GEOTECHNICAL INVESTIGATION

FOR

NSW HOUSING CORPORATION PTY LIMITED

2-4 BURLEIGH STREET & 20-24 RAILWAY PARADE, BURWOOD

REPORT GG11730.002A

28 JULY 2025

Geotechnical Investigation for a proposed mixed-use development at 2-4 Burleigh Street and 20-24 Railway Parade, Burwood

Prepared for

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For and on behalf of Green Geotechnics

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1. INTRODUCTION

This report presents the results of a Geotechnical Investigation undertaken by Green Geotechnics Pty Limited for a proposed multi-level mixed use residential unit development to be constructed at 2-4 Burleigh Street and 20-24 Railway Parade, Burwood, NSW. The assessment was commissioned by NSW Housing Corporation Pty Ltd.

We understand from the supplied Pre-DA Architectural Design prepared by PTI Architecture that that the proposed development comprises the construction of a thirty-nine storey mixed-use residential unit building overlying a five-level basement. The finished floor level of the lower basement is set at Reduced Level (RL) 10.5 metres Australian Height Datum (AHD). Construction of the basement will require bulk excavation to depths of 15.5 to 16.5 metres below the existing ground surface. Localised deeper excavations will likely be required for footings, lift overrun pits, crane pads, and service trenches.

Structural loads have not been advised but we have assumed column loads in the high to very high range will apply for this type of development.

Further, we understand that the site is located within a Class 5 Acid Sulfate Soils area, and therefore a preliminary assessment will be required to accompany DA Submission.

The purpose of the investigation was to:

- assess the subsurface conditions over the site including ground water levels,
- classify the underlying bedrock,
- classify the site in accordance with AS2870,
- classify the site in accordance with AS1170.4.
- provide recommendations regarding appropriate foundation systems for the site including design parameters,
- provide recommendations for temporary and permanent batter slopes,
- provide parameters for the temporary and permanent support of the excavation including design parameters for shoring wall analysis and anchor design,
- provide recommendations regarding vibration control during rock excavation,
- provide an exposure classification in accordance with AS2870 & AS2159.
- undertake a Preliminary Acid Sulfate Soils Assessment, and

- provide recommendations for further geotechnical investigations.

2. INVESTIGATION PROCEDURE

2.1 Fieldwork Details

The fieldwork was carried out on 25 November 2024 and comprised a site walkover together with the drilling of one (1) cored borehole numbered BH1, to a target depth of 19 metres below the existing ground surface.

The borehole was drilled using Hanjin DB8 track mounted drilling rig supplied and operated by BG Drilling. BH1 was commenced using rotary solid flight augers until at least low strength shale bedrock was encountered. The borehole was then advanced into the underlying bedrock to the target depth using NMLC sized diamond coring equipment.

Soil strengths were assessed by undertaking Standard Penetration Tests (SPT's) at regular depth intervals in the borehole. The SPT N values were then augmented by undertaking pocket penetrometer readings on cohesive soil samples recovered from the SPT split spoon sampler.

The recovered rock core from BH1 was logged, boxed and photographed. To assist in assessing rock strengths the recovered rock core was Point Load Index tested, with tests undertaken at a nominal depth interval of 1 metre.

Groundwater observations were made during auger drilling. To further assess groundwater levels, a PVC standpipe piezometer was installed in BH1 shortly after drilling.

The surface reduced levels of the boreholes were determined by interpolation between spot levels shown on the provided site survey plan, and so should be considered to be approximate. The datum of the levels is Australian Height Datum (AHD).

The site location is shown in the attached Figure GG11730.002A. The borehole locations, as shown on Figure GG11730.002B, were determined by taped measurements from existing surface features shown on the survey plan provided by the client. Photographs of the site indicating the borehole locations are provided in Figure GG11730.002C.

The fieldwork was completed in the full-time presence of our Senior Field Geologist who set out the boreholes, nominated the sampling and testing, and prepared the borehole logs. The logs which include the approximate surface reduced levels and groundwater observations together with photos of the rock core and Point Load Index test results, are attached to this report, together with a glossary of the terms and symbols used in the logs.

For further details of the investigation techniques adopted, reference should be made to the attached explanation notes.

Environmental and contamination testing of the soils was beyond the agreed scope of the works.

2.2 Laboratory Testing

In order to assess the soils for their aggressiveness in accordance with AS2159 and AS2870, selected representative soil samples were tested to determine the following:

- pH,
- Sulphate Content (SO4),
- Chloride Content (CL), and
- Electrical Conductivity (EC).

The detailed test reports are provided in Appendix B and are further discussed in Section 4.9 of this report.

3. SITE CONDITIONS AND REGIONAL GEOLOGY

3.1 Site Description

The site is identified as Lots A, B, C, D and E in DP 438222 and comprises a roughly rectangular shaped parcel of land with a combined area of approximately 1,329m^2.

At the time of our assessment No.20, No.22 and No.24 Railway Parade were occupied by terraced single storey brick rendered mixed use buildings with metal roofs. The dwellings have concrete hard stand areas to the rear with metal car ports. No.2 and No.4 also comprise single storey brick structures with pitched tile roofs which extend back to the same rear courtyard at the dwellings fronting Railway Parade.

Site vegetation comprises garden beds with shrubs and trees. The ground surface on the site falls approximately 1 metre to the north, from approximately RL27 metres AHD to RL26 metres AHD.

To the north of the site is Railway Parade and to the west is Burleigh Street. To the east of the site is No.18A Railway Parade, a two-storey brick residential unit building with separate garage set back around 1 metre from the site boundary. To the south of the site is No.6 Burleigh Street, a two-storey brick residence which has been constructed to the boundary with the subject site.

3.2 Regional Geology

The 1:100,000 series geological map of Sydney (Geological Survey of NSW, Geological Series Sheet 9130) indicates that the site is underlain by Triassic Age bedrock belonging to the Ashfield Shale formation of the Wiannamatta Group. Bedrock within this formation comprises shale, claystone and laminite with occasional sandstone interbeds.

For the development of a site-specific geotechnical model, the observed subsurface conditions from the boreholes have been grouped into six (6) geotechnical units which are summarised below in Table 3.1.

TABLE 3.1 – Summary of Subsurface Conditions

Unit	Material Type	Depth to top of Layer (m)*	Depth to base of Layer (m)*	Material Description
1	Topsoil / Fill	Surface	0.4m	Asphalt thickness 10mm, sandy gravel fill to 0.2m depth, below which is a medium plasticity silty clay topsoil, dark brown in colour, moist.
2	Residual Soil – Firm to Stiff, Stiff and to Very Stiff Clay	0.4m	1.4m	Silty clays of medium and high plasticity with traces of ironstone and shale gravel. Generally firm to stiff becoming stiff and very stiff with depth, and moist becoming dry to moist.
3	Class 5 Shale	1.4m	3.5m	Extremely weathered extremely low to very low strength shale, orange to brown and grey brown in colour with frequent clay seams. Not core drilled.
4	Class 4 Shale	3.5m	5.4m	Highly weathered to moderately weathered dark grey to grey, mostly low strength shale bedrock with frequent clay seams and iron stained bedding partings and joints.
5	Class 3 Shale	5.4m	7.2m	Slightly weathered to fresh dark grey shale bedrock with occasional clay seams, bedding partings and steeply inclined joints. Medium strength
6	Class 2 Shale	7.2m	19.0m	Fresh dark grey shale bedrock with bedding partings and steeply inclined joints. High strength

TABLE 3.2 – Summary of Bedrock Classification

Borehole ID	Depth of Rock Classification (m)			
	Class 5	Class 4	Class 3	Class 2
1	1.4 – 3.5m	3.5 – 5.4m	5.4 – 7.2m	7.2 – 19.0m

Groundwater seepage was not observed during auger drilling.

The piezometer installed in BH1 was re-measured on 2 December 2024, with groundwater recorded at a depth of 13.4 metres, which is within the Class 2 shale bedrock.

4. GEOTECHNICAL RECOMMENDATIONS

4.1 Primary Geotechnical Considerations

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

- Basement excavation and retention to limit lateral deflections and ground loss as a result of excavations, resulting in damage to nearby structures,
- Rock excavation and the generation of ground borne vibrations, and
- Foundation design for structural loads.

4.2 Site Classification to AS2870

The classification has been prepared in accordance with the guidelines set out in the "Residential Slabs and Footings" Code, AS2870 – 2011.

Because there are structures/pavements present on the site, abnormal moisture conditions (AMC) prevail at the subject site (Refer to Section 1.3.3 of AS2870).

Because of the AMC present, the site is classified a ***Problem Site (P).*** However, provided the recommendations given in Section 4.8 are adopted and the footings bear in the underlying shale bedrock, the site may be reclassified ***Moderately Reactive (M).***

4.3 Site Classification to AS1170.4 (Earthquake)

The site sub-soil classification has been determined using AS1170.4-2007. The classification is based on the results of the borehole drilling. The depth of soil recorded in the subsurface profile is less than 3 metres, therefore the site is classified as a Rock Site (B_e). An earthquake hazard factor (Z) of 0.08 applies to sites within the Sydney region.

