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Preliminary Geotechnical Desktop Study
And
Intrusive Geotechnical Investigation Report

Proposed Gledswood Hills High School

9 Gregory Hills Drive, Gledswood Hills

Report No 20465/5-AA

COVER PAGE

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NSW Department of Education
School Infrastructure NSW (SINSW)
GPO Box 33
SYDNEY NSW 2001

Dear Sir

re: **Proposed Gledswood Hills High School**
9 Gregory Hills Drive, Gledswood Hills
Preliminary Desktop Geotechnical Study & Intrusive Geotechnical Investigation Report

Please find herewith report on an Intrusive Geotechnical Investigation carried out for the proposed new Gledswood Hills High School at Gledswood Hills.

If you have any questions, please do not hesitate to contact the undersigned.

Yours faithfully
GEOTECHNIQUE PTY LTD

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EXECUTIVE SUMMARY

The NSW Government is proposing to construct a new Gledswood Hills High School at 9 Gregory Hills Drive, Gledswood, to meet the growth in educational demand in Gregory Hills and Gledswood Hills and the broader South West Growth Area. The proposed activities include construction of school buildings, hall, car park etc. The assessments and recommendations presented in this PDGS and IGI report are summarised below:

- The natural subsurface profile across the site for proposed school is likely to comprise a sequence of fill and residual soils underlain by shale bedrock. The thickness of fill varies from 43.5m to 7.5m and depth to bedrock varies from about 6.0m to 13.0m from existing ground surface. The thickness of residual soils overlying the bedrock is anticipated to be up to about 3.0m thick. The depth to groundwater is likely to be more than 14.0m.
- The fill and residual soils across the site are likely to vary from none-saline to saline. But because large number of sampling and testing will be required to delineate non-saline soils, the proposed activities are to be carried out in accordance with Salinity Management Plan (SMP).
- The fill and residual soils across the site are unlikely to be acid sulphate or potential acid sulphate soils. Therefore, disturbance and/or excavation of residual soils during the proposed activities may be carried out without an approved Acid Sulphate Soil Management Plan (ASSMP).
- Fill Management Protocol prepared by ADE indicates that the fill across the site might have been placed in controlled manner (Reference 8). However, additional sampling and testing may be carried out to ascertain the nature of fill for the purposes of design development and value management prior to construction.
- Additional earthwork or site preparation for construction of proposed school is likely to involve some excavation (including removing unsuitable foundation materials) and fill operations. Excavations can be achieved using conventional earthmoving equipment such as excavators and dozers and fill should be placed in accordance with Australian Standard AS3798 (Reference 10). It is unlikely that the excavation works will encounter significant groundwater inflow. Minor groundwater inflow or seepage, if encountered, can be handled with conventional sump and pump method.
- Cut and fill slopes during and after earthworks should be battered for stability or retained with engineered retaining structures. Although it is unlikely that the batter slopes would require retention with engineered retaining structures, appropriate retaining structures for the proposed activities are anticipated to include gravity walls or cantilever walls.
- At the completion of earthworks, preliminary Geotechnical Model for the site is likely to comprise three Geotechnical Units namely fill underlain by residual soil, which in turn is underlain by bedrock. Residual soil and bedrock units are assessed to be suitable foundation materials for proposed school buildings and other structures. But suitability of existing fill materials as foundation materials for proposed school buildings will have to be ascertained by conducting additional sampling and testing.

- Appropriate footings for the proposed buildings and retaining structures are likely to comprise shallow (pad or strip) footings founded on existing fill, if confirmed to be controlled, or deep footing socketed into residual soils or bedrock. Deep footings (bored piers, screw piles etc) may be preferable if footings are required to withstand significant lateral and uplift loads. The site for the proposed school construction is almost levelled and assessed to have a "Very Low Risk" of slope instability to the property at existing conditions. It is also our assessment that the risk of slope instability across the site can be maintained at “Very Low” so that the site will be suitable for proposed school construction from slope stability considerations provided earthworks and construction of proposed structures are carried out in accordance with recommendations provided in this report.
- The potential geotechnical risks or issues at the site includes presence of saline soils and variations in nature and thickness of existing fill and depth to bedrock. These risks can be managed or mitigated with the recommended mitigation measures presented in Table 12.
- From geotechnical engineering considerations, the potential impact from the proposed activities on the locality, community and/or the environment are insignificant.

Based on above discussion, it is our assessment that the potential geotechnical risks at the site for the proposed activities are minor and can be addressed if earthworks and design of proposed structures are carried out in accordance with recommendation provided in this report. Furthermore, it is our assessment that the potential impact from the proposed activities on the locality, community and/or the environment is insignificant. Therefore, the site is suitable for construction of proposed new high school provided earthworks and designs of ground floor slabs and footings of proposed school structures are carried out in accordance with recommendations provided in this report.

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ATTACHMENTS

1.0 INTRODUCTION AND DECLARATION

This Preliminary Geotechnical Desktop Study (PGDS) and Intrusive Geotechnical Investigation (IGI) report has been prepared by Geotechnique Pty Ltd on behalf of the NSW Department of Education (DoE) to assess the potential environmental impacts that could arise from construction of the new Gledswood Hills High School (the **Proposal**) at 9 Gregory Hills Drive, Gledswood Hills (the **site**). The works are proposed by the DoE to meet the growth in educational demand in Gregory Hills and Gledswood Hills and the broader South West Growth Area. Figure 1 below shows the location of the site.

Figure 1 - Location of Proposed Gledswood Hills High School

This report has been prepared to provide assessment of subsurface conditions across the site in order to provide geotechnical recommendations on site preparation and the design of the proposed school structures. The IGI was completed in accordance with Australian Standard AS1726 (Reference 1).

2.0 SUMMARY OF ACTIVITIES

The activity proposed by DoE involves the construction and operation of a new high school at the site accommodating 1000 students, including:

- A series of school buildings along the northern, eastern and southern site boundaries.
- A school hall.
- An assembly area, sports field and multi sports courts.
- Car parking and a Kiss and Drop zone.
- Associated on and off-site infrastructure to support the school, including a new pedestrian crossing and relocation of the existing bus stop on Gregory Hills Drive to the site frontage.

Figure 2 shows footprints of proposed buildings, car park and sports fields etc.

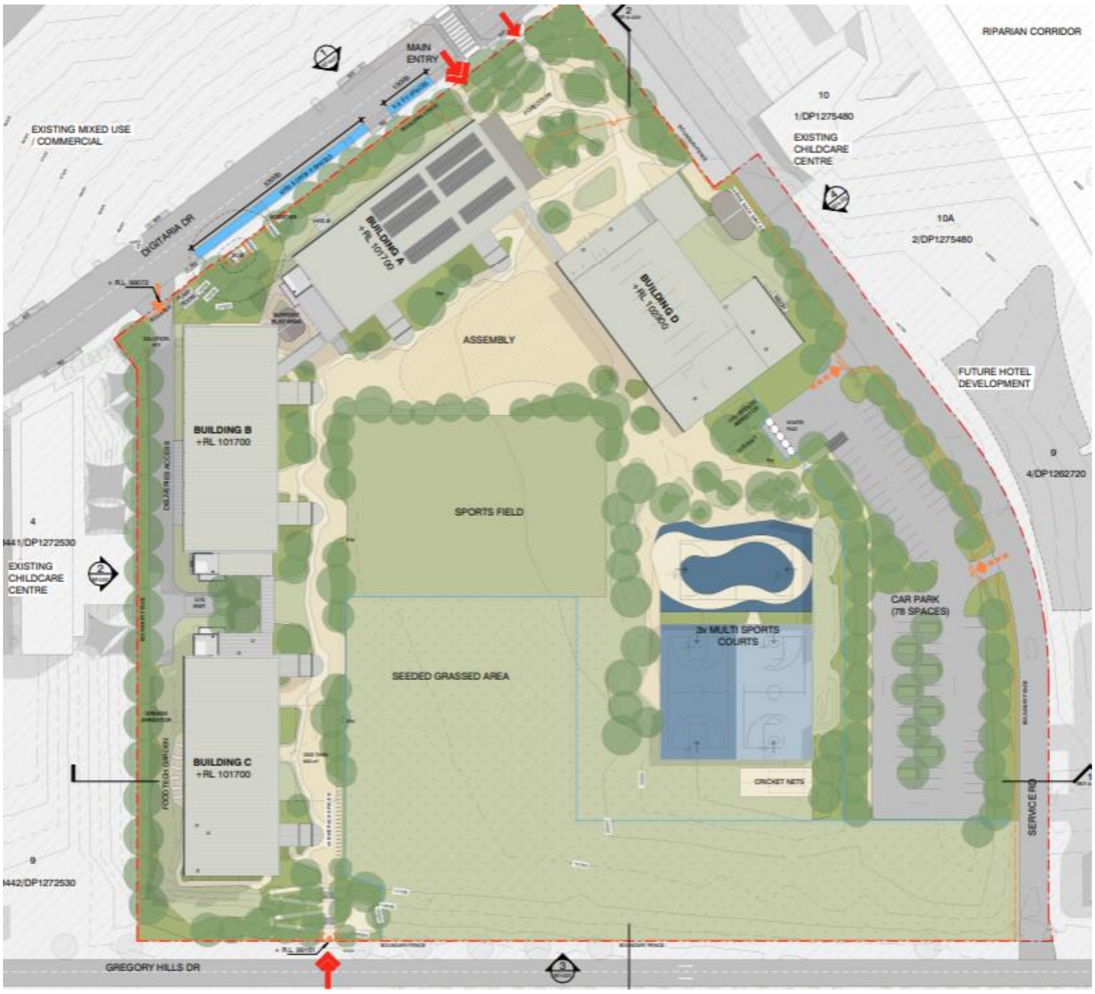

Figure 2 - Footprints of Proposed Structures in Proposed Gledswood Hills High School

3.0 SITE DESCRIPTION

The site is located at 9 Gregory Hills Drive, Gledswood Hills, within the Camden Local Government Area (LGA), approximately 60km southwest of the Sydney CBD and approximately 3.5km from Narellan Town Centre. It comprises one lot, legally described as Lot 2 DP1262720, that measures approximately 4.15ha in area. The site is bound by Digitaria Drive to the north and Gregory Hills Drive to the south. To the east lies two vacant lots, a childcare centre and a fast-food outlet. To the west lies another childcare centre and a vacant lot (which also has approval for a childcare centre). Figure 1 is an aerial image of the site.

4.0 CONCEPT APPROVAL

The site of the proposed high school forms part of a larger site that is made up of eight separate lots, which are subject to an approved Concept Development Application (DA) (DA/2017/45/1) for a mixed-use development comprising bulky goods premises, business premises, food and drink premises, indoor recreation facilities, two hotels and a cinema.

This report has considered the concept approval (DA/2017/45/1) for a mixed-use development and it has been determined that potential impacts of the proposed activity on concept approval can be appropriately mitigated or managed as detailed in Salinity Management Plan (SMP) prepared by Douglas Partners and presented in Attachment A (Reference 2).

5.0 CONSULTANT REPORT CONTENT

5.1 Background Information

5.1.1 Regional Geology and Soil Landscape

Reference to the Geological Map of Wollongong-Port Hacking (scale 1:100,000) indicates that the bedrock at the site is Bringelly Shale, belonging to the Wianamatta Group of rocks and comprising shale, carbonaceous claystone, laminite, fine to medium grained lithic sandstone, and rare coal (Reference 3).

Reference to the Soil Landscape Map of Wollongong-Port Hacking (scale 1:100,000) indicates that the landscape at the site belongs to Blacktown Group, which is characterised with gently undulating rises on Wianamatta Group shales, with local relief to 30.0m, ground slope of less than 5 percent and broad rounded crests. The sub-surface soil within this landscape is likely to be up to 3.0m thick, moderately reactive, highly plastic and with poor drainage (Reference 4).

5.1.2 Soil Salinity

Reference to Map showing Salinity Potential in Western Sydney (Scale Approximate 1:143,000) prepared by Department of Infrastructures, Planning and Natural Resources (2002) indicates moderately salinity potential across the site (Reference 5).

Douglas Partners has completed a Salinity Investigation for Lot 701 DP 1154772 in Gregory Hills Drive, Gledswood Hills, and prepared a report in 2012 (Reference 2). This report indicates that the materials within the proposed high school site are non-saline to very saline. However, very saline soils are localised in the north eastern portion of the school site as indicated below in Figure 3, extracted from Reference 2. It should however be noted that significant fill has been placed across the site after preparation of Reference 2.

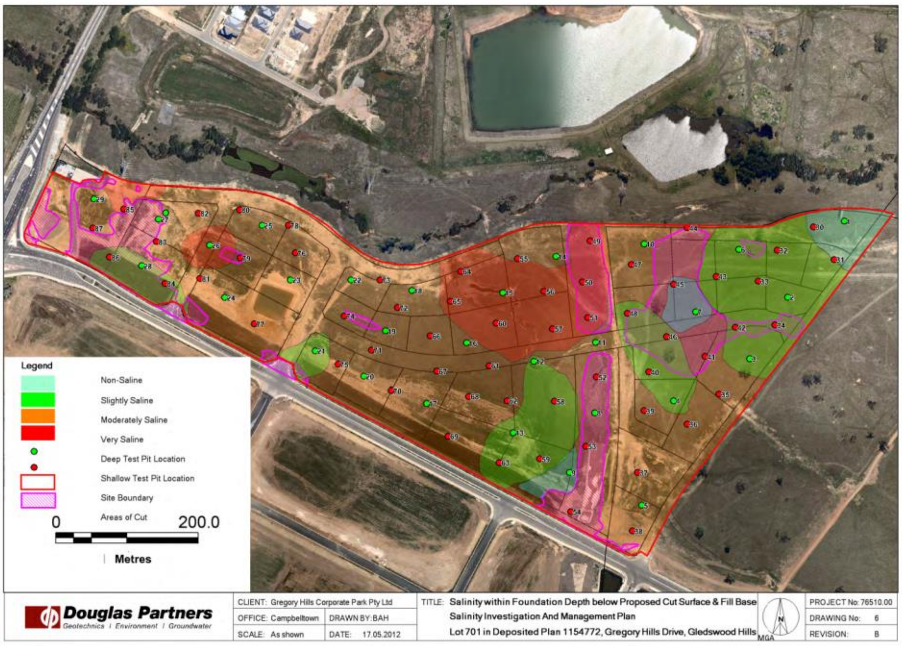

Figure 3 - Variation in Salinity of Soil Materials across the Proposed High School Site in 2012

5.1.3 Acid Sulphate Soils

Department of Land and Water Conservation has produced Acid Sulphate Soil Risk Maps for areas with known or potential occurrence of acid sulphate soils in NSW. Proposed high school site is located outside the areas with known or probabilities of occurrences of acid sulphate soils across. Furthermore, reference to Acid Sulphate Soil Risk Map (Edition 2, 1:25,000) of Liverpool covering areas in the vicinity of the site indicates no known occurrence of acid sulphate soil at the site (Reference 6).

5.1.4 Groundwater

A search of the website of Department of Primary Industries Office of Water for registered groundwater bore data shows one registered bore within radius of 500.0m of the site and depth to groundwater is about 23.0m from existing ground surface (Reference 7). The groundwater is likely to be fresh.

There is no water body, such as a creek, river, or wetland close to and transecting the site. It is noted that a tributary of South Creek transecting the north eastern portion of the site has been realigned out of the site and filled up in early 2010s. South Creek is located approximately 110.0m to the north of the site.

5.1.5 Fill Management Protocol

We understand that the site for proposed high school at Gledswood Hills was initially proposed to be subdivided for commercial development. The site preparation for commercial development required importation of approximately 330,000 m^3 of material classified as Virgin Excavated Natural Material (VENM) or materials classified understood either a general or specific recovery exemption. For importation of such materials ADE Consulting Group Pty Ltd (ADE) prepared a Fill Management Protocol (Reference 8). In addition to advice on contamination acceptance criteria for importation of fill, this protocol also provides the following geotechnical requirements for importation of materials:

- The maximum particle size of the imported material must not exceed 150.0mm. The maximum particle size of greater than 150.0mm is acceptable if the material can readily breakdown under normal compaction conditions
- The imported material should have a liquid limit (obtained by Atterberg Limit test) of less than 50.0%. Material with a Liquid Limit up to 50.0% will be acceptable if Shrink Swell Index test certificates show that shrink swell index is ≤2.0.
- The imported material should have a California Bearing Ratio (CBR) of at least 5.0% and should not contain any unsuitable material defined in Australian Standard AS3798 (Reference 8).
- The imported soils should be moderate salinity or better as the site is in an area of known moderate salinity.

ADE has reviewed the findings presented in various reports prepared for the site and stated that the ADE considers that the soil materials imported into site during the period November 2013 to April 2017 were imported in accordance with the site's Fill Management Protocol (Reference 8) and are suitable for the proposed commercial/industrial land use (Reference 9).

5.2 Results of Preliminary Geotechnical Desktop Study

Preliminary Geotechnical Desktop Study (PGDS) indicates the following:

- The natural subsurface profile across the site for proposed school is likely to comprise a sequence of residual soils underlain by shale bedrock. The thickness of residual soils overlying the bedrock is anticipated to be up to about 3.0m thick. However, it is likely that significant fill has been placed across the site so that the thickness of soil materials overlying bedrock could be significantly more than 3.0m.

- The residual soils are likely to be saline and therefore disturbance and/or excavation of residual soils during the proposed activities may have to be carried out in accordance with SMP prepared by Douglas Partners (Reference 2).
- Residual soils across the site are unlikely to be acid sulphate or potential acid sulphate soils. Therefore, disturbance and/or excavation of residual soils during the proposed activities do not require an Acid Sulphate Soil Management Plan (ASSMP).
- Fill Management Protocol prepared by ADE indicates that the fill across the site might have been placed in a controlled manner (Reference 8). However, we recommend for additional sampling and testing to confirm: (1) the presence or absence of saline and acid sulphate soils; and (2) the fill is actually controlled in nature and suitable as foundation materials.
- Additional earthwork or site preparation for construction of proposed school is likely to involve some excavation (including removing unsuitable foundation materials) and fill operations. Excavations can be achieved using conventional earthmoving equipment such as excavators and dozers and fill should be placed in accordance with Australian Standard AS3798 (Reference 10). It is unlikely that the excavation works will encounter significant groundwater inflow. Minor groundwater inflow or seepage, if encountered, can be handled with conventional sump and pump method.
- Cut and fill slopes during and after earthworks should be battered for stability or retained with engineered retaining structures. Although it is unlikely that the batter slopes would require retention with engineered retaining structures, appropriate retaining structures for the proposed activities are anticipated to include gravity walls or cantilever walls.
- At the completion of earthworks, preliminary Geotechnical Model for the site is likely to comprise three Geotechnical Units namely fill underlain by residual soil, which in turn is underlain by bedrock. Residual soil and bedrock units are assessed to be suitable foundation materials for proposed school buildings and other structures. But suitability of fill materials as foundation materials for proposed school buildings will have to be ascertained by conducting additional sampling and testing.
- Appropriate footings for the proposed buildings and retaining structures are likely to comprise shallow (pad or strip) footings founded on fill or deep footing socketed into residual soils or bedrock. Deep footings (bored piers, screw piles etc) may be preferable if footings are required to withstand significant lateral and uplift loads.
- The site for the proposed school construction is almost levelled and assessed to have a "Very Low Risk” of slope instability to the property at existing conditions. It is also our assessment that the risk of slope instability across the site can be maintained at “Very Low” so that the site will be suitable for proposed school construction from slope stability considerations provided earthworks and construction of proposed structures are carried out in accordance with recommendations provided in this report.

Based on above discussion the potential geotechnical limitations on the proposed school construction include presence of potentially uncontrolled fill and salinity of soils encountered across the site. It is our assessment that these limitations are minor and can be addressed if earthworks and design of proposed structures are carried out in accordance with recommendation provided in an IGI report. Therefore, it is our assessment that the the site is suitable for construction of proposed new high school provided earthworks and designs of ground floor slabs and footings of proposed buildings are carried out in accordance with recommendations provided in this report.

5.3 Results of Intrusive Geotechnical Investigation

5.3.1 Subsurface Profile

Scopes of work for IGI included drilling of 15 boreholes, distributed across the site, and conducting field and laboratory tests to assess the nature of subsurface materials. Borehole locations plan is presented in Appendix A. Borehole logs detailing sub-surface profiles encountered in boreholes are also presented in Appendix A and summarised below in Table 1.

Table 1 - Sub-surface Profiles encountered in Boreholes

Borehole No	Easting (m)	Northing (m)	Ground Surface RL (m AHD)	Termination Depth (m)	Depth for Fill (m)	Depth for Residual Soil (m)	Depth to Bedrock (m)
BH1a	293989.6	6233014.8	102.2	8.0	0.0-4.5	4.5-6.1	6.1
BH2	293931.7	6233045.5	101.4	1.5	0.0->1.5	-	-
BH3a	293875.3	6233075.8	100.9	7.0	0.0-4.0	4.0-6.0	6.0
BH4a	293817.5	6233106.7	100.3	7.4	0.0-5.5	5.5-6.8	6.8
BH5	293843.8	6233156.0	101.3	1.3	0.0->1.3	-	-
BH6	293896.4	6233141.9	101.4	0.6	0.0->0.6	-	-
BH7	293959.8	6233110.0	102.4	0.6	0.0->0.6	-	-
BH8a	294015.0	6233063.4	102.6	12.5	0.0-6.5	6.5-11.0	11.0
BH9a	294025.5	6233117.3	102.5	5.3	0.0->5.3	-	
BH10	294014.4	6233180.2	102.1	1.3	0.0->1.3	-	-
BH11	293955.5	6233189.9	102.1	14.0	0.0-7.0	7.0-12.8	12.8
BH12	293869.3	6233202.7	101.4	10.3	0.0-7.0	7.0-9.5	9.5
BH13	293902.8	6233234.4	101.1	8.0	0.0-7.5	7.5-8.0	8.0
BH14	293952.6	6233241.2	101.2	13.5	0.0-7.5	7.5-13.0	13.0
BH15	294001.5	6233248.5	100.5	4.8	0.0->4.8	-	13.0

Table 1 indicates that the subsurface profiles across the site generally comprise a sequence of fill and residual soils underlain by bedrock. The thickness of fill varies across the site from about 4.5m to 7.5m and the depth to bedrock is anticipated to vary from about 6.0m to 13.0m from existing ground surface.

The subsurface materials may in general be described as follows:

Fill	Silty CLAY, low to medium plasticity, brown, moisture content lower than plastic limit, generally well compacted, with some gravel and boulders/concrete blocks. Gravelly CLAY, low to medium plasticity, grey, moisture content generally lower than plastic limit, generally well compacted, with some gravel and boulders
Residual Soil	Silty CLAY, medium to high plasticity, brown, orange, moisture content generally lower than or equal to plastic limit, stiff to very stiff
Bedrock	SHALE, grey, extremely to distinctly weathered, low to medium strength

Groundwater level was not encountered in boreholes up to their termination depths of about 0.6m to 14.0m from existing ground surface. Therefore, we anticipate depth to regional groundwater level across the site to be more than 14.0m during normal climatic conditions. However, it should be noted that the groundwater levels might vary due to rainfall and other factors not evident during field work.

