Geotechnical Investigation Report

Project
Proposed Mixed Residential & Commercial Development
2A Gregory Place,
Harris Park NSW

Prepared for
2A Gregory Place Pty Ltd

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Contents

1 INTRODUCTION 1
2 PROPOSED DEVELOPMENT 1
3 SITE DESCRIPTION & REGIONAL GEOLOGY 2
3.1 Site Location and Description 2
3.2 Regional Geology 2
4 FIELDWORK 3
5 GROUNDWATER 4
6 LABORATORY RESULTS 5
7 PRELIMINARY ACID SULFATE SOILS ASSESSMENT 6
7.1 Desktop Assessment 6
7.2 Sampling and Analytical Plan 7
7.3 Acid Sulfate Soil Sampling 7
7.4 Laboratory Analysis – Field Screening Test 7
7.5 Laboratory Analysis – Chromium Reducible Sulfur Suite 8
8 SUBSURFACE CONDITIONS 9
9 COMMENTS & RECOMMENDATIONS 9
9.1 Excavation Conditions and Vibration 9
9.2 Excavation Stability 10
9.3 Lateral Earth Pressures 12
9.4 Foundations 13
9.5 Groundwater Seepage Control 14
9.6 Impact on Adjoining Structures 15
9.7 Acid Sulfate Soils 16
10 LIMITATIONS 16

Appendices

APPENDIX A – Site Photographs
APPENDIX B – Borehole Location Plan
APPENDIX C – Borehole Logs and Explanatory Notes
APPENDIX D – Groundwater Monitoring & Pump Test Results
APPENDIX E – Laboratory Test Certificates

1 INTRODUCTION

This report presents the results of a geotechnical investigation undertaken by Alliance Geotechnical Pty Ltd (Alliance) for Raad Property Acquisition No. 10 Pty Ltd (the Client) for the proposed development at 2a Gregory Place, Harris Park NSW (the site). The investigation was undertaken in accordance with the scope of works outlined in Alliance's fee proposal (estimate No. 04965, dated 18 May 2021).

2 PROPOSED DEVELOPMENT

To assist with the geotechnical investigation, the following documents were provided by the Client:

- Architectural plans, Stanisic Architects, 30/09/2021
- Acid Sulfate Soils Map- sheet ASS_010, Parramatta Local Environmental Plan 2011
- Phase 1 Contamination Investigation, Sullivan Environmental Science, 26/08/2015
- Site analysis plan,
- Site survey, Strata Surv Pty Ltd, 19/04/2006

Based on the provided documents, it is understood that the proposed development will comprise the construction of five buildings up to 8 storeys in height over a common two level basement. The proposed design level for the top of the excavation will be at 6.0mRL and the proposed base excavation level will be at -1.00mRL.

There is an existing stormwater channel (Clay Cliff Channel) that runs across the southern side of the site at roughly 2.5mRL and will be 6m away from the southern boundary of the proposed development.

Alliance understands that the client requires geotechnical information to assist in the design of the proposed development.

This report assesses the surface and sub-surface conditions and provides comments and recommendations related to:

- Existing geotechnical and groundwater conditions;
- Suitable footings and foundation material including allowable bearing pressures;
- Shoring and retaining wall design parameters
- Maximum temporary batter slopes and temporary retaining systems;
- Excavation conditions and vibration management;
- Soil aggressivity in relation to buried steel and concrete elements;
- Advice on the subgrade preparation below slab on ground;
- Two weeks of groundwater monitoring and rising head testing to assess the groundwater inflow rate;
- Preliminary ASSA and determine the need for an ASSMP

3 SITE DESCRIPTION & REGIONAL GEOLOGY

3.1 Site Location and Description

The site is located within the residential area of Harris Park, NSW. The general site location is shown in Figure 1.

Figure 1: Site Location (extracted from Google Earth).

The site is bounded by Hambledon Cottage Reserve to the north, residential dwellings across Gregory Place to the east, Experiment Farm Reserve to the west and mixed use dwellings including Old Lady of Lebanon Cathedral and residential dwellings to the south. Clay Cliff Creek traverses the south end of the site.

At the time of the geotechnical investigation, the open area serves as car parks for the offices located in the existing warehouse building. The site survey indicates that the highest section of the site is at 10.44mRL at the southwestern side of the site to 4.42mRL on the northern end of the site. The Clay Cliff Creek gently grades to the west from 2.67mRL to 2.13mRL. It should be noted that all the reduced levels shown in this report are relative to AHD.

3.2 Regional Geology

The NSW Department of Mineral Resources 1:100,000 Geological Map of Sydney (Geological Series Sheet 9130) indicated the site is underlain by Ashfield Shale (Rwa) and Quaternary Alluvial Deposits (Qha). Ashfield Shale is described as *black to dark-grey shale and laminate*. Quaternary Alluvial Deposits are described as *silt, clay, fluvially deposited lithic to quartz-lithic sand, gravel.*

Ashfield Shale comprises a sequence of shale, claystone and interbedded siltstone. Ashfield Shale like the Bringelly Shale typically weathers to a plastic clayey residual soil. The depth of weathering is affected by the parent type (i.e. shale beds versus siltstone versus claystone, jointing, defects and local groundwater conditions). The depth of residual soils is expected to vary across the site, though it is

typically deeper in low lying areas. Residual soils derived from weathering of Ashfield Shale typically comprise medium to high plasticity clays with a low California Bearing Ratio (CBR typically <3%).

The Quaternary Alluvium comprises quartz and lithic sand, silt, and clay deposited by river action. The sand, silt and clay occur as alternating layers. In places the clay and silt layers may peat. Laterally discontinuous layers of gravel may also be present. Alluvial deposits tend to be variable due to the historical meandering of the river and flood events. The near-surface sands are anticipated to be loose to medium dense and poorly graded. Gravel layers that may be present are anticipated to be dense to very dense and well graded.

Figure 2 shows the site location on an extract of 1:100,000 Sydney geological map.

Figure 2 Site Location on Extract of Sydney Geological Map

4 FIELDWORK

To achieve the project objectives, the following scope of work was carried out on site between 19th November and 23rd November 2021. A second phase of investigations were carried out on 24th January 2022 for the geotechnical investigation:

- Review of the geological maps and the provided drawings;
- Site walkover inspection by a geotechnical engineer;
- Five boreholes drilled to a maximum depth of 18.0m;
- Additional 4 boreholes drilled to a maximum depth of 7m in replacement of the Cone Penetration testing (CPT) due to time constraints and CPT rig unavailability.
- Standard Penetration Tests (SPTs) at 1.5m depth intervals;
- Installation of three groundwater monitoring wells;

Selected site photographs taken during the fieldwork are presented in Appendix A.

After the site walkover and inspection, the proposed borehole locations were checked against Dial Before You Dig (DBYD) plans for services and utilities by a qualified service locator. The boreholes were drilled using a track mounted drilling rig operated by our subcontractor, BG Drilling Pty Ltd. Boreholes were advanced through the soil profile using solid flight augers fitted with a tungsten carbide bit (TC-bit). NMLC drilling techniques were used to core through bedrock upon TC-bit refusal on hard material inferred as bedrock. Standard Penetration Tests (SPT) were undertaken at 1.5m depth intervals in the soil.

An Alliance geotechnical engineer was on site full-time to witness the drilling, log the boreholes and collect soil and rock samples for geotechnical laboratory testing. The encountered soil profiles were documented by an experienced geotechnical engineer from Alliance in accordance with AS1726 - 2017 Geotechnical Site Investigation.

At completion boreholes were backfilled with drilling spoil and 150mm capping layer of quick set concrete and made flush with the surrounding surface. The site was reinstated to its original condition.

The location of all boreholes that were carried out have been presented in the investigation location plan Appendix B. Table 1 below summarises the termination depths of all boreholes that were carried out.

Table 1 Summary of Borehole Termination Depths (m)

Type	Location ID	Existing Ground Surface Level (mRL)	Termination Depth (m)
Borehole	**BH01**	4.70	18.45
	BH02	5.50	17.52
	BH03	5.15	14.90
	BH04	5.00	18.00
	BH05	5.00	19.00
	BH06	5.18	4.75
	BH07	5.18	1.50
	BH08	5.40	5.50
	BH09	5.40	6.20

The borehole logs are provided in Appendix C. These results should be read in conjunction with the attached Explanatory Note which explains the terms, abbreviations, and symbols used, together with the interpretation and limitation of the logging procedure.

5 GROUNDWATER

Groundwater seepage was encountered in all the boreholes during augering. Due to the introduction of water into the boreholes for coring, Alliance could not make further observations of groundwater levels for BH01 to BH05.

Standpipe piezometers were installed to monitor groundwater levels and obtain groundwater samples from the zone of interest. They were constructed from 50mm diameter PVC piping, with a slotted PVC section filter packed, which comprised of sand or gravel located in the zone to be monitored and sampled.

Standpipe construction details were nominated by the geotechnical engineer on-site once the ground conditions and aquifer location were confirmed. A summary of the standpipe installation details is provided in Table 2. Installed standpipe details are presented in the borehole logs provided in Appendix C.

The groundwater levels in the monitoring wells were recorded on 16 December 2021 and 24 January 2022 and are presented in Table 2.

It should be noted that groundwater seepage condition is subject to seasonal and climatic conditions and may vary across the site. It is expected the groundwater seepage occurs through the interface of residual soil and bedrock.

Table 2 Groundwater levels

Well	Borehole Elevation (mRL)	Well Screen Depth (m)	Well Screen Length (m)	Groundwater level (mRL)	
				16/12/2021	24/01/2022
BH01	4.70	0.5 – 13.0	13.0	3.21	3.12
BH02	5.5	1.0 – 11.0	10.0	3.72	3.88
BH05	5.0	2.13 – 8.13	6.0	3.77	3.76

Rising head tests were undertaken in three of the monitoring wells (BH01, BH02 and BH05) on 24 January 2022.

The tests result along with the groundwater monitoring results are presented in Appendix D. The soil permeability value has been calculated using the rising head test results in accordance with the Hvorslev (1951) method as provided in Table 3.

Table 3 Rising Head Test Result

Monitoring Well	Test duration (min)	Calculated Hydraulic Conductivity (m/day)	Calculated Hydraulic Conductivity (m/s)
BH01	1.90	0.0982	1.14 x 10^-6
BH02	1.42	0.1683	1.95 x 10^-6
BH05	0.42	0.8617	9.97 x 10^-6

6 LABORATORY RESULTS

The Point Load Strength Index (Is_{50}) test was undertaken on rock core samples obtained from all cored boreholes and are recorded on the core log sheets presented in Appendix C.

Soil aggressivity tests were performed for the durability design of concrete and steel purposes in a NATA accredited laboratory. A summary of the laboratory testing results is provided in Table 4. The

laboratory test results are summarised in Table 4. The laboratory test certificate and detailed results can be found in Appendix E.

Table 4 Soil Aggressivity Test Results

Test	Unit	BH01 1.0m	BH01 2.0m	BH02 1.5-2.5m	BH03 3.5m	BH04 4.5m	BH05 4.0m
Chloride	mg/kg	<10	<10	17	<10	10	34
Conductivity(1)	uS/cm	16	46	42	23	23	50
pH(1)	pH	7.3	8.0	7.0	7.5	6.7	7.1
Resistivity	Ohm.m	640	220	240	430	430	200
Sulfate (as SO_4)	mg/kg (ppm)	<10	24	61	15	25	66
Moisture	%	10	14	14	13	28	17
Results(2)	In relation to concrete	*Mild*	*Mild*	*Non-aggressive*	*Mild*	*Non-aggressive*	*Non-aggressive*
	In relation to steel	*Non-aggressive*	*Non-aggressive*	*Non-aggressive*	*Non-aggressive*	*Non-aggressive*	*Non-aggressive*

(1): Tests were done on a 1:5 aqueous extract at 25°C as recorded.
(2): Assessed in accordance with AS 2159 – 2009, Table 6.4.2 (C) and Table 6.5.2 (C)

7 PRELIMINARY ACID SULFATE SOILS ASSESSMENT

7.1 Desktop Assessment

Observations compiled during the site inspection, and via aerial photography interpretation, were compared against various geomorphic and site characteristics outlined in in Table 2.3 and Section 4 of ASSMAC (1998) indicating likely ASS occurrence. A comparison of site specific and geomorphic features with those indicative of potential ASS presence are presented in Table 5.

Table 5 ASS Desktop Assessment

Characteristic	Feature	Comment
Sediment Characteristics	Sediments of recent geological age (Holocene)	Yes (Underlying modern filling)
	Marine or estuarine sediments	No
	Areas identified in geological descriptions or in maps as bearing sulfide minerals, coal deposits or former marine shales/sediments	No
	Deep estuarine sediments greater than 10 m below ground surface (Holocene or Pleistocene age (only an issue if deep excavation or drainage is proposed).	Unknown
Landscape Characteristics	Presence of ASS risk classes 1 to 5	Class 5 (Located ≤500m of areas of ASS risk mapped as Class 1 to 4)
	Soil horizons less than 5 mAHD	Yes
	Waterlogged or scalded areas	Not identified

	Tidal lakes, coastal wetlands, or back swamp areas	Not identified
	Interdune swales or coastal sand dunes (if deep excavation or drainage proposed).	Not identified
Vegetation Characteristics	Areas where dominant vegetation is mangroves, reeds, rushes, and other vegetation associated with areas of shallow watertables such as paperbarks (*Melaleuca spp.*) and casuarinas (*Casuarina spp.*), and some *Eucalyptus spp*.	Not identified

Based on the review of ASS characteristics features relating to the site, a number of indicators of ASS were identified that indicate potentially ASS presence onsite, and a requirement to conduct sampling and laboratory analysis to confirm whether ASS are present at the site.

7.2 Sampling and Analytical Plan

Alliance has utilised four (4) borehole locations to collect soil samples for the preliminary assessment of ASS at the site.

Soil samples were collected at 0.5 to 1.0 m intervals to a depth of 1.0m below expected depth of disturbance, borehole collapse, or to the depth of encountered bedrock. Alliance understands that the proposed bulk excavation depth is no more than 9m below ground level (bgl).

Soil samples were subject to preliminary field screen testing to establish values of existing or field pH (pHf) and pH following peroxide oxidation (pHfox). Results obtained were compared to criteria in Table 2.3 and Appendix 1 of the Assessment Guidelines in Acid Sulfate Soils Manual 1998 (ASSMAC 1998) to establish the potential presence of Actual ASS or Potential ASS. Following review of results obtained for field screen testing, samples were selected for quantitative ASS analysis using the Chromium Reducible Sulfur Suite, as per the methodology described in AS4969–2008 *Analysis of Acid Sulfate Soil*.

7.3 Acid Sulfate Soil Sampling

Samples were collected at each of the four (4) test locations (BH01, BH02, BH04, and BH05) for ASS laboratory analysis purposes. A total of forty-two (42) soil samples were collected at 0.5 m intervals within the soil profile to the depth of encountered bedrock (between 4m and 8m bgl). The location of each borehole is presented in Appendix A.

Each soil sample was placed in a leak proof plastic bag and wrapped tightly with duct tape to minimise contact with air and avoid moisture loss from the sample. Samples were then placed in an insulated container, with ice, and transported immediately (following fieldwork) to the analytical laboratory under chain of custody conditions.

7.4 Laboratory Analysis – Field Screening Test

Forty-two (42) soil samples collected were subjected to preliminary field screen testing.

The soil samples were analysed for pHf to determine if the pH was less than the preliminary ‘actual acid sulfate soil’ screening criterion of <pH 4. Reported pHf values were ≥pH 6.8, indicating that actual acid sulfate soils (AASS) were unlikely to be present in soils onsite between the surface and encountered bedrock.

Analytical laboratory reported pH values (pHfox) of hydrogen peroxide oxidised soil samples reported two soil sample (BH04_4.5 & BH04_5.5) with a pHfox values of pH 2.9 and pH 3.3 respectively, which

is less than the preliminary screening criterion of <pH 3.5 for potential presence of potential ASS (PASS).

The analytical laboratory reported a pH reduction >1 pH unit between pHf and pHfox of twenty-five (25) soil samples with each sample reporting strong or extreme reactions to the addition of hydrogen peroxide.

In light of the field screen testing results, PASS may be present onsite between the surface and encountered bedrock.

7.5 Laboratory Analysis – Chromium Reducible Sulfur Suite

A total of five (5) soil samples were selected for analysis by Chromium Reducible Sulfur Suite. The quantitative laboratory analytical results were compared with the action criteria adopted that would trigger a need for an acid sulfate soils management plan (ASSMP).

For the purpose of selecting site specific action criteria, as per Table 4.4 of ASSMAC 1998, Alliance has assumed that the soil type present on site is 'Fine Texture – medium to heavy clays and silty clays' and that > 1,000 tonnes of soil would be disturbed as part of the proposed works. Based on the reported laboratory results, one of the five soil samples (BH04 4.5) exceeded the adopted acid trail action criteria (18 mol H^+ / tonne), with an acidity value of 19 mol H^+ / tonne.

Sullivan (2018) states that "If Net Acidity of any individual ASS material is equal to or greater than the action criterion, an ASSMP will need to be prepared" to manage ASS during ground disturbance works at the site.

The laboratory analytical results are summarised in Appendix E along with the laboratory documentation.

8 SUBSURFACE CONDITIONS

The subsurface conditions encountered during drilling along with site observations have been used to summarise the subsurface profile in Table 6. Reference to the individual borehole log sheets should be made for a full description of the subsurface conditions encountered at each borehole.

Table 6 - Summary of Subsurface Profile

Ground Profile	Consistency/ Strength	RL at top of unit (mRL)	Depth to top of unit (m)	Thickness (m)
Fill: Silty Sandy CLAY: low plasticity, dark grey, with gravel poorly to moderately compacted	-	4.70 – 5.50	0	0.2 – 1.5
Alluvium: Sandy/Silty CLAY: pale grey, orange brown, low to medium plasticity, fine to medium grained sand	Very soft to firm	3.5 – 5.3	0.2 – 1.5	2.7 – 5.9
Residual: Silty CLAY; dark grey and brown, low to medium plasticity	Stiff to very Stiff	(-1.0) - 0.5	4.7 - 6	0 – 1.5
SHALE (Class V and IV); dark grey and grey brown, extremely weathered to highly weathered	Very low strength	(-2.5) - 1.0	4.2 - 7.5	1.1 – 5.5
SHALE (Class II and better): dark grey, fresh	Medium to high strength	(-6.4) - (-0.8)	5.5 – 11.6	Not penetrated

The site subsurface profile comprises uncontrolled fill (up to 1.5m thick) underlain by very soft to firm alluvium silty clay (up to 5.9m thick). Stiff to very stiff residual clay (up to 1.5m thick) is underlaying the alluvium clay stratum in some areas. The alluvial/residual soil is underlain extremely to highly weathered, very low strength shale (1.1 to 5.5m thick), which is underlain by fresh, medium to high strength shale at depths ranging between -6.4mRL and -0.8mRL (thickness not proven).

BH08 and BH09 were terminated due to TC-bit refusal, this is inferred as the top of shale bedrock.

It should be noted that very soft to soft clays (up to 4.5m thick) were encountered at some locations. BH07 was terminated at 1.5m due to TC-bit refusal, this is likely attributed to the auger hitting a concrete slab extending from the existing warehouse at that location.

9 COMMENTS & RECOMMENDATIONS

9.1 Excavation Conditions and Vibration

Based on the subsurface conditions encountered and summarised in Table 6, bulk excavations are expected to encounter very soft to firm alluvium silty clay to an average depth of 5.5m (0.5mRL) from the top of the excavation. Stiff to very stiff residual clay to an average depth of 6.5m (-0.5mRL) from the top of the excavation. Extremely weathered to highly weathered, very low strength shale (Class V and IV) is expected to be encountered to depths of 8.0m (-2.0mRL), which is underlain by fresh, medium to high strength shale (Class II and better). The base of the excavation is generally expected to encounter extremely weathered to highly weathered, very low strength shale (Class V and IV).

Excavations through the overlying soils, extremely low strength and very low strength shale (Class V and IV) are expected to be readily achievable using conventional earthworks equipment such as a tracked excavator with tiger toothed bucket. Excavations within low strength shale (Class III and better)

may require larger excavators (i.e. >30 tonnes) and the use of ripping or rock impact breakers for bulk excavations. Low vibration equipment may be necessary near all site boundaries where vibrations could impact on adjacent building footings and structures.

Vibration monitoring may be required if excavation of medium and high strength shale bedrock is proposed to be undertaken within 10m of the site boundaries particularly along the eastern boundary. Alliance recommends the use of continuous vibration monitors with auditory and visual sensors if large hydraulic rock breaking hammers are to be used to excavate medium to high strength rock without prior saw cutting.

Generally, the ground vibration Peak Particle Velocity (PPV) should be limited to 5 mm/s at the property boundaries. The maximum 5 mm/s vibration limit is not expected to be exceeded if rock breaker equipment and excavation methods are restricted as indicated in Table 7 below.

Table 7 Recommendations for Rock Breaking Equipment

Distance from Adjacent Structure (m)	Maximum Peak Particle Velocity 5mm/s	
	Equipment	**Operating Limit (% of Maximum Capacity)**
1.5 to 2.5	hand-operated jackhammer only	100
2.5 to 5.0	300 kg rock hammer	50
5.0 to 10.0	300 kg rock hammer or 600 kg rock hammer	100 50

It is recommended that vibration monitoring be included as part of the geotechnical monitoring program.

A dilapidation survey on nearby structures and infrastructure is recommended to be undertaken by a structural engineer prior to the commencement of any site excavations. The report should include precise measurements of the existing defects and cracks presented with the relevant photos.

9.2 Excavation Stability

The proposed excavation can be undertaken by adopting unsupported batter slopes provided that the batter slopes in the soil does not extend below the ‘zone of influence’ of any adjacent structures and infrastructure (i.e. a 45° line in clay drawn from the foundation level of any adjacent structure and infrastructure).

The recommended maximum temporary batter slopes for excavations presented in Table 8. Surface protection of the batter faces will be needed to prevent erosion and loss of surface materials.

Table 8 Maximum Excavation Batter Slopes above the Groundwater Level

Material	Maximum Temporary Dry Batter Slope (H: V)
Very soft to firm Clay	3 : 1
Stiff to hard Clay	1 : 1
Shale (Class IV and V)	1 : 1.5
Shale (Class III)	1 : 2*
Shale (Class II)	Vertical*
* Subject to inspection by a geotechnical engineer in 1.5m vertical lifts and carrying out remedial works if recommended (shotcrete, rock bolting, etc.).	

As shown in the table above, very soft to firm clays have a maximum temporary dry batter slope angle of 3:1 (H:V). The batter slopes in very soft to firm clays will be very shallow and are unfeasible. Therefore unsupported batter slopes are not feasible and the excavation should be supported by a properly designed shoring system. Based on the available geotechnical data, it is recommended to install a shoring system along all excavation boundaries.

The shoring system should be designed to support the existing surcharge within the zone of influence of the excavation which is generally a horizontal distance of 2H from the edge of the excavation with H being the depth of the excavation.

The shoring system could take the form of a secant pile wall or diaphragm wall. Referring to the groundwater monitoring results; the groundwater seepage is expected to be encountered below 3.88mRL. Therefore, adequate dewatering during and ahead of the excavation from within secant/diaphragm wall will be required. The excavation will be required to be tanked to withstand long term hydrostatic pressures.

The shoring system walls would need to be extended below the proposed excavation base level. It is recommended that the minimum depth of embedment of the piles be 2m below the excavation, however allowance should be made where the pad footings could undermine the pile wall. The final socket depth of the shoring system should be determined by the design engineer based on the stability of the shoring wall and the applied lateral loads.

The shoring system needs to be designed using WALLAP, PLAXIS or similar finite element analysis programs as soil structure interaction methods need to be used.

Referring to the bedrock cores obtained from the boreholes, the fractured zones and defects have been observed at different depths. Therefore, specific requirements set out above for excavation support and also the stability of the shale face should be assessed by an experienced geotechnical engineer as the excavation proceeds. Excavation depths should not exceed 1.5m lifts. It is recommended that the excavation be inspected by an experienced geotechnical engineer before proceeding further or applying any face treatment.

The anchoring system should be designed to provide temporary support with long-term lateral support being later transformed on to the permanent structure. The anchors should have a minimum free length of 4m or below a line 45 degrees from the base of excavation, whichever is the greater.

Anchors will need to be installed progressively as the excavation proceeds and will require the permission of the adjacent landowners for anchors to be extended into their land. Also, the adjacent neighbouring footing level and underground service levels in the road reserve must be confirmed prior to finalising anchor design.

Temporary anchors may be designed using the allowable bond stresses presented in Table 9 below.

Table 9 - Bond Stress for Temporary Anchor Design

Description	Allowable Bond Stress (kPa)
Shale (very low strength, Class V and IV)	150
Shale (Low strength, Class III)	300
Shale (Medium strength, Class II)	450
Shale (High strength, Class I)	600

Periodic lift-off checks of installed anchors should be carried out during the construction to ensure lock off-load is maintained. It is recommended that the anchors be installed and proof-tested in accordance with the requirements of AS4678-2002 and RMS QA Specification B114.

A geotechnical monitoring program report should be prepared for this project to assess and confirm that the shoring wall deflections and movements are within tolerable limits accepted in design. The installation of survey points and inclinometers (particularly along the southern boundary) should be considered as a part of the construction monitoring program.

9.3 Lateral Earth Pressures

The temporary shoring system or permanent retaining wall should be designed in accordance with the AS4678 - 2002 Earth Retaining Structures.

If it is critical to limit the horizontal deformation an earth pressure coefficient ‘at rest’ (K_0) should be adopted. Where some lateral movement is acceptable, an ‘active’ lateral earth pressure coefficient (K_a) is recommended.

Retaining structures should be designed for any footing surcharge loads that may present within the zone of influence of the side walls. In addition, provisions are to be made for permanent and effective drainage behind the wall.

Recommended material properties for the design of temporary and permanent support are provided in Table 10 below.

