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Report

Salinity Management Plan
Proposed New Amity College Campus
Lot 1 DP 525996 No 85 Byron Road and
Lot 2 DP 525996 No 63 Ingleburn Road
Leppington, NSW

Prepared for:
Amity College
C/- Gran Associates Pty Ltd
Level 1, 597 Darling Street
ROZELLE NSW 2039

Ref: JC18322C-r1(rev)
May 2019

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10th May 2019

Our Ref: JC18322C-r1(rev)

Amity College
C/- Gran Associates Pty Ltd
Level 1, 597 Darling Street
ROZELLE NSW 2039

Attention: Mr Peter Reed

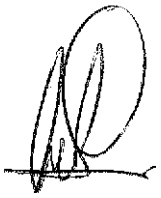
Dear Sir

Re: Salinity Management Plan
Proposed New Amity College Campus
Lot 1 DP 525996 No 85 Byron Road and
Lot 2 DP 525996 No 63 Ingleburn Road Leppington

Further to our Geotechnical and Salinity Investigation report (referenced JC18322A-r2(rev2) dated May 2019), this report presents our Salinity Management Plan (SMP) for the above site.

Should you have any queries, please contact the undersigned.

Yours faithfully,
GeoEnviro Consultancy Pty Ltd



Solern Liew MIEA CPEng NER
Director

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1. INTRODUCTION

This report presents the results of our Salinity Management Plan for the site referred to as Lot 1 DP 525996 No 85 Byron Road and Lot 2 DP 525996 No 63 Ingleburn Road Leppington as shown on Drawing No 1.

We understand that the site occupies an area of about 3.3 hectares and the major southern and middle portions of the site is Zoned SP2 (Education Establishment) with the front portion of the site Zoned R3 (Residential). The proposed New Amity College Campus will occupy the portion of site Zoned SP2 and based on the masterplan drawings provided, the proposed school buildings will be 4 to 5 storeys high and will include a basement level requiring excavation up to 6m deep. Refer for Drawing No 2 for zoning plan and Drawing No 3 for proposed development plan.

The site was the subject of a geotechnical and salinity investigation undertaken by GeoEnviro and this was compiled in our report referenced JC18322A-r2(rev2) dated April 2019 (Reference 1).

The objective of this SMP was to provide a salinity management strategy to mitigate potential adverse impact of saline soils on the proposed development.

2. SITE INFORMATION

2.1 Site Location

The site is located at the south western corner of Ingleburn Road and Byron Road in Leppington and is approximately trapezoidal in shape measuring about 100m along Ingleburn Road and 290m along Bryon Road. The site widens to 125m at the rear. Refer to Drawing No 1 for site locality.

The site is within the jurisdiction of Camden Council, Parish of Cook and County of Cumberland.

Surrounding properties consist mainly of semi-rural residential allotments.

2.2 Site Topography and Ground Cover

The site is situated in a region typically characterised as gently undulating with relatively uniform ground surface generally falling to the north and north west towards Bonds Creek and Kemps Creek at angles typically ranging from 2 to 6 degrees**.**

Within the site, the northern portion of the site is approximately level with a slight dip to the north at angles of less than 2 degrees. Ground surface on the southern portion generally slopes towards a depression along western boundary at angles of between 3 and 4 degrees. Based on the survey drawing (Drawing No 1), the south eastern corner of the site is at Reduced Level (RL) 102.5m Australian Height Datum (AHD) and the north western corner of the site is at RL 93m AHD.

2.3 Ground Cover and Salinity Indicators

The site ground cover consists predominantly of thick grass with tree canopies on the southern portion. The site appeared well drained with no visible signs of permanent water-logged areas, groundwater or "springs" and this is confirmed by survey drawing and the uniformly hard and dry natural clay which exists across the entire site.

There were no obvious signs and indicators of salinity impacts such salt crystals on the surface, salt attacks and markings on existing building footings and vegetation distress.

2.4 Soil Landscape and Geological Setting

The 1:100,000 Soil Landscape of Penrith Series 9030 (Reference 3) prepared by the Soil Conservation Services of NSW indicates the site to be underlain by Residual soil belonging to the Blacktown landscape group. Typically, soil consists of highly plastic and moderately reactive subsoils with low permeability. Refer to Drawing No 4 for site locality with reference to the soil landscape map.

The 1:100,000 Geological Map of Penrith Series 9030 (Reference 4) indicates the underlying bedrock to consist of Bringelly shale of the Wianamatta Group consisting of shale, carbonaceous claystone, claystone, laminite, fine to medium grained lithic sandstone, rare coal and tuff. Refer to Drawing No 5 for site locality with respect to the geological setting.

2.5 Hydrology and Hydrogeology

Topography, surface cover and geology control the hydrogeology of the site. It is anticipated that the majority of rainfall runoff will flow to Scalibrini Creek which leads to Bonds Creek and then into Kemps Creek to the north west.

Groundwater is also expected to flow in a general direction towards the west to Scalibrini Creek. Due to the relatively impervious nature of the underlying subsurface soil and bedrock, rainfall runoff infiltrating through the subsurface soil and expected bedrock profiles is expected to be minimal.

Based on our local knowledge and previous investigation of the general surrounding area, we expect permanent groundwater table to be at a significant depth below the proposed basement excavation level (ie 6m depth). The results of this investigation confirmed the subsurface profile to be dry with no subsurface groundwater seepage, aquifers or "springs".

Our search of the NSW Department of Primary Industries groundwater database for the region indicates five groundwater bores within 1km from the site as summarised below;

Bore ID	Depth (m)	SWL (m)	Northing (mAMG)	Easting (mAMG)	Recorded Use	Water Bearing Zones (m)
GW110356	6.00	2.50	6238969.0	297896.0	Monitoring	2.50-6.00
GW110359	6.00	2.90	6238973.0	297920.0	Monitoring	2.90-6.00
GW110358	7.00	4.90	6238993.0	297917.0	Monitoring	4.90-7.00
GW112660	-	-	6239181.0	296770.0	Monitoring	-

The above monitoring boreholes were located within an existing service station site along Camden Valley Way, approximately 600m to the west and the groundwater encountered is likely to be trapped groundwater around and within the underground tank farm and this is typical of service station sites.

2.6 Soil Salinity Map

Based on soil salinity risk map (Reference 5) prepared by the Western Sydney Regional Organisation of Councils Ltd, the site is situated in area with moderate salinity potential. Refer to Drawing No 6 for soil salinity map.

2.7 Acid Sulphate Soil Map

The acid sulphate soil risk map prepared by the Department of Land and Water Conservation (Reference 12) indicates the site to be situated in an area with "No Known Occurrence" of acid sulphate soil. Refer to Drawing No 7 for an extract of the map prepared by the Department of Land and Water Conservation.

2.8 Site Description

A site visit was carried out on the 23rd to 30th April 2018 and 4th April 2019 by a soil scientist and a geotechnical engineer to observe existing site features. Reference should be made to Drawing No 2 for site features.

At the time of the site investigation, the site was mainly used for residential with the southern rear portion of the site consisting of medium dense trees. Refer to attached Drawing No 2 for site features. The following is a summary of site features noted;

Site Feature	Description
A	Driveway constructed of crushed rock.
B	Single-storey brick, weatherboard and tile dwelling with a metal garage to the rear.
C	Single-storey fibro/metal dwelling with a number of small metal, timber and fibro sheds to the west. Sheds used for storage of miscelaneous items. Some minor hydrocarbon staining visible on surface
D	Driveway constructed of crushed rock, sandstone and traces of building debris (eg bricks and asphalt lumps)
E	Metal, timber and fibro shed with building extensions.
F	Area of previous numerous small buildings and sheds. Previous market garden area (1950s)
G	Backfilled depression with rubbish fill consisting of concrete boulders, bricks, glass and asbestos fragments
H	Recent Market Garden beds
I	Previous market garden/agricultural area

3. SALINITY INVESTIGATION

Field investigation was carried out on the 23rd and 24th April 2018 and 4th April 2019 was carried out in accordance with AS1726-2017 (Reference 11). The investigation involved drilling of forty five boreholes (BH 1 to BH 45) across the site as shown on Drawing No 8. The boreholes were drilled using a truck mounted B80 drill rig and a pendulum drill rig equipped for site investigation. The truck mounted drill rig boreholes (BH 1 to 40) were drilled using spiral augers attached to a V-bit to refusal followed by Tungsten Carbide (TC) bit drilling into shale to depths of about 0.9m to 4.0m below existing ground surface. The pendulum drill rig boreholes (BH 41 to 45) were drilled using a TC bit to refusal in shale at depths varying from 1.3m to 2.8m below existing grounds surface.

In order to assess the strength of the subsurface soil, Standard Penetration Testing (SPT) was carried out in the boreholes. Hand penetrometer testing was carried out on the recovered SPT split-tube clayey samples to augment the SPT results. The strength of the bedrock in the augered boreholes was subjectively assessed by examining the bedrock fragments from the drilling and engineering judgement.

Environmental soil samples were collected in duplicate from surface and at lower depths. Disturbed samples were taken from the site to our laboratory for analysis.

The test locations were located by offset measurements relative to site boundaries and site features. Refer to Drawing No 8 for borehole location plan and Borehole Logs in Appendix A for subsurface profiles encountered in each borehole. The reduced levels shown on the borehole logs were obtained from interpolation contour lines obtained from the surface plan (Drawing No 1).

To assess the likely impact of soil salinity to the proposed development, strategic soil sampling was carried out across the site targeting the following areas;

Salinity risk areas	**Borehole sampling**
Previous market garden area	BH 1, BH 5, BH 45
Current Market Gardens	BH 44
Built up Areas	BH 17
Buried Fill area and Depression area	BH 26, BH 28, BH 43
Proposed onsite stormwater detention area	BH 42
Treed area (Elevated area)	BH 31, BH 35, BH 41,

Samples were analysed for the following;

- pH
- Electrical Conductivity (Ec)
- Cation Exchange Capacity (CEC)
- Exchangeable Sodium Percentage (ESP)
- Chloride (Cl)
- Sulphate (S04)
- Resistivity
- Emerson Dispersion
- Particle Size Distribution

Emerson and Particle Size analysis was carried out in our NATA accredited laboratory. The salinity analysis was carried out by Envirolab Services. The laboratory test reports for the salinity assessment are attached in Appendix C of this report

4. SUBSURFACE CONDITIONS

Reference should be made to the Borehole Reports in Appendix A for a summary of subsurface profiles encountered in each borehole locations. Drawing No 9 to 11 provides typical soil and rock profile across the site.

The following is a summary of subsurface conditions noted;

Topsoil and Topsoil/Fill

Topsoil and topsoil/fill were encountered in all boreholes except BH 17 and 18 and 28 generally consisting of Clayey Silt of low liquid limit. Thickness of the topsoil and topsoil/fill was found to range from 200mm to 400mm.

in BH 23 some asphalt lumps and crushed rock were encountered noting that BH 23 was excavated along the edge of the accessway (Site Feature D).

Fill

Fill which thickness ranging from 300mm to 600mm was encountered on the surface of BH 17, 18 and 28 comprising of Clayey Silt/Silty Clay and Gravelly Silt.

Some asbestos and tile fragments were encountered within the fill in BH 28 and this fill appeared to have been placed in the previous depression area (ie Site Feature G). Based on test pits excavated as part of the contamination assessment (Reference 1), the buried fill from Site Feature G was found to be in excess of 2.3m and contains rubbish including concrete brick, plastic, metal and glass.

Natural Soil

Underlying the topsoil and fill in all boreholes, natural soil consisting generally of high plasticity Silty Clay was encountered. In general, the plasticity of the clay reduces to medium plasticity at lower depths with the inclusion of ironstone and siltstone bands, Gravelly Silty Clay and Interbedded Clay and Siltstone in some boreholes.

The natural clayey soil was generally assessed to be dry to moist (ie moisture content less than or equal to the plastic limit). Based on the SPT and hand penetrometer results, the upper 1.2m of the natural clay profile was assessed to be very stiff to hard and the strength increases to hard at lower depths.

Bedrock

Bedrock consisting of Siltstone and Shale/Siltstone was encountered in all boreholes except BH 3, 10, 14, 18 and 24 at depths ranging from 0.9m to 3.0m below existing ground surface. The Siltstone and Shale/Siltstone was subjectively assessed to be low to medium strength and extremely weathered to distinctly weathered.

Groundwater

All boreholes were found to be dry during and shortly after completion of the site investigation.

5. POLICIES AND GUIDELINES

5.1 Urban Salinity and Proposed Development

We understand that the proposed development will include the following;

- Bulk earthworks to regrade the site to design levels and basement excavation for the proposed school buildings.
- Construction of roads including footpaths and pedestrian pavements.
- Laying of underground services including drainage pipes, sewer pipes, water supply pipes, gas pipes and conduits (electrical and telecommunication).
- Formation of playing fields and reserves.
- Construction of retaining walls and school buildings

Salinity refers to the presence of excess salt in the environment and is able to occur if salts which are naturally found in soil or groundwater mobilise, allowing capillary rise and evaporation to concentrate the salt at the upper subsurface soil profile. Such movements are caused by changes in the natural water cycle. In urban areas, the processes which cause salinity are intensified by the increased volumes of water added to the natural system from irrigation of gardens, lawn and parks and from leaking infrastructures (eg pipes, sewer, stormwater, etc) and pool.

In recognition of the potential adverse impact of salinity to development, the Western Sydney Regional Organisation of Councils Ltd has a Salinity Code of Practice (Reference 5) to address the issue of salinity. It was acknowledged in the Code that salinity problems can change substantially over time and it is difficult to predict exactly where salinity will occur and how it will respond to the changing environment conditions.

5.2 Salinity Management Policy and Objectives

The salinity management policy to be adopted is as follows;

- The development of the site is carried out within the objectives and framework adopted by the Western Sydney Salinity Code of Practice. (Reference 5)
- The saline environment does not adversely impact on private and public assets.
- Adequate documentation and monitoring works are in placed and appropriate management practices are adopted.

The main objectives of this Salinity Management Plan (SMP) were to;

- Identify potential impacts of saline environment on the site during and after construction.
- Establish responsibilities and procedures for the various parties involved in the proposed development.
- Establish procedures to review the implementation process and corrective actions to improve the performance.

5.3 Guidelines and Code of Practice

The fundamental criterion for assessing soil salinity is based on Electrical Conductivity (Reference 2).

Class	**EC_e (ds/m)**
Non-Saline	<2
Slightly Saline	2-4
Moderately Saline	4-8
Very Saline	8-16
Highly Saline	>16

Soil dispersion relates to stability of the soil in the presence of water. The following is a measure of soil dispersion;

Emerson Class No	**Dispersibility**
1	Very High
2	High
3	High to Moderate
4	Moderate
5 and 6	Slight
7 and 8	Negligible/Aggregated

Sodic soils are dispersible and are vulnerable to erosion and tunnelling. Sodicity is a measure of Exchangeable Sodium Percentage (ESP) and Cation Exchangeable Capacity (CEC).

The following is a measure of soil sodicity;

ESP (%)	**Rating**
Less than 5	Non-Sodic
5 to 15	Sodic
Greater than 15	Highly Sodic

The measure of Cation Exchangeable Capacity is as follows;

CEC ($cmol^+/kg$)	**Rating**
Less than 6	Very Low
6 to 12	Low
12 to 25	Moderate
25 to 40	High
Greater than 40	Very High

In addition to the above, the presence of Sulphate and Chloride in the soil has the potential to cause high soil aggressivity to concrete and steel structures, in particular if the structures are in direct contact with the soil. The following is a measure of soil aggressivity to concrete based on the Australian Standard (Reference 7).

Sulfate expressed as SO_3		**PH**	**Chloride in water (ppm)**	**Soil conditions A***	**Soil conditions B#**
In Soil (ppm)	**In Groundwater (ppm)**				
<5000	<1000	>5.5	<6000	Non-aggressive	Non-aggressive
5000-1000	1000-3000	4.5-5.5	6000-12000	Mild	Mild
10000-20000	3000-10000	4-4.5	12000-30000	Severe	Moderate
>20000	>10000	<4	>30000	Very Severe	Severe

Approximate 100ppm of SO_4=80ppm of SO_3
* Soil condition A = High permeability soils (eg sands and gravels) which is below groundwater
# Soil conditions B = Low permeability soils (eg silts and clays) and all soils above groundwater

The following is a measure of soil aggressivity to steel piles based on the Australian Standard (Reference 7).

pH	Chlorides (Cl)		Resistivity Ohm.cm	Soil conditions A*	Soil conditions B#
	In Soil Ppm	In water ppm			
>5	<5000	<1000	>5000	Non-aggressive	Non-aggressive
4-5	5000-20000	1000-10000	2000-5000	Mild	Non-aggressive
3-4	20000-50000	10000-20000	1000-2000	Moderate	Mild
<3	>50000	>20000	<1000	Severe	Moderate

* Soil condition A = High permeability soils (eg sands and gravels) which is below groundwater
# Soil conditions B = Low permeability soils (eg silts and clays) and all soils above groundwater

In addition to the above, the AS 3600-2018 "Concrete" (Referenced 10) outlines an exposure classification for concrete in sulfate soils as follows;

Exposure Conditions			Exposure Classification	
Sulphate expressed as SO_3		PH	Soil conditions A*	Soil conditions B#
In Soil (ppm)	In Groundwater (ppm)			
<5000	<1000	>5.5	A2	A1
5000-1000	1000-3000	4.5-5.5	B1	A2
10000-20000	3000-10000	4-4.5	B2	B1
>20000	>10000	<4	C2	B2

Approximate 100ppm of SO4=80ppm of SO^3
* Soil condition A = High permeability soils (eg sands and gravels) which is below groundwater
# Soil conditions B = Low permeability soils (eg silts and clays) and all soils above groundwater

6. LABORATORY TEST RESULTS

The following is a summary of the laboratory test results;

Sample	Depth (m)	pH	EC	Factor	Ece	Cl	SO4	Resistivity	CEC	ESP
BH1	0.00-0.10	6.1	0.05	10	0.45					
	0.60-0.70	5.5	0.13	7.5	0.98	99	93	9200	7.9	14
	2.50-2.80	5.3	0.26	8	2.08	290	86	2300		
BH5	0.00-0.10	6.3	0.06	10	0.56					
	1.00-1.45	5.0	0.57	7	3.99	670	130	1700		
	2.50-2.90	5.0	0.69	8	5.52	710	180	2100		
BH17	0.00-0.10	6.8	0.18	10	1.80					
	0.50-0.60	7.3	0.10	7	0.70	20	10	7100		
	1.00-1.45	6.0	0.20	8	1.60	98	210	6600		
BH26	0.00-0.10	5.7	0.10	10	0.96					
	0.50-0.60	5.6	0.12	7	0.84	92	60	9700		
	1.00-1.45	5.0	0.48	8	3.84	480	230	4000	9.4	17
BH28	0.00-0.10	6.9	0.15	10	1.50					
	0.50-0.60	5.7	0.06	7.5	0.47	23	55	6900		
	1.00-1.45	5.1	0.55	8	4.40	560	170	6000		
BH31	0.00-0.10	6.0	0.05	10	0.48					
	0.50-0.60	6.1	0.06	7.5	0.43	20	48	7700	8.2	3
	1.00-1.45	5.1	0.57	8	4.56	600	240	4600		
BH35	0.50-0.60	5.2	0.38	7	2.66	290	230			
BH41	0.0-0.1	6.0	0.07	10	0.66					
	0.5-0.6	5.1	0.62	7	4.34	740	170		12	9
	1.4-1.5	5.3	0.50	8	4.00	550	140	2000		
BH42	0.0-0.1	6.0	0.06	10	0.56					
	0.4-0.5	6.4	0.06	7	0.41	10	59	17000		
	1.0-1.1	5.7	0.13	8	1.04	47	70			

Note: EC – Electrical Conductivity (dS/m)
EC_e-Electrical Conductivity (dS/m)
CEC – Cation Exchange Capacity (meq/100g or cmol+/kg)
ESP – Exchangeable Sodium Percentage (%)
Resistivity – ohm/cm
CL – Chloride (mg/kg)
SO4- Sulphate (mg/kg)

	Class	EC_e (ds/m)
	Non-Saline	<2
	Slightly Saline	2-4
	Moderately Saline	4-8
	Very Saline	8-16
	Highly Saline	>16

Sample	Depth (m)	pH	EC	Factor	Ece	Cl	SO4	Resistivity	CEC	ESP
BH43	0.0-0.1	6.6	0.10	10	0.97					
	0.5-0.6	6.0	0.13	7	0.91	33	89			
	1.2-1.3	5.1	0.40	8	3.20	330	210		14	13
BH44	0.0-0.1	6.9	0.11	10	1.10					
	0.4-0.5	6.7	0.10	7	0.67	20	10	10000		
	1.4-1.5	5.4	0.14	8	1.12	38	130		11	16
BH45	0.0-0.1	6.3	0.05	10	0.50					
	0.6-0.7	5.4	0.20	7	1.40	95	210			
	1.6-1.7	4.8	0.32	8	2.56	290	90	3100		

Note: EC – Electrical Conductivity (dS/m)
EC_e-Electrical Conductivity (dS/m)
CEC – Cation Exchange Capacity (meq/100g or cmol+/kg)
ESP – Exchangeable Sodium Percentage (%)
Resistivity – ohm/cm
CL – Chloride (mg/kg)
SO4- Sulphate (mg/kg)

	Class	EC_e (ds/m)
	Non-Saline	<2
	Slightly Saline	2-4
	Moderately Saline	4-8
	Very Saline	8-16
	Highly Saline	>16

Emerson Class

Test Pit	Emerson Class	Dispersiveness
BH 1 (0.6-0.7m)	2	High
BH 1 (2.5-2.8m)	1	Very High
BH 5 (1.0-1.45m)	1	Very High
BH 5 (2.5-2.7m)	1	Very High
BH 17 (0.5-0.6m)	1	Very High
BH 17 (1.0-1.45m)	2	High
BH 26 (0.5-0.6m)	5	Slight
BH 26 (1.0-1.45m)	2	High

Test Pit	Emerson Class	Dispersiveness
BH 28 (0.5-0.6m)	2	High
BH 28 (1.0-1.45m)	1	Very High
BH 31 (0.5-0.6m)	4	Moderate
BH 31 (1.0-1.45m)	2	High
BH 35 (0.5-0.6m)	2	High

Particle Size

Test Pit	Clay/Silt (%)	Sand (%)	Gravel (%)
BH 1 (2.5-2.8m)	89	9	0
BH 26 (0.5-0.6m)	88	12	0
BH 31 (1.0-1.45m)	80	20	0

7. SALINITY HAZARD IDENTIFICATION AND ASSESSMENT

7.1 Surface Indicators

The following are site indicators which are used to identify the presence of soil salinity;

- Scorching or absence of vegetation cover
- Salt encrustations and salt crystals on the ground surface.
- Dieback of trees or trees which show signs of distress.
- Salt attacks and markings on existing building footings.

There were no obvious signs and indicators of salinity impacts on the site.

7.2 Groundwater

Based on our local knowledge and borehole investigation, we expect permanent groundwater table to be at a significant depth below the proposed basement excavation level (ie 6m depth). The results of this investigation confirmed the subsurface profile to be dry with no subsurface groundwater seepage, aquifers or "springs".

7.3 Salinity Assessment and Salt Profiles

The fundamental measurement of soil salinity is EC_e values and based on the laboratory test results, the site salinity may be generalised as follows;

- The topsoil was assessed to be Non Saline with EC values ranging from 0.45 to 1.8 dS/m.

- The natural soil in the upper 1m was generally assessed to be Non to Slightly Saline with EC values ranging from 0.41 to 2.66 dS/m, except in BH 41 where Moderately Saline soil (ie 4.34 dS/m) was encountered.

- The natural soil below 1m was generally assessed to be Slightly Saline to Moderately Saline with EC values ranging from 1.04 to 5.52 dS/m. Some Non Saline soil (ie 1.60 dS/m) was encountered below 1m in BH 17.

Based on the Emerson and the Exchangeable Sodium Percentage (ESP) test results, the insitu soil was found to be generally Highly to Very Highly Dispersive and Sodic to Very Sodic.

The subsurface soil was found to have low concentrations of Sulphate and a minimum pH value of 4.8 and therefore the soil is considered to be Mildly aggressive to buried concrete structures and therefore the site may be classified as "Class A2" in accordance to AS 3600-2018 "Concrete" (Reference 10).

The subsurface soil was found to have low concentrations of Chloride and with a minimum pH value of 4.8 and the lowest resistivity of 1700 ohms/cm, the site was assessed to be Mildly aggressive to buried steel structures based on AS 2159 (Reference 7).

The concentration of salts in the subsurface soil may be modelled to three different profiles as follows based on the DWLC (2002) guidelines (Reference 5);

- 'Normal' Salt Profiles – The salinity levels in this profile increase with depth and there is no rising groundwater effect to bring the salts to the surface. This profile is common over the entire site.

- 'Recharge' Salt Profiles – The salinity levels in this profile are low and fairly constant with depth. This salt profile does not appear to have occurred on any part of the site.

- Discharge' Salt Profiles – The salinity levels in this profile reduce with depth and generally occurs when subsurface flows rises up due to the topography and vegetation uptake and salt is being brought up to the surface. This salt profile does not appear to have occurred on any part of the site with the exception of BH 41.

The following Figure 1 shows typical salt profile shapes with depths for the site;

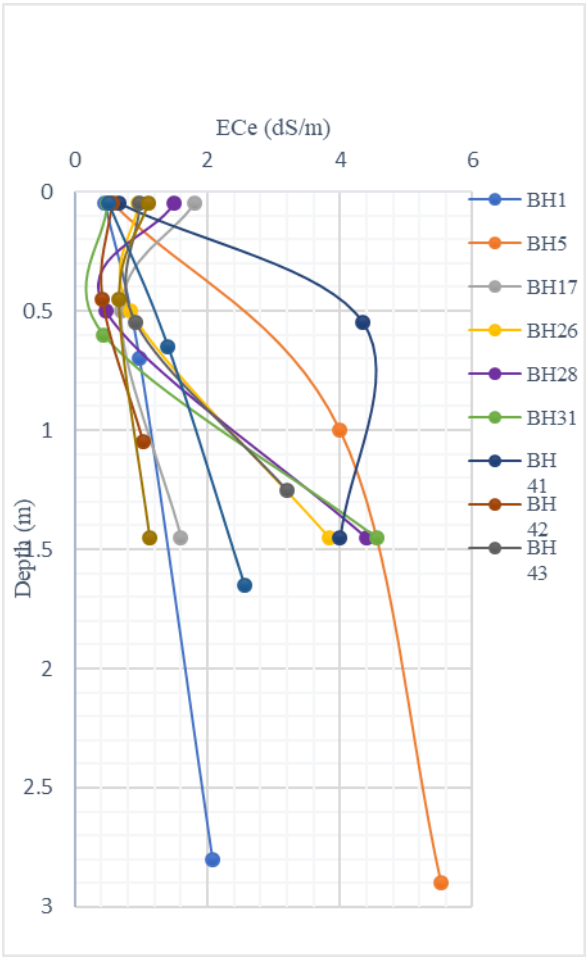

Figure 1: Salt Profile Shapes from Boreholes

7.4 Salinity Hazards

The impact of saline hazard on the development should be properly managed to ensure;

- The construction and maintenance of the proposed school development do not result in a deterioration of the saline environment. Hazards derived from improper implementation of construction works and management of site may include;
    - Excavation and displacement of saline, sodic or dispersive soil during bulk earthworks.
    - Uncontrolled soil erosion and dispersion of sodic and dispersive soil down hill and into receiving waters.
    - Concentrations of salt due to altered surface and subsurface flows. Concentrations of salt may also occur from inadequate design of roads, drainage and footings resulting in impeded subsurface flows.
    - Increase in surface salt levels from poor management of playing fields and landscaping areas.
- The saline environment does not impact on the development. Hazards derived from improper design may include;
    - Damage to school buildings caused by deterioration of bricks, mortar and concrete when salt drawn up into capillaries of bricks and mortar expands resulting in spalling.
    - Deterioration of concrete kerbs and gutters as a result of chemical reaction between concrete and sulphates.
    - High chloride content in the soil may result in corrosion of steel reinforcement and buried metal structures.
    - Damage to underground pipes and infrastructures.
    - Water logging of ground surface due to sealing effect of sodic and dispersive soil.
    - Loss of vegetation cover and plants due to high salt content resulting in retardation of plants.

8. SALINITY MANAGEMENT PLAN

The salinity management plan takes into consideration the following;

- The assets to be constructed such as roads, buildings, services and playing fields.
- The construction activities during development and the maintenance required
- The associated salinity hazards and risks of the assets and activities (ie construction and maintenance)
- The likelihood of such hazards and risks eventuating
- The management of the hazards and risks including control measures
- The party responsible for the implementation and management of control measures.

The likelihood of hazards and risks eventuating may be categorised into three levels as follows;

Low: The risk is minimal and is not likely to occur unless under exceptional circumstances. Normal management procedures should be sufficient.

Moderate: The risk is likely to occur and some management procedures should be in placed to reduce such risk.

High: The risk is highly likely to occur and proper management and treatment will be required to mitigate the risk.

