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Trinity Grammar School
PROJECT: Proposed Redevelopment
LOCATION: 113-119 Prospect Road, Summer Hill

SURFACE LEVEL: 49.3 AHD
EASTING: 327168
NORTHING: 6247449
DIP/AZIMUTH: 90°/--

BORE No: BH03
PROJECT No: 86861.00
DATE: 19/7/2019
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering	Graphic Log	Rock Strength	Water	Fracture Spacing (m)	Discontinuities	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
			EW HW MW SW FS FR		Ex Low / Very Low / Low / Medium / High / Very High / Ex High		0.01 / 0.05 / 0.10 / 0.50 / 1.00	B - Bedding J - Joint S - Shear F - Fault				
49	0.05	BRICK PAVERS: 50mm thick.										
	0.2	FILL/SAND: fine to medium grained, yellow-brown dry to moist, fill.							A/E			
		Silty CLAY CI-CH: medium to high plasticity, orange-brown mottled red-brown, trace ironstone gravel, w~PL, stiff to very stiff, residual soil.							A/E			
48	1	1.1m: pale grey, w<PL, very stiff to hard, grading into weathered rock.							A/E S			7,27/140 refusal
47	2											
	2.1	SHALE: pale grey-brown, very low strength.							S			14,27/150 refusal
46	3							3m: CORE LOSS: 700mm				
	3.7								C	44	15	
45	4							4.04m: J 85°, st, ro, fe 4.31m: J 85°, pl, ro, cly 1mm 4.6-4.65m: J(x2) 30-35°, pl, ti, fe				PL(A) = 0.2
	4.0	SHALE: grey-brown, low and medium strength, extremely to highly weathered, fractured then slightly fractured, with 15% clay seams and 10% fine grained pale grey sandstone laminations.										
44	5							5.58m: J 85°, pl, ti 5.64m: J 35°, pl, ti, cly 1mm 5.87m: J 45°, ti, cly 1mm 6m: J 45°, pl, ti, fe 6.12m: J 40-60°, un, ro, fe	C	100	99	PL(A) = 0.7
	5.0	SHALE: dark grey, medium strength, slightly weathered then fresh, slightly fractured, with orange brown iron-staining and 20% fine grained pale grey sandstone laminations.										PL(A) = 0.5
43	6											
	6.6	6.4-6.5m: very high strength siderite band.										
42	7	SHALE: dark grey, medium strength, fresh, slightly fractured and unbroken, with 20% fine grained pale grey sandstone laminations.						6.96m: B 0°, pl, ro, cly 2mm 7.54m: B 0°, pl, ro, cly 2mm	C	100	100	PL(A) = 0.6
	8							8.08m: B 0°, pl, ro, cly 3mm				PL(A) = 0.7
41	9								C	100	100	PL(A) = 0.8
40								9.5m: B 0°, pl, ro, cly 2mm 9.76-9.93m: J 85°, pl, ro,				

RIG: Hanjin DB8 **DRILLER:** Rockwell Drilling **LOGGED:** LS/SI **CASING:** HW to 3.0m

TYPE OF BORING: Solid flight auger (TC) to 3.0m, NMLC core to 10.15m.

WATER OBSERVATIONS: No free groundwater observed whilst augering.

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Trinity Grammar School
PROJECT: Proposed Redevelopment
LOCATION: 113-119 Prospect Road, Summer Hill

SURFACE LEVEL: 49.3 AHD
EASTING: 327168
NORTHING: 6247449
DIP/AZIMUTH: 90°/--

BORE No: BH03
PROJECT No: 86861.00
DATE: 19/7/2019
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
	10.15	Bore discontinued at 10.15m						cly 1mm 9.94-9.98m: J(x4) 45°, pl, ro, cly 1mm	C	100	100	PL(A) = 0.6

RIG: Hanjin DB8 **DRILLER:** Rockwell Drilling **LOGGED:** LS/SI **CASING:** HW to 3.0m

TYPE OF BORING: Solid flight auger (TC) to 3.0m, NMLC core to 10.15m.

WATER OBSERVATIONS: No free groundwater observed whilst augering.

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Trinity Grammar School
PROJECT: Proposed Redevelopment
LOCATION: 113-119 Prospect Road, Summer Hill

SURFACE LEVEL: 47.5 AHD
EASTING: 327139
NORTHING: 6247380
DIP/AZIMUTH: 90°/--

BORE No: BH04
PROJECT No: 86861.00
DATE: 15/7/2019
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering	Graphic Log	Rock Strength	Water	Fracture Spacing (m)	Discontinuities	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
			EW HW MW SW FS FR		Ex Low / Very Low / Low / Medium / High / Very High / Ex High		0.01 / 0.05 / 0.10 / 0.50 / 1.00	B - Bedding J - Joint S - Shear F - Fault				
47	0.2	FILL/Sandy CLAY: dark brown, sand is fine to medium grained, trace rootlets, w>PL, apparently moderately compacted, fill.							A/E			
		FILL/Silty CLAY: brown and pale grey, w~PL, apparently moderately compacted, no odour, fill.							A/E			
1									A/E			
	1.2	Silty CLAY CI-CH: medium to high plasticity, orange mottled red, trace fine subangular ironstone gravel, w>PL, stiff, residual soil.							S			4,5,5 N = 10
46												
2		2.0m: orange mottled pale grey, with some fine to medium subangular ironstone gravel.							E			
									S			4,4,6 N = 10
45												
3												
		3.5m: hard, grading into weathered shale.							S			4/20 refusal Hammer Bouncing
44									A			
4												
43												
5												
42									A			
6	6.0	SHALE: grey-brown, very low strength, with higher strength orange-brown iron indurated bands.										
41												
7	7.03	SHALE: grey to grey-brown, very low strength, highly weathered, fragmented.						7.08-7.12m: fg 7.23m: B 0°, pl, sm, cly, vn 7.3-7.33m: Ds 7.33-7.36m: Cs 7.36-7.38m: Cz 7.44-7.46m: Ds 7.57-7.62m: Cz 7.88-8.0m: J 75°, pl, sm, cln	A			
40												
8	7.95	SHALE: dark grey, medium strength, slightly weathered, fragmented to fractured with clay seams. 8.2-8.3m: very high strength siderite bands							C	100	55	PL(A) = 0.2 PL(A) = 0.08 PL(A) = 0.6 PL(A) = 0.6
39								8.1m: B 0°, pl, fe, sm, cly co 1mm 8.18-8.19m: Cs 8.28m: B 0°, pl, sm, fe stn 8.3-8.31m: Cz 8.54m: B 0°, pl, sm, cly co 5mm 8.68m: B 0°, pl, sm, cly co 5mm 8.7m: B 0°, pl, sm, cly				
9												
	9.2	SHALE: dark grey, medium then low to medium strength, slightly weathered and fractured, with <5% fine grained pale grey sandstone laminations.							C	100	47	PL(A) = 0.6 PL(A) = 0.6
38												

RIG: Hanjin DB8 **DRILLER:** GSDE **LOGGED:** AH/SI **CASING:** PVC to 0.6m

TYPE OF BORING: Solid flight auger (TC) to 7.03m, NMLC core to 10.49m.

WATER OBSERVATIONS: No free groundwater observed whilst augering.

REMARKS: Piezometer construction: (screen to 10.0m, blank to 5.5); Backfill: (sand to 5.0m, bentonite to 0.2m, concrete to surface); Gatic surface completion.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Trinity Grammar School
PROJECT: Proposed Redevelopment
LOCATION: 113-119 Prospect Road, Summer Hill

SURFACE LEVEL: 47.5 AHD
EASTING: 327139
NORTHING: 6247380
DIP/AZIMUTH: 90°/--

BORE No: BH04
PROJECT No: 86861.00
DATE: 15/7/2019
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
37	10.49	Bore discontinued at 10.49m						co 3mm 8.78-9.25m: B(x13) 0°, pl, sm, cly co 1-3mm 9.49-9.62m: B(x4) 0°, pl, sm, cly co 1-3mm 9.86m: B 0°, pl, sm, cly vn 10.04m: B 0°, pl, sm, cly co 2mm 10.3-10.44m: B(x5) 0°, pl, sm, cly co 1-3mm 10.30-10.49m: J 75°, st, sm, fe stn	C	100	47	PL(A) = 0.7
36	11											
35	12											
34	13											
33	14											
32	15											
31	16											
30	17											
29	18											
28	19											

RIG: Hanjin DB8 **DRILLER:** GSDE **LOGGED:** AH/SI **CASING:** PVC to 0.6m

TYPE OF BORING: Solid flight auger (TC) to 7.03m, NMLC core to 10.49m.