Table 10 Typical Material Properties for Retention Design

Geotechnical Units	c' (kPa)	∅′ (degrees)	γ (kN/m^3)	K_a	K_p	K_o	E' (MPa)	ϑ'
Alluvial: clay, very soft to firm	0	22	17	0.46	2.20	0.63	2	0.3
Residual Clay: stiff to very Stiff	7	28	19	0.36	2.77	0.53	10	0.3
Shale (Class V and IV)	20	28	23	0.36	2.77	0.53	100	0.3
Shale (Class II and better)	100	35	24	0.27	3.69	0.5	700	0.25

Legend:
∅′ : Effective Friction Angle
c': Effective Cohesion
γ: Bulk Unit Weight
K_a: Active earth pressure
K_o: Earth pressure at rest
Kp: Passive earth pressure
E': Elasticity Modulus
ϑ': Poisson's Ratio

9.4 Foundations

Based on the subsurface geotechnical conditions encountered and the anticipated loads applied by the proposed multi-storey buildings, the load of the structure could be supported on the shallow foundation (pad footings) founded on at least medium strength shale (Class II) bedrock at the lower basement level. Shallow foundations can be designed based on a maximum allowable bearing pressure of 3500kPa for footings founded in medium strength shale (Class II). The recommended allowable bearing pressures are such that the anticipated settlements are of 1% of the footing width. Serviceability should be checked by carrying out a settlement assessment to ensure that the footing settlements are within the tolerable range. Bearing capacities of greater than 3500 kPa could be achieved but at least 50% of footings would require spoon testing to a depth of at least 1.5 times the footing width or a minimum of 1.5 m below the base of the footing to verify the quality of the founding strata.

Due to ground variability, it is possible that medium strength shale (Class II) may not be encountered consistently throughout the site at the proposed bottom of excavation. If this is the case, piles are recommended to be founded in at least medium strength shale (Class II). The basement should be founded on similar strata throughout the site to reduce the risk of differential settlement. The recommended design parameters for the foundations are presented in Table 11.

Table 11 Recommended Preliminary Geotechnical Design Parameters for Deep Foundations

Description	Friction Angle (φ')	Bulk Unit Weight, (kN/m^3)	End Bearing Capacity (kPa)		Compressive Socket Side Shear (kPa)	Elastic Modulus (MPa)
			Ultimate	Allowable	Ultimate	
Shale (Class V and IV)	28	19	3000	1000	150	500
Shale (Class III)	32	21	7500	2500	500	700
Shale (Class II and better	35	22	10500	3500	600	1000

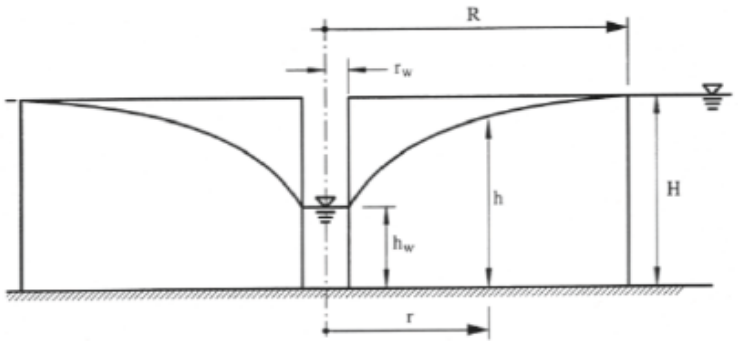
A preliminary value of 0.33 should be used for geotechnical reduction factor (Φg). In accordance with AS2159-2009 "Piling–Design and Installation", for limit state design, the ultimate geotechnical pile capacity shall be multiplied by a geotechnical reduction factor (Φg). This factor is derived from an

Average Risk Rating (ARR) which considers geotechnical uncertainties, redundancy of the foundation system, construction supervision, and the quantity and type of pile testing (if any). Where testing is undertaken, or more comprehensive ground investigation is carried out, it may be possible to adopt a larger Φg value that results in a more economical pile design. Further geotechnical advice will be required in consultation with the pile designer and piling contractor, to develop an appropriate Φg value.

The recommendations for design bearing pressures are based on settlement to be less than 1% of the minimum footing dimension (Pells et al 1998). Serviceability limit state loads and Elasticity Modulus values should be used to carry out a separate settlement assessment to ensure that the pile settlements are within the tolerable range. Settlements should be checked using the ULS loads and the Ultimate Bearing Capacity from the table. In addition, the SLS loads and the Serviceability Bearing Pressure in the table should be used to check that the pile base remains in the elastic range.

9.5 Groundwater Seepage Control

The flow rate into the proposed basement excavation assuming a basement area of 19,603m^2 was calculated in accordance with Dupuit-Thiem equation for steady-state unconfined flow using the following parametric equation for radial inflow through a uniform material under gravity conditions.



$$Q = \frac{\pi k (H^2 - h_w^2)}{\ln (R/r_w)}$$

Where:

Q = groundwater inflow (m^3/s)

k = hydraulic conductivity (m/s)

H = Height of water table above assumed impermeable basement (m)

H_w = height of dewatering above assumed impermeable basement (m)

R = Radius of drawdown (m)

R_w = equivalent radius of excavation (m)

Adopted equation parameter values for the basement are summarised in Table 12.

Table 12 – Adopted Values for Inflow Rate Calculations – Worst Case

Parameters		Description
K (m/s)	**1.14x 10^-6---> BH01 1.95 x 10^-6---> BH02 9.97 x 10^-6 ---> BH05**	Worse-case soil/rock conductivity from the rising head test is at BH05
H (m)	**4.88**	Maximum excavation depth to the maximum observed groundwater level
h_w (m)	**0**	Assuming basement dewatering adequate to keep the groundwater level at the basement level
R (m)	**137**	Assumed based on basement dimensions
r_w (m)	**91**	Based on the equivalent radius of the basement area

Total expected unfactored inflow in the excavation ranges between 4.7 to 57.5 ML/yr.

Based on industry practice and Water NSW requirements, the estimated expected unfactored inflow rate will be scrutinized by Water NSW and a dewatering management plan for submission to Water NSW along with a water license may be required. Further hydrogeological assessment and monitoring is required to derive a more accurate estimate for the groundwater inflows.

It should be noted that the inflow would ideally be dominated by fracture pathways, through joints and bedding. The empirical equations are based on uniform porous media and not ideal from fractured systems. As a result, even one large vertical joint set could significantly increase the amount of water inflow into the excavation.

It is anticipated that such seepage could be controlled and managed by using sump pumping techniques and that provision is to be allowed in design for an appropriately designed long term drainage system.

During the design life of the building, groundwater seepage should be controlled by a properly designed drainage system including a sub-floor drainage system to create a free-draining layer below the basement slab.

Also, adequate drainage should be provided for the retaining wall where it is proposed to install shotcrete. Therefore, the basement side walls, and base slab are not required to be designed for hydrostatic pressure.

9.6 Impact on Adjoining Structures

Consideration needs to be given to the following as part of the construction of the proposed development:

- **Utilities in the area**: An existing stormwater channel (Clay Cliff Channel) runs across the southern side of the site at roughly 2.5mRL and will be 6m away from the southern boundary of the proposed development. It needs to be ensured that the excavation and construction does not impact any existing utilities. A Specialist Engineering Assessment (SEA) report may need to be prepared to this effect.
- **Groundwater drawdown**: groundwater table drawdown due to dewatering of the excavation can lead to movement in the adjoining buildings. Further groundwater investigations along with a hydrogeological assessment and monitoring is required to understand the drawdown effects accurately.

9.7 Acid Sulfate Soils

Based on the desktop review data, fieldwork observations, and the laboratory analytical results, Alliance concludes that:

- The sulfur trail and acid trail analytical results for one of the five soil samples analysed, triggered the adopted action criteria (0.03 %S oxidisable and 18 mol H^+ / tonne).
- The liming rate required for remediation of the AASS and PASS across the site is currently 1.4kg $CaCO_3$ / tonne; and
- The identified potential ASS at the site is likely to be disturbed by the construction phase of the proposed works.

Based on these conclusions, and in accordance with ASSMAC (1998), Alliance recommends the following:

- Undertake a supplementary acid sulfate soils assessment within areas of the site that were inaccessible at the time of this assessment, following demolition of site structures and gained access to site soils.
- Development of an acid sulfate soils management plan for the site to:
- document the procedures and standards to be followed to manage the risks posed by PASS during ground disturbance works at the site association with proposed construction;
- Outline the management measures to be implemented to minimise the potential for adverse environmental impacts resulting from the disturbance of ASS; and
- Manage the offsite disposal of excavated materials aligned to the NSW EPA Waste Classification Guidelines Part 1: Classifying Waste (NSW EPA, 2014a) and Waste Classification Guidelines Part 4: Acid Sulfate Soils (NSW EPA, 2014b).

10 LIMITATIONS

Alliance Geotechnical Pty Ltd (Alliance) has prepared this report for the site located at 2a Gregory Place, Harris Park NSW in accordance with Alliance's fee proposal and Terms of Engagement. This geotechnical report has been prepared for Raad Property Acquisition No. 10 Pty Ltd for this project and for the purposes outlined in this report. This report cannot be relied upon for other projects, other parties on this site or any other site. The comments and recommendations provided in this report assume that the geotechnical recommendations contained in this report will be fully complied with during the design and construction of the proposed site development.

The borehole investigation and laboratory testing results provided in this report are indicative of the subsurface conditions at the site only at the specific sampling and testing locations, and to the depths drilled at the time of the investigation. Subsurface conditions can change significantly due to geological and human processes. Where variations in conditions are encountered further geotechnical advice should be sought from Alliance.

APPENDIX A – Site Photographs

Photo 1 – Drilling setup

Photo 2 – Alluvium Soil recovered in an auger

APPENDIX B – Borehole Location Plan

Site Investigation Plan

Client Name:	2A Gregory Place Pty Ltd	Figure / Drawing Number:	13091-GR-1-B
Project Name:	Proposed Mixed Use Development	Figure / Drawing Date:	27/01/2022
Project Location:	2A Gregory Place, Harris Park NSW 2150	Report Number:	13091-GR-1-1

APPENDIX C – Borehole Logs and Explanatory Notes

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Explanatory Notes
Drill & Excavation Logs

General

Information obtained from site investigations is recorded on log sheets. Soils and very low strength rock are commonly drilled using a combination of solid-flight augers with a Tungsten-Carbide (TC) bit. Descriptions of these materials presented on the “Borehole Log” are based on a combination of regular sampling and in-situ testing. Rock coring techniques commences once material is encountered that cannot be penetrated using a combination of solid-flight augers and Tungsten-carbide bit. The "Cored Borehole Log" presents data from drilling where a core barrel has been used to recover material - commonly rock.

The "Excavation - Geological Log" presents data and drawings from exposures of soil and rock resulting from excavation of pits or trenches.

The heading of the log sheets contains information on Project Identification, Hole or Test Pit Identification, Location and Elevation. The main section of the logs contains information on methods and conditions, material description and structure presented as a series of columns in relation to depth below the ground surface which is plotted on the left side of the log sheet. The scale is presented in the depth column as metres below ground level.

As far as is practicable the data contained on the log sheets is factual. Some interpretation is included in the identification of material boundaries in areas of partial sampling, the location of areas of core loss, description and classification of material, estimation of strength and identification of drilling induced fractures, and geological unit. Material description and classifications are based on Australian Standard Geotechnical Site Investigations: AS 1726 - 2017 with some modifications as defined below.

These notes contain an explanation of the terms and abbreviations commonly used on the log sheets.

Drilling

Drilling, Casing and Excavating

Drilling methods deployed are abbreviated as follows

Abbreviation	Method
AS	Auger Screwing
ADV	Auger Drilling with V-Bit
ADT	Auger Drilling with TC Bit
BH	Backhoe
E	Excavator
HA	Hand Auger
HQ	HQ core barrel (~63.5 mm diameter core) *
HMLC	HMLC core barrel (~63.5 mm diameter core) *
NMLC	NMLC core barrel (~51.9 mm diameter core) *
NQ	NQ core barrel (~47.6 mm diameter core) *
RR	Rock Roller
WB	Wash-bore drilling

* Core diameters are approximate and vary due to the strength of material being drilled.

Drilling Fluid/Water

The drilling fluid used is identified and loss of return to the surface estimated as a percentage. It is introduced to assist with the drill process, in particular, when core drilling. The introduction of drill fluid/water does not allow for accurate identification of water seepages.

Drilling Penetration/Drill Depth

Core lifts are identified by a line and depth with core loss per run as a percentage. Ease of penetration in non-core drilling is abbreviated as follows:

Abbreviation	Description
VE	Very Easy
E	Easy
F	Firm
H	Hard
VH	Very Hard

Groundwater Levels

Date of measurement is shown.


Standing water level measured in completed borehole


Level taken during or immediately after drilling


Groundwater inflow water level

Samples/Tests

Samples collected and testing undertaken are abbreviated as follows

Abbreviation	Test
ES	Environmental Sample
DS	Disturbed Sample
BS	Bulk Sample
U50	Undisturbed (50 mm diameter)
C	Core Sample
SPT	Standard Penetration Test
N	Result of SPT (*sample taken)
VS	Vane Shear Test
IMP	Borehole Impression Device
PBT	Plate Bearing Test
PZ	Piezometer Installation
HP	Hand Penetrometer Test
HB	Hammer Bouncing

Excavation Logs

Explanatory notes are provided at the bottom of drill log sheets. Information about the origin, geology and pedology may be entered in the "Structure and other Observations" column. The depth of the base of excavation (for the logged section) at the appropriate depth in the "Material Description" column. Refusal of excavation plant is noted should it occur. A sketch of the exposure may be added. Photos are recommended.

Material Description – Soil

Material Description - In accordance with AS 1726-2017

Classification Symbol - In accordance with the Unified Classification System (AS 1726-2017).

Abbreviation	Typical Name
GW	Well-graded gravels, gravel-sand mixtures, little or no fines.
GP	Poorly graded gravels and gravel-sand mixtures, little or no fines, uniform gravels
GM	Silty gravels, gravel-sand-silt mixtures
GC	Clay ey gravels, gravel-sand-clay mixtures.
SW	Well graded sands, gravelly sands, little or no fines.
SP	Poorly graded sands and gravelly sands; little or no fines, uniform sands.
SM	Silty sand, sand-silt mixtures.
SC	Clayey sands, sand-clay mixtures.
ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity
CL, CI	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.
OL	Organic silts and organic silty clays of low plasticity. *
MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, clastic silts.
CH	Inorganic clays of high plasticity, fat clays
OH	Organic clays of medium to high plasticity, organic silts. *
Pt	Peat and other highly organic soils. *

* Additional details may be provided in accordance with the Von Post classification system (1922).

Organic Soils - Identification using laboratory testing:

Material	Organic Content - % of dry mass
Inorganic	<2
Organic Soil	<2 ≤ 25
Peat	> 25

Organic Soils - Descriptive terms for the degree of decomposition of peat:

Term	Decomposition	Remains	Squeeze
Fibrous	Little or none	Clearly recognizable	Only water No solid
Pseudo-fibrous	Moderate	Mixture of fibrous and amorphous	Turbid water < 50% solids
Amorphous	Full	Not recognizable	Paste > 50% solids

Particle Characteristics– Definitions are as follows:

Fraction	Component (& subdivision)		Size (mm)
Oversize	Boulders		> 200
	Cobbles		> 63 ≤ 200
Coarse grained soils	Gravel	Coarse	> 19 ≤ 63
		Medium	> 6.7 ≤ 19
		Fine	> 2.36 ≤ 6.7
	Sand	Coarse	> 0.6 ≤ 2.36
		Medium	> 0.2 ≤ 0.6
		Fine	> 0.075 ≤ 0.21
Fine grained soils	Silt		0.002 ≤ 0.075
	Clay		< 0.002

Secondary and minor soil components

In coarse grained soils – The proportions of secondary and minor components are generally estimated from a visual and tactile assessment of the soils. Descriptions for secondary and minor soil components in coarse grained soils are as follows.

Designation of components	Percentage fines	Terminology (as applicable)	Percentage accessory coarse fraction	Terminology (as applicable)
Minor	≤ 5	Trace clay / silt	≤ 5	Trace sand / gravel
	> 5 ≤12	With clay / silt	> 5 ≤12	With sand / gravel
Secondary	> 12	Silty or clayey	> 30	Sandy or gravelly

Descriptions for secondary and minor soil components in fine grained soils are as follows.

Designation of components	Percentage coarse grained soils	Terminology (as applicable)
Minor	≤ 5	Trace sand / gravel / silt / clay
	> 5 ≤12	With sand / gravel / silt / clay
Secondary	> 30	Sandy / gravelly / silty / clayey

Plasticity Terms – Definitions for fine grained soils are as follows:

Descriptive Term	Range of Liquid Limit for silt	Range of Liquid Limit for clay
Low Plasticity	≤ 50	≤ 35
Medium Plasticity	N/A	> 35 ≤50
High Plasticity	> 50%	> 50

Particle Characteristics

Particle shape and angularity are estimated from a visual assessment of coarse-grained soil particle characteristics. Terminology used includes the following:

Particle shape – spherical, platy, elongated,

Particle angularity –angular, sub-angular, sub-rounded, rounded.

Moisture Condition – Abbreviations are as follows:

D	Dry, looks and feels dry
M	Moist, No free water on remoulding
W	Wet, free water on remoulding

Moisture content of fine-grained soils is based on judgement of the soils moisture content relative to the plastic and liquid limit as follows:

MC < PL	Moist, dry of plastic limit
MC ≈ PL	Moist, near plastic limit
MC > PL	Moist, wet of plastic limit
MC ≈ LL	Wet, near liquid limit
MC > LL	Wet of liquid limit

Consistency - of cohesive soils in accordance with AS 1726-2017, Table 11 are abbreviated as follows:

Consistency Term	Abbreviation	Indicative Undrained Shear Strength Range (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
Friable	**Fr**	-

Density Index (%) of granular soils is estimated or is based on SPT results. Abbreviations are as follows:

Description	Abbreviation	Relative Density	SPT N
Very Loose	VL	< 15%	0 - 4
Loose	L	15 - 35%	4 - 10
Medium Dense	MD	35 - 65%	10 - 30
Dense	D	65 - 85%	30 - 50
Very Dense	VD	> 85%	> 50

Structures - Fissuring and other defects are described in accordance with AS 1726-2017 using the terminology for rock defects

Origin - Where practicable an assessment is provided of the probable origin of the soil, e.g. fill, topsoil, alluvium, colluvium, residual soil.

MATERIAL DESCRIPTION - ROCK

Material Description

Descriptions of rock for geotechnics and engineering geology in civil engineering

Identification of rock type, composition and texture based on visual features in accordance with AS 1726-2017.

Rock Naming – Where possible conventional geological names are used within the logs. Engineering properties cannot be inferred directly from the rock names in the table, but the use of a particular name provides an indicative range of characteristics to the reader. Lithological identification of rock is provided to appreciate the geology of an area, to correlate geological profiles seen in boreholes or to distinguish boulders from bedrock.

Grain Size – Grain size is done in accordance with AS1726-2017 as follows:

Coarse grained	Mainly 0.6 to 2 mm
Medium grained	0.2 to 0.6 mm
Fine grained	0.06 to 0.2 mm

Colour – Rock colour is described in the moist condition.

Texture and Fabric - Frequently used terms include:

Sedimentary Rock	Metamorphic Rock	Igneous
Bedded	Cleaved	Massive
Interbedded	Foliated	Flow banded
Laminated	Schistose	Folded
Folded	Banded	Lineated
Massive	Lineated	Porphyritic
Graded	Gneissose	Crystalline
Cross-bedded	Folded	Amorphous

Bedding and Laminated – AS 1726 – 2017 bedding and laminated rock descriptions are provided below with additional detail from BS EN ISO 14689-1 as guidance.

Description	Spacing (mm)
Very Thickly Bedded	> 2000
Thickly Bedded	> 600 ≤ 2000
Medium Bedded	> 200 ≤ 600
Thinly Bedded	> 60 ≤ 200
Very Thinly Bedded	> 20 ≤ 60
Thickly Laminated	> 6 ≤ 20
Thinly Laminated	< 6

Features, inclusions and minor components – Features, inclusions and minor components within the rock material shall be described where those features could be significant such as gas bubbles, mineral veins, carbonaceous material, salts, swelling minerals, mineral inclusions, ironstone or carbonate bands, cross-stratification or minerals the readily oxidise upon atmospheric exposure.

Moisture content – Where possible descriptions are made by the feel and appearance of the rock using one according to following terms:

Dry	Looks and feels dry.
Moist	Feels cool, darkened in colour, but no water is visible on the surface
Wet	Feels cool, darkened in colour, water film or droplets visible on the surface

The moisture content of rock cored with water may not be representative of its in-situ condition.

Durability – Descriptions of the materials durability such as tendency to develop cracks, break into smaller pieces or disintegrate upon exposure to air or in contact with water are provided where observed.

Rock Material Strength – The strength of the rock material is based on uniaxial compressive strength (UCS). The following terms are used:

Rock Strength Class	Abbreviation	UCS (MPa)	Point Load Strength Index, $I_{s\,(50)}$ (MPa)
Very Low	VL	> 0.6 ≤ 2	> 0.03 ≤ 0.1
Low	L	> 2 ≤ 6	> 0.1 ≤ 0.3
Medium	M	> 6 ≤ 20	> 0.3 ≤ 1
High	H	> 20 ≤ 60	> 1 ≤ 3
Very High	VH	> 60 ≤ 200	> 3 ≤ 10
Extremely High	EH	> 200	> 10

Strengths are estimated and where possible supported by Point Load Index Testing of representative samples. Test results are plotted on the graphical logs as follows:

D	Diametral Point Load Test
A	Axial Point Load Test

Where the estimated strength log covers more than one range it indicates the rock strength varies between the limits shown. Point Load Strength Index test results are presented as $I_{s\,(50)}$ values in MPa.

Weathering - Weathering classification assists in identification but does not imply engineering properties. Descriptions are as follows:

Term (Abbreviation)	Description
Fresh (FR)	No signs of mineral decomposition or colour change.
Slightly Weathered (SW)	partly stained or discoloured. Not or little change to strength from fresh rock.
Moderately Weathered (MW)	material is completely discoloured, little or no change of strength from fresh rock.
Highly Weathered (HW)	material is completely discoloured, significant decrease in strength from fresh rock.
Extremely Weathered (EW)	Material has soil properties. Mass structure, material texture and fabric of original rock are still visible.
Residual Soil (RS)	Material has soil properties. Mass structure and material texture and fabric of original rock not visible, but the soil has not been significantly transported.

Alteration – Physical and chemical changes of the rock material due to geological processes by fluids at depth at pressures and temperatures above atmospheric conditions. Unlike weathering, alteration shows no relationship to topography and may occur at any depth. When altered materials are recognized, the following terms are used:

Term		Abbreviation		Definition
Extremely Altered		XA		Material has soil properties. Structure, texture and fabric of original rock are still visible. The rock name is replaced with the name of the parent material, e.g. Extremely Altered basalt. Soil descriptive terms are used.
Highly Altered	Distinctly altered	HA	DA	The whole of the rock material is discoloured. Rock strength is changed by alteration. Some primary minerals are altered to clay minerals. Porosity may be higher or lower due to loss of minerals or precipitation of secondary minerals in pores.
Moderately Altered	Distinctly altered	MA	DA	The whole of the rock material is discoloured Little or no change of strength from fresh rock. The term 'Distinctly Altered' is used where it is not practicable to distinguish between 'Highly Altered' and 'Moderately Altered'. Distinctly Altered is defined as follows: The rock may be highly discoloured; Porosity may be higher due to mineral loss; or may be lower due to precipitation of secondary minerals in pores; and Some change of rock strength.
Slightly Altered		SA		Rock is slightly discoloured Little or no change of strength from fresh rock.

Alteration is only described in the context of the project where it has relevance to the civil and structural design.

Defect Descriptions

General and Detailed Descriptions – Defect descriptions are provided to suit project requirements. Generalized descriptions are used for some projects where it is unnecessary to describe each individual defect in a rock mass, or where multiple similar defects are present which are too numerous to log individually. The part of the rock mass to which this applies is delineated.

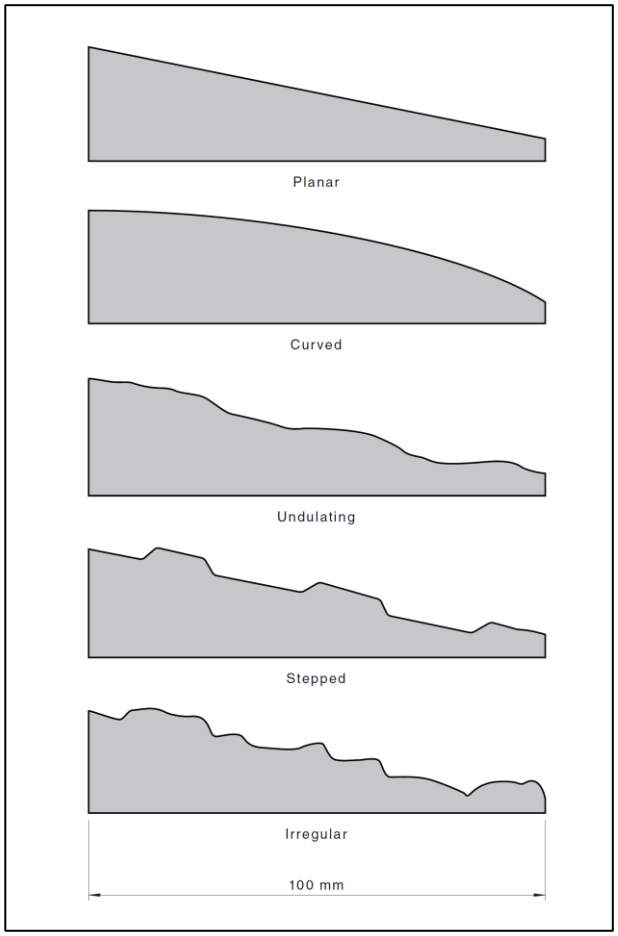
Detailed descriptions are given of defects judged to be particularly significant in the context of the project. For example, crushed seams in an apparently unstable slope. As a minimum, general descriptions outlining the number of defect sets within the rock mass and their broad characteristics are provided where it is possible to do so.

Defect Type – Defect abbreviations are as follows:

BP	Bedding Parting	**FL**	Foliation	**SP**	Shear Plane
CL	Cleavage	**FZ**	Fracture Zone	**SZ**	Shear Zone
CS	Crushed Seam	**HB**	Handling break	**VN**	Vein
DB	Drilling break	**JT**	Joint		
DL	Drill Lift	**SM**	Seam		

Defect Orientation – The dip and dip direction are recorded as a two-digit and three-digit number separated by a slash, e.g. 50/240 only when orientated core are collected and there is not core loss that could obscure core orientation. If alternative measurements are made, such as dip and strike or dip direction relative to magnetic north this shall be documented.

Surface Shape –At the medium scale of observation, description of the roughness of the surface shall be enhanced by description of the shape of the defect surface using the following terms, as illustrated below:



Defect Coatings and Seam Composition – Coatings are described using the following terms:

(a) *Clean* No visible coating.
(b) *Stained* No visible coating but surfaces are discoloured.
(c) *Veneer* A visible coating of soil or mineral, too thin to measure; may be patchy.
(d) *Coating* A visible coating up to 1 mm thick. Soil in-fill greater than 1 mm shall be described using defect terms (e.g. infilled seam). Defects greater than 1 mm aperture containing rock material great described as a vein.