The following is a Salinity Management Plan considered relevant to the proposed development;

Assets and Procedures	Possible Hazards or Environmental Risks	Risk Class	Control Measures and Management	Action
Earthworks – Cut	1. Soil erosion and scouring of sodic soil from excavation works. 2. Instability of slope from disintegration of sodic and dispersive soils. 3. Concentration of runoff and deposition of salts.	High	1. Avoid exposure and disturbance of sodic soil by minimising cut. 2. Deeper excavations in excess of 0.9m should be covered and retained by retaining walls or batters to not steeper than 1 Vertical to 2 Horizontal. 3. Vegetation of all batter slopes and bare surface. 4. Install adequate erosion controls such as silt fence. 5. Treatment of exposed surface with lime. 6. Install appropriate surface and subsurface drains.	Developer/ Contractor
Earthworks – Fill and Stockpiling	1. Subsurface flows may be impeded. 2. Soil erosion and scouring of sodic fill.	High	1. Avoid exposure and disturbance of sodic soil. 2. Vegetation of all batter slopes and bare surface. 3. Install adequate erosion controls such as silt fence. 4. Treatment of sodic and dispersive soil with lime.. 5. Install appropriate surface and subsurface drains.	Developer/ Contractor
Roadworks and car parks	1. Excavation and compaction of subgrade may impede subsurface flows resulting in accumulation of salts. 2. Road construction will alter surface flows and salts will be deposited in a concentrated area.	Moderate	1. Install appropriate subsoil drainage at the upgradient side of road to ease subsurface flows. 2. Design roads to minimise the effect of concentration of surface flows.	Developer/ Contractor/ Designer
Trenching and Backfilling for Pipes and Services	1. Trenching will bring saline soil up to the surface. 2. Differential settlement of trench backfill due to erosion and tunnelling 3. Migration of fines from surrounding dispersive soil into the trench resulting in ground subsidence. 4. Migration of salts through the trenches & accumulation of salts downstream resulting in salt attack on concrete & steel infrastructures.	Moderate	1. Avoid displacement of saline soil from the bottom to the top. 2. It is recommended rubber-ring jointed pipes be used. 3. Special types of 'pipe-bedding' (eg clean coarse sand) are to be used. 4. Ensure adequate compaction of trench backfill to reduce the permeability of the trench. 5. Soil erosion and tunnelling may be treated by using lime. 6. Use of non sodic and non dispersive soil in the trench. 7. Use of geofabrics to prevent migration of fines into the trench.	Developer/ Contractor

Assets and Procedures	**Possible Hazards or Environmental Risks**	**Risk Class**	**Control Measures and Management**	**Action**
Drainage Pipes and Pits	1. Structural degradation of concrete due to salt attack.	Low to Moderate	1. Ensure use of appropriate concrete grade not less than 32 MPa characteristic strength. 2. Minimise excavation into sodic and dispersive soil.	Developer/ Drainage Contractor
Conduits and Duct crossing	1. Structural degradation of steel due to salt attack	Low to Moderate	1. Appropriate corrosion protection measures be in place. 2. Ensure construction of subsurface drains at the bottom.	Developer/ Electrical Contractor
Street Lightings and Signage	1. Salt attack on steel and concrete structures	Moderate	1. Adopt Mildly aggressive soil.	Developer/ Contractor
Slabs and Concrete Foundations	1. Structural degradation of concrete due to salt attack. 2. Corrosion of steel reinforcement and spalling of concrete	Low to Moderate	1. Install appropriate waterproofing membranes under slab 2. Durability design based on Class A2 AS3600. 3. Ensure use of appropriate concrete grade not less than 32 MPa characteristic strength. 4. Ensure adequate concrete cover from reinforcement. Normally concrete cover is not less than 60mm. A lesser cover may be appropriate subject to other protection measures in placed 5. Placement of damp proof course and vapour barriers where required. 6. Construction of adequate surface and subsurface drainage around the slabs.	Developer/ Contractor
Steel Foundations and Buried Steel poles	1.Corrosion of steel	Low	1. Design for Mildly aggressive soils by adopting a corrosion rate of 0.01-0.02mm/year (AS2159)	Developer/ Contractor
Masonry Walls	1. Structural degradation of brick and masonry walls	Moderate	1. Placement of damp proof course and vapour barriers. 2. Use correct mortar and ensure appropriate mix.	Contractor
Concrete and bitumen driveways	1. Structural degradation of concrete caused by salt. 2. Deformation and cracking of asphalt seal.	Low to Moderate	1. Construct appropriate surface and subsoil drains to intercept flows. 2. Use appropriate concrete grade.	Builder

Assets and Procedures	**Possible Hazards or Environmental Risks**	**Risk Class**	**Control Measures and Management**	**Action**
Sewer and water pipes	1. Structural degradation caused by salt 2. Subsidence of service trenches caused by tunnelling and erosion. 3. Migration of fines into the trenches and transportation of salts downstream.	Low to moderate	1. Design system to minimise the interception of surface and subsurface flows. 2. Ensure service trenches do not intercept the groundwater. 3. Adequate compaction of the service trenches	Builder/ Designer
Steel fencing	1. Corrosion and pitting of steel members in contact with the soil generally limited to 1m depth.	Low	1. Use concrete footings with appropriate grade. 2. Design for Mildly aggressive soils by adopting a corrosion rate of 0.01-0.02mm/year (AS2159)	Builder/ Designer
Landscaping	1. Growth impairment or death	Moderate	1. Select appropriate tree planting schemes. 2. Avoid planting trees and vegetation which are sensitive to salts.	Developer/ Designer
Playing Fields	1. Accumulation of salts on the ground surface from irrigation 2. Increase in salinity level from fertilisers.	High	1. Avoid over irrigation and over fertilising of playing fields.	Owner

9. GENERAL RECOMMENDATIONS

9.1 Earthworks and Construction

In general, for earthworks and construction, the management plan recommends the following;

- Earthworks for the development of the site will require stripping of the topsoil to expose the natural clay. Though the topsoil was assessed to be Non Saline, some form of treatment by mixing with lime and other additives is recommended to reduce salinity and improve topsoil properties.
- Avoid exposure and disturbance of sodic and dispersive soil to minimising erosion and siltation. Erosion and sediment control plans should be developed and implemented by the earthworks contractor in accordance with the NSW Department of Housing Document "Managing Urban Stormwater: Soils and Construction (1998). All erosion and sediment controls should be installed prior to commencement of any earthworks.
- Trenching for underground services should be carried out in a manner such that there is minimal rotation and vertical displacement of the original soil profile as the lower soil profile is assessed to be more saline. Alternatively the excavated slightly to moderately saline material may be treated by using lime and/or placed at depths greater than 1.0m from finished level.
- Site regrading by earthworks particularly involving excavation should be kept to a minimum to avoid disturbing the Slightly to Moderately Saline soils. The Slightly to Moderately Saline soil may be capped with 1.0m of Non to Slightly saline soil. Surplus Slightly to Moderately Saline soils for use on site to form building platforms may be treated by mixing with lime. Typical mix proportion of lime to soil is between 3 and 6% (by weight) and the optimum mix proportion may be determined from laboratory testing.

- Appropriate batter slopes for excavations should be adopted to prevent erosion and scouring. Under good drainage conditions, the following batter slopes or less may be adopted;

Material	Recommended Minimum Batter Slopes
Compacted Fill	3 Horizontal : 1 Vertical
Very stiff residual clay	2 Horizontal : 1 Vertical
Weathered Shale/Siltstone	1 Horizontal : 1 Vertical

- The roadworks should be planned to reduce cutting and filling to a minimum and the earthworks undertaken in stages to alleviate erosion and localised instability problem. To minimise the effects of erosion, all road batters, whether in cut or fill should be stabilised by planting (or the application of a sprayed-on mulch) with appropriate species of vegetation as soon as practical after construction.
- Special considerations must be given to the design, bedding of pipework for stormwater and other services, as the soils within these areas are generally 'erodible' or 'dispersive'. It is recommended rubber-ring jointed pipes be used. Special types of 'pipe-bedding' (eg clean coarse sand) may also be required.
- The insitu soil was found to be sodic to highly sodic and highly dispersive, therefore unstable in the presence of water resulting in tunnelling. Construction of infrastructures should include adequate compaction of service trenches and construction of cut-off walls (eg concrete collars) to prevent migration of fines and prevent breakdown of soil structures.
- Prevention of soil erosion, tunnelling and salt scalds may be treated by using gypsum or lime.
- All excavation works into the Moderately Saline soil should be minimised by staging the construction into small areas to prevent salinity from developing.
- Time of exposure of bare ground (without vegetation) should be kept to a minimum and this will depend on weather conditions. Weather forecasts should be regularly updated and if extended periods of rain are forecast, the bare ground should be covered with stable fill such as ripped sandstone or stabilised with lime.

- During construction, hay bales and other temporary erosion control devices should be placed at appropriate locations in areas where concentrated flows are expected and suitable dish drains should be constructed to retard flow and trap silt particles during heavy runoff.

- Length of overland flow slopes which are bare of vegetation from the earthworks should be kept to a minimum not exceeding 20m. Overland flow slopes may be reduced by bunding and placement of silt fencing or hay bales.

- Further sampling and laboratory analysis may be required out in areas showing signs of instability in order to determine preventative course of action and minimise potential salinity problems.

- Adequate revegetation of the site should be carried out and this may involve treatment of topsoil material and planting appropriate plant species which are salt-tolerant.

- Adequate surface and subsurface drainages should be provided to prevent water logging, tunnelling, scouring and erosion caused by sodic soil.

9.2 Building Structures and Infrastructures

Reference should be made to AS 2159 (Reference 7) and AS 3600 (Reference 10) for recommendations on protection of buried concrete and steel structures.

Based on the laboratory test results, the following durability classification may be adopted;

- Mildly Aggressive for Concrete Structures,

- Mildly Aggressive for Steel Structures.

As the site is situated within a saline prone environment, the following are general recommendations for future building and infrastructure construction;

- A high impact waterproof membrane, not just a vapour proof membrane, should be lain under slabs (refer to NSW Building Code of Australia). The waterproof membrane must be extended to the outside face of the external edge beam up to the finishing ground level, as detailed in the Building Code of Australia (BCA).

- For masonry building construction, the damp proof course must consist of poly-ethylene or poly-ethylene coated metal and correctly placed in accordance with BCA. Ground levels immediately adjacent to masonry walls must be kept below the damp proof course

- For slab on ground construction, a layer of bedding sand at least 50mm thick should be laid under the slab to allow free drainage of water and to prevent pooling of water potentially carrying salts.

- Concrete floor slabs to comprise of Class 32MPa concrete or sulphate resisting Type SR cement with a water cement ratio of 0.5. Similar concrete should be used for bored piers or footings.

- Slabs must be vibrated and cured for a minimum 3 days

- The minimum cover to reinforcement should be 30mm from a membrane in contact with the ground.

- The minimum cover to reinforcement should be 60mm for strip footings and beams.

- Admixtures for waterproofing and /or corrosion prevention may be used.

- Use of salt tolerant masonry and mortar below the damp proof course

- Constant monitoring of water pipes to detect any leakages and the repair of damages pipes as soon as possible after detection

- Use Copper or non-metallic pipes instead of galvanised iron

- Ensure any underground services are provided with adequate corrosion protection

- Reference should be made to the AS 2159 and AS3600 guidelines (Reference 7 and 10) for recommendations on durability protection of buried concrete and steel structures

10. OTHER MANAGEMNET ISSUES

10.1 Health and Safety

Contractors and subcontractors performing work activities are expected to meet all Workcover's and other applicable Commonwealth and State/Territory requirements for employee's health and safety.

Appropriate personal protective equipment and clothings and on-site monitoring during fieldwork should be observed.

10.2 Records and Documentations

The entire process of the remedial works shall be sufficiently recorded and documented. Such information shall be systematically stored by the Project Manager and Council.

10.3 Compliance and Corrective Actions

The salinity management plan shall be taken to ensure the objectives outlined in above Section 5.2 are met and the works comply with the current regulations and practices. This will include;

- The monitoring of environmental performance on a regularly basis;
- Regularly perform audit of the environmental management system
- Record, investigate and analysis accidents/incidents

In the event where the objectives are not met, appropriate documentation should be made and corrective actions be undertaken.

11. LIMITATIONS

The findings contained in this report are the results of discreet/specific sampling methodologies used in accordance with normal practices and standards. There is no investigation which is thorough enough to preclude the presence of material which presently, or in future, may be considered hazardous to the site. The site may subject of dumping of rubbish fill in the past and the scope of this report do not cover for future dumping and burial of such material on the subject site.

As regulatory evaluation criteria are constantly updated, concentrations of contaminants presently considered low, may in the future fall short of regulatory standards that require further investigation/redemption.

The statements presented in these documents are intended to advise you of what should be your realistic expectations of this report, and to present you with recommendations on how to minimise the risks associated with the groundworks for this project. The document is not intended to reduce the level of responsibility accepted by GeoEnviro Consultancy Pty Ltd, but rather to ensure that all parties who may rely on this report are aware of the responsibilities each assumes in so doing.

Attached in Appendix C are documents entitled "Important Information about Your Environmental Site Assessment" in conjunction with which this report must be read, as it details important limitations regarding the investigation undertaken and this report.

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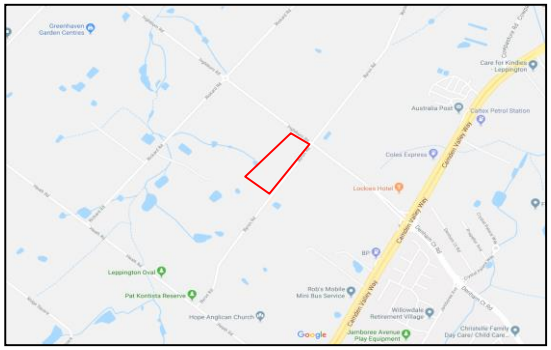
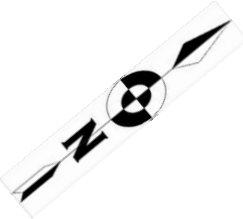
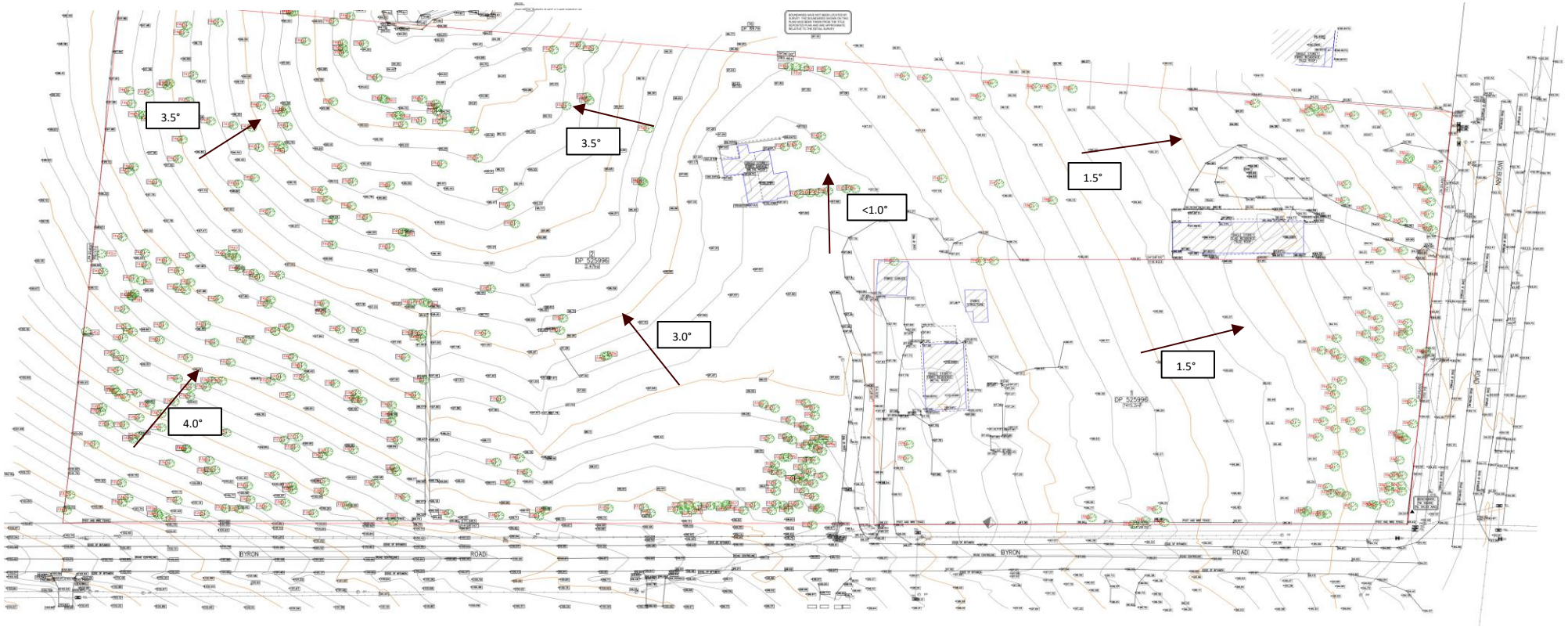
REFERENCES

1. *Geotechnical and Salinity Investigation – Proposed New Amity College Campus - Lot 1 DP 525996 No 85 Byron Road and Lot 2 DP 525996 No 63 Ingleburn Road, Leppington – GeoEnviro Consultancy Ref JC18322A-r2(rev2) dated May 2019*
2. *Department of Land and Water Conservation – "Site Investigation for Urban Salinity".2002*
3. *1:100,000 Soil Landscape Map of Penrith – Soil Conservation Service of NSW; Sheet 9030 - 1989*
4. *1:100,000 Geological Map of Penrith– Geological Series Sheet 9030 (Edition 1) 1991*
5. *Salinity Code of Practice – Western Sydney Regional Organisation of Councils Ltd – 2003 (Amended January 2004)*
6. *What do all the numbers mean? A guide for the interpretation of soil test results. – Department of Conservation and Land Management, 1992*
7. *Australian Standard, AS 2159-2009 "Piling – Design and Installation", 2009*
8. *Australian Standard, AS 2870 -2011 "Residential Slabs and Footings".*
9. *Australian Standard, AS 3798 - 2007"Bulk Earthworks for Commercial and Residential Site*
10. *Australian Standard, AS 3600- 2018"Concete Structures"*
11. *Australian Standard AS1726:2017 . "Geotechnical Site Investigations".*



Site Locality





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Subject Site

7.0° Slope Angle

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Drawn By: AT	Date: 1/4/19	Gran Associates Pty Ltd
Checked By: SL	Date: 1/4/19	85 Byron Road and 63 Ingleburn Road Leppington
Revision By:	Date:	Site Locality and Survey Plan
Scale: Not to Scale	A3	Project No: JC18322A / Drawing No:1

Site Feature	Description
A	Driveway constructed of crushed rock.
B	Single-storey brick, weatherboard and tile dwelling with a metal garage to the rear.
C	Single-storey fibro/metal dwelling with a number of small metal, timber and fibro sheds to the west. Sheds used for storage of miscelaneous items. Some minor hydrocarbon staining visible on surface
D	Driveway constructed of crushed rock, sandstone and traces of building debris (eg bricks and asphalt lumps)
E	Metal, timber and fibro shed with building extensions.
F	Area of previous numerous small buildings and sheds. Previous market garden area (1950s)
G	Backfilled depression with rubbish fill consisting of concrete boulders, bricks, glass and asbestos fragments
H	Recent Market Garden beds
I	Previous market garden/agricultural area

Note: The extent site features are only indicative

Legend

A Site Feature

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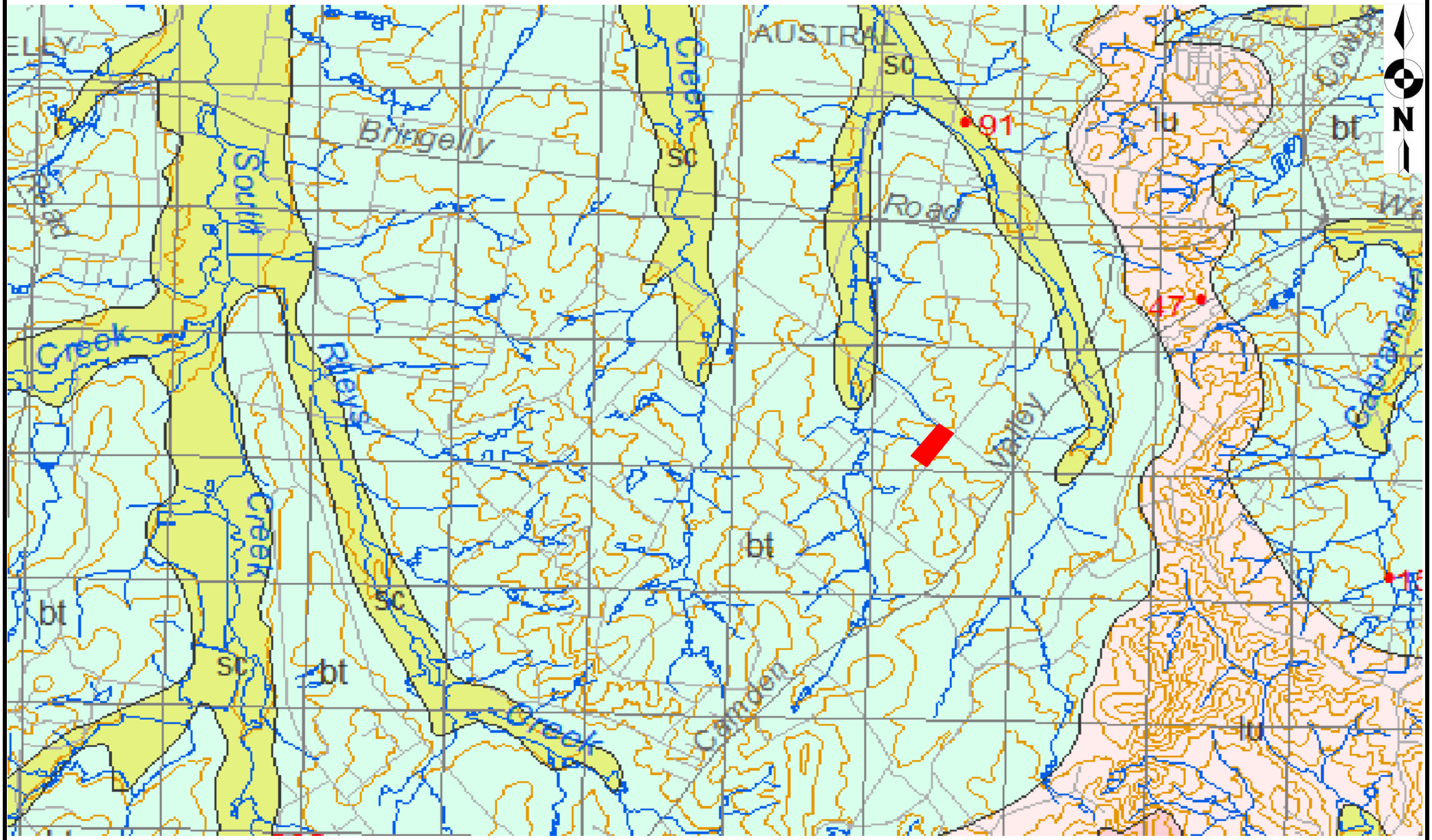
Drawn By: AT	Date: 6/6/18	Gran Associates Pty Ltd 85 Byron Road and 63 Ingleburn Road Leppington Site Zoning and Features Plan	
Checked By: SL	Date: 6/6/18		
Revision By:	Date:		
Scale: Not to Scale	A3	Project No: JC18322A	Drawing No: 2

GeoEnviro Consultancy Unit 5, 39-41 Fourth Avenue, Blacktown NSW 2148, Australia Tel: (02) 96798733 Fax: (02) 96798744	Drawn By: AT	Date: 1/4/19	**Gran Associates Pty Ltd** **85 Byron Road and 63 Ingleburn Road Leppington** **Proposed Development Plan**
	Checked By: SL	Date: 1/4/19	
	Revision By:	Date:	
	Scale: Not to Scale	A3	Project No: JC18322A / Drawing No: 3



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	Subject Site
bt	Blacktown Landscape Group
sc	South Creek Landscape Group
lu	Luddenham Landscape Group

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Drawn By: AT	Date: 1/4/19	Gran Associates Pty Ltd	
Checked By: SL	Date: 1/4/19	85 Byron Road and 63 Ingleburn Road Leppington	
Revision By:	Date:	Soil Landscape Group Map	
Scale: Not to Scale	A3	Project No: JC18322A	Drawing No: 4

Legend

- Subject Site
- Bringelly Shale (Rwb)
- Fluvial Deposit (Qal)

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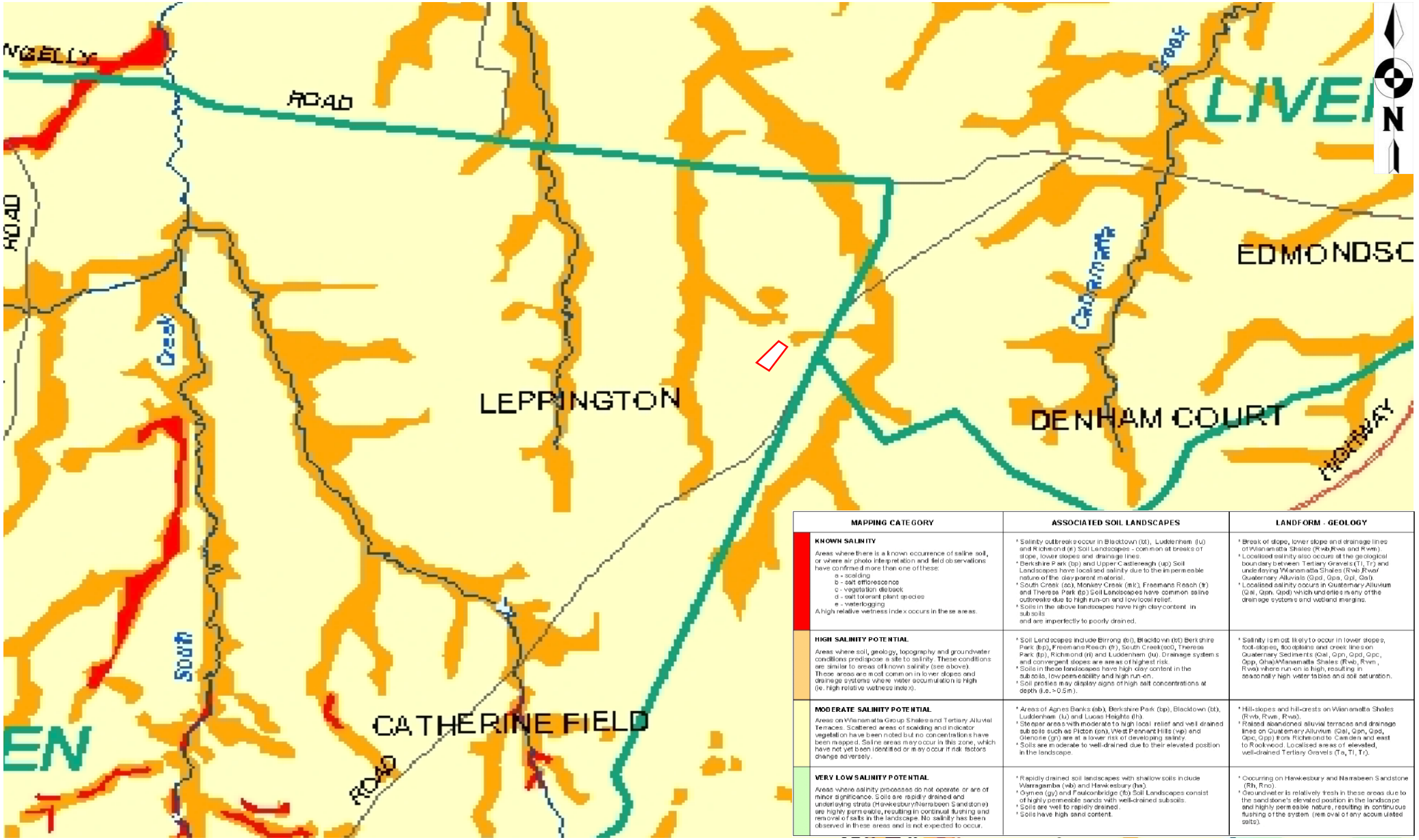
Drawn By: AT	Date: 1/4/19	Gran Associates Pty Ltd 85 Byron Road and 63 Ingleburn Road Leppington Geological Unit Map	
Checked By: SL	Date: 1/4/19		
Revision By:	Date:		
Scale: Not to Scale	A3	Project No: JC18322A	Drawing No: 5



MAPPING CATEGORY	ASSOCIATED SOIL LANDSCAPES	LANDFORM - GEOLOGY
KNOWN SALINITY Areas where there is a known occurrence of saline soil, or where air photo interpretation and field observations have confirmed more than one of these: a - scalding b - salt efflorescence c - vegetation dieback d - salt tolerant plant species e - waterlogging A high relative wetness index occurs in these areas.	* Salinity outbreaks occur in Blacktown (bt), Luddenham (lu) and Richmond (rl) Soil Landscapes - common at breaks of slope, lower slopes and drainage lines. * Berkshire Park (bp) and Upper Castlereagh (up) Soil Landscapes have localised salinity due to the impermeable nature of the clay parent material. * South Creek (sc), Monkey Creek (mk), Freemans Reach (fr) and Theresa Park (tp) Soil Landscapes have common saline outbreaks due to high run-on and low local relief. * Soils in the above landscapes have high clay content in subsoils and are imperfectly to poorly drained.	* Break of slope, lower slope and drainage lines of Wianamatta Shales (Rwb,Rwa and Rwm). * Localised salinity also occurs at the geological boundary between Tertiary Gravels (Tl, Tr) and underlaying Wianamatta Shales (Rwb,Rwa)/ Quaternary Alluvials (Qpd, Qpa, Qpl, Qal). * Localised salinity occurs in Quaternary Alluvium (Qal, Qpn, Qpd) which underlies many of the drainage systems and wetland margins.
HIGH SALINITY POTENTIAL Areas where soil, geology, topography and groundwater conditions predispose a site to salinity. These conditions are similar to areas of known salinity (see above). These areas are most common in lower slopes and drainage systems where water accumulation is high (ie. high relative wetness index).	* Soil Landscapes include Birrong (bi), Blacktown (bt) Berkshire Park (bp), Freemans Reach (fr), South Creek(sc0, Theresa Park (tp), Richmond (rl) and Luddenham (lu). Drainage systems and convergent slopes are areas of highest risk. * Soils in these landscapes have high clay content in the subsoils, low permeability and high run-on. * Soil profiles may display signs of high salt concentrations at depth (i.e. >0.5m).	* Salinity is most likely to occur in lower slopes, foot-slopes, floodplains and creek lines on Quaternary Sediments (Qal, Qpn, Qpd, Qpc, Qpp, Qha)/Wianamatta Shales (Rwb, Rwm, Rwa) where run-on is high, resulting in seasonally high water tables and soil saturation.
MODERATE SALINITY POTENTIAL Areas on Wianamatta Group Shales and Tertiary Alluvial Terraces. Scattered areas of scalding and indicator vegetation have been noted but no concentrations have been mapped. Saline areas may occur in this zone, which have not yet been identified or may occur if risk factors change adversely.	* Areas of Agnes Banks (ab), Berkshire Park (bp), Blacktown (bt), Luddenham (lu) and Lucas Heights (lh). * Steepar areas with moderate to high local relief and well drained subsoils such as Picton (pn), West Pennant Hills (wp) and Glenorie (gn) are at a lower risk of developing salinity. * Soils are moderate to well-drained due to their elevated position in the landscape.	* Hill-slopes and hill-crests on Wianamatta Shales (Rwb, Rwm, Rwa). * Raised abandoned alluvial terraces and drainage lines on Quaternary Alluvium (Qal, Qpn, Qpd, Qpc, Qpp) from Richmond to Camden and east to Rookwood. Localised areas of elevated, well-drained Tertiary Gravels (Ta, Tl, Tr).
VERY LOW SALINITY POTENTIAL Areas where salinity processes do not operate or are of minor significance. Soils are rapidly drained and underlaying strata (Hawkesbury/Narrabeen Sandstone) are highly permeable, resulting in continual flushing and removal of salts in the landscape. No salinity has been observed in these areas and is not expected to occur.	* Rapidly drained soil landscapes with shallow soils include Warragamba (wb) and Hawkesbury (ha). * Gymea (gy) and Faulconbridge (fb) Soil Landscapes consist of highly permeable sands with well-drained subsoils. * Soils are well to rapidly drained. * Soils have high sand content.	* Occurring on Hawkesbury and Narrabeen Sandstone (Rh, Rnc). * Groundwater is relatively fresh in these areas due to the sandstone's elevated position in the landscape and highly permeable nature, resulting in continuous flushing of the system (removal of any accumulated salts).