WATER OBSERVATIONS: No free groundwater observed whilst augering.

REMARKS: Piezometer construction: (screen to 10.0m, blank to 5.5); Backfill: (sand to 5.0m, bentonite to 0.2m, concrete to surface); Gatic surface completion.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Trinity Grammar School
PROJECT: Proposed Redevelopment
LOCATION: 113-119 Prospect Road, Summer Hill

SURFACE LEVEL: 47.5 AHD
EASTING: 327130
NORTHING: 6247354
DIP/AZIMUTH: 90°/--

BORE No: BH05
PROJECT No: 86861.00
DATE: 15/7/2019
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering	Graphic Log	Rock Strength	Water	Fracture Spacing (m)	Discontinuities	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
			EW HW MW SW FS FR		Ex Low Very Low Low Medium High Very High Ex High		0.01 0.05 0.10 0.50 1.00	B - Bedding J - Joint S - Shear F - Fault				
47	0.2	FILL/Clayey SAND: fine to medium grained, dark brown, trace rootlets, moist, apparently moderately compacted, no odour, fill.							A/E			
		FILL/Silty CLAY: medium plasticity, brown and orange, trace fine subangular ironstone gravel and ash, w>PL, apparently moderately compacted, no odour, fill.							A/E			
46	1								A/E			
									S			4,4,5 N = 9
	1.8	Silty CLAY CI-CH: medium to high plasticity, orange mottled red, trace fine subangular ironstone gravel, w>PL, firm, residual.							E			
45	2	2.5m: orange mottled pale grey, with fine to medium subangular ironstone gravel.							S			1,1,2 N = 3
	3	3.0m: pale grey w<PL, hard, grading into weathered shale.										
44												
	4								S			25/100 refusal
43												
	5											
42									S			16,25 refusal
	6											
	6.0	SHALE: pale grey-brown, very low strength.										
41	7											
	7.0	SHALE: dark grey, medium strength, slightly weathered then fresh stained, fractured and slightly fractured, with 10% fine grained pale grey sandstone laminations.						7.0-7.2m: B(x5) 0°, pl, st fe 7.25m: B 0°, cly 5mm 7.35m: J 45-60°, un, ti 7.6-7.75m: B 0°-5°, fe	C	100	53	PL(A) = 0.4
40	8											
								8.3m: J 25°, un, ro, ti 8.55m: B 0°, fe				PL(A) = 0.4
39	8.6	SHALE: dark grey, medium strength, fresh, slightly fractured and unbroken with 5% fine grained pale grey sandstone laminations.							C	100	100	
	9											
38												PL(A) = 0.6
								9.65m: J 80° , un, ro, cln 9.72m: J 45°, pl, ro, cln				

RIG: Hanjin DB8 **DRILLER:** BG Drilling **LOGGED:** AH/SI **CASING:** HW to 6.5m

TYPE OF BORING: Solid flight auger (TC) to 7.0m, NMLC core to 10.92m.

WATER OBSERVATIONS: No free groundwater observed whilst augering.

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Trinity Grammar School
PROJECT: Proposed Redevelopment
LOCATION: 113-119 Prospect Road, Summer Hill

SURFACE LEVEL: 47.5 AHD
EASTING: 327130
NORTHING: 6247354
DIP/AZIMUTH: 90°/--

BORE No: BH05
PROJECT No: 86861.00
DATE: 15/7/2019
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
37		SHALE: dark grey, medium strength, fresh, slightly fractured and unbroken with 5% fine grained pale grey sandstone laminations. *(continued)*						10.7m: J 45°, un, ro, cln	C	100	100	PL(A) = 0.8
11	10.92	Bore discontinued at 10.92m										
36	12											
35	13											
34	14											
33	15											
32	16											
31	17											
30	18											
29	19											
28												

RIG: Hanjin DB8 **DRILLER:** BG Drilling **LOGGED:** AH/SI **CASING:** HW to 6.5m

TYPE OF BORING: Solid flight auger (TC) to 7.0m, NMLC core to 10.92m.

WATER OBSERVATIONS: No free groundwater observed whilst augering.

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Trinity Grammar School
PROJECT: Proposed Redevelopment
LOCATION: 113-119 Prospect Road, Summer Hill

SURFACE LEVEL: 48.2 AHD
EASTING: 327083
NORTHING: 6247363
DIP/AZIMUTH: 90°/--

BORE No: BH06
PROJECT No: 86861.00
DATE: 18/7/2019
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering	Graphic Log	Rock Strength	Water	Fracture Spacing (m)	Discontinuities (B - Bedding, J - Joint, S - Shear, F - Fault)	Type	Core Rec. %	RQD %	Test Results & Comments
48	0.3	FILL/SAND: fine to medium grained, brown, with silt and trace rootlets, moist, fill.							A/E			
	0.6	FILL/Clayey SAND: fine to medium grained, dark brown, trace fine subangular shale gravel, moist, fill.							A			
47	1	Silty CLAY CI-CH: medium to high plasticity, pale grey mottled red-brown, with fine to medium subangular ironstone gravel, w<PL, very stiff to hard, residual.							A			
									S			25,10/10 refusal
46	2											
	2.1	SHALE: pale grey-brown, very low strength.										
		2.7m: grey, very low strength with low strength bands.							S			8,25/130 refusal
45	3											
44	4											
	4.07	SHALE: grey with orange-brown iron-staining, very low strength with low to medium strength bands, highly to moderately weathered, fragmented to fractured.						4.21-4.24m: Cs 30mm 4.33-5.35m: pl, ti, fe 4.44-4.53m: B(x3) 45-60°, pl, ti, fe 4.58-4.61m: Cs 30mm 4.74-5.0m: B 30°, pl, ro, cly 1mm 4.86-4.89m: J 50°, pl, ro, fe	C	100	0	PL(A) = 0.4
	4.6	SHALE: dark grey with orange brown iron-staining, medium strength with some low strength bands, slightly weathered, fractured, with 5-10% fine grained pale grey sandstone laminations.						4.94m: J 60°, pl, ti, fe 5mm 4.97-5.0m: Ds 30mm 5m: J 85°, st, ti, fe 5.32m: J 30°, pl, ro, fe 5.54-5.61m: J 45°, pl, ro, fe 5.64m: J 60°, pl, ti, fe 5.678m: J 60°, pl, fe 3mm 5.7-5.77m: J(x7) 30-45°, pl, ro, fe 6.25m: J 30°, pl, ro, fe 6.26-6.28m: J(x3), 20-30°, pl, ro, fe 6.27m: J 60°, pl, ti, fe 4mm 6.36m: J 0-20°, un, ro, cly 5mm	C	100	40	PL(A) = 0.4 PL(A) = 0.9 PL(A) = 0.6
43	5											
42	6											
41	7											
	7.0	SHALE: dark grey, medium strength, fresh, unbroken, with 5% fine grained pale grey sandstone laminations.						6.43m: J 30°, pl, ro, fe 6.53-6.63m: J(x2) 80°, un, ro, fe 6.58-6.6m: Ds 20mm 6.76m: J 85°, st, ro, fe 6.84m: B 0°, pl, ro, cly 7mm 6.85-6.87m: J(x3) 40°-70°, un, ro, fe 6.95m: J 50°, pl, ro, fe 7.2m: J 45°, pl, ro, fe/ cly 2mm	C	100	100	PL(A) = 0.5 PL(A) = 0.9
40	8											
39	9											

RIG: Hanjin DB8 **DRILLER:** Rockwell Drilling **LOGGED:** LS/SI **CASING:** HW to 4.0m

TYPE OF BORING: Solid flight auger (TC) to 4.0m, NMLC core to 10.35m.