Defect Spacing, Length, Openness and Thickness – described directly in millimetres and metres. In general descriptions, half order of magnitude categories are used, e.g. joint spacing typically 100 mm to 300 mm, sheared zones 1 m to 3 m thick.

Depending on project requirements and the scale of observation, spacing may be described as the mean spacing within a set of defects, or as the spacing between all defects within the rock mass. Where spacing is measured within a specific set of defects, measurements shall be made perpendicular to the defect set.

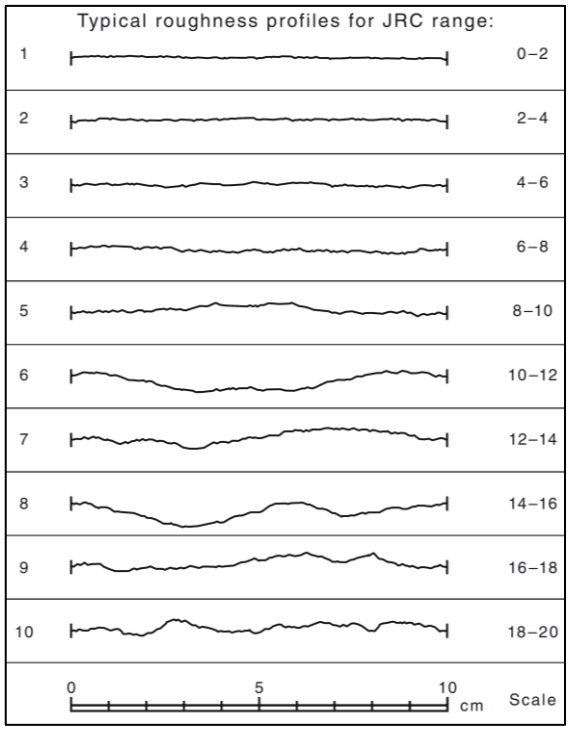
Defect spacing and length (sometimes called persistence), shall be described directly inmillimetres and metres.

Stratigraphic Unit - Geological maps related to the project are used for the designation of lithological formation name and, where possible geological unit name, e.g. Bringelly Shale, Potts Hill Sandstone Member.

Defect Roughness and Shape – Defect surface roughness is described as follows:

Very rough	Many large surface irregularities with amplitude generally more than 1 mm.
Rough	Many small surface irregularities with amplitude generally less than 1 mm.
Smooth	Smooth to touch. Few or no surface irregularities.
Polished	Shiny smooth surface
Slickensided	Grooved or striated surface, usually polished.

Where applicable Joint Roughness Range (JRC) is provided as follows:



Joint roughness profiles and corresponding JRC range based on Barton, N and Choubey, V. The Shear Strength of Rock Joints in Theory and Practice. *Rock Mechanics.* Vol. 10 (1977), pp. 1–54.

Where possible the mineralogy of the coating is identified.

Defect Infilling - abbreviated as follows:

CA	Calcite	**KT**	Chlorite
CN	Clean	**MS**	Secondary Mineral
Cy	Clay	**MU**	Unidentified Mineral
CS	Crushed Seam	**Qz**	Quartz
Fe	Iron Oxide	**X**	Carbonaceous

Parameters Related to Core Drilling

Total Core Recovery – T

Defect Spacing or Fracture Index – T

Rock Quality Designation – Y

Core Loss – Core loss occurs when material is lost during the drilling process It is shown at the bottom of the run unless otherwise indicated where core loss is known.

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Borehole Log

Client: 2A Gregory Place Pty Ltd
Project: Proposed Mixed Development
Location: 2A Gregory Place, Harris Park NSW

Started: 19/11/2021
Finished: 19/11/2021
Borehole Size 110 mm

Rig Type: Hanin D&B 8D
Hole Location: Refer Drawing: 13091-GR-1-A
Driller: SZ
Logged: KT

RL Surface: 4.70m
Contractor: BG Drilling Pty Ltd
Bearing: ---
Checked: MS

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Moisture Condition	Consistency/ Density Index	Additional Observations
ADDT		4.70	0		-	CONCRETE SLAB, 100mm thickness.		-	-	FILL
					-	FILL: Sandy CLAY, low plasticity, dark grey, appears poorly to moderately compacted		M	-	
		4					SPT 1, 2, 1 N=3			
			1		SP	SAND, medium grained, brown and orange. trace clay	ASS: 0.5m ASS: 1.0m	M	VL	ALLUVIUM
	▼ GW Table Encounter 1.6m during Augering	3				At 1.6m, becomes wet.	SPT 0, 1, 3 N=4	W		
			2				ASS: 1.5m ES 2.0m			
		2			SC	Clayey SAND, medium grained, dark grey and orange brown.	ASS: 2.5m	M	MD	RESIDUAL
			3			At 3.0m. As above, with fine ironstone gravel.	SPT 5, 5, 8 N=13			
		1					ASS: 3.0 ASS: 3.5m			
			4				ASS: 4.0m			
		0			CI	SILTSTONE / SHALE: extremely weathered, recovered as Gravelly CLAY, medium plastcity, dark grey.	SPT 18/100mm HB	MC < PL	VSt - H	EXTREMELY WEATHERED SHALE
			5							
		-1				Borehole BH01 continued as cored hole				
			6							
		-2								
			7							
		-3								
			8							
		-4								
			9							
		-5								
			10							

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Cored Borehole Log

Client: 2A Gregory Place Pty Ltd
Project: Proposed Mixed Development
Location: 2A Gregory Place, Harris Park NSW
Hole Location: Refer Drawing: 13091-GR-1-A
Started: 19/11/2021
Finished: 19/11/2021
Borehole Size: 110 mm

Rig Type: Hanin D&B 8D
Hole Coordinates E, N
Driller: SZ
Logged: KT
RL Surface: 4.70m
Contractor: BG Drilling Pty Ltd
Bearing: ---
Checked: MS

Method	Water	RL (m)	Depth (m)	Graphic Log	Material Description	Weathering	Estimated Strength (● Axial, ○ Diametral) EL -0.03 / VL -0.1 / L -0.3 / M -1 / H -3 / VH -10 / EH	$Is_{(50)}$ MPa D- diametral A- axial	RQD %	Defect Spacing mm (30, 100, 300, 1000, 3000)	Additional Data
		4	1								
		3	2								
		2	3								
		1	4								
		0	5		Continued from non-cored borehole						
		-1	6		SHALE, dark grey, laminated at 0°. 1mm-10mm spacing.	FR	○ ●	D 0.15 A 1.31	88		5.57 - BP, 0°, PL, RO, CN. 6.10 - BP, 0°, PL, RO, CN. 6.28 - BP, 10°, PL, RO, CN. 6.30 - BP, 10°, PL, RO, CN. 6.58-6.6 - BP, 0°, UN, RO, CN x 2.
		-2	7				●	D 0.51 A 1.82			6.98 - BP, 20°, PL, RO, CN. 7.06 - BP, 0°, UN, RO, CN. 7.24 - BP, 0°, PL, RO, CN.
		-3	8		SHALE, dark grey.						7.60 - BP, 0°, PL, RO, CN. 7.64 - JT, 45°, PL, RO, CN. 7.68 - JT, 45°, PL, RO, CN. 7.82 - BP, 0°, PL, RO, CN. 7.92 - BP, 10°, PL, RO, CN. 8.22 - BP, 5°, PL, RO, CN. 8.30 - BP, 0°, UN, RO, CN.
		-4	9				○	D 0.35 A 0.79	82		8.52 - BP, 0°, PL, RO, CN. 8.60 - BP, 0°, PL, RO, CN. 8.92 - BP, 0°, PL, RO, CN. 9.06 - JT, 10°, PL, RO, CN. 9.14 - BP, 0°, PL, RO, CN. 9.26 - JT, 20°, PL, RO, CN.
		-5	10								9.54 - BP, 0°, UN, RO, CN. 9.88 - BP, 0°, UN, RO, CN.

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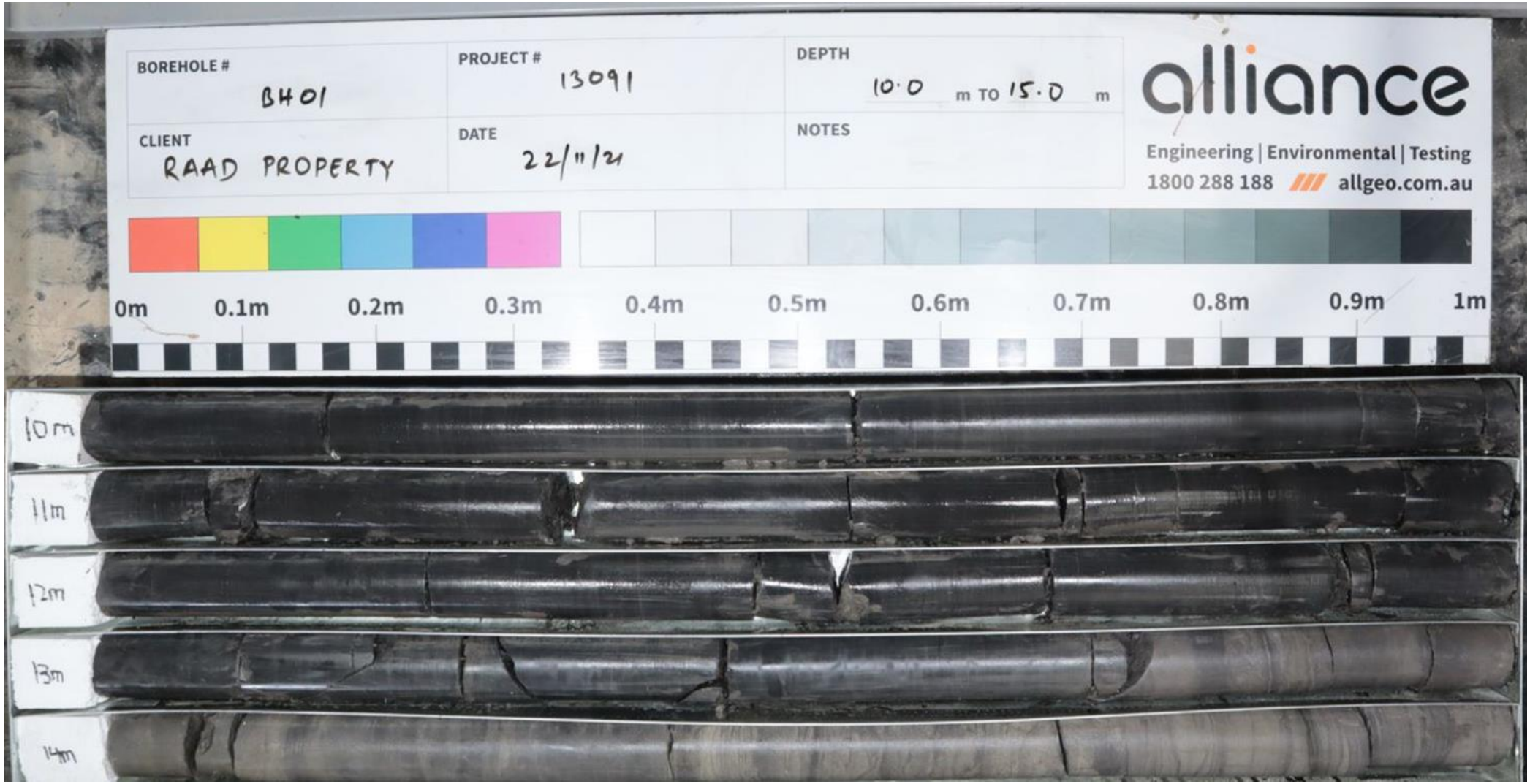
Cored Borehole Log

Client: 2A Gregory Place Pty Ltd
Project: Proposed Mixed Development
Location: 2A Gregory Place, Harris Park NSW
Hole Location: Refer Drawing: 13091-GR-1-A
Started: 19/11/2021
Finished: 19/11/2021
Borehole Size: 110 mm

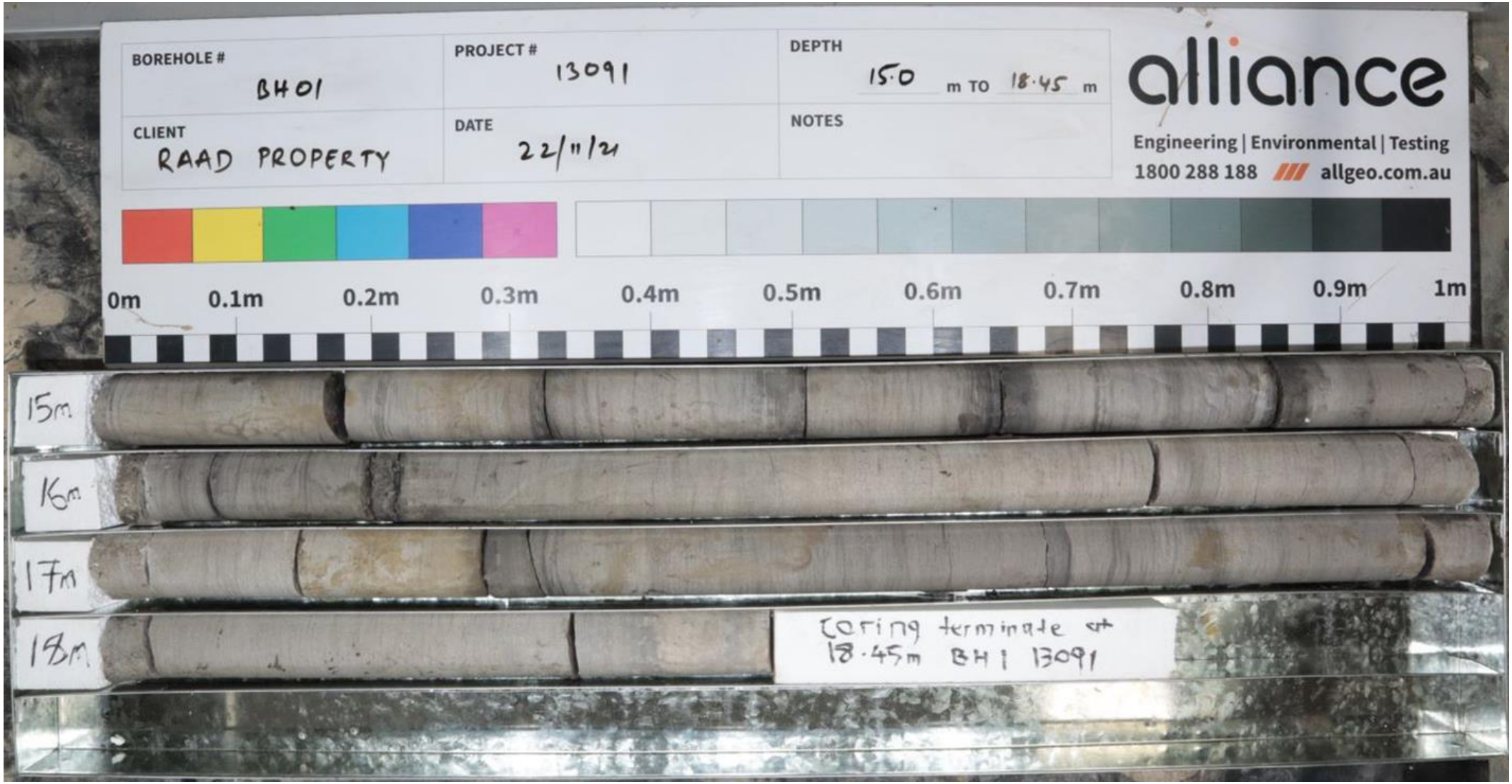
Rig Type: Hanin D&B 8D
Hole Coordinates E, N
Driller: SZ
Logged: KT
RL Surface: 4.70m
Contractor: BG Drilling Pty Ltd
Bearing: ---
Checked: MS

Depth (m)	RL (m)	Material Description	Weathering	Is(50) MPa D- diametral A- axial	RQD %	Defect Spacing mm	Additional Data
11	-6	SHALE, dark grey. *(continued)*	FR	D 0.51 A 1.21	82		10.16 - BP, 0°, PL, RO, CN. 10.54 - JT, 0°, UN, RO, CN. 10.93 - BP, 0°, PL, RO, SN. 11.12 - BP, 0°, PL, RO, SN. 11.34 - BP, 0°, PL, RO, SN.
12	-7						11.68 - BP, 5°, PL, RO, SN. 11.70 - BP, 5°, PL, RO, SN. 11.78 - BP, 0°, PL, RO, SN. 12.06 - BP, 0°, ST, RO, CN. 12.24 - BP, 0°, UN, RO, CN.
13	-8				78		12.48 - BP, 0°, UN, RO, CN. 12.53 - JT, 20°, PL, RO, CN. 12.68 - BP, 0°, PL, RO, CN. 12.90 - JT, 5°, PL, RO, CN. 13.17 - JT, 60°, PL, RO, CN. 13.31 - JT, 45°, PL, RO, CN.
14	-9	Interbedded SANDSTONE/SHALE: Sandstone (80%), fine grained, pale grey, Shale (20%), grey and dark grey, 1mm-10mm average spacing.		D 2.04 A 1.7			13.70 - BP, 0°, PL, RO, CN. 13.71 - JT, 45°, PL, RO, SN. 13.94 - BP, 0°, PL, RO, CN. 14.10 - BP, 0°, PL, RO, CO. 14.11 - JT, 10°, PL, RO, CO. 14.12 - JT, 10°, UN, RO, CN. 14.42 - BP, 0°, UN, RO, CN.
15	-10			D 1.83 A 3.66			14.68 - JT, 15°, PL, RO, CN. 14.90 - BP, 0°, PL, RO, CN.
16	-11	SANDSTONE, pale grey, fine grained, bedded at 0°-10°, variable spacing.		D 3 A 3.55	92		15.17 - JT, 15°, PL, RO, CN. 15.32 - BP, 0°, PL, RO, CN. 15.63 - BP, 0°, PL, RO, CN. 15.82 - BP, 0°, PL, RO, CN. 16.08 - BP, 5°, PL, RO, CN. 16.20 - SM, 20mm.
17	-12						16.78 - BP, 0°, PL, RO, CN. 17.04 - BP, 0°, UN, RO, CN. 17.16 - BP, 0°, PL, RO, CN. 17.30 - BP, 0°, PL, RO, CN. 17.33 - JT, 20°, PL, RO, CN.
18	-13			D 1.86 A 2.49	97		17.89 - BP, 0°, PL, RO, CN. 18.06 - BP, 5°, UN, PL, RO, CN. 18.38 - BP, 0°, PL, RO, CN.
19	-14	BH01 terminated at 18.45m					
20	-15						

Client Name:	2A Gregory Place Pty Ltd	Figure / Drawing Number:	Corebox Photos
Project Name:	Proposed Mixed Use Development	Figure / Drawing Date:	25/11/2021
Project Location:	2A Gregory Place, Harris Park NSW 2150	Report Number:	13091-GR-1-1



Client Name:	2A Gregory Place	Figure / Drawing Number:	Corebox Photos
Project Name:	Proposed Mixed Use Development	Figure / Drawing Date:	25/11/2021
Project Location:	2A Gregory Place, Harris Park NSW 2150	Report Number:	13091-GR-1-1



Client Name:	2A Gregory Place Pty Ltd	Figure / Drawing Number:	Corebox Photos
Project Name:	Proposed Mixed Use Development	Figure / Drawing Date:	25/11/2021
Project Location:	2A Gregory Place, Harris Park NSW 2150	Report Number:	13091-GR-1-1

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BH No: BH02
PAGE 1 OF 3
Job No: 13091

Borehole Log

Client: 2A Gregory Place Pty Ltd
Project: Proposed Mixed Development
Location: 2A Gregory Place, Harris Park NSW

Started: 23/11/2021
Finished: 23/11/2021
Borehole Size 110 mm

Rig Type: Christie Engineering (CE180) **Hole Location:** Refer Drawing: 13091-GR-1-A **Driller:** MW **Logged:** DX
RL Surface: 5.50m **Contractor:** BG Drilling Pty Ltd **Bearing:** --- **Checked:** MS

Method	Water	Well Details	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Moisture Condition	Consistency/ Density Index	Additional Observations
ADTDT	GW Table Encounter 2.3m during Augering		5.50	0		-	CONCRETE SLAB, 150mm thickness.		-	-	FILL
						-	FILL: Silty SAND, fine to medium grained, pale brown, trace clay, trace fine gravel		M	-	
			5			SP	Silty SAND: fine to medium grained sand, brown and red mottled yellow, trace clay	SPT 1, 1, 2 N=3 ASS: 0.5m ASS: 1.0m	M	VL	ALLUVIUM
			4	1				SPT 2, 3, 3 N=6 ASS: 1.5m			
				2		CL-CI	Sandy CLAY: low to medium plasticity, orange mottled yellow, fine to medium grained sand, trace silt	ES 1.5m - 2.5m ASS: 2.0m ASS: 2.5m	M - W	F	
			3	3		SP	SAND: fine to medium grained, yellow-brown	SPT 2, 1, 3 N=4 ASS: 3.0m ASS: 3.5m ASS: 4.0m	W	VL	RESIDUAL
			2	4							
			1	5			At 4.7m: becoming pale grey	SPT 1, 4, 6 N=10 ASS: 4.5m ASS: 5.0m ASS: 5.5m	W	L - MD	
			0	6		CI	SHALE: extremly weathered. Recovered as Gravelly CLAY, medium plasticity, dark grey.	ASS: 6.0m ASS: 6.5m	MC < PL	H	EXTREMELY WEATHERED SHALE
			-1	7							
			-2	8			Borehole BH02 continued as cored hole				
			-3	9							
			-4	10							

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Cored Borehole Log

Client: 2A Gregory Place Pty Ltd
Project: Proposed Mixed Development
Location: 2A Gregory Place, Harris Park NSW
Hole Location: Refer Drawing: 13091-GR-1-A
Started: 23/11/2021
Finished: 23/11/2021
Borehole Size: 110 mm

Rig Type: Christie Engineering (CE180)
Hole Coordinates E, N
Driller: MW
Logged: DX
RL Surface: 5.50m
Contractor: BG Drilling Pty Ltd
Bearing: ---
Checked: MS

Method	Water	Well Details	RL (m)	Depth (m)	Graphic Log	Material Description	Weathering	Estimated Strength (● Axial, ○ Diametral) EL -0.03 VL -0.1 L -0.3 M -1 H -3 VH -10 EH	$Is_{(50)}$ MPa D- diametral A- axial	RQD %	Defect Spacing mm (30 100 300 1000 3000)	Additional Data
			5	1								
			4	2								
			3	3								
			2	4								
			1	5								
			0	6								
			-1	7		Continued from non-cored borehole						
NMLC			-2	8		CLAY, grey (likely cave- in).	EW					7.20 - 7.28 - Silty clay: grey, high plasticity, (cave-ins).
						SHALE: dark grey, thinly laminated at 0°, 1mm-10m spacing.	SW		D A 1.2 1.8			7.30 - JT, 10°, UN, RO, CN. 7.62 - BP, 0°, PL, SO, VN, clay. 7.73 - BP, 0°, PL, SO, VN, clay. 7.87 - BP, 0°, PL, SO, VN, clay. 7.88 - BP, 0°, PL, SO, VN, clay.
			-3	9						94		8.46 - BP, 0°, PL, SO, CN. 8.64 - BP, 0°, PL, SO, CN. 8.80 - JT, 5°, PL, SO, CN. 9.04 - JT, 10°, PL, SO, CN.
			-4	10					D A 1.09 2.2			9.36 - JT, 20°, UN, SO, CN. 9.43 - JT, 10°, UN, SO, CN. 9.53 - BP, 0°, PL, SO, CN. 9.54 - BP, 0°, PL, SO, CN. 9.59 - BP, 5°, PL, SO, CN. 9.76 - JT, 30°, PL, SO, CN.