Legend

Subject Site

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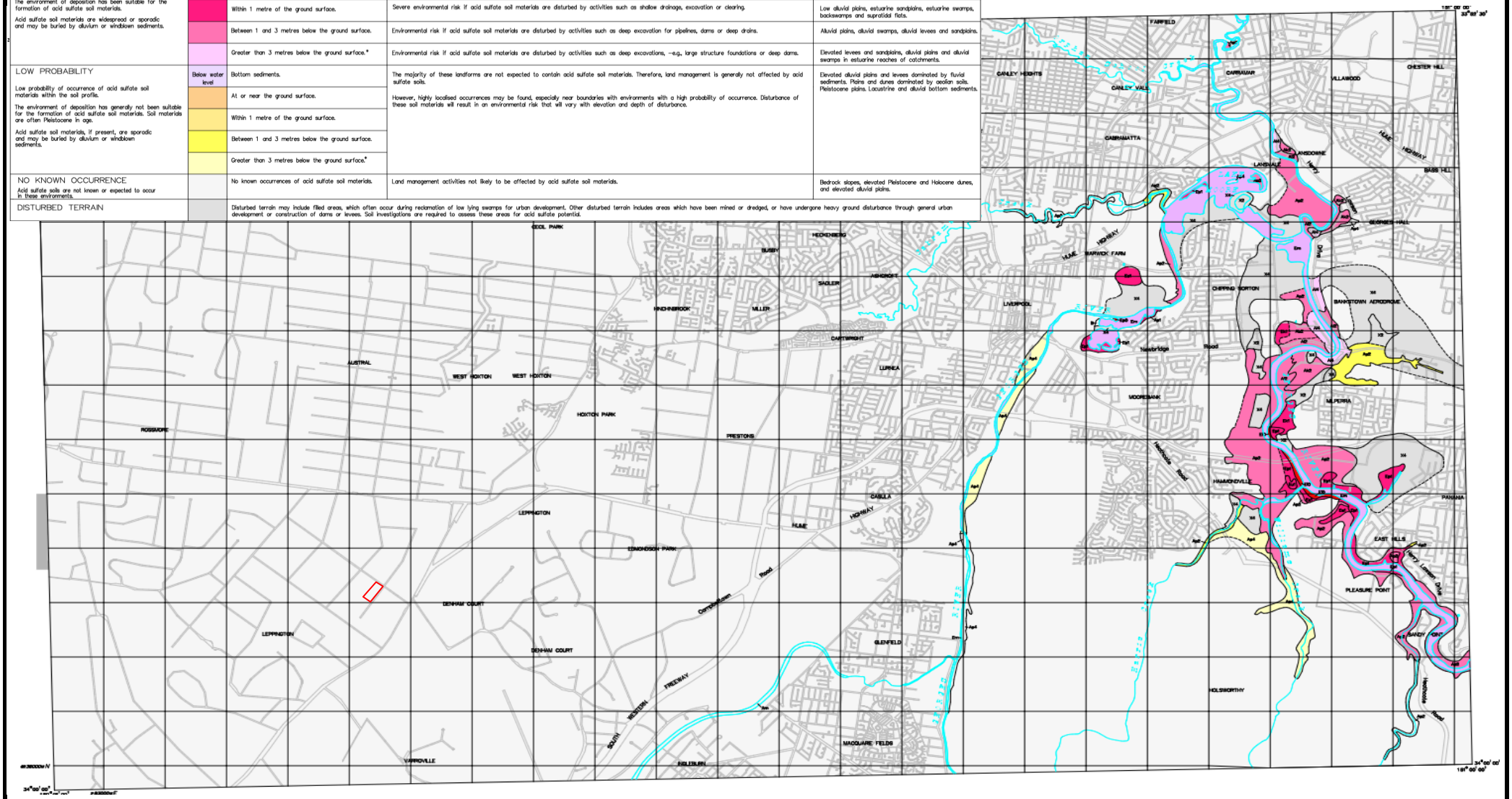
Drawn By: AT	Date: 1/4/19	Gran Associates Pty Ltd 85 Byron Road and 63 Ingleburn Road Leppington Soil Salinity Map	
Checked By: SL	Date: 1/4/19		
Revision By:	Date:		
Scale: Not to Scale	A3	Project No: JC18322A	Drawing No: 6

Map Class Description	Depth to Acid Sulfate Soil Materials		Environmental Risk	Typical Landform Types
HIGH PROBABILITY High probability of occurrence of acid sulfate soil materials within the soil profile. The environment of deposition has been suitable for the formation of acid sulfate soil materials. Acid sulfate soil materials are widespread or sporadic and may be buried by alluvium or windblown sediments.	Below water level	Bottom sediments.	Severe environmental risk if bottom sediments are disturbed by activities such as dredging.	Bottom sediments of lakes, lagoons, tidal creeks, rivers and estuaries.
		At or near the ground surface.	Severe environmental risk if acid sulfate soil materials are disturbed by activities such as shallow drainage, excavation or clearing.	Estuarine swamps, intertidal flats and supratidal flats.
		Within 1 metre of the ground surface.	Severe environmental risk if acid sulfate soil materials are disturbed by activities such as shallow drainage, excavation or clearing.	Low alluvial plains, estuarine sandplains, estuarine swamps, backswamps and supratidal flats.
		Between 1 and 3 metres below the ground surface.	Environmental risk if acid sulfate soil materials are disturbed by activities such as deep excavation for pipelines, dams or deep drains.	Alluvial plains, alluvial swamps, alluvial levees and sandplains.
		Greater than 3 metres below the ground surface.*	Environmental risk if acid sulfate soil materials are disturbed by activities such as deep excavations, –e.g., large structure foundations or deep dams.	Elevated levees and sandplains, alluvial plains and alluvial swamps in estuarine reaches of catchments.
LOW PROBABILITY Low probability of occurrence of acid sulfate soil materials within the soil profile. The environment of deposition has generally not been suitable for the formation of acid sulfate soil materials. Soil materials are often Pleistocene in age. Acid sulfate soil materials, if present, are sporadic and may be buried by alluvium or windblown sediments.	Below water level	Bottom sediments.	The majority of these landforms are not expected to contain acid sulfate soil materials. Therefore, land management is generally not affected by acid sulfate soils. However, highly localised occurrences may be found, especially near boundaries with environments with a high probability of occurrence. Disturbance of these soil materials will result in an environmental risk that will vary with elevation and depth of disturbance.	Elevated alluvial plains and levees dominated by fluvial sediments. Plains and dunes dominated by aeolian soils. Pleistocene plains. Lacustrine and alluvial bottom sediments.
		At or near the ground surface.		
		Within 1 metre of the ground surface.		
		Between 1 and 3 metres below the ground surface.		
		Greater than 3 metres below the ground surface.*		
NO KNOWN OCCURRENCE Acid sulfate soils are not known or expected to occur in these environments.		No known occurrences of acid sulfate soil materials.	Land management activities not likely to be affected by acid sulfate soil materials.	Bedrock slopes, elevated Pleistocene and Holocene dunes, and elevated alluvial plains.
DISTURBED TERRAIN		Disturbed terrain may include filled areas, which often occur during reclamation of low lying swamps for urban development. Other disturbed terrain includes areas which have been mined or dredged, or have undergone heavy ground disturbance through general urban development or construction of dams or levees. Soil investigations are required to assess these areas for acid sulfate potential.		



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Drawn By: AT	Date: 1/4/19	Gran Associates Pty Ltd 85 Byron Road and 63 Ingleburn Road Leppington Acid Sulphate Soil Risk Map	
Checked By: SL	Date: 1/4/19		
Revision By:	Date:		
Scale: Not to Scale	A3	Project No: JC18322A	Drawing No: 7

Legend

Borehole

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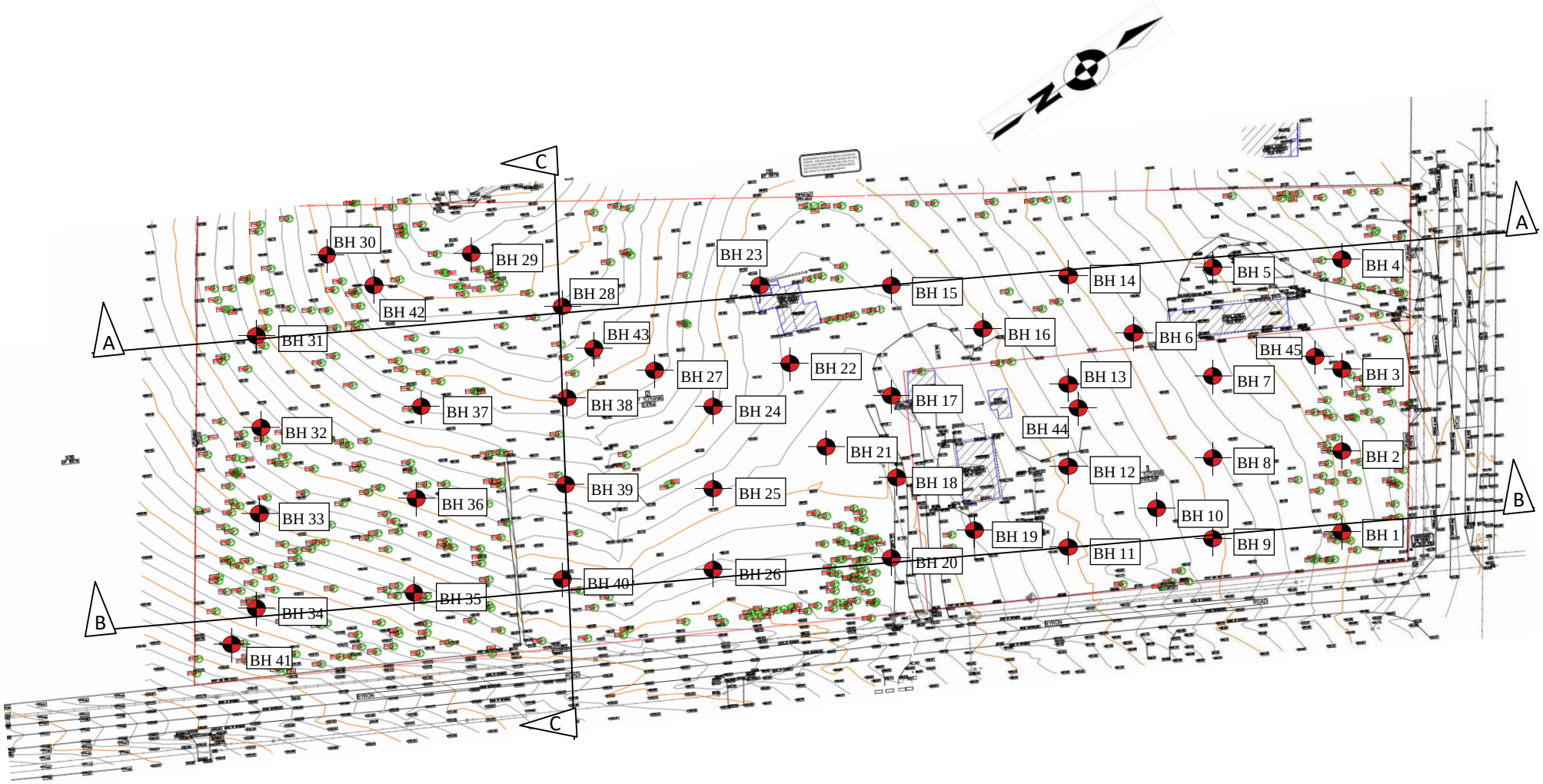
Drawn By: AT	Date: 15/4/19	Gran Associates Pty Ltd	
Checked By: SL	Date: 15/4/19	85 Byron Road and 63 Ingleburn Road Leppington	
Revision By:	Date:	Borehole Location Plan	
Scale: Not to Scale	A3	Project No: JC18322A	Drawing No: 8



Note: Refer to Drawing Nos 10, 11 and 12 for soil/rock profiles of Sections A-A, B-B and C-C

Legend

Borehole

Section

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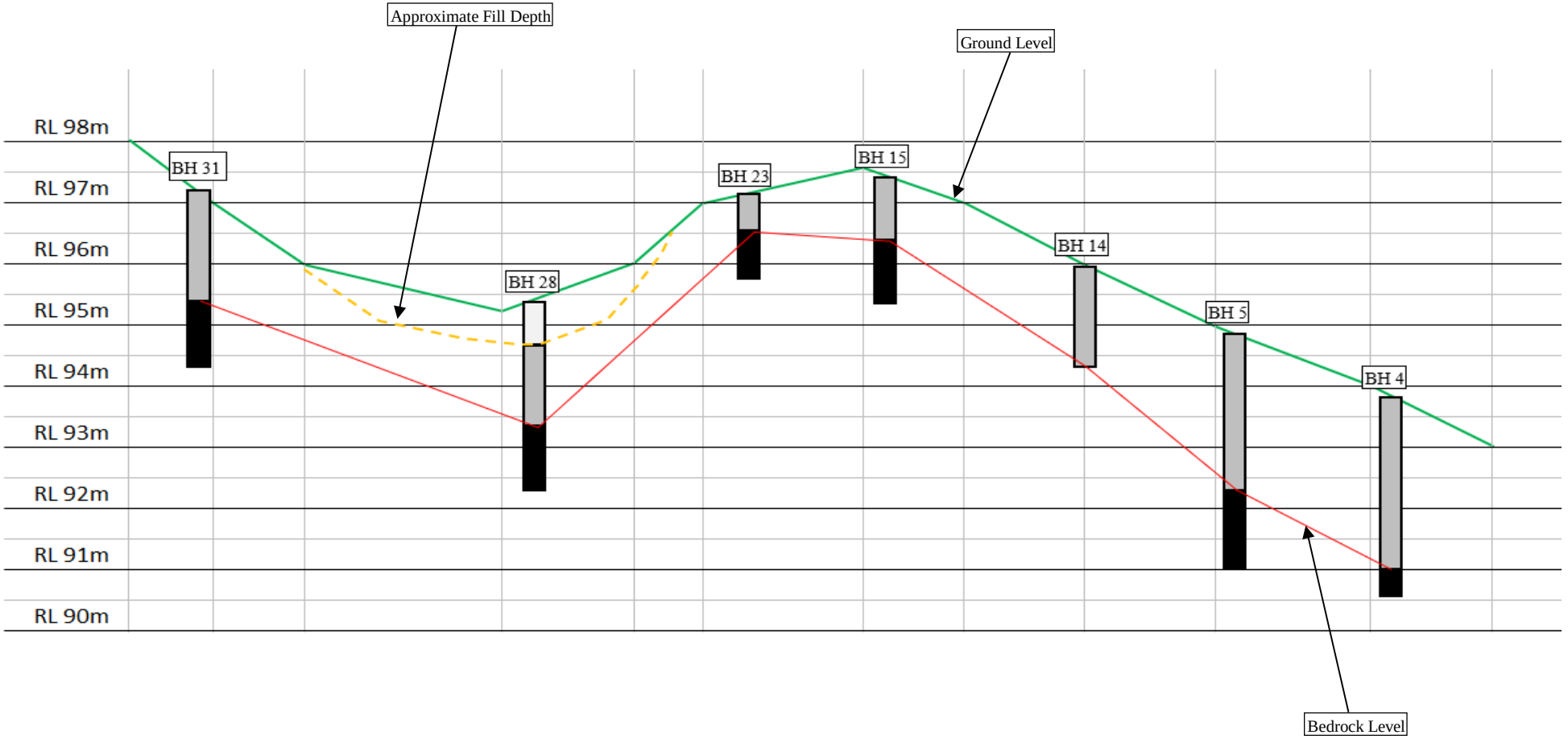
Drawn By: AT	Date: 5/3/19	Gran Associates Pty Ltd	
Checked By: SL	Date: 5/3/19	85 Byron Road and 63 Ingleburn Road Leppington	
Revision By:	Date:	Topographic Map and Borehole Transect Section	
Scale: Not to Scale	A3	Project No: JC18322A	Drawing No: 9



Legend

- Fill
- Natural
- Bedrock

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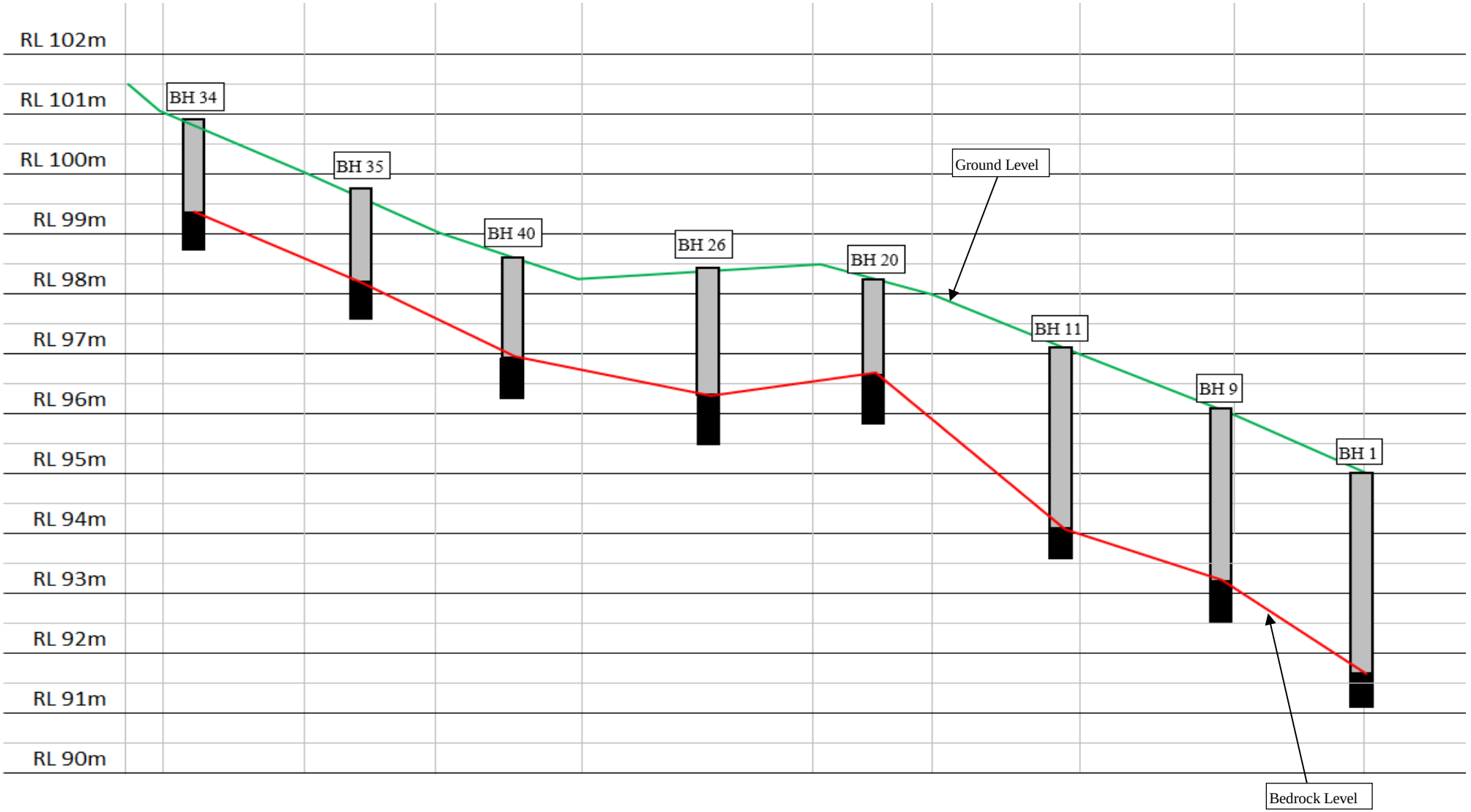
Drawn By: AT	Date: 5/3/19	Gran Associates Pty Ltd	
Checked By: SL	Date: 5/3/19	85 Byron Road and 63 Ingleburn Road Leppington	
Revision By:	Date:	Soil/Rock Profile Transect - Section A-A	
Scale: Not to Scale	A3	Project No: JC18322A	Drawing No: 10



Legend

- Fill
- Natural
- Bedrock

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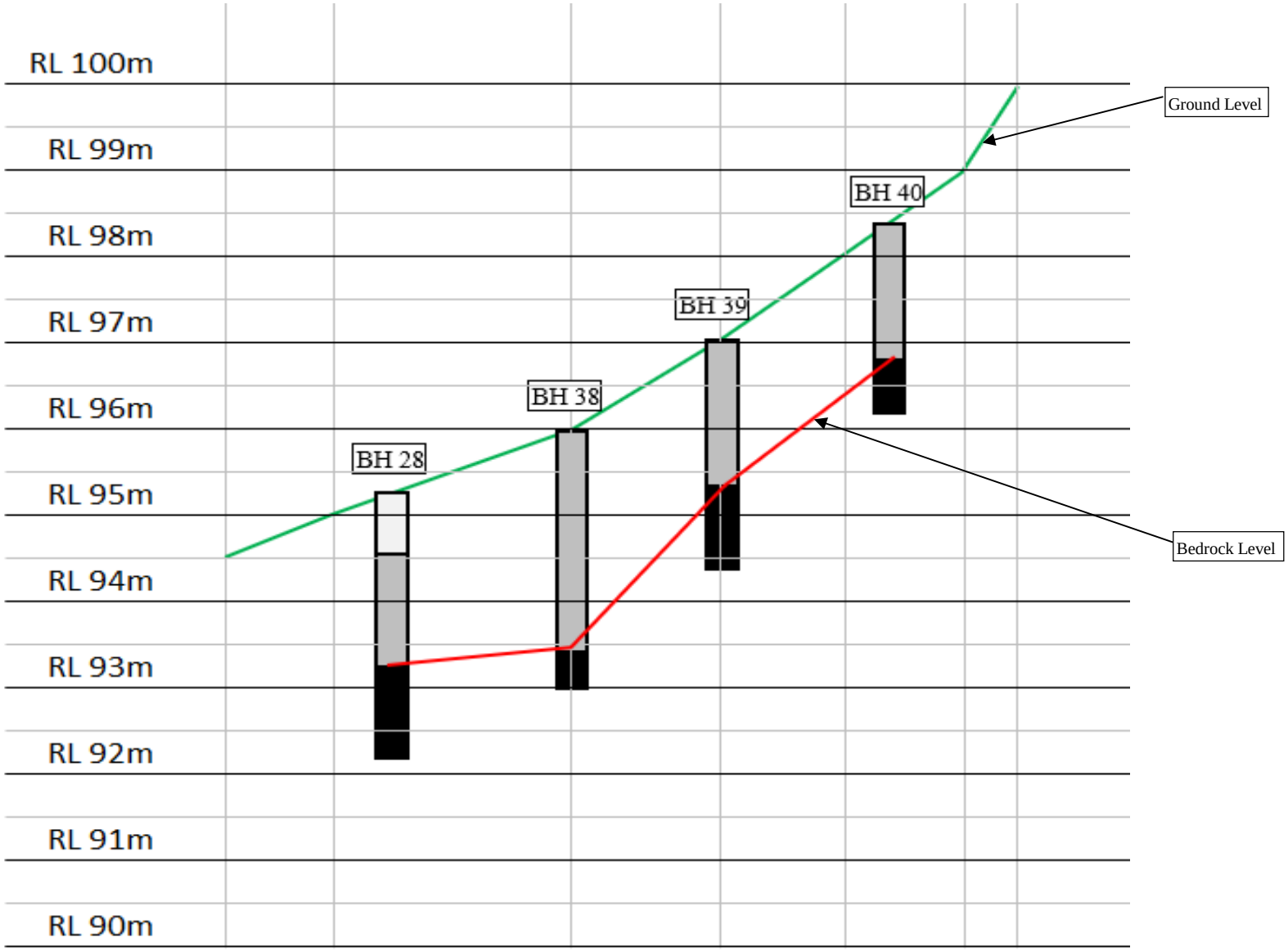
Drawn By: AT	Date: 5/3/19	Gran Associates Pty Ltd	
Checked By: SL	Date: 5/3/19	85 Byron Road and 63 Ingleburn Road Leppington	
Revision By:	Date:	Soil/Rock Profile Transect - Section B-B	
Scale: Not to Scale	A3	Project No: JC18322A	Drawing No: 11



Legend

- Fill
- Natural
- Bedrock

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Drawn By: AT	Date: 5/3/19	Gran Associates Pty Ltd	
Checked By: SL	Date: 5/3/19	85 Byron Road and 63 Ingleburn Road Leppington	
Revision By:	Date:	Soil/Rock Profile Transect - Section C-C	
Scale: Not to Scale	A3	Project No: JC18322A	Drawing No: 12

APPENDIX A
Borehole Reports

GeoEnviro Consultancy Pty Ltd
Unit 5, 39-41 Fourth Avenue, Blacktown NSW 2148, Australia
Tel: (02) 96798733 Fax: (02) 96798744

Borehole Report

Borehole no: 1

Client: Gran Associates Pty Ltd
Job no: JC18322A

Project: Proposed Amity College
Date: 23/4/18

Location: 85 Byron Road and 63 Ingleburn Road Leppington
Logged by: SG

Drill Model and Mounting: B80 | Slope: 90° | R.L. Surface: 95.0m

Hole Diameter: 100mm | Bearing: Vertical | Datum: AHD

Method	Support	Water	Notes: Samples, Tests, etc	Depth(m)	Classification Symbol	Unified Soil Classification	Material Description Soil Type, Plasticity or Particle Characteristic, colour, secondary and minor component	Moisture Content	Consistency/Density Index	Hand Penetrometer kPa	Structure and Additional Observations
V	NIL	DRY	DS				Topsoil: Clayey Silt: low liquid limit, brown with fine grained gravel				
						CI-CH	Silty Clay: medium to high plasticity, red brown with fine to medium grained gravel	D			
				1.0							
			6,20/30mm N>20						H	>600	V bit refusal at 1.2
TC						CI	Silty Clay: medium plasticity, grey with heavy ironstaining, and ironstone and siltstone bands	D -M			
				2.0							
			DS								
				3.0			Interbedded Clay and Siltstone				
							Siltstone: grey brown, low to medium strength, extremely weathered to distinctly weathered				TC bit refusal at 3.8m
				4.0			End of BH 1 at 3.8m				
				5.0							
				6.0							
				7.0							
				8.0							

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Borehole Report

Borehole no: 2

Client: Gran Associates Pty Ltd

Job no: JC18322A

Project: Proposed Amity College

Date: 23/4/18

Location: 85 Byron Road and 63 Ingleburn Road Leppington

Logged by: SG

Drill Model and Mounting: B80 | Slope: 90° | R.L. Surface: 94.8m

Hole Diameter: 100mm | Bearing: Vertical | Datum: AHD

Method	Support	Water	Notes: Samples, Tests, etc	Depth(m)	Classification Symbol	Unified Soil Classification	Material Description (Soil Type, Plasticity or Particle Characteristic, colour, secondary and minor component)	Moisture Content	Consistency/Density Index	Hand Penetrometer kPa	Structure and Additional Observations
V	NIL	DRY					Topsoil: Clayey Silt: low liquid limit, brown with trace of fine grained gravel				
						CH	Silty Clay: high plasticity, red brown with fine grained gravel	D			
			7,10,19 N=29	1.0					H	>600	
TC						CI	Silty Clay: medium plasticity, dark grey brown with ironstaining and fine grained gravel	D	H	>600	V bit refusal at 1.5m
				2.0			As above but grey with ironstaining and fine grained gravel				
			8,21,16 /70mm N>37	3.0			Siltstone: grey brown, low to medium strength, extremely weathered to distinctly weathered				
				4.0							TC bit refusal at 4.0m
							End of BH 2 at 4.0m				
				5.0							
				6.0							
				7.0							
				8.0							

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Borehole Report

Borehole no: 3

Client: Gran Associates Pty Ltd

Job no: JC18322A

Project: Proposed Amity College

Date: 23/4/18

Location: 85 Byron Road and 63 Ingleburn Road Leppington

Logged by: SG

Drill Model and Mounting: B80 | Slope: 90° | R.L. Surface: 94.5m

Hole Diameter: 100mm | Bearing: Vertical | Datum: AHD

Method	Support	Water	Notes: Samples, Tests, etc	Depth(m)	Classification Symbol	Unified Soil Classification	Material Description (Soil Type, Plasticity or Particle Characteristic, colour, secondary and minor component)	Moisture Content	Consistency/Density Index	Hand Penetrometer kPa	Structure and Additional Observations
V	NIL	DRY					Topsoil: Clayey Silt: low liquid limit, brown with trace of fine grained gravel				
						CH	Silty Clay: high plasticity, red brown with fine grained gravel	D			
			2,11,22 N=33	1.0		CI	Gravelly Silty Clay: medium plasticity, red brown with fine to medium grained gravel and ironstone bands	D	H	>600	V bit refusal at 1.5m
TC				2.0		CI	Silty Clay: medium plasticity, grey brown with ironstaining and fine to medium grained gravel	D	H	>600	SPT bouncing at 2.85m
			11,13,19 /50mm N>32	3.0		CI	Gravelly Silty Clay: medium plasticity, red grey with fine to medium grained gravel	D			TC but refusal at 3.4m
							End of BH 3 at 3.4m				
				4.0							
				5.0							
				6.0							
				7.0							
				8.0							

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Borehole Report

Borehole no: 4

Client: Gran Associates Pty Ltd
Job no: JC18322A

Project: Proposed Amity College
Date: 23/4/18

Location: 85 Byron Road and 63 Ingleburn Road Leppington
Logged by: SG

Drill Model and Mounting: B80 | Slope: 90° | R.L. Surface: 93.8m

Hole Diameter: 100mm | Bearing: Vertical | Datum: AHD

Method	Support	Water	Notes: Samples, Tests, etc	Depth(m)	Classification Symbol	Unified Soil Classification	Material Description Soil Type, Plasticity or Particle Characteristic, colour, secondary and minor component	Moisture Content	Consistency/Density Index	Hand Penetrometer kPa	Structure and Additional Observations
V	NIL	DRY					Topsoil: Clayey Silt: low liquid limit, brown with trace of fine grained gravel				
						CI-CH	Silty Clay: medium to high plasticity, brown with fine to medium grained gravel	D			
			5,13,18 N=31	1.0					H	>600	
						CI	Silty Clay: medium plasticity, grey brown with ironstaining and fine to medium grained gravel				V bit refusal at 1.5m
TC				2.0			As above but grey with ironstaining and ironstone bands				
			10,15,21 N=36	3.0					H	>600	
							Shale/Siltstone: brown grey, low strength, extremely weathered to distinctly weathered				
							End of BH 4 at 3.4m				
				4.0							
				5.0							
				6.0							
				7.0							
				8.0							