4.4 Excavation Conditions and Vibration Control

All excavation recommendations should be complemented with reference to the NSW Government Code of Practice for Excavation work, dated January 2020.

It would be appropriate before commencing excavation to undertake a dilapidation survey of any adjacent structures that may potentially be damaged. This will provide a reasonable basis for assessing any future claims of damage.

Based on the subsurface conditions observed in boreholes, the proposed basement excavation is expected to encounter fill, shallow residual soils and weathered to fresh shale bedrock. The bedrock was assessed to be extremely low strength becoming medium and high strength with depth. Based on the results of the point load index testing, the fresh shale bedrock has correlated Unconfined Compressive Strengths up to 35 MPa, with majority of the fresh bedrock having correlated Unconfined Compressive Strengths around 15-25 MPa.

Excavation of the soils and the upper extremely low strength shale will be achievable using conventional excavation equipment, such as the buckets of hydraulic excavators. Excavators alone without assistance will not be able to remove any significant amount of the rock. Hydraulic breakers mounted on an excavator or jack hammers will be required to break up the majority of the rock before it can be removed using an excavator.

During the use of hydraulic impact hammers, precautions must be made to reduce the risk of vibrational damage to adjoining structures. At the commencement of the use of hydraulic impact hammers we recommend that full time quantitative vibration monitoring be carried out on the adjoining residences or at the boundaries by an experienced vibration consultant or geotechnical engineer to check that vibrations are within acceptable limits.

Australian Standard AS 2187: Part 2-2006 recommends the frequency dependent guideline values and assessment methods given in BS 7385 Part 2-1993 “Evaluation and measurement for vibration in buildings Part 2” as they “are applicable to Australian conditions”. The standard sets guide values for building vibration based on the lowest vibration levels above which damage has been credibly demonstrated. These levels are judged to give a minimum risk of vibration-induced damage, where the minimal risk for a named effect is usually taken as a 95% probability of no effect.

Sources of vibration that are considered in the standard include demolition, blasting (carried out during mineral extraction or construction excavation), piling, ground treatments (e.g. compaction), construction equipment, tunnelling, road and rail traffic and industrial machinery.

For residential structures, BS 7385 recommends vibration criteria of 7.5 mm/s to 10 mm/s for frequencies between 4 Hz and 15 Hz, and 10 mm/s to 25 mm/s for frequencies between 15 Hz to 40 Hz and above. These values would normally be applicable for new residential structures or residential structures in good condition.

Higher values would normally apply to commercial structures, and more conservative criteria would normally apply to heritage structures. However, structures can withstand vibration levels significantly higher than those required to maintain comfort for their occupants. Human comfort is therefore likely to be the critical factor in vibration management.

Excavation methods should be adopted which limit ground vibrations at the adjoining developments to not more than 10mm/sec. Vibration monitoring is recommended to verify that this is achieved. The limits of 5mm/sec and 10mm/sec are expected to be achievable if rock breaker equipment or other excavation methods are restricted as indicated in Table 4.1.

Table 4.1 – Recommendations for rock breaking equipment

Distance from adjoining structure (m)	Maximum Peak Particle Velocity 5mm/sec		Maximum Peak Particle Velocity 10mm/sec	
	Equipment	Operating Limit (% of maximum capacity)	Equipment	Operating Limit (% of maximum capacity)
1.5 to 2.5	Hand operated jack hammer only	100	300 kg rock hammer	50
2.5 to 5.0	300 kg rock hammer	50	300 kg rock hammer	100
			600 kg rock hammer	50
5.0 to 10.00	300 kg rock hammer	100	600 kg rock hammer	100
	600 kg rock hammer	50	900 kg rock hammer	50

At all times, the excavation equipment must be operated by experienced personnel, per the manufacturer's instructions, and in a manner, consistent with minimising vibration effects.

If during excavation with the hydraulic impact hammers, vibrations are found to be excessive or there is concern, then alternative lower vibration emitting equipment, such as rock saws, rock grinders or smaller hammers may need to be used. The use of a rotary grinder or rock sawing in conjunction with ripping presents an alternative low vibration excavation technique, however, productivity is likely to be slower. When using a rock saw or rotary grinder, the resulting dust must be suppressed by spraying with water.

It is pointed out that the rock classification system used in Table 3.2 is intended primarily for use in the design of foundations, and is not intended to be used to directly assess rock excavation characteristics. Excavation contractors should refer to the detailed engineering logs and where available, core photographs, laboratory strength tests, and inspection of rock core samples, and should not rely solely on the rock classifications presented in geotechnical engineering reports when assessing the suitability of their excavation equipment for the proposed development. Further geotechnical advice must be sought if rock excavation characteristics are critical to the proposed development.

It should be noted that vibrations that are below threshold levels for building damage may be experienced at adjoining developments. Rock excavation methodology should also consider acceptable noise limits as per the "Interim Construction Noise Guideline" (NSW EPA).

The excavated material will also need to be classified for disposal purposes, which will require environmental testing of the various materials.

4.5 Groundwater Assessment

Groundwater or significant seepage was not observed during drilling of the boreholes. A standpipe piezometer was installed into BH1 after drilling.

Groundwater was observed in the piezometer at a depth of 13.4 metres on 2 December 2024. The piezometer was re-measured on 23 July 2025 with water recorded at a depth of 13.1 metres, which suggest only minor seasonal fluctuation.

At the time of the secondary measurement in July 2025 an additional piezometer had been installed by others. No construction details are available for the additional well, however the well was effectively dry, with only minor slurry in the base of the well at depth of 9.3 metres.

To assess groundwater inflow rates, a rising head permeability test was carried in BH1. The test was carried out using the slug method whereby the water level in the piezometer was lowered using a mechanical bailer followed by the measurement of water recovery in the well over a period of time. The permeability rate of the bedrock has then been determined using the Horslev (1951) method.

Based on the results of the rising head permeability test we have calculated the permeability (K) of the shale bedrock to be in the order of 1.15741E-07 m/sec, or 0.01m/day. This value is considered to be within typical ranges for a Class 2 shale bedrock.

As part of the groundwater assessment Green Geotechnics have undertaken an assessment of groundwater inflow volumes (Q) from seepage within the bedrock. The assessment has considered various drawdown scenarios, and is based on data obtained during the permeability testing.

Table 4.2 below provides annual dewatering volumes in megalitres per year and is based on the following adopted parameters:

- Standing Water level – 13.0m (RL13.96)
- Bulk Excavation Level RL10.5
- Excavation footprint – 28m x 48m
- Permeability (K) - 1.15741E-07 m/sec

TABLE 4.2 – Estimate of dewatering volume

Drawdown Distance (m) from site boundary	Annual Q Volume (ML/Year)
25m	2.3
50m	0.21
100m	0.1

The above values are below the 3ML/year threshold value set by WaterNSW.

It must also be acknowledged that the above values given in Table 4.2 are considered conservative, as we would expect inflow from discreet seams or defects in the rock to decrease considerably with time as the bedding seams/joints are drained. It is further noted that the above estimates of inflow have ignored the presence of temporary shoring walls, which will be required to support the excavation (see below in Section 4.6). Experience suggests that the installation of solder pile walls with shotcrete infill panels significantly reduces or in some instances stops water inflow from discreet seams or defects in the rock.

Based on the above, any groundwater inflows into the excavation should not have an adverse impact on the proposed development or on the neighbouring sites and should be manageable. We however recommend that monitoring of seepage be implemented during the excavation works to confirm the capacity of the drainage system.

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

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

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

4.6 Excavation Retention & Support Design

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

Based on the provided architectural plans, the depth of the excavation, the encountered subsurface conditions and limited setbacks, temporary batters are not recommended for this site. Unsupported vertical cuts of the soil are not recommended for this site as these carry the risk of potential slumping especially after a period of wet weather. Slumping of the material may result in injury to personnel and/or damage to nearby structures/infrastructures and equipment.

A suitable retention system will be required for the support of the soil and weathered bedrock within the excavation. For this site, we consider that an anchored and/or propped soldier pile wall with mass concrete in between the piles to be the most suitable. Anchors/props and mass concrete must be installed progressively as excavation proceeds. The piles should be founded in Unit 5 (Class 3) shale or better.

The existence of significant horizontal in-situ stresses in bedrock, particularly in the Sydney basin, is well established. The release of such stresses during the basement excavation may cause adverse impact on the stability of the excavation faces and thus increase the movements. Monitoring of several deep excavations within sandstone and shale in the Sydney region indicates that the lateral displacement at the top of the excavation is generally between 0.5mm to 2mm per meter depth of excavation.

As the maximum depth of excavation into shale is of about 15m, a lateral deflection at the crest of the excavation between 7.5mm to 30mm can be expected which will reduce in a stepped fashion to zero at the bulk excavation level. Monitoring of the lateral movement as the excavation progresses is recommended.

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

When considering the design of the support system, it will be necessary to allow for the loading from structures in adjoining properties, any ground surface slope and the water table present.

For the design of temporary structures where some ground movement is acceptable, an active earth pressure coefficient (K_a) may be adopted. However, where adjoining structures are within the zone of influence of the excavation, or it is necessary to limit lateral deflections, it will be necessary to adopt at rest (K_o) conditions. K_o conditions should also be used to design the permanent support system.