WATER OBSERVATIONS: No free groundwater observed whilst augering.

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Trinity Grammar School
PROJECT: Proposed Redevelopment
LOCATION: 113-119 Prospect Road, Summer Hill

SURFACE LEVEL: 48.2 AHD
EASTING: 327083
NORTHING: 6247363
DIP/AZIMUTH: 90°/--

BORE No: BH06
PROJECT No: 86861.00
DATE: 18/7/2019
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
38		10.05-10.15m: very high strength band.							C	100	100	PL(A) = 5.4
	10.35	Bore discontinued at 10.35m										
37	11											
36	12											
35	13											
34	14											
33	15											
32	16											
31	17											
30	18											
29	19											

RIG: Hanjin DB8 **DRILLER:** Rockwell Drilling **LOGGED:** LS/SI **CASING:** HW to 4.0m

TYPE OF BORING: Solid flight auger (TC) to 4.0m, NMLC core to 10.35m.

WATER OBSERVATIONS: No free groundwater observed whilst augering.

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Trinity Grammar School
PROJECT: Proposed Redevelopment
LOCATION: 113-119 Prospect Road, Summer Hill

SURFACE LEVEL: 47.6 AHD
EASTING: 327118
NORTHING: 6247326
DIP/AZIMUTH: 90°/--

BORE No: BH07
PROJECT No: 86861.00
DATE: 15/7/2019
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Type	Core Rec. %	RQD %	Test Results & Comments
47	0.3	FILL/Clayey SAND: fine to medium grained, dark brown, trace rootlets, moist, apparently moderately compacted, no odour, fill.							A/E			
		FILL/Silty CLAY: medium plasticity, pale grey and brown, trace fine to medium subangular ironstone and shale gravel, w>PL, apparently moderately compacted, fill.							A/E*			
46	1.6	Silty CLAY CI-CH: medium to high plasticity, pale grey mottled orange-red, with fine to medium subangular ironstone gravel, w<PL, very stiff, residual.							S			2,3,3 N = 6
45		2.5m: hard, grading into weathered shale, with orange-brown indurated bands.							A			
44									S			8,21/100 refusal
43									S			12,21,30 N = 51
42									A			
41									A			
40	7.05	SHALE: pale grey with orange-brown iron-staining, very low and low strength, highly weathered, fractured and slightly fractured, with 5% fine grained pale grey sandstone laminations.						7.05-7.45m: B 0°-5°, fe 7.45m: J 35°, pl, ro, fe 7.6m: J 45-75°, un, ro, fe 7.9m: J30-70°, un, ro, fe 8.05-8.5m: B 5-10°, fe, cly 8.8m: J 60°, pl, ro, cln 9.2m: B 0°, fe 9.2-9.33m: Ds	C	100	30	PL(A) = 0.1 PL(A) = 0.3
38	9.33	SHALE: dark grey, medium strength, fresh, slightly fractured.										

RIG: Hanjin DB8 **DRILLER:** GSDE **LOGGED:** AH/SI **CASING:** PVC to 0.6m

TYPE OF BORING: Solid flight auger (TC) to 7.05m, NMLC core to 10.15m.

WATER OBSERVATIONS: No free groundwater observed whilst augering.

REMARKS: *BD01/150719: Duplicate taken at 0.9-1.0m.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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BOREHOLE LOG

CLIENT: Trinity Grammar School
PROJECT: Proposed Redevelopment
LOCATION: 113-119 Prospect Road, Summer Hill

SURFACE LEVEL: 47.6 AHD
EASTING: 327118
NORTHING: 6247326
DIP/AZIMUTH: 90°/--

BORE No: BH07
PROJECT No: 86861.00
DATE: 15/7/2019
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
	10.15	Bore discontinued at 10.15m							C	100	30	PL(A) = 0.6

RIG: Hanjin DB8 **DRILLER:** GSDE **LOGGED:** AH/SI **CASING:** PVC to 0.6m

TYPE OF BORING: Solid flight auger (TC) to 7.05m, NMLC core to 10.15m.

WATER OBSERVATIONS: No free groundwater observed whilst augering.

REMARKS: *BD01/150719: Duplicate taken at 0.9-1.0m.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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BOREHOLE LOG

CLIENT: Trinity Grammar School
PROJECT: Proposed Redevelopment
LOCATION: 113-119 Prospect Road, Summer Hill

SURFACE LEVEL: 48.1 AHD
EASTING: 327073
NORTHING: 6247299
DIP/AZIMUTH: 90°/--

BORE No: BH08
PROJECT No: 86861.00
DATE: 15/7/2019
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering	Graphic Log	Rock Strength	Water	Fracture Spacing (m)	Discontinuities (B - Bedding, J - Joint, S - Shear, F - Fault)	Type	Core Rec. %	RQD %	Test Results & Comments
48	0.3	FILL/Clayey SAND: fine to medium grained, dark brown, trace rootlets, moist, apparently moderately compacted, no odour, fill.							E			
	0.8	FILL/Silty CLAY: medium plasticity, grey and brown, trace fine subangular ironstone and shale gravel, trace ash, w>PL, apparently moderately compacted, fill.							E			
47	1								E			
									S			3,4,4 N = 8
		Silty CLAY CI-CH: medium to high plasticity, orange mottled red, trace fine subangular ironstone gravel, w>PL, stiff, residual.										
46	2											
		2.5m: pale grey mottled orange-brown, w<PL, hard, grading into weathered shale.							S			8/40 refusal
45	3											
		3.4m: with orange brown iron indurated bands.							C	100	0	pp = 300 pp = 280 pp = 210 pp = 200
44	4											
	4.7	SHALE: grey-brown, very low strength, extremely to highly weathered with clay bands.						4.7m: J 30°, pl, ro, fe				pp = 420
43	5								C	87	0	
	5.55	SHALE: pale grey and brown, very low to low strength, highly weathered, fractured and slightly fractured, with clay and iron indurated bands.						5.5m: CORE LOSS: 50mm 5.75m: J 45°, un, ro, fe	C	65	0	PL(A) = 0.3 pp = 520
42	6											
								6.6m: CORE LOSS: 1050mm				
41	7											
	7.65	SHALE: grey-brown, very low then low strength, highly then slightly weathered, fractured and slightly fractured, with clay bands.						7.77-7.85m: J 80°, un, ro, fe 7.85-8.3m: B(x8) 0-5°, fe				PL(A) = 0.2
40	8							8.3-9.1m: B(x8) 0°, fe, cly 5-10mm	C	100	0	PL(A) = 0.1
39	9							9.2m: J 45°, pl, ro, fe 9.3m: J 30-45°, cu, ro, fe 9.5m: J 30°, pl, ro, cln	C	100	93	PL(A) = 0.2
	9.85							9.85m: B 5°, fe, cly 5mm				

RIG: Hanjin DB8 **DRILLER:** GSDE **LOGGED:** AH/SI **CASING:** PVC to 0.6m

TYPE OF BORING: Solid flight auger (TC) to 3.4m, NMLC core to 11.4m.

WATER OBSERVATIONS: No free groundwater observed whilst augering.

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Trinity Grammar School
PROJECT: Proposed Redevelopment
LOCATION: 113-119 Prospect Road, Summer Hill

SURFACE LEVEL: 48.1 AHD
EASTING: 327073
NORTHING: 6247299
DIP/AZIMUTH: 90°/--

BORE No: BH08
PROJECT No: 86861.00
DATE: 15/7/2019
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
38		SHALE: dark grey, medium to high strength, fresh, slightly fractured, with <5% fine grained pale grey sandstone laminations *(continued)*										PL(A) = 0.6
									C	100	93	
37	11							10.8m: J 60°, pl, sm, cln 11.02m: J 80°, pl, ro, fe 11.16-11.30m: J(x3) 45°, pl, sm, cly				PL(A) = 1.6
	11.4	Bore discontinued at 11.4m										
36	12											
35	13											
34	14											
33	15											
32	16											
31	17											
30	18											
29	19											

RIG: Hanjin DB8 **DRILLER:** GSDE **LOGGED:** AH/SI **CASING:** PVC to 0.6m

TYPE OF BORING: Solid flight auger (TC) to 3.4m, NMLC core to 11.4m.