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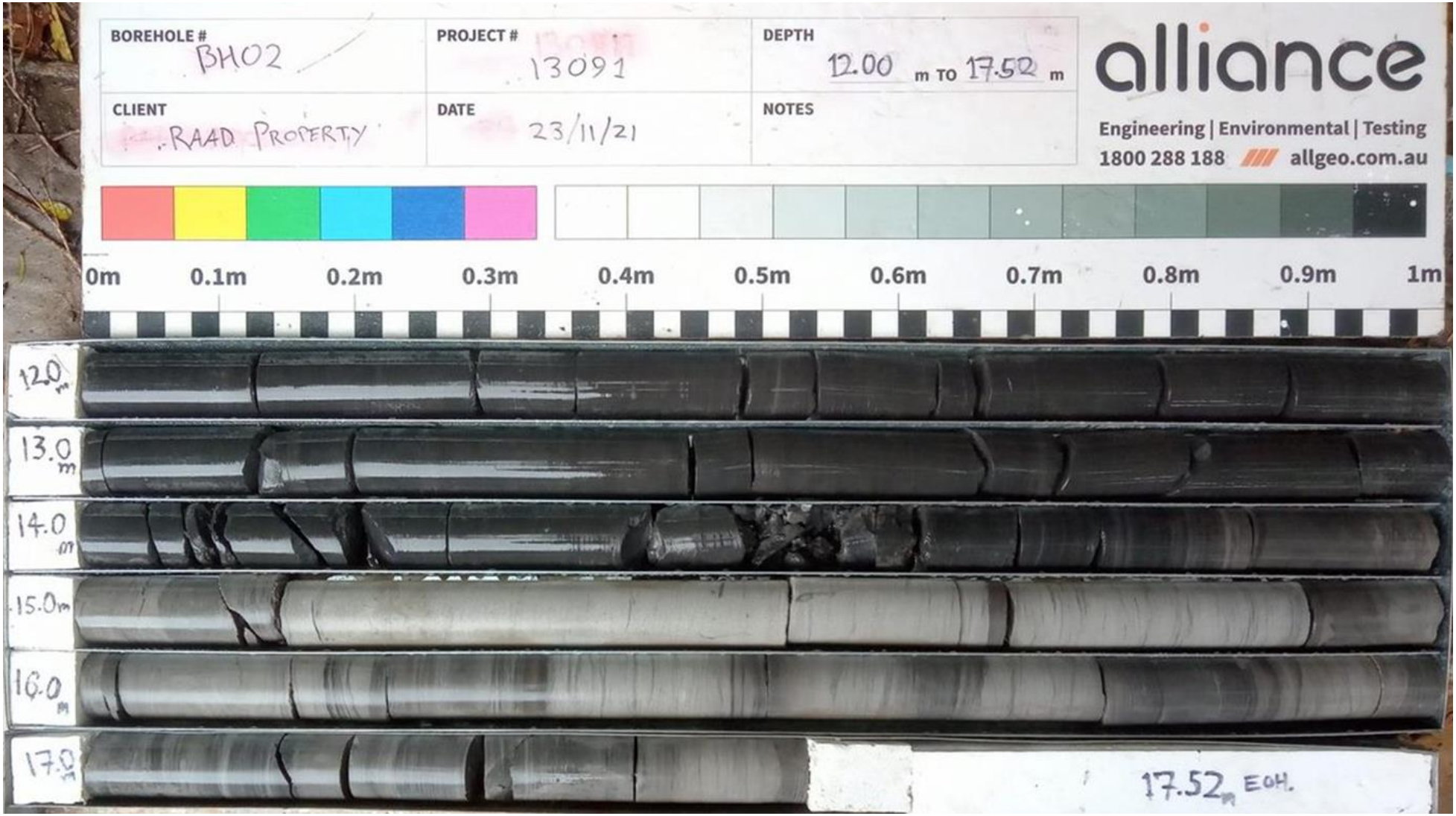
Cored Borehole Log

Client: 2A Gregory Place Pty Ltd
Started: 23/11/2021
Project: Proposed Mixed Development
Finished: 23/11/2021
Location: 2A Gregory Place, Harris Park NSW
Hole Location: Refer Drawing: 13091-GR-1-A
Borehole Size: 110 mm
Rig Type: Christie Engineering (CE180)
Hole Coordinates E, N
Driller: MW
Logged: DX
RL Surface: 5.50m
Contractor: BG Drilling Pty Ltd
Bearing: ---
Checked: MS

Method	Water	Well Details	RL (m)	Depth (m)	Graphic Log	Material Description	Weathering	Estimated Strength (● - Axial, ○ - Diametral) EL -0.03 VL -0.1 L -0.3 M -1 H -3 VH -10 EH	$Is_{(50)}$ MPa D- diametral A- axial	RQD %	Defect Spacing mm 30 100 300 1000 3000	Additional Data
NMLC			-5	11		SHALE: dark grey, thinly laminated at 0°, 1mm-10m spacing. *(continued)*	SW					9.80 - BP, 0°, PL, SO, CN. 10.40 - BP, 0°, CU, SO, CN. 10.61 - FZ, 20mm, shale gravel. 10.68 - BP, 0°, PL, SO, CN. 10.75 - JT, 5°, CU, SO, CN. 10.81 - BP, 0°, PL, SO, CN. 11.06 - BP, 0°, PL, SO, CN.
			-6	12					D 0.52 A 0.71	76		11.39 - BP, 0°, PL, SO, CN. 11.49 - BP, 0°, PL, SO, CN. 11.50 - BP, 0°, PL, SO, CN. 11.68 - JT, 30°, UN, SO, CN. 11.70 - BP, 0°, PL, SO, CN. 11.78 - BP, 0°, PL, SO, CN.
			-7	13								12.13 - BP, 0°, PL, SO, CN. 12.30 - JT, 5°, CU, SO, CN. 12.37 - BP, 5°, PL, SO, CN. 12.49 - BP, 5°, UN, SO, CN. 12.55 - BP, 0°, PL, SO, CN. 12.63 - BP, 0°, PL, SO, CN. 12.67 - BP, 0°, PL, SO, CN. 12.80 - BP, 0°, PL, SO, CN. 12.89 - BP, 0°, PL, SO, CN. 13.02 - BP, 0°, PL, SO, CN. 13.13 - JT, 20°, PL, SO, CN.
			-8	14					D 0.64 A 1.27	47		13.45 - BP, 0°, PL, SO, CN. 13.50 - BP, 0°, PL, SO, CN. 13.66 - JT, 30°, PL, SO, CN. 13.73 - BP, 0°, UN, SO, CN. 13.82 - JT, 45°, PL, SO, CN. 13.94 - JT, 20°, PL, SO, CN. 14.05 - BP, 0°, PL, SO, CN. 14.08 - BP, 0°, PL, SO, CN. 14.09 - BP, 0°, PL, SO, CN. 14.11 - BP, 0°, UN, SO, CN. 14.17 - JT, 50°, PL, SO, CN. 14.20 - JT, 50°, PL, SO, CN. 14.27 - BP, 0°, PL, SO, CN.
			-9	15			HW SW		D 0.52 A 0.67			14.42 - JT, 30°, UN, SO, CN. 14.50 - 14.56 - CZ, 60mm. 14.56 - BP, 0°, UN, RO, VN, clay. 14.60 - BP, 0°, PL, SO, CN. 14.66 - BP, 0°, PL, SO, CN. 14.72 - BP, 0°, PL, SO, CN. 14.84 - BP, 0°, PL, SO, CN.
			-10	16		SANDSTONE: fine grained, pale grey and grey, thinly laminated shale at 0°, variable spacing.			D 1.7 A 2.83	88		15.08 - JT, 45°, PL, RO, CN. 15.50 - BP, 0°, PL, RO, CN. 15.66 - BP, 0°, PL, RO, CN. 15.89 - BP, 0°, PL, SO, CN. 16.04 - BP, 5°, PL, RO, CN. 16.13 - BP, 5°, UN, RO, VN, clay. 16.21 - BP, 0°, PL, SO, CN. 16.49 - BP, 0°, PL, RO, CN.
			-11	17					D 1.83 A 2.62			16.73 - BP, 0°, PL, SO, CN. 16.84 - BP, 0°, PL, SO, CN. 17.12 - JT, 15°, UN, SO, CN. 17.17 - BP, 0°, PL, RO. 17.26 - BP, 5°, PL, RO, CN. 17.29 - JT, 45°, UN, RO, CN. 17.39 - BP, 0°, PL, SO, CN.
			-12			BH02 terminated at 17.52m						
			-13	18								
			-14	19								
				20								

alliance	Client Name:	2A Gregory Place Pty Ltd	Figure / Drawing Number:	Corebox Photos
	Project Name:	Proposed Mixed Use Development	Figure / Drawing Date:	25/11/2021
	Project Location:	2A Gregory Place, Harris Park NSW 2150	Report Number:	13091-GR-1-1



alliance	Client Name:	2A Gregory Place Pty Ltd	Figure / Drawing Number:	Corebox Photos
	Project Name:	Proposed Mixed Use Development	Figure / Drawing Date:	25/11/2021
	Project Location:	2A Gregory Place, Harris Park NSW 2150	Report Number:	13091-GR-1-1

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BH No: BH03
PAGE 1 OF 3
Job No: 13091

Borehole Log

Client: 2A Gregory Place Pty Ltd
Project: Proposed Mixed Development
Location: 2A Gregory Place, Harris Park NSW

Started: 22/11/2021
Finished: 22/11/2021
Borehole Size 110 mm

Rig Type: Christie Engineering (CE180) **Borehole Location:** Refer Drawing: 13091-GR-1-A **Driller:** MW **Logged:** KT
RL Surface: 5.15m **Contractor:** BG Drilling Pty Ltd **Bearing:** --- **Checked:** MS

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Moisture Condition	Consistency/ Density Index	Additional Observations
ADT		5	1		-	CONCRETE SLAB, 150mm thickness.		-	-	FILL
					-	FILL: Sandy GRAVEL, fine to coarse gravel, grey and brown, with fine to medium grained sand, appears well compacted		D	-	
					-	FILL: Clayey SAND / Sandy CLAY, low plasticity, dark grey and dark brown, with medium grained sand, trace gravel		M	-	
		4			SC	Clayey SAND: fine to medium grained, orange and brown		M	VL - L	ALLUVIUM
	▼ GW Table Encouneter 2.0m during Augering		2		SP	SAND: fine grained, orange and brown, poorly graded	SPT 2, 3, 2 N=5	M	VL - L	
		3				At 2.0, becoming moist to wet		M - W		
			3		SP	SAND: medium grained, brown, poorly graded, trace clay		M - W	VL - L	
		2			SC	Clayey SAND: medium grained, grey and brown, poorly graded	SPT 3, 6, 7 N=13 ES at 3.5m	M - W	MD	
		1	4							
							SPT 2, 4, 5 N=9			
		0	5		CL-CI	CLAY with silt: grey and brown orange, low to medium plasticity, trace medium grained sand.		MC ~ PL	St	RESIDUAL
		-1	6		CI	SHALE: extremely weathered. Recovered as Gravelly CLAY, medium plasticity, grey and dark grey.		MV < PL	VSt - H	EXTREMELY WEATHERED SHALE
		-2	7							
		-3	8			Borehole BH03 continued as cored hole				
		-4	9							
			10							

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Cored Borehole Log

Client: 2A Gregory Place Pty Ltd
Project: Proposed Mixed Development
Location: 2A Gregory Place, Harris Park NSW
Hole Location: Refer Drawing: 13091-GR-1-A
Started: 22/11/2021
Finished: 22/11/2021
Borehole Size: 110 mm

Rig Type: Christie Engineering (CE180)
Hole Coordinates E, N
Driller: MW
Logged: KT
RL Surface: 5.15m
Contractor: BG Drilling Pty Ltd
Bearing: ---
Checked: MS

Method	Water	RL (m)	Depth (m)	Graphic Log	Material Description	Weathering	Estimated Strength (● Axial, ○ Diametral) EL -0.03 VL -0.1 L -0.3 M -1 H -3 VH -10 EH	$Is_{(50)}$ MPa D- diametral A- axial	RQD %	Defect Spacing mm 30 100 300 1000 3000	Additional Data
		5	1								
		4									
			2								
		3									
			3								
		2									
			4								
		1									
			5								
		0									
			6								
		-1									
			7								
		-2			Continued from non-cored borehole						
NMLC					SHALE: dark grey, laminated at 0°-10°, variable spacing.	FR	○ ●	D A 0.81 1.55	68		7.32 - JT, 30°, PL, RO, CN. 7.48 - BP, 0°, PL, RO, CN. 7.72 - BP, 0, PL, RO, CN. 7.74 - JT, 15°, PL, RO, CN.
			8								
		-3									8.16 - BP, 0°, UN, RO, CN. 8.20 - BP, 0°, UN, RO, CN. 8.44 - BP, 0°, UN, RO, CN.
			9								8.75 - JT, 5°, UN, RO, CN. 8.82 - JT, 5°, UN, RO, CN. 8.89 - JT, 30°, UN, RO, CN. 8.94 - JT, 30°, PL, RO, CN. 8.97 - JT, 15°, UN, RO, CN. 9.22 - JT, 0°, PL, RO, CN.
		-4					○ ●	D A 0.09 11.21	74		
			10								9.86 - BP, 0°, UN, RO, CN.

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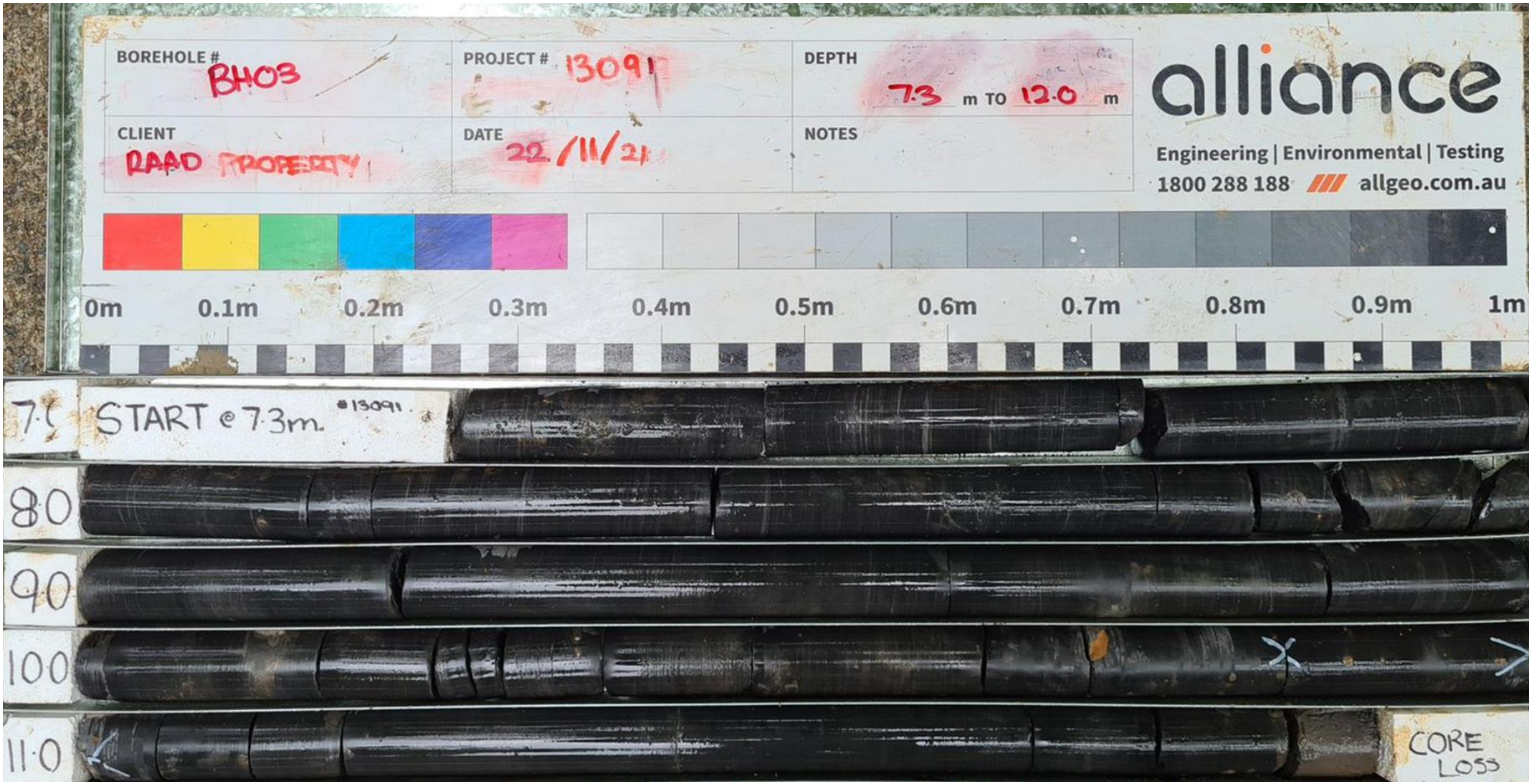
Cored Borehole Log

Client: 2A Gregory Place Pty Ltd
Started: 22/11/2021
Project: Proposed Mixed Development
Finished: 22/11/2021
Location: 2A Gregory Place, Harris Park NSW
Hole Location: Refer Drawing: 13091-GR-1-A
Borehole Size: 110 mm
Rig Type: Christie Engineering (CE180)
Hole Coordinates E, N
Driller: MW
Logged: KT
RL Surface: 5.15m
Contractor: BG Drilling Pty Ltd
Bearing: ---
Checked: MS

Method	Water	RL (m)	Depth (m)	Graphic Log	Material Description	Weathering	Estimated Strength (● Axial, ○ Diametral) EL -0.03 VL -0.1 L -0.3 M -1 H -3 VH -10 EH	$Is_{(50)}$ MPa D- diametral A- axial	RQD %	Defect Spacing mm 30 100 300 1000 3000	Additional Data
NMLC		-5	11		SHALE: dark grey, laminated at 0°-10°, variable spacing. *(continued)*	FR			74		10.04 - BP, 0°, UN, RO, CN. 10.17 - BP, 0°, PL, RO, CN. 10.24 - BP, 0°, PL, RO, CN. 10.26 - BP, 0°, PL, RO, CN. 10.28 - BP, 0°, PL, RO, CN. 10.36 - BP, 0°, PL, RO, CN. 10.64 - BP, 0°, UN, RO, CN. 10.71 - JT, 5°, PL, RO, CN.
		-6									11.06 - BP, 0°, PL, RO, CN. 11.12 - BP, 0°, PL, RO, CN. 11.18 - BP, 0°, PL, RO, CN.
			12					D 0.6 A 0.62			
		-7			Core Loss: 100mm.	N/A					11.75 - BP, 0°, UN, RO, CN. 11.84 - BP, 0°, UN, RO, CN. Core loss 100mm.
					SHALE: dark grey, laminated at 0°-10°, variable spacing.	SW			86		
		-8	13								
			14					D 0.47 A 0.8 D 0.37 A 0.82			
		-9									
			15		BH03 terminated at 14.9m						
		-10									
			16								
		-11									
			17								
		-12									
			18								
		-13									
			19								
		-14									
			20								



Client Name:	2A Gregory Place Pty Ltd	Figure / Drawing Number:	Corebox Photos
Project Name:	Proposed Mixed Use Development	Figure / Drawing Date:	25/11/2021
Project Location:	2A Gregory Place, Harris Park NSW 2150	Report Number:	13091-GR-1-1

alliance	Client Name:	2A Gregory Place Pty Ltd	Figure / Drawing Number:	Corebox Photos
	Project Name:	Proposed Mixed Use Development	Figure / Drawing Date:	25/11/2021
	Project Location:	2A Gregory Place, Harris Park NSW 2150	Report Number:	13091-GR-1-1

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Borehole Log

Client: 2A Gregory Place Pty Ltd
Project: Proposed Mixed Development
Location: 2A Gregory Place, Harris Park NSW
Started: 19/11/2021
Finished: 22/11/2021
Borehole Size 110 mm

Rig Type: Hanin D&B 8D | **Hole Location:** Refer Drawing: 13091-GR-1-A | **Driller:** SZ | **Logged:** KT
RL Surface: 5.00m | **Contractor:** BG Drilling Pty Ltd | **Bearing:** --- | **Checked:** MS

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Moisture Condition	Consistency/ Density Index	Additional Observations
DT						CONCRETE SLAB, 200mm thickness.		-	-	FILL
ADT		4	1		-	FILL: Sandy GRAVEL, fine to coarse gravel, well graded, dark grey and pale yellow, with silt. Appears moderately to poorly compacted.	SPT 1, 2, 2 N=4 ASS: 0.5m ASS: 1.0m	M	-	
	GW Table Encounter 2.8m during Augering	3	2		CL	Silty CLAY: low plasticity, yellow and dark grey, with fine grained sand.	SPT 0, 0, 0 N=0 ASS: 1.5m ASS: 2.0m	MC >~ PL	VS	ALLUVIUM
		2	3		CL	Silty CLAY: low plasticity, yellow dark grey, with fine grained sand.	SPT 1, 2, 2 N=4 ASS: 3.0m	MC > PL	S - F	
		1	4		CL-CI	Silty Sandy CLAY: low to medium plasticity, dark grey orange yellow, fine grained sand.	SPT 2, 1, 1 N=2 ASS & ES: 4.5m	MC > PL	S	
		0	5		SP	Silty SAND, light grey, fine grained.	ASS: 5.5m	M - W	VL - L	
		-1	6		CI	Silty CLAY, medium plasticity, dark grey pale yellow, trace shale gravel.	SPT 25, Refusal ASS: 6.5m	MC ~ PL	H	RESIDUAL
		-2	7		CI	SHALE: extremely weathered. Recovered as Silty Sandy CLAY, medium plasticity, dark grey pale yellow, trace shale gravel.	SPT Refusal ASS: 7.5m ASS: 8.0m	MC ~ PL	H	EXTREMELY WEATHERED SHALE
		-3	8							
		-4	9			Borehole BH04 continued as cored hole				
		-5	10							

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Cored Borehole Log

Client: 2A Gregory Place Pty Ltd
Project: Proposed Mixed Development
Location: 2A Gregory Place, Harris Park NSW
Hole Location: Refer Drawing: 13091-GR-1-A
Started: 19/11/2021
Finished: 22/11/2021
Borehole Size: 110 mm

Rig Type: Hanin D&B 8D
Hole Coordinates E, N
Driller: SZ
Logged: KT
RL Surface: 5.00m
Contractor: BG Drilling Pty Ltd
Bearing: ---
Checked: MS

Method	Water	RL (m)	Depth (m)	Graphic Log	Material Description	Weathering	Estimated Strength (● - Axial, ○ - Diametral) EL -0.03 VL -0.1 L -0.3 M -1 H -3 VH -10 EH	$Is_{(50)}$ MPa D- diametral A- axial	RQD %	Defect Spacing mm 30 100 300 1000 3000	Additional Data
		4	1								
		3	2								
		2	3								
		1	4								
		0	5								
		-1	6								
		-2	7								
		-3	8								
					Continued from non-cored borehole						
NMLC		-4	9		SHALE: dark grey, with clay (possible cave-in)	EW					8.95 - SM, 50mm.
					SHALE: dark grey, laminated at 0°, 10mm-20mm spacing.	FR	○ ●	D 0.19 A 1.51	80		9.03 - BP, 0°, UN, RO, CN. 9.10 - BP, 0°, PL, RO, CN. 9.26 - BP, 0°, UN, RO, CN. 9.54 - BP, 0°, UN, RO, CN. 9.55 - BP, 0°, UN, RO, CN. 9.80 - BP, 0°, UN, RO, CN. 9.92 - BP, 10°, UN, RO, CN.
		-5	10								

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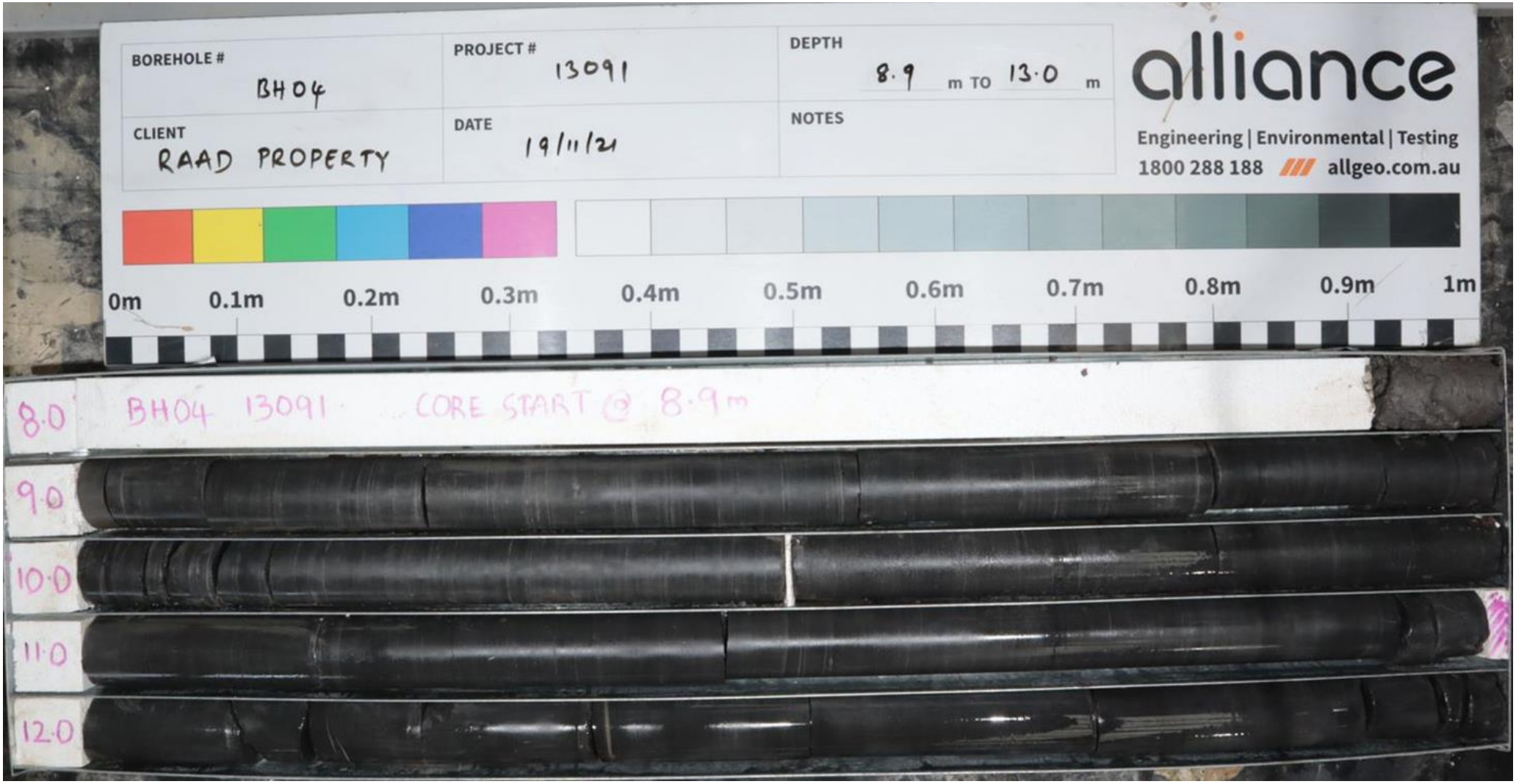
Cored Borehole Log