5.3.2 Existing Fill

Boreholes and test pits distributed across the site encountered fill. The fill thickness is anticipated to be variable but up to about 7.5m thick. Fill generally comprises silty clay of low to medium plasticity with some gravel and gravelly clay of medium plasticity. However, some boreholes and test pits also encountered random boulders.

It is visual assessment that the properties of fill materials encountered in boreholes/test pits are likely to satisfy suggested specifications for the fill materials to be imported into the site (Reference 8). In addition, the results of SPT conducted during current IGI suggest that the fill has been well compacted. However, some boreholes/test pits encountered random boulders not expected in controlled fill. Figure 4 shows boulders encountered in a test pit as an illustration. Therefore, it is our assessment that the existing fill has been well compacted to be suitable as foundation materials for construction of the proposed school buildings, but placement of fill might not have been controlled adequately to avoid boulders.

Figure 4 - Illustration of Randon Boulders encountered in Test Pits

As records on fill placement and results of field density tests indicating that the existing fill has been placed and compacted in controlled manner are not available, the existing fill should be considered as uncontrolled fill mainly because of presence of boulders not expected in controlled fill. Therefore, fill may be left at existing conditions if school buildings and other significant structures are supported by piers founded on natural soils or bedrock and designed in accordance with recommendations provided in this report.

5.3.3 Laboratory Tests

Representative soil samples recovered from boreholes/test pits were tested in the NATA accredited laboratories in accordance with relevant Australian Standards, to determine the following:

- Reactivity of subsurface soils in terms of Atterberg limits
- Salinity and aggressivity of subsurface soils in terms of Electrical Conductivity (EC), pH, chloride, resistivity

Detailed laboratory test results are presented in Appendix B and summaries of test results are presented in the following Tables 2 and 3.

Table 2 - Results of Atterberg Limits Tests

Borehole No	Sample Depth (m)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Shrinkage Limit (%)
BH2	0.7-1.0	41.0	15.0	25.0	13.0
BH5	0.8-1.0	Not Obtainable			1.5
BH10	0.7-0.9	36.0	16.0	20.0	11.0
BH13	1.5-1.95	43.0	18.0	25.0	11.5

Table 3 - Results of Chemical Properties Tests

Borehole No	Sample Depth (m)	EC (μS/cm)	pH	Chloride (ppm)	Sulphate (ppm)	Resistivity (ohm-m)
BH1	0.5-0.7	300	7.4	150	270	1500
BH1	1.0-1.2	480	7.8	200	380	1200
BH2	0.8-1.0	300	8.0	90	330	1600
BH3	1.0-1.2	530	8.1	140	590	1100
BH3	2.8-3.0	260	6.2	230	140	2000
BH4	0.4-0.6	360	7.6	120	280	1500
BH8	0.4-0.6	280	7.9	70	330	1800
BH8	1.0-1.2	390	8.1	170	390	1200
BH9	0.4-0.6	420	8.1	160	340	1300
BH9	1.0-1.2	420	8.1	170	350	1300
BH11	1.0-1.2	310	5.7	170	310	1900
BH11	3.0-3.2	410	8.3	150	350	1300
BH11	5.0-5.2	400	8.2	180	330	1400
BH11	7.0-7.2	460	8.4	190	290	1400
BH12	1.5-1.95	520	7.9	210	530	1100
BH12	3.0-3.45	510	7.9	170	610	1100
BH12	4.5-4.95	410	7.9	130	380	1400
BH12	10.0-10.2	510	8.6	580	170	960
BH15	1.5-1.95	450	8.2	110	340	1500
BH15	3.0-3.45	350	8.5	130	200	1600
BH14	1.0-1.2	510	7.9	280	400	1100
BH14	3.0-3.2	460	8.3	190	290	1400
BH14	5.0-5.2	450	8.2	230	280	1400
BH14	7.5-7.7	410	8.2	190	270	1500

5.3.4 Recommended Geotechnical Model for the Site

Boreholes and test pits indicate that the subsurface profile across the site comprises a sequence of fill and residual soils underlain by bedrock. The thickness of fill and depth to bedrock across the site are variable. Based on borehole/test pit information detailed in this report, a Geotechnical Model constituting three Geotechnical Units and detailed below in Table 4 is suggested for the site of the proposed new high school. Each Geotechnical Unit represents a specific nature of soil or bedrock encountered across the site. Based on visual assessment and results of SPT tests, indicative strength parameters, in terms of cohesion and internal friction angle, as well as modulus for each Geotechnical Unit are presented below in Table 4.

Table 4 - Recommended Geotechnical Model

Geotechnical Unit	Material Description	Indicative Depth to Top of Unit (m)
Unit 1	Fill	0.0
Unit 2	Residual Soil	4.0-7.5
Unit 3	Bedrock	6.0-13.0

Table 5 - Effective Strength Parameters and Modulus

Geotechnical Units	Unit Weight (kN/m^3)	Undrained Cohesion (kPa)	Effective Cohesion (kPa)	Friction Angle (deg)	Young's Modulus (MPa)	Poisson's Ratio
Unit 1	18.5	100.0	3.0	28.0	20.0	0.30
Unit 2	19.0	150.0	5.0	27.0	30.0	0.30
Unit 3	21.0	400.0	30.0	30.0	100.0	0.25

5.3.5 Soil Salinity

Soil salinity is generally assessed by measuring Electrical Conductivity (EC) of a soil sample made up of 1:5 soil water suspension. Thus, determined EC is multiplied by a factor varying from 6 to 23, based on the texture of the soil sample, to obtain Corrected Electrical Conductivity designated as ECe (Reference 11). Alternatively, ECe may be directly measured in soil saturation extracts. Soils are classified as saline if ECe of the saturated extracts exceed 4.0dS/m. The criteria for assessment of soil salinity classes are shown in the following Table 6 (Reference 11).

Table 6 - Criteria for Soil Salinity Classification

Classification	EC$_e$ (dS/m)	Comments
Non-saline	<2	Salinity effects mostly negligible
Slightly saline	2 – 4	Yields of very sensitive crops may be affected
Moderately saline	4 – 8	Yields of many crops affected
Very saline	8 – 16	Only tolerant crops yield satisfactorily
Highly saline	>16	Only a few tolerant crops yield satisfactorily

Electrical conductivity (EC) values for 24 representative soil samples are summarised in Table 3. For clayey soils encountered across the site an appropriate multiplying factor is assumed to vary from 9 to 10. Even if a factor of 10 is used, estimates of ECe values for soil samples are estimated to vary from about 2.6dS/m to 5.3dS/m. More than half of samples show ECe values of more than 4.0dS/m. Both fill materials and residual soils across the site are assessed to be saline or non-saline soils.

As soils samples for salinity tests were collected from varying depths across the site and a large number of sampling and testing will be required to delineate areas with saline soils with the fill and residual soils, it is our recommendation that the soils likely to be disturbed or excavated during proposed activities are considered Moderately Saline. Therefore, earthworks for the proposed school construction should be carried out in accordance with SMP prepared by Douglas Partners (Reference 2).

5.3.6 Exposure Classification

Australian Standard AS2870 (Reference 12) provides guidelines to assess Exposure Classification for saline and acid/sulphate soils. Table 7 below provides salinity and Exposure Classifications based on EC_e, and Table 8 provides Exposure Classification based on acidic and sulphate soils (Reference 12).

Table 7 – Exposure Classifications for Saline Soils

Electrical Conductivity, EC_e (dS/m)	Exposure Classification	Salinity Classification
<2	A1	Non-saline
2 – 4	A1	Slightly saline
4 – 8	A2	Moderately saline
8 – 16	B1	Very saline
>16	B2	Highly saline

Table 8 – Exposure Classifications for Sulphate Soils

Sulphate expressed as SO_3		pH	Exposure Classification*	
In Soil (ppm)	In Groundwater (ppm)		Soil Condition A	Soil Condition B
<5000	<1000	>5.5	A2	A1
5000-10000	1000-3000	4.5-5.5	B1	A2
10000-20000	3000-10000	4.0-4.5	B2	B1
>20000	>10000	<4.0	C2	B2

*Soil Condition A = high permeability soils (e.g. sands and gravels) which are below groundwater
*Soil Condition B = low permeability soils (e.g. silts and clays) and all soils above groundwater

Soils across the site are predominantly clayey and therefore appropriate "Soil Condition is assessed to be "Condition B". Therefore, based on laboratory test results presented in Tables 3 and guidelines on Exposure Classifications presented in Tables 7 and 8, the Exposure Classifications for site is Class A1 or A2. ECe values are dominant. Therefore, we recommend that the proposed school construction use construction materials (such as concrete, bricks) and construction methods appropriate for Exposure Class A2. However, Exposure Classification for sites for individual structures may be reassessed after post earthworks salinity assessment.

5.3.7 Aggressivity Classification

Australian Standard AS2159 (Reference 13) provides Aggressivity Classifications of soil and groundwater applicable to iron/steel and concrete piles. The Aggressivity Classifications applicable to iron/steel piles is provided below in Table 9 and that applicable to concrete piles is provided in Table 10.

Table 9 – Aggressivity Classification for Steel

Chloride		pH	Resistivity (ohm cm)	Soil Condition A*	Soil Condition B#
In Soil (ppm)	In Water (ppm)				
<5000	<1000	>5.0	>5000	Non-aggressive	Non-aggressive
5000-20000	1000-10000	4.0-5.0	2000-5000	Mild	Non-aggressive
20000-50000	10000-20000	3.0-4.0	1000-2000	Moderate	Mild
>50000	>20000	<3.0	<1000	Severe	Moderate

Table 10 – Aggressivity Classification for Concrete

Sulphate expressed as SO_4		pH	Chloride in Water (ppm)	Soil Condition A	Soil Condition B
In Soil (ppm)	**In Groundwater (ppm)**				
<5000	<1000	>5.5	<6000	Mild	Non-aggressive
5000-10000	1000-3000	4.5-5.5	6000-12000	Moderate	Mild
10000-20000	3000-1000	4.0-4.5	12000-30000	Severe	Moderate
>20000	>10000	<4.0	>30000	Very Severe	Severe

As discussed above soils across the site are clayey and therefore Soil Condition B is appropriate. Based on laboratory test results presented in Tables 3 and guidelines on Aggressivity Classifications presented in Tables 9 and 10, the soils across the site are assessed to be Non-aggressivity to Mildly Aggressive to steel piles (Reference 13) but Non-aggressive to concrete piles. Resistivity is dominant for steel piles. Therefore, we recommend that the piles supporting proposed school structures are designed to suit aggressivity classification indicated above (Reference 13).

5.3.8 Soil Reactivity

Reactivity of soils across the site is assessed by determination of Atterberg Limits for representative samples and results are presented in Table 2. One of four samples tested was non-reactive. But three samples show Liquid limits of more than 35.0% and Plasticity Index of more than 20.0%. Therefore, it is our assessment that soil across the site is reactive and therefore susceptible to shrink and swell movements. This fact should be considered in the design and construction of proposed school structures.

5.3.9 Excavation Conditions

Proposed new high school construction is anticipated to involve some cut and fill operations. Although details on depth of excavation are not known, we anticipate proposed excavations will not be deeper than about 2.5m from existing ground surface. However, deeper excavation may be involved if existing fill is assessed to be unsuitable foundation materials. Therefore, the materials to be excavated are anticipated to comprise fill and residual soils. No bedrock excavation is anticipated.

It is our assessment that the excavation works for the proposed school construction can be achieved using conventional earthmoving equipment such as excavators and dozers.

Based on site observation during field works, we do not anticipate significant groundwater inflow during excavations to depth of about 5.0m. Minor groundwater inflow, if any, could be managed by a conventional sump and pump method. However, trafficability problems could arise locally during wet weather or if water is allowed to pond at the site.

5.3.10 Fill Placement

Site preparation for proposed high school construction may involve placement of some fill. Significant fill placement may be required if existing fill is to be replaced with new controlled fill for whatever reason. Existing fill may have to be removed if it is confirmed to be uncontrolled and not suitable for construction of proposed school structures. However, based on Fill Management Protocol (Reference 8) and results of current IGI it is likely that the existing fill is controlled and therefore suitable for construction of proposed high school. However, additional testing may be conducted to ascertain properties of the existing fill for design development/upgrade and value management prior to construction.

Fill placement, if required, should be carried out in a controlled manner and we recommend the following procedures for placement of controlled fill:

- Strip existing topsoil and stockpile separately for possible future uses or dispose off the site. Topsoil may be used in landscaping. Existing fill may also have to be stripped if confirmed to be uncontrolled.
- Undertake proof rolling, using an 8 to 10 tonnes roller of the exposed fill (or residual soils if existing fill is removed) to detect potentially weak spots (ground heave). Excavate areas of localised heaving to a depth of about 300mm and replace with granular fill, compacted as described below.
- Undertake proof rolling of soft spots backfilled with granular fill, as described above. If the backfilled area shows movement during proof rolling, this office should be contacted for further recommendations.
- Place suitable fill materials on proof rolled surface. Fill should be placed in horizontal layers of 200mm to 250mm maximum loose thickness and compacted to a Minimum Dry Density Ratio (MDDR) of 98% Standard, at moisture content within 2% of Optimum Moisture Content (OMC). However, the upper 500mm of controlled fill forming subgrade for access roads and car parks should be compacted to a MDDR of 100% Standard, at moisture content within 2% of OMC. Controlled fill should preferably comprise non-reactive fill (e.g. crushed sandstone), with a maximum particle size not exceeding 75mm, or low plasticity clay. The fill materials, residual soils and bedrock obtained from excavations within the site may also be selectively used in controlled fill, after crushing to sizes finer than 75mm, moisture conditioning, and removal of unsuitable materials.
- Fill placement should be supervised to ensure that material quality, layer thickness, testing frequency and compaction criteria conform to the specifications. We recommend "Level 1" supervision and testing, in accordance with AS3798 (Reference 10).

5.3.11 Batter Slopes and Retaining Structures

The site preparation for construction of the proposed school may involve cut and fill operations. Cuts are likely to be limited in fill and generally temporary in nature. The cut and fill slopes should be battered for stability or retained by engineered retaining structures. For battered slopes, we recommend the following:

- For short-term stability in controlled fill and residual soils = 1 vertical to 1 horizontal
- For long-term stability in controlled fill and residual soils = 1 vertical to 2.5 horizontal

It is also recommended that batter slopes are provided with adequate surface and sub-surface drainage, and the crest of the batter slope is at least 1.0m away from the property boundaries. However, if cut and fill slopes steeper than those recommended above are required for whatever reason, these slopes should be retained by engineered retaining structures. Appropriate retaining structures for the proposed works are anticipated to comprise cantilever walls and gravity walls. The pressure distribution on such walls is assumed to be triangular in shape and estimated as follows:

$$p_h = \gamma k H$$

Where,

p_h = Horizontal pressure (kN/m^2)
γ = Total unit weights of retained materials (kN/m^3)
k = Coefficient of earth pressure (k_a or k_o)
H = Retained height (m)

For design of flexible retaining structures where some lateral movement is acceptable, an active earth pressure coefficient (k_a) is recommended. However, if it is critical to limit the horizontal deformation, use of an earth pressure coefficient at rest (k_0) is recommended. Recommended earth pressure coefficients for the design of retaining structures are presented below:

- Total Unit Weight = 18.5kN/m^3
- Coefficient of active earth pressure = 0.35
- Coefficient of at rest earth pressure = 0.55

The above coefficients are based on the assumptions that the ground level behind the retaining structure is horizontal, and the retained material is effectively drained. Additional earth pressures resulting from surcharge load (buildings, infrastructures, etc) on retained materials and groundwater pressure, if any should also be allowed for in design of retaining structures. The design of any retaining structure should also be checked for bearing capacity, overturning, sliding and overall stability of the slope.

5.3.12 Site Classification

Australian Standard AS2870 (Reference 12) indicates that a building site can be classified based on thickness of clayey foundation soils and reactivity (shrink swell movements) of foundation soils. Site preparation for the proposed construction works is anticipated to involve some cut and fill operations. At the completion of site preparation, the thickness of clayey foundation soils, comprising fill and residual soils across the site is anticipated to be more than 5.0m.

As existing conditions, the site for proposed high school is assessed to belong to “Class P” in accordance with Reference 12 because existing fill is yet to be confirmed to be controlled.

Table 2 indicates most of subsurface soils across the site are reactive and susceptible to shrink swell movement. Therefore, if existing fill is confirmed to be controlled based on review of field density tests carried out during fill placement and/or additional testing, the building site for proposed new high school is anticipated to belong to “Class H1” in accordance with Australian Standard AS2870 (Reference 11). However, site classifications for a specific structure should be confirmed by sampling and testing of foundation soils after construction of building platforms are completed.

5.3.13 Floor Slabs

We anticipate that the foundation materials at ground floor levels of proposed school buildings will be existing fill. If the existing fill is confirmed to be controlled, the ground floor slabs for the proposed buildings may be designed and constructed as ground bearing slabs or suspended slabs supported by footings designed in accordance with recommendations provided in this report. Ground bearing floor slabs of proposed buildings may be designed to suit Site “Class H1” in accordance with Australian Standard AS2870 (Reference 12). Therefore, shrink swell movements of 40.0mm to 60.0mm is anticipated for Class H1. The design of ground bearing slabs should also consider likely shrink swell movements due to the effect of climatic factors. However, this movement can be reduced by providing a layer of 100mm to 200mm thick roadbase or crushed sandstone and minimising wetting and drying of foundation soils/subgrade.

Alternatively, we recommend a Modulus of Subgrade Reaction value of 25kPa/mm.

It should be noted that the site classification in accordance with AS2870 is applicable only for design of footing systems for a single dwelling, house, townhouse or similar structure that would be detached or separated by a party wall or common walls. Therefore, site recommended site classification may not be applicable for proposed school buildings.

However, if existing fill is confirmed to be uncontrolled, ground floor slabs for the proposed buildings should be constructed as suspended slabs supported by footings designed in accordance with recommendations provided in this report. It is recommended that the suspended slabs are isolated from shrink swell movements of reactive foundation soils (estimated to be 40.0mm to 60.0mm for Class H1 site) by forming voids between foundation soils and the slabs.

5.3.14 Footings

Loading conditions for the proposed school buildings are not known at this stage. However, we consider that appropriate footings would comprise shallow footings (pad and strip footings) founded on controlled fill or deep footings (bored piers or screw piles) socketed into residual soils or founded on bedrock. Deep footings would be preferable if footings are required to support high vertical loads as well as significant lateral and uplift pressures. The recommended allowable bearing pressures for design of shallow and deep footings are presented in the following Table 11.

Table 11 – Recommended Bearing Pressures

Founding Material	Founding Depth from Existing Ground Surface (m)	Ultimate Bearing Pressure (kPa)	Ultimate Shaft Adhesion (kPa)	Allowable Bearing Pressure (kPa)	Allowable Shaft Adhesion (kPa)
Unit 1 Controlled Fill	1.0-1.5	300.0	Ignore	125.0	Ignore
Unit 2 Residual Soil	4.0-7.5	1500.0	30.0	400.0	10.0
Unit 3 Bedrock	6.0-13.0	3000.0	150.0	800.0	80.0

The following should be noted:

- The ultimate bearing pressure and shaft adhesion are based on the ultimate capacities mobilised at large displacements, about 5.0% to 10.0% of pile diameter or minimum footing width. These values assume a clean rock socket with a roughness Category of R2 or better (Reference 14).
- The allowable bearing pressure and shaft adhesion are based on the capacities mobilised at displacements of about 1.0% of pile diameter or minimum footing width.
- The ultimate and allowable bearing pressures for Unit 3 are based on the assumptions that the piers are socketed at last 0.3m into appropriate rock units.
- Differential settlements are estimated to be about halves the estimated total settlements.
- The shaft adhesions against uplift pressures are halves the shaft adhesions for compressive loads presented in above table.
- For limit state design, geotechnical strength reduction factor ϕ_g of 0.50 is recommended in accordance with AS2159 (Reference 13). However, reduction factor ϕ_g can be increased up to 0.7 to 0.8 if pile design is verified by analyses of pile load tests and sufficient construction monitoring is carried out.

It is preferable that the footings are founded on similar foundation. As depths of bedrock with the recommended allowable bearing pressures is anticipated to vary across the site, the founding depths of footings to be constructed will also vary. Therefore, an experienced Geotechnical Engineer should confirm bearing pressures at founding levels during construction, on the basis of assessment made during footing excavation or pier hole drilling.

5.3.15 Saline Soil Management Plan

Most soils across the site are assessed to be saline. Although some soils are anticipated to be non-saline, a large number of sampling and testing will be required to delineate areas with non-saline soils. Therefore, for ease of earthworks, we recommend that the entire soils across the site are considered to be saline. Therefore, earthworks for the proposed activities should be carried out in accordance with SMP prepared by Douglas Partners (Reference 2)

The objective of this SMP is to minimise the impacts of saline and dispersive soils on the proposed activities and minimise the impact of the proposed activities on the existing salinity and hydrology. More specifically, this SSMP aims to address the following.

- Minimise the disruption to natural surface water drainage
- Minimise the potential for waterlogging or surface water pooling
- Minimise the potential for raising the water table beneath the site
- Minimise the potential for cyclic wetting and drying areas
- Minimise the potential for excessive soil erosion
- Minimise the degradation of building products (masonry, concrete, steel) in the presence of aggressive and/or saline soils

Erosion and sediment control should be carried out in accordance with Erosion and Sediment Control Plan (ESCP) recommended by TTW (Reference 15).

However, as supplement to the SMP recommended by Douglas Partners (Reference 2) and ESCP recommended by TTW (Reference 15), we recommend the following to minimise the impact of the proposed activities on soil salinity and erosion and vice versa.

- Map the current primary drainage lines and incorporate these into the surface water drainage system for the site. Do not fill in or block these drainage lines unless appropriate alternative drainage is provided.
- Where creation of individual building platform requires substantial cut and/or fill consider the use of tiered buildings and/or building with slabs suspended on piers. This will minimise the obstruction of the natural surface water flow.
- Minimise the use of retaining structures; use safely inclined slopes, with grass and plant cover as an alternative. Gabion walls are also a better alternative as they are free draining.
- Reduce groundwater recharge through appropriate land use and land management practices. This can be achieved by minimising deep infiltration and by maximising vegetation cover, planting deep-rooted trees and the use of salt tolerant plants.
- Construct a V-drain behind the crest of all slopes to divert water away from the slope face.

- Ensure that earthworks and construction activities do not affect the natural flow of groundwater. Where groundwater is intercepted during proposed activities, the flow should be diverted to stormwater drains or creeks by providing appropriate surface and sub-surface drainage.
- On-site water detention in un-lined basins should be prevented, as this provides a localised potential groundwater re-charge. Lined basins, relying solely on evaporation should be used as an alternative.
- The finished ground surface after completion of earthworks should be provided with adequate fall to the street or stormwater manholes to allow run-off of water and prevent water ponding, waterlogging and infiltration of rainwater.
- Construction materials and methods should be appropriate to assess Exposure and Aggressivity Classification recommended in this report.