WATER OBSERVATIONS: No free groundwater observed whilst augering.

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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BOREHOLE LOG

CLIENT: Trinity Grammar School
PROJECT: Proposed Redevelopment
LOCATION: 113-119 Prospect Road, Summer Hill

SURFACE LEVEL: 47.6 AHD
EASTING: 327116
NORTHING: 6247295
DIP/AZIMUTH: 90°/--

BORE No: BH09
PROJECT No: 86861.00
DATE: 15/7/2019
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering	Graphic Log	Rock Strength	Water	Fracture Spacing (m)	Discontinuities	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
		B - Bedding J - Joint S - Shear F - Fault	EW HW MW SW FS FR		Ex Low Very Low Low Medium High Very High Ex High		0.01 0.05 0.10 0.50 1.00					
47	0.3	FILL/Clayey SAND: fine to medium grained, dark brown, trace rootlets, moist, apparently moderately compacted, fill.							A/E			
		FILL/Silty CLAY: medium plasticity, pale grey and brown, trace fine to medium subangular ironstone and shale gravel, w>PL,apparently poorly compacted, fill.							A/E			
46	1								A/E			
									S			2,2,3 N = 5
	2								E			
45	2.5	Silty CLAY CI-CH: medium to high plasticity, orange mottled red, trace fine subangular ironstone gravel, w>PL, firm, residual.							E			
									S			1,2,3 N = 5
	3											
44									E*			
	4	4.0m: pale grey mottled orange-red, w<PL, very stiff to hard, grading into weathered shale.							S			11/50 refusal
43												
	5											
42									S			5,23,23 N = 46
	6											
41												
	7											
	7.5	SHALE: grey brown, very low strength, slightly weathered, fractured.										
40	7.75	SHALE: dark grey with orange brown iron staining, low to medium strength, slightly weathered, to fresh stained, fractured to slightly fractured, with 5% fine grained pale grey sandstone laminations.						7.62m: B 0°, cly 10mm 7.7 to 7.9m: J75°, un, ro, fe 7.9m: B 20°, un, ro, fe 8.15m: J 45°, pl, ro, fe 8.35-8.65m: B(x3) 0°-5°, fe	C	100	33	PL(A) = 0.3
	8											
39												PL(A) = 0.3
	9							8.9 & 9.2m: B(x2) 0°, fe				
38									C	100	98	PL(A) = 0.3
	10.0											

RIG: Hanjin DB8 **DRILLER:** BG Drilling **LOGGED:** AH/SI **CASING:** HW to 6.0m

TYPE OF BORING: Solid flight auger (TC) to 7.08m, NMLC core to 11.0m.

WATER OBSERVATIONS: No free groundwater observed whilst augering.

REMARKS: *BD02/150719: Duplicate taken at 3.4-3.5m.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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BOREHOLE LOG

CLIENT: Trinity Grammar School
PROJECT: Proposed Redevelopment
LOCATION: 113-119 Prospect Road, Summer Hill

SURFACE LEVEL: 47.6 AHD
EASTING: 327116
NORTHING: 6247295
DIP/AZIMUTH: 90°/--

BORE No: BH09
PROJECT No: 86861.00
DATE: 15/7/2019
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
37		SHALE: dark grey, medium strength, fresh, unbroken, with 10% fine grained pale grey sandstone laminations.							C	100	98	PL(A) = 0.4
	11 11.0	Bore discontinued at 11.0m						10.9m: J 85°, pl, ro, cly				
36	12											
35	13											
34	14											
33	15											
32	16											
31	17											
30	18											
29	19											
28												

RIG: Hanjin DB8 **DRILLER:** BG Drilling **LOGGED:** AH/SI **CASING:** HW to 6.0m

TYPE OF BORING: Solid flight auger (TC) to 7.08m, NMLC core to 11.0m.

WATER OBSERVATIONS: No free groundwater observed whilst augering.

REMARKS: *BD02/150719: Duplicate taken at 3.4-3.5m.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Trinity Grammar School
PROJECT: Proposed Redevelopment
LOCATION: 113-119 Prospect Road, Summer Hill

SURFACE LEVEL: 45.8 AHD
EASTING: 327180
NORTHING: 6247376
DIP/AZIMUTH: 90°/--

BORE No: BH10
PROJECT No: 86861.00
DATE: 23/7/2019
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering	Graphic Log	Rock Strength	Water	Fracture Spacing (m)	Discontinuities	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
			EW HW MW SW FS FR		Ex Low / Very Low / Low / Medium / High / Very High / Ex High		0.01 / 0.05 / 0.10 / 0.50 / 1.00	B - Bedding J - Joint S - Shear F - Fault				
45	0.5	FILL/SAND: medium to coarse grained, brown, with some silt, trace rootlets in top 0.1m, moist, poorly compacted, fill.							A/E			
		0.1m: trace fine subangular shale gravel.							A/E			
1	1.1	FILL/Silty CLAY: medium plasticity, brown and red, with fine subangular ironstone gravel, trace coarse grained sand, w>PL, poorly compacted, fill.							A/E*			
		Silty CLAY CI-CH: medium to high plasticity, red brown mottled pale grey, w>PL, stiff, residual.							S			4,6,7 N = 13
44	2	2.1m: pale grey mottled red-brown with iron indurated bands, w<PL, very stiff to hard, grading into weathered shale.										
									S			4,20/100 refusal
43	3											
42	4								S			9,25/100 refusal
41	5								C	100	0	
	5.5	SHALE: grey to dark grey with orange brown iron-staining, very low strength, highly weathered, fractured.						5.6-5.7m: J(x4) 30-40°, pl, ti, fe 5.8-6.24m: J(x10) 20-40°, pl, ti, fe 5.96m: J 85°, pl, ro, fe 6.11m: J 80°, pl, ti, cly 1mm.fe 6.26m: CORE LOSS: 340mm 6.6-6.68m: Cs 80 mm 6.7-6.82m: J 70-80°, st, ti, fe 6.82m: J 60-85°, ti, fe 6.99-7.1m: J (x6) 30-45°, pl, fe/cly 2mm 7.11m: J 45°, pl, fe/cly 5mm 7.2-7.29m: J(x4) 30-50°, un, ti, fe 7.55-7.59m: B(x2) 0°, pl, ro, fe/ cly 8.55m: J 50-75°, un, ti, cly vn				PL(A) = 0.3
40	6											
	6.6	SHALE: grey-brown, very low and low strength, highly weathered, fractured.							C	89	32	PL(A) = 0.2
39	7											
	7.85	SHALE: dark grey, medium strength, fresh, unbroken, with 5-10% fine grained pale grey sandstone laminations.										PL(A) = 0.4
38	8											
37	9								C	100	100	PL(A) = 0.5
36												PL(A) = 0.8

RIG: Hanjin DB8 **DRILLER:** BG Drilling **LOGGED:** LS/SI **CASING:** HW to 4.0m

TYPE OF BORING: Solid flight auger (TC) to 4.0m, NMLC core to 10.83m.

WATER OBSERVATIONS: Groundwater seepage observed at 4.0m.

REMARKS: *BD23072019-1: Duplicate taken at 0.9-1.0m.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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BOREHOLE LOG

CLIENT: Trinity Grammar School
PROJECT: Proposed Redevelopment
LOCATION: 113-119 Prospect Road, Summer Hill

SURFACE LEVEL: 45.8 AHD
EASTING: 327180
NORTHING: 6247376
DIP/AZIMUTH: 90°/--

BORE No: BH10
PROJECT No: 86861.00
DATE: 23/7/2019
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
35		SHALE: dark grey, medium strength, fresh, unbroken, with 5-10% fine grained pale grey sandstone laminations. *(continued)*						10.27m: B 0, ro, cly 5mm	C	100	100	PL(A) = 0.6 PL(A) = 5
	10.83	10.6-10.7m: very high strength siderite band.										
		Bore discontinued at 10.83m										
34	11											
	12											
33	13											
32	14											
31	15											
30	16											
29	17											
28	18											
27	19											
26												

RIG: Hanjin DB8 **DRILLER:** BG Drilling **LOGGED:** LS/SI **CASING:** HW to 4.0m

TYPE OF BORING: Solid flight auger (TC) to 4.0m, NMLC core to 10.83m.