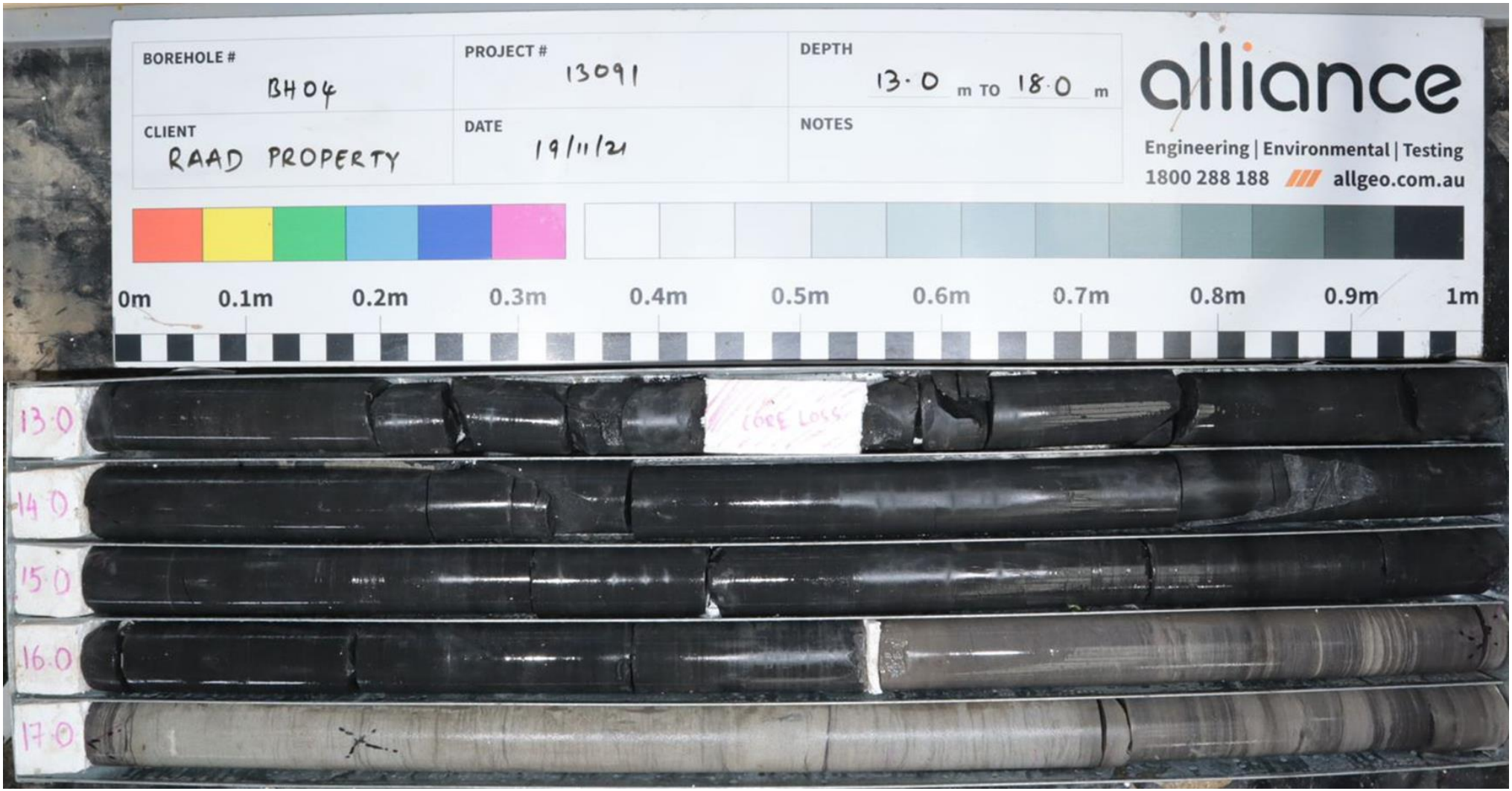
Client: 2A Gregory Place Pty Ltd
Project: Proposed Mixed Development
Location: 2A Gregory Place, Harris Park NSW
Hole Location: Refer Drawing: 13091-GR-1-A
Started: 19/11/2021
Finished: 22/11/2021
Borehole Size: 110 mm

Rig Type: Hanin D&B 8D
Hole Coordinates E, N
Driller: SZ
Logged: KT
RL Surface: 5.00m
Contractor: BG Drilling Pty Ltd
Bearing: ---
Checked: MS

Method	Water	RL (m)	Depth (m)	Graphic Log	Material Description	Weathering	Estimated Strength (● - Axial, ○ - Diametral) EL -0.03 VL -0.1 L -0.3 M -1 H -3 VH -10 EH	$Is_{(50)}$ MPa D- diametral A- axial	RQD %	Defect Spacing mm (30 100 300 1000 3000)	Additional Data
NMLC					SHALE: dark grey, laminated at 0°, 10mm-20mm spacing. *(continued)*	FR			80		10.06 - BP, 0°, PL, RO, CN. 10.07 - JT ,10°, UN, RO, CN. 10.09 - BP, 0°, PL, RO, CN. 10.10 - JT ,10°, UN, RO, CN. 10.16 - BP, 0°, PL, RO, CN.
		-6	11				○ ●	D A 0.48 1.3			10.80 - BP, 0°, UN, RO, CN.
							○ ●	D A 0.06 11.27			
		-7	12								11.80 - BP, 0°, PL, RO, CN. 11.93 - BP, 15°, UN, RO, CN. 11.95 - BP, 0°, UN, RO, CN.
					Core Loss: 2mm.	N/A			75		Core Loss 2mm.
					SHALE: dark grey, laminated at 0°, 10mm-20mm spacing.	FR	○ ●	D A 0.19 0.83			12.10 - JT, 60°, UN, RO, CN. 12.17 - BP, 0°, UN, RO, CN. 12.26 - BP, 0°, UN, RO, CN. 12.37 - BP, 0°, UN, RO, CN. 12.70 - BP, 0°, UN, RO, CN.
		-8	13								12.91 - BP, 0°, UN, RO, CN. 12.97 - BP, 10°, UN, RO, CN.
							●	D A 0.16 0.15			13.21 - BP, 10°, UN, RO, CN. 13.26 - CS, 30mm. 13.30 - JT, 0°, UN, RO, CN. 13.36 - JT, 10°, UN, RO, CN. 13.40 - BP, 15°, UN, RO, CN.
					Core loss: 100mm.	N/A					Core loss 100mm.
					SHALE: dark grey, laminated at 0°, 10mm-20mm spacing.	FR					13.60 - JT, 0°, UN, RO, CN. 13.65 - BP, 5°, UN, RO, CN, CS. 13.80 - JT, 10°, UN, RO, CN.
		-9	14								14.18 - BP, 0°, PL, RO, CN. 14.26 - BP, 0°, PL, RO, CN. 14.40 - BP, 0°, PL, RO, CN.
							●	D A 0.27 1.02			
		-10	15								14.77 - BP, 0°, PL, RO, CN.
							○ ●	D A 0.11 0.54	66		15.33 - BP, 0°, PL, RO, CN. 15.45 - BP, 10°, UN, RO, CN.
		-11	16								16.04 - BP, 0°, UN, RO, CN.
							●	D A 0.3 0.65			16.20 - BP, 0°, UN, RO, CN. 16.40 - BP, 0°, UN, RO, CN.
					INTERBEDDED SANDSTONE/SHALE: Sandstone (80%) pale grey, fine grained, shale (20%), dark grey laminations at 0°-10°.						16.56 - BP, 0°, UN, RO, CN.
		-12	17				○ ●	D A 0.068 0.39	93		
		-13	18								17.72 - BP, 0°, UN, RO, CN. 17.74 - BP, 0°, UN, RO, CN. 17.95 - BP, 0°, UN, RO, CN.
					BH04 terminated at 18m						
		-14	19								
		-15	20								



Client Name:	2A Gregory Place Pty Ltd	Figure / Drawing Number:	Corebox Photos
Project Name:	Proposed Mixed Use Development	Figure / Drawing Date:	25/11/2021
Project Location:	2A Gregory Place, Harris Park NSW 2150	Report Number:	13091-GR-1-1



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	Project Name:	Proposed Mixed Use Development	Figure / Drawing Date:	25/11/2021
	Project Location:	2A Gregory Place, Harris Park NSW 2150	Report Number:	13091-GR-1-1

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Borehole Log

Client: 2A Gregory Place Pty Ltd
Project: Proposed Mixed Development
Location: 2A Gregory Place, Harris Park NSW

Started: 19/11/2021
Finished: 19/11/2021
Borehole Size 110 mm

Rig Type: Hanin D&B 8D
Hole Location: Refer Drawing: 13091-GR-1-A
Driller: SZ
Logged: KT

RL Surface: 5.00m
Contractor: BG Drilling Pty Ltd
Bearing: ---
Checked: MS

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Moisture Condition	Consistency/ Density Index	Additional Observations
ADT					-	ASPHALT CONCRETE: 50mm thickness		-	-	FILL
					-	FILL: SAND, medium grained, brown and orange, trace fine gravel, appears moderately compacted		M	-	
							SPT 4, 6, 7 N=13			
		4	1		CL-CI	Sandy CLAY: low to medium plasticity, grey and brown	ASS: 0.5m	MC ~ PL	F - St	ALLUVIUM
							ASS: 1.0m			
							SPT 1, 3, 2 N=5			
		3	2				ASS: 1.5m			
						At 2.0, becoming MC >~ PL.	ASS: 2.0m	MC >~ PL	F	
	GW Table Encouneter 2.5m during Augering						ASS: 2.5m			
		2	3		CL-CI	Sandy CLAY: low to medium plasticity, grey and orange brown, fine to medium sand, with silt.	SPT 2, 2, 2 N=4	MC >~ PL	F	
							ASS: 3.0m			
						At 3.5. As above, dark grey and orange-brown.	ASS 3.5m			
		1	4				ASS & ES: 4.0m			
							SPT 2, 3, 4 N=7			
		0	5				ASS: 4.5m			
					CI	CLAY: medium plasticity, dark grey, with silt, trace fine sand.	ASS: 5.0m	MC >~ PL	VSt	RESIDUAL
							ASS: 5.5m			
		-1	6				SPT 10, 18, 23/15cm HB			
					CI	SHALE: extremely weathered. Recovered as Gravelly CLAY, medium plasticity, grey and brown.		MC >~ PL	H	EXTREMELY WEATHERED SHALE
		-2	7							
		-3	8							
		-4	9							
		-5	10							

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Borehole Log

Client: 2A Gregory Place Pty Ltd
Project: Proposed Mixed Development
Location: 2A Gregory Place, Harris Park NSW

Started: 19/11/2021
Finished: 19/11/2021
Borehole Size 110 mm

Rig Type: Hanin D&B 8D
Hole Location: Refer Drawing: 13091-GR-1-A
Driller: SZ
Logged: KT
RL Surface: 5.00m
Contractor: BG Drilling Pty Ltd
Bearing: ---
Checked: MS

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Moisture Condition	Consistency/ Density Index	Additional Observations
ADT		-6	11		CI	SHALE: extremely weathered. Recovered as Gravelly CLAY, medium plasticity, grey and brown. *(continued)*		MC ≥ PL	H	
		-7	12			Borehole BH05 continued as cored hole				
		-8	13							
		-9	14							
		-10	15							
		-11	16							
		-12	17							
		-13	18							
		-14	19							
		-15	20							

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Cored Borehole Log

Client: 2A Gregory Place Pty Ltd
Project: Proposed Mixed Development
Location: 2A Gregory Place, Harris Park NSW
Hole Location: Refer Drawing: 13091-GR-1-A
Started: 19/11/2021
Finished: 19/11/2021
Borehole Size: 110 mm

Rig Type: Hanin D&B 8D
Hole Coordinates E, N
Driller: SZ
Logged: KT
RL Surface: 5.00m
Contractor: BG Drilling Pty Ltd
Bearing: ---
Checked: MS

Method	Water	RL (m)	Depth (m)	Graphic Log	Material Description	Weathering	Estimated Strength (● Axial, ○ Diametral) EL -0.03 VL -0.1 L -0.3 M -1 H -3 VH -10 EH	$Is_{(50)}$ MPa D- diametral A- axial	RQD %	Defect Spacing mm 30 100 300 1000 3000	Additional Data
		-6	11		Continued from non-cored borehole						
NMLC		-7	12		SHALE: dark grey with pale grey laminates.	FR		D A 0.21 0.86	62		11.65 - BP, 0°, UN, RO, CN. 11.74 - BP, 0°, UN, RO, CN. 11.80 - BP, 0°, UN, RO, CN. 11.86 - BP, 0°, UN, RO, CN. 11.98 - BP, 0°, UN, RO, CN. 12.01 - BP, 0°, UN, RO, CN. 12.14 - BP, 0°, PL, RO, CN.
		-8	13					D A 0.22 1.07			12.75 - BP, 5°, PL, RO, CN. 12.96 - BP, 0°, PL, RO, CN. 13.20 - BP, 0°, UN, RO, CN.
		-9	14								13.63 - BP, 0°, UN, RO, CN. 13.75 - SM. 13.80 - BP, 10°, UN, RO, CN. 13.92 - BP, 5°, PL, RO, CN. 14.09 - BP, 0°, UN, RO, CN. 14.15 - BP, 0°, UN, RO, CN. 14.21 - BP, 0°, UN, RO, CN. 14.24 - BP, 0°, UN, RO, CN. 14.27 - BP, 0°, UN, RO, CN. 14.30 - BP, 0°, UN, RO, CN. 14.37 - BP, 0°, UN, RO, CN. 14.45 - BP, 0°, UN, RO, CN. 14.55 - BP, 0°, UN, RO, CN. 14.56 - BP, 0°, UN, RO, CN. 14.57 - BP, 0°, UN, RO, CN.
		-10	15					D A 0.18 0.83	41		14.63 - JT, 0°, UN, RO, CN. 14.69 - BP, 0°, UN, RO, CN. 14.80 - BP, 0°, UN, RO, CN. 14.87 - BP, 0°, UN, RO, CN. 14.93 - BP, 0°, UN, RO, CN. 14.96 - JT, 0°, UN, RO, CN. 15.09 - BP, 0°, UN, RO, CN. 15.55 - JT, 90°, CU, RO, CN. 16.13 - BP, 15°, PL, RO, CN.
		-11	16					D A 0.54 0.66			
		-12	17								16.72 - JT, 5°, PL, RO, CN. 16.81 - BP, 10°, PL, RO, CN. 16.95 - BP, 0°, UN, RO, CN.
		-13	18		INTERBEDDED SANDSTONE/SHALE: sandstone (70%) pale grey and grey, fine grained, shale (30%), dark grey, bedded at 0°-10°, variable spacing.			D A 0.63 1.7	85		17.15 - BP, 0-5°, UN, RO, CN. 17.19 - JT, 80°, PL, RO, CN. 17.24 - BP, 0°, UN, RO, CN. 17.82 - BP, 0-5°, PL, RO, CN. 18.24 - BP, 0-5°, PL, RO, CN.
		-14	19								18.80 - JT, 0-5°, PL, RO, CN.
		-15	20		BH05 terminated at 19m						

alliance	Client Name:	2A Gregory Place Pty Ltd	Figure / Drawing Number:	Corebox Photos
	Project Name:	Proposed Mixed Use Development	Figure / Drawing Date:	25/11/2021
	Project Location:	2A Gregory Place, Harris Park NSW 2150	Report Number:	13091-GR-1-1

alliance	Client Name:	2A Gregory Place Pty Ltd	Figure / Drawing Number:	Corebox Photos
	Project Name:	Proposed Mixed Use Development	Figure / Drawing Date:	25/11/2021
	Project Location:	2A Gregory Place, Harris Park NSW 2150	Report Number:	13091-GR-1-1

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BH No: BH06
Sheet: 1 of 1
Job No: 13091

Borehole Log

Client: 2A Gregory Place Pty Ltd
Project: Proposed Mixed Development
Location: 2A Gregory Place, Harris Park NSW

Started: 24/1/2022
Finished: 24/1/2022
Borehole Size 110 mm

Rig Type: Geoprobe | **Hole Location:** Refer Drawing: 13091-GR-1-A | **Driller:** NW | **Logged:** AC
RL Surface: 5.18m | **Contractor:** Stratacore | **Bearing:** --- | **Checked:** AS

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Moisture Condition	Consistency/ Density Index	Additional Observations
ADT		5.0	0.0		-	CONCRETE: 160mm.		-	-	CONCRETE
					-	FILL: Silty CLAY: low to medium plasticity, brown, with concrete fragments, appears moderately compacted.		MC ~ PL	-	FILL
		4.5	0.5				SPT 1, 1, 2 N=3			
		4.0	1.0							
			1.5		CH	Silty CLAY: medium plasticity, brown.	SPT 0, 0, 0 N=0	MC > PL	VS	ALLUVIUM
	▼ GW Table Encounter 2.0m during Augering	3.5	2.0		CH	CLAY: high plasticity, dark grey.			St	
		3.0	2.5							
		2.5	3.0				SPT 2, 3, 5 N=8			
		2.0	3.5		CH	CLAY: high plasticity, dark grey, with fine grained sand, grey.				
		1.5	4.0							
		1.0	4.5		-	SHALE: extremely weathered, very low strength, recovered as CLAY, low plasticity, dark grey.	SPT 9, 20 HB at 150mm		H	EXTREMELY WEATHERED BEDROCK
		0.5	5.0			Hammer bounce. TC-bit refusal. Borehole BH06 terminated at 4.75m				

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BH No: BH07
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Job No: 13091

Borehole Log

Client: 2A Gregory Place Pty Ltd
Project: Proposed Mixed Development
Location: 2A Gregory Place, Harris Park NSW

Started: 24/1/2022
Finished: 24/1/2022
Borehole Size 110 mm

Rig Type: Geoprobe
Hole Location: Refer Drawing: 13091-GR-1-A
Driller: NW
Logged: AC
RL Surface: 5.18m
Contractor: Stratacore
Bearing: ---
Checked: AS

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Moisture Condition	Consistency/ Density Index	Additional Observations
ADT	Not Encountered	5.0	0.0		-	CONCRETE: 170mm.		-	-	CONCRETE
			0.5		-	FILL: Clayey SAND: fine grained, poorly graded, dark brown and orange, with concrete fragments, appears poorly compacted.		MC ~ PL		FILL
		4.5			SP	Silty SAND: fine grained, poorly graded, dark brown.	SPT 4, 4, 5 N=9		L	ALLUVIUM
		4.0	1.0							
			1.5			TC-bit refusal. Borehole BH07 terminated at 1.5m				
		3.5	2.0							
		3.0	2.5							
		2.5	3.0							
		2.0	3.5							
		1.5	4.0							
		1.0	4.5							
		0.5	5.0							

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BH No: BH08
Sheet: 1 of 2
Job No: 13091

Borehole Log

Client: 2A Gregory Place Pty Ltd
Project: Proposed Mixed Development
Location: 2A Gregory Place, Harris Park NSW

Started: 24/01/2022
Finished: 24/01/2022
Borehole Size 110 mm

Rig Type: Geoprobe | **Hole Location:** Refer Drawing: 13091-GR-1-A | **Driller:** NW | **Logged:** AC
RL Surface: 5.40m | **Contractor:** Stratacore | **Bearing:** --- | **Checked:** AS

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Moisture Condition	Consistency/ Density Index	Additional Observations
ADT		5.40	0.0		-	CONCRETE: 150mm.		-	-	CONCRETE
					-	FILL: Clayey SAND: fine grained, poorly graded, dark brown, with concrete fragments, appears poorly compacted.		M		FILL
		5.0	0.5		-	FILL: Silty SAND: fine grained, poorly graded, orange, appears poorly compacted, with concrete fragments.	SPT 3, 2, 2 N=4			
		4.5	1.0		Cl	Sandy CLAY: medium plasticity, yellow-orange, medium grained sand.		MC > PL	S	ALLUVIUM
		4.0	1.5				SPT 2, 1, 0 N=1			
		3.5	2.0							
		3.0	2.5							
	GW Table Encounter 3.0m during Augering	2.5	3.0		Cl	Sandy CLAY: low to medium plasticity, orange, medium grained sand.	SPT 0, 0, 0 N=0		VS	
		2.0	3.5			At 3.3m, becomes white grey.				
		1.5	4.0							
		1.0	4.5				SPT 0, 0, 4 N=4		F	
		0.5	5.0							

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BH No: BH08
Sheet: 2 of 2
Job No: 13091

Borehole Log

Client: 2A Gregory Place Pty Ltd
Project: Proposed Mixed Development
Location: 2A Gregory Place, Harris Park NSW

Started: 24/01/2022
Finished: 24/01/2022
Borehole Size 110 mm

Rig Type: Geoprobe
Hole Location: Refer Drawing: 13091-GR-1-A
Driller: NW
Logged: AC
RL Surface: 5.40m
Contractor: Stratacore
Bearing: ---
Checked: AS

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Moisture Condition	Consistency/ Density Index	Additional Observations
ADT		0.0	5.5		SC	Clayey SAND: fine grained, poorly graded, white-grey, low plasticity clay.		W MC > PL	F	
		-0.5	6.0			TC- bit refusal, inferred bedrock Borehole BH08 terminated at 5.5m				
		-1.0	6.5							
		-1.5	7.0							
		-2.0	7.5							
		-2.5	8.0							
		-3.0	8.5							
		-3.5	9.0							
		-4.0	9.5							
		-4.5	10.0							

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BH No: BH09
Sheet: 1 of 2
Job No: 13091

Borehole Log

Client: 2A Gregory Place Pty Ltd
Project: Proposed Mixed Development
Location: 2A Gregory Place, Harris Park NSW

Started: 24/01/2022
Finished: 24/01/2022
Borehole Size 110 mm

Rig Type: Geoprobe | **Hole Location:** Refer Drawing: 13091-GR-1-A | **Driller:** NW | **Logged:** AC
RL Surface: 5.40m | **Contractor:** Stratacore | **Bearing:** --- | **Checked:** AS

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Moisture Condition	Consistency/ Density Index	Additional Observations
ADT		5.0	0.0		-	FILL: SAND: fine grained, poorly graded, orange, appears poorly compacted.		MC ~ PL	-	FILL
					CI-CH	CLAY: medium to high plasticity, dark grey, with sub-angular coarse gravel.			S	ALLUVIUM
		4.5	0.5				SPT 2, 1, 1 N=2			
		4.0	1.0							
			1.5		CI-CH	CLAY: high plasticity, grey, with sub-angular coarse gravel.		MC > PL	VS	
		3.5	2.0				SPT 0, 0, 0 N=0			
		3.0	2.5							
	▼ GW Table Encounter 3.0m during Augering	2.5	3.0						F	
							SPT 3, 3, 4 N=7			
		2.0	3.5							
		1.5	4.0							
		1.0	4.5		SP	SAND: fine grained, poorly graded, grey.		W	VL	
		0.5	5.0				SPT 3, 1, 2 N=3			

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W: www.allgeo.com.au

BH No: BH09
Sheet: 2 of 2
Job No: 13091

Borehole Log

Client: 2A Gregory Place Pty Ltd
Project: Proposed Mixed Development
Location: 2A Gregory Place, Harris Park NSW

Started: 24/01/2022
Finished: 24/01/2022
Borehole Size 110 mm

Rig Type: Geoprobe
Hole Location: Refer Drawing: 13091-GR-1-A
Driller: NW
Logged: AC
RL Surface: 5.40m
Contractor: Stratacore
Bearing: ---
Checked: AS

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Moisture Condition	Consistency/ Density Index	Additional Observations
ADT		0.0	5.5		SP	SAND: fine grained, poorly graded, grey. *(continued)*		W	VL	
		-0.5	6.0							
		-1.0	6.5			TC-bit refusal, inferred bedrock Borehole BH09 terminated at 6.2m				
		-1.5	7.0							
		-2.0	7.5							
		-2.5	8.0							
		-3.0	8.5							
		-3.5	9.0							
		-4.0	9.5							
		-4.5	10.0							

APPENDIX D – Groundwater Monitoring & Pump Test Results

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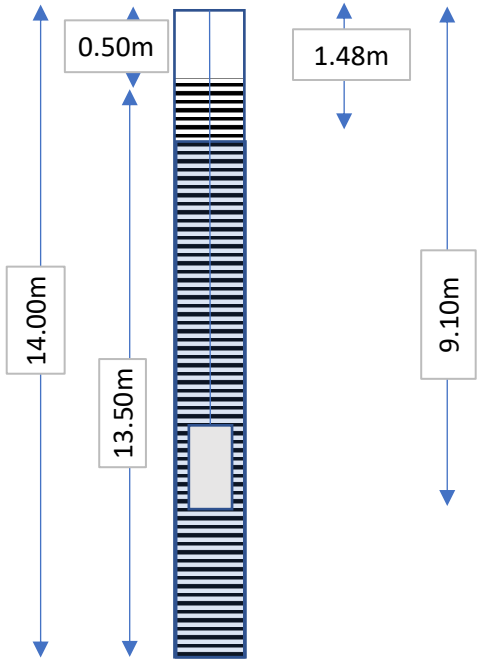
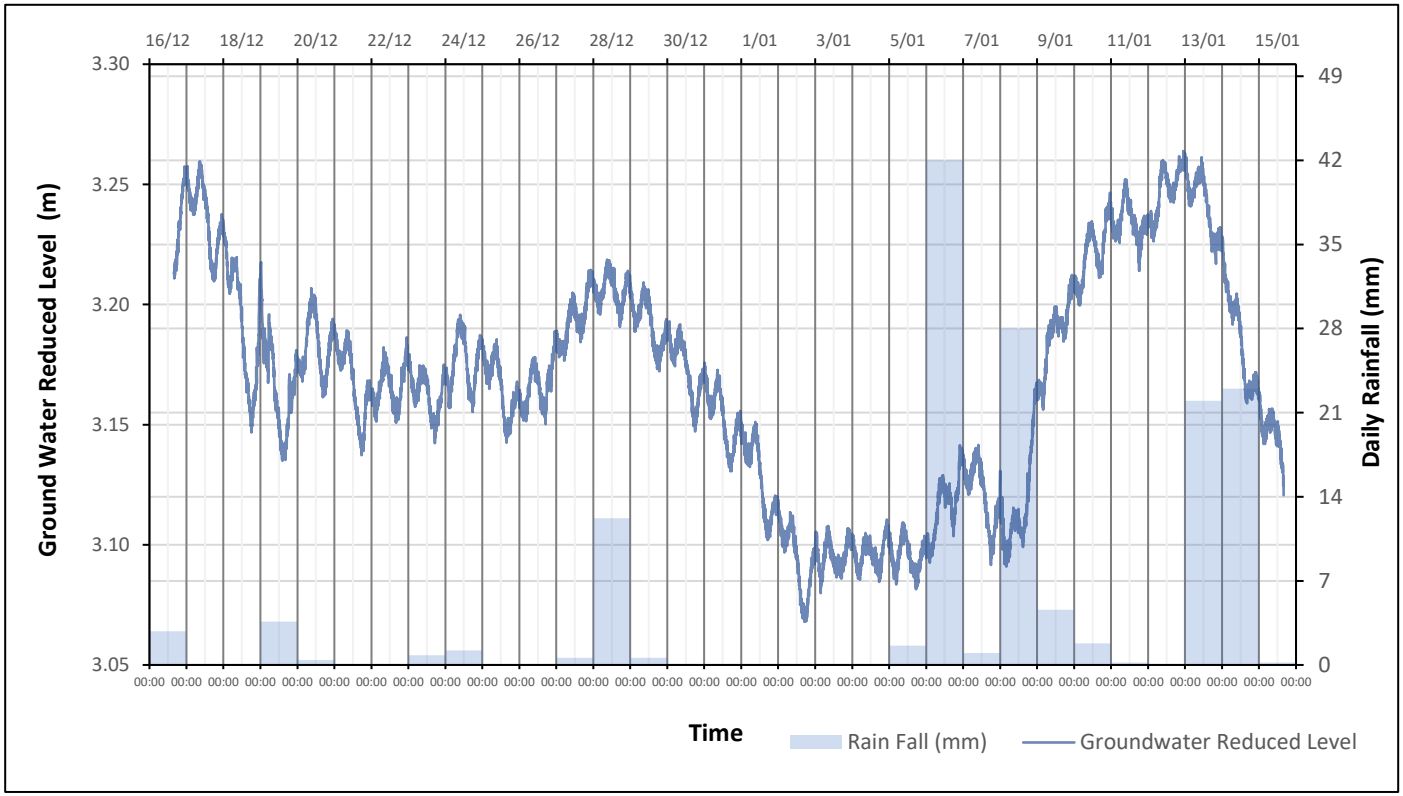
Groundwater Monitoring