A triangular lateral earth pressure distribution should be adopted for cantilevered walls, and a rectangular or trapezoidal lateral earth pressure distribution should be adopted for walls that are progressively propped at their top and base, and/or where two or more rows of anchors are used. A triangular earth pressure distribution should be adopted when determining the load on shotcrete infill panels.

Cantilever type shoring structures require movement at the top of the wall in order to develop their capacity. Given that such movement may cause distress in adjacent structures, consideration should be given to providing a minimum of three levels of lateral bracing or support for the shoring system installed at this site.

As previously discussed, anchors or internal props should be considered. Where anchors are used and they extend into the adjoining property, it will be necessary to obtain the permission of the property owners.

Anchor designs should be based on bonding to be developed behind an ‘active zone’ determined by drawing a line from the base of the retained height at 45° from horizontal.

Anchors should be proof loaded as follows:

- 1.5 times working load for permanent anchors;
- 1.3 times working load for temporary anchors.

Anchors should be installed into the weathered rock.

Retaining walls may be designed using the parameters provided below in Table 4.3.

TABLE 4.3 – Retaining Wall Design Parameters

Material Unit	Bulk Unit Weight (kN/m^3)	Effective Cohesion C' (kPa)	Effective Angle of Friction, ϕ (Deg)	Poisson's Ratio	Elastic Modulus E' (MPa)	Earth Pressure Co-efficients			Ultimate Bond Stress for Anchors (kPa)
						At Rest (K_o)	Active (K_a)	Allowable Toe Resistance (kPa)	
1	18	0	24	0.3	8	0.6	0.4	-	-
2	19	2	27	0.3	25	0.55	0.36	-	-
3	21	30	28	0.25	80	0.53	0.36	-	35
4	22	50	31	0.25	150	0.47	0.31	-	70
5	23	100	33	0.2	350	0.44	0.28	300	250
6	23	200	34	0.2	800	0.4	0.25	500	400

The embedment of retaining walls can be used to achieve passive support. A triangular passive earth pressure distribution (increasing linearly with depth) may be assumed, starting from 0.5 m below excavation toe/base level.

4.7 Drainage and Basement Floor Slab Construction

Following bulk excavation for the proposed basement, shale bedrock is expected to be exposed at the basement floor BEL.

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

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

4.8 Foundation Design

On completion of bulk excavation, Class 2 shale bedrock is expected to be exposed over the floor of the basement. We therefore recommend that the proposed building be uniformly supported on footings founded in the underlying bedrock.

Foundation design parameters for the various units are provided in Table 4.4 below

TABLE 4.4 – Foundation Design Parameters

(Unit) Material	Maximum Allowable (Working Stress) Values (kPa)			Ultimate Strength Limit State Values (kPa)		
	End Bearing Pressure	Shaft Friction in compression#	Shaft Friction in tension*	End Bearing Pressure	Shaft Friction in compression#	Shaft Friction in tension*
(1) Fill	-	-	-	-	-	-
(2) Stiff Clay	150	20	10	450	60	30
(3) Class 5 Shale	700	70	35	3,000	100	50
(4) Class 4 Shale	1000	100	50	4,500	150	75
(5) Class 3 Shale	3500	350	175	10,000	600	300
(6) Class 2 Shale**	6,000	600	300	30,000	800	400

Note: Parameters for Class 3 and 2 shale bedrock are provided for strip and pad footings and bored piles only – these should not be used for CFA piles.

* Uplift capacity of piles in tension loading should also be checked for inverted cone pull out mechanism.

clean socket of roughness category R2 or better is assumed

** Requires spoon testing in a minimum of 30% of footings

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 Φ_g 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 Φ_g value.

Settlements for footings on rock are anticipated to be about 1% of the minimum footing dimension, based on serviceability parameters as per Table 4.4. Settlements for pad footings in clayey soils are anticipated to be up to about 15mm where loading does not exceed the maximum allowable values.

All shallow footings should be poured with minimal delay (i.e. preferably on the same day of excavation) or the base of the footing should be protected by a concrete blinding layer after cleaning of loose spoil and inspection.

Drilling of rock sockets into the low to medium strength or better shale will require the use of large piling rigs equipped with rock augers. Some limited groundwater inflow should be anticipated into the bored pile excavations. We expect any minor seepage to be controllable by conventional pumping methods. However, some contingency for pouring concrete by tremie methods should be allowed.

Bored pile footings should be drilled, cleaned, inspected and poured with minimal delay, on the same day. Water should be prevented from ponding in the base of footings as this will tend to soften the foundation material, resulting in further excavation and cleaning being required.

The initial stages of footing excavation/drilling should be inspected by a geotechnical engineer/engineering geologist to ascertain that the recommended foundation material has been reached and to check initial assumptions about foundation conditions and possible variations that may occur between borehole locations. The need for further inspections can be assessed following the initial visit.

4.9 Exposure Classification to AS2870 & AS2159

The aggressiveness or erosion potential of an environment in building materials, particularly concrete and steel is dependent on the levels of soil pH and the types of salts present, generally sulphates and chlorides. In order to determine the degree of aggressiveness, the test values obtained are compared to Tables 6.4.2 (C) and 6.5.2 (C) in AS2159 – 2009 Piling – Design and Installation and Tables 5.1 and 5.2 of AS2870-2011. In regard to the electrical conductivity, the laboratory test results have been multiplied by the appropriate factor to convert the results to EC_e.

The soils on the site consist of low permeability clays and shale bedrock above a regional groundwater table. Therefore, the soil conditions B are considered appropriate. The test results are summarised in Table 4.5 below.

Table 4.5 – Exposure Classification Summary Table

Sample ID	Location	Depth (m)	pH	EC_e (dS/m)	Sulfate (ppm)	Chloride (ppm)	Exposure Classification AS2159		Exposure Classification AS2870
							Steel Piles	Concrete Piles	
S1	BH1	0.6	5.1	0.6	80	80	Non Aggressive	Non Aggressive	A1
S2	BH1	1.10	6.0	0.8	30	50	Non Aggressive	Non Aggressive	A1

5. FURTHER GEOTECHNICAL INPUT

The following summarises the scope of further geotechnical work recommended within this report. For specific details reference should be made to the relevant sections of this report.

- Undertake detailed geotechnical investigations of the site following demolition of existing structures or when access for drilling equipment is provided. The additional investigations should include the drilling of at least two (2) further cored boreholes which extend a minimum of three (3) metres below bulk excavation level.

- Complete dilapidation surveys of the adjoining buildings and structures.

- Inspection of shoring piles during installation,

- Where required, quantitative monitoring of transmitted vibrations during rock excavation using rock hammers.

- Inspection of footing excavations to ascertain that the recommended foundation has been reached and to check initial assumptions regarding foundation conditions and possible variations that may occur.

- We also recommend that Green Geotechnics view the proposed earthworks and structural drawings in order to confirm they are within the guidelines of this report.

Nevertheless, it will be essential during excavation and construction works that progressive geotechnical inspections be commissioned to check initial assumptions about excavation and foundation conditions and possible variations that may occur between inspected and tested locations and to provide further relevant geotechnical advice.

6. ACID SULFATE SOILS ASSESSMENT

6.1 Introduction

ASS are the common name given to sediments and soils containing iron sulfides which, when exposed to oxygen generate sulfuric acid. Natural processes formed the majority of acid sulfate sediments when certain conditions existed in the Holocene geological period (the last 10,000 years). Formation conditions require the presence of iron-rich sediments, sulfate (usually from seawater), removal of reaction products such as bicarbonate, the presence of sulfate reducing bacteria and a plentiful supply of organic matter. It should be noted that these conditions exist in mangroves, salt marsh vegetation or tidal areas, and at the bottom of coastal rivers and lakes.

The relatively specific conditions under which acid sulfate soils are formed usually limit their occurrence to low lying parts of coastal floodplains, rivers and creeks. This includes areas with saline or brackish water such as deltas, coastal flats, backswamps and seasonal or permanent freshwater swamps that were formerly brackish. Due to flooding and stormwater erosion, these sulfidic sediments may continue to be re-distributed through the sands and sediments of the estuarine floodplain region. Sulfidic sediment may be found at any depth in suitable coastal sediments – usually beneath the water table.

Any lowering in the water table that covers and protects potential ASS will result in their aeration and the exposure of iron sulfide sediments to oxygen. The lowering in the water table can occur naturally due to seasonal fluctuations and drought or any human intervention, when carrying out any excavations during site development. Potential ASS can also be the exposed to air during physical disturbance with the material at the disturbance face, as well as the extracted material, both potentially being oxidised. The oxidation of iron sulfide sediments in potential ASS results in ASS soils.

Successful management of areas with ASS is possible but must take into account the specific nature of the site and the environmental consequences of development. While it is preferable that sites exhibiting acid sulfate characteristics not be disturbed, management techniques have been devised to minimise and manage impacts in certain circumstances.

When works involving the disturbance of soil or the change of groundwater levels are proposed in coastal areas, a preliminary assessment should be undertaken to determine whether acid sulfate soils are present and if the proposed works are likely to disturb these soils.