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Borehole Report

Borehole no: 5

Client: Gran Associates Pty Ltd
Job no: JC18322A

Project: Proposed Amity College
Date: 23/4/18

Location: 85 Byron Road and 63 Ingleburn Road Leppington
Logged by: SG

Drill Model and Mounting: B80 | Slope: 90° | R.L. Surface: 94.8m

Hole Diameter: 100mm | Bearing: Vertical | Datum: AHD

Method	Support	Water	Notes: Samples, Tests, etc	Depth(m)	Classification Symbol	Unified Soil Classification	Material Description (Soil Type, Plasticity or Particle Characteristic, colour, secondary and minor component)	Moisture Content	Consistency/Density Index	Hand Penetrometer kPa	Structure and Additional Observations
V	NIL	DRY	DS				Topsoil: Clayey Silt: low liquid limit, brown with trace of fine grained gravel				
			DS			CH	Silty Clay: high plasticity, red brown with fine to medium grained gravel	D			
			DS	1.0							
			6,11,13 N=24			CI	Silty Clay: medium plasticity, grey with ironstaining and trace of ironstone bands		H	>600	
				2.0							
			8,17 /30mm N>17				As above but with siltstone bands		H	>600	SPT bouncing at 2.68m V bit refusal at 2.7m
TC				3.0			Siltstone: brown and grey, low to medium strength, extremely weathered to distinctly weathered				
				4.0							TC bit refusal at 4.0m
							End of BH 5 at 4.0m				
				5.0							
				6.0							
				7.0							
				8.0							

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Borehole Report

Borehole no: 6

Client: Gran Associates Pty Ltd
Job no: JC18322A

Project: Proposed Amity College
Date: 23/4/18

Location: 85 Byron Road and 63 Ingleburn Road Leppington
Logged by: SG

Drill Model and Mounting: B80 | Slope: 90° | R.L. Surface: 95.8m

Hole Diameter: 100mm | Bearing: Vertical | Datum: AHD

Method	Support	Water	Notes: Samples, Tests, etc	Depth(m)	Classification Symbol	Unified Soil Classification	Material Description (Soil Type, Plasticity or Particle Characteristic, colour, secondary and minor component)	Moisture Content	Consistency/Density Index	Hand Penetrometer kPa	Structure and Additional Observations
V	NIL	DRY					Topsoil: Clayey Silt: low liquid limit, brown with trace of fine grained gravel				
						CH	Silty Clay: high plasticity, red brown with fine grained gravel	D			
				1.0		CI	Silty Clay: medium plasticity, brown red				
			5,14,16 N=30				As above but grey brown with ironstone bands		H	>600	
				2.0							V bit refusal at 2.6m
TC							Siltstone: brown, low to medium strength, distinctly weathered with ironstone bands				
				3.0							TC bit refusal at 3.3m
							End of BH 6 at 3.3m				
				4.0							
				5.0							
				6.0							
				7.0							
				8.0							

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Borehole Report

Borehole no: 7

Client: Gran Associates Pty Ltd
Job no: JC18322A

Project: Proposed Amity College
Date: 23/4/18

Location: 85 Byron Road and 63 Ingleburn Road Leppington
Logged by: SG

Drill Model and Mounting: B80 | Slope: 90° | R.L. Surface: 95.4m

Hole Diameter: 100mm | Bearing: Vertical | Datum: AHD

Method	Support	Water	Notes: Samples, Tests, etc	Depth(m)	Classification Symbol	Unified Soil Classification	Material Description Soil Type, Plasticity or Particle Characteristic, colour, secondary and minor component	Moisture Content	Consistency/Density Index	Hand Penetrometer kPa	Structure and Additional Observations
V	NIL	DRY		0.0			Topsoil: Clayey Silt: low liquid limit, brown with trace of fine grained gravel	D			
						CH	Silty Clay: high plasticity, red brown	D			
			10,16,18 N=34	1.0					H		
						CI	Silty Clay: medium plasticity, grey brown with trace of ironstaining and ironstone bands				
				2.0							
			8,12,18 /40mm N>30								V bit refusal at 2.8m
TC				3.0			Siltstone: grey, low to medium strength, extremely weathered to distinctly weathered with ironstaining and clay bands				SPT bouncing at 2.84m TC bit refusal at 3.6m
							End of BH 7 at 3.6m				
				4.0							
				5.0							
				6.0							
				7.0							
				8.0							

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Borehole Report

Borehole no: 8

Client: Gran Associates Pty Ltd
Job no: JC18322A

Project: Proposed Amity College
Date: 23/4/18

Location: 85 Byron Road and 63 Ingleburn Road Leppington
Logged by: SG

Drill Model and Mounting: B80 | Slope: 90° | R.L. Surface: 95.8m

Hole Diameter: 100mm | Bearing: Vertical | Datum: AHD

Method	Support	Water	Notes: Samples, Tests, etc	Depth(m)	Classification Symbol	Unified Soil Classification	Material Description (Soil Type, Plasticity or Particle Characteristic, colour, secondary and minor component)	Moisture Content	Consistency/Density Index	Hand Penetrometer kPa	Structure and Additional Observations
V	NIL	DRY					Topsoil: Clayey Silt: low liquid limit, brown with trace of fine grained gravel	D			
			U50			CH	Silty Clay: high plasticity, red brown	D			
			6,11,13 N=24	1.0		CI	Silty Clay: medium plasticity, red and grey		H	>600	
				2.0							V bit refusal at 2.6m
TC				3.0			Siltstone: grey brown, low to medium strength, extremely weathered to distinctly weathered				TC bit refusal at 3.1
							End of BH 8 at 3.1m				
				4.0							
				5.0							
				6.0							
				7.0							
				8.0							

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Borehole Report

Borehole no: 9

Client: Gran Associates Pty Ltd
Job no: JC18322A

Project: Proposed Amity College
Date: 23/4/18

Location: 85 Byron Road and 63 Ingleburn Road Leppington
Logged by: SG

Drill Model and Mounting: B80 | Slope: 90° | R.L. Surface: 96.1m

Hole Diameter: 100mm | Bearing: Vertical | Datum: AHD

Method	Support	Water	Notes: Samples, Tests, etc	Depth(m)	Classification Symbol	Unified Soil Classification	Material Description Soil Type, Plasticity or Particle Characteristic, colour, secondary and minor component	Moisture Content	Consistency/Density Index	Hand Penetrometer kPa	Structure and Additional Observations
V	NIL	DRY					Topsoil: Clayey Silt: low liquid limit, brown with trace of fine grained gravel	D			
						CH	Silty Clay: high plasticity, red brown	D			
				1.0							
			9,18,24 N=42			CI	Silty Clay: medium plasticity, grey brown with ironstaining and trace of ironstone bands		H	>600	
				2.0							V bit refusal at 2.8m
TC				3.0			Siltstone: grey brown, low to medium strength, extremely weathered to distinctly weathered				TC bit refusal at 3.6m
							End of BH 9 at 3.6m				
				4.0							
				5.0							
				6.0							
				7.0							
				8.0							

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Borehole Report

Borehole no: 10

Client: Gran Associates Pty Ltd
Job no: JC18322A

Project: Proposed Amity College
Date: 23/4/18

Location: 85 Byron Road and 63 Ingleburn Road Leppington
Logged by: SG

Drill Model and Mounting: B80 | Slope: 90° | R.L. Surface: 96.3m

Hole Diameter: 100mm | Bearing: Vertical | Datum: AHD

Method	Support	Water	Notes: Samples, Tests, etc	Depth(m)	Classification Symbol	Unified Soil Classification	Material Description Soil Type, Plasticity or Particle Characteristic, colour, secondary and minor component	Moisture Content	Consistency/Density Index	Hand Penetrometer kPa	Structure and Additional Observations
V	NIL	DRY					Topsoil: Clayey Silt: low liquid limit, brown with trace of fine grained gravel	D			
						CH	Silty Clay: high plasticity, red brown with trace of fine grained gravel	D	Vst		
			7,8,10 N=18	1.0		CI	Silty Clay: medium plasticity, grey red with fine grained gravel		H	>600	
				2.0			As above but grey with ironstaining and fine to medium grained gravel				V bit refusal at 2.6m
							End of BH 10 at 2.6m				
				3.0							
				4.0							
				5.0							
				6.0							
				7.0							
				8.0							

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Borehole Report

Borehole no: 11

Client: Gran Associates Pty Ltd
Job no: JC18322A

Project: Proposed Amity College
Date: 23/4/18

Location: 85 Byron Road and 63 Ingleburn Road Leppington
Logged by: SG

Drill Model and Mounting: B80 | Slope: 90° | R.L. Surface: 97.1m

Hole Diameter: 100mm | Bearing: Vertical | Datum: AHD

Method	Support	Water	Notes: Samples, Tests, etc	Depth(m)	Classification Symbol	Unified Soil Classification	Material Description Soil Type, Plasticity or Particle Characteristic, colour, secondary and minor component	Moisture Content	Consistency/Density Index	Hand Penetrometer kPa	Structure and Additional Observations
V	NIL	DRY					Topsoil: Clayey Silt: low liquid limit, brown with trace of fine grained gravel	D			
			DB			CH	Silty Clay: high plasticity, red brown with fine grained gravel	D			
				1.0		CI	Silty Clay: medium plasticity, grey brown with ironstaining and ironstone bands				
			8,15,17 N=32						H		
				2.0							
			11,15,22 /60mm N>37								SPT bouncing at 2.86m
TC				3.0			Siltstone: grey brown, low to medium strength, extremely weathered to distinctly weathered				V bit refusal at 2.9m TC bit refusal at 3.4m
							End of BH 11 at 3.4m				
				4.0							
				5.0							
				6.0							
				7.0							
				8.0							

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Borehole Report

Borehole no: 12

Client: Gran Associates Pty Ltd

Job no: JC18322A

Project: Proposed Amity College

Date: 23/4/16

Location: 85 Byron Road and 63 Ingleburn Road Leppington

Logged by: SG

Drill Model and Mounting: B80 | Slope: 90° | R.L. Surface: 96.9m

Hole Diameter: 100mm | Bearing: Vertical | Datum: AHD

Method	Support	Water	Notes: Samples, Tests, etc	Depth(m)	Classification Symbol	Unified Soil Classification	Material Description Soil Type, Plasticity or Particle Characteristic, colour, secondary and minor component	Moisture Content	Consistency/Density Index	Hand Penetrometer kPa	Structure and Additional Observations
V	NIL	DRY					Topsoil: Clayey Silt: low liquid limit, brown	D			
						CH	Silty Clay: high plasticity, red brown	D	Vst		
			4,8,10 N=18	1.0		CI	Silty Clay: medium plasticity, grey and red with ironstone gravel bands		H	>600	
				2.0							V bit refusal at 2.8m
TC				3.0			Siltstone: grey brown, low to medium strength, extremely weathered to distinctly weathered				TC bit refusal at 3.6m
							End of BH 12 at 3.6m				
				4.0							
				5.0							
				6.0							
				7.0							
				8.0							

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Borehole Report

Borehole no: 13

Client: Gran Associates Pty Ltd
Job no: JC18322A

Project: Proposed Amity College
Date: 23/4/18

Location: 85 Byron Road and 63 Ingleburn Road Leppington
Logged by: SG

Drill Model and Mounting: B80 | Slope: 90° | R.L. Surface: 96.5m

Hole Diameter: 100mm | Bearing: Vertical | Datum: AHD

Method	Support	Water	Notes: Samples, Tests, etc	Depth(m)	Classification Symbol	Unified Soil Classification	Material Description (Soil Type, Plasticity or Particle Characteristic, colour, secondary and minor component)	Moisture Content	Consistency/Density Index	Hand Penetrometer kPa	Structure and Additional Observations
V	NIL	DRY					Topsoil: Clayey Silt: low liquid limit, brown with trace of fine grained gravel	D			
						CI-CH	Silty Clay: medium to high plasticity, red brown with fine grained gravel	D			
				1.0							
TC			4,18 /50mm N>18			CI	Silty Clay: medium plasticity, grey with ironstaining and ironstone bands		H	>600	SPT bouncing at 1.2m V bit refusal at 1.2m
				2.0			Siltstone: grey brown, low to medium strength, extremely weathered to distinctly weathered				
							End of BH 13 at 2.5m				
				3.0							
				4.0							
				5.0							
				6.0							
				7.0							
				8.0							

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Borehole Report

Borehole no: 14

Client: Gran Associates Pty Ltd
Job no: JC18322A

Project: Proposed Amity College
Date: 23/4/18

Location: 85 Byron Road and 63 Ingleburn Road Leppington
Logged by: SG

Drill Model and Mounting: B80 | Slope: 90° | R.L. Surface: 95.9m

Hole Diameter: 100mm | Bearing: Vertical | Datum: AHD

Method	Support	Water	Notes: Samples, Tests, etc	Depth(m)	Classification Symbol	Unified Soil Classification	Material Description Soil Type, Plasticity or Particle Characteristic, colour, secondary and minor component	Moisture Content	Consistency/Density Index	Hand Penetrometer kPa	Structure and Additional Observations
V	NIL	DRY					Topsoil: Clayey Silt: low liquid limit, brown	D			
			DB			CH	Silty Clay: high plasticity, red brown	D			
				1.0		CI	Silty Clay: medium plasticity, grey brown		H	>600	
			8,15,22 N=37								V bit refusal at 1.6m
							End of BH 14 at 1.6m				
				2.0							
				3.0							
				4.0							
				5.0							
				6.0							
				7.0							
				8.0							

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Borehole Report

Borehole no: 15

Client: Gran Associates Pty Ltd

Job no: JC18322A

Project: Proposed Amity College

Date: 24/4/18

Location: 85 Byron Road and 63 Ingleburn Road Leppington

Logged by: SG

Drill Model and Mounting: B80 | Slope: 90° | R.L. Surface: 97.4m

Hole Diameter: 100mm | Bearing: Vertical | Datum: AHD

Method	Support	Water	Notes: Samples, Tests, etc	Depth(m)	Classification Symbol	Unified Soil Classification	Material Description Soil Type, Plasticity or Particle Characteristic, colour, secondary and minor component	Moisture Content	Consistency/Density Index	Hand Penetrometer kPa	Structure and Additional Observations
V	NIL	DRY					Topsoil: Clayey Silt: low liquid limit, brown	D			
			DS			CH	Silty Clay: high plasticity, red brown	D	(H)		
				1.0		CI	Silty Clay: medium plasticity, grey brown with fine grained gravel				V bit refusal at 1.2m
TC							Siltstone: grey brown, low to medium strength, extremely weathered to distinctly weathered				TC bit refusal at 1.8m
				2.0			End of BH 15 at 1.8m				
				3.0							
				4.0							
				5.0							
				6.0							
				7.0							
				8.0							

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Borehole Report

Borehole no: 16

Client: Gran Associates Pty Ltd
Job no: JC18322A

Project: Proposed Amity College
Date: 24/4/18

Location: 85 Byron Road and 63 Ingleburn Road Leppington
Logged by: SG

Drill Model and Mounting: B80 | Slope: 90° | R.L. Surface: 97.1m

Hole Diameter: 100mm | Bearing: Vertical | Datum: AHD

Method	Support	Water	Notes: Samples, Tests, etc	Depth(m)	Classification Symbol	Unified Soil Classification	Material Description Soil Type, Plasticity or Particle Characteristic, colour, secondary and minor component	Moisture Content	Consistency/Density Index	Hand Penetrometer kPa	Structure and Additional Observations
V	NIL	DRY					Topsoil: Clayey Silt: low liquid limit, brown	D			
						CH	Silty Clay: high plasticity, red brown	D			
				1.0		CI	Silty Clay: medium plasticity, grey brown				
			5,18,19 N=27						H		
											V bit refusal at 1.6m
TC				2.0			Siltstone: grey brown, low to medium strength, extremely weathered to distinctly weathered				
							End of BH 16 at 2.0m				
				3.0							
				4.0							
				5.0							
				6.0							
				7.0							
				8.0							

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Borehole Report

Borehole no: 17

Client: Gran Associates Pty Ltd

Job no: JC18322A

Project: Proposed Amity College

Date: 24/4/18

Location: 85 Byron Road and 63 Ingleburn Road Leppington

Logged by: SG

Drill Model and Mounting: B80 | Slope: 90° | R.L. Surface: 97.8m

Hole Diameter: 100mm | Bearing: Vertical | Datum: AHD

Method	Support	Water	Notes: Samples, Tests, etc	Depth(m)	Classification Symbol	Unified Soil Classification	Material Description Soil Type, Plasticity or Particle Characteristic, colour, secondary and minor component	Moisture Content	Consistency/Density Index	Hand Penetrometer kPa	Structure and Additional Observations
V	NIL	DRY	DS				Fill: Clayey Silt/Gravelly Silt: low liquid limit, brown with crushed rock and a trace of brick fragments	D			Driveway
			DS			CH	Silty Clay: high plasticity, red brown	D			
				1.0		CI	Silty Clay: medium plasticity, grey brown				
			15,12 /20mm						H		SPT bouncing at 1.17m V bit refusal at 1.3m
TC			N>12				Siltstone: grey brown, low to medium strength, extremely weathered to distinctly weathered				
				2.0							TC bit refusal at 2.0m
							End of BH 17 at 2.0m				
				3.0							
				4.0							
				5.0							
				6.0							
				7.0							
				8.0							

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Borehole Report

Borehole no: 18

Client: Gran Associates Pty Ltd

Job no: JC18322A

Project: Proposed Amity College

Date: 24/4/18

Location: 85 Byron Road and 63 Ingleburn Road Leppington

Logged by: SG

Drill Model and Mounting: B80 | Slope: 90° | R.L. Surface: 98.0m

Hole Diameter: 100mm | Bearing: Vertical | Datum: AHD

Method	Support	Water	Notes: Samples, Tests, etc	Depth(m)	Classification Symbol	Unified Soil Classification	Material Description (Soil Type, Plasticity or Particle Characteristic, colour, secondary and minor component)	Moisture Content	Consistency/Density Index	Hand Penetrometer kPa	Structure and Additional Observations
V	NIL	DRY					Fill: Gravelly Silt: low liquid limit, dark grey	D			Driveway
						CH	Silty Clay: high plasticity, red brown with fine grained gravel	D			
			3,10,19 N=29	1.0		CI	Silty Clay: medium plasticity, grey brown with ironstaining and fine grained gravel		H	>600	V bit refusal at 1.6m
							End of BH 18 at 1.6m				
				2.0							
				3.0							
				4.0							
				5.0							
				6.0							
				7.0							
				8.0							

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Borehole Report

Borehole no:19

Client: Gran Associates Pty Ltd
Job no: JC18322A

Project: Proposed Amity College
Date: 24/4/18

Location: 85 Byron Road and 63 Ingleburn Road Leppington
Logged by: SG

Drill Model and Mounting: B80 | Slope: 90° | R.L. Surface: 97.7m

Hole Diameter: 100mm | Bearing: Vertical | Datum: AHD

Method	Support	Water	Notes: Samples, Tests, etc	Depth(m)	Classification Symbol	Unified Soil Classification	Material Description Soil Type, Plasticity or Particle Characteristic, colour, secondary and minor component	Moisture Content	Consistency/Density Index	Hand Penetrometer kPa	Structure and Additional Observations
V	NIL	DRY					Topsoil: Clayey Silt: low liquid limit, brown with fine grained gravel	D			
						CH	Silty Clay: high plasticity, red brown with fine grained gravel	D	Vst		
				1.0							
			3,4,6 N=10							450	
						CI	Silty Clay: medium plasticity, grey with ironstaining		H	600	
				2.0							V bit refusal at 2.4m
TC							Siltstone: grey brown, low to medium strength, extremely weathered to distinctly weathered				
				3.0							TC bit refusal at 3.0m
							End of BH 19 at 3.0m				
				4.0							
				5.0							
				6.0							
				7.0							
				8.0							

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Borehole Report

Borehole no: 20

Client: Gran Associates Pty Ltd
Job no: JC18322A

Project: Proposed Amity College
Date: 24/4/18

Location: 85 Byron Road and 63 Ingleburn Road Leppington
Logged by: SG

Drill Model and Mounting: B80 | Slope: 90° | R.L. Surface: 98.3m

Hole Diameter: 100mm | Bearing: Vertical | Datum: AHD

Method	Support	Water	Notes: Samples, Tests, etc	Depth(m)	Classification Symbol	Unified Soil Classification	Material Description Soil Type, Plasticity or Particle Characteristic, colour, secondary and minor component	Moisture Content	Consistency/Density Index	Hand Penetrometer kPa	Structure and Additional Observations
V	NIL	DRY					Topsoil/Fill: Gravelly Clayey Silt: brown	D			Driveway
						CH	Silty Clay: high plasticity, red brown with fine grained gravel	D			
				1.0		CI	Silty Clay: medium plasticity, grey brown with fine gravel gravel and ironstone bands		H		
			6,12,18 /70mm N>30				As above but with siltstone bands				SPT bouncing at 1.37m V bit refusal at 1.6m
TC				2.0			Siltstone/Shale: grey brown, low to medium strength, extremely weathered to distinctly weathered				TC bit refusal at 2.4m
							End of BH 20 at 2.4m				
				3.0							
				4.0							
				5.0							
				6.0							
				7.0							
				8.0							

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Borehole Report

Borehole no: 21

Client: Gran Associates Pty Ltd
Job no: JC18322A

Project: Proposed Amity College
Date: 24/4/18

Location: 85 Byron Road and 63 Ingleburn Road Leppington
Logged by: SG

Drill Model and Mounting: B80 | Slope: 90° | R.L. Surface: 97.8m

Hole Diameter: 100mm | Bearing: Vertical | Datum: AHD

Method	Support	Water	Notes: Samples, Tests, etc	Depth(m)	Classification Symbol	Unified Soil Classification	Material Description Soil Type, Plasticity or Particle Characteristic, colour, secondary and minor component	Moisture Content	Consistency/Density Index	Hand Penetrometer kPa	Structure and Additional Observations
V	NIL	DRY					Topsoil/fill: Clayey Silt: brown a trace of plastic	D			
						CH	Silty Clay: high plasticity, red brown	D	(H)		
						CI	Silty Clay: medium plasticity, grey brown with fine grained gravel				V bit refusal at 0.9m
				1.0							
TC							Siltstone: grey brown, low to medium strength, extremely weathered to distinctly weathered				TC bit refusal at 1.4m
							End of BH 21 at 1.4m				
				2.0							
				3.0							
				4.0							
				5.0							
				6.0							
				7.0							
				8.0							

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Borehole Report

Borehole no: 22

Client: Gran Associates Pty Ltd
Job no: JC18322A

Project: Proposed Amity College
Date: 24/4/18

Location: 85 Byron Road and 63 Ingleburn Road Leppington
Logged by: SG

Drill Model and Mounting: B80 | Slope: 90° | R.L. Surface: 97.5m

Hole Diameter: 100mm | Bearing: Vertical | Datum: AHD

Method	Support	Water	Notes: Samples, Tests, etc	Depth(m)	Classification Symbol	Unified Soil Classification	Material Description Soil Type, Plasticity or Particle Characteristic, colour, secondary and minor component	Moisture Content	Consistency/Density Index	Hand Penetrometer kPa	Structure and Additional Observations
V	NIL	DRY					Topsoil: Clayey Silt: low liquid limit, brown				
						CH	Silty Clay: high plasticity, red brown	D			
				1.0		CI	Silty Clay: medium plasticity, grey brown		H		
			14,14,22 N=36								V bit refusal at 1.4m
TC				2.0			Siltstone: grey brown, low to medium strength, extremely weathered to distinctly weathered				TC bit refusal at 2.2m
							End of BH 22 at 2.2m				
				3.0							
				4.0							
				5.0							
				6.0							
				7.0							
				8.0							

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Borehole Report

Borehole no: 23

Client: Gran Associates Pty Ltd
Job no: JC18322A

Project: Proposed Amity College
Date: 24/4/18

Location: 85 Byron Road and 63 Ingleburn Road Leppington
Logged by: SG

Drill Model and Mounting: B80 | Slope: 90° | R.L. Surface: 97.2m

Hole Diameter: 100mm | Bearing: Vertical | Datum: AHD

Method	Support	Water	Notes: Samples, Tests, etc	Depth(m)	Classification Symbol	Unified Soil Classification	Material Description (Soil Type, Plasticity or Particle Characteristic, colour, secondary and minor component)	Moisture Content	Consistency/Density Index	Hand Penetrometer kPa	Structure and Additional Observations
V	NIL	DRY					Topsoil/fill: Clayey Silt: low liquid limit, brown with crushed rock with an asphalt lump	D			Driveway
						CH	Silty Clay: high plasticity, red brown	D			
						CI	Silty Clay: medium plasticity, grey brown with fine to medium grained gravel		(H)		V bit refusal at 0.9m
				1.0							
TC							Siltstone: grey brown, low to medium strength, extremely weathered to distinctly weathered				TC refusal at 1.5m
							End of BH 23 at 1.5m				
				2.0							
				3.0							
				4.0							
				5.0							
				6.0							
				7.0							
				8.0							

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Borehole Report

Borehole no: 24

Client: Gran Associates Pty Ltd

Job no: JC18322A

Project: Proposed Amity College

Date: 24/4/18

Location: 85 Byron Road and 63 Ingleburn Road Leppington

Logged by: SG

Drill Model and Mounting: B80 | Slope: 90° | R.L. Surface: 97.0m

Hole Diameter: 100mm | Bearing: Vertical | Datum: AHD

Method	Support	Water	Notes: Samples, Tests, etc	Depth(m)	Classification Symbol	Unified Soil Classification	Material Description Soil Type, Plasticity or Particle Characteristic, colour, secondary and minor component	Moisture Content	Consistency/Density Index	Hand Penetrometer kPa	Structure and Additional Observations
V	NIL	DRY					Topsoil/fill: Clayey Silt: low liquid limit, brown with some gravel	D			
						CH	Silty Clay: high plasticity, red brown	D	(H)		
				1.0		CI	Silty Clay: medium plasticity, grey brown				V bit refusal at 0.9m
							End of BH 24 at 0.9m				
				2.0							
				3.0							
				4.0							
				5.0							
				6.0							
				7.0							
				8.0							

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Borehole Report

Borehole no: 25

Client: Gran Associates Pty Ltd

Job no: JC18322A

Project: Proposed Amity College

Date: 24/4/18

Location: 85 Byron Road and 63 Ingleburn Road Leppington

Logged by: SG

Drill Model and Mounting: B80 | Slope: 90° | R.L. Surface: 97.4m

Hole Diameter: 100mm | Bearing: Vertical | Datum: AHD

Method	Support	Water	Notes: Samples, Tests, etc	Depth(m)	Classification Symbol	Unified Soil Classification	Material Description Soil Type, Plasticity or Particle Characteristic, colour, secondary and minor component	Moisture Content	Consistency/Density Index	Hand Penetrometer kPa	Structure and Additional Observations
V	NIL	DRY					Topsoil/Fill: Clayey Silt: low liquid limit, brown	D			
			U50			CH	Silty Clay: high plasticity, red brown	D	(H)		
				1.0		CI	Silty Clay: medium plasticity, grey brown				V bit refusal at 1.0m
TC							Siltstone: grey brown, low to medium strength, distinctly weathered				TC bit refusal at 1.6m
							End of BH 25 at 1.6m				
				2.0							
				3.0							
				4.0							
				5.0							
				6.0							
				7.0							
				8.0							

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Borehole Report

Borehole no: 26

Client: Gran Associates Pty Ltd
Job no: JC18322A

Project: Proposed Amity College
Date: 24/4/18

Location: 85 Byron Road and 63 Ingleburn Road Leppington
Logged by: SG

Drill Model and Mounting: B80 | Slope: 90° | R.L. Surface: 98.4m

Hole Diameter: 100mm | Bearing: Vertical | Datum: AHD

Method	Support	Water	Notes: Samples, Tests, etc	Depth(m)	Classification Symbol	Unified Soil Classification	Material Description Soil Type, Plasticity or Particle Characteristic, colour, secondary and minor component	Moisture Content	Consistency/Density Index	Hand Penetrometer kPa	Structure and Additional Observations
V	NIL	DRY	DS				Topsoil: Clayey Silt: low liquid limit, brown	D			
			DS			CH	Silty Clay: high plasticity, red brown	D			
						CI	Silty Clay: medium plasticity, brown and grey with ironstaining				
				1.0							
			3,9,12 N=21						H	>600	
							As above with siltstone bands				
				2.0							V bit refusal at 2.2m
TC							Siltstone: grey brown, low to medium strength, extremely weathered to distinctly weathered				
				3.0							TC bit refusal at 3.0m
							End of BH 26 at 3.0m				
				4.0							
				5.0							
				6.0							
				7.0							
				8.0							

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Borehole Report

Borehole no: 27

Client: Gran Associates Pty Ltd
Job no: JC18322A

Project: Proposed Amity College
Date: 24/4/18

Location: 85 Byron Road and 63 Ingleburn Road Leppington
Logged by: SG

Drill Model and Mounting: B80 | Slope: 90° | R.L. Surface: 96.2m

Hole Diameter: 100mm | Bearing: Vertical | Datum: AHD

Method	Support	Water	Notes: Samples, Tests, etc	Depth(m)	Classification Symbol	Unified Soil Classification	Material Description Soil Type, Plasticity or Particle Characteristic, colour, secondary and minor component	Moisture Content	Consistency/Density Index	Hand Penetrometer kPa	Structure and Additional Observations
V	NIL	DRY					Topsoil: Clayey Silt: low liquid limit, brown	D			
						CH	Silty Clay: high plasticity, red brown with fine grained gravel	D			
				1.0		CI	Silty Clay: medium plasticity, grey with ironstaining				
			8,12,14 N=26						H	>600	
				2.0							V bit refusal at 2.7m
TC				3.0			Siltstone: grey brown, low to medium strength, extremely weathered to distinctly weathered				TC bit refusal at 3.4m
							End of BH 27 at 3.4m				
				4.0							
				5.0							
				6.0							
				7.0							
				8.0							

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Borehole Report

Borehole no: 28

Client: Gran Associates Pty Ltd
Job no: JC18322A

Project: Proposed Amity College
Date: 24/4/18

Location: 85 Byron Road and 63 Ingleburn Road Leppington
Logged by: SG

Drill Model and Mounting: B80 | Slope: 90° | R.L. Surface: 95.3m

Hole Diameter: 100mm | Bearing: Vertical | Datum: AHD

Method	Support	Water	Notes: Samples, Tests, etc	Depth(m)	Classification Symbol	Unified Soil Classification	Material Description Soil Type, Plasticity or Particle Characteristic, colour, secondary and minor component	Moisture Content	Consistency/Density Index	Hand Penetrometer kPa	Structure and Additional Observations
V	NIL	DRY	DS				Fill: Clayey Silt/Silty Clay: low liquid limit, brown with Asbestos and tile fragments	D			
			DS								
						CI-CH	Silty Clay: medium to high plasticity, grey brown with ironstaining				
			5,11,11	1.0							
			N=22			CI	Silty Clay: medium plasticity, grey with ironstaining		H	>600	V bit refusal at 1.9m
TC				2.0			Siltstone/Shale: grey brown, low to medium strength, extremely weathered to distinctly weathered				
				3.0							TC bit refusal at 3.2m
							End of BH 28 at 3.2m				
				4.0							
				5.0							
				6.0							
				7.0							
				8.0							