Client :	2A Gregory Place Pty Ltd	**Location:**	BH01
Project :	Proposed Mixed Residential and Commercial Development	**Job Number :**	13091
Test Location:	(refer to drawing 13091-GR-1-A)	**Test Date :**	16/12/2021
Test Method :	-	**Tested By :**	AH

Test	BH01				
Borehole Data	**Unit**	**Value**	**Borehole Data**	**Unit**	**Value**
Initial Ground Water Depth (bgs)	m	1.48	**Solid Casing Length(L)**	m	0.5
Casing Radius (r_c)	m	0.025	**Screened Length (L_e)**	m	13.5
Borehole Radius (r_w)	m	0.05	**Existing Ground RL**	m	4.7

Well and Logger Details	
Time	16/12/2021 15:53





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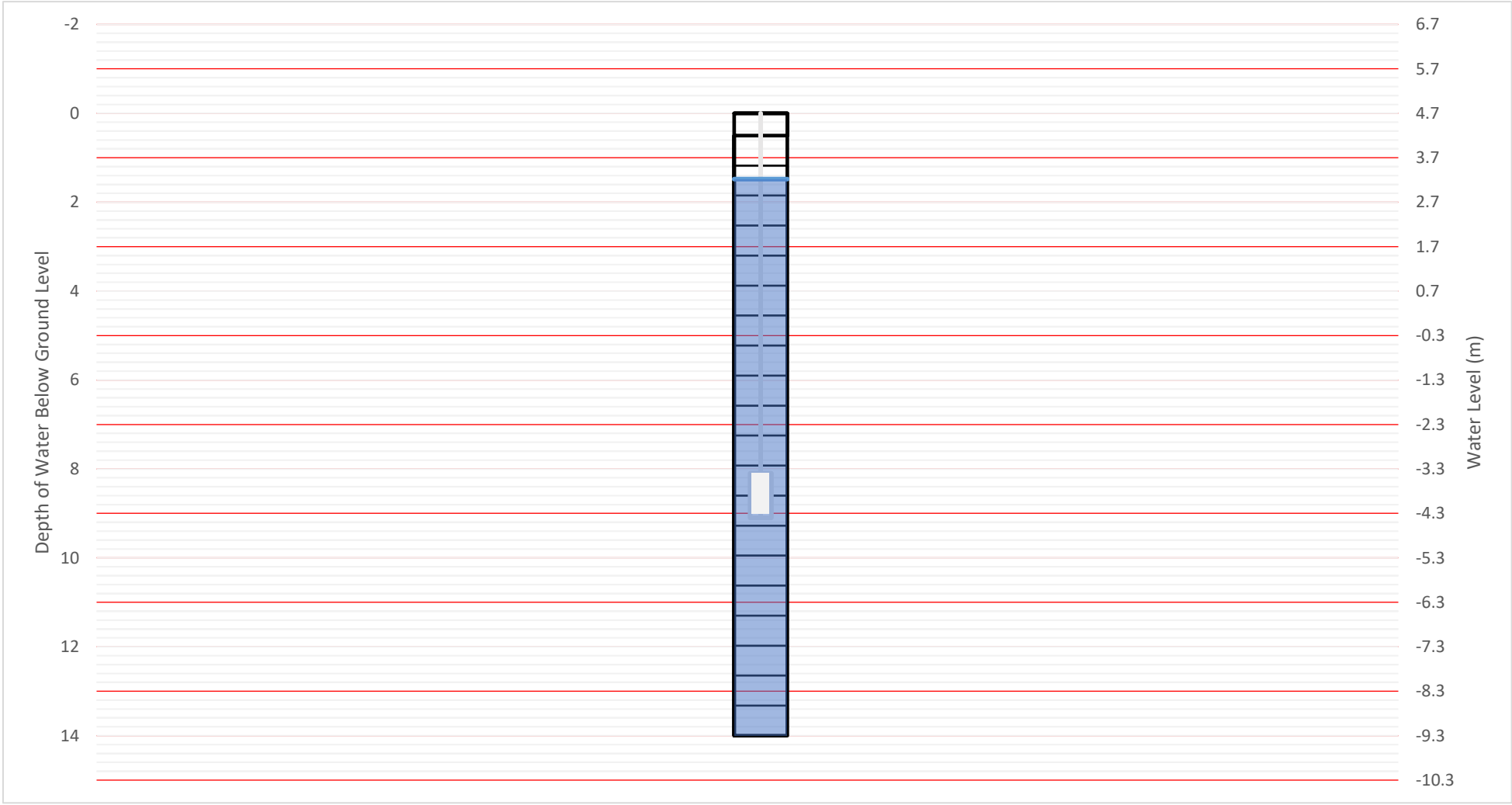
Scaled Well and Logger Details		
Ground RL	m	4.7
Solid Length	m	0.5
Slotted Length	m	13.5
Logger Install Depth	m	9.1
Initial Water Level	m	1.48



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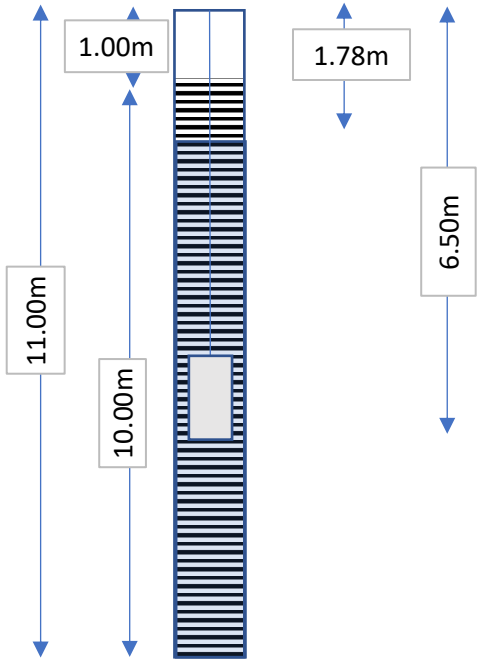
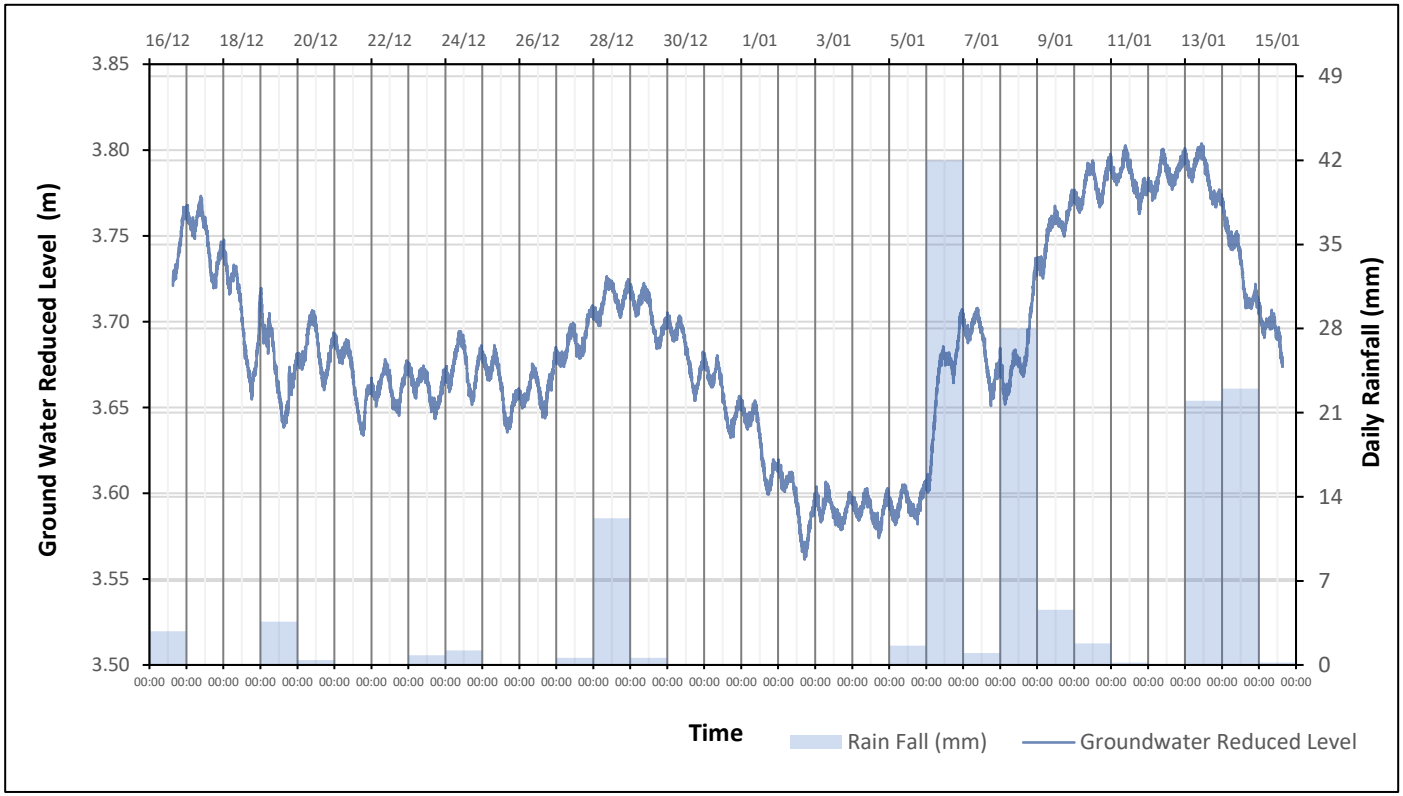
Groundwater Monitoring

Client :	2A Gregory Place Pty Ltd	**Location:**	BH02
Project :	Proposed Mixed Residential and Commercial Development	**Job Number :**	13091
Test Location:	(refer to drawing 13091-GR-1-A)	**Test Date :**	16/12/2021
Test Method :	-	**Tested By :**	AH

Test	BH02				
Borehole Data	**Unit**	**Value**	**Borehole Data**	**Unit**	**Value**
Initial Ground Water Depth (bgs)	m	1.78	**Solid Casing Length(L)**	m	1
Casing Radius (r_c)	m	0.025	**Screened Length (L_e)**	m	10
Borehole Radius (r_w)	m	0.05	**Existing Ground RL**	m	5.5

Well and Logger Details	
Time	16/12/2021 15:15





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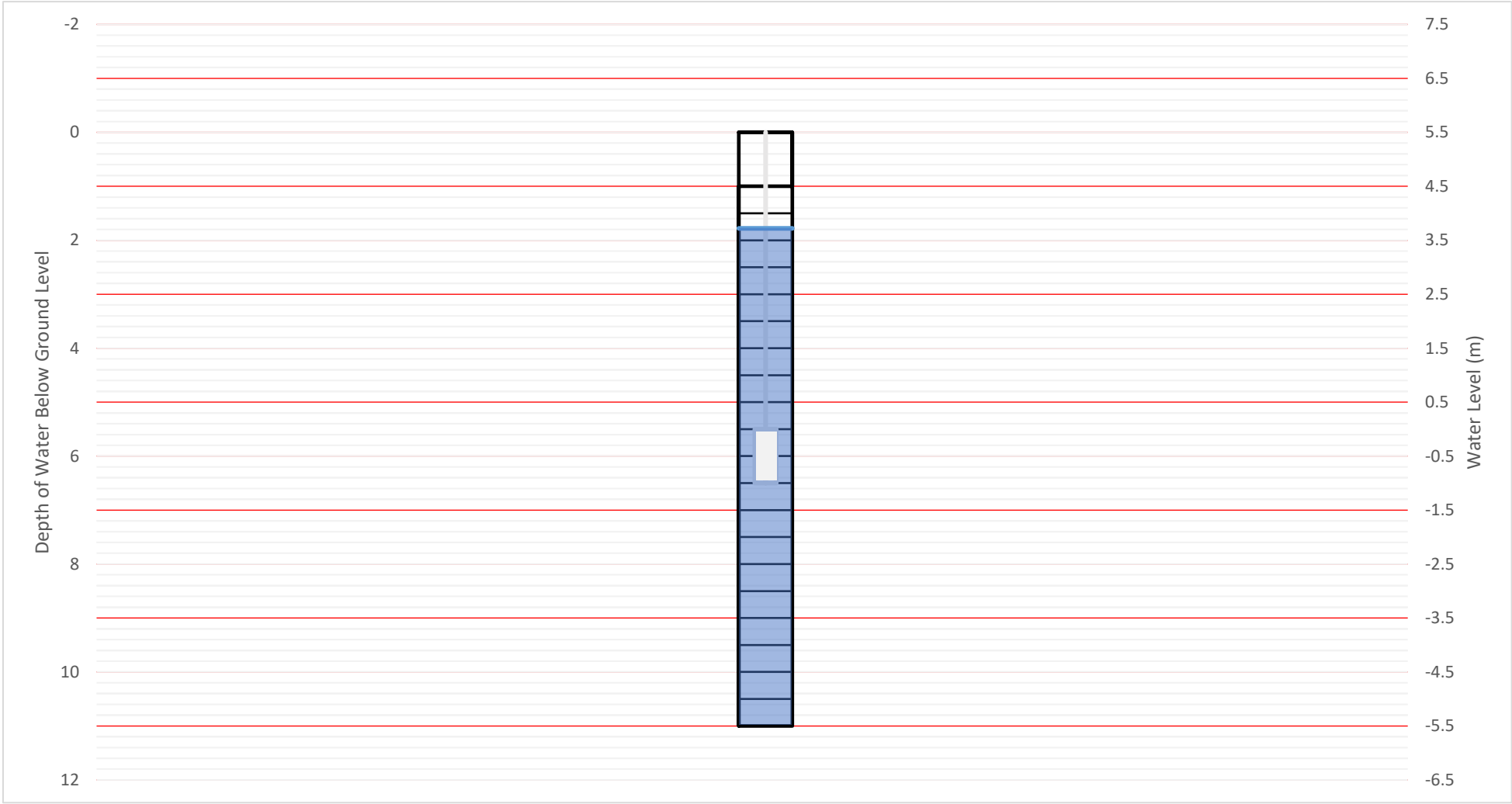
Scaled Well and Logger Details		
Ground RL	m	5.5
Solid Length	m	1
Slotted Length	m	10
Logger Install Depth	m	6.5
Initial Water Level	m	1.78



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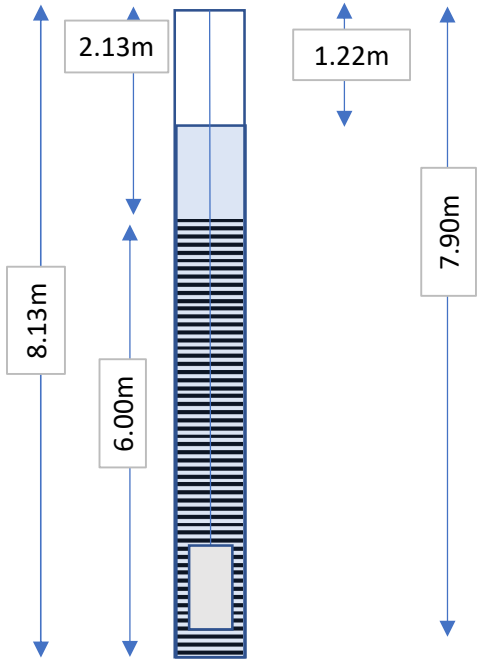
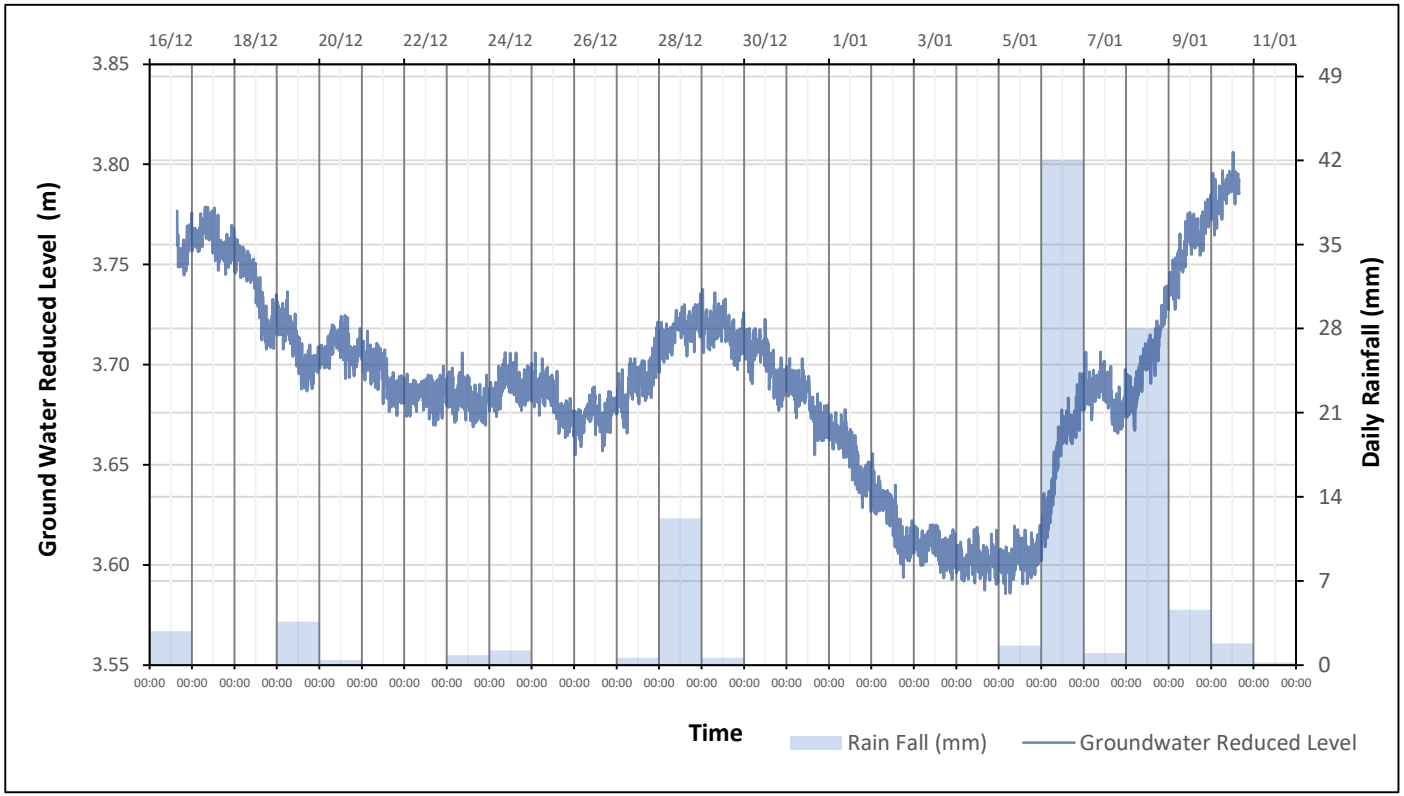
Groundwater Monitoring

Client :	2A Gregory Place Pty Ltd	**Location:**	BH05
Project :	Proposed Mixed Residential and Commercial Development	**Job Number :**	13091
Test Location:	(refer to drawing 13091-GR-1-A)	**Test Date :**	16/12/2021
Test Method :	-	**Tested By :**	AH

Test	BH05				
Borehole Data	**Unit**	**Value**	**Borehole Data**	**Unit**	**Value**
Initial Ground Water Depth (bgs)	m	1.22	**Solid Casing Length(L)**	m	2.13
Casing Radius (r_c)	m	0.025	**Screened Length (L_e)**	m	6
Borehole Radius (r_w)	m	0.05	**Existing Ground RL**	m	5

Well and Logger Details	
Time	16/12/2021 15:32





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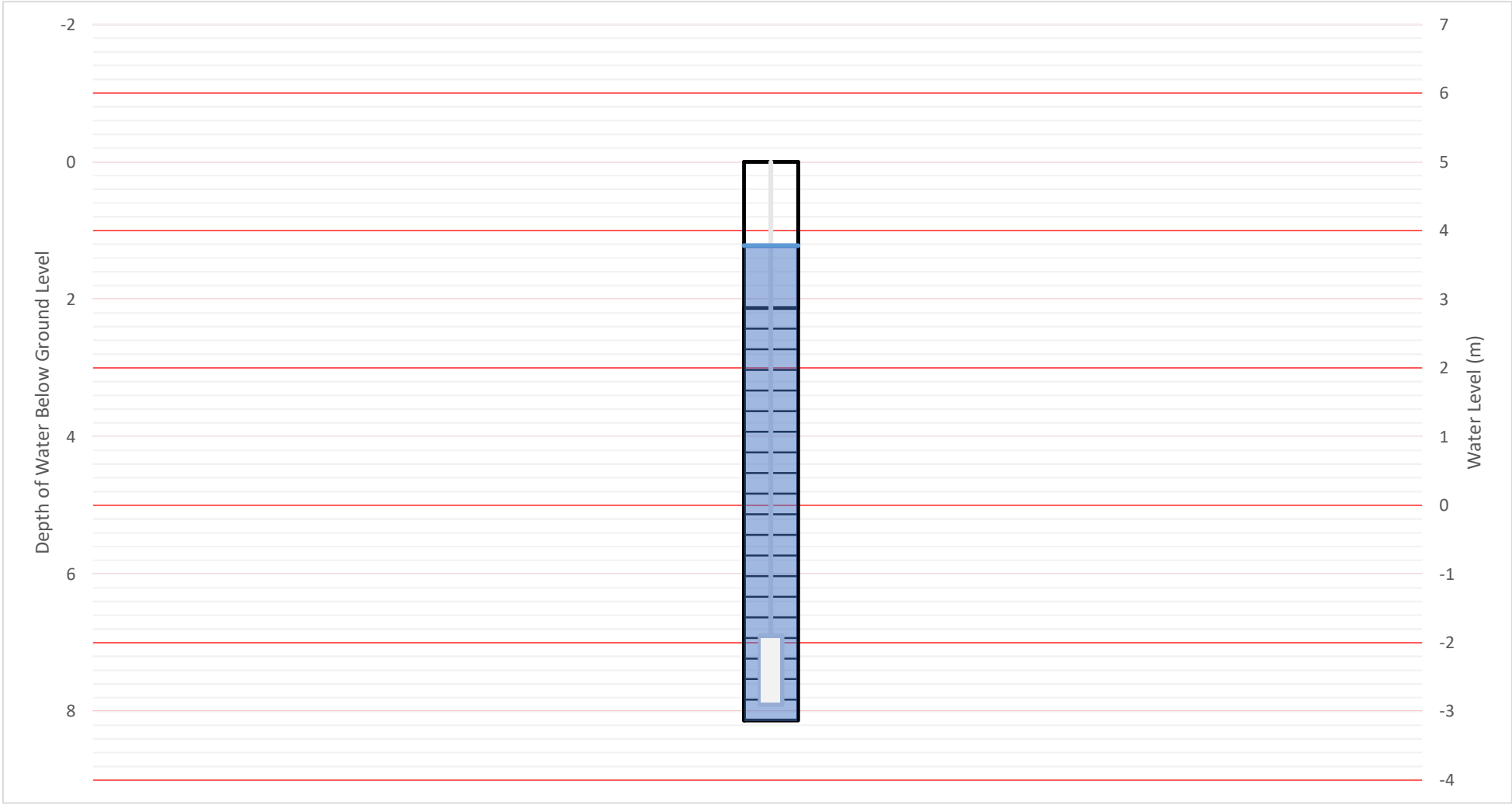
Scaled Well and Logger Details		
Ground RL	m	5
Solid Length	m	2.13
Slotted Length	m	6
Logger Install Depth	m	7.9
Initial Water Level	m	1.22



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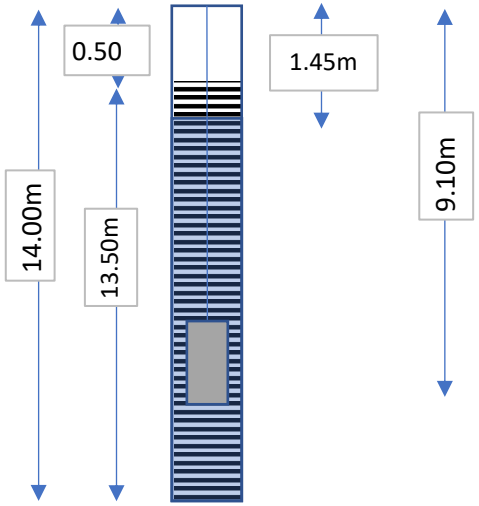
Rising Head Permeability Test Report

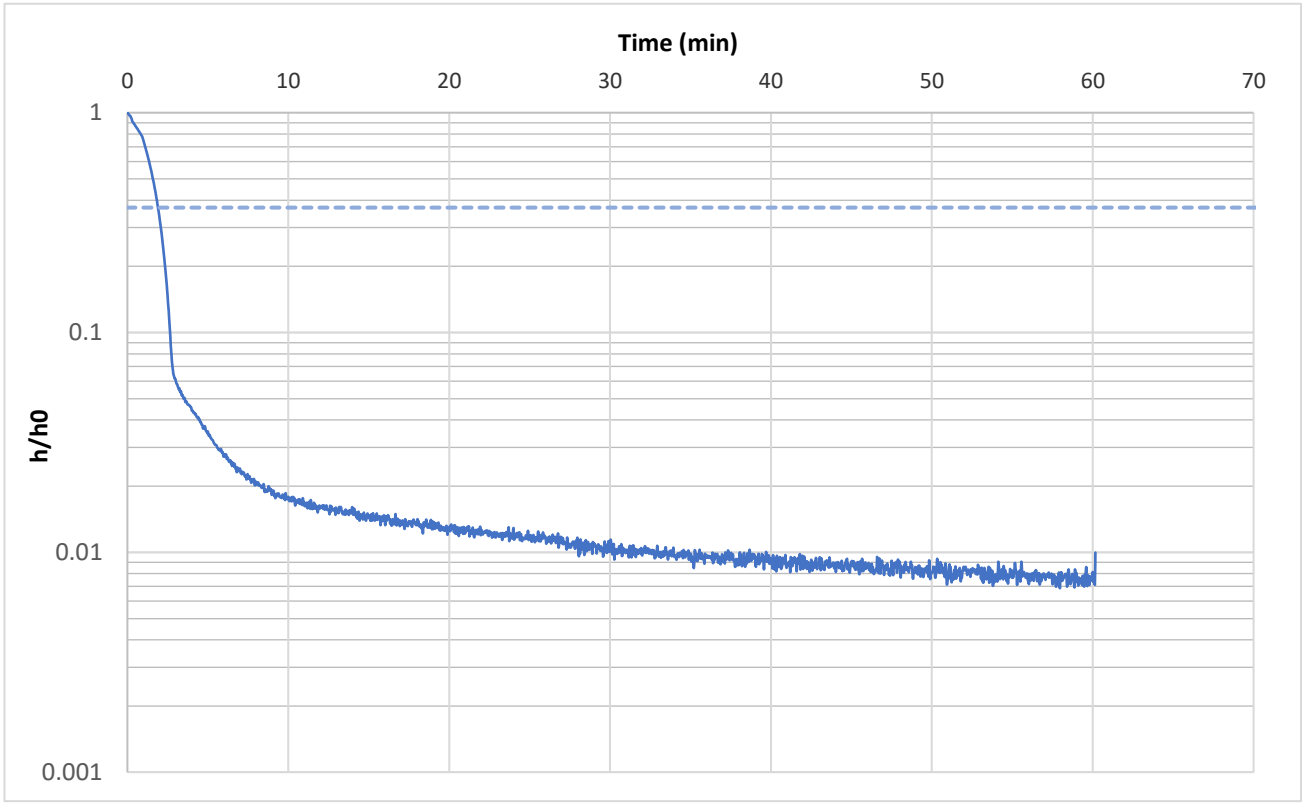
Client :	2A Gregory Place Pty Ltd	**Location:**	BH01
Project :	Proposed Mixed Residential and Commercial Development	**Job Number :**	13091
Test Location:	(refer to drawing 13091-GR-1-A)	**Test Date :**	24/01/2022
Test Method :	Hvorslev's Method (1951)	**Tested By :**	KT