6.2 Presence of ASS

Reference to the Botany Bay ASS Risk Map indicates the property is within an area where there are no known occurrences of ASS. It should be noted that maps are a guide only.

The following geomorphic or site criteria are normally used to determine if acid sulfate soils are likely to be present:

- sediments of recent geological age (Holocene),
- soil horizons less than 5 in AHD,
- marine or estuarine sediments and tidal lakes,
- in coastal wetlands or back swamp areas

6.3 Assessment

The property is at an elevation of about RL26 metres AHD and is underlain by residual soils overlying bedrock belonging to the Ashfield Shale formation. This is not consistent with the geomorphic criteria necessary for the presence of ASS. Based on our site observations and previous investigations undertaken in the immediate vicinity of the site, it is our opinion that the proposed construction will not intercept any ASS. Any seepage into the basement is expected to be minor, and as a consequence, construction will not result in the lowering of any groundwater that may be present in the area.

Our assessment is the proposed construction will not require the preparation of an Acid Sulfate Soil Management Plan.

7. RESPONSE TO SEARS

We understand that the development is considered a state significant development (SSD) and therefore a Secretary's Environmental Assessment (SEAR) is required. Item 13 of the SEARS addresses groundwater, specifically:

- *Assess potential impacts on soil resources and related infrastructure and riparian lands on and near the site, including soil erosion, salinity and acid sulfate soils.*
- *Provide a Surface and Groundwater Impact Assessment that assesses potential impacts on:*
    - *surface water resources (quality and quantity) including related infrastructure, hydrology, dependent ecosystems, drainage lines, downstream assets and watercourses.*
    - *groundwater resources in accordance with the Groundwater Guidelines.*

Based on the location of the site within an urban setting, and considering the proposed structure will cover the majority of the sites footprint we do foresee any impacts to soil resources or riparian lands. As per the assessment in Section 7 the site is not impacted by Acid Sulfate Soil, and based on the laboratory test results presented in Section 4.9 the soils are non-saline. Soil erosion will be controlled by the installation of a temporary shoring wall around the perimeter of the basement.

As per the assessment and recommendations provided in Section 4.5, we do not anticipate the basement excavations encountering a regional or free flowing groundwater table. Further, there are no watercourse or water dependant ecosystems on the site. Therefore, we see no reason why the development would impact on surface water resources, hydrology, ecosystems, downstream assets or watercourses.

8. GENERAL RECOMMENDATIONS

The parameters and recommendations presented in this report are preliminary only and should not be adopted for IFC structural and hydraulic designs. Prior to finalising the structural and hydraulic design for the development it is essential that the additional investigations recommended in Section 5 of this report are carried out.

The recommendations presented in this report include specific issues to be addressed during the construction phase of the project. In the event that any of the construction phase recommendations presented in this report are not implemented, the general recommendations may become inapplicable and Green Geotechnics accept no responsibility whatsoever for the performance of the structure where recommendations are not implemented in full and properly tested, inspected and documented.

Occasionally, the subsurface conditions may be found to be different (or may be interpreted to be different) from those expected. Variation can also occur with groundwater conditions, especially after climatic changes. If such differences appear to exist, we recommend that you immediately contact this office.

This report provides advice on geotechnical aspects for the proposed civil and structural design. As part of the documentation stage of this project, Contract Documents and Specifications may be prepared based on our report. However, there may be design features we are not aware of or have not commented on for a variety of reasons. The designers should satisfy themselves that all the necessary advice has been obtained. If required, we could be commissioned to review the geotechnical aspects of contract documents to confirm the intent of our recommendations has been correctly implemented.

This report has been prepared for the particular project described and no responsibility is accepted for the use of any part of this report in any other context or for any other purpose. If there is any change in the proposed development described in this report then all recommendations should be reviewed. Copyright in this report is the property of Green Geotechnics. We have used a degree of care, skill and diligence normally exercised by consulting engineers in similar circumstances and locality. No other warranty expressed or implied is made or intended. Subject to payment of all fees due for the investigation, the client alone shall have a licence to use this report. The report shall not be reproduced except in full.

REPORT INFORMATION

Introduction

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

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

Borehole and Test Pit Logs

The borehole and test pit logs presented in this report are an engineering and/or geological interpretation of the subsurface conditions, and their reliability will depend to some extent on frequency of sampling and the method of drilling or excavation.

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

Groundwater

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

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

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

Reports

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

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

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

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

Site Anomalies

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

Copyright

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FIGURES

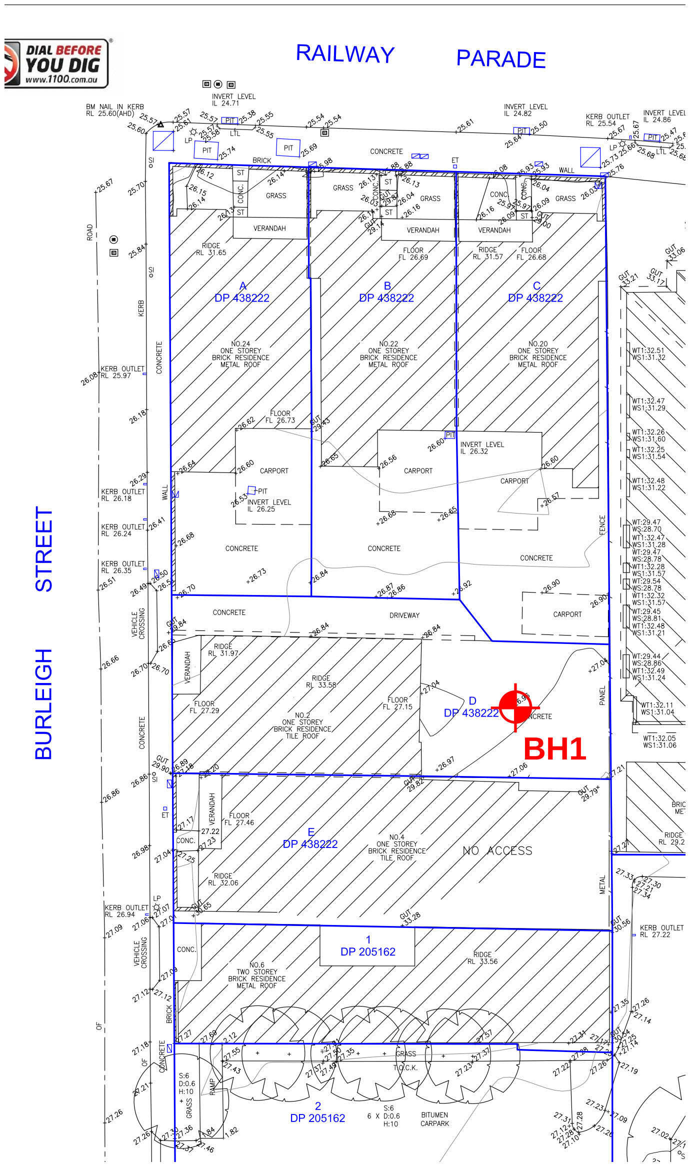
GREEN GEOTECHNICS	Project No: GG11730.002	Geotechnical Investigation: 2-4 Burleigh Street and 20-24 Railway Parade, Burwood SITE LOCATION PLAN	Figure No: GG11730.002A
	Client: NSW Housing Corporation Pty Ltd		Drawn By: MG
	Date: 28 January 2025		Scale: Unknown

Legend:

= Borehole

= Test Pit

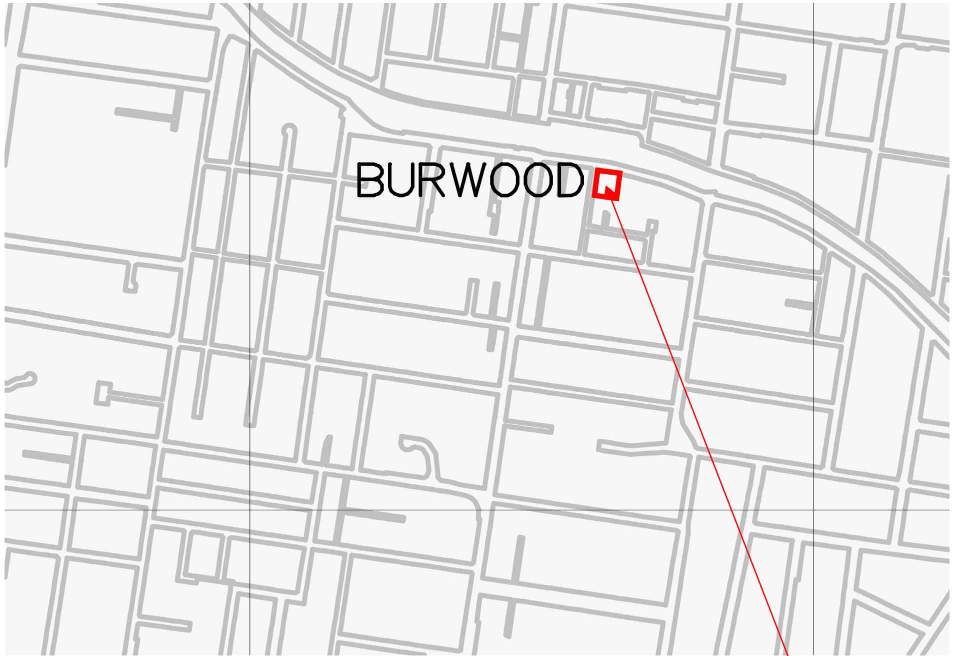
= DCP



GREEN GEOTECHNICS	Project No: GG11730.002	Geotechnical Investigation 2-4 Burleigh Street and 20-24 Railway Parade, Burwood **TEST LOCATION PLAN**	Figure No: GG11730.002B
	Client: NSW Housing Corporation Pty Ltd		Drawn By: MG
	Date: 28 January 2025		Scale: Unknown