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Borehole Report

Borehole no: 29

Client: Gran Associates Pty Ltd

Job no: JC18322A

Project: Proposed Amity College

Date: 30/4/18

Location: 85 Byron Road and 63 Ingleburn Road Leppington

Logged by: SG

Drill Model and Mounting: B80 | Slope: 90° | R.L. Surface: 94.6m

Hole Diameter: 100mm | Bearing: Vertical | Datum: AHD

Method	Support	Water	Notes: Samples, Tests, etc	Depth(m)	Classification Symbol	Unified Soil Classification	Material Description Soil Type, Plasticity or Particle Characteristic, colour, secondary and minor component	Moisture Content	Consistency/Density Index	Hand Penetrometer kPa	Structure and Additional Observations
V	NIL	DRY					Topsoil: Clayey Silt: low liquid limit, brown with trace of fine grained gravel	D			
						CI-CH	Silty Clay: medium to high plasticity, red brown/grey	D			
				1.0					H	>600	SPT bouncing at 1.19m
			12,18			CI	Silty Clay: medium plasticity, grey with ironstaining and ironstone bands				V bit refusal at 1.2m
TC			/40mm N>18				Siltstone: grey brown, low to medium strength, extremely weathered to distinctly weathered				TC bit refusal at 1.7m
				2.0			End of BH 29 at 1.7m				
				3.0							
				4.0							
				5.0							
				6.0							
				7.0							
				8.0							

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Borehole Report

Borehole no: 30

Client: Gran Associates Pty Ltd

Job no: JC18322A

Project: Proposed Amity College

Date: 30/4/18

Location: 85 Byron Road and 63 Ingleburn Road Leppington

Logged by: SG

Drill Model and Mounting: B80 | Slope: 90° | R.L. Surface: 95.8m

Hole Diameter: 100mm | Bearing: Vertical | Datum: AHD

Method	Support	Water	Notes: Samples, Tests, etc	Depth(m)	Classification Symbol	Unified Soil Classification	Material Description Soil Type, Plasticity or Particle Characteristic, colour, secondary and minor component	Moisture Content	Consistency/Density Index	Hand Penetrometer kPa	Structure and Additional Observations
V	NIL	DRY					Topsoil: Clayey Silt: low liquid limit, brown	D			
			U50			CI-CH	Silty Clay: medium to high plasticity, red brown	D			
				1.0		CI	Silty Clay: medium plasticity, grey brown				V bit refusal at 1.2m
			16,16 /120mm						H	>600	SPT bouncing at 1.27m
TC			N>16				Siltstone: grey brown, low to medium strength, extremely weathered to distinctly weathered				TC bit refusal at 1.8m
				2.0			End of BH 30 at 1.8m				
				3.0							
				4.0							
				5.0							
				6.0							
				7.0							
				8.0							

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Borehole Report

Borehole no: 31

Client: Gran Associates Pty Ltd
Job no: JC18322A

Project: Proposed Amity College
Date: 30/4/18

Location: 85 Byron Road and 63 Ingleburn Road Leppington
Logged by: SG

Drill Model and Mounting: B80 | Slope: 90° | R.L. Surface: 97.2m

Hole Diameter: 100mm | Bearing: Vertical | Datum: AHD

Method	Support	Water	Notes: Samples, Tests, etc	Depth(m)	Classification Symbol	Unified Soil Classification	Material Description (Soil Type, Plasticity or Particle Characteristic, colour, secondary and minor component)	Moisture Content	Consistency/Density Index	Hand Penetrometer kPa	Structure and Additional Observations
V	NIL	DRY	DS				Topsoil: Clayey Silt: low liquid limit, brown	D			
			DS			CI-CH	Silty Clay: medium to high plasticity, red grey	D			
				1.0							
			8,12,19 N=31			CI	Silty Clay: medium plasticity, grey with ironstaining		H	>600	
											V bit refusal at 1.6m
TC				2.0			Siltstone: grey brown, low to medium strength, extremely weathered to distinctly weathered				
											TC bit refusal at 2.6m
							End of BH 31 at 2.6m				
				3.0							
				4.0							
				5.0							
				6.0							
				7.0							
				8.0							

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Borehole Report

Borehole no: 32

Client: Gran Associates Pty Ltd
Job no: JC18322A

Project: Proposed Amity College
Date: 30/4/18

Location: 85 Byron Road and 63 Ingleburn Road Leppington
Logged by: SG

Drill Model and Mounting: B80 | Slope: 90° | R.L. Surface: 97.9m

Hole Diameter: 100mm | Bearing: Vertical | Datum: AHD

Method	Support	Water	Notes: Samples, Tests, etc	Depth(m)	Classification Symbol	Unified Soil Classification	Material Description (Soil Type, Plasticity or Particle Characteristic, colour, secondary and minor component)	Moisture Content	Consistency/Density Index	Hand Penetrometer kPa	Structure and Additional Observations
V	NIL	DRY					Topsoil: Clayey Silt: low liquid limit, brown	D			
						CI-CH	Silty Clay: medium to high plasticity, red brown	D			
				1.0		CI	Silty Clay: medium plasticity, grey with ironstaining				
			5,13,17 N=30						H	>600	
TC				2.0							V bit refusal at 1.6m
							Siltstone: grey brown, low to medium strength, extremely weathered to distinctly weathered				
							End of BH 32 at 2.5m				
				3.0							
				4.0							
				5.0							
				6.0							
				7.0							
				8.0							

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Borehole Report

Borehole no: 33

Client: Gran Associates Pty Ltd
Job no: JC18322A

Project: Proposed Amity College
Date: 30/4/18

Location: 85 Byron Road and 63 Ingleburn Road Leppington
Logged by: SG

Drill Model and Mounting: B80 | Slope: 90° | R.L. Surface: 98.9m

Hole Diameter: 100mm | Bearing: Vertical | Datum: AHD

Method	Support	Water	Notes: Samples, Tests, etc	Depth(m)	Classification Symbol	Unified Soil Classification	Material Description (Soil Type, Plasticity or Particle Characteristic, colour, secondary and minor component)	Moisture Content	Consistency/Density Index	Hand Penetrometer kPa	Structure and Additional Observations
V	NIL	DRY					Topsoil: Clayey Silt: low liquid limit, brown	D			
			DS			CI-CH	Silty Clay: medium to high plasticity, red brown	D			
				1.0		CI	Silty Clay: medium plasticity, grey with ironstaining				
			7,12,15 N=27						H	>600	
				2.0							V bit refusal at 1.9m
TC							Siltstone: grey brown, low to medium strength, extremely weathered to distinctly weathered				
											TC bit refusal at 2.8m
				3.0			End of BH 33 at 2.8m				
				4.0							
				5.0							
				6.0							
				7.0							
				8.0							

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Borehole Report

Borehole no: 34

Client: Gran Associates Pty Ltd
Job no: JC18322A

Project: Proposed Amity College
Date: 30/4/18

Location: 85 Byron Road and 63 Ingleburn Road Leppington
Logged by: SG

Drill Model and Mounting: B80 | Slope: 90° | R.L. Surface: 100.9m

Hole Diameter: 100mm | Bearing: Vertical | Datum: AHD

Method	Support	Water	Notes: Samples, Tests, etc	Depth(m)	Classification Symbol	Unified Soil Classification	Material Description (Soil Type, Plasticity or Particle Characteristic, colour, secondary and minor component)	Moisture Content	Consistency/Density Index	Hand Penetrometer kPa	Structure and Additional Observations
V	NIL	DRY					Topsoil: Clayey Silt: low liquid limit, brown	D			
						CH	Silty Clay: high plasticity, red brown	D			
				1.0		CI	Silty Clay: medium plasticity grey with ironstaining		H	>600	SPT bouncing at 1.35m V bit refusal at 1.4m
			5,11,12 /50mm N>23								
TC				2.0			Shale/Siltstone: grey brown, low to medium strength, extremely weathered to distinctly weathered				TC bit refusal at 2.0m
							End of BH 34 at 2.0m				
				3.0							
				4.0							
				5.0							
				6.0							
				7.0							
				8.0							

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Borehole Report

Borehole no: 35

Client: Gran Associates Pty Ltd
Job no: JC18322A

Project: Proposed Amity College
Date: 30/4/18

Location: 85 Byron Road and 63 Ingleburn Road Leppington
Logged by: SG

Drill Model and Mounting: B80 | Slope: 90° | R.L. Surface: 99.8m

Hole Diameter: 100mm | Bearing: Vertical | Datum: AHD

Method	Support	Water	Notes: Samples, Tests, etc	Depth(m)	Classification Symbol	Unified Soil Classification	Material Description Soil Type, Plasticity or Particle Characteristic, colour, secondary and minor component	Moisture Content	Consistency/Density Index	Hand Penetrometer kPa	Structure and Additional Observations
V	NIL	DRY					Topsoil: Clayey Silt: low liquid limit, brown	D			
			DS			CH	Silty Clay: high plasticity, red brown	D			
				1.0		CI	Silty Clay: medium plasticity grey with ironstaining		H	>600	V bit refusal at 1.4m
			8,14,18 /20mm N>32								
TC				2.0			Shale/Siltstone: grey brown, low to medium strength, extremely weathered to distinctly weathered				TC bit refusal at 2.1m
							End of BH 35 at 2.1m				
				3.0							
				4.0							
				5.0							
				6.0							
				7.0							
				8.0							

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Borehole Report

Borehole no: 36

Client: Gran Associates Pty Ltd
Job no: JC18322A

Project: Proposed Amity College
Date: 30/4/18

Location: 85 Byron Road and 63 Ingleburn Road Leppington
Logged by: SG

Drill Model and Mounting: B80 | Slope: 90° | R.L. Surface: 97.8m

Hole Diameter: 100mm | Bearing: Vertical | Datum: AHD

Method	Support	Water	Notes: Samples, Tests, etc	Depth(m)	Classification Symbol	Unified Soil Classification	Material Description Soil Type, Plasticity or Particle Characteristic, colour, secondary and minor component	Moisture Content	Consistency/Density Index	Hand Penetrometer kPa	Structure and Additional Observations
V	NIL	DRY					Topsoil: Clayey Silt: low liquid limit, brown	D			
						CI	Silty Clay: medium plasticity, grey red	D			
			3,8,13 N=21	1.0					H	>600	Disturbed Sample Taken
				2.0			As above but with shale bands				V bit refusal at 2.4m
TC							Shale/Siltstone: grey brown, low to medium strength, extremely weathered to distinctly weathered				
				3.0							TC bit refusal at 3.0m
							End of BH 36 at 3.0m				
				4.0							
				5.0							
				6.0							
				7.0							
				8.0							

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Borehole Report

Borehole no: 37

Client: Gran Associates Pty Ltd
Job no: JC18322A

Project: Proposed Amity College
Date: 30/4/18

Location: 85 Byron Road and 63 Ingleburn Road Leppington
Logged by: SG

Drill Model and Mounting: B80 | Slope: 90° | R.L. Surface: 96.4m

Hole Diameter: 100mm | Bearing: Vertical | Datum: AHD

Method	Support	Water	Notes: Samples, Tests, etc	Depth(m)	Classification Symbol	Unified Soil Classification	Material Description (Soil Type, Plasticity or Particle Characteristic, colour, secondary and minor component)	Moisture Content	Consistency/Density Index	Hand Penetrometer kPa	Structure and Additional Observations
V	NIL	DRY					Topsoil: Clayey Silt: low liquid limit, brown	D			
						CH	Silty Clay: high plasticity, red brown	D			
				1.0							
			8,11,13 N=24			CI	Silty Clay: medium plasticity, grey red with ironstaining		H	>600	V bit refusal at 1.4m
TC				2.0			Shale/Siltstone: grey brown, low to medium strength, extremely weathered to distinctly weathered				TC bit refusal at 2.4m
							End of BH 37 at 2.4m				
				3.0							
				4.0							
				5.0							
				6.0							
				7.0							
				8.0							

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Borehole Report

Borehole no: 38

Client: Gran Associates Pty Ltd
Job no: JC18322A

Project: Proposed Amity College
Date: 30/4/18

Location: 85 Byron Road and 63 Ingleburn Road Leppington
Logged by: SG

Drill Model and Mounting: B80 | Slope: 90° | R.L. Surface: 96.0m

Hole Diameter: 100mm | Bearing: Vertical | Datum: AHD

Method	Support	Water	Notes: Samples, Tests, etc	Depth(m)	Classification Symbol	Unified Soil Classification	Material Description Soil Type, Plasticity or Particle Characteristic, colour, secondary and minor component	Moisture Content	Consistency/Density Index	Hand Penetrometer kPa	Structure and Additional Observations
V	NIL	DRY					Topsoil/Fill: Clayey Silt: low liquid limit, brown	D			
						CH	Silty Clay: high plasticity, red brown	D			
			6,11,17 N=28	1.0					H	>600	
						CI	Silty Clay: medium plasticity, grey red with ironstaining				
TC				2.0			As above with siltstone bands				V bit refusal at 2.2m
				3.0			Siltstone: grey brown, low to medium strength, extremely weathered to distinctly weathered				
							End of BH 38 at 3.0m				
				4.0							
				5.0							
				6.0							
				7.0							
				8.0							

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Borehole Report

Borehole no: 39

Client: Gran Associates Pty Ltd
Job no: JC18322A

Project: Proposed Amity College
Date: 30/4/18

Location: 85 Byron Road and 63 Ingleburn Road Leppington
Logged by: SG

Drill Model and Mounting: B80 | Slope: 90° | R.L. Surface: 97.1m

Hole Diameter: 100mm | Bearing: Vertical | Datum: AHD

Method	Support	Water	Notes: Samples, Tests, etc	Depth(m)	Classification Symbol	Unified Soil Classification	Material Description (Soil Type, Plasticity or Particle Characteristic, colour, secondary and minor component)	Moisture Content	Consistency/Density Index	Hand Penetrometer kPa	Structure and Additional Observations
V	NIL	DRY					Topsoil: Clayey Silt: low liquid limit, brown	D			
						CI-CH	Silty Clay: medium to high plasticity, red brown	D			
				1.0		CI	Silty Clay: medium plasticity, grey red with ironstaining				
			6,9,12 N=21						H	>600	
											V bit refusal at 1.7m
TC				2.0			Siltstone: grey brown, low to medium strength, extremely weathered to distinctly weathered				
											TC bit refusal at 2.6m
							End of BH 39 at 2.6m				
				3.0							
				4.0							
				5.0							
				6.0							
				7.0							
				8.0							

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Borehole Report

Borehole no: 40

Client: Gran Associates Pty Ltd
Job no: JC18322A

Project: Proposed Amity College
Date: 30/4/18

Location: 85 Byron Road and 63 Ingleburn Road Leppington
Logged by: SG

Drill Model and Mounting: B80 | Slope: 90° | R.L. Surface: 98.5m

Hole Diameter: 100mm | Bearing: Vertical | Datum: AHD

Method	Support	Water	Notes: Samples, Tests, etc	Depth(m)	Classification Symbol	Unified Soil Classification	Material Description Soil Type, Plasticity or Particle Characteristic, colour, secondary and minor component	Moisture Content	Consistency/Density Index	Hand Penetrometer kPa	Structure and Additional Observations
V	NIL	DRY					Topsoil: Clayey Silt: low liquid limit, brown	D			
			DB			CI-CH	Silty Clay: medium to high plasticity, red brown	D			
				1.0			As above but grey brown				
			4,10,13 N=23						H	>600	
TC				2.0			Siltstone: grey brown, low to medium strength, extremely weathered to distinctly weathered				V bit refusal at 1.6m TC bit refusal at 2.2m
							End of BH 40 at 2.2m				
				3.0							
				4.0							
				5.0							
				6.0							
				7.0							
				8.0							

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Borehole Report

Borehole no: 41

Client: Gran Associates Pty Ltd
Job no: JC18322A

Project: Proposed Amity College
Date: 4/4/19

Location: 85 Byron Road and 63 Ingleburn Road Leppington
Logged by: AT

Drill Model and Mounting: 5-tonne excavator | Slope: 90° | R.L. Surface: 101.6m

Hole Diameter: 200mm | Bearing: Vertical | Datum: AHD

Method	Support	Water	Notes: Samples, Tests, etc	Depth(m)	Classification Symbol	Unified Soil Classification	Material Description Soil Type, Plasticity or Particle Characteristic, colour, secondary and minor component	Moisture Content	Consistency/Density Index	Hand Penetrometer kPa	Structure and Additional Observations
AUGER	NIL	DRY	DS				Topsoil: Clayey Silt: low liquid limit, brown	D			
			DS			CH	Silty Clay: high plasticity, red brown	M			
				1.0		CI	Silty Clay: medium plasticity, grey brown	D-M			
			DS				As above but with shale bands				
				2.0							
							Shale/Siltstone: grey brown				
				3.0			End of BH 41 at 2.8m				
				4.0							
				5.0							
				6.0							
				7.0							
				8.0							

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Borehole Report

Borehole no: 42

Client: Gran Associates Pty Ltd

Job no: JC18322A

Project: Proposed Amity College

Date: 4/4/19

Location: 85 Byron Road and 63 Ingleburn Road Leppington

Logged by: AT

Drill Model and Mounting: 5-tonne excavator | Slope: 90° | R.L. Surface: 95.3m

Hole Diameter: 200mm | Bearing: Vertical | Datum: AHD

Method	Support	Water	Notes: Samples, Tests, etc	Depth(m)	Classification Symbol	Unified Soil Classification	Material Description Soil Type, Plasticity or Particle Characteristic, colour, secondary and minor component	Moisture Content	Consistency/Density Index	Hand Penetrometer kPa	Structure and Additional Observations
AUGER	NIL	DRY	DS				Topsoil: Clayey Silt: low liquid limit, brown	D			
			DS			CH	Silty Clay: high plasticity, red brown	M			
				1.0		CI	Silty Clay: medium plasticity, grey brown	D			
			DS				Shale: grey brown				
							End of BH 42 at 1.3m				Refusal at 1.3m
				2.0							
				3.0							
				4.0							
				5.0							
				6.0							
				7.0							
				8.0							

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Borehole Report

Borehole no: 43

Client: Gran Associates Pty Ltd
Job no: JC18322A

Project: Proposed Amity College
Date: 4/4/19

Location: 85 Byron Road and 63 Ingleburn Road Leppington
Logged by: AT

Drill Model and Mounting: 5-tonne excavator | Slope: 90° | R.L. Surface: 95.7m

Hole Diameter: 200mm | Bearing: Vertical | Datum: AHD

Method	Support	Water	Notes: Samples, Tests, etc	Depth(m)	Classification Symbol	Unified Soil Classification	Material Description Soil Type, Plasticity or Particle Characteristic, colour, secondary and minor component	Moisture Content	Consistency/Density Index	Hand Penetrometer kPa	Structure and Additional Observations
AUGER	NIL	DRY	DS				Topsoil: Clayey Silt: low liquid limit, brown	D-M			
			DS			CH	Silty Clay: high plasticity, red brown	D-M			
				1.0		CI	Silty Clay: medium plasticity, brown				
			DS				As above but grey	D			
			DS	2.0							
							Siltstone: grey brown,				
							End of BH 43 at 2.8m				Refusal at 2.4m
				3.0							
				4.0							
				5.0							
				6.0							
				7.0							
				8.0							

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Borehole Report

Borehole no: 44

Client: Gran Associates Pty Ltd

Job no: JC18322A

Project: Proposed Amity College

Date: 4/4/19

Location: 85 Byron Road and 63 Ingleburn Road Leppington

Logged by: AT

Drill Model and Mounting: 5-tonne excavator | Slope: 90° | R.L. Surface: 95.6m

Hole Diameter: 200mm | Bearing: Vertical | Datum: AHD

Method	Support	Water	Notes: Samples, Tests, etc	Depth(m)	Classification Symbol	Unified Soil Classification	Material Description Soil Type, Plasticity or Particle Characteristic, colour, secondary and minor component	Moisture Content	Consistency/Density Index	Hand Penetrometer kPa	Structure and Additional Observations
AUGER	NIL	DRY	DS				Topsoil: Clayey Silt: low liquid limit, brown	M-W			
			DS	1.0		CH	Silty Clay: high plasticity, red brown	M			
						CI	Silty Clay: medium plasticity, brown	D-M			
			DS	2.0			Shale: grey brown				
							End of BH 44 at 2.0m				
				3.0							
				4.0							
				5.0							
				6.0							
				7.0							
				8.0							

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Borehole Report

Borehole no: 45

Client: Gran Associates Pty Ltd

Job no: JC18322A

Project: Proposed Amity College

Date: 4/4/19

Location: 85 Byron Road and 63 Ingleburn Road Leppington

Logged by: AT

Drill Model and Mounting: 5-tonne excavator | Slope: 90° | R.L. Surface: 94.4m

Hole Diameter: 200mm | Bearing: Vertical | Datum: AHD

Method	Support	Water	Notes: Samples, Tests, etc	Depth(m)	Classification Symbol	Unified Soil Classification	Material Description Soil Type, Plasticity or Particle Characteristic, colour, secondary and minor component	Moisture Content	Consistency/Density Index	Hand Penetrometer kPa	Structure and Additional Observations
AUGER	NIL	DRY	DG				Topsoil: Clayey Silt: low liquid limit, brown	D			
			DG	1.0		CH	Silty Clay: high plasticity, red brown	D-M			
			DG	2.0		CI	Silty Clay: medium plasticity, grey red with ironstone gravel	D			
							Shale: grey brown				
				3.0			End of BH 45 at 1.4m				Refusal at 1..4m
				4.0							
				5.0							
				6.0							
				7.0							
				8.0							

APPENDIX B
Laboratory Test Certificates

GeoEnviro Consultancy Pty Ltd
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Test Results - California Bearing Ratio

Client / Address: Gran Associates Pty Ltd / Rozelle — Job No: JC18322A

Project: Proposed Amity College — Date: 6/6/18

Location: 85 Byron Road and 63 Ingleburn Road Leppington — Report No: R01A

SAMPLE INFORMATION Test Methods						
Lab Reference No.			SR11985	SR11986	SR11987	
Date Sampled			24-Apr-18	24-Apr-18	24-Apr-18	
Date Tested			08-May-18	08-May-18	08-May-18	
Sample Identification			BH 11 (0.3-0.6m)	BH 14 (0.3-0.7m)	BH 40 (0.4-0.7m)	
Laboratory Specimen Description			Silty Clay: red brown	Silty Clay: red brown	Silty Clay: red brown	
TEST RESULTS						
Laboratory Compaction & Moisture Content - Test Methods AS1289 5.1.1 Mould A and AS1289 2.1.1						
Maximum Dry Density t/m3			1.65	1.65	1.61	
Optimum Moisture Content %			20.5	21.0	22.0	
Field Moisture Content %			15.0	15.0	17.0	
% Of Oversize 19mm			-	-	-	
Replacement of Oversize (See note B)			-	-	-	
California Bearing Ratio - Test Method AS1289 6.1.1						
CBR TEST	Dry Density t/m3	Before Soaking	1.64	1.65	1.60	
		After Soaking	1.60	1.59	1.56	
	Density Ratio %	Before Soaking	99.5	100.0	99.5	
		After Soaking	97.0	97.0	97.0	
	Moisture Content %	Before Soaking	20.0	21.0	22.5	
		After Soaking	24.0	22.0	26.0	
	Number of Days Soaked		4	4	4	
	Surcharge kg		6.75	6.75	6.75	
	Moisture Content After Test %	Top 30mm	29.5	31.5	29.0	
		Whole Sample	24.0	22.0	26.0	
	Swell After Soaking %		2.5	3.5	2.6	
	Penetration mm		2.5	2.5	2.5	
	CBR Value %		2.5	2.5	3.0	

Notes: (A) Test specimen was compacted to a target dry density of 100 percent standard (AS 1289 5.1.1)

(B) If specified the percentage of oversize retained on the 19mm may be replaced by an equal portion of –19mm to +4.75mm

Remarks

Authorised Signatory _____ Solern Liew Date 6/6/18

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Test Results - Shrink/Swell Index

Client / Address: Gran Associates Pty Ltd / Rozelle | Job No: JC18322A

Project: Proposed Amity College | Date: 6/6/18

Location: 85 Byron Road and 63 Ingleburn Road Leppington | Report No: R02A

Test Procedure: AS 1289 7.1.1

Sample Identification	BH 8 (0.4-0.7m)	BH 25 (0.4-0.7m)	BH 30 (0.5-0.8m)	
Sample Register No	SR11979	SR11980	SR11981	
Sample Date	24-Apr-18	24-Apr-18	24-Apr-18	
Test Date	2-May-18	2-May-18	2-May-18	
Sample Procedure	AS 1289 1.1, 1.2.1 (6.5.3)	AS 1289 1.1, 1.2.1 (6.5.3)	AS 1289 1.1, 1.2.1 (6.5.3)	
Test Results				
Test Procedure	AS 1289 2.1.1	AS 1289 2.1.1	AS 1289 2.1.1	
Moisture Content				
Initial %	15.5	11.0	14.5	
Final %	24.0	15.5	23.0	
Test Procedure	AS 1289 7.1.1	AS 1289 7.1.1	AS 1289 7.1.1	
Estimated UCS				
Before Test kPa	>600	>600	>600	
After Test kPa	210	>600	280	
Swell %	10.7	3.1	5.8	
Shrinkage %	2.4	0.6	1.6	
Shrink/Swell Index %/pF	4.3	1.2	2.5	
Material Description	Silty Clay: red brown with trace of gravel	Gravelly Silty Clay: grey brown	Silty Clay: grey brown	

Remarks

Authorised Signatory _____ Solern Liew Date 6/6/18

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Test Results - Atterberg Limits

Client / Address: Gran Associates Pty Ltd / Rozelle — Job No: JC18322A

Project: Proposed Amity College — Date: 6/6/18

Location: 85 Byron Road and 63 Ingleburn Road Leppington — Report No: R03A

Sample Identification	BH 5 (0.4-0.6m)	BH 15 (0.4-0.7m)	BH 33 (0.4-0.7m)	
Sample Register No	SR11982	SR11983	SR11984	
Sample Date	24-Apr-18	24-Apr-18	24-Apr-18	
Test Date	5-May-18	5-May-18	5-May-18	
Sample Procedure	AS 1289 1.1, 1.2.1 (6.5.3)	AS 1289 1.1, 1.2.1 (6.5.3)	AS 1289 1.1, 1.2.1 (6.5.3)	
Test Results				
Test Procedure:	AS 1289 3.1.2	AS 1289 3.1.2	AS 1289 3.1.2	
Liquid Limit (%)	61	59	58	
Test Procedure:	AS 1289 3.2.1	AS 1289 3.2.1	AS 1289 3.2.1	
Plastic Limit (%)	27	28	28	
Test Procedure:	AS 1289 3.3.1	AS 1289 3.3.1	AS 1289 3.3.1	
Plasticity Index (%)	34	31	30	
Test Procedure:	AS 1289 3.4.1	AS 1289 3.4.1	AS 1289 3.4.1	
Linear Shrinkage (%)	18.0	16.5	15.5	
Test Procedure:	AS 1289 2.1.1	AS 1289 2.1.1	AS 1289 2.1.1	
Natural Moisture Content %	16.0	16.0	18.0	
Material Description	(CH) Silty Clay: high plasticity, red brown	(CH) Silty Clay: high plasticity, red brown	(CH) Silty Clay: high plasticity, red brown	

Remarks

Authorised Signatory  Solern Liew Date 6/6/18

GeoEnviro Consultancy Pty Ltd
Unit 5, 39-41 Fourth Avenue, Blacktown NSW 2148, Australia
Tel: (02) 96798733 Fax: (02) 96798744

Emerson Class Number

Client / Address: Gran Associates / Rozelle — Job No: JC18322C

Project: Proposed Amity College — Date: 8/4/19

Location: 85 Byron Road and 63 Ingleburn Road Leppington — Report No: R04A

Sample Identification	BH 1 (0.6-0.7m)	BH 1 (2.5-2.8m)	BH 5 (1.0-1.45m)	BH 5 (2.5-2.7m)	BH 17 (0.5-0.6m)
Sample Register No	SR12658	SR12659	SR12660	SR12661	SR12662
Sample Date	27-Mar-19	27-Mar-19	27-Mar-19	27-Mar-19	27-Mar-19
Test Date	29-Mar-19	29-Mar-19	29-Mar-19	29-Mar-19	29-Mar-19
Sample Procedure	AS 1289 1.1, 1.2.1 (6.5.4)	AS 1289 1.1, 1.2.1 (6.5.4)	AS 1289 1.1, 1.2.1 (6.5.4)	AS 1289 1.1, 1.2.1 (6.5.4)	AS 1289 1.1, 1.2.1 (6.5.4)
Test Procedure	AS 1289 1.1, 1.2.1, 3.8.1				
Test Results					
Air Dried crumbs					
Time in water:	2:14	12:31	2:14	12:30	2:14
Time dispersion starts:	2:21	12:32	2:21	12:32	2:21
Remoulded Soil					
Time in water	-	-	-	-	-
Time dispersion starts	-	-	-	-	-
Type of water	Distilled	Distilled	Distilled	Distilled	Distilled
Temp. of water	24°	24°	24°	24°	24°
Emerson Class Number					
Class No.	2	1	1	1	1

Remarks

Authorised Signatory _____ Solern Liew Date 8/4/19

GeoEnviro Consultancy Pty Ltd
Unit 5, 39-41 Fourth Avenue, Blacktown NSW 2148, Australia
Tel: (02) 96798733 Fax: (02) 96798744

Emerson Class Number

Client / Address: Gran Associates / Rozelle — Job No: JC18322C

Project: Proposed Amity College — Date: 8/4/19

Location: 85 Byron Road and 63 Ingleburn Road Leppington — Report No: R05A

Sample Identification	BH 17 (1.0-1.45m)	BH 26 (0.5-0.6m)	BH 26 (1.0-1.45m)	BH 28 (0.5-0.6m)	BH 28 (1.0-1.45m)
Sample Register No	SR12663	SR12664	SR12665	SR12666	SR12667
Sample Date	27-Mar-19	27-Mar-19	27-Mar-19	27-Mar-19	27-Mar-19
Test Date	29-Mar-19	29-Mar-19	29-Mar-19	29-Mar-19	29-Mar-19
Sample Procedure	AS 1289 1.1, 1.2.1 (6.5.4)	AS 1289 1.1, 1.2.1 (6.5.4)	AS 1289 1.1, 1.2.1 (6.5.4)	AS 1289 1.1, 1.2.1 (6.5.4)	AS 1289 1.1, 1.2.1 (6.5.4)
Test Procedure	AS 1289 1.1, 1.2.1, 3.8.1				