WATER OBSERVATIONS: Groundwater seepage observed at 4.0m.

REMARKS: *BD23072019-1: Duplicate taken at 0.9-1.0m.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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BOREHOLE LOG

CLIENT: Trinity Grammar School
PROJECT: Proposed Redevelopment
LOCATION: 113-119 Prospect Road, Summer Hill

SURFACE LEVEL: 45.6 AHD
EASTING: 327177
NORTHING: 6247351
DIP/AZIMUTH: 90°/--

BORE No: BH11
PROJECT No: 86861.00
DATE: 23/7/2019
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering	Graphic Log	Rock Strength	Water	Fracture Spacing (m)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
45	0.3	FILL/SAND: medium to coarse, dark grey-brown, with silt, trace rootlets in top 0.1m, moist, fill.							A/E			
		FILL/Silty CLAY: medium plasticity, brown mottled pale grey, with fine to medium subangular shale and ironstone gravel, w>PL, damp, apparently poorly compacted, fill.							A/E			
	1								A/E			
									S			3,3,3 N = 6
44									A/E			
	2	2.0m: moist to wet							A/E			
	2.5	Silty CLAY CI-CH: medium to high plasticity, grey mottled red brown and brown, with fine subangular ironstone gravel, w>PL, firm, residual soil.							A/E			
43									S			2,3,3 N = 6
	3	3.1m: pale grey mottled red brown, very stiff.							A			
42									A			
	4								S			8,13,17 N = 30
41												
	5	5.0m: pale grey, w<PL, very stiff to hard, with iron indurated bands, grading into weathered shale.										
40									S			8,14,18 N = 32
	6											
39												
	7								S			20,25/100 refusal
	7.5	SHALE: pale grey-brown, very low strength.										
38												
	8											
37	8.6	SHALE: grey to dark grey with orange-brown iron-staining, low and low to medium strength, slightly weathered, fractured, with 5-10% fine grained pale grey sandstone laminations.						8.5-8.59m: Cs 90mm 8.63m: J 50°, st, ro, fe/cly 4mm	S			9,25,10/50 refusal PL(A) = 0.3
	9								C	100	84	
36								9.37-9.42m: Ds 10mm 9.48m: J 25°, pl, ti, fe				PL(A) = 0.5
	9.85							9.72-9.85m: J 80-85°, un, ro, cly 1mm/ fe				

RIG: Hanjin DB8 **DRILLER:** BG Drilling **LOGGED:** LS/SI **CASING:** HW to 8.5m

TYPE OF BORING: Hand auger to 0.5m, solid flight auger (TC) to 8.5m, NMLC coring to 11.28m.

WATER OBSERVATIONS: Possible pearched water at 2.0-3.1m.

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Trinity Grammar School
PROJECT: Proposed Redevelopment
LOCATION: 113-119 Prospect Road, Summer Hill

SURFACE LEVEL: 45.6 AHD
EASTING: 327177
NORTHING: 6247351
DIP/AZIMUTH: 90°/--

BORE No: BH11
PROJECT No: 86861.00
DATE: 23/7/2019
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
35	11	SHALE: dark grey, medium strength, fresh, slightly fractured, with 5% fine grained pale grey sandstone laminations. *(continued)*						9.81-9.86m: Ds 20mm 10.05m: J 50°, pl, ro, cly vn 10.14m: J 45°, st, ro, cly 1mm 10.17-10.23m: B(x2) 0°, pl, ro, cly 2mm	C	100	84	PL(A) = 0.6 PL(A) = 0.8
34	11.28	Bore discontinued at 11.28m										
33	12											
32	13											
31	14											
30	15											
29	16											
28	17											
27	18											
26	19											

RIG: Hanjin DB8 **DRILLER:** BG Drilling **LOGGED:** LS/SI **CASING:** HW to 8.5m

TYPE OF BORING: Hand auger to 0.5m, solid flight auger (TC) to 8.5m, NMLC coring to 11.28m.

WATER OBSERVATIONS: Possible pearched water at 2.0-3.1m.

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Trinity Grammar School
PROJECT: Proposed Redevelopment
LOCATION: 113-119 Prospect Road, Summer Hill

SURFACE LEVEL: 45.2 AHD
EASTING: 327175
NORTHING: 6247299
DIP/AZIMUTH: 90°/--

BORE No: BH12
PROJECT No: 86861.00
DATE: 18/7/2019
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering	Graphic Log	Rock Strength	Water	Fracture Spacing (m)	Discontinuities	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
			EW HW MW SW FS FR		Ex Low / Very Low / Low / Medium / High / Very High / Ex High		0.01 / 0.05 / 0.10 / 0.50 / 1.00	B - Bedding J - Joint S - Shear F - Fault				
45	0.4	FILL/SAND: medium to coarse grained, brown, with silt, moist, apparently poorly compacted, fill.										
		FILL/Silty CLAY: medium plasticity, brown mottled pale grey and red-brown, with fine subangular shale gravel, w<PL, apparently poorly compacted, fill.							S			4,2,3 N = 5
44	1								A/E			
		1.8m: gravelly clay.										
43	2								A/E			
		2.4m: with some medium subangular ironstone gravel.							S			2,2,2 N = 4
42	3					▽			A/E			
	3.3	FILL/Silty CLAY: medium plasticity, grey-brown, with fine subangular shale gravel, w>PL, apparently poorly compacted, fill (possibly natural).							A/E			
41	4								A/E			
	4.3	Silty CLAY CI-CH: medium to high plasticity, grey-brown mottled red brown trace fine subangular ironstone gravel, w>PL firm to stiff.							S			3,3,4 N = 7
		5.0m: red brown mottled pale grey, very stiff.							A			
40	5								A			
									A			
									S			5,5,14 N = 19
39	6											
38	7								S			19,20 refusal
	7.0	7.0m; pale grey with orange brown iron indurated bands, very stiff to hard.						7m: CORE LOSS: 2000mm				
37	8								C	33	0	
36	9											
	9.0											PL(A) = 0.5
	10.0											

RIG: Hanjin DB8 **DRILLER:** Rockwell Drilling **LOGGED:** LS/SI **CASING:** HW to 7.0m

TYPE OF BORING: Solid flight auger (TC) to 7.0m, NMLC core to 13.4m.

WATER OBSERVATIONS: Groundwater seepage observed at 3.3m.

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▽	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Trinity Grammar School
PROJECT: Proposed Redevelopment
LOCATION: 113-119 Prospect Road, Summer Hill

SURFACE LEVEL: 45.2 AHD
EASTING: 327175
NORTHING: 6247299
DIP/AZIMUTH: 90°/--

BORE No: BH12
PROJECT No: 86861.00
DATE: 18/7/2019
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering	Graphic Log	Rock Strength	Water	Fracture Spacing (m)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
35		SHALE: dark grey, medium and high strength, moderately to slightly weathered, slightly fractured, with 5% fine grained pale grey sandstone laminations.										PL(A) = 0.4
		10.8-10.9m: very high strength siderite band.						10.24m: J 45°, pl, ro, cly 1mm 10.51m: J 45°, ro, cly 2mm	C	100	98	PL(A) = 7.1
34	11							10.89-10.9m: B(x2) 0° pl, ro, cly 1mm				
												PL(A) = 1
33	12								C	100	100	PL(A) = 0.5
	12.8	LAMINITE: 70% grey siltstone and 30% fine grained pale grey sandstone, high strength, fresh, unbroken.										
32	13							13.1-13.23m: B(x2) 0° pl, ro, cly 1mm				PL(A) = 1.3
	13.4	Bore discontinued at 13.4m										
31	14											
30	15											
29	16											
28	17											
27	18											
26	19											

RIG: Hanjin DB8 **DRILLER:** Rockwell Drilling **LOGGED:** LS/SI **CASING:** HW to 7.0m

TYPE OF BORING: Solid flight auger (TC) to 7.0m, NMLC core to 13.4m.