Location of BH1

GREEN GEOTECHNICS	Project No: GG11730.002	Geotechnical Investigation	Page: 1 of 1
	Client: NSW Housing Corporation Pty Ltd	2-4 Burleigh Street and 20-24 Railway Parade, Burwood	
	Date: 28 January 2025	**SITE PHOTOGRAPHS**	



Botany Bay Acid Sulfate Soils Risk Map

Acid Sulfate Soils Classification Mapping (Source ePlanning Spatial Viewer)

Subject Site

GREEN GEOTECHNICS	Project No: GG11730.001	Acid Sulfate Soils Assessment 2-4 Burleigh Street and 20-24 Railway Parade, Burwood **ACID SULFATE SOILS MAPPING**	Figure No: GG11730.001C
	Client: NSW Housing Corporation Pty Ltd		Drawn By: MG
	Date: 28 January 2025		Scale: Unknown

APPENDIX A – BOREHOLE LOGS, CORE PHOTOGRAPHS & POINT LOAD TEST RESULTS

GREEN GEOTECHNICS

Borehole No.
BH1
Page 1 of 5

Engineering Log - Borehole

Project No.: GG11730.002

Client:	NSW Housing Corporation Pty Ltd	Commenced:	25/11/2024
Project Name:	Geotechnical Investigation:	Completed:	25/11/2024
Hole Location:	2-4 Burleigh Street and 20-24 Railway Parade, Burwood	Logged By:	JK
Hole Position:	See Plan	Checked By:	MG

Drill Model and Mounting:	Hanjin DB8	Inclination:	-90°	RL Surface:	26.96 m		
Hole Diameter:	110 mm	Bearing:		Datum:	AHD	Operator:	AC

Drilling Information | **Soil Description** | **Observations**

Method	Support	Penetration	Groundwater Levels	Samples & Field Tests	Recovery	RL (m)	Depth (m)	Graphic Log	Group Symbol	Material Description Fraction, Colour, Structure, Bedding, Plasticity, Sensitivity, Additional	Moisture Condition	Consistency Relative Density	Structure and Additional Observations
AD/T							0.10m			ASPHALTIC CONCRETE: 100mm thick.			
							0.20m		GW	FILL Sandy GRAVEL: dark grey, sand is fine to medium grained; with dark grey gravel.	D		FILL
							0.40m		CI	TOPSOIL Silty CLAY: medium plasticity, dark brown.	M		TOPSOIL
				0.60m D-S1 0.70m			0.80m		CH	Silty CLAY: high plasticity, orange brown with pale grey.	M	F to St	RESIDUAL SOIL
				1.00m SPT 22 N=22+ (S2 at 1.10m) 1.15m		26.0	1 / 1.40m		CI /CH	Silty CLAY: medium to high plasticity, pale grey with orange brown, trace of shale gravel; (completely weathered shale).	M / M / D	St / VSt	
						25.0	2			SHALE: pale grey with orange brown and dark brown, with clay seams. estimate very low strength (Class 5).	D		ROCK
						24.0	3						
						23.0	4 / 4.15m			SHALE: becoming dark grey.			
						22.0	5			Continued on cored borehole sheet			

Method
AS - Auger Screwing
ADV - Auger V Bit
ADT - Auger Tungsten Carbide Bit
RR - Rock Roller
WB - Washbore

Support
C - Casing

Penetration
No resistance ranging to refusal

Water
Level (Date)
Inflow
Partial Loss
Complete Loss

Graphic Log/Core Loss
Core recovered (hatching indicates material)
Core loss

Samples and Tests
U - Undisturbed Sample
D - Disturbed Sample
SPT - Standard Penetration Test
PP - Pocket Penetrometer

Classification Symbols and Soil Descriptions
Based on Unified Soil Classification System

Moisture Condition
D - Dry
M - Moist
W - Wet
w - Moisture Content
PL - Plastic Limit
LL - Liquid Limit

Consistency/Relative Density
VS - Very Soft
S - Soft
F - Firm
VSt - Very Stiff
H - Hard
Fr - Friable
VL - Very Loose
L - Loose
MD - Medium Dense
D - Dense
VD - Very Dense

GREEN GEOTECHNICS

Engineering Log - Cored Borehole

Project No.: GG11730.002

Client:	NSW Housing Corporation Pty Ltd	Commenced:	25/11/2024
Project Name:	Geotechnical Investigation:	Completed:	25/11/2024
Hole Location:	2-4 Burleigh Street and 20-24 Railway Parade, Burwood	Logged By:	JK
Hole Position:	See Plan	Checked By:	MG

Drill Model and Mounting:	Hanjin DB8	Inclination:	-90°	RL Surface:	26.96 m		
Barrel Type and Length:	Stepped Face 3 m	Bearing:		Datum:	AHD	Operator:	AC

Drilling Information | **Rock Substance** | **Rock Mass Defects**

Method	Support	Water	TCR (%)	RQD (%)	RL (m)	Depth (m)	Graphic Log	Material Description (rock type: grain characteristics, colour, structure, minor components)	Weathering	Strength (UCS=I$_{s(50)}$; ● - Axial; ○ - Diametral; ■ - UCS; VL L M H VH EH)	Average Defect Spacing (mm) (10 30 100 300 1000)	Defect Description (thickness, type, inclination, planarity, roughness, coating/infilling)
					26.0	1						
					25.0	2						
					24.0	3						
					23.0	4		4.15m Continued from non-cored borehole sheet				
NMLC		100% Water Return	100	43				SHALE: dark grey with orange brown and pale grey.	HW			P, 0°, clay, PR, RF; clay, SM; clay, SM
					22.0	5		4.66m SHALE: dark grey with pale grey, laminated at 0-5°.	MW to SW			P, 0°, PR, SM; CS, clay; clay, SM; clay, SM; P, 0°, PR, RF; P, 0°, PR, RF; P, 0°, PR, RF; CS, clay; P, 0°, PR, RF
			100	84					FR			DB; P, 0°, PR, SM

Method
AS - Auger Screwing
WB - Washbore
HQ3 - HQ3 Core Barrel
NQ3 - NQ3 Core Barrel
NMLC - NMLC Core Barrel

Water
Level (Date)
Inflow
Partial Loss
Complete Loss

Support
T - Timbering

Graphic Log/Core Loss
Core recovered (hatching indicates material)
Core loss

Weathering
FR - Fresh
SW - Slightly Weathered
MW - Moderately Weathered
DW - Distinctly Weathered
HW - Highly Weathered
XW - Extremely Weathered
RS - Residual Soil

Strength
VL - Very Low
L - Low
M - Medium
H - High
VH - Very High
EH - Extremely High

Engineering Log - Cored Borehole

Project No.: GG11730.002

Client:	NSW Housing Corporation Pty Ltd	Commenced:	25/11/2024
Project Name:	Geotechnical Investigation:	Completed:	25/11/2024
Hole Location:	2-4 Burleigh Street and 20-24 Railway Parade, Burwood	Logged By:	JK
Hole Position:	See Plan	Checked By:	MG

Drill Model and Mounting:	Hanjin DB8	Inclination:	-90°	RL Surface:	26.96 m		
Barrel Type and Length:	Stepped Face 3 m	Bearing:		Datum:	AHD	Operator:	AC

Drilling Information | **Rock Substance** | **Rock Mass Defects**

Method	Support	Water	TCR (%)	RQD (%)	RL (m)	Depth (m)	Graphic Log	Material Description (rock type: grain characteristics, colour, structure, minor components)	Weathering	Strength	Average Defect Spacing (mm)	Defect Description (thickness, type, inclination, planarity, roughness, coating/infilling)
NMLC		100% Water Return	100	84	20.0 – 19.0	7 – 8		SHALE: dark grey with pale grey, laminated at 0-5°.*(continued)*	FR	H	100–300	P, 0°, PR, SM; J, 45°, IR, RF; P, 0°, PR, SM; P, 0°, PR, SM; P, 0°, PR, RF; J, 45°, clay, IR, RF, Infill; P, 0°, PR, SM; P, 0°, PR, SM; P, 0°, PR, SM; P, 0°, PR, SM; P, 0°, clay VN, PR, RF; P, 0°, PR, RF; P, 0°, PR, SM; P, 2°, PR, RF; DB; HB; HB
		100% Water Return	100	100	18.0 – 16.0	9 – 11				H	300–1000	P, 0°, PR, SM; P, 0°, PR, SM; P, 0°, PR, SM; P, 0°, PR, SM; P, 0°, PR, SM; P, 0°, PR, SM; P, 0°, PR, SM; P, 0°, PR, SM; P, 0°, PR, RF; DB
			100	100								