Test	**BH01**				
Borehole Data	**Unit**	**Value**	**Borehole Data**	**Unit**	**Value**
Initial Ground Water Depth (bgs)	m	1.45	**Solid Casing Length (L)**	m	0.5
Groundwater Depth at t=0s	m	6.83	**Screened Length (L_e)**	m	13.5
Casing Radius (r_c)	m	0.025	**Characteristic Time (t_0)**	min	1.900016667
Borehole Radius (r_w)	m	0.05	**Hydraulic Conductivity (k)**	m/day	**0.0982**

$$K = \frac{r_c^2 \cdot \ln\left(\frac{L_e}{r_w}\right)}{2 \cdot L_e \cdot t_0}$$

Logger Details	
Time	1:00pm





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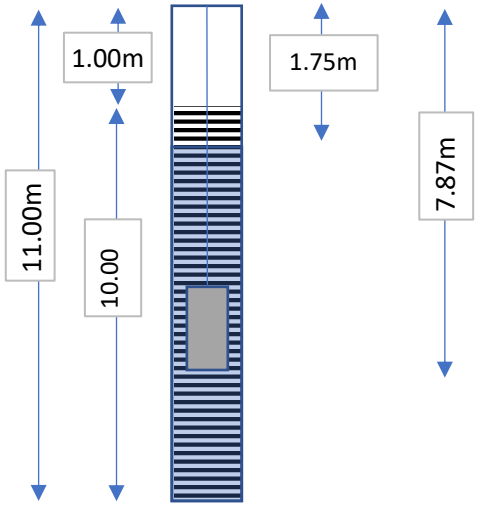
Rising Head Permeability Test Report

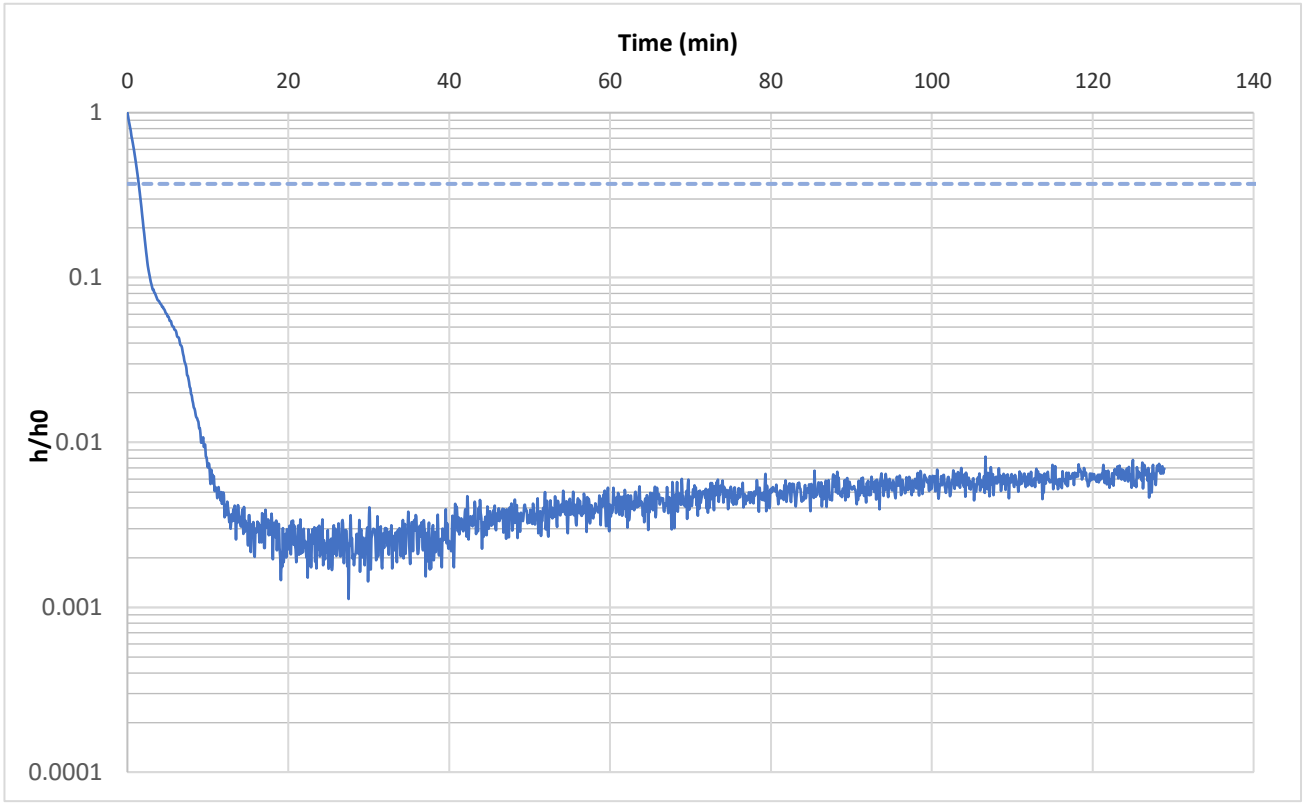
Client :	2A Gregory Place Pty Ltd	**Location:**	BH02
Project :	Proposed Mixed Residential and Commercial Development	**Job Number :**	13091
Test Location:	(refer to drawing 13091-GR-1-A)	**Test Date :**	24/01/2022
Test Method :	Hvorslev's Method (1951)	**Tested By :**	KT

Test	**BH02**				
Borehole Data	**Unit**	**Value**	**Borehole Data**	**Unit**	**Value**
Initial Ground Water Depth (bgs)	m	1.75	**Solid Casing Length (L)**	m	1
Groundwater Depth at t=0s	m	5.67	**Screened Length (L_e)**	m	10
Casing Radius (r_c)	m	0.025	**Characteristic Time (t_0)**	min	1.416683333
Borehole Radius (r_w)	m	0.05	**Hydraulic Conductivity (k)**	m/day	**0.1683**

$$K = \frac{r_c^2 \cdot \ln\left(\frac{L_e}{r_w}\right)}{2 \cdot L_e \cdot t_0}$$

Logger Details	
Time	11:15am





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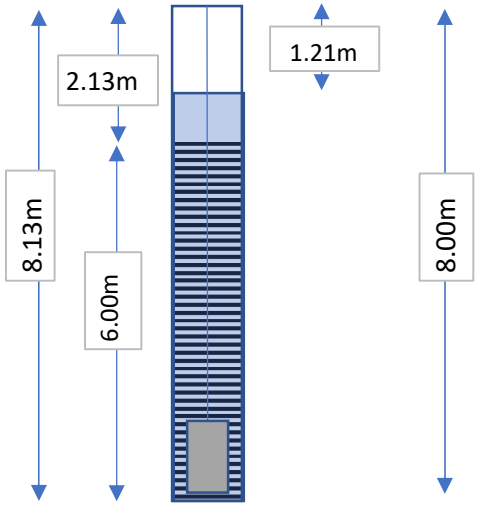
Rising Head Permeability Test Report

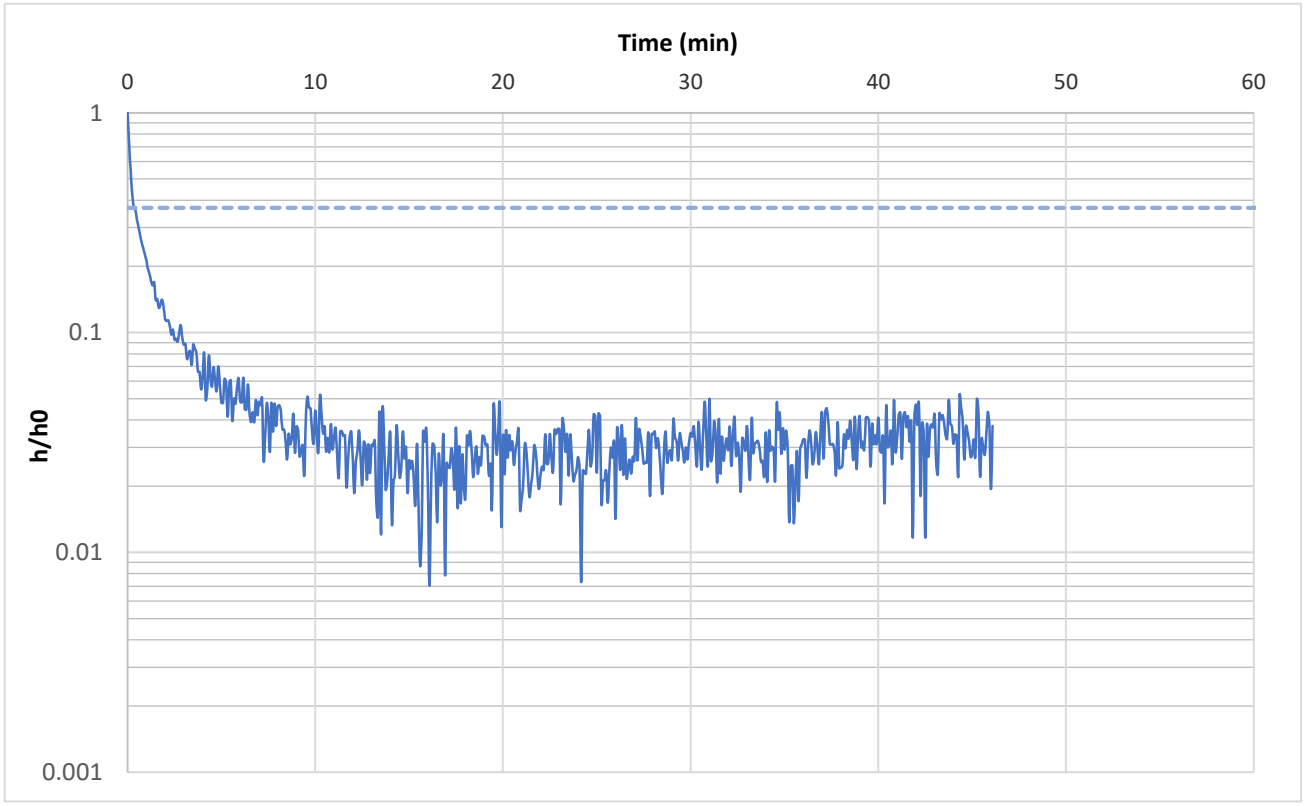
Client :	2A Gregory Place Pty Ltd	**Location:**	BH05
Project :	Proposed Mixed Residential and Commercial Development	**Job Number :**	13091
Test Location:	(refer to drawing 13091-GR-1-A)	**Test Date :**	24/01/2022
Test Method :	Hvorslev's Method (1951)	**Tested By :**	KT

Test	**BH05**				
Borehole Data	**Unit**	**Value**	**Borehole Data**	**Unit**	**Value**
Initial Ground Water Depth (bgs)	m	1.21	**Solid Casing Length (L)**	m	2.13
Groundwater Depth at t=0s	m	1.96	**Screened Length (L_e)**	m	6
Casing Radius (r_c)	m	0.025	**Characteristic Time (t_0)**	min	0.416683333
Borehole Radius (r_w)	m	0.05	**Hydraulic Conductivity (k)**	m/day	**0.8617**

$$K = \frac{r_c^2 \cdot \ln\left(\frac{L_e}{r_w}\right)}{2 \cdot L_e \cdot t_0}$$

Logger Details	
Time	10:16am





APPENDIX E – Laboratory Test Certificates

Alliance Geotechnical
10 Welder Road
Seven Hills
NSW 2147

NATA Accredited
Accreditation Number 1261
Site Number 18217

Accredited for compliance with ISO/IEC 17025 – Testing
NATA is a signatory to the ILAC Mutual Recognition Arrangement for the mutual recognition of the equivalence of testing, medical testing, calibration, inspection, proficiency testing scheme providers and reference materials producers reports and certificates.

Attention: **Matt Swinbourn**

Report **845588-S**
Project name GREGORY PLACE
Project ID 13091
Received Date Nov 24, 2021

Client Sample ID			**BH01 2.0**	**BH02 1.5-2.5**	**BH03 3.5**	**BH04 4.5**
Sample Matrix			**Soil**	**Soil**	**Soil**	**Soil**
Eurofins Sample No.			**S21-No72747**	**S21-No72748**	**S21-No72749**	**S21-No72750**
Date Sampled			**Nov 19, 2021**	**Nov 23, 2021**	**Nov 22, 2021**	**Nov 19, 2021**
Test/Reference	LOR	Unit				
Chloride	10	mg/kg	< 10	17	< 10	10
Conductivity (1:5 aqueous extract at 25°C as rec.)	10	uS/cm	46	42	23	23
pH (1:5 Aqueous extract at 25°C as rec.)	0.1	pH Units	8.0	7.0	7.5	6.7
Resistivity*	0.5	ohm.m	220	240	430	430
Sulphate (as SO4)	10	mg/kg	24	61	15	25
% Moisture	1	%	14	14	13	28

Client Sample ID			**BH05 4.0**	**BH01 0.5**	**BH01 1.0**	**BH01 1.5**
Sample Matrix			**Soil**	**Soil**	**Soil**	**Soil**
Eurofins Sample No.			**S21-No72751**	**S21-No72752**	**S21-No72753**	**S21-No72754**
Date Sampled			**Nov 19, 2021**	**Nov 19, 2021**	**Nov 19, 2021**	**Nov 19, 2021**
Test/Reference	LOR	Unit				
Chloride	10	mg/kg	34	-	< 10	-
Conductivity (1:5 aqueous extract at 25°C as rec.)	10	uS/cm	50	-	16	-
pH (1:5 Aqueous extract at 25°C as rec.)	0.1	pH Units	7.1	-	7.3	-
Resistivity*	0.5	ohm.m	200	-	640	-
Sulphate (as SO4)	10	mg/kg	66	-	< 10	-
% Moisture	1	%	17	-	10	-
Acid Sulfate Soils Field pH Test						
pH-F (Field pH test)*	0.1	pH Units	-	8.2	7.7	7.5
pH-FOX (Field pH Peroxide test)*	0.1	pH Units	-	7.2	5.4	5.7
Reaction Ratings*[S05]	0	-	-	4.0	2.0	2.0

Client Sample ID			BH01 2.0	BH01 2.5	BH01 3.0	BH01 3.5
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins Sample No.			S21-No72755	S21-No72756	S21-No72757	S21-No72758
Date Sampled			Nov 19, 2021	Nov 19, 2021	Nov 19, 2021	Nov 19, 2021
Test/Reference	LOR	Unit				
Acid Sulfate Soils Field pH Test						
pH-F (Field pH test)*	0.1	pH Units	7.8	7.8	7.6	7.7
pH-FOX (Field pH Peroxide test)*	0.1	pH Units	6.6	6.7	6.2	6.9
Reaction Ratings*[S05]	0	-	4.0	4.0	4.0	4.0

Client Sample ID			BH01 4.0	BH02 0.5	BH02 1.0	BH02 1.5
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins Sample No.			S21-No72759	S21-No72760	S21-No72761	S21-No72762
Date Sampled			Nov 19, 2021	Nov 23, 2021	Nov 23, 2021	Nov 23, 2021
Test/Reference	LOR	Unit				
Acid Sulfate Soils Field pH Test						
pH-F (Field pH test)*	0.1	pH Units	7.7	7.7	7.7	7.7
pH-FOX (Field pH Peroxide test)*	0.1	pH Units	6.8	7.2	7.3	7.0
Reaction Ratings*[S05]	0	-	4.0	4.0	4.0	4.0

Client Sample ID			BH02 2.0	BH02 2.5	BH02 3.0	BH02 3.5
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins Sample No.			S21-No72763	S21-No72764	S21-No72765	S21-No72766
Date Sampled			Nov 23, 2021	Nov 23, 2021	Nov 23, 2021	Nov 23, 2021
Test/Reference	LOR	Unit				
Acid Sulfate Soils Field pH Test						
pH-F (Field pH test)*	0.1	pH Units	7.4	7.0	7.0	8.1
pH-FOX (Field pH Peroxide test)*	0.1	pH Units	6.3	6.2	5.9	6.2
Reaction Ratings*[S05]	0	-	2.0	2.0	2.0	2.0

Client Sample ID			BH02 4.0	BH02 4.5	BH02 5.0	BH02 5.5
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins Sample No.			S21-No72767	S21-No72768	S21-No72769	S21-No72770
Date Sampled			Nov 23, 2021	Nov 23, 2021	Nov 23, 2021	Nov 23, 2021
Test/Reference	LOR	Unit				
Acid Sulfate Soils Field pH Test						
pH-F (Field pH test)*	0.1	pH Units	8.1	8.2	7.9	8.0
pH-FOX (Field pH Peroxide test)*	0.1	pH Units	6.2	6.4	7.1	5.0
Reaction Ratings*[S05]	0	-	2.0	2.0	2.0	2.0

Client Sample ID			BH02 6.0	BH02 6.5	BH04 0.5	BH04 1.0
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins Sample No.			S21-No72771	S21-No72772	S21-No72773	S21-No72774
Date Sampled			Nov 23, 2021	Nov 23, 2021	Nov 19, 2021	Nov 19, 2021
Test/Reference	LOR	Unit				
Acid Sulfate Soils Field pH Test						
pH-F (Field pH test)*	0.1	pH Units	8.4	8.4	10	8.5
pH-FOX (Field pH Peroxide test)*	0.1	pH Units	8.0	8.1	8.4	6.0
Reaction Ratings*[S05]	0	-	4.0	4.0	4.0	4.0

Client Sample ID			BH04 1.5	BH04 2.0	BH04 3.0	BH04 4.5
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins Sample No.			S21-No72775	S21-No72776	S21-No72777	S21-No72778
Date Sampled			Nov 19, 2021	Nov 19, 2021	Nov 19, 2021	Nov 19, 2021
Test/Reference	LOR	Unit				
Acid Sulfate Soils Field pH Test						
pH-F (Field pH test)*	0.1	pH Units	7.9	8.5	7.8	7.1
pH-FOX (Field pH Peroxide test)*	0.1	pH Units	5.7	6.7	5.1	2.9
Reaction Ratings*[S05]	0	-	2.0	4.0	4.0	2.0

Client Sample ID			BH04 5.5	BH04 6.5	BH04 7.5	BH04 8.0
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins Sample No.			S21-No72779	S21-No72780	S21-No72781	S21-No72782
Date Sampled			Nov 19, 2021	Nov 19, 2021	Nov 19, 2021	Nov 19, 2021
Test/Reference	LOR	Unit				
Acid Sulfate Soils Field pH Test						
pH-F (Field pH test)*	0.1	pH Units	7.1	7.7	7.4	8.4
pH-FOX (Field pH Peroxide test)*	0.1	pH Units	3.3	7.4	7.6	7.9
Reaction Ratings*[S05]	0	-	2.0	4.0	4.0	4.0

Client Sample ID			BH05 0.5	BH05 1.0	BH05 1.5	BH05 2.0
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins Sample No.			S21-No72783	S21-No72784	S21-No72785	S21-No72786
Date Sampled			Nov 19, 2021	Nov 19, 2021	Nov 19, 2021	Nov 19, 2021
Test/Reference	LOR	Unit				
Acid Sulfate Soils Field pH Test						
pH-F (Field pH test)*	0.1	pH Units	8.9	8.0	7.6	7.5
pH-FOX (Field pH Peroxide test)*	0.1	pH Units	8.9	6.5	4.8	6.8
Reaction Ratings*[S05]	0	-	4.0	4.0	2.0	4.0

Client Sample ID			BH05 2.5	BH05 3.0	BH05 3.5	BH05 4.0
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins Sample No.			S21-No72787	S21-No72788	S21-No72789	S21-No72790
Date Sampled			Nov 19, 2021	Nov 19, 2021	Nov 19, 2021	Nov 19, 2021
Test/Reference	LOR	Unit				
Acid Sulfate Soils Field pH Test						
pH-F (Field pH test)*	0.1	pH Units	7.3	7.5	7.2	7.1
pH-FOX (Field pH Peroxide test)*	0.1	pH Units	6.8	7.6	5.1	4.9
Reaction Ratings*[S05]	0	-	4.0	4.0	2.0	2.0

Client Sample ID			BH05 4.5	BH05 5.0	BH05 5.5
Sample Matrix			Soil	Soil	Soil
Eurofins Sample No.			S21-No72791	S21-No72792	S21-No72793
Date Sampled			Nov 19, 2021	Nov 19, 2021	Nov 19, 2021
Test/Reference	LOR	Unit			
Acid Sulfate Soils Field pH Test					
pH-F (Field pH test)*	0.1	pH Units	6.9	6.8	7.0
pH-FOX (Field pH Peroxide test)*	0.1	pH Units	3.7	5.0	4.1
Reaction Ratings*[S05]	0	-	2.0	2.0	2.0

Sample History

Where samples are submitted/analysed over several days, the last date of extraction is reported.

If the date and time of sampling are not provided, the Laboratory will not be responsible for compromised results should testing be performed outside the recommended holding time.

Description	Testing Site	Extracted	Holding Time
Chloride	Sydney	Dec 01, 2021	28 Days
- Method: In-house method LTM-INO-4270 Anions by Ion Chromatography			
Conductivity (1:5 aqueous extract at 25°C as rec.)	Sydney	Dec 01, 2021	7 Days
- Method: LTM-INO-4030 Conductivity			
pH (1:5 Aqueous extract at 25°C as rec.)	Sydney	Dec 01, 2021	7 Days
- Method: LTM-GEN-7090 pH by ISE			
Sulphate (as SO4)	Sydney	Dec 01, 2021	28 Days
- Method: In-house method LTM-INO-4270 Sulphate by Ion Chromatograph			
% Moisture	Sydney	Nov 30, 2021	14 Days
- Method: LTM-GEN-7080 Moisture			
Acid Sulfate Soils Field pH Test	Sydney	Dec 02, 2021	7 Days
- Method: LTM-GEN-7060 Determination of field pH (pHF) and field pH peroxide (pHFOX) tests			

eurofins | Environment Testing

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IANZ # 1290

Company Name: Alliance Geotechnical
Address: 10 Welder Road
Seven Hills
NSW 2147

Project Name: GREGORY PLACE
Project ID: 13091

Order No.:
Report #: 845588
Phone: 1800 288 188
Fax: 02 9675 1888

Received: Nov 24, 2021 6:11 PM
Due: Dec 1, 2021
Priority: 5 Day
Contact Name: Matt Swinbourn

Eurofins Analytical Services Manager : Andrew Black

Sample Detail						Acid Sulfate Soils Field pH Test	Aggressivity Soil Set	Moisture Set
Melbourne Laboratory - NATA # 1261 Site # 1254								
Sydney Laboratory - NATA # 1261 Site # 18217						X	X	X
Brisbane Laboratory - NATA # 1261 Site # 20794								
Mayfield Laboratory - NATA # 1261 Site # 25079								
Perth Laboratory - NATA # 2377 Site # 2370								
External Laboratory								
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**			
1	BH01 2.0	Nov 19, 2021		Soil	S21-No72747		X	X
2	BH02 1.5-2.5	Nov 23, 2021		Soil	S21-No72748		X	X
3	BH03 3.5	Nov 22, 2021		Soil	S21-No72749		X	X
4	BH04 4.5	Nov 19, 2021		Soil	S21-No72750		X	X
5	BH05 4.0	Nov 19, 2021		Soil	S21-No72751		X	X
6	BH01 0.5	Nov 19, 2021		Soil	S21-No72752	X		
7	BH01 1.0	Nov 19, 2021		Soil	S21-No72753	X	X	X
8	BH01 1.5	Nov 19, 2021		Soil	S21-No72754	X		
9	BH01 2.0	Nov 19, 2021		Soil	S21-No72755	X		

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NATA # 1261 Site # 18217

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Mayfield Laboratory - NATA # 1261 Site # 25079								
Perth Laboratory - NATA # 2377 Site # 2370								
External Laboratory								
10	BH01 2.5	Nov 19, 2021		Soil	S21-No72756	X		
11	BH01 3.0	Nov 19, 2021		Soil	S21-No72757	X		
12	BH01 3.5	Nov 19, 2021		Soil	S21-No72758	X		
13	BH01 4.0	Nov 19, 2021		Soil	S21-No72759	X		
14	BH02 0.5	Nov 23, 2021		Soil	S21-No72760	X		
15	BH02 1.0	Nov 23, 2021		Soil	S21-No72761	X		
16	BH02 1.5	Nov 23, 2021		Soil	S21-No72762	X		
17	BH02 2.0	Nov 23, 2021		Soil	S21-No72763	X		
18	BH02 2.5	Nov 23, 2021		Soil	S21-No72764	X		
19	BH02 3.0	Nov 23, 2021		Soil	S21-No72765	X		
20	BH02 3.5	Nov 23, 2021		Soil	S21-No72766	X		

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Mayfield Laboratory - NATA # 1261 Site # 25079								
Perth Laboratory - NATA # 2377 Site # 2370								
External Laboratory								
21	BH02 4.0	Nov 23, 2021		Soil	S21-No72767	X		
22	BH02 4.5	Nov 23, 2021		Soil	S21-No72768	X		
23	BH02 5.0	Nov 23, 2021		Soil	S21-No72769	X		
24	BH02 5.5	Nov 23, 2021		Soil	S21-No72770	X		
25	BH02 6.0	Nov 23, 2021		Soil	S21-No72771	X		
26	BH02 6.5	Nov 23, 2021		Soil	S21-No72772	X		
27	BH04 0.5	Nov 19, 2021		Soil	S21-No72773	X		
28	BH04 1.0	Nov 19, 2021		Soil	S21-No72774	X		
29	BH04 1.5	Nov 19, 2021		Soil	S21-No72775	X		
30	BH04 2.0	Nov 19, 2021		Soil	S21-No72776	X		
31	BH04 3.0	Nov 19, 2021		Soil	S21-No72777	X		

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Brisbane Laboratory - NATA # 1261 Site # 20794								
Mayfield Laboratory - NATA # 1261 Site # 25079								
Perth Laboratory - NATA # 2377 Site # 2370								
External Laboratory								
32	BH04 4.5	Nov 19, 2021		Soil	S21-No72778	X		
33	BH04 5.5	Nov 19, 2021		Soil	S21-No72779	X		
34	BH04 6.5	Nov 19, 2021		Soil	S21-No72780	X		
35	BH04 7.5	Nov 19, 2021		Soil	S21-No72781	X		
36	BH04 8.0	Nov 19, 2021		Soil	S21-No72782	X		
37	BH05 0.5	Nov 19, 2021		Soil	S21-No72783	X		
38	BH05 1.0	Nov 19, 2021		Soil	S21-No72784	X		
39	BH05 1.5	Nov 19, 2021		Soil	S21-No72785	X		
40	BH05 2.0	Nov 19, 2021		Soil	S21-No72786	X		
41	BH05 2.5	Nov 19, 2021		Soil	S21-No72787	X		
42	BH05 3.0	Nov 19, 2021		Soil	S21-No72788	X		

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Mayfield Laboratory - NATA # 1261 Site # 25079								
Perth Laboratory - NATA # 2377 Site # 2370								
External Laboratory								
43	BH05 3.5	Nov 19, 2021		Soil	S21-No72789	X		
44	BH05 4.0	Nov 19, 2021		Soil	S21-No72790	X		
45	BH05 4.5	Nov 19, 2021		Soil	S21-No72791	X		
46	BH05 5.0	Nov 19, 2021		Soil	S21-No72792	X		
47	BH05 5.5	Nov 19, 2021		Soil	S21-No72793	X		
Test Counts						42	6	6

Internal Quality Control Review and Glossary

General

1. Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples follows guidelines delineated in the National Environment Protection (Assessment of Site Contamination) Measure 1999, as amended May 2013 and are included in this QC report where applicable. Additional QC data may be available on request.
2. All soil/sediment/solid results are reported on a dry basis, unless otherwise stated.
3. All biota/food results are reported on a wet weight basis on the edible portion, unless otherwise stated.
4. Actual LORs are matrix dependant. Quoted LORs may be raised where sample extracts are diluted due to interferences.
5. Results are uncorrected for matrix spikes or surrogate recoveries except for PFAS compounds.
6. SVOC analysis on waters are performed on homogenised, unfiltered samples, unless noted otherwise.
7. Samples were analysed on an 'as received' basis.
8. Information identified on this report with blue colour, indicates data provided by customer, that may have an impact on the results.
9. This report replaces any interim results previously issued.

