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Concordia Growth Area, Concordia SA

SUPPLEMENTARY GEOTECHNICAL INVESTIGATION

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1 INTRODUCTION

A supplementary geotechnical investigation has been undertaken by Wallbridge Gilbert Aztec (WGA) across the proposed Concordia Growth Area (CGA) at Concordia, SA.

The CGA covers an area of around 950 hectares in the Barossa Council area, as shown in Figure 1.

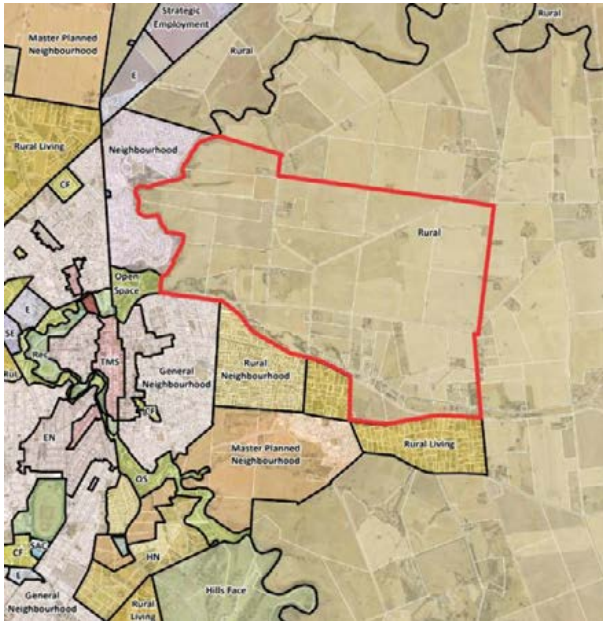


Figure 1: CGA Locality Plan

The purpose of the supplementary geotechnical investigation was to obtain additional information on the subsurface conditions in the CGA and identify key geotechnical issues that will need to be addressed for the proposed urban development.

The supplementary geotechnical investigation was commissioned by the Department for Trade and Investment via Invitation to Supply dated 30 May 2024. The scope and extent of the supplementary geotechnical investigation was broadly in accordance with a proposal prepared by WGA, dated 27 June 2024.

This report outlines the supplementary geotechnical investigation undertaken and summarises the subsurface conditions encountered. Key geotechnical considerations relating to the proposed residential land division are presented in Section 4.

A preliminary geotechnical investigation was previously undertaken at the site by WGA in 2019 (Reference 1), which included drilling boreholes within two key development areas as part of the Master Planning phase. The results of the previous geotechnical investigation have been referred to and are included in this report.

2 OUTLINE OF THE INVESTIGATION

2.1 Field Work

The field work for the supplementary geotechnical investigation was carried out on 26 August 2024 and comprised drilling 12 boreholes (denoted BHS1 to BHS12) to depths ranging between about 1.2 m (refusal) and 4.2 m at selected accessible locations across the CGA.

The boreholes were drilled using portable drilling methods which involved advancing continuous push tubes with a hand-held jack hammer.

The locations of the boreholes are shown approximately on Figure A1 in Appendix A, which includes the boreholes drilled in 2019 (denoted BH1 to BH12). The borehole locations were selected to provide a broad coverage of the proposed development area, within the restrictions imposed by landowners, existing crops, watercourses and underground services.

The soil profile encountered in the boreholes was logged by a Geotechnical Engineer from WGA and is described on the engineering logs contained in Appendix B. Also presented in Appendix B are two explanation sheets which outline the terms and symbols used in the preparation of the logs.

2.2 Laboratory Testing

The scope of laboratory testing undertaken comprised:

- Atterberg limits and particle size distribution testing (3 samples);
- A durability suite, comprising acidity, chloride, sulphate and electrical conductivity and resistivity (3 samples).

An Estimated CBR value was calculated Atterberg limits and particle size distribution testing using a procedure adopted by the Department for Infrastructure and Transport (DIT).

The Estimated CBR value is considered to be empirically equivalent to a laboratory 4 day soaked CBR test in which the sample has been conditioned to the optimum moisture content and compacted to a dry density ratio of 95% based on Modified compactive effort (AS 1289 5.2.1).

The laboratory testing was conducted at the NATA registered Adelaide laboratory of Coffey Testing in accordance with the relevant sections of AS 1289 *“Methods of Testing Soils for Engineering Purposes”* and DIT Materials Testing Procedures.

The durability testing was performed at the Melbourne based laboratory of Eurofins|MGT Pty Ltd.

The results of the laboratory testing are presented on the test results sheets contained in Appendix C.

3 SITE CONDITIONS

3.1 General

The CGA comprises approximately 950 hectares of largely undeveloped agricultural land to the north east of Gawler.

The site is bounded by the North Para River to the west and a combination of the Barossa Valley Way, Calton Road, Whitelaw Creek and a railway corridor to the south. Rural roads are located along the eastern and northern boundaries.

The ground surface across the site is undulating and broadly slopes down to the west. Several ephemeral watercourses and drainage gullies are located on the site.

Farm houses are scattered across the proposed development area, mainly along the southern boundary. Unsealed public roads pass through the site.

At the time of the investigation a large portion of the site was covered with juvenile crops. A photograph of the typical site conditions is shown in Figure 2.



Figure 2: Typical Site Conditions

3.2 Site Features

A site walkover was performed by a geotechnical engineer at the time of the investigation.

No significant geological or geomorphological surface features were observed during the site walk-over that would potentially negatively impact on the construction of a residential land division. Over the eastern and northern portion of the CGA, the ground surface appears largely unchanged from the natural conditions, the only modifications being small dams with earth fill embankments and local structures, such as hay sheds and farm houses.

No rock outcrops were noted although the ground surface was largely covered with crops and not able to be trafficked. Excluding the banks of the North Para River, no areas of slope instability (landslides) or wet ground (springs) were observed during the site walk-over and the watercourses within the site were dry.

High voltage and low voltage power lines cross through the site and a large communications tower is located centrally to the west.

Some mature trees (typically native species) were located sporadically around the site, although more densely vegetated around the residences.

3.3 Regional Geology

The Geological Survey of South Australia (1:100,000 scale “Adelaide” sheet) indicates that the proposed development area is expected to be mainly underlain by Proterozoic aged bedrock of the Woolshed Flat Shale formation (Ndw).

Local pockets of undifferentiated Tertiary aged sediments and ferricrete (T) occur in places, whilst Undifferentiated Quaternary aged alluvium is expected to be present along the North Para River.

The Woolshed Flat Shale typically comprises black to dark grey, shale, dolomite and siltstone.

An excerpt from the “Adelaide” map sheet showing the regional geology is reproduced as Figure 3 (alluvium is shaded green, Tertiary sediments orange and bedrock brown).

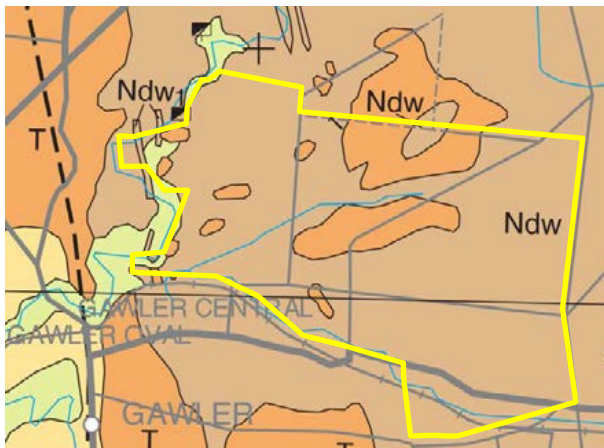


Figure 3: Excerpt from the “Adelaide” Geological Map Sheet

The Department for Environment, Water and Natural Resources released a series of Land System Reports as part of the Soil and Land Program which provide information on the near surface soil profiles across the state. The CGA lies within the Kalbeeba Land System (KLB) which is typically underlain by bedrock (siltstones, slates and fine sandstones). The bedrock is deeply weathered in places such that there is no rock-like material within the upper 2 m. The rocks and deep weathering materials are commonly capped by a veneer of carbonate of aeolian origin, which has been leached into the upper layers of the rock. In places it has become indurated to calcrete. There are localized deposits of outwash clays, silts and sands on lower slopes and drainage depressions. Remnant Tertiary sediments occur in the south.

Most of the soils are moderately deep to shallow over basement rock. Typically they have hard loamy surfaces overlying either weathering rock, or more commonly a red friable clay loamy to clayey subsoil. Some are calcareous throughout. On rising ground there are limited areas of deep clay loamy to clayey gradational soils on highly weathered rocks. On minor lower slopes and creek flats, deep red loam over clay soils predominate, with small areas of deep sandy loams and heavy dark soils. Sandier soils occur on Tertiary remnants.

The geological survey of south Australia (1 inch : 1 mile scale) “Gawler” map sheet from 1953 is reproduced as Figure 4. The map sheet shows the general topography of the area, as well as the presence of a former quarry along North Para River. The map also shows that the bedding in the bedrock generally dips down to the east at 20° to 40°.

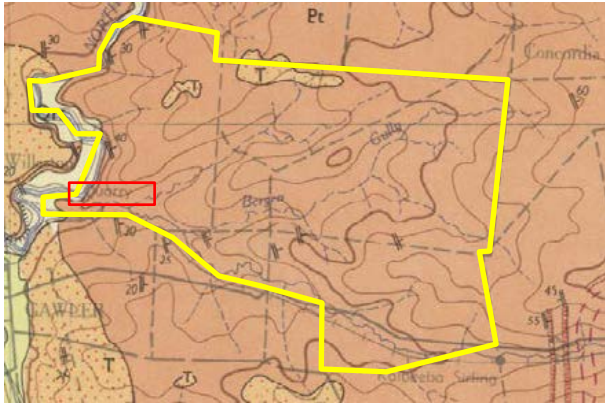


Figure 4: Historical Geological Map showing Former Quarry and Topography

3.4 Aerial Photography

Aerial photography is publicly available over the western portion of the site from 1949 and is presented in Figure 5.



Figure 5: Historical Aerial Imagery

The imagery shows no significant development has occurred over the site when compared to the current conditions, with the exception of some additional farmhouses, local residential allotments and more mature trees around the watercourses and residences.

Anecdotally, the inside of the horseshoe bend along the North Para River was formerly mined for sand deposits. This was subject of the previous geotechnical investigation by WGA in 2019, however no compelling evidence of mining activities was observed. The quarry shown in Figure 4 may be the sand mine.

3.5 Previous Investigations (Reference 1)

The previous investigation undertaken by WGA in 2019 targeted four areas identified by Concordia Land. The areas comprised:

- Areas 1 and 2: western side of the site, adjacent to the North Para River. These areas are possibly underlain by fill associated with past sand mining activities;
- Areas 3 and 4: near Springbett Road. These areas form part of the proposed Town Centre and may be underlain by bedrock at shallow depth.

The field work for the geotechnical investigation was carried out on 11 June 2019 and comprised the following activities:

- Drilling 6 boreholes (denoted BH1 to BH6) to depths of between 1.25 m (refusal) and 4 m within Areas 3 and 4;
- Drilling 6 boreholes (denoted BH7 and BH12) to depths of ranging between about 3 m and 6 m in Areas 1 and 2.

The boreholes were drilled with a Toyota Landcruiser mounted Rockmaster drilling rig using continuous push tube sampling techniques.

The locations of the boreholes are shown approximately on Figure 6 and included in Figure A1 of Appendix A.



Figure 6: Historical Borehole Locations

The subsurface profile encountered in Areas 1 and 2 generally comprised about 0.7 m to 1.15 m of brown silty sand and sandy clay, which was moist and loose at the surface becoming dry below about 0.4 m. It was not possible to conclusively prove that this material was fill or undisturbed natural soil, although it is most likely that the upper 300 mm or so has been disturbed by agricultural activities. In BH7 the clayey sand between depths of about 1.1 m and 2.1 m contained minor gravel and charcoal (possible decayed roots) and therefore this layer could possibly be fill. In BH10, gravel (weathered siltstone) was encountered to a depth of about 0.7 m and this material is thought to be fill.

The soils did not contain any anthropogenic material and generally the fill material was very similar to the natural alluvial soils expected in the area. As can be seen from aerial imagery the site appears largely undisturbed over the last 70 years.

The underlying soils comprised mainly Recent aged alluvium to the limit of drilling.

Natural soils were generally encountered from the surface in Areas 3 and 4.

The natural soil profile encountered typically comprised:

- **Topsoil:** low to medium plasticity sandy clay, 0.1 to 0.45 m thick;
- **Recent Alluvium:** locally encountered in lower lying creek systems and valleys, comprising variable clay and sand with trace gravel and charcoal/cinder;
- **B-horizon:** red brown, clay and sandy of mainly high plasticity, locally medium plasticity, and extending to depths of between 0.25 m and 0.5 m; over
- **Calcareous Soils:** including low to medium plasticity sandy clay with calcrete gravel and silty sand with calcrete gravel (representing a rubbly calcrete cap at the top of the formation). Extending to a depth of about 0.55 m to 1.9 m in places; overlying

- **Residual Clay:** mainly high locally medium plasticity, red brown, brown with variable yellow brown and pale brown pockets of weathered rock at depth. Generally extending to the limit of drilling; locally overlying
- **Extremely Weathered Rock:** encountered in boreholes BH1, BH3 and BH5. Shale, siltstone and schist with pockets of residual clay, yellow brown, pale brown, white. Rock fabric visible. Remoulds to sandy silt and silty sand. Locally less weathered. Refusal to push tube sampling was met in BH1 at 1.25 m depth.

Borehole BH6, drilled in the valley along the northern boundary of Area 4, encountered a slightly different soil profile comprising alluvial clays. Dark grey to black B-horizon clay extended to 1.1 m depth over dark brown and brown high plasticity clay to 3.7 m with quartzite gravel to 3.9 m. Probable residual clays were present below 3.9 m.

A summary of the subsurface stratigraphy in each of the previous boreholes is presented in Table 1, showing the depth to the base of the formation in metres (or depth range where interbedded), whilst the borehole logs are presented in Appendix B.

Table 1: Summary of the Previous Borehole Stratigraphy (Reference 1)

STRATIGRAPHIC UNIT	BH1	BH2	BH3	BH4	BH5	BH6
Topsoil	0.1	0.15	0.15	0.2	0.3	0.5
Alluvial Clay	0.25	1.9		0.5		3.7
Calcareous	0.55	0.5 to 1.5	0.6	1.8	0.6	
Residual Clay		4.0 (TD)	1.3	3.0 (TD)		4.0 (TD)
Weathered Rock	1.25 (PTR)		4.0 (TD)		3.0 (TD)	
STRATIGRAPHIC UNIT	BH7	BH8	BH9	BH10	BH11	BH12
Fill	1.1 ⁽¹⁾	1.15	0.7	0.7	1.5	0.8
Recent Alluvium	4.0 (TD) (CGA 2.1-3.2)	6.0 (TD) (CGA 4.5-6)	3.0 (TD) (CGA 0.7-2.4)	3.0 (TD)	4.0 (TD) (CGA 3-4)	4.0 (TD) (CGA 2.9-4)
Notes:						
⁽¹⁾ Difficult to assess fill presence – site won material						
TD: Target Depth; PTR: Push Tube Refusal; NE: Not Encountered; CGA: Coarse grained alluvium						

The alluvial and residual clays were generally of very stiff to hard consistency, although locally friable.

The sandy soils were generally in a dry to moist condition, whilst the moisture content of the clays was typically less than the plastic limit.

No groundwater was encountered over the depth ranges investigated (up to 6 m).

3.6 Stratigraphy

Descriptions of the materials encountered in the boreholes are presented on the engineering logs contained in Appendix B.

Fill was generally not encountered in the boreholes although the surficial topsoil had been locally disturbed and the surficial clays in BHS11 appeared to be locally sourced fill although difficult to distinguish from the natural clays.

The natural subsurface profile was broadly consistent with the regional geology and previous investigation (Reference 1) and generally comprised alluvial clays, with variable calcareous inclusions at depth overlying either weathered rock (siltstone) or Tertiary Sand.

A summary of the stratigraphy in each of the boreholes is summarised in Table 2, showing the depth to the base of the formation in metres (or depth range where interbedded). Push tube refusal was met in boreholes BHS1, BHS5, BHS7 and BHS12 on weathered siltstone at depths as shallow as 1.2 m and on cemented Tertiary sand in borehole BH S12 at a depth of 2.2 m.

Table 2: Summary of the Current Borehole Stratigraphy

STRATIGRAPHIC UNIT	BHS1	BHS2	BHS3	BHS4	BHS5	BHS6
Fill	NE	NE	NE	NE	NE	NE
Topsoil	0.15	NE	Veneer	NE	NE	0.1
Alluvial Clay	NE	4.2 (TD)	0.35	0.45	0.25	0.4
Calcareous Soils	0.4	NE	1.0	1.1	0.9 ⁽²⁾	1.3 ⁽²⁾
Residual Clay	0.8	NE	2.7	2.2	3.3	1.3
Weathered Rock	1.2 (PTR)	NE	4.1 (TD)	4.1 (TD)	3.7 (PTR)	3.0 (TD)
STRATIGRAPHIC UNIT	BHS7	BHS8	BHS9	BHS10	BHS11	BHS12
Fill	NE	NE	NE	NE	0.3 ⁽¹⁾	NE
Topsoil	0.2	0.15	0.15	0.15	NE	0.3
Alluvial Clay	NE	1.8	0.45	0.35	1.8	NE
Calcareous	0.8	0.35 to 1.0	1.35	0.7	0.7 to 1.5	0.4
Residual Clay	1.45	NE	2.2	NE	4.1 (TD)	NE
Weathered Rock	1.6 (PTR)	NE	3.0 (TD)	NE	NE	1.2 (PTR)
Tertiary Sand	NE	4.1 (TD)	NE	2.2 (PTR)	NE	NE
Notes: ⁽¹⁾ Difficult to assess fill presence – site won material ⁽²⁾ Transitional at base TD: Target Depth; PTR: Push Tube Refusal; NE: Not Encountered						

The alluvial clays were generally of high plasticity, dark brown, red brown and brown, with variable inclusions of pale brown and white calcareous clay (ranging from trace pockets to an appreciable proportion). A thin or rubbly calcrete cap was locally encountered in the calcareous layer. The calcareous proportion generally reduced with depth, becoming absent locally.

The weathered rock profile included a layer of residual clay, generally brown to green-brown with local grey mottle and black speckle, high plasticity and heavily fissured grading to silty clay and reducing in plasticity with depth. The siltstone was mainly highly weathered and of very low to low strength, locally with medium strength fragments. Push tube refusal was generally met on the medium strength rock.

The Tertiary profile was locally encountered in boreholes BHS8 and BHS10. The profile comprised mainly sand and silty sand, grey, red, pale brown to white and variably cemented, locally as sandy clay with cemented silty gravels.

3.7 Laboratory Testing

The results of the laboratory testing are presented in Table 3 and Table 4.

Table 3: Summary of Laboratory Test Results - Classification

BOREHOLE	DEPTH RANGE (m)	ATTERBERG LIMITS (%)			PARTICLE SIZE DISTRIBUTION (% PASSING SIEVE)		LABORATORY ESTIMATED CBR VALUE (%)
		Liquid Limit	Plasticity Index	Linear Shrinkage	2.36 mm	0.075 mm	
BHS2	0.3 to 0.6	73	49	18	99	88	3
BHS6	0.15 to 0.4	64	38	14.5	99	89	4
BHS11	0.4 to 0.7	65	45	15.5	98	85	3.5

The classification tests indicate that the alluvial clays tested are of high plasticity with around 10% to 15% sand.

Table 4: Summary of Laboratory Testing - Durability

BOREHOLE	DEPTH (m)	pH (UNITS)	CHLORIDE (mg/kg)	SULPHATE (mg/kg)	EC _{1:5} (µS/cm)	TDS (mg/kg)
BHS1	0.4 to 0.75	9.1	150	130	400	220
BHS4	0.15 to 0.3	6.8	11	<30	310	170
BHS10	0.5 to 0.7	8.1	8.3	<30	160	84
Note: EC _{1:5} = Extract Electrical Conductivity at 1:5 dilution ratio; TDS = Total Dissolved Solids						

The durability testing indicates that the soils tested are neutral to slightly alkaline with relatively low concentrations of sulphates and chlorides.

4 GEOTECHNICAL ASSESSMENT

4.1 General

Based on the results of the investigation, the key geotechnical considerations for the proposed residential land division are as follows:

- The presence of high plasticity clays with the potential to undergo relatively large shrink-swell movements with changes in soil moisture content;
- The presence of rock strength materials (weathered bedrock) at shallow depth and excavatability considerations; and
- The presence of Tertiary sediments which can be variably cemented and cause excavatability issues where strongly cemented rock strength materials (ferricrete) occur.

Whilst not observed in the locations investigated, there is the potential for fill to be present in developed areas (near farm dams and residences) which will need to be removed and replaced.

4.2 Site Characteristics

4.2.1 Shrink-swell Movements

The soil profile over the CGA varies and therefore shrink-swell movements due to soil moisture content changes will also vary.

The medium and high plasticity residual clays encountered in the boreholes are assessed to be moderately to highly reactive with respect to shrink-swell movements caused by changes in soil moisture content. Based on a visual-tactile assessment, shrink-swell indices are estimated to range from about 2% to 3.5% for the high plasticity clays and around 1.5% for the medium plasticity clays.

The sandy topsoil is assessed to be non-reactive, whilst the weathered rock and Tertiary profiles are assessed to vary from non-reactive to slightly reactive with respect to shrink-swell movements.

Based upon the design soil suction change profile for Adelaide contained in AS 2870-2011, a characteristic surface movement (y_s) ranging from less than 20 mm to 70 mm is estimated for the borehole locations at the current ground surface levels. The range in y_s values is largely reflective of variations in thickness of the more reactive clays and the depth to rock.

In accordance with a classification system presented in AS 2870-2011, a site classification of Class M-D (moderately reactive site, with deep moisture changes, which can experience moderate ground movements resulting from moisture content changes) is typically expected, although locally ranging from Class S (Slightly reactive) to Class H2-D (very highly reactive site, with deep moisture changes, which can experience very high ground movements resulting from moisture content changes). The indicative site classifications for each borehole are summarised in Table 5.

Table 5: Summary of Site Classifications to AS 2870-2011

SITE CLASSIFICATION*	RANGE OF y_s VALUES (mm)	BOREHOLE
Class S	<20	BH5, BH6, BHS1, BHS10
Class M-D	20 to 40	BH1, BH2, BH3, BH4, BH7, BH8, BHS6, BHS7, BHS8, BHS9, BHS12
Class H1-D	40 to 60	BH9, BH10, BHS3, BHS4
Class H2-D	60 to 70	BHS2, BHS5, BHS11
Notes: *for a site which experiences normal soil moisture conditions, as outlined in AS 2870-2011		

Where controlled fill is deeper than about 0.4 m the overall site classification would be Class P (Fill site).

The predicted y_s values and site classifications presented in Table 5 assume that the site generally remains at the current surface level. Where the depth of proposed cut and/or fill exceeds about 0.3 m, the predicted shrink-swell movements will vary and a further assessment is required. The following conditions should be noted:

- Where the allotment is in a relatively deep cut a lower y_s value is typically predicted as the thickness of the more reactive clays at shallow depth is reduced.
- Where clayey fill is present beneath an allotment a higher y_s value is expected. This is because AS 2870-2011 considers clayey fill less than 5 years old to be in an uncracked condition and therefore markedly more reactive than in the cracked condition.

Should future moisture content changes in the foundation soils result in soil suction values outside the suction change profile presented in AS 2870-2011, a larger y_s value may occur. Such changes could occur adjacent to leaking water services or where soils are desiccated by tree roots.

Tree effects have not been considered in the preliminary site classifications presented in Table 5. The effects of existing or proposed trees should be considered in the final site classification, by assessing the potential surface movement due to tree-induced suction effects.

4.2.2 Site Factor

Bedrock is typically expected to be present at depths of between about 1 m and 6 m of the current ground surface levels, although locally deeper based on the investigation work to date.

Using the Classification System presented in AS 1170.4-2007 “*Structural design actions Part 4: Earthquake actions in Australia*”, it is assessed that the site sub-soil class would be Class Be (Rock) or Class Ce (shallow soil site) where rock occurs deeper than 3 m.

The natural soils are not considered to be vulnerable to liquefaction during an earthquake event with a recurrence interval of 1 in 500 years.

4.2.3 Presence of Rock Strength materials

Weathered bedrock was encountered in several boreholes at depths ranging from about 0.4 m to 3.3 m and is anticipated to be present near the termination depths in most of the remaining boreholes.

The bedrock typically comprised siltstone (local schist and shale) and was generally extremely weathered and would remould under finger pressure to soil strength material, local pockets of less weathered (distinctly weathered) rock of very low to medium strength were encountered towards the base of the borehole. The extremely weathered rock has soil strength properties and was able to be sampled with the push tube.

In BH1, BHS1, BHS5, BHS7 and BHS12 the rock was less weathered and push tube refusal was met on distinctly weathered rock at a depth of about 1.2 m to 3.7 m.

The overlying soil strength materials are expected to be excavatable using conventional earthmoving equipment such as large backhoes and tracked excavators. Production rates would be expected to be less in the extremely weathered rock. Floaters of less weathered rock strength materials could occur in the residual soils and extremely weathered rock and where present such floaters may be difficult to excavate in confined excavations.

Rock strength materials (below the depth of push tube refusal) are expected to result in lower production rates and require specialist methods of excavation such as a large tracked excavator fitted with a rock pick or rock hammer. Such materials were only encountered locally over the depth ranges investigated, but may occur in other areas not investigated.

4.2.4 Presence of Fill Materials

Fill was generally not encountered in the boreholes drilled over the CGA development area.

Previous boreholes drilled adjacent to the North Para River indicated that up to about 1.5 m of fill may be encountered locally. This fill comprised site won soils and was difficult to distinguish from the natural profile and it is possible that the fill is Recent creek alluvium.

The boreholes did not encounter any materials such as imported fill, rubbish or other deleterious materials which might be associated with a former landfill or uncontrolled filling activities. Additionally, the aerial photographs reviewed (refer to Section 3.3) do not indicate that significant or widespread disturbance due to past human activities (such as sand mining) has occurred within the CGA boundary.

None-the-less there is evidence to suggest that in places the soil profile may have been disturbed or reworked in the past and the upper 200 mm to 300 mm is likely to have been disturbed by previous cultivation.

In view of the uncertainty with the presence of fill associated past sand mining activities near to the North Para River, it is recommended that an allowance be made in the bulk earthworks to remove the existing soils in the local area of possible sand mining to a nominal depth of 1 m beneath proposed pavements or allotments. Such removal would not be required in reserves or open space areas where structures are not proposed.

The excavated soil may be reused as controlled fill provided it is suitably moisture conditioned and compacted. It is recommended that a minimum dry density ratio of 98% Standard be adopted for controlled fill beneath pavements and allotments.

Further investigations to more reliably assess the depth of fill and extent of the bulk earthworks required should be undertaken during the detailed design phase. Such investigations would typically involve excavating test pits or trial trenches.

4.2.5 Presence of Groundwater

Groundwater was not encountered in any of the boreholes drilled during either investigation. As a result dewatering of shallow excavations is not expected to be required.

Shallow perched groundwater could occur locally in places during extended wet periods and watercourses and gullies could be water bearing in wetter periods. Water is expected along the North Para River.

4.2.6 Weak and Compressible Soils

Weak and compressible soils are generally not expected across the site.

Locally weaker soils may be present in the base of watercourses or where surface water ponds for an extended period. Where present such materials are not expected to extend to an appreciable depth and are expected to be readily removed as part of the bulk earthworks.

4.2.7 Acid Sulphate Soils

The natural soils are not expected to be potential acid sulphate soils, particularly where calcareous.

The Southern South Australia Acid Sulphate Soil Potential Map prepared by the Department for Environment and Water (2018) indicates that a negligible portion of the CGA land would be susceptible to the development of acid sulphate soils.

Highly organic soils may be locally present along watercourses, particularly the North Para River and Whitelaw Creek, and these soils may be potential acid sulphate soils.

4.2.8 Durability

The results of the laboratory chemical tests (Table 4) indicate that the natural soils are typically neutral/slightly alkaline with relatively low concentrations of sulphates and chlorides.

An exposure classification of “Non-aggressive” is considered appropriate for buried concrete above the groundwater table, in accordance with the guidelines of Table 6.4.2(C) in AS 2159-2009 “Piling - Design and Installation”.

The saturated extract electrical conductivity (EC_e) for heavy clays, assessed from laboratory assessed EC (1:5) values, is less than 4 dS/m. In accordance with Table 4.8.2 in AS 3600-2018 “Concrete Structures” the soils are considered to be non-saline or only slightly saline. An exposure classification of “A1” is considered appropriate for residential slabs.

4.3 Footing Systems (Preliminary Advice)

Based on the limited investigations completed to date, a stiffened raft footing system is expected to be suitable for single or double storey residential buildings across the CGA. No ground improvement work, such as preloading, is required prior to conducting the bulk earthworks.

It is recommended that footings for residential buildings may be designed based on the guidelines presented in AS 2870-2011 “Residential Slabs and Footings”.

The characteristic surface movement (y_s value) for the raft design will depend on the subsurface profile at each allotment which will be influenced by the extent of any cut or fill. As a guideline only, the typical (preliminary) site classifications and y_s values assessed for the site are presented in Section 4.2.1 for the site at the current ground surface level. Note that a wide range of y_s values have been assessed for the CGA and further investigation work would be required to more reliably assess the distribution of the various soil profiles.

In the assessment of potential shrink-swell movements, AS 2870-2011 states that reactive clay fill less than 5 years old must be considered to be in an *uncracked* condition and as a result has a greater potential to undergo future shrink-swell movements. Accordingly all clayey fill placed as part of the recent site remediation bulk earthworks must be considered to be in an uncracked condition. Preferably the lower plasticity, less reactive clays should be used as general fill in order to limit future shrink-swell movements.

Each allotment will require a site specific site classification in accordance with AS 2870-2011. This will typically require the drilling of a further three boreholes to a depth of at least 3 m on each individual allotment.

4.4 Pavement Subgrade CBR

Depending on the extent of site earthworks pavements are generally expected to be founded in alluvial clays. Locally, calcareous soils or weathered rock could be encountered at subgrade level.

Laboratory testing was undertaken on 3 samples of potential subgrade material in order to assess a representative CBR value for the alluvial clay. The results of the laboratory CBR testing are presented in Table 3.

Based on the results of the limited laboratory testing and our experience with similar soil types, it is recommended that flexible pavements be designed based on the following subgrade CBR values:

- High plasticity alluvial/residual clay: 3%;
- Low and medium plasticity clay and calcareous soils: 5%;
- Extremely weathered rock: 8%.

It is important to note that the design subgrade CBR values provided above are preliminary only. Further geotechnical investigation, including laboratory CBR testing (including 4-day soaked tests) should be undertaken once the design subgrade level along the alignment of the proposed roads has been finalised.

In high plasticity soils, the subgrade CBR value could be increased by the addition of hydrated lime. Laboratory trials would need to be undertaken to assess the optimum proportion of lime to be added. For preliminary design the addition of 3% to 4% hydrated lime (by dry weight) is considered reasonable. The addition of lime would have the additional benefit of reducing the shrink-swell potential of the soil.

The recommended preliminary design CBR values assumes that:

- The site is prepared in accordance with the recommendations contained in Section 4.5.1. The upper 200 mm of subgrade is moisture conditioned to within $\pm 2\%$ of the optimum moisture content, and compacted to achieve a dry density ratio of at least 98% based on Standard compaction (AS 1289 5.1.1);
- Any areas of weak, wet or spongy subgrade (CBR value generally less than 3%) are identified by proof-rolling and observation during construction and remedial works (such as over-excavation) undertaken;
- The pavement is adequately drained to prevent saturation of the pavement materials and underlying subgrade; and
- Field testing is undertaken on subgrade and pavement materials during construction to ensure compliance with the above recommendations.

The medium and high plasticity clays are assessed to typically have a high potential to undergo shrink-swell movements with man-made or environmental changes in soil moisture content (refer to Section 4.2.1). Designing pavements in accordance with the above recommended CBR values will not necessarily reduce the effects of shrink-swell soil movements on the surface condition of the pavement. Such shrink-swell movements may cause surface undulations (which may affect surface drainage or riding quality) or cracking of the asphalt seal.

Shrink-swell movements may be reduced (but not eliminated) by providing adequate surface and subsurface drainage to prevent water pooling adjacent to the pavement and avoiding the planting of trees in close proximity to the pavement. If trees are to be planted close to the pavement, native trees with relatively low affinity for moisture should be selected.

Alternative methods to reduce the impact of shrink-swell movements can include subgrade replacement or stabilisation with the addition of lime.

It is recommended that QA/QC testing be undertaken on subgrade and pavement materials during construction.

4.5 Considerations for Earthworks

4.5.1 Site Preparation

Whilst fill was not encountered in this investigation, fill may be present locally on site. The possible fill encountered near the North Para River during the previous investigation would require further investigations to reliably assess the depth range and lateral extent. Any existing fill should be considered to be uncontrolled and therefore should be stripped from the proposed development areas and replaced with controlled fill.

Preferably, the organic topsoil should be stripped from the site prior to bulk earthworks, to expose the natural clays (B-horizon). Based on the results of the investigation, a depth of stripping of around 0.2 m (ranging from absent to about 150 mm to 500 mm) is generally expected to be required below the existing ground level to remove the topsoil. Deeper pockets of topsoil or cultivated soils may also be present in areas not investigated.

Following excavation of fill and topsoil materials it is recommended that in areas to be filled the exposed natural subgrade be proof-rolled with a vibrating pad foot roller of at least 8 tonnes static weight to identify any soft, wet or weak areas which may require remedial works, such as over-excavation and replacement.

Following proof-rolling and any remedial works, the site (where required) may be filled to the design subgrade level using “*controlled fill*”.

Prior to compaction, the controlled fill shall be moisture conditioned to within 2% of the optimum moisture content and compacted in layers not exceeding 250 mm in loose thickness to achieve a dry density ratio of at least 95% based on Standard compaction (AS 1289 5.1.1), increasing to 98% Standard compaction in the upper 200 mm of subgrade along pavement alignments.

Where the ground slope is steeper than 8H:1V, the controlled fill would need to be keyed into the natural hillslope using a series of horizontal benches.

The natural soils, excluding the topsoil, may be re-used as controlled fill provided that adequate moisture conditioning and compaction is undertaken during placement. It is noted that the clays of high plasticity may be difficult to moisture condition.

The weathered rock materials may also be used as controlled fill, although some processing (such as screening or crushing) of less weathered over-size particles (larger than 100 mm in size) may be required to produce a well graded fill which can be tested using conventional density testing techniques. The maximum particle size within a layer should not exceed two-thirds of the compacted layer thickness.

The existing topsoil is only considered suitable for re-use as landscaping fill.

It is recommended that any fill be placed under Level 1 overview, as outlined in AS 3798 “*Guidelines on earthworks for commercial and residential developments*”.

In areas of proposed cut, it is recommended that the topsoil is initially stripped and stockpiled separately to the underlying soils. Following bulk excavation, the exposed natural subgrade shall be proof-rolled, as outlined above.

4.5.2 Excavatability and Dewatering

Based on the subsurface profile encountered in the boreholes and the resistance to drilling encountered by the portable hand gear and small 4WD mounted drilling rig, excavation of service trenches in soil strength materials (topsoil, residual clays and extremely weathered rock) are expected to be achievable using conventional earthmoving machinery such as large backhoes and tracked excavators (of at least 10 t mass).

However, excavations into rock strength material (or strongly cemented Tertiary sediments such as encountered in borehole BHS10) are expected to be more difficult than in the overlying soils, particularly in confined excavations such as trenches. As a guideline, these conditions are expected at about the depth where push tube refusal was encountered (refer Table 2), which was as shallow as 1.2 m depth in places. It is noted that a strongly cemented ferricrete capping may be present on the Tertiary sediments in places.

Excavations extending into the rock strength material (below push tube refusal depths) are likely to encounter increased resistance and lower production rates would be expected. The use of a single tyne ripping tooth and/or hydraulic rock breaker fitted to a large excavator is likely to be required to enable the efficient excavation of rock strength materials in trench excavations. For bulk earthworks, ripping with a large bulldozer (CAT D9T or equivalent) is expected to be required.

Groundwater was not encountered in the boreholes and therefore dewatering of shallow excavations (less than 3 m deep) is not expected to be required. However, perched groundwater could occur in the topsoil and near the existing watercourses and along the North Para River during extended wet periods.

4.5.3 Trench Stability

The clays and weathered rock encountered in the boreholes are expected to stand vertically unsupported for short periods in trenches up to about 2 m deep. Where persistent, adversely orientated fissures or defects are present or groundwater seepage is encountered, stability would be impaired. Exposure to rainfall or desiccation cracking, vibrations and surcharging from traffic and construction equipment would also tend to further reduce the stability of vertical excavations.

Where highly calcareous soils or uncemented Tertiary sediments are encountered, flatter batters will be required.

Vertical sided excavations deeper than 1.5 m must not be entered without adequate shoring in accordance with Work Health and Safety legislation. Alternatively a temporary batter slope of 1H:1V (clay) or 2H:1V (topsoil, highly calcareous or sandy soils) could be adopted or trenches could be suitably benched.

4.5.4 Trafficability

Trafficability of the high plasticity clays is expected to be very poor when wet. To reduce the potential for delays or cost over-runs it is preferable that the bulk earthworks are not undertaken during the wetter winter months. Trafficability of the sandy alluvial soils is expected to be poor where the soils are dry and/or loose.

The provision of a 250 mm thick layer of well graded quarry rubble (or similar) on top of the natural soils would be expected to assist trafficability during construction. Alternatively lime stabilisation could be considered.

4.5.5 Water Management

Particular attention should be undertaken during construction to prevent large changes in moisture content in the highly reactive subgrade soils.

Desiccation of the subgrade soils could result in excessive soil swelling movements following construction of the pavements, whilst the ponding of water could result in softening of the subgrade.

Stormwater and surface run-off must not be allowed to pool adjacent to pavements.

Consideration should be given to providing a subsurface cut-off trench on the uphill side of pavements in areas of significant cut to prevent saturation of the pavement and subgrade materials.

Trees and shrubs should be carefully selected and located to minimise desiccation effects beneath footings and pavements.

4.6 Safety in Design

This report presents factual information about the subsurface conditions at the site and an assessment of how these conditions might impact on the design and construction of a residential development from a geotechnical perspective. At the time of reporting the design and documentation of the proposed development had not been finalised and as a result Safety in Design issues have not been considered in this report. It is the responsibility of the designer to use the information contained herein to prepare a Safety in Design Report which is appropriate for the proposed development.

Specific input on geotechnical issues for the Safety in Design report can be provided as part of the detailed design phase if required.

5 LIMITATIONS

The recommendations contained within this report have been based on the subsurface conditions encountered in a limited number of boreholes and the judgement and opinion of WGA. To the best of our knowledge, the subsurface conditions described in this report provide a reasonable interpretation of the typical subsurface conditions likely to be encountered at the site.

It must be accepted that variations in subsurface conditions are likely to occur between the locations investigated and such variations may impact on the design recommendations provided. Under no circumstances can it be assumed that this report represents the actual subsurface conditions at all locations over the site.

Further geotechnical investigations must be conducted as part of the detailed design phase of the land division. Such investigations would typically include excavating test pits with a large tracked excavator to better assess the presence of fill and the presence of rock strength materials and associated excavatability issues.

Yours faithfully



Roger Grounds

for

WALLBRIDGE GILBERT AZTEC

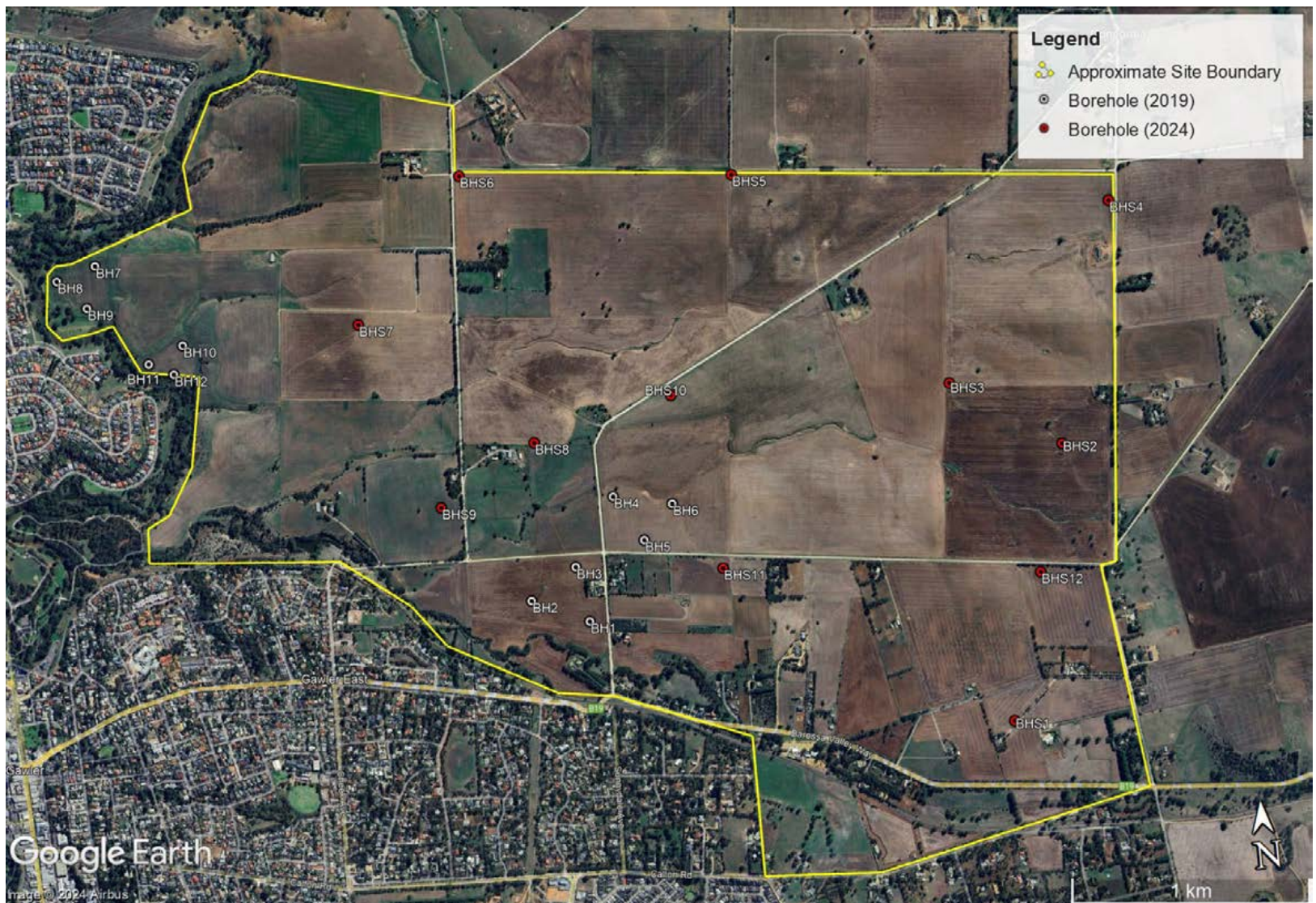
References:

1. *Proposed Concordia Land Division: Preliminary Geotechnical Investigation*. WGA report WGA190926-RP-GE-0001_B, dated 26 June 2019.

APPENDIX A

FIGURES





BH ID	Easting	Northing
BH1	295996	6169770
BH2	295759	6169873
BH3	295954	6170001
BH4	296132	6170283
BH5	296249	6170093
BH6	296377	6170235
BH7	294037	6171404
BH8	293872	6171352
BH9	293990	6171230
BH10	294379	6171046
BH11	294231	6170978
BH12	294333	6170928
BHS1	297742	6169225
BHS2	298027	6170367
BHS3	297574	6170653
BHS4	298297	6171366
BHS5	296727	6171589
BHS6	295588	6171667
BHS7	295120	6171078
BHS8	295819	6170532
BHS9	295410	6170290
BHS10	296405	6170687
BHS11	296570	6169951
BHS12	297897	6169838

Drawn by	HRJ
Approved	RWG
Date	12/09/2024
Dimensions	-
Original	-

WGA

Client:	DEPARTMENT FOR TRADE AND INVESTMENT		
Project:	CONCORDIA GROWTH AREA, CONCORDIA SUPPLEMENTARY GEOTECHNICAL INVESTIGATION		
Title:	BOREHOLE LOCATION PLAN		
Job No.:	WGA241280	Ref.	FIGURE A1

APPENDIX B

RESULTS OF THE INVESTIGATION





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Date Drilled: 26/08/2024

Date Logged: 26/08/2024

Logged by: HRJ

Drilling Method: Push Tube

Drill Rig/Mount: Portable

Borehole No.

BH S1

Page 1

Legend:

Moisture Condition	Density Index - Granular	Consistency - Cohesive
D - Dry	VL/L - Very Loose/Loose	VS - Very Soft Vst-Very Stiff
M - Moist	MD- Medium Dense	S - Soft H - Hard
W - Wet	D/VD- Dense/Very Dense	F - Firm Fb - Friable
Wp - Plastic Limit		St - Stiff
USCS: Unified Soil Classification System		↓GW = Groundwater

Project Number: WGA241280

Location: CONCORDIA GROWTH AREA

		Composition of soil	Condition of soil			Structure and additional observations
Depth below surface (m)	USCS Symbol	Soil Description (type, plasticity, grading, colour, secondary and minor components)	Moisture Condition	Consistency or Density Index	Hand Penetrometer Reading (kPa)	(e.g. soil origin, defects, cementing, likely I_{pt} (%))
0.15	CL	Sandy CLAY, medium plasticity, dark brown, fine to coarse grained sand, rootlets	≈Wp	Fb		Possible fill to 0.35 m
0.5	CL	Thin rubbly calcrete cap over sandy CLAY, low plasticity, pale brown, fine to coarse grained sand, calcareous, dark brown sandy layer at base (50 mm thick) possible former topsoil	<Wp	Fb		Residual Soil
	CL	Sandy CLAY, medium plasticity, brown, pale brown, green brown, fine to coarse sand silty texture, fissured, trace fine gravel	<Wp			
1.0		SILTSTONE, distinctly weathered, low to medium strength, green brown, brown, pale brown, laminated grey mottle	D			Weathered bedrock
1.5		Borehole terminated at 1.2 m (push tube refusal)				
2.0						
2.5						
3.0						

Depth to Groundwater: None Observed

Trees at Site: No



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Drilling Method: Push Tube

Drill Rig/Mount: Portable

Borehole No.

BH S2

Page 1

Legend:

Moisture Condition	Density Index - Granular	Consistency - Cohesive
D - Dry	VL/L - Very Loose/Loose	VS - Very Soft Vst-Very Stiff
M - Moist	MD- Medium Dense	S - Soft H - Hard
W - Wet	D/VD- Dense/Very Dense	F - Firm Fb - Friable
Wp - Plastic Limit		St - Stiff
USCS: Unified Soil Classification System		↓GW = Groundwater

Project Number: WGA241280

Location: CONCORDIA GROWTH AREA

		Composition of soil	Condition of soil			Structure and additional observations
Depth below surface (m)	USCS Symbol	Soil Description (type, plasticity, grading, colour, secondary and minor components)	Moisture Condition	Consistency or Density Index	Hand Penetrometer Reading (kPa)	(e.g. soil origin, defects, cementing, likely I_{pt} (%))
	CH	CLAY, high plasticity, dark brown, some sand, rootlets top 50 mm	~Wp	H		
0.5					>600	
					>600	
1.0					520	
					530	
	CH	Sandy CLAY, high plasticity, brown, pale brown, fine to coarse grained sand, slightly calcareous	~Wp	H		
1.5					>600	
					>600	
2.0						
					>600	
	CH	CLAY, high plasticity, brown, black speckle, with pale brown calcareous pockets, trace fine gravel, alluvial and calcrete	~Wp	H		
2.5						
					>600	
3.0						

Depth to Groundwater: None Observed

Trees at Site: No



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Logged by: HRJ

Drilling Method: Push Tube

Drill Rig/Mount: Portable

Borehole No.

BH S2

Page 2

Legend:

Moisture Condition	Density Index - Granular	Consistency - Cohesive
D - Dry	VL/L - Very Loose/Loose	VS - Very Soft Vst-Very Stiff
M - Moist	MD- Medium Dense	S - Soft H - Hard
W - Wet	D/VD- Dense/Very Dense	F - Firm Fb - Friable
Wp - Plastic Limit		St - Stiff
USCS: Unified Soil Classification System		↓GW = Groundwater

Project Number: WGA241280

Location: CONCORDIA GROWTH AREA

		Composition of soil	Condition of soil			Structure and additional observations
Depth below surface (m)	USCS Symbol	Soil Description (type, plasticity, grading, colour, secondary and minor components)	Moisture Condition	Consistency or Density Index	Hand Penetrometer Reading (kPa)	(e.g. soil origin, defects, cementing, likely I_{pt} (%))
	CH	CLAY, as above	>Wp	H		
3.5					>600	
4.0		Moisture increases With minor grey mottle, weak slickensides			600 >600	Fissured
4.5		Borehole terminated at 4.2 m (target depth)				
5.0						
5.5						
6.0						

Depth to Groundwater: None Observed

Trees at Site: No



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Drilling Method: Push Tube

Drill Rig/Mount: Portable

Borehole No.

BH S3

Page 1

Legend:

Moisture Condition	Density Index - Granular	Consistency - Cohesive
D - Dry	VL/L - Very Loose/Loose	VS - Very Soft Vst-Very Stiff
M - Moist	MD- Medium Dense	S - Soft H - Hard
W - Wet	D/VD- Dense/Very Dense	F - Firm Fb - Friable
Wp - Plastic Limit		St - Stiff
USCS: Unified Soil Classification System		↓GW = Groundwater

Project Number: WGA241280

Location: CONCORDIA GROWTH AREA

		Composition of soil	Condition of soil			Structure and additional observations
Depth below surface (m)	USCS Symbol	Soil Description (type, plasticity, grading, colour, secondary and minor components)	Moisture Condition	Consistency or Density Index	Hand Penetrometer Reading (kPa)	(e.g. soil origin, defects, cementing, likely I_{pt} (%))
	CH	Thin topsoil layer over CLAY/sandy CLAY, high plasticity, red brown, fine to medium grained sand	≈Wp		530	
0.35						
0.5	CL	Sandy CLAY, low plasticity, pale brown, white, fine to coarse grained sand, calcareous, with highly calcareous pockets reducing below 0.7 m depth, grades medium to high plasticity	>Wp		>600	
					450	
1.0						
	CH	Transitionally grading to CLAY, high plasticity, brown, trace to some sand, fissured	>Wp		560	Residual Clay
					470	
1.5					500	
					570	
					>600	
	CH	Silty CLAY, high plasticity, brown, orange brown, red brown, grey, with rock fabric in places (extremely weathered) and trace gravel				
2.0					600	
2.5		Quartz gravel layer			600	
		SILTSTONE, extremely weathered, recovered as silty CLAY, high plasticity to clayey SILT, low plasticity, orange brown, grey, red	M		580	Weathered bedrock
3.0		brown, yellow brown, brown				

Depth to Groundwater: None Observed

Trees at Site: No



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Date Logged: 26/08/2024

Logged by: HRJ

Drilling Method: Push Tube

Drill Rig/Mount: Portable

Borehole No.

BH S3

Page 2

Legend:

Moisture Condition	Density Index - Granular	Consistency - Cohesive
D - Dry	VL/L - Very Loose/Loose	VS - Very Soft Vst-Very Stiff
M - Moist	MD- Medium Dense	S - Soft H - Hard
W - Wet	D/VD- Dense/Very Dense	F - Firm Fb - Friable
Wp - Plastic Limit		St - Stiff
USCS: Unified Soil Classification System		↓GW = Groundwater

Project Number: WGA241280

Location: CONCORDIA GROWTH AREA

		Composition of soil	Condition of soil			Structure and additional observations
Depth below surface (m)	USCS Symbol	Soil Description (type, plasticity, grading, colour, secondary and minor components)	Moisture Condition	Consistency or Density Index	Hand Penetrometer Reading (kPa)	(e.g. soil origin, defects, cementing, likely I_{pt} (%))
		SILTSTONE, mainly extremely weathered, recovered as silty CLAY, medium plasticity, orange brown, grey brown, red brown, with sand, with quartz gravel 3.0 m - 3.3 m				
3.5						
		Recovered as silty clayey SAND, trace very low strength fragments, distinct rock fabric				
4.0						
		Borehole terminated at 4.1 m (target depth)				
4.5						
5.0						
5.5						
6.0						

Depth to Groundwater: None Observed

Trees at Site: No



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Logged by: HRJ

Drilling Method: Push Tube

Drill Rig/Mount: Portable

Borehole No.

BH S4

Page 1

Legend:

Moisture Condition	Density Index - Granular	Consistency - Cohesive
D - Dry	VL/L - Very Loose/Loose	VS - Very Soft Vst-Very Stiff
M - Moist	MD- Medium Dense	S - Soft H - Hard
W - Wet	D/VD- Dense/Very Dense	F - Firm Fb - Friable
Wp - Plastic Limit		St - Stiff
USCS: Unified Soil Classification System		↓GW = Groundwater

Project Number: WGA241280

Location: CONCORDIA GROWTH AREA

		Composition of soil	Condition of soil			Structure and additional observations
Depth below surface (m)	USCS Symbol	Soil Description (type, plasticity, grading, colour, secondary and minor components)	Moisture Condition	Consistency or Density Index	Hand Penetrometer Reading (kPa)	(e.g. soil origin, defects, cementing, likely I_{pt} (%))
	CH	CLAY/sandy CLAY, high plasticity, red brown, dark brown, fine to medium grained sand			600	NATURAL
0.45					>600	
	CL	Sandy CLAY, medium plasticity, brown, pale brown, fine to coarse grained sand, calcareous	<Wp	Fb		Calcareous
1.0						
	CH	Silty CLAY, high plasticity, brown, orange brown, red brown, black speckle, some sand, transitional with calcareous pockets to 1.4 m	>Wp	H		Residual Clay
1.5					>600	
					>600	
2.0					>600	
	ML	SILTSTONE, extremely weathered, recovered as sandy SILT, with residual clay pockets and layers up to 100 mm thick, distinct rock fabric	M			Weathered bedrock
2.5						
3.0						

Depth to Groundwater: None Observed

Trees at Site: No



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Logged by: HRJ

Drilling Method: Push Tube

Drill Rig/Mount: Portable

Borehole No.

BH S4

Page 2

Legend:

Moisture Condition	Density Index - Granular	Consistency - Cohesive
D - Dry	VL/L - Very Loose/Loose	VS - Very Soft Vst-Very Stiff
M - Moist	MD- Medium Dense	S - Soft H - Hard
W - Wet	D/VD- Dense/Very Dense	F - Firm Fb - Friable
Wp - Plastic Limit		St - Stiff
USCS: Unified Soil Classification System		↓GW = Groundwater

Project Number: WGA241280

Location: CONCORDIA GROWTH AREA

		Composition of soil	Condition of soil			Structure and additional observations
Depth below surface (m)	USCS Symbol	Soil Description (type, plasticity, grading, colour, secondary and minor components)	Moisture Condition	Consistency or Density Index	Hand Penetrometer Reading (kPa)	(e.g. soil origin, defects, cementing, likely I_{pt} (%))
		SILTSTONE, as above	M			
3.5						
4.0					>600	
4.5		Borehole terminated at 4.1 m (target depth)				
5.0						
5.5						
6.0						

Depth to Groundwater: None Observed

Trees at Site: No



Drill Rig/Mount: Portable

Portable

Page 1

Location: CONCORDIA GROWTH AREA

Moisture Condition	Density Index - Granular	Consistency - Cohesive
D - Dry	VL/L - Very Loose/Loose	VS - Very Soft Vst-Very Stiff
M - Moist	MD- Medium Dense	S - Soft H - Hard
W - Wet	D/VD- Dense/Very Dense	F - Firm Fb - Friable
Wp - Plastic Limit		St - Stiff
USCS: Unified Soil Classification System		↓GW = Groundwater

		Composition of soil	Condition of soil			Structure and additional observations
Depth below surface (m)	USCS Symbol	Soil Description (type, plasticity, grading, colour, secondary and minor components)	Moisture Condition	Consistency or Density Index	Hand Penetrometer Reading (kPa)	(e.g. soil origin, defects, cementing, likely I _{pt} (%))
0.25	CH	Sandy CLAY, high plasticity, dark red brown, fine to medium grained sand	<Wp	H		NATURAL B-horizon
	CL	Sandy CLAY, medium plasticity, brown, pale brown calcareous mottle, fine to coarse grained sand, highly calcareous pockets, trace gravel	D/<Wp	Fb		Calcareous
	CH	Sandy CLAY, high plasticity, brown, with pale brown calcareous sandy pockets				Transitional
1.0	CH	CLAY, high plasticity, brown, red brown, black speckle, fissured	≤Wp	H		Residual Clay
1.5					>600	
			>Wp		520	
					500	
2.0					530	
					560	
					550	
2.5		With grey mottle			550	
					590	
					>600	
3.0		With extremely weathered pockets			>600	

Trees at Site: No



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Date Drilled: 26/08/2024

Date Logged: 26/08/2024

Logged by: HRJ

Drilling Method: Push Tube

Drill Rig/Mount: Portable

Borehole No.

BH S5

Page 2

Legend:

Moisture Condition	Density Index - Granular	Consistency - Cohesive
D - Dry	VL/L - Very Loose/Loose	VS - Very Soft Vst-Very Stiff
M - Moist	MD- Medium Dense	S - Soft H - Hard
W - Wet	D/VD- Dense/Very Dense	F - Firm Fb - Friable
Wp - Plastic Limit		St - Stiff
USCS: Unified Soil Classification System		↓GW = Groundwater

Project Number: WGA241280

Location: CONCORDIA GROWTH AREA

		Composition of soil	Condition of soil			Structure and additional observations
Depth below surface (m)	USCS Symbol	Soil Description (type, plasticity, grading, colour, secondary and minor components)	Moisture Condition	Consistency or Density Index	Hand Penetrometer Reading (kPa)	(e.g. soil origin, defects, cementing, likely I_{pt} (%))
	CH	CLAY, high plasticity, brown/red brown, with yellow, pale grey, weathered rock pockets, fissured	>Wp			
3.5		SILTSTONE, extremely to distinctly weathered, with residual clay pockets, recovered as silty SAND, silty CLAY, with very low to medium strength fragments, white, pale orange brown, red brown	M			Weathered bedrock
4.0		Borehole terminated at 3.7 m (push tube refusal)				
4.5						
5.0						
5.5						
6.0						

Depth to Groundwater: None Observed

Trees at Site: No



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Date Drilled: 26/08/2024

Date Logged: 26/08/2024

Logged by: HRJ

Drilling Method: Push Tube

Drill Rig/Mount: Portable

Borehole No.

BH S6

Page 1

Legend:

Moisture Condition	Density Index - Granular	Consistency - Cohesive
D - Dry	VL/L - Very Loose/Loose	VS - Very Soft Vst-Very Stiff
M - Moist	MD- Medium Dense	S - Soft H - Hard
W - Wet	D/VD- Dense/Very Dense	F - Firm Fb - Friable
Wp - Plastic Limit		St - Stiff
USCS: Unified Soil Classification System		↓GW = Groundwater

Project Number: WGA241280

Location: CONCORDIA GROWTH AREA

		Composition of soil	Condition of soil			Structure and additional observations
Depth below surface (m)	USCS Symbol	Soil Description (type, plasticity, grading, colour, secondary and minor components)	Moisture Condition	Consistency or Density Index	Hand Penetrometer Reading (kPa)	(e.g. soil origin, defects, cementing, likely I_{pt} (%))
	CL	Sandy CLAY, medium plasticity, dark brown, fine to medium grained sand, organics	<Wp			NATURAL Topsoil
	CH	CLAY, high plasticity, dark red brown, some sand	≈Wp	H		B-horizon
					>600	
0.5	CH	Sandy CLAY, high plasticity, brown, pale brown calcareous pockets, fine to coarse grained sand, trace gravel	<Wp	Fb		Calcareous
1.0	CH	Sandy CLAY, high plasticity, brown, fine to medium grained sand, slightly calcareous, silty texture	<Wp	Fb		Residual Clay
1.5		SILTSTONE, extremely weathered, recovered as silty SAND/sandy SILT, fine to coarse grained sand, low plasticity, white, pale orange brown, pale brown, trace very low strength fragments	M			Weathered bedrock
2.0		Extremely to distinctly weathered, very low to low strength fragments				
2.5						
3.0		Borehole terminated at 3.0 m (target depth)				

Depth to Groundwater: None Observed

Trees at Site: No



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Date Drilled: 26/08/2024

Date Logged: 26/08/2024

Logged by: HRJ

Drilling Method: Push Tube

Drill Rig/Mount: Portable

Borehole No.

BH S7

Page 1

Legend:

Moisture Condition	Density Index - Granular	Consistency - Cohesive
D - Dry	VL/L - Very Loose/Loose	VS - Very Soft Vst-Very Stiff
M - Moist	MD- Medium Dense	S - Soft H - Hard
W - Wet	D/VD- Dense/Very Dense	F - Firm Fb - Friable
Wp - Plastic Limit		St - Stiff
USCS: Unified Soil Classification System		↓GW = Groundwater

Project Number: WGA241280

Location: CONCORDIA GROWTH AREA

		Composition of soil	Condition of soil			Structure and additional observations
Depth below surface (m)	USCS Symbol	Soil Description (type, plasticity, grading, colour, secondary and minor components)	Moisture Condition	Consistency or Density Index	Hand Penetrometer Reading (kPa)	(e.g. soil origin, defects, cementing, likely I_{pt} (%))
	CL	Sandy CLAY, medium plasticity, dark brown, fine to coarse grained sand, rootlets, trace calcrete	Wp~			TOPSOIL
	CL	Sandy CLAY, low plasticity, pale brown, fine to coarse grained sand, with fine to medium calcrete, calcareous	<Wp	Fb		Calcareous
0.5						
	CL	Low to medium plasticity				
	CH	Silty CLAY, high plasticity, red brown, orange brown, with distinctly weathered rock fabric (as below), with sand, fissured	<Wp	Fb		Residual Clay
1.0				H		
					>600	
1.45					>600	
1.5		SILTSTONE, distinctly weathered, low strength, grey, orange brown, brown				Weathered bedrock
		Borehole terminated at 1.6 m (push tube refusal)				
2.0						
2.5						
3.0						

Depth to Groundwater: None Observed

Trees at Site: No



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Date Drilled: 26/08/2024

Date Logged: 26/08/2024

Logged by: HRJ

Drilling Method: Push Tube

Drill Rig/Mount: Portable

Borehole No.

BH S8

Page 1

Legend:

Moisture Condition	Density Index - Granular	Consistency - Cohesive
D - Dry	VL/L - Very Loose/Loose	VS - Very Soft Vst-Very Stiff
M - Moist	MD- Medium Dense	S - Soft H - Hard
W - Wet	D/VD- Dense/Very Dense	F - Firm Fb - Friable
Wp - Plastic Limit		St - Stiff
USCS: Unified Soil Classification System		↓GW = Groundwater

Project Number: WGA241280

Location: CONCORDIA GROWTH AREA

		Composition of soil	Condition of soil			Structure and additional observations
Depth below surface (m)	USCS Symbol	Soil Description (type, plasticity, grading, colour, secondary and minor components)	Moisture Condition	Consistency or Density Index	Hand Penetrometer Reading (kPa)	(e.g. soil origin, defects, cementing, likely I_{pt} (%))
0.15	SC	Clayey SAND, fine to coarse, dark brown, low plasticity, organics, rootlets	M			NATURAL
0.35	CH	Sandy CLAY, high plasticity, dark red brown, fine to medium	<Wp	Fb		Topsoil
0.5	SC	Clayey SAND, fine to coarse, pale brown, low to medium plasticity, high plasticity	D	Fb		B-horizon
1.0						
1.5	CL	Sandy CLAY, medium plasticity, brown, pale brown pockets, fine to coarse grained sand, calcareous pockets	<Wp	Fb		Calcareous
2.0	CL	Sandy CLAY, medium plasticity, brown, pale grey, fine to coarse grained sand, with cemented silt gravels	<Wp	Fb		Alluvium
2.5	SM	Silty SAND, fine to medium, pale grey, pale red, variably cemented	D-M	D/MD		Possible Tertiary
3.0						Tertiary Sand

Depth to Groundwater: None Observed

Trees at Site: No



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Date Drilled: 26/08/2024

Date Logged: 26/08/2024

Logged by: HRJ

Drilling Method: Push Tube

Drill Rig/Mount: Portable

Borehole No.

BH S8

Page 2

Legend:

Moisture Condition	Density Index - Granular	Consistency - Cohesive
D - Dry	VL/L - Very Loose/Loose	VS - Very Soft Vst-Very Stiff
M - Moist	MD- Medium Dense	S - Soft H - Hard
W - Wet	D/VD- Dense/Very Dense	F - Firm Fb - Friable
Wp - Plastic Limit		St - Stiff
USCS: Unified Soil Classification System		↓GW = Groundwater

Project Number: WGA241280

Location: CONCORDIA GROWTH AREA

		Composition of soil	Condition of soil			Structure and additional observations
Depth below surface (m)	USCS Symbol	Soil Description (type, plasticity, grading, colour, secondary and minor components)	Moisture Condition	Consistency or Density Index	Hand Penetrometer Reading (kPa)	(e.g. soil origin, defects, cementing, likely I_{pt} (%))
	SM	Silty SAND, as above	D-M	D/MD		
3.5						
4.0						
		Borehole terminated at 4.1 m (target depth)				
4.5						
5.0						
5.5						
6.0						

Depth to Groundwater: None Observed

Trees at Site: No



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Date Drilled: 26/08/2024

Date Logged: 26/08/2024

Logged by: HRJ

Drilling Method: Push Tube

Drill Rig/Mount: Portable

Borehole No.

BH S9

Page 1

Legend:

Moisture Condition	Density Index - Granular	Consistency - Cohesive
D - Dry	VL/L - Very Loose/Loose	VS - Very Soft Vst-Very Stiff
M - Moist	MD- Medium Dense	S - Soft H - Hard
W - Wet	D/VD- Dense/Very Dense	F - Firm Fb - Friable
Wp - Plastic Limit		St - Stiff
USCS: Unified Soil Classification System		↓GW = Groundwater

Project Number: WGA241280

Location: CONCORDIA GROWTH AREA

		Composition of soil	Condition of soil			Structure and additional observations
Depth below surface (m)	USCS Symbol	Soil Description (type, plasticity, grading, colour, secondary and minor components)	Moisture Condition	Consistency or Density Index	Hand Penetrometer Reading (kPa)	(e.g. soil origin, defects, cementing, likely I_{pt} (%))
0.15	SC	Clayey SAND, fine to medium, dark brown, low plasticity	M			NATURAL
						Topsoil
	CH	Sandy CLAY, high plasticity, red brown, fine to medium grained sand	<Wp	H/Fb		B-horizon
			≥Wp			
0.45						
	CL	Sandy CLAY, low plasticity, pale brown, fine to coarse grained sand, with fine to medium calcrete reducing, calcareous	<Wp	Fb		Calcareous
1.0						
	CL	Sandy CLAY, medium plasticity, brown, pale brown pockets, fine to coarse grained sand, calcareous sand				
1.35						
1.5	CH	CLAY, high plasticity, orange brown, brown, black speckle, highly fissured, silty texture	≈Wp	H	>600	Residual Clay
					>600	
2.0		With weathered rock pockets			>600	
		SILTSTONE, extremely to distinctly weathered, recovered as silty	M			Weathered rock
		SAND, fine to medium, pale orange, brown, white, pale red brown,				
2.5		low plasticity, with variable very low to low strength rock fragments				
3.0		Borehole terminated at 3.0 m (target depth)				

Depth to Groundwater: None Observed

Trees at Site: No



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Date Drilled: 26/08/2024

Date Logged: 26/08/2024

Logged by: HRJ

Drilling Method: Push Tube

Drill Rig/Mount: Portable

Borehole No.

BH S10

Page 1

Legend:

Moisture Condition	Density Index - Granular	Consistency - Cohesive
D - Dry	VL/L - Very Loose/Loose	VS - Very Soft Vst-Very Stiff
M - Moist	MD- Medium Dense	S - Soft H - Hard
W - Wet	D/VD- Dense/Very Dense	F - Firm Fb - Friable
Wp - Plastic Limit		St - Stiff
USCS: Unified Soil Classification System		↓GW = Groundwater

Project Number: WGA241280

Location: CONCORDIA GROWTH AREA

		Composition of soil	Condition of soil			Structure and additional observations
Depth below surface (m)	USCS Symbol	Soil Description (type, plasticity, grading, colour, secondary and minor components)	Moisture Condition	Consistency or Density Index	Hand Penetrometer Reading (kPa)	(e.g. soil origin, defects, cementing, likely I_{pt} (%))
0.15	CL	Sandy CLAY, medium plasticity, dark brown, fine to medium grained sand	<Wp			NATURAL Topsoil
0.35	CH	CLAY, high plasticity, red brown, some sand	<Wp	Fb/H		B-horizon
0.5	CL	Sandy CLAY, medium plasticity, brown, white pockets, fine to coarse grained sand, with calcrete inclusions	<Wp	Fb		Calcareous
1.0	SM	Silty SAND, fine to medium, pale brown, white, pale grey, low plasticity, variably cemented	D-M	D/MD		Tertiary Sand
1.5						
2.0						
		Mainly red, orange, increased cementation				
2.5		Borehole terminated at 2.2 m (near refusal)				
3.0						

Depth to Groundwater: None Observed

Trees at Site: No



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Date Drilled: 26/08/2024

Date Logged: 26/08/2024

Logged by: HRJ

Drilling Method: Push Tube

Drill Rig/Mount: Portable

Borehole No.

BH S11

Page 1

Legend:

Moisture Condition	Density Index - Granular	Consistency - Cohesive
D - Dry	VL/L - Very Loose/Loose	VS - Very Soft Vst-Very Stiff
M - Moist	MD- Medium Dense	S - Soft H - Hard
W - Wet	D/VD- Dense/Very Dense	F - Firm Fb - Friable
Wp - Plastic Limit		St - Stiff
USCS: Unified Soil Classification System		↓GW = Groundwater

Project Number: WGA241280

Location: CONCORDIA GROWTH AREA

		Composition of soil	Condition of soil			Structure and additional observations
Depth below surface (m)	USCS Symbol	Soil Description (type, plasticity, grading, colour, secondary and minor components)	Moisture Condition	Consistency or Density Index	Hand Penetrometer Reading (kPa)	(e.g. soil origin, defects, cementing, likely I_{pt} (%))
	FILL	Sandy CLAY, medium plasticity, dark brown, fine to medium grained sand, rootlets	≈Wp			FILL
0.15						Site won
0.3	CL	Sandy CLAY, medium plasticity, brown, fine to medium grained sand, trace quartzite gravel	<Wp	Fb		Possible fill
0.5	CH	CLAY, high plasticity, red brown, trace sand, hard fragments	<Wp	H/Fb		NATURAL
						B-horizon
	CH	Sandy CLAY, high plasticity, brown, pale brown pockets, fine to coarse grained sand, calcareous pockets	<Wp	Fb		
1.0						
		Trace quartzite gravel				
1.5						
		Calcareous largely stops				
2.0		CLAY, high plasticity, brown, red brown, trace sand, fissured, hard fragments	<Wp	H	>600	Residual Clay
			>Wp		>600	
2.5						
					>600	
3.0						

Depth to Groundwater: None Observed

Trees at Site: No



60 Wyatt Street, Adelaide
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Date Drilled: 26/08/2024

Date Logged: 26/08/2024

Logged by: HRJ

Drilling Method: Push Tube

Drill Rig/Mount: Portable

Borehole No.

BH S11

Page 2

Legend:

Moisture Condition	Density Index - Granular	Consistency - Cohesive
D - Dry	VL/L - Very Loose/Loose	VS - Very Soft Vst-Very Stiff
M - Moist	MD- Medium Dense	S - Soft H - Hard
W - Wet	D/VD- Dense/Very Dense	F - Firm Fb - Friable
Wp - Plastic Limit		St - Stiff
USCS: Unified Soil Classification System		↓GW = Groundwater

Project Number: WGA241280

Location: CONCORDIA GROWTH AREA

		Composition of soil	Condition of soil			Structure and additional observations
Depth below surface (m)	USCS Symbol	Soil Description (type, plasticity, grading, colour, secondary and minor components)	Moisture Condition	Consistency or Density Index	Hand Penetrometer Reading (kPa)	(e.g. soil origin, defects, cementing, likely I_{pt} (%))
	CH	CLAY, as above	>Wp	H	>600	
3.5	CH	Silty CLAY, high plasticity, red brown, minor grey, trace weathered rock fragments, increasing to depth	>Wp	H	>600	
4.0		Local quartzite gravel			>600	
		Borehole terminated at 4.1 m (target depth)				
4.5						
5.0						
5.5						
6.0						

Depth to Groundwater: None Observed

Trees at Site: No



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Date Drilled: 26/08/2024

Date Logged: 26/08/2024

Logged by: HRJ

Drilling Method: Push Tube

Drill Rig/Mount: Portable

Borehole No.

BH S12

Page 1

Legend:

Moisture Condition	Density Index - Granular	Consistency - Cohesive
D - Dry	VL/L - Very Loose/Loose	VS - Very Soft Vst-Very Stiff
M - Moist	MD- Medium Dense	S - Soft H - Hard
W - Wet	D/VD- Dense/Very Dense	F - Firm Fb - Friable
Wp - Plastic Limit		St - Stiff
USCS: Unified Soil Classification System		↓GW = Groundwater

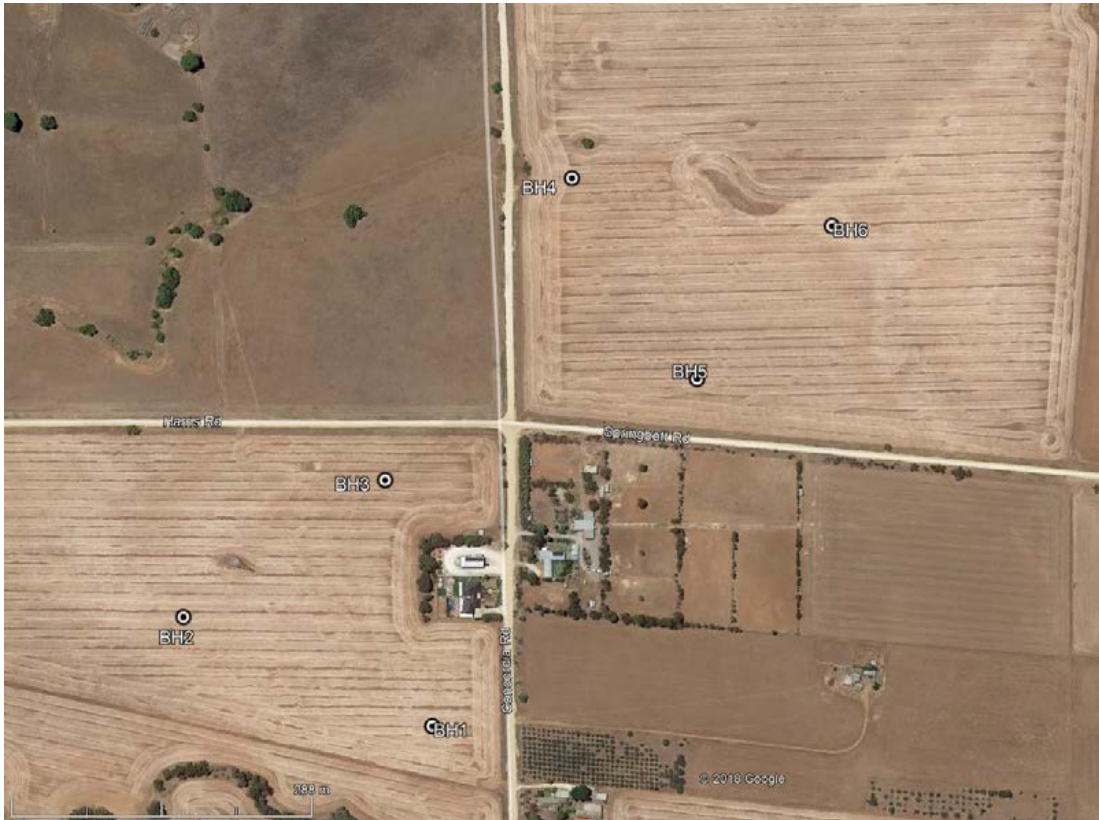
Project Number: WGA241280

Location: CONCORDIA GROWTH AREA

		Composition of soil	Condition of soil			Structure and additional observations
Depth below surface (m)	USCS Symbol	Soil Description (type, plasticity, grading, colour, secondary and minor components)	Moisture Condition	Consistency or Density Index	Hand Penetrometer Reading (kPa)	(e.g. soil origin, defects, cementing, likely I_{pt} (%))
	CL	Sandy CLAY, medium plasticity, dark brown, fine to coarse grained sand, rootlets, minor organics, reduce below 0.1 m with calcrete gravel inclusions	<Wp		560	NATURAL Topsoil
	CL	Sandy CLAY, low plasticity, pale brown, fine to coarse grained sand, calcareous	<Wp			Calcareous
0.5		SILTSTONE, distinctly weathered, recovered as very low to low strength fragments, green brown, grey, pale brown at 0.7 m, with medium strength fragments	D			Weathered bedrock
1.0						
1.5		Borehole terminated at 1.2 m (push tube refusal)				
2.0						
2.5						
3.0						

Depth to Groundwater: None Observed

Trees at Site: No



Map data: Google



Drawn by	HRJ
Approved	RWG
Date	20-06-19
Dimensions	-
Original	-

WGA
WALLBRIDGE GILBERT
AZTEC

Client:	CONCORDIA LAND		
Project:	PROPOSED CONCORDIA LAND DIVISION CONCORDIA		
Title:	BOREHOLE LOCATION PLAN		
Project No.:	WGA190926	Ref.	FIGURE 1



60 Wyatt Street, Adelaide
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Date Drilled: 11/06/2019

Date Logged: 11/06/2019

Logged by: HJ

Drilling Method: Push Tube

Drill Rig/Mount: Rockmaster

Borehole No.

BH 1

Legend:

Moisture Condition	Density Index - Granular	Consistency - Cohesive
D - Dry	VL/L - Very Loose/Loose	VS - Very Soft Vst-Very Stiff
M - Moist	MD- Medium Dense	S - Soft H - Hard
W - Wet	D/VD- Dense/Very Dense	F - Firm Fb - Friable
Wp - Plastic Limit		St - Stiff
USCS: Unified Soil Classification System		↓ GW = Groundwater

Job Number: WGA190926

Location: CONCORDIA LAND DIVISION

		Composition of soil	Condition of soil			Structure and additional observations
Depth below surface (m)	USCS Symbol	Soil Description (type, plasticity, grading, colour, secondary and minor components)	Moisture Condition	Consistency or Density Index	Hand Penetrometer Reading (kPa)	(e.g. soil origin, defects, cementing, likely I_{pt} (%))
	CL	Sandy CLAY, low plasticity, dark brown, fine to medium grained sand	≤Wp	Fb		NATURAL
0.25	CL	Sandy CLAY, medium plasticity, dark red-brown, fine to medium grained sand, organics				ploughed surface topsoil
0.5	SM/SC	Thin calcrete cap over clayey/silty SAND, fine to coarse, white, pale brown, low plasticity, highly calcareous	M			highly calcareous
0.55						
1.0		SCHIST, extremely weathered, yellow-brown, pale brown, recovered as clayey SAND, fine to coarse, low plasticity, with variable gravel, increasing with depth, rock fabric evident, micaceous flecks	M			XW bedrock
1.25						
1.5		Borehole terminated at 1.25m (push tube refusal)				
2.0						
2.5						
3.0						

Depth to Groundwater: None Observed

Trees at Site: No

Legend:

Moisture Condition	Density Index - Granular	Consistency - Cohesive
D - Dry	VL/L - Very Loose/Loose	VS - Very Soft Vst-Very Stiff
M - Moist	MD- Medium Dense	S - Soft H - Hard
W - Wet	D/VD- Dense/Very Dense	F - Firm Fb - Friable
Wp - Plastic Limit		St - Stiff
USCS: Unified Soil Classification System		↓ GW = Groundwater

Job Number: **WGA190926**

Location: **CONCORDIA LAND DIVISION**

		Composition of soil	Condition of soil			Structure and additional observations
Depth below surface (m)	USCS Symbol	Soil Description (type, plasticity, grading, colour, secondary and minor components)	Moisture Condition	Consistency or Density Index	Hand Penetrometer Reading (kPa)	(e.g. soil origin, defects, cementing, likely I_{pt} (%))
0.15	CL	Sandy CLAY, low plasticity, dark brown, fine to medium grained sand, organics, rootlets	≥Wp	Fb		NATURAL Topsoil
0.5	CH	Sandy CLAY, high plasticity, red-brown, fine to medium grained sand	<Wp	H/Fb	>600	B-Horizon
					>600	
	CL	Sandy CLAY, low plasticity, pale brown, white, fine to coarse grained sand, some fine to medium gravel, calcareous, calcrete	<Wp	Fb		calcareous
1.0	CL	Grades medium plasticity, with brown pockets clay				
1.5		Clay pockets increasing, calcareous reducing				
				H	>600	
2.0	CH	CLAY, high plasticity, red-brown, trace fine to medium grained sand	>Wp	H	>600	
					>600	
2.5						
		with trace fine to medium gravel, yellow, red, white (sandstone and quartzite)			>600	
3.0						

Depth to Groundwater: None Observed

Trees at Site: No

Legend:

Moisture Condition	Density Index - Granular	Consistency - Cohesive
D - Dry	VL/L - Very Loose/Loose	VS - Very Soft Vst-Very Stiff
M - Moist	MD- Medium Dense	S - Soft H - Hard
W - Wet	D/VD- Dense/Very Dense	F - Firm Fb - Friable
Wp - Plastic Limit		St - Stiff
USCS: Unified Soil Classification System		↓GW = Groundwater

Job Number: WGA190926

Location: CONCORDIA LAND DIVISION

		Composition of soil	Condition of soil			Structure and additional observations
Depth below surface (m)	USCS Symbol	Soil Description (type, plasticity, grading, colour, secondary and minor components)	Moisture Condition	Consistency or Density Index	Hand Penetrometer Reading (kPa)	(e.g. soil origin, defects, cementing, likely I_{pt} (%))
	CH	CLAY, as above	>Wp	H		
					>600	
3.5					600	
					580	
					420	
				Vst	400	
4.0					370	
		Borehole terminated at 4m (target depth)				
4.5						
5.0						
5.5						
6.0						

Depth to Groundwater: None Observed

Trees at Site: No

Legend:

Moisture Condition	Density Index - Granular	Consistency - Cohesive
D - Dry	VL/L - Very Loose/Loose	VS - Very Soft Vst-Very Stiff
M - Moist	MD- Medium Dense	S - Soft H - Hard
W - Wet	D/VD- Dense/Very Dense	F - Firm Fb - Friable
Wp - Plastic Limit		St - Stiff
USCS: Unified Soil Classification System		↓ GW = Groundwater

Job Number: **WGA190926**

Location: **CONCORDIA LAND DIVISION**

		Composition of soil	Condition of soil			Structure and additional observations
Depth below surface (m)	USCS Symbol	Soil Description (type, plasticity, grading, colour, secondary and minor components)	Moisture Condition	Consistency or Density Index	Hand Penetrometer Reading (kPa)	(e.g. soil origin, defects, cementing, likely I_{pt} (%))
	CL	Sandy CLAY, medium plasticity, dark brown, fine to medium grained sand, organics, rootlets	<Wp	Fb		NATURAL Topsoil
0.5	SM	Silty SAND, fine to coarse, pale brown, white, low plasticity, trace fine to medium gravel, calcareous, calcrete	<Wp/D	MD L		Highly calcareous
1.0	CL/CH	Sandy CLAY, medium to high plasticity, red-brown, brown, pale brown pockets, fine to coarse grained sand	<Wp	Fb		residual clay
			≥Wp	H	>600	
1.5		SHALE/SCHIST, extremely weathered, yellow, white, brown, generally recovered as silty SAND/Sandy SILT with clayey pockets, locally residual clay (silty CLAY, medium to high plasticity, brown) rock fabric visible, very low strength gravel	M		>600	XW SHALE/SCHIST
2.0						
2.5						
3.0						

Depth to Groundwater: None Observed

Trees at Site: No

Legend:

Moisture Condition	Density Index - Granular	Consistency - Cohesive
D - Dry	VL/L - Very Loose/Loose	VS - Very Soft Vst-Very Stiff
M - Moist	MD- Medium Dense	S - Soft H - Hard
W - Wet	D/VD- Dense/Very Dense	F - Firm Fb - Friable
Wp - Plastic Limit		St - Stiff
USCS: Unified Soil Classification System		↓GW = Groundwater

Job Number: **WGA190926**

Location: **CONCORDIA LAND DIVISION**

		Composition of soil	Condition of soil			Structure and additional observations
Depth below surface (m)	USCS Symbol	Soil Description (type, plasticity, grading, colour, secondary and minor components)	Moisture Condition	Consistency or Density Index	Hand Penetrometer Reading (kPa)	(e.g. soil origin, defects, cementing, likely I_{pt} (%))
		SHALE/SCHIST, As above	M			
3.5						
4.0						
4.5		Borehole terminated at 4m (target depth)				
5.0						
5.5						
6.0						

Depth to Groundwater: None Observed

Trees at Site: No



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Telephone 08 8223 7433
Email adelaide@wga.com.au

Date Drilled: 11/06/2019
Date Logged: 11/06/2019
Logged by: HJ
Drilling Method: Push Tube
Drill Rig/Mount: Rockmaster
Borehole No. BH 4

Legend:

Moisture Condition	Density Index - Granular	Consistency - Cohesive
D - Dry	VL/L - Very Loose/Loose	VS - Very Soft Vst-Very Stiff
M - Moist	MD- Medium Dense	S - Soft H - Hard
W - Wet	D/VD- Dense/Very Dense	F - Firm Fb - Friable
Wp - Plastic Limit		St - Stiff
USCS: Unified Soil Classification System		↓ GW = Groundwater

Job Number: **WGA190926**

Location: **CONCORDIA LAND DIVISION**

		Composition of soil	Condition of soil			Structure and additional observations
Depth below surface (m)	USCS Symbol	Soil Description (type, plasticity, grading, colour, secondary and minor components)	Moisture Condition	Consistency or Density Index	Hand Penetrometer Reading (kPa)	(e.g. soil origin, defects, cementing, likely I_{pt} (%))
	CL	Sandy CLAY, low plasticity, dark brown, fine to medium grained sand, organics, rootlets	<Wp	Fb		NATURAL Topsoil
	CH	Sandy CLAY/CLAY, high plasticity, red-brown, fine to medium grained sand	<Wp	H		B-Horizon
0.5					>600	
	CL	Sandy CLAY, low to medium plasticity, grey-brown, fine to coarse grained sand, trace fine to medium gravel, porous, calcareous	<Wp	Fb/H Fb/H	>600	calcareous
1.0						
		slightly calcareous				
1.5						
	CL/CH	Grades sandy CLAY, medium to high plasticity, red-brown, brown, fine to coarse grained sand, trace fine to medium gravel, gravelly lenses	>Wp	H	>600	Residual clay
2.0					>600	
	CH	Grades CLAY, high plasticity, red-brown, brown, trace yellow-brown pockets, some fine to coarse grained sand, trace silty, trace fine to medium gravel and weathered rock lenses			>600	
2.5					>600	
3.0		Borehole terminated at 3m (target depth)			500	

Depth to Groundwater: None Observed

Trees at Site: No



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South Australia 5000
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Date Drilled: 11/06/2019
Date Logged: 11/06/2019
Logged by: HJ
Drilling Method: Push Tube
Drill Rig/Mount: Rockmaster

Borehole No.
BH 5

Legend:

Moisture Condition	Density Index - Granular	Consistency - Cohesive
D - Dry	VL/L - Very Loose/Loose	VS - Very Soft Vst-Very Stiff
M - Moist	MD- Medium Dense	S - Soft H - Hard
W - Wet	D/VD- Dense/Very Dense	F - Firm Fb - Friable
Wp - Plastic Limit		St - Stiff
USCS: Unified Soil Classification System		↓ GW = Groundwater

Job Number: WGA190926

Location: CONCORDIA LAND DIVISION

		Composition of soil	Condition of soil			Structure and additional observations
Depth below surface (m)	USCS Symbol	Soil Description (type, plasticity, grading, colour, secondary and minor components)	Moisture Condition	Consistency or Density Index	Hand Penetrometer Reading (kPa)	(e.g. soil origin, defects, cementing, likely I_{pt} (%))
	CL	Sandy CLAY, medium plasticity, dark brown, fine to medium grained sand, organics	<Wp	Fb		NATURAL topsoil
0.5	CL	Sandy CLAY, medium plasticity, brown, white, orange-brown, fine to coarse grained sand, calcareous	<Wp	Fb		calcareous
1.0		SILTSTONE, extremely weathered, remoulds to silty sandy CLAY, low plasticity, yellow-brown, white, fine to medium grained sand, rock fabric, with zones of CLAY, medium to high plasticity, brown, residual clay	D-M			weathered bedrock with residual clay
1.5		Mainly residual clay				
2.0		SILTSTONE, distinctly weathered, yellow, white, pale yellow-brown, very low and low strength, remoulds to silty SAND	D-M			DW Siltstone
2.5						
3.0		Borehole terminated at 3m (target depth)				

Depth to Groundwater: None Observed

Trees at Site: No

Legend:

Moisture Condition	Density Index - Granular	Consistency - Cohesive
D - Dry	VL/L - Very Loose/Loose	VS - Very Soft Vst-Very Stiff
M - Moist	MD- Medium Dense	S - Soft H - Hard
W - Wet	D/VD- Dense/Very Dense	F - Firm Fb - Friable
Wp - Plastic Limit		St - Stiff
USCS: Unified Soil Classification System		↓ GW = Groundwater

Job Number: **WGA190926**

Location: **CONCORDIA LAND DIVISION**

		Composition of soil	Condition of soil			Structure and additional observations
Depth below surface (m)	USCS Symbol	Soil Description (type, plasticity, grading, colour, secondary and minor components)	Moisture Condition	Consistency or Density Index	Hand Penetrometer Reading (kPa)	(e.g. soil origin, defects, cementing, likely I_{pt} (%))
	CL	Sandy CLAY, low to medium plasticity, dark brown, fine to medium grained sand, organics, rootlets, trace fine gravel	<Wp	Fb		NATURAL Topsoil
0.5						
	CH	CLAY, high plasticity, dark grey/black, dark brown, trace fine to medium grained sand	<Wp	H	>600	B-horizon
					>600	
1.0						
	CH	CLAY, high plasticity, dark brown, some fine to medium grained sand	<Wp		>600	alluvium
			>Wp		600	
1.5					440	
		Sandy CLAY/CLAY		VSt	450	
					380	
2.0					350	
					420	
				H	410	
					440	
2.5				VSt	390	
					380	
3.0					250	

Depth to Groundwater: None Observed

Trees at Site: No

Legend:

Moisture Condition	Density Index - Granular	Consistency - Cohesive
D - Dry	VL/L - Very Loose/Loose	VS - Very Soft Vst-Very Stiff
M - Moist	MD- Medium Dense	S - Soft H - Hard
W - Wet	D/VD- Dense/Very Dense	F - Firm Fb - Friable
Wp - Plastic Limit		St - Stiff
USCS: Unified Soil Classification System		↓GW = Groundwater

Job Number: WGA190926

Location: CONCORDIA LAND DIVISION

		Composition of soil	Condition of soil			Structure and additional observations
Depth below surface (m)	USCS Symbol	Soil Description (type, plasticity, grading, colour, secondary and minor components)	Moisture Condition	Consistency or Density Index	Hand Penetrometer Reading (kPa)	(e.g. soil origin, defects, cementing, likely I_{pt} (%))
	CH	Sandy CLAY/CLAY, as above	>Wp	H	400	
					450	
3.5	CH	CLAY, high plasticity, brown, with pockets of fine to coarse grained sand and gravel	≥Wp	H	>600	
					>600	
	CH	Gravelly CLAY, high plasticity, brown, orange-brown, fine to coarse grained quartzite				
4.0	CH	CLAY, high plasticity, brown, grey-green mottle			>600	possible Hindmarsh Clay
		Borehole Terminated 4.0 m				
4.5						
5.0						
5.5						
6.0						

Depth to Groundwater: None Observed

Trees at Site: No

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Date Drilled: 11/06/2019

Date Logged: 11/06/2019

Logged by: HJ

Drilling Method: Push Tube

Drill Rig/Mount: Rockmaster

Borehole No.

BH7

Page 1 of 2

Legend:

Moisture Condition	Density Index - Granular	Consistency - Cohesive
D - Dry	VL/L - Very Loose/Loose	VS - Very Soft Vst-Very Stiff
M - Moist	MD- Medium Dense	S - Soft H - Hard
W - Wet	D/VD- Dense/Very Dense	F - Firm Fb - Friable
Wp - Plastic Limit		St - Stiff
USCS: Unified Soil Classification System		↓GW = Groundwater

Job Number: WGA190926

Location: CONCORDIA LAND DIVISION

		Composition of soil	Condition of soil			Structure and additional observations
Depth below surface (m)	USCS Symbol	Soil Description (type, plasticity, grading, colour, secondary and minor components)	Moisture Condition	Consistency or Density Index	Hand Penetrometer Reading (kPa)	(e.g. soil origin, defects, cementing, likely I _{pt} (%))
	FILL	Silty SAND, fine to medium, brown, low plasticity, organics, top 0.3m	M			POSSIBLE FILL
0.5		fine roots throughout	D			
1.0						
	SC	Clayey SAND, fine to medium, brown, low plasticity, minor rootlets	D-M	MD		
1.5		Pale brown fine gravel to 1.5m	M			
		with dark brown mottle, cinders				
2.0		Quartzite				
	SM	Silty SAND, fine to medium, orange, low plasticity	M	L-MD		NATURAL
3.0						

Depth to Groundwater: None Observed

Trees at Site: No

Legend:

Moisture Condition	Density Index - Granular	Consistency - Cohesive
D - Dry	VL/L - Very Loose/Loose	VS - Very Soft Vst-Very Stiff
M - Moist	MD- Medium Dense	S - Soft H - Hard
W - Wet	D/VD- Dense/Very Dense	F - Firm Fb - Friable
Wp - Plastic Limit		St - Stiff
USCS: Unified Soil Classification System		↓GW = Groundwater

Job Number: WGA190926

Location: CONCORDIA LAND DIVISION

		Composition of soil	Condition of soil			Structure and additional observations
Depth below surface (m)	USCS Symbol	Soil Description (type, plasticity, grading, colour, secondary and minor components)	Moisture Condition	Consistency or Density Index	Hand Penetrometer Reading (kPa)	(e.g. soil origin, defects, cementing, likely I_{pt} (%))
	SM	silty SAND, as above	M	L-MD		
3.2						
	SC/CL	Sandy CLAY/Clayey SAND, fine to medium, low plasticity, brown, trace pale brown pockets, trace fine to medium gravel, solution calcrete	M/≤Wp	MD/Fb		
3.5						
4.0						
		Borehole terminated at 4m (target depth)				
4.5						
5.0						
5.5						
6.0						

Depth to Groundwater: None Observed

Trees at Site: No

Legend:

Moisture Condition	Density Index - Granular	Consistency - Cohesive
D - Dry	VL/L - Very Loose/Loose	VS - Very Soft Vst-Very Stiff
M - Moist	MD- Medium Dense	S - Soft H - Hard
W - Wet	D/VD- Dense/Very Dense	F - Firm Fb - Friable
Wp - Plastic Limit		St - Stiff
USCS: Unified Soil Classification System		↓ GW = Groundwater

Job Number: WGA190926

Location: CONCORDIA LAND DIVISION

		Composition of soil	Condition of soil			Structure and additional observations
Depth below surface (m)	USCS Symbol	Soil Description (type, plasticity, grading, colour, secondary and minor components)	Moisture Condition	Consistency or Density Index	Hand Penetrometer Reading (kPa)	(e.g. soil origin, defects, cementing, likely I _{pt} (%))
	FILL	Silty SAND, fine to medium, brown, low plasticity, rootlets	M			POSSIBLE FILL
0.5			D			
		Quartite fragment				
1.0						
1.15						
	SC	Clayey SAND, fine to medium, brown, dark brown mottle, low plasticity, rootlets	M	D		NATURAL
1.5	SC	Clayey SAND, fine to medium, brown, low plasticity	M	MD		
	SC/CL	Sandy CLAY/Clayey SAND, fine to coarse grained sand, low plasticity, brown, trace cinders, rootlets, trace fine to medium gravel, solution calcrete	M/<Wp	MD/Fb	540	
2.0	CL	Grades sandy CLAY	<Wp	H/Fb		porous structure
2.5					>600	
					540	
					580	
3.0						

Depth to Groundwater: None Observed

Trees at Site: No

Legend:

Moisture Condition	Density Index - Granular	Consistency - Cohesive
D - Dry	VL/L - Very Loose/Loose	VS - Very Soft Vst-Very Stiff
M - Moist	MD- Medium Dense	S - Soft H - Hard
W - Wet	D/VD- Dense/Very Dense	F - Firm Fb - Friable
Wp - Plastic Limit		St - Stiff
USCS: Unified Soil Classification System		↓GW = Groundwater

Job Number: WGA190926

Location: CONCORDIA LAND DIVISION

		Composition of soil	Condition of soil			Structure and additional observations
Depth below surface (m)	USCS Symbol	Soil Description (type, plasticity, grading, colour, secondary and minor components)	Moisture Condition	Consistency or Density Index	Hand Penetrometer Reading (kPa)	(e.g. soil origin, defects, cementing, likely I_{pt} (%))
	CL	Sandy CLAY, as above	<Wp	H/Fb	520	
3.5					>600	
					540	
			≥Wp			
4.0	CL	Silty CLAY, medium plasticity, brown, grey-brown, some fine to medium grained sand, micaceous, porous	>Wp	VSt	370	
					300	
					240	
4.5					250	
	SC	Grades clayey SAND, fine to medium, brown, grey-brown, low plasticity, locally sandy CLAY pockets	M	MD		
5.0					420	
	SP/SM	SAND/Silty SAND, fine to medium, pale yellow-brown, pale brown, low plasticity	M	L-MD		
5.5						
		Grades fine to coarse grained sand				
6.0		Borehole terminated at 6m (target depth)				

Depth to Groundwater: None Observed

Trees at Site: No



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Date Drilled: 11/06/2019
Date Logged: 11/06/2019
Logged by: HJ
Drilling Method: Push Tube
Drill Rig/Mount: Rockmaster
Borehole No. BH 9

Legend:

Moisture Condition	Density Index - Granular	Consistency - Cohesive
D - Dry	VL/L - Very Loose/Loose	VS - Very Soft Vst-Very Stiff
M - Moist	MD- Medium Dense	S - Soft H - Hard
W - Wet	D/VD- Dense/Very Dense	F - Firm Fb - Friable
Wp - Plastic Limit		St - Stiff
USCS: Unified Soil Classification System		↓ GW = Groundwater

Job Number: **WGA190926**

Location: **CONCORDIA LAND DIVISION**

		Composition of soil	Condition of soil			Structure and additional observations
Depth below surface (m)	USCS Symbol	Soil Description (type, plasticity, grading, colour, secondary and minor components)	Moisture Condition	Consistency or Density Index	Hand Penetrometer Reading (kPa)	(e.g. soil origin, defects, cementing, likely I_{pt} (%))
	FILL	Silty SAND, fine to medium, brown, low plasticity, rootlets	M			POSSIBLE FILL
0.5			D			
1.0	SC	Clayey SAND, fine to medium, dark brown, brown, low plasticity, rootlets	D-M	MD-D		NATURAL
1.5	SM/SC	Silty/Clayey SAND, fine to medium, with calcrete nodules micaceous pockets				porous structure
2.0						
2.5	CL	Sandy CLAY, medium plasticity, grey-brown, fine to medium grained sand, trace fine gravel, porous Cinders	<Wp	H	450 >600	
3.0		Borehole Terminated 3.0 m			>600	

Depth to Groundwater: None Observed

Trees at Site: No



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Date Drilled: 11/06/2019
Date Logged: 11/06/2019
Logged by: HJ
Drilling Method: Push Tube
Drill Rig/Mount: Rockmaster
Borehole No. BH 10

Legend:

Moisture Condition	Density Index - Granular	Consistency - Cohesive
D - Dry	VL/L - Very Loose/Loose	VS - Very Soft Vst-Very Stiff
M - Moist	MD- Medium Dense	S - Soft H - Hard
W - Wet	D/VD- Dense/Very Dense	F - Firm Fb - Friable
Wp - Plastic Limit		St - Stiff
USCS: Unified Soil Classification System		↓ GW = Groundwater

Job Number: WGA190926

Location: CONCORDIA LAND DIVISION

		Composition of soil	Condition of soil			Structure and additional observations
Depth below surface (m)	USCS Symbol	Soil Description (type, plasticity, grading, colour, secondary and minor components)	Moisture Condition	Consistency or Density Index	Hand Penetrometer Reading (kPa)	(e.g. soil origin, defects, cementing, likely I_{pt} (%),
	FILL	Sandy CLAY, low plasticity, brown, dark brown, fine to coarse grained sand, some fine to coarse gravel, weathered shale rock	<Wp			FILL
0.5		Fines decreasing				
1.0	CL	Sandy CLAY, low plasticity, brown, dark brown, fine to coarse grained sand	<Wp	Fb		POSSIBLE FILL
1.5	CL	Sandy CLAY, medium plasticity, orange-brown, brown, red-brown, fine to coarse grained sand, some fine to coarse gravel, quartzite, weathered rock	<Wp	H/Fb	>600	NATURAL
2.0						
2.5					>600	
3.0		Borehole Terminated 3.0 m				

Depth to Groundwater: None Observed

Trees at Site: No

Legend:

Moisture Condition	Density Index - Granular	Consistency - Cohesive
D - Dry	VL/L - Very Loose/Loose	VS - Very Soft Vst-Very Stiff
M - Moist	MD- Medium Dense	S - Soft H - Hard
W - Wet	D/VD- Dense/Very Dense	F - Firm Fb - Friable
Wp - Plastic Limit		St - Stiff
USCS: Unified Soil Classification System		↓ GW = Groundwater

Job Number: **WGA190926**

Location: **CONCORDIA LAND DIVISION**

		Composition of soil	Condition of soil			Structure and additional observations
Depth below surface (m)	USCS Symbol	Soil Description (type, plasticity, grading, colour, secondary and minor components)	Moisture Condition	Consistency or Density Index	Hand Penetrometer Reading (kPa)	(e.g. soil origin, defects, cementing, likely I_{pt} (%))
	FILL	Silty SAND, fine to medium, brown, non to low plasticity, rootlets top 0.1m and trace throughout, structureless	M			POSSIBLE FILL
0.5			D			
1.0						
	SC	Clayey SAND, fine to medium, brown, low plasticity, rootlets	M	L/MD		
1.5						
	CL/SC	Sandy CLAY/Clayey SAND, fine to medium, low plasticity, brown, porous, rootlets	M/<Wp	Fb/MD		NATURAL
2.0						
		Grading brown/orange-brown				
2.5						
4.0						

Depth to Groundwater: None Observed

Trees at Site: No

Legend:

Moisture Condition	Density Index - Granular	Consistency - Cohesive
D - Dry	VL/L - Very Loose/Loose	VS - Very Soft Vst-Very Stiff
M - Moist	MD- Medium Dense	S - Soft H - Hard
W - Wet	D/VD- Dense/Very Dense	F - Firm Fb - Friable
Wp - Plastic Limit		St - Stiff
USCS: Unified Soil Classification System		↓GW = Groundwater

Job Number: WGA190926

Location: CONCORDIA LAND DIVISION

		Composition of soil	Condition of soil			Structure and additional observations
Depth below surface (m)	USCS Symbol	Soil Description (type, plasticity, grading, colour, secondary and minor components)	Moisture Condition	Consistency or Density Index	Hand Penetrometer Reading (kPa)	(e.g. soil origin, defects, cementing, likely I_{pt} (%))
	SC/CL	Sandy CLAY/Clayey SAND, as above	M/<Wp	MD/Fb		
3.5						
3.55						
	SM	Silty SAND, fine to coarse, orange-brown, low plasticity, trace fine to medium gravel, solution calcrete gravels	M			
4.0						
		Borehole terminated at 4m (target depth)				
4.5						
5.0						
5.5						
6.0						

Depth to Groundwater: None Observed

Trees at Site: No



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Date Drilled: 11/06/2019
Date Logged: 11/06/2019
Logged by: HJ
Drilling Method: Push Tube
Drill Rig/Mount: Rockmaster

Borehole No.
BH 12

1 of 2

Legend:

Moisture Condition	Density Index - Granular	Consistency - Cohesive
D - Dry	VL/L - Very Loose/Loose	VS - Very Soft Vst-Very Stiff
M - Moist	MD- Medium Dense	S - Soft H - Hard
W - Wet	D/VD- Dense/Very Dense	F - Firm Fb - Friable
Wp - Plastic Limit		St - Stiff
USCS: Unified Soil Classification System		↓ GW = Groundwater

Job Number: WGA190926

Location: CONCORDIA LAND DIVISION

		Composition of soil	Condition of soil			Structure and additional observations
Depth below surface (m)	USCS Symbol	Soil Description (type, plasticity, grading, colour, secondary and minor components)	Moisture Condition	Consistency or Density Index	Hand Penetrometer Reading (kPa)	(e.g. soil origin, defects, cementing, likely I _{pt} (%))
	FILL	Silty SAND, fine to medium, brown, low plasticity, abundant rootlets	M			POSSIBLE FILL
0.5			D			
1.0	SC	Clayey SAND, fine to medium, brown, low plasticity, trace rootlets	M	L		NATURAL
1.5		With dark brown mottle				
2.0	CL	Sandy CLAY, medium plasticity, dark brown, with brown sand seams, porous, trace cinders	<Wp	H	>600	
2.5	CL	Sandy CLAY, medium plasticity, orange-brown, brown, fine to medium grained sand, porous	<Wp	H/Fb	600	
3.0	SC/CL	Grading clayey SAND/Sandy CLAY			540 >600 >600	

Depth to Groundwater: None Observed

Trees at Site: No



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Legend:

Moisture Condition	Density Index - Granular	Consistency - Cohesive
D - Dry	VL/L - Very Loose/Loose	VS - Very Soft Vst-Very Stiff
M - Moist	MD- Medium Dense	S - Soft H - Hard
W - Wet	D/VD- Dense/Very Dense	F - Firm Fb - Friable
Wp - Plastic Limit		St - Stiff
USCS: Unified Soil Classification System		↓GW = Groundwater

Date Drilled: 11/06/2019

Date Logged: 11/06/2019

Logged by: HJ

Drilling Method: Push Tube

Drill Rig/Mount: Rockmaster

Borehole No.

BH 12

2 of 2

Job Number: WGA190926

Location: CONCORDIA LAND DIVISION

		Composition of soil	Condition of soil			Structure and additional observations
Depth below surface (m)	USCS Symbol	Soil Description (type, plasticity, grading, colour, secondary and minor components)	Moisture Condition	Consistency or Density Index	Hand Penetrometer Reading (kPa)	(e.g. soil origin, defects, cementing, likely I_{pt} (%))
3.15	SC/CL	Clayey SAND/Sandy CLAY, low plasticity, orange-brown, brown, fine to medium grained sand	M/<Wp			
3.5	SM	Silty SAND, fine to medium, brown, low plasticity	M	L/MD		
		with clay fines				
3.85	SC	Clayey SAND, fine to medium, brown, grey-brown, low plasticity, micaceous, trace fine to medium gravel				
4.0						
4.5		Borehole terminated at 4m (target depth)				
5.0						
5.5						
6.0						

Depth to Groundwater: None Observed

Trees at Site: No

BH1



BH2



BH3



Note: Core trays are 750 mm in length

BH4



BH5



BH6



Note: Core trays are 750 mm in length



Client: **CONCORDIA LAND**

Project: **PROPOSED CONCORDIA LAND DIVISION**

Title: **BOREHOLE PHOTOGRAPHS**

Job No: **WGA190926**

Reference

Page 2/4

Date

JUN 2019

BH7



BH8



BH9



Note: Core trays are 750 mm in length



Client: **CONCORDIA LAND**

Project: **PROPOSED CONCORDIA LAND DIVISION**

Title: **BOREHOLE PHOTOGRAPHS**

Job No: **WGA190926**

Reference

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Date

JUN 2019

BH10



BH11



BH12



Note: Core trays are 750 mm in length

DESCRIPTION AND CLASSIFICATION OF SOILS⁽¹⁾ FOR ENGINEERING PURPOSES EXPLANATION SHEET TO ACCOMPANY ENGINEERING LOGS (SHEET 1)

CLASSIFICATION SYMBOL & SOIL NAME

Soils are described in general accordance with the Unified Soil Classification (UCS) as shown in Table 1 on Sheet 2 using visual-tactile methods.

PARTICLE SIZES

NAME	FRACTION	SIZE
Boulders		>200 mm
Cobbles		63 mm to 200 mm
Gravel	coarse	20 mm to 63 mm
	medium	6.7 mm to 20 mm
	fine	2.36 mm to 6.7 mm
Sand	coarse	600 µm to 2.36 mm
	medium	210 µm to 600 µm
	fine	75 µm to 210 µm

MOISTURE CONDITION

Dry Looks and feels dry. Cohesive soils are hard, friable or powdery. Uncemented granular soils run freely through hands.

Moist Soil feels cool and darkened in colour. Cohesive soils can be moulded. Granular soils tend to cohere.

Wet Similar to moist but with free water forming on hands when handled.

CONSISTENCY OF COHESIVE SOILS

TERM	UNDRAINED STRENGTH Su (kPa)	FIELD ASSESSMENT
Very Soft	≤12	A finger can be pushed well into the soil with little effort.
Soft	12 to 25	A finger can be pushed into the soil to about 25 mm depth.
Firm	25 to 50	The soil can be indented about 5 mm with the thumb.
Stiff	50 to 100	The surface of the soil can be indented with the thumb.
Very Stiff	100 to 200	The surface of the soil can be marked, but not indented with thumb pressure.
Hard	>200	The surface of the soil can be marked only with the thumbnail.
Friable	Not able to be measured	Crumbles or powders when scraped by thumbnail.

The undrained shear strength is assessed in the field using a pocket or hand penetrometer (PP). The undrained shear strength is approximately one half of the hand penetrometer reading.

DENSITY INDEX OF GRANULAR SOILS

TERM	DENSITY INDEX (%)
Very loose	Less than 15
Loose	15 to 35
Medium Dense	35 to 65
Dense	65 to 85
Very Dense	Greater than 85

MINOR COMPONENTS

TERM	FIELD ASSESSMENT	PROPORTION OF MINOR COMPONENT IN:
Trace of	Presence just detectable by feel or eye.	Coarse grained soils: ≤5% Fine grained soils: ≤15%
With some	Presence easily detected by feel or eye.	Coarse grained soils: >5 to ≤12% Fine grained soils: >15 to ≤30%

SOIL STRUCTURE

INCLUSIONS		CEMENTING	
Layers	Continuous across exposure or sample.	Weakly Cemented	Easily broken up by hand in air or water.
Lenses	Discontinuous layers of lenticular shape.	Moderately Cemented	Effort is required to break up the soil by hand in air or water.
Pockets	Irregular inclusions of different material.		

SOIL ORIGIN

MATERIALS WEATHERED IN-SITU

Extremely weathered material	Structure and fabric of parent rock visible.
Residual soil	Structure and fabric of parent rock not visible.

TRANSPORTED SOILS

Aeolian	Deposited by wind.
Alluvial	Deposited by streams and rivers.
Colluvial	Deposited on slopes (transported downslope by gravity)
Fill	Placed by man. Fill may be markedly more variable between tested locations than naturally occurring soils.
Marine	Deposited in ocean basins, bays, beaches and estuaries.

Note: (1) materials found in the ground are generally described as a soil if the material can be remoulded or disintegrated by hand in the field condition or in water. Other materials are described using rock description terms.

Table 1: SOIL CLASSIFICATION AND FIELD IDENTIFICATION AND DESCRIPTION (SHEET 2)

FIELD IDENTIFICATION PROCEDURES (excluding particles larger than 60 mm and basing fractions on estimated mass)					USC	PRIMARY NAME
COARSE GRAINED SOILS More than 65% of material less than 63 mm is larger than 0.075 mm	GRAVELS More than half of coarse fraction is larger than 2.0 mm	CLEAN GRAVELS (Little or no fines)	Wide range in grain size and substantial amounts of all intermediate particle sizes.		GW	GRAVEL
			Predominantly one size or a range of sizes with more intermediate sizes missing.		GP	GRAVEL
		GRAVELS WITH FINES (Appreciable amount of fines)	Non-plastic fines (for identification procedures see ML below)		GM	SILTY GRAVEL
			Plastic fines (for identification procedures see CL below)		GC	CLAYEY GRAVEL
	SANDS More than half of coarse fraction is smaller than 2.0 mm	CLEAN SANDS (Little or no fines)	Well graded. Wide range in grain sizes and substantial amounts of all intermediate sizes.		SW	SAND
			Poorly graded. Predominantly one size or a range of sizes with some intermediate sizes missing		SP	SAND
		SANDS WITH FINES (Appreciable amount of fines)	Non-plastic fines (for identification procedures see ML Below)		SM	SILTY SAND
			Plastic fines (for identification procedures see CL below)		SC	CLAYEY SAND
IDENTIFICATION PROCEDURES ON PARTICLES <0.2 mm						
FINE GRAINED SOILS More than 35% of material less than 63 mm is smaller than 0.075 mm	SILTS & CLAYS Liquid limit less than or equal to 50	DRY STRENGTH	DILATANCY	TOUGHNESS		
		None to low	Quick to slow	None	ML	SILT
		Medium to high	None	Medium	CL	CLAY
		Low to medium	Slow to very slow	Low	OL	ORGANIC SILT
	SILTS & CLAYS Liquid limit greater than 50	Low to medium	Slow to very slow	Low to medium	MH	SILT
		High	None	High	CH	CLAY
		Medium to high	None	Low to medium	OH	ORGANIC CLAY
HIGHLY ORGANIC SOILS		Identified by colour, odour, spongy feel and frequently by fibrous texture.			Pt	PEAT
* Low plasticity – Liquid Limit W _L Less than 35 % * Medium plasticity - W _L between 35% and 50%						

APPENDIX C

LABORATORY TEST RESULTS



Wallbridge Gilbert Aztec
60 Wyatt Street
ADELAIDE
SA 5000



NATA Accredited
Accreditation Number 1261
Site Number 1254

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

Attention: **H Jensen**

Report **1133358-S**
 Project name **LAND DIVISION**
 Project ID **241280**
 Received Date **Aug 28, 2024**

Client Sample ID			BH1 0.4-0.75	BH4 0.15-0.3	BH10 0.5-0.7
Sample Matrix			Soil	Soil	Soil
Eurofins Sample No.			M24- Au0075750	M24- Au0075751	M24- Au0075752
Date Sampled			Aug 28, 2024	Aug 28, 2024	Aug 28, 2024
Test/Reference	LOR	Unit			
Chloride	5	mg/kg	150	11	8.3
Conductivity (1:5 aqueous extract at 25 °C as rec.)	10	uS/cm	400	310	160
pH (1:5 Aqueous extract at 25 °C as rec.)	0.1	pH Units	9.1	6.8	8.1
Sulphate (as SO4)	30	mg/kg	130	< 30	< 30
Total Dissolved Solids (calculated from EC)*	0.01	mg/kg	220	170	84
Sample Properties					
% Moisture	1	%	14	23	12

Sample History

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

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

Description	Testing Site	Extracted	Holding Time
Chloride	Melbourne	Aug 30, 2024	28 Days
- Method: LTM-INO-4090 Chloride by Discrete Analyser			
Conductivity (1:5 aqueous extract at 25 °C as rec.)	Melbourne	Aug 30, 2024	7 Days
- Method: LTM-INO-4030 Conductivity			
pH (1:5 Aqueous extract at 25 °C as rec.)	Melbourne	Aug 30, 2024	7 Days
- Method: LTM-GEN-7090 pH in soil by ISE			
Sulphate (as SO ₄)	Melbourne	Aug 30, 2024	28 Days
- Method: LTM-INO-4110 Sulfate by Discrete Analyser			
Total Dissolved Solids (calculated from EC)*	Melbourne	Sep 02, 2024	7 Days
- Method: LTM-INO-4030 Conductivity			
% Moisture	Melbourne	Aug 28, 2024	14 Days
- Method: LTM-GEN-7080 Moisture			



web: www.eurofins.com.au
email: EnviroSales@eurofins.com

ABN: 50 005 085 521

Melbourne 6 Monterey Road Dandenong South VIC 3175 +61 3 8564 5000 NATA# 1261 Site# 1254	Geelong 19/8 Lewalan Street Grovedale VIC 3216 +61 3 8564 5000 NATA# 1261 Site# 25403	Sydney 179 Magowar Road Girraween NSW 2145 +61 2 9900 8400 NATA# 1261 Site# 18217	Canberra Unit 1,2 Dacre Street Mitchell ACT 2911 +61 2 6113 8091 NATA# 1261 Site# 25466	Brisbane 1/21 Smallwood Place Murarie QLD 4172 T: +61 7 3902 4600 NATA# 1261 Site# 20794 & 2780	Newcastle 1/2 Frost Drive Mayfield West NSW 2304 +61 2 4968 8448 NATA# 1261 Site# 25079
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ABN: 91 05 0159 898

Perth 46-48 Banksia Road Welshpool WA 6106 +61 8 6253 4444 NATA# 2377 Site# 2370

ABN: 47 009 120 549

Perth ProMicro 46-48 Banksia Road Welshpool WA 6106 +61 8 6253 4444 NATA# 2561 Site# 2554
--

NZBN: 9429046024954

Auckland 35 O'Rorke Road Penrose, Auckland 1061 +64 9 526 4551 IANZ# 1327	Auckland (Focus) Unit C1/4 Pacific Rise, Mount Wellington, Auckland 1061 +64 9 525 0568 IANZ# 1308	Christchurch 43 Detroit Drive Rolleston, Christchurch 7675 +64 3 343 5201 IANZ# 1290	Tauranga 1277 Cameron Road, Gate Pa, Tauranga 3112 +64 9 525 0568 IANZ# 1402
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Company Name: Wallbridge Gilbert Aztec
Address: 60 Wyatt Street
ADELAIDE
SA 5000

Project Name: LAND DIVISION
Project ID: 241280

Order No.:
Report #: 1133358
Phone: 08 8223 7433
Fax: 08 8232 0967

Received: Aug 28, 2024 3:00 PM
Due: Sep 4, 2024
Priority: 5 Day
Contact Name: H Jensen

Eurofins Analytical Services Manager : Karl Bulow

Sample Detail						Chloride	Conductivity (1:5 aqueous extract at 25 °C as rec.)	pH (1:5 Aqueous extract at 25 °C as rec.)	Sulphate (as SO4)	Total Dissolved Solids (calculated from EC)*	Moisture Set
Melbourne Laboratory - NATA # 1261 Site # 1254						X	X	X	X	X	X
External Laboratory											
No	Sample ID	Sample Date	Sampling Time	Matrix	LAB ID						
1	BH1 0.4-0.75	Aug 28, 2024		Soil	M24-Au0075750	X	X	X	X	X	X
2	BH4 0.15-0.3	Aug 28, 2024		Soil	M24-Au0075751	X	X	X	X	X	X
3	BH10 0.5-0.7	Aug 28, 2024		Soil	M24-Au0075752	X	X	X	X	X	X
Test Counts						3	3	3	3	3	3

Internal Quality Control Review and Glossary

General

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

Holding Times

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

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

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

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

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

Units

mg/kg: milligrams per kilogram	mg/L: milligrams per litre	ppm: parts per million
µg/L: micrograms per litre	ppb: parts per billion	%: Percentage
org/100 mL: Organisms per 100 millilitres	NTU: Nephelometric Turbidity Units	MPN/100 mL: Most Probable Number of organisms per 100 millilitres
CFU: Colony Forming Unit	Colour: Pt-Co Units (CU)	

Terms

APHA	American Public Health Association
CEC	Cation Exchange Capacity
COC	Chain of Custody
CP	Client Parent - QC was performed on samples pertaining to this report
CRM	Certified Reference Material (ISO17034) - reported as percent recovery.
Dry	Where moisture has been determined on a solid sample, the result is expressed on a dry weight basis.
Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
LOR	Limit of Reporting.
LCS	Laboratory Control Sample - reported as percent recovery.
Method Blank	In the case of solid samples, these are performed on laboratory-certified clean sands and in the case of water samples, these are performed on de-ionised water.
NCP	Non-Client Parent - QC performed on samples not pertaining to this report, QC represents the sequence or batch that client samples were analysed within.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
SPIKE	Addition of the analyte to the sample and reported as percentage recovery.
SRA	Sample Receipt Advice
Surr - Surrogate	The addition of a similar compound to the analyte target is reported as percentage recovery. See below for acceptance criteria.
TBTO	Tributyltin oxide (<i>bis</i> -tributyltin oxide) - individual tributyltin compounds cannot be identified separately in the environment; however, free tributyltin was measured, and its values were converted stoichiometrically into tributyltin oxide for comparison with regulatory limits.
TCLP	Toxicity Characteristic Leaching Procedure
TEQ	Toxic Equivalency Quotient or Total Equivalence
QSM	US Department of Defense Quality Systems Manual Version 6.0
US EPA	United States Environmental Protection Agency
WA DWER	Sum of PFBA, PFPeA, PFHxA, PFHpA, PFOA, PFBS, PFHxS, PFOS, 6:2 FTSA, 8:2 FTSA

QC - Acceptance Criteria

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

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

Results <10 times the LOR:	No Limit
Results between 10-20 times the LOR:	RPD must lie between 0-50%
Results >20 times the LOR:	RPD must lie between 0-30%

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

Surrogate Recoveries: Recoveries must lie between 20-130% for Speciated Phenols & 50-150% for PFAS. SVOCs recoveries 20 – 150%, VOC recoveries 50 – 150%

PFAS field samples containing surrogate recoveries above the QC limit designated in QSM 6.0, where no positive PFAS results have been reported or reviewed, and no data was affected.

QC Data General Comments

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

Quality Control Results

Test				Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Method Blank										
Chloride				mg/kg	< 5			5	Pass	
Conductivity (1:5 aqueous extract at 25 °C as rec.)				uS/cm	< 10			10	Pass	
Sulphate (as SO4)				mg/kg	< 30			30	Pass	
LCS - % Recovery										
Chloride				%	112			70-130	Pass	
Conductivity (1:5 aqueous extract at 25 °C as rec.)				%	105			70-130	Pass	
Test	Lab Sample ID	QA Source		Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Duplicate										
					Result 1	Result 2	RPD			
Conductivity (1:5 aqueous extract at 25 °C as rec.)	M24-Au0075267	NCP		uS/cm	230	230	<1	30%	Pass	
pH (1:5 Aqueous extract at 25 °C as rec.)	M24-Au0075267	NCP		pH Units	7.4	7.6	pass	30%	Pass	
Total Dissolved Solids (calculated from EC)*	M24-Au0075267	NCP		mg/kg	130	130	<1	30%	Pass	
Duplicate										
Sample Properties					Result 1	Result 2	RPD			
% Moisture	M24-Au0075900	NCP		%	19	17	7.0	30%	Pass	
Duplicate										
					Result 1	Result 2	RPD			
Chloride	M24-Au0075751	CP		mg/kg	11	12	9.0	30%	Pass	
Sulphate (as SO4)	M24-Au0075751	CP		mg/kg	< 30	30	20	30%	Pass	

Comments
Sample Integrity

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

Authorised by:

Catherine Wilson	Analytical Services Manager
Caitlin Breeze	Senior Analyst-Inorganic
Mary Makarios	Senior Analyst-Sample Properties



Glenn Jackson
Managing Director

Final Report – this report replaces any previously issued Report

- Indicates Not Requested

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

Measurement uncertainty of test data is available on request or please [click here](#).

Eurofins shall not be liable for loss, cost, damages or expenses incurred by the client, or any other person or company, resulting from the use of any information or interpretation given in this report. In no case shall Eurofins be liable for consequential damages including, but not limited to, lost profits, damages for failure to meet deadlines and lost production arising from this report. This document shall not be reproduced except in full and relates only to the items tested. Unless indicated otherwise, the tests were performed on the samples as received.

Material Test Report

Report Number: ADEL0100-1
Issue Number: 1
Date Issued: 06/09/2024
Client: Wallbridge Gilbert Aztec
60 Wyatt Street, Adelaide SA 5000
Contact: Henry Jensen
Project Number: ADEL0100
Project Name: Land Division
Project Location: Concordia
Client Reference: WGA241280
Work Request: 919
Sample Number: ADEL919A
Date Sampled: 28/08/2024
Dates Tested: 28/08/2024 - 06/09/2024
Sampling Method: Sampled by Client
The results apply to the sample as received
Preparation Method: In accordance with the test method
Sample Location: BH2 0.3-0.6m



Adelaide Laboratory
Unit 2, 30-34 Ragless Street St Marys SA 5042
Phone: 04 3978 6290



Accredited for compliance with ISO/IEC 17025 - Testing

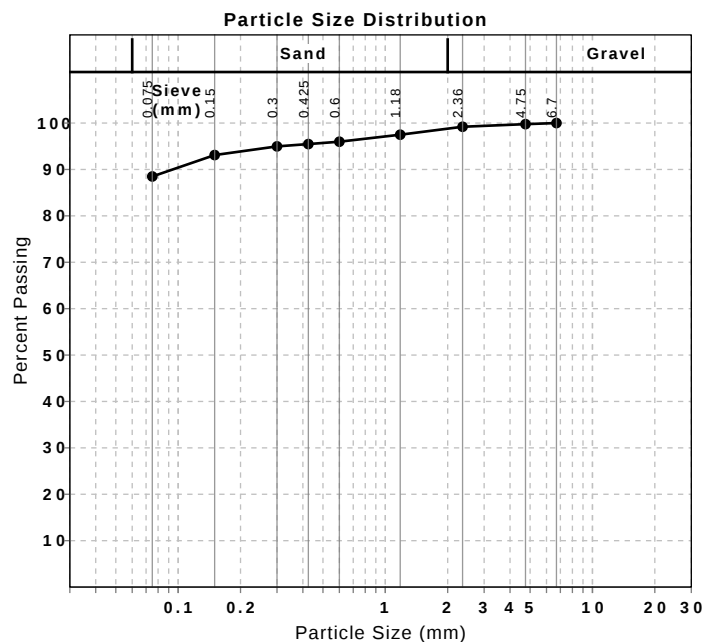
Approved Signatory: Jhorden Minutillo
Laboratory Manager
Laboratory Accreditation Number: 431

Particle Size Distribution (DPTI (SA) TP134)			
Sieve	Passed %	Passing Limits	
6.7 mm	100		
4.75 mm	100		
2.36 mm	99		
1.18 mm	97		
0.6 mm	96		
0.425 mm	95		
0.3 mm	95		
0.15 mm	93		
0.075 mm	88		

Atterberg Limit (DPTI (SA) TP143 & TP141)		Min	Max
Sample History	Air Dried		
Preparation Method	Dry Sieve		
Liquid Limit (%)	73		
Plastic Limit (%)	24		
Plasticity Index (%)	49		

Linear Shrinkage (DPTI (SA) TP143)		Min	Max
Linear Shrinkage (%)	18.0		
Cracking Crumpling Curling	Cracking & Curling		

Estimation of CBR from Classification Test (DPTI (SA) TP133)		Min	Max
Lab-estimated CBR (%)	3.0		



Material Test Report

Report Number: ADEL0100-1
Issue Number: 1
Date Issued: 06/09/2024
Client: Wallbridge Gilbert Aztec
60 Wyatt Street, Adelaide SA 5000
Contact: Henry Jensen
Project Number: ADEL0100
Project Name: Land Division
Project Location: Concordia
Client Reference: WGA241280
Work Request: 919
Sample Number: ADEL919B
Date Sampled: 28/08/2024
Dates Tested: 28/08/2024 - 06/09/2024
Sampling Method: Sampled by Client
The results apply to the sample as received
Preparation Method: In accordance with the test method
Sample Location: BH6 0.15-0.4m



Adelaide Laboratory
Unit 2, 30-34 Ragless Street St Marys SA 5042
Phone: 04 3978 6290



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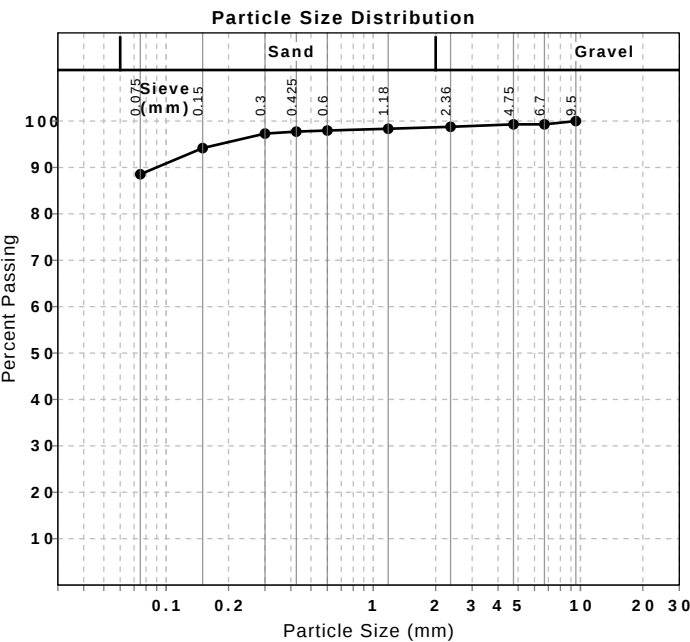
Approved Signatory: Jhorden Minutillo
Laboratory Manager
Laboratory Accreditation Number: 431

Particle Size Distribution (DPTI (SA) TP134)			
Sieve	Passed %	Passing Limits	
9.5 mm	100		
6.7 mm	99		
4.75 mm	99		
2.36 mm	99		
1.18 mm	98		
0.6 mm	98		
0.425 mm	98		
0.3 mm	97		
0.15 mm	94		
0.075 mm	89		

Atterberg Limit (DPTI (SA) TP143 & TP141)		Min	Max
Sample History	Air Dried		
Preparation Method	Dry Sieve		
Liquid Limit (%)	64		
Plastic Limit (%)	26		
Plasticity Index (%)	38		

Linear Shrinkage (DPTI (SA) TP143)		Min	Max
Linear Shrinkage (%)	14.5		
Cracking Crumbling Curling	Cracking & Curling		

Estimation of CBR from Classification Test (DPTI (SA) TP133)		Min	Max
Lab-estimated CBR (%)	4.0		



Material Test Report

Report Number: ADEL0100-1
Issue Number: 1
Date Issued: 06/09/2024
Client: Wallbridge Gilbert Aztec
60 Wyatt Street, Adelaide SA 5000
Contact: Henry Jensen
Project Number: ADEL0100
Project Name: Land Division
Project Location: Concordia
Client Reference: WGA241280
Work Request: 919
Sample Number: ADEL919C
Date Sampled: 28/08/2024
Dates Tested: 28/08/2024 - 06/09/2024
Sampling Method: Sampled by Client
The results apply to the sample as received
Preparation Method: In accordance with the test method
Sample Location: BH11 0.4-0.7m



Adelaide Laboratory
Unit 2, 30-34 Ragless Street St Marys SA 5042
Phone: 04 3978 6290



Accredited for compliance with ISO/IEC 17025 - Testing

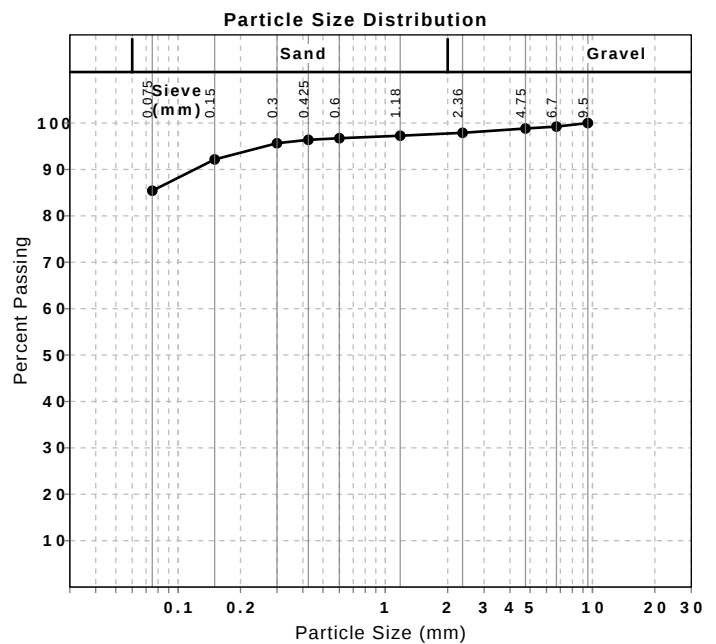
Approved Signatory: Jhorden Minutillo
Laboratory Manager
Laboratory Accreditation Number: 431

Particle Size Distribution (DPTI (SA) TP134)			
Sieve	Passed %	Passing Limits	
9.5 mm	100		
6.7 mm	99		
4.75 mm	99		
2.36 mm	98		
1.18 mm	97		
0.6 mm	97		
0.425 mm	96		
0.3 mm	96		
0.15 mm	92		
0.075 mm	85		

Atterberg Limit (DPTI (SA) TP143 & TP141)		Min	Max
Sample History	Air Dried		
Preparation Method	Dry Sieve		
Liquid Limit (%)	65		
Plastic Limit (%)	20		
Plasticity Index (%)	45		

Linear Shrinkage (DPTI (SA) TP143)		Min	Max
Linear Shrinkage (%)	15.5		
Cracking Crumbling Curling	Curling		

Estimation of CBR from Classification Test (DPTI (SA) TP133)		Min	Max
Lab-estimated CBR (%)	3.5		





GUIDE TO INTERPRETING YOUR WGA GEOTECHNICAL REPORT

This geotechnical report has been prepared by an experienced WGA Engineer. These notes have been prepared by WGA to assist the Client interpret and understand the report limitations.

SCOPE OF SERVICES

This report has been prepared in accordance with the scope of services set out in the contract, or as otherwise agreed, between the Client and WGA. In some circumstances, the scope of the services may have been altered by a range of factors such as time, budget and access restrictions.

GEOTECHNICAL INVESTIGATIONS

Geotechnical engineering is based extensively on professional judgment and opinion. It is far less precise than other engineering disciplines.

Geotechnical engineering reports are prepared to meet the specific needs of individual clients. This report was prepared expressly for the Client for the purposes indicated in the agreed scope of services. Use by any other persons for any purpose, or by the Client for a different purpose, may result in problems.

For example, a report prepared for a consulting civil engineer may not be adequate for a construction contractor or even another consulting engineer.

This report must not be used for any project other than that originally specified at the time the report was prepared, without seeking additional geotechnical advice.

PROJECT-SPECIFIC FACTORS

This report is based on a subsurface investigation designed to meet the requirements of a specific project. The subsurface investigation was formulated based on factors which include the nature of the development, its size and configuration, the location of any existing development on the site, and the location of access roads and parking areas. Unless further geotechnical advice is obtained in writing, this

report may not provide appropriate recommendations if:

- the nature of the proposed development is changed; or
- the size, configuration, location or orientation of the proposed development is modified.

The report findings cannot be applied to any other sites, including adjacent sites.

SUBSURFACE CONDITIONS

Subsurface conditions are created by natural processes and the activity of man and may, therefore, be modified by changing natural forces or man-made influences. For example, water levels can vary with time and fill may be placed on a site. The report is based on conditions which existed at the time of subsurface exploration.

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

THIRD PARTY INTERPRETATION OF FINDINGS

WGA should be retained to assist other design professionals in the interpretation of relevant geotechnical findings, and to review the adequacy of plans and specifications relative to geotechnical issues. Costly problems can occur when other design professionals develop plans based on misinterpretations of a geotechnical report.

ENGINEERING LOGS SHOULD NOT BE SEPARATED FROM THE REPORT

The report presents the findings of the geotechnical investigation and must not be copied or altered in any way.



Engineering logs and cross-sections are developed by geotechnical engineers based upon their interpretation of field logs and laboratory testing of samples. These logs and figures should not be redrawn for inclusion in other documents or separated from the report in any way.

To reduce the likelihood of misinterpretation, contractors should be given access to the complete geotechnical report prepared or authorised for use. The following publication should be referenced for further information.

Guidelines for the Provision of Geotechnical Information in construction Contracts (Engineers Australia, National Headquarters, Canberra 1987).

RELIANCE ON SUPPLIED DATA

In preparing the report, WGA may have relied upon data, surveys, analyses, designs, plans and other information provided by the Client and other individuals and organisations. Unless otherwise stated in the report, WGA has not verified the accuracy or completeness of such data. WGA will not be liable in relation to incorrect conclusions should any data, information or condition be incorrect or have been concealed, withheld, misinterpreted or otherwise not fully disclosed to WGA.

LIMITATIONS OF SITE INVESTIGATIONS

In making an assessment of a site from a limited number of boreholes or test pits it is inevitable that variations will occur between test locations. Subsurface exploration identifies specific subsurface conditions only at those points from which samples have been taken. The likelihood that subsurface variations will not be detected can be reduced by increasing the frequency of test locations, although this has cost implications. The investigation program undertaken is a professional estimate of a reasonable scope of investigation required to provide a general profile of the subsurface conditions. The data derived from the site investigation program and subsequent laboratory testing are extrapolated across the site to form an inferred geotechnical model and an engineering opinion is formed about overall subsurface conditions and their likely behaviour with regard to the proposed development.

Despite subsurface exploration, the actual conditions at the site might differ from those inferred to exist, since no subsurface exploration program, no matter how comprehensive, can reveal all subsurface conditions and anomalies.

The engineering logs are the subjective interpretation of the subsurface conditions encountered at a particular location, made by experienced personnel. The interpretation may be limited by the method of investigation, and cannot always be definitive. For example, inspection of an excavation or test pit allows a greater area of the subsurface profile to be inspected than borehole investigations, however, such methods are limited by depth and site disturbance restrictions.

The actual interface between materials may be far more gradual or abrupt than assumed based on the facts obtained from the subsurface exploration. Nothing can be done to change the actual site conditions which exist, but steps can be taken to reduce the impact of unexpected conditions. For this reason, the services of WGA should be retained through design and construction stages, to identify variances, conduct additional tests if required and recommend solutions to any problems encountered on site.



FOR FURTHER INFORMATION CONTACT:

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