Strength: UCS=·I$_{s(50)}$ ● - Axial ○ - Diametral ■ - UCS; VL L M H VH EH
Average Defect Spacing: 10 30 100 300 1000

Method
AS - Auger Screwing
WB - Washbore
HQ3 - HQ3 Core Barrel
NQ3 - NQ3 Core Barrel
NMLC - NMLC Core Barrel

Water
Level (Date)
Inflow
Partial Loss
Complete Loss

Support
T - Timbering

Graphic Log/Core Loss
Core recovered (hatching indicates material)
Core loss

Weathering
FR - Fresh
SW - Slightly Weathered
MW - Moderately Weathered
DW - Distinctly Weathered
HW - Highly Weathered
XW - Extremely Weathered
RS - Residual Soil

Strength
VL - Very Low
L - Low
M - Medium
H - High
VH - Very High
EH - Extremely High

Engineering Log - Cored Borehole

Project No.: GG11730.002

Client:	NSW Housing Corporation Pty Ltd	Commenced:	25/11/2024
Project Name:	Geotechnical Investigation:	Completed:	25/11/2024
Hole Location:	2-4 Burleigh Street and 20-24 Railway Parade, Burwood	Logged By:	JK
Hole Position:	See Plan	Checked By:	MG

Drill Model and Mounting:	Hanjin DB8	Inclination:	-90°	RL Surface:	26.96 m		
Barrel Type and Length:	Stepped Face 3 m	Bearing:		Datum:	AHD	Operator:	AC

Drilling Information / Rock Substance / Rock Mass Defects

Method | Support | Water | TCR (%) | RQD (%) | RL (m) | Depth (m) | Graphic Log | Material Description (rock type: grain characteristics, colour, structure, minor components) | Weathering | Strength (UCS=·$I_{s(50)}$ ● - Axial ○ - Diametral ■ - UCS; VL L M H VH EH) | Average Defect Spacing (mm) (10 30 100 300 1000) | Defect Description (thickness, type, inclination, planarity, roughness, coating/infilling)

Method: NMLC

Water: 2/12/2024 (level); 100% Water Return (to ~14.6 m); 80% Water Return (~14.6 m to ~17.8 m)

TCR / RQD: 100 / 100 (to ~14.6 m); 100 / 63 (~14.6 m to ~17.8 m); 100 / 88 (from ~17.8 m)

RL (m): 14.0 (13 m), 13.0 (14 m), 12.0 (15 m), 11.0 (16 m), 10.0 (17 m)

Material Description: SHALE: dark grey with pale grey, laminated at 0-5°.*(continued)*

Weathering: FR

Defect Description:
- J, 90°, clay VN, IR, RF
- P, 0°, PR, SM
- P, 0°, PR, SM
- P, 0°, PR, SM
- HB
- HB
- J, 90°, clay VN, IR, RF
- P, 0°, PR, RF
- P, 0°, PR, RF
- HB
- DB
- J, 90°, IR, RF
- J, 90°, IR, SM
- P, 0°, PR, RF
- J, 90°, IR, RF
- P, 0°, PR, RF
- P, 0°, PR, SM
- HB
- P, 0°, PR, SM
- P, 0°, PR, SM
- P, 0°, PR, RF
- P, 0°, PR, SM
- P, 0°, PR, SM
- P, 0°, PR, SM
- DB

Method
AS - Auger Screwing
WB - Washbore
HQ3 - HQ3 Core Barrel
NQ3 - NQ3 Core Barrel
NMLC - NMLC Core Barrel

Water
Level (Date)
Inflow
Partial Loss
Complete Loss

Support
T - Timbering

Graphic Log/Core Loss
Core recovered (hatching indicates material)
Core loss

Weathering
FR - Fresh
SW - Slightly Weathered
MW - Moderately Weathered
DW - Distinctly Weathered
HW - Highly Weathered
XW - Extremely Weathered
RS - Residual Soil

Strength
VL - Very Low
L - Low
M - Medium
H - High
VH - Very High
EH - Extremely High

GREEN GEOTECHNICS

Cored Borehole No.
BH1
Page 5 of 5

Engineering Log - Cored Borehole

Project No.: GG11730.002

Client:	NSW Housing Corporation Pty Ltd	Commenced:	25/11/2024
Project Name:	Geotechnical Investigation:	Completed:	25/11/2024
Hole Location:	2-4 Burleigh Street and 20-24 Railway Parade, Burwood	Logged By:	JK
Hole Position:	See Plan	Checked By:	MG

Drill Model and Mounting:	Hanjin DB8	Inclination:	-90°	RL Surface:	26.96 m		
Barrel Type and Length:	Stepped Face 3 m	Bearing:		Datum:	AHD	Operator:	AC

Drilling Information							Rock Substance				Rock Mass Defects	
Method	Support	Water	TCR (%)	RQD (%)	RL (m)	Depth (m)	Graphic Log	Material Description rock type: grain characteristics, colour, structure, minor components	Weathering	Strength UCS=·I$_{s(50)}$ ● - Axial ○ - Diametral ■ - UCS VL L M H VH EH	Average Defect Spacing (mm) 10 30 100 300 1000	Defect Description thickness, type, inclination, planarity, roughness, coating/infilling
NMLC		80% Water Return	100	88				SHALE: dark grey with pale grey, laminated at 0-5°.*(continued)*	FR			J, 90°, IR, RF J, 85°, IR, RF P, 3°, PR, RF J, 45°, open, tight
					8.0	19	19.00m	Hole Terminated at 19.00 m End				
					7.0	20						
					6.0	21						
					5.0	22						
					4.0	23						

Method
AS - Auger Screwing
WB - Washbore
HQ3 - HQ3 Core Barrel
NQ3 - NQ3 Core Barrel
NMLC - NMLC Core Barrel

Water
Level (Date)
Inflow
Partial Loss
Complete Loss

Support
T - Timbering

Graphic Log/Core Loss
Core recovered (hatching indicates material)
Core loss

Weathering
FR - Fresh
SW - Slightly Weathered
MW - Moderately Weathered
DW - Distinctly Weathered
HW - Highly Weathered
XW - Extremely Weathered
RS - Residual Soil

Strength
VL - Very Low
L - Low
M - Medium
H - High
VH - Very High
EH - Extremely High

Project No: GG11730.001A	Geotechnical Investigation 2-4 Burleigh Street and 20-24 Railway Parade, Burwood **CORE PHOTO - BH1**
Client: NSW Housing Corporation Pty Ltd	
Date Cored: 3 December 2024	

Box : 1 of 1

GREEN GEOTECHNICS

Green Geotechnics Pty Ltd
PO Box 3244, Rouse Hill NSW 2155
Phone: 0477 779 684 | Email: matt@greengeo.com.au

POINT LOAD STRENGTH INDEX

Project No: GG11730.002
Project Address: 2-4 Burleigh Street and 20-24 Railway Parade, Burwood
Client: NSW Housing Corporation Pty Ltd

Test Method: AS 4133.4.1
Test Date: 26/11/2024
Tested By: MG
Page: 1 of 2

Borehole No: BH1
Date Drilled: 25/11/2024

Depth	Test Type	**Is(50) (Mpa)**	Rock Type	Rock Structure	Moisture
4.90	D	**0.19**	SH	LA	M
	A	**0.18**	SH	LA	M
5.66	D	**0.11**	SH	LA	D-M
	A	**0.56**	SH	LA	D-M
6.67	D	**0.20**	SH	LA	D
	A	**0.94**	SH	LA	D
7.68	D	**0.10**	SH	LA	D
	A	**0.83**	SH	LA	D
8.53	D	**0.14**	SH	LA	D
	A	**1.11**	SH	LA	D
9.60	D	**0.18**	SH	LA	D
	A	**1.70**	SH	LA	D

Borehole No: BH1
Date Drilled: 25/11/2024

Depth	Test Type	**Is(50) (Mpa)**	Rock Type	Rock Structure	Moisture
10.67	D	**0.12**	SH	LA	D
	A	**0.57**	SH	LA	D
11.49	D	**0.06**	SH	LA	D
	A	**0.50**	SH	LA	D
12.64	D	**0.24**	SH	LA	D
	A	**0.51**	SH	LA	D
13.78	D	**0.55**	SH	LA	D
	A	**0.85**	SH	LA	D
14.35	D	**0.11**	SH	LA	D
	A	**0.68**	SH	LA	D
15.37	D	**0.16**	SH	LA	D
	A	**0.49**	SH	LA	D

STRUCTURE	TEST TYPE	MOISTURE CONDITION	ROCK TYPE
MA= MASSIVE	A= AXIAL	W= WET	SS= SANDSTONE
BE= BEDDED	D= DIAMETRAL	M= MOIST	ST= SILTSTONE
LA= LAMINATED	I= IRREGULAR	D= DRY	SH= SHALE
CR= CRYSTALLINE	C= CUBE		YS= CLAYSTONE
			IG= IGNEOUS

Green Geotechnics Pty Ltd
PO Box 3244, Rouse Hill NSW 2155
Phone: 0477 779 684 | Email: matt@greengeo.com.au