Test Results

Air Dried crumbs					
Time in water:	12:30	2:14	12:30	2:14	12:32
Time dispersion starts:	12:33	-	12:32	3:40	12:33
Remoulded Soil					
Time in water	-	3:53	-	-	-
Time dispersion starts	-	-	-	-	-
Type of water	Distilled	Distilled	Distilled	Distilled	Distilled
Temp. of water	24°	24°	24°	24°	24°
Emerson Class Number					
Class No.	2	5	2	2	1

Remarks

Authorised Signatory  Solern Liew Date 8/4/19

GeoEnviro Consultancy Pty Ltd
Unit 5, 39-41 Fourth Avenue, Blacktown NSW 2148, Australia
Tel: (02) 96798733 Fax: (02) 96798744

Emerson Class Number

Client / Address: Gran Associates / Rozelle — Job No: JC18322C
Project: Proposed Amity College — Date: 8/4/19
Location: 85 Byron Road and 63 Ingleburn Road Leppington — Report No: R06A

Sample Identification	BH 31 (0.5-0.6m)	BH 31 (1.0-1.45m)	BH 35 (0.5-0.6m)		
Sample Register No	SR12668	SR12669	SR12670		
Sample Date	27-Mar-19	27-Mar-19	27-Mar-19		
Test Date	29-Mar-19	29-Mar-19	29-Mar-19		
Sample Procedure	AS 1289 1.1, 1.2.1 (6.5.4)	AS 1289 1.1, 1.2.1 (6.5.4)	AS 1289 1.1, 1.2.1 (6.5.4)		
Test Procedure	AS 1289 1.1, 1.2.1, 3.8.1				
Test Results					
Air Dried crumbs					
Time in water:	12:31	12:32	2:14		
Time dispersion starts:	-	12:33	3:39		
Remoulded Soil					
Time in water	3:53	-	-		
Time dispersion starts	-	-	-		
Type of water	Distilled	Distilled	Distilled		
Temp. of water	24°	24°	24°		
Emerson Class Number					
Class No.	4	2	2		

Remarks

Authorised Signatory _____ Solern Liew Date 8/4/19

GeoEnviro Consultancy Pty Ltd
Unit 5, 39-41 Fourth Avenue, Blacktown NSW 2148, Australia
Tel: (02) 96798733 Fax: (02) 96798744

Atterberg Limits & Particle Size Distribution

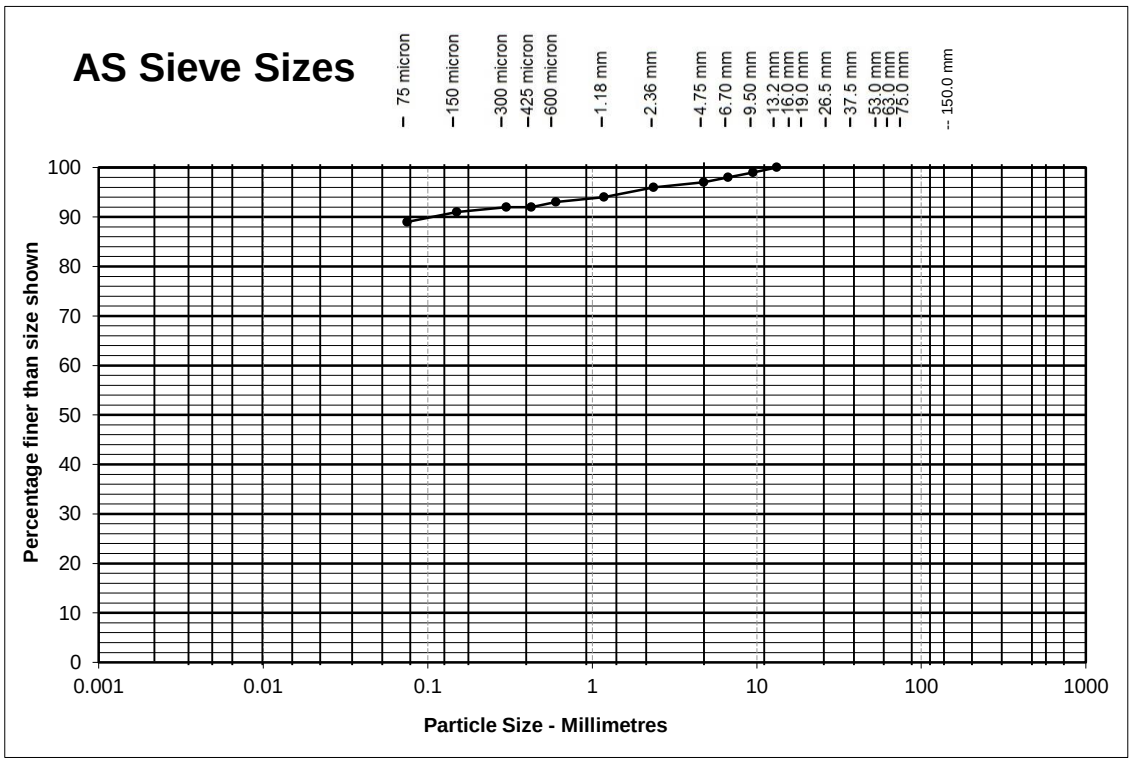
Client / Address: Gran Associates / Rozelle	Job No: JC18322C
Project: Proposed Amity College	Date: 8/4/19
Location: 85 Byron Road and 63 Ingleburn Road Leppington	Report No: R07A
Lab Reference No: SR12659	Sample Identification: BH 1 (2.5-2.8m)
Laboratory Specimen Description:	

Test Method	Test Results	Test Procedure
Liquid Limit (%)	ND	AS 1289 3.1.1
Plasitc Limit (%)	ND	AS 1289 3.2.1
Plasticity Index (%)	ND	AS 1289 3.3.1
Linear Shrinkage (%)	ND	AS 1289 3.4.1
Natural Moisture %	ND	AS 1289 2.1.1
Sample History:	Air drier	
Preparation Method.	Dry sieved	
Condition of linear shrinkage.	Curling linear shrinkage.	
Linear shrinkage mould length.	250mm	

ND = not determined NO = not obtainable NP = non plastic

Test Procedure AS1289 2.1.1, 3.6.3

Sieve Size	% Passing	Specification
150 mm		
75 mm		
63 mm		
53 mm		
37.5 mm		
26.5 mm		
19 mm		
16 mm		
13.2 mm	100	
9.5 mm	99	
6.7 mm	98	
4.75 mm	97	
2.36 mm	96	
1.18 mm	94	
600 um	93	
425 um	92	
300 um	92	
150 um	91	
75 um	89	



clay	silt			sand			gravel			cobbles
	fine	medium	coarse	fine	medium	coarse	fine	medium	coarse	

Remarks:

Authorised Signatory _____ _____ Solern Liew Date 8/4/19

GeoEnviro Consultancy Pty Ltd
Unit 5, 39-41 Fourth Avenue, Blacktown NSW 2148, Australia
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Atterberg Limits & Particle Size Distribution

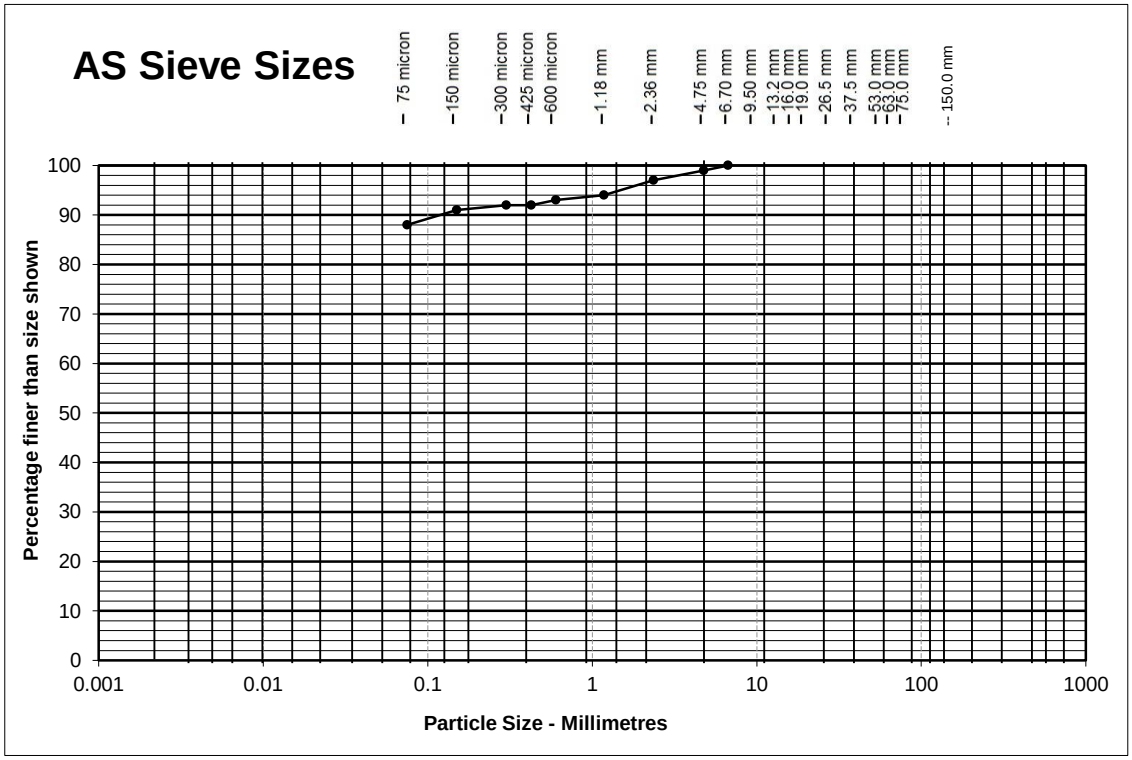
Client / Address: Gran Associates / Rozelle	Job No: JC18322C
Project: Proposed Amity College	Date: 8/4/19
Location: 85 Byron Road and 63 Ingleburn Road Leppington	Report No: R08A
Lab Reference No: SR12664	Sample Identification: BH 26 (0.5-0.6m)
Laboratory Specimen Description:	

Test Method	Test Results	Test Procedure
Liquid Limit (%)	ND	AS 1289 3.1.1
Plasitc Limit (%)	ND	AS 1289 3.2.1
Plasticity Index (%)	ND	AS 1289 3.3.1
Linear Shrinkage (%)	ND	AS 1289 3.4.1
Natural Moisture %	ND	AS 1289 2.1.1
Sample History:	Air drier	
Preparation Method.	Dry sieved	
Condition of linear shrinkage.	Curling linear shrinkage.	
Linear shrinkage mould length.	250mm	

ND = not determined NO = not obtainable NP = non plastic

Test Procedure AS1289 2.1.1, 3.6.3

Sieve Size	% Passing	Specification
150 mm		
75 mm		
63 mm		
53 mm		
37.5 mm		
26.5 mm		
19 mm		
16 mm		
13.2 mm		
9.5 mm		
6.7 mm	100	
4.75 mm	99	
2.36 mm	97	
1.18 mm	94	
600 um	93	
425 um	92	
300 um	92	
150 um	91	
75 um	88	



clay	silt			sand			gravel			cobbles
	fine	medium	coarse	fine	medium	coarse	fine	medium	coarse	

Remarks:

Authorised Signatory _____ _____ Solern Liew Date 8/4/19

GeoEnviro Consultancy Pty Ltd
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Atterberg Limits & Particle Size Distribution

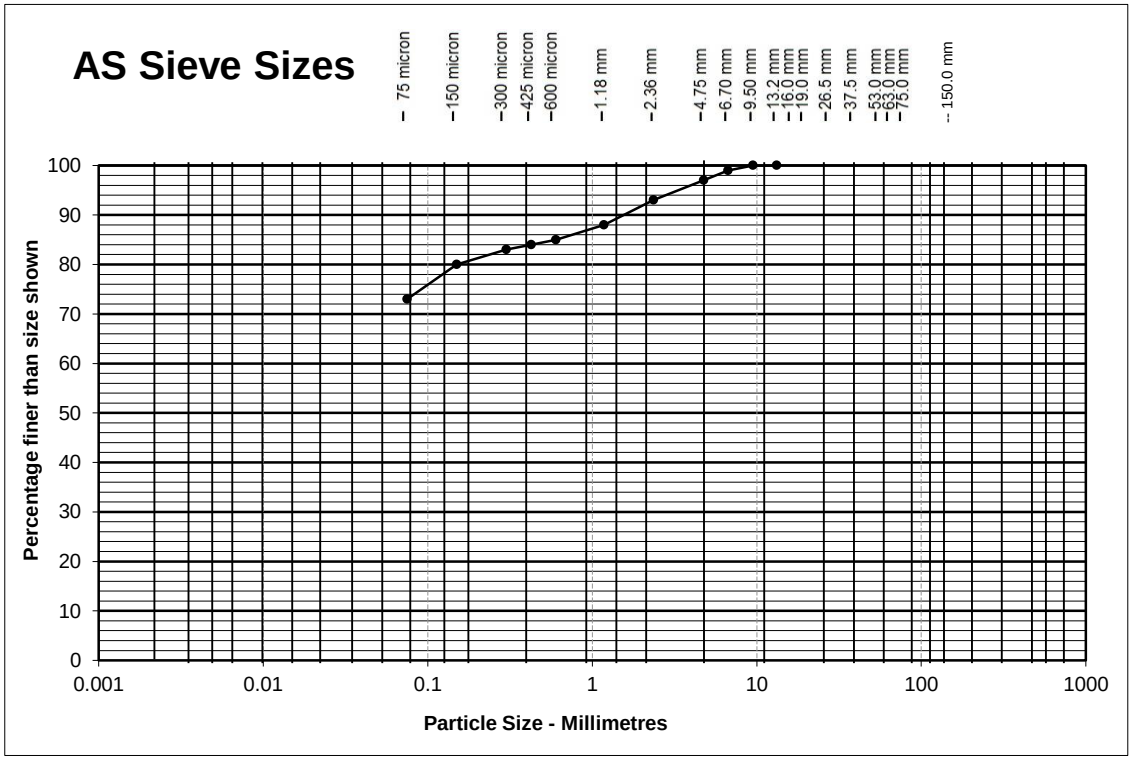
Client / Address: Gran Associates / Rozelle	Job No: JC18322C
Project: Proposed Amity College	Date: 8/4/19
Location: 85 Byron Road and 63 Ingleburn Road Leppington	Report No: R09A
Lab Reference No: SR12669	Sample Identification: BH 31 (1.0-1.45m)
Laboratory Specimen Description:	

Test Method	Test Results	Test Procedure
Liquid Limit (%)	ND	AS 1289 3.1.1
Plasitc Limit (%)	ND	AS 1289 3.2.1
Plasticity Index (%)	ND	AS 1289 3.3.1
Linear Shrinkage (%)	ND	AS 1289 3.4.1
Natural Moisture %	ND	AS 1289 2.1.1
Sample History:	Air drier	
Preparation Method.	Dry sieved	
Condition of linear shrinkage.	Curling linear shrinkage.	
Linear shrinkage mould length.	250mm	

ND = not determined NO = not obtainable NP = non plastic

Test Procedure AS1289 2.1.1, 3.6.3

Sieve Size	% Passing	Specification
150 mm		
75 mm		
63 mm		
53 mm		
37.5 mm		
26.5 mm		
19 mm		
16 mm		
13.2 mm	100	
9.5 mm	100	
6.7 mm	99	
4.75 mm	97	
2.36 mm	93	
1.18 mm	88	
600 um	85	
425 um	84	
300 um	83	
150 um	80	
75 um	73	



clay	silt			sand			gravel			cobbles
	fine	medium	coarse	fine	medium	coarse	fine	medium	coarse	

Remarks:

Authorised Signatory _____ _____ Solern Liew Date 8/4/19

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CERTIFICATE OF ANALYSIS 191051

Client Details

Client	Geoenviro Consultancy Pty Ltd
Attention	Solern Liew
Address	PO Box 1543, Macquarie Centre, North Ryde, NSW, 2113

Sample Details

Your Reference	**JC18322A, Leppington**
Number of Samples	49 Soil, 1 Material
Date samples received	07/05/2018
Date completed instructions received	07/05/2018

Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.

Samples were analysed as received from the client. Results relate specifically to the samples as received.

Results are reported on a dry weight basis for solids and on an as received basis for other matrices.

Please refer to the last page of this report for any comments relating to the results.

Report Details

Date results requested by	15/05/2018
Date of Issue	15/05/2018

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Asbestos Approved By
Analysed by Asbestos Approved Identifier: Lucy Zhu
Authorised by Asbestos Approved Signatory: Lucy Zhu

Results Approved By
Alexander Mitchell Maclean, Senior Chemist
Dragana Tomas, Senior Chemist
Jeremy Faircloth, Organics Supervisor
Long Pham, Team Leader, Metals
Lucy Zhu, Asbsestos Analyst
Nancy Zhang, Assistant Lab Manager
Priya Samarawickrama, Senior Chemist

Authorised By

Jacinta Hurst, Laboratory Manager

vTRH(C6-C10)/BTEXN in Soil						
Our Reference		191051-29	191051-30	191051-31	191051-32	191051-33
Your Reference	UNITS	BH5	BH17	BH19	BH23	BH28
Composite Reference		-	-	-	-	-
Depth		0.00-0.10	0.00-0.10	0.00-0.10	0.00-0.10	0.00-0.10
Date Sampled		30/04/2018	30/04/2018	30/04/2018	30/04/2018	30/04/2018
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	09/05/2018	09/05/2018	09/05/2018	09/05/2018	09/05/2018
Date analysed	-	11/05/2018	11/05/2018	11/05/2018	11/05/2018	11/05/2018
TRH C_6 - C_9	mg/kg	<25	<25	<25	<25	<25
TRH C_6 - C_{10}	mg/kg	<25	<25	<25	<25	<25
vTPH C_6 - C_{10} less BTEX (F1)	mg/kg	<25	<25	<25	<25	<25
Benzene	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Toluene	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	mg/kg	<1	<1	<1	<1	<1
m+p-xylene	mg/kg	<2	<2	<2	<2	<2
o-Xylene	mg/kg	<1	<1	<1	<1	<1
naphthalene	mg/kg	<1	<1	<1	<1	<1
Total +ve Xylenes	mg/kg	<1	<1	<1	<1	<1
Surrogate aaa-Trifluorotoluene	%	88	88	88	90	88

vTRH(C6-C10)/BTEXN in Soil			
Our Reference		191051-35	191051-36
Your Reference	UNITS	BH34	Duplicate A
Composite Reference		-	-
Depth		0.00-0.10	-
Date Sampled		30/04/2018	30/04/2018
Type of sample		Soil	Soil
Date extracted	-	09/05/2018	09/05/2018
Date analysed	-	11/05/2018	11/05/2018
TRH C_6 - C_9	mg/kg	<25	<25
TRH C_6 - C_{10}	mg/kg	<25	<25
vTPH C_6 - C_{10} less BTEX (F1)	mg/kg	<25	<25
Benzene	mg/kg	<0.2	<0.2
Toluene	mg/kg	<0.5	<0.5
Ethylbenzene	mg/kg	<1	<1
m+p-xylene	mg/kg	<2	<2
o-Xylene	mg/kg	<1	<1
naphthalene	mg/kg	<1	<1
Total +ve Xylenes	mg/kg	<1	<1
Surrogate aaa-Trifluorotoluene	%	87	91

svTRH (C10-C40) in Soil						
Our Reference		191051-29	191051-30	191051-31	191051-32	191051-33
Your Reference	UNITS	BH5	BH17	BH19	BH23	BH28
Composite Reference		-	-	-	-	-
Depth		0.00-0.10	0.00-0.10	0.00-0.10	0.00-0.10	0.00-0.10
Date Sampled		30/04/2018	30/04/2018	30/04/2018	30/04/2018	30/04/2018
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	09/05/2018	09/05/2018	09/05/2018	09/05/2018	09/05/2018
Date analysed	-	10/05/2018	10/05/2018	10/05/2018	10/05/2018	10/05/2018
TRH C_{10} - C_{14}	mg/kg	<50	<50	<50	<50	<50
TRH C_{15} - C_{28}	mg/kg	<100	<100	<100	<100	<100
TRH C_{29} - C_{36}	mg/kg	<100	<100	<100	<100	<100
TRH >C_{10} -C_{16}	mg/kg	<50	<50	<50	<50	<50
TRH >C_{10} - C_{16} less Naphthalene (F2)	mg/kg	<50	<50	<50	<50	<50
TRH >C_{16} -C_{34}	mg/kg	<100	<100	<100	<100	<100
TRH >C_{34} -C_{40}	mg/kg	<100	<100	<100	<100	<100
Total +ve TRH (>C10-C40)	mg/kg	<50	<50	<50	<50	<50
Surrogate o-Terphenyl	%	81	80	81	82	80

svTRH (C10-C40) in Soil			
Our Reference		191051-35	191051-36
Your Reference	UNITS	BH34	Duplicate A
Composite Reference		-	-
Depth		0.00-0.10	-
Date Sampled		30/04/2018	30/04/2018
Type of sample		Soil	Soil
Date extracted	-	09/05/2018	09/05/2018
Date analysed	-	10/05/2018	10/05/2018
TRH C_{10} - C_{14}	mg/kg	<50	<50
TRH C_{15} - C_{28}	mg/kg	<100	<100
TRH C_{29} - C_{36}	mg/kg	<100	<100
TRH >C_{10} -C_{16}	mg/kg	<50	<50
TRH >C_{10} - C_{16} less Naphthalene (F2)	mg/kg	<50	<50
TRH >C_{16} -C_{34}	mg/kg	<100	<100
TRH >C_{34} -C_{40}	mg/kg	<100	<100
Total +ve TRH (>C10-C40)	mg/kg	<50	<50
Surrogate o-Terphenyl	%	79	80

PAHs in Soil						
Our Reference		191051-29	191051-30	191051-31	191051-32	191051-33
Your Reference	UNITS	BH5	BH17	BH19	BH23	BH28
Composite Reference		-	-	-	-	-
Depth		0.00-0.10	0.00-0.10	0.00-0.10	0.00-0.10	0.00-0.10
Date Sampled		30/04/2018	30/04/2018	30/04/2018	30/04/2018	30/04/2018
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	09/05/2018	09/05/2018	09/05/2018	09/05/2018	09/05/2018
Date analysed	-	10/05/2018	10/05/2018	10/05/2018	10/05/2018	10/05/2018
Naphthalene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthylene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Fluorene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Phenanthrene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Anthracene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Fluoranthene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Pyrene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(a)anthracene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Chrysene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(b,j+k)fluoranthene	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Benzo(a)pyrene	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Indeno(1,2,3-c,d)pyrene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Dibenzo(a,h)anthracene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(g,h,i)perylene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Total +ve PAH's	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Benzo(a)pyrene TEQ calc (zero)	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(a)pyrene TEQ calc(half)	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(a)pyrene TEQ calc(PQL)	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Surrogate p-Terphenyl-d14	%	104	100	108	104	99

PAHs in Soil			
Our Reference		191051-35	191051-36
Your Reference	UNITS	BH34	Duplicate A
Composite Reference		-	-
Depth		0.00-0.10	-
Date Sampled		30/04/2018	30/04/2018
Type of sample		Soil	Soil
Date extracted	-	09/05/2018	09/05/2018
Date analysed	-	10/05/2018	10/05/2018
Naphthalene	mg/kg	<0.1	<0.1
Acenaphthylene	mg/kg	<0.1	<0.1
Acenaphthene	mg/kg	<0.1	<0.1
Fluorene	mg/kg	<0.1	<0.1
Phenanthrene	mg/kg	<0.1	<0.1
Anthracene	mg/kg	<0.1	<0.1
Fluoranthene	mg/kg	<0.1	<0.1
Pyrene	mg/kg	<0.1	<0.1
Benzo(a)anthracene	mg/kg	<0.1	<0.1
Chrysene	mg/kg	<0.1	<0.1
Benzo(b,j+k)fluoranthene	mg/kg	<0.2	<0.2
Benzo(a)pyrene	mg/kg	<0.05	<0.05
Indeno(1,2,3-c,d)pyrene	mg/kg	<0.1	<0.1
Dibenzo(a,h)anthracene	mg/kg	<0.1	<0.1
Benzo(g,h,i)perylene	mg/kg	<0.1	<0.1
Total +ve PAH's	mg/kg	<0.05	<0.05
Benzo(a)pyrene TEQ calc (zero)	mg/kg	<0.5	<0.5
Benzo(a)pyrene TEQ calc(half)	mg/kg	<0.5	<0.5
Benzo(a)pyrene TEQ calc(PQL)	mg/kg	<0.5	<0.5
Surrogate p-Terphenyl-d14	%	106	105

Organochlorine Pesticides in soil						
Our Reference		191051-1	191051-2	191051-3	191051-4	191051-5
Your Reference	UNITS	C1	C2	C3	C4	C5
Composite Reference		8 + 9 + 10	11 + 12 + 13	14 + 15 + 16	17 + 18 + 19	20 + 21 + 22
Depth		-	-	-	-	-
Date Sampled		30/04/2018	30/04/2018	30/04/2018	30/04/2018	30/04/2018
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	09/05/2018	09/05/2018	09/05/2018	09/05/2018	09/05/2018
Date analysed	-	10/05/2018	10/05/2018	10/05/2018	10/05/2018	10/05/2018
HCB	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
alpha-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
gamma-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
beta-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Heptachlor	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
delta-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Aldrin	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Heptachlor Epoxide	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
gamma-Chlordane	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
alpha-chlordane	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Endosulfan I	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
pp-DDE	mg/kg	<0.1	<0.1	0.2	<0.1	<0.1
Dieldrin	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Endrin	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
pp-DDD	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Endosulfan II	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
pp-DDT	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Endrin Aldehyde	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Endosulfan Sulphate	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Methoxychlor	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Total +ve DDT+DDD+DDE	mg/kg	<0.1	<0.1	0.2	<0.1	<0.1
Surrogate TCMX	%	104	110	104	111	103

Organochlorine Pesticides in soil						
Our Reference		191051-6	191051-7	191051-29	191051-30	191051-31
Your Reference	UNITS	C6	C7	BH5	BH17	BH19
Composite Reference		23 + 24 + 25	26 + 27 + 28	-	-	-
Depth		-	-	0.00-0.10	0.00-0.10	0.00-0.10
Date Sampled		30/04/2018	30/04/2018	30/04/2018	30/04/2018	30/04/2018
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	09/05/2018	09/05/2018	09/05/2018	09/05/2018	09/05/2018
Date analysed	-	10/05/2018	10/05/2018	10/05/2018	10/05/2018	10/05/2018
HCB	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
alpha-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
gamma-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
beta-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Heptachlor	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
delta-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Aldrin	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Heptachlor Epoxide	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
gamma-Chlordane	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
alpha-chlordane	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Endosulfan I	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
pp-DDE	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Dieldrin	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Endrin	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
pp-DDD	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Endosulfan II	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
pp-DDT	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Endrin Aldehyde	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Endosulfan Sulphate	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Methoxychlor	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Total +ve DDT+DDD+DDE	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Surrogate TCMX	%	104	101	105	106	104

Organochlorine Pesticides in soil					
Our Reference		191051-32	191051-33	191051-35	191051-36
Your Reference	UNITS	BH23	BH28	BH34	Duplicate A
Composite Reference		-	-	-	-
Depth		0.00-0.10	0.00-0.10	0.00-0.10	-
Date Sampled		30/04/2018	30/04/2018	30/04/2018	30/04/2018
Type of sample		Soil	Soil	Soil	Soil
Date extracted	-	09/05/2018	09/05/2018	09/05/2018	09/05/2018
Date analysed	-	10/05/2018	10/05/2018	10/05/2018	10/05/2018
HCB	mg/kg	<0.1	<0.1	<0.1	<0.1
alpha-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1
gamma-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1
beta-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1
Heptachlor	mg/kg	<0.1	<0.1	<0.1	<0.1
delta-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1
Aldrin	mg/kg	<0.1	<0.1	<0.1	<0.1
Heptachlor Epoxide	mg/kg	<0.1	<0.1	<0.1	<0.1
gamma-Chlordane	mg/kg	<0.1	<0.1	<0.1	<0.1
alpha-chlordane	mg/kg	<0.1	<0.1	<0.1	<0.1
Endosulfan I	mg/kg	<0.1	<0.1	<0.1	<0.1
pp-DDE	mg/kg	<0.1	<0.1	<0.1	<0.1
Dieldrin	mg/kg	<0.1	<0.1	<0.1	<0.1
Endrin	mg/kg	<0.1	<0.1	<0.1	<0.1
pp-DDD	mg/kg	<0.1	<0.1	<0.1	<0.1
Endosulfan II	mg/kg	<0.1	<0.1	<0.1	<0.1
pp-DDT	mg/kg	<0.1	<0.1	<0.1	<0.1
Endrin Aldehyde	mg/kg	<0.1	<0.1	<0.1	<0.1
Endosulfan Sulphate	mg/kg	<0.1	<0.1	<0.1	<0.1
Methoxychlor	mg/kg	<0.1	<0.1	<0.1	<0.1
Total +ve DDT+DDD+DDE	mg/kg	<0.1	<0.1	<0.1	<0.1
Surrogate TCMX	%	105	107	105	105

PCBs in Soil						
Our Reference		191051-1	191051-2	191051-3	191051-4	191051-5
Your Reference	UNITS	C1	C2	C3	C4	C5
Composite Reference		8 + 9 + 10	11 + 12 + 13	14 + 15 + 16	17 + 18 + 19	20 + 21 + 22
Depth		-	-	-	-	-
Date Sampled		30/04/2018	30/04/2018	30/04/2018	30/04/2018	30/04/2018
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	09/05/2018	09/05/2018	09/05/2018	09/05/2018	09/05/2018
Date analysed	-	10/05/2018	10/05/2018	10/05/2018	10/05/2018	10/05/2018
Aroclor 1016	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Aroclor 1221	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Aroclor 1232	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Aroclor 1242	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Aroclor 1248	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Aroclor 1254	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Aroclor 1260	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Total +ve PCBs (1016-1260)	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Surrogate TCLMX	%	104	110	104	111	103

PCBs in Soil						
Our Reference		191051-6	191051-7	191051-29	191051-30	191051-31
Your Reference	UNITS	C6	C7	BH5	BH17	BH19
Composite Reference		23 + 24 + 25	26 + 27 + 28	-	-	-
Depth		-	-	0.00-0.10	0.00-0.10	0.00-0.10
Date Sampled		30/04/2018	30/04/2018	30/04/2018	30/04/2018	30/04/2018
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	09/05/2018	09/05/2018	09/05/2018	09/05/2018	09/05/2018
Date analysed	-	10/05/2018	10/05/2018	10/05/2018	10/05/2018	10/05/2018
Aroclor 1016	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Aroclor 1221	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Aroclor 1232	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Aroclor 1242	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Aroclor 1248	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Aroclor 1254	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Aroclor 1260	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Total +ve PCBs (1016-1260)	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Surrogate TCLMX	%	104	101	105	106	104