WATER OBSERVATIONS: Groundwater seepage observed at 3.3m.

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

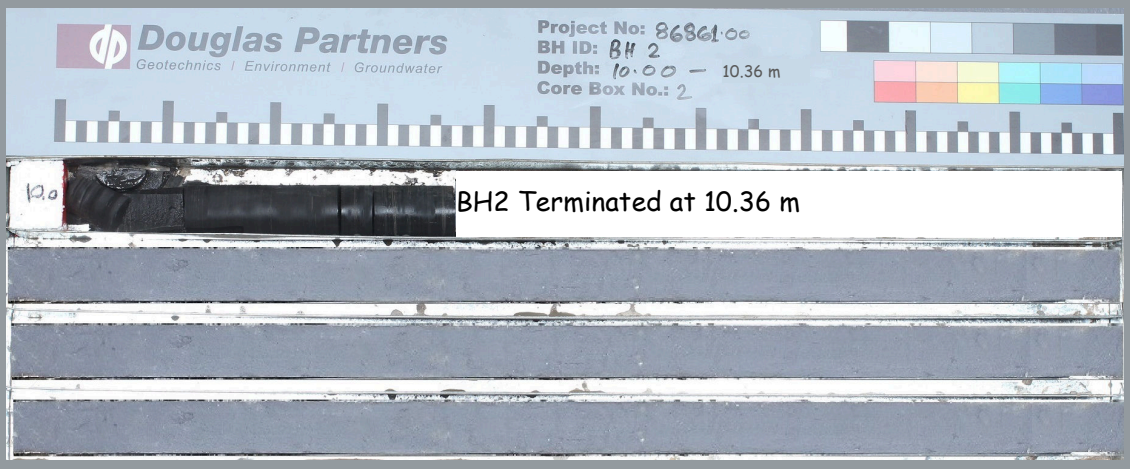
A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BORE: 2 PROJECT: SUMMER HILL JULY 2019

5.50 – 10.00m

BORE: 2 PROJECT: SUMMER HILL JULY 2019

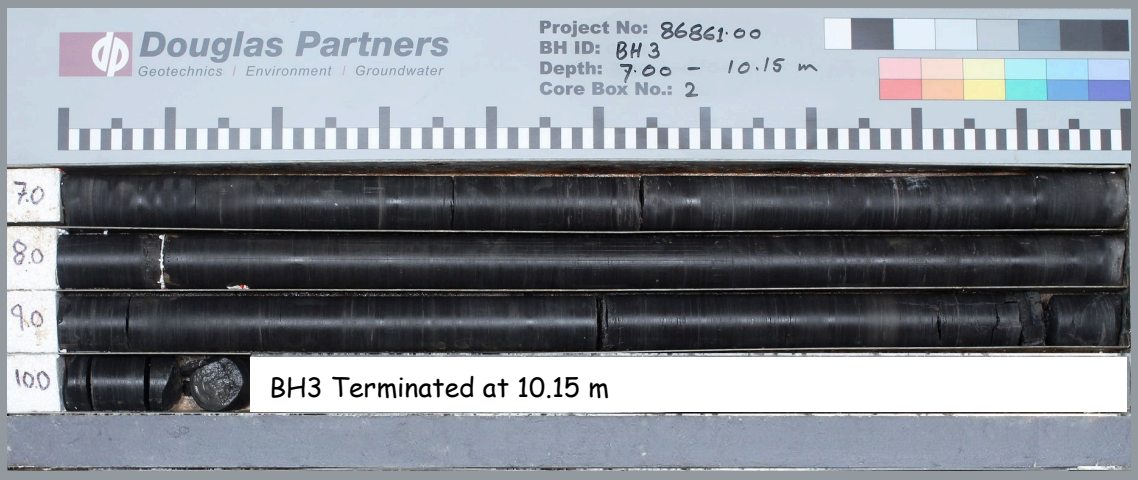


10.00 – 10.36m

BORE: 3 PROJECT: SUMMER HILL JULY 2019

3.00 – 7.00m

BORE: 3 PROJECT: SUMMER HILL JULY 2019



7.00 – 10.15m

BORE: 4 **PROJECT: SUMMER HILL** **JULY 2019**

7.03 – 10.49m

BORE: 5 **PROJECT: SUMMER HILL** **JULY 2019**

7.00 – 10.92m

BORE: 6 PROJECT: SUMMER HILL JULY 2019

4.00 – 8.00m

BORE: 6 PROJECT: SUMMER HILL JULY 2019

8.0 – 10.35m

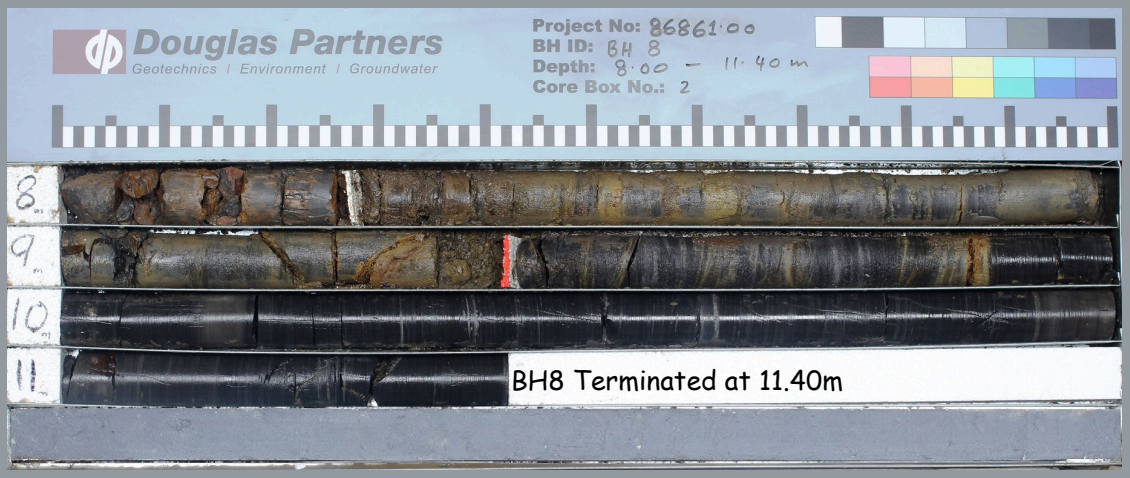
BORE: 7 **PROJECT: SUMMER HILL** **JULY 2019**