POINT LOAD STRENGTH INDEX

Project No: GG11730.002
Project Address: 2-4 Burleigh Street and 20-24 Railway Parade, Burwood
Client: NSW Housing Corporation Pty Ltd

Test Method: AS 4133.4.1
Test Date: 26/11/2024
Tested By: MG

Borehole No: BH1

Date Drilled: 25/11/2024

Depth	Test Type	Is(50) (Mpa)	Rock Type	Rock Structure	Moisture
16.51	D	**0.09**	SH	LA	D
	A	**0.71**	SH	LA	D
17.58	D	**0.16**	SH	LA	D
	A	**0.92**	SH	LA	D
18.46	D	**0.23**	SH	LA	D
	A	**0.85**	SH	LA	D

Borehole No: BH1

Date Drilled: 25/11/2024

Depth	Test Type	Is(50) (Mpa)	Rock Type	Rock Structure	Moisture

STRUCTURE
MA= MASSIVE
BE= BEDDED
LA= LAMINATED
CR= CRYSTALLINE

TEST TYPE
A= AXIAL
D= DIAMETRAL
I= IRREGULAR
C= CUBE

MOISTURE CONDITION
W= WET
M= MOIST
D= DRY

ROCK TYPE
SS= SANDSTONE
ST= SILTSTONE
SH= SHALE
YS= CLAYSTONE
IG= IGNEOUS

SAMPLING & IN-SITU TESTING

Sampling

Sampling is carried out during drilling or test pitting to allow engineering examination (and laboratory testing where required) of the soil or rock. Disturbed samples taken during drilling provide information on colour, type, inclusions and, depending upon the degree of disturbance, some information on strength and structure. Undisturbed samples are taken by pushing a thin walled sample tube into the soil and withdrawing it to obtain a sample of the soil in a relatively undisturbed state. Such samples yield information on structure and strength and are necessary for laboratory determination of shear strength and compressibility.

Test Pits

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

Large Diameter Augers

Boreholes can be drilled using a large diameter auger, typically up to 300 mm or larger in diameter mounted on a standard drilling rig. The cuttings are returned to the surface at intervals (generally not more than 0.5 m) and are disturbed but usually unchanged in moisture content.

Continuous Spiral Flight Augers

The borehole is advanced using 90-115 mm diameter continuous spiral flight augers which are withdrawn at intervals to allow sampling or in-situ testing. This is a relatively economical means of drilling in clays and sands above the water table. Samples are returned to the surface, or may be collected after withdrawal of the auger flights, but they are disturbed and may be mixed with soils from the sides of the hole.

Non-core Rotary Drilling

The borehole is advanced using a rotary bit, with water or drilling mud being pumped down the drill rods and returned up the annulus, carrying the drill cuttings. Only major changes in stratification can be determined from the cuttings, together with some information from the rate of penetration.

Diamond Core Rock Drilling

A continuous core sample of can be obtained using a diamond tipped core barrel, usually with a 50 mm internal diameter (NMLC). The borehole is advanced using a water or mud flush to lubricate the bit and removed cuttings.

Standard Penetration Tests

Standard penetration tests (SPT) are used as a means of estimating the density or strength of soils and of obtaining a relatively undisturbed sample. The test procedure is described in Australian Standard 1289, Methods of Testing Soils for Engineering Purposes - Test 6.3.1. The test is carried out in a borehole by driving a 50 mm diameter split sample tube under the impact of a 63 kg hammer with a free fall of 760 mm. It is normal for the tube to be driven in three successive 150 mm increments and the 'N' value is taken as the number of blows for the last 300 mm. In dense sands, very hard clays or weak rock, the full 450 mm penetration may not be practicable, and the test is discontinued.

The test results are reported in the following form.

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

  4,6,7
  N=13

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

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

Dynamic Cone Penetrometer Tests / Perth Sand Penetrometer Tests

Dynamic penetrometer tests (DCP or PSP) are carried out by driving a steel rod into the ground using a standard weight of hammer falling a specified distance. As the rod penetrates the soil the number of blows required to penetrate each successive 150 mm depth are recorded. Two types of penetrometer are commonly used.

- Perth sand penetrometer - a 16 mm diameter flat ended rod is driven using a 9 kg hammer dropping 600 mm (AS 1289, Test 6.3.3). This test was developed for testing the density of sands and is mainly used in granular soils and filling.

- Cone penetrometer - a 16 mm diameter rod with a 20 mm diameter cone end is driven using a 9 kg hammer dropping 510 mm (AS 1289, Test 6.3.2). This test was developed initially for pavement subgrade investigations, and correlations of the test results with California Bearing Ratio have been published by various road authorities.

SOIL DESCRIPTIONS

Description and Classification Methods

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

Soil Types

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

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

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

Type	Particle Size (mm)
Coarse Gravel	20 – 63
Medium Gravel	6 – 20
Fine Sand	2.36 – 6
Coarse Sand	0.6 – 2.36
Medium Sand	0.2 – 0.6
Fine Sand	0.075 – 0.2

The proportions of secondary constituents of soils are described as:

Term	Proportion
And	Specify
Adjective	20 - 35%
Slightly	12 - 20%
With some	5 - 12%
With a trace of	0 - 5%

Definitions of grading terms used are:

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

Cohesive Soils

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

Description	Abbreviation	Undrained Shear Strength (kPa)
Very soft	VS	<12
Soft	S	12 - 25
Firm	F	25 - 50
Stiff	ST	50 - 100
Very stiff	VST	100 - 200
Hard	H	200

Cohesionless Soils

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

Relative Density	Abbreviation	SPT N Value	CPT qc value (MPa)
Very loose	VL	<4	<2
Loose	L	4 - 10	2 -5
Medium Dense	MD	10-30	5-15
Dense	D	30-50	15-25
Very Dense	VD	>50	>25

Soil Origin

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

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

Transported soils may be further subdivided into:

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

ROCK DESCRIPTIONS

GREEN
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Rock Strength

The Rock strength is defined by the Point Load Strength Index ($Is_{(50)}$) and refers to the strength of the rock substance and not the strength of the overall rock mass, which may be considerably weaker due to defects. The test procedure is described by Australian Standard 4133.4.1 - 1993. The terms used to describe rock strength are as follows:

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

* Assumes a ratio of 20:1 for UCS to $IS_{(50)}$

Degree of Weathering

The degree of weathering of rock is classified as follows:

Term	Abbreviation	Description
Residual Soil	RS	Soil developed on extremely weathered rock, the mass structure and substance fabric are no longer evident.
Extremely weathered	EW	Rock substance has soil properties, i.e. it can be remoulded and classified as a soil but the texture of the original rock is still evident.
Highly weathered	HW	Limonite staining or bleaching affects whole of rock substance and other signs of decomposition are evident. Porosity and strength may be altered as a result of iron leaching or deposition. Colour and strength of original fresh rock is not recognisable.
Distinctly Weathered	DW	Rock strength usually changed by weathering. The rock may be highly discoloured usually by iron staining.
Moderately weathered	MW	Staining and discolouration of rock substance has taken place.
Slightly weathered	SW	Rock substance is slightly discoloured but shows little or no change of strength from fresh rock.
Fresh	FR	No signs of decomposition or staining.

Degree of Fracturing

The following classification applies to the spacing of natural fractures in core samples (bedding plane partings, joints and other defects, excluding drilling breaks

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

Stratification Spacing

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

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

Rock Quality Designation

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

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

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

ABBREVIATIONS

Introduction

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

Drilling or Excavation Methods

C	Core Drilling
R	Rotary drilling
ADT	Auger Drill TC Bit
ADV	Auger Drill V Brit
NMLC	Diamond core - 52 mm dia
NQ	Diamond core - 47 mm dia
HQ	Diamond core - 63 mm dia
PQ	Diamond core - 81 mm dia

Water

Z	Water seep
V	Water level

Sampling and Testing

A	Auger sample
B	Bulk sample
D	Disturbed sample
S	Chemical sample
U50	Undisturbed tube sample (50mm)
W	Water sample
PP	Pocket Penetrometer (kPa)
PL	Point load strength Is(50) MPa
S	Standard Penetration Test
V	Shear vane (kPa)

Description of Defects in Rock

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

Defect Type

C	Crushed Seam
DB	Drilling Break
DL	Drilling Lift
EW	Extremely Weathered Seam
HB	Handling Break
IS	Infilled Seam
J	Joint
MB	Mechanical Break
P	Parting
S	Sheared Surface
SS	Sheared Seam
SZ	Sheared Zone

Orientation

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

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

Coating or Infilling Term

cn	clean
ct	coating
sn	stained
vn	veneer

Coating Descriptor

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

Shape

cu	curved
ir	irregular
pr	planar
st	stepped
un	undulating

Roughness

po	polished
rf	rough
sl	slickensided
sm	smooth
vr	very rough

Other

fg	fragmented
bnd	band
qtz	quartz

SYMBOLS

Graphic Symbols for Soil and Rock

General

 Asphalt

 Road base

 Concrete

 Filling

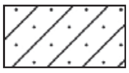
Soils

 Topsoil

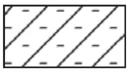
 Peat

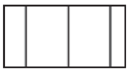
 Clay

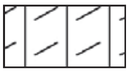
 Silty clay

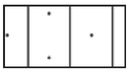
 Sandy clay

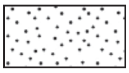
 Gravelly clay

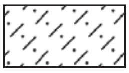
 Shaly clay

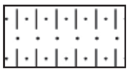
 Silt

 Clayey silt

 Sandy silt

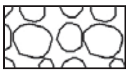
 Sand

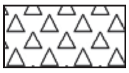
 Clayey sand

 Silty sand

 Gravel

 Sandy gravel

 Cobbles, boulders

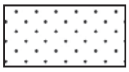
 Talus

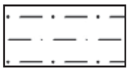
Sedimentary Rocks

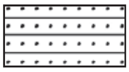
 Boulder conglomerate

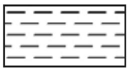
 Conglomerate

 Conglomeratic sandstone

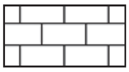
 Sandstone

 Siltstone

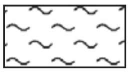
 Laminite

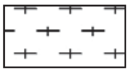
 Mudstone, claystone, shale

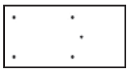
 Coal

 Limestone

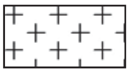
Metamorphic Rocks

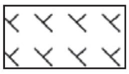
 Slate, phyllite, schist

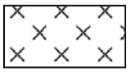
 Gneiss

 Quartzite

Igneous Rocks

 Granite

 Dolerite, basalt, andesite

 Dacite, epidote

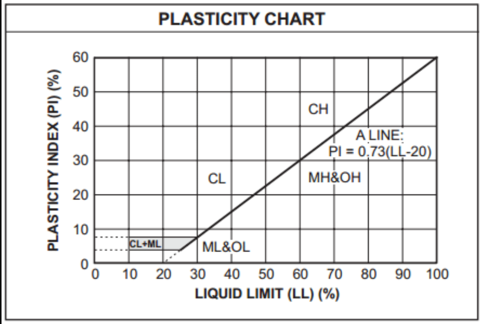
 Tuff, breccia

 Porphyry

UNIFIED SOIL CLASSIFICATION TABLE

Field Identification Procedures (Excluding particles larger than 75um and basing fractions on estimated weights)				Group Symbols	Typical Names	Information Required for Describing Soils	Laboratory Classification Criteria	
Coarse-grained soils More than half of the material is large that 75um sieve size[b] (The 75um sieve size is about the particle visible to the naked eye)	Gravels More than half of the coarse fraction is larger than a 4mm sieve	Clean gravels (little or no fines)	Wide range in grain size and substantial amounts of all intermediate particle sizes	*GW*	Well graded gravels, gravel-sand mixtures, little or no fines	Give typical name: indicative approximate percentages of sand and gravel; maximum size; angularity; surface condition, and hardness of the coarse grains; local of geologic name and other pertinent descriptive information; and symbols in parentheses For undisturbed soils add information on stratification, degree of compactness, cementation, moisture conditions and drainage characteristics Example: *Silty Sand*, gravelly; about 20% hard, angular gravel particles 12mm maximum size; rounded and subangular sand grains, coarse to fine, about 15% non-plastic fines low dry strength; well compacted and moist in place; alluvial sand; *(SM)*	Use grain size curve in identifying the fractions as given under field identification Determine percentages of gravel and sand from grain size curve Depending on percentage of fines (fraction smaller than 75um sieve size) coarse grained soils are classified as follows Less than 5% GW, GP, SW, SP More than 12% GM, GC, SM, SC 5 to 12% Borderline cases requiring use of dual symbol	$C_u = \frac{D_{60}}{D_{10}}$ Greater than 4 $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ Between 1 and 3
			Predominantly one size or range of sizes with some intermediate sizes missing	*GP*	Poorly graded gravels, grave-sand mixtures, little or no fines			Not meeting all graduation requirements for *GW*
		Gravels with fines (appreciable amount of fines)	Nonplastic fines (for identification procedures see *ML* below)	*GM*	Silty gravels, poorly graded gravel-sand-silt mixtures			Atterberg limits below "A" line or *PI* less than 4 — Above "A" line with *PI* between 4 and 7 are borderline cases of requiring use of dual symbols
			Plastic fines (for identification procedures see *CL* below)	*GC*	Clayey gravels, poorly graded gravel-sand-clay mixtures			Atterberg limits above "A" line with *PI* greater than 7
	Sands More than half of the coarse fraction is smaller than a 4mm sieve	Clean sands (little or no fines)	Wide range in grain size and substantial amounts of all intermediate particle sizes	*SW*	Well graded sands, gravelly sands, little or no fines			$C_u = \frac{D_{60}}{D_{10}}$ Greater than 6 $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ Between 1 and 3
			Predominantly one size or range of sizes with some intermediate sizes missing	*SP*	Poorly graded sands, gravelly sands, little or no fines			Not meeting all graduation requirements for *SW*
		Sands with fines (appreciable amount of fines)	Nonplastic fines (for identification procedures see *ML* below)	*SM*	Silty sands, poorly graded sand-silt mixtures			Atterberg limits below "A" line or *PI* less than 5 — Above "A" line with *PI* between 4 and 7 are borderline cases of requiring use of dual symbols
			Plastic fines (for identification procedures see *CL* below)	*SC*	Clayey sands, poorly graded sand-clay mixtures			Atterberg limits above "A" line with *PI* greater than 7

Identification Procedures of Fractions Smaller than 380 um Sieve Size		Dry Strength (crushing characteristics)	Dilatancy (reaction to shaking)	Toughness (consistency near plastic limit)	Group Symbols	Typical Names	Information Required for Describing Soils
Find-grained soils More than half of the material is smaller than 75um sieve size	Silts and clays liquid limit less than 50	None to slight	Quick to slow	None	*ML*	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands with slit plasticity	Give typical name: indicative degree and character of plasticity, amount and maximum size of coarse grains; colour in wet condition, odour if any, local or geologic name, and other pertinent descriptive information, and symbol in parentheses For undisturbed soils add information on structure, stratification, consistency in undisturbed and remoulded states, moisture and drainage conditions Example: *Clayey Silt*, brown; slightly plastic; small percentage of fine sand; numerous vertical root holes; firm and dry in place; loess; *(ML)*
		Medium to high	None to very slow	Medium	*CL*	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays	
		Slight to medium	Slow	Slight	*OL*	Organic silts and organic silt-clays of low plasticity	
	Silts and clays liquid limit greater than 50	Slight to medium	Slow to none	Slight to medium	*MH*	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, clastic silts	
		High to very high	None	High	*CH*	Inorganic clays of high plasticity, fat clays	
		Medium to high	None to very slow	Slight to medium	*OH*	Organic clays of medium to high plasticity	
Highly Organic Soils		Readily identified by colour, odour, spongy feel and frequently by fibrous texture			*Pt*	Peat and other highly organic soils	



Plasticity Chart
For laboratory classification of fine-grained soils

Note: 1 Soils possessing characteristics of two groups are designated by combinations of group symbols (eg. GW-GC, well graded gravel-sand mixture with clay fines
2 Soils with liquid limits of the order of 35 to 50 may be visually classified as being of medium plasticity

APPENDIX B – LABORATORY TEST RESULTS

CERTIFICATE OF ANALYSIS

Work Order	: **ES2438450**	Page	: 1 of 2
Client	: **GREEN GEOTECHNICS PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: MR MATTHEW GREEN	Contact	: Customer Services ES
Address	: PO BOX 3244 ROUSE HILL 2155	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: ----	Telephone	: +61-2-8784 8555
Project	: GG11730	Date Samples Received	: 25-Nov-2024 16:37
Order number	: ----	Date Analysis Commenced	: 26-Nov-2024
C-O-C number	: ----	Issue Date	: 28-Nov-2024 12:07
Sampler	: ----		
Site	: ----		
Quote number	: EN/222		
No. of samples received	: 2		
No. of samples analysed	: 2		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Ankit Joshi	Senior Chemist - Inorganics	Sydney Inorganics, Smithfield, NSW

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contract for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- ED045G: The presence of Thiocyanate, Thiosulfate and Sulfite can positively contribute to the chloride result, thereby may bias results higher than expected. Results should be scrutinised accordingly.

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	GG11730/S1	GG11730/S2	----	----	----
			Sampling date / time	25-Nov-2024 00:00	25-Nov-2024 00:00	----	----	----
Compound	CAS Number	LOR	Unit	ES2438450-001	ES2438450-002	--------	--------	--------
				Result	Result	----	----	----
EA002: pH 1:5 (Soils)								
pH Value	----	0.1	pH Unit	**5.1**	**6.0**	----	----	----
EA010: Conductivity (1:5)								
Electrical Conductivity @ 25°C	----	1	µS/cm	**75**	**97**	----	----	----
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	0.1	%	**20.1**	**7.6**	----	----	----
ED040S : Soluble Sulfate by ICPAES								
Sulfate as SO4 2-	14808-79-8	10	mg/kg	**80**	**30**	----	----	----
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	10	mg/kg	**80**	**50**	----	----	----