PCBs in Soil					
Our Reference		191051-32	191051-33	191051-35	191051-36
Your Reference	UNITS	BH23	BH28	BH34	Duplicate A
Composite Reference		-	-	-	-
Depth		0.00-0.10	0.00-0.10	0.00-0.10	-
Date Sampled		30/04/2018	30/04/2018	30/04/2018	30/04/2018
Type of sample		Soil	Soil	Soil	Soil
Date extracted	-	09/05/2018	09/05/2018	09/05/2018	09/05/2018
Date analysed	-	10/05/2018	10/05/2018	10/05/2018	10/05/2018
Aroclor 1016	mg/kg	<0.1	<0.1	<0.1	<0.1
Aroclor 1221	mg/kg	<0.1	<0.1	<0.1	<0.1
Aroclor 1232	mg/kg	<0.1	<0.1	<0.1	<0.1
Aroclor 1242	mg/kg	<0.1	<0.1	<0.1	<0.1
Aroclor 1248	mg/kg	<0.1	<0.1	<0.1	<0.1
Aroclor 1254	mg/kg	<0.1	<0.1	<0.1	<0.1
Aroclor 1260	mg/kg	<0.1	<0.1	<0.1	<0.1
Total +ve PCBs (1016-1260)	mg/kg	<0.1	<0.1	<0.1	<0.1
Surrogate TCLMX	%	105	107	105	105

Acid Extractable metals in soil						
Our Reference		191051-1	191051-2	191051-3	191051-4	191051-5
Your Reference	UNITS	C1	C2	C3	C4	C5
Composite Reference		8 + 9 + 10	11 + 12 + 13	14 + 15 + 16	17 + 18 + 19	20 + 21 + 22
Depth		-	-	-	-	-
Date Sampled		30/04/2018	30/04/2018	30/04/2018	30/04/2018	30/04/2018
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	09/05/2018	09/05/2018	09/05/2018	09/05/2018	09/05/2018
Date analysed	-	10/05/2018	10/05/2018	10/05/2018	10/05/2018	10/05/2018
Arsenic	mg/kg	8	7	9	7	7
Cadmium	mg/kg	<0.4	<0.4	<0.4	<0.4	<0.4
Chromium	mg/kg	20	19	19	17	15
Copper	mg/kg	13	13	23	25	16
Lead	mg/kg	23	19	25	45	21
Mercury	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Nickel	mg/kg	5	4	5	11	13
Zinc	mg/kg	18	19	120	170	50

Acid Extractable metals in soil						
Our Reference		191051-6	191051-7	191051-29	191051-30	191051-31
Your Reference	UNITS	C6	C7	BH5	BH17	BH19
Composite Reference		23 + 24 + 25	26 + 27 + 28	-	-	-
Depth		-	-	0.00-0.10	0.00-0.10	0.00-0.10
Date Sampled		30/04/2018	30/04/2018	30/04/2018	30/04/2018	30/04/2018
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	09/05/2018	09/05/2018	09/05/2018	09/05/2018	09/05/2018
Date analysed	-	10/05/2018	10/05/2018	10/05/2018	10/05/2018	10/05/2018
Arsenic	mg/kg	4	6	13	7	7
Cadmium	mg/kg	<0.4	<0.4	<0.4	0.5	<0.4
Chromium	mg/kg	18	17	18	25	17
Copper	mg/kg	20	23	18	56	15
Lead	mg/kg	21	32	30	92	27
Mercury	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Nickel	mg/kg	10	12	4	15	6
Zinc	mg/kg	39	160	20	430	52

Acid Extractable metals in soil					
Our Reference		191051-32	191051-33	191051-35	191051-36
Your Reference	UNITS	BH23	BH28	BH34	Duplicate A
Composite Reference		-	-	-	-
Depth		0.00-0.10	0.00-0.10	0.00-0.10	-
Date Sampled		30/04/2018	30/04/2018	30/04/2018	30/04/2018
Type of sample		Soil	Soil	Soil	Soil
Date prepared	-	09/05/2018	09/05/2018	09/05/2018	09/05/2018
Date analysed	-	10/05/2018	10/05/2018	10/05/2018	10/05/2018
Arsenic	mg/kg	11	10	5	13
Cadmium	mg/kg	<0.4	0.6	<0.4	<0.4
Chromium	mg/kg	13	17	17	17
Copper	mg/kg	19	90	23	18
Lead	mg/kg	26	120	20	30
Mercury	mg/kg	<0.1	<0.1	<0.1	<0.1
Nickel	mg/kg	13	17	11	4
Zinc	mg/kg	150	550	43	20

Misc Inorg - Soil						
Our Reference		191051-19	191051-23	191051-26	191051-29	191051-30
Your Reference	UNITS	TP26	TP31	TP26	BH5	BH17
Composite Reference		-	-	-	-	-
Depth		0.0-0.1	0.0-0.1	0.0-0.1	0.00-0.10	0.00-0.10
Date Sampled		30/04/2018	30/04/2018	30/04/2018	30/04/2018	30/04/2018
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	11/05/2018	11/05/2018	11/05/2018	11/05/2018	11/05/2018
Date analysed	-	11/05/2018	11/05/2018	11/05/2018	11/05/2018	11/05/2018
pH 1:5 soil:water	pH Units	5.7	6.0	5.9	6.3	6.8
Electrical Conductivity 1:5 soil:water	µS/cm	96	48	170	56	180

Misc Inorg - Soil						
Our Reference		191051-33	191051-37	191051-38	191051-39	191051-40
Your Reference	UNITS	BH28	BH1	BH1	BH1	BH5
Composite Reference		-	-	-	-	-
Depth		0.00-0.10	0.00-0.10	0.60-0.70	2.50-2.80	1.00-1.45
Date Sampled		30/04/2018	30/04/2018	30/04/2018	30/04/2018	30/04/2018
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	11/05/2018	11/05/2018	11/05/2018	11/05/2018	11/05/2018
Date analysed	-	11/05/2018	11/05/2018	11/05/2018	11/05/2018	11/05/2018
pH 1:5 soil:water	pH Units	6.9	6.1	5.5	5.3	5.0
Electrical Conductivity 1:5 soil:water	µS/cm	150	45	130	260	570
Chloride, Cl 1:5 soil:water	mg/kg	[NA]	[NA]	99	290	670
Sulphate, SO4 1:5 soil:water	mg/kg	[NA]	[NA]	93	86	130

Misc Inorg - Soil						
Our Reference		191051-41	191051-42	191051-43	191051-44	191051-45
Your Reference	UNITS	BH5	BH17	BH17	BH26	BH26
Composite Reference		-	-	-	-	-
Depth		2.50-2.90	0.50-0.60	1.00-1.45	0.50-0.60	1.00-1.45
Date Sampled		30/04/2018	30/04/2018	30/04/2018	30/04/2018	30/04/2018
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	11/05/2018	11/05/2018	11/05/2018	11/05/2018	11/05/2018
Date analysed	-	11/05/2018	11/05/2018	11/05/2018	11/05/2018	11/05/2018
pH 1:5 soil:water	pH Units	5.0	7.3	6.0	5.6	5.0
Electrical Conductivity 1:5 soil:water	µS/cm	690	100	200	120	480
Chloride, Cl 1:5 soil:water	mg/kg	710	20	98	92	480
Sulphate, SO4 1:5 soil:water	mg/kg	180	10	210	60	230

Misc Inorg - Soil						
Our Reference		191051-46	191051-47	191051-48	191051-49	191051-50
Your Reference	UNITS	BH28	BH28	BH31	BH31	BH35
Composite Reference		-	-	-	-	-
Depth		0.50-0.60	1.00-1.45	0.50-0.60	1.00-1.45	0.50-0.60
Date Sampled		30/04/2018	30/04/2018	30/04/2018	30/04/2018	30/04/2018
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	11/05/2018	11/05/2018	11/05/2018	11/05/2018	11/05/2018
Date analysed	-	11/05/2018	11/05/2018	11/05/2018	11/05/2018	11/05/2018
pH 1:5 soil:water	pH Units	5.7	5.1	6.1	5.1	5.2
Electrical Conductivity 1:5 soil:water	µS/cm	62	550	57	570	380
Chloride, Cl 1:5 soil:water	mg/kg	23	560	20	600	290
Sulphate, SO4 1:5 soil:water	mg/kg	55	170	48	240	230

Moisture						
Our Reference		191051-1	191051-2	191051-3	191051-4	191051-5
Your Reference	UNITS	C1	C2	C3	C4	C5
Composite Reference		8 + 9 + 10	11 + 12 + 13	14 + 15 + 16	17 + 18 + 19	20 + 21 + 22
Depth		-	-	-	-	-
Date Sampled		30/04/2018	30/04/2018	30/04/2018	30/04/2018	30/04/2018
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	09/05/2018	09/05/2018	09/05/2018	09/05/2018	09/05/2018
Date analysed	-	10/05/2018	10/05/2018	10/05/2018	10/05/2018	10/05/2018
Moisture	%	6.4	7.9	8.2	7.0	9.3

Moisture						
Our Reference		191051-6	191051-7	191051-29	191051-30	191051-31
Your Reference	UNITS	C6	C7	BH5	BH17	BH19
Composite Reference		23 + 24 + 25	26 + 27 + 28	-	-	-
Depth		-	-	0.00-0.10	0.00-0.10	0.00-0.10
Date Sampled		30/04/2018	30/04/2018	30/04/2018	30/04/2018	30/04/2018
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	09/05/2018	09/05/2018	09/05/2018	09/05/2018	09/05/2018
Date analysed	-	10/05/2018	10/05/2018	10/05/2018	10/05/2018	10/05/2018
Moisture	%	9.9	11	6.0	9.8	9.3

Moisture					
Our Reference		191051-32	191051-33	191051-35	191051-36
Your Reference	UNITS	BH23	BH28	BH34	Duplicate A
Composite Reference		-	-	-	-
Depth		0.00-0.10	0.00-0.10	0.00-0.10	-
Date Sampled		30/04/2018	30/04/2018	30/04/2018	30/04/2018
Type of sample		Soil	Soil	Soil	Soil
Date prepared	-	09/05/2018	09/05/2018	09/05/2018	09/05/2018
Date analysed	-	10/05/2018	10/05/2018	10/05/2018	10/05/2018
Moisture	%	5.8	9.0	10	6.0

Asbestos ID - soils						
Our Reference		191051-29	191051-30	191051-31	191051-32	191051-33
Your Reference	UNITS	BH5	BH17	BH19	BH23	BH28
Composite Reference		-	-	-	-	-
Depth		0.00-0.10	0.00-0.10	0.00-0.10	0.00-0.10	0.00-0.10
Date Sampled		30/04/2018	30/04/2018	30/04/2018	30/04/2018	30/04/2018
Type of sample		Soil	Soil	Soil	Soil	Soil
Date analysed	-	10/05/2018	10/05/2018	10/05/2018	10/05/2018	10/05/2018
Sample mass tested	g	Approx. 30g	Approx. 35g	Approx. 30g	Approx. 35g	Approx. 30g
Sample Description	-	Brown fine-grained soil & rocks	Brown coarse-grained soil & rocks	Brown coarse-grained soil & rocks	Brown sandy soil & rocks	Brown coarse-grained soil & rocks
Asbestos ID in soil	-	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected
Trace Analysis	-	No asbestos detected	No asbestos detected	No asbestos detected	No asbestos detected	No asbestos detected

Asbestos ID - soils		
Our Reference		191051-35
Your Reference	UNITS	BH34
Composite Reference		-
Depth		0.00-0.10
Date Sampled		30/04/2018
Type of sample		Soil
Date analysed	-	10/05/2018
Sample mass tested	g	Approx. 35g
Sample Description	-	Brown sandy soil & rocks
Asbestos ID in soil	-	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected
Trace Analysis	-	No asbestos detected

Asbestos ID - materials		
Our Reference		191051-34
Your Reference	UNITS	BH28 - ACM
Composite Reference		-
Depth		-
Date Sampled		30/04/2018
Type of sample		Material
Date analysed	-	11/05/2018
Mass / Dimension of Sample	-	60x40x5mm
Sample Description	-	Beige fibre cement material
Asbestos ID in materials	-	Chrysotile asbestos detected

ESP/CEC				
Our Reference		191051-38	191051-45	191051-48
Your Reference	UNITS	BH1	BH26	BH31
Composite Reference		-	-	-
Depth		0.60-0.70	1.00-1.45	0.50-0.60
Date Sampled		30/04/2018	30/04/2018	30/04/2018
Type of sample		Soil	Soil	Soil
Date prepared	-	10/05/2018	10/05/2018	10/05/2018
Date analysed	-	11/05/2018	11/05/2018	11/05/2018
Exchangeable Ca	meq/100g	2.2	0.2	2.2
Exchangeable K	meq/100g	0.2	0.3	0.4
Exchangeable Mg	meq/100g	4.4	7.4	5.4
Exchangeable Na	meq/100g	1.1	1.6	0.27
Cation Exchange Capacity	meq/100g	7.9	9.4	8.2
ESP	%	14	17	3

Method ID	Methodology Summary
ASB-001	Asbestos ID - Qualitative identification of asbestos in bulk samples using Polarised Light Microscopy and Dispersion Staining Techniques including Synthetic Mineral Fibre and Organic Fibre as per Australian Standard 4964-2004.
Inorg-001	pH - Measured using pH meter and electrode in accordance with APHA latest edition, 4500-H+. Please note that the results for water analyses are indicative only, as analysis outside of the APHA storage times.
Inorg-002	Conductivity and Salinity - measured using a conductivity cell at 25°C in accordance with APHA latest edition 2510 and Rayment & Lyons.
Inorg-008	Moisture content determined by heating at 105+/-5 °C for a minimum of 12 hours.
Inorg-081	Anions - a range of Anions are determined by Ion Chromatography, in accordance with APHA latest edition, 4110-B. Alternatively determined by colourimetry/turbidity using Discrete Analyer.
Metals-009	Determination of exchangeable cations and cation exchange capacity in soils using 1M Ammonium Chloride exchange and ICP-AES analytical finish.
Metals-020	Determination of various metals by ICP-AES.
Metals-021	Determination of Mercury by Cold Vapour AAS.
Org-003	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-FID. F2 = (>C10-C16)-Naphthalene as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater (HSLs Tables 1A (3, 4)). Note Naphthalene is determined from the VOC analysis.
Org-003	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-FID. F2 = (>C10-C16)-Naphthalene as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater (HSLs Tables 1A (3, 4)). Note Naphthalene is determined from the VOC analysis. Note, the Total +ve TRH PQL is reflective of the lowest individual PQL and is therefore "Total +ve TRH" is simply a sum of the positive individual TRH fractions (>C10-C40).
Org-005	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC with dual ECD's.
Org-005	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC with dual ECD's. Note, the Total +ve reported DDD+DDE+DDT PQL is reflective of the lowest individual PQL and is therefore simply a sum of the positive individually report DDD+DDE+DDT.
Org-006	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC-ECD.
Org-006	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC-ECD. Note, the Total +ve PCBs PQL is reflective of the lowest individual PQL and is therefore" Total +ve PCBs" is simply a sum of the positive individual PCBs.

Method ID	Methodology Summary
Org-012	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-MS. Benzo(a)pyrene TEQ as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater - 2013. For soil results:- 1. 'EQ PQL'values are assuming all contributing PAHs reported as <PQL are actually at the PQL. This is the most conservative approach and can give false positive TEQs given that PAHs that contribute to the TEQ calculation may not be present. 2. 'EQ zero'values are assuming all contributing PAHs reported as <PQL are zero. This is the least conservative approach and is more susceptible to false negative TEQs when PAHs that contribute to the TEQ calculation are present but below PQL. 3. 'EQ half PQL'values are assuming all contributing PAHs reported as <PQL are half the stipulated PQL. Hence a mid-point between the most and least conservative approaches above. Note, the Total +ve PAHs PQL is reflective of the lowest individual PQL and is therefore "Total +ve PAHs" is simply a sum of the positive individual PAHs.
Org-014	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS.
Org-016	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS. Water samples are analysed directly by purge and trap GC-MS. F1 = (C6-C10)-BTEX as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater.
Org-016	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS. Water samples are analysed directly by purge and trap GC-MS. F1 = (C6-C10)-BTEX as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater. Note, the Total +ve Xylene PQL is reflective of the lowest individual PQL and is therefore "Total +ve Xylenes" is simply a sum of the positive individual Xylenes.

QUALITY CONTROL: vTRH(C6-C10)/BTEXN in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-8	[NT]
Date extracted	-			09/05/2018	29	09/05/2018	09/05/2018		09/05/2018	[NT]
Date analysed	-			11/05/2018	29	11/05/2018	11/05/2018		11/05/2018	[NT]
TRH C_6 - C_9	mg/kg	25	Org-016	<25	29	<25	<25	0	94	[NT]
TRH C_6 - C_{10}	mg/kg	25	Org-016	<25	29	<25	<25	0	94	[NT]
Benzene	mg/kg	0.2	Org-016	<0.2	29	<0.2	<0.2	0	75	[NT]
Toluene	mg/kg	0.5	Org-016	<0.5	29	<0.5	<0.5	0	96	[NT]
Ethylbenzene	mg/kg	1	Org-016	<1	29	<1	<1	0	93	[NT]
m+p-xylene	mg/kg	2	Org-016	<2	29	<2	<2	0	104	[NT]
o-Xylene	mg/kg	1	Org-016	<1	29	<1	<1	0	96	[NT]
naphthalene	mg/kg	1	Org-014	<1	29	<1	<1	0	[NT]	[NT]
Surrogate aaa-Trifluorotoluene	%		Org-016	90	29	88	92	4	86	[NT]

QUALITY CONTROL: svTRH (C10-C40) in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-8	[NT]
Date extracted	-			09/05/2018	29	09/05/2018	09/05/2018		09/05/2018	[NT]
Date analysed	-			10/05/2018	29	10/05/2018	10/05/2018		10/05/2018	[NT]
TRH C_{10} - C_{14}	mg/kg	50	Org-003	<50	29	<50	<50	0	129	[NT]
TRH C_{15} - C_{28}	mg/kg	100	Org-003	<100	29	<100	<100	0	117	[NT]
TRH C_{29} - C_{36}	mg/kg	100	Org-003	<100	29	<100	<100	0	108	[NT]
TRH >C_{10} -C_{16}	mg/kg	50	Org-003	<50	29	<50	<50	0	129	[NT]
TRH >C_{16} -C_{34}	mg/kg	100	Org-003	<100	29	<100	<100	0	117	[NT]
TRH >C_{34} -C_{40}	mg/kg	100	Org-003	<100	29	<100	<100	0	108	[NT]
Surrogate o-Terphenyl	%		Org-003	79	29	81	81	0	89	[NT]

QUALITY CONTROL: PAHs in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-8	[NT]
Date extracted	-			09/05/2018	29	09/05/2018	09/05/2018		09/05/2018	[NT]
Date analysed	-			10/05/2018	29	10/05/2018	10/05/2018		10/05/2018	[NT]
Naphthalene	mg/kg	0.1	Org-012	<0.1	29	<0.1	<0.1	0	107	[NT]
Acenaphthylene	mg/kg	0.1	Org-012	<0.1	29	<0.1	<0.1	0	[NT]	[NT]
Acenaphthene	mg/kg	0.1	Org-012	<0.1	29	<0.1	<0.1	0	[NT]	[NT]
Fluorene	mg/kg	0.1	Org-012	<0.1	29	<0.1	<0.1	0	107	[NT]
Phenanthrene	mg/kg	0.1	Org-012	<0.1	29	<0.1	<0.1	0	113	[NT]
Anthracene	mg/kg	0.1	Org-012	<0.1	29	<0.1	<0.1	0	[NT]	[NT]
Fluoranthene	mg/kg	0.1	Org-012	<0.1	29	<0.1	<0.1	0	111	[NT]
Pyrene	mg/kg	0.1	Org-012	<0.1	29	<0.1	<0.1	0	110	[NT]
Benzo(a)anthracene	mg/kg	0.1	Org-012	<0.1	29	<0.1	<0.1	0	[NT]	[NT]
Chrysene	mg/kg	0.1	Org-012	<0.1	29	<0.1	<0.1	0	102	[NT]
Benzo(b,j+k)fluoranthene	mg/kg	0.2	Org-012	<0.2	29	<0.2	<0.2	0	[NT]	[NT]
Benzo(a)pyrene	mg/kg	0.05	Org-012	<0.05	29	<0.05	<0.05	0	106	[NT]
Indeno(1,2,3-c,d)pyrene	mg/kg	0.1	Org-012	<0.1	29	<0.1	<0.1	0	[NT]	[NT]
Dibenzo(a,h)anthracene	mg/kg	0.1	Org-012	<0.1	29	<0.1	<0.1	0	[NT]	[NT]
Benzo(g,h,i)perylene	mg/kg	0.1	Org-012	<0.1	29	<0.1	<0.1	0	[NT]	[NT]
Surrogate p-Terphenyl-d14	%		Org-012	114	29	104	109	5	98	[NT]

QUALITY CONTROL: Organochlorine Pesticides in soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-8	[NT]
Date extracted	-			09/05/2018	29	09/05/2018	09/05/2018		09/05/2018	[NT]
Date analysed	-			10/05/2018	29	10/05/2018	10/05/2018		10/05/2018	[NT]
HCB	mg/kg	0.1	Org-005	<0.1	29	<0.1	<0.1	0	[NT]	[NT]
alpha-BHC	mg/kg	0.1	Org-005	<0.1	29	<0.1	<0.1	0	106	[NT]
gamma-BHC	mg/kg	0.1	Org-005	<0.1	29	<0.1	<0.1	0	[NT]	[NT]
beta-BHC	mg/kg	0.1	Org-005	<0.1	29	<0.1	<0.1	0	93	[NT]
Heptachlor	mg/kg	0.1	Org-005	<0.1	29	<0.1	<0.1	0	100	[NT]
delta-BHC	mg/kg	0.1	Org-005	<0.1	29	<0.1	<0.1	0	[NT]	[NT]
Aldrin	mg/kg	0.1	Org-005	<0.1	29	<0.1	<0.1	0	102	[NT]
Heptachlor Epoxide	mg/kg	0.1	Org-005	<0.1	29	<0.1	<0.1	0	96	[NT]
gamma-Chlordane	mg/kg	0.1	Org-005	<0.1	29	<0.1	<0.1	0	[NT]	[NT]
alpha-chlordane	mg/kg	0.1	Org-005	<0.1	29	<0.1	<0.1	0	[NT]	[NT]
Endosulfan I	mg/kg	0.1	Org-005	<0.1	29	<0.1	<0.1	0	[NT]	[NT]
pp-DDE	mg/kg	0.1	Org-005	<0.1	29	<0.1	<0.1	0	105	[NT]
Dieldrin	mg/kg	0.1	Org-005	<0.1	29	<0.1	<0.1	0	109	[NT]
Endrin	mg/kg	0.1	Org-005	<0.1	29	<0.1	<0.1	0	99	[NT]
pp-DDD	mg/kg	0.1	Org-005	<0.1	29	<0.1	<0.1	0	106	[NT]
Endosulfan II	mg/kg	0.1	Org-005	<0.1	29	<0.1	<0.1	0	[NT]	[NT]
pp-DDT	mg/kg	0.1	Org-005	<0.1	29	<0.1	<0.1	0	[NT]	[NT]
Endrin Aldehyde	mg/kg	0.1	Org-005	<0.1	29	<0.1	<0.1	0	[NT]	[NT]
Endosulfan Sulphate	mg/kg	0.1	Org-005	<0.1	29	<0.1	<0.1	0	100	[NT]
Methoxychlor	mg/kg	0.1	Org-005	<0.1	29	<0.1	<0.1	0	[NT]	[NT]
Surrogate TCMX	%		Org-005	103	29	105	106	1	124	[NT]

QUALITY CONTROL: Organochlorine Pesticides in soil					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date extracted	-			[NT]	1	09/05/2018	09/05/2018		[NT]	[NT]
Date analysed	-			[NT]	1	10/05/2018	10/05/2018		[NT]	[NT]
HCB	mg/kg	0.1	Org-005	[NT]	1	<0.1	<0.1	0	[NT]	[NT]
alpha-BHC	mg/kg	0.1	Org-005	[NT]	1	<0.1	<0.1	0	[NT]	[NT]
gamma-BHC	mg/kg	0.1	Org-005	[NT]	1	<0.1	<0.1	0	[NT]	[NT]
beta-BHC	mg/kg	0.1	Org-005	[NT]	1	<0.1	<0.1	0	[NT]	[NT]
Heptachlor	mg/kg	0.1	Org-005	[NT]	1	<0.1	<0.1	0	[NT]	[NT]
delta-BHC	mg/kg	0.1	Org-005	[NT]	1	<0.1	<0.1	0	[NT]	[NT]
Aldrin	mg/kg	0.1	Org-005	[NT]	1	<0.1	<0.1	0	[NT]	[NT]
Heptachlor Epoxide	mg/kg	0.1	Org-005	[NT]	1	<0.1	<0.1	0	[NT]	[NT]
gamma-Chlordane	mg/kg	0.1	Org-005	[NT]	1	<0.1	<0.1	0	[NT]	[NT]
alpha-chlordane	mg/kg	0.1	Org-005	[NT]	1	<0.1	<0.1	0	[NT]	[NT]
Endosulfan I	mg/kg	0.1	Org-005	[NT]	1	<0.1	<0.1	0	[NT]	[NT]
pp-DDE	mg/kg	0.1	Org-005	[NT]	1	<0.1	<0.1	0	[NT]	[NT]
Dieldrin	mg/kg	0.1	Org-005	[NT]	1	<0.1	<0.1	0	[NT]	[NT]
Endrin	mg/kg	0.1	Org-005	[NT]	1	<0.1	<0.1	0	[NT]	[NT]
pp-DDD	mg/kg	0.1	Org-005	[NT]	1	<0.1	<0.1	0	[NT]	[NT]
Endosulfan II	mg/kg	0.1	Org-005	[NT]	1	<0.1	<0.1	0	[NT]	[NT]
pp-DDT	mg/kg	0.1	Org-005	[NT]	1	<0.1	<0.1	0	[NT]	[NT]
Endrin Aldehyde	mg/kg	0.1	Org-005	[NT]	1	<0.1	<0.1	0	[NT]	[NT]
Endosulfan Sulphate	mg/kg	0.1	Org-005	[NT]	1	<0.1	<0.1	0	[NT]	[NT]
Methoxychlor	mg/kg	0.1	Org-005	[NT]	1	<0.1	<0.1	0	[NT]	[NT]
Surrogate TCMX	%		Org-005	[NT]	1	104	106	2	[NT]	[NT]

QUALITY CONTROL: PCBs in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-8	[NT]
Date extracted	-			09/05/2018	29	09/05/2018	09/05/2018		09/05/2018	[NT]
Date analysed	-			10/05/2018	29	10/05/2018	10/05/2018		10/05/2018	[NT]
Aroclor 1016	mg/kg	0.1	Org-006	<0.1	29	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1221	mg/kg	0.1	Org-006	<0.1	29	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1232	mg/kg	0.1	Org-006	<0.1	29	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1242	mg/kg	0.1	Org-006	<0.1	29	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1248	mg/kg	0.1	Org-006	<0.1	29	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1254	mg/kg	0.1	Org-006	<0.1	29	<0.1	<0.1	0	102	[NT]
Aroclor 1260	mg/kg	0.1	Org-006	<0.1	29	<0.1	<0.1	0	[NT]	[NT]
Surrogate TCLMX	%		Org-006	103	29	105	106	1	101	[NT]

QUALITY CONTROL: PCBs in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date extracted	-			[NT]	1	09/05/2018	09/05/2018		[NT]	[NT]
Date analysed	-			[NT]	1	10/05/2018	10/05/2018		[NT]	[NT]
Aroclor 1016	mg/kg	0.1	Org-006	[NT]	1	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1221	mg/kg	0.1	Org-006	[NT]	1	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1232	mg/kg	0.1	Org-006	[NT]	1	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1242	mg/kg	0.1	Org-006	[NT]	1	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1248	mg/kg	0.1	Org-006	[NT]	1	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1254	mg/kg	0.1	Org-006	[NT]	1	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1260	mg/kg	0.1	Org-006	[NT]	1	<0.1	<0.1	0	[NT]	[NT]
Surrogate TCLMX	%		Org-006	[NT]	1	104	106	2	[NT]	[NT]

QUALITY CONTROL: Acid Extractable metals in soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-8	[NT]
Date prepared	-			09/05/2018	29	09/05/2018	09/05/2018		09/05/2018	[NT]
Date analysed	-			10/05/2018	29	10/05/2018	10/05/2018		10/05/2018	[NT]
Arsenic	mg/kg	4	Metals-020	<4	29	13	12	8	107	[NT]
Cadmium	mg/kg	0.4	Metals-020	<0.4	29	<0.4	<0.4	0	98	[NT]
Chromium	mg/kg	1	Metals-020	<1	29	18	19	5	105	[NT]
Copper	mg/kg	1	Metals-020	<1	29	18	16	12	111	[NT]
Lead	mg/kg	1	Metals-020	<1	29	30	27	11	103	[NT]
Mercury	mg/kg	0.1	Metals-021	<0.1	29	<0.1	<0.1	0	105	[NT]
Nickel	mg/kg	1	Metals-020	<1	29	4	4	0	105	[NT]
Zinc	mg/kg	1	Metals-020	<1	29	20	17	16	103	[NT]

QUALITY CONTROL: Acid Extractable metals in soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-			[NT]	1	09/05/2018	09/05/2018		[NT]	[NT]
Date analysed	-			[NT]	1	10/05/2018	10/05/2018		[NT]	[NT]
Arsenic	mg/kg	4	Metals-020	[NT]	1	8	9	12	[NT]	[NT]
Cadmium	mg/kg	0.4	Metals-020	[NT]	1	<0.4	<0.4	0	[NT]	[NT]
Chromium	mg/kg	1	Metals-020	[NT]	1	20	21	5	[NT]	[NT]
Copper	mg/kg	1	Metals-020	[NT]	1	13	12	8	[NT]	[NT]
Lead	mg/kg	1	Metals-020	[NT]	1	23	24	4	[NT]	[NT]
Mercury	mg/kg	0.1	Metals-021	[NT]	1	<0.1	<0.1	0	[NT]	[NT]
Nickel	mg/kg	1	Metals-020	[NT]	1	5	5	0	[NT]	[NT]
Zinc	mg/kg	1	Metals-020	[NT]	1	18	19	5	[NT]	[NT]

QUALITY CONTROL: Misc Inorg - Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-8	191051-41
Date prepared	-			11/05/2018	19	11/05/2018	11/05/2018		11/05/2018	11/05/2018
Date analysed	-			11/05/2018	19	11/05/2018	11/05/2018		11/05/2018	11/05/2018
pH 1:5 soil:water	pH Units		Inorg-001	[NT]	19	5.7	5.7	0	102	[NT]
Electrical Conductivity 1:5 soil:water	µS/cm	1	Inorg-002	<1	19	96	88	9	94	[NT]
Chloride, Cl 1:5 soil:water	mg/kg	10	Inorg-081	<10	40	670	800	18	87	#
Sulphate, SO4 1:5 soil:water	mg/kg	10	Inorg-081	[NT]	40	130	170	27	89	#

QUALITY CONTROL: Misc Inorg - Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-			[NT]	40	11/05/2018	11/05/2018		[NT]	[NT]
Date analysed	-			[NT]	40	11/05/2018	11/05/2018		[NT]	[NT]
pH 1:5 soil:water	pH Units		Inorg-001	[NT]	40	5.0	4.8	4	[NT]	[NT]
Electrical Conductivity 1:5 soil:water	µS/cm	1	Inorg-002	[NT]	40	570	710	22	[NT]	[NT]

QUALITY CONTROL: ESP/CEC					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-8	[NT]
Date prepared	-			10/05/2018	[NT]	[NT]	[NT]	[NT]	10/05/2018	[NT]
Date analysed	-			11/05/2018	[NT]	[NT]	[NT]	[NT]	11/05/2018	[NT]
Exchangeable Ca	meq/100g	0.1	Metals-009	<0.1	[NT]	[NT]	[NT]	[NT]	113	[NT]
Exchangeable K	meq/100g	0.1	Metals-009	<0.1	[NT]	[NT]	[NT]	[NT]	108	[NT]
Exchangeable Mg	meq/100g	0.1	Metals-009	<0.1	[NT]	[NT]	[NT]	[NT]	103	[NT]
Exchangeable Na	meq/100g	0.1	Metals-009	<0.1	[NT]	[NT]	[NT]	[NT]	107	[NT]

Result Definitions

NT	Not tested
NA	Test not required
INS	Insufficient sample for this test
PQL	Practical Quantitation Limit
<	Less than
>	Greater than
RPD	Relative Percent Difference
LCS	Laboratory Control Sample
NS	Not specified
NEPM	National Environmental Protection Measure
NR	Not Reported

Quality Control Definitions

Blank	This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.
Duplicate	This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.
Matrix Spike	A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.
LCS (Laboratory Control Sample)	This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.
Surrogate Spike	Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

Australian Drinking Water Guidelines recommend that Thermotolerant Coliform, Faecal Enterococci, & E.Coli levels are less than 1cfu/100mL. The recommended maximums are taken from "Australian Drinking Water Guidelines", published by NHMRC & ARMC 2011.