7.05 – 10.15m

BORE: 8 PROJECT: SUMMER HILL JULY 2019

3.40 – 8.00m

BORE: 8 PROJECT: SUMMER HILL JULY 2019



8.00 – 11.40m

BORE: 9 PROJECT: SUMMER HILL JULY 2019

7.08 – 11.00m

BORE: 10 PROJECT: SUMMER HILL JULY 2019

4.00 – 8.00m

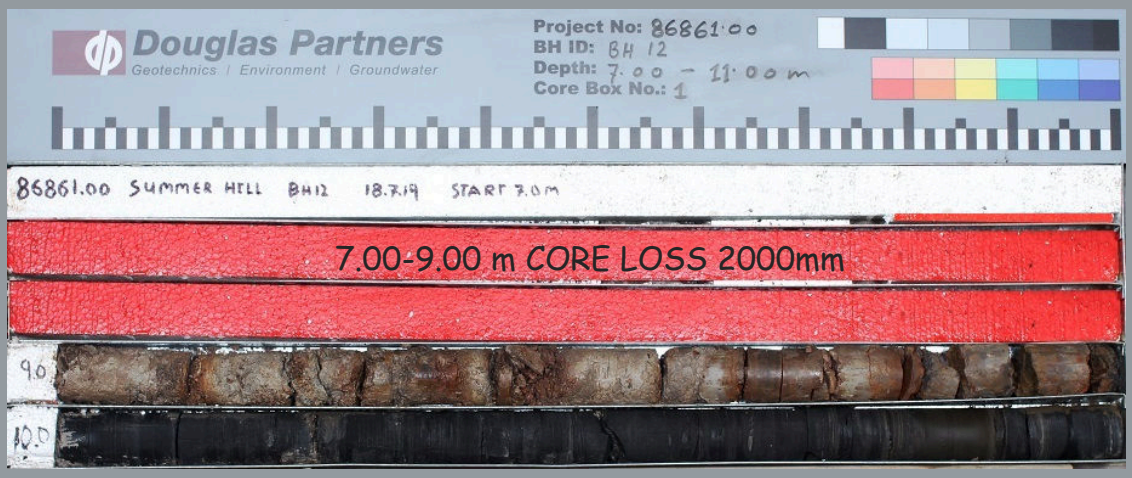
BORE: 10 PROJECT: SUMMER HILL JULY 2019

8.00 – 10.83m

BORE: 11 **PROJECT: SUMMER HILL** **JULY 2019**

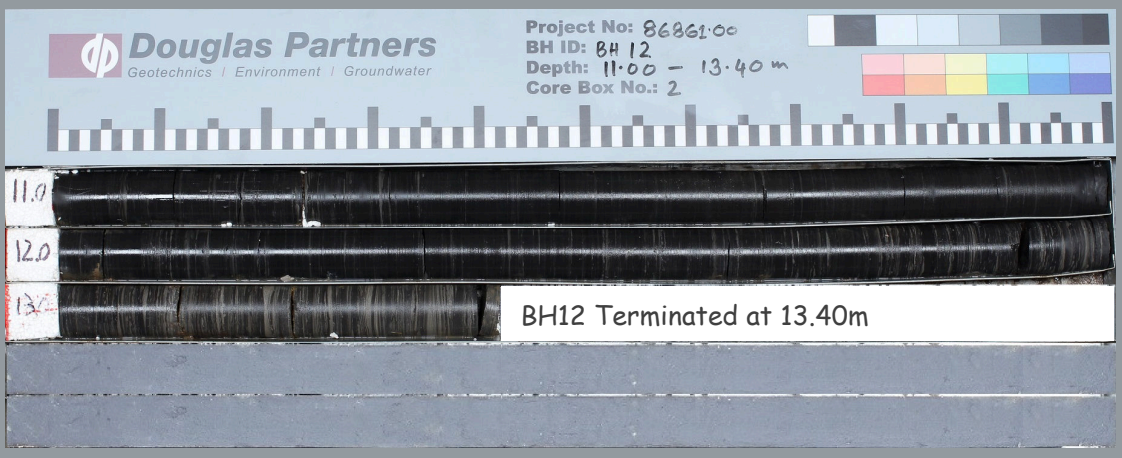
8.50 – 11.28m

BORE: 12 PROJECT: SUMMER HILL JULY 2019



7.00 – 11.00m

BORE: 12 PROJECT: SUMMER HILL JULY 2019



11.00 – 13.40m

Appendix D

Laboratory Test Results

Envirolab Services Pty Ltd
ABN 37 112 535 645
12 Ashley St Chatswood NSW 2067
ph 02 9910 6200 fax 02 9910 6201
customerservice@envirolab.com.au
www.envirolab.com.au

CERTIFICATE OF ANALYSIS 224203

Client Details

Client	Douglas Partners Pty Ltd
Attention	Alexander Hanna
Address	96 Hermitage Rd, West Ryde, NSW, 2114

Sample Details

Your Reference	**86867.00, Summer Hill**
Number of Samples	4 soil
Date samples received	19/08/2019
Date completed instructions received	19/08/2019

Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.

Samples were analysed as received from the client. Results relate specifically to the samples as received.

Results are reported on a dry weight basis for solids and on an as received basis for other matrices.

Please refer to the last page of this report for any comments relating to the results.

Report Details

Date results requested by	21/08/2019
Date of Issue	21/08/2019

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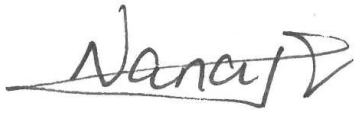
Accredited for compliance with ISO/IEC 17025 - Testing. **Tests not covered by NATA are denoted with ***

Results Approved By
Diego Bigolin, Team Leader, Inorganics

Authorised By



Nancy Zhang, Laboratory Manager

Misc Inorg - Soil					
Our Reference		224203-1	224203-2	224203-3	224203-4
Your Reference	UNITS	BH1_1.5-1.95	BH2_2.5-2.95	BH8_1.0-1.45	BH12_2.5-2.95
Date Sampled		24/07/2019	24/07/2019	15/07/2019	18/07/2019
Type of sample		soil	soil	soil	soil
Date prepared	-	20/08/2019	20/08/2019	20/08/2019	20/08/2019
Date analysed	-	20/08/2019	20/08/2019	20/08/2019	20/08/2019
pH 1:5 soil:water	pH Units	5.3	5.8	4.7	6.6
Electrical Conductivity 1:5 soil:water	µS/cm	24	15	73	33
Chloride, Cl 1:5 soil:water	mg/kg	10	<10	10	10
Sulphate, SO4 1:5 soil:water	mg/kg	20	<10	95	27

Method ID	Methodology Summary
Inorg-001	pH - Measured using pH meter and electrode in accordance with APHA latest edition, 4500-H+. Please note that the results for water analyses are indicative only, as analysis outside of the APHA storage times.
Inorg-002	Conductivity and Salinity - measured using a conductivity cell at 25°C in accordance with APHA latest edition 2510 and Rayment & Lyons.
Inorg-081	Anions - a range of Anions are determined by Ion Chromatography, in accordance with APHA latest edition, 4110-B. Waters samples are filtered on receipt prior to analysis. Alternatively determined by colourimetry/turbidity using Discrete Analyser.

QUALITY CONTROL: Misc Inorg - Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	224203-3
Date prepared	-			20/08/2019	2	20/08/2019	20/08/2019		20/08/2019	20/08/2019
Date analysed	-			20/08/2019	2	20/08/2019	20/08/2019		20/08/2019	20/08/2019
pH 1:5 soil:water	pH Units		Inorg-001	[NT]	2	5.8	5.8	0	101	[NT]
Electrical Conductivity 1:5 soil:water	µS/cm	1	Inorg-002	<1	2	15	15	0	99	[NT]
Chloride, Cl 1:5 soil:water	mg/kg	10	Inorg-081	<10	2	<10	<10	0	99	101
Sulphate, SO4 1:5 soil:water	mg/kg	10	Inorg-081	<10	2	<10	<10	0	105	#

Result Definitions

NT	Not tested
NA	Test not required
INS	Insufficient sample for this test
PQL	Practical Quantitation Limit
<	Less than
>	Greater than
RPD	Relative Percent Difference
LCS	Laboratory Control Sample
NS	Not specified
NEPM	National Environmental Protection Measure
NR	Not Reported

Quality Control Definitions

Blank	This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.
Duplicate	This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.
Matrix Spike	A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.
LCS (Laboratory Control Sample)	This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.
Surrogate Spike	Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

Australian Drinking Water Guidelines recommend that Thermotolerant Coliform, Faecal Enterococci, & E.Coli levels are less than 1cfu/100mL. The recommended maximums are taken from "Australian Drinking Water Guidelines", published by NHMRC & ARMC 2011.

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.

Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.

Spikes for Physical and Aggregate Tests are not applicable.

For VOCs in water samples, three vials are required for duplicate or spike analysis.

Duplicates: >10xPQL - RPD acceptance criteria will vary depending on the analytes and the analytical techniques but is typically in the range 20%-50% – see ELN-P05 QA/QC tables for details; <10xPQL - RPD are higher as the results approach PQL and the estimated measurement uncertainty will statistically increase.

Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals; 60-140% for organics (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

In circumstances where no duplicate and/or sample spike has been reported at 1 in 10 and/or 1 in 20 samples respectively, the sample volume submitted was insufficient in order to satisfy laboratory QA/QC protocols.

When samples are received where certain analytes are outside of recommended technical holding times (THTs), the analysis has proceeded. Where analytes are on the verge of breaching THTs, every effort will be made to analyse within the THT or as soon as practicable.

Where sampling dates are not provided, Envirolab are not in a position to comment on the validity of the analysis where recommended technical holding times may have been breached.

Measurement Uncertainty estimates are available for most tests upon request.

Analysis of aqueous samples typically involves the extraction/digestion and/or analysis of the liquid phase only (i.e. NOT any settled sediment phase but inclusive of suspended particles if present), unless stipulated on the Envirolab COC and/or by correspondence. Notable exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, total recoverable metals and PFAS where solids are included by default.

Report Comments

MISC_INORG_DRY:SULPHATE # Poor spike recovery was obtained for this sample. This is due to matrix interferences. However, an acceptable recovery was obtained for the LCS.

Material Test Report

Douglas Partners
Geotechnics / Environment / Groundwater
Douglas Partners Pty Ltd
Sydney Laboratory
96 Hermitage Road West Ryde NSW 2114
Phone: (02) 9809 0666
Fax: (02) 9809 0666
Email: andrew.hutchings@douglaspartners.com.au

Accredited for compliance with ISO/IEC 17025 - Testing

Approved Signatory: Andrew Hutchings
Laboratory Manager
NATA Accredited Laboratory Number: 828

Report Number: **86861.00-1**
Issue Number: 1
Date Issued: 30/08/2019
Client: Bloompark Consulting Pty Ltd
Suite 2.04, North Sydney NSW 2060
Contact: Peter Brogan
Project Number: 86861.00
Project Name: Proposed Redevelopment
Project Location: Prospect Road, SUMMER HILL
Work Request: 4805
Sample Number: 19-4805A
Date Sampled: 20/08/2019
Dates Tested: 20/08/2019 - 28/08/2019
Sampling Method: Sampled by Engineering Department
The results apply to the sample as received
Sample Location: **BH3 (0.9-1.0m)**
Material: Silty CLAY: Orange-brown mottled red-brown, trace ironstone gravel

Atterberg Limit (AS1289 3.1.2 & 3.2.1 & 3.3.1)		Min	Max
Sample History	Oven Dried		
Preparation Method	Dry Sieve		
Liquid Limit (%)	69		
Plastic Limit (%)	25		
Plasticity Index (%)	**44**		

Linear Shrinkage (AS1289 3.4.1)		Min	Max
Linear Shrinkage (%)	16.0		
Cracking Crumbling Curling	None		

Material Test Report

Douglas Partners
Geotechnics / Environment / Groundwater
Douglas Partners Pty Ltd
Sydney Laboratory
96 Hermitage Road West Ryde NSW 2114
Phone: (02) 9809 0666
Fax: (02) 9809 0666
Email: andrew.hutchings@douglaspartners.com.au

Accredited for compliance with ISO/IEC 17025 - Testing

Approved Signatory: Andrew Hutchings
Laboratory Manager
NATA Accredited Laboratory Number: 828

Report Number: **86861.00-1**
Issue Number: 1
Date Issued: 30/08/2019
Client: Bloompark Consulting Pty Ltd
Suite 2.04, North Sydney NSW 2060
Contact: Peter Brogan
Project Number: 86861.00
Project Name: Proposed Redevelopment
Project Location: Prospect Road, SUMMER HILL
Work Request: 4805
Sample Number: 19-4805B
Date Sampled: 20/08/2019
Dates Tested: 20/08/2019 - 28/08/2019
Sampling Method: Sampled by Engineering Department
The results apply to the sample as received
Sample Location: **BH4 (2.0-2.45m)**
Material: Silty CLAY: Orange mottled pale grey, with some subangular ironstone gravel

Atterberg Limit (AS1289 3.1.2 & 3.2.1 & 3.3.1)		Min	Max
Sample History	Oven Dried		
Preparation Method	Dry Sieve		
Liquid Limit (%)	57		
Plastic Limit (%)	21		
Plasticity Index (%)	**36**		

Linear Shrinkage (AS1289 3.4.1)		Min	Max
Linear Shrinkage (%)	14.0		
Cracking Crumbling Curling	None		

Material Test Report

Douglas Partners
Geotechnics / Environment / Groundwater
Douglas Partners Pty Ltd
Sydney Laboratory
96 Hermitage Road West Ryde NSW 2114
Phone: (02) 9809 0666
Fax: (02) 9809 0666
Email: andrew.hutchings@douglaspartners.com.au

Accredited for compliance with ISO/IEC 17025 - Testing

Approved Signatory: Andrew Hutchings
Laboratory Manager
NATA Accredited Laboratory Number: 828

Report Number: **86861.00-1**
Issue Number: 1
Date Issued: 30/08/2019
Client: Bloompark Consulting Pty Ltd
Suite 2.04, North Sydney NSW 2060
Contact: Peter Brogan
Project Number: 86861.00
Project Name: Proposed Redevelopment
Project Location: Prospect Road, SUMMER HILL
Work Request: 4805
Sample Number: 19-4805C
Date Sampled: 20/08/2019
Dates Tested: 20/08/2019 - 28/08/2019
Sampling Method: Sampled by Engineering Department
The results apply to the sample as received
Sample Location: **BH9 (2.5-2.95m)**
Material: Silty CLAY: Orange mottled red, trace fine subangular ironstone gravel

Atterberg Limit (AS1289 3.1.2 & 3.2.1 & 3.3.1)		Min	Max
Sample History	Oven Dried		
Preparation Method	Dry Sieve		
Liquid Limit (%)	66		
Plastic Limit (%)	28		
Plasticity Index (%)	**38**		

Linear Shrinkage (AS1289 3.4.1)		Min	Max
Linear Shrinkage (%)	16.0		
Cracking Crumbling Curling	None		

Material Test Report

Douglas Partners
Geotechnics / Environment / Groundwater
Douglas Partners Pty Ltd
Sydney Laboratory
96 Hermitage Road West Ryde NSW 2114
Phone: (02) 9809 0666
Fax: (02) 9809 0666
Email: andrew.hutchings@douglaspartners.com.au

Accredited for compliance with ISO/IEC 17025 - Testing

Approved Signatory: Andrew Hutchings
Laboratory Manager
NATA Accredited Laboratory Number: 828

Report Number: **86861.00-1**
Issue Number: 1
Date Issued: 30/08/2019
Client: Bloompark Consulting Pty Ltd
Suite 2.04, North Sydney NSW 2060
Contact: Peter Brogan
Project Number: 86861.00
Project Name: Proposed Redevelopment
Project Location: Prospect Road, SUMMER HILL
Work Request: 4805
Sample Number: 19-4805D
Date Sampled: 20/08/2019
Dates Tested: 20/08/2019 - 28/08/2019
Sampling Method: Sampled by Engineering Department
The results apply to the sample as received
Sample Location: **BH11 (2.5-2.95m)**
Material: Silty CLAY: Grey mottled red brown and brown, with fine subangular ironstone gravel

Atterberg Limit (AS1289 3.1.2 & 3.2.1 & 3.3.1)		Min	Max
Sample History	Oven Dried		
Preparation Method	Dry Sieve		
Liquid Limit (%)	67		
Plastic Limit (%)	27		
Plasticity Index (%)	**40**		

Linear Shrinkage (AS1289 3.4.1)		Min	Max
Linear Shrinkage (%)	15.5		
Cracking Crumbling Curling	None		

Material Test Report

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Accredited for compliance with ISO/IEC 17025 - Testing

NATA
WORLD RECOGNISED ACCREDITATION

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Laboratory Manager
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Moisture Content AS 1289 2.1.1			
Sample Number	Sample Location	Moisture Content (%)	Material
19-4805A	BH3 (0.9-1.0m)	23.2 %	Silty CLAY: Orange-brown mottled red-brown, trace ironstone gravel
19-4805B	BH4 (2.0-2.45m)	21.1 %	Silty CLAY: Orange mottled pale grey, with some subangular ironstone gravel
19-4805C	BH9 (2.5-2.95m)	24.9 %	Silty CLAY: Orange mottled red, trace fine subangular ironstone gravel
19-4805D	BH11 (2.5-2.95m)	33.5 %	Silty CLAY: Grey mottled red brown and brown, with fine subangular ironstone gravel