Holding Times

Please refer to 'Sample Preservation and Container Guide' for holding times (QS3001).

For samples received on the last day of holding time, notification of testing requirements should have been received at least 6 hours prior to sample receipt deadlines as stated on the SRA.

If the Laboratory did not receive the information in the required timeframe, and regardless of any other integrity issues, suitably qualified results may still be reported.

Holding times apply from the date of sampling, therefore compliance to these may be outside the laboratory's control.

For VOCs containing vinyl chloride, styrene and 2-chloroethyl vinyl ether the holding time is 7 days however for all other VOCs such as BTEX or C6-10 TRH then the holding time is 14 days.

Units

mg/kg: milligrams per kilogram
mg/L: milligrams per litre
ug/L: micrograms per litre
ppm: Parts per million
ppb: Parts per billion
%: Percentage
org/100mL: Organisms per 100 millilitres
NTU: Nephelometric Turbidity Units
MPN/100mL: Most Probable Number of organisms per 100 millilitres

Terms

Dry	Where a moisture has been determined on a solid sample the result is expressed on a dry basis.
LOR	Limit of Reporting.
SPIKE	Addition of the analyte to the sample and reported as percentage recovery.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
LCS	Laboratory Control Sample - reported as percent recovery.
CRM	Certified Reference Material - reported as percent recovery.
Method Blank	In the case of solid samples these are performed on laboratory certified clean sands and in the case of water samples these are performed on de-ionised water.
Surr - Surrogate	The addition of a like compound to the analyte target and reported as percentage recovery.
Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
USEPA	United States Environmental Protection Agency
APHA	American Public Health Association
TCLP	Toxicity Characteristic Leaching Procedure
COC	Chain of Custody
SRA	Sample Receipt Advice
QSM	US Department of Defense Quality Systems Manual Version
CP	Client Parent - QC was performed on samples pertaining to this report
NCP	Non-Client Parent - QC performed on samples not pertaining to this report, QC is representative of the sequence or batch that client samples were analysed within.
TEQ	Toxic Equivalency Quotient
WA DWER	Sum of PFBA, PFPeA, PFHxA, PFHpA, PFOA, PFBS, PFHxS, PFOS, 6:2 FTSA, 8:2 FTSA

QC - Acceptance Criteria

The acceptance criteria should be used as a guide only and may be different when site specific Sampling Analysis and Quality Plan (SAQP) have been implemented

RPD Duplicates: Global RPD Duplicates Acceptance Criteria is 30% however the following acceptance guidelines are equally applicable:

Results <10 times the LOR : No Limit

Results between 10-20 times the LOR : RPD must lie between 0-50%

Results >20 times the LOR : RPD must lie between 0-30%

NOTE: pH duplicates are reported as a range not as RPD

Surrogate Recoveries: Recoveries must lie between 20-130% Phenols & 50-150% PFASs..

PFAS field samples that contain surrogate recoveries in excess of the QC limit designated in QSM where no positive PFAS results have been reported have been reviewed and no data was affected.

.

QC Data General Comments

1. Where a result is reported as a less than (<), higher than the nominated LOR, this is due to either matrix interference, extract dilution required due to interferences or contaminant levels within the sample, high moisture content or insufficient sample provided.
2. Duplicate data shown within this report that states the word "BATCH" is a Batch Duplicate from outside of your sample batch, but within the laboratory sample batch at a 1:10 ratio. The Parent and Duplicate data shown is not data from your samples.
3. pH and Free Chlorine analysed in the laboratory - Analysis on this test must begin within 30 minutes of sampling. Therefore, laboratory analysis is unlikely to be completed within holding time.Analysis will begin as soon as possible after sample receipt.
4. Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of recovery the term "INT" appears against that analyte.
5. For Matrix Spikes and LCS results a dash "-" in the report means that the specific analyte was not added to the QC sample.
6. Duplicate RPDs are calculated from raw analytical data thus it is possible to have two sets of data.

Quality Control Results

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Method Blank							
Chloride	mg/kg	< 10			10	Pass	
Conductivity (1:5 aqueous extract at 25°C as rec.)	uS/cm	< 10			10	Pass	
LCS - % Recovery							
Chloride	%	95			70-130	Pass	
Conductivity (1:5 aqueous extract at 25°C as rec.)	%	96			70-130	Pass	
Resistivity*	%	95			70-130	Pass	
Sulphate (as SO4)	%	94			70-130	Pass	

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Duplicate									
				Result 1	Result 2	RPD			
Chloride	S21-No72747	CP	mg/kg	< 10	< 10	<1	30%	Pass	
Conductivity (1:5 aqueous extract at 25°C as rec.)	S21-De07095	NCP	uS/cm	160	210	25	30%	Pass	
pH (1:5 Aqueous extract at 25°C as rec.)	S21-De07095	NCP	pH Units	6.6	6.3	<1	30%	Pass	
Resistivity*	S21-De07095	NCP	ohm.m	63	48	25	30%	Pass	
Sulphate (as SO4)	S21-No72747	CP	mg/kg	24	24	<1	30%	Pass	
Duplicate									
				Result 1	Result 2	RPD			
% Moisture	S21-No72748	CP	%	14	15	8.0	30%	Pass	

Comments

Sample Integrity

Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	Yes
Sample correctly preserved	Yes
Appropriate sample containers have been used	Yes
Sample containers for volatile analysis received with minimal headspace	Yes
Samples received within HoldingTime	Yes
Some samples have been subcontracted	No

Qualifier Codes/Comments

Code	Description
S05	Field Screen uses the following fizz rating to classify the rate the samples reacted to the peroxide: 1.0; No reaction to slight. 2.0; Moderate reaction. 3.0; Strong reaction with persistent froth. 4.0; Extreme reaction.

Authorised by:

Andrew Black	Analytical Services Manager
Charl Du Preez	Senior Analyst-Inorganic (NSW)

Glenn Jackson
General Manager

Final Report – this report replaces any previously issued Report

- Indicates Not Requested

* Indicates NATA accreditation does not cover the performance of this service

Measurement uncertainty of test data is available on request or please click here.

Alliance Geotechnical
10 Welder Road
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NATA Accredited
Accreditation Number 1261
Site Number 20794

Accredited for compliance with ISO/IEC 17025 – Testing
NATA is a signatory to the ILAC Mutual Recognition Arrangement for the mutual recognition of the equivalence of testing, medical testing, calibration, inspection, proficiency testing scheme providers and reference materials producers reports and certificates.

Attention: **Matt Swinbourn**

Report **855644-S**
Project name ADDITIONAL: GREGORY PLACE
Project ID 13091
Received Date Jan 13, 2022

Client Sample ID			**BH01 1.0**	**BH02 5.5**	**BH04 4.5**	**BH04 5.5**
Sample Matrix			**Soil**	**Soil**	**Soil**	**Soil**
Eurofins Sample No.			**S22-Ja12223**	**S22-Ja12224**	**S22-Ja12225**	**S22-Ja12226**
Date Sampled			**Nov 19, 2021**	**Nov 19, 2021**	**Nov 19, 2021**	**Nov 19, 2021**
Test/Reference	LOR	Unit				
Actual Acidity (NLM-3.2)						
pH-KCL (NLM-3.1)	0.1	pH Units	6.3	7.3	5.3	5.9
Titratable Actual Acidity (NLM-3.2)	2	mol H+/t	3.0	< 2	19	3.0
Titratable Actual Acidity (NLM-3.2)	0.003	% pyrite S	0.010	< 0.003	0.030	< 0.003
Potential Acidity - Chromium Reducible Sulfur						
Chromium Reducible Sulfur (s-SCr) (NLM-2.1)[S04]	0.005	% S	< 0.005	< 0.005	< 0.005	< 0.005
Chromium Reducible Sulfur (a-SCr) (NLM-2.1)	3	mol H+/t	< 3	< 3	< 3	< 3
Extractable Sulfur						
Sulfur - KCl Extractable	0.005	% S	N/A	N/A	N/A	N/A
HCl Extractable Sulfur	0.005	% S	N/A	N/A	N/A	N/A
Retained Acidity (S-NAS)						
Net Acid soluble sulfur (SNAS) NLM-4.1	0.02	% S	N/A	N/A	N/A	N/A
Net Acid soluble sulfur (s-SNAS) NLM-4.1[S02]	0.02	% S	N/A	N/A	N/A	N/A
Net Acid soluble sulfur (a-SNAS) NLM-4.1	10	mol H+/t	N/A	N/A	N/A	N/A
HCl Extractable Sulfur Correction Factor	1	factor	2.0	2.0	2.0	2.0
Acid Neutralising Capacity (ANCbt)						
Acid Neutralising Capacity - (ANCbt) (NLM-5.2)	0.01	% CaCO3	N/A	0.25	N/A	N/A
Acid Neutralising Capacity - (s-ANCbt) (NLM-5.2)[S03]	0.02	% S	N/A	0.08	N/A	N/A
Acid Neutralising Capacity - (a-ANCbt) (NLM-5.2)	2	mol H+/t	N/A	49	N/A	N/A
ANC Fineness Factor		factor	1.5	1.5	1.5	1.5
Net Acidity (Including ANC)						
CRS Suite - Net Acidity - NASSG (Including ANC)	0.02	% S	< 0.02	< 0.02	0.03	< 0.02
CRS Suite - Net Acidity - NASSG (Including ANC)	10	mol H+/t	< 10	< 10	19	< 10
CRS Suite - Liming Rate - NASSG (Including ANC)[S01]	1	kg CaCO3/t	< 1	< 1	1.4	< 1
Extraneous Material						
<2mm Fraction	0.005	g	55	52	40	55
>2mm Fraction	0.005	g	< 0.005	0.61	< 0.005	< 0.005
Analysed Material	0.1	%	100	99	100	100
Extraneous Material	0.1	%	< 0.1	1.2	< 0.1	< 0.1
% Moisture	1	%	10	11	28	8.3

Client Sample ID			BH05 4.5
Sample Matrix			Soil
Eurofins Sample No.			S22-Ja12227
Date Sampled			Nov 19, 2021
Test/Reference	LOR	Unit	
Actual Acidity (NLM-3.2)			
pH-KCL (NLM-3.1)	0.1	pH Units	5.6
Titratable Actual Acidity (NLM-3.2)	2	mol H+/t	8.0
Titratable Actual Acidity (NLM-3.2)	0.003	% pyrite S	0.010
Potential Acidity - Chromium Reducible Sulfur			
Chromium Reducible Sulfur (s-SCr) (NLM-2.1)[S04]	0.005	% S	0.006
Chromium Reducible Sulfur (a-SCr) (NLM-2.1)	3	mol H+/t	3.6
Extractable Sulfur			
Sulfur - KCl Extractable	0.005	% S	N/A
HCl Extractable Sulfur	0.005	% S	N/A
Retained Acidity (S-NAS)			
Net Acid soluble sulfur (SNAS) NLM-4.1	0.02	% S	N/A
Net Acid soluble sulfur (s-SNAS) NLM-4.1[S02]	0.02	% S	N/A
Net Acid soluble sulfur (a-SNAS) NLM-4.1	10	mol H+/t	N/A
HCl Extractable Sulfur Correction Factor	1	factor	2.0
Acid Neutralising Capacity (ANCbt)			
Acid Neutralising Capacity - (ANCbt) (NLM-5.2)	0.01	% CaCO3	N/A
Acid Neutralising Capacity - (s-ANCbt) (NLM-5.2)[S03]	0.02	% S	N/A
Acid Neutralising Capacity - (a-ANCbt) (NLM-5.2)	2	mol H+/t	N/A
ANC Fineness Factor		factor	1.5
Net Acidity (Including ANC)			
CRS Suite - Net Acidity - NASSG (Including ANC)	0.02	% S	0.02
CRS Suite - Net Acidity - NASSG (Including ANC)	10	mol H+/t	12
CRS Suite - Liming Rate - NASSG (Including ANC)[S01]	1	kg CaCO3/t	< 1
Extraneous Material			
<2mm Fraction	0.005	g	49
>2mm Fraction	0.005	g	< 0.005
Analysed Material	0.1	%	100
Extraneous Material	0.1	%	< 0.1
% Moisture	1	%	9.8

Sample History

Where samples are submitted/analysed over several days, the last date of extraction is reported.

If the date and time of sampling are not provided, the Laboratory will not be responsible for compromised results should testing be performed outside the recommended holding time.

Description	Testing Site	Extracted	Holding Time
Chromium Reducible Sulfur Suite			
Chromium Suite	Brisbane	Jan 18, 2022	6 Week
- Method: LTM-GEN-7070 Chromium Reducible Sulfur Suite			
Extraneous Material	Brisbane	Jan 18, 2022	6 Week
- Method: LTM-GEN-7050/7070			
% Moisture	Sydney	Jan 17, 2022	14 Days
- Method: LTM-GEN-7080 Moisture			

eurofins | Environment Testing

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IANZ # 1290

Company Name: Alliance Geotechnical
Address: 10 Welder Road
Seven Hills
NSW 2147

Project Name: ADDITIONAL: GREGORY PLACE
Project ID: 13091

Order No.:
Report #: 855644
Phone: 1800 288 188
Fax: 02 9675 1888

Received: Jan 13, 2022 3:10 PM
Due: Jan 20, 2022
Priority: 5 Day
Contact Name: Matt Swinbourn

Eurofins Analytical Services Manager : Andrew Black

Sample Detail						Chromium Reducible Sulfur Suite	Moisture Set
Melbourne Laboratory - NATA # 1261 Site # 1254							
Sydney Laboratory - NATA # 1261 Site # 18217							X
Brisbane Laboratory - NATA # 1261 Site # 20794						X	
Mayfield Laboratory - NATA # 1261 Site # 25079							
Perth Laboratory - NATA # 2377 Site # 2370							
External Laboratory							
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**		
1	BH01 1.0	Nov 19, 2021		Soil	S22-Ja12223	X	X
2	BH02 5.5	Nov 19, 2021		Soil	S22-Ja12224	X	X
3	BH04 4.5	Nov 19, 2021		Soil	S22-Ja12225	X	X
4	BH04 5.5	Nov 19, 2021		Soil	S22-Ja12226	X	X
5	BH05 4.5	Nov 19, 2021		Soil	S22-Ja12227	X	X
Test Counts						5	5

Internal Quality Control Review and Glossary

General

1. Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples follows guidelines delineated in the National Environment Protection (Assessment of Site Contamination) Measure 1999, as amended May 2013 and are included in this QC report where applicable. Additional QC data may be available on request.
2. All soil/sediment/solid results are reported on a dry basis, unless otherwise stated.
3. All biota/food results are reported on a wet weight basis on the edible portion, unless otherwise stated.
4. Actual LORs are matrix dependant. Quoted LORs may be raised where sample extracts are diluted due to interferences.
5. Results are uncorrected for matrix spikes or surrogate recoveries except for PFAS compounds.
6. SVOC analysis on waters are performed on homogenised, unfiltered samples, unless noted otherwise.
7. Samples were analysed on an 'as received' basis.
8. Information identified on this report with blue colour, indicates data provided by customer that may have an impact on the results.
9. This report replaces any interim results previously issued.

Holding Times

Please refer to 'Sample Preservation and Container Guide' for holding times (QS3001).

For samples received on the last day of holding time, notification of testing requirements should have been received at least 6 hours prior to sample receipt deadlines as stated on the SRA.

If the Laboratory did not receive the information in the required timeframe, and regardless of any other integrity issues, suitably qualified results may still be reported.

Holding times apply from the date of sampling, therefore compliance to these may be outside the laboratory's control.

For VOCs containing vinyl chloride, styrene and 2-chloroethyl vinyl ether the holding time is 7 days however for all other VOCs such as BTEX or C6-10 TRH then the holding time is 14 days.

Units

mg/kg: milligrams per kilogram
mg/L: milligrams per litre
µg/L: micrograms per litre
ppm: parts per million
ppb: parts per billion
%: Percentage
org/100mL: Organisms per 100 millilitres
NTU: Nephelometric Turbidity Units
MPN/100mL: Most Probable Number of organisms per 100 millilitres

Terms

Dry	Where a moisture has been determined on a solid sample the result is expressed on a dry basis.
LOR	Limit of Reporting.
SPIKE	Addition of the analyte to the sample and reported as percentage recovery.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
LCS	Laboratory Control Sample - reported as percent recovery.
CRM	Certified Reference Material - reported as percent recovery.
Method Blank	In the case of solid samples these are performed on laboratory certified clean sands and in the case of water samples these are performed on de-ionised water.
Surr - Surrogate	The addition of a like compound to the analyte target and reported as percentage recovery.
Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
USEPA	United States Environmental Protection Agency
APHA	American Public Health Association
TCLP	Toxicity Characteristic Leaching Procedure
COC	Chain of Custody
SRA	Sample Receipt Advice
QSM	US Department of Defense Quality Systems Manual Version 5.4
CP	Client Parent - QC was performed on samples pertaining to this report
NCP	Non-Client Parent - QC performed on samples not pertaining to this report, QC is representative of the sequence or batch that client samples were analysed within.
TEQ	Toxic Equivalency Quotient
WA DWER	Sum of PFBA, PFPeA, PFHxA, PFHpA, PFOA, PFBS, PFHxS, PFOS, 6:2 FTSA, 8:2 FTSA

QC - Acceptance Criteria

The acceptance criteria should be used as a guide only and may be different when site specific Sampling Analysis and Quality Plan (SAQP) have been implemented

RPD Duplicates: Global RPD Duplicates Acceptance Criteria is 30% however the following acceptance guidelines are equally applicable:

Results <10 times the LOR: No Limit

Results between 10-20 times the LOR: RPD must lie between 0-50%

Results >20 times the LOR : RPD must lie between 0-30%

NOTE: pH duplicates are reported as a range not as RPD

Surrogate Recoveries: Recoveries must lie between 20-130% for Speciated Phenols & 50-150% for PFAS

PFAS field samples that contain surrogate recoveries in excess of the QC limit designated in QSM 5.4 where no positive PFAS results have been reported have been reviewed and no data was affected.

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QC Data General Comments

1. Where a result is reported as a less than (<), higher than the nominated LOR, this is due to either matrix interference, extract dilution required due to interferences or contaminant levels within the sample, high moisture content or insufficient sample provided.
2. Duplicate data shown within this report that states the word "BATCH" is a Batch Duplicate from outside of your sample batch, but within the laboratory sample batch at a 1:10 ratio. The Parent and Duplicate data shown is not data from your samples.
3. pH and Free Chlorine analysed in the laboratory - Analysis on this test must begin within 30 minutes of sampling. Therefore, laboratory analysis is unlikely to be completed within holding time.Analysis will begin as soon as possible after sample receipt.
4. Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of recovery the term "INT" appears against that analyte.
5. For Matrix Spikes and LCS results a dash "-" in the report means that the specific analyte was not added to the QC sample.
6. Duplicate RPDs are calculated from raw analytical data thus it is possible to have two sets of data.

Quality Control Results

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
LCS - % Recovery							
Actual Acidity (NLM-3.2)							
pH-KCL (NLM-3.1)	%	101			80-120	Pass	
Titratable Actual Acidity (NLM-3.2)	%	91			80-120	Pass	
LCS - % Recovery							
Potential Acidity - Chromium Reducible Sulfur							
Chromium Reducible Sulfur (s-SCr) (NLM-2.1)	%	96			80-120	Pass	

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Duplicate									
Actual Acidity (NLM-3.2)				Result 1	Result 2	RPD			
pH-KCL (NLM-3.1)	B22-Ja09978	NCP	pH Units	5.2	5.3	<1	30%	Pass	
Titratable Actual Acidity (NLM-3.2)	B22-Ja09978	NCP	mol H+/t	11	11	<1	30%	Pass	
Titratable Actual Acidity (NLM-3.2)	B22-Ja09978	NCP	% pyrite S	0.020	0.020	<1	30%	Pass	
Duplicate									
Potential Acidity - Chromium Reducible Sulfur				Result 1	Result 2	RPD			
Chromium Reducible Sulfur (s-SCr) (NLM-2.1)	B22-Ja09978	NCP	% S	< 0.005	< 0.005	<1	30%	Pass	
Chromium Reducible Sulfur (a-SCr) (NLM-2.1)	B22-Ja09978	NCP	mol H+/t	< 3	< 3	<1	30%	Pass	
Duplicate									
Extractable Sulfur				Result 1	Result 2	RPD			
Sulfur - KCl Extractable	B22-Ja09978	NCP	% S	N/A	N/A	N/A	30%	Pass	
HCl Extractable Sulfur	B22-Ja09978	NCP	% S	N/A	N/A	N/A	30%	Pass	
Duplicate									
Retained Acidity (S-NAS)				Result 1	Result 2	RPD			
Net Acid soluble sulfur (SNAS) NLM-4.1	B22-Ja09978	NCP	% S	N/A	N/A	N/A	30%	Pass	
Net Acid soluble sulfur (s-SNAS) NLM-4.1	B22-Ja09978	NCP	% S	N/A	N/A	N/A	30%	Pass	
Net Acid soluble sulfur (a-SNAS) NLM-4.1	B22-Ja09978	NCP	mol H+/t	N/A	N/A	N/A	30%	Pass	
Duplicate									
Acid Neutralising Capacity (ANCbt)				Result 1	Result 2	RPD			
Acid Neutralising Capacity - (ANCbt) (NLM-5.2)	B22-Ja09978	NCP	% CaCO3	N/A	N/A	N/A	30%	Pass	
Acid Neutralising Capacity - (s-ANCbt) (NLM-5.2)	B22-Ja09978	NCP	% S	N/A	N/A	N/A	30%	Pass	
ANC Fineness Factor	B22-Ja09978	NCP	factor	1.5	1.5	<1	30%	Pass	
Duplicate									
Net Acidity (Including ANC)				Result 1	Result 2	RPD			
CRS Suite - Net Acidity - NASSG (Including ANC)	B22-Ja09978	NCP	% S	0.02	0.02	<1	30%	Pass	
CRS Suite - Net Acidity - NASSG (Including ANC)	B22-Ja09978	NCP	mol H+/t	11	11	<1	30%	Pass	
CRS Suite - Liming Rate - NASSG (Including ANC)	B22-Ja09978	NCP	kg CaCO3/t	< 1	< 1	<1	30%	Pass	
Duplicate									
				Result 1	Result 2	RPD			
% Moisture	N22-Ja12008	NCP	%	< 1	< 1	<1	30%	Pass	

Comments

Sample Integrity

Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	Yes
Sample correctly preserved	Yes
Appropriate sample containers have been used	Yes
Sample containers for volatile analysis received with minimal headspace	Yes
Samples received within HoldingTime	Yes
Some samples have been subcontracted	No

Qualifier Codes/Comments

Code	Description
S01	Liming rate is calculated and reported on a dry weight basis assuming use of fine agricultural lime (CaCO3) and using a safety factor of 1.5 to allow for non-homogeneous mixing and poor reactivity of lime. For conversion of Liming Rate from 'kg/t dry weight' to 'kg/m3 in-situ soil' multiply 'reported results' x 'wet bulk density of soil in t/m3'
S02	Retained Acidity is Reported when the pHKCl is less than pH 4.5
S03	Acid Neutralising Capacity is only required if the pHKCl if greater than or equal to pH 6.5
S04	Acid Sulfate Soil Samples have a 24 hour holding time unless frozen or dried within that period

Authorised by:

Emma Beesley	Analytical Services Manager
Myles Clark	Senior Analyst-SPOCAS (QLD)

Glenn Jackson
General Manager

Final Report – this report replaces any previously issued Report

- Indicates Not Requested

* Indicates NATA accreditation does not cover the performance of this service

Measurement uncertainty of test data is available on request or please click here.