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.

Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.

Spikes for Physical and Aggregate Tests are not applicable.

For VOCs in water samples, three vials are required for duplicate or spike analysis.

Duplicates: <5xPQL - any RPD is acceptable; >5xPQL - 0-50% RPD is acceptable.

Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals; 60-140% for organics (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

In circumstances where no duplicate and/or sample spike has been reported at 1 in 10 and/or 1 in 20 samples respectively, the sample volume submitted was insufficient in order to satisfy laboratory QA/QC protocols.

When samples are received where certain analytes are outside of recommended technical holding times (THTs), the analysis has proceeded. Where analytes are on the verge of breaching THTs, every effort will be made to analyse within the THT or as soon as practicable.

Where sampling dates are not provided, Envirolab are not in a position to comment on the validity of the analysis where recommended technical holding times may have been breached.

Measurement Uncertainty estimates are available for most tests upon request.

Report Comments

Asbestos: A portion of the supplied sample was sub-sampled for asbestos analysis according to Envirolab procedures.
We cannot guarantee that this sub-sample is indicative of the entire sample. Envirolab recommends supplying
40-50g of sample in its own container.
Note: Samples were sub-sampled from jars provided by the client.

Misc Inorg.
Percent recovery is not possible to report due to the high concentration
of the element/s in the sample/s. However an acceptable recovery was
obtained for the LCS.

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CERTIFICATE OF ANALYSIS 210572

Client Details

Client	Geoenviro Consultancy Pty Ltd
Attention	Solern Liew
Address	PO Box 1543, Macquarie Centre, North Ryde, NSW, 2113

Sample Details

Your Reference	**JC18322C-r1, Leppington**
Number of Samples	12 Soil
Date samples received	31/01/2019
Date completed instructions received	31/01/2019

Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.

Samples were analysed as received from the client. Results relate specifically to the samples as received.

Results are reported on a dry weight basis for solids and on an as received basis for other matrices.

Report Details

Date results requested by	04/02/2019
Date of Issue	04/02/2019

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Results Approved By
Priya Samarawickrama, Senior Chemist

Authorised By

Jacinta Hurst, Laboratory Manager

Misc Inorg - Soil						
Our Reference		210572-1	210572-2	210572-3	210572-4	210572-5
Your Reference	UNITS	BH1	BH1	BH5	BH5	BH17
Depth		0.6-0.7	2.5-2.8	1.0-1.45	2.5-2.9	0.5-0.6
Date Sampled		31/01/2019	31/01/2019	31/01/2019	31/01/2019	31/01/2019
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	04/02/2019	04/02/2019	04/02/2019	04/02/2019	04/02/2019
Date analysed	-	04/02/2019	04/02/2019	04/02/2019	04/02/2019	04/02/2019
Resistivity in soil*	ohm m	92	23	17	21	71

Misc Inorg - Soil						
Our Reference		210572-6	210572-7	210572-8	210572-9	210572-10
Your Reference	UNITS	BH17	BH26	BH26	BH28	BH28
Depth		1.0-1.45	0.5-0.6	1.0-1.45	0.5-0.6	1.0-1.45
Date Sampled		31/01/2019	31/01/2019	31/01/2019	31/01/2019	31/01/2019
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	04/02/2019	04/02/2019	04/02/2019	04/02/2019	04/02/2019
Date analysed	-	04/02/2019	04/02/2019	04/02/2019	04/02/2019	04/02/2019
Resistivity in soil*	ohm m	66	97	40	69	60

Misc Inorg - Soil			
Our Reference		210572-11	210572-12
Your Reference	UNITS	BH31	BH31
Depth		0.5-0.6	1.0-1.45
Date Sampled		31/01/2019	31/01/2019
Type of sample		Soil	Soil
Date prepared	-	04/02/2019	04/02/2019
Date analysed	-	04/02/2019	04/02/2019
Resistivity in soil*	ohm m	77	46

Method ID	Methodology Summary
Inorg-002	Conductivity and Salinity - measured using a conductivity cell at 25oC in accordance with APHA 22nd ED 2510 and Rayment & Lyons. Resistivity is calculated from Conductivity.

QUALITY CONTROL: Misc Inorg - Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Date prepared	-			04/02/2019	2	04/02/2019	04/02/2019		04/02/2019	[NT]
Date analysed	-			04/02/2019	2	04/02/2019	04/02/2019		04/02/2019	[NT]
Resistivity in soil*	ohm m	1	Inorg-002	[NT]	2	23	22	4	[NT]	[NT]

QUALITY CONTROL: Misc Inorg - Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-			[NT]	10	04/02/2019	04/02/2019		[NT]	[NT]
Date analysed	-			[NT]	10	04/02/2019	04/02/2019		[NT]	[NT]
Resistivity in soil*	ohm m	1	Inorg-002	[NT]	10	60	41	38	[NT]	[NT]

Result Definitions

NT	Not tested
NA	Test not required
INS	Insufficient sample for this test
PQL	Practical Quantitation Limit
<	Less than
>	Greater than
RPD	Relative Percent Difference
LCS	Laboratory Control Sample
NS	Not specified
NEPM	National Environmental Protection Measure
NR	Not Reported

Quality Control Definitions

Blank	This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.
Duplicate	This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.
Matrix Spike	A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.
LCS (Laboratory Control Sample)	This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.
Surrogate Spike	Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

Australian Drinking Water Guidelines recommend that Thermotolerant Coliform, Faecal Enterococci, & E.Coli levels are less than 1cfu/100mL. The recommended maximums are taken from "Australian Drinking Water Guidelines", published by NHMRC & ARMC 2011.

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.

Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.

Spikes for Physical and Aggregate Tests are not applicable.

For VOCs in water samples, three vials are required for duplicate or spike analysis.

Duplicates: >10xPQL - RPD acceptance criteria will vary depending on the analytes and the analytical techniques but is typically in the range 20%-50% – see ELN-P05 QA/QC tables for details; <10xPQL - RPD are higher as the results approach PQL and the estimated measurement uncertainty will statistically increase.

Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals; 60-140% for organics (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

In circumstances where no duplicate and/or sample spike has been reported at 1 in 10 and/or 1 in 20 samples respectively, the sample volume submitted was insufficient in order to satisfy laboratory QA/QC protocols.

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Where sampling dates are not provided, Envirolab are not in a position to comment on the validity of the analysis where recommended technical holding times may have been breached.

Measurement Uncertainty estimates are available for most tests upon request.

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www.envirolab.com.au

CERTIFICATE OF ANALYSIS 215148

Client Details

Client	Geoenviro Consultancy Pty Ltd
Attention	Adrian Tejada
Address	PO Box 1543, Macquarie Centre, North Ryde, NSW, 2113

Sample Details

Your Reference	**JC18322C, Leppington**
Number of Samples	15 Soil
Date samples received	08/04/2019
Date completed instructions received	08/04/2019

Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.

Samples were analysed as received from the client. Results relate specifically to the samples as received.

Results are reported on a dry weight basis for solids and on an as received basis for other matrices.

Report Details

Date results requested by	12/04/2019
Date of Issue	12/04/2019

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Results Approved By
Ken Nguyen, Reporting Supervisor
Priya Samarawickrama, Senior Chemist

Authorised By

Nancy Zhang, Laboratory Manager

Misc Inorg - Soil						
Our Reference		215148-1	215148-2	215148-3	215148-4	215148-5
Your Reference	UNITS	BH41	BH41	BH41	BH42	BH42
Depth		0.0-0.1	0.5-0.6	1.4-1.5	0.0-0.1	0.4-0.5
Date Sampled		04/04/2019	04/04/2019	04/04/2019	04/04/2019	04/04/2019
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	12/04/2019	12/04/2019	12/04/2019	12/04/2019	12/04/2019
Date analysed	-	12/04/2019	12/04/2019	12/04/2019	12/04/2019	12/04/2019
pH 1:5 soil:water	pH Units	6.0	5.1	5.3	6.0	6.4
Electrical Conductivity 1:5 soil:water	µS/cm	66	620	500	56	59
Chloride, Cl 1:5 soil:water	mg/kg	[NA]	740	550	[NA]	10
Sulphate, SO4 1:5 soil:water	mg/kg	[NA]	170	140	[NA]	59
Resistivity in soil*	ohm m	[NA]	[NA]	20	[NA]	170

Misc Inorg - Soil						
Our Reference		215148-6	215148-7	215148-8	215148-9	215148-10
Your Reference	UNITS	BH42	BH43	BH43	BH43	BH44
Depth		1.0-1.1	0.0-0.1	0.5-0.6	1.2-1.3	0.0-0.1
Date Sampled		04/04/2019	04/04/2019	04/04/2019	04/04/2019	04/04/2019
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	12/04/2019	12/04/2019	12/04/2019	12/04/2019	12/04/2019
Date analysed	-	12/04/2019	12/04/2019	12/04/2019	12/04/2019	12/04/2019
pH 1:5 soil:water	pH Units	5.7	6.6	6.0	5.1	6.9
Electrical Conductivity 1:5 soil:water	µS/cm	130	97	130	400	110
Chloride, Cl 1:5 soil:water	mg/kg	47	[NA]	33	330	[NA]
Sulphate, SO4 1:5 soil:water	mg/kg	70	[NA]	89	210	[NA]

Misc Inorg - Soil						
Our Reference		215148-11	215148-12	215148-13	215148-14	215148-15
Your Reference	UNITS	BH44	BH44	BH45	BH45	BH45
Depth		0.4-0.5	1.4-1.5	0.0-0.1	0.6-0.7	1.6-1.7
Date Sampled		04/04/2019	04/04/2019	04/04/2019	04/04/2019	04/04/2019
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	12/04/2019	12/04/2019	12/04/2019	12/04/2019	12/04/2019
Date analysed	-	12/04/2019	12/04/2019	12/04/2019	12/04/2019	12/04/2019
pH 1:5 soil:water	pH Units	6.7	5.4	6.3	5.4	4.8
Electrical Conductivity 1:5 soil:water	µS/cm	96	140	50	200	320
Chloride, Cl 1:5 soil:water	mg/kg	20	38	[NA]	95	290
Sulphate, SO4 1:5 soil:water	mg/kg	10	130	[NA]	210	90
Resistivity in soil*	ohm m	100	[NA]	[NA]	[NA]	31

ESP/CEC				
Our Reference		215148-2	215148-9	215148-12
Your Reference	UNITS	BH41	BH43	BH44
Depth		0.5-0.6	1.2-1.3	1.4-1.5
Date Sampled		04/04/2019	04/04/2019	04/04/2019
Type of sample		Soil	Soil	Soil
Date prepared	-	12/04/2019	12/04/2019	12/04/2019
Date analysed	-	12/04/2019	12/04/2019	12/04/2019
Exchangeable Ca	meq/100g	0.4	3.3	0.7
Exchangeable K	meq/100g	0.2	0.2	0.3
Exchangeable Mg	meq/100g	10	8.7	8.4
Exchangeable Na	meq/100g	1.0	1.8	1.8
Cation Exchange Capacity	meq/100g	12	14	11
ESP	%	9	13	16

Method ID	Methodology Summary
Inorg-001	pH - Measured using pH meter and electrode in accordance with APHA latest edition, 4500-H+. Please note that the results for water analyses are indicative only, as analysis outside of the APHA storage times.
Inorg-002	Conductivity and Salinity - measured using a conductivity cell at 25°C in accordance with APHA latest edition 2510 and Rayment & Lyons.
Inorg-002	Conductivity and Salinity - measured using a conductivity cell at 25oC in accordance with APHA 22nd ED 2510 and Rayment & Lyons. Resistivity is calculated from Conductivity.
Inorg-081	Anions - a range of Anions are determined by Ion Chromatography, in accordance with APHA latest edition, 4110-B. Alternatively determined by colourimetry/turbidity using Discrete Analyer.
Metals-009	Determination of exchangeable cations and cation exchange capacity in soils using 1M Ammonium Chloride exchange and ICP-AES analytical finish.

QUALITY CONTROL: Misc Inorg - Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	215148-5
Date prepared	-			12/04/2019	3	12/04/2019	12/04/2019		12/04/2019	12/04/2019
Date analysed	-			12/04/2019	3	12/04/2019	12/04/2019		12/04/2019	12/04/2019
pH 1:5 soil:water	pH Units		Inorg-001	[NT]	3	5.3	5.2	2	102	[NT]
Electrical Conductivity 1:5 soil:water	µS/cm	1	Inorg-002	<1	3	500	620	21	100	[NT]
Chloride, Cl 1:5 soil:water	mg/kg	10	Inorg-081	<10	3	550	700	24	89	84
Sulphate, SO4 1:5 soil:water	mg/kg	10	Inorg-081	<10	3	140	140	0	92	75
Resistivity in soil*	ohm m	1	Inorg-002	<1	3	20	16	22	[NT]	[NT]

QUALITY CONTROL: Misc Inorg - Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-			[NT]	13	12/04/2019	12/04/2019		[NT]	[NT]
Date analysed	-			[NT]	13	12/04/2019	12/04/2019		[NT]	[NT]
pH 1:5 soil:water	pH Units		Inorg-001	[NT]	13	6.3	6.3	0	[NT]	[NT]
Electrical Conductivity 1:5 soil:water	µS/cm	1	Inorg-002	[NT]	13	50	50	0	[NT]	[NT]

QUALITY CONTROL: ESP/CEC						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Date prepared	-			12/04/2019	2	12/04/2019	12/04/2019		12/04/2019	[NT]
Date analysed	-			12/04/2019	2	12/04/2019	12/04/2019		12/04/2019	[NT]
Exchangeable Ca	meq/100g	0.1	Metals-009	<0.1	2	0.4	0.3	29	104	[NT]
Exchangeable K	meq/100g	0.1	Metals-009	<0.1	2	0.2	0.2	0	107	[NT]
Exchangeable Mg	meq/100g	0.1	Metals-009	<0.1	2	10	9.6	4	102	[NT]
Exchangeable Na	meq/100g	0.1	Metals-009	<0.1	2	1.0	1.0	0	100	[NT]
ESP	%	1	Metals-009	[NT]	2	9	9	0	[NT]	[NT]

Result Definitions

NT	Not tested
NA	Test not required
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PQL	Practical Quantitation Limit
<	Less than
>	Greater than
RPD	Relative Percent Difference
LCS	Laboratory Control Sample
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APPENDIX C
Explanatory Notes

EXPLANATORY NOTES

Introduction

These notes have been provided to amplify the geotechnical report with regard to investigation procedures, classification methods and certain matters relating to the Discussion and Comments sections. Not all notes are necessarily relevant to all reports.

Geotechnical reports are based on information gained from finite sub-surface probing, excavation, boring, sampling or other means of investigation, supplemented by experience and knowledge of local geology. For this reason they must be regarded as interpretative rather than factual documents, limited to some extent by the scope of information on which they rely.

Description and Classification Methods
The methods the description and classification of soils and rocks used in this report are based on Australian standard 1726, the SSA Site investigation Code, in general descriptions cover the following properties - strength or density, colour, structure, soil or rock type and inclusions. Identification and classification of soil and rock involves to a large extent, judgement within the acceptable level commonly adopted by current geotechnical practices.

Soil types are described according to the predominating particle size, qualified by the grading or other particles present (eg sandy clay) on the following bases:

Soil Classification	Particle Size
Clay	Less than 0.002mm
Silt	0.002 to 0.6mm
Sand	0.6 to 2.00mm
Gravel	2.00m to 60.00mm

Soil Classification	Particle size
Clay	less than 0.002mm
Silt	0.002 to 0.06mm
Sand	0.06 to 2.00mm
Gravel	2.00mm to 60.00mm

Cohesive soils are classified on the basis of strength, either by laboratory testing or engineering examination. The strength terms are defined as follows:

Classification	Undrained Shear Strength kPa
Very Soft	Less than 12
Soft	12 - 25
Firm	25 - 50
Stiff	50 - 100
Very Stiff	100 - 200
Hard	Greater than 200

Non-cohesive soils are classified on the basis of relative density, generally from the results of standard penetration tests (SPT) or Dutch cone penetrometer test (CPT), as below:

Relative Dense	SPT 'N' Value (blows/300mm)	CPT Cone Value (q_c-Mpa)
Very Loose	Less than 5	Less than 2
Loose	5 - 10	2 - 5
Medium Dense	10 - 30	5 - 15
Dense	30 - 50	15 - 25
Very Dense	> 50	> 25

Rock types are classified by their geological names, together with descriptive terms on degrees of weathering strength, defects and other minor components. Where relevant, further information regarding rock classification, is given on the following sheet.

Sampling
Sampling is carried out during drilling to allow engineering examination (and laboratory testing where required) of the soil or rock.

Disturbed samples taken during drilling provided information on plasticity, grained size, colour, type, moisture content, inclusions and depending upon the degree of disturbance, some information on strength and structure.

Undisturbed samples are taken by pushing a thin walled sample tube (normally know as U_{50}) into the soil and withdrawing a sample of the soil in a relatively undisturbed state. Such Samples yield information on structure and strength and are necessary for laboratory determination of shear strength and compressibility. Undisturbed sampling is generally effective only in cohesive soils. Details of the type and method of sampling are given in the report.

Field Investigation Methods
The following is a brief summary of investigation methods currently carried out by this company and comments on their use and application.

Hand Auger Drilling
The borehole is advanced by manually operated equipment. The diameter of the borehole ranges from 50mm to 100mm. Penetration depth of hand augered boreholes may be limited by premature refusal on a variety of materials, such as hard clay, gravels or ironstone.

Test Pits
These are excavated with a tractor-mounted backhoe or a tracked excavator, allowing close examination of the insitu soils if it is safe to descend into the pit. The depth of penetration is limited to about 3.0m for a backhoe and up to 6.0m for an excavator. A potential disadvantage is the disturbance caused by the excavation.

Care must be taken if construction is to be carried out near, or within the test pit locations, to either adequately recompact the backfill during construction, or to design the structure or accommodate the poorly compacted backfill.

Large Diameter Auger (eg Pengo)
The hole is advanced by a rotating plate or short spiral auger generally 300mm or larger in diameter. The cuttings are returned to the surface at intervals (generally of not more than 05m) and are disturbed, but usually unchanged in moisture content. Identification of soil strata is generally much more reliable than with continuous spiral flight augers and is usually supplemented by occasional undisturbed tube sampling.

Continuous Spiral Flight Augers
The hole is advanced by using 90mm - 115mm diameter continuous spiral flight augers, which are withdrawn at intervals to allow sampling or insitu testing. This is a relatively economical means of drilling in clays and in sands above the water table. Samples are returned to the surface, or may be collected after withdrawal of the augers flights, but they are very disturbed and may be highly mixed with soil of other stratum.

Information from the drilling (as distinct from specific sampling by SPT or undisturbed samples) is of relatively low reliability due to remoulding, mixing or softening of samples by ground water, resulting in uncertainties of the original sample depth.

Continuous Spiral Flight Augers (continued)
The spiral augers are usually advanced by using a V - bit through the soil profile refusal, followed by Tungsten Carbide (TC) bit, to penetrate into bedrock. The quality and continuity of the bedrock may be assessed by examination of the recovered rock fragments and through observation of the drilling penetration resistance.

Non - core Rotary Drilling (Wash Boring)
The hole is advanced by a rotary bit, with water being pumped down the drill rod and returned up the annulus, carrying the cuttings, together with some information from the "feel" and rate of penetration.

Rotary Mud Stabilised Drilling
This is similar to rotary drilling, but uses drilling mud as a circulating fluid, which may consist of a range of products, from bentonite to polymers such as Revert or Biogel. The mud tends to mask the cuttings and reliable identification is again only possible from separate intact sampling (eg SPT and U_{50} samples).

Continuous Core Drilling
A continuous core sample is obtained using a diamond tipped core barrel. Providing full core recovery is achieved (which is not always possible in very weak rock and granular soils) this technique provides a very reliable (but relatively expensive) method of investigation. In rocks an NMLC triple tube core barrel which gives a core of about 50mm diameter, is usually used with water flush.

Portable Proline Drilling
This is manually operated equipment and is only used in sites which require bedrock core sampling and there is restricted site access to truck mounted drill rigs. The boreholes are usually advanced initially using a tricone roller bit and water circulation to penetrate the upper soil profile. In some instances a hand auger may be used to penetrate the soil profile. Subsequent drilling into bedrock involves the use of NMLC triple tube equipment, using water as a lubricant.

Standard Penetration Tests
Standard penetration tests are used mainly in non-cohesive soils, but occasionally also in cohesive soils, as a means of determining density or strength and of obtaining a relatively undisturbed sample. The test procedure is described in Australian Standard 1289 "Methods of testing Soils for Engineering Purpose"- Test F31.

The test is carried out in a borehole by driving a 50mm diameter split sample tube under the impact of a 63Kg hammer with a free fall of 769mm. It is normal for the tube to be driven in three successive 150mm increments and the "N" value is taken as the number of blows for the last 300mm. In dense sands, very hard clays or weak rocks, the full 450mm penetration may not be practicable and the test is discontinued.

The test results are reported in the following form:

- In a case where full penetration is obtained with successive blows counts for each 150mm of, say 4, 6, and 7 blows.

  as 4, 6, 7
  N = 13

- In a case where the test is discontinued short of full penetration, say after 15 blows for the first 150mm and 30 blows for the next 40mm.

  as 15,30/40mm

The results of the tests can be related empirically to the engineering properties of the soil. Occasionally the test methods is used to obtain samples in 50mm diameter thin walled samples tubes in clays. In these circumstances, the best results are shown on the bore logs in brackets.

Dynamic Cone Penetration Test
A modification to the SPT test is where the same driving system is used with a solid 60^0 tipped steel cone of the same diameter as the SPT hollow sampler. The cone can be continuously driven into the borehole and is normally used in areas with thick layers of soft clays or loose sand. The results of this test are shown as 'N_c' on the bore logs, together with the number of blows per 150mm penetration.

Cone Penetrometer Testing and Interpretation
Cone penetrometer testing (sometimes referred to as Dutch Cone-CPT) described in this report, has been carried out using an electrical friction cone penetrometer and the test is described in Australian Standard 1289 test F5.1.

In the test, a 35mm diameter rod with cone tipped end is pushed continuously into the soil, the reaction being provided by a specially designed truck or rig, which is fitted with a hydraulic ram system. Measurements are made of the end bearing resistance on the cone and the friction resistance on a separate 130mm long sleeve, immediately behind the cone. Transducer in the tip of the assembly are connected by electrical wires passing through the centre of the push rods to an amplifier and recorder unit mounted on the control truck.

As penetration occurs (at a rate of approximately 20mm per second) the information is output on continuous chart recorders. The plotted results in this report have been traced from the original records. The information provided on the charts comprises:

- Cone resistance - the actual end bearing force divided by the cross sectional area of the cone, expressed in Mpa.
- Sleeve friction - the frictional force on the sleeve divided by the surface area, expressed in kPa.
- Friction ratio - the ratio of sleeve friction to cone resistance, expressed in percentage.

There are two scales available for measurement of cone resistance. The lower "A" scale (0-5Mpa) is used in very soft soils where increased sensitivity is required and is shown in the graphs as a dotted line. The main "B" scale (0-50Mpa) is less sensitive and is shown as a full line.

The ratios of the sleeve resistance to cone resistance will vary with the type of soil encountered, with higher relative frictions in clays than in sands. Friction ratios of 1% to 2% are commonly encountered in sands and very soft clays, rising to 4% to 10% in stiff clays.

In sands, the relationship between cone resistance and SPT value is commonly in the range:

$$q_c \text{ (Mpa)} = (0.4 \text{ to } 0.6)\ N \text{ (blows per 300mm)}$$

In clays the relationship between undrained shear strength and cone resistance is commonly in the range:

$$q_c = (12 \text{ to} 18)\ C_u$$

Interpretation of CPT values can also be made to allow estimate of modulus or compressibility values to allow calculation of foundation settlements. Inferred stratification, as shown on the attached report, is assessed from the cone and friction traces, from experience and information from nearby boreholes etc.

Cone Penetrometer Testing and Interpretation continued
This information is presented for general guidance, but must be regarded as being to some extent interpretive. The test method provides a continuous profile of engineering properties and where precise information or soil classification is required, direct drilling and sampling may be preferable.

Portable Dynamic Cone Penetrometer (AS1289)
Portable dynamic cone penetrometer tests are carried out by driving a rod in to the ground with a falling weight hammer and measuring the blows per successive 100mm increments of penetration.

There are two similar tests, Cone Penetrometer (commonly known as Scala Penetrometer) and the Perth Sand Penetrometer. Scala Penetrometer is commonly adopted by this company and consists of a 16mm rod with a 20mm diameter cone end, driven with a 9kg hammer, dropping 510mm (AS 1289 Test F3.2).

Laboratory Testing
Laboratory testing is carried out in accordance with Australian Standard 1289 "Methods of Testing Soil for Engineering Purposes". Details of the test procedures are given on the individual report forms.

Engineering Logs
The engineering logs presented herein are an engineering and/or geological interpretation of the sub-surface conditions and their reliability will depend to some extent on frequency of sampling and the method of drilling. Ideally, continuous undisturbed sampling or core drilling will provide the most reliable assessment, however, this is not always practicable or possible to justify economically. As it is, the boreholes represent only a small sample of the total sub-surface profile. Interpretation of the information and its application to design and construction should take into account the spacing of boreholes, frequency of sampling and the possibility of other than "straight line" variations between the boreholes.

Ground water
Where ground water levels are measured in boreholes, there are several potential problems:
- In low permeability soils, ground water although present, may enter the hole slowly, or perhaps not at all, during the investigation period.
- A localised perched water table may lead to a erroneous indication of the true water table.
- Water table levels will vary from time to time, due to the seasons or recent weather changes. They may not be the same at the time of construction as indicated in the report.
- The use of water or mud as a drilling fluid will mask any ground water inflow. Water has to be blown out of the hole and drilling mud must be washed out of the hole if any water observations are to be made.

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

Engineering Reports
Engineering reports are prepared by qualified personnel and are based on the information obtained and on current engineering standards of interpretation and analysis. Where the report has been prepared for a specific design proposal is changed, say to a twenty storey building. If this occurs, the company will be pleased to review the report and sufficiency of the investigation work.

Every care is taken with the report as it relates to interpretation of sub-surface conditions, discussions of geotechnical aspects and recommendations or suggestions for design and construction. However, the company cannot always anticipate or assume responsibility for:
- Unexpected variations in ground conditions. The potential for this will depend partly on bore spacing and sampling frequency.
- Changes in policy or interpretation of policy by statutory authorities.
- The actions of contractors responding to commercial pressures.

If these occur, the company will be pleased to assist with investigation or advice to resolve the matter.

Site Anomalies
In the event that conditions encountered on site during construction appear to vary from those which were expected from the information contained in the report, the company request immediate notification. Most problems are much more readily resolved when conditions are exposed than at some later stage, well after the event.

Reproduction of Information for Contractual Purposes
Attention is drawn to the document “Guidelines for the Provision of Geotechnical Information trader Documents”, published by the Institute of Engineers Australia. Where information obtained for this investigation is provided for tender purposes, it is recommended that all information, including the written report and discussion, be made available. In circumstances where the discussion or comments section is not relevant to the contractual situation, it may be appropriate to prepare a specially edited document. The Company would be pleased to assist in this regard and/or make additional copies of the report available for contract purpose, at a nominal charge.

Site Inspection

The Company will always be pleased to provide engineering inspection services for geotechnical aspect of work to which this report is related. This could range from a site visit to confirm that the conditions exposed are as expected, to full time engineering presence on site

Review of Design
Where major civil or structural developments are proposed, or where only a limited investigation has been completed, or where the geotechnical conditions are complex, it is prudent to have the design reviewed by a Senior Geotechnical Engineer.

Graphic Symbols For Soil and Rock

SOIL


Fill


Topsoil


Gravel (GW , GP)


Sand (SP, SW)


Silt (ML, MH)


Clay (CL, CH)


Clayey Gravel (GC)


Silty Sand (SM)


Clayey Sand (SC)


Sandy Silt (ML)


Gravelly Clay (CL, CH)


Silty Clay (CL, CH)


Sandy Clay (CL, CH)


Peat or Organic Soil

ROCK


Shale


Sandstone


Siltstone,Mudstone,Claystone


Granite, Gabbro


Dolerite, Diorite


Basalt, Andesite

Other Materials


Concrete


Bitumen, Asphaltic Concrete, Coal


Ironstone Gravel


Organic Material