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PRELIMINARY GEOTECHNICAL INVESTIGATION REPORT

5-9 Cowan Road,

St Ives NSW

Prepared for

Prosper 5-9 Cowan Road

St Ives Pty Limited

Report No: GS9614-1A/Rev1

25th August 2025

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REFERENCES

1. Australian Standard – AS 1726-2017 Geotechnical Site Investigation.
2. Australian Standard – AS 1170.4-2007 Structural Design Actions – Part 4: Earthquake actions in Australia.
3. Australian Standard – AS3798-2007 Guidelines on Earthworks for Commercial and Residential Developments.
4. Australian Standard – AS 2870-2011 Residential slabs and footings.
5. Australian Standard – AS 2159-2009 Piling - Design and installation.
6. Pells P.J.N, Mostyn, G. & Walker B.F., “Foundations on Sandstone and Shale in the Sydney Region”, Australian Geomechanics Journal, 1998.

EXECUTIVE SUMMARY

GSNE Services Pty Ltd ("GSNE Services") was appointed by Prosper 5-9 Cowan Road St Ives Pty Limited (the "client") to undertake a Geotechnical Site Investigation ("GSI") within the property located at 5-9 Cowan Road, St Ives NSW (the "site").

The proposed works include demolition of existing structures, site preparation works, excavation and construction of the building and associated landscaping works. Specifically, the SSDA seeks development consent for:

- Demolition of the existing row of 10 attached townhouses at the site;
- Construction of an 9-storey residential flat building comprising:
    - 74 new dwellings (62 market residential units and 12 affordable housing units)
    - 3 basement levels for car parking
    - Communal open space at Ground Level and Level 7
- landscaping; and
- associated site works.

A site investigation was requested by the Client to accompany a detailed State Significant Development Application (SSDA) for a residential development (including in-fill affordable housing) at 5-9 Cowan Road, St Ives within the Ku-ring-gai Local Government Area (LGA).

This report concludes that the proposed mixed-use development is suitable and warrants approval subject to the implementation of the following mitigation measures pre-construction and during construction.

- Dilapidation surveys of adjacent properties and infrastructure.
- Preparation of a geotechnical monitoring plan (GMP) to satisfy RMS requirements.
- Inclinometer installation and monitoring during construction to satisfy RMS/Rail Corp
- requirements (RMS to confirm if this is required).
- Temporary working platform assessment.
- Footing and shoring pile inspections during construction.

1. INTRODUCTION

GSNE Services Pty Ltd ("GSNE Services") was appointed by Prosper 5-9 Cowan Road St Ives Pty Limited (the "client") to undertake a Geotechnical Site Investigation ("GSI") within the property located at 5-9 Cowan Road, St Ives NSW (the "site").

The location of the property is presented in Figure 1 of Appendix B.

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This report has been prepared to address the Secretary's Environmental Assessment Requirements (SEARs) issued for the project (SSD-88948458) on 25 July 2025, in particular Section 12 - Ground and Groundwater Conditions.

The site investigation was carried out on 11th, 12th & 16th June 2025 and was followed by geotechnical interpretation, assessment, and preparation of a geotechnical report.

The purpose of the investigation was to assess the ground conditions and feasibility of the site from a geotechnical perspective for the proposed eight-storey dwelling with three level basement carparking and storage. The investigation included assessment of the site's existing geotechnical conditions to provide general recommendations for the design and construction of the proposed development.

This report presents the results of the geotechnical site investigation, laboratory testing, interpretation, and an assessment of the site's existing geotechnical conditions as a basis to provide recommendations for the design and construction of ground structures for the proposed development.

To assist in reading the report, reference should be made to the "Important Information about Your Geotechnical Report" attached as Appendix A.

2. AVAILABLE INFORMATION

Before preparing this report, the following information was made available to or was referred to by GSNE:

- Survey Report, by Rygate & Company Pty Ltd, drawing title: Plan of levels and details at Nos 5-9 Cowan Road, Ref no:80743, Plan No.80743-D.DWG, Date of Survey 16 April 2025.
- Architectural drawings prepared by PBD Architects, project No.2518, Issue P5, dated 25th August 2025.

3. SCOPE OF WORK

Following the brief, fieldwork for the geotechnical site investigation was carried out by an Experienced Geotechnical Professional from GSNE, following in general the guidelines provided in Australian Standard AS 1726-2017 (Reference 1) and comprised the following:

- Collate and review Dial-Before-You-Dig (DBYD) plans.
- A site walk-over inspection by a Geotechnical Engineer in order to determine the overall surface conditions and to identify relevant site features.
- Review of DBYD plans and service locating carried out using electromagnetic detection equipment to ensure that the investigation locations are free from underground utilities.
- GSNE proposed machine drilling of three (3) boreholes, two boreholes at the rear side of the site and one borehole adjacent to Cowan Roadside, with each borehole including augering and rock coring.
- Standard Penetrometer Testing (SPT) was carried out in each of the boreholes within the soils at nominal 1.5m, 3.0m, 4.5m and/or 6m depth intervals to assist with the determination of the in-situ conditions.
- The approximate locations of the boreholes completed during the site investigation are shown on “Figure 1 – Borehole Locations”, attached in Appendix B
- Soil and rock logged in accordance with AS1726-2017 Geotechnical Investigations.
- Recovered soil samples sent to NATA certified laboratories for Soil Salinity, Aggressivity and Reactivity tests.
- Rock cores placed in boxes, logged, photographed and taken to our laboratory for point load strength testing.
- Three groundwater wells were installed, and GSNE will measure groundwater levels over a four-week period to establish the groundwater level.

Based on the results of the site investigation and laboratory testing, GSNE carried out a geotechnical interpretation and assessment of the main potential geotechnical issues that may be associated with the proposed development. This geotechnical report was prepared to summarise the results of the geotechnical site investigation, interpretation, assessment, and recommendation.

4. SITE DESCRIPTION

The site is located at 5-9 Cowan Road, St Ives, within the Ku-ring-gai Local Government Area, and is legally described as SP30097. The site has an area of approximately 3,467.7sqm and is rectangular in shape.

The site currently contains a single row of ten, two-storey attached townhouses. The site is defined by large mature trees along the northern, eastern and western boundaries. Vehicular access to the site is provided at the southern boundary of the site from Cowan Road. The site is relatively flat.

The site adjoins St Ives Shopping Village to the north and east. Existing residential development (No. 3 Cowan Road) and St Ives Christ Church border the site to the south. To the west, two storey detached houses are located along Cowan Road.

The site is located 800-metres east of Cowan Creek which is separated from the site by Pymble Golf Club. The site is also located within 105-metres of Emerald Fitness Centre, 245-metres from St Ives Village Green, and 210-metres from St Ives Playground. The building heights in the immediate locality are generally single to two-storeys, with increased heights of up to 5-storeys on Mona Vale Road, opposite St Ives Christ Church. The location of the property and borehole locations are presented in Figure 1 of Appendix B

No surface standing water was observed.

5. PROPOSED DEVELOPMENT

Based on the information provided by the client and the architectural drawings, we understand that the proposed development will comprise:

- Demolition of the existing row of 10 attached townhouses at the site;
- Construction of an 9-storey residential flat building comprising:
    - 74 new dwellings (62 market residential units and 12 affordable housing units)
    - 3 basement levels for car parking
    - Communal open space at Ground Level and Level 7
- landscaping; and
- associated site works.

The proposal also incorporates 15% of the total gross floor area for affordable housing and seeks to utilise the incentive controls under Chapter 2, Part 2, Division 1, Section 16 of State Environmental Planning Policy (Housing) 2021 (Housing SEPP) to achieve 30% additional building height and 30% additional floor space ratio (FSR).

6. SUBSURFACE CONDITIONS

6.1 Geology

Reference to the Sydney 1:100,000 Geological Series Sheet 9130 Edition 1, dated 1983, by the Geological Survey of New South Wales, Department of Mineral Resources, indicates the site is underlain by Wianamatta Group of Ashfield Shale (Rwa) comprising black to dark grey shale, and laminite.

The assessment of the subsurface materials observed and discussed in Section 6.2, is consistent with the published geology, (Rwa) encountered at the greatest depths reached.

6.2 Ground Profile

The subsoil conditions encountered within the boreholes are summarised in Table 1 and are described in detail in the attached engineering borehole logs, core photographs, point load test, and laboratory test results (i.e. Appendices C to E). The ground excavation characteristics and related design purposes should be according to the borehole logs and specific test results.

In general terms, the ground profile comprises:

1. Topsoil / Fill materials.
2. Soil comprising generally Silty CLAY.
3. Extremely to highly weathered Shale.
4. Medium Strength Shale Class III.

Geotechnical ground model in more detail is shown in Table 1.

Table 1. Geotechnical Model - Summary of Subsurface Conditions (depth)

Unit	Description	BH1(1)	BH2(1)	BH3(1)
Surface levels (m AHD) approximately		172.0	171.0	171.0
FILL / TOPSOIL	Silty Clay with sand, grey, brown	0.0-1.5	0.0-1.2	0.0-0.5
Residual Soil	Silty CLAY, medium to high plasticity, grey, mottled orange, Stiff to Very Stiff, moist	1.5-4.5	1.2-4.5	0.5-3.5
	Silty CLAY, high plasticity, grey, hard, moist	4.5-10	4.5-7.7	3.5-7.5
	Extremely weathered material (shale), pale grey, orange, moist. Soil strength (Hard) to extremely low estimated strength.	10.0-12.7	-	7.5-10.0
Bedrock (2)	SHALE, dark grey extremely weathered, assessed Class V SHALE[1], Very Low Strength	-	-	10.0-11.3
	SHALE, grey, brown with pale grey laminations, developed horizontal beddings, highly weathered assessed Class IV SHALE[1], Low Strength	-	7.7-9.5	-
	SHALE, dark grey with pale grey laminations, moderately weathered horizontal beddings, thinly laminated to laminated, assessed bands of interspersed Class III SHALE[1], Medium Strength	12.7-15.0	9.5-12.15	11.3-13.07

6.3 Groundwater

Groundwater was not encountered during auger boring in the boreholes. Water level measurement was not possible during core drilling in the rock due to the appearance of water required for coring.

Groundwater monitoring wells were installed in each of the three boreholes drilled, those being BH1, BH2 and BH3.

Natural groundwater flows may be in the form of minor seepage through natural joints and defects in the bedrock. After heavy rain, groundwater may be present in the fill due to infiltration from the surface. It should be noted that groundwater levels may be subject to seasonal and daily fluctuations influenced by factors like rainfall and the future development of the surrounding properties.

Groundwater levels were measured in the installed groundwater monitoring wells (see Table 2 below).

Table 2. Standing Groundwater Levels

Borehole/ well	Date and time	Level (m bgl)	Surface Level (m AHD)	Level (m AHD)
BH1/W1	27.06.2025	8.5 & 6.8	172	163.5/165.2
BH2/W2	&	7.9 & 8.2	171	163.1/162.8
BH3/W3	15.07.2025	7.5 & 5.7	171	163.5/165.3

6.4 Laboratory Testing

Recovered soil samples from the site were submitted to the following laboratories:

- SGS Environmental for soil chemical analysis.
- GSNE Services for point load testing for rock core samples.
- Aargus Laboratories for Atterberg testing.

These tests included:

- Chemical testing (Salinity, pH, Chloride (Cl^-), sulphates (SO_4^{2-}), and electrical conductivity) to assess soil salinity and aggressively towards buried concrete and steel piles or other structures.
- Point Load Strength Index (PLSI) testing on rock core samples from each borehole (total of 18 samples from all boreholes) for rock substance strength (Is_{50}).
- Atterberg's testing on two samples to assess soil reactivity

6.5 Soil Salinity and Aggressivity Test Results

Soil samples recovered from the boreholes were tested for salinity, electrical conductivity (EC), pH, chloride (Cl-), and Sulphate (S04) content.

The results are presented in Table 3, with the details attached in Appendix D. Results are assessed in conjunction with the exposure classification for soil aggressive levels for buried concrete and steel elements, following AS 2159-2009.

Table 3. Soil Salinity and Aggressivity Test Results

Borehole	Depth (m) bgl	pH	Conductivity (µS/cm)	Sulphate (SO_4) (mg/kg or ppm)	Chloride (CL^-) (mg/kg or ppm)	Salinity Condition
BH1	0.4-0.5	5.8	27	49	8.3	Non saline
BH1	2.5-2.6	4.5	50	72	14	Non saline
BH2	1.2-1.3	4.8	66	88	25	Non saline
BH2	5.4-5.5	4.6	53	80	17	Non saline
BH3	0.4-0.5	4.2	46	60	18	Non saline
BH3	1.4-1.5	4.5	52	69	22	Non saline

The above test results indicate that the site is non saline, non-aggressive to steel piles and mild-aggressive for concrete piles.

6.6 Exposure Classification

An Exposure classification of A1 for Concrete in Saline soils, and an Exposure classification of A2 for Concrete in Sulphate and Chloride soils

6.7 Point Load Strength Index Test Results

The point load test results (Is_{50}) range from 0.07-0.58, corresponding to unconfined compressive strength values of 1.4 to 11.6 MPa, using a multiplication factor of twenty. The details of the results are summarised in Appendix E.

6.8 Atterberg's test Results

Soil samples recovered from the boreholes were sent to NATA accredited laboratory at Tuggerah, Atterberg's test results are presented in Table 4.

Table 4 .Atterberg test results:

Borehole	Depth(m)	Liquid Limit (%)	Plastic Limit (%)	Linear Shrinkage (%)
BH1	4.0-4.1	58	21	14.5
BH2	2.4-2.5	62	22	14.0

The above results indicate that the site contains high plasticity soils.

7. GEOTECHNICAL ASSESSMENT

7.1 General

Based on the ground conditions encountered during the investigation, it was found that filling material varied between 0.5m to 1.5m BGL, underlain by residual Silty CLAY, then, extremely to highly weathered bedrock.

Key geotechnical constraints to the development include excavation conditions, groundwater control (during construction and long-term), temporary shoring, permanent retaining, foundation conditions, and hazards related to slope instability risk. Recommendations for the design and construction of the development are provided in the following sections.

7.2 Site Lot Classification

After considering the area geology, the soil profile encountered in the bores, the site is classified as CLASS 'P' with respect to foundation construction (Australian Standard 2870-2011 Residential Slabs and Footings).

However, site classification H1 can be used if the excavation is continued into the natural ground and fill material is removed prior to placement of the footing, Class H1 indicates that the soil is highly reactive clay site which may experience very high ground movement from moisture changes.

It has been estimated that the Characteristic Surface Movement (ys) of the underlying natural soil material will be in the range of 40-60mm.

7.3 Excavation Conditions

Excavation is expected to be through fill materials, then residual soils and shale bedrock of variable strength. Excavation within the soils and extremely low to low strength bedrock is expected to be readily achieved using a large hydraulic excavator down to the level of medium strength bedrock. However, localised use of rock breaking equipment or ripping may be required if and where high strength bands are encountered.

Excavation in medium strength rock will require the use of heavy ripping and/or hydraulic rock hammers. Excavation for foundations or trenches in this strength of rock would require the use of hydraulic hammers and possibly a rock saw. Both noise and vibration would be generated by any excavation work within these bedrock materials.

Where dust is likely to be a nuisance, suitable screens or barricades may be adopted during demolition, excavation and building works. Water sprays may also be used to dampen down the surface and reduce dust emission.

The rock classification system in Table 1 above is intended for use in the design of foundations and should not be used to directly assess the rock excavation characteristics. Contractors should refer to the engineering logs, core photographs, and point load test results when assessing the suitability of their excavation equipment.

7.4 Vibration Control

Consideration should be given to a vibration monitoring plan to monitor the potential vibration effects of demolition works, during piling and excavation on existing buildings within adjoining properties, and roads along the site boundary.

Recommended Maximum Peak Particle Velocity (PPV) for different types of buildings or structures is summarised in Table 5. Induced vibrations in structures adjacent to the excavation should not be exceeded.

Table 5. Recommended Maximum Peak Particle Velocity

Type of Building or Structure	Max. PPV (mm/sec)
Historical or structures in sensitive conditions	2
Residential and low-rise buildings	5
Brick or unreinforced structures in good condition	10
Commercial and industrial buildings or structures of reinforced concrete or steel construction.	25

It is recommended to carry out monitoring during excavation using a vibration monitoring instrument (seismograph) and alarm levels (being the appropriate PPV) selected in accordance with the type of structures present within the zone of influence of the proposed excavation.

If vibrations in adjacent structures exceed the above values or appear excessive during construction, excavation should cease, and the project Geotechnical Engineer should be contacted immediately for appropriate reviews.

It is recommended that a dilapidation survey of the existing buildings within adjoining properties is conducted. Preparation of dilapidation survey report and vibration monitoring plan together with vibration monitoring should constitute as “Hold Points”.

7.5 Batter Slopes

The following temporary batter slopes may be considered for areas where sufficient space exists between the proposed basement and the boundaries, dependent on the slope of the adjacent existing ground, and where any adjacent buildings (or infrastructure) are located outside a zone of influence obtained by drawing a line up at 45° from the toe of the proposed excavation.

Recommended maximum slopes for temporary batters are provided in Table 6 below.

Table 6. Recommended Batter Slopes (Temporary)

Material	Max. Batter Slope (H: V)
Natural Soils	1.5:1
Class V/IV Shale	1:1
Class III Shale	0.5:1

[1] Subject to assessment by a Geotechnical Professional Engineer to assess stability and provide recommendations as required.

Where batter slopes are not considered appropriate, temporary shoring should be provided. Shoring design should consider both short-term (construction) and permanent conditions as well as the presence of adjacent buildings and roads.

Where any adjacent buildings (or infrastructure) are located within a zone of influence obtained by drawing a line up at 45° from the toe of the proposed excavation, consideration should be given to inspection pits to determine the requirement for underpinning in any affected adjacent properties.

Shoring wall will be required around the perimeter of the site, the final basement structure should incorporate a watertight shoring/retaining wall system around the basement perimeter.

Based on the ground conditions encountered and the requirements of the proposed development, consideration may be given to contiguous pile wall. The use of contiguous pile walls allows a small gap between piles which could allow groundwater inflow during excavation. The use of strip drains behind the piles and shotcrete in weak areas susceptible to inflow during excavation, may limit the amount of groundwater ingress but may be limited in its effectiveness if inflow rates are high.

All vertical drains should be connected to a perimeter drain provided at the toe of the final excavation, which should discharge to the site stormwater system to provide long term drainage behind excavation walls.

For the maximum retained height being considered, a temporary anchorage system is likely to be required to provide the required lateral support during construction. Where two or more rows of anchors are required to support the shoring due to increased retained height or where significant lateral movements cannot be tolerated (e.g. due to adjacent infrastructure), the shoring/basement wall should be designed as a braced structure.

Anchor designs should be based on allowing effective bonding to be developed behind an ‘active zone’ determined by drawing a line at 45° from the base of the wall to intersect the ground surface behind the excavated face. It is considered that basement floor slabs will provide permanent restraint to the retaining walls where these are incorporated into the permanent works. Anchors are therefore considered to be temporary but depending on the sensitivity of the adjacent infrastructure, it may be necessary to incorporate the temporary anchors into the permanent works to control deflections.

Anchor installation beyond the property boundaries will be subject to approval by owners of adjoining properties, and roads. Where an anchorage system is shown to be impractical, or limiting deflection of the shoring wall and adjacent assets is critical, then consideration of other temporary support options would be necessary.

These options include the following:

- Temporary solutions such as installation of props associated with staged excavation.
- Staged excavations and temporary partial berms in front of walls.
- Top-down construction where floor slabs and beams are constructed at the top of the shoring wall and at floor levels of the upper basement levels prior to excavation within the basement level underneath the floor slabs.

The shoring wall and anchors can be designed using the recommended parameters provided in Section 7.5 below.

As well as vibration monitoring outlined in Section 7.3, monitoring of shoring to ensure lateral movement is within tolerable limits should also be carried out adjacent to the existing buildings and road (RMS) infrastructure.

This should be carried out as part of a Geotechnical Monitoring Plan.

Detailed design of anchored or propped retaining walls should utilise commercial software packages such as Wallap, RS2 or Plaxis 2D/3D that can model the sequence of anchor installation and excavation to ensure deflections are within tolerable limits, and the effect of excavation on adjacent road. The design of retaining structures should also consider horizontal pressures due to surcharge loads from any adjacent infrastructure.

A dilapidation survey may be required prior to excavation for the existing buildings within the adjoining properties and the section of roads adjoining the site.

Detailed construction supervision, monitoring and inspections will be required during piling and subsequent bulk excavation and should be carried out by an experienced Geotechnical Engineer, in addition to inspection of the structural elements by the Project Structural Engineer. The inspections should constitute as “Hold Points”.

7.6 Earth Retaining Structures

Earth retaining structures should be designed to withstand the lateral earth pressure, hydrostatic pressure and earthquake load (if applicable) pressures, and the applied surcharge loads in their zone of influence, including existing structures, traffic and construction related activities.

For the design of flexible retaining structures, where some lateral movement is acceptable, it is recommended that the design be based on active lateral earth pressure. Should it be critical to limit the horizontal deformation of a retaining structure, use of an earth pressure coefficient "at rest" should be considered, such as the case when the shoring wall is in the final permanent state and is restrained by the concrete slab in its final state.

Recommended parameters for the design of earth retaining structures in the soils and rock horizons underlying the site are presented in Table 7. Parameters are from Bertuzzi and Pells 2002 paper.

Table 7. Geotechnical Design Parameters for Retaining Structures

Unit	Unit Weight Υ(kN/m^3)	Effective Cohesion *c'* (kPa)	Effective Internal Friction Angle Φ' (degrees)	Modulus of Elasticity $E_{s,h}$ (MPa)
Fill	17	2	22	5
Residual Silty Clay Stiff	19	5	26	15
Residual Silty Clay Very stiff to hard	20	8	26	30
Class V Shale	21	25	28	75
Class IV Shale	22	50	29	200
Class III Shale	23	100	33	300

Note: *In geotechnical analysis, clayey soils are often assumed to behave under undrained conditions in temporary works like shoring wall design, where pore water pressure has insufficient time to dissipate. This assumption allows the use of undrained shear strength parameters (such as Cu, the undrained cohesion) rather than effective stress parameters. However, it is still recommended to check the drained condition as well.*

Table 8 provides coefficients of lateral earth pressure for the soils and rock horizons encountered during the geotechnical site investigation. The coefficients provided are based on a horizontal ground surface and fully drained conditions.

Table 8. Coefficients of Lateral Earth Pressure

Unit	Coefficient of Active Lateral Earth Pressure Ka[(1)]	Coefficient of Lateral Earth Pressure at rest Ko[(1)]	Coefficient of Passive Lateral Earth Pressure Kp[(2)]
Fill	0.45	0.63	Ignore
Natural Clayey Soils	0.39	0.56	2.56
Class V/IV Shale	0.36	0.53	2.77
Class III Shale	0.31	0.47	3.0

(1) These values assume that some wall movement and relaxation of horizontal stress will occur due to the excavation. Actual in-situ K_0 values may be higher, particularly in the rock units. For Class II and III Shale, geotechnical inspection of the excavated faces may be required.

(2) Includes a reduction factor to the ultimate value of Kpa to consider strain incompatibility between active and passive pressure conditions. Parameters assume horizontal backfill and not back wall friction.

- If present, adverse jointing systems in the rock may result in higher active earth pressures than those outlined above. Potential areas of block or wedge failure should therefore be identified during construction and appropriate stabilization measures adopted.
- Coefficient of active and passive lateral earth pressure Ka and Kp, respectively, can be calculated using Rankine's or Coulomb's equations, as appropriate.
- Coefficient of lateral earth pressure at rest Ko, can be calculated using Jacky's equation.

The coefficients of lateral earth pressure should be verified by the project Structural Engineer prior to use in the design of retaining walls. Simplified calculations of lateral active (or at rest) and passive earth pressures can be carried out using Rankine's equation shown below:

$Pa = K\,\gamma\,H - 2c\sqrt{K}$ For calculation of Lateral Active or At Rest Earth Pressure

$Pp = K_p\,\gamma\,H + 2c\sqrt{K_p}$ For calculation of Passive Earth Pressure

Where:

- Pa = Active (or at rest) Earth Pressure (kN/m^2)
- Pp = Passive Earth Pressure (kN/m^2)
- γ = Bulk density (kN/m^3)
- K = Coefficient of Earth Pressure (Ka or Ko)
- K_p = Coefficient of Passive Earth Pressure
- H = Retained height (m)
- c = Effective Cohesion (kN/m^2)

If adopted, temporary anchors will require embedment in bedrock. Allowable bond stresses may be adopted for temporary anchors, as detailed in Table 9 below.

Table 9. Allowable Bond Stress for Temporary Anchors

Units	Allowable Bond Stress (KPa)
Natural Clayey Soils	10
Class IV Shale	100
Class III Shale	200

Anchors should undergo proof testing following installation. The anchors can be designed for the parameters recommended above providing:

- The bond (socket) length to be at least 3.0m.
- For the allowable bond stresses listed above, it is assumed that the boreholes for each anchor are bored using standard percussive techniques and are well cleaned to have a suitable socket roughness to achieve these allowable bond stresses.
- Anchors are proof tested to 1.3 times the design working load specified by the Structural Engineer, before they are locked off at working load. Anchor testing should constitute as a “Hold Point”.

7.7 Subgrade Preparation and Earthworks

The following general procedure is provided for site preparation of building platforms and pavements:

- Strip topsoil and remove any unsuitable material from site.
- Excavate residual soils and rock (if encountered) stockpiling for re-use as engineered fill or remove to spoil.
- Where Silty clay is exposed at formation level, the exposed surface should be treated, and moisture conditioned to within 2% of optimum moisture content (OMC) followed by proof rolling with a smooth drum roller. Soft or loose areas should be excavated and replaced with approved fill material.
- Where rock is exposed at footing level, it should be free of loose or softened material.

The suitability of imported materials for filling should be subject to the following criteria:

- The materials should be clean (i.e. free of contaminants, deleterious or organic material), free of inclusions of >120mm in size; high plasticity material and soft material be removed and suitably conditioned to meet the design assumptions where fill material is proposed to be used.
- Material with excessive moisture content should not be used without conditioning.
- The materials should satisfy the Australian Standard AS 3798-2007 (Reference 3).

The final surface levels of all cut and fill areas should be compacted to enable the subgrade to achieve adequate strength for the proposed building platforms.

For the fill construction, the recommended compaction targets should be the following:

- Moisture content of ±2% of OMC (Optimal Moisture Content).
- Minimum density ratio of 98% of the maximum dry density for the building platforms of the proposed dwellings.
- The loose thickness of layer should not exceed 300mm during the compaction.

Design and construction of earthworks should be carried out in accordance with Australian Standard AS 3798-2007 (Reference 3).

Inspections by the project Geotechnical Engineer will be required during earthworks, subgrade preparation and proof rolling. The inspections should constitute as “Hold Points”.

7.8 Foundations

7.8.1 Strip/Pad Footing System and Slab panels and internal beams

The footings for the proposed residential building with three basement levels will likely be established in Residual Soils/Shale (Class V/IV). The strip/pad footings for small/isolated structures may be found in the natural Silty Clay/Clay and penetrate through any fill material, tree roots and be found at least 100 mm into the recommended founding material. The allowable bearing capacities presented in Table 3 can be adopted for the design of the pad/strip footings and slab panels/internal beams for proposed structures at the site.

Table 10: Allowable Bearing Capacity for Pad/Strip Footings

Material	Allowable Bearing Capacity (kPa)
Silty Clay, Stiff	100
Silty Clay, Very Stiff to Hard	200-300

It should be noted that the soil profile may vary across the site. The foundation depths quoted in this report are measured from the surface during our testing and may vary accordingly if any filling or excavation works are carried out. It is recommended that a geotechnical engineer be engaged during footing excavation stage to confirm the founding depth and founding material for all units, particularly where footing design is based on Stiff to Very Stiff material at the site.

The Settlement of a footing is dependent on the load applied to the footing and the foundation conditions below the footing. All footings for the same structure should be founded on the strata of similar stiffness to minimize the risk of differential movements, with articulation provided where appropriate.

7.8.2 Bored Piles

It is recommended that all footings be found on consistent bedrock. Considering the likely loads imposed on the ground by the planned six-storey building with three basements, this could be achieved by pile foundations with piles founding on Class III. Other cases where piles may be required include the need to increase the resistance against lateral seismic and wind loads.

Design of shallow and pile foundations should be carried out in accordance with Australian Standards AS2870-2011 (Reference 4) and AS2159-2009 (Reference 5), respectively.

Table 11 provides geotechnical parameters recommended for design of shallow and piled foundations.

Table 11. Geotechnical Foundation Design Capacities

Unit	Allowable Capacity Values (kPa)		Ultimate Capacity Values	
	End Bearing Pressure[1] (kPa)	Shaft Adhesion Compression (Tension)[2]	End Bearing Pressure (MPa)	Shaft Adhesion Compression (Tension)[2] (kPa)
Fill	N/A[3]	N/A	N/A[3]	N/A
Residual Clay Soils (Stiff to Hard)	100	10 (5)	N/A	N/A
Class V Shale[4]	700	25 (15)	Max 2	75 (35)
Class IV Shale	1,000	100 (50)	Max 3	150 (75)
Class III Shale	2,500 [4]	135 (68)	7.5	400 (200)

[1] With a minimum embedment depth of 1.0m for deep foundations and 0.4m for shallow foundations.
[2] Clean rock socket of roughness of at least R2 category (refer to Pells et al (1998)), grooves of depth 1mm to 4mm and width greater than 5mm at spacing of 50mm to 200mm. Shaft Adhesion in Tension is 50% of Compression, applicable to piles only.
[3] N/A, Not Applicable, not recommended for the proposed building of this development.
[4] Rock classes based on the criteria in Pells et al (1998) paper "Foundations on Shale and Sandstone in the Sydney Region". Bearing capacity values are also from Pells et al. (1998).

Shaft adhesion may be applied to socketed piles adopted for foundations provided socket shaft lengths confirm to appropriate classes of Shale and accepted levels of shaft sidewall cleanliness and roughness. The rock socket sidewalls should be free of soil and crushed rock to the extent that natural rock is exposed over at least 80% of the socket sidewall. Shaft adhesion should be reduced or ignored within socket lengths that are smeared and fail to satisfy cleanliness requirements. Additional attention to cleanliness of socket sidewalls may be required where presence of clay seams and weathered bands is evident over socket lengths.

Where the piles penetrate soils that are susceptible to shrinkage and swelling, we recommend that the shaft adhesion be ignored in the zone of seasonal moisture variations due to the potential of shrinkage cracking.

Any groundwater or surface water run-off that has accumulated at bulk excavation level, should be removed prior to concrete pouring. Any loose debris and wet soils should also be removed from excavations.

An experienced Geotechnical Professional should review footing designs to ensure compliance with the recommendations in the geotechnical report and assess foundation excavations to ensure suitable materials of appropriate bearing capacity have been reached. The presence of water within foundation excavations may negate satisfactory examination of founding surfaces and certification of founding materials quality. Foundation inspections should only be undertaken under conditions satisfying WHS requirements.

Verification of the capacity of the shallow and pile foundations by inspections would be required and inspections should constitute “Hold Points”.

7.9 Groundwater Management

The results of the geotechnical site investigation indicate that natural groundwater levels may be present within this site in the form of seepage through natural defects in the underlying weathered bedrock, at the rock-soil interface, and potentially through defects in the residual soils. It is considered that groundwater levels will be within the bulk excavation level.

The actual quantity and rates of flow of seepage to be expected during excavation is unknown, and GSNE recommends undertaking inflow testing to assess ground permeability and inflow rates and volumes. It may be prudent to consider precautionary drainage measures in the design and construction of the proposed development.

Drainage measures could include the following:

- Strip drains or drainage materials are installed behind the shoring walls in conjunction with collection trenches or pipes and pits connected to the building stormwater system. A temporary storage tank and pump system may be required.
- Depending on the inflow rate during excavation, groundwater seepage and surface water run-off may be controlled by sump and pump methods during construction.
- Natural defects in the rock may be sealed with cement grout or any alternative suitable sealant to reduce seepage inflow.

Seasonal variations (or other causes) resulting in elevated groundwater levels (e.g. due to heavy rainfall, broken services, etc.) may increase seepage flows through soils and weathered bedrock during excavation or in the long term during the design life of the building.

To better understand the groundwater levels and reservoir of the site and the surrounding areas, GSNE recommends undertaking groundwater inflow testing to assess ground permeability at basement level and to assess potential groundwater inflow rates.

This will give an indication of the ground permeability, recharge of the water table and indicative flow rates and volumes of groundwater into the proposed excavation. This can be carried out using the groundwater wells previously installed.

With groundwater levels expected above the bulk excavation level, statutory bodies such as Water NSW may require tanking of the basement, and licensing for groundwater extraction during excavation and construction of the development.

7.10 Geotechnical Monitoring and Inspections

It is highly recommended that inclinometers to be installed, and monitoring be undertaken during the construction phase to assess the impact of the basement excavations on the adjacent road, and adjacent buildings.

Measurements would be taken at the following stages:

- Prior to excavation commencement as a baseline reading
- Immediately after installation of temporary retaining works
- After installation of each row anchors and props or struts
- During excavation at approximately 1.5m lift intervals
- Every 3rd day after excavating to the lowest basement level until the installation of basement slabs and permanent retaining structures.
- Immediately after the construction of permanent retaining walls; and,
- Immediately after backfilling of retaining walls.

These requirements and stages are stipulated by the NSW Government and RMS in the document 'RMS Technical Direction "Geotechnology" GTD 2020/001' dated 2nd July 2020.

The measurements should be reported to the site engineer and be compared with the allowable deflection values provided by the design engineer.

7.11 Contingency Plan

If the surveyed deflection/settlement and ground movement exceeds the acceptable limits, the following actions shall be carried out:

- The project Structural and Geotechnical consultant shall be notified immediately for further advice.
- Excavation operations may need to be ceased, adjacent areas that have settled shall be backfilled with spoil or other suitable material.
- Additional bracing shall be installed adjacent to areas of temporary or permanent shoring.

7.12 Site Earthquake Classification

The results of the geotechnical site investigation indicate the presence of fill and natural cohesive soils, underlain by Class IV/III Shale of low to medium strength.

In accordance with Australian Standard AS 1170.4-2007 (Reference 2) the site may be classified as a "Rock site" (Class B_e) for design of foundations and retaining walls embedded in the bed rock.

The Hazard Factor (Z) for Sydney in accordance with AS 1170.4-2007 is 0.08.

7.13 Further Geotechnical Input

Below is a summary of the additional work that should be carried out:

Pre-Construction

• Dilapidation surveys of adjacent properties and infrastructure.

• Preparation of a geotechnical monitoring plan (GMP) to satisfy RMS requirements.

During Construction

• Inclinometer installation and monitoring during construction to satisfy RMS/Rail Corp requirements (RMS to confirm if this is required).

• Temporary working platform assessment.

• Footing and shoring pile inspections during construction.

8. LIMITATIONS

The geotechnical assessment of the subsurface profile and geotechnical conditions within the proposed development area and the conclusions and recommendations presented in this report have been based on available information obtained during the work carried out by GSNE Services and in the provided documents listed in Section 2 of this report. Inferences about the nature and continuity of ground conditions away from and beyond the locations of field exploration tests are made but cannot be guaranteed.

It is recommended that ground conditions including subsurface and groundwater conditions, encountered during construction and excavation vary substantially from those presented within this report, GSNE Services, be contacted immediately for further advice and any necessary review of recommendations. GSNE Services does not accept any liability for site conditions not observed or accessible during the time of the investigation or inspection.

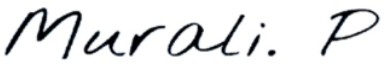
This report and associated documentation and the information herein have been prepared solely for the use of **Prosper 5-9 Cowan Road St Ives Pty Limited** and any reliance assumed by third parties on this report shall be at such parties' own risk. Any ensuing liability resulting from the use of the report by third parties cannot be transferred to GSNE Services, directors or employees.

Thank you for the opportunity to undertake this work. We would be pleased to provide further information on any aspects of this report.

For and on behalf of

GSNE Services Pty Ltd

Written by:



Murali Pamu

Senior Geotechnical Engineer

Reviewed By:

Nima Pirhadi
Ph.D., Civil/Geotech. Eng.,
CPEng, NER, PRE, RPEQ, MIE Aust.
Principal Geotechnical Engineer

Appendix A

Important Information about your Geotechnical Report

IMPORTANT INFORMATION ABOUT YOUR GEOTECHNICAL ENGINEERING REPORT

More construction problems are caused by site subsurface conditions than any other factor. As troublesome as subsurface problems can be, their frequency and extent have been lessened considerably in recent years, due in large measure to programs and publications of ASFE/ The Association of Engineering Firms Practicing in the Geosciences.

The following suggestions and observations are offered to help you reduce the geotechnical-related delays, cost-overruns and other costly headaches that can occur during a construction project.

A GEOTECHNICAL ENGINEERING REPORT IS BASED ON A UNIQUE SET OF PROJECT-SPECIFIC FACTORS

A geotechnical engineering report is based on a subsurface exploration plan designed to incorporate a unique set of project-specific factors. These typically include the general nature of the structure involved, its size and configuration, the location of the structure on the site and its orientation, physical concomitants such as access roads, parking lots, and underground utilities, and the level of additional risk which the client assumed by virtue of limitations imposed upon the exploratory program.

To help avoid costly problems, consult the geotechnical engineer to determine how any factors which change subsequent to the date of the report may affect its recommendations.

Unless your consulting geotechnical engineer indicates otherwise, *your geotechnical engineering report should NOT be used:*

- when the nature of the proposed structure is changed: for example, if an office building will be erected instead of a parking garage, or if a refrigerated warehouse will be built instead of an un-refrigerated one,
- when the size or configuration of the proposed structure is altered,
- when the location or orientation of the proposed structure is modified,
- when there is a change of ownership, or

for application to an adjacent site.

Geotechnical engineers cannot accept responsibility for problems which may develop if they are not consulted after factors considered in their report's development have changed.

Geotechnical reports present the results of investigations carried out for a specific project and usually for a specific phase of the project. The report may not be relevant for other phases of the project, or where project details change.

The advice herein relates only to this project and the scope of works provided by the Client.

Soil and Rock Descriptions are based on AS1726-1993, using visual and tactile assessment except at discrete locations where field and/or laboratory tests have been carried out. Refer to the attached terms and symbols sheets for definitions.

MOST GEOTECHNICAL "FINDINGS" ARE PROFESSIONAL ESTIMATES

Site exploration identifies actual subsurface conditions only at those points where samples are taken, when they are taken. Data derived through sampling and subsequent laboratory testing are extrapolated by geotechnical engineers who then render an opinion about overall subsurface conditions, their likely reaction to proposed construction activity, and appropriate foundation design. Even under optimal circumstances actual conditions may differ from those inferred to exist, because no geotechnical engineer, no matter how

qualified, and no subsurface exploration program, no matter how comprehensive, can reveal what is hidden by earth, rock and time. The actual interface between materials may be far more gradual or abrupt than a report indicates. Actual conditions in areas not sampled may differ from predictions. *Nothing can be done to prevent the unanticipated, but steps can be taken to help minimize their impact. For this reason, most experienced owners retain their geotechnical consultants through the construction stage,* to identify variances, conduct additional tests which may be needed, and to recommend solutions to problems encountered on site.

SUBSURFACE CONDITIONS CAN CHANGE

Subsurface conditions may be modified by constantly changing natural forces. Because a geotechnical engineering report is based on conditions which existed at the time of subsurface exploration, *construction decisions should not be based on a geotechnical engineering report whose adequacy may have been affected by time.* Speak with the geotechnical consultant to learn if additional tests are advisable before construction starts.

Construction operations at or adjacent to the site and natural events such as floods, earthquakes or groundwater fluctuations may also affect subsurface conditions, and thus, the continuing adequacy of a geotechnical report. The geotechnical engineer should be kept apprised of any such events, and should be consulted to determine if additional tests are necessary.

Subsurface conditions can change with time and can vary between test locations. Construction activities at or adjacent to the site and natural events such as flood, earthquake or groundwater fluctuations can also affect the subsurface conditions.

GEOTECHNICAL SERVICES ARE PERFORMED FOR SPECIFIC PURPOSES AND PERSONS

Geotechnical engineers' reports are prepared to meet the specific needs of specific individuals. A report prepared for a consulting civil engineer may not be adequate for a construction contractor, or even some other consulting civil engineer. Unless indicated otherwise, this report was prepared expressly for the client involved and expressly for purposes indicated by the client. Use by any other persons for any purpose, or by the client for a different purpose, may result in problems.
No individual other than the client should apply this report for its intended purpose without first conferring with the geotechnical engineer. No person should apply this report for any purpose other than that originally contemplated without first conferring with the geotechnical engineer.

A GEOTECHNICAL ENGINEERING REPORT IS SUBJECT TO MISINTERPRETATION

Costly problems can occur when other design professional develop their plans based on misinterpretations of a geotechnical engineering report. To help avoid these problems, the geotechnical engineer should be retained to work with other appropriate design professionals to explain relevant geotechnical findings and to review the adequacy of their plans and specifications relative to geotechnical issues.

The interpretation of the discussion and recommendations contained in this report are based on extrapolation/interpretation from data obtained at discrete locations. Actual conditions in areas not sampled or investigated may differ from those predicted

BORING LOGS SHOULD NOT BE SEPARATED FROM THE ENGINEERING REPORT

Final boring logs are developed by geotechnical engineers based upon their interpretation of field logs (assembled by site personnel) and laboratory evaluation of field samples. Only final boring logs customarily are included in geotechnical engineering reports. These logs should not under any circumstances be redrawn for inclusion in architectural or other design drawings because drafters may commit errors or omissions in the

transfer process. Although photographic reproduction eliminates this problem, it does nothing to minimize the possibility of contractors misinterpreting the logs during bid preparation. When this occurs, delays, disputes and unanticipated costs are the all-too-frequent result.

To minimise the likelihood of boring log misinterpretation, give contractors ready access in the complete geotechnical engineering report prepared or authorized for their use. Those who do not provide such access may proceed under mistaken impression that simply disclaiming responsibility for the accuracy of subsurface information always insulates them from attendant liability. Providing the best available information to contractors helps prevent costly construction problems and the adversarial attitudes which aggravate them to disproportionate scale.

READ RESPONSIBILITY CLAUSES CLOSELY

Because geotechnical engineering is based extensively on judgment and opinion, it is far less exact than other design disciplines. This situation has resulted in wholly unwarranted claims being lodged against geotechnical consultants. To help prevent this problem, geotechnical engineers have developed model clauses for use in written transmittals. These are not exculpatory clauses designed to foist geotechnical engineers' liabilities onto someone else. Rather, they are definitive clauses which identify where geotechnical engineers' responsibilities begin and end. Their use helps all parties involved recognize their individual responsibilities and take appropriate action. Some of these definitive clauses are likely to appear in your geotechnical engineering report, and you are encouraged to read them closely. Your geotechnical engineer will be pleased to give full and frank answers to your questions.

OTHER STEPS YOU CAN TAKE TO REDUCE RISK

Your consulting geotechnical engineer will be pleased to discuss other techniques which can be employed to mitigate risk. In addition, ASFE has developed a variety of materials which may be beneficial. Contact ASFE for a complimentary copy of its publications directory.

FURTHER GENERAL NOTES

Groundwater levels indicated on the logs are taken at the time of measurement and may not reflect the actual groundwater levels at those specific locations. It should be noted that groundwater levels can fluctuate due to seasonal and tidal activities.

Appendix B

Site Plan

SITE LOCALITY MAP

sw.gov.au/

PROJECT DETAILS		DRAWING DETAILS			
Project Title	Geotechnical Site Investigation	**Figure No.**	1	**Rev No.**	0
Project No.	GS9614-1A	**Scale**	As above	**Size**	A4
Client	GROWTHBUILT	**Drawn by**	DB	**Date**	11.06.2025
Site Address	5-9 Cowan Road, St. Ives NSW	**Approved by**	MP	**Date**	11.06.2025

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SOLUTIONS THAT LAST

Appendix C

Bore Logs

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SOLUTIONS THAT LAST

GEOTECHNICAL SITE INVESTIGATION LOG: BH1

PROJECT NO.:	GS9614-1A	**DRILLING DATE:**	11-06-2025	**TOTAL DEPTH:**	15
PROJECT NAME:	Geotechnical Site Investigation	**DRILLING CO.:**	BG Drilling Pty Ltd	**COORDINATES:**	
CLIENT:	GROWTHBUILT	**METHOD:**	Drill Rig		
ADDRESS:	5-9 Cowan Road, St Ives	**DRILLER:**		**GROUND ELEV.:**	
		LOGGED BY:	DB	**CHECKED BY:**	NP

Method	Soil Symbol	Depth Scale	Lithologic Description	SPT	Comments / Additional Notes
			Ground Surface at		
Auger (Solid-Stem)		0	**Fill** Silty sandy Clay, dark brown, moderately compacted	3, 3, 7 N=10	
		1	1.5 m **Residual** Silty clay, orange brown, medium to high plasticity, Stiff to Very Stiff	4, 6, 9 N=15	
		2			
		3		6, 11, 16 N=27	
		4	4.5 m **Residual** Silty clay, orange brown, medium to high plasticity, Hard	5, 15, 6R, Refusal	
		5			
		6			

Disclaimer:

Consistency
- VS = Very Soft
- S = Soft
- F = Firm
- St = Stiff
- VSt = Very Stiff
- H = Hard

Density Index
- VL = Very Loose
- L = Loose
- MD = Mediium Dense
- D = Dense
- VD = Very Dense

Samples
- B = Bulk
- D = Disturbed
- U50 = Undisturbed Sample (Retrieved in 50mm dia tube)
- N = S.P.T Values

Moisture
- D = Dry
- M = Moist
- W = Wet
- Wp = Plastic Limit
- Wl = Liquid Limit

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SOLUTIONS THAT LAST

GEOTECHNICAL SITE INVESTIGATION LOG: BH1

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ADDRESS:	5-9 Cowan Road, St Ives	**DRILLER:**		**GROUND ELEV.:**	
		LOGGED BY:	DB	**CHECKED BY:**	NP

Method	Soil Symbol	Depth Scale	Lithologic Description	SPT	Comments / Additional Notes
		6	**Residual** *(continued)* Silty clay, orange brown, medium to high plasticity, Hard	6, 12R Refusal	
		7			
				3, 12R Refusal	
		8	8.2 m		
			Residual Silty Clay with sand, dark brown, medium to high plasticity, Hard		
		9			
		10	10 m		
			Bedrock Shale, dark grey, extremely weathered, Soil strength Hard	6, 13, 16R Refusal	
		11			
		12			

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		LOGGED BY:	DB	**CHECKED BY:**	NP

Method	Soil Symbol	Depth Scale	Lithologic Description	SPT	Comments / Additional Notes
Auger (Solid-Stem)		12	**Bedrock** *(continued)* Shale, dark grey, extremely weathered, Soil strength Hard 12.7 m		Continued as cored borehole, Rock coring starts@12.5m
		13			
		14			
		15			
		16			
		17			
		18			

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GEOTECHNICAL SITE INVESTIGATION LOG:

BH1-Core Log

GSNE SERVICES PTY LTD

PROJECT NO.:	GS9614-1A	**DRILLING DATE:**	11-06-2025	**TOTAL DEPTH:**	15
PROJECT NAME:	Geotechnical Site Investigation	**DRILLING CO.:**	BG Drilling Pty Ltd	**COORDINATES:**	
CLIENT:	GROWTHBUILT	**METHOD:**	Drill Rig		
ADDRESS:	5-9 Cowan Road, St Ives	**DRILLER:**		**GROUND ELEV.:**	
		LOGGED BY:	DB	**CHECKED BY:**	NP

Depth Scale	Drilling Method	Drill Run Info: Run No.	RQD or (%)	TCR (%)	Fractures	Strength	Weathering	Graphic Log	Lithologic Description		Comments / Additional Notes
									Ground Surface at		
0											
1											
2											
3											
4											
5											

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GEOTECHNICAL SITE INVESTIGATION LOG:

BH1-Core Log

GSNE SERVICES PTY LTD

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Depth Scale	Drilling Method	Drill Run Info: Run No.	RQD or (%)	TCR (%)	Fractures	Strength	Weathering	Graphic Log	Lithologic Description		Comments / Additional Notes
5											
6											
7											
8											
9											
10											

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Depth Scale	Drilling Method	Drill Run Info: Run No.	RQD or (%)	TCR (%)	Fractures	Strength	Weathering	Graphic Log	Lithologic Description		Comments / Additional Notes
10											
11											
12	HQ3 Diamond Coring										Rock coring starts@12.5m
13		1	60	100		M	HW		Bedrock Shale, dark grey, Distinctly Weathered, Medium Strength		Is(50) Axial = 0.49MPa Is(50) Axial = 0.43MPa
14											Is(50) Axial = 0.26Mpa Is(50) Axial = 0.32MPa
15											Is(50) Axial = 0.29MPa

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- H = Hard

Density Index
- VL = Very Loose
- L = Loose
- MD = Mediium Dense
- D = Dense
- VD = Very Dense

Samples
- B = Bulk
- D = Disturbed
- U50 = Undisturbed Sample (Retrieved in 50mm dia tube)
- N = S.P.T Values

Moisture
- D = Dry
- M = Moist
- W = Wet
- Wp = Plastic Limit
- Wl = Liquid Limit

GEOTECHNICAL SITE INVESTIGATION LOG:

BH1-Core Log

GSNE SERVICES PTY LTD

PROJECT NO.:	GS9614-1A	**DRILLING DATE:**	11-06-2025	**TOTAL DEPTH:**	15
PROJECT NAME:	Geotechnical Site Investigation	**DRILLING CO.:**	BG Drilling Pty Ltd	**COORDINATES:**	
CLIENT:	GROWTHBUILT	**METHOD:**	Drill Rig		
ADDRESS:	5-9 Cowan Road, St Ives	**DRILLER:**		**GROUND ELEV.:**	
		LOGGED BY:	DB	**CHECKED BY:**	NP

Depth Scale	Drilling Method	Drill Run Info: Run No.	RQD or (%)	TCR (%)	Fractures	Strength	Weathering	Graphic Log	Lithologic Description		Comments / Additional Notes
15									Test Hole BH1-Core Log Terminated at 15 m		
16											
17											
18											
19											
20											

Disclaimer:

Consistency

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- VSt = Very Stiff
- H = Hard

Density Index

- VL = Very Loose
- L = Loose
- MD = Mediium Dense
- D = Dense
- VD = Very Dense

Samples

- B = Bulk
- D = Disturbed
- U50 = Undisturbed Sample (Retrieved in 50mm dia tube)
- N = S.P.T Values

Moisture

- D = Dry
- M = Moist
- W = Wet
- Wp = Plastic Limit
- Wl = Liquid Limit

GSNE SERVICES PTY LTD
SOLUTIONS THAT LAST

GEOTECHNICAL SITE INVESTIGATION LOG: BH2

PROJECT NO.:	GS9614-1A	**DRILLING DATE:**	12-06-2025	**TOTAL DEPTH:**	12.15
PROJECT NAME:	Geotechnical Site Investigation	**DRILLING CO.:**	BG Drilling Pty Ltd	**COORDINATES:**	
CLIENT:	GROWTHBUILT	**METHOD:**	Drill Rig		
ADDRESS:	5-9 Cowan Road, St Ives	**DRILLER:**		**GROUND ELEV.:**	
		LOGGED BY:	DB	**CHECKED BY:**	NP

Method	Soil Symbol	Depth Scale	Lithologic Description	SPT	Comments / Additional Notes
			Ground Surface at		
Auger (Solid-Stem)		0	**Fill** Silty snady Clay, brown, moderately compacted	4, 6, 5 N=11	
		1	1.2 m **Residual** Silty clay, orange brown, medium to high plasticity, Stiff	4, 6, 8 N=14	
		2	2.5 m Silty clay, light grey, medium to high plasticity, Very Stiff to Hard	3, 12, 14 N=26	
		3			
		4		7, 20, 30R Refusal	
		5	5.5 m **Residual** Silty Clay, grey, medium to high plasticity, Hard		
		6			

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Density Index
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- L = Loose
- MD = Mediium Dense
- D = Dense
- VD = Very Dense

Samples
- B = Bulk
- D = Disturbed
- U50 = Undisturbed Sample (Retrieved in 50mm dia tube)
- N = S.P.T Values

Moisture
- D = Dry
- M = Moist
- W = Wet
- Wp = Plastic Limit
- Wl = Liquid Limit

GSNE SERVICES PTY LTD
SOLUTIONS THAT LAST

GEOTECHNICAL SITE INVESTIGATION LOG: BH2

PROJECT NO.:	GS9614-1A	**DRILLING DATE:**	12-06-2025	**TOTAL DEPTH:**	12.15
PROJECT NAME:	Geotechnical Site Investigation	**DRILLING CO.:**	BG Drilling Pty Ltd	**COORDINATES:**	
CLIENT:	GROWTHBUILT	**METHOD:**	Drill Rig		
ADDRESS:	5-9 Cowan Road, St Ives	**DRILLER:**		**GROUND ELEV.:**	
		LOGGED BY:	DB	**CHECKED BY:**	NP

Method	Soil Symbol	Depth Scale	Lithologic Description	SPT	Comments / Additional Notes
Auger (Solid-Stem)		6	**Residual** *(continued)* Silty Clay, grey, medium to high plasticity, Hard	4, 2, 12R Refusal	
		7			
		7.7 m		7, 16R Refusal	Borehole continued as cored borehole,; Rock coring starts @7.7m
		8			
		9			
		10			
		11			
		12			

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Density Index
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- L = Loose
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- D = Dense
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Samples
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- D = Disturbed
- U50 = Undisturbed Sample (Retrieved in 50mm dia tube)
- N = S.P.T Values

Moisture
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- W = Wet
- Wp = Plastic Limit
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GEOTECHNICAL SITE INVESTIGATION LOG:

BH2-Core Log

GSNE SERVICES PTY LTD

PROJECT NO.:	GS9614-1A	**DRILLING DATE:**	12-06-2025	**TOTAL DEPTH:**	12.15
PROJECT NAME:	Geotechnical Site Investigation	**DRILLING CO.:**	BG Drilling Pty Ltd	**COORDINATES:**	
CLIENT:	GROWTHBUILT	**METHOD:**	Drill Rig		
ADDRESS:	5-9 Cowan Road, St Ives	**DRILLER:**		**GROUND ELEV.:**	
		LOGGED BY:	DB	**CHECKED BY:**	NP

Depth Scale	Drilling Method	Drill Run Info: Run No.	RQD or (%)	TCR (%)	Fractures	Strength	Weathering	Graphic Log	Lithologic Description		Comments / Additional Notes
									Ground Surface at		
0											
1											
2											
3											
4											
5											

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Density Index

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- L = Loose
- MD = Mediium Dense
- D = Dense
- VD = Very Dense

Samples

- B = Bulk
- D = Disturbed
- U50 = Undisturbed Sample (Retrieved in 50mm dia tube)
- N = S.P.T Values

Moisture

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- M = Moist
- W = Wet
- Wp = Plastic Limit
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GEOTECHNICAL SITE INVESTIGATION LOG:

BH2-Core Log

GSNE SERVICES PTY LTD

PROJECT NO.:	GS9614-1A	**DRILLING DATE:**	12-06-2025	**TOTAL DEPTH:**	12.15
PROJECT NAME:	Geotechnical Site Investigation	**DRILLING CO.:**	BG Drilling Pty Ltd	**COORDINATES:**	
CLIENT:	GROWTHBUILT	**METHOD:**	Drill Rig		
ADDRESS:	5-9 Cowan Road, St Ives	**DRILLER:**		**GROUND ELEV.:**	
		LOGGED BY:	DB	**CHECKED BY:**	NP

Depth Scale	Drilling Method	Drill Run Info: Run No.	RQD or (%)	TCR (%)	Fractures	Strength	Weathering	Graphic Log	Lithologic Description		Comments / Additional Notes
5											
6											
7											
8	HQ3 Diamond Coring	1	55	100		L	HW		Bedrock Shale, Highly weathered, grey, Low Strength		Rock coring starts@7.7m Is(50) Axial = 0.09MPa Is(50) Axial = 0.07MPa
9										9.5 m	
10		2	70	100		M	MW		Bedrock Shale, grey, Highly Weathered, Medium Strength		Is(50) Axial = 0.15MPa

Disclaimer:

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Density Index
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- L = Loose
- MD = Mediium Dense
- D = Dense
- VD = Very Dense

Samples
- B = Bulk
- D = Disturbed
- U50 = Undisturbed Sample (Retrieved in 50mm dia tube)
- N = S.P.T Values

Moisture
- D = Dry
- M = Moist
- W = Wet
- Wp = Plastic Limit
- Wl = Liquid Limit

GEOTECHNICAL SITE INVESTIGATION LOG:

BH2-Core Log

GSNE SERVICES PTY LTD

PROJECT NO.:	GS9614-1A	**DRILLING DATE:**	12-06-2025	**TOTAL DEPTH:**	12.15
PROJECT NAME:	Geotechnical Site Investigation	**DRILLING CO.:**	BG Drilling Pty Ltd	**COORDINATES:**	
CLIENT:	GROWTHBUILT	**METHOD:**	Drill Rig		
ADDRESS:	5-9 Cowan Road, St Ives	**DRILLER:**		**GROUND ELEV.:**	
		LOGGED BY:	DB	**CHECKED BY:**	NP

Depth Scale	Drilling Method	Drill Run Info: Run No.	RQD or (%)	TCR (%)	Fractures	Strength	Weathering	Graphic Log	Lithologic Description		Comments / Additional Notes
10	HQ3 Diamond Coring	2	70	100		M	MW		Bedrock *(continued)* Shale, grey, Highly Weathered, Medium Strength		Is(50) Axial = 0.17MPa
11											Is(50) Axial = 0.20MPa
12									12.15 m		Is(50) Axial = 0.26MPa
13									Test Hole BH2-Core Log Terminated at 12.15 m		Is(50) Axial = 0.40MPa
14											
15											

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- L = Loose
- MD = Mediium Dense
- D = Dense
- VD = Very Dense

Samples
- B = Bulk
- D = Disturbed
- U50 = Undisturbed Sample (Retrieved in 50mm dia tube)
- N = S.P.T Values

Moisture
- D = Dry
- M = Moist
- W = Wet
- Wp = Plastic Limit
- Wl = Liquid Limit

GSNE SERVICES PTY LTD
SOLUTIONS THAT LAST

GEOTECHNICAL SITE INVESTIGATION LOG: BH3

PROJECT NO.:	GS9614-1A	**DRILLING DATE:**	12-06-2025	**TOTAL DEPTH:**	13.07
PROJECT NAME:	Geotechnical Site Investigation	**DRILLING CO.:**	BG Drilling Pty Ltd	**COORDINATES:**	
CLIENT:	GROWTHBUILT	**METHOD:**	Drill Rig		
ADDRESS:	5-9 Cowan Road, St Ives	**DRILLER:**		**GROUND ELEV.:**	
		LOGGED BY:	DB	**CHECKED BY:**	NP

Method	Soil Symbol	Depth Scale	Lithologic Description	SPT	Comments / Additional Notes
			Ground Surface at		
Auger (Solid-Stem)		0	**FILL** Silty Clay with sand, brown, moderately compacted	6, 7,12 N=19	
			0.5 m **Residual** Silty Clay, brown, medium to high plasticity, Stiff to Very Stiff	6,13,15 N=28	
		3		4,16,12R Refusal	
			3.5 m **Residual** Silty Clay, grey brown, medium to high plasticity, Hard	6,18,4R Refusal	
		6			

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Density Index
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- L = Loose
- MD = Mediium Dense
- D = Dense
- VD = Very Dense

Samples
- B = Bulk
- D = Disturbed
- U50 = Undisturbed Sample (Retrieved in 50mm dia tube)
- N = S.P.T Values

Moisture
- D = Dry
- M = Moist
- W = Wet
- Wp = Plastic Limit
- Wl = Liquid Limit

GSNE SERVICES PTY LTD
SOLUTIONS THAT LAST

GEOTECHNICAL SITE INVESTIGATION LOG: BH3

PROJECT NO.:	GS9614-1A	**DRILLING DATE:**	12-06-2025	**TOTAL DEPTH:**	13.07
PROJECT NAME:	Geotechnical Site Investigation	**DRILLING CO.:**	BG Drilling Pty Ltd	**COORDINATES:**	
CLIENT:	GROWTHBUILT	**METHOD:**	Drill Rig		
ADDRESS:	5-9 Cowan Road, St Ives	**DRILLER:**		**GROUND ELEV.:**	
		LOGGED BY:	DB	**CHECKED BY:**	NP

Method	Soil Symbol	Depth Scale	Lithologic Description	SPT	Comments / Additional Notes
Auger (Solid-Stem)		6	**Residual** *(continued)* Silty Clay, grey brown, medium to high plasticity, Hard	8R Refusal	
		7	7.5 m **Bedrock**	5,12,14R Refusal	
		8	SHALE, dark grey, Extremely Weathered, Very Low Strength		
		9		8R Refusal	
		10	10 m		Borehole continued as cored borehole
		11			
		12			

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- D = Dense
- VD = Very Dense

Samples
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- D = Disturbed
- U50 = Undisturbed Sample (Retrieved in 50mm dia tube)
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Moisture
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GEOTECHNICAL SITE INVESTIGATION LOG:

BH3 - Core

GSNE SERVICES PTY LTD

PROJECT NO.:	GS9614-1A	**DRILLING DATE:**	12-06-2025	**TOTAL DEPTH:**	13.07
PROJECT NAME:	Geotechnical Site Investigation	**DRILLING CO.:**	BG Drilling Pty Ltd	**COORDINATES:**	
CLIENT:	GROWTHBUILT	**METHOD:**	Drill Rig		
ADDRESS:	5-9 Cowan Road, St Ives	**DRILLER:**		**GROUND ELEV.:**	
		LOGGED BY:	DB	**CHECKED BY:**	NP

Depth Scale	Drilling Method	Drill Run Info: Run No.	RQD or (%)	TCR (%)	Fractures	Strength	Weathering	Graphic Log	Lithologic Description		Comments / Additional Notes
									Ground Surface at		
0											
1											
2											
3											
4											
5											

Disclaimer:

Consistency

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- St = Stiff
- VSt = Very Stiff
- H = Hard

Density Index

- VL = Very Loose
- L = Loose
- MD = Mediium Dense
- D = Dense
- VD = Very Dense

Samples

- B = Bulk
- D = Disturbed
- U50 = Undisturbed Sample (Retrieved in 50mm dia tube)
- N = S.P.T Values

Moisture

- D = Dry
- M = Moist
- W = Wet
- Wp = Plastic Limit
- Wl = Liquid Limit

GEOTECHNICAL SITE INVESTIGATION LOG:

BH3 - Core

GSNE SERVICES PTY LTD

PROJECT NO.:	GS9614-1A	**DRILLING DATE:**	12-06-2025	**TOTAL DEPTH:**	13.07
PROJECT NAME:	Geotechnical Site Investigation	**DRILLING CO.:**	BG Drilling Pty Ltd	**COORDINATES:**	
CLIENT:	GROWTHBUILT	**METHOD:**	Drill Rig		
ADDRESS:	5-9 Cowan Road, St Ives	**DRILLER:**		**GROUND ELEV.:**	
		LOGGED BY:	DB	**CHECKED BY:**	NP

Depth Scale	Drilling Method	Drill Run Info: Run No.	RQD or (%)	TCR (%)	Fractures	Strength	Weathering	Graphic Log	Lithologic Description		Comments / Additional Notes
5											
6											
7											
8											
9											
10											

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- N = S.P.T Values

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GEOTECHNICAL SITE INVESTIGATION LOG:

BH3 - Core

GSNE SERVICES PTY LTD

PROJECT NO.:	GS9614-1A	**DRILLING DATE:**	12-06-2025	**TOTAL DEPTH:**	13.07
PROJECT NAME:	Geotechnical Site Investigation	**DRILLING CO.:**	BG Drilling Pty Ltd	**COORDINATES:**	
CLIENT:	GROWTHBUILT	**METHOD:**	Drill Rig		
ADDRESS:	5-9 Cowan Road, St Ives	**DRILLER:**		**GROUND ELEV.:**	
		LOGGED BY:	DB	**CHECKED BY:**	NP

Depth Scale	Drilling Method	Drill Run Info: Run No.	RQD or (%)	TCR (%)	Fractures	Strength	Weathering	Graphic Log	Lithologic Description		Comments / Additional Notes
10	HQ3 Diamond Coring								Bedrock SHALE, dark grey,extremely weathered, very low strength		Rock coring starts@10m; 10.0m-10.3m - No Core
11									11.3 m		
									Bedrock SHALE, dark grey, moderately weathered, medium strength		Is(50) Axial = 0.36 Is(50) Axial = 0.58
12		1	65	95		M	MW				Is(50) Axial = 0.54
											Is(50) Axial = 0.35
13									13.07 m		Is(50) Axial = 0.33
									Test Hole BH3 - Core Terminated at 13.07 m		
14											
15											

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Samples
- B = Bulk
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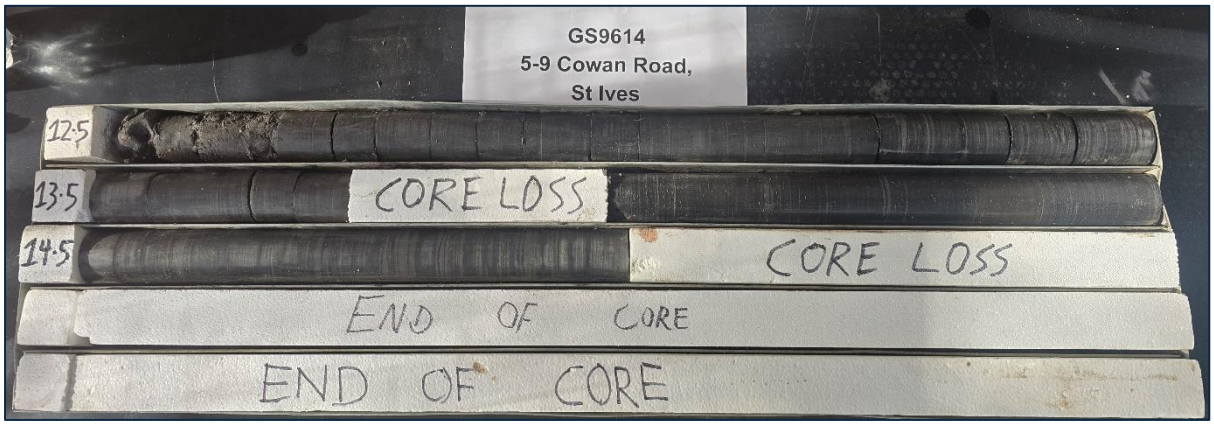
- U50 = Undisturbed Sample (Retrieved in 50mm dia tube)
- N = S.P.T Values

Moisture
- D = Dry
- M = Moist
- W = Wet
- Wp = Plastic Limit
- Wl = Liquid Limit

Site Address: 5-9 Cowan Road, St Ives, NSW, 2075 Job No:GS9614-1A

Rock Core Photos

BH1 (12.5m-15.0m)



BH2 (7.7m-12.15m)

BH3 (10.3m-13.1m)

Appendix D

Laboratory Results

ANALYTICAL REPORT

Accreditation No. 2562

CLIENT DETAILS

Contact	Mark Kelly
Client	AARGUS ENGINEERING TRUST
Address	PO BOX 398 DRUMMOYNE NSW 1470
Telephone	1300137038
Facsimile	(Not specified)
Email	mark.kelly@aargus.net
Project	**GS9614-1A 5-9 Cown Rd, St. Ives Geotechn**
Order Number	**GS9614-1A**
Samples	6

LABORATORY DETAILS

Manager	Shane McDermott
Laboratory	SGS Alexandria Environmental
Address	Unit 16, 33 Maddox St Alexandria NSW 2015
Telephone	+61 2 8594 0400
Facsimile	+61 2 8594 0499
Email	au.environmental.sydney@sgs.com
SGS Reference	**SE285514 R0**
Date Received	1/7/2025
Date Reported	8/7/2025

COMMENTS

Accredited for compliance with ISO/IEC 17025 - Testing. NATA accredited laboratory 2562(4354).

SIGNATORIES

Dong LIANG
Metals/Inorganics Team Leader

Shane MCDERMOTT
Laboratory Manager

Ying Ying ZHANG
Laboratory Technician

pH in soil (1:5) [AN101] Tested: 3/7/2025

PARAMETER	UOM	LOR	BH1 0.4-0.5 SOIL - 11/6/2025 SE285514.001	BH1 2.5-2.6 SOIL - 11/6/2025 SE285514.002	BH2 1.2-1.3 SOIL - 11/6/2025 SE285514.003	BH2 5.4-5.5 SOIL - 11/6/2025 SE285514.004	BH3 0.4-0.5 SOIL - 11/6/2025 SE285514.005
pH	pH Units	0.1	**5.8**	**4.5**	**4.8**	**4.6**	**4.2**

PARAMETER	UOM	LOR	BH3 1.4-1.5 SOIL - 11/6/2025 SE285514.006
pH	pH Units	0.1	**4.5**

Conductivity and TDS by Calculation - Soil [AN106] Tested: 3/7/2025

PARAMETER	UOM	LOR	BH1 0.4-0.5 SOIL - 11/6/2025 SE285514.001	BH1 2.5-2.6 SOIL - 11/6/2025 SE285514.002	BH2 1.2-1.3 SOIL - 11/6/2025 SE285514.003	BH2 5.4-5.5 SOIL - 11/6/2025 SE285514.004	BH3 0.4-0.5 SOIL - 11/6/2025 SE285514.005
Conductivity of Extract (1:5 as received)	µS/cm	1	27	50	66	53	46
Salinity (by calculation)*	mg/kg	5	110	190	260	200	170

PARAMETER	UOM	LOR	BH3 1.4-1.5 SOIL - 11/6/2025 SE285514.006
Conductivity of Extract (1:5 as received)	µS/cm	1	52
Salinity (by calculation)*	mg/kg	5	200

Soluble Anions (1:5) in Soil/Solids by Ion Chromatography [AN245] Tested: 3/7/2025

PARAMETER	UOM	LOR	BH1 0.4-0.5 SOIL - 11/6/2025 SE285514.001	BH1 2.5-2.6 SOIL - 11/6/2025 SE285514.002	BH2 1.2-1.3 SOIL - 11/6/2025 SE285514.003	BH2 5.4-5.5 SOIL - 11/6/2025 SE285514.004	BH3 0.4-0.5 SOIL - 11/6/2025 SE285514.005
Chloride	mg/kg	0.25	8.3	14	25	17	18
Sulfate	mg/kg	5	49	72	88	80	60

PARAMETER	UOM	LOR	BH3 1.4-1.5 SOIL - 11/6/2025 SE285514.006
Chloride	mg/kg	0.25	22
Sulfate	mg/kg	5	69

Moisture Content [AN002] Tested: 3/7/2025

PARAMETER	UOM	LOR	BH1 0.4-0.5 SOIL - 11/6/2025 SE285514.001	BH1 2.5-2.6 SOIL - 11/6/2025 SE285514.002	BH2 1.2-1.3 SOIL - 11/6/2025 SE285514.003	BH2 5.4-5.5 SOIL - 11/6/2025 SE285514.004	BH3 0.4-0.5 SOIL - 11/6/2025 SE285514.005
% Moisture	%w/w	1	**19.0**	**14.3**	**17.6**	**14.5**	**13.6**

PARAMETER	UOM	LOR	BH3 1.4-1.5 SOIL - 11/6/2025 SE285514.006
% Moisture	%w/w	1	**13.0**

METHOD	METHODOLOGY SUMMARY
AN002	The test is carried out by drying (at either 40°C or 105°C) a known mass of sample in a weighed evaporating basin. After fully dry the sample is re-weighed. Samples such as sludge and sediment having high percentages of moisture will take some time in a drying oven for complete removal of water.
AN101	pH in Soil Sludge Sediment and Water: pH is measured electrometrically using a combination electrode and is calibrated against 3 buffers purchased commercially. For soils, sediments and sludges, an extract with water (or 0.01M CaCl2) is made at a ratio of 1:5 and the pH determined and reported on the extract. Reference APHA 4500-H+.
AN106	Conductivity and TDS by Calculation: Conductivity is measured by meter with temperature compensation and is calibrated against a standard solution of potassium chloride. Conductivity is generally reported as µmhos /cm or µS/cm @ 25°C. For soils, an extract of as received sample with water is made at a ratio of 1:5 and the EC determined and reported on the extract, or calculated back to the as-received sample. Salinity can be estimated from conductivity using a conversion factor, which for natural waters, is in the range 0.55 to 0.75. Reference APHA 2510 B.
AN245	Anions by Ion Chromatography: A water sample is injected into an eluent stream that passes through the ion chromatographic system where the anions of interest ie Br, Cl, NO2, NO3 and SO4 are separated on their relative affinities for the active sites on the column packing material. Changes to the conductivity and the UV-visible absorbance of the eluent enable identification and quantitation of the anions based on their retention time and peak height or area. APHA 4110 B

FOOTNOTES

*	NATA accreditation does not cover the performance of this service.	-	Not analysed.	UOM	Unit of Measure.
**	Indicative data, theoretical holding time exceeded.	NVL	Not validated.	LOR	Limit of Reporting.
***	Indicates that both * and ** apply.	IS	Insufficient sample for analysis.	↑↓	Raised/lowered Limit of Reporting.
		LNR	Sample listed, but not received.		

Unless it is reported that sampling has been performed by SGS, the samples have been analysed as received.
Solid samples expressed on a dry weight basis.

Where "Total" analyte groups are reported (for example, Total PAHs, Total OC Pesticides) the total will be calculated as the sum of the individual analytes, with those analytes that are reported as <LOR being assumed to be zero. The summed (Total) limit of reporting is calculated by summing the individual analyte LORs and dividing by two. For example, where 16 individual analytes are being summed and each has an LOR of 0.1 mg/kg, the "Totals" LOR will be 1.6 / 2 (0.8 mg/kg). Where only 2 analytes are being summed, the " Total" LOR will be the sum of those two LORs.

Some totals may not appear to add up because the total is rounded after adding up the raw values.

If reported, measurement uncertainty follow the ± sign after the analytical result and is expressed as the expanded uncertainty calculated using a coverage factor of 2, providing a level of confidence of approximately 95%, unless stated otherwise in the comments section of this report.

Results reported for samples tested under test methods with codes starting with ARS-SOP, radionuclide or gross radioactivity concentrations are expressed in becquerel (Bq) per unit of mass or volume or per wipe as stated on the report. Becquerel is the SI unit for activity and equals one nuclear transformation per second.
Note that in terms of units of radioactivity:

a. 1 Bq is equivalent to 27 pCi
b. 37 MBq is equivalent to 1 mCi

For results reported for samples tested under test methods with codes starting with ARS-SOP, less than (<) values indicate the detection limit for each radionuclide or parameter for the measurement system used. The respective detection limits have been calculated in accordance with ISO 11929.

The QC and MU criteria are subject to internal review according to the SGS QAQC plan and may be provided on request or alternatively can be found here: www.sgs.com.au/en-gb/environment-health-and-safety.

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ATTERBERG LIMITS AND LINEAR SHRINKAGE TEST REPORT

Client		Growthbuilt		Job Number	LC9614 - 1a
Project		Geotechnical Investigation		Date	10/07/2025
Location		5 - 9 Cowan Rd, St Ives		Page	1 of 1
SAMPLE DETAILS					
Sample Number		MT1	MT2		
Date Sampled		11/06/2025	11/06/2025		
Sample Location / Source		BH 1	BH 2		
Depth	(m)	4.0 - 4.1	2.4 - 2.5		
Material Description		Silty Clay, Reddish Brown	Silty Clay with some rock fragments, Reddish Brown and Grey		
Sample History		Air Dried	Air Dried		
Method of Preparation		Dry Sieved	Dry Sieved		
Shrinkage Mould Length	mm	254	250		
TEST METHOD		**TEST RESULTS**			
Liquid Limit					
AS1289 3.1.2	☑ %	58	62		
RMS (NSW) T108	☐				
Plastic Limit					
AS1289 3.2.1	☑ %	21	22		
RMS (NSW) T109	☐				
Plasticity Index					
AS1289 3.3.1	☑ %	37	40		
RMS (NSW) T109	☐				
Linear Shrinkage					
AS1289 3.4.1	☑ %	14.5	14.0		
RMS (NSW) T113	☐				
Cracking Occurred		Yes ☐ No ☑	Yes ☐ No ☑	Yes ☐ No ☐	Yes ☐ No ☐
Crumbling Occurred		Yes ☐ No ☑	Yes ☐ No ☑	Yes ☐ No ☐	Yes ☐ No ☐
Curling Occurred		Yes ☐ No ☑	Yes ☐ No ☑	Yes ☐ No ☐	Yes ☐ No ☐

Notes:

NATA

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Approved Signatory: Mark Hoveling

Date: 10/07/2025

Appendix E

Point load Test Results

GSNE SERVICES PTY LTD
SOLUTIONS THAT LAST

POINT LOAD STRENGTH INDEX REPORT

Client:	GROWTHBUILT	**Date Tested:**	19/06/2025
Address:	5-9 Cowan Road, St Ives	**Job No:**	GS9614-1A
Project Address:	5-9 Cowan Road, St Ives	**Storage History:**	Core Boxes

Borehole ID	Depth (m)	Sample Description	Test Type	Point Load Index Is (50)	UCS (MPa)	Notes
BH1	12.73	Shale	Diametral	**0.28**	**5.60**	Sample Moist
			Axial	**0.49**	**9.80**	Sample Moist
BH1	13.14	Shale	Diametral	**0.30**	**6.00**	Sample Moist
			Axial	**0.43**	**8.60**	Sample Moist
BH1	13.55	Shale	Diametral	**0.40**	**8.00**	Sample Moist
			Axial	**0.26**	**5.20**	Sample Moist
BH1	13.99	Shale	Diametral	**0.44**	**8.80**	Sample Moist
			Axial	**0.32**	**6.40**	Sample Moist
BH1	14.50	Shale	Diametral	**0.31**	**6.20**	Sample Moist
			Axial	**0.29**	**5.80**	Sample Moist
BH2	8.02	Shale	Diametral	**0.08**	**1.60**	Sample Moist
			Axial	**0.09**	**1.80**	Sample Moist
BH2	8.46	Shale	Diametral	**0.09**	**1.80**	Sample Moist
			Axial	**0.07**	**1.40**	Sample Moist
BH2	9.11	Shale	Diametral	**0.17**	**3.40**	Sample Moist
			Axial	**0.02**	**0.40**	Sample Moist
BH2	9.55	Shale	Diametral	**0.36**	**7.20**	Sample Moist
			Axial	**0.15**	**3.00**	Sample Moist
BH2	10.19	Shale	Diametral	**0.32**	**6.40**	Sample Moist
			Axial	**0.17**	**3.40**	Sample Moist
BH2	10.70	Shale	Diametral	**0.44**	**8.80**	Sample Moist
			Axial	**0.20**	**4.00**	Sample Moist
BH2	11.33	Shale	Diametral	**0.19**	**3.80**	Sample Moist
			Axial	**0.26**	**5.20**	Sample Moist
BH2	11.88	Shale	Diametral	**0.59**	**11.80**	Sample Moist
			Axial	**0.40**	**8.00**	Sample Moist
BH3	11.26	Shale	Diametral	**0.45**	**9.00**	Sample Moist
			Axial	**0.36**	**7.20**	Sample Moist
BH3	11.45	Shale	Diametral	**0.73**	**14.60**	Sample Moist
			Axial	**0.58**	**11.60**	Sample Moist
BH3	12.18	Shale	Diametral	**0.33**	**6.60**	Sample Moist
			Axial	**0.54**	**10.80**	Sample Moist
BH3	12.58	Shale	Diametral	**0.37**	**7.40**	Sample Moist
			Axial	**0.35**	**7.00**	Sample Moist
BH3	12.82	Shale	Diametral	**0.44**	**8.80**	Sample Moist
			Axial	**0.33**	**6.60**	Sample Moist

Comments:

UCS - Unconfined Compressive Test.

Multiplication Factor of 20 was used to calculate UCS

Sheet 1 of 1

Tested By: DB

Checked By: NP