5.3.16 Slope Stability

Site factors such as slope angles, depth of insitu soils, strengths of sub-surface materials, and concentrations of water generally govern the stability of a site. "Practice Note Guidelines for Landslide Risk Management", prepared by Australian Geomechanics Society (Reference 15), recommends that the landslide (slope failure) risk at a site is assessed on the basis of the likelihood of a landslide (slope failure) event and the consequences of that event. Applying the above guidelines, the risk of landslide (slope failure) across the site at its existing conditions is assessed as follows:

- Qualitative Measures of Likelihood - For the existing site conditions, it is our assessment that an event of a landslide (slope failure) is "Rare", which means slope failures are conceivable but under exceptional circumstances, with indicative annual probability of $\approx 10^{-5}$.
- Qualitative Measures of Consequences to Property - It is our assessment that the consequences of landslide (slope failure) in the site to the property would be "Medium", resulting in moderate damage to some structures, or significant part of the site requiring large reinstatement/stabilisation works.

Based on the above Qualitative Measures, the site for the proposed upgrade is assessed to have a "Very Low to Low Risk" to the property. The definitions of the risk levels are provided in Reference 15 and an abstract is presented below.

Risk Level		**Implication**
VH	Very High Risk	Extensive detailed investigation and research, planning and implementation of treatment options, essential to reduce risk to acceptable levels; may be too expensive and not practical.
H	High Risk	Detailed investigation, planning and implementation of treatment options required to reduce risk to acceptable levels.
M	Moderate Risk	Tolerable, provided treatment plan is implemented to maintain or reduce risks. May be accepted. Might require investigation and planning of treatment options.
L	Low Risk	Usually accepted. Treatment requirements and responsibility to be defined to maintain or reduce risk.
VL	Very Low Risk	Acceptable. Manage by normal slope maintenance procedures.

Based on a “Very Low to Low" risk to property, it is considered that the site is assessed to be suitable for construction of the proposed school from slope stability consideration providing site preparation works and construction of proposed structures do increase the risk of slope instability. Therefore, risk of slope instability does not impose any limitation of proposed upgrade works.

6.0 POTENTIAL GEOTECHNICAL CONSTRAINTS OR RISKS

Based on anticipated site conditions, the potential geotechnical constraints or risks on proposed high school construction include the following.

- The risk of variability in the thickness of fill across the site.
- The risk of variability in the depth to bedrock across the site
- The risk that the existing fill across the site may be uncontrolled in nature.
- The risk of occurrence of saline soils.

Boreholes and test pits distributed across the site encountered fill. The thickness of fill across the site varies from about 4.5m to 7.5m from existing ground surface. Likewise, the depth to bedrock across the site varies from about 6.0m to 13.0m. It will be preferably that footings of proposed buildings are founded on similar foundation materials. Therefore, designer of building should consider impacts of these variabilities on design and costing of the buildings.

Fill generally comprises silty clay of low to medium plasticity with some gravel and gravelly clay of medium plasticity. However, some boreholes and test pits also encountered random boulders. Although the existing fill appears to be well compacted, placement of fill might not have been controlled adequately. Therefore, designer of piles supporting building should consider likelihood that the existing fill may random boulders and its impacts on design and costing of the buildings.

The subsurface materials, including fill materials and residual soils across the site, vary from non-saline soils to saline soil. As large number of sampling and testing will be required to delineate areas with saline and non-saline soil, it is our recommendation that the soils likely to be disturbed or excavated during proposed activities are considered Moderately Saline. Therefore, earthworks for the proposed activities should be carried out in accordance with an SMP recommended by Douglas Partners (Reference 2). The designer should consider the management of saline soil during proposed activities and its impact on design and costing of the buildings etc.

The geotechnical constraints or risks associated with variabilities in thickness and nature of fill and depth to bedrock can be addressed by conducting additional investigation or inspection during construction stage. Although additional investigation is desirable to arrive at appropriate structural design and cost management, the structural design can also be based on currently available information which can be confirmed during construction stage.

Likewise, constrained associated with saline soil can be addressed if earthworks are carried out in accordance with SMP recommended by Douglas Partners (Reference 2). Recommended mitigation measures to address the abovementioned geotechnical constraints are provided below in this report.

7.0 MITIGATION MEASURES FOR GEOTECHNICAL RISKS

As discussed above in this report, the potential geotechnical constraints or risk on proposed high school construction include variabilities in thickness and nature of existing fill, depth to bedrock and salinity of soils. Table 12 in the following page presents recommended mitigation measures to address these geotechnical constraints or risks.

8.0 SIGNIFICANCE OF ENVIRONMENTAL IMPACTS

Based on nature of potential geotechnical risks or issues at the site, it is our assessment that the potential impacts of proposed activities can be appropriately mitigated or managed in accordance with the recommended mitigation measures presented in Table 12. Therefore, from geotechnical engineering consideration, it is determined that the extent and nature of potential impacts from the proposed activities are “Low” and will not have significant impact on the locality, community and/or the environment.

9.0 CONCLUSIONS

Based on results of PGDS and IGI, it is our assessment that the 9 Gregory Hills, Gledswood Hills, is suitable for construction of proposed new high school from geotechnical engineering considerations provided: (1) geotechnical constraints imposed by presence of saline soils and the possibility that the existing fill are addressed in accordance with mitigation measures provided in this report; and (2) site preparation and design of floor slabs and footings of proposed buildings are carried out in accordance with geotechnical recommendations provided in this report. Furthermore, it is our assessment that an additional investigation is desirable, not necessary, to improve understanding on the variations in the thickness and nature of the fill and variation in the depth to bedrock for structural design purpose and value management. From geotechnical engineering considerations, the extent and nature of potential impacts from the proposed activities are “Low” and will not have significant impact on the locality, community and/or the environment.

If you have any questions, please do not hesitate to contact the undersigned.

Yours faithfully
GEOTECHNIQUE PTY LTD

INDRA JWORCHAN
Principal Geotechnical Engineer

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Table 12 – Recommended Mitigation Measures to Manage Geotechnical Risks

Project Stage **Design (D)** **Construction (C)** **Operation (O)**	**Mitigation measure**	**Reason for Mitigation Measure**	**Relevant Section of Report**
D & C	The designer should recognise variability in thickness of fill across the site and ascertain that the design allows for this variability and its implications in project design and costing. It is preferable that the fill thickness variability is confirmed by additional borehole drilling and/or inspections during construction stage to reduce the risk of this variability.	To reduce the risk or uncertainties due to variation in thickness and nature of existing fill. This will assist in design of activity or structures appropriate to the site conditions so that variation claims during construction stage can be minimised. Appropriate design will ensure optimal use of construction materials and minimal environmental impacts.	Section 5.3.2
D, C & O	The designer should recognise variability in the depth to bedrock to ascertain that the designs of activities are appropriate to site conditions and its impact on project design and costing. The depth to bedrock will need to be confirmed by additional borehole drilling or inspections during construction stage	To reduce the risk or uncertainties due to variation in depth to bedrock so that actual founding depths for piers supporting buildings and other major structures are known. This means appropriate and reliable foundation design can be achieved and potential variation claims during construction stage can be minimised. Appropriate and economical design will ensure optimal use of steel, concrete etc and minimal environmental impacts.	Section 5.3.1
D & C	The designer should recognise the possibility that the existing fill across the site is of variable nature. Review results of geotechnical investigations carried out to ascertain the existing fill is suitable as foundation materials. Alternatively, it can be assumed that the existing fill is uncontrolled and ensure the design is suitable for site underlain by uncontrolled fill.	To reduce the risk or uncertainties in the nature of fill so that the site can be prepared appropriately to be suitable for proposed activity and minimise potential risk of variation claims during construction stage. Appropriate design will ensure optimal use of steel, concrete etc and minimal environmental impacts.	Section 5.3.2

D, C & O	The designer should recognise that the subsurface soils across the site are saline and therefore disturbance and excavation of soils across the site should be carried out in accordance Saline Soil Management Plan (SMP) recommended by Douglas Partners. The cost for management of saline soil should be considered in project costing. It is possible that non-saline soil may be encountered in some portions of the site. If additional testing is carried out to delineate areas with non-saline soil, disturbance, and excavation of non-saline soils may be carried out without SMP.	To manage adverse impacts from the saline soils to the proposed activity and vice versa and to reduce variation claims during construction stage.	Section 5.1.2, 5.3.5, 5.3.15

ATTACHMENT A

Saline Soil Management Plan

Prepared by Douglas Partners

Douglas Partners
Geotechnics | Environment | Groundwater

Integrated Practical Solutions

Report on
Salinity Investigation and Management Plan

Proposed Subdivision
Lot 701 in Deposited Plan 1154772
Gregory Hills Drive
Gledswood Hills

Prepared for
Gregory Hills Corporate Park Pty Ltd

Project 76510.00
May 2012

9. Salinity Management Plan

The current salinity investigation indicates that materials within the Site are non-saline to very saline. Testing of other parameters associated with salinity indicates that the materials are non-aggressive to severely aggressive to steel in all locations (by the resistivity and chloride criteria of AS2159) and mildly aggressive to moderately aggressive to concrete within the Site (by the pH and sulphate criteria of AS2159). In addition, shallow soils were highly sodic.

The following management strategies are confined to the management of those factors with a potential to impact on the development.

A. Management should focus on capping of the upper surface of the sodic soils, both exposed by excavation and placed as filling, with a more permeable material to prevent ponding, to reduce capillary rise, to act as a drainage layer and to reduce the potential for erosion.

B. When possible, place excavated materials in fill areas with similar salinity characteristics (ie: place material onto in-situ soils with a similar or higher aggressivity or salinity classification). With respect to imported fill material, testing should be undertaken prior to importation, to determine the salinity characteristics of the material, which should be non-aggressive and non-saline to slightly saline where possible but in any case not more aggressive or more saline than the material on which it is to be placed.

C. Sodic soils can also be managed by maintaining vegetation where possible and planting new salt tolerant species. The addition of organic matter, gypsum and lime can also be considered where appropriate. After gypsum addition, reduction of sodicity levels may require some time for sufficient infiltration and leaching of sodium into the subsoils, however capping of exposed sodic material should remain the primary management method. Topsoil added at the completion of bulk earthworks is, in effect, also adding organic matter which may help infiltration and leaching of sodium.

D. Avoiding water collecting in low lying areas, in depressions, or behind fill. This can lead to water logging of the soils, evaporative concentration of salts, and eventual breakdown in soil structure resulting in accelerated erosion.

E. Any pavements should be designed to be well drained of surface water. There should not be excessive concentrations of runoff or ponding that would lead to waterlogging of the pavement or additional recharge to the groundwater through any more permeable zones in the underlying filling material.

F. Surface drains should generally be provided along the top of batter slopes to reduce the potential for concentrated flows of water down slopes possibly causing scour.

G. Salt tolerant grasses and trees should be considered for landscaping, to reduce soil erosion as in Strategy A above and to maintain the existing evapo-transpiration and groundwater levels. Reference should be made to an experienced landscape planner or agronomist.

The following additional strategies are recommended for completion of service installation and for building construction. These strategies should be complementary to standard good building practices, including cover to reinforcement within concrete and correct installation of a brick damp course (where used), so that it cannot be bridged to allow moisture to move into brick work and up the wall.

H. Where materials are classified as non-aggressive to concrete piles (refer Drawing 4), piles should nevertheless have a minimum strength of 32 MPa and a minimum cover to reinforcement of 45 mm (as per AS2159).

I. Where materials are classified as mildly aggressive to concrete piles (refer Drawing 4), piles should have a minimum strength of 32 MPa and a minimum cover to reinforcement of 60 mm (as per AS2159) to limit the corrosive effects of the surrounding materials (in accordance with AS2159).

J. Where materials are classified as moderately aggressive to concrete piles (refer Drawing 4), piles should have a minimum strength of 40 MPa and a minimum cover to reinforcement of 65 mm (as per AS2159) to limit the corrosive effects of the surrounding materials (in accordance with AS2159).

K. With regard to concrete structures, for non-saline and slightly saline materials with salinities less than 4 dS/m (refer Drawing 6):

  - Where materials are classified as non-aggressive to concrete (refer AS3600 – A1 and Drawing 3), slabs and foundations should have a minimum strength of 20 MPa, and should be allowed to cure for a minimum of three days (as per AS3600) to limit the corrosive effects of the surrounding materials;
  - Where materials are classified as mildly aggressive to concrete (refer AS3600 – A2 and Drawing 3), slabs and foundations should have a minimum strength of 25 MPa, and should be allowed to cure for a minimum of three days (as per AS3600) to limit the corrosive effects of the surrounding materials; and
  - Where materials are classified as moderately aggressive to concrete (refer AS3600 – B1 and Drawing 3), slabs and foundations should have a minimum strength of 32 MPa, and should be allowed to cure for a minimum of seven days (as per AS3600) to limit the corrosive effects of the surrounding materials.

L. With regard to concrete structures, for moderately saline materials with salinities of 4 – 8 dS/m (refer Drawing 6):

  - Where materials are classified as non-aggressive to concrete (refer AS3600 – A1 and Drawing 3), slabs and foundations should have a minimum strength of 25 MPa, a minimum cover to reinforcement of 45 mm from unprotected ground and should be allowed to cure for a minimum of three days (as per AS3600) to limit the corrosive effects of the surrounding materials;
  - Where materials are classified as mildly aggressive to concrete (refer AS3600 – A2 and Drawing 3), slabs and foundations should have a minimum strength of 25 MPa, a minimum cover to reinforcement of 45 mm from unprotected ground and should be allowed to cure for a minimum of three days (as per AS3600) to limit the corrosive effects of the surrounding materials; and
  - Where materials are classified as moderately aggressive to concrete (refer AS3600 – B1 and Drawing 3), slabs and foundations should have a minimum strength of 32 MPa, a minimum cover to reinforcement of 45 mm from unprotected ground and should be allowed to cure for a minimum of seven days (as per AS3600) to limit the corrosive effects of the surrounding materials.

M. With regard to concrete structures, for very saline materials with salinities of 8 – 16 dS/m (refer Drawing 6):

  - Where materials are classified as non-aggressive to concrete (refer AS3600 – A1 and Drawing 3), slabs and foundations should have a minimum strength of 32 MPa, a minimum cover to reinforcement of 50 mm from unprotected ground and should be allowed to cure for a minimum of seven days (as per AS3600) to limit the corrosive effects of the surrounding materials;
  - Where materials are classified as mildly aggressive to concrete (refer AS3600 – A2 and Drawing 3), slabs and foundations should have a minimum strength of 32 MPa, a minimum cover to reinforcement of 50 mm from unprotected ground and should be allowed to cure for a minimum of seven days (as per AS3600) to limit the corrosive effects of the surrounding materials; and

- Where materials are classified as moderately aggressive to concrete (refer AS3600 – B1 and Drawing 3), slabs and foundations should have a minimum strength of 32 MPa, a minimum cover to reinforcement of 50 mm from unprotected ground and should be allowed to cure for a minimum of seven days (as per AS3600) to limit the corrosive effects of the surrounding materials.

N. Any future installation of concrete pipes up to a maximum diameter of 750 mm, in the defined areas of moderately saline to very saline or mildly aggressive to moderately aggressive material at services depths, should employ fibre reinforced cement. Alternatively, concrete pipes in these areas should be encased in outer PVC conduits or should have a minimum equivalent strength as defined in L and M above.

O. Concrete pipes with a larger diameter than 750 mm should utilise sulphate resistant cement.

P. Resistivity results indicate materials that are aggressive to steel (Drawing 5, Appendix A). This drawing identifies mild aggressivity to steel (1000 – 2000 Ohm-cm), moderate aggressivity to steel (<1000 Ohm-cm, Condition B) and severe aggressivity to steel (<1000 Ohm-cm, Condition A) over the Site. For these areas, the following corrosion allowances (as per AS 2159 – 2009) should be taken into account by the designer:

- Mild: uniform corrosion allowance 0.01 – 0.02 mm/year;
- Moderate: uniform corrosion allowance 0.02 – 0.04 mm/year.
- Severe: uniform corrosion allowance 0.04 – 0.1 mm/year

In instances where a coating is applied to the pile, if the design life of the pile is greater than the design life for the coating, consideration must be given to corrosion of the pile in accordance with the above list.

Q. In all masonary buildings a brick damp course should be installed so that it cannot be bridged either internally or externally. This will prevent moisture moving into brickwork and up the wall.

R. The use of a bedding layer of sand (100 mm thick), overlain by a membrane of thick plastic (damp proof as opposed to vapour proof), is recommended under concrete slabs to act as a moisture barrier and drainage layer and to restrict capillary rise under the slab. As an alternative method for protection of concrete slabs for non-residential construction, high strength (32 MPa) concrete may be placed directly on a layer of crushed rock. Such rock should be sourced locally from an area classified as non-saline or slightly saline or should be imported after stockpiling, testing and classification as non-saline or slightly saline.

ATTACHMENT B

Drawing No 20645/3-AA1 Plan Showing Locations of Boreholes

Borehole Logs

Imagery © NearMap.com

LEGEND

🟥	Site Boundary
●	Borehole
🟧	Test Pit

Scale 1:2000

GEOTECHNIQUE® PTY LTD

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Contract No DDWO 05592/23
Gledswood / Gregory Hills New High School
Lot 2 DP1262720
9 Gregory Hills Drive, Gledswood Hills

Borehole and Test Pit Locations

Drawing No: 20465/3-AA1
Job No: 20465/3
Drawn By: MH
Date: 24 January 2024
Checked By: JH

File No: 20465-3
Layers: 0, AA1

engineering log - borehole

Client : NSW Department of Education - School Infrasructure
Project : New High School - Property 7
Location : 9 Gregory Hills Drive, Gledswood Hills

Job No. : 20465/3
Borehole No. : BH1
Date : 21/11/2023
Logged/Checked by: JH/IJ

drill model and mounting : Landcruiser Mounted Drill Rig **slope :** **deg.** **R.L. surface :** 102.198
hole diameter : 100 **mm** **bearing :** **deg.** **datum :** AHD

method	groundwater	env samples	PID reading (ppm)	geo samples	field test	depth or R.L. in meters	graphic log	classification symbol	**MATERIAL DESCRIPTION** soil type, plasticity or particle characteristic, colour, secondary and minor components.	moisture condition	consistency density index	hand penetrometer kPa	Remarks and additional observations
						0	▨		FILL: Silty Clay, low plasticity, brown, with gravel	D			Well compacted
				DS		0.5	▨						
	DRY			DS		1	▨						
						1.5			Borehole BH1 terminated at 1.5m on suspected boulder				
						2							
						2.5							
						3							
						3.5							
						4							
						4.5							

engineering log - borehole

Client : NSW Department of Education - School Infrasructure
Project : New High School - Property 7
Location : 9 Gregory Hills Drive, Gledswood Hills

Job No. : 20465/3
Borehole No. : BH1a
Date : 27/11/2023
Logged/Checked by: JH/IJ

drill model and mounting : Truck Mounted Commachio 200 **slope :** **deg.** **R.L. surface :**

hole diameter : 100 **mm** **bearing :** **deg.** **datum :**

method	groundwater	env samples	PID reading (ppm)	geo samples	field test	depth or R.L. in meters	graphic log	classification symbol	MATERIAL DESCRIPTION soil type, plasticity or particle characteristic, colour, secondary and minor components.	moisture condition	consistency density index	hand penetrometer kPa	Remarks and additional observations
						0	▦		FILL: Silty Clay, low plasticity, brown	D			Well compacted
						0.5							
						1							
						1.5							
						2							
						2.5							
					N=19 5,8,11	3	▦		FILL: Silty Clay, medium plasticity, brown, with gravel				
						3.5							
						4							
						4.5	▨	CI-CH	Silty CLAY, medium to high plasticity, brown to orange	M≤PL	St-VSt		Residual

engineering log - borehole

Client : NSW Department of Education - School Infrasructure
Project : New High School - Property 7
Location : 9 Gregory Hills Drive, Gledswood Hills

Job No. : 20465/3
Borehole No. : BH1a
Date : 27/11/2023
Logged/Checked by: JH/IJ

drill model and mounting : Truck Mounted Commachio 200 **slope :** **deg.** **R.L. surface :**
hole diameter : 100 **mm** **bearing :** **deg.** **datum :**

method	groundwater	env samples	PID reading (ppm)	geo samples	field test	depth or R.L. in meters	graphic log	classification symbol	MATERIAL DESCRIPTION soil type, plasticity or particle characteristic, colour, secondary and minor components.	moisture condition	consistency density index	hand penetrometer kPa	Remarks and additional observations
				DS		5							
						5.5							
						6							
						6.5			SHALE, grey, extremely weathered, low strength				Bedrock
						7							
				DS									
	DRY					7.5		CI-CH	SHALE, grey, distinctly weathered, medium strength	M<PL	VSt		
						8			Borehole BH1a terminated at 8.0m due to refusal on bedrock				
						8.5							
						9							
						9.5							

engineering log - borehole

Client : NSW Department of Education - School Infrasructure
Job No. : 20465/3
Project : New High School - Property 7
Borehole No. : BH2
Location : 9 Gregory Hills Drive, Gledswood Hills
Date : 21/11/2023
Logged/Checked by: JH/IJ

drill model and mounting : Landcruiser Mounted Drill Rig **slope :** **deg.** **R.L. surface :** 101.398

hole diameter : 100 **mm** **bearing :** **deg.** **datum :** AHD

method	groundwater	env samples	PID reading (ppm)	geo samples	field test	depth or R.L. in meters	graphic log	classification symbol	MATERIAL DESCRIPTION soil type, plasticity or particle characteristic, colour, secondary and minor components.	moisture condition	consistency density index	hand penetrometer kPa	Remarks and additional observations
						0	▨		FILL: Silty Clay, low plasticity, brown, with gravel	D			Well compacted
						0.5	▨						
		U_{50}		DS			▨						
						1	▨						
	DRY			DS			▨						
						1.5			Borehole BH2 terminated at 1.5m due to refusal on suspected boulder				
						2							
						2.5							
						3							
						3.5							
						4							
						4.5							

engineering log - borehole

Client : NSW Department of Education - School Infrasructure
Project : New High School - Property 7
Location : 9 Gregory Hills Drive, Gledswood Hills

Job No. : 20465/3
Borehole No. : BH3
Date : 21/11/2023
Logged/Checked by: JH/IJ

drill model and mounting : Landcruiser Mounted Drill Rig **slope :** **deg.** **R.L. surface :** 100.868
hole diameter : 100 **mm** **bearing :** **deg.** **datum :** AHD

method	groundwater	env samples	PID reading (ppm)	geo samples	field test	depth or R.L. in meters	graphic log	classification symbol	MATERIAL DESCRIPTION soil type, plasticity or particle characteristic, colour, secondary and minor components.	moisture condition	consistency density index	hand penetrometer kPa	Remarks and additional observations
						0	▨		FILL: Silty Clay, medium plasticity, brown, with gravel	D			Well compacted
						0.5	▨						
				DS		1	▨						
						1.5	▨						
						2	▨						
						2.5	▨						
	DRY			DS			▨						
						3			Borehole BH3 terminated at 3.0m on suspected boulder				
						3.5							
						4							
						4.5							

engineering log - borehole

Client : NSW Department of Education - School Infrasructure
Project : New High School - Property 7
Location : 9 Gregory Hills Drive, Gledswood Hills

Job No. : 20465/3
Borehole No. : BH3a
Date : 23/11/2023
Logged/Checked by: JH/IJ

drill model and mounting : Truck Mounted Commachio 200 **slope :** **deg.** **R.L. surface :** 100.868
hole diameter : 100 **mm** **bearing :** **deg.** **datum :** AHD

method	groundwater	env samples	PID reading (ppm)	geo samples	field test	depth or R.L. in meters	graphic log	classification symbol	MATERIAL DESCRIPTION soil type, plasticity or particle characteristic, colour, secondary and minor components.	moisture condition	consistency density index	hand penetrometer kPa	Remarks and additional observations
						0			FILL: Silty Clay, medium plasticity, brown, with gravel	D			
						0.5							
						1							
						1.5							
						2							
						2.5							
						3							
						3.5							
						4		CI-CH	Silty CLAY, medium to high plasticity, orange-brown	M<PL	St-VSt		Residual
						4.5							

engineering log - borehole

Client : NSW Department of Education - School Infrasructure
Project : New High School - Property 7
Location : 9 Gregory Hills Drive, Gledswood Hills

Job No. : 20465/3
Borehole No. : BH3a
Date : 23/11/2023
Logged/Checked by: JH/IJ

drill model and mounting : Truck Mounted Commachio 200 **slope :** **deg.** **R.L. surface :** 100.868
hole diameter : 100 **mm** **bearing :** **deg.** **datum :** AHD

method	groundwater	env samples	PID reading (ppm)	geo samples	field test	depth or R.L. in meters	graphic log	classification symbol	MATERIAL DESCRIPTION soil type, plasticity or particle characteristic, colour, secondary and minor components.	moisture condition	consistency density index	hand penetrometer kPa	Remarks and additional observations
						5							
						5.5							
				DS	N=19 4,8,11	6			SHALE, grey, distinctly weathered, low to medium strength, with ironstone fragments				Bedrock
	DRY					6.5							
						7			Borehole BH3a terminated at 7.0m				
						7.5							
						8							
						8.5							
						9							
						9.5							

engineering log - borehole

Client : NSW Department of Education - School Infrasructure
Project : New High School - Property 7
Location : 9 Gregory Hills Drive, Gledswood Hills

Job No. : 20465/3
Borehole No. : BH4
Date : 21/11/2023
Logged/Checked by: JH/IJ

drill model and mounting : Landcruiser Mounted Drill Rig **slope :** **deg.** **R.L. surface :** 100.281
hole diameter : 100 **mm** **bearing :** **deg.** **datum :** AHD

method	groundwater	env samples	PID reading (ppm)	geo samples	field test	depth or R.L. in meters	graphic log	classification symbol	MATERIAL DESCRIPTION soil type, plasticity or particle characteristic, colour, secondary and minor components.	moisture condition	consistency density index	hand penetrometer kPa	Remarks and additional observations
	DRY			DS		0 0.5	▨		FILL: Silty Clay, low plasticity, brown, with gravel	D			Well compacted
						1 1.5 2 2.5 3 3.5 4 4.5			Borehole BH4 terminated at 0.6m due to refusal on boulder				

engineering log - borehole

Client : NSW Department of Education - School Infrasructure
Project : New High School - Property 7
Location : 9 Gregory Hills Drive, Gledswood Hills

Job No. : 20465/3
Borehole No. : BH4a
Date : 08/12/2023
Logged/Checked by: JH/IJ

drill model and mounting : Commachio 200 Track Mount Drill Rig **slope :** **deg.** **R.L. surface :**

hole diameter : 100 **mm** **bearing :** **deg.** **datum :**

method	groundwater	env samples	PID reading (ppm)	geo samples	field test	depth or R.L. in meters	graphic log	classification symbol	**MATERIAL DESCRIPTION** soil type, plasticity or particle characteristic, colour, secondary and minor components.	moisture condition	consistency density index	hand penetrometer kPa	Remarks and additional observations
						0	▨		FILL: Silty Clay, low plasticity, brown, with gravel	D	D		Well compacted
						0.5	▨						
						1	▨						
						1.5	▨						
						2	▨						
						2.5	▨						
					N=26 8,8,18	3	▨						
						3.5	▨						
						4	▨						
					N=34 8,13,21	4.5	▨						

engineering log - borehole

Client : NSW Department of Education - School Infrasructure **Job No. :** 20465/3
Project : New High School - Property 7 **Borehole No. :** BH4a
Location : 9 Gregory Hills Drive, Gledswood Hills **Date :** 08/12/2023
Logged/Checked by: JH/IJ

drill model and mounting : Commachio 200 Track Mount Drill Rig **slope :** **deg.** **R.L. surface :**
hole diameter : 100 **mm** **bearing :** **deg.** **datum :**

method	groundwater	env samples	PID reading (ppm)	geo samples	field test	depth or R.L. in meters	graphic log	classification symbol	MATERIAL DESCRIPTION soil type, plasticity or particle characteristic, colour, secondary and minor components.	moisture condition	consistency density index	hand penetrometer kPa	Remarks and additional observations
						5							
					4,17, HB	5.5 6		CI-CH	Silty CLAY, medium to high plasticity, brown to grey	M≤PL	St		Residual
	DRY				N=44 7,21,24	6.5 7			SHALE, brown to grey, extremely to distinctly weathered, low to medium strength				Bedrock
						7.5 8 8.5 9 9.5			Borehole BH4a terminated at 7.4m due to auger refusal				

engineering log - borehole

Client : NSW Department of Education - School Infrasructure
Project : New High School - Property 7
Location : 9 Gregory Hills Drive, Gledswood Hills

Job No. : 20465/3
Borehole No. : BH5
Date : 21/11/2023
Logged/Checked by: JH/IJ

drill model and mounting : Landcruiser Mounted Drill Rig **slope :** **deg.** **R.L. surface :** 100.281
hole diameter : 100 **mm** **bearing :** **deg.** **datum :** AHD

method	groundwater	env samples	PID reading (ppm)	geo samples	field test	depth or R.L. in meters	graphic log	classification symbol	MATERIAL DESCRIPTION soil type, plasticity or particle characteristic, colour, secondary and minor components.	moisture condition	consistency density index	hand penetrometer kPa	Remarks and additional observations
						0	▨		FILL: Silty Clay, low plasticity, brown, with gravel	D			Well compacted
						0.5	▨						
				DS			▨						
						1	▨						
	DRY						▨						
									Borehole BH5 terminated at 1.3m due to refusal on suspected boulder				
						1.5							
						2							
						2.5							
						3							
						3.5							
						4							
						4.5							

engineering log - borehole

Client : NSW Department of Education - School Infrasructure
Project : New High School - Property 7
Location : 9 Gregory Hills Drive, Gledswood Hills
Job No. : 20465/3
Borehole No. : BH6
Date : 21/11/2023
Logged/Checked by: JH/IJ

drill model and mounting : Landcruiser Mounted Drill Rig **slope :** **deg.** **R.L. surface :** 101.423
hole diameter : 100 **mm** **bearing :** **deg.** **datum :** AHD

method	groundwater	env samples	PID reading (ppm)	geo samples	field test	depth or R.L. in meters	graphic log	classification symbol	MATERIAL DESCRIPTION soil type, plasticity or particle characteristic, colour, secondary and minor components.	moisture condition	consistency density index	hand penetrometer kPa	Remarks and additional observations
	DRY			DS		0 0.5	▨		FILL: Silty Clay, low plasticity, brown, with gravel	D			Well compacted
						1 1.5 2 2.5 3 3.5 4 4.5			Borehole BH6 terminated at 0.6m due to refusal on boulder				

engineering log - borehole

Client : NSW Department of Education - School Infrasructure
Job No. : 20465/3
Project : New High School - Property 7
Borehole No. : BH7
Location : 9 Gregory Hills Drive, Gledswood Hills
Date : 21/11/2023
Logged/Checked by: JH/IJ

drill model and mounting : Landcruiser Mounted Drill Rig
slope : **deg.**
R.L. surface : 102.365
hole diameter : 100 **mm**
bearing : **deg.**
datum : AHD

method	groundwater	env samples	PID reading (ppm)	geo samples	field test	depth or R.L. in meters	graphic log	classification symbol	MATERIAL DESCRIPTION soil type, plasticity or particle characteristic, colour, secondary and minor components.	moisture condition	consistency density index	hand penetrometer kPa	Remarks and additional observations
	DRY			DS		0 0.5	▨		FILL: Silty Clay, low plasticity, brown, with gravel	D			Well compacted Large objects noted
						1 1.5 2 2.5 3 3.5 4 4.5			Borehole BH7 terminated at 0.6m due to refusal on suspected boulder				

engineering log - borehole

Client : NSW Department of Education - School Infrasructure
Project : New High School - Property 7
Location : 9 Gregory Hills Drive, Gledswood Hills

Job No. : 20465/3
Borehole No. : BH8
Date : 21/11/2023
Logged/Checked by: JH/IJ

drill model and mounting : Landcruiser Mounted Drill Rig **slope :** **deg.** **R.L. surface :** 102.589
hole diameter : 100 **mm** **bearing :** **deg.** **datum :** AHD

method	groundwater	env samples	PID reading (ppm)	geo samples	field test	depth or R.L. in meters	graphic log	classification symbol	MATERIAL DESCRIPTION soil type, plasticity or particle characteristic, colour, secondary and minor components.	moisture condition	consistency density index	hand penetrometer kPa	Remarks and additional observations
						0	▨		FILL: Silty Clay, low plasticity, brown, with gravel	D			Well compacted Likely large object
				DS		0.5	▨						
						1	▨						
	DRY			DS			▨						
									Borehole BH8 terminated at 1.3m due to refusal on suspected boulder				
						1.5							
						2							
						2.5							
						3							
						3.5							
						4							
						4.5							

engineering log - borehole

Client : NSW Department of Education - School Infrasructure
Project : New High School - Property 7
Location : 9 Gregory Hills Drive, Gledswood Hills

Job No. : 20465/3
Borehole No. : BH8a
Date : 08/12/2023
Logged/Checked by: JH/IJ

drill model and mounting : Commachio 200 Series Track Moun **slope :** **deg.** **R.L. surface :**

hole diameter : 100 **mm** **bearing :** **deg.** **datum :**

method	groundwater	env samples	PID reading (ppm)	geo samples	field test	depth or R.L. in meters	graphic log	classification symbol	MATERIAL DESCRIPTION soil type, plasticity or particle characteristic, colour, secondary and minor components.	moisture condition	consistency density index	hand penetrometer kPa	Remarks and additional observations
						0	▨		FILL: Silty Clay, low plasticity, brownn, with gravel				Well compacted
						0.5	▨						
						1	▨						
						1.5	▨						
						2	▨						
						2.5	▨						
					N=3 1,1,12	3	▨						
						3.5	▨						
						4	▨						
					N=31 7,13,18	4.5	▨						

engineering log - borehole

Client : NSW Department of Education - School Infrasructure
Project : New High School - Property 7
Location : 9 Gregory Hills Drive, Gledswood Hills

Job No. : 20465/3
Borehole No. : BH8a
Date : 08/12/2023
Logged/Checked by: JH/IJ

drill model and mounting : Commachio 200 Series Track Moun **slope :** **deg.** **R.L. surface :**
hole diameter : 100 **mm** **bearing :** **deg.** **datum :**

method	groundwater	env samples	PID reading (ppm)	geo samples	field test	depth or R.L. in meters	graphic log	classification symbol	MATERIAL DESCRIPTION soil type, plasticity or particle characteristic, colour, secondary and minor components.	moisture condition	consistency density index	hand penetrometer kPa	Remarks and additional observations
						5							
						5.5							
						6							
					N=30 6,12,18			CI-CH	Silty CLAY, medium to high plasticity, brown	M≤PL	VSt		Residual
						6.5							
						7							
						7.5		-	Silty CLAY, medium to high plasticity, brown mottled grey	-	-		
					N=18 5,7,11								
						8							
						8.5							
						9							
					N=35 8,13,22								
						9.5							

engineering log - borehole

Client : NSW Department of Education - School Infrasructure
Project : New High School - Property 7
Location : 9 Gregory Hills Drive, Gledswood Hills

Job No. : 20465/3
Borehole No. : BH8a
Date : 08/12/2023
Logged/Checked by: JH/IJ

drill model and mounting : Commachio 200 Series Track Moun **slope :** **deg.** **R.L. surface :**
hole diameter : 100 **mm** **bearing :** **deg.** **datum :**

method	groundwater	env samples	PID reading (ppm)	geo samples	field test	depth or R.L. in meters	graphic log	classification symbol	MATERIAL DESCRIPTION soil type, plasticity or particle characteristic, colour, secondary and minor components.	moisture condition	consistency density index	hand penetrometer kPa	Remarks and additional observations
						10 10.5	▨						
	DRY					11 11.5 12	≡		SHALE, grey, extremely weathered, low strength				Bedrock
						12.5 13 13.5 14 14.5			Borehole BH8a terminated at 12.5m				

engineering log - borehole

Client : NSW Department of Education - School Infrasructure **Job No. :** 20465/3
Project : New High School - Property 7 **Borehole No. :** BH9
Location : 9 Gregory Hills Drive, Gledswood Hills **Date :** 21/11/2023
Logged/Checked by: JH/IJ

drill model and mounting : Landcruiser Mounted Drill Rig **slope :** **deg.** **R.L. surface :** 102.510
hole diameter : 100 **mm** **bearing :** **deg.** **datum :** AHD

method	groundwater	env samples	PID reading (ppm)	geo samples	field test	depth or R.L. in meters	graphic log	classification symbol	MATERIAL DESCRIPTION soil type, plasticity or particle characteristic, colour, secondary and minor components.	moisture condition	consistency density index	hand penetrometer kPa	Remarks and additional observations
						0	▨		FILL: Silty Clay, low plasticity, brown, with gravel	D			Well compacted
				DS		0.5	▨						
						1	▨		FILL: Gravelly Clay, low to medium plasticity, grey				
	DRY			DS			▨						
									Borehole BH9 terminated at 1.3m due to refusal				
						1.5							
						2							
						2.5							
						3							
						3.5							
						4							
						4.5							

engineering log - borehole

Client : NSW Department of Education - School Infrasructure
Job No. : 20465/3
Project : New High School - Property 7
Borehole No. : BH9a
Location : 9 Gregory Hills Drive, Gledswood Hills
Date : 27/11/2023
Logged/Checked by: JH/IJ

drill model and mounting : Commachio 200 Truck Mounted **slope :** **deg.** **R.L. surface :** 102.589
hole diameter : 100 **mm** **bearing :** **deg.** **datum :** AHD

method	groundwater	env samples	PID reading (ppm)	geo samples	field test	depth or R.L. in meters	graphic log	classification symbol	MATERIAL DESCRIPTION soil type, plasticity or particle characteristic, colour, secondary and minor components.	moisture condition	consistency density index	hand penetrometer kPa	Remarks and additional observations
						0	▨		FILL: Silty Clay, low plasticity, brown, with gravel	D			Well compacted
						0.5	▨						
						1	▨		FILL: Gravelly Clay, low to medium plasticity, grey	D			Well compacted
						1.5	▨						
						2	▨						
						2.5	▨						
					N=24 4,10,14	3	▨						
						3.5	▨						
						4	▨						
						4.5	▨						

engineering log - borehole

Client : NSW Department of Education - School Infrasructure
Project : New High School - Property 7
Location : 9 Gregory Hills Drive, Gledswood Hills

Job No. : 20465/3
Borehole No. : BH9a
Date : 27/11/2023
Logged/Checked by: JH/IJ

drill model and mounting : Commachio 200 Truck Mounted **slope :** **deg.** **R.L. surface :** 102.589

hole diameter : 100 **mm** **bearing :** **deg.** **datum :** AHD

method	groundwater	env samples	PID reading (ppm)	geo samples	field test	depth or R.L. in meters	graphic log	classification symbol	MATERIAL DESCRIPTION soil type, plasticity or particle characteristic, colour, secondary and minor components.	moisture condition	consistency density index	hand penetrometer kPa	Remarks and additional observations
	DRY					5	▨						
						5.5 6 6.5 7 7.5 8 8.5 9 9.5			Borehole BH9a terminated at 5.3m due to refusal on suspected boulder				

engineering log - borehole

Client : NSW Department of Education - School Infrasructure
Project : New High School - Property 7
Location : 9 Gregory Hills Drive, Gledswood Hills

Job No. : 20465/3
Borehole No. : BH10
Date : 21/11/2023
Logged/Checked by: JH/IJ

drill model and mounting : Landcruiser Mounted Drill Rig **slope :** **deg.** **R.L. surface :** 102.061
hole diameter : 100 **mm** **bearing :** **deg.** **datum :** AHD

method	groundwater	env samples	PID reading (ppm)	geo samples	field test	depth or R.L. in meters	graphic log	classification symbol	MATERIAL DESCRIPTION soil type, plasticity or particle characteristic, colour, secondary and minor components.	moisture condition	consistency density index	hand penetrometer kPa	Remarks and additional observations
						0	▨		FILL: Silty Clay, low plasticity, brown, with gravel	D			Well compacted
						0.5	▨						
				DS			▨						
						1	▨						
	DRY			DS			▨						
									Borehole BH10 terminated at 1.3m due to refusal on suspected boulder				
						1.5							
						2							
						2.5							
						3							
						3.5							
						4							
						4.5							

engineering log - borehole

Client : NSW Department of Education - School Infrasructure
Project : New High School - Property 7
Location : 9 Gregory Hills Drive, Gledswood Hills

Job No. : 20465/3
Borehole No. : BH11
Date : 22/11/2023
Logged/Checked by: JH/IJ

drill model and mounting : Edson Series 100 Truck Mount **slope :** **deg.** **R.L. surface :** 102.115
hole diameter : 100 **mm** **bearing :** **deg.** **datum :** AHD

method	groundwater	env samples	PID reading (ppm)	geo samples	field test	depth or R.L. in meters	graphic log	classification symbol	MATERIAL DESCRIPTION soil type, plasticity or particle characteristic, colour, secondary and minor components.	moisture condition	consistency density index	hand penetrometer kPa	Remarks and additional observations
						0	▨		FILL: Silty Clay, low plasticity, brown, with gravel	D			Well compacted
						0.5							
				DS		1							
						1.5							
						2							
						2.5							
				DS		3	▨		FILL: Gravelly Clay, low to medium plasticity, grey	D			Well compacted
						3.5							
						4							
						4.5							

engineering log - borehole

Client : NSW Department of Education - School Infrasructure
Project : New High School - Property 7
Location : 9 Gregory Hills Drive, Gledswood Hills

Job No. : 20465/3
Borehole No. : BH11
Date : 22/11/2023
Logged/Checked by: JH/IJ

drill model and mounting : Edson Series 100 Truck Mount **slope :** **deg.** **R.L. surface :** 102.115
hole diameter : 100 **mm** **bearing :** **deg.** **datum :** AHD

method	groundwater	env samples	PID reading (ppm)	geo samples	field test	depth or R.L. in meters	graphic log	classification symbol	MATERIAL DESCRIPTION soil type, plasticity or particle characteristic, colour, secondary and minor components.	moisture condition	consistency density index	hand penetrometer kPa	Remarks and additional observations
				DS		5			FILL: Silty Clay, medium plasticity, brown	D			Well compacted
						5.5							
						6							
						6.5							
				DS		7		CI-CH	Silty CLAY, medium to high plasticity, brown	M≤PL	St-VSt		Residual
						7.5							
						8							
						8.5							
						9							
						9.5							

engineering log - borehole

Client : NSW Department of Education - School Infrasructure **Job No. :** 20465/3
Project : New High School - Property 7 **Borehole No. :** BH11
Location : 9 Gregory Hills Drive, Gledswood Hills **Date :** 22/11/2023
Logged/Checked by: JH/IJ

drill model and mounting : Edson Series 100 Truck Mount **slope :** **deg.** **R.L. surface :** 102.115
hole diameter : 100 **mm** **bearing :** **deg.** **datum :** AHD

method	groundwater	env samples	PID reading (ppm)	geo samples	field test	depth or R.L. in meters	graphic log	classification symbol	MATERIAL DESCRIPTION soil type, plasticity or particle characteristic, colour, secondary and minor components.	moisture condition	consistency density index	hand penetrometer kPa	Remarks and additional observations
						10	▨						
						10.5	▨						
						11	▨						
						11.5	▨						
						12	▨						
						12.5	▨						
							☰		SHALE, grey, distinctly weathered, low to medium strength				Bedrock
						13	☰						
						13.5	☰						
	DRY						☰						
						14			Borehole BH11 terminated at 14.0m				
						14.5							

engineering log - borehole

Client : NSW Department of Education - School Infrasructure
Project : New High School - Property 7
Location : 9 Gregory Hills Drive, Gledswood Hills

Job No. : 20465/3
Borehole No. : BH12
Date : 23/11/2023
Logged/Checked by: JH/IJ

drill model and mounting : Truck Mounted Commachio 200 **slope :** **deg.** **R.L. surface :** 101.352
hole diameter : 100 **mm** **bearing :** **deg.** **datum :** AHD

method	groundwater	env samples	PID reading (ppm)	geo samples	field test	depth or R.L. in meters	graphic log	classification symbol	MATERIAL DESCRIPTION soil type, plasticity or particle characteristic, colour, secondary and minor components.	moisture condition	consistency density index	hand penetrometer kPa	Remarks and additional observations
						0	▨		FILL: Silty Clay, low plasticity, brown with gravel	D			Well compacted
						0.5	▨						
						1	▨						
					N=26 5,12,14	1.5	▨						
						2	▨						
						2.5	▨						
					N=25 4,10,15	3	▨						
						3.5	▨						
						4	▨						
					N=32 11,15,17	4.5	▨						

engineering log - borehole

Client : NSW Department of Education - School Infrasructure **Job No. :** 20465/3
Project : New High School - Property 7 **Borehole No. :** BH12
Location : 9 Gregory Hills Drive, Gledswood Hills **Date :** 23/11/2023
Logged/Checked by: JH/IJ

drill model and mounting : Truck Mounted Commachio 200 **slope :** **deg.** **R.L. surface :** 101.352
hole diameter : 100 **mm** **bearing :** **deg.** **datum :** AHD

method	groundwater	env samples	PID reading (ppm)	geo samples	field test	depth or R.L. in meters	graphic log	classification symbol	MATERIAL DESCRIPTION soil type, plasticity or particle characteristic, colour, secondary and minor components.	moisture condition	consistency density index	hand penetrometer kPa	Remarks and additional observations
						5	▩						
						7	▨	CI-CH	Silty CLAY, medium to high plasticity, brown to orange	M≤PL	St-VSt		Residual
						9	▤		SHALE, brown-grey, extremely weathered, low strength				
						9.5	▤		SHALE, brown-grey, distinctly weathered, medium strength				Bedrock

engineering log - borehole

Client : NSW Department of Education - School Infrasructure **Job No. :** 20465/3
Project : New High School - Property 7 **Borehole No. :** BH12
Location : 9 Gregory Hills Drive, Gledswood Hills **Date :** 23/11/2023
Logged/Checked by: JH/IJ

drill model and mounting : Truck Mounted Commachio 200 **slope :** **deg.** **R.L. surface :** 101.352
hole diameter : 100 **mm** **bearing :** **deg.** **datum :** AHD

method	groundwater	env samples	PID reading (ppm)	geo samples	field test	depth or R.L. in meters	graphic log	classification symbol	MATERIAL DESCRIPTION soil type, plasticity or particle characteristic, colour, secondary and minor components.	moisture condition	consistency density index	hand penetrometer kPa	Remarks and additional observations
	DRY			DS		10	▤						
						10.5			Borehole BH12 terminated at 10.3m				
						11							
						11.5							
						12							
						12.5							
						13							
						13.5							
						14							
						14.5							

engineering log - borehole

Client : NSW Department of Education - School Infrasructure **Job No. :** 20465/3
Project : New High School - Property 7 **Borehole No. :** BH13
Location : 9 Gregory Hills Drive, Gledswood Hills **Date :** 27/11/2023
Logged/Checked by: JH/IJ

drill model and mounting : Commachio Mounted Truck Drill **slope :** **deg.** **R.L. surface :** 101.143
hole diameter : 100 **mm** **bearing :** **deg.** **datum :** AHD

method	groundwater	env samples	PID reading (ppm)	geo samples	field test	depth or R.L. in meters	graphic log	classification symbol	MATERIAL DESCRIPTION soil type, plasticity or particle characteristic, colour, secondary and minor components.	moisture condition	consistency density index	hand penetrometer kPa	Remarks and additional observations
						0	▨		FILL: Silty Clay, low plasticity, brown, with gravel	D	D		Well compacted
						0.5	▨						
						1	▨						
					N=37 6,15,22	1.5	▨						
						2	▨						
						2.5	▨						
					N=25 6,13,12	3	▨						
						3.5	▨						
						4	▨						
						4.5	▨						

engineering log - borehole

Client : NSW Department of Education - School Infrasructure
Project : New High School - Property 7
Location : 9 Gregory Hills Drive, Gledswood Hills

Job No. : 20465/3
Borehole No. : BH13
Date : 27/11/2023
Logged/Checked by: JH/IJ

drill model and mounting : Commachio Mounted Truck Drill **slope :** **deg.** **R.L. surface :** 101.143
hole diameter : 100 **mm** **bearing :** **deg.** **datum :** AHD

method	groundwater	env samples	PID reading (ppm)	geo samples	field test	depth or R.L. in meters	graphic log	classification symbol	MATERIAL DESCRIPTION soil type, plasticity or particle characteristic, colour, secondary and minor components.	moisture condition	consistency density index	hand penetrometer kPa	Remarks and additional observations
				DS		5							
						5.5							
						6							
						6.5							
						7							
				DS		7.5		CI-CH	Silty CLAY, medium to high plasticity, brown to orange	M≤PL	St-VSt		Residual
	DRY												
						8			Borehole BH13 terminated at 8.0m				
						8.5							
						9							
						9.5							

engineering log - borehole

Client : NSW Department of Education - School Infrasructure
Project : New High School - Property 7
Location : 9 Gregory Hills Drive, Gledswood Hills

Job No. : 20465/3
Borehole No. : BH14
Date : 22/11/2023
Logged/Checked by: JH/IJ

drill model and mounting : Edson Series 100 Truck Mount **slope :** **deg.** **R.L. surface :** 101.243
hole diameter : 100 **mm** **bearing :** **deg.** **datum :** AHD

method	groundwater	env samples	PID reading (ppm)	geo samples	field test	depth or R.L. in meters	graphic log	classification symbol	MATERIAL DESCRIPTION soil type, plasticity or particle characteristic, colour, secondary and minor components.	moisture condition	consistency density index	hand penetrometer kPa	Remarks and additional observations
						0	▨		FILL: Silty Clay, low plasticity, brown, with gravel	D			Well compacted
						0.5	▨						
				DS		1	▨						
						1.5	▨						
						2	▨		Silty Clay, medium plasticity, brown with gravel	D			Well compacted
						2.5	▨						
				DS		3	▨						
						3.5	▨						
						4	▨						
						4.5	▨						

engineering log - borehole

Client : NSW Department of Education - School Infrasructure **Job No. :** 20465/3
Project : New High School - Property 7 **Borehole No. :** BH14
Location : 9 Gregory Hills Drive, Gledswood Hills **Date :** 22/11/2023
Logged/Checked by: JH/IJ

drill model and mounting : Edson Series 100 Truck Mount **slope :** **deg.** **R.L. surface :** 101.243
hole diameter : 100 **mm** **bearing :** **deg.** **datum :** AHD

method	groundwater	env samples	PID reading (ppm)	geo samples	field test	depth or R.L. in meters	graphic log	classification symbol	MATERIAL DESCRIPTION soil type, plasticity or particle characteristic, colour, secondary and minor components.	moisture condition	consistency density index	hand penetrometer kPa	Remarks and additional observations
				DS		5	▩						
						5.5	▩						
						6	▩						
						6.5	▩						
						7	▩						
				DS		7.5	▨	CI-CH	Silty CLAY, medium to high plasticity, orange-brown	M≤PL	St-VSt		Residual
						8	▨						
						8.5	▨						
						9	▨						
						9.5	▨						

engineering log - borehole

Client : NSW Department of Education - School Infrasructure
Project : New High School - Property 7
Location : 9 Gregory Hills Drive, Gledswood Hills

Job No. : 20465/3
Borehole No. : BH14
Date : 22/11/2023
Logged/Checked by: JH/IJ

drill model and mounting : Edson Series 100 Truck Mount **slope :** **deg.** **R.L. surface :** 101.243
hole diameter : 100 **mm** **bearing :** **deg.** **datum :** AHD

method	groundwater	env samples	PID reading (ppm)	geo samples	field test	depth or R.L. in meters	graphic log	classification symbol	MATERIAL DESCRIPTION soil type, plasticity or particle characteristic, colour, secondary and minor components.	moisture condition	consistency density index	hand penetrometer kPa	Remarks and additional observations
						10	▨						
						10.5	▨						
						11	▨						
						11.5	▨						
						12	▨						
						12.5	▨						
	DRY					13	▤		SHALE, grey, extremely to distinctly weathered, low to medium strength				Bedrock
						13.5			Borehole BH14 terminated at 13.5m				
						14							
						14.5							

engineering log - borehole

Client : NSW Department of Education - School Infrasructure **Job No. :** 20465/3
Project : New High School - Property 7 **Borehole No. :** BH15
Location : 9 Gregory Hills Drive, Gledswood Hills **Date :** 27/11/2023
Logged/Checked by: JH/IJ

drill model and mounting : Truck Mounted Commachio 200 **slope :** **deg.** **R.L. surface :** 100.459
hole diameter : 100 **mm** **bearing :** **deg.** **datum :** AHD

method	groundwater	env samples	PID reading (ppm)	geo samples	field test	depth or R.L. in meters	graphic log	classification symbol	MATERIAL DESCRIPTION soil type, plasticity or particle characteristic, colour, secondary and minor components.	moisture condition	consistency density index	hand penetrometer kPa	Remarks and additional observations
						0			FILL: Silty Clay, low plasticity, brown, with gravel	D			Well compacted
						0.5							
						1			FILL: Gravelly Clay, low to medium plasticity, grey	D			Well compacted
					N=23 6,11,12	1.5							
						2							
						2.5							
					N=33 11,16,17	3							
						3.5							
						4							
	DRY					4.5							
									Borehole BH15 terminated at 4.8m due to				

engineering log - borehole

Client : NSW Department of Education - School Infrasructure
Project : New High School - Property 7
Location : 9 Gregory Hills Drive, Gledswood Hills

Job No. : 20465/3
Borehole No. : BH15
Date : 27/11/2023
Logged/Checked by: JH/IJ

drill model and mounting : Truck Mounted Commachio 200 **slope :** **deg.** **R.L. surface :** 100.459

hole diameter : 100 **mm** **bearing :** **deg.** **datum :** AHD

method	groundwater	env samples	PID reading (ppm)	geo samples	field test	depth or R.L. in meters	graphic log	classification symbol	MATERIAL DESCRIPTION soil type, plasticity or particle characteristic, colour, secondary and minor components.	moisture condition	consistency density index	hand penetrometer kPa	Remarks and additional observations
									refusal on concrete boulder				
						5							
						5.5							
						6							
						6.5							
						7							
						7.5							
						8							
						8.5							
						9							
						9.5							

engineering log - excavation

Client : NSW Department of Education - School Infrasructure **Job No :** 20465/3
Project : New High School - Property 7 **Pit No :** TP1a
Location : 9 Gregory Hills Drive, Gledswood Hills **Date :** 22/11/2023
Logged/Checked by: JH

Equipment type and model: 5.5 Tonne Excavator **R.L. surface :** 102.198
Excavation dimensions : 2.4 **m long** .45 **m wide** **datum :** AHD

groundwater	env samples	PID reading (ppm)	geo samples	field tests	depth or R.L. in meters	graphic log	classification symbol	MATERIAL DESCRIPTION soil type, plasticity or particle characteristic, colour, secondary and minor components.	moisture condition	consistency density index	hand penetrometer kPa	Remarks and additional observations
					0			FILL: Silty Clay, low plasticity, brown with gravel	D			with sandstone boulders Well compacted
					0.5							
					1							
					1.5							
					2							
					2.5							
					3			TP1a Terminated due to limit of reach				
					3.5							
					4							
					4.5							

engineering log - excavation

Client : NSW Department of Education - School Infrasructure **Job No :** 20465/3
Project : New High School - Property 7 **Pit No :** TP4a
Location : 9 Gregory Hills Drive, Gledswood Hills **Date :** 22/11/2023
Logged/Checked by: JH

Equipment type and model: 5.5 Tonne Excavator **R.L. surface :** 100.281
Excavation dimensions : 2.4 **m long** .45 **m wide** **datum :** AHD

groundwater	env samples	PID reading (ppm)	geo samples	field tests	depth or R.L. in meters	graphic log	classification symbol	MATERIAL DESCRIPTION soil type, plasticity or particle characteristic, colour, secondary and minor components.	moisture condition	consistency density index	hand penetrometer kPa	Remarks and additional observations
					0 0.5 1 1.5 2 2.5			FILL: Silty Clay, low plasticity, brown with gravel	D			Well compacted
					3 3.5 4 4.5			TP4a Terminated due to limit of reach				

form no. 001 version 04 - 05/11

engineering log - excavation

Client : NSW Department of Education - School Infrasructure **Job No :** 20465/3
Project : New High School - Property 7 **Pit No :** TP5a
Location : 9 Gregory Hills Drive, Gledswood Hills **Date :** 22/11/2023
Logged/Checked by: JH

Equipment type and model: 5.5 Tonne Excavator **R.L. surface :** 102.281
Excavation dimensions : 2.4 **m long** .45 **m wide** **datum :** AHD

groundwater	env samples	PID reading (ppm)	geo samples	field tests	depth or R.L. in meters	graphic log	classification symbol	MATERIAL DESCRIPTION soil type, plasticity or particle characteristic, colour, secondary and minor components.	moisture condition	consistency density index	hand penetrometer kPa	Remarks and additional observations
					0			FILL: Silty Clay, low plasticity, brown with gravel				with sandstone and concrete boulders Well compacted
					2.5			TP5a Terminated due to refusal on large boulder				

engineering log - excavation

Client : NSW Department of Education - School Infrasructure **Job No :** 20465/3
Project : New High School - Property 7 **Pit No :** TP6a
Location : 9 Gregory Hills Drive, Gledswood Hills **Date :** 22/11/2023
Logged/Checked by: JH

Equipment type and model: 5.5 Tonne Excavator **R.L. surface :** 101.423
Excavation dimensions : 2.4 **m long** .45 **m wide** **datum :** AHD

groundwater	env samples	PID reading (ppm)	geo samples	field tests	depth or R.L. in meters	graphic log	classification symbol	MATERIAL DESCRIPTION soil type, plasticity or particle characteristic, colour, secondary and minor components.	moisture condition	consistency density index	hand penetrometer kPa	Remarks and additional observations
					0			FILL: Silty Clay, low plasticity, brown with gravel				with sandstone boulders Well compacted
					0.5							
					1							
					1.5							
					2							
					2.5			TP6a Terminated due to refusal on large boulder				
					3							
					3.5							
					4							
					4.5							

engineering log - excavation

Client : NSW Department of Education - School Infrasructure **Job No :** 20465/3
Project : New High School - Property 7 **Pit No :** TP8a
Location : 9 Gregory Hills Drive, Gledswood Hills **Date :** 22/11/2023
Logged/Checked by: JH

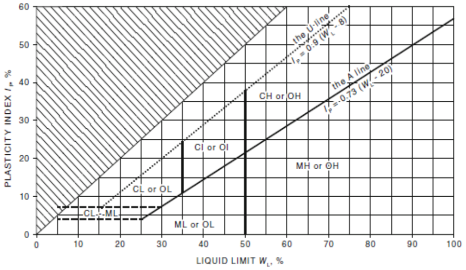
Equipment type and model: 5.5 Tonne Excavator **R.L. surface :** 102.589
Excavation dimensions : 2.4 **m long** .45 **m wide** **datum :** AHD

groundwater	env samples	PID reading (ppm)	geo samples	field tests	depth or R.L. in meters	graphic log	classification symbol	**MATERIAL DESCRIPTION** **soil type, plasticity or particle characteristic, colour, secondary and minor components.**	moisture condition	consistency density index	hand penetrometer kPa	**Remarks and additional observations**
					0			FILL: Silty Clay, low plasticity, brown with gravel				with sandstone boulders Well compacted
					0.5							
					1							
					1.5							
					2							
					2.5			TP8a Terminated due to refusal on large boulder				
					3							
					3.5							
					4							
					4.5							

Log Symbols & Abbreviations (Non-cored Borehole Log)

Log Column	Symbol/Value	Description		
Drilling Method	V-bit TC-bit RR DB BB	Hardened steel 'V' shaped bit attached to auger Tungsten Carbide bit attached to auger Tricone (Rock Roller) bit Drag bit Blade bit		
Groundwater	Dry ▼ ►	Groundwater not encountered to the drilled or auger refusal depth Groundwater level at depths shown on log Groundwater seepage at depths shown on log		
Environment Sample	GP G P	Glass bottle and plastic bag sample over depths shown on log Glass bottle sample over depths shown on log Plastic bag sample over depths shown on log		
PID Reading	100	PID reading in ppm		
Geotechnical Sample	DS DB U_{50}	Disturbed Small bag sample over depths shown on log Disturbed Bulk sample over depths shown on log Undisturbed 50mm tube sample over depths shown on log		
Field Test	N=10 3,5,5	Standard Penetration Test (SPT) 'N' value. Individual numbers indicate blows per 150mm penetration.		
	N=R 10,15/100	'R' represents refusal to penetration in hard/very dense soils or in cobbles or boulders. The first number represents10 blows for 150mm penetration whereas the second number represents 15 blows for 100mm penetration where SPT met refusal		
	DCP/PSP 5 6 R/10	Dynamic Cone Penetration (DCP) or Perth Sand Penetrometer (PSP). Each number represents blows per 100mm penetration. 'R/10' represents refusal after 10mm penetration in hard/very dense soils or in gravels or boulders.		
Classification	GP GW GM GC SP SW SM SC ML MI MH CL CI CH	Poorly Graded GRAVEL Well graded GRAVEL Silty GRAVEL Clayey GRAVEL Poorly graded SAND Well graded SAND Silty SAND Clayey SAND SILT / Sandy SILT / clayey SILT, low plasticity SILT / Sandy SILT / clayey SILT, medium plasticity SILT / Sandy SILT / clayey SILT, high plasticity CLAY / Silty CLAY / Sandy CLAY / Gravelly CLAY, low plasticity CLAY / Silty CLAY / Sandy CLAY / Gravelly CLAY, medium plasticity CLAY / Silty CLAY / Sandy CLAY / Gravelly CLAY, high plasticity		
Moisture Condition Cohesive soils	M<PL M=PL M>PL	Moisture content less than Plastic Limit Moisture content equal to Plastic Limit Moisture content to be greater than Plastic Limit		
Cohesionless soils	D M W	Dry - Runs freely through hand Moist - Tends to cohere Wet - Tends to cohere		
Consistency Cohesive soils		**Term**	**Undrained shear strength, C_u (kPa)**	**Hand Penetrometer (Qu)**
	VS	Very Soft	≤12	<25
	S	Soft	>12 & ≤25	25 – 50
	F	Firm	>25 & ≤50	50 – 100
	St	Stiff	>50 & ≤100	100 – 200
	VSt	Very Stiff	>100 & ≤200	200 – 400
	H	Hard	>200	>400
Density Index Cohesionless soils		**Term**	**Density Index, I_D (%)**	**SPT 'N' (blows/300mm)**
	VL	Very Loose	≤15	≤5
	L	Loose	>15 & ≤35	>5 & ≤10
	M	Medium Dense	>35 & ≤65	>10 & ≤30
	D	Dense	>65 & ≤85	>30 & ≤50
	VD	Very Dense	>85	>50
Hand Penetrometer	100 200	Unconfined compressive strength (q_u) in kPa determined using pocket penetrometer, at depths shown on log		
Remarks		Geological origin of soils		
	Residual Alluvium Colluvial Aeolian Marine	Residual soils above bedrock River deposited Alluvial soils Gravity deposited Colluvial soils Wind deposited Aeolian soils Marine Soils		

AS1726 : 2017– Unified Soil Classification System

Major Divisions		Particle size (mm)	Group Symbol	Typical Names	Field Identifications Sand and Gravels			Laboratory classification					
									% Fines (2)	Plasticity of Fine Fraction	$C_u = D_{60}/D_{10}$	$C_c = (D_{30})^2/(D_{10}D_{60})$	Notes
OVERSIZE	BOULDERS	>200											
	COBBLES	63											
COARSE GRAINED SOIL (more than 65% of soil excluding oversize fraction is greater than 0.075mm)	GRAVEL (more than half of coarse fraction is larger than 2.36mm)	Coarse 19	GW	Well-graded gravels, gravel-sand mixtures, little or no fines	Wide range in grain size and substantial amounts of all intermediate sizes, not enough fines to bind coarse grains, no dry strength			Use the gradation of material passing 63mm for classification of fractions according to the criteria given in 'Major Divisions'	≤5	-	>4	between 1 and 3	1. Identify lines by the method given for fine grained soils
			GP	Poorly graded gravels, gravel-sand mixtures, little or no fines, uniform gravels	Predominantly one size or range of sizes with some intermediate sizes missing, not enough fines to bind coarse grains, no dry strength				≤5	-	Fails to comply with above		
		Medium 6.7	GM	Silty gravels, gravel-sand-silt mixtures	'Dirty' materials with excess of non-plastic fines, zero to medium dry strength				≥12	Below 'A' line or I_p<4	-	-	2. Borderline classifications occur when the percentage of fines (fraction smaller than 0.075mm size) is greater than 5% and less than 12%. Borderline classifications require the use of dual symbols e.g. SP-SM, GW-GC
		Fine 2.36	GC	Clayey gravels, gravel-sand-clay mixtures	'Dirty' materials with excess of plastic fines, medium to high dry strength				≥12	Above 'A' line or I_p>7	-	-	
	SAND (more than half of coarse fraction is smaller than 2.36mm)	Coarse 0.6	SW	Well-graded sands, gravelly sands, little or no fines	Wide range in grain size and substantial amounts of all intermediate sizes, not enough fines to bind coarse grains, no dry strength				≤5	-	>6	between 1 and 3	
		Medium 0.21	SP	Poorly graded sands and gravelly sands; little or no fines, uniform sands	Predominantly one size or range of sizes with some intermediate sizes missing, not enough fines to bind coarse grains, no dry strength				≤5	-	Fails to comply with above		
			SM	Silty sands, sand-silt mixtures	'Dirty' materials with excess of non-plastic fines, zero to medium dry strength				≥12	Below 'A' line or I_p<4	-	-	
		Fine 0.075	SC	Clayey sand, sand-clay mixtures	'Dirty' materials with excess of plastic fines, medium to high dry strength				≥12	Above 'A' line of I_p>7	-	-	
FINE GRAINED SOIL (more than 35% of soil excluding oversize fraction is less than 0.075mm)	SILT (0.075mm to 0.002mm) & CLAY (<0.002mm) Liquid Limit<50%		ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity	**Dry Strength**	**Dilatancy**	**Toughness**						
					None to low	Slow to rapid	Low		More than 35% passing 0.075mm	Below 'A' line			
			CL, CI	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays	Medium to high	None to very slow	Medium			Above 'A' line			
			OL	Organic silts and organic silty clays of low plasticity	Low to medium	Slow	Low			Below 'A' line			
	SILT (0.075mm to 0.002mm) & CLAY (<0.002mm) Liquid Limit>50%		MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts	Low to medium	None to slow	Low to medium			Below 'A' line			
			CH	Inorganic clays of medium to high plasticity, fat clays	High to very high	None	High			Above 'A' line			
			OH (1)	Organic clays of medium to high plasticity, organic silts	Medium to high	None to very slow	Low to medium			Below 'A' line			
	HIGHLY ORGANIC SOILS		Pt (1)	Peat and highly organic soils	Identified by colour, odour, spongy feel and generally by fibrous texture				Effervesces with H_2O_2				

Log Symbols & Abbreviations (Cored Borehole Log)

Log Column	Symbol / Abbreviation	Description		
Core Size		Nominal Core Size (mm)		
	NQ	47		
	NMLC	52		
	HQ	63		
Water Loss	──◀	Complete water loss		
	──◁	Partial water loss		
Weathering (AS1726:2017)	RS	Residual Soil	Material is weathered to such an extent that it has soil properties. Mass structure and material texture and fabric of original rock are no longer visible, but the soil has not been significantly transported	
	XW	Extremely Weathered	Material is weathered to such an extent that it has soil properties. Mass structure and material texture and fabric of original rock are still visible	
	HW	Highly Weathered	The whole of the rock material is discoloured, usually by iron staining or bleaching to the extent that the colour of the original rock is not recognizable. Rock strength is significantly changed by weathering. Some primary minerals have weathered to clay minerals. Porosity may be increased by leaching, or may be decreased due to deposition of weathering products in pores.	
	MW	Moderately Weathered	The whole of the rock material is discoloured, usually by iron staining or bleaching to the extent that the colour of the original rock is not recognizable, but shows little or no change of strength from fresh rock	
	SW	Slightly Weathered	Rock is partially discoloured with staining or bleaching along joints but shows little or no change in strength from fresh rock	
	FR	Fresh	Rock shows no sign of decomposition of individual minerals or colour changes	
		Note : Where it is not possible to distinguish between HW and MW rock the term Distinctly Weathered (DW) may be used. DW is defined as 'Rock strength usually changed by weathering. The rock may be highly discoloured, usually by ironstaining. Porosity may be increased by leaching, or may be decreased by deposition of weathering products in pores'		
Strength (AS1726:2017)		**Term**	**Point Load Strength Index (I_{s50}, MPa)**	
	VL	Very Low	≥0.03	≤0.1
	L	Low	>0.1	≤0.3
	M	Medium	>0.3	≤1
	H	High	>1	≤3
	VH	Very High	>3	≤10
	EH	Extremely High	>10	
Defect Spacing		**Description**	**Spacing (mm)**	
		Extremely closely spaced	<20	
		Very closely spaced	20 to 60	
		Closely spaced	60 to 200	
		Medium spaced	200 to 600	
		Widely spaced	600 to 2000	
		Very widely spaced	2000 to 6000	
		Extremely widely spaced	>6000	
Defect Description (AS1726:2017) Type				
	Pt	Parting		
	Jo	Joint		
	Sh	Sheared Surface		
	Sz	Sheared Zone		
	Ss	Sheared Seam		
	Cs	Crushed Seam		
	Is	Infilled Seam		
	Ews	Extremely Weathered Seam		
Macro-surface geometry	St	Stepped		
	Cu	Curved		
	Un	Undulating		
	Ir	Irregular		
	Pl	Planar		
Micro-surface geometry	Vro	Very Rough		
	Ro	Rough		
	Sm	Smooth		
	Po	Polished		
	Sl	Slickensided		
Coating or infilling	cn	clean		
	sn	stained		
	vn	veneer		
	cg	coating		

AS1726 – Identification of Sedimentary Rocks for Engineering Purposes

Grain Size mm		Bedded rocks (mostly sedimentary)								
More than 20	20	Grain Size Description				At least 50% of grains are of carbonate			At least 50% of grains are of fine-grained volcanic rock	
	6	RUDACEOUS		CONGLOMERATE Rounded boulders, cobbles and gravel cemented in a finer matrix Breccia Irregular rock fragments in a finer matrix		LIMESTONE and DOLOMITE (undifferentiated)	Calcirudite		Fragments of volcanic ejecta in a finer matrix Rounded grains AGGLOMERATE Angular grains VOLCANIC BRECCIA	SALINE ROCKS Halite Anhydrite
	2									
	0.6	ARENACEOUS	Coarse	SANDSTONE Angular or rounded grains, commonly cemented by clay, calcite or iron minerals Quartzite Quartz grains and siliceous cement Arkose Many feldspar grains Greywacke Many rock chips			Calcarenite		Cemented volcanic ash TUFF	Gypsum
	0.2		Medium							
	0.06		Fine							
	0.002	ARGILLACEOUS		MUDSTONE	SILTSTONE Mostly silt	Calcareous Mudstone	Calcisiltite	CHALK	Fine-grained TUFF	
	Less than 0.002			SHALE Fissile	CLAYSTONE Mostly clay		Calcilutite		Very fine-grained TUFF	
Amorphous or crypto-crystalline				Flint: occurs as hands of nodules in the chalk Chert: occurs as nodules and beds in limestone and calcareous sandstone						COAL LIGNITE
				Granular cemented – except amorphous rocks						
				SILICEOUS		CALCAREOUS			SILICEOUS	CARBONACEOUS
				SEDIMENTARY ROCKS Granular cemented rocks vary greatly in strength, some sandstones are stronger than many Igneous rocks. Bedding may not show in hand specimens and is best seen in outcrop. Only sedimentary rocks, and some metamorphic rocks derived from them, contain fossils Calcareous rocks contain calcite (calcium carbonate) which effervesces with dilute hydrochloric acid						

AS1726 – Identification of Metamorphic and Igneous Rocks for Engineering Purposes

Obviously foliated rocks (mostly metamorphic)		Rocks with massive structure and crystalline texture (mostly igneous)						Grain size (mm)
Grain size description		MARBLE QUARTZITE Granulite HORNFELS Amphibolite Serpentine	Grain size description	Pegmatite		GABBRO	Pyrosenite	More than 20 20
COARSE	GNEISS Well developed but often widely spaced foliation sometimes with schistose bands Migmatite Irregularly foliated: mixed schists and gneisses		COARSE	GRANITE	Diorite		Peridorite	6
				These rocks are sometimes phorphyritic and are then described, for example, as porphyritic granite				2
MEDIUM	SCHIST Well developed undulose foliation; generally much mica		MEDIUM	Micorgranite	Microdiorite	Dolerite		0.6
				These rocks are sometimes phorphyritic and are then described as porphyries				0.2 0.06
FINE	PHYLLITE Slightly undulose foliation; sometimes 'spotted'		FINE	RHYOLITE	ANDESITE	BASALT		0.002
	SLATE Well developed plane cleavage (foliation)			These rocks are sometimes phorphyritic and are then described as porphyries				Less than 0.002
	Mylonite Found in fault zones, mainly in igneous and metamorphic areas			Obsidian	Volcanic glass			Amorphous or cryptocrystalline
CRYSTALLINE				Pale<--->Dark				
SILICEOUS		Mainly SILICEOUS		ACID Much quartz	INTERMEDIATE Some quartz	BASIC Little or no quartz	ULTRA BASIC	
METAMORPHIC ROCKS Most metamorphic rocks are distinguished by foliation which may impart fissility. Foliation in gneisses is best observed in outcrop. Non-foliated metamorphics are difficult to recognize except by association. Any rock baked by contact metamorphism is described as 'hornfels' and is generally somewhat stronger than the parent rock Most fresh metamorphic rocks are strong although perhaps fissile			IGNEOUS ROCKS Composed of closely interlocking mineral grains. Strong when fresh; not porous Mode of occurrence : 1 Batholith; 2 Laccoliths; 3 Sills; 4 Dykes; 5 Lava Flows; 6 Veins					

ATTACHMENT C

Laboratory Test Results

TEST RESULTS - ATTERBERG LIMITS

Test Procedure AS1289 3.1.1, 3.2.1, 3.3.1, 3.4.1

NSW DEPARTMENT OF EDUCATION - SCHOOL INFRASTRUCTUR
PO BOX 33
SYDNEY NSW 2000

Laboratory: Penrith
Job No: 20465/1

PROJECT: PRELIMINARY GEOTECHNICAL INVESTIGATION
NEW HIGH SCHOOL - PROPERTY 7 - 9 GREGORY HILLS DRIVE, GLEDSWOOD HILLS

Page 2 of 1

Date Tested: 10/01/2024

Tested By: BG
Checked By: AK

Sample Identification	Borehole 13
Laboratory Number	20465/1-4
Depth (m)	1.5 - 1.95
Test Description	
Liquid Limit (W_L)	43%
Plastic Limit (W_P)	18%
Plastic Index (I_P)	25%
Linear Shrinkage (LS)	11.5%
Mould Length (mm)	127
Sample History	Oven Dried Dry Sieved
Material Description	FILL: Silty Clay, medium plasticity, brown, some fine to medium gravel

A Kench

Report Date
15/01/2024

NATA

Accredited for compliance with ISO/IEC 17025 - Testing.

Nata Accreditation Number 2734
Corporate Site Number 2727

Approved Signatory

GEOTECH
TESTING PTY LTD ®
ABN 71 076 676 321

TEST RESULTS - ATTERBERG LIMITS

Test Procedure AS1289 3.1.1, 3.2.1, 3.3.1, 3.4.1

NSW DEPARTMENT OF EDUCATION - SCHOOL INFRASTRUCTUR
PO BOX 33
SYDNEY NSW 2000

Laboratory: Penrith
Job No: 20465/3

PROJECT: INTRUSIVE GEOTECHNICAL INVESTIGATION
NEW HIGH SCHOOL - PROPERTY 7 - 9 GREGORY HILLS DRIVE, GLEDSWOOD HILLS

Date Tested: 10/01/2024

Tested By: BG
Checked By: AK

Sample Identification	Borehole 2	Borehole 5	Borehole 10
Laboratory Number	20465/1-1	20465/1-2	20465/1-3
Depth (m)	0.7 - 1.0	0.8 - 1.0	0.7 - 0.9
Test Description			
Liquid Limit (W_L)	41%	Not Obtainable	36%
Plastic Limit (W_P)	16%	15%	16%
Plastic Index (I_P)	25%	Not Obtainable	20%
Linear Shrinkage (LS)	13.0%	1.5%	11.0%
Mould Length (mm)	127	127	125
Sample History	Oven Dried Dry Sieved	Oven Dried Dry Sieved	Oven Dried Dry Sieved
Material Description	FILL: Silty Clay, medium plasticity, brown, some fine to medium gravel	FILL: Silty Clay, non plastic, brown, some fine to medium gravel	FILL: Silty Clay, low to medium plasticity, brown, some fine to medium gravel

Form No R004 Version 13 - 07/21 - Issued by ER

A Kench

Report Date
15/01/2024

NATA

Accredited for compliance with ISO/IEC 17025 - Testing.

Nata Accreditation Number 2734
Corporate Site Number 2727

Approved Signatory

ANALYTICAL REPORT

Accreditation No. 2562

CLIENT DETAILS | | LABORATORY DETAILS |
|---|---|---|---|
| Contact | Indra Jworchan | Manager | Huong Crawford |
| Client | Geotechnique | Laboratory | SGS Alexandria Environmental |
| Address | P.O. Box 880
NSW 2751 | Address | Unit 16, 33 Maddox St
Alexandria NSW 2015 |
| Telephone | 02 4722 2700 | Telephone | +61 2 8594 0400 |
| Facsimile | 02 4722 6161 | Facsimile | +61 2 8594 0499 |
| Email | indra.jworchan@geotech.com.au | Email | au.environmental.sydney@sgs.com |
| Project | **20465/3 Gregory Hills Drive, Gregory Hil** | SGS Reference | **SE258512 R0** |
| Order Number | **20465/3** | Date Received | 19/12/2023 |
| Samples | 24 | Date Reported | 4/1/2024 |

COMMENTS

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

SIGNATORIES

	yingying zhang
Dong LIANG	**Ying Ying ZHANG**
Metals/Inorganics Team Leader	Laboratory Technician

Conductivity and TDS by Calculation - Soil [AN106] Tested: 28/12/2023

			BH1	BH1	BH2	BH3	BH3
			SOIL	SOIL	SOIL	SOIL	SOIL
			0.5-0.7	1.0-1.2	0.8-1.0	1.0-1.2	2.8-3.0
			15/12/2023	15/12/2023	15/12/2023	15/12/2023	15/12/2023
PARAMETER	**UOM**	**LOR**	**SE258512.001**	**SE258512.002**	**SE258512.003**	**SE258512.004**	**SE258512.005**
Conductivity of Extract (1:5 dry sample basis)	µS/cm	1	300	480	300	530	260

			BH4	BH8	BH8	BH9	BH9
			SOIL	SOIL	SOIL	SOIL	SOIL
			0.4-0.6	0.4-0.6	1.0-1.2	0.4-0.6	1.0-1.2
			15/12/2023	15/12/2023	15/12/2023	15/12/2023	15/12/2023
PARAMETER	**UOM**	**LOR**	**SE258512.006**	**SE258512.007**	**SE258512.008**	**SE258512.009**	**SE258512.010**
Conductivity of Extract (1:5 dry sample basis)	µS/cm	1	360	280	390	420	420

			BH11	BH11	BH11	BH11	BH12
			SOIL	SOIL	SOIL	SOIL	SOIL
			1.0-1.2	3.0-3.2	5.0-5.2	7.0-7.2	1.5-1.95
			15/12/2023	15/12/2023	15/12/2023	15/12/2023	15/12/2023
PARAMETER	**UOM**	**LOR**	**SE258512.011**	**SE258512.012**	**SE258512.013**	**SE258512.014**	**SE258512.015**
Conductivity of Extract (1:5 dry sample basis)	µS/cm	1	310	410	400	460	520

			BH12	BH12	BH12	BH15	BH15
			SOIL	SOIL	SOIL	SOIL	SOIL
			3.0-3.45	4.5-4.95	10.0-10.2	1.5-1.95	3.0-3.45
			15/12/2023	15/12/2023	15/12/2023	15/12/2023	15/12/2023
PARAMETER	**UOM**	**LOR**	**SE258512.016**	**SE258512.017**	**SE258512.018**	**SE258512.019**	**SE258512.020**
Conductivity of Extract (1:5 dry sample basis)	µS/cm	1	510	410	510	450	350

			BH14	BH14	BH14	BH14
			SOIL	SOIL	SOIL	SOIL
			1.0-1.2	3.0-3.2	5.0-5.2	7.5-7.7
			15/12/2023	15/12/2023	15/12/2023	15/12/2023
PARAMETER	**UOM**	**LOR**	**SE258512.021**	**SE258512.022**	**SE258512.023**	**SE258512.024**
Conductivity of Extract (1:5 dry sample basis)	µS/cm	1	510	460	450	410

Moisture Content [AN002] Tested: 27/12/2023

			BH1	BH1	BH2	BH3	BH3
			SOIL	SOIL	SOIL	SOIL	SOIL
			0.5-0.7	1.0-1.2	0.8-1.0	1.0-1.2	2.8-3.0
			15/12/2023	15/12/2023	15/12/2023	15/12/2023	15/12/2023
PARAMETER	**UOM**	**LOR**	**SE258512.001**	**SE258512.002**	**SE258512.003**	**SE258512.004**	**SE258512.005**
% Moisture	%w/w	1	9.4	9.2	6.6	9.9	12.8

			BH4	BH8	BH8	BH9	BH9
			SOIL	SOIL	SOIL	SOIL	SOIL
			0.4-0.6	0.4-0.6	1.0-1.2	0.4-0.6	1.0-1.2
			15/12/2023	15/12/2023	15/12/2023	15/12/2023	15/12/2023
PARAMETER	**UOM**	**LOR**	**SE258512.006**	**SE258512.007**	**SE258512.008**	**SE258512.009**	**SE258512.010**
% Moisture	%w/w	1	9.8	6.6	4.6	6.8	8.9

			BH11	BH11	BH11	BH11	BH12
			SOIL	SOIL	SOIL	SOIL	SOIL
			1.0-1.2	3.0-3.2	5.0-5.2	7.0-7.2	1.5-1.95
			15/12/2023	15/12/2023	15/12/2023	15/12/2023	15/12/2023
PARAMETER	**UOM**	**LOR**	**SE258512.011**	**SE258512.012**	**SE258512.013**	**SE258512.014**	**SE258512.015**
% Moisture	%w/w	1	10.9	10.2	10.6	11.1	8.5

			BH12	BH12	BH12	BH15	BH15
			SOIL	SOIL	SOIL	SOIL	SOIL
			3.0-3.45	4.5-4.95	10.0-10.2	1.5-1.95	3.0-3.45
			15/12/2023	15/12/2023	15/12/2023	15/12/2023	15/12/2023
PARAMETER	**UOM**	**LOR**	**SE258512.016**	**SE258512.017**	**SE258512.018**	**SE258512.019**	**SE258512.020**
% Moisture	%w/w	1	10.7	9.0	11.3	12.3	9.6

			BH14	BH14	BH14	BH14
			SOIL	SOIL	SOIL	SOIL
			1.0-1.2	3.0-3.2	5.0-5.2	7.5-7.7
			15/12/2023	15/12/2023	15/12/2023	15/12/2023
PARAMETER	**UOM**	**LOR**	**SE258512.021**	**SE258512.022**	**SE258512.023**	**SE258512.024**
% Moisture	%w/w	1	8.1	11.8	11.3	10.9

Soluble Anions in Soil from 1:2 DI Extract by Ion Chromatography [AN245] Tested: 27/12/2023

			BH1	BH1	BH2	BH3	BH3
			SOIL	SOIL	SOIL	SOIL	SOIL
			0.5-0.7	1.0-1.2	0.8-1.0	1.0-1.2	2.8-3.0
			15/12/2023	15/12/2023	15/12/2023	15/12/2023	15/12/2023
PARAMETER	**UOM**	**LOR**	**SE258512.001**	**SE258512.002**	**SE258512.003**	**SE258512.004**	**SE258512.005**
Chloride	mg/kg	0.25	150	200	90	140	230
Sulfate	mg/kg	0.5	270	380	330	590	140

			BH4	BH8	BH8	BH9	BH9
			SOIL	SOIL	SOIL	SOIL	SOIL
			0.4-0.6	0.4-0.6	1.0-1.2	0.4-0.6	1.0-1.2
			15/12/2023	15/12/2023	15/12/2023	15/12/2023	15/12/2023
PARAMETER	**UOM**	**LOR**	**SE258512.006**	**SE258512.007**	**SE258512.008**	**SE258512.009**	**SE258512.010**
Chloride	mg/kg	0.25	120	70	170	160	170
Sulfate	mg/kg	0.5	280	330	390	340	350

			BH11	BH11	BH11	BH11	BH12
			SOIL	SOIL	SOIL	SOIL	SOIL
			1.0-1.2	3.0-3.2	5.0-5.2	7.0-7.2	1.5-1.95
			15/12/2023	15/12/2023	15/12/2023	15/12/2023	15/12/2023
PARAMETER	**UOM**	**LOR**	**SE258512.011**	**SE258512.012**	**SE258512.013**	**SE258512.014**	**SE258512.015**
Chloride	mg/kg	0.25	170	150	180	190	210
Sulfate	mg/kg	0.5	310	350	330	290	530

			BH12	BH12	BH12	BH15	BH15
			SOIL	SOIL	SOIL	SOIL	SOIL
			3.0-3.45	4.5-4.95	10.0-10.2	1.5-1.95	3.0-3.45
			15/12/2023	15/12/2023	15/12/2023	15/12/2023	15/12/2023
PARAMETER	**UOM**	**LOR**	**SE258512.016**	**SE258512.017**	**SE258512.018**	**SE258512.019**	**SE258512.020**
Chloride	mg/kg	0.25	170	130	580	110	130
Sulfate	mg/kg	0.5	610	380	170	340	200

			BH14	BH14	BH14	BH14
			SOIL	SOIL	SOIL	SOIL
			1.0-1.2	3.0-3.2	5.0-5.2	7.5-7.7
			15/12/2023	15/12/2023	15/12/2023	15/12/2023
PARAMETER	**UOM**	**LOR**	**SE258512.021**	**SE258512.022**	**SE258512.023**	**SE258512.024**
Chloride	mg/kg	0.25	280	190	230	190
Sulfate	mg/kg	0.5	400	290	280	270

pH in soil (1:2) [AN101] Tested: 27/12/2023

PARAMETER	UOM	LOR	BH1 SOIL 0.5-0.7 15/12/2023 SE258512.001	BH1 SOIL 1.0-1.2 15/12/2023 SE258512.002	BH2 SOIL 0.8-1.0 15/12/2023 SE258512.003	BH3 SOIL 1.0-1.2 15/12/2023 SE258512.004	BH3 SOIL 2.8-3.0 15/12/2023 SE258512.005
pH (1:2)	pH Units	-	7.4	7.8	8.0	8.1	6.2

PARAMETER	UOM	LOR	BH4 SOIL 0.4-0.6 15/12/2023 SE258512.006	BH8 SOIL 0.4-0.6 15/12/2023 SE258512.007	BH8 SOIL 1.0-1.2 15/12/2023 SE258512.008	BH9 SOIL 0.4-0.6 15/12/2023 SE258512.009	BH9 SOIL 1.0-1.2 15/12/2023 SE258512.010
pH (1:2)	pH Units	-	7.6	7.9	8.1	8.1	8.1

PARAMETER	UOM	LOR	BH11 SOIL 1.0-1.2 15/12/2023 SE258512.011	BH11 SOIL 3.0-3.2 15/12/2023 SE258512.012	BH11 SOIL 5.0-5.2 15/12/2023 SE258512.013	BH11 SOIL 7.0-7.2 15/12/2023 SE258512.014	BH12 SOIL 1.5-1.95 15/12/2023 SE258512.015
pH (1:2)	pH Units	-	5.7	8.3	8.2	8.4	7.9

PARAMETER	UOM	LOR	BH12 SOIL 3.0-3.45 15/12/2023 SE258512.016	BH12 SOIL 4.5-4.95 15/12/2023 SE258512.017	BH12 SOIL 10.0-10.2 15/12/2023 SE258512.018	BH15 SOIL 1.5-1.95 15/12/2023 SE258512.019	BH15 SOIL 3.0-3.45 15/12/2023 SE258512.020
pH (1:2)	pH Units	-	7.9	7.9	8.6	8.2	8.5

PARAMETER	UOM	LOR	BH14 SOIL 1.0-1.2 15/12/2023 SE258512.021	BH14 SOIL 3.0-3.2 15/12/2023 SE258512.022	BH14 SOIL 5.0-5.2 15/12/2023 SE258512.023	BH14 SOIL 7.5-7.7 15/12/2023 SE258512.024
pH (1:2)	pH Units	-	7.9	8.3	8.2	8.2

Conductivity (1:2) in soil [AN106] Tested: 27/12/2023

PARAMETER	UOM	LOR	BH1 SOIL 0.5-0.7 15/12/2023 SE258512.001	BH1 SOIL 1.0-1.2 15/12/2023 SE258512.002	BH2 SOIL 0.8-1.0 15/12/2023 SE258512.003	BH3 SOIL 1.0-1.2 15/12/2023 SE258512.004	BH3 SOIL 2.8-3.0 15/12/2023 SE258512.005
Conductivity (1:2) @25 C*	µS/cm	1	690	810	640	870	510
Resistivity (1:2)*	ohm cm	-	1500	1200	1600	1100	2000

PARAMETER	UOM	LOR	BH4 SOIL 0.4-0.6 15/12/2023 SE258512.006	BH8 SOIL 0.4-0.6 15/12/2023 SE258512.007	BH8 SOIL 1.0-1.2 15/12/2023 SE258512.008	BH9 SOIL 0.4-0.6 15/12/2023 SE258512.009	BH9 SOIL 1.0-1.2 15/12/2023 SE258512.010
Conductivity (1:2) @25 C*	µS/cm	1	660	570	810	770	760
Resistivity (1:2)*	ohm cm	-	1500	1800	1200	1300	1300

PARAMETER	UOM	LOR	BH11 SOIL 1.0-1.2 15/12/2023 SE258512.011	BH11 SOIL 3.0-3.2 15/12/2023 SE258512.012	BH11 SOIL 5.0-5.2 15/12/2023 SE258512.013	BH11 SOIL 7.0-7.2 15/12/2023 SE258512.014	BH12 SOIL 1.5-1.95 15/12/2023 SE258512.015
Conductivity (1:2) @25 C*	µS/cm	1	530	750	700	720	930
Resistivity (1:2)*	ohm cm	-	1900	1300	1400	1400	1100

PARAMETER	UOM	LOR	BH12 SOIL 3.0-3.45 15/12/2023 SE258512.016	BH12 SOIL 4.5-4.95 15/12/2023 SE258512.017	BH12 SOIL 10.0-10.2 15/12/2023 SE258512.018	BH15 SOIL 1.5-1.95 15/12/2023 SE258512.019	BH15 SOIL 3.0-3.45 15/12/2023 SE258512.020
Conductivity (1:2) @25 C*	µS/cm	1	870	720	1000	670	610
Resistivity (1:2)*	ohm cm	-	1100	1400	960	1500	1600

PARAMETER	UOM	LOR	BH14 SOIL 1.0-1.2 15/12/2023 SE258512.021	BH14 SOIL 3.0-3.2 15/12/2023 SE258512.022	BH14 SOIL 5.0-5.2 15/12/2023 SE258512.023	BH14 SOIL 7.5-7.7 15/12/2023 SE258512.024
Conductivity (1:2) @25 C*	µS/cm	1	890	740	730	650
Resistivity (1:2)*	ohm cm	-	1100	1400	1400	1500

METHOD	METHODOLOGY SUMMARY
AN002	The test is carried out by drying (at either 40°C or 105°C) a known mass of sample in a weighed evaporating basin. After fully dry the sample is re-weighed. Samples such as sludge and sediment having high percentages of moisture will take some time in a drying oven for complete removal of water.
AN101	pH in Soil Sludge Sediment and Water: pH is measured electrometrically using a combination electrode and is calibrated against 3 buffers purchased commercially. For soils, an extract with water is made at a ratio of 1:2 and the pH determined and reported on the extract after 1 hour extraction (pH 1:2) or after 1 hour extraction and overnight aging (pH (1:2) aged). Reference APHA 4500-H+.
AN106	Conductivity and TDS by Calculation: Conductivity is measured by meter with temperature compensation and is calibrated against a standard solution of potassium chloride. Conductivity is generally reported as µmhos /cm or µS/cm @ 25°C. For soils, an extract of as received sample with water is made at a ratio of 1:5 and the EC determined and reported on the extract, or calculated back to the as-received sample. Salinity can be estimated from conductivity using a conversion factor, which for natural waters, is in the range 0.55 to 0.75. Reference APHA 2510 B.
AN106	Resistivity of the extract is reported on the extract basis and is the reciprocal of conductivity. Salinity and TDS can be calculated from the extract conductivity and is reported back to the soil basis.
AN245	Anions by Ion Chromatography: A water sample or extract is injected into an eluent stream that passes through the ion chromatographic system where the anions of interest ie Br, Cl, NO2, NO3 and SO4 are separated on their relative affinities for the active sites on the column packing material. Changes to the conductivity and the UV-visible absorbance of the eluent enable identification and quantitation of the anions based on their retention time and peak height or area. APHA 4110 B

FOOTNOTES

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

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

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

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

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

Results reported for samples tested under test methods with codes starting with ARS-SOP, radionuclide or gross radioactivity concentrations are expressed in becquerel (Bq) per unit of mass or volume or per wipe as stated on the report. Becquerel is the SI unit for activity and equals one nuclear transformation per second.
Note that in terms of units of radioactivity:
a. 1 Bq is equivalent to 27 pCi
b. 37 MBq is equivalent to 1 mCi

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

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

STATEMENT OF QA/QC PERFORMANCE

SE258512 R0

CLIENT DETAILS

Contact	Indra Jworchan
Client	Geotechnique
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Facsimile	02 4722 6161
Email	indra.jworchan@geotech.com.au
Project	**20465/3 Gregory Hills Drive, Gregory Hil**
Order Number	**20465/3**
Samples	24

LABORATORY DETAILS

Manager	Huong Crawford
Laboratory	SGS Alexandria Environmental
Address	Unit 16, 33 Maddox St Alexandria NSW 2015
Telephone	+61 2 8594 0400
Facsimile	+61 2 8594 0499
Email	au.environmental.sydney@sgs.com
SGS Reference	**SE258512 R0**
Date Received	19 Dec 2023
Date Reported	04 Jan 2024

COMMENTS

All the laboratory data for each environmental matrix was compared to SGS' stated Data Quality Objectives (DQO). Comments arising from the comparison were made and are reported below.

The data relating to sampling was taken from the Chain of Custody document.
This QA/QC Statement must be read in conjunction with the referenced Analytical Report.
The Statement and the Analytical Report must not be reproduced except in full.

All Data Quality Objectives were met with the exception of the following:

Extraction Date	Conductivity (1:2) in soil	24 items
	Conductivity and TDS by Calculation - Soil	24 items
	pH in soil (1:2)	24 items
	Soluble Anions in Soil from 1:2 DI Extract by Ion Chromatography	24 items
Analysis Date	Conductivity (1:2) in soil	24 items
	Conductivity and TDS by Calculation - Soil	24 items

SAMPLE SUMMARY

Sample counts by matrix	24 Soil	Type of documentation received	COC
Date documentation received	20/12/2023@6:30pr	Samples received in good order	Yes
Samples received without headspace	N/A	Sample temperature upon receipt	25.8°C
Sample container provider	Client	Turnaround time requested	Standard
Samples received in correct containers	Yes	Sufficient sample for analysis	Yes
Sample cooling method	None	Samples clearly labelled	Yes
Complete documentation received	Yes		

SGS holding time criteria are drawn from current regulations and are highly dependent on sample container preservation as specified in the SGS "Field Sampling Guide for Containers and Holding Time" (ref: GU-(AU)-ENV.001). Soil samples guidelines are derived from NEPM "Schedule B(3) Guideline on Laboratory Analysis of Potentially Contaminated Soils". Water sample guidelines are derived from "AS/NZS 5667.1 : 1998 Water Quality - sampling part 1" and APHA "Standard Methods for the Examination of Water and Wastewater" 21st edition 2005.

Extraction and analysis holding time due dates listed are calculated from the date sampled, although holding times may be extended after laboratory extraction for some analytes. The due dates are the suggested dates that samples may be held before extraction or analysis and still be considered valid.

Extraction and analysis dates are shown in **Green** when within suggested criteria or **Red** with an appended dagger symbol (†) when outside suggested criteria. If the

Conductivity (1:2) in soil

Method: ME-(AU)-[ENV]AN106

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
BH1	SE258512.001	LB300597	15 Dec 2023	19 Dec 2023	22 Dec 2023	27 Dec 2023†	22 Dec 2023	28 Dec 2023†
BH1	SE258512.002	LB300597	15 Dec 2023	19 Dec 2023	22 Dec 2023	27 Dec 2023†	22 Dec 2023	28 Dec 2023†
BH2	SE258512.003	LB300597	15 Dec 2023	19 Dec 2023	22 Dec 2023	27 Dec 2023†	22 Dec 2023	28 Dec 2023†
BH3	SE258512.004	LB300597	15 Dec 2023	19 Dec 2023	22 Dec 2023	27 Dec 2023†	22 Dec 2023	28 Dec 2023†
BH3	SE258512.005	LB300597	15 Dec 2023	19 Dec 2023	22 Dec 2023	27 Dec 2023†	22 Dec 2023	28 Dec 2023†
BH4	SE258512.006	LB300597	15 Dec 2023	19 Dec 2023	22 Dec 2023	27 Dec 2023†	22 Dec 2023	28 Dec 2023†
BH8	SE258512.007	LB300597	15 Dec 2023	19 Dec 2023	22 Dec 2023	27 Dec 2023†	22 Dec 2023	28 Dec 2023†
BH8	SE258512.008	LB300597	15 Dec 2023	19 Dec 2023	22 Dec 2023	27 Dec 2023†	22 Dec 2023	28 Dec 2023†
BH9	SE258512.009	LB300597	15 Dec 2023	19 Dec 2023	22 Dec 2023	27 Dec 2023†	22 Dec 2023	28 Dec 2023†
BH9	SE258512.010	LB300597	15 Dec 2023	19 Dec 2023	22 Dec 2023	27 Dec 2023†	22 Dec 2023	28 Dec 2023†
BH11	SE258512.011	LB300597	15 Dec 2023	19 Dec 2023	22 Dec 2023	27 Dec 2023†	22 Dec 2023	28 Dec 2023†
BH11	SE258512.012	LB300597	15 Dec 2023	19 Dec 2023	22 Dec 2023	27 Dec 2023†	22 Dec 2023	28 Dec 2023†
BH11	SE258512.013	LB300597	15 Dec 2023	19 Dec 2023	22 Dec 2023	27 Dec 2023†	22 Dec 2023	28 Dec 2023†
BH11	SE258512.014	LB300597	15 Dec 2023	19 Dec 2023	22 Dec 2023	27 Dec 2023†	22 Dec 2023	28 Dec 2023†
BH12	SE258512.015	LB300597	15 Dec 2023	19 Dec 2023	22 Dec 2023	27 Dec 2023†	22 Dec 2023	28 Dec 2023†
BH12	SE258512.016	LB300597	15 Dec 2023	19 Dec 2023	22 Dec 2023	27 Dec 2023†	22 Dec 2023	28 Dec 2023†
BH12	SE258512.017	LB300597	15 Dec 2023	19 Dec 2023	22 Dec 2023	27 Dec 2023†	22 Dec 2023	28 Dec 2023†
BH12	SE258512.018	LB300597	15 Dec 2023	19 Dec 2023	22 Dec 2023	27 Dec 2023†	22 Dec 2023	28 Dec 2023†
BH15	SE258512.019	LB300597	15 Dec 2023	19 Dec 2023	22 Dec 2023	27 Dec 2023†	22 Dec 2023	28 Dec 2023†
BH15	SE258512.020	LB300597	15 Dec 2023	19 Dec 2023	22 Dec 2023	27 Dec 2023†	22 Dec 2023	28 Dec 2023†
BH14	SE258512.021	LB300598	15 Dec 2023	19 Dec 2023	22 Dec 2023	27 Dec 2023†	22 Dec 2023	27 Dec 2023†
BH14	SE258512.022	LB300598	15 Dec 2023	19 Dec 2023	22 Dec 2023	27 Dec 2023†	22 Dec 2023	27 Dec 2023†
BH14	SE258512.023	LB300598	15 Dec 2023	19 Dec 2023	22 Dec 2023	27 Dec 2023†	22 Dec 2023	27 Dec 2023†
BH14	SE258512.024	LB300598	15 Dec 2023	19 Dec 2023	22 Dec 2023	27 Dec 2023†	22 Dec 2023	27 Dec 2023†

Conductivity and TDS by Calculation - Soil

Method: ME-(AU)-[ENV]AN106

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
BH1	SE258512.001	LB300641	15 Dec 2023	19 Dec 2023	22 Dec 2023	28 Dec 2023†	22 Dec 2023	28 Dec 2023†
BH1	SE258512.002	LB300641	15 Dec 2023	19 Dec 2023	22 Dec 2023	28 Dec 2023†	22 Dec 2023	28 Dec 2023†
BH2	SE258512.003	LB300641	15 Dec 2023	19 Dec 2023	22 Dec 2023	28 Dec 2023†	22 Dec 2023	28 Dec 2023†
BH3	SE258512.004	LB300641	15 Dec 2023	19 Dec 2023	22 Dec 2023	28 Dec 2023†	22 Dec 2023	28 Dec 2023†
BH3	SE258512.005	LB300641	15 Dec 2023	19 Dec 2023	22 Dec 2023	28 Dec 2023†	22 Dec 2023	28 Dec 2023†
BH4	SE258512.006	LB300641	15 Dec 2023	19 Dec 2023	22 Dec 2023	28 Dec 2023†	22 Dec 2023	28 Dec 2023†
BH8	SE258512.007	LB300641	15 Dec 2023	19 Dec 2023	22 Dec 2023	28 Dec 2023†	22 Dec 2023	28 Dec 2023†
BH8	SE258512.008	LB300641	15 Dec 2023	19 Dec 2023	22 Dec 2023	28 Dec 2023†	22 Dec 2023	28 Dec 2023†
BH9	SE258512.009	LB300641	15 Dec 2023	19 Dec 2023	22 Dec 2023	28 Dec 2023†	22 Dec 2023	28 Dec 2023†
BH9	SE258512.010	LB300641	15 Dec 2023	19 Dec 2023	22 Dec 2023	28 Dec 2023†	22 Dec 2023	28 Dec 2023†
BH11	SE258512.011	LB300641	15 Dec 2023	19 Dec 2023	22 Dec 2023	28 Dec 2023†	22 Dec 2023	28 Dec 2023†
BH11	SE258512.012	LB300641	15 Dec 2023	19 Dec 2023	22 Dec 2023	28 Dec 2023†	22 Dec 2023	28 Dec 2023†
BH11	SE258512.013	LB300641	15 Dec 2023	19 Dec 2023	22 Dec 2023	28 Dec 2023†	22 Dec 2023	28 Dec 2023†
BH11	SE258512.014	LB300641	15 Dec 2023	19 Dec 2023	22 Dec 2023	28 Dec 2023†	22 Dec 2023	28 Dec 2023†
BH12	SE258512.015	LB300641	15 Dec 2023	19 Dec 2023	22 Dec 2023	28 Dec 2023†	22 Dec 2023	28 Dec 2023†
BH12	SE258512.016	LB300641	15 Dec 2023	19 Dec 2023	22 Dec 2023	28 Dec 2023†	22 Dec 2023	28 Dec 2023†
BH12	SE258512.017	LB300641	15 Dec 2023	19 Dec 2023	22 Dec 2023	28 Dec 2023†	22 Dec 2023	28 Dec 2023†
BH12	SE258512.018	LB300641	15 Dec 2023	19 Dec 2023	22 Dec 2023	28 Dec 2023†	22 Dec 2023	28 Dec 2023†
BH15	SE258512.019	LB300641	15 Dec 2023	19 Dec 2023	22 Dec 2023	28 Dec 2023†	22 Dec 2023	28 Dec 2023†
BH15	SE258512.020	LB300641	15 Dec 2023	19 Dec 2023	22 Dec 2023	28 Dec 2023†	22 Dec 2023	28 Dec 2023†
BH14	SE258512.021	LB300640	15 Dec 2023	19 Dec 2023	22 Dec 2023	28 Dec 2023†	22 Dec 2023	28 Dec 2023†
BH14	SE258512.022	LB300640	15 Dec 2023	19 Dec 2023	22 Dec 2023	28 Dec 2023†	22 Dec 2023	28 Dec 2023†
BH14	SE258512.023	LB300640	15 Dec 2023	19 Dec 2023	22 Dec 2023	28 Dec 2023†	22 Dec 2023	28 Dec 2023†
BH14	SE258512.024	LB300640	15 Dec 2023	19 Dec 2023	22 Dec 2023	28 Dec 2023†	22 Dec 2023	28 Dec 2023†

Moisture Content

Method: ME-(AU)-[ENV]AN002

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
BH1	SE258512.001	LB300540	15 Dec 2023	19 Dec 2023	29 Dec 2023	27 Dec 2023	01 Jan 2024	28 Dec 2023
BH1	SE258512.002	LB300540	15 Dec 2023	19 Dec 2023	29 Dec 2023	27 Dec 2023	01 Jan 2024	28 Dec 2023
BH2	SE258512.003	LB300540	15 Dec 2023	19 Dec 2023	29 Dec 2023	27 Dec 2023	01 Jan 2024	28 Dec 2023
BH3	SE258512.004	LB300540	15 Dec 2023	19 Dec 2023	29 Dec 2023	27 Dec 2023	01 Jan 2024	28 Dec 2023
BH3	SE258512.005	LB300540	15 Dec 2023	19 Dec 2023	29 Dec 2023	27 Dec 2023	01 Jan 2024	28 Dec 2023
BH4	SE258512.006	LB300540	15 Dec 2023	19 Dec 2023	29 Dec 2023	27 Dec 2023	01 Jan 2024	28 Dec 2023
BH8	SE258512.007	LB300540	15 Dec 2023	19 Dec 2023	29 Dec 2023	27 Dec 2023	01 Jan 2024	28 Dec 2023

SGS holding time criteria are drawn from current regulations and are highly dependent on sample container preservation as specified in the SGS "Field Sampling Guide for Containers and Holding Time" (ref: GU-(AU)-ENV.001). Soil samples guidelines are derived from NEPM "Schedule B(3) Guideline on Laboratory Analysis of Potentially Contaminated Soils". Water sample guidelines are derived from "AS/NZS 5667.1 : 1998 Water Quality - sampling part 1" and APHA "Standard Methods for the Examination of Water and Wastewater" 21st edition 2005.

Extraction and analysis holding time due dates listed are calculated from the date sampled, although holding times may be extended after laboratory extraction for some analytes. The due dates are the suggested dates that samples may be held before extraction or analysis and still be considered valid.

Extraction and analysis dates are shown in **Green** when within suggested criteria or **Red** with an appended dagger symbol (†) when outside suggested criteria. If the

Moisture Content (continued)

Method: ME-(AU)-[ENV]AN002

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
BH8	SE258512.008	LB300540	15 Dec 2023	19 Dec 2023	29 Dec 2023	27 Dec 2023	01 Jan 2024	28 Dec 2023
BH9	SE258512.009	LB300540	15 Dec 2023	19 Dec 2023	29 Dec 2023	27 Dec 2023	01 Jan 2024	28 Dec 2023
BH9	SE258512.010	LB300540	15 Dec 2023	19 Dec 2023	29 Dec 2023	27 Dec 2023	01 Jan 2024	28 Dec 2023
BH11	SE258512.011	LB300540	15 Dec 2023	19 Dec 2023	29 Dec 2023	27 Dec 2023	01 Jan 2024	28 Dec 2023
BH11	SE258512.012	LB300540	15 Dec 2023	19 Dec 2023	29 Dec 2023	27 Dec 2023	01 Jan 2024	28 Dec 2023
BH11	SE258512.013	LB300540	15 Dec 2023	19 Dec 2023	29 Dec 2023	27 Dec 2023	01 Jan 2024	28 Dec 2023
BH11	SE258512.014	LB300540	15 Dec 2023	19 Dec 2023	29 Dec 2023	27 Dec 2023	01 Jan 2024	28 Dec 2023
BH12	SE258512.015	LB300540	15 Dec 2023	19 Dec 2023	29 Dec 2023	27 Dec 2023	01 Jan 2024	28 Dec 2023
BH12	SE258512.016	LB300540	15 Dec 2023	19 Dec 2023	29 Dec 2023	27 Dec 2023	01 Jan 2024	28 Dec 2023
BH12	SE258512.017	LB300540	15 Dec 2023	19 Dec 2023	29 Dec 2023	27 Dec 2023	01 Jan 2024	28 Dec 2023
BH12	SE258512.018	LB300540	15 Dec 2023	19 Dec 2023	29 Dec 2023	27 Dec 2023	01 Jan 2024	28 Dec 2023
BH15	SE258512.019	LB300540	15 Dec 2023	19 Dec 2023	29 Dec 2023	27 Dec 2023	01 Jan 2024	28 Dec 2023
BH15	SE258512.020	LB300540	15 Dec 2023	19 Dec 2023	29 Dec 2023	27 Dec 2023	01 Jan 2024	28 Dec 2023
BH14	SE258512.021	LB300537	15 Dec 2023	19 Dec 2023	29 Dec 2023	27 Dec 2023	01 Jan 2024	28 Dec 2023
BH14	SE258512.022	LB300537	15 Dec 2023	19 Dec 2023	29 Dec 2023	27 Dec 2023	01 Jan 2024	28 Dec 2023
BH14	SE258512.023	LB300537	15 Dec 2023	19 Dec 2023	29 Dec 2023	27 Dec 2023	01 Jan 2024	28 Dec 2023
BH14	SE258512.024	LB300537	15 Dec 2023	19 Dec 2023	29 Dec 2023	27 Dec 2023	01 Jan 2024	28 Dec 2023

pH in soil (1:2)

Method: ME-(AU)-[ENV]AN101

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
BH1	SE258512.001	LB300597	15 Dec 2023	19 Dec 2023	22 Dec 2023	27 Dec 2023†	28 Dec 2023	28 Dec 2023
BH1	SE258512.002	LB300597	15 Dec 2023	19 Dec 2023	22 Dec 2023	27 Dec 2023†	28 Dec 2023	28 Dec 2023
BH2	SE258512.003	LB300597	15 Dec 2023	19 Dec 2023	22 Dec 2023	27 Dec 2023†	28 Dec 2023	28 Dec 2023
BH3	SE258512.004	LB300597	15 Dec 2023	19 Dec 2023	22 Dec 2023	27 Dec 2023†	28 Dec 2023	28 Dec 2023
BH3	SE258512.005	LB300597	15 Dec 2023	19 Dec 2023	22 Dec 2023	27 Dec 2023†	28 Dec 2023	28 Dec 2023
BH4	SE258512.006	LB300597	15 Dec 2023	19 Dec 2023	22 Dec 2023	27 Dec 2023†	28 Dec 2023	28 Dec 2023
BH8	SE258512.007	LB300597	15 Dec 2023	19 Dec 2023	22 Dec 2023	27 Dec 2023†	28 Dec 2023	28 Dec 2023
BH8	SE258512.008	LB300597	15 Dec 2023	19 Dec 2023	22 Dec 2023	27 Dec 2023†	28 Dec 2023	28 Dec 2023
BH9	SE258512.009	LB300597	15 Dec 2023	19 Dec 2023	22 Dec 2023	27 Dec 2023†	28 Dec 2023	28 Dec 2023
BH9	SE258512.010	LB300597	15 Dec 2023	19 Dec 2023	22 Dec 2023	27 Dec 2023†	28 Dec 2023	28 Dec 2023
BH11	SE258512.011	LB300597	15 Dec 2023	19 Dec 2023	22 Dec 2023	27 Dec 2023†	28 Dec 2023	28 Dec 2023
BH11	SE258512.012	LB300597	15 Dec 2023	19 Dec 2023	22 Dec 2023	27 Dec 2023†	28 Dec 2023	28 Dec 2023
BH11	SE258512.013	LB300597	15 Dec 2023	19 Dec 2023	22 Dec 2023	27 Dec 2023†	28 Dec 2023	28 Dec 2023
BH11	SE258512.014	LB300597	15 Dec 2023	19 Dec 2023	22 Dec 2023	27 Dec 2023†	28 Dec 2023	28 Dec 2023
BH12	SE258512.015	LB300597	15 Dec 2023	19 Dec 2023	22 Dec 2023	27 Dec 2023†	28 Dec 2023	28 Dec 2023
BH12	SE258512.016	LB300597	15 Dec 2023	19 Dec 2023	22 Dec 2023	27 Dec 2023†	28 Dec 2023	28 Dec 2023
BH12	SE258512.017	LB300597	15 Dec 2023	19 Dec 2023	22 Dec 2023	27 Dec 2023†	28 Dec 2023	28 Dec 2023
BH12	SE258512.018	LB300597	15 Dec 2023	19 Dec 2023	22 Dec 2023	27 Dec 2023†	28 Dec 2023	28 Dec 2023
BH15	SE258512.019	LB300597	15 Dec 2023	19 Dec 2023	22 Dec 2023	27 Dec 2023†	28 Dec 2023	28 Dec 2023
BH15	SE258512.020	LB300597	15 Dec 2023	19 Dec 2023	22 Dec 2023	27 Dec 2023†	28 Dec 2023	28 Dec 2023
BH14	SE258512.021	LB300598	15 Dec 2023	19 Dec 2023	22 Dec 2023	27 Dec 2023†	28 Dec 2023	27 Dec 2023
BH14	SE258512.022	LB300598	15 Dec 2023	19 Dec 2023	22 Dec 2023	27 Dec 2023†	28 Dec 2023	27 Dec 2023
BH14	SE258512.023	LB300598	15 Dec 2023	19 Dec 2023	22 Dec 2023	27 Dec 2023†	28 Dec 2023	27 Dec 2023
BH14	SE258512.024	LB300598	15 Dec 2023	19 Dec 2023	22 Dec 2023	27 Dec 2023†	28 Dec 2023	27 Dec 2023

Soluble Anions in Soil from 1:2 DI Extract by Ion Chromatography

Method: ME-(AU)-[ENV]AN245

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
BH1	SE258512.001	LB300599	15 Dec 2023	19 Dec 2023	22 Dec 2023	27 Dec 2023†	24 Jan 2024	03 Jan 2024
BH1	SE258512.002	LB300599	15 Dec 2023	19 Dec 2023	22 Dec 2023	27 Dec 2023†	24 Jan 2024	03 Jan 2024
BH2	SE258512.003	LB300599	15 Dec 2023	19 Dec 2023	22 Dec 2023	27 Dec 2023†	24 Jan 2024	03 Jan 2024
BH3	SE258512.004	LB300599	15 Dec 2023	19 Dec 2023	22 Dec 2023	27 Dec 2023†	24 Jan 2024	03 Jan 2024
BH3	SE258512.005	LB300599	15 Dec 2023	19 Dec 2023	22 Dec 2023	27 Dec 2023†	24 Jan 2024	03 Jan 2024
BH4	SE258512.006	LB300599	15 Dec 2023	19 Dec 2023	22 Dec 2023	27 Dec 2023†	24 Jan 2024	03 Jan 2024
BH8	SE258512.007	LB300599	15 Dec 2023	19 Dec 2023	22 Dec 2023	27 Dec 2023†	24 Jan 2024	03 Jan 2024
BH8	SE258512.008	LB300599	15 Dec 2023	19 Dec 2023	22 Dec 2023	27 Dec 2023†	24 Jan 2024	03 Jan 2024
BH9	SE258512.009	LB300599	15 Dec 2023	19 Dec 2023	22 Dec 2023	27 Dec 2023†	24 Jan 2024	03 Jan 2024
BH9	SE258512.010	LB300599	15 Dec 2023	19 Dec 2023	22 Dec 2023	27 Dec 2023†	24 Jan 2024	03 Jan 2024
BH11	SE258512.011	LB300599	15 Dec 2023	19 Dec 2023	22 Dec 2023	27 Dec 2023†	24 Jan 2024	03 Jan 2024
BH11	SE258512.012	LB300599	15 Dec 2023	19 Dec 2023	22 Dec 2023	27 Dec 2023†	24 Jan 2024	03 Jan 2024
BH11	SE258512.013	LB300599	15 Dec 2023	19 Dec 2023	22 Dec 2023	27 Dec 2023†	24 Jan 2024	03 Jan 2024
BH11	SE258512.014	LB300599	15 Dec 2023	19 Dec 2023	22 Dec 2023	27 Dec 2023†	24 Jan 2024	03 Jan 2024

SGS holding time criteria are drawn from current regulations and are highly dependent on sample container preservation as specified in the SGS "Field Sampling Guide for Containers and Holding Time" (ref: GU-(AU)-ENV.001). Soil samples guidelines are derived from NEPM "Schedule B(3) Guideline on Laboratory Analysis of Potentially Contaminated Soils". Water sample guidelines are derived from "AS/NZS 5667.1 : 1998 Water Quality - sampling part 1" and APHA "Standard Methods for the Examination of Water and Wastewater" 21st edition 2005.

Extraction and analysis holding time due dates listed are calculated from the date sampled, although holding times may be extended after laboratory extraction for some analytes. The due dates are the suggested dates that samples may be held before extraction or analysis and still be considered valid.

Extraction and analysis dates are shown in **Green** when within suggested criteria or **Red** with an appended dagger symbol (†) when outside suggested criteria. If the

Soluble Anions in Soil from 1:2 DI Extract by Ion Chromatography (continued)

Method: ME-(AU)-[ENV]AN245

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
BH12	SE258512.015	LB300599	15 Dec 2023	19 Dec 2023	22 Dec 2023	27 Dec 2023†	24 Jan 2024	03 Jan 2024
BH12	SE258512.016	LB300599	15 Dec 2023	19 Dec 2023	22 Dec 2023	27 Dec 2023†	24 Jan 2024	03 Jan 2024
BH12	SE258512.017	LB300599	15 Dec 2023	19 Dec 2023	22 Dec 2023	27 Dec 2023†	24 Jan 2024	03 Jan 2024
BH12	SE258512.018	LB300599	15 Dec 2023	19 Dec 2023	22 Dec 2023	27 Dec 2023†	24 Jan 2024	03 Jan 2024
BH15	SE258512.019	LB300599	15 Dec 2023	19 Dec 2023	22 Dec 2023	27 Dec 2023†	24 Jan 2024	03 Jan 2024
BH15	SE258512.020	LB300599	15 Dec 2023	19 Dec 2023	22 Dec 2023	27 Dec 2023†	24 Jan 2024	03 Jan 2024
BH14	SE258512.021	LB300600	15 Dec 2023	19 Dec 2023	22 Dec 2023	27 Dec 2023†	24 Jan 2024	28 Dec 2023
BH14	SE258512.022	LB300600	15 Dec 2023	19 Dec 2023	22 Dec 2023	27 Dec 2023†	24 Jan 2024	28 Dec 2023
BH14	SE258512.023	LB300600	15 Dec 2023	19 Dec 2023	22 Dec 2023	27 Dec 2023†	24 Jan 2024	28 Dec 2023
BH14	SE258512.024	LB300600	15 Dec 2023	19 Dec 2023	22 Dec 2023	27 Dec 2023†	24 Jan 2024	28 Dec 2023

SURROGATES

Surrogate results are evaluated against upper and lower limit criteria established in the SGS QA/QC plan (Ref: MP-(AU)-[ENV]QU-022). At least two of three routine level soil sample surrogate spike recoveries for BTEX/VOC are to be within 70-130% where control charts have not been developed and within the established control limits for charted surrogates. Matrix effects may void this as an acceptance criterion. Water sample surrogate spike recoveries are to be within 40-130%. The presence of emulsions, surfactants and particulates may void this as an acceptance criterion.

Result is shown in **Green** when within suggested criteria or **Red** with an appended reason identifer when outside suggested criteria. Refer to the footnotes section at the end of this report for failure reasons.

No surrogates were required for this job.

METHOD BLANKS

Blank results are evaluated against the limit of reporting (LOR), for the chosen method and its associated instrumentation, typically 2.5 times the statistically determined method detection limit (MDL).

Result is shown in **Green** when within suggested criteria or **Red** with an appended dagger symbol (†) when outside suggested criteria.

Conductivity (1:2) in soil

Method: ME-(AU)-[ENV]AN106

Sample Number	Parameter	Units	LOR	Result
LB300597.001	Conductivity (1:2) @25 C*	µS/cm	1	<1
LB300598.001	Conductivity (1:2) @25 C*	µS/cm	1	<1

Conductivity and TDS by Calculation - Soil

Method: ME-(AU)-[ENV]AN106

Sample Number	Parameter	Units	LOR	Result
LB300640.001	Conductivity of Extract (1:5 dry sample basis)	µS/cm	1	1.33
LB300641.001	Conductivity of Extract (1:5 dry sample basis)	µS/cm	1	0.8

Soluble Anions in Soil from 1:2 DI Extract by Ion Chromatography

Method: ME-(AU)-[ENV]AN245

Sample Number	Parameter	Units	LOR	Result
LB300599.001	Chloride	mg/kg	0.25	<0.25
	Sulfate	mg/kg	0.5	<0.5
LB300599.025	Chloride	mg/kg	0.25	<0.25
	Sulfate	mg/kg	0.5	<0.5
LB300600.001	Chloride	mg/kg	0.25	<0.25
	Sulfate	mg/kg	0.5	<0.5

DUPLICATES

Duplicates are calculated as Relative Percentage Difference (RPD) using the formula: RPD = | OriginalResult - ReplicateResult | x 100 / Mean

The RPD is evaluated against the Maximum Allowable Difference (MAD) criteria and can be graphically represented by a curve calculated from the Statistical Detection Limit (SDL) and Limiting Repeatability (LR) using the formula: MAD = 100 x SDL / Mean + LR

Where the Maximum Allowable Difference evaluates to a number larger than 200 it is displayed as 200.

RPD is shown in **Green** when within suggested criteria or **Red** with an appended reason identifer when outside suggested criteria. Refer to the footnotes section at the end of this report for failure reasons.

NOTE: The RPD reported is calculated from the unrounded data for the original and replicate result. Manual calculation of the RPD from the rounded data reported may

Conductivity (1:2) in soil

Method: ME-(AU)-[ENV]AN106

Original	Duplicate	Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
SE258512.010	LB300597.014	Conductivity (1:2) @25 C*	µS/cm	1	760	780	30	3
		Resistivity (1:2)*	ohm cm	-	1300	1300	31	3
SE258512.020	LB300597.025	Conductivity (1:2) @25 C*	µS/cm	1	610	630	30	3
		Resistivity (1:2)*	ohm cm	-	1600	1600	31	3
SE258512.022	LB300598.014	Conductivity (1:2) @25 C*	µS/cm	1	740	750	30	3
		Resistivity (1:2)*	ohm cm	-	1400	1300	31	3
SE258512.024	LB300598.017	Conductivity (1:2) @25 C*	µS/cm	1	650	640	30	1
		Resistivity (1:2)*	ohm cm	-	1500	1600	31	1

Conductivity and TDS by Calculation - Soil

Method: ME-(AU)-[ENV]AN106

Original	Duplicate	Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
SE258512.010	LB300641.014	Conductivity of Extract (1:5 dry sample basis)	µS/cm	1	420	410	30	1
SE258512.020	LB300641.025	Conductivity of Extract (1:5 dry sample basis)	µS/cm	1	350	390	31	9
SE258512.024	LB300640.020	Conductivity of Extract (1:5 dry sample basis)	µS/cm	1	410	400	30	2

Moisture Content

Method: ME-(AU)-[ENV]AN002

Original	Duplicate	Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
SE258512.010	LB300540.011	% Moisture	%w/w	1	8.9	8.2	42	8
SE258512.020	LB300540.022	% Moisture	%w/w	1	9.6	11.0	40	14
SE258512.022	LB300537.011	% Moisture	%w/w	1	11.8	11.5	39	2
SE258512.024	LB300537.014	% Moisture	%w/w	1	10.9	9.9	40	10

pH in soil (1:2)

Method: ME-(AU)-[ENV]AN101

Original	Duplicate	Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
SE258512.010	LB300597.014	pH (1:2)	pH Units	-	8.1	8.1	31	0
SE258512.020	LB300597.025	pH (1:2)	pH Units	-	8.5	8.5	31	0
SE258512.022	LB300598.014	pH (1:2)	pH Units	-	8.3	8.3	31	1
SE258512.024	LB300598.017	pH (1:2)	pH Units	-	8.2	8.2	31	0

Soluble Anions in Soil from 1:2 DI Extract by Ion Chromatography

Method: ME-(AU)-[ENV]AN245

Original	Duplicate	Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
SE258512.010	LB300599.014	Chloride	mg/kg	0.25	170	170	30	4
		Sulfate	mg/kg	0.5	350	360	31	5
SE258512.020	LB300599.027	Chloride	mg/kg	0.25	130	130	30	5
		Sulfate	mg/kg	0.5	200	210	31	7
SE258512.022	LB300600.014	Chloride	mg/kg	0.25	190	200	30	4
		Sulfate	mg/kg	0.5	290	300	31	3
SE258512.024	LB300600.017	Chloride	mg/kg	0.25	190	190	30	3
		Sulfate	mg/kg	0.5	270	270	31	1

LABORATORY CONTROL SAMPLES

Laboratory Control Standard (LCS) results are evaluated against an expected result, typically the concentration of analyte spiked into the control during the sample preparation stage, producing a percentage recovery. The criteria applied to the percentage recovery is established in the SGS QA /QC plan (Ref: MP-(AU)-[ENV]QU-022). For more information refer to the footnotes in the concluding page of this report.

Recovery is shown in **Green** when within suggested criteria or **Red** with an appended dagger symbol (†) when outside suggested criteria.

Conductivity (1:2) in soil

Method: ME-(AU)-[ENV]AN106

Sample Number	Parameter	Units	LOR	Result	Expected	Criteria %	Recovery %
LB300597.002	Conductivity (1:2) @25 C*	µS/cm	1	310	303	70 - 130	102
LB300598.002	Conductivity (1:2) @25 C*	µS/cm	1	320	303	70 - 130	106

Conductivity and TDS by Calculation - Soil

Method: ME-(AU)-[ENV]AN106

Sample Number	Parameter	Units	LOR	Result	Expected	Criteria %	Recovery %
LB300640.002	Conductivity of Extract (1:5 dry sample basis)	µS/cm	1	NA	303	85 - 115	101
LB300641.002	Conductivity of Extract (1:5 dry sample basis)	µS/cm	1	NA	303	85 - 115	104

pH in soil (1:2)

Method: ME-(AU)-[ENV]AN101

Sample Number	Parameter	Units	LOR	Result	Expected	Criteria %	Recovery %
LB300597.003	pH (1:2)	pH Units	-	7.4	7.415	98 - 102	100
LB300598.003	pH (1:2)	pH Units	-	7.4	7.415	98 - 102	100

Soluble Anions in Soil from 1:2 DI Extract by Ion Chromatography

Method: ME-(AU)-[ENV]AN245

Sample Number	Parameter	Units	LOR	Result	Expected	Criteria %	Recovery %
LB300599.002	Chloride	mg/kg	0.25	37	40	70 - 130	93
	Sulfate	mg/kg	0.5	37	40	70 - 130	92
LB300599.026	Chloride	mg/kg	0.25	37	40	70 - 130	94
	Sulfate	mg/kg	0.5	37	40	70 - 130	92
LB300600.002	Chloride	mg/kg	0.25	43	40	70 - 130	107
	Sulfate	mg/kg	0.5	42	40	70 - 130	106

MATRIX SPIKES

Matrix Spike (MS) results are evaluated as the percentage recovery of an expected result, typically the concentration of analyte spiked into a field sub -sample during the sample preparation stage. The original sample's result is subtracted from the sub-sample result before determining the percentage recovery. The criteria applied to the percentage recovery is established in the SGS QA/QC plan (ref: MP-(AU)-[ENV]QU-022). For more information refer to the footnotes in the concluding page of this report.

Recovery is shown in **Green** when within suggested criteria or **Red** with an appended reason identifer when outside suggested criteria. Refer to the footnotes section at the end of this report for failure reasons.

No matrix spikes were required for this job.

MATRIX SPIKE DUPLICATES

Matrix spike duplicates are calculated as Relative Percent Difference (RPD) using the formula: RPD = | OriginalResult - ReplicateResult | x 100 / Mean

The original result is the analyte concentration of the matrix spike. The Duplicate result is the analyte concentration of the matrix spike duplicate.

The RPD is evaluated against the Maximum Allowable Difference (MAD) criteria and can be graphically represented by a curve calculated from the Statistical Detection Limit (SDL) and Limiting Repeatability (LR) using the formula: MAD = 100 x SDL / Mean + LR

Where the Maximum Allowable Difference evaluates to a number larger than 200 it is displayed as 200.

RPD is shown in **Green** when within suggested criteria or **Red** with an appended reason identifer when outside suggested criteria. Refer to the footnotes section at the

No matrix spike duplicates were required for this job.

Samples analysed as received.

Solid samples expressed on a dry weight basis.

QC criteria are subject to internal review according to the SGS QA/QC plan and may be provided on request or alternatively can be found here: https://www.sgs.com.au/~/media/Local/Australia/Documents/Technical Documents/MP-AU-ENV-QU-022 QA QC Plan.pdf

*	NATA accreditation does not cover the performance of this service.
**	Indicative data, theoretical holding time exceeded.
***	Indicates that both * and ** apply.
-	Sample not analysed for this analyte.
IS	Insufficient sample for analysis.
LNR	Sample listed, but not received.
LOR	Limit of reporting.
QFH	QC result is above the upper tolerance.
QFL	QC result is below the lower tolerance.
①	At least 2 of 3 surrogates are within acceptance criteria.
②	RPD failed acceptance criteria due to sample heterogeneity.
③	Results less than 5 times LOR preclude acceptance criteria for RPD.
④	Recovery failed acceptance criteria due to matrix interference.
⑤	Recovery failed acceptance criteria due to the presence of significant concentration of analyte (i.e. the concentration of analyte exceeds the spike level).
⑥	LOR was raised due to sample matrix interference.
⑦	LOR was raised due to dilution of significantly high concentration of analyte in sample.
⑧	Reanalysis of sample in duplicate confirmed sample heterogeneity and inconsistency of results.
⑨	Recovery failed acceptance criteria due to sample heterogeneity.
⑩	LOR was raised due to high conductivity of the sample (required dilution).
†	Refer to relevant report comments for further information.

GEOTECHNIQUE PTY LTD

E-MAILED
20/12/23 @ 6.30 pm

Laboratory Test Request / Chain of Custody Record

Lemko Place
PENRITH NSW 2750

P O Box 880
PENRITH NSW 2751

Tel: (02) 4722 2700
Fax: (02) 4722 6161
email: info@geotech.com.au

Page

TO: SGS ENVIRONMENTAL SERVICES
UNIT 16
33 MADDOX STREET
ALEXANDRIA NSW 2015

PH: 02 8594 0400 **FAX:** 02 8594 0499
ATTN: Ms Emily Yin

Sampling By: JH
Job No: 20465/3
Project: Proposed High School
Project Manager: IJ
Location: Gregory Hills Drive, Gregory Hills

SGS EHS Sydney COC
SE258512

	Sampling details				Results required by: IJ							
	Location	Depth	Soil	Water	EC (1:5)	Aggressivity					Remarks	Keep Sample
1	BH1	0.5-0.7	DSP		✓	✓						✓
2	BH1	1.0-1.2	DSP		✓	✓					Aggressivity Test Includes	✓
3	BH2	0.8-1.0	DSP		✓	✓					pH, Cl, SO4 and Resistivity	✓
4	BH3	1.0-1.2	DSP		✓	✓						✓
5	BH3	2.8-3.0'	DSP		✓	✓						✓
6	BH4	0.4-0.6	DSP		✓	✓						✓
7	BH8	0.4-0.6	DSP		✓	✓						✓
8	BH8	1.0-1.2	DSP		✓	✓						✓
9	BH9	0.4-0.6	DSP		✓	✓						✓
10	BH9	1.0-1.2	DSP		✓	✓						✓
11	BH11	1.0-1.2	DSP		✓	✓						✓
12	BH11	3.0-3.2	DSP		✓	✓						✓
13	BH11	5.0-5.2	DSP		✓	✓						✓
14	BH11	7.0-7.2	DSP		✓	✓						✓
15	BH12	1.5-1.95	DSP		✓	✓						✓
16	BH12	3.0-3.45	DSP		✓	✓						✓
17	BH12	4.5-4.95	DSP		✓	✓						✓
18	BH12	10.0-10.2	DSP		✓	✓						✓
19	BH15	1.5-1.95	DSP		✓	✓						✓
20	BH15	3.0-3.45	DSP		✓	✓						✓
21	BH14	1.0-1.2	DSP		✓	✓						✓
22	BH14	3.0-3.2	DSP		✓	✓						✓
23	BH14	5.0-5.2	DSP		✓	✓						✓
24	BH14	7.5-7.7	DSP		✓	✓						✓

Full Excel Output File Please

Relinquished by			Received by			
Name	Signature	Date	Name	Signature		
Indra Jworchan		15-Dec-23	G.F		19/12/23	2:15

Legend:
WG
WP
Form No 4.7F2-5 SGS

USG Undisturbed soil sample (glass j
DSG Disturbed soil sample (glass jar)
DSP Disturbed soil sample (small plastic bag)
✓ Test required
* Purge & Trap
# Geotechnique Screen

SE258512

SAMPLE RECEIPT ADVICE

CLIENT DETAILS

Contact	Indra Jworchan
Client	Geotechnique
Address	P.O. Box 880 NSW 2751
Telephone	02 4722 2700
Facsimile	02 4722 6161
Email	indra.jworchan@geotech.com.au
Project	**20465/3 Gregory Hills Drive, Gregory Hil**
Order Number	**20465/3**
Samples	24

LABORATORY DETAILS

Manager	Huong Crawford
Laboratory	SGS Alexandria Environmental
Address	Unit 16, 33 Maddox St Alexandria NSW 2015
Telephone	+61 2 8594 0400
Facsimile	+61 2 8594 0499
Email	au.environmental.sydney@sgs.com
Samples Received	Tue 19/12/2023
Report Due	Tue 2/1/2024
SGS Reference	**SE258512**

SUBMISSION DETAILS

This is to confirm that 24 samples were received on Tuesday 19/12/2023. Results are expected to be ready by COB Tuesday 2/1/2024. Please quote SGS reference SE258512 when making enquiries. Refer below for details relating to sample integrity upon receipt.

Sample counts by matrix	24 Soil	Type of documentation received	COC
Date documentation received	20/12/2023@6:30pm	Samples received in good order	Yes
Samples received without headspace	N/A	Sample temperature upon receipt	25.8°C
Sample container provider	Client	Turnaround time requested	Standard
Samples received in correct containers	Yes	Sufficient sample for analysis	Yes
Sample cooling method	None	Samples clearly labelled	Yes
Complete documentation received	Yes		

Unless otherwise instructed, water and bulk samples will be held for one month from date of report, and soil samples will be held for two months.

COMMENTS

SAMPLE RECEIPT ADVICE

SE258512

CLIENT DETAILS

Client Geotechnique

Project 20465/3 Gregory Hills Drive, Gregory Hil

SUMMARY OF ANALYSIS

No.	Sample ID	Conductivity (1:2) in soil	Conductivity and TDS by Calculation - Soil	Moisture Content	pH in soil (1:2)	Soluble Anions in Soil from 1:2 DI Extract by Ion
001	BH1 0.5-0.7	2	1	1	1	2
002	BH1 1.0-1.2	2	1	1	1	2
003	BH2 0.8-1.0	2	1	1	1	2
004	BH3 1.0-1.2	2	1	1	1	2
005	BH3 2.8-3.0	2	1	1	1	2
006	BH4 0.4-0.6	2	1	1	1	2
007	BH8 0.4-0.6	2	1	1	1	2
008	BH8 1.0-1.2	2	1	1	1	2
009	BH9 0.4-0.6	2	1	1	1	2
010	BH9 1.0-1.2	2	1	1	1	2
011	BH11 1.0-1.2	2	1	1	1	2
012	BH11 3.0-3.2	2	1	1	1	2
013	BH11 5.0-5.2	2	1	1	1	2
014	BH11 7.0-7.2	2	1	1	1	2
015	BH12 1.5-1.95	2	1	1	1	2
016	BH12 3.0-3.45	2	1	1	1	2
017	BH12 4.5-4.95	2	1	1	1	2
018	BH12 10.0-10.2	2	1	1	1	2
019	BH15 1.5-1.95	2	1	1	1	2
020	BH15 3.0-3.45	2	1	1	1	2
021	BH14 1.0-1.2	2	1	1	1	2
022	BH14 3.0-3.2	2	1	1	1	2
023	BH14 5.0-5.2	2	1	1	1	2
024	BH14 7.5-7.7	2	1	1	1	2

The above table represents SGS' interpretation of the client-supplied Chain Of Custody document.
The numbers shown in the table indicate the number of results requested in each package.
Please indicate as soon as possible should your request differ from these details .
Testing as per this table shall commence immediately unless the client intervenes